DRAINAGE REPORT

ALLEN & MAJOR
ASSOCIATES, INC.

200-400 Quannapowitt Parkway
Wakefield, MA

APPLICANT:
CCF Quannapowitt Property Company, LLC
185 Dartmouth Street
Boston, MA 02116

PREPARED BY:
Allen & Major Associates, Inc.
100 Commerce Way, Suite 5
Woburn, Massachusetts 01801

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SECTION 1.0 -
DRAINAGE REPORT

Introduction

The purpose of this drainage report is to provide an overview of the proposed stormwater management system for the proposed development of 200-400 Quannapowitt Parkway, Wakefield, MA, (the site). The report will show by means of narrative, calculations and exhibits that there is no increase in the peak rate of runoff from the Site at all of the study points for each of the required (2-, 10- and 100-year) design storm events.

The proposed mixed-use redevelopment includes razing the existing building, and constructing three detached multi-story buildings with approximately 485 multifamily units and retail space. Other improvements to the site include renovation and reconstruction of all surface parking, landscaping, and underground utilities servicing the redevelopment. The stormwater management system (SMS) will be enhanced to maximize treatment and infiltration of stormwater on site.

The SMS incorporates structural and non-structural Best Management Practices (BMPs) to provide stormwater quality treatment and conveyance. The SMS includes deep-sump hooded catch basins, drain manholes, underground piping, underground infiltration chambers, bioretention cells, surface infiltration basins vegetated filter strip with stone diaphragm, roof drains, and an Operation & Maintenance Plan.

Site Categorization for Stormwater Regulations

According to the Massachusetts Stormwater Handbook the proposed site improvements at 200 Quannapowitt Parkway are considered "redevelopment" due to the reduction in impervious area. Under proposed conditions, the project will increase the amount of green (pervious) surfaces by approximately 26,000 s.f. (0.60 acres). A "redevelopment" project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions. See the discussion of Stormwater Management Standards that follows.

There is work proposed within MA DEP jurisdictional areas. Therefore, approval under the Massachusetts Wetlands Protection Act is required and a Notice of Intent (NOI) filing has been prepared and submitted as part of this project.

Site Location and Access

The site is located entirely within the Town of Wakefield, Massachusetts and is situated between Interstate-95 to the west and Lake Quannapowitt to the east. Access to

Quannapowitt Parkway is provided off Lowell Street to the north and North Ave to the south.

Existing Site Conditions

The majority of the existing building is currently vacant and previously used as office space with a small percentage dedicated to a data center. The Site is generally flat, varying 0-5 feet in elevation, with a low point around the perimeter of the property and a high point at the center in the general location of the existing building. The Site is surrounded by wetlands as shown on the accompanying plans. These wetlands are fed primarily by surface runoff from the existing roof and parking lot. The majority of this runoff flows unmitigated with no treatment prior to discharge at the resource areas. These wetlands are also connected to Lake Quannapowitt by two underground culverts located at the southern and eastern corners of the property.

All runoff from the Site was analyzed at three study points. Study Point #1 is a summation of all runoff towards the existing culvert to the south connecting to the lake. Study Point #2 is a summation of all site runoff from the site into the lake. Study Point #3 is a summation of all runoff towards the existing culvert to the east connecting to the lake. All Site runoff eventually discharges to Lake Quannapowitt through the two culverts described above, direct entry from roof leaders, or overland flow from the grassed area bordering the lake. Copies of the Watershed plans (Existing and Proposed), providing the boundaries and contributing areas are provided in the back pocket of this report.

Existing Soil Conditions

The on-site soils were identified using the USDA Natural Resources Conservation Services (NRCS) Soil Survey for Middlesex County. The site is primarily Soil Type 656 – Udorthents-Urban Land Complex. Urban Land consists of areas where the soil has been altered or obscured by buildings or paved areas. These structures cover 75 percent or more of the surface area. A copy of the soil mapping is included in the Appendix of this report.

Haley & Aldrich (H&A) performed some preliminary subsurface explorations on the property and described their findings in a Memorandum titled "Due Diligence Geotechnical Investigation". It's estimated that a 2-6' surficial layer of fill exists across the site. The fill consists primarily of reworked natural granular soils placed during previous site development. The memorandum went on to describe the groundwater conditions as follows:

"Groundwater observation wells were not installed as part of this investigation. Previous explorations on adjacent parcels, as well as water levels in the adjacent Lake Quannapowitt, suggest that groundwater is likely present about 3 to 5 feet below

existing site grades. This is consistent with where groundwater levels were interpreted in the recent CPT explorations. The Lake is dam controlled and reported to be maintained at approximately El. 79."

H&A went on to perform additional sub-surface investigations by digging eight (8) test pits throughout areas designated for stormwater management. These test pits were consistent with earlier findings showing fill across the site describing the soils as sandy/silty loam. Mottling was not apparent in any of the pits however water was observed between 2.7' and 7' below grade after an extended period of time. It is important to note that two-days prior to the test pit excavations, the surrounding area experienced above average rainfall with depths up to 1-inch recorded in the Boston area.

The Town Engineer witnessed several of the eight (8) test pits and has recommended TP-6 be used to establish the groundwater elevation 81.0' across the site for design purposes. The test pit logs prepared by H&A are provided in the appendix of this report.

FEMA Floodplain/Environmental Due Diligence

The Site borders and has a hydraulic connection to FEMA *Zone "AE"* elevation 83.0. *Zone "AE" areas* are areas of 1% annual chance (or 100-year) flood area. The official Flood Insurance Rate Map (FIRM) for the site is dated June 4, 2010 and shown on FEMA panel 25017C0314E. A copy of the FEMA FIRM is included in the appendix of this report.

Environmentally Sensitive Zones

The Commonwealth of Massachusetts asserts control over numerous protected and regulated areas including: Areas of Critical Environmental Concern (ACEC); Outstanding Resource Waters (ORWs); Priority and Protected Habitat for rare and endangered species, and areas protected under the Wetlands Protection Act. The subject property is not located within any of these regulated areas.

Drainage Analysis Methodology

A peak rate of runoff will be determined using techniques and data found in the following:

1. Urban Hydrology for Small Watersheds – Technical Release 55 by the United States Department of Agriculture Soils Conservation Service, June 1986. Runoff curve numbers and 24-hour precipitation values were obtained from this reference.
2. HydroCAD © Stormwater Modeling System by HydroCAD Software Solutions LLC, version 10.00-24. The HydroCAD program was used to generate the runoff hydrographs for the watershed areas, to determine discharge/ stage/storage characteristics for the stormwater BMPs, to perform drainage routing and to

combine the results of the runoff hydrographs. HydroCAD uses the TR-20 methodology of the SCS Unit Hydrograph procedure (SCS-UH).

Proposed Conditions – Peak Rate of Runoff

The stormwater runoff analysis of the existing and proposed conditions includes an estimate of the peak rate of runoff from various rainfall events. Peak runoff rates were developed using TR55 Urban Hydrology for Small Watersheds, developed by the U.S. Department of Commerce, Engineering Division and the HydroCAD computer program. Further, the analysis has been prepared in accordance with the MassDEP and the Town of Wakefield requirements and standard engineering practices. The peak rate of runoff has been estimated for each watershed during the 2, 10, and 100-year storm events.

The stormwater runoff model demonstrates that the overall peak rates of runoff into Lake Quannapowitt will not be increased under proposed conditions during all storm events. The following table provides a summary of the estimated peak rates of runoff for each of the design storm events. The HydroCAD worksheets are included in Section 3 and 4 of this report.

STUDY POINT #1 (Lake Quannapowitt)			
	2-Year	10-Year	100-Year
Existing Flow (CFS)	11.15	21.51	35.14
Proposed Flow (CFS)	1.30	9.72	27.94
Decrease (CFS)	**9.85 (88%)**	**11.79 (55%)**	**7.20 (20%)**
Existing Volume (CF)	93,763	180,656	319,039
Proposed Volume (CF)	31,257	117,436	255,402
Decrease (CF)	**62,506 (67%)**	**63,220 (35%)**	**63,637 (20%)**

MASSDEP Stormwater Performance Standards

The MA DEP Stormwater Management Policy was developed to improve water quality by implementing performance standards for stormwater management. The intent is to implement the stormwater management standards through the review of Notice of Intent filings by the issuing authority (Conservation Commission or DEP). The following section outlines how the proposed Stormwater Management System meets the standards set forth by the Policy.

BMP's implemented in the design include –

- Deep Sump Catch Basins
- Sediment Forebay & Water Quality Swale
- Subsurface Structures
- Bioretention Areas
- Surface Infiltration Basin

- Specific Maintenance Schedule

Stormwater Best Management Practices (BMP's) have been incorporated into the design of the project to mitigate the anticipated pollutant loading. An Operations and Maintenance Plan has been developed for the project, which addresses the long-term maintenance requirements of the proposed system.

Temporary erosion and sedimentation controls will be incorporated into the construction phase of the project. These temporary controls may include straw bale and/or silt fence barriers, inlet sediment traps, slope stabilization, and stabilized construction entrances.

The Massachusetts Department of Environmental Protection has established ten (10) Stormwater Management Standards. A project that meets or exceeds the standards is presumed to satisfy the regulatory requirements regarding stormwater management. The Standards are enumerated below as well as descriptions and supporting calculations as to how the Project will comply with the Standards:

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

   The proposed development will not introduce any new outfalls with direct discharge to a wetland area or waters of the Commonwealth of Massachusetts. All discharges will be treated for water quality and the rate will not be increased over existing conditions.

2. *Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.*

   The proposed development has been designed so that the post-development peak discharge rates do not exceed the predevelopment peak discharge rates. A summary of the existing and proposed discharge rates is included within this document.

3. *Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater*

management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

The proposed site improvements are classified as a "redevelopment" under the MA DEP Stormwater Management Standards based upon a reduction in impervious area. Consequently, compliance with Standard #3 is required only to the maximum extent practicable. This reduction is achieved with the installation of landscape areas.
Existing impervious area = 10.3 ± acres
Proposed impervious area = 9.7 ± acres
Change in impervious area = -0.6 ± acres

See the appendix located in section 6 of this report for stormwater recharge calculations.

4. *Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This standard is met when:*
    - *Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;*
    - *Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and*
    - *Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.*

Standard #4 is met when structural stormwater best management practices are sized to capture and treat the required water quality volume and pretreatment is provided in accordance with the Massachusetts Stormwater Handbook. Standard #4 also requires that suitable source control measures are identified in the Long-term Pollution Prevention Plan. The water quality volume for the site redevelopment is captured and treated using the BMPs listed above.

The implemented BMPs have been designed to treat the contributing water quality volume. These water quality calculations can be seen within the appendix of this report.

The proposed stormwater management system has been designed to remove 80% of the average annual post-construction load for each treatment train. The TSS removal calculations can be seen within the appendix of this report.

5. *For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.*

   The proposed redevelopment is considered a source of higher potential pollutant loads due to 1,000 or more expected vehicle trips per day. The SMS will be designed to treat 1" water quality volume.

6. *Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.*

   The project site does not discharge stormwater within a Zone II or Interim Wellhead Protection Area or near a critical area. Critical Areas are Outstanding Resource Waters as designated in 314 CMR 4.00, Special Resource Waters as

designated in 314 CMR 4.00, recharge areas for public water supplies as defined in 310 CMR 22.02, bathing beaches as defined in 105 CMR 445.000, cold-water fisheries as defined in 314 CMR 9.02 and 310 CMR 10.04, and shellfish growing areas as defined in 314 CMR 9.02 and 310 CMR 10.04.

7. *A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.*

   The proposed project is considered a redevelopment under the MA DEP Stormwater Management Standards as there is a decrease in the amount of total impervious area.

8. *A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.*

   A plan to control construction-related impacts, including erosion, sedimentation and other pollutant sources during construction has been developed. A detailed Erosion and Sedimentation Control Plan is included in the Permit Drawings. The proponent will prepare and submit a Stormwater Pollution Prevention Plan (SWPPP) prior to commencement of construction activities that will result in the disturbance of one acre of land or more.

9. *A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.*

   A Long-Term Operation & Maintenance (O&M) Plan has been developed for the proposed stormwater management system and is included within this document. See Section 2.0 of this report.

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

There are no expected illicit discharges to the stormwater management system. The applicant will submit the Illicit Discharge Compliance Statement prior to the discharge of stormwater runoff to the post-construction stormwater best management practices and prior to the issuance of a Certificate of Compliance.

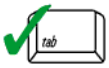
See the next page for the MassDEP Stormwater Checklist.

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

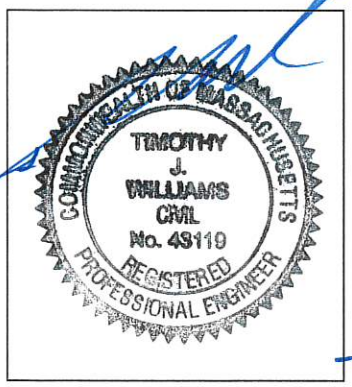
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



Signature and Date

3/16/21

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.

SECTION 2.0 -
OPERATION & MAINTENANCE PLAN

Introduction

In accordance with the standards set forth by the Stormwater Management Policy issued by the Massachusetts Department of Environmental Protection (MassDEP), Allen & Major Associates, Inc. has prepared the following Operations & Maintenance (O&M) Plan for the existing development at 200 Quannapowitt Parkway, Wakefield, MA.

The plan is broken down into three major sections. The first section describes construction-related erosion and sedimentation controls (Demolition & Construction Maintenance Plan). The second section describes the long-term pollution prevention measures (Long Term Pollution Prevention Plan). The third section is a post-construction operation and maintenance plan designed to address the long-term maintenance needs of the stormwater management system (Long-Term Maintenance Plan – Facilities Description).

Notification Procedures for Change of Responsibility for O&M

The Stormwater Management System (SMS) for this project is owned by Cabot, Cabot & Forbes (owner). The owner shall be legally responsible for the long-term operation and maintenance of this SMS as outlined in this Operation and Maintenance Plan.

The owner shall submit an annual summary report and the completed Operation & Maintenance Schedule & Checklist to the Public Works Engineering Division and Conservation Commission (via email or print copy), highlighting inspection and maintenance activities including performances of BMPs. Should ownership of the SMS change, the owner will continue to be responsible until the succeeding owner shall notify the Commission that the succeeding owner has assumed such responsibility. Upon subsequent transfers, the responsibility shall continue to be that of transferring owner until the transferee owner notifies the Commission of its assumption of responsibility.

In the event the SMS will serve multiple lots/owners, such as the subdivision of the existing parcel or creation of lease areas, the owner(s) shall establish an association on other legally enforceable arrangements under which the association or a single party shall have legal responsibility for the operation and maintenance of the entire SMS. The legal instrument creating such responsibility shall be recorded with the Registry of Deeds and promptly following its recording, a copy thereof shall be furnished to the Commission.

Contact Information

Stormwater Management System Owner:	CCF Quannapowitt Property Company, LLC 185 Dartmouth Street Boston, MA 02116 Phone: 617-603-4000

Emergency Contact Information:

Allen & Major Associates, Inc. (Site Civil Engineer)	Phone: (781) 935-6889
Wakefield Department of Public Works	Phone: 781-246-6301
Wakefield Conservation Commission	Phone: 781-224-5015
Wakefield Fire Department (non-emergency line)	Phone: 781-246-6435
MassDEP Emergency Response	Phone: (888) 304-1133
Clean Harbors Inc (24-Hour Line)	Phone: (800) 645-8265

Demolition & Construction Maintenance Plan

1. Call Digsafe: 1-888-344-7233
2. Contact the Town of Wakefield at least three (3) days prior to start of demolition and/or construction activities.
3. Install Erosion Control measures as shown on the Plans prepared by A&M. The Town of Wakefield shall review the installation of straw bales and silt fencing prior to the start of any site demolition work. Install Construction fencing if determined to be necessary at the commencement of construction.
4. Install construction entrances, straw bales, and silt fence at the locations shown on the Erosion Control Plan prepared by A&M.
5. Site access shall be achieved only from the designated construction entrances.
6. Cut and clear trees in construction areas only (within the limit of work; see plans).
7. Stockpiles of materials subject to erosion shall be stabilized with erosion control matting or temporary seeding whenever practicable, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased.
8. Install silt sacks and straw bales around each drain inlet prior to any demolition and or construction activities.

9. All erosion control measures shall be inspected weekly and after every rainfall event. Records of these inspections shall be kept on-site for review.
10. All erosion control measures shall be maintained, repaired, or replaced as required or at the direction of the owner's engineer or the Town of Wakefield.
11. Sediment accumulation up-gradient of the straw bales, silt fence, and stone check dams greater than 6" in depth shall be removed and disposed of in accordance with all applicable regulations.
12. If it appears that sediment is exiting the site, silt sacks shall be installed in all catch basins adjacent to the site. Sediment accumulation on all adjacent catch basin inlets shall be removed and the silt sack replaced if torn or damaged.
13. Install stone check dams on-site during construction as needed. Refer to the erosion control details. Temporary sediment basins combined with stone check damns shall be installed on-site during construction to control and collect runoff from upland areas of this site during demolition and construction activities.
14. The contractor shall comply with the Sedimentation and Erosion Control Notes as shown on the Site Development Plans and Specifications.
15. The stabilized construction entrances shall be inspected weekly and records of inspections kept. The entrances shall be maintained by adding additional clean, angular, durable stone to remove the soil from the construction vehicle's tires when exiting the site. If soil is still leaving the site via the construction vehicle tires, adjacent roadways shall be kept clean by street sweeping.
16. Dust pollution shall be controlled using on-site water trucks and/or an approved soil stabilization product.
17. During demolition and construction activities, Status Reports on compliance with this O&M Document shall be submitted weekly. The report shall document any deficiencies and corrective actions taken by the applicant.

Long-Term Pollution Prevention Plan

Standard #4 from the MassDEP Stormwater Management Handbook requires that a Long-Term Pollution Prevention Plan (LTPPP) be prepared and incorporated as part of the Operation and Maintenance Plan of the Stormwater Management System. The purpose of the LTPPP is to identify potential sources of pollution that may affect the quality of stormwater discharges, and to describe the implementation of practices to reduce the pollutants in stormwater discharges. The following items describe the source control and proper procedures of the LTPPP.

- Housekeeping
  The existing development has been designed to maintain a high level of water quality treatment for all stormwater discharge to the wetland areas. An Operation and Maintenance (O&M) plan has been prepared and is included in this section of the report. The owner (or its designee) is responsible for adherence to the O&M plan in a strict and complete manner.

- Storing of Materials & Water Products
  The trash and waste program for the site includes exterior dumpsters. There is a trash contractor used to pick up the waste material in the dumpsters. The stormwater drainage system has water quality inlets designed to capture trash and debris.

- Vehicle Washing
  Outdoor vehicle washing has the potential to result in high loads of nutrients, metals, and hydrocarbons during dry weather conditions, as the detergent-rich water used to wash the grime off the vehicle enters the stormwater drainage system. The existing development does not include any designated vehicle washing areas, nor is it expected that any vehicle washing will take place on-site.

- Spill Prevention & Response
  Sources of potential spill hazards include vehicle fluids, liquid fuels, pesticides, paints, solvents, and liquid cleaning products. The majority of the spill hazards would likely occur within the buildings and would not enter the stormwater drainage system. However, there are spill hazards from vehicle fluids or liquid fuels located outside of the buildings. These exterior spill hazards have the potential to enter the stormwater drainage system and are to be addressed as follows:

  1. Spill hazards of pesticides, paints, and solvents shall be remediated using the Manufacturers' recommended spill cleanup protocol.
  2. Vehicle fluids and liquid fuel spill shall be remediated according to the local and state regulations governing fuel spills.
  3. The owner shall have the following equipment and materials on hand to address a spill clean-up: brooms, dust pans, mops, rags, gloves, absorptive material, sand, sawdust, plastic and metal trash containers.
  4. All spills shall be cleaned up immediately after discovery.

5. Spills of toxic or hazardous material shall be reported, regardless of size, to the Massachusetts Department of Environmental Protection at (888) 304-1333.
6. Should a spill occur, the pollution prevention plan will be adjusted to include measures to prevent another spill of a similar nature. A description of the spill, along with the causes and cleanup measures will be included in the updated pollution prevention plan.

- Maintenance of Lawns, Gardens, and Other Landscaped Areas

  It should be recognized that this is a general guideline towards achieving high quality and well-groomed landscaped areas. The grounds staff/landscape contractor must recognize the shortcomings of a general maintenance plan such as this, and modify and/or augment it based on weekly, monthly, and yearly observations. In order to assure the highest quality conditions, the staff must also recognize and appreciate the need to be aware of the constantly changing conditions of the landscaping and be able to respond to them on a proactive basis. No trees shall be planted over the drain lines or recharge area, and that only shallow rooted plants and shrubs will be allowed.

  - Fertilizer

    Maintenance practices should be aimed at reducing environmental, mechanical and pest stresses to promote healthy and vigorous growth. When necessary, pest outbreaks should be treated with the most sensitive control measure available. Synthetic chemical controls should be used only as a last resort to organic and biological control methods. Fertilizer, synthetic chemical controls and pest management applications (when necessary) shall be performed only by licensed applicators in accordance with the manufacturer's label instructions when environmental conditions are conducive to controlled product application.

    Only slow-release organic fertilizers should be used in the planting and mulch areas to limit the amount of nutrients that could enter downstream resource areas. Fertilization of the planting and mulch areas will be performed within manufacturers labeling instructions and shall not exceed an NPK ration of 1:1:1 (i.e. Triple 10 fertilizer mix), considered a low nitrogen mixture. Fertilizers approved for the use under this O&M Plan are as follows:

    Type: NUFARM TRUEPOWER® (Selective Herbicide)
    BAYER ACCLAIM® (Extra Herbicide)
    DOW VISTA™ (XRT Herbicide)
    DISMISS™ (Turf Herbicide)

- Suggested Aeration Program

  In-season aeration of lawn areas is good cultural practice, and is recommended whenever feasible. It should be accomplished with a solid thin tine aeration method to reduce disruption to the use of the area. The depth of solid tine aeration is similar to core type, but should be performed when the soil is somewhat drier for a greater overall effect.

  Depending on the intensity of use, it can be expected that all landscaped lawn areas will need aeration to reduce compaction at least once per year. The first operation should occur in late May following the spring season. Methods of reducing compaction will vary based on the nature of the compaction. Compaction on newly established landscaped areas is generally limited to the top 2-3" and can be alleviated using hollow core or thin tine aeration methods.

  The spring aeration should consist of two passes at opposite directions with 1/4" hollow core tines penetrating 3-5" into the soil profile. Aeration should occur when the soil is moist but not saturated. The soil cores should be shattered in place and dragged or swept back into the turf to control thatch. If desired the cores may also be removed and the area top-dressed with sand or sandy loam. If the area drains on average too slowly, the topdressing should contain a higher percentage of sand. If it is draining on average too quickly, the top dressing should contain a higher percentage of soil and organic matter.

- Landscape Maintenance Program Practices:
  - Lawn
    1. Mow a minimum of once a week in spring, to a height of 2" to 2 1/2" high. Mowing should be frequent enough so that no more than 1/3 of grass blade is removed at each mowing. The top growth supports the roots; the shorter the grass is cute, the less the roots will grow. Short cutting also dries out the soil and encourages weeds to germinate.
    2. Mow approximately once every two weeks from July 1st to August 15th depending on lawn growth.
    3. Mow on a ten-day cycle in fall, when growth is stimulated by cooler nights and increased moisture.
    4. Do not remove grass clippings after mowing.

5. Keep mower blades sharp to prevent ragged cuts on grass leaves, which cause a brownish appearance and increase the chance for disease to enter a leaf.

- Shrubs
  1. Mulch not more than 3" depth with shredded pine or fir bark.
  2. Hand prune annually, immediately after blooming, to remove 1/3 of the above-ground biomass (older stems). Stem removals are to occur within 6" of the ground to open up shrub and maintain two-year wood (the blooming wood).
  3. Hand-prune evergreen shrubs only as needed to remove dead and damaged wood and to maintain the naturalistic form of the shrub. Never mechanically shear evergreen shrubs.
- Trees
  1. Provide aftercare of new tree plantings for the first three years.
  2. Do not fertilize trees, it artificially stimulates them (unless tree health warrants).
  3. Water once a week for the first year; twice a month for the second; once a month for the third year.
  4. Prune trees on a four-year cycle.
- Invasive Species
  1. Inform the Conservation Commission Agent prior to the removal of invasive species proposed either through hand work or through chemical removal.

- Storage and Use of Herbicides and Pesticides

  Prior to the use of any herbicides and pesticides, the pest management company or owner shall obtain written approval from the Wakefield Conservation Commission and comply with any additional requirements established at that time.

  Integrated Pest Management is the combination of all methods (of pest control) which may prevent, reduce, suppress, eliminate, or repel an insect population. The main requirements necessary to support any pest population are food, shelter and water, and any upset of the balance of these will assist in controlling a pest population. Scientific pest management is the knowledgeable use of all pest control methods (sanitation, mechanical, chemical) to benefit mankind's health, welfare, comfort, property and food. A Pest Management Professional (PMP)

should be retained who is licensed with the Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs, Department of Agricultural Resources.

The site manager will be provided with approved bulletin before entering into or renewing an agreement to apply pesticides for the control of indoor household or structural pests, refer to 333 CMR 13.08.

Before beginning each application, the applicator must post a Department approved notice on all of the entrances to the treated room or area. The applicator must leave such notices posted after the application. The notice will be posted at conspicuous point(s) of access to the area treated. The location and number of signs will be determined by the configuration of the area to be treated based on the applicator's best judgment. It is intended to give sufficient notice so that no one comes into an area being treated unaware that the applicator is working and pesticides are being applied. However, if the contracting entity does not want the signs posted, he/she may sign a Department approved waiver indicating this.

The applicator or employer will provide to any person upon their request the following information on previously conducted applications:

1. Name and phone number of pest control company;
2. Date and time of the application;
3. Name and license number of the applicator;
4. Target pests; and
5. Name and EPA Registration Number of pesticide products applied.

- Pet Waste Management
  The owner's landscape crew (or designee) shall remove any obvious pet waste that has been left behind by pet owners within the development. The pet waste shall be disposed of in accordance with local and state regulations.
- Operations and Management of Septic Systems
  There are no proposed septic systems within the limits of the project.
- Management of Deicing Chemicals and Snow
  Snow will be stockpiled on site until the accumulated snow becomes a hazard to the daily operations of the site. It will be the responsibility of the snow removal contractor to properly dispose of transported snow according to MassDEP, Bureau of Resource Protection – Snow Disposal Guideline #BRPG01-01, governing the proper disposal of snow. It will be the responsibility of the snow removal contractor to follow these guidelines and all applicable laws and regulations

The owner's maintenance staff (or its designee) will be responsible for the clearing of the sidewalk and building entrances. The owner may be required to use a de-icing agent such as potassium chloride to maintain a safe walking surface. If used, the de-icing agent for the walkways and building entrances will be kept within the storage rooms located within the building. If used, de-icing agents will not be stored outside. The owner's maintenance staff will limit the application of sand.

Long-Term Maintenance Plan – Facilities Description

A maintenance log will be kept (i.e. report) summarizing inspections, maintenance, and any corrective actions taken. The log will include the date on which each inspection or maintenance task was performed, a description of the inspection findings or maintenance completed, and the name of the inspector or maintenance personnel performing the task. If a maintenance task requires the clean-out of any sediments or debris, the location where the sediment and debris was disposed after removal will be indicated. The log will be made accessible to department staff and a copy provided to the department upon request.

The following is a description of the Stormwater Management System for the project site.

Stormwater Collection System – On-Site:

The stormwater collection system is a series of inlets located at low points within the limits of the paved area. All of the proposed on-site catch basins incorporate a deep sump and hooded outlet. The catch basins are connected by a closed gravity pipe network routed to an isolator row within the underground detention chambers.

Roof runoff discharges directly to the underground chambers, bioretention area, or surface infiltration basin. All remaining runoff along the perimeter of the site and within the parkway, sheet flows through a sediment forebay before overflowing into the wetland areas or drainage channel.

Pretreatment BMPs: Regular maintenance of these BMPs is especially critical because they typically receive the highest concentration of suspended solids during the first flush of a storm event.

- Deep Sump Catch Basin:
  Precast structure equipped with grated inlet and 4' sump to allow sediment to settle out.
- Isolator Row:
  Single row of underground chambers wrapped in geotextile to filter out sediment. Equipped with overflow into remaining chambers.
- Sediment Forebay & Water Quality Swale:

Settling basin constructed at the incoming discharge points of a stormwater BMP.

Treatment BMPs:

- Exfiltrating Bioretention Area:
  Shallow depressions filled with sandy soil topped with a thick layer of mulch and planted with dense native vegetation. Equipped with overflow and underdrain.

Infiltration BMPs:

- Subsurface Structures:
  Underground chambers surrounded by stone used to store large volumes of stormwater and allow for infiltration into the groundwater.
- Infiltration Basin:
  Stormwater runoff impoundments that are constructed over permeable soils.

Other Maintenance Activity:

- Mosquito Control - Both above ground and underground stormwater BMPs have the potential to serve as mosquito breeding areas. Good design, proper operation and maintenance, and treatment with larvicides can minimize this potential. See the supplemental information for Mosquito Control in Stormwater Management Practices, and the Operation and Maintenance Plan Schedule for inspection schedule.
- Street Sweeping - Clear accumulations of winter sand in parking lots and along roadways at least once a year, preferably in the spring. Accumulations on pavement may be removed by pavement sweeping. Accumulations of sand along road shoulders may be removed by grading excess sand to the pavement edge and removing it manually or by a front-end loader.

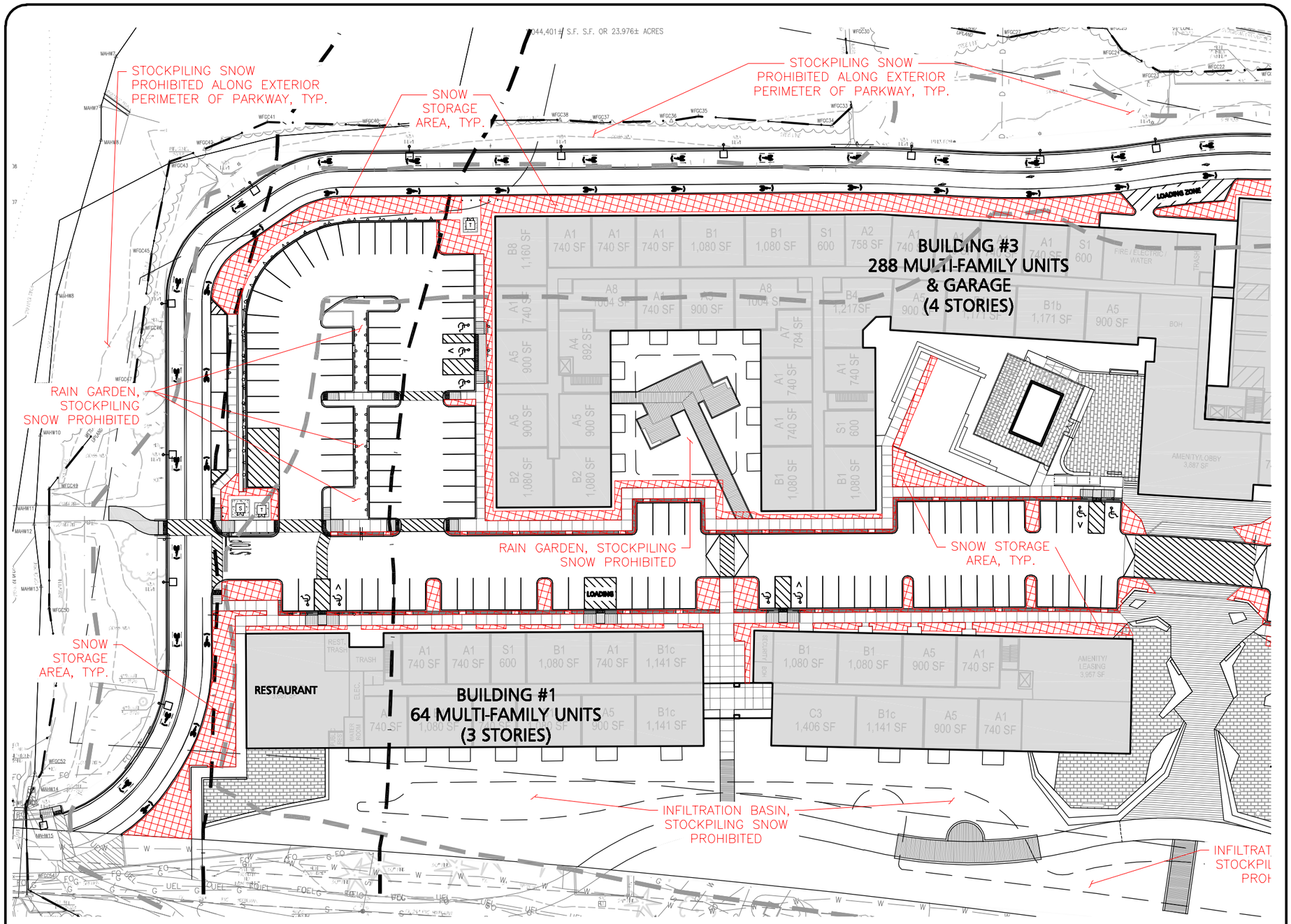
Inspection and Maintenance Frequency and Corrective Measures

In accordance with MA DEP Stormwater Handbook: Volume 2, Chapter 2; the previously described BMPs will be inspected and the identified deficiencies will be corrected. Clean-out must include the removal and legal disposal of any accumulated sediments, trash, and debris. In any and all cases, operations, inspections, and maintenance activities shall utilize best practical measures to avoid and minimize impacts to wetland resource areas outside the footprint of the SMS.

Supplemental Information

- Snow Storage Exhibits
- Operation & Maintenance Plan Schedule

- Massachusetts Stormwater Handbook, Chapter 5, Miscellaneous Stormwater Topics, Mosquito Control in Stormwater Management Practices.
- MassDEP Bureau of Water Resources Snow Disposal Guidance
- Stormtech Isolator Row O&M Manual



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NOTES:

1. SNOW SHALL BE STOCKPILED ON SITE UNTIL THE ACCUMULATED SNOW BECOMES A HAZARD TO THE DAILY OPERATIONS OF THE SITE. IT WILL BE THE RESPONSIBILITY OF THE SNOW REMOVAL CONTRACTOR TO PROPERLY DISPOSE OF TRANSPORTED SNOW ACCORDING TO MASSDEP, BUREAU OF RESOURCE PROTECTION – SNOW DISPOSAL GUIDELINE #BRPG01-01, GOVERNING THE PROPER DISPOSAL OF SNOW. IT WILL BE THE RESPONSIBILITY OF THE SNOW REMOVAL CONTRACTOR TO FOLLOW THESE GUIDELINES AND ALL APPLICABLE LAWS AND REGULATIONS.

2. THE OWNER'S MAINTENANCE STAFF (OR ITS DESIGNEE) WILL BE RESPONSIBLE FOR THE CLEARING OF THE SIDEWALK AND BUILDING ENTRANCES.

GRAPHIC SCALE

60 0 30 60 120 240

(IN FEET)
1 inch = 60 ft.

APPLICANT/OWNER:
CCF QUANNAPOWITT PROPERTY COMPANY, LLC
185 DARTMOUTH STREET
BOSTON, MA 02116

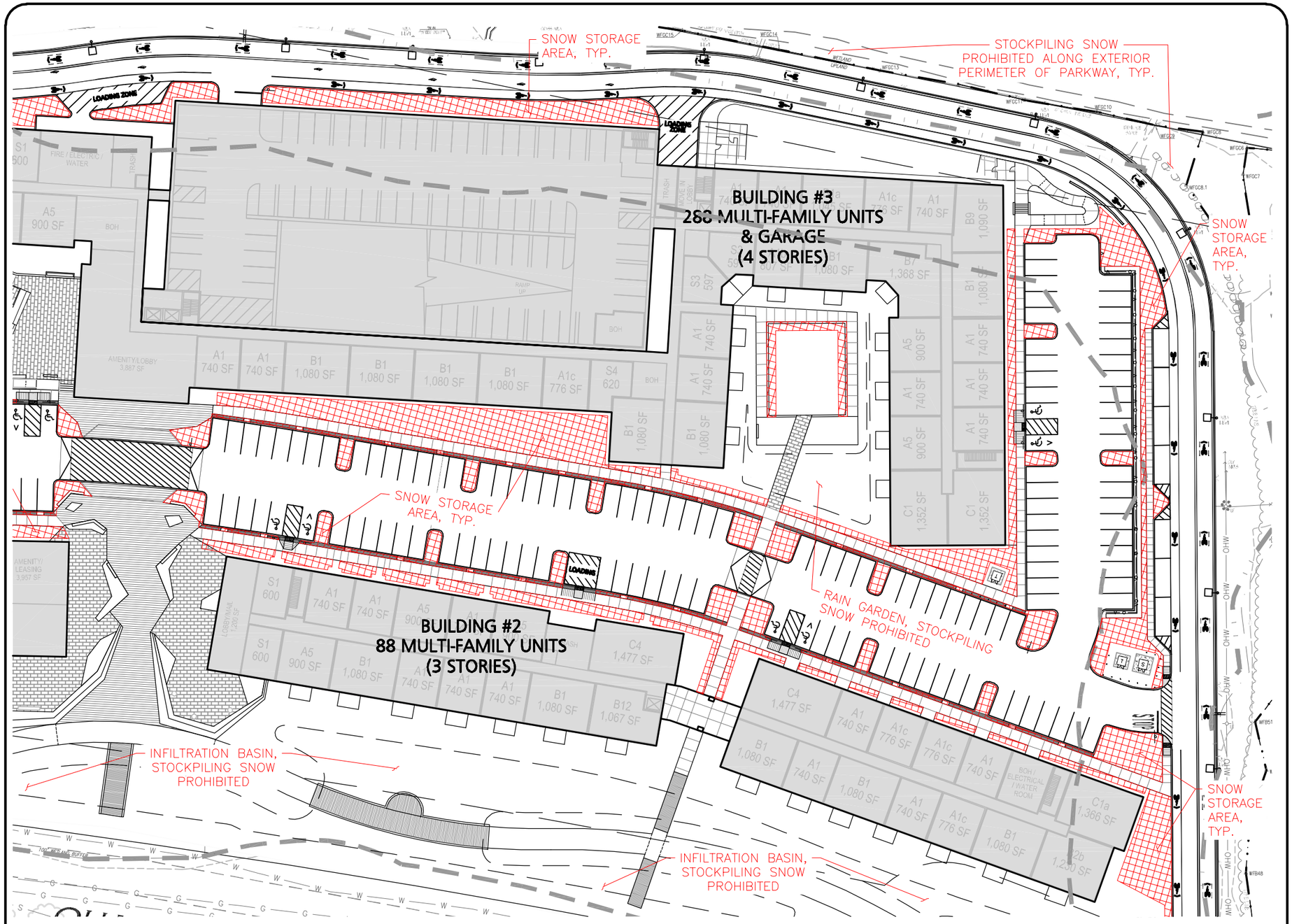
PROJECT:
200-400 QUANNAPOWITT PARKWAY
WAKEFIELD, MA 01880

PROJECT NO.	1623-11	DATE:	04/08/2022
SCALE:	AS NOTED	DWG. NAME:	C-1623-11
DESIGNED BY:	ND	CHECKED BY:	TW

PREPARED BY:
ALLEN & MAJOR ASSOCIATES, INC.
civil engineering ◆ land surveying
environmental consulting ◆ landscape architecture
www.allenmajor.com
250 COMMERCIAL STREET
SUITE 1001
MANCHESTER, NH 03101
TEL: (603) 627-5500
FAX: (603) 627-5501
WOBURN, MA ◆ LAKEVILLE, MA ◆ MANCHESTER, NH

DRAWING TITLE:
SNOW STORAGE EXHIBIT

SHEET No.
1A



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PROJECT NO.	1623-11	DATE:	04/08/2022
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PREPARED BY:

ALLEN & MAJOR ASSOCIATES, INC.
civil engineering ◆ land surveying
environmental consulting ◆ landscape architecture
www.allenmajor.com
250 COMMERCIAL STREET
SUITE 1001
MANCHESTER, NH 03101
TEL: (603) 627-5500
FAX: (603) 627-5501
WOBURN, MA ◆ LAKEVILLE, MA ◆ MANCHESTER, NH

DRAWING TITLE:
SNOW STORAGE EXHIBIT

SHEET No.
1B

OPERATION AND MAINTENANCE PLAN SCHEDULE **Date:**

ALLEN & MAJOR ASSOCIATES, INC.

Project: 200 Quannapowitt Parkway
Project Address: 200 Quannapowitt Parkway Wakefield, MA

Responsible for O&M Plan: Cabot, Cabot & Forbes
Address: 185 Dartmouth Street Boston, MA

All information within table is derived from Massachussetts Stormwater Handbook: Volume 2, Chapter 2

BMP CATEGORY	BMP OR MAINTENANCE ACTIVITY	SCHEDULE/ FREQUENCY	NOTES	ESTIMATED ANNUAL MAINTENANCE COST	INSPECTION PERFORMED	
					DATE:	BY:
STRUCTURAL PRETREATMENT BMPs	DEEP SUMP CATCH BASIN	Four times per year (quarterly).	Inspect and clean catch basin units whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin.	$1,000		
	SEDIMENT FOREBAY & WATER QUALITY SWALE	Inspect monthly and clean four times per year (quarterly).	Remove accumulated sediment quarterly. Check for signs of rilling and gullying and repar as needed.	$250		
INFILTRATION BMPs	BIORETENTION AREA & RAIN GARDEN	Remove trash monthly. Remove and replace dead vegetation, prune and mulch annually.	Inspect & remove trash, Mulch, Remove dead vegetation, Replace dead vegetation, Prune, Replace entire media & all vegetation.	$3,000		
	INFILTRATION BASIN	Inspect after every major storm during first 3 months of operation and twice a year thereafter. Clean pretreatment devices twice a year and after every major storm.	Inspect to ensure proper functioning. Mow the buffer area, side slopes, and basin bottom if grassed floor; rake if stone bottom; remove trash and debris; remove grass clippings and accumulated organic matter. Inspect and clean pretreatment devices.	$1,500		
	SUBSURFACE STRUCTURES	Inspect structure inlets at least twice a year. Remove debris that may clog the system as needed.	Because subsurface structures are installed underground, they are extremely difficult to maintain. Remove any debris that might clog the system.	$500		
OTHER MAINTENANCE ACTIVITY	MISQUITO CONTROL	Inspect BMPs as needed to ensure the system's drainage time is less than the maximum 72 hour period.	Massachusetts stormwater handbook requires all stormwater practices that are designed to drain do so within 72 hours to reduce the number of mosquitos that mature to adults since the aquatic stage of a mosquito is 7-10 days.	$100		
	SNOW STORAGE	Clear and remove snow to approved storage locations as necessary to ensure systems are working properly and are protected from meltwater pollutants.	Carefully select snow disposal sites before winter. Avoid dumping removed snow over catch basins, or in detention ponds, sediment forebays, rivers, wetlands, and flood plains. It is also prohibited to dump snow in the bioretention basins or gravel swales.	$500		
	STREET SWEEPING	Clear accumulations of winter sand in parking lots and along roadways at least once a year, preferably in the spring.	Sweep, power broom or vacuum paved areas. Submit information that confirms that all street sweepings have been completed in accordance with state and local requirements	$2,000		

Chapter 5
Miscellaneous Stormwater Topics

Mosquito Control in Stormwater Management Practices

Both aboveground and underground stormwater BMPs have the potential to serve as mosquito breeding areas. Good design, proper operation and maintenance and treatment with larvicides can minimize this potential.

EPA recommends that stormwater treatment practices dewater within 3 days (72 hours) to reduce the number of mosquitoes that mature to adults, since the aquatic stage of many mosquito species is 7 to 10 days. Massachusetts has had a 72-hour dewatering rule in its Stormwater Management Standards since 1996. The 2008 technical specifications for BMPs set forth in Volume 2, Chapter 2 of the Massachusetts Stormwater Handbook also concur with this practice by requiring that all stormwater practices designed to drain do so within 72 hours.

Some stormwater practices are designed to include permanent wet pools. These practices – if maintained properly – can limit mosquito breeding by providing habitat for mosquito predators. Additional measures that can be taken to reduce mosquito populations include increasing water circulation, attracting mosquito predators by adding suitable habitat, and applying larvicides.

The Massachusetts State Reclamation and Mosquito Control Board (SRMCB), through the Massachusetts Mosquito Control Districts, can undertake further mosquito control actions specifically for the purpose of mosquito control pursuant to Massachusetts General Law Chapter 252. The Mosquito Control Board, http://www.mass.gov/agr/mosquito/, describes mosquito control methods and is in the process of developing guidance documents that describe Best Management Practices for mosquito control projects.

The SRMCB and Mosquito Control Districts are not responsible for operating and maintaining stormwater BMPs to reduce mosquito populations. The owners of property that construct the stormwater BMPs or municipalities that "accept" them through local subdivision approval are responsible for their maintenance.[1] The SRMCB is composed of officials from MassDEP, Department of Agricultural Resources, and Department of Conservation and Recreation. The nine (9) Mosquito Control Districts overseen by the SRMCB are located throughout Massachusetts, covering 176 municipalities.

Construction Period Best Management Practices for Mosquito Control

To minimize mosquito breeding during construction, it is essential that the following actions be taken to minimize the creation of standing pools by taking the following actions:

- ***Minimize Land Disturbance:*** Minimizing land disturbance reduces the likelihood of mosquito breeding by reducing silt in runoff that will cause construction period controls to clog and retain standing pools of water for more than 72 hours.
- ***Catch Basin inlets:*** Inspect and refresh filter fabric, hay bales, filter socks or stone dams on a regular basis to ensure that any stormwater ponded at the inlet drains within 8 hours after precipitation stops. Shorter periods may be necessary to avoid hydroplaning in roads

[1] MassDEP and MassHighway understand that the numerous stormwater BMPs along state highways pose a unique challenge. To address this challenge, the 2004 MassHighway Stormwater Handbook will provide additional information on appropriate operation and maintenance practices for mosquito control when the Handbook is revised to reflect the 2008 changes to the Stormwater Management Standards..

caused by water ponded at the catch basin inlet. Treat catch basin sumps with larvicides such as *Bacillus sphaericus* (*Bs*) using a licensed pesticide applicator.

- ***Check Dams:*** If temporary check dams are used during the construction period to lag peak rate of runoff or pond runoff for exfiltration, inspect and repair the check dams on a regular basis to ensure that any stormwater ponded behind the check dam drains within 72 hours.
- ***Design construction period sediment traps*** to dewater within 72 hours after precipitation. Because these traps are subject to high silt loads and tend to clog, treat them with the larvicide *Bs* after it rains from June through October, until the first frost occurs.
- ***Construction period open conveyances:*** When temporary manmade ditches are used for channelizing construction period runoff, inspect them on a regular basis to remove any accumulated sediment to restore flow capacity to the temporary ditch.
- ***Revegetating Disturbed Surfaces:*** Revegetating disturbed surfaces reduces sediment in runoff that will cause construction period controls to clog and retain standing pools of water for greater than 72 hours.
- ***Sediment fences/hay bale barriers:*** When inspections find standing pools of water beyond the 24-hour period after a storm, take action to restore barrier to its normal function.

Post-Construction Stormwater Treatment Practices

- Mosquito control begins with the environmentally sensitive site design. Environmentally sensitive site design that minimizes impervious surfaces reduces the amount of stormwater runoff. Disconnecting runoff using the LID Site Design credits outlined in the Massachusetts Stormwater Handbook reduces the amount of stormwater that must be conveyed to a treatment practice. Utilizing green roofs minimizes runoff from smaller storms. Storage media must be designed to dewater within 72 hours after precipitation.
- Mosquito control continues with the selection of structural stormwater BMPs that are unlikely to become breeding grounds for mosquitoes, such as:
    - ***Bioretention Areas/Rain Gardens/Sand Filter:*** These practices tend not to result in mosquito breeding. If any level spreaders, weirs or sediment forebays are used as part of the design, inspect them and correct them as necessary to prevent standing pools of water for more than 72 hours.
    - ***Infiltration Trenches:*** This practice tends not to result in mosquito breeding. If any level spreaders, weirs, or sediment forebays are used as part of the design, inspect them and correct them as necessary to prevent standing pools of water for more than 72 hours.
- Another mosquito control strategy is to select BMPs that can become habitats for mosquito predators, such as:
    - ***Constructed Stormwater Wetlands:*** Habitat features can be incorporated in constructed stormwater wetlands to attract dragonflies, amphibians, turtles, birds, bats, and other natural predators of mosquitoes.
    - ***Wet Basins:*** Wet basins can be designed to incorporate fish habitat features, such as deep pools. Introduce fish in consultation with Massachusetts Division of Fisheries and Wildlife. Vegetation within wet basins designed as fish habitat must be properly managed to ensure that vegetation does not overtake the habitat. Proper design to ensure that no low circulation or "dead" zones are created may reduce the potential for mosquito breeding. Introducing bubblers may increase water circulation in the wet basin.

Effective mosquito controls require proponents to design structural BMPs to prevent ponding and facilitate maintenance and, if necessary, the application of larvicides. Examples of such design practices include the following:

- ***Basins:*** Provide perimeter access around wet basins, extended dry detention basins and dry detention basins for both larviciding and routine maintenance. Control vegetation to ensure that access pathways stay open.
- ***BMPs without a permanent pool of water:*** All structural BMPs that do not rely on a permanent pool of water must drain and completely dewater within 72 hours after precipitation. This includes dry detention basins, extended dry detention basins, infiltration basins, and dry water quality swales. Use underdrains at extended dry detention basins to drain the small pools that form due to accumulation of silts. Wallace indicates that extended dry extended detention basins may breed more mosquitoes than wet basins. It is, therefore, imperative to design outlets from extended dry detention basins to completely dewater within the 72-hour period.
- ***Energy Dissipators and Flow Spreaders:*** Currier and Moeller, 2000 indicate that shallow recesses in energy dissipators and flow spreaders trap water where mosquitoes breed. Set the riprap in grout to reduce the shallow recesses and minimize mosquito breeding.
- ***Outlet control structures:*** Debris trapped in small orifices or on trash racks of outlet control structures such as multiple stage outlet risers may clog the orifices or the trash rack, causing a standing pool of water. Optimize the orifice size or trash rack mesh size to provide required peak rate attenuation/water quality detention/retention time while minimizing clogging.
- ***Rain Barrels and Cisterns:*** Seal lids to reduce the likelihood of mosquitoes laying eggs in standing water. Install mosquito netting over inlets. The cistern system should be designed to ensure that all collected water is drained into it within 72 hours.
- ***Subsurface Structures, Deep Sump Catch Basins, Oil Grit Separators, and Leaching Catch Basins:*** Seal all manhole covers to reduce likelihood of mosquitoes laying eggs in standing water. Install mosquito netting over the outlet (CALTRANS 2004).

The Operation and Maintenance Plan should provide for mosquito prevention and control.

- ***Check dams:*** Inspect permanent check dams on the schedule set forth in the O&M Plan. Inspect check dams 72 hours after storms for standing water ponding behind the dam. Take corrective action if standing water is found.
- ***Cisterns:*** Apply *Bs* larvicide in the cistern if any evidence of mosquitoes is found. The Operation and Maintenance Plan shall specify how often larvicides should be applied to waters in the cistern.
- ***Water quality swales:*** Remove and properly dispose of any accumulated sediment as scheduled in the Operation and Maintenance Plan.
- ***Larvicide Treatment:*** The Operation and Maintenance Plan must include measures to minimize mosquito breeding, including larviciding.
- The party identified in the Operation and Maintenance Plan as responsible for maintenance shall see that larvicides are applied as necessary to the following stormwater treatment practices: catch basins, oil/grit separators, wet basins, wet water quality swales, dry extended detention basins, infiltration basins, and constructed stormwater wetlands. The Operation and Maintenance Plan must ensure that all larvicides are applied by a licensed pesticide applicator and in compliance with all pesticide label requirements.
- The Operation and Maintenance Plan should identify the appropriate larvicide and the time and method of application. For example, *Bacillus sphaericus (Bs*), the preferred

larvicide for stormwater BMPs, should be hand-broadcast.[2] Alternatively, Altosid, a Methopren product, may be used. Because some practices are designed to dewater between storms, such as dry extended detention and infiltration basins, the Operation and Maintenance Plan should provide that larviciding must be conducted during or immediately after wet weather, when the detention or infiltration basin has a standing pool of water, unless a product is used that can withstand extended dry periods.

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[2] *Bacillus thuringienis israelensis* or *Bti* is usually applied by helicopter to wetlands and floodplains

Roads and Stormwater BMPs

In general, the stormwater BMPs used for land development projects can also be used for new roadways and roadway improvement projects. However, for improvement of existing roads, there are often constraints that limit the choice of BMP. These constraints derive from the linear configuration of the road, the limited area within the existing right-of-way, the structural and safety requirements attendant to good roadway design, and the long-term maintainability of the roadway drainage systems. The MassHighway Handbook provides strategies for dealing with the constraints associated with providing stormwater BMPs for roadway redevelopment projects.

Roadway design can minimize impacts caused by stormwater. Reducing roadway width reduces the total and peak volume of runoff. Designing a road with country drainage (no road shoulders or curbs) disconnects roadway runoff. Disconnection of roadway runoff is eligible for the Low Impact Site Design Credit provided the drainage is disconnected in accordance with specifications outlined in Volume 3.

Like other parties, municipalities that work within wetlands jurisdictional areas and adjacent buffer zones must design and implement structural stormwater best management practices in accordance with the Stormwater Management Standards and the Stormwater Management Handbook. In addition, in municipalities and areas where state agencies operate stormwater systems, the DPWs (or other town or state agencies) must meet the "good housekeeping" requirement of the municipality's or agency's MS4 permit.

MassHighway has taken stormwater management one step further by working with MassDEP to develop the MassHighway Storm Water Handbook for Highways and Bridges. The purpose of the MassHighway Handbook is to provide guidance for persons involved in the design, permitting, review and implementation of state highway projects, especially those involving existing roadways where physical constraints often limit the stormwater management options available. These constraints, like those common to redevelopment sites, may make it difficult to comply precisely with the requirements of the Stormwater Management Standards and the Massachusetts Stormwater Handbook.[3] In response to these constraints, MassDEP and MHD developed specific design, permitting, review and implementation practices that meet the unique challenges of providing environmental protection for existing state roads. The information in the MassHighway Handbook may also aid in the planning and design of projects to build new highways and to add lanes to existing highways, since they may face similar difficulties in meeting the requirements of the Stormwater Management Standards.

Although it is very useful, the MassHighway Handbook does not allow MassHighway projects to proceed without individual review and approval by the issuing authority when subject to the Wetlands Protection Act Regulations, 310 CMR 10.00, or the 401 Water Quality Certification Regulations, 314 CMR 9.00. For example, MassHighway must provide a Conservation Commission with a project-specific Operation and Maintenance Plan in accordance with Standard 9 that documents how the project's post-construction BMPs will be operated and maintained.[4]

[3] The 2004 MassHighway Handbook outlines standardized methods for dealing with these constraints as they apply to highway redevelopment projects. MassDEP and MassHighway intend to work together to provide guidance for add a lane projects when the 2004 Handbook is revised to reflect the 2008 changes to the Stormwater Management Standards.

[4] The general permit for municipal separate storm sewer systems (the MS4 Permit) requires MassHighway to develop and implement procedures for the proper operation and maintenance of stormwater BMPs. To

Some municipalities have asked if the MassHighway Handbook governs municipal road projects. The answer is no.[5] The MassHighway Handbook was developed in response to the unique problems and challenges arising out of the management of the state highway system. Like other project proponents, cities and towns planning road or other projects in areas subject to jurisdiction under the Wetlands Protection Act must design and implement LID, non-structural and structural best management practices in accordance with the Stormwater Management Standards and the Massachusetts Stormwater Handbook.

avoid duplication of effort, MassHighway may be able rely on the same procedures to fulfill the operation and maintenance requirements of Standard 9 and the MS 4 Permit.

[5] Although the MassHighway Handbook does not govern municipal road projects, cities and towns may find some of the information presented in the Handbook useful.

Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection
One Winter Street Boston, MA 02108 • 617-292-5500

Charles D. Baker
Governor

Karyn E. Polito
Lieutenant Governor

Kathleen A. Theoharides
Secretary

Martin Suuberg
Commissioner

Massachusetts Department of Environmental Protection
Bureau of Water Resources
Snow Disposal Guidance

Effective Date: December 23, 2019

Applicability: Applies to all federal, state, regional and local agencies, as well as to private businesses.

Supersedes: Bureau of Resource Protection (BRP) Snow Disposal Guideline No. BRPG97-1 issued December 12, 1997 and BRPG01-01 issued March 8, 2001; Bureau of Water Resources (BWR) snow disposal guidance issued December 21, 2015 and December 12, 2018.

Approved by: Kathleen Baskin, Assistant Commissioner, Bureau of Water Resources

PURPOSE: To provide guidelines to all government agencies and private businesses regarding snow disposal site selection, site preparation and maintenance, and emergency snow disposal options that are protective of wetlands, drinking water, and water bodies, and are acceptable to the Massachusetts Department of Environmental Protection (MassDEP), Bureau of Water Resources.

APPLICABILITY: These Guidelines are issued by MassDEP's Bureau of Water Resources on behalf of all Bureau Programs (including Drinking Water Supply, Wetlands and Waterways, Wastewater Management, and Watershed Planning and Permitting). They apply to all federal agencies, state agencies, state authorities, municipal agencies and private businesses disposing of snow in the Commonwealth of Massachusetts.

INTRODUCTION

Finding a place to dispose of collected snow poses a challenge to municipalities and businesses as they clear roads, parking lots, bridges, and sidewalks. While MassDEP is aware of the threats to public safety caused by snow, collected snow that is contaminated with road salt, sand, litter, and automotive pollutants such as oil also threatens public health and the environment.

As snow melts, road salt, sand, litter, and other pollutants are transported into surface water or through the soil where they may eventually reach the groundwater. Road salt and other pollutants can contaminate water supplies and are toxic to aquatic life at certain levels. Sand washed into

waterbodies can create sand bars or fill in wetlands and ponds, impacting aquatic life, causing flooding, and affecting our use of these resources.

There are several steps that communities can take to minimize the impacts of snow disposal on public health and the environment. These steps will help communities avoid the costs of a contaminated water supply, degraded waterbodies, and flooding. Everything that occurs on the land has the potential to impact the Commonwealth's water resources. Given the authority of local government over the use of the land, municipal officials and staff have a critically important role to play in protecting our water resources.

The purpose of these guidelines is to help federal agencies, state agencies, state authorities, municipalities and businesses select, prepare, and maintain appropriate snow disposal sites before the snow begins to accumulate through the winter. Following these guidelines and obtaining the necessary approvals may also help municipalities in cases when seeking reimbursement for snow disposal costs from the Federal Emergency Management Agency is possible.

RECOMMENDED GUIDELINES

These snow disposal guidelines address: (1) site selection; (2) site preparation and maintenance; and (3) emergency snow disposal.

1. SITE SELECTION

The key to selecting effective snow disposal sites is to locate them adjacent to or on pervious surfaces in upland areas or upland locations on impervious surfaces away from water resources and drinking water wells. At these locations, the snow meltwater can filter into the soil, leaving behind sand and debris which can be removed in the spring. The following conditions should be followed:

- Within water supply Zone A and Zone II, avoid storage or disposal of snow and ice containing deicing chemicals that has been collected from streets located outside these zones. Municipalities may have a water supply protection land use control that prohibits the disposal of snow and ice containing deicing chemicals from outside the Zone A and Zone II, subject to the Massachusetts Drinking Water Regulations at 310 CMR 22.20C and 310 CMR 22.21(2).
- Avoid storage or disposal of snow or ice in Interim Wellhead Protection Areas (IWPA) of public water supply wells, and within 75 feet of a private well, where road salt may contaminate water supplies.
- Avoid dumping snow into any waterbody, including rivers, the ocean, reservoirs, ponds, or wetlands. In addition to water quality impacts and flooding, snow disposed of in open water can cause navigational hazards when it freezes into ice blocks.
- Avoid dumping snow on MassDEP-designated high and medium-yield aquifers where it may contaminate groundwater.
- Avoid dumping snow in sanitary landfills and gravel pits. Snow meltwater will create more contaminated leachate in landfills posing a greater risk to groundwater, and in gravel pits, there is little opportunity for pollutants to be filtered out of the meltwater because groundwater is close to the land surface.

- Avoid disposing of snow on top of storm drain catch basins or in stormwater drainage systems including detention basins, swales or ditches. Snow combined with sand and debris may block a stormwater drainage system, causing localized flooding. A high volume of sand, sediment, and litter released from melting snow also may be quickly transported through the system into surface water.

Recommended Site Selection Procedures

It is important that the municipal Department of Public Works or Highway Department, Conservation Commission, and Board of Health work together to select appropriate snow disposal sites. The following steps should be taken:

- Estimate how much snow disposal capacity may be needed for the season so that an adequate number of disposal sites can be selected and prepared.
- Identify sites that could potentially be used for snow disposal, such as municipal open space (e.g., parking lots or parks).
- Select sites located in upland locations that are not likely to impact sensitive environmental resources first.
- If more storage space is still needed, prioritize the sites with the least environmental impact (using the site selection criteria, and local or MassGIS maps as a guide).

Snow Disposal Mapping Assistance

MassDEP has an online mapping tool to assist in identifying possible locations to potentially dispose of snow. MassDEP encourages municipalities to use this tool to identify possible snow disposal options. The tool identifies wetland resource areas, public drinking water supplies and other sensitive locations where snow should not be disposed. The tool may be accessed through the Internet at the following web address: **https://maps.env.state.ma.us/dep/arcgis/js/templates/PSF/**.

2. SITE PREPARATION AND MAINTENANCE

In addition to carefully selecting disposal sites before the winter begins, it is important to prepare and maintain these sites to maximize their effectiveness. The following maintenance measures should be undertaken for all snow disposal sites:

- A silt fence or equivalent barrier should be placed securely on the downgradient side of the snow disposal site.
- Wherever possible maintain a 50-foot vegetated buffer between the disposal site and adjacent waterbodies to filter pollutants from the meltwater.
- Clear debris from the site prior to using the site for snow disposal.
- Clear debris from the site and properly dispose of it at the end of the snow season, and no later than May 15.

3. SNOW DISPOSAL APPROVALS

Proper snow disposal may be undertaken through one of the following approval procedures:

- Routine snow disposal – Minimal, if any, administrative review is required in these cases when upland and pervious snow disposal locations or upland locations on impervious surfaces that have functioning and maintained stormwater management systems have been identified, mapped, and used for snow disposal following ordinary snowfalls. Use of upland and pervious snow disposal sites avoids wetland resource areas and allows snow meltwater to recharge groundwater and will help filter pollutants, sand, and other debris. This process will address the majority of snow removal efforts until an entity exhausts all available upland snow disposal sites. The location and mapping of snow disposal sites will help facilitate each entity's routine snow management efforts.
- Emergency Certifications – If an entity demonstrates that there is no remaining capacity at upland snow disposal locations, local conservation commissions may issue an Emergency Certification under the Massachusetts Wetlands Protection regulations to authorize snow disposal in buffer zones to wetlands, certain open water areas, and certain wetland resource areas (i.e. within flood plains). Emergency Certifications can only be issued at the request of a public agency or by order of a public agency for the protection of the health or safety of citizens, and are limited to those activities necessary to abate the emergency. See 310 CMR 10.06(1)-(4). Use the following guidelines in these emergency situations:
    - Dispose of snow in open water with adequate flow and mixing to prevent ice dams from forming.
    - Do not dispose of snow in salt marshes, vegetated wetlands, certified vernal pools, shellfish beds, mudflats, drinking water reservoirs and their tributaries, Zone IIs or IWPAs of public water supply wells, Outstanding Resource Waters, or Areas of Critical Environmental Concern.
    - Do not dispose of snow where trucks may cause shoreline damage or erosion.
    - Consult with the municipal Conservation Commission to ensure that snow disposal in open water complies with local ordinances and bylaws.

- Severe Weather Emergency Declarations – In the event of a large-scale severe weather event, MassDEP may issue a broader Emergency Declaration under the Wetlands Protection Act which allows federal agencies, state agencies, state authorities, municipalities, and businesses greater flexibility in snow disposal practices. Emergency Declarations typically authorize greater snow disposal options while protecting especially sensitive resources such as public drinking water supplies, vernal pools, land containing shellfish, FEMA designated floodways, coastal dunes, and salt marsh. In the event of severe winter storm emergencies, the snow disposal site maps created by municipalities will enable MassDEP and the Massachusetts Emergency Management Agency (MEMA) in helping communities identify appropriate snow disposal locations.

  If upland disposal sites have been exhausted, the Emergency Declaration issued by MassDEP allows for snow disposal near water bodies. In these situations, a buffer of at

least 50 feet, preferably vegetated, should still be maintained between the site and the waterbody. Furthermore, it is essential that the other guidelines for preparing and maintaining snow disposal sites be followed to minimize the threat to adjacent waterbodies.

Under extraordinary conditions, when all land-based snow disposal options are exhausted, the Emergency Declaration issued by MassDEP may allow disposal of snow in certain waterbodies under certain conditions. ***A federal agency, state agency, state authority, municipality or business seeking to dispose of snow in a waterbody should take the following steps***:

- Call the emergency contact phone number [(888) 304-1133)] and notify the MEMA of the municipality's intent.
- MEMA will ask for some information about where the requested disposal will take place.
- MEMA will confirm that the disposal is consistent with MassDEP's Severe Weather Emergency Declaration and these guidelines and is therefore approved.

During declared statewide snow emergency events, MassDEP's website will also highlight the emergency contact phone number [(888) 304-1133)] for authorizations and inquiries. For further non-emergency information about this Guidance you may contact your MassDEP Regional Office Service Center:

Northeast Regional Office, Wilmington, 978-694-3246
Southeast Regional Office, Lakeville, 508-946-2714
Central Regional Office, Worcester, 508-792-7650
Western Regional Office, Springfield, 413-755-2114

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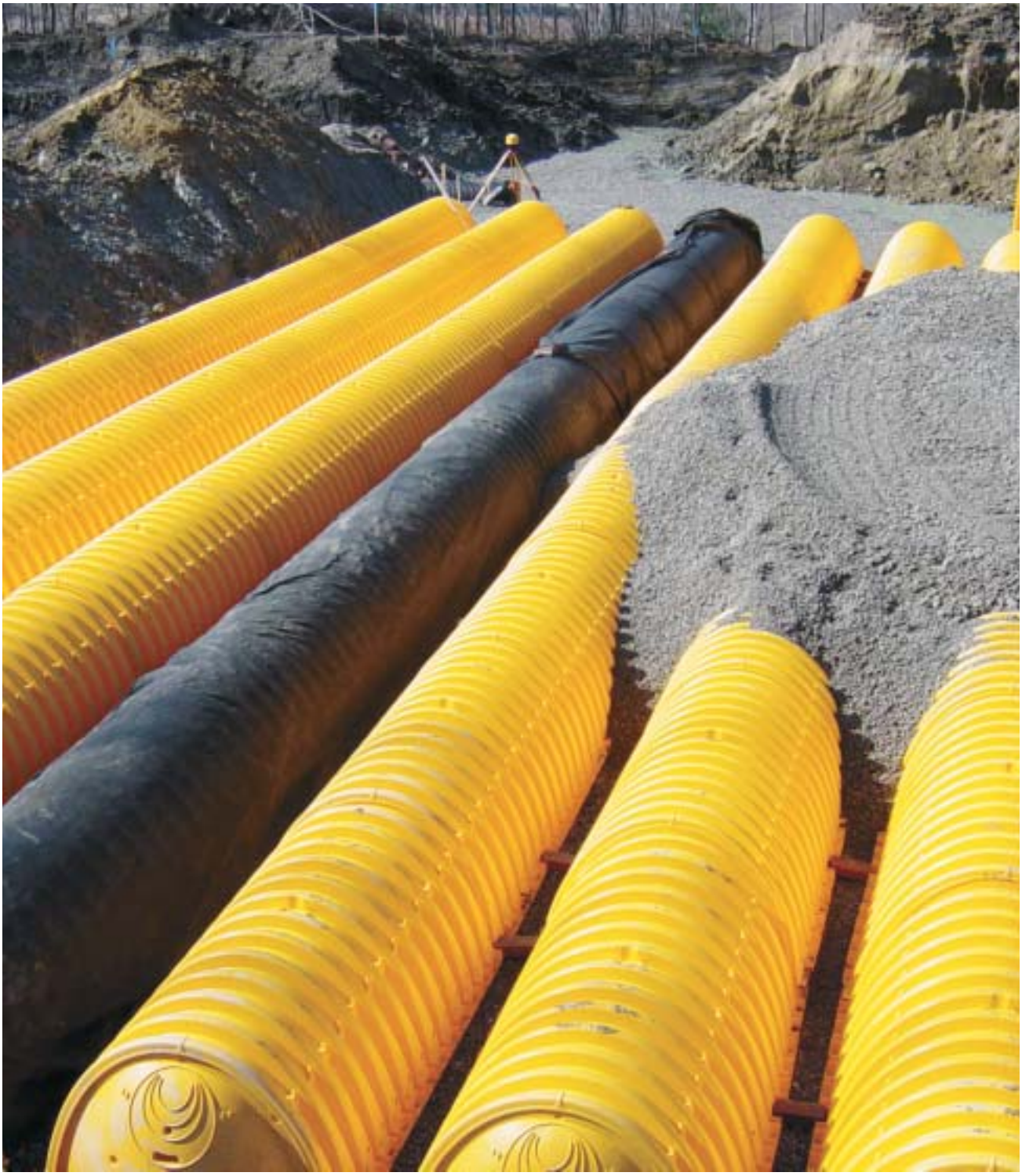


Isolator™ Row O&M Manual

StormTech® Chamber System for Stormwater Management

1.0 The Isolator™ Row

1.1 INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a patent pending technique to inexpensively enhance Total Suspended Solids (TSS) removal and provide easy access for inspection and maintenance.

Looking down the Isolator Row from the manhole opening, woven geotextile is shown between the chamber and stone base.

1.2 THE ISOLATOR™ ROW

The Isolator Row is a row of StormTech chambers, either SC-740 or SC-310 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

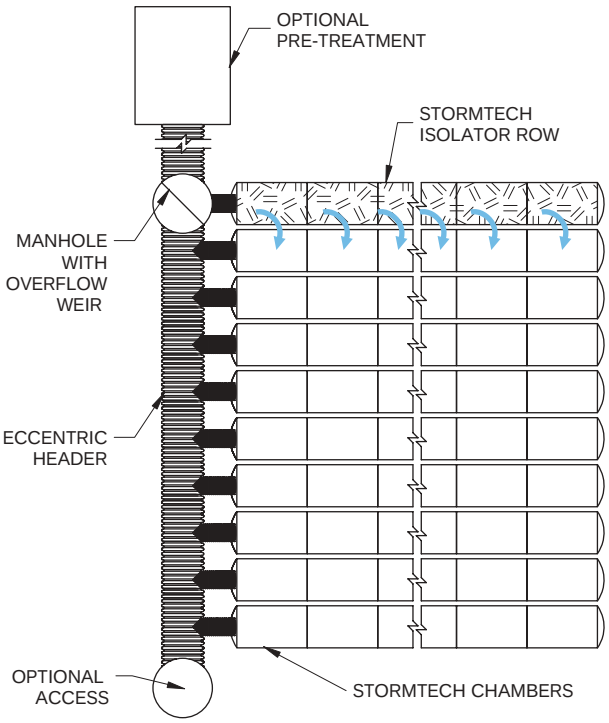
Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber.

The Isolator Row is typically designed to capture the "first flush" and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row but typically includes a high flow weir such that storm water flowrates or volumes that exceed the capacity of the Isolator Row overtop the over flow weir and discharge through a manifold to the other chambers.

The Isolator Row may also be part of a treatment train. By treating storm water prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins, oil-water separators or can be innovative storm water treatment devices. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.

StormTech Isolator Row with Overflow Spillway
(not to scale)



2.0 Isolator Row Inspection/Maintenance

2.1 INSPECTION

The frequency of Inspection and Maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

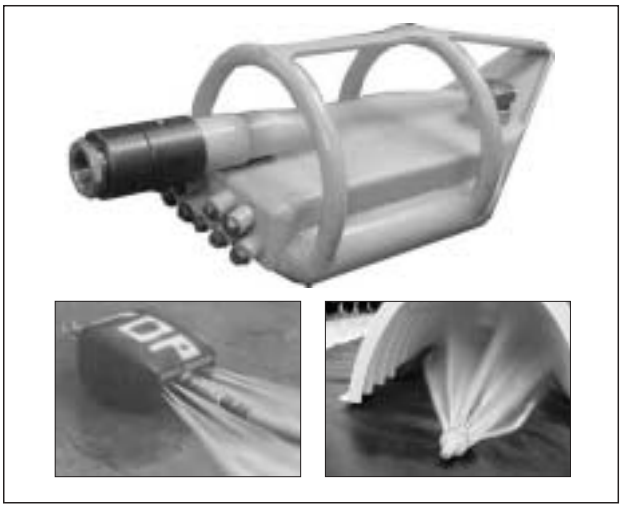
At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

2.2 MAINTENANCE

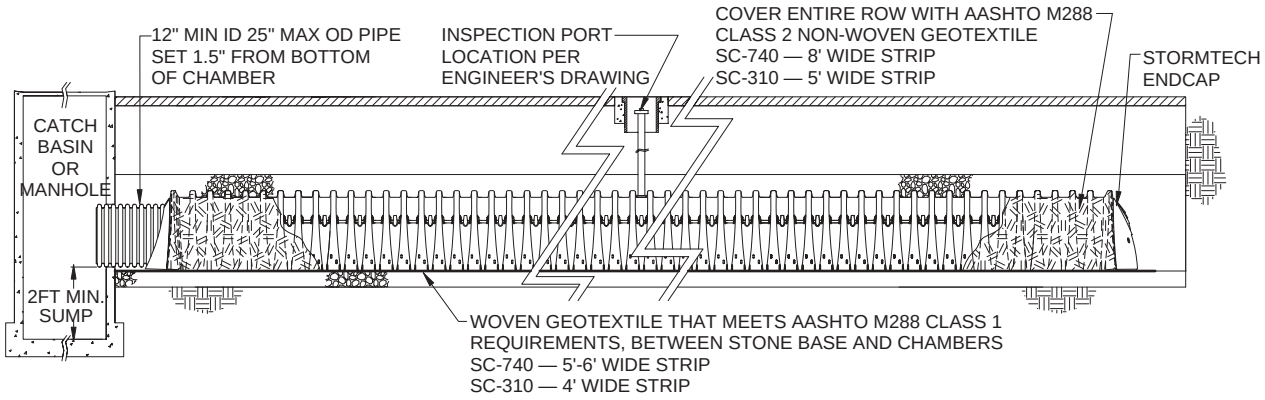
The Isolator Row was designed to reduce the cost of periodic maintenance. By “isolating” sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.



Examples of culvert cleaning nozzles appropriate for Isolator Row maintenance. (These are not StormTech products.)

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45” are best. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)



3.0 Isolator Row Step By Step Maintenance Procedures

Step 1) Inspect Isolator Row for sediment

A) Inspection ports (if present)

i. Remove lid from floor box frame

ii. Remove cap from inspection riser

iii. Using a flashlight and stadia rod, measure depth of sediment and record results on maintenance log.

iv. If sediment is at, or above, 3 inch depth proceed to Step 2. If not proceed to step 3.

B) All Isolator Rows

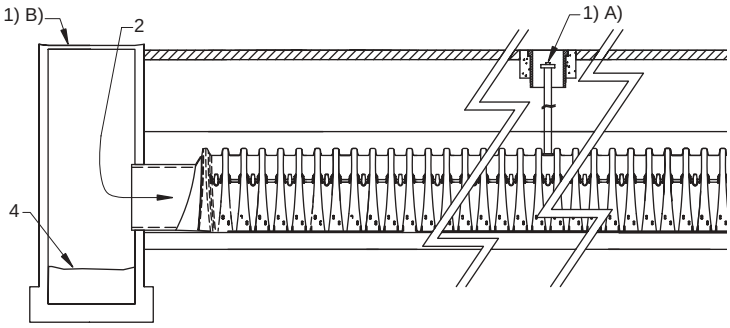
i. Remove cover from manhole at upstream end of Isolator Row

ii. Using a flashlight, inspect down Isolator Row through outlet pipe

1. Mirrors on poles or cameras may be used to avoid a confined space entry
2. Follow OSHA regulations for confined space entry if entering manhole

iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches) proceed to Step 2. If not proceed to Step 3.

StormTech Isolator Row (not to scale)



Step 2) Clean out Isolator Row using the JetVac process

A) A fixed culvert cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable

B) Apply multiple passes of JetVac until backflush water is clean

C) Vacuum manhole sump as required

Step 3) Replace all caps, lids and covers, record observations and actions

Step 4) Inspect & clean catch basins and manholes upstream of the StormTech system

Sample Maintenance Log

Date	Stadia Rod Readings		Sediment Depth (1) - (2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/01	6.3 ft.	none		New installation. Fixed point is CI frame at grade	djm
9/24/01		6.2	0.1 ft.	Some grit felt	sm
6/20/03		5.8	0.5 ft.	Mucky feel, debris visible in manhole and in Isolator row, maintenance due	rv
7/7/03	6.3 ft.		0	System jetted and vacuumed	djm

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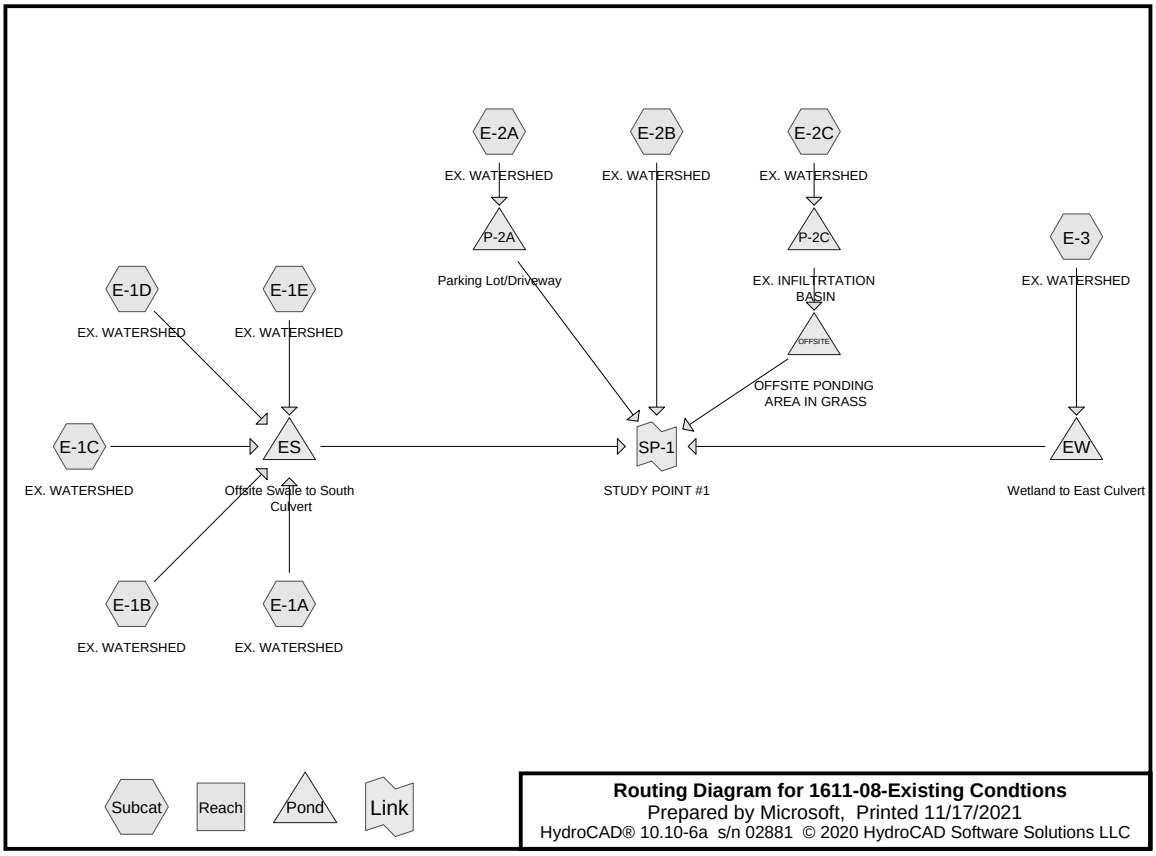
SECTION 3.0 -
EXISTING DRAINAGE ANALYSIS



Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	3.10	2
2	10-Year	Type III 24-hr		Default	24.00	1	4.50	2
3	100-Year	Type III 24-hr		Default	24.00	1	6.50	2

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatchment Numbers
0	0	31,336	0	0	31,336	<50% Grass cover, Poor	E-1A, E-1B, E-1C, E-1D, E-1E, E-2A, E-2B, E-2C
0	0	137,725	0	0	137,725	>75% Grass cover, Good	E-1A, E-1B, E-1C, E-1D, E-1E, E-2B, E-2C, E-3
0	0	15,843	0	0	15,843	Gravel surface	E-1E
0	0	0	0	446,798	446,798	Impervious	E-1A, E-1B, E-1C, E-1D, E-1E, E-2A, E-2B, E-2C, E-3
0	0	150,817	242,101	0	392,918	Woods, Good	E-3
0	0	0	46,239	0	46,239	Woods/grass comb., Good	E-1A, E-1B, E-1C, E-1D
0	**0**	**335,721**	**288,340**	**446,798**	**1,070,859**	**TOTAL AREA**	

Summary for Subcatchment E-1A: EX. WATERSHED

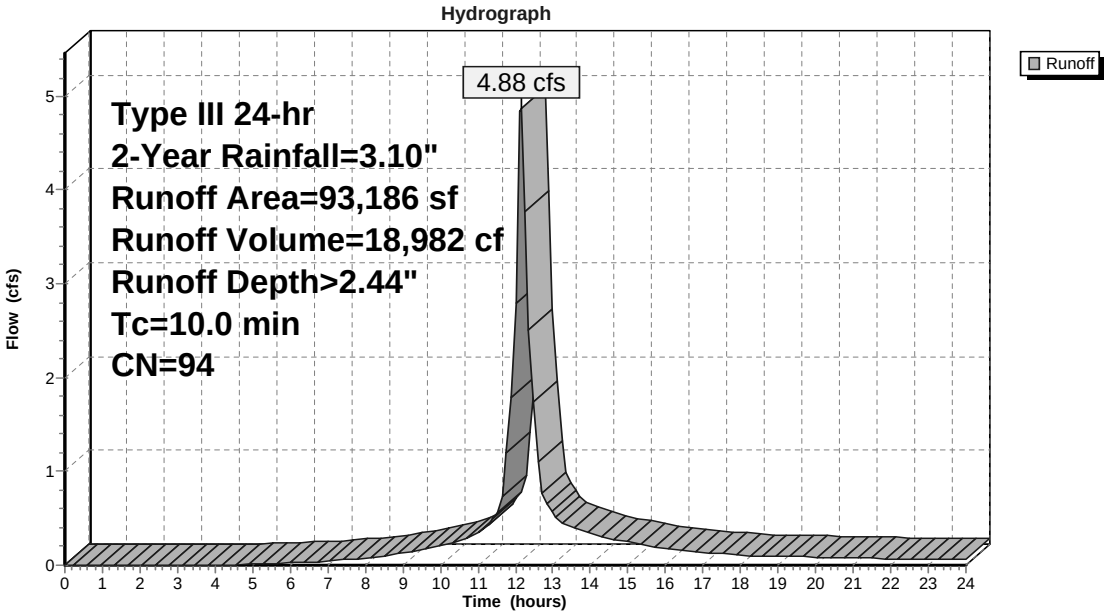
Runoff = 4.88 cfs @ 12.14 hrs, Volume= 18,982 cf, Depth> 2.44"
Routed to Pond ES : Offsite Swale to South Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
	6,343	86	<50% Grass cover, Poor, HSG C
	8,692	74	>75% Grass cover, Good, HSG C
	5,285	79	Woods/grass comb., Good, HSG D
*	72,866	98	Impervious
	93,186	94	Weighted Average
	20,320		21.81% Pervious Area
	72,866		78.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment E-1A: EX. WATERSHED



Summary for Subcatchment E-1B: EX. WATERSHED

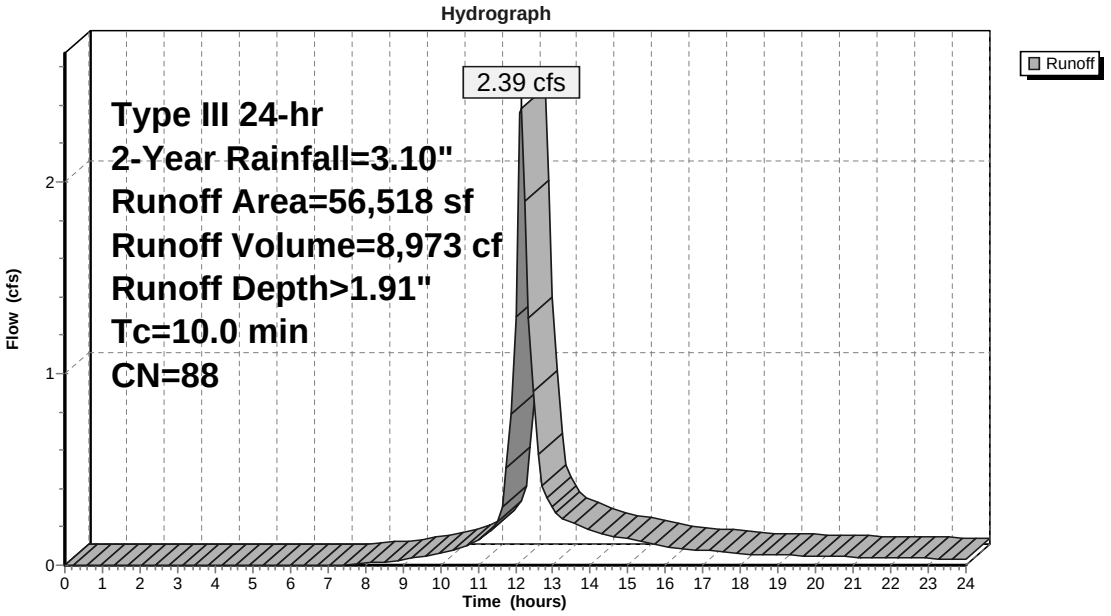
Runoff = 2.39 cfs @ 12.14 hrs, Volume= 8,973 cf, Depth> 1.91"
Routed to Pond ES : Offsite Swale to South Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
	3,722	86	<50% Grass cover, Poor, HSG C
	8,826	74	>75% Grass cover, Good, HSG C
	14,964	79	Woods/grass comb., Good, HSG D
*	29,006	98	Impervious
	56,518	88	Weighted Average
	27,512		48.68% Pervious Area
	29,006		51.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment E-1B: EX. WATERSHED



Summary for Subcatchment E-1C: EX. WATERSHED

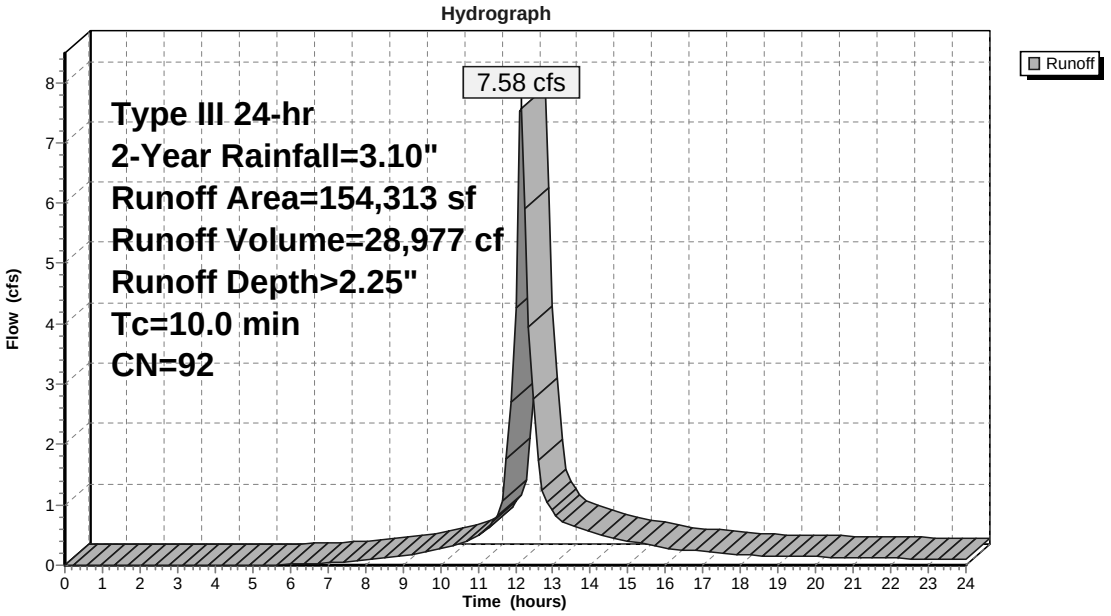
Runoff = 7.58 cfs @ 12.14 hrs, Volume= 28,977 cf, Depth> 2.25"
Routed to Pond ES : Offsite Swale to South Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
	3,840	86	<50% Grass cover, Poor, HSG C
	20,360	74	>75% Grass cover, Good, HSG C
	23,421	79	Woods/grass comb., Good, HSG D
*	106,692	98	Impervious
	154,313	92	Weighted Average
	47,621		30.86% Pervious Area
	106,692		69.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment E-1C: EX. WATERSHED



Summary for Subcatchment E-1D: EX. WATERSHED

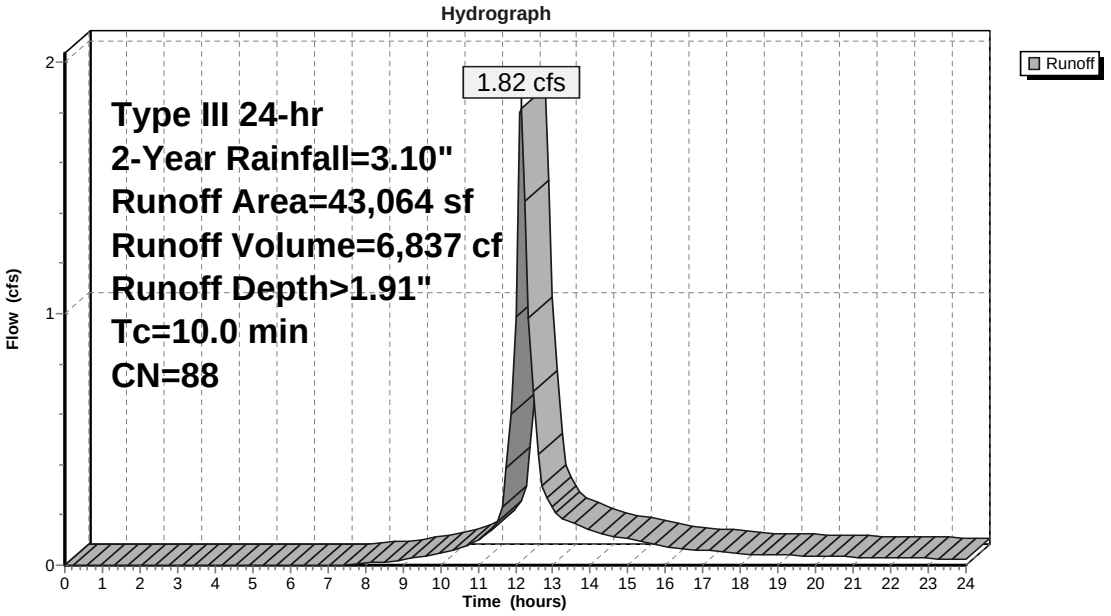
Runoff = 1.82 cfs @ 12.14 hrs, Volume= 6,837 cf, Depth> 1.91"
Routed to Pond ES : Offsite Swale to South Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
	5,705	86	<50% Grass cover, Poor, HSG C
	12,809	74	>75% Grass cover, Good, HSG C
	2,569	79	Woods/grass comb., Good, HSG D
*	21,981	98	Impervious
	43,064	88	Weighted Average
	21,083		48.96% Pervious Area
	21,981		51.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment E-1D: EX. WATERSHED



Summary for Subcatchment E-1E: EX. WATERSHED

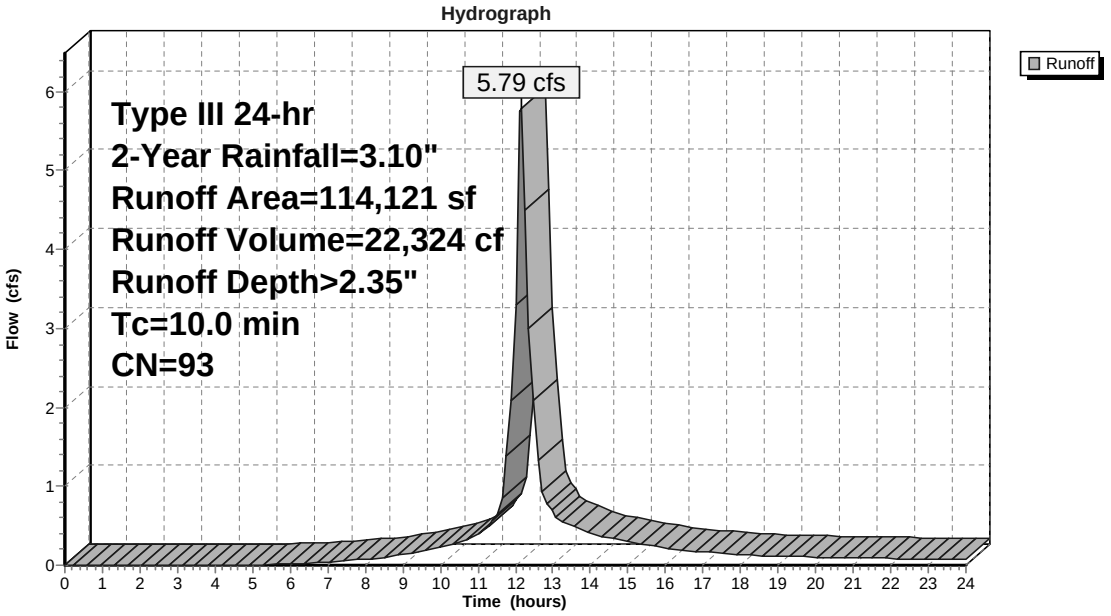
Runoff = 5.79 cfs @ 12.14 hrs, Volume= 22,324 cf, Depth> 2.35"
Routed to Pond ES : Offsite Swale to South Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
	6,384	86	<50% Grass cover, Poor, HSG C
	17,883	74	>75% Grass cover, Good, HSG C
	15,843	96	Gravel surface, HSG C
*	74,011	98	Impervious
	114,121	93	Weighted Average
	40,110		35.15% Pervious Area
	74,011		64.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment E-1E: EX. WATERSHED



Summary for Subcatchment E-2A: EX. WATERSHED

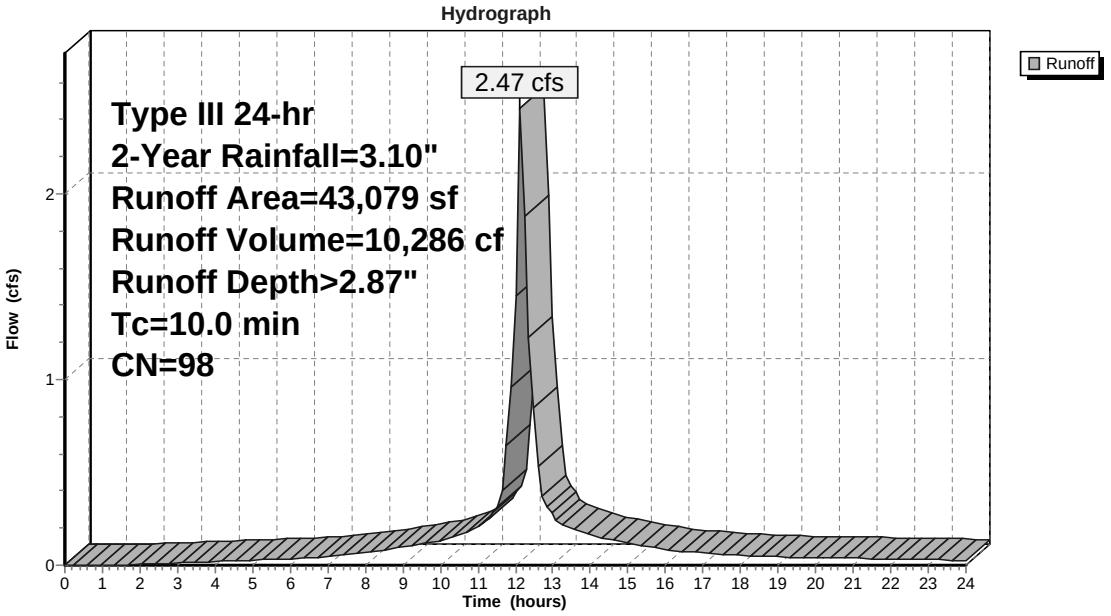
Runoff = 2.47 cfs @ 12.14 hrs, Volume= 10,286 cf, Depth> 2.87"
Routed to Pond P-2A : Parking Lot/Driveway

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
	1,483	86	<50% Grass cover, Poor, HSG C
*	41,596	98	Impervious
	43,079	98	Weighted Average
	1,483		3.44% Pervious Area
	41,596		96.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment E-2A: EX. WATERSHED



Summary for Subcatchment E-2B: EX. WATERSHED

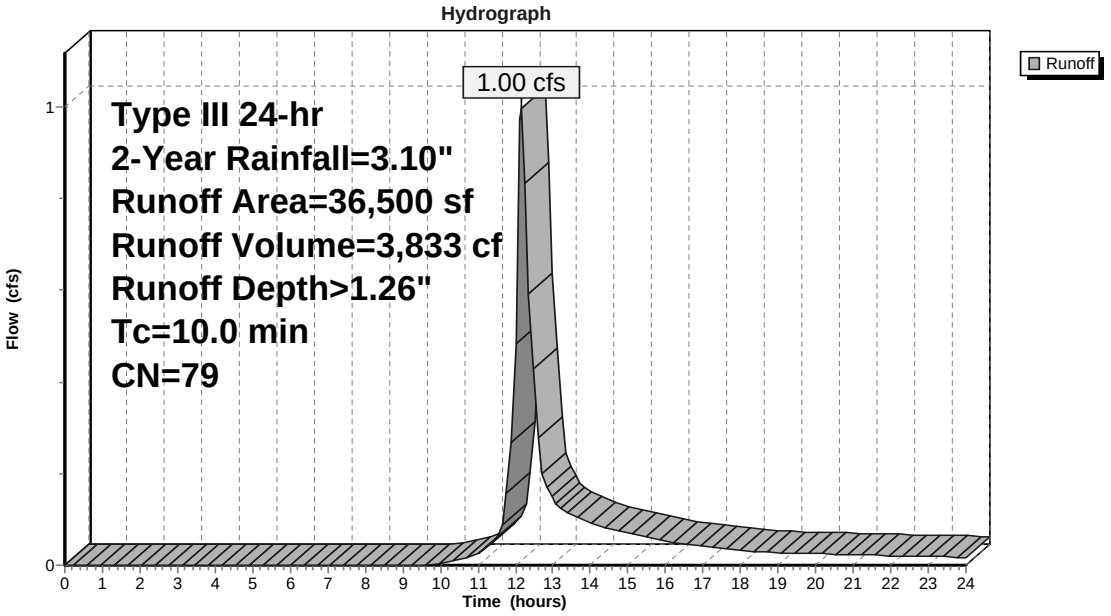
Runoff = 1.00 cfs @ 12.15 hrs, Volume= 3,833 cf, Depth> 1.26"
Routed to Link SP-1 : STUDY POINT #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
	1,043	86	<50% Grass cover, Poor, HSG C
	28,476	74	>75% Grass cover, Good, HSG C
*	6,981	98	Impervious
	36,500	79	Weighted Average
	29,519		80.87% Pervious Area
	6,981		19.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment E-2B: EX. WATERSHED



Summary for Subcatchment E-2C: EX. WATERSHED

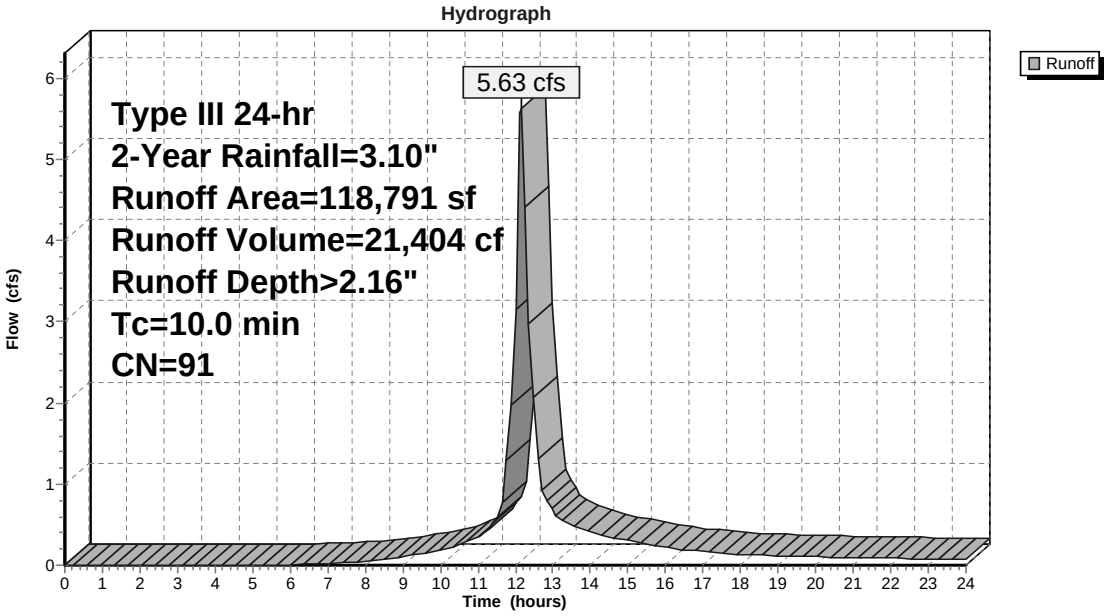
Runoff = 5.63 cfs @ 12.14 hrs, Volume= 21,404 cf, Depth> 2.16"
Routed to Pond P-2C : EX. INFILTRTATION BASIN

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
	2,816	86	<50% Grass cover, Poor, HSG C
	31,699	74	>75% Grass cover, Good, HSG C
*	84,276	98	Impervious
	118,791	91	Weighted Average
	34,515		29.06% Pervious Area
	84,276		70.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment E-2C: EX. WATERSHED



Summary for Subcatchment E-3: EX. WATERSHED

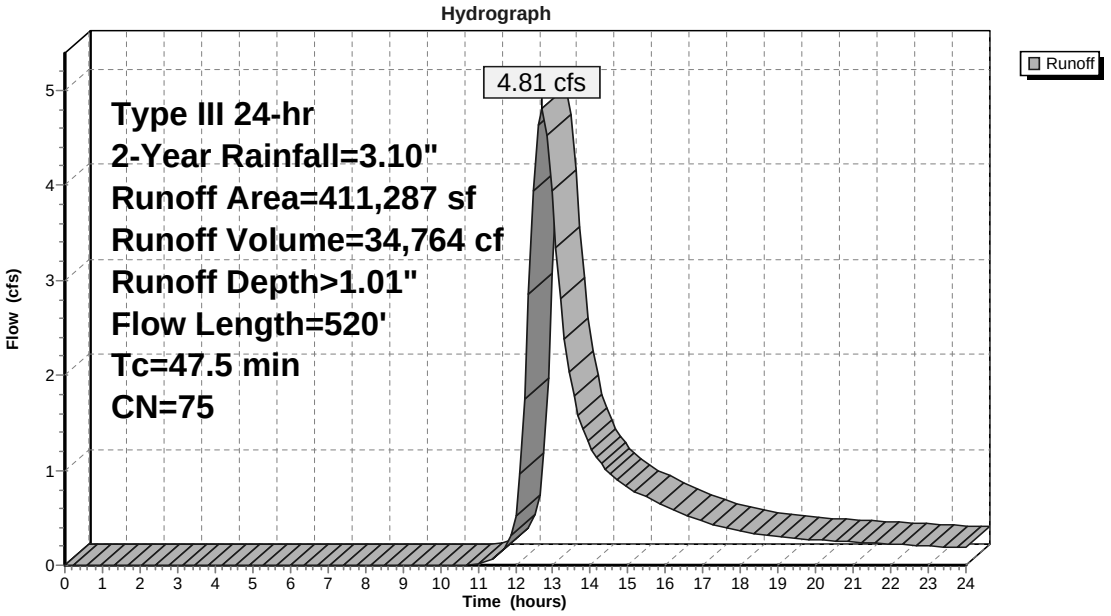
Runoff = 4.81 cfs @ 12.70 hrs, Volume= 34,764 cf, Depth> 1.01"
Routed to Pond EW : Wetland to East Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
	242,101	77	Woods, Good, HSG D
*	9,389	98	Impervious
	150,817	70	Woods, Good, HSG C
	8,980	74	>75% Grass cover, Good, HSG C
	411,287	75	Weighted Average
	401,898		97.72% Pervious Area
	9,389		2.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.3	100	0.0100	0.06		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
1.3	40	0.0100	0.50		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
17.9	380	0.0050	0.35		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
47.5	520	Total			

Subcatchment E-3: EX. WATERSHED



Summary for Pond ES: Offsite Swale to South Culvert

Inflow Area = 461,202 sf, 66.04% Impervious, Inflow Depth > 2.24" for 2-Year event
Inflow = 22.44 cfs @ 12.14 hrs, Volume= 86,092 cf
Outflow = 5.28 cfs @ 12.62 hrs, Volume= 60,562 cf, Atten= 76%, Lag= 28.7 min
Primary = 5.28 cfs @ 12.62 hrs, Volume= 60,562 cf
Routed to Link SP-1 : STUDY POINT #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs / 2
Peak Elev= 80.62' @ 12.62 hrs Surf.Area= 48,224 sf Storage= 44,993 cf

Plug-Flow detention time= 207.2 min calculated for 60,562 cf (70% of inflow)
Center-of-Mass det. time= 116.3 min (917.7 - 801.4)

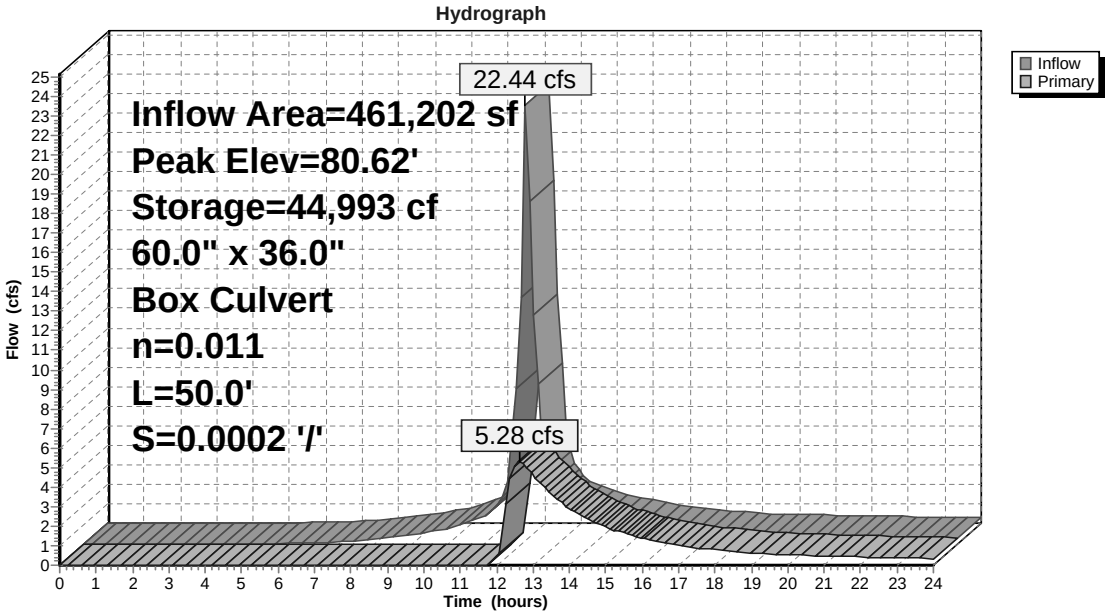
Volume	Invert	Avail.Storage	Storage Description
#1	79.00'	136,108 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
79.00	17,000	1,200.0	0	0	17,000
80.00	27,000	4,000.0	21,808	21,808	1,175,651
81.00	63,900	4,200.0	44,146	65,954	1,306,222
82.00	76,600	4,250.0	70,154	136,108	1,340,108

Device	Routing	Invert	Outlet Devices
#1	Primary	80.00'	**60.0" W x 36.0" H Box Culvert** L= 50.0' Box, headwall w/3 square edges, Ke= 0.500 Inlet / Outlet Invert= 80.00' / 79.99' S= 0.0002 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 15.00 sf

Primary OutFlow Max=5.26 cfs @ 12.62 hrs HW=80.62' TW=0.00' (Dynamic Tailwater)
↑**1=Culvert** (Barrel Controls 5.26 cfs @ 2.25 fps)

Pond ES: Offsite Swale to South Culvert



Summary for Pond EW: Wetland to East Culvert

Inflow Area = 411,287 sf, 2.28% Impervious, Inflow Depth > 1.01" for 2-Year event
Inflow = 4.81 cfs @ 12.70 hrs, Volume= 34,764 cf
Outflow = 0.09 cfs @ 24.00 hrs, Volume= 1,939 cf, Atten= 98%, Lag= 677.7 min
Primary = 0.09 cfs @ 24.00 hrs, Volume= 1,939 cf
Routed to Link SP-1 : STUDY POINT #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs / 2
Peak Elev= 80.47' @ 24.00 hrs Surf.Area= 90,898 sf Storage= 32,806 cf

Plug-Flow detention time= 507.1 min calculated for 1,929 cf (6% of inflow)
Center-of-Mass det. time= 340.9 min (1,233.1 - 892.2)

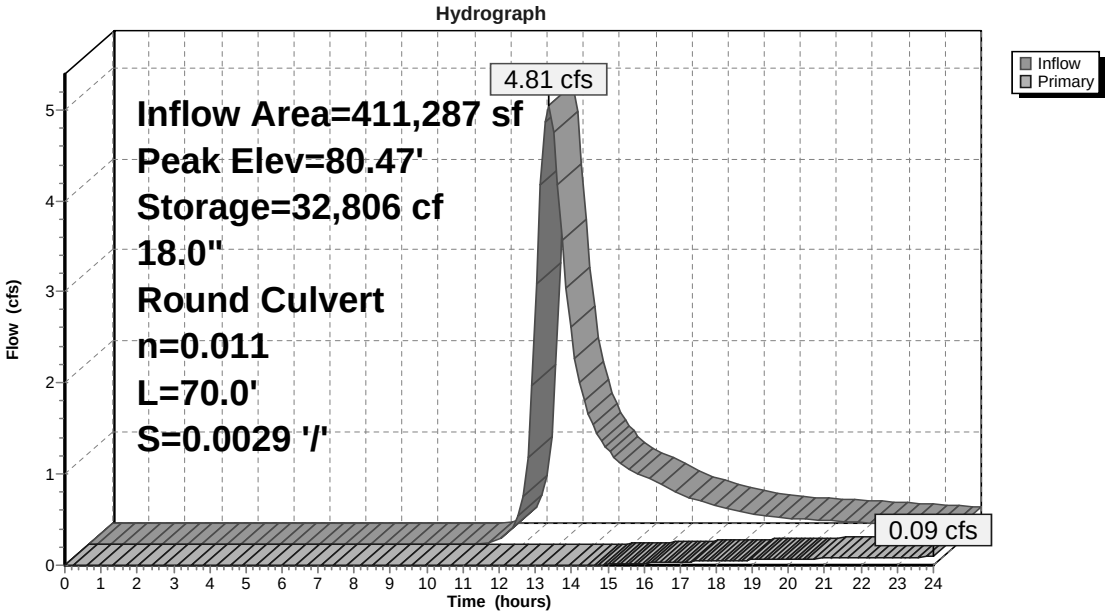
Volume	Invert	Avail.Storage	Storage Description
#1	80.00'	290,435 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
80.00	52,000	1,200.0	0	0	52,000
81.00	149,000	2,600.0	96,341	96,341	475,356
82.00	243,000	4,300.0	194,094	290,435	1,408,807

Device	Routing	Invert	Outlet Devices
#1	Primary	80.30'	**18.0" Round Culvert** L= 70.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 80.30' / 80.10' S= 0.0029 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.77 sf

Primary OutFlow Max=0.09 cfs @ 24.00 hrs HW=80.47' TW=0.00' (Dynamic Tailwater)
1=Culvert (Barrel Controls 0.09 cfs @ 1.33 fps)

Pond EW: Wetland to East Culvert



Summary for Pond OFFSITE: OFFSITE PONDING AREA IN GRASS

Inflow Area = 118,791 sf, 70.94% Impervious, Inflow Depth > 1.75" for 2-Year event
Inflow = 5.17 cfs @ 12.19 hrs, Volume= 17,353 cf
Outflow = 5.15 cfs @ 12.23 hrs, Volume= 17,144 cf, Atten= 0%, Lag= 2.3 min
Primary = 5.15 cfs @ 12.23 hrs, Volume= 17,144 cf
Routed to Link SP-1 : STUDY POINT #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs / 2
Peak Elev= 82.73' @ 12.23 hrs Surf.Area= 4,997 sf Storage= 1,656 cf

Plug-Flow detention time= 18.3 min calculated for 17,059 cf (98% of inflow)
Center-of-Mass det. time= 11.5 min (825.9 - 814.4)

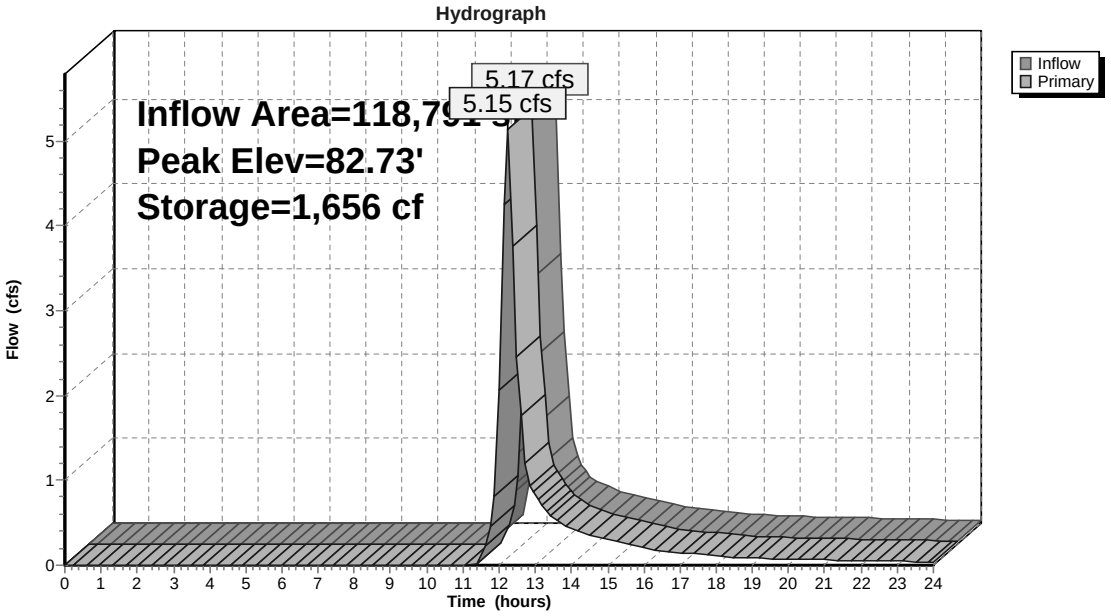
Volume	Invert	Avail.Storage	Storage Description
#1	82.10'	3,254 cf	**OFFSITE PONDING AREA (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
82.10	230	0	0
83.00	7,000	3,254	3,254

Device	Routing	Invert	Outlet Devices
#1	Primary	82.27'	**8.0" Round (3) 8" HDPE X 3.00 w/ 2.0" inside fill** L= 21.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 82.10' / 81.40' S= 0.0333 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.28 sf
#2	Primary	82.60'	**30.0' long x 10.0' breadth WEIR FLOW OVER WALKING PATH** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=5.03 cfs @ 12.23 hrs HW=82.73' TW=0.00' (Dynamic Tailwater)
↑**1=(3) 8" HDPE** (Inlet Controls 1.48 cfs @ 1.81 fps)
└**2=WEIR FLOW OVER WALKING PATH** (Weir Controls 3.55 cfs @ 0.90 fps)

Pond OFFSITE: OFFSITE PONDING AREA IN GRASS



Summary for Pond P-2A: Parking Lot/Driveway

Inflow Area = 43,079 sf, 96.56% Impervious, Inflow Depth > 2.87" for 2-Year event
Inflow = 2.47 cfs @ 12.14 hrs, Volume= 10,286 cf
Outflow = 2.37 cfs @ 12.14 hrs, Volume= 10,284 cf, Atten= 4%, Lag= 0.4 min
Primary = 2.37 cfs @ 12.14 hrs, Volume= 10,284 cf
Routed to Link SP-1 : STUDY POINT #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs / 2
Peak Elev= 84.03' @ 12.14 hrs Surf.Area= 504 sf Storage= 52 cf

Plug-Flow detention time= 0.6 min calculated for 10,284 cf (100% of inflow)
Center-of-Mass det. time= 0.5 min (760.6 - 760.2)

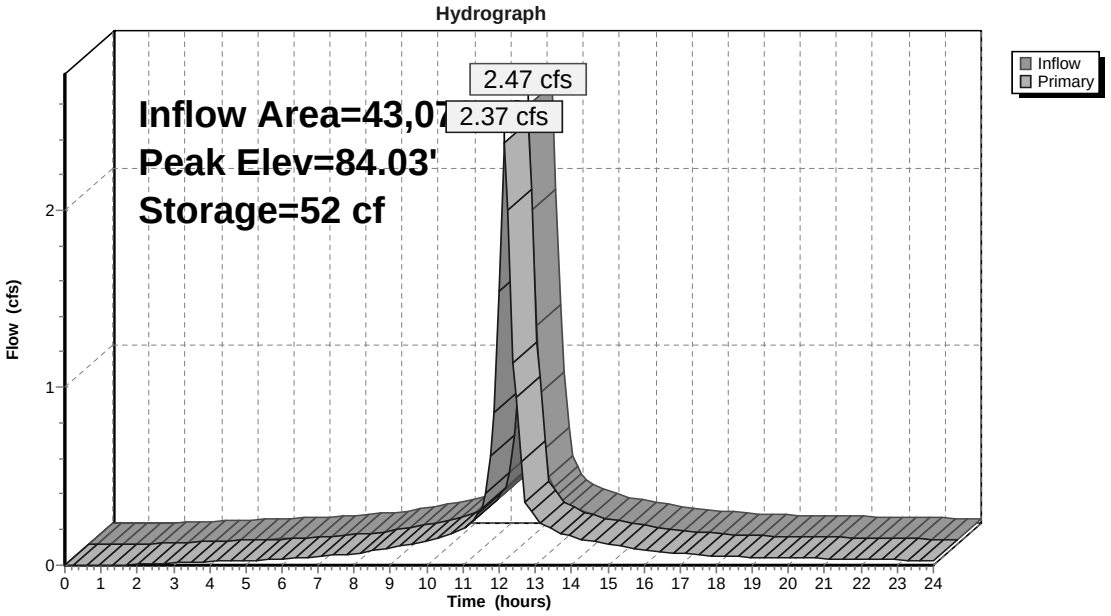
Volume	Invert	Avail.Storage	Storage Description
#1	82.38'	14 cf	**4.00'D x 1.10'H Ex.CB**
#2	83.45'	1,680 cf	**Parking/Driveway (Prismatic)**Listed below (Recalc)
		1,694 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
83.45	4	0	0
84.00	103	29	29
84.50	6,500	1,651	1,680

Device	Routing	Invert	Outlet Devices
#1	Primary	82.46'	**6.0" Round 6"PVC w/ 1.0" inside fill** L= 170.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 82.38' / 81.00' S= 0.0081 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.17 sf
#2	Primary	84.00'	**120.0' long x 50.0' breadth Weir Flow Over Curb Towards Lake** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=2.28 cfs @ 12.14 hrs HW=84.03' TW=0.00' (Dynamic Tailwater)
1=6"PVC (Barrel Controls 0.68 cfs @ 3.88 fps)
2=Weir Flow Over Curb Towards Lake (Weir Controls 1.60 cfs @ 0.46 fps)

Pond P-2A: Parking Lot/Driveway



Summary for Pond P-2C: EX. INFILTRTATION BASIN

Inflow Area = 118,791 sf, 70.94% Impervious, Inflow Depth > 2.16" for 2-Year event
Inflow = 5.63 cfs @ 12.14 hrs, Volume= 21,404 cf
Outflow = 5.21 cfs @ 12.19 hrs, Volume= 19,267 cf, Atten= 7%, Lag= 2.8 min
Discarded = 0.04 cfs @ 12.19 hrs, Volume= 1,914 cf
Primary = 5.17 cfs @ 12.19 hrs, Volume= 17,353 cf
Routed to Pond OFFSITE : OFFSITE PONDING AREA IN GRASS

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs / 2
Peak Elev= 83.41' @ 12.19 hrs Surf.Area= 6,692 sf Storage= 2,820 cf
Flood Elev= 83.30' Surf.Area= 5,645 sf Storage= 2,114 cf

Plug-Flow detention time= 72.1 min calculated for 19,171 cf (90% of inflow)
Center-of-Mass det. time= 25.5 min (832.2 - 806.7)

Volume	Invert	Avail.Storage	Storage Description
#1	82.50'	8,308 cf	**EX. INFILTRATION BASIN (Prismatic)**Listed below (Recalc)

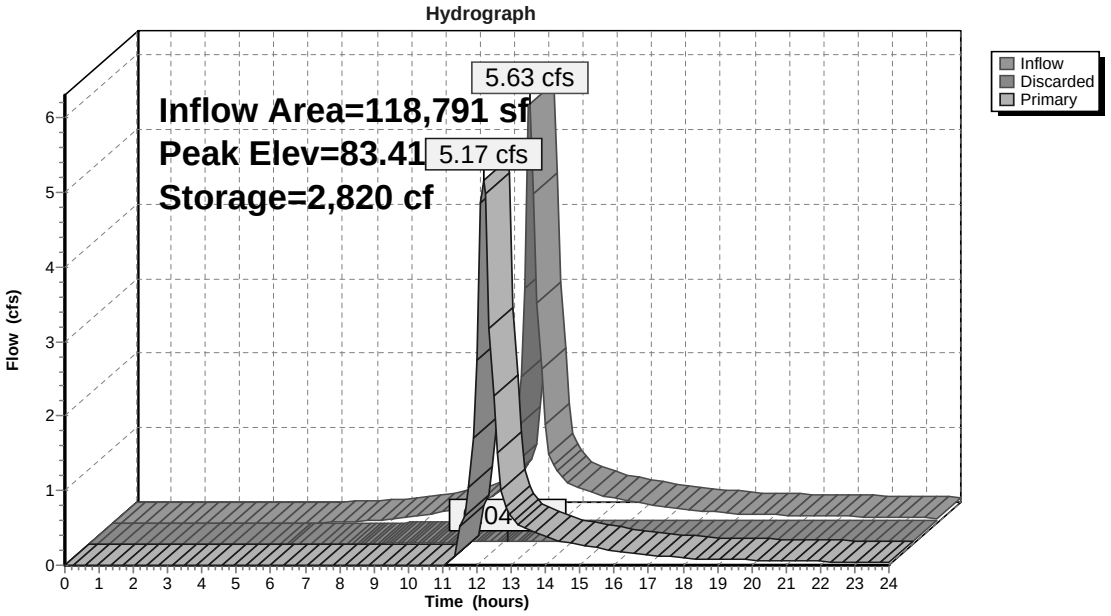
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
82.50	430	0	0
83.00	2,900	833	833
84.00	12,050	7,475	8,308

Device	Routing	Invert	Outlet Devices
#1	Primary	83.30'	**50.0' long x 60.0' breadth GRASS/LAWN AREA** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Discarded	82.50'	**0.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 12.19 hrs HW=83.41' (Free Discharge)
2=Exfiltration (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=4.93 cfs @ 12.19 hrs HW=83.41' TW=82.72' (Dynamic Tailwater)
1=GRASS/LAWN AREA (Weir Controls 4.93 cfs @ 0.89 fps)

Pond P-2C: EX. INFILTRTATION BASIN

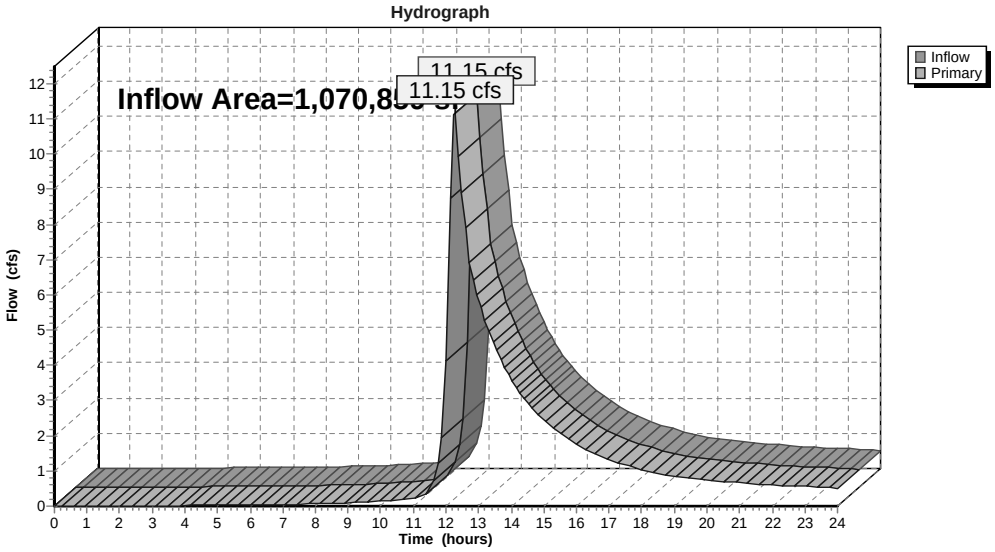


Summary for Link SP-1: STUDY POINT #1

Inflow Area = 1,070,859 sf, 41.72% Impervious, Inflow Depth > 1.05" for 2-Year event
Inflow = 11.15 cfs @ 12.26 hrs, Volume= 93,763 cf
Primary = 11.15 cfs @ 12.26 hrs, Volume= 93,763 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs

Link SP-1: STUDY POINT #1



Summary for Subcatchment E-1A: EX. WATERSHED

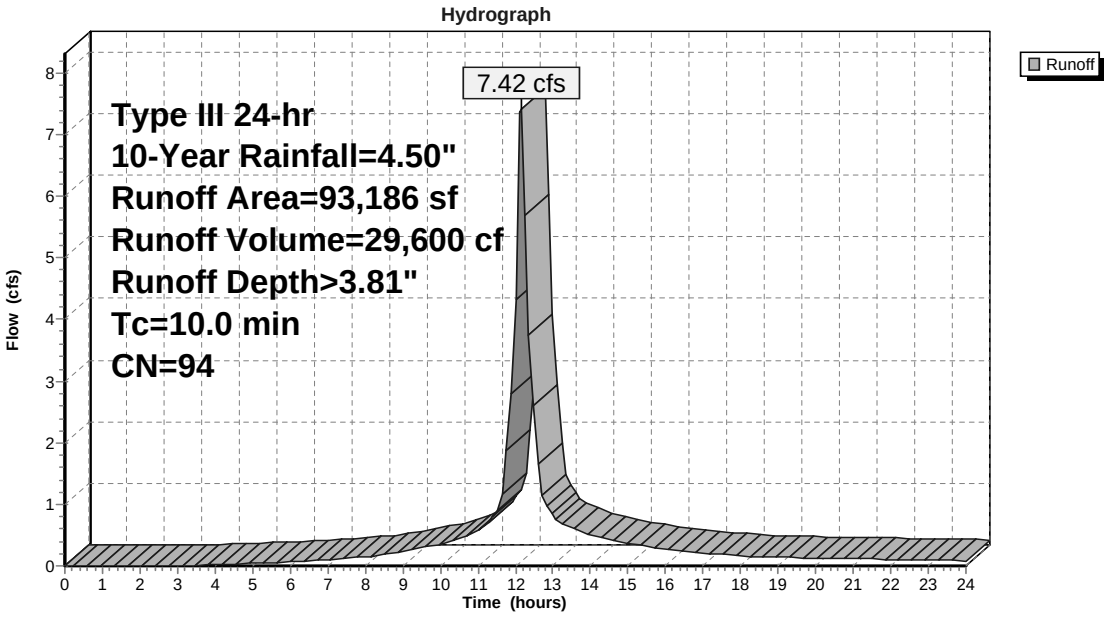
Runoff = 7.42 cfs @ 12.14 hrs, Volume= 29,600 cf, Depth> 3.81"
Routed to Pond ES : Offsite Swale to South Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
	6,343	86	<50% Grass cover, Poor, HSG C
	8,692	74	>75% Grass cover, Good, HSG C
	5,285	79	Woods/grass comb., Good, HSG D
*	72,866	98	Impervious
	93,186	94	Weighted Average
	20,320		21.81% Pervious Area
	72,866		78.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment E-1A: EX. WATERSHED



Summary for Subcatchment E-1B: EX. WATERSHED

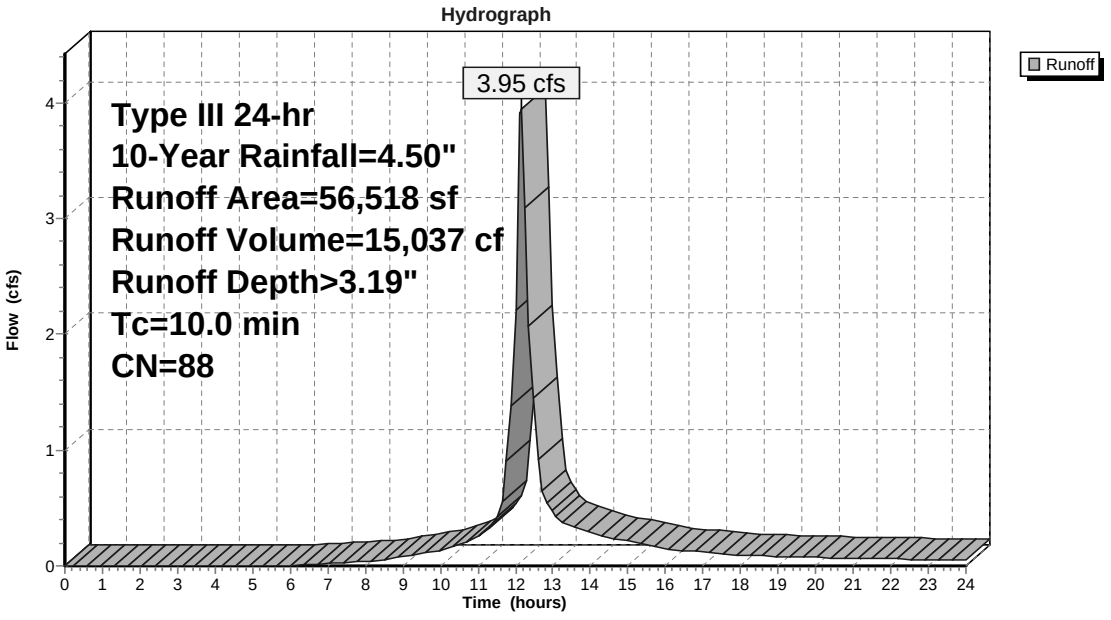
Runoff = 3.95 cfs @ 12.14 hrs, Volume= 15,037 cf, Depth> 3.19"
Routed to Pond ES : Offsite Swale to South Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
	3,722	86	<50% Grass cover, Poor, HSG C
	8,826	74	>75% Grass cover, Good, HSG C
	14,964	79	Woods/grass comb., Good, HSG D
*	29,006	98	Impervious
	56,518	88	Weighted Average
	27,512		48.68% Pervious Area
	29,006		51.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment E-1B: EX. WATERSHED



Summary for Subcatchment E-1C: EX. WATERSHED

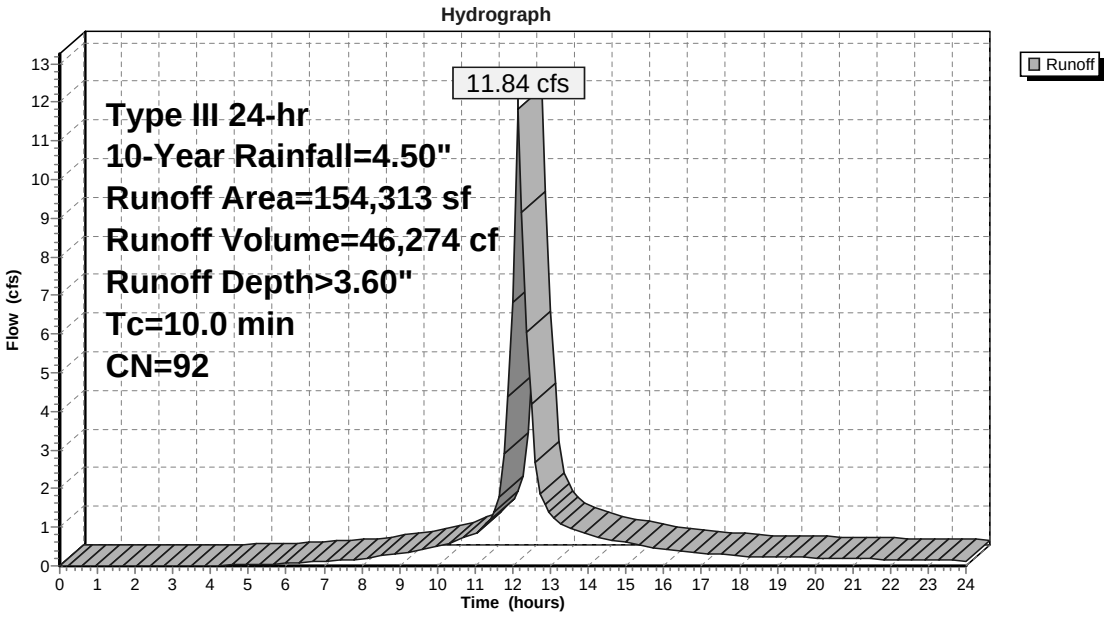
Runoff = 11.84 cfs @ 12.14 hrs, Volume= 46,274 cf, Depth> 3.60"
Routed to Pond ES : Offsite Swale to South Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
	3,840	86	<50% Grass cover, Poor, HSG C
	20,360	74	>75% Grass cover, Good, HSG C
	23,421	79	Woods/grass comb., Good, HSG D
*	106,692	98	Impervious
	154,313	92	Weighted Average
	47,621		30.86% Pervious Area
	106,692		69.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment E-1C: EX. WATERSHED



Summary for Subcatchment E-1D: EX. WATERSHED

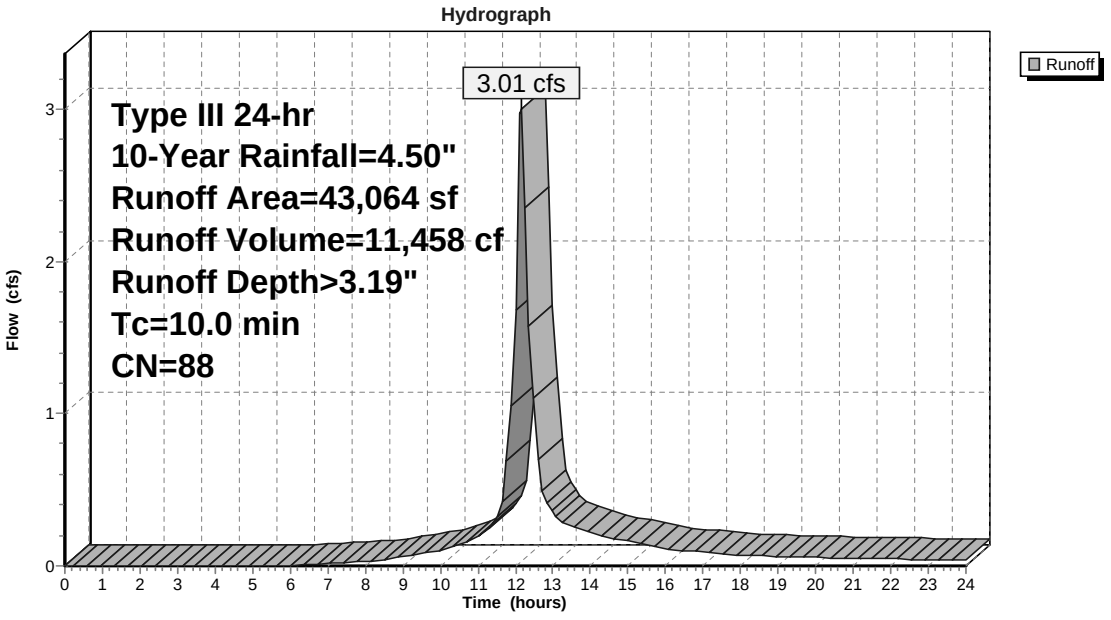
Runoff = 3.01 cfs @ 12.14 hrs, Volume= 11,458 cf, Depth> 3.19"
Routed to Pond ES : Offsite Swale to South Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
	5,705	86	<50% Grass cover, Poor, HSG C
	12,809	74	>75% Grass cover, Good, HSG C
	2,569	79	Woods/grass comb., Good, HSG D
*	21,981	98	Impervious
	43,064	88	Weighted Average
	21,083		48.96% Pervious Area
	21,981		51.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment E-1D: EX. WATERSHED



Summary for Subcatchment E-1E: EX. WATERSHED

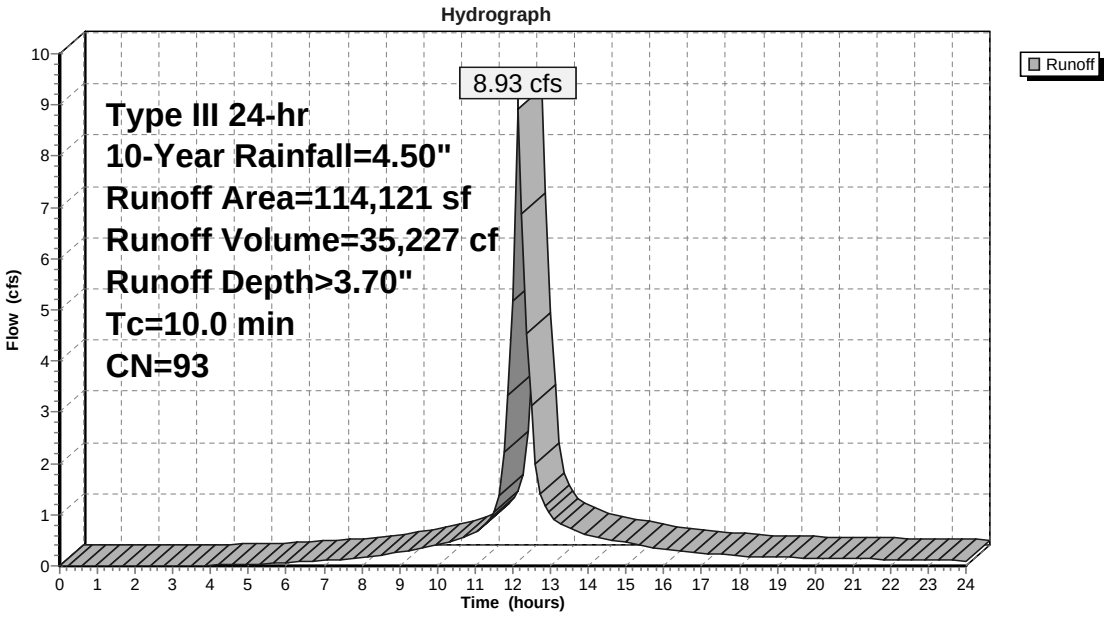
Runoff = 8.93 cfs @ 12.14 hrs, Volume= 35,227 cf, Depth> 3.70"
Routed to Pond ES : Offsite Swale to South Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
	6,384	86	<50% Grass cover, Poor, HSG C
	17,883	74	>75% Grass cover, Good, HSG C
	15,843	96	Gravel surface, HSG C
*	74,011	98	Impervious
	114,121	93	Weighted Average
	40,110		35.15% Pervious Area
	74,011		64.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment E-1E: EX. WATERSHED



Summary for Subcatchment E-2A: EX. WATERSHED

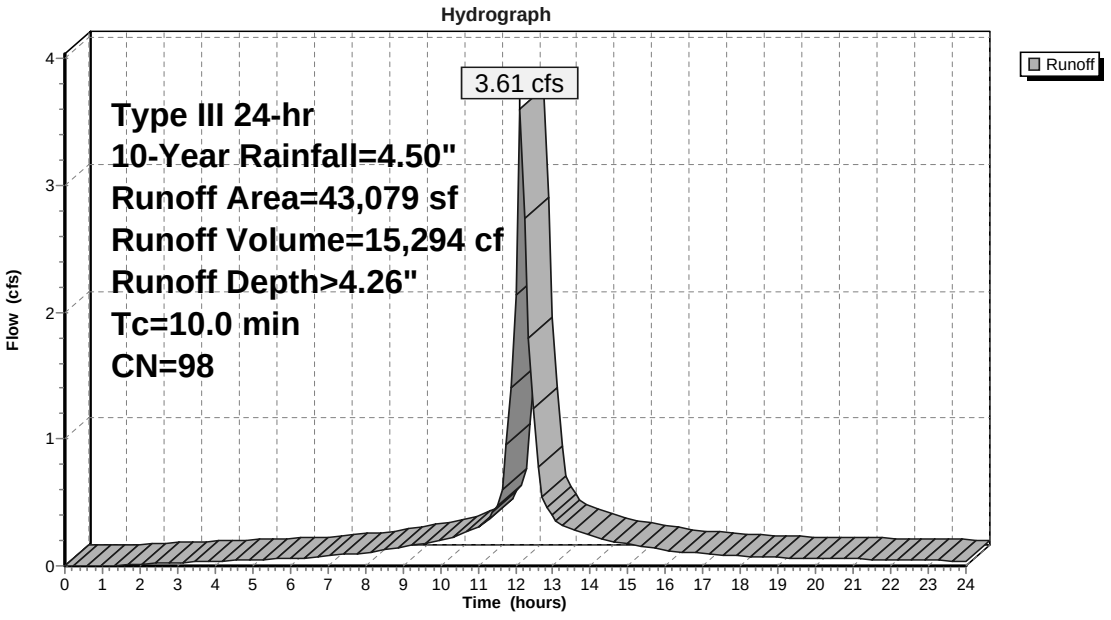
Runoff = 3.61 cfs @ 12.14 hrs, Volume= 15,294 cf, Depth> 4.26"
Routed to Pond P-2A : Parking Lot/Driveway

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
	1,483	86	<50% Grass cover, Poor, HSG C
*	41,596	98	Impervious
	43,079	98	Weighted Average
	1,483		3.44% Pervious Area
	41,596		96.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment E-2A: EX. WATERSHED



Summary for Subcatchment E-2B: EX. WATERSHED

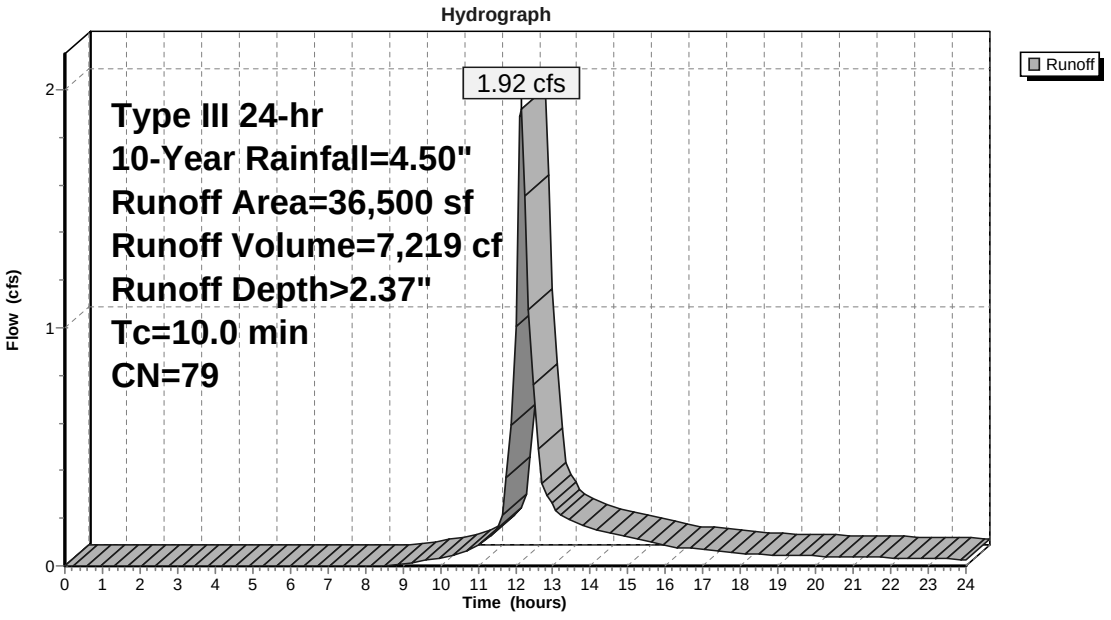
Runoff = 1.92 cfs @ 12.15 hrs, Volume= 7,219 cf, Depth> 2.37"
Routed to Link SP-1 : STUDY POINT #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
	1,043	86	<50% Grass cover, Poor, HSG C
	28,476	74	>75% Grass cover, Good, HSG C
*	6,981	98	Impervious
	36,500	79	Weighted Average
	29,519		80.87% Pervious Area
	6,981		19.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment E-2B: EX. WATERSHED



Summary for Subcatchment E-2C: EX. WATERSHED

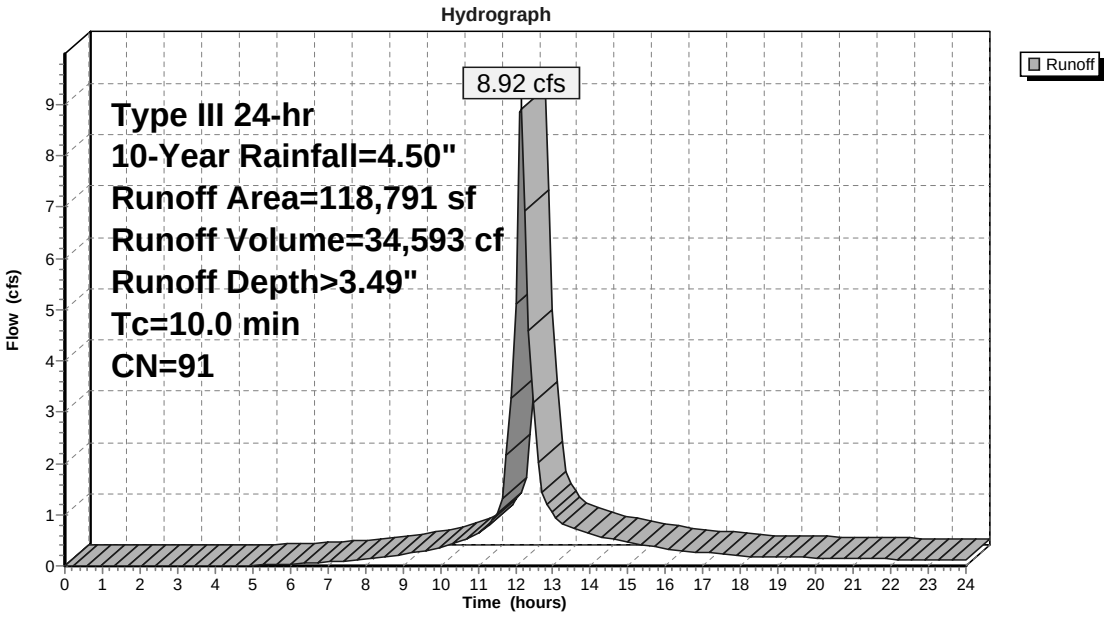
Runoff = 8.92 cfs @ 12.14 hrs, Volume= 34,593 cf, Depth> 3.49"
Routed to Pond P-2C : EX. INFILTRTATION BASIN

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
	2,816	86	<50% Grass cover, Poor, HSG C
	31,699	74	>75% Grass cover, Good, HSG C
*	84,276	98	Impervious
	118,791	91	Weighted Average
	34,515		29.06% Pervious Area
	84,276		70.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment E-2C: EX. WATERSHED



Summary for Subcatchment E-3: EX. WATERSHED

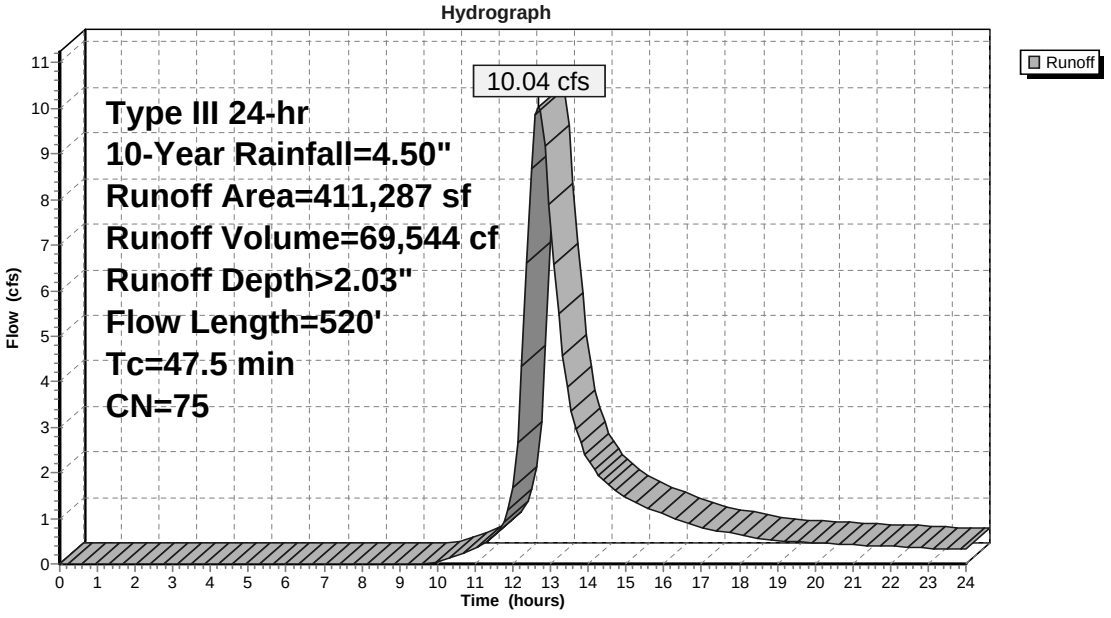
Runoff = 10.04 cfs @ 12.67 hrs, Volume= 69,544 cf, Depth> 2.03"
Routed to Pond EW : Wetland to East Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
	242,101	77	Woods, Good, HSG D
*	9,389	98	Impervious
	150,817	70	Woods, Good, HSG C
	8,980	74	>75% Grass cover, Good, HSG C
	411,287	75	Weighted Average
	401,898		97.72% Pervious Area
	9,389		2.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.3	100	0.0100	0.06		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
1.3	40	0.0100	0.50		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
17.9	380	0.0050	0.35		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
47.5	520	Total			

Subcatchment E-3: EX. WATERSHED



Summary for Pond ES: Offsite Swale to South Culvert

Inflow Area = 461,202 sf, 66.04% Impervious, Inflow Depth > 3.58" for 10-Year event
Inflow = 35.14 cfs @ 12.14 hrs, Volume= 137,597 cf
Outflow = 11.18 cfs @ 12.52 hrs, Volume= 111,164 cf, Atten= 68%, Lag= 22.8 min
Primary = 11.18 cfs @ 12.52 hrs, Volume= 111,164 cf
Routed to Link SP-1 : STUDY POINT #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs / 2
Peak Elev= 81.00' @ 12.52 hrs Surf.Area= 63,796 sf Storage= 65,805 cf

Plug-Flow detention time= 171.3 min calculated for 111,164 cf (81% of inflow)
Center-of-Mass det. time= 99.1 min (888.0 - 788.9)

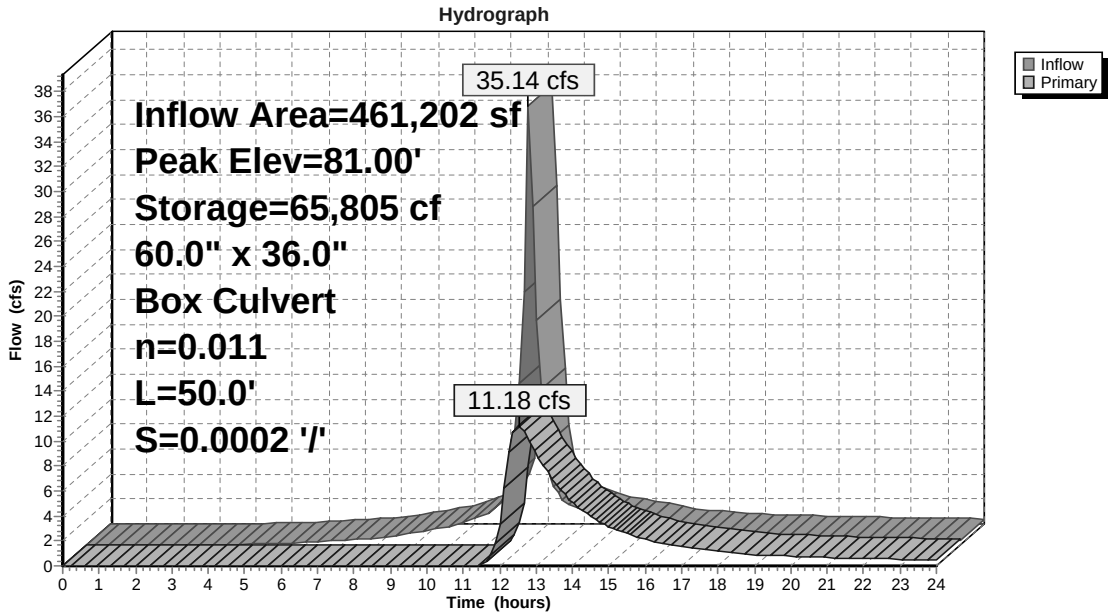
Volume	Invert	Avail.Storage	Storage Description
#1	79.00'	136,108 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
79.00	17,000	1,200.0	0	0	17,000
80.00	27,000	4,000.0	21,808	21,808	1,175,651
81.00	63,900	4,200.0	44,146	65,954	1,306,222
82.00	76,600	4,250.0	70,154	136,108	1,340,108

Device	Routing	Invert	Outlet Devices
#1	Primary	80.00'	**60.0" W x 36.0" H Box Culvert** L= 50.0' Box, headwall w/3 square edges, Ke= 0.500 Inlet / Outlet Invert= 80.00' / 79.99' S= 0.0002 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 15.00 sf

Primary OutFlow Max=11.11 cfs @ 12.52 hrs HW=80.99' TW=0.00' (Dynamic Tailwater)
1=Culvert (Barrel Controls 11.11 cfs @ 2.98 fps)

Pond ES: Offsite Swale to South Culvert



Summary for Pond EW: Wetland to East Culvert

Inflow Area = 411,287 sf, 2.28% Impervious, Inflow Depth > 2.03" for 10-Year event
Inflow = 10.04 cfs @ 12.67 hrs, Volume= 69,544 cf
Outflow = 0.49 cfs @ 19.47 hrs, Volume= 16,913 cf, Atten= 95%, Lag= 407.7 min
Primary = 0.49 cfs @ 19.47 hrs, Volume= 16,913 cf
Routed to Link SP-1 : STUDY POINT #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs / 2
Peak Elev= 80.67' @ 19.47 hrs Surf.Area= 111,949 sf Storage= 54,017 cf

Plug-Flow detention time= 411.5 min calculated for 16,913 cf (24% of inflow)
Center-of-Mass det. time= 272.7 min (1,145.0 - 872.3)

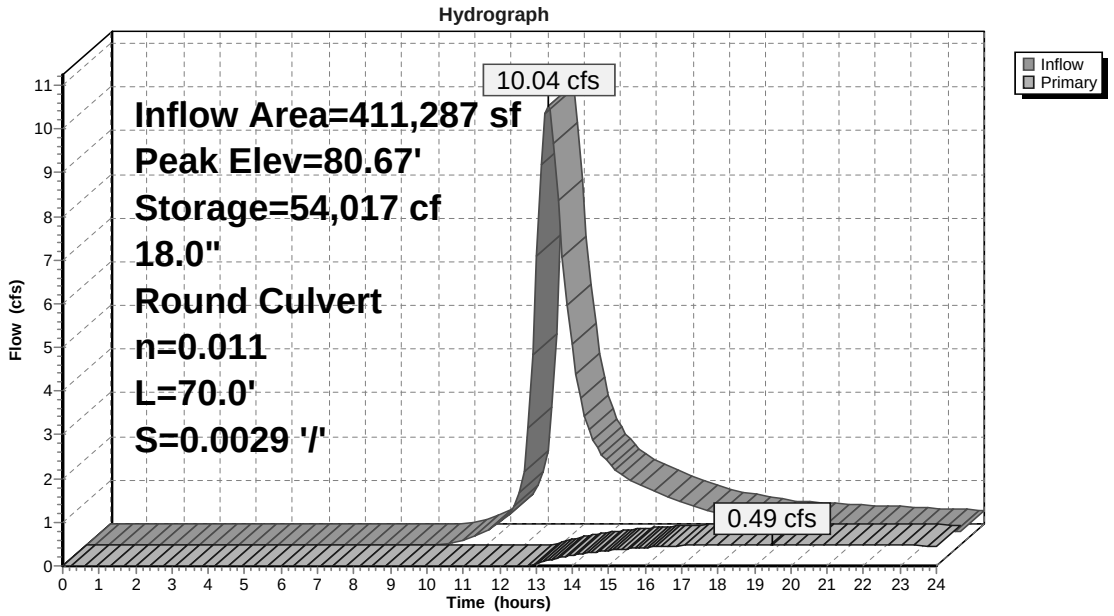
Volume	Invert	Avail.Storage	Storage Description
#1	80.00'	290,435 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
80.00	52,000	1,200.0	0	0	52,000
81.00	149,000	2,600.0	96,341	96,341	475,356
82.00	243,000	4,300.0	194,094	290,435	1,408,807

Device	Routing	Invert	Outlet Devices
#1	Primary	80.30'	**18.0" Round Culvert** L= 70.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 80.30' / 80.10' S= 0.0029 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.77 sf

Primary OutFlow Max=0.49 cfs @ 19.47 hrs HW=80.67' TW=0.00' (Dynamic Tailwater)
1=Culvert (Barrel Controls 0.49 cfs @ 2.14 fps)

Pond EW: Wetland to East Culvert



Summary for Pond OFFSITE: OFFSITE PONDING AREA IN GRASS

Inflow Area = 118,791 sf, 70.94% Impervious, Inflow Depth > 3.06" for 10-Year event
Inflow = 8.26 cfs @ 12.18 hrs, Volume= 30,319 cf
Outflow = 8.21 cfs @ 12.22 hrs, Volume= 30,068 cf, Atten= 1%, Lag= 2.5 min
Primary = 8.21 cfs @ 12.22 hrs, Volume= 30,068 cf
Routed to Link SP-1 : STUDY POINT #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs / 2
Peak Elev= 82.80' @ 12.22 hrs Surf.Area= 5,468 sf Storage= 1,984 cf

Plug-Flow detention time= 15.0 min calculated for 30,068 cf (99% of inflow)
Center-of-Mass det. time= 9.9 min (814.8 - 804.8)

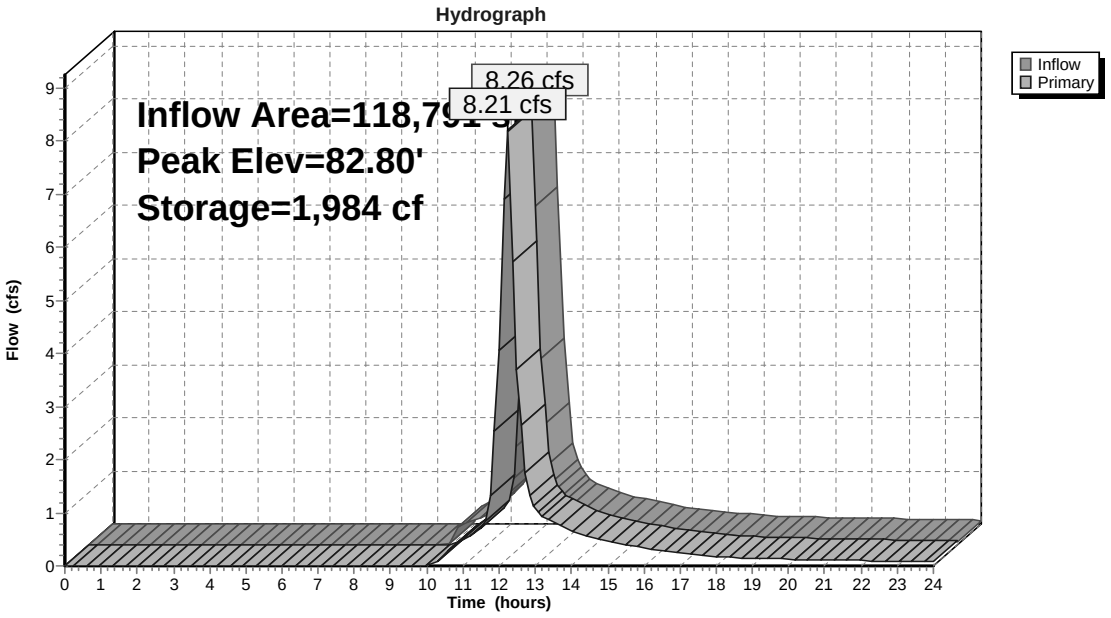
Volume	Invert	Avail.Storage	Storage Description
#1	82.10'	3,254 cf	**OFFSITE PONDING AREA (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
82.10	230	0	0
83.00	7,000	3,254	3,254

Device	Routing	Invert	Outlet Devices
#1	Primary	82.27'	**8.0" Round (3) 8" HDPE X 3.00 w/ 2.0" inside fill** L= 21.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 82.10' / 81.40' S= 0.0333 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.28 sf
#2	Primary	82.60'	**30.0' long x 10.0' breadth WEIR FLOW OVER WALKING PATH** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=7.96 cfs @ 12.22 hrs HW=82.79' TW=0.00' (Dynamic Tailwater)
1=(3) 8" HDPE (Inlet Controls 1.71 cfs @ 2.02 fps)
2=WEIR FLOW OVER WALKING PATH (Weir Controls 6.26 cfs @ 1.09 fps)

Pond OFFSITE: OFFSITE PONDING AREA IN GRASS



Summary for Pond P-2A: Parking Lot/Driveway

Inflow Area = 43,079 sf, 96.56% Impervious, Inflow Depth > 4.26" for 10-Year event
Inflow = 3.61 cfs @ 12.14 hrs, Volume= 15,294 cf
Outflow = 3.69 cfs @ 12.14 hrs, Volume= 15,292 cf, Atten= 0%, Lag= 0.0 min
Primary = 3.69 cfs @ 12.14 hrs, Volume= 15,292 cf
Routed to Link SP-1 : STUDY POINT #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs / 2
Peak Elev= 84.04' @ 12.14 hrs Surf.Area= 684 sf Storage= 60 cf

Plug-Flow detention time= 0.5 min calculated for 15,216 cf (99% of inflow)
Center-of-Mass det. time= 0.4 min (753.3 - 752.9)

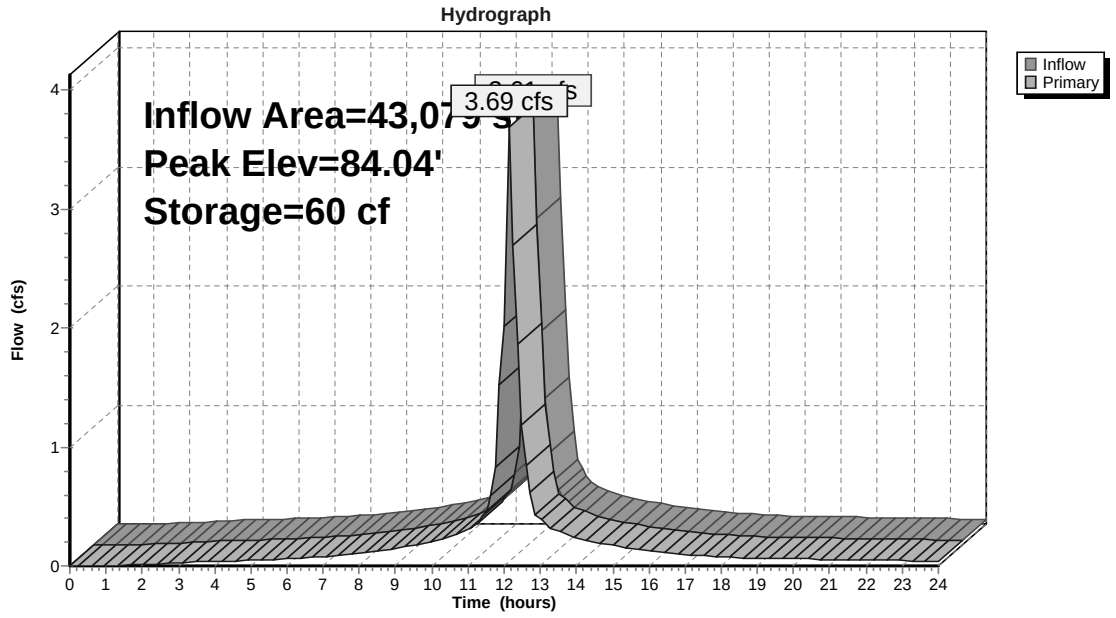
Volume	Invert	Avail.Storage	Storage Description
#1	82.38'	14 cf	**4.00'D x 1.10'H Ex.CB**
#2	83.45'	1,680 cf	**Parking/Driveway (Prismatic)**Listed below (Recalc)
		1,694 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
83.45	4	0	0
84.00	103	29	29
84.50	6,500	1,651	1,680

Device	Routing	Invert	Outlet Devices
#1	Primary	82.46'	**6.0" Round 6"PVC w/ 1.0" inside fill** L= 170.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 82.38' / 81.00' S= 0.0081 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.17 sf
#2	Primary	84.00'	**120.0' long x 50.0' breadth Weir Flow Over Curb Towards Lake** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=3.53 cfs @ 12.14 hrs HW=84.04' TW=0.00' (Dynamic Tailwater)
1=6"PVC (Barrel Controls 0.68 cfs @ 3.89 fps)
2=Weir Flow Over Curb Towards Lake (Weir Controls 2.85 cfs @ 0.55 fps)

Pond P-2A: Parking Lot/Driveway



Summary for Pond P-2C: EX. INFILTRTATION BASIN

Inflow Area = 118,791 sf, 70.94% Impervious, Inflow Depth > 3.49" for 10-Year event
Inflow = 8.92 cfs @ 12.14 hrs, Volume= 34,593 cf
Outflow = 8.30 cfs @ 12.18 hrs, Volume= 32,443 cf, Atten= 7%, Lag= 2.4 min
Discarded = 0.04 cfs @ 12.18 hrs, Volume= 2,123 cf
Primary = 8.26 cfs @ 12.18 hrs, Volume= 30,319 cf
Routed to Pond OFFSITE : OFFSITE PONDING AREA IN GRASS

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs / 2
Peak Elev= 83.46' @ 12.18 hrs Surf.Area= 7,077 sf Storage= 3,110 cf
Flood Elev= 83.30' Surf.Area= 5,645 sf Storage= 2,114 cf

Plug-Flow detention time= 53.1 min calculated for 32,281 cf (93% of inflow)
Center-of-Mass det. time= 20.9 min (814.3 - 793.4)

Volume	Invert	Avail.Storage	Storage Description
#1	82.50'	8,308 cf	**EX. INFILTRATION BASIN (Prismatic)** Listed below (Recalc)

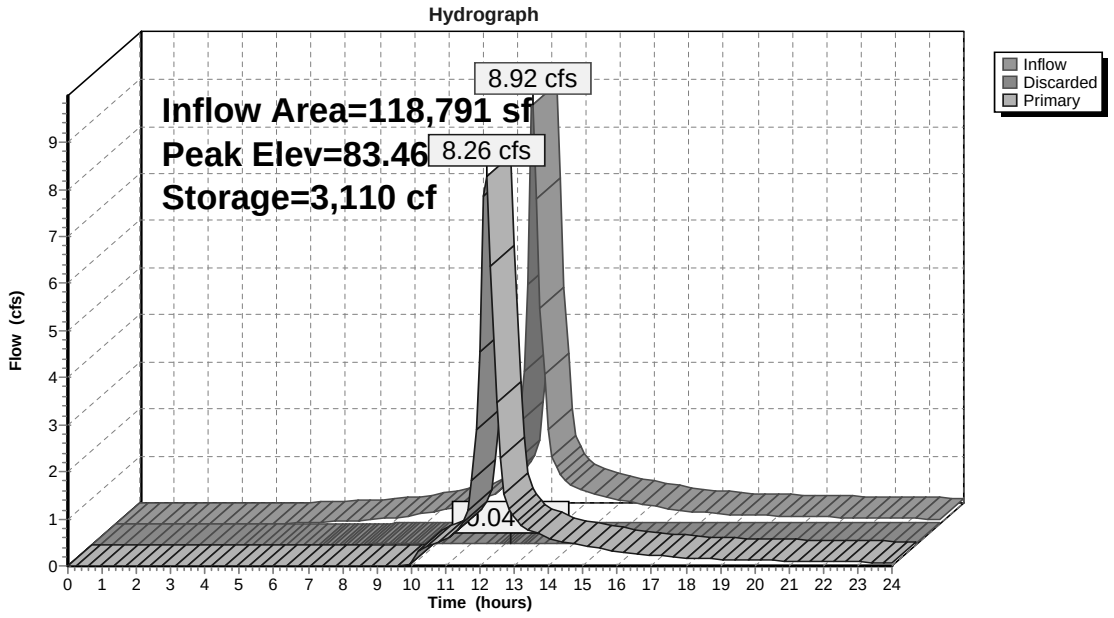
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
82.50	430	0	0
83.00	2,900	833	833
84.00	12,050	7,475	8,308

Device	Routing	Invert	Outlet Devices
#1	Primary	83.30'	**50.0' long x 60.0' breadth GRASS/LAWN AREA** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Discarded	82.50'	**0.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 12.18 hrs HW=83.45' (Free Discharge)
↑**2=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=7.84 cfs @ 12.18 hrs HW=83.45' TW=82.78' (Dynamic Tailwater)
↑**1=GRASS/LAWN AREA** (Weir Controls 7.84 cfs @ 1.04 fps)

Pond P-2C: EX. INFILTRTATION BASIN

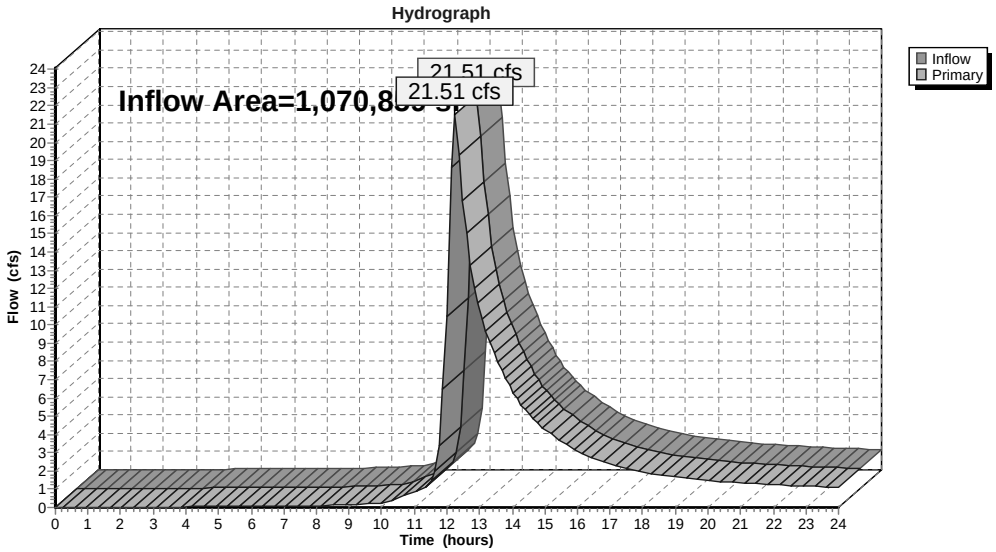


Summary for Link SP-1: STUDY POINT #1

Inflow Area = 1,070,859 sf, 41.72% Impervious, Inflow Depth > 2.02" for 10-Year event
Inflow = 21.51 cfs @ 12.25 hrs, Volume= 180,656 cf
Primary = 21.51 cfs @ 12.25 hrs, Volume= 180,656 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs

Link SP-1: STUDY POINT #1



Summary for Subcatchment E-1A: EX. WATERSHED

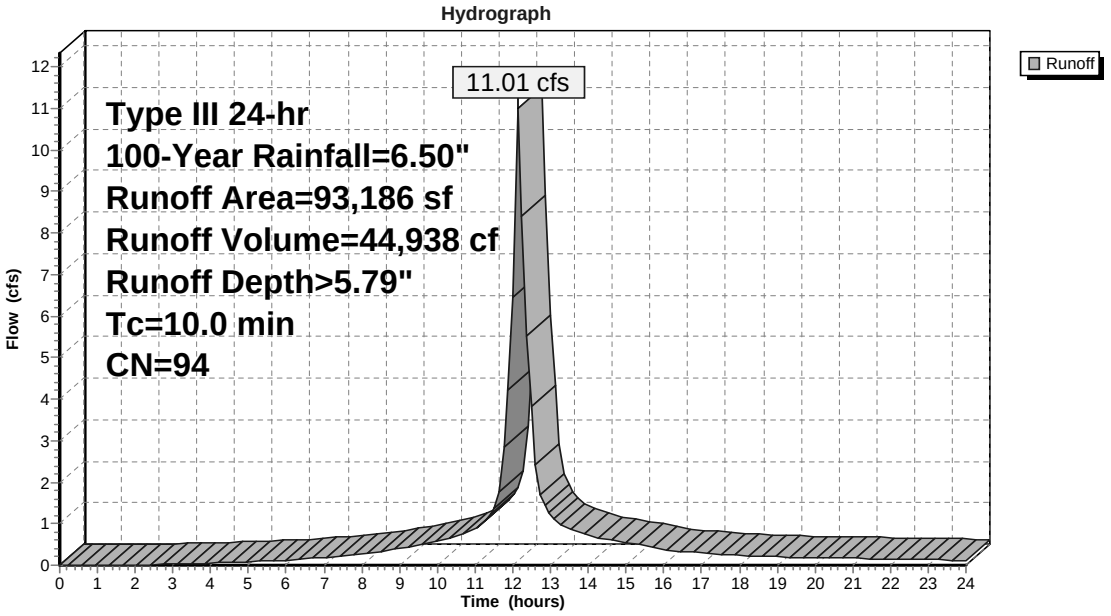
Runoff = 11.01 cfs @ 12.14 hrs, Volume= 44,938 cf, Depth> 5.79"
Routed to Pond ES : Offsite Swale to South Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
	6,343	86	<50% Grass cover, Poor, HSG C
	8,692	74	>75% Grass cover, Good, HSG C
	5,285	79	Woods/grass comb., Good, HSG D
*	72,866	98	Impervious
	93,186	94	Weighted Average
	20,320		21.81% Pervious Area
	72,866		78.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment E-1A: EX. WATERSHED



Summary for Subcatchment E-1B: EX. WATERSHED

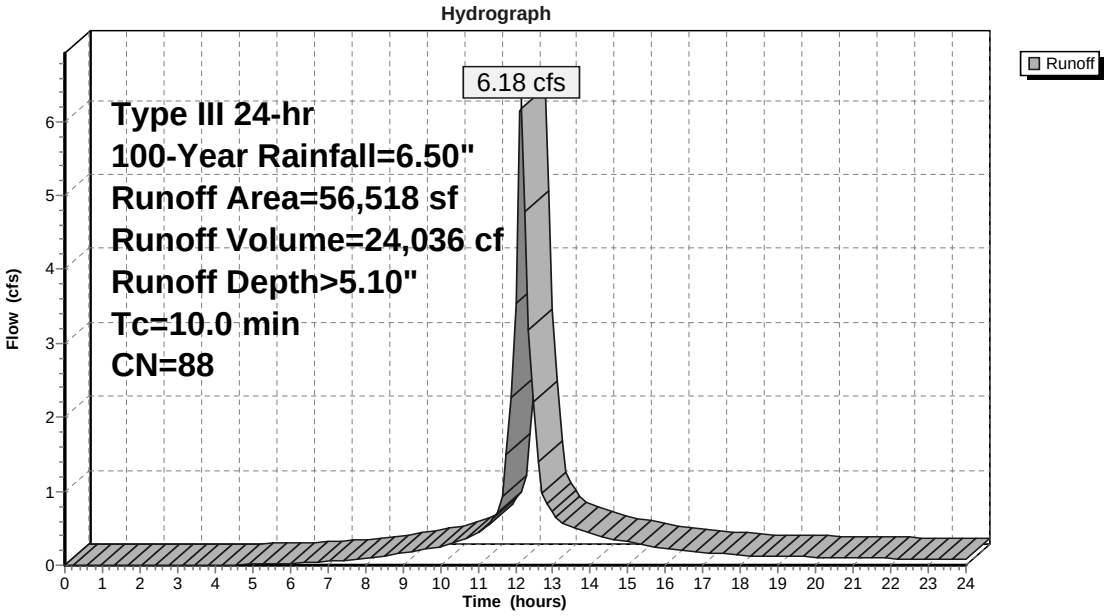
Runoff = 6.18 cfs @ 12.14 hrs, Volume= 24,036 cf, Depth> 5.10"
Routed to Pond ES : Offsite Swale to South Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
	3,722	86	<50% Grass cover, Poor, HSG C
	8,826	74	>75% Grass cover, Good, HSG C
	14,964	79	Woods/grass comb., Good, HSG D
*	29,006	98	Impervious
	56,518	88	Weighted Average
	27,512		48.68% Pervious Area
	29,006		51.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment E-1B: EX. WATERSHED



Summary for Subcatchment E-1C: EX. WATERSHED

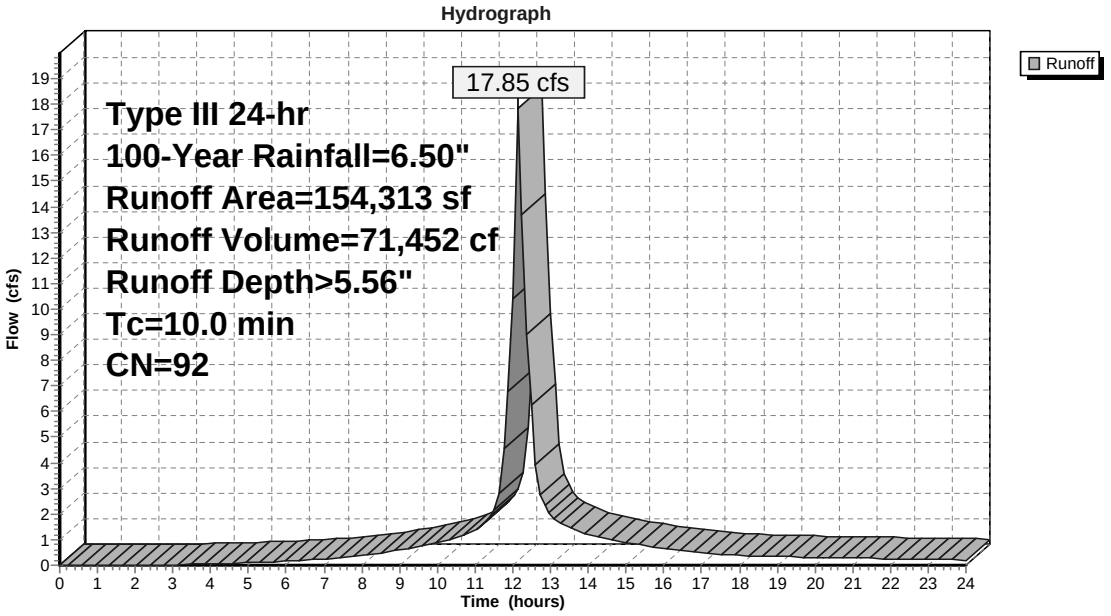
Runoff = 17.85 cfs @ 12.14 hrs, Volume= 71,452 cf, Depth> 5.56"
Routed to Pond ES : Offsite Swale to South Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
	3,840	86	<50% Grass cover, Poor, HSG C
	20,360	74	>75% Grass cover, Good, HSG C
	23,421	79	Woods/grass comb., Good, HSG D
*	106,692	98	Impervious
	154,313	92	Weighted Average
	47,621		30.86% Pervious Area
	106,692		69.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment E-1C: EX. WATERSHED



Summary for Subcatchment E-1D: EX. WATERSHED

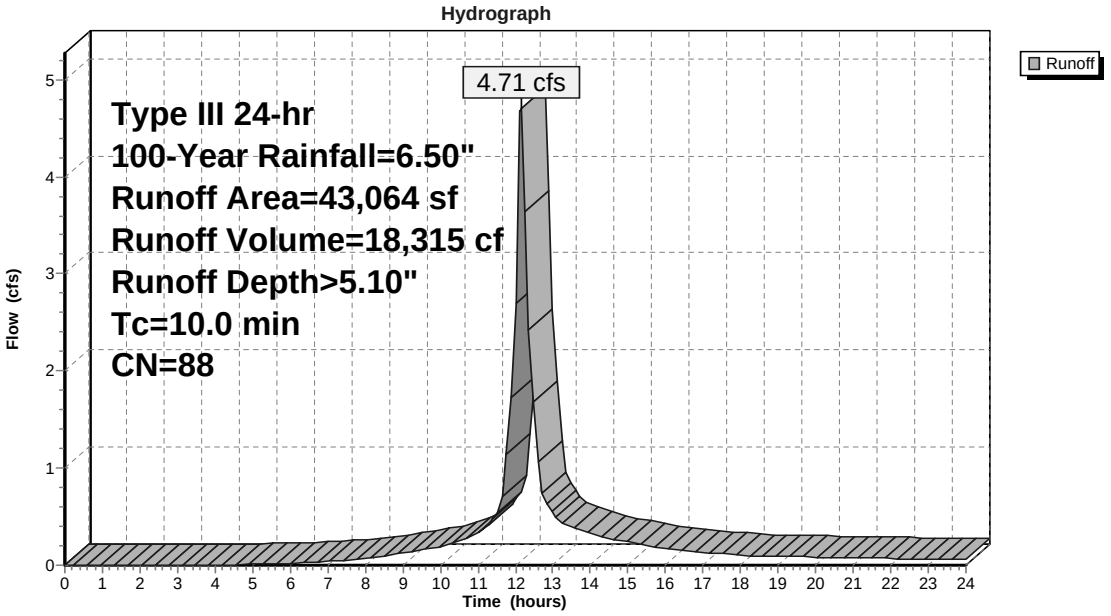
Runoff = 4.71 cfs @ 12.14 hrs, Volume= 18,315 cf, Depth> 5.10"
Routed to Pond ES : Offsite Swale to South Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
	5,705	86	<50% Grass cover, Poor, HSG C
	12,809	74	>75% Grass cover, Good, HSG C
	2,569	79	Woods/grass comb., Good, HSG D
*	21,981	98	Impervious
	43,064	88	Weighted Average
	21,083		48.96% Pervious Area
	21,981		51.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment E-1D: EX. WATERSHED



Summary for Subcatchment E-1E: EX. WATERSHED

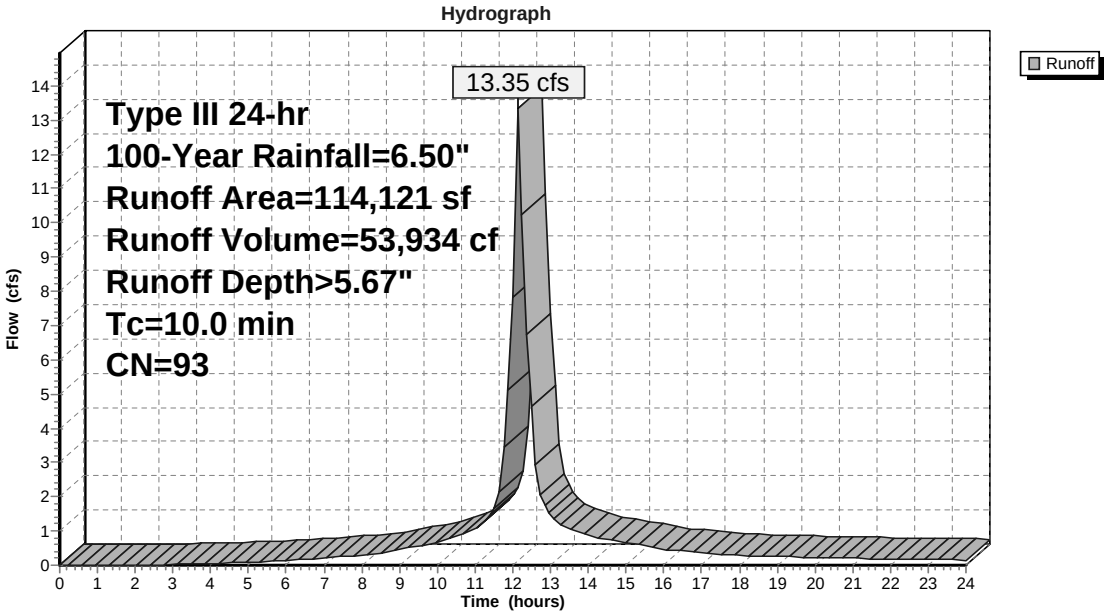
Runoff = 13.35 cfs @ 12.14 hrs, Volume= 53,934 cf, Depth> 5.67"
Routed to Pond ES : Offsite Swale to South Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
	6,384	86	<50% Grass cover, Poor, HSG C
	17,883	74	>75% Grass cover, Good, HSG C
	15,843	96	Gravel surface, HSG C
*	74,011	98	Impervious
	114,121	93	Weighted Average
	40,110		35.15% Pervious Area
	74,011		64.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment E-1E: EX. WATERSHED



Summary for Subcatchment E-2A: EX. WATERSHED

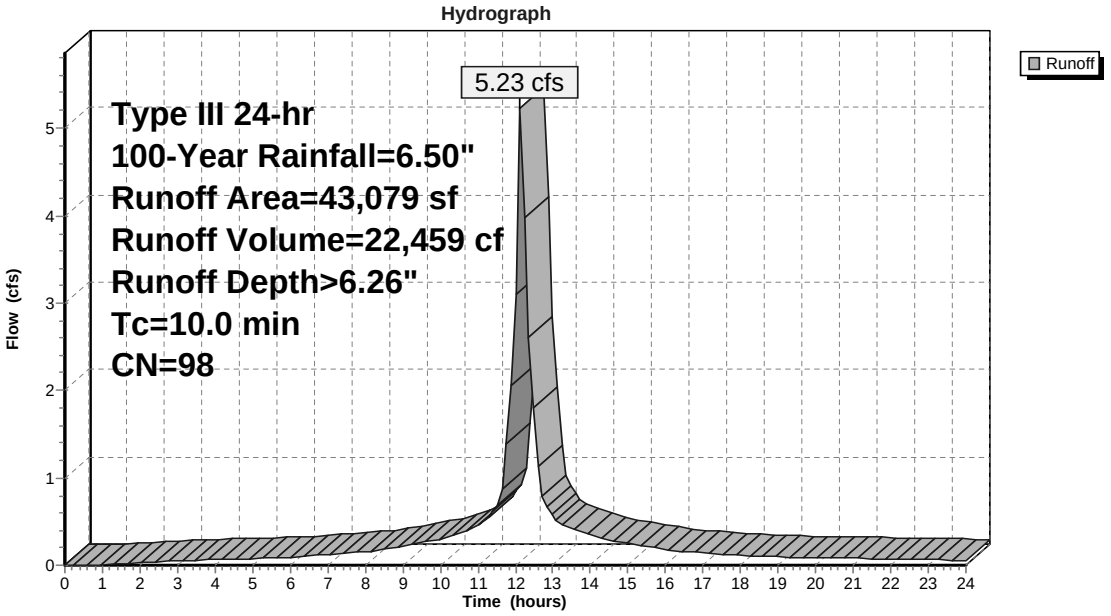
Runoff = 5.23 cfs @ 12.14 hrs, Volume= 22,459 cf, Depth> 6.26"
Routed to Pond P-2A : Parking Lot/Driveway

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
	1,483	86	<50% Grass cover, Poor, HSG C
*	41,596	98	Impervious
	43,079	98	Weighted Average
	1,483		3.44% Pervious Area
	41,596		96.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment E-2A: EX. WATERSHED



Summary for Subcatchment E-2B: EX. WATERSHED

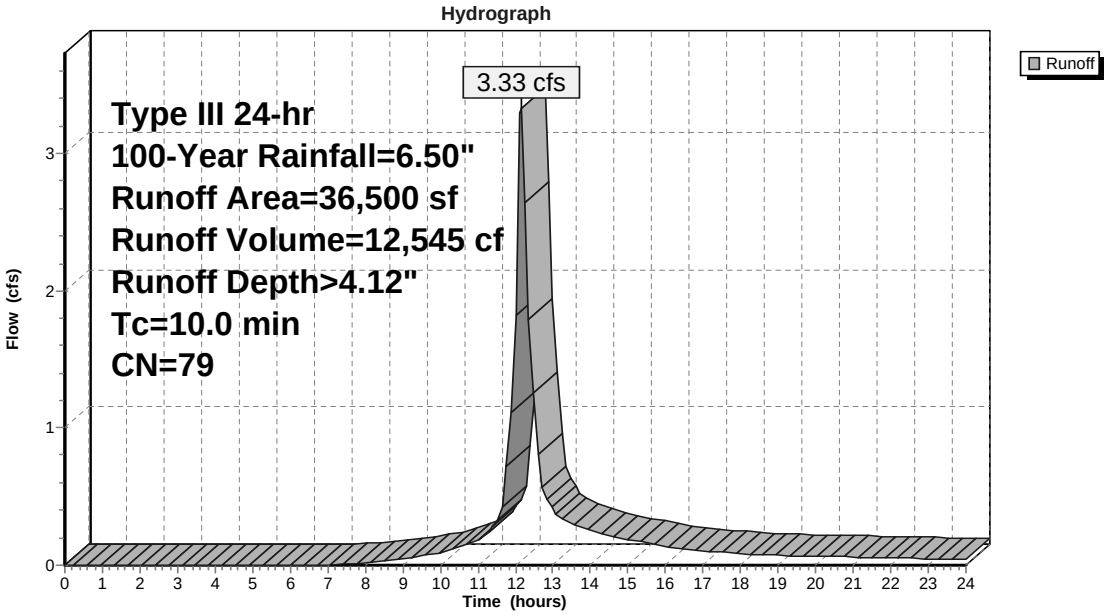
Runoff = 3.33 cfs @ 12.14 hrs, Volume= 12,545 cf, Depth> 4.12"
Routed to Link SP-1 : STUDY POINT #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
	1,043	86	<50% Grass cover, Poor, HSG C
	28,476	74	>75% Grass cover, Good, HSG C
*	6,981	98	Impervious
	36,500	79	Weighted Average
	29,519		80.87% Pervious Area
	6,981		19.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment E-2B: EX. WATERSHED



Summary for Subcatchment E-2C: EX. WATERSHED

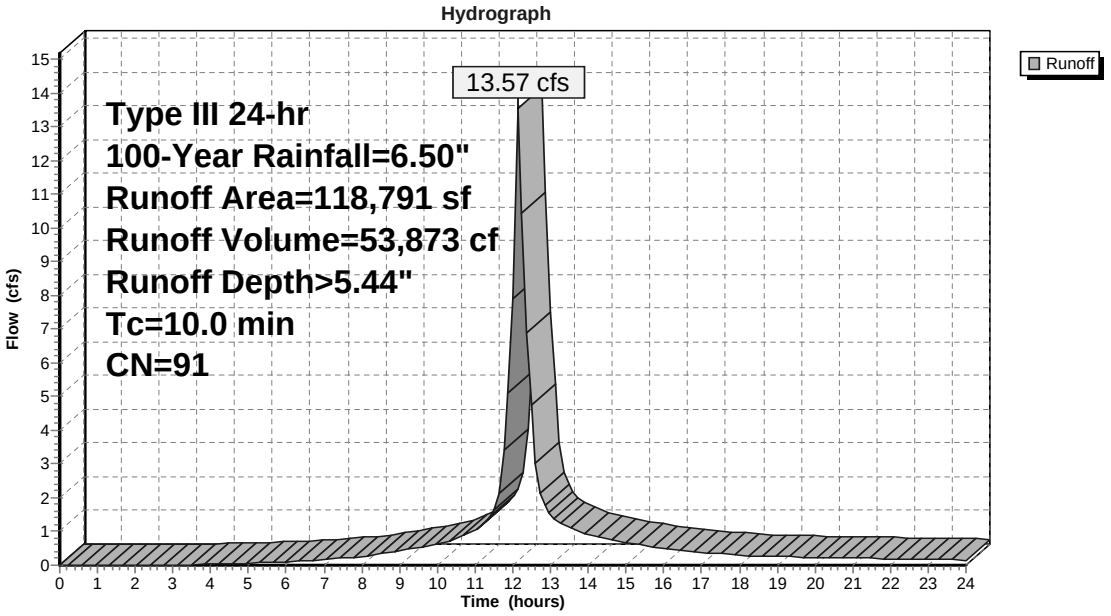
Runoff = 13.57 cfs @ 12.14 hrs, Volume= 53,873 cf, Depth> 5.44"
Routed to Pond P-2C : EX. INFILTRTATION BASIN

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
	2,816	86	<50% Grass cover, Poor, HSG C
	31,699	74	>75% Grass cover, Good, HSG C
*	84,276	98	Impervious
	118,791	91	Weighted Average
	34,515		29.06% Pervious Area
	84,276		70.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment E-2C: EX. WATERSHED



Summary for Subcatchment E-3: EX. WATERSHED

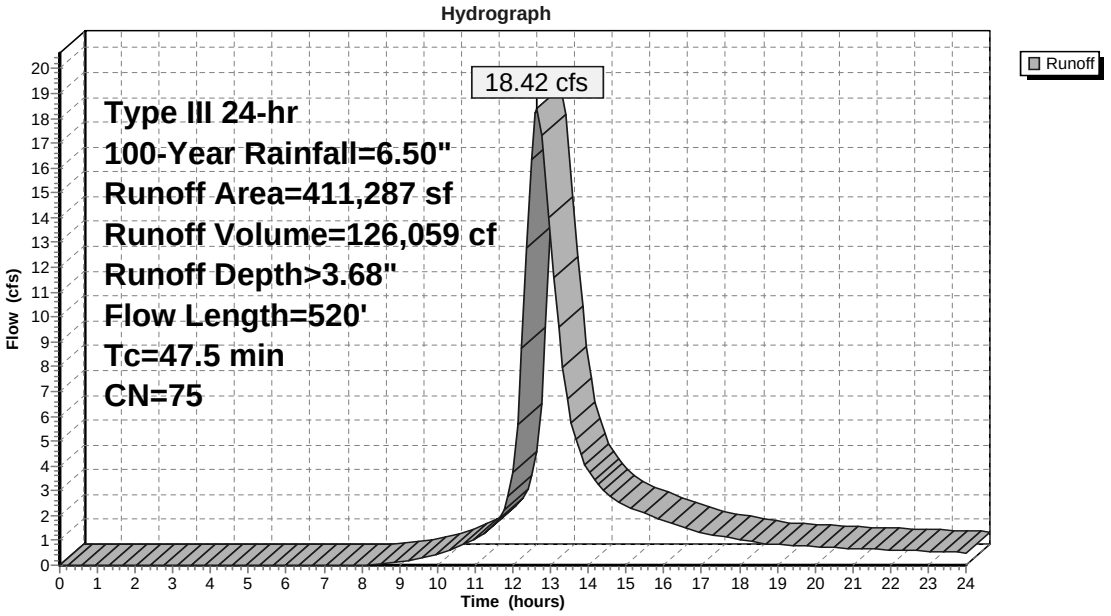
Runoff = 18.42 cfs @ 12.65 hrs, Volume= 126,059 cf, Depth> 3.68"
Routed to Pond EW : Wetland to East Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
	242,101	77	Woods, Good, HSG D
*	9,389	98	Impervious
	150,817	70	Woods, Good, HSG C
	8,980	74	>75% Grass cover, Good, HSG C
	411,287	75	Weighted Average
	401,898		97.72% Pervious Area
	9,389		2.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.3	100	0.0100	0.06		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
1.3	40	0.0100	0.50		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
17.9	380	0.0050	0.35		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
47.5	520	Total			

Subcatchment E-3: EX. WATERSHED



Summary for Pond ES: Offsite Swale to South Culvert

Inflow Area = 461,202 sf, 66.04% Impervious, Inflow Depth > 5.53" for 100-Year event
Inflow = 53.11 cfs @ 12.14 hrs, Volume= 212,675 cf
Outflow = 18.73 cfs @ 12.49 hrs, Volume= 185,122 cf, Atten= 65%, Lag= 21.0 min
Primary = 18.73 cfs @ 12.49 hrs, Volume= 185,122 cf
Routed to Link SP-1 : STUDY POINT #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs / 2
Peak Elev= 81.39' @ 12.49 hrs Surf.Area= 68,663 sf Storage= 91,518 cf

Plug-Flow detention time= 146.8 min calculated for 185,122 cf (87% of inflow)
Center-of-Mass det. time= 90.0 min (867.8 - 777.9)

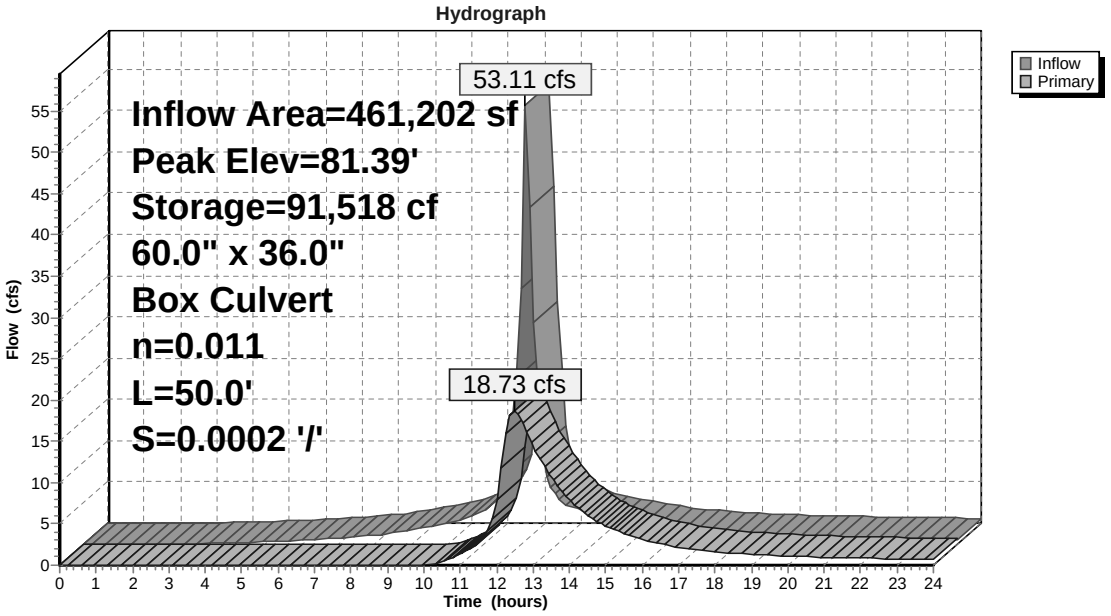
Volume	Invert	Avail.Storage	Storage Description
#1	79.00'	136,108 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
79.00	17,000	1,200.0	0	0	17,000
80.00	27,000	4,000.0	21,808	21,808	1,175,651
81.00	63,900	4,200.0	44,146	65,954	1,306,222
82.00	76,600	4,250.0	70,154	136,108	1,340,108

Device	Routing	Invert	Outlet Devices
#1	Primary	80.00'	**60.0" W x 36.0" H Box Culvert** L= 50.0' Box, headwall w/3 square edges, Ke= 0.500 Inlet / Outlet Invert= 80.00' / 79.99' S= 0.0002 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 15.00 sf

Primary OutFlow Max=18.70 cfs @ 12.49 hrs HW=81.38' TW=0.00' (Dynamic Tailwater)
↑**1=Culvert** (Barrel Controls 18.70 cfs @ 3.60 fps)

Pond ES: Offsite Swale to South Culvert



Summary for Pond EW: Wetland to East Culvert

Inflow Area = 411,287 sf, 2.28% Impervious, Inflow Depth > 3.68" for 100-Year event
Inflow = 18.42 cfs @ 12.65 hrs, Volume= 126,059 cf
Outflow = 1.40 cfs @ 16.74 hrs, Volume= 49,855 cf, Atten= 92%, Lag= 245.2 min
Primary = 1.40 cfs @ 16.74 hrs, Volume= 49,855 cf
Routed to Link SP-1 : STUDY POINT #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs / 2
Peak Elev= 80.95' @ 16.74 hrs Surf.Area= 142,533 sf Storage= 88,526 cf

Plug-Flow detention time= 372.9 min calculated for 49,855 cf (40% of inflow)
Center-of-Mass det. time= 250.8 min (1,106.5 - 855.7)

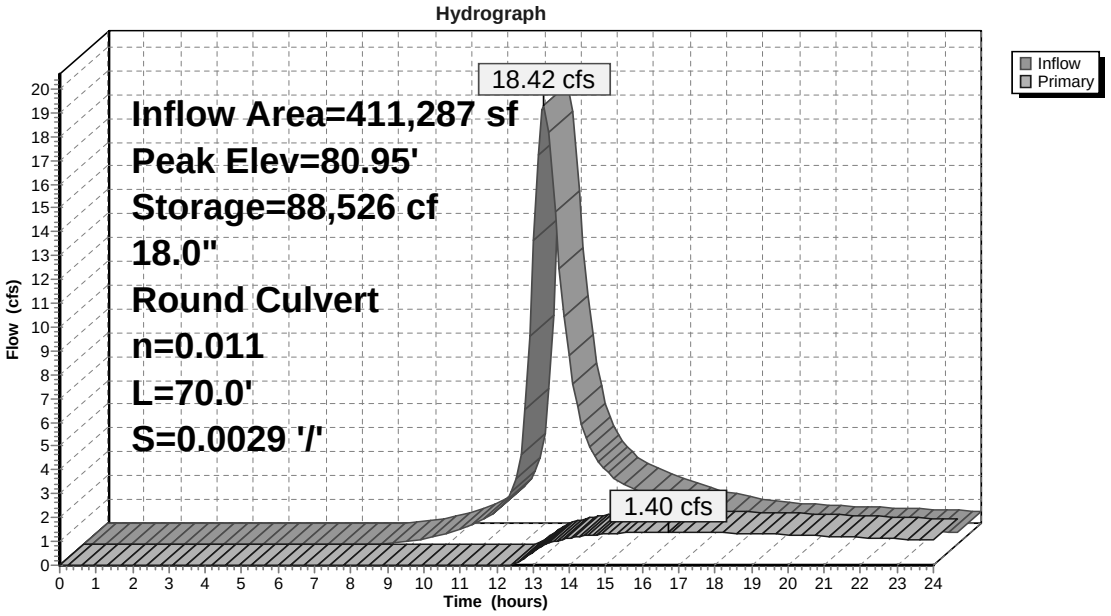
Volume	Invert	Avail.Storage	Storage Description
#1	80.00'	290,435 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
80.00	52,000	1,200.0	0	0	52,000
81.00	149,000	2,600.0	96,341	96,341	475,356
82.00	243,000	4,300.0	194,094	290,435	1,408,807

Device	Routing	Invert	Outlet Devices
#1	Primary	80.30'	**18.0" Round Culvert** L= 70.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 80.30' / 80.10' S= 0.0029 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.77 sf

Primary OutFlow Max=1.40 cfs @ 16.74 hrs HW=80.95' TW=0.00' (Dynamic Tailwater)
1=Culvert (Barrel Controls 1.40 cfs @ 2.83 fps)

Pond EW: Wetland to East Culvert



Summary for Pond OFFSITE: OFFSITE PONDING AREA IN GRASS

Inflow Area = 118,791 sf, 70.94% Impervious, Inflow Depth > 4.99" for 100-Year event
Inflow = 12.64 cfs @ 12.17 hrs, Volume= 49,365 cf
Outflow = 12.54 cfs @ 12.22 hrs, Volume= 49,061 cf, Atten= 1%, Lag= 2.5 min
Primary = 12.54 cfs @ 12.22 hrs, Volume= 49,061 cf
Routed to Link SP-1 : STUDY POINT #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs / 2
Peak Elev= 82.87' @ 12.21 hrs Surf.Area= 6,027 sf Storage= 2,411 cf

Plug-Flow detention time= 12.5 min calculated for 48,817 cf (99% of inflow)
Center-of-Mass det. time= 8.8 min (802.6 - 793.8)

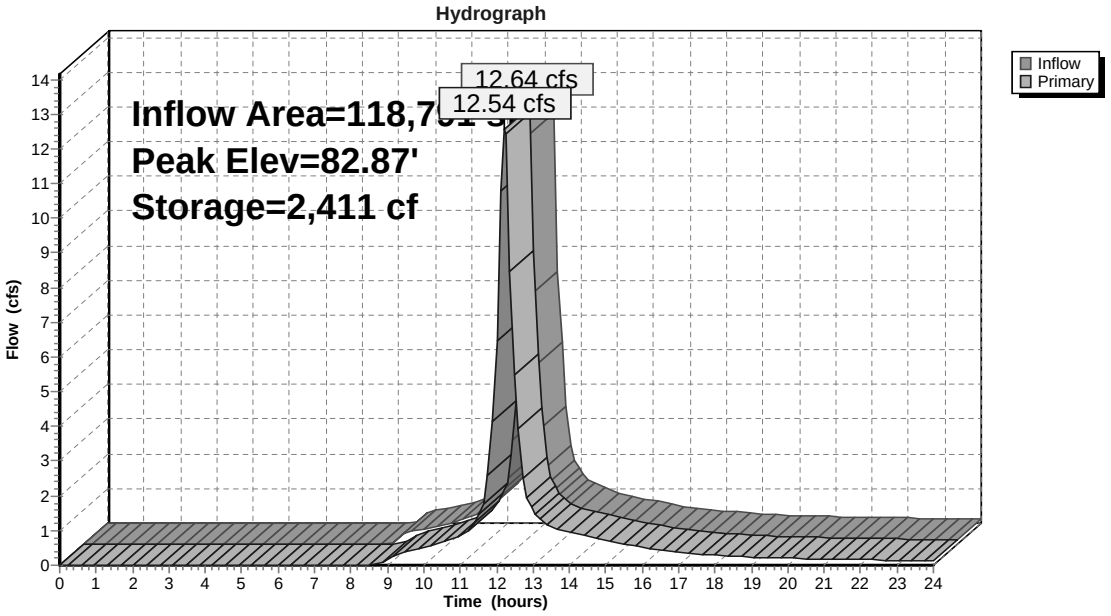
Volume	Invert	Avail.Storage	Storage Description
#1	82.10'	3,254 cf	**OFFSITE PONDING AREA (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
82.10	230	0	0
83.00	7,000	3,254	3,254

Device	Routing	Invert	Outlet Devices
#1	Primary	82.27'	**8.0" Round (3) 8" HDPE X 3.00 w/ 2.0" inside fill** L= 21.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 82.10' / 81.40' S= 0.0333 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.28 sf
#2	Primary	82.60'	**30.0' long x 10.0' breadth WEIR FLOW OVER WALKING PATH** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=12.07 cfs @ 12.22 hrs HW=82.86' TW=0.00' (Dynamic Tailwater)
1=(3) 8" HDPE (Inlet Controls 1.92 cfs @ 2.28 fps)
2=WEIR FLOW OVER WALKING PATH (Weir Controls 10.15 cfs @ 1.29 fps)

Pond OFFSITE: OFFSITE PONDING AREA IN GRASS



Summary for Pond P-2A: Parking Lot/Driveway

Inflow Area = 43,079 sf, 96.56% Impervious, Inflow Depth > 6.26" for 100-Year event
Inflow = 5.23 cfs @ 12.14 hrs, Volume= 22,459 cf
Outflow = 5.16 cfs @ 12.14 hrs, Volume= 22,456 cf, Atten= 1%, Lag= 0.2 min
Primary = 5.16 cfs @ 12.14 hrs, Volume= 22,456 cf
Routed to Link SP-1 : STUDY POINT #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs / 2
Peak Elev= 84.06' @ 12.14 hrs Surf.Area= 857 sf Storage= 71 cf

Plug-Flow detention time= 0.4 min calculated for 22,344 cf (99% of inflow)
Center-of-Mass det. time= 0.4 min (747.4 - 747.1)

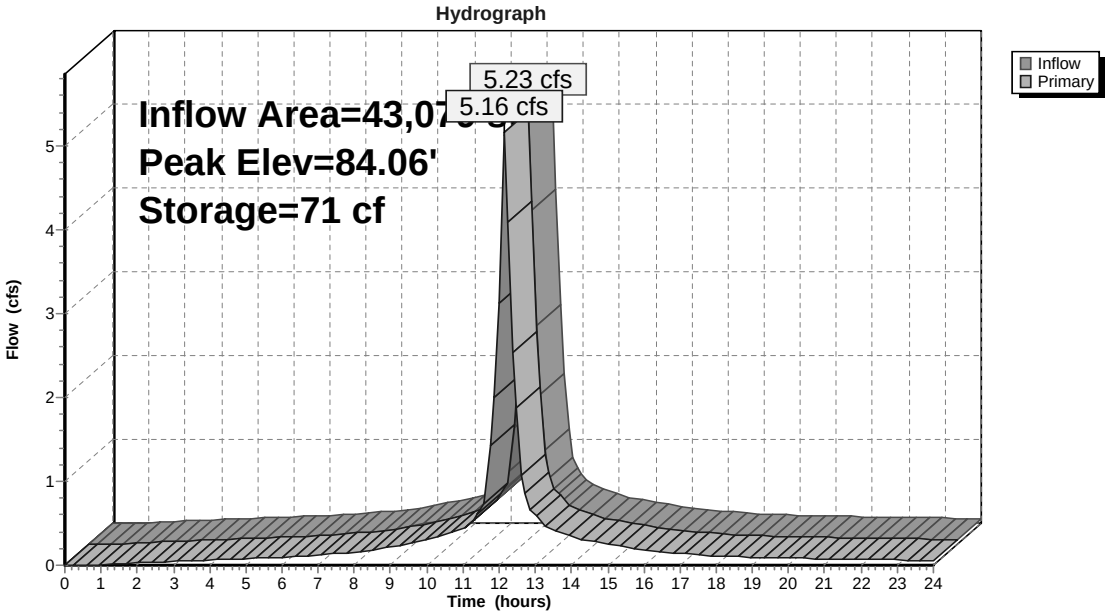
Volume	Invert	Avail.Storage	Storage Description
#1	82.38'	14 cf	**4.00'D x 1.10'H Ex.CB**
#2	83.45'	1,680 cf	**Parking/Driveway (Prismatic)**Listed below (Recalc)
		1,694 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
83.45	4	0	0
84.00	103	29	29
84.50	6,500	1,651	1,680

Device	Routing	Invert	Outlet Devices
#1	Primary	82.46'	**6.0" Round 6"PVC w/ 1.0" inside fill** L= 170.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 82.38' / 81.00' S= 0.0081 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.17 sf
#2	Primary	84.00'	**120.0' long x 50.0' breadth Weir Flow Over Curb Towards Lake** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=4.95 cfs @ 12.14 hrs HW=84.06' TW=0.00' (Dynamic Tailwater)
1=6"PVC (Barrel Controls 0.68 cfs @ 3.90 fps)
2=Weir Flow Over Curb Towards Lake (Weir Controls 4.27 cfs @ 0.63 fps)

Pond P-2A: Parking Lot/Driveway



Summary for Pond P-2C: EX. INFILTRTATION BASIN

Inflow Area = 118,791 sf, 70.94% Impervious, Inflow Depth > 5.44" for 100-Year event
Inflow = 13.57 cfs @ 12.14 hrs, Volume= 53,873 cf
Outflow = 12.69 cfs @ 12.17 hrs, Volume= 51,707 cf, Atten= 7%, Lag= 2.1 min
Discarded = 0.05 cfs @ 12.17 hrs, Volume= 2,342 cf
Primary = 12.64 cfs @ 12.17 hrs, Volume= 49,365 cf
Routed to Pond OFFSITE : OFFSITE PONDING AREA IN GRASS

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs / 2
Peak Elev= 83.51' @ 12.17 hrs Surf.Area= 7,547 sf Storage= 3,485 cf
Flood Elev= 83.30' Surf.Area= 5,645 sf Storage= 2,114 cf

Plug-Flow detention time= 39.6 min calculated for 51,450 cf (96% of inflow)
Center-of-Mass det. time= 17.2 min (798.8 - 781.7)

Volume	Invert	Avail.Storage	Storage Description
#1	82.50'	8,308 cf	**EX. INFILTRATION BASIN (Prismatic)**Listed below (Recalc)

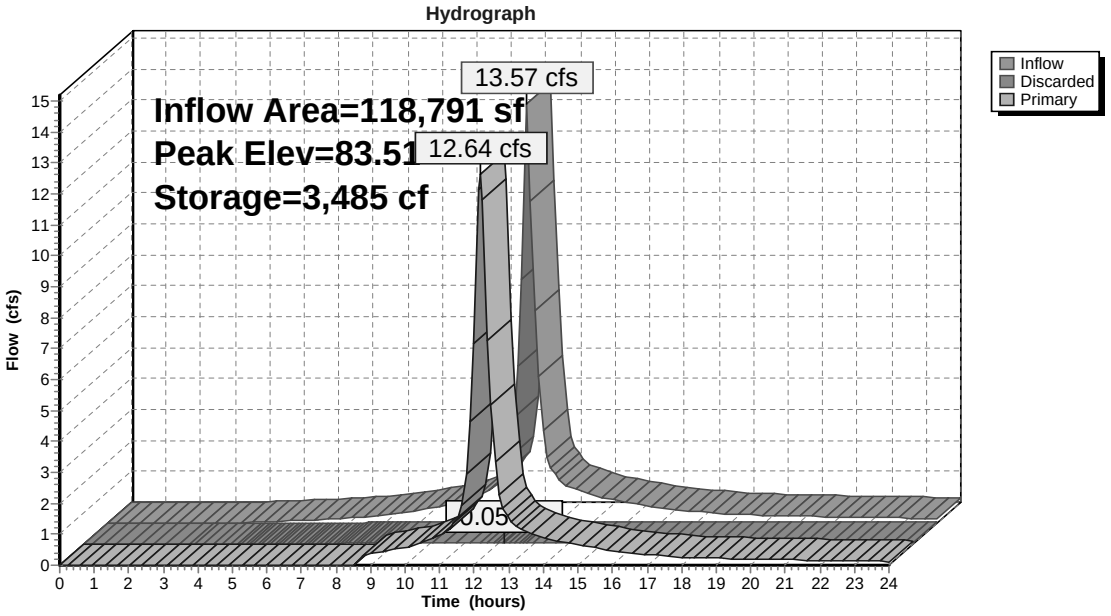
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
82.50	430	0	0
83.00	2,900	833	833
84.00	12,050	7,475	8,308

Device	Routing	Invert	Outlet Devices
#1	Primary	83.30'	**50.0' long x 60.0' breadth GRASS/LAWN AREA** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Discarded	82.50'	**0.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.05 cfs @ 12.17 hrs HW=83.50' (Free Discharge)
2=Exfiltration (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=11.99 cfs @ 12.17 hrs HW=83.50' TW=82.85' (Dynamic Tailwater)
1=GRASS/LAWN AREA (Weir Controls 11.99 cfs @ 1.20 fps)

Pond P-2C: EX. INFILTRTATION BASIN

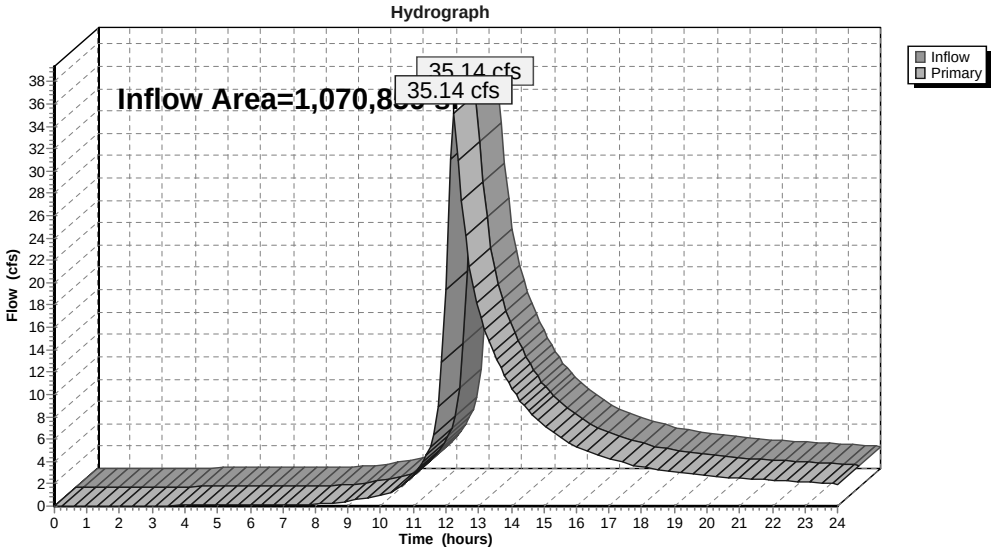


Summary for Link SP-1: STUDY POINT #1

Inflow Area = 1,070,859 sf, 41.72% Impervious, Inflow Depth > 3.58" for 100-Year event
Inflow = 35.14 cfs @ 12.24 hrs, Volume= 319,039 cf
Primary = 35.14 cfs @ 12.24 hrs, Volume= 319,039 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.12 hrs

Link SP-1: STUDY POINT #1



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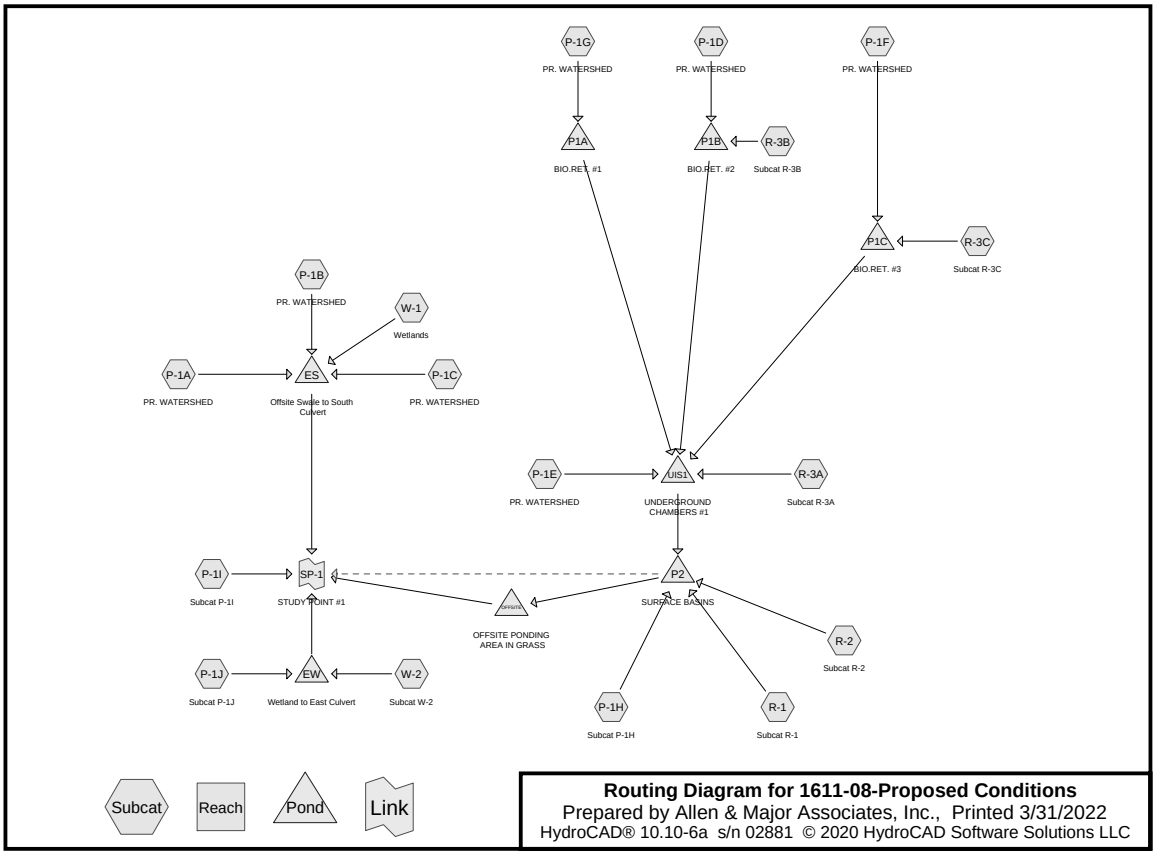
SECTION 4.0 -
PROPOSED DRAINAGE ANALYSIS



Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	3.10	2
2	10-Year	Type III 24-hr		Default	24.00	1	4.50	2
3	100-Year	Type III 24-hr		Default	24.00	1	6.50	2

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatchment Numbers
0	0	221,059	599	0	221,658	>75% Grass cover, Good	P-1A, P-1B, P-1C, P-1D, P-1E, P-1F, P-1G, P-1H, P-1I, P-1J, R-1, R-2, R-3A, W-1, W-2
0	0	415,520	3,188	0	418,709	Paved parking	P-1A, P-1B, P-1C, P-1D, P-1E, P-1F, P-1G, P-1H, P-1I, P-1J, R-1, R-2, R-3A, R-3B, R-3C, W-1, W-2
0	0	148,315	0	0	148,315	Woods, Good	W-2
0	0	0	282,177	0	282,177	Woods/grass comb., Good	W-1, W-2
0	**0**	**784,894**	**285,965**	**0**	**1,070,859**	**TOTAL AREA**	

Summary for Subcatchment P-1A: PR. WATERSHED

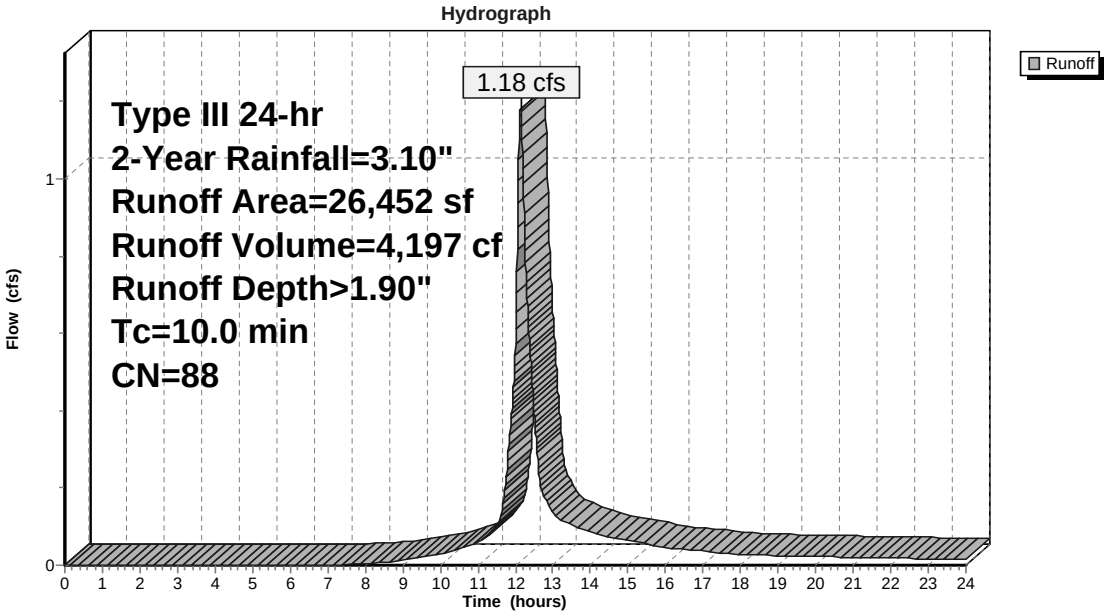
Runoff = 1.18 cfs @ 12.14 hrs, Volume= 4,197 cf, Depth> 1.90"
Routed to Pond ES : Offsite Swale to South Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
7,960	98	Paved parking, HSG C
3,795	98	Paved parking, HSG C
3,188	98	Paved parking, HSG D
11	98	Paved parking, HSG C
4,721	74	>75% Grass cover, Good, HSG C
6,286	74	>75% Grass cover, Good, HSG C
402	74	>75% Grass cover, Good, HSG C
88	74	>75% Grass cover, Good, HSG C
26,452	88	Weighted Average
11,497		43.46% Pervious Area
14,955		56.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment P-1A: PR. WATERSHED



Summary for Subcatchment P-1B: PR. WATERSHED

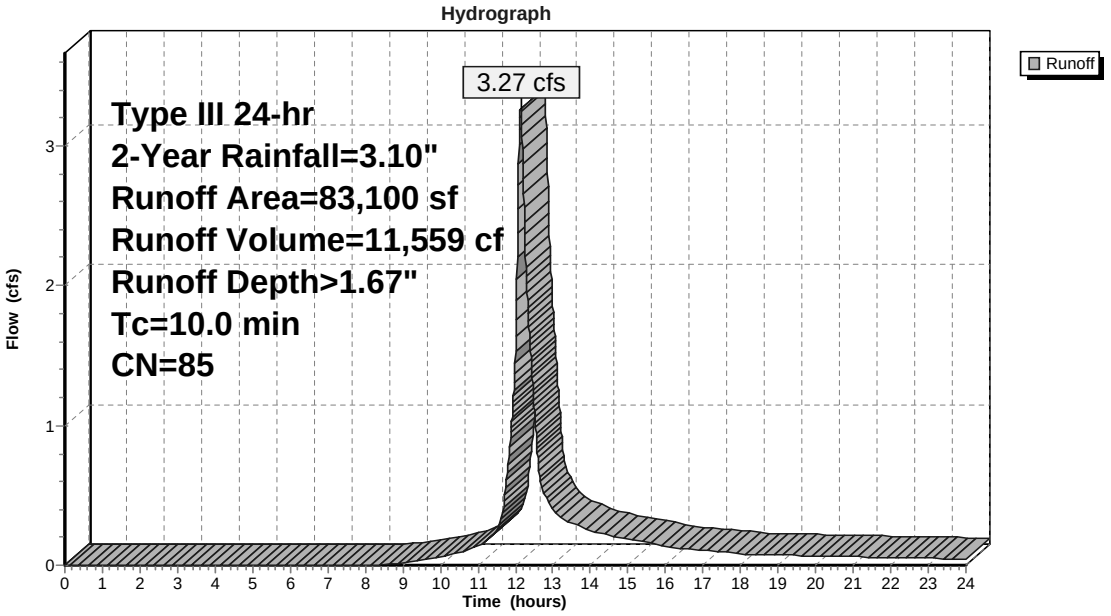
Runoff = 3.27 cfs @ 12.14 hrs, Volume= 11,559 cf, Depth> 1.67"
Routed to Pond ES : Offsite Swale to South Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
45	98	Paved parking, HSG C
0	98	Paved parking, HSG C
43	98	Paved parking, HSG C
0	98	Paved parking, HSG C
38,768	98	Paved parking, HSG C
1,827	74	>75% Grass cover, Good, HSG C
2,703	74	>75% Grass cover, Good, HSG C
679	74	>75% Grass cover, Good, HSG C
60	74	>75% Grass cover, Good, HSG C
30	74	>75% Grass cover, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
26	74	>75% Grass cover, Good, HSG C
14	74	>75% Grass cover, Good, HSG C
9,123	74	>75% Grass cover, Good, HSG C
2	74	>75% Grass cover, Good, HSG C
5,052	74	>75% Grass cover, Good, HSG C
8,899	74	>75% Grass cover, Good, HSG C
15,828	74	>75% Grass cover, Good, HSG C
83,100	85	Weighted Average
44,244		53.24% Pervious Area
38,856		46.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment P-1B: PR. WATERSHED



Summary for Subcatchment P-1C: PR. WATERSHED

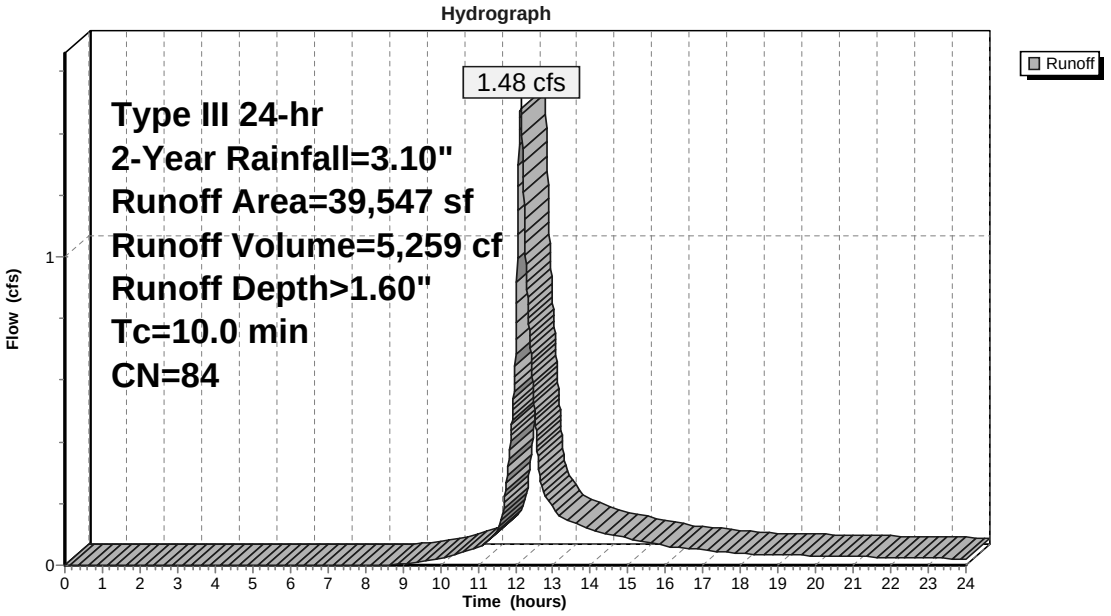
Runoff = 1.48 cfs @ 12.14 hrs, Volume= 5,259 cf, Depth> 1.60"
Routed to Pond ES : Offsite Swale to South Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
227	80	>75% Grass cover, Good, HSG D
16,521	98	Paved parking, HSG C
18	98	Paved parking, HSG C
2,500	74	>75% Grass cover, Good, HSG C
214	74	>75% Grass cover, Good, HSG C
68	74	>75% Grass cover, Good, HSG C
95	74	>75% Grass cover, Good, HSG C
3,398	74	>75% Grass cover, Good, HSG C
368	74	>75% Grass cover, Good, HSG C
16,138	74	>75% Grass cover, Good, HSG C
39,547	84	Weighted Average
23,007		58.18% Pervious Area
16,540		41.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment P-1C: PR. WATERSHED



Summary for Subcatchment P-1D: PR. WATERSHED

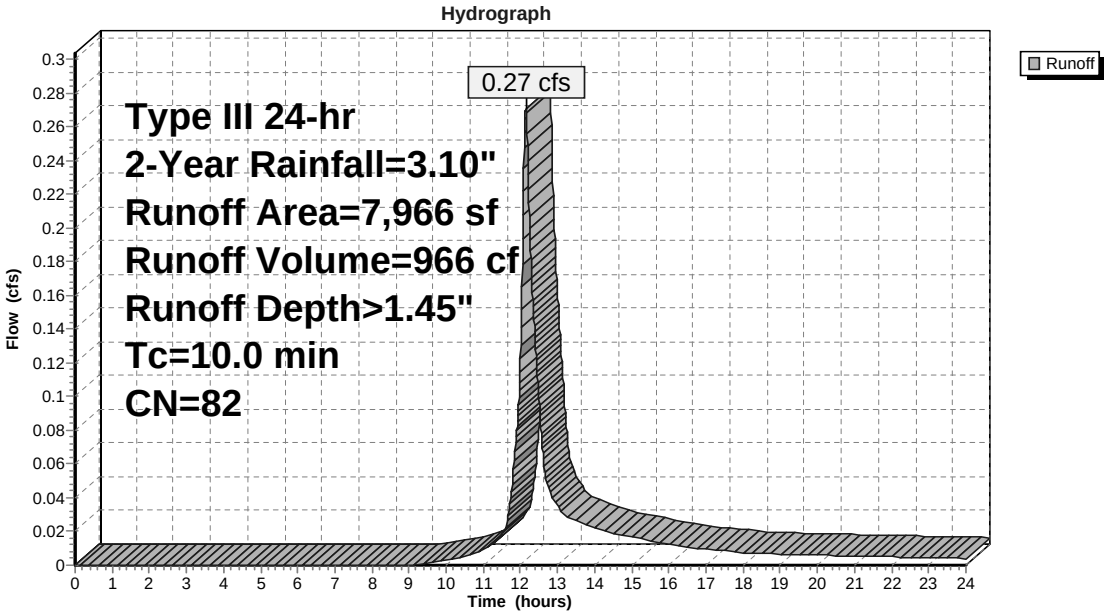
Runoff = 0.27 cfs @ 12.14 hrs, Volume= 966 cf, Depth> 1.45"
Routed to Pond P1B : BIO.RET. #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
240	98	Paved parking, HSG C
2,251	98	Paved parking, HSG C
81	98	Paved parking, HSG C
80	98	Paved parking, HSG C
80	98	Paved parking, HSG C
80	98	Paved parking, HSG C
1,810	74	>75% Grass cover, Good, HSG C
3,340	74	>75% Grass cover, Good, HSG C
4	74	>75% Grass cover, Good, HSG C
7,966	82	Weighted Average
5,154		64.70% Pervious Area
2,812		35.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment P-1D: PR. WATERSHED



Summary for Subcatchment P-1E: PR. WATERSHED

Runoff = 6.49 cfs @ 12.14 hrs, Volume= 23,408 cf, Depth> 2.25"
Routed to Pond UIS1 : UNDERGROUND CHAMBERS #1

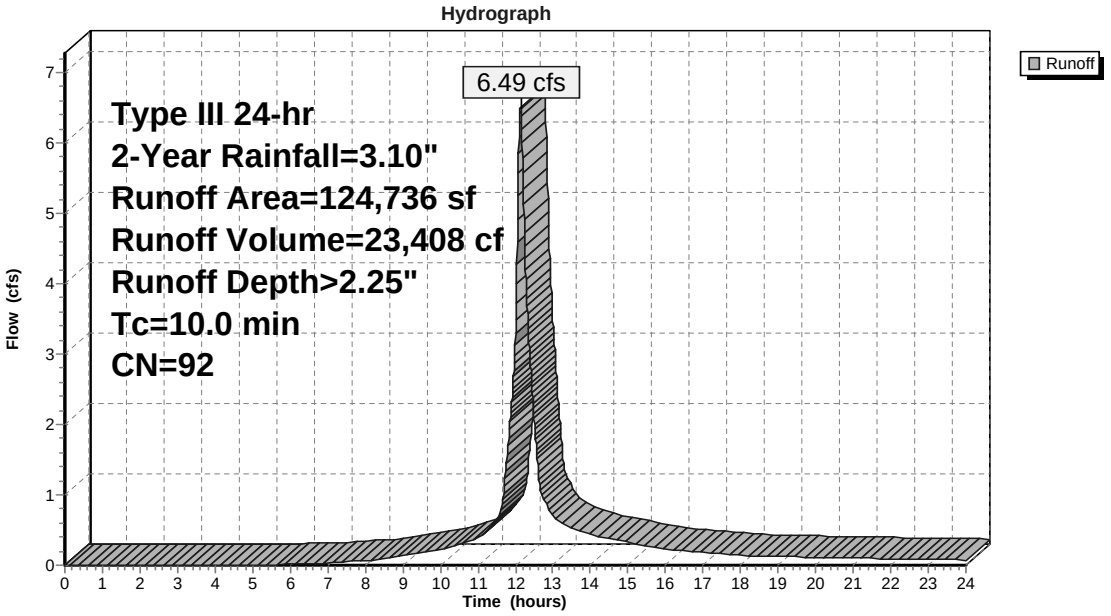
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
68	98	Paved parking, HSG C
6	98	Paved parking, HSG C
0	98	Paved parking, HSG C
0	98	Paved parking, HSG C
92,743	98	Paved parking, HSG C
0	98	Paved parking, HSG C
4,692	74	>75% Grass cover, Good, HSG C
1,328	74	>75% Grass cover, Good, HSG C
389	74	>75% Grass cover, Good, HSG C
73	74	>75% Grass cover, Good, HSG C
97	74	>75% Grass cover, Good, HSG C
73	74	>75% Grass cover, Good, HSG C
111	74	>75% Grass cover, Good, HSG C
123	74	>75% Grass cover, Good, HSG C
562	74	>75% Grass cover, Good, HSG C
6,210	74	>75% Grass cover, Good, HSG C
883	74	>75% Grass cover, Good, HSG C
721	74	>75% Grass cover, Good, HSG C
160	74	>75% Grass cover, Good, HSG C
140	74	>75% Grass cover, Good, HSG C
131	74	>75% Grass cover, Good, HSG C
172	74	>75% Grass cover, Good, HSG C
338	74	>75% Grass cover, Good, HSG C
61	74	>75% Grass cover, Good, HSG C
935	74	>75% Grass cover, Good, HSG C
77	74	>75% Grass cover, Good, HSG C
65	74	>75% Grass cover, Good, HSG C
148	74	>75% Grass cover, Good, HSG C
890	74	>75% Grass cover, Good, HSG C
158	74	>75% Grass cover, Good, HSG C
205	74	>75% Grass cover, Good, HSG C
205	74	>75% Grass cover, Good, HSG C
289	74	>75% Grass cover, Good, HSG C
223	74	>75% Grass cover, Good, HSG C
203	74	>75% Grass cover, Good, HSG C
231	74	>75% Grass cover, Good, HSG C

337	74	>75% Grass cover, Good, HSG C
2,324	74	>75% Grass cover, Good, HSG C
143	74	>75% Grass cover, Good, HSG C
141	74	>75% Grass cover, Good, HSG C
1,084	74	>75% Grass cover, Good, HSG C
799	74	>75% Grass cover, Good, HSG C
1,277	74	>75% Grass cover, Good, HSG C
959	74	>75% Grass cover, Good, HSG C
155	74	>75% Grass cover, Good, HSG C
126	74	>75% Grass cover, Good, HSG C
127	74	>75% Grass cover, Good, HSG C
94	74	>75% Grass cover, Good, HSG C
102	74	>75% Grass cover, Good, HSG C
133	74	>75% Grass cover, Good, HSG C
652	74	>75% Grass cover, Good, HSG C
86	74	>75% Grass cover, Good, HSG C
140	74	>75% Grass cover, Good, HSG C
43	74	>75% Grass cover, Good, HSG C
152	74	>75% Grass cover, Good, HSG C
27	74	>75% Grass cover, Good, HSG C
135	74	>75% Grass cover, Good, HSG C
502	74	>75% Grass cover, Good, HSG C
998	74	>75% Grass cover, Good, HSG C
125	74	>75% Grass cover, Good, HSG C
1,085	74	>75% Grass cover, Good, HSG C
280	74	>75% Grass cover, Good, HSG C
124,736	92	Weighted Average
31,919		25.59% Pervious Area
92,817		74.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment P-1E: PR. WATERSHED



Summary for Subcatchment P-1F: PR. WATERSHED

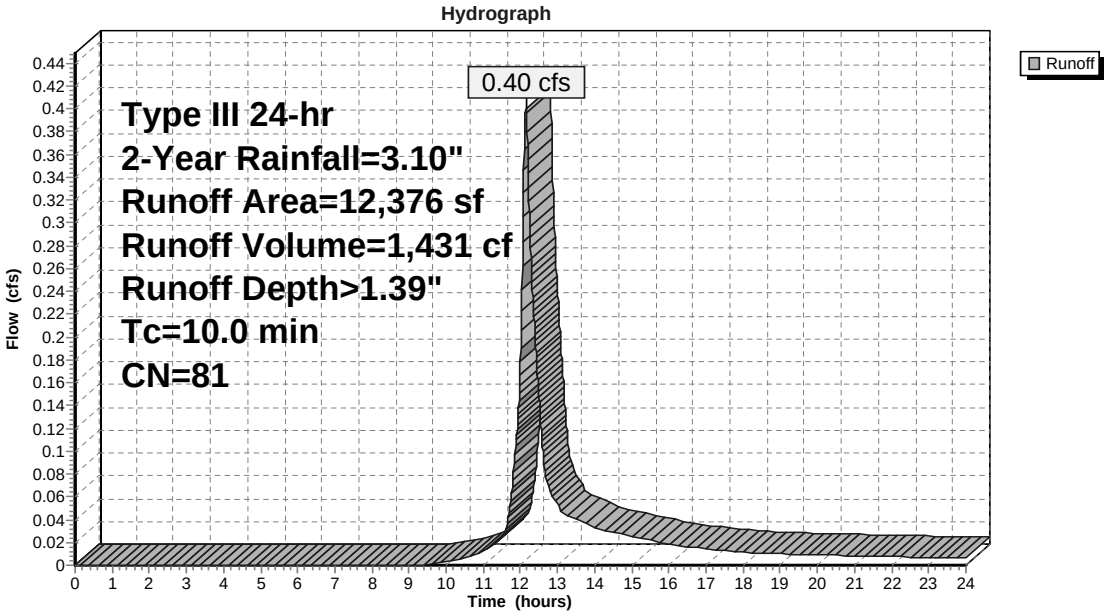
Runoff = 0.40 cfs @ 12.14 hrs, Volume= 1,431 cf, Depth> 1.39"
Routed to Pond P1C : BIO.RET. #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
379	98	Paved parking, HSG C
2,558	98	Paved parking, HSG C
80	98	Paved parking, HSG C
80	98	Paved parking, HSG C
81	98	Paved parking, HSG C
320	98	Paved parking, HSG C
80	98	Paved parking, HSG C
2,248	74	>75% Grass cover, Good, HSG C
1,849	74	>75% Grass cover, Good, HSG C
4,702	74	>75% Grass cover, Good, HSG C
12,376	81	Weighted Average
8,799		71.10% Pervious Area
3,577		28.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment P-1F: PR. WATERSHED



Summary for Subcatchment P-1G: PR. WATERSHED

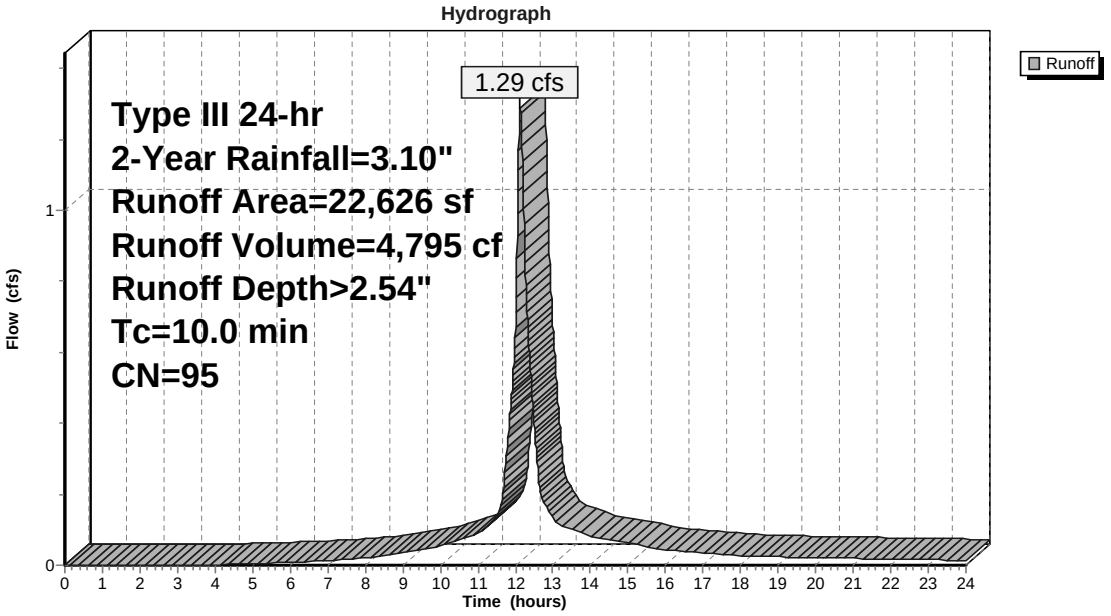
Runoff = 1.29 cfs @ 12.14 hrs, Volume= 4,795 cf, Depth> 2.54"
Routed to Pond P1A : BIO.RET. #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
19,703	98	Paved parking, HSG C
3	98	Paved parking, HSG C
75	74	>75% Grass cover, Good, HSG C
831	74	>75% Grass cover, Good, HSG C
906	74	>75% Grass cover, Good, HSG C
50	74	>75% Grass cover, Good, HSG C
1,057	74	>75% Grass cover, Good, HSG C
22,626	95	Weighted Average
2,919		12.90% Pervious Area
19,706		87.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment P-1G: PR. WATERSHED



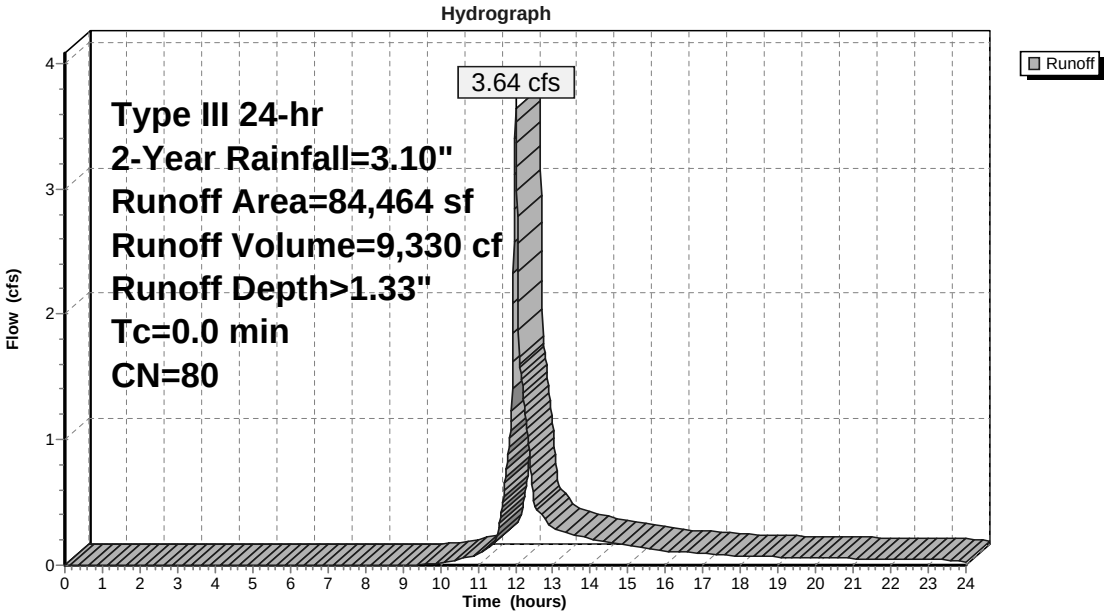
Summary for Subcatchment P-1H: Subcat P-1H

Runoff = 3.64 cfs @ 12.00 hrs, Volume= 9,330 cf, Depth> 1.33"
Routed to Pond P2 : SURFACE BASINS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
21,973	98	Paved parking, HSG C
687	98	Paved parking, HSG C
7,846	74	>75% Grass cover, Good, HSG C
12,808	74	>75% Grass cover, Good, HSG C
126	74	>75% Grass cover, Good, HSG C
149	74	>75% Grass cover, Good, HSG C
50	74	>75% Grass cover, Good, HSG C
200	74	>75% Grass cover, Good, HSG C
205	74	>75% Grass cover, Good, HSG C
13,065	74	>75% Grass cover, Good, HSG C
9,984	74	>75% Grass cover, Good, HSG C
17,371	74	>75% Grass cover, Good, HSG C
84,464	80	Weighted Average
61,803		73.17% Pervious Area
22,661		26.83% Impervious Area

Subcatchment P-1H: Subcat P-1H



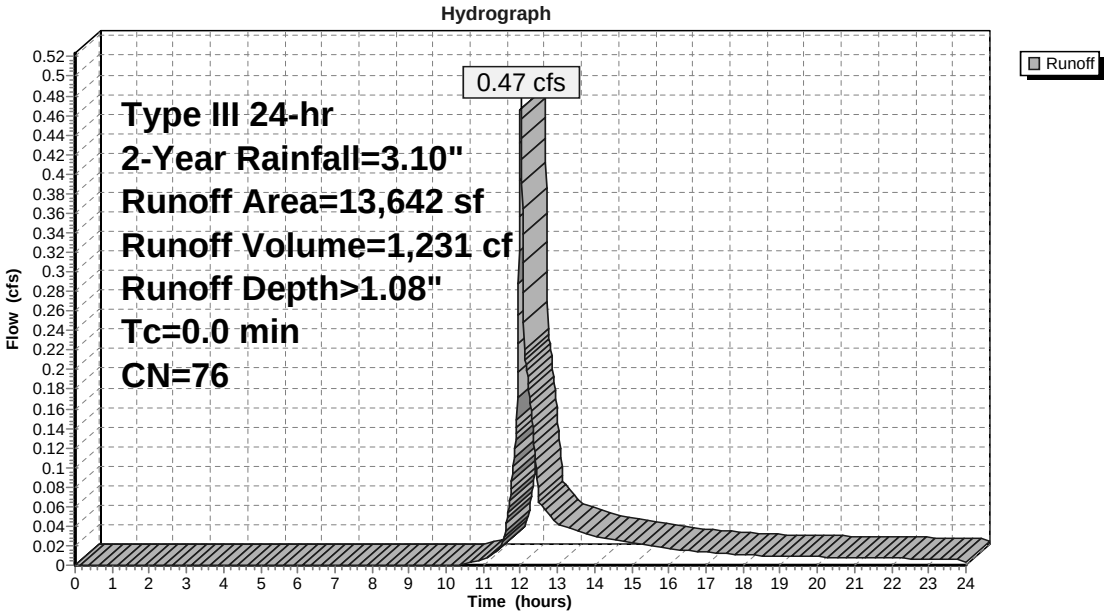
Summary for Subcatchment P-1I: Subcat P-1I

Runoff = 0.47 cfs @ 12.00 hrs, Volume= 1,231 cf, Depth> 1.08"
Routed to Link SP-1 : STUDY POINT #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
462	98	Paved parking, HSG C
537	98	Paved parking, HSG C
984	74	>75% Grass cover, Good, HSG C
2,558	74	>75% Grass cover, Good, HSG C
9,101	74	>75% Grass cover, Good, HSG C
13,642	76	Weighted Average
12,643		92.68% Pervious Area
999		7.32% Impervious Area

Subcatchment P-1I: Subcat P-1I



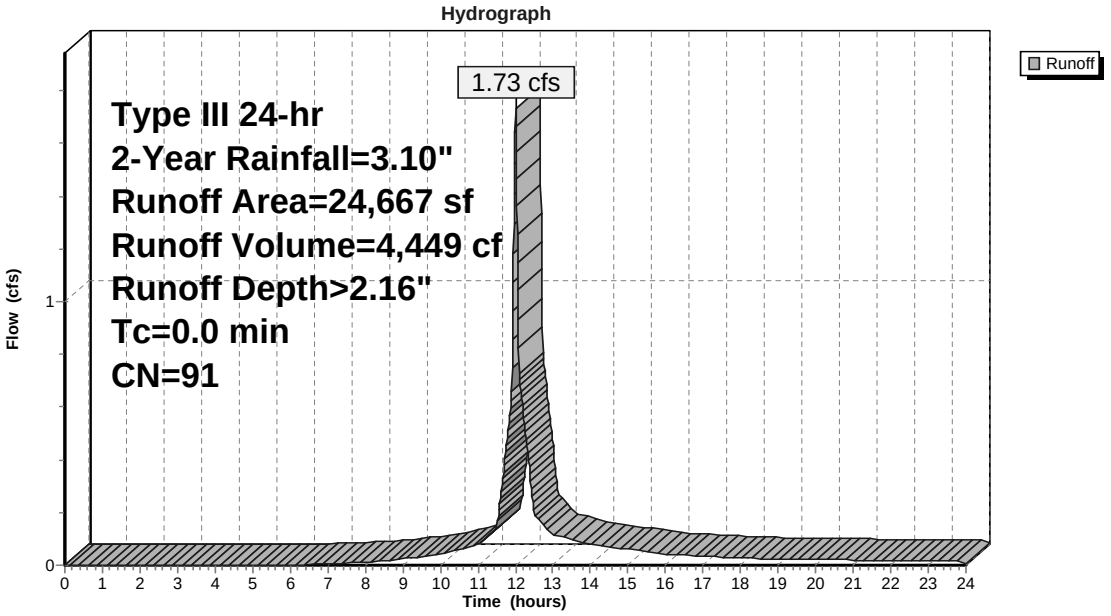
Summary for Subcatchment P-1J: Subcat P-1J

Runoff = 1.73 cfs @ 12.00 hrs, Volume= 4,449 cf, Depth> 2.16"
Routed to Pond EW : Wetland to East Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
9	74	>75% Grass cover, Good, HSG C
2,736	74	>75% Grass cover, Good, HSG C
17	80	>75% Grass cover, Good, HSG D
6	98	Paved parking, HSG C
0	98	Paved parking, HSG C
0	98	Paved parking, HSG C
2	98	Paved parking, HSG C
17,717	98	Paved parking, HSG C
834	74	>75% Grass cover, Good, HSG C
191	74	>75% Grass cover, Good, HSG C
2,512	74	>75% Grass cover, Good, HSG C
643	74	>75% Grass cover, Good, HSG C
24,667	91	Weighted Average
6,942		28.14% Pervious Area
17,725		71.86% Impervious Area

Subcatchment P-1J: Subcat P-1J



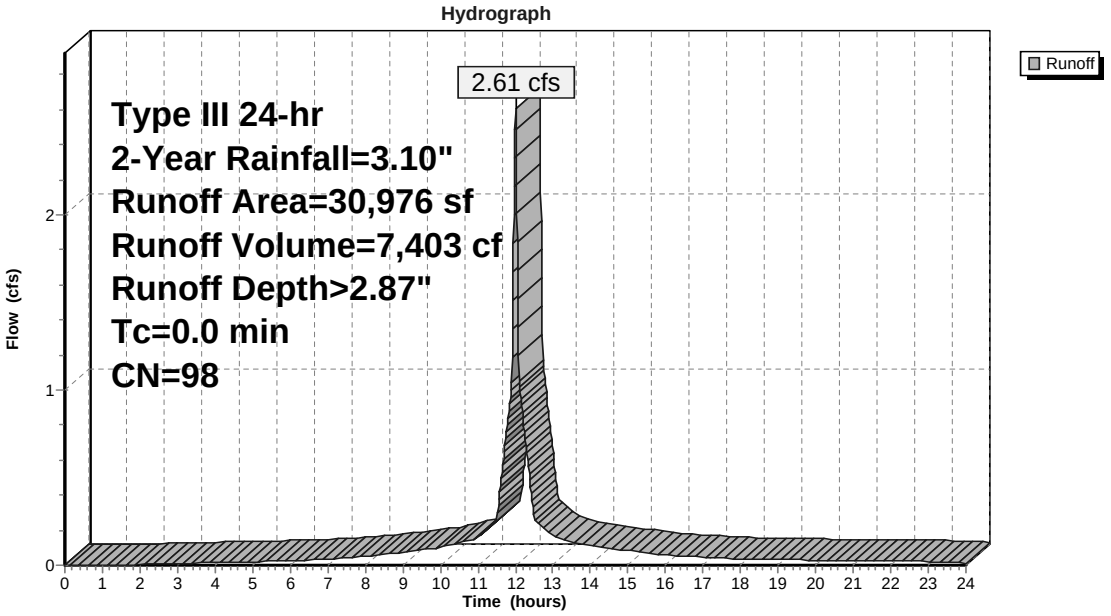
Summary for Subcatchment R-1: Subcat R-1

Runoff = 2.61 cfs @ 12.00 hrs, Volume= 7,403 cf, Depth> 2.87"
Routed to Pond P2 : SURFACE BASINS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
0	74	>75% Grass cover, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
30,976	98	Paved parking, HSG C
30,976	98	Weighted Average
0		0.00% Pervious Area
30,976		100.00% Impervious Area

Subcatchment R-1: Subcat R-1



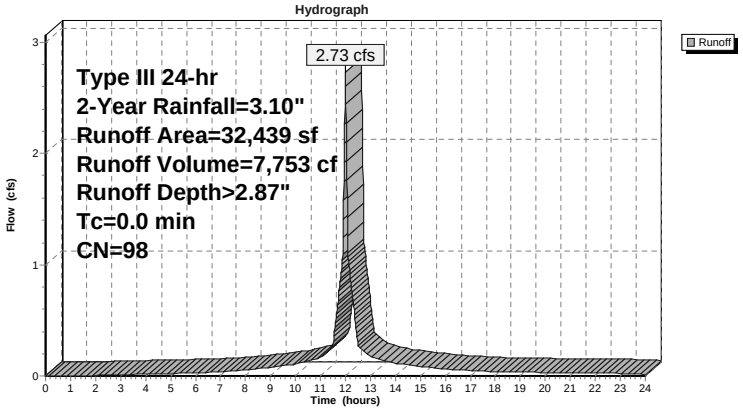
Summary for Subcatchment R-2: Subcat R-2

Runoff = 2.73 cfs @ 12.00 hrs, Volume= 7,753 cf, Depth> 2.87"
Routed to Pond P2 : SURFACE BASINS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
0	74	>75% Grass cover, Good, HSG C
32,439	98	Paved parking, HSG C
32,439	98	Weighted Average
0		0.00% Pervious Area
32,439		100.00% Impervious Area

Subcatchment R-2: Subcat R-2



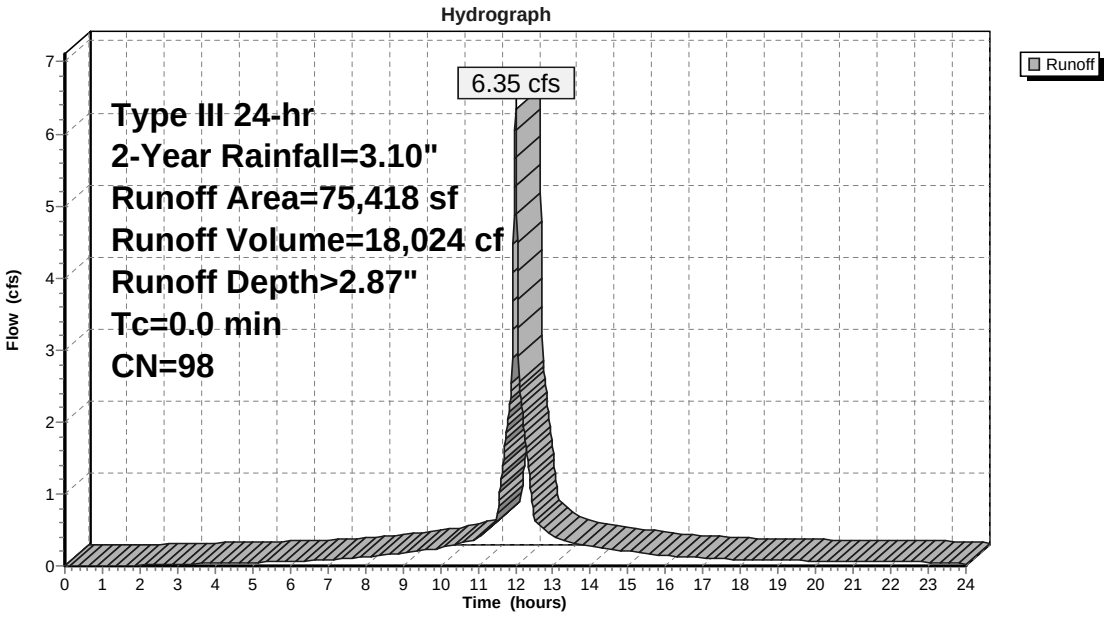
Summary for Subcatchment R-3A: Subcat R-3A

Runoff = 6.35 cfs @ 12.00 hrs, Volume= 18,024 cf, Depth> 2.87"
Routed to Pond UIS1 : UNDERGROUND CHAMBERS #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
0	74	>75% Grass cover, Good, HSG C
11,234	98	Paved parking, HSG C
0	74	>75% Grass cover, Good, HSG C
55,024	98	Paved parking, HSG C
9,161	98	Paved parking, HSG C
75,418	98	Weighted Average
0		0.00% Pervious Area
75,418		100.00% Impervious Area

Subcatchment R-3A: Subcat R-3A



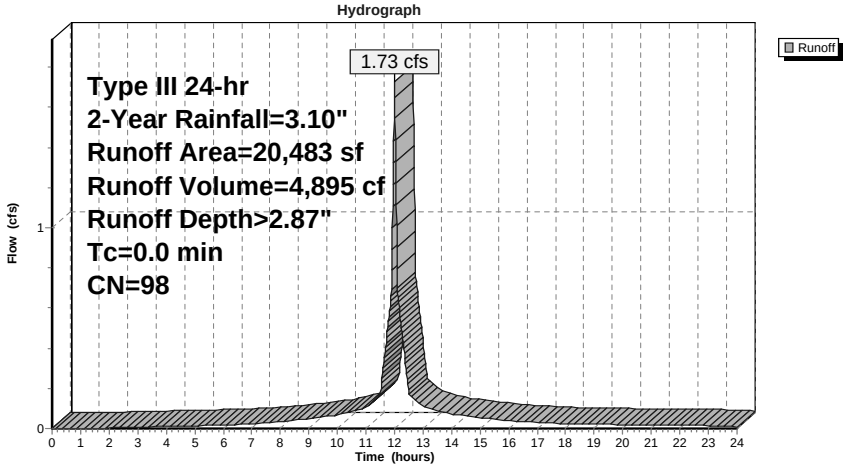
Summary for Subcatchment R-3B: Subcat R-3B

Runoff = 1.73 cfs @ 12.00 hrs, Volume= 4,895 cf, Depth> 2.87"
Routed to Pond P1B : BIO.RET. #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
20,483	98	Paved parking, HSG C
20,483		100.00% Impervious Area

Subcatchment R-3B: Subcat R-3B



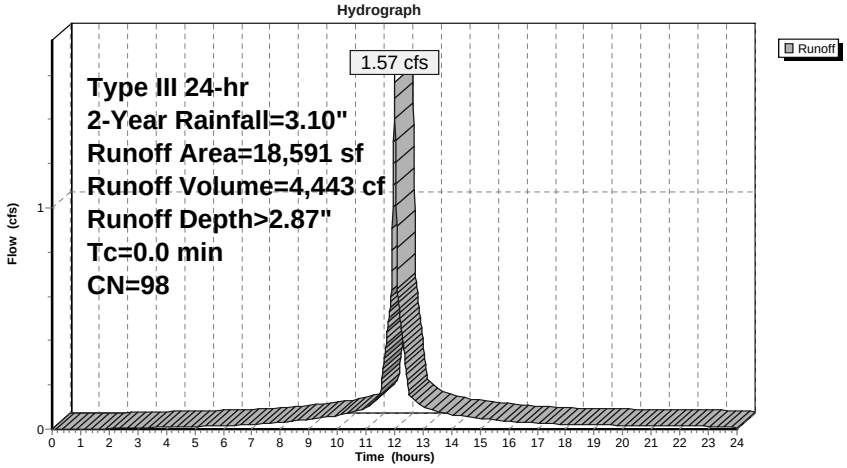
Summary for Subcatchment R-3C: Subcat R-3C

Runoff = 1.57 cfs @ 12.00 hrs, Volume= 4,443 cf, Depth> 2.87"
Routed to Pond P1C : BIO.RET. #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
18,591	98	Paved parking, HSG C
18,591		100.00% Impervious Area

Subcatchment R-3C: Subcat R-3C



Summary for Subcatchment W-1: Wetlands

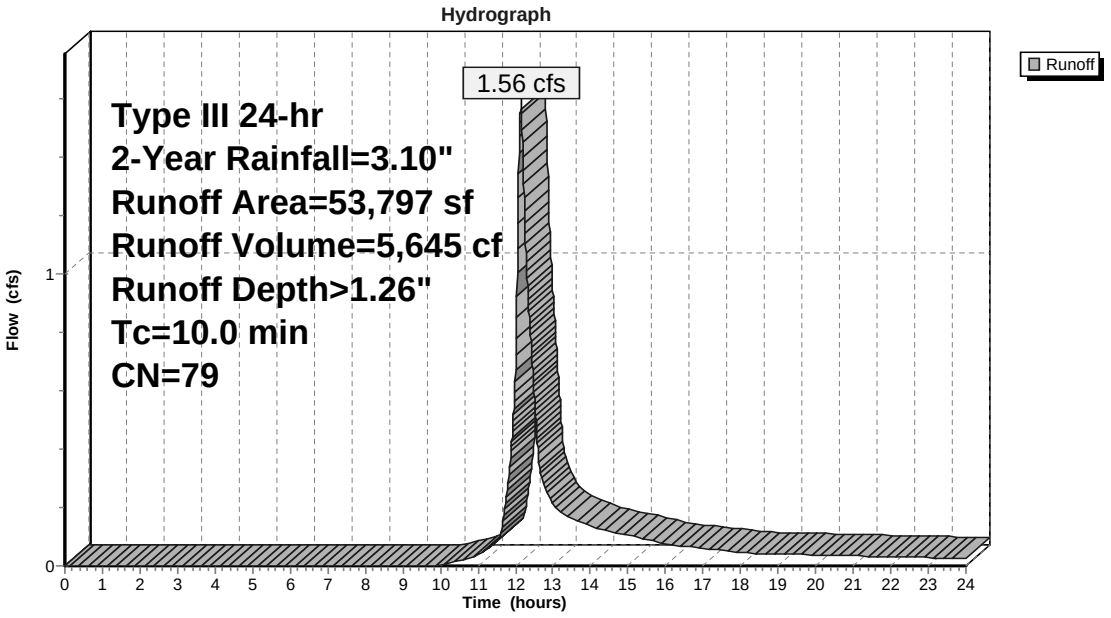
Runoff = 1.56 cfs @ 12.15 hrs, Volume= 5,645 cf, Depth> 1.26"
Routed to Pond ES : Offsite Swale to South Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
355	80	>75% Grass cover, Good, HSG D
13,345	79	Woods/grass comb., Good, HSG D
33,140	79	Woods/grass comb., Good, HSG D
2,541	74	>75% Grass cover, Good, HSG C
3,885	74	>75% Grass cover, Good, HSG C
532	98	Paved parking, HSG C
53,797	79	Weighted Average
53,265		99.01% Pervious Area
532		0.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment W-1: Wetlands



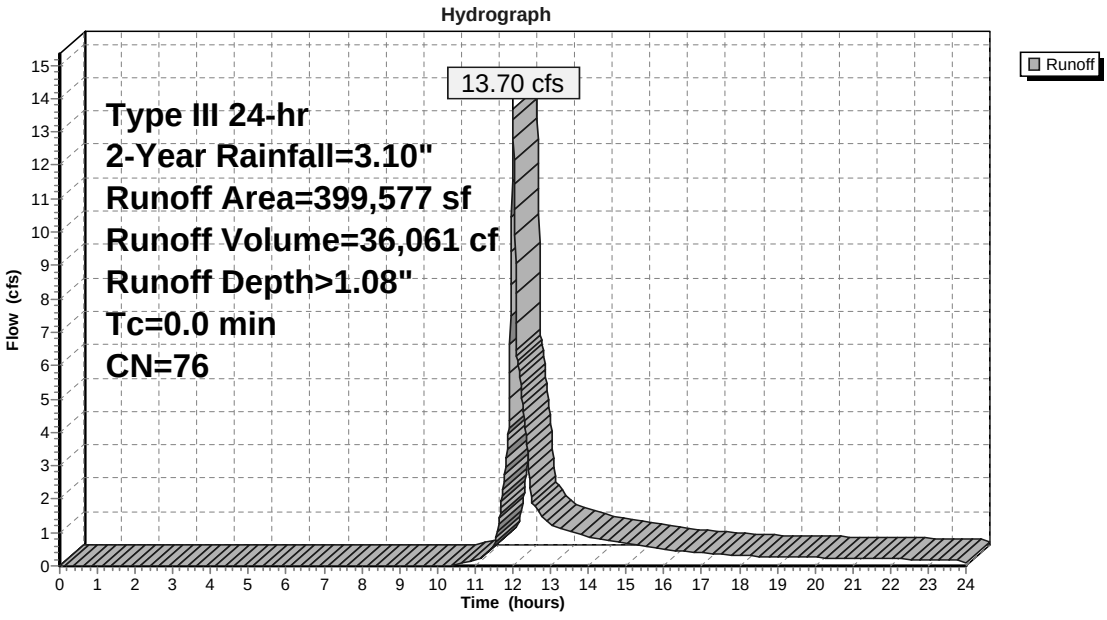
Summary for Subcatchment W-2: Subcat W-2

Runoff = 13.70 cfs @ 12.00 hrs, Volume= 36,061 cf, Depth> 1.08"
Routed to Pond EW : Wetland to East Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
21,123	79	Woods/grass comb., Good, HSG D
30,497	79	Woods/grass comb., Good, HSG D
184,072	79	Woods/grass comb., Good, HSG D
1	98	Paved parking, HSG C
9,619	98	Paved parking, HSG C
69,917	70	Woods, Good, HSG C
4,708	70	Woods, Good, HSG C
13,341	70	Woods, Good, HSG C
60,349	70	Woods, Good, HSG C
5,949	74	>75% Grass cover, Good, HSG C
399,577	76	Weighted Average
389,956		97.59% Pervious Area
9,621		2.41% Impervious Area

Subcatchment W-2: Subcat W-2



Summary for Pond ES: Offsite Swale to South Culvert

Inflow Area = 202,896 sf, 34.94% Impervious, Inflow Depth > 1.58" for 2-Year event
Inflow = 7.50 cfs @ 12.14 hrs, Volume= 26,659 cf
Outflow = 0.13 cfs @ 21.95 hrs, Volume= 2,733 cf, Atten= 98%, Lag= 588.5 min
Primary = 0.13 cfs @ 21.95 hrs, Volume= 2,733 cf
Routed to Link SP-1 : STUDY POINT #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 80.08' @ 21.95 hrs Surf.Area= 29,315 sf Storage= 24,004 cf

Plug-Flow detention time= 593.7 min calculated for 2,732 cf (10% of inflow)
Center-of-Mass det. time= 422.4 min (1,255.6 - 833.2)

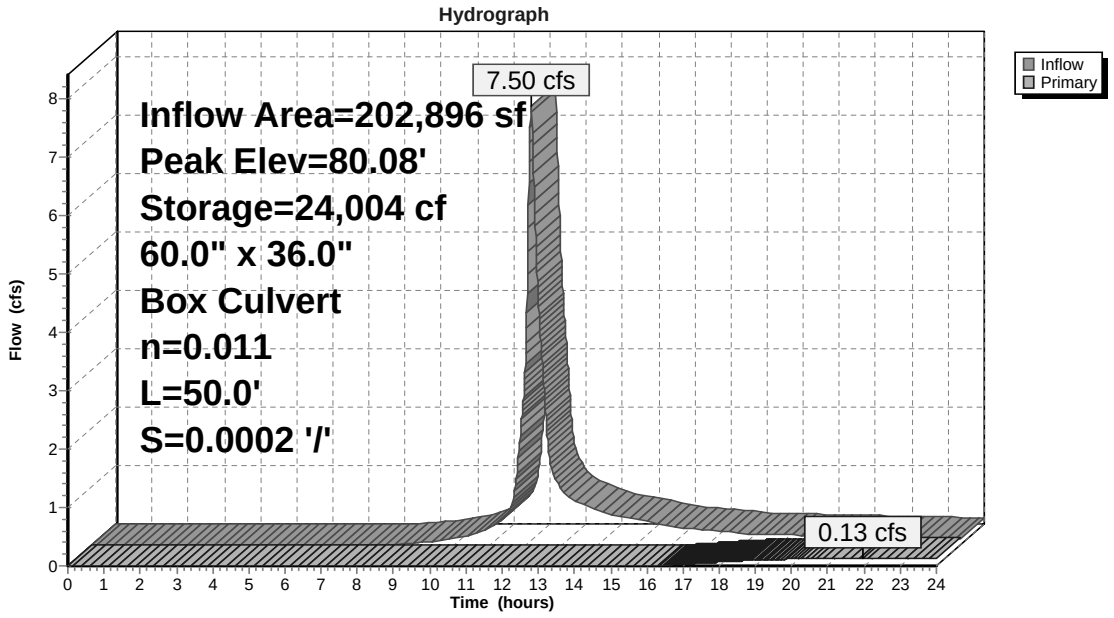
Volume	Invert	Avail.Storage	Storage Description
#1	79.00'	136,108 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
79.00	17,000	1,200.0	0	0	17,000
80.00	27,000	4,000.0	21,808	21,808	1,175,651
81.00	63,900	4,200.0	44,146	65,954	1,306,222
82.00	76,600	4,250.0	70,154	136,108	1,340,108

Device	Routing	Invert	Outlet Devices
#1	Primary	80.00'	**60.0" W x 36.0" H Box Culvert** L= 50.0' Box, headwall w/3 square edges, Ke= 0.500 Inlet / Outlet Invert= 80.00' / 79.99' S= 0.0002 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 15.00 sf

Primary OutFlow Max=0.13 cfs @ 21.95 hrs HW=80.08' TW=0.00' (Dynamic Tailwater)
1=Culvert (Barrel Controls 0.13 cfs @ 0.45 fps)

Pond ES: Offsite Swale to South Culvert



Summary for Pond EW: Wetland to East Culvert

Inflow Area = 424,244 sf, 6.45% Impervious, Inflow Depth > 1.15" for 2-Year event
Inflow = 15.42 cfs @ 12.00 hrs, Volume= 40,510 cf
Outflow = 0.15 cfs @ 23.99 hrs, Volume= 3,958 cf, Atten= 99%, Lag= 719.3 min
Primary = 0.15 cfs @ 23.99 hrs, Volume= 3,958 cf
Routed to Link SP-1 : STUDY POINT #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 80.51' @ 23.99 hrs Surf.Area= 94,784 sf Storage= 36,554 cf

Plug-Flow detention time= 503.1 min calculated for 3,958 cf (10% of inflow)
Center-of-Mass det. time= 338.2 min (1,184.2 - 846.0)

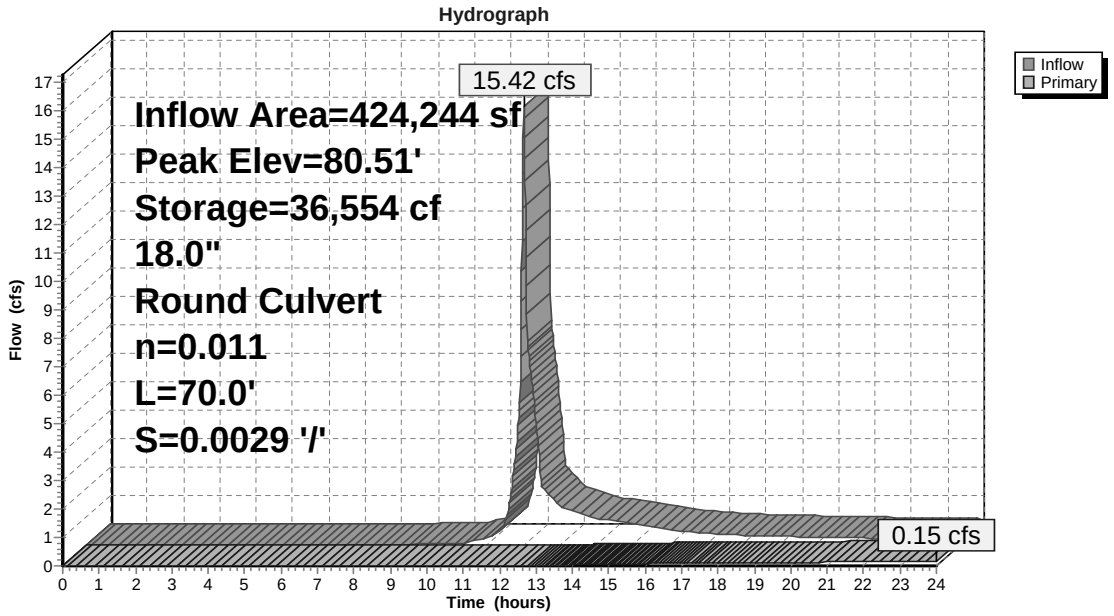
Volume	Invert	Avail.Storage	Storage Description
#1	80.00'	290,435 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
80.00	52,000	1,200.0	0	0	52,000
81.00	149,000	2,600.0	96,341	96,341	475,356
82.00	243,000	4,300.0	194,094	290,435	1,408,807

Device	Routing	Invert	Outlet Devices
#1	Primary	80.30'	**18.0" Round Culvert** L= 70.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 80.30' / 80.10' S= 0.0029 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.77 sf

Primary OutFlow Max=0.15 cfs @ 23.99 hrs HW=80.51' TW=0.00' (Dynamic Tailwater)
1=Culvert (Barrel Controls 0.15 cfs @ 1.52 fps)

Pond EW: Wetland to East Culvert



Summary for Pond OFFSITE: OFFSITE PONDING AREA IN GRASS

Inflow Area = 430,077 sf, 74.28% Impervious, Inflow Depth > 0.45" for 2-Year event
Inflow = 0.84 cfs @ 14.59 hrs, Volume= 15,961 cf
Outflow = 0.83 cfs @ 14.81 hrs, Volume= 15,837 cf, Atten= 1%, Lag= 12.9 min
Primary = 0.83 cfs @ 14.81 hrs, Volume= 15,837 cf
Routed to Link SP-1 : STUDY POINT #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 82.44' @ 14.81 hrs Surf.Area= 2,774 sf Storage= 508 cf

Plug-Flow detention time= 10.2 min calculated for 15,837 cf (99% of inflow)
Center-of-Mass det. time= 7.1 min (1,049.5 - 1,042.3)

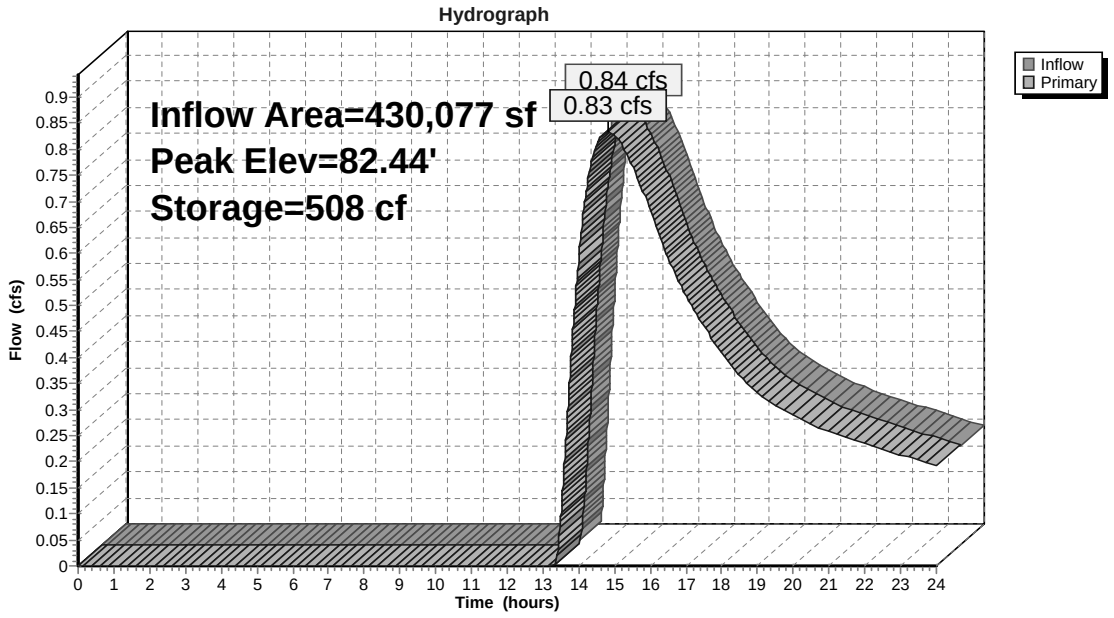
Volume	Invert	Avail.Storage	Storage Description
#1	82.10'	3,254 cf	**OFFSITE PONDING AREA (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
82.10	230	0	0
83.00	7,000	3,254	3,254

Device	Routing	Invert	Outlet Devices
#1	Primary	82.10'	**8.0" Round (3) 8" HDPE X 3.00** L= 21.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 82.10' / 81.40' S= 0.0333 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf
#2	Primary	82.60'	**30.0' long x 10.0' breadth WEIR FLOW OVER WALKING PATH** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=0.83 cfs @ 14.81 hrs HW=82.44' TW=0.00' (Dynamic Tailwater)
1=(3) 8" HDPE (Inlet Controls 0.83 cfs @ 1.56 fps)
2=WEIR FLOW OVER WALKING PATH (Controls 0.00 cfs)

Pond OFFSITE: OFFSITE PONDING AREA IN GRASS



Summary for Pond P1A: BIO.RET. #1

Inflow Area = 22,626 sf, 87.10% Impervious, Inflow Depth > 2.54" for 2-Year event
Inflow = 1.29 cfs @ 12.14 hrs, Volume= 4,795 cf
Outflow = 1.29 cfs @ 12.14 hrs, Volume= 4,602 cf, Atten= 0%, Lag= 0.4 min
Primary = 1.29 cfs @ 12.14 hrs, Volume= 4,602 cf
Routed to Pond UIS1 : UNDERGROUND CHAMBERS #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 86.47' @ 12.14 hrs Surf.Area= 658 sf Storage= 236 cf
Flood Elev= 86.40' Surf.Area= 606 sf Storage= 191 cf

Plug-Flow detention time= 38.9 min calculated for 4,602 cf (96% of inflow)
Center-of-Mass det. time= 15.8 min (800.4 - 784.7)

Volume	Invert	Avail.Storage	Storage Description
#1	86.00'	157 cf	**BIORETENTION #1 (Irregular)**Listed below (Recalc)
#2	86.00'	98 cf	**BIORETENTION #1 (Irregular)**Listed below (Recalc)
#3	86.50'	3,461 cf	**PARKING LOT (Irregular)**Listed below (Recalc)
		3,716 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
86.00	241	148.0	0	0	241
86.50	392	154.0	157	157	404

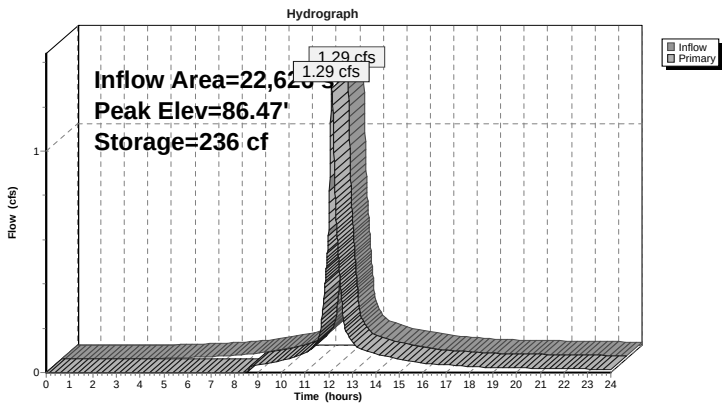
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
86.00	118	166.0	0	0	118
86.50	287	172.0	98	98	300

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
86.50	1,011	195.0	0	0	1,011
87.00	15,764	649.0	3,461	3,461	31,504

Device	Routing	Invert	Outlet Devices
#1	Primary	83.97'	**8.0" Round (2) 8" HDPE X 2.00** L= 28.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 83.97' / 83.83' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Device 1	86.40'	**8.0" Horiz. (2) 8" GRATES X 2.00** C= 0.600 Limited to weir flow at low heads
#3	Primary	83.97'	**12.0" Round (2) 12" HDPE X 2.00** L= 24.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 83.97' / 83.83' S= 0.0058 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#4	Device 3	86.40'	**24.0" x 24.0" Horiz. (2) 24" GRATES X 2.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.28 cfs @ 12.14 hrs HW=86.47' TW=84.98' (Dynamic Tailwater)
- **1=(2) 8" HDPE** (Passes 0.27 cfs of 3.95 cfs potential flow)
  - **2=(2) 8" GRATES** (Weir Controls 0.27 cfs @ 0.88 fps)
- **3=(2) 12" HDPE** (Passes 1.02 cfs of 9.24 cfs potential flow)
  - **4=(2) 24" GRATES** (Weir Controls 1.02 cfs @ 0.88 fps)

Pond P1A: BIO.RET. #1



Summary for Pond P1B: BIO.RET. #2

Inflow Area = 28,449 sf, 81.88% Impervious, Inflow Depth > 2.47" for 2-Year event
Inflow = 1.85 cfs @ 12.00 hrs, Volume= 5,861 cf
Outflow = 1.17 cfs @ 12.08 hrs, Volume= 3,814 cf, Atten= 37%, Lag= 4.5 min
Primary = 1.17 cfs @ 12.08 hrs, Volume= 3,814 cf
Routed to Pond UIS1 : UNDERGROUND CHAMBERS #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 86.61' @ 12.08 hrs Surf.Area= 4,310 sf Storage= 2,470 cf
Flood Elev= 86.50' Surf.Area= 4,230 sf Storage= 2,021 cf

Plug-Flow detention time= 195.7 min calculated for 3,814 cf (65% of inflow)
Center-of-Mass det. time= 93.1 min (859.2 - 766.1)

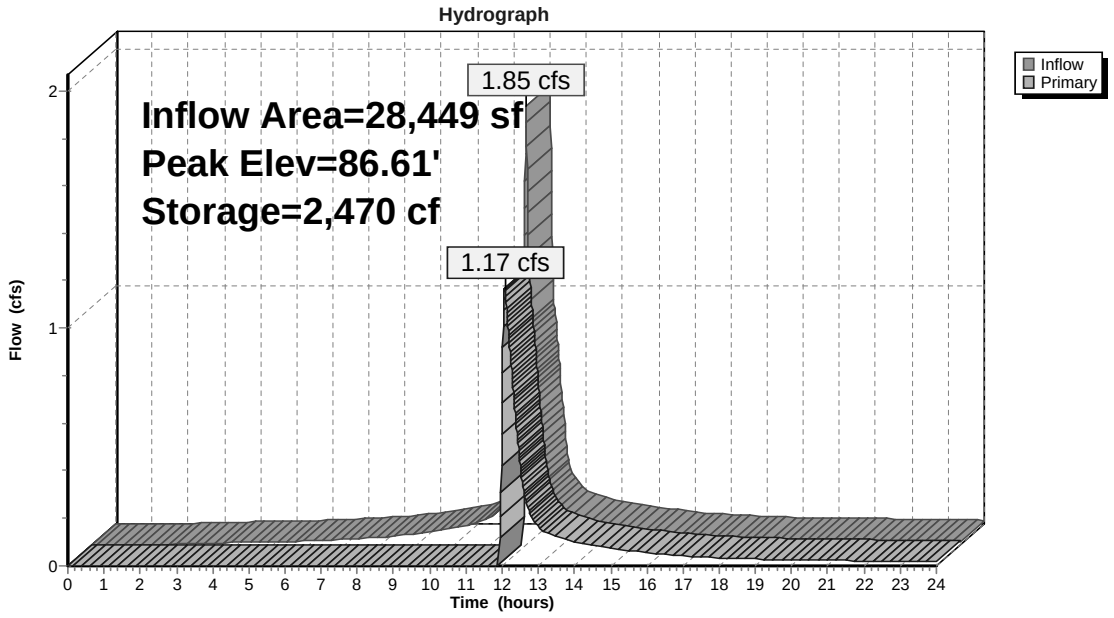
Volume	Invert	Avail.Storage	Storage Description
#1	86.00'	6,641 cf	**BIORETENTION #2 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
86.00	3,856	244.0	0	0	3,856
86.50	4,230	254.0	2,021	2,021	4,271
87.00	4,618	263.0	2,211	4,232	4,664
87.50	5,020	273.0	2,409	6,641	5,111

Device	Routing	Invert	Outlet Devices
#1	Primary	83.78'	**6.0" Round (2) 6" HDPE X 2.00** L= 56.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 83.78' / 83.50' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf
#2	Device 1	86.50'	**8.0" Horiz. (5) 8" OVERFLOW X 5.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.17 cfs @ 12.08 hrs HW=86.61' TW=84.94' (Dynamic Tailwater)
↑**1=(2) 6" HDPE** (Passes 1.17 cfs of 1.64 cfs potential flow)
↑**2=(5) 8" OVERFLOW** (Weir Controls 1.17 cfs @ 1.06 fps)

Pond P1B: BIO.RET. #2



Summary for Pond P1C: BIO.RET. #3

Inflow Area = 30,967 sf, 71.58% Impervious, Inflow Depth > 2.28" for 2-Year event
Inflow = 1.74 cfs @ 12.00 hrs, Volume= 5,874 cf
Outflow = 1.40 cfs @ 12.05 hrs, Volume= 4,584 cf, Atten= 19%, Lag= 2.7 min
Primary = 1.40 cfs @ 12.05 hrs, Volume= 4,584 cf
Routed to Pond UIS1 : UNDERGROUND CHAMBERS #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 86.64' @ 12.05 hrs Surf.Area= 3,073 sf Storage= 1,677 cf
Flood Elev= 86.50' Surf.Area= 2,855 sf Storage= 1,269 cf

Plug-Flow detention time= 147.9 min calculated for 4,584 cf (78% of inflow)
Center-of-Mass det. time= 65.6 min (839.5 - 773.9)

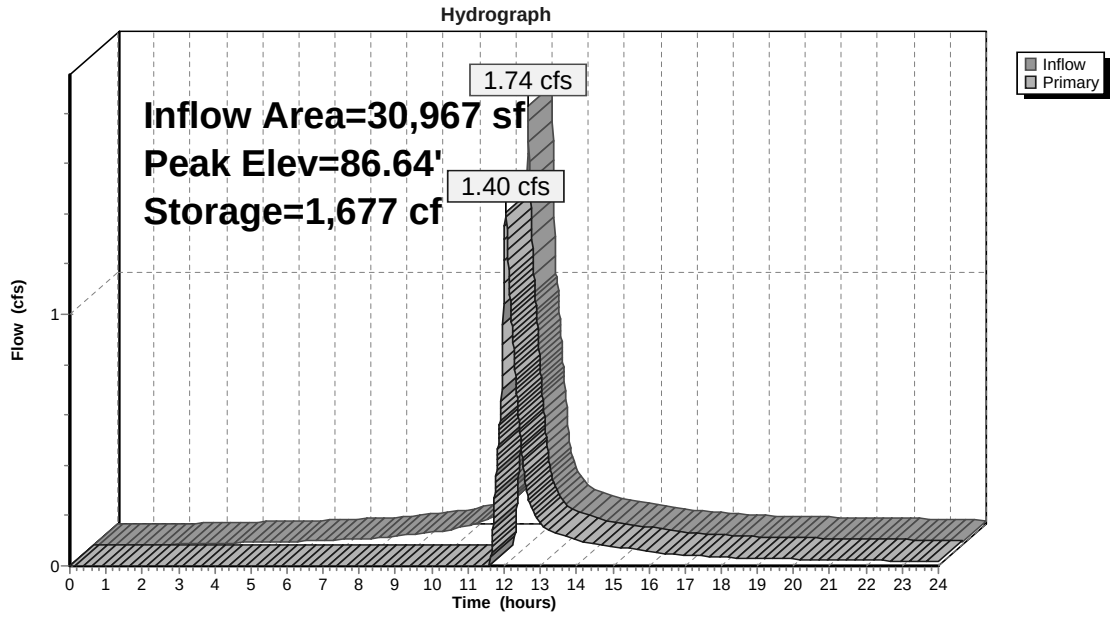
Volume	Invert	Avail.Storage	Storage Description
#1	86.00'	4,927 cf	**BIORETENTION #3 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
86.00	2,232	410.0	0	0	2,232
86.50	2,855	420.0	1,269	1,269	2,924
87.00	3,683	502.0	1,630	2,899	8,945
87.50	4,444	512.0	2,029	4,927	9,791

Device	Routing	Invert	Outlet Devices
#1	Primary	83.82'	**6.0" Round (2) 6" HDPE X 2.00** L= 63.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 83.82' / 83.50' S= 0.0051 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf
#2	Device 1	86.50'	**8.0" Horiz. (4) 8" OVERFLOW X 4.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.40 cfs @ 12.05 hrs HW=86.64' TW=84.88' (Dynamic Tailwater)
↑**1=(2) 6" HDPE** (Passes 1.40 cfs of 1.61 cfs potential flow)
↑**2=(4) 8" OVERFLOW** (Weir Controls 1.40 cfs @ 1.21 fps)

Pond P1C: BIO.RET. #3



Summary for Pond P2: SURFACE BASINS

Inflow Area = 430,077 sf, 74.28% Impervious, Inflow Depth > 1.80" for 2-Year event
Inflow = 15.43 cfs @ 12.07 hrs, Volume= 64,499 cf
Outflow = 1.24 cfs @ 14.59 hrs, Volume= 23,459 cf, Atten= 92%, Lag= 151.6 min
Primary = 0.84 cfs @ 14.59 hrs, Volume= 15,961 cf
Routed to Pond OFFSITE : OFFSITE PONDING AREA IN GRASS
Secondary = 0.40 cfs @ 14.59 hrs, Volume= 7,498 cf
Routed to Link SP-1 : STUDY POINT #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 84.39' @ 14.59 hrs Surf.Area= 36,812 sf Storage= 43,213 cf
Flood Elev= 84.30' Surf.Area= 36,024 sf Storage= 39,786 cf

Plug-Flow detention time= 349.2 min calculated for 23,449 cf (36% of inflow)
Center-of-Mass det. time= 212.4 min (1,042.3 - 829.9)

Volume	Invert	Avail.Storage	Storage Description
#1	83.00'	90,039 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)
83.00	25,325	2,737.0	0	0	25,325
84.00	33,567	2,757.0	29,349	29,349	34,490
84.50	37,710	2,768.0	17,809	47,159	39,520
85.00	41,870	2,778.0	19,886	67,045	44,146
85.50	50,234	2,799.0	22,994	90,039	53,570

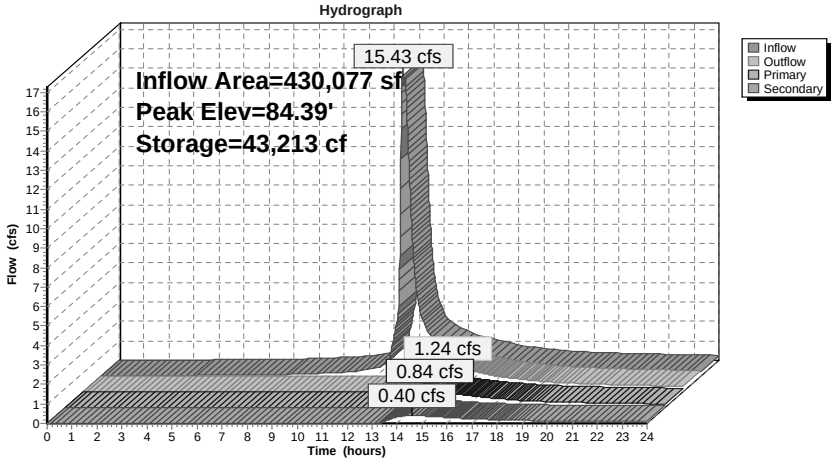
Device	Routing	Invert	Outlet Devices
#1	Secondary	82.40'	**6.0" Round (2) 6" PVC X 2.00** L= 140.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 82.40' / 81.00' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf
#2	Device 1	84.30'	**8.0" Horiz. (2) 8" OVERFLOW X 2.00** C= 0.600 Limited to weir flow at low heads
#3	Primary	83.30'	**50.0' long x 60.0' breadth GRASS/LAWN AREA** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#4	Device 3	84.30'	**12.0' long x 8.0' breadth EMERGENCY OVERFLOW**

Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50
Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=0.84 cfs @ 14.59 hrs HW=84.39' TW=82.44' (Dynamic Tailwater)
└─**3=GRASS/LAWN AREA** (Passes 0.84 cfs of 150.76 cfs potential flow)
└─**4=EMERGENCY OVERFLOW** (Weir Controls 0.84 cfs @ 0.75 fps)

Secondary OutFlow Max=0.40 cfs @ 14.59 hrs HW=84.39' TW=0.00' (Dynamic Tailwater)
└─**1=(2) 6" PVC** (Passes 0.40 cfs of 1.89 cfs potential flow)
└─**2=(2) 8" OVERFLOW** (Weir Controls 0.40 cfs @ 1.00 fps)

Pond P2: SURFACE BASINS



Summary for Pond UIS1: UNDERGROUND CHAMBERS #1

Inflow Area = 282,197 sf, 82.71% Impervious, Inflow Depth > 2.31" for 2-Year event
Inflow = 12.50 cfs @ 12.06 hrs, Volume= 54,433 cf
Outflow = 11.93 cfs @ 12.16 hrs, Volume= 40,014 cf, Atten= 5%, Lag= 6.0 min
Primary = 11.93 cfs @ 12.16 hrs, Volume= 40,014 cf
Routed to Pond P2 : SURFACE BASINS

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 84.98' @ 12.16 hrs Surf.Area= 15,622 sf Storage= 17,577 cf
Flood Elev= 84.50' Surf.Area= 15,622 sf Storage= 14,159 cf

Plug-Flow detention time= 153.7 min calculated for 39,997 cf (73% of inflow)
Center-of-Mass det. time= 65.4 min (857.5 - 792.1)

Volume	Invert	Avail.Storage	Storage Description
#1B	83.00'	2,488 cf	**8.17'W x 416.16'L x 2.33'H Field B** 7,930 cf Overall - 1,710 cf Embedded = 6,220 cf x 40.0% Voids
#2B	83.50'	1,710 cf	**ADS_StormTech SC-310 +Cap** x 116 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 116 Chambers in 2 Rows
#3C	83.00'	3,040 cf	**8.17'W x 508.72'L x 2.33'H Field C** 9,694 cf Overall - 2,093 cf Embedded = 7,601 cf x 40.0% Voids
#4C	83.50'	2,093 cf	**ADS_StormTech SC-310 +Cap** x 142 Inside #3 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 142 Chambers in 2 Rows
#5D	83.00'	2,369 cf	**14.83'W x 223.92'L x 2.33'H Field D** 7,750 cf Overall - 1,828 cf Embedded = 5,922 cf x 40.0% Voids
#6D	83.50'	1,828 cf	**ADS_StormTech SC-310 +Cap** x 124 Inside #5 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 124 Chambers in 4 Rows
#7E	83.00'	3,182 cf	**21.50'W x 209.68'L x 2.33'H Field E** 10,519 cf Overall - 2,565 cf Embedded = 7,954 cf x 40.0% Voids
#8E	83.50'	2,565 cf	**ADS_StormTech SC-310 +Cap** x 174 Inside #7

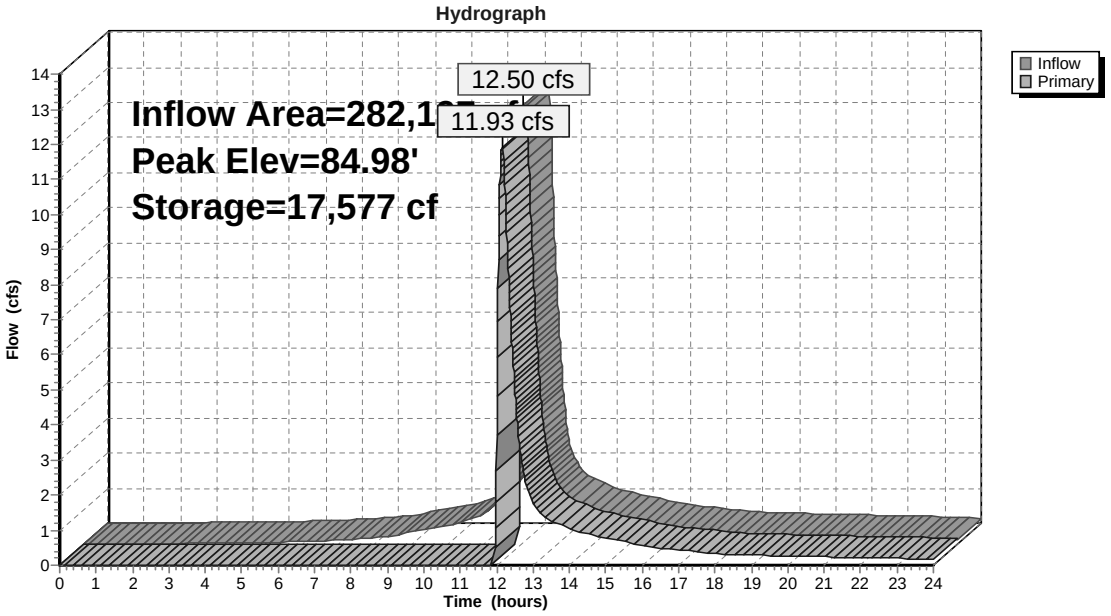
			Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 174 Chambers in 6 Rows
#9	83.00'	860 cf	**4.00'D x 3.60'H Vertical Cone/Cylinder** x 19
		20,135 cf	Total Available Storage

Storage Group B created with Chamber Wizard
Storage Group C created with Chamber Wizard
Storage Group D created with Chamber Wizard
Storage Group E created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	83.34'	**24.0" Round (3) 24" HDPE X 3.00** L= 130.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 83.34' / 83.00' S= 0.0026 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	84.50'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir X 3.00** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=11.93 cfs @ 12.16 hrs HW=84.98' TW=83.65' (Dynamic Tailwater)
↑**1=(3) 24" HDPE** (Passes 11.93 cfs of 23.32 cfs potential flow)
↑**2=Broad-Crested Rectangular Weir** (Weir Controls 11.93 cfs @ 2.07 fps)

Pond UIS1: UNDERGROUND CHAMBERS #1

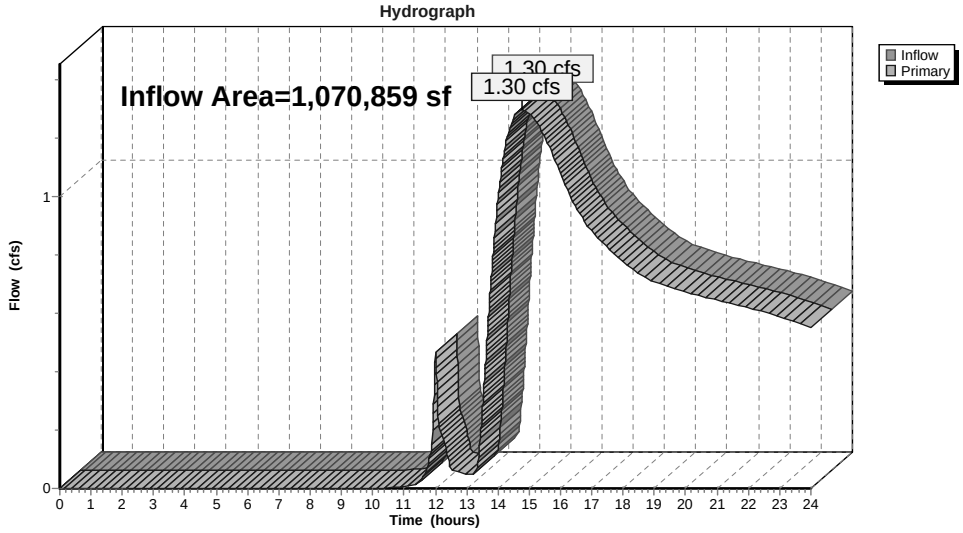


Summary for Link SP-1: STUDY POINT #1

Inflow Area = 1,070,859 sf, 39.10% Impervious, Inflow Depth > 0.35" for 2-Year event
Inflow = 1.30 cfs @ 14.78 hrs, Volume= 31,257 cf
Primary = 1.30 cfs @ 14.78 hrs, Volume= 31,257 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node SP-2

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link SP-1: STUDY POINT #1



Summary for Subcatchment P-1A: PR. WATERSHED

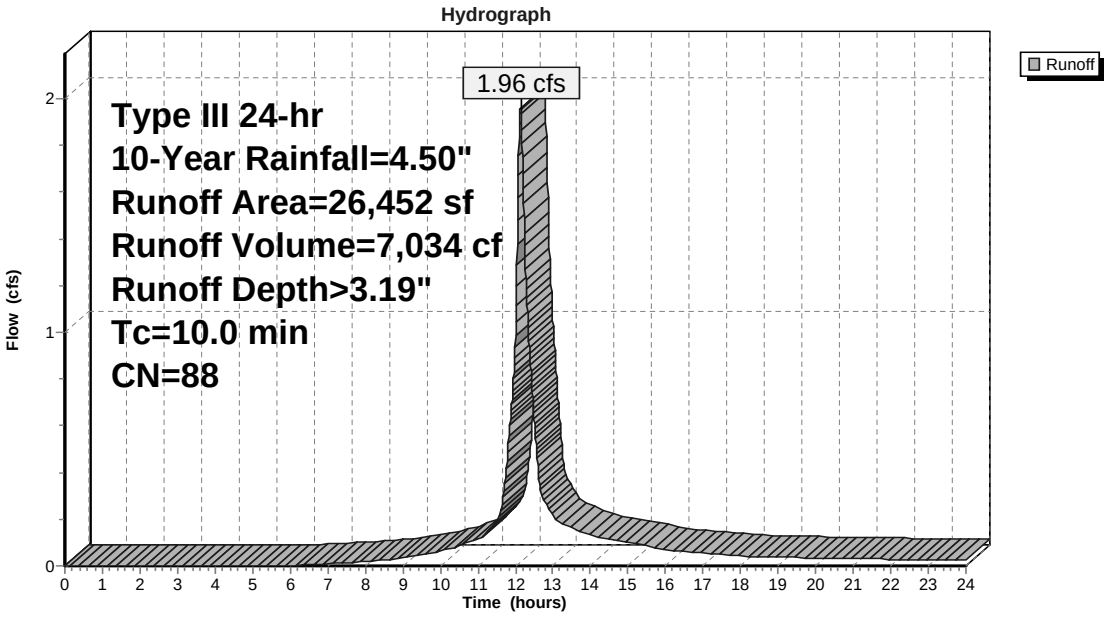
Runoff = 1.96 cfs @ 12.14 hrs, Volume= 7,034 cf, Depth> 3.19"
Routed to Pond ES : Offsite Swale to South Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
7,960	98	Paved parking, HSG C
3,795	98	Paved parking, HSG C
3,188	98	Paved parking, HSG D
11	98	Paved parking, HSG C
4,721	74	>75% Grass cover, Good, HSG C
6,286	74	>75% Grass cover, Good, HSG C
402	74	>75% Grass cover, Good, HSG C
88	74	>75% Grass cover, Good, HSG C
26,452	88	Weighted Average
11,497		43.46% Pervious Area
14,955		56.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment P-1A: PR. WATERSHED



Summary for Subcatchment P-1B: PR. WATERSHED

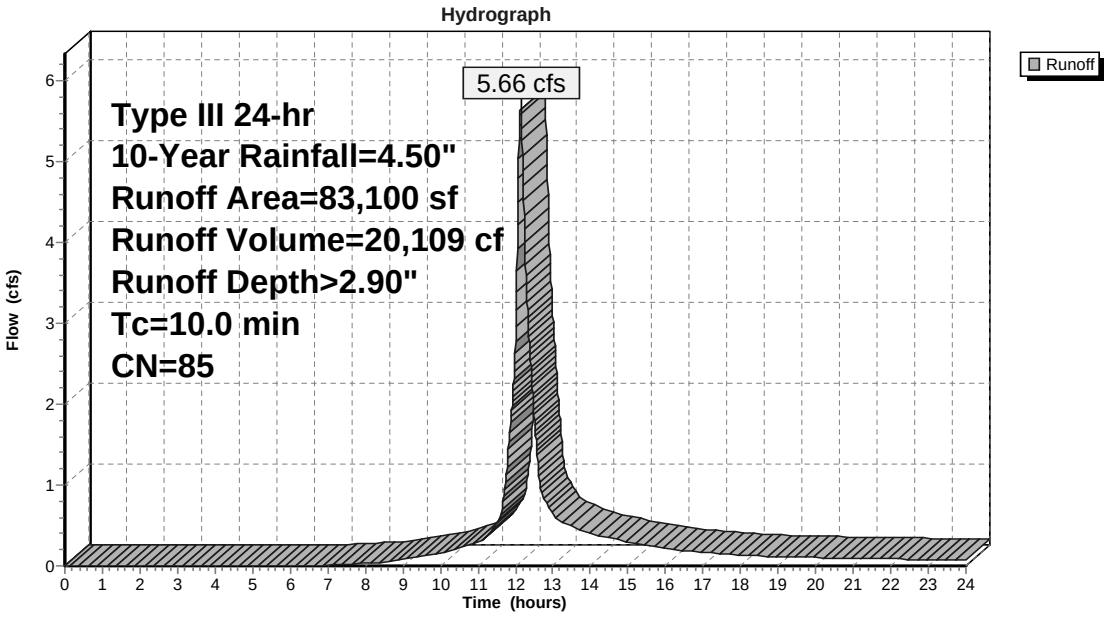
Runoff = 5.66 cfs @ 12.14 hrs, Volume= 20,109 cf, Depth> 2.90"
Routed to Pond ES : Offsite Swale to South Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
45	98	Paved parking, HSG C
0	98	Paved parking, HSG C
43	98	Paved parking, HSG C
0	98	Paved parking, HSG C
38,768	98	Paved parking, HSG C
1,827	74	>75% Grass cover, Good, HSG C
2,703	74	>75% Grass cover, Good, HSG C
679	74	>75% Grass cover, Good, HSG C
60	74	>75% Grass cover, Good, HSG C
30	74	>75% Grass cover, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
26	74	>75% Grass cover, Good, HSG C
14	74	>75% Grass cover, Good, HSG C
9,123	74	>75% Grass cover, Good, HSG C
2	74	>75% Grass cover, Good, HSG C
5,052	74	>75% Grass cover, Good, HSG C
8,899	74	>75% Grass cover, Good, HSG C
15,828	74	>75% Grass cover, Good, HSG C
83,100	85	Weighted Average
44,244		53.24% Pervious Area
38,856		46.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment P-1B: PR. WATERSHED



Summary for Subcatchment P-1C: PR. WATERSHED

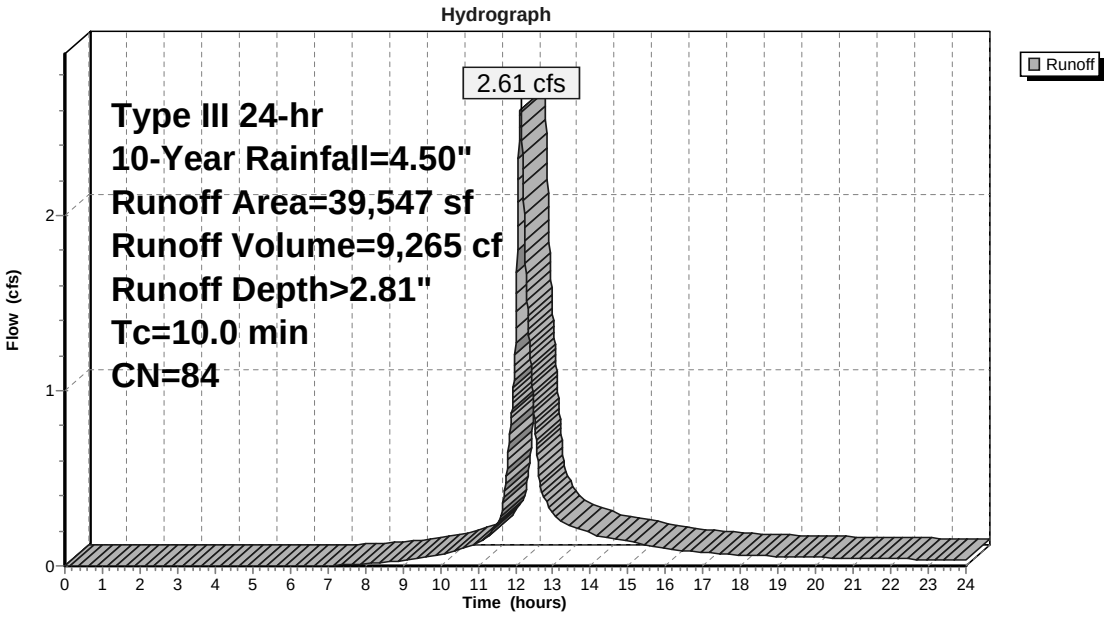
Runoff = 2.61 cfs @ 12.14 hrs, Volume= 9,265 cf, Depth> 2.81"
Routed to Pond ES : Offsite Swale to South Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
227	80	>75% Grass cover, Good, HSG D
16,521	98	Paved parking, HSG C
18	98	Paved parking, HSG C
2,500	74	>75% Grass cover, Good, HSG C
214	74	>75% Grass cover, Good, HSG C
68	74	>75% Grass cover, Good, HSG C
95	74	>75% Grass cover, Good, HSG C
3,398	74	>75% Grass cover, Good, HSG C
368	74	>75% Grass cover, Good, HSG C
16,138	74	>75% Grass cover, Good, HSG C
39,547	84	Weighted Average
23,007		58.18% Pervious Area
16,540		41.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment P-1C: PR. WATERSHED



Summary for Subcatchment P-1D: PR. WATERSHED

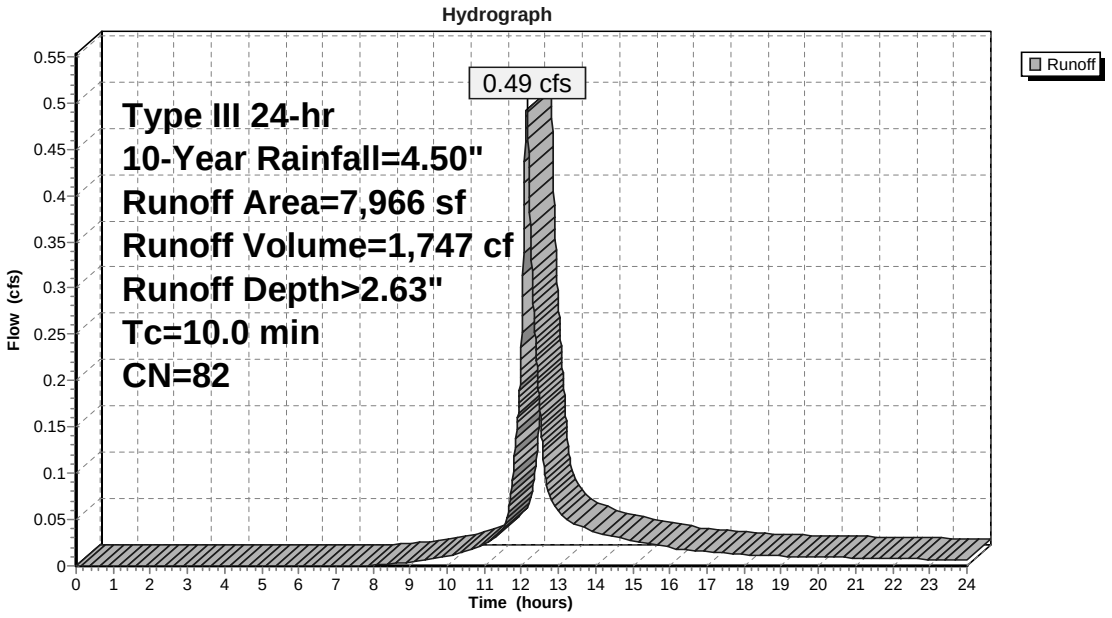
Runoff = 0.49 cfs @ 12.14 hrs, Volume= 1,747 cf, Depth> 2.63"
Routed to Pond P1B : BIO.RET. #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
240	98	Paved parking, HSG C
2,251	98	Paved parking, HSG C
81	98	Paved parking, HSG C
80	98	Paved parking, HSG C
80	98	Paved parking, HSG C
80	98	Paved parking, HSG C
1,810	74	>75% Grass cover, Good, HSG C
3,340	74	>75% Grass cover, Good, HSG C
4	74	>75% Grass cover, Good, HSG C
7,966	82	Weighted Average
5,154		64.70% Pervious Area
2,812		35.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment P-1D: PR. WATERSHED



Summary for Subcatchment P-1E: PR. WATERSHED

Runoff = 10.13 cfs @ 12.14 hrs, Volume= 37,384 cf, Depth> 3.60"
Routed to Pond UIS1 : UNDERGROUND CHAMBERS #1

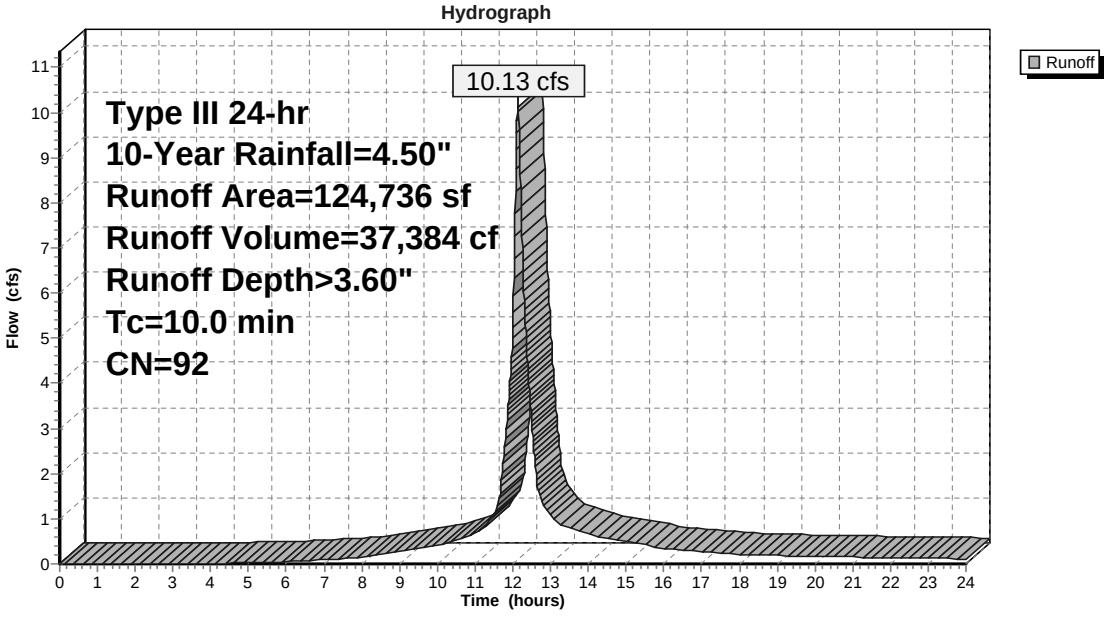
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
68	98	Paved parking, HSG C
6	98	Paved parking, HSG C
0	98	Paved parking, HSG C
0	98	Paved parking, HSG C
92,743	98	Paved parking, HSG C
0	98	Paved parking, HSG C
4,692	74	>75% Grass cover, Good, HSG C
1,328	74	>75% Grass cover, Good, HSG C
389	74	>75% Grass cover, Good, HSG C
73	74	>75% Grass cover, Good, HSG C
97	74	>75% Grass cover, Good, HSG C
73	74	>75% Grass cover, Good, HSG C
111	74	>75% Grass cover, Good, HSG C
123	74	>75% Grass cover, Good, HSG C
562	74	>75% Grass cover, Good, HSG C
6,210	74	>75% Grass cover, Good, HSG C
883	74	>75% Grass cover, Good, HSG C
721	74	>75% Grass cover, Good, HSG C
160	74	>75% Grass cover, Good, HSG C
140	74	>75% Grass cover, Good, HSG C
131	74	>75% Grass cover, Good, HSG C
172	74	>75% Grass cover, Good, HSG C
338	74	>75% Grass cover, Good, HSG C
61	74	>75% Grass cover, Good, HSG C
935	74	>75% Grass cover, Good, HSG C
77	74	>75% Grass cover, Good, HSG C
65	74	>75% Grass cover, Good, HSG C
148	74	>75% Grass cover, Good, HSG C
890	74	>75% Grass cover, Good, HSG C
158	74	>75% Grass cover, Good, HSG C
205	74	>75% Grass cover, Good, HSG C
205	74	>75% Grass cover, Good, HSG C
289	74	>75% Grass cover, Good, HSG C
223	74	>75% Grass cover, Good, HSG C
203	74	>75% Grass cover, Good, HSG C
231	74	>75% Grass cover, Good, HSG C

337	74	>75% Grass cover, Good, HSG C
2,324	74	>75% Grass cover, Good, HSG C
143	74	>75% Grass cover, Good, HSG C
141	74	>75% Grass cover, Good, HSG C
1,084	74	>75% Grass cover, Good, HSG C
799	74	>75% Grass cover, Good, HSG C
1,277	74	>75% Grass cover, Good, HSG C
959	74	>75% Grass cover, Good, HSG C
155	74	>75% Grass cover, Good, HSG C
126	74	>75% Grass cover, Good, HSG C
127	74	>75% Grass cover, Good, HSG C
94	74	>75% Grass cover, Good, HSG C
102	74	>75% Grass cover, Good, HSG C
133	74	>75% Grass cover, Good, HSG C
652	74	>75% Grass cover, Good, HSG C
86	74	>75% Grass cover, Good, HSG C
140	74	>75% Grass cover, Good, HSG C
43	74	>75% Grass cover, Good, HSG C
152	74	>75% Grass cover, Good, HSG C
27	74	>75% Grass cover, Good, HSG C
135	74	>75% Grass cover, Good, HSG C
502	74	>75% Grass cover, Good, HSG C
998	74	>75% Grass cover, Good, HSG C
125	74	>75% Grass cover, Good, HSG C
1,085	74	>75% Grass cover, Good, HSG C
280	74	>75% Grass cover, Good, HSG C
124,736	92	Weighted Average
31,919		25.59% Pervious Area
92,817		74.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment P-1E: PR. WATERSHED



Summary for Subcatchment P-1F: PR. WATERSHED

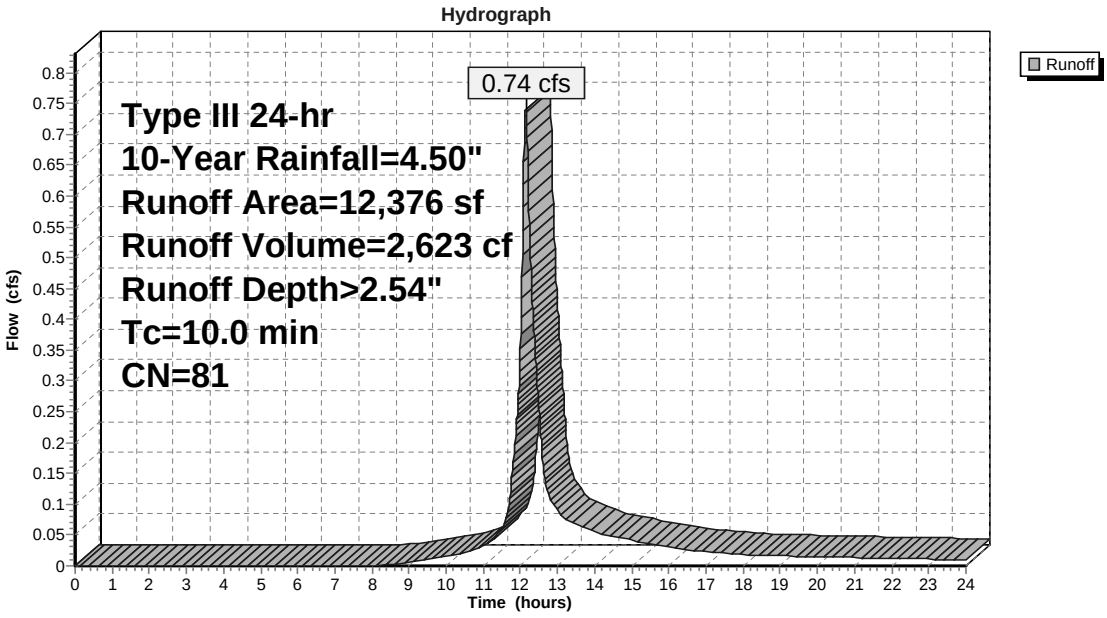
Runoff = 0.74 cfs @ 12.14 hrs, Volume= 2,623 cf, Depth> 2.54"
Routed to Pond P1C : BIO.RET. #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
379	98	Paved parking, HSG C
2,558	98	Paved parking, HSG C
80	98	Paved parking, HSG C
80	98	Paved parking, HSG C
81	98	Paved parking, HSG C
320	98	Paved parking, HSG C
80	98	Paved parking, HSG C
2,248	74	>75% Grass cover, Good, HSG C
1,849	74	>75% Grass cover, Good, HSG C
4,702	74	>75% Grass cover, Good, HSG C
12,376	81	Weighted Average
8,799		71.10% Pervious Area
3,577		28.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment P-1F: PR. WATERSHED



Summary for Subcatchment P-1G: PR. WATERSHED

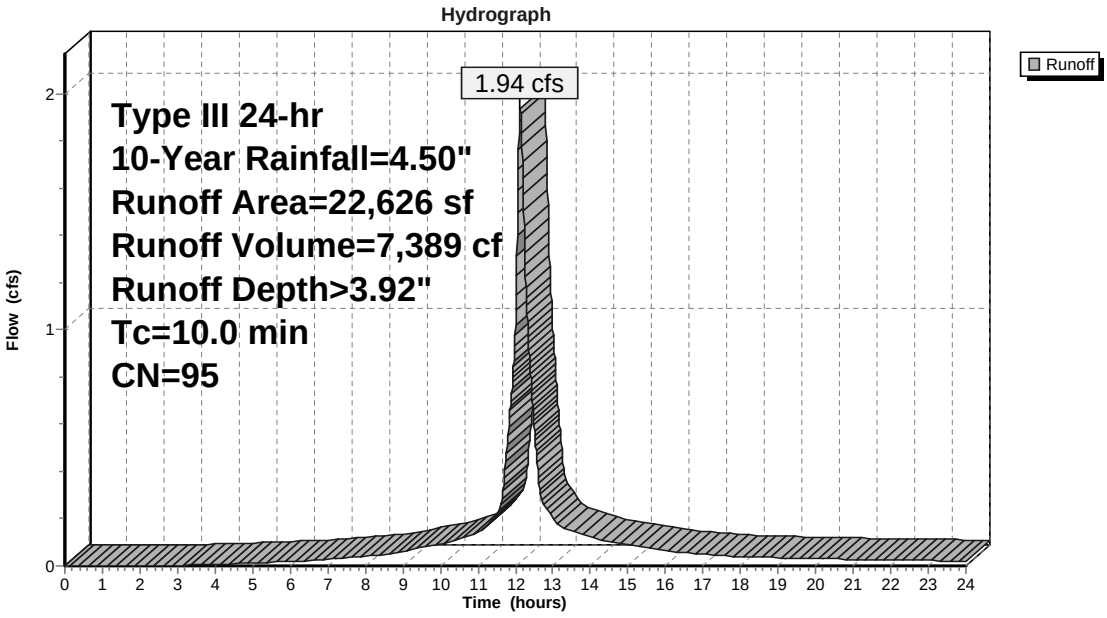
Runoff = 1.94 cfs @ 12.13 hrs, Volume= 7,389 cf, Depth> 3.92"
Routed to Pond P1A : BIO.RET. #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
19,703	98	Paved parking, HSG C
3	98	Paved parking, HSG C
75	74	>75% Grass cover, Good, HSG C
831	74	>75% Grass cover, Good, HSG C
906	74	>75% Grass cover, Good, HSG C
50	74	>75% Grass cover, Good, HSG C
1,057	74	>75% Grass cover, Good, HSG C
22,626	95	Weighted Average
2,919		12.90% Pervious Area
19,706		87.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment P-1G: PR. WATERSHED



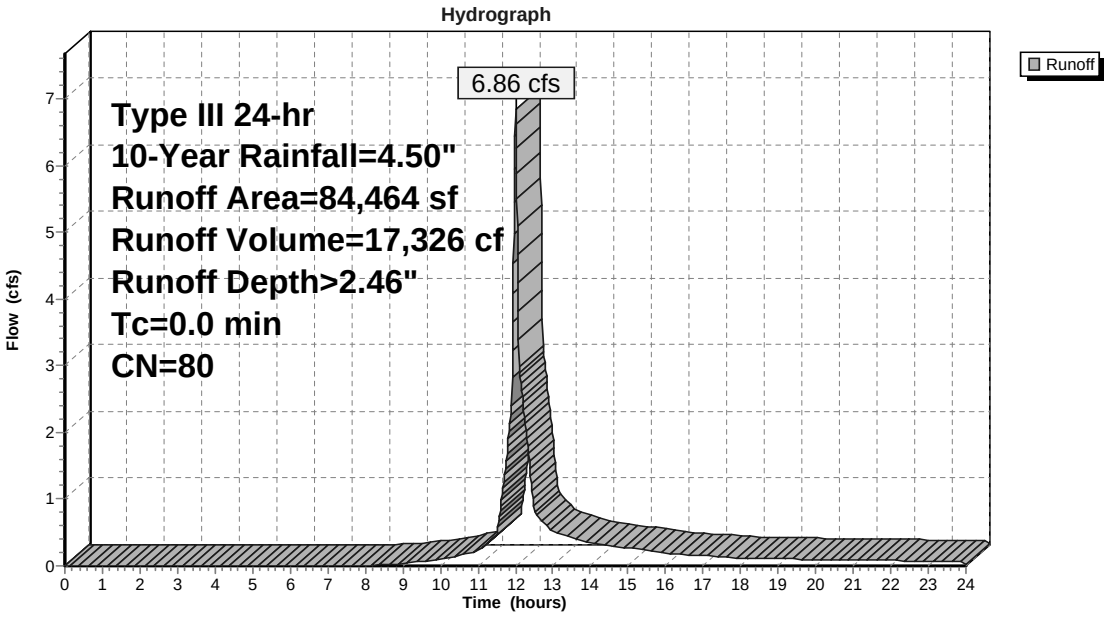
Summary for Subcatchment P-1H: Subcat P-1H

Runoff = 6.86 cfs @ 12.00 hrs, Volume= 17,326 cf, Depth> 2.46"
Routed to Pond P2 : SURFACE BASINS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
21,973	98	Paved parking, HSG C
687	98	Paved parking, HSG C
7,846	74	>75% Grass cover, Good, HSG C
12,808	74	>75% Grass cover, Good, HSG C
126	74	>75% Grass cover, Good, HSG C
149	74	>75% Grass cover, Good, HSG C
50	74	>75% Grass cover, Good, HSG C
200	74	>75% Grass cover, Good, HSG C
205	74	>75% Grass cover, Good, HSG C
13,065	74	>75% Grass cover, Good, HSG C
9,984	74	>75% Grass cover, Good, HSG C
17,371	74	>75% Grass cover, Good, HSG C
84,464	80	Weighted Average
61,803		73.17% Pervious Area
22,661		26.83% Impervious Area

Subcatchment P-1H: Subcat P-1H



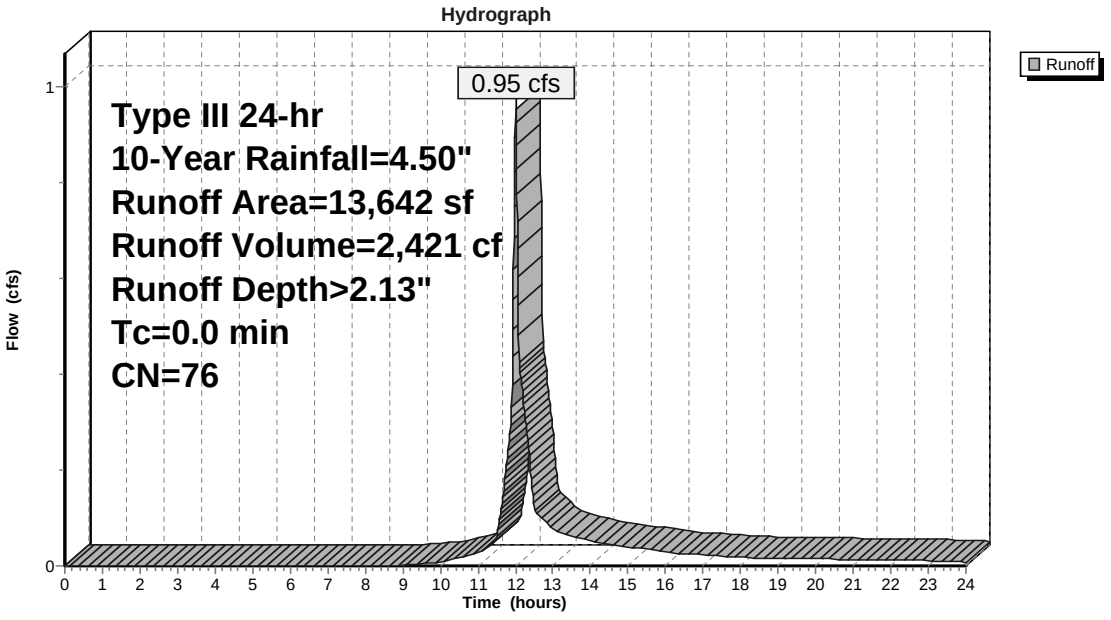
Summary for Subcatchment P-1I: Subcat P-1I

Runoff = 0.95 cfs @ 12.00 hrs, Volume= 2,421 cf, Depth> 2.13"
Routed to Link SP-1 : STUDY POINT #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
462	98	Paved parking, HSG C
537	98	Paved parking, HSG C
984	74	>75% Grass cover, Good, HSG C
2,558	74	>75% Grass cover, Good, HSG C
9,101	74	>75% Grass cover, Good, HSG C
13,642	76	Weighted Average
12,643		92.68% Pervious Area
999		7.32% Impervious Area

Subcatchment P-1I: Subcat P-1I



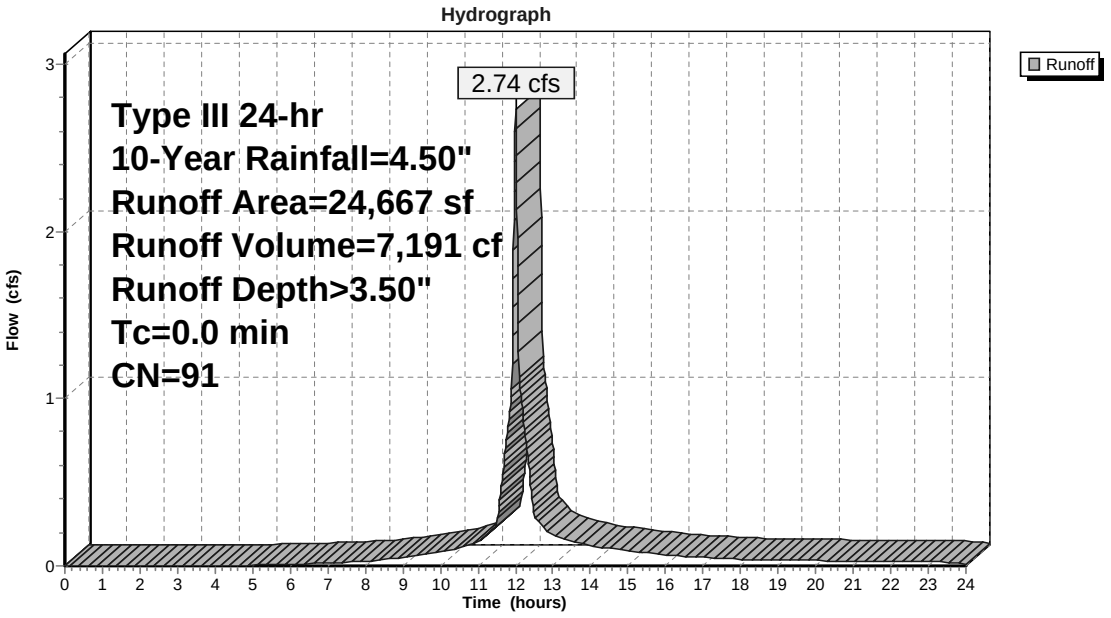
Summary for Subcatchment P-1J: Subcat P-1J

Runoff = 2.74 cfs @ 12.00 hrs, Volume= 7,191 cf, Depth> 3.50"
Routed to Pond EW : Wetland to East Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
9	74	>75% Grass cover, Good, HSG C
2,736	74	>75% Grass cover, Good, HSG C
17	80	>75% Grass cover, Good, HSG D
6	98	Paved parking, HSG C
0	98	Paved parking, HSG C
0	98	Paved parking, HSG C
2	98	Paved parking, HSG C
17,717	98	Paved parking, HSG C
834	74	>75% Grass cover, Good, HSG C
191	74	>75% Grass cover, Good, HSG C
2,512	74	>75% Grass cover, Good, HSG C
643	74	>75% Grass cover, Good, HSG C
24,667	91	Weighted Average
6,942		28.14% Pervious Area
17,725		71.86% Impervious Area

Subcatchment P-1J: Subcat P-1J



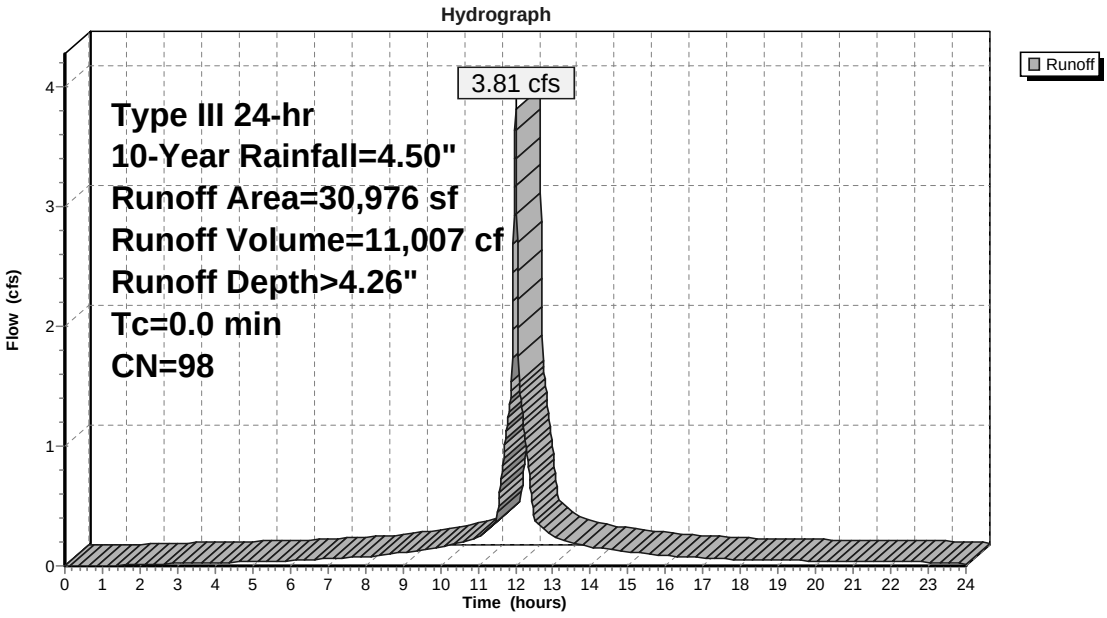
Summary for Subcatchment R-1: Subcat R-1

Runoff = 3.81 cfs @ 12.00 hrs, Volume= 11,007 cf, Depth> 4.26"
Routed to Pond P2 : SURFACE BASINS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
0	74	>75% Grass cover, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
30,976	98	Paved parking, HSG C
30,976	98	Weighted Average
0		0.00% Pervious Area
30,976		100.00% Impervious Area

Subcatchment R-1: Subcat R-1



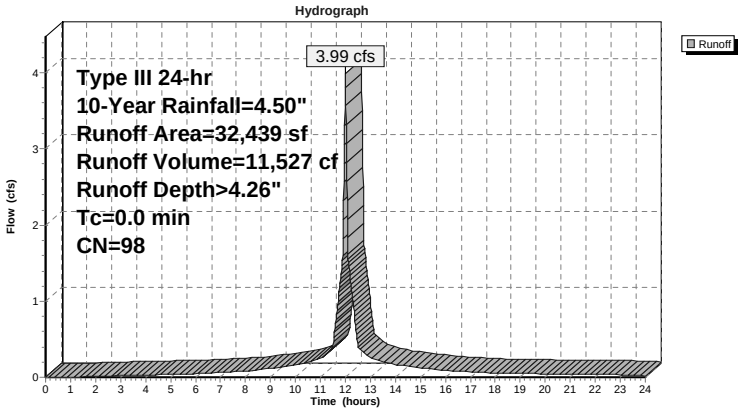
Summary for Subcatchment R-2: Subcat R-2

Runoff = 3.99 cfs @ 12.00 hrs, Volume= 11,527 cf, Depth> 4.26"
Routed to Pond P2 : SURFACE BASINS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
0	74	>75% Grass cover, Good, HSG C
32,439	98	Paved parking, HSG C
32,439	98	Weighted Average
0		0.00% Pervious Area
32,439		100.00% Impervious Area

Subcatchment R-2: Subcat R-2



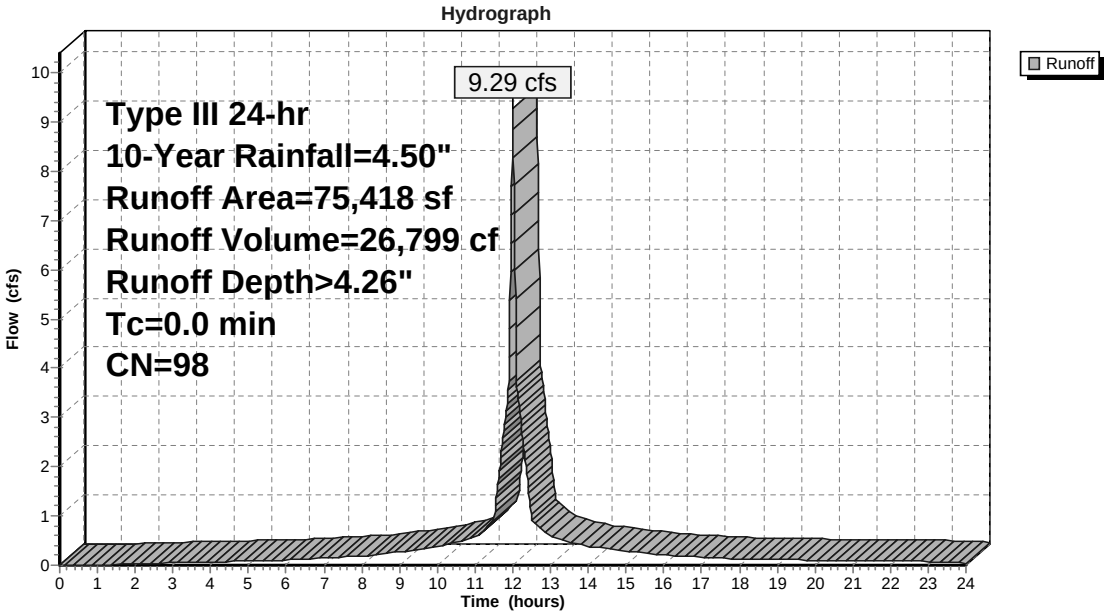
Summary for Subcatchment R-3A: Subcat R-3A

Runoff = 9.29 cfs @ 12.00 hrs, Volume= 26,799 cf, Depth> 4.26"
Routed to Pond UIS1 : UNDERGROUND CHAMBERS #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
0	74	>75% Grass cover, Good, HSG C
11,234	98	Paved parking, HSG C
0	74	>75% Grass cover, Good, HSG C
55,024	98	Paved parking, HSG C
9,161	98	Paved parking, HSG C
75,418	98	Weighted Average
0		0.00% Pervious Area
75,418		100.00% Impervious Area

Subcatchment R-3A: Subcat R-3A



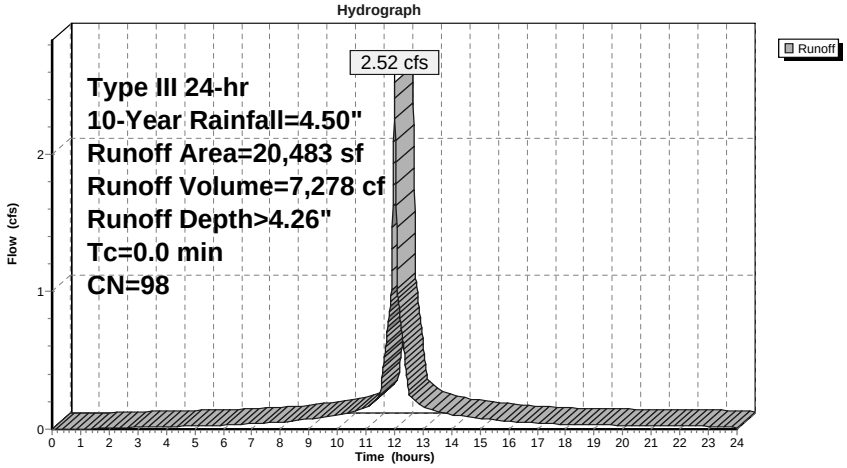
Summary for Subcatchment R-3B: Subcat R-3B

Runoff = 2.52 cfs @ 12.00 hrs, Volume= 7,278 cf, Depth> 4.26"
Routed to Pond P1B : BIO.RET. #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
20,483	98	Paved parking, HSG C
20,483		100.00% Impervious Area

Subcatchment R-3B: Subcat R-3B



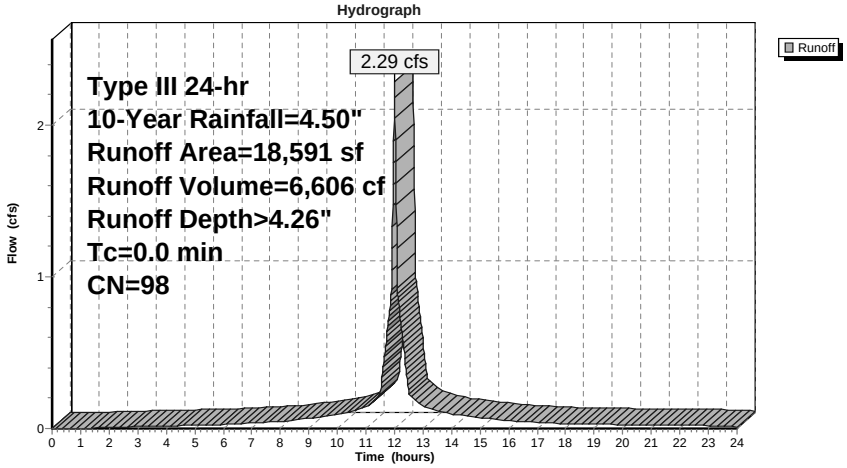
Summary for Subcatchment R-3C: Subcat R-3C

Runoff = 2.29 cfs @ 12.00 hrs, Volume= 6,606 cf, Depth> 4.26"
Routed to Pond P1C : BIO.RET. #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
18,591	98	Paved parking, HSG C
18,591		100.00% Impervious Area

Subcatchment R-3C: Subcat R-3C



Summary for Subcatchment W-1: Wetlands

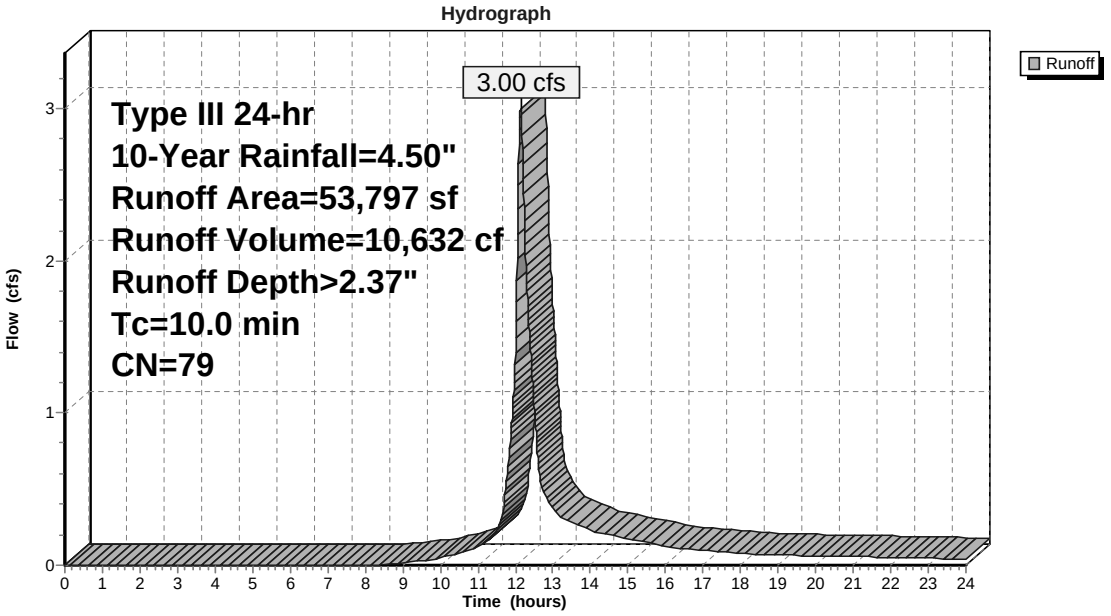
Runoff = 3.00 cfs @ 12.14 hrs, Volume= 10,632 cf, Depth> 2.37"
Routed to Pond ES : Offsite Swale to South Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
355	80	>75% Grass cover, Good, HSG D
13,345	79	Woods/grass comb., Good, HSG D
33,140	79	Woods/grass comb., Good, HSG D
2,541	74	>75% Grass cover, Good, HSG C
3,885	74	>75% Grass cover, Good, HSG C
532	98	Paved parking, HSG C
53,797	79	Weighted Average
53,265		99.01% Pervious Area
532		0.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment W-1: Wetlands



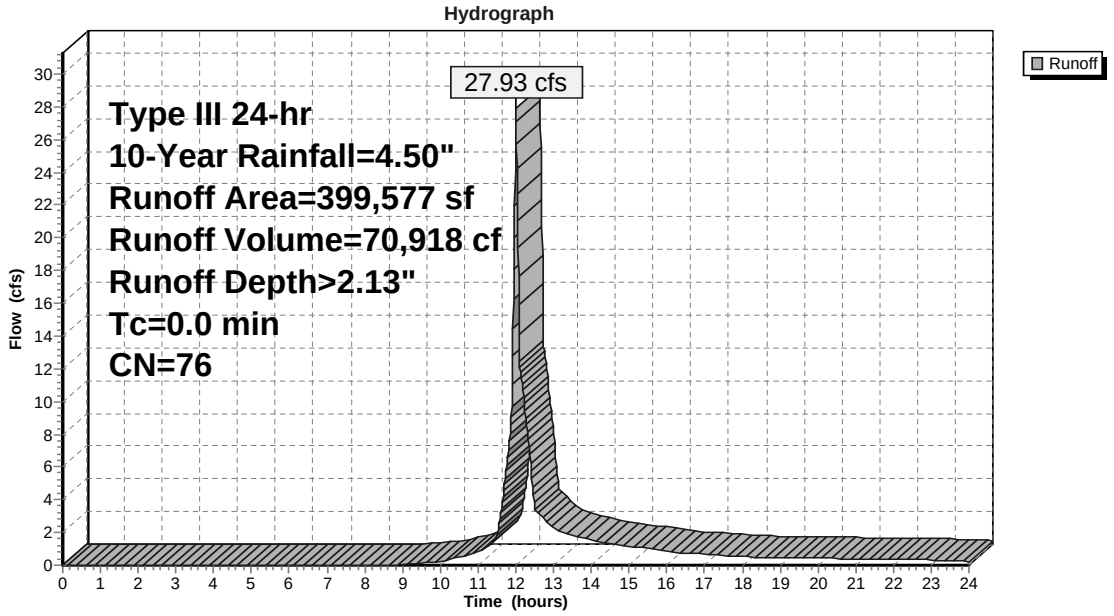
Summary for Subcatchment W-2: Subcat W-2

Runoff = 27.93 cfs @ 12.00 hrs, Volume= 70,918 cf, Depth> 2.13"
Routed to Pond EW : Wetland to East Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
21,123	79	Woods/grass comb., Good, HSG D
30,497	79	Woods/grass comb., Good, HSG D
184,072	79	Woods/grass comb., Good, HSG D
1	98	Paved parking, HSG C
9,619	98	Paved parking, HSG C
69,917	70	Woods, Good, HSG C
4,708	70	Woods, Good, HSG C
13,341	70	Woods, Good, HSG C
60,349	70	Woods, Good, HSG C
5,949	74	>75% Grass cover, Good, HSG C
399,577	76	Weighted Average
389,956		97.59% Pervious Area
9,621		2.41% Impervious Area

Subcatchment W-2: Subcat W-2



Summary for Pond ES: Offsite Swale to South Culvert

Inflow Area = 202,896 sf, 34.94% Impervious, Inflow Depth > 2.78" for 10-Year event
Inflow = 13.23 cfs @ 12.14 hrs, Volume= 47,040 cf
Outflow = 1.03 cfs @ 13.81 hrs, Volume= 22,359 cf, Atten= 92%, Lag= 100.3 min
Primary = 1.03 cfs @ 13.81 hrs, Volume= 22,359 cf
Routed to Link SP-1 : STUDY POINT #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 80.24' @ 13.81 hrs Surf.Area= 34,413 sf Storage= 29,145 cf

Plug-Flow detention time= 297.3 min calculated for 22,359 cf (48% of inflow)
Center-of-Mass det. time= 182.3 min (999.6 - 817.3)

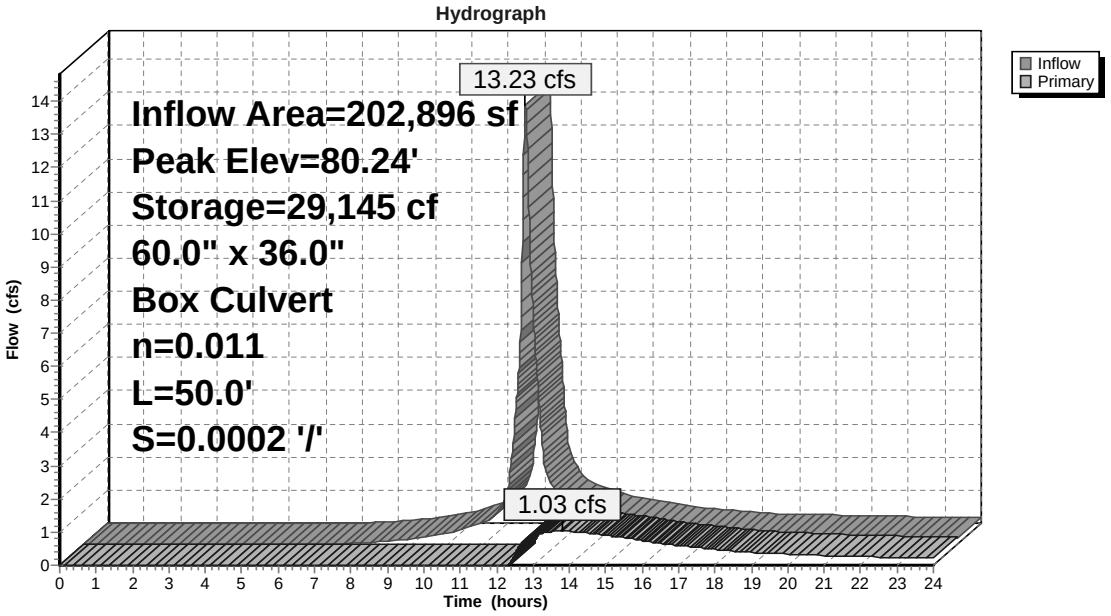
Volume	Invert	Avail.Storage	Storage Description
#1	79.00'	136,108 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
79.00	17,000	1,200.0	0	0	17,000
80.00	27,000	4,000.0	21,808	21,808	1,175,651
81.00	63,900	4,200.0	44,146	65,954	1,306,222
82.00	76,600	4,250.0	70,154	136,108	1,340,108

Device	Routing	Invert	Outlet Devices
#1	Primary	80.00'	**60.0" W x 36.0" H Box Culvert** L= 50.0' Box, headwall w/3 square edges, Ke= 0.500 Inlet / Outlet Invert= 80.00' / 79.99' S= 0.0002 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 15.00 sf

Primary OutFlow Max=1.03 cfs @ 13.81 hrs HW=80.24' TW=0.00' (Dynamic Tailwater)
↑**1=Culvert** (Barrel Controls 1.03 cfs @ 1.15 fps)

Pond ES: Offsite Swale to South Culvert



Summary for Pond EW: Wetland to East Culvert

Inflow Area = 424,244 sf, 6.45% Impervious, Inflow Depth > 2.21" for 10-Year event
Inflow = 30.66 cfs @ 12.00 hrs, Volume= 78,109 cf
Outflow = 0.60 cfs @ 17.74 hrs, Volume= 22,601 cf, Atten= 98%, Lag= 344.2 min
Primary = 0.60 cfs @ 17.74 hrs, Volume= 22,601 cf
Routed to Link SP-1 : STUDY POINT #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 80.72' @ 17.74 hrs Surf.Area= 116,350 sf Storage= 58,722 cf

Plug-Flow detention time= 414.2 min calculated for 22,601 cf (29% of inflow)
Center-of-Mass det. time= 279.9 min (1,107.4 - 827.5)

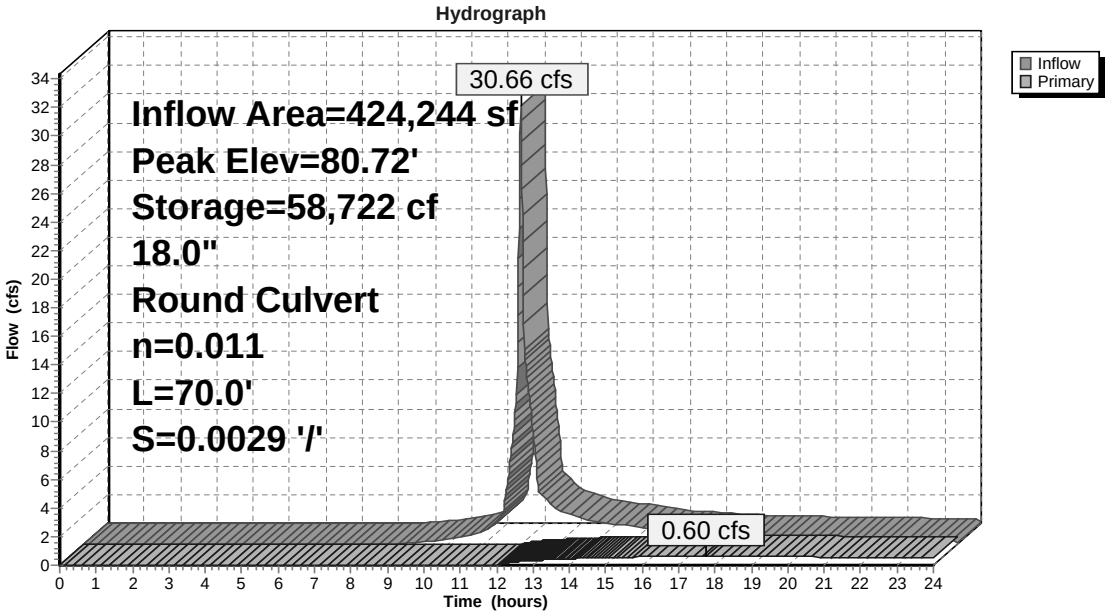
Volume	Invert	Avail.Storage	Storage Description
#1	80.00'	290,435 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
80.00	52,000	1,200.0	0	0	52,000
81.00	149,000	2,600.0	96,341	96,341	475,356
82.00	243,000	4,300.0	194,094	290,435	1,408,807

Device	Routing	Invert	Outlet Devices
#1	Primary	80.30'	**18.0" Round Culvert** L= 70.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 80.30' / 80.10' S= 0.0029 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.77 sf

Primary OutFlow Max=0.60 cfs @ 17.74 hrs HW=80.72' TW=0.00' (Dynamic Tailwater)
1=Culvert (Barrel Controls 0.60 cfs @ 2.27 fps)

Pond EW: Wetland to East Culvert



Summary for Pond OFFSITE: OFFSITE PONDING AREA IN GRASS

Inflow Area = 430,077 sf, 74.28% Impervious, Inflow Depth > 1.38" for 10-Year event
Inflow = 6.99 cfs @ 12.50 hrs, Volume= 49,288 cf
Outflow = 6.95 cfs @ 12.54 hrs, Volume= 49,111 cf, Atten= 1%, Lag= 2.3 min
Primary = 6.95 cfs @ 12.54 hrs, Volume= 49,111 cf
Routed to Link SP-1 : STUDY POINT #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 82.76' @ 12.54 hrs Surf.Area= 5,176 sf Storage= 1,777 cf

Plug-Flow detention time= 8.1 min calculated for 49,111 cf (100% of inflow)
Center-of-Mass det. time= 6.2 min (910.1 - 903.9)

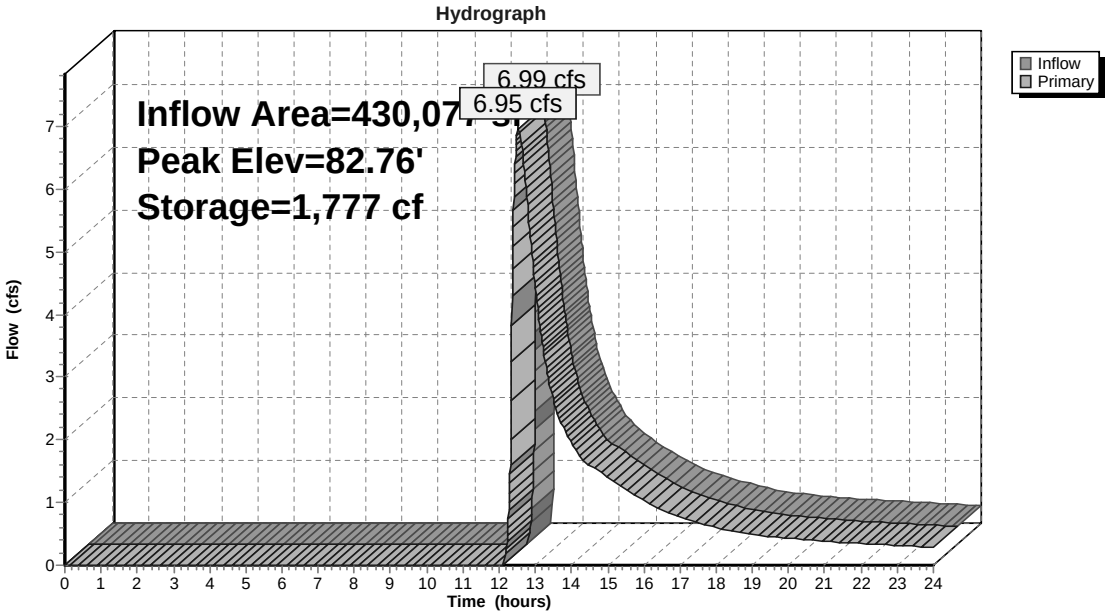
Volume	Invert	Avail.Storage	Storage Description
#1	82.10'	3,254 cf	**OFFSITE PONDING AREA (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
82.10	230	0	0
83.00	7,000	3,254	3,254

Device	Routing	Invert	Outlet Devices
#1	Primary	82.10'	**8.0" Round (3) 8" HDPE X 3.00** L= 21.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 82.10' / 81.40' S= 0.0333 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf
#2	Primary	82.60'	**30.0' long x 10.0' breadth WEIR FLOW OVER WALKING PATH** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=6.94 cfs @ 12.54 hrs HW=82.76' TW=0.00' (Dynamic Tailwater)
1=(3) 8" HDPE (Inlet Controls 2.28 cfs @ 2.18 fps)
2=WEIR FLOW OVER WALKING PATH (Weir Controls 4.67 cfs @ 0.99 fps)

Pond OFFSITE: OFFSITE PONDING AREA IN GRASS



Summary for Pond P1A: BIO.RET. #1

Inflow Area = 22,626 sf, 87.10% Impervious, Inflow Depth > 3.92" for 10-Year event
Inflow = 1.94 cfs @ 12.13 hrs, Volume= 7,389 cf
Outflow = 1.93 cfs @ 12.14 hrs, Volume= 7,196 cf, Atten= 0%, Lag= 0.3 min
Primary = 1.93 cfs @ 12.14 hrs, Volume= 7,196 cf
Routed to Pond UIS1 : UNDERGROUND CHAMBERS #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 86.50' @ 12.14 hrs Surf.Area= 675 sf Storage= 252 cf
Flood Elev= 86.40' Surf.Area= 606 sf Storage= 191 cf

Plug-Flow detention time= 28.4 min calculated for 7,193 cf (97% of inflow)
Center-of-Mass det. time= 12.5 min (786.3 - 773.8)

Volume	Invert	Avail.Storage	Storage Description
#1	86.00'	157 cf	**BIORETENTION #1 (Irregular)**Listed below (Recalc)
#2	86.00'	98 cf	**BIORETENTION #1 (Irregular)**Listed below (Recalc)
#3	86.50'	3,461 cf	**PARKING LOT (Irregular)**Listed below (Recalc)
		3,716 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
86.00	241	148.0	0	0	241
86.50	392	154.0	157	157	404

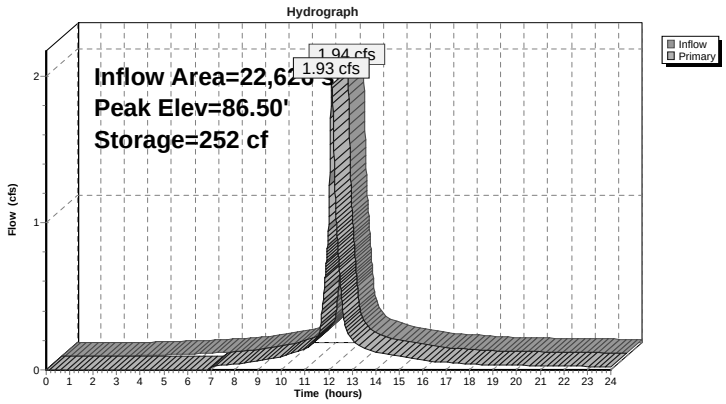
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
86.00	118	166.0	0	0	118
86.50	287	172.0	98	98	300

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
86.50	1,011	195.0	0	0	1,011
87.00	15,764	649.0	3,461	3,461	31,504

Device	Routing	Invert	Outlet Devices
#1	Primary	83.97'	**8.0" Round (2) 8" HDPE X 2.00** L= 28.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 83.97' / 83.83' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Device 1	86.40'	**8.0" Horiz. (2) 8" GRATES X 2.00** C= 0.600 Limited to weir flow at low heads
#3	Primary	83.97'	**12.0" Round (2) 12" HDPE X 2.00** L= 24.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 83.97' / 83.83' S= 0.0058 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#4	Device 3	86.40'	**24.0" x 24.0" Horiz. (2) 24" GRATES X 2.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.93 cfs @ 12.14 hrs HW=86.50' TW=85.13' (Dynamic Tailwater)
- **1=(2) 8" HDPE** (Passes 0.40 cfs of 3.78 cfs potential flow)
  - **2=(2) 8" GRATES** (Weir Controls 0.40 cfs @ 1.01 fps)
- **3=(2) 12" HDPE** (Passes 1.53 cfs of 8.85 cfs potential flow)
  - **4=(2) 24" GRATES** (Weir Controls 1.53 cfs @ 1.01 fps)

Pond P1A: BIO.RET. #1



Summary for Pond P1B: BIO.RET. #2

Inflow Area = 28,449 sf, 81.88% Impervious, Inflow Depth > 3.81" for 10-Year event
Inflow = 2.76 cfs @ 12.00 hrs, Volume= 9,025 cf
Outflow = 1.63 cfs @ 11.98 hrs, Volume= 6,970 cf, Atten= 41%, Lag= 0.0 min
Primary = 1.63 cfs @ 11.98 hrs, Volume= 6,970 cf
Routed to Pond UIS1 : UNDERGROUND CHAMBERS #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 86.69' @ 12.09 hrs Surf.Area= 4,377 sf Storage= 2,845 cf
Flood Elev= 86.50' Surf.Area= 4,230 sf Storage= 2,021 cf

Plug-Flow detention time= 156.0 min calculated for 6,970 cf (77% of inflow)
Center-of-Mass det. time= 72.8 min (832.3 - 759.5)

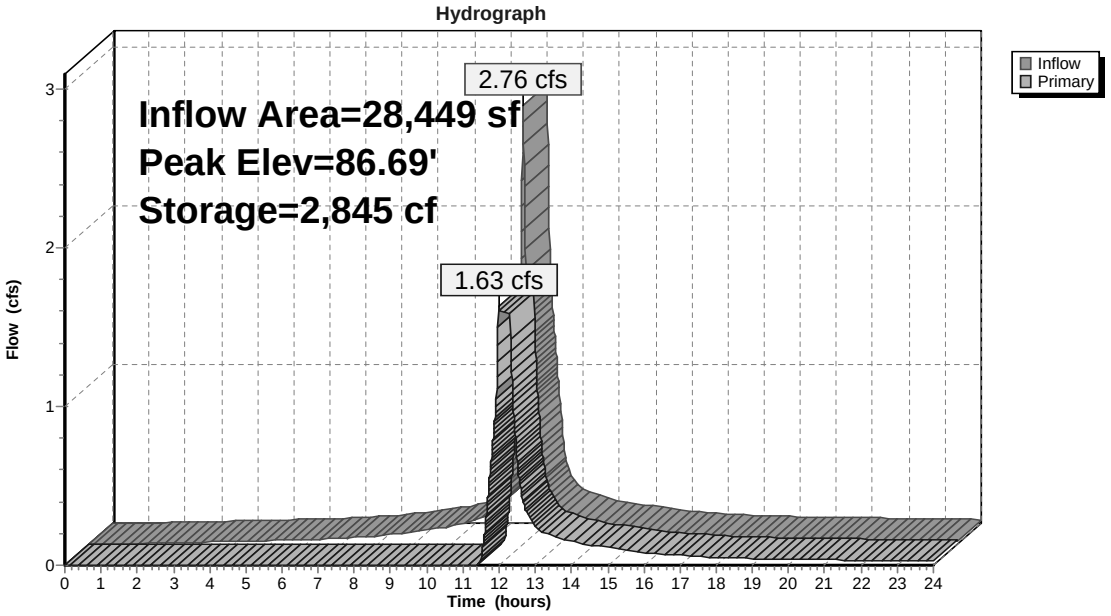
Volume	Invert	Avail.Storage	Storage Description
#1	86.00'	6,641 cf	**BIORETENTION #2 (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
86.00	3,856	244.0	0	0	3,856
86.50	4,230	254.0	2,021	2,021	4,271
87.00	4,618	263.0	2,211	4,232	4,664
87.50	5,020	273.0	2,409	6,641	5,111

Device	Routing	Invert	Outlet Devices
#1	Primary	83.78'	**6.0" Round (2) 6" HDPE X 2.00** L= 56.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 83.78' / 83.50' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf
#2	Device 1	86.50'	**8.0" Horiz. (5) 8" OVERFLOW X 5.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.61 cfs @ 11.98 hrs HW=86.63' TW=85.03' (Dynamic Tailwater)
- **1=(2) 6" HDPE** (Outlet Controls 1.61 cfs @ 4.11 fps)
  - **2=(5) 8" OVERFLOW** (Passes 1.61 cfs of 1.69 cfs potential flow)

Pond P1B: BIO.RET. #2



Summary for Pond P1C: BIO.RET. #3

Inflow Area = 30,967 sf, 71.58% Impervious, Inflow Depth > 3.58" for 10-Year event
Inflow = 2.64 cfs @ 12.00 hrs, Volume= 9,229 cf
Outflow = 1.57 cfs @ 12.32 hrs, Volume= 7,932 cf, Atten= 40%, Lag= 19.0 min
Primary = 1.57 cfs @ 12.32 hrs, Volume= 7,932 cf
Routed to Pond UIS1 : UNDERGROUND CHAMBERS #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 86.74' @ 12.15 hrs Surf.Area= 3,247 sf Storage= 2,014 cf
Flood Elev= 86.50' Surf.Area= 2,855 sf Storage= 1,269 cf

Plug-Flow detention time= 115.8 min calculated for 7,932 cf (86% of inflow)
Center-of-Mass det. time= 53.1 min (820.6 - 767.5)

Volume	Invert	Avail.Storage	Storage Description
#1	86.00'	4,927 cf	**BIORETENTION #3 (Irregular)**Listed below (Recalc)

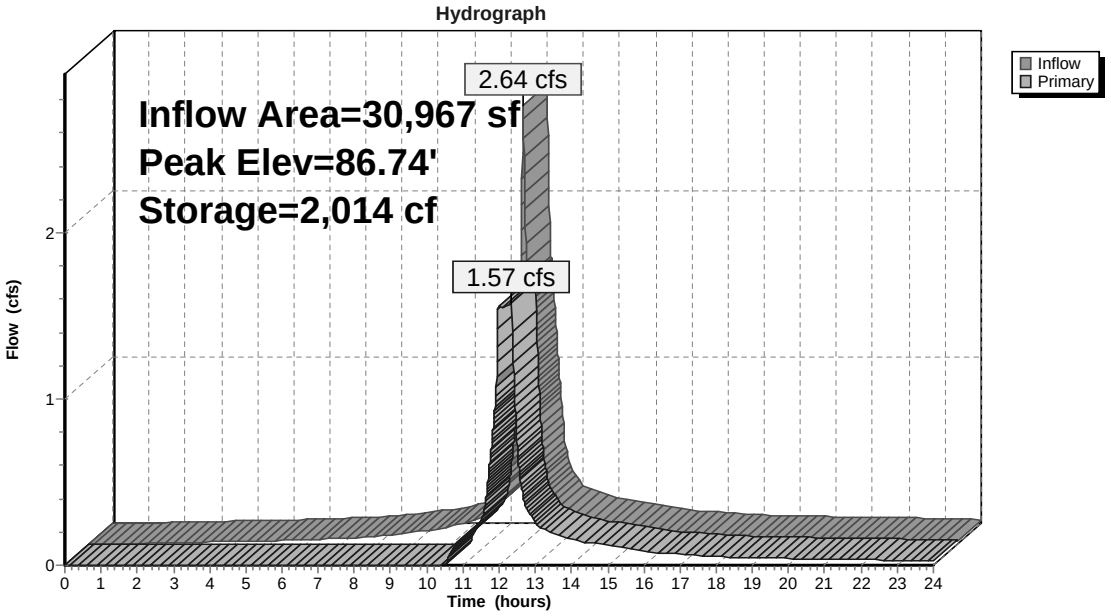
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
86.00	2,232	410.0	0	0	2,232
86.50	2,855	420.0	1,269	1,269	2,924
87.00	3,683	502.0	1,630	2,899	8,945
87.50	4,444	512.0	2,029	4,927	9,791

Device	Routing	Invert	Outlet Devices
#1	Primary	83.82'	**6.0" Round (2) 6" HDPE X 2.00** L= 63.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 83.82' / 83.50' S= 0.0051 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf
#2	Device 1	86.50'	**8.0" Horiz. (4) 8" OVERFLOW X 4.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.57 cfs @ 12.32 hrs HW=86.69' TW=85.02' (Dynamic Tailwater)
↑**1=(2) 6" HDPE** (Outlet Controls 1.57 cfs @ 4.01 fps)
↑**2=(4) 8" OVERFLOW** (Passes 1.57 cfs of 2.20 cfs potential flow)

Pond P1C: BIO.RET. #3

Hydrograph



Summary for Pond P2: SURFACE BASINS

Inflow Area = 430,077 sf, 74.28% Impervious, Inflow Depth > 3.12" for 10-Year event
Inflow = 30.11 cfs @ 12.01 hrs, Volume= 111,646 cf
Outflow = 8.97 cfs @ 12.50 hrs, Volume= 70,231 cf, Atten= 70%, Lag= 29.5 min
Primary = 6.99 cfs @ 12.50 hrs, Volume= 49,288 cf
Routed to Pond OFFSITE : OFFSITE PONDING AREA IN GRASS
Secondary = 1.98 cfs @ 12.50 hrs, Volume= 20,942 cf
Routed to Link SP-1 : STUDY POINT #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 84.68' @ 12.50 hrs Surf.Area= 39,150 sf Storage= 53,926 cf
Flood Elev= 84.30' Surf.Area= 36,024 sf Storage= 39,786 cf

Plug-Flow detention time= 197.7 min calculated for 70,231 cf (63% of inflow)
Center-of-Mass det. time= 96.1 min (908.5 - 812.4)

Volume	Invert	Avail.Storage	Storage Description
#1	83.00'	90,039 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)
83.00	25,325	2,737.0	0	0	25,325
84.00	33,567	2,757.0	29,349	29,349	34,490
84.50	37,710	2,768.0	17,809	47,159	39,520
85.00	41,870	2,778.0	19,886	67,045	44,146
85.50	50,234	2,799.0	22,994	90,039	53,570

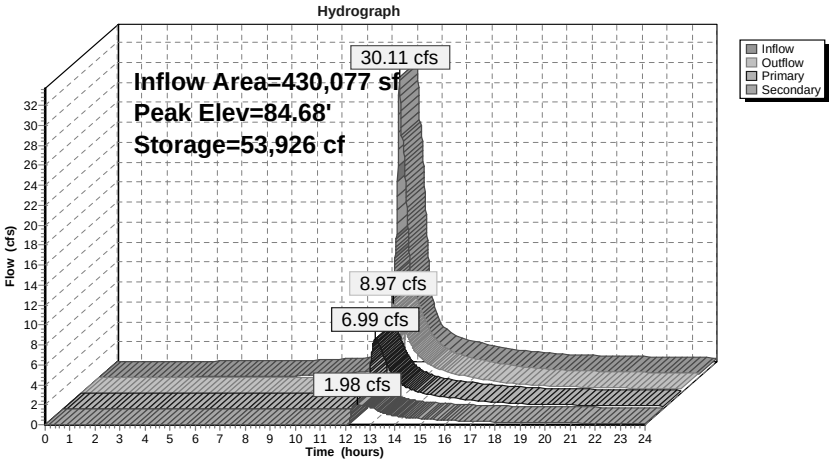
Device	Routing	Invert	Outlet Devices
#1	Secondary	82.40'	**6.0" Round (2) 6" PVC X 2.00** L= 140.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 82.40' / 81.00' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf
#2	Device 1	84.30'	**8.0" Horiz. (2) 8" OVERFLOW X 2.00** C= 0.600 Limited to weir flow at low heads
#3	Primary	83.30'	**50.0' long x 60.0' breadth GRASS/LAWN AREA** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#4	Device 3	84.30'	**12.0' long x 8.0' breadth EMERGENCY OVERFLOW**

Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50
Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=6.99 cfs @ 12.50 hrs HW=84.68' TW=82.76' (Dynamic Tailwater)
└─**3=GRASS/LAWN AREA** (Passes 6.99 cfs of 213.08 cfs potential flow)
└─**4=EMERGENCY OVERFLOW** (Weir Controls 6.99 cfs @ 1.55 fps)

Secondary OutFlow Max=1.98 cfs @ 12.50 hrs HW=84.68' TW=0.00' (Dynamic Tailwater)
└─**1=(2) 6" PVC** (Barrel Controls 1.98 cfs @ 5.04 fps)
└─**2=(2) 8" OVERFLOW** (Passes 1.98 cfs of 2.06 cfs potential flow)

Pond P2: SURFACE BASINS



Summary for Pond UIS1: UNDERGROUND CHAMBERS #1

Inflow Area = 282,197 sf, 82.71% Impervious, Inflow Depth > 3.67" for 10-Year event
Inflow = 18.75 cfs @ 12.00 hrs, Volume= 86,281 cf
Outflow = 18.45 cfs @ 12.15 hrs, Volume= 71,786 cf, Atten= 2%, Lag= 8.7 min
Primary = 18.45 cfs @ 12.15 hrs, Volume= 71,786 cf
Routed to Pond P2 : SURFACE BASINS

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 85.13' @ 12.15 hrs Surf.Area= 15,622 sf Storage= 18,504 cf
Flood Elev= 84.50' Surf.Area= 15,622 sf Storage= 14,159 cf

Plug-Flow detention time= 118.7 min calculated for 71,757 cf (83% of inflow)
Center-of-Mass det. time= 50.6 min (831.8 - 781.2)

Volume	Invert	Avail.Storage	Storage Description
#1B	83.00'	2,488 cf	**8.17'W x 416.16'L x 2.33'H Field B** 7,930 cf Overall - 1,710 cf Embedded = 6,220 cf x 40.0% Voids
#2B	83.50'	1,710 cf	**ADS_StormTech SC-310 +Cap** x 116 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 116 Chambers in 2 Rows
#3C	83.00'	3,040 cf	**8.17'W x 508.72'L x 2.33'H Field C** 9,694 cf Overall - 2,093 cf Embedded = 7,601 cf x 40.0% Voids
#4C	83.50'	2,093 cf	**ADS_StormTech SC-310 +Cap** x 142 Inside #3 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 142 Chambers in 2 Rows
#5D	83.00'	2,369 cf	**14.83'W x 223.92'L x 2.33'H Field D** 7,750 cf Overall - 1,828 cf Embedded = 5,922 cf x 40.0% Voids
#6D	83.50'	1,828 cf	**ADS_StormTech SC-310 +Cap** x 124 Inside #5 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 124 Chambers in 4 Rows
#7E	83.00'	3,182 cf	**21.50'W x 209.68'L x 2.33'H Field E** 10,519 cf Overall - 2,565 cf Embedded = 7,954 cf x 40.0% Voids
#8E	83.50'	2,565 cf	**ADS_StormTech SC-310 +Cap** x 174 Inside #7

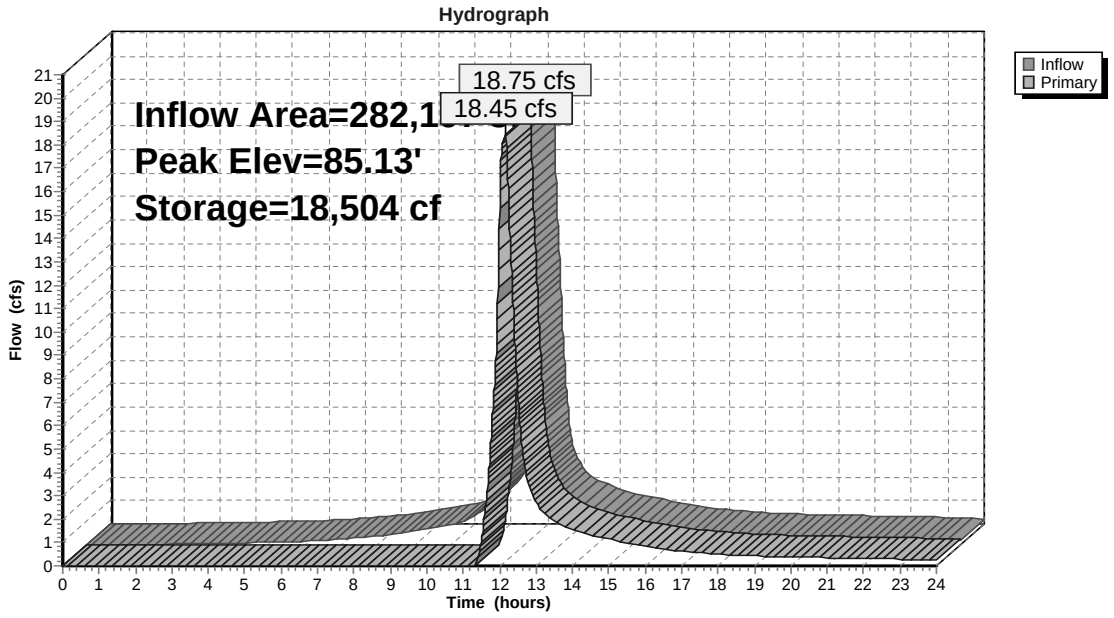
			Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 174 Chambers in 6 Rows
#9	83.00'	860 cf	**4.00'D x 3.60'H Vertical Cone/Cylinder** x 19
		20,135 cf	Total Available Storage

Storage Group B created with Chamber Wizard
Storage Group C created with Chamber Wizard
Storage Group D created with Chamber Wizard
Storage Group E created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	83.34'	**24.0" Round (3) 24" HDPE X 3.00** L= 130.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 83.34' / 83.00' S= 0.0026 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	84.50'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir X 3.00** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=18.45 cfs @ 12.15 hrs HW=85.13' TW=84.32' (Dynamic Tailwater)
└─**1=(3) 24" HDPE** (Passes 18.45 cfs of 26.60 cfs potential flow)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 18.45 cfs @ 2.46 fps)

Pond UIS1: UNDERGROUND CHAMBERS #1

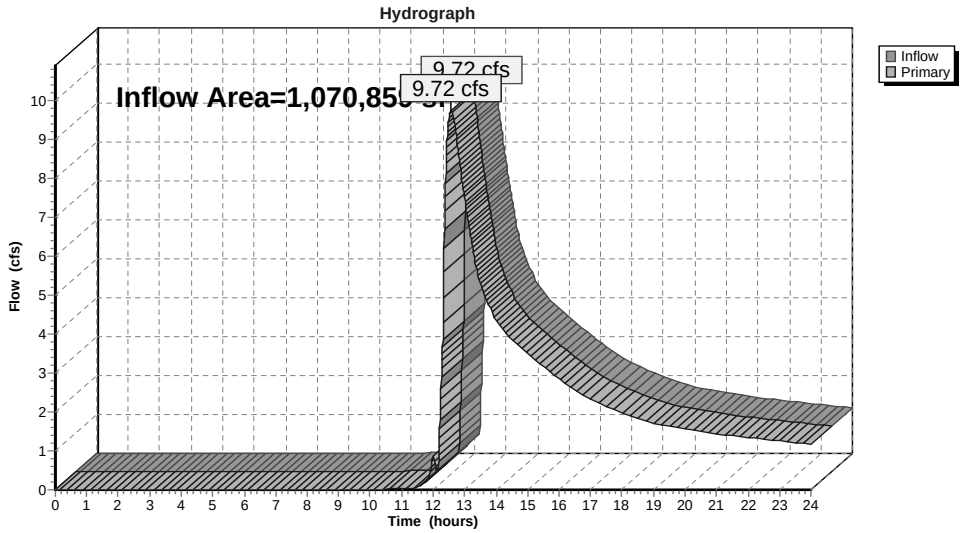


Summary for Link SP-1: STUDY POINT #1

Inflow Area = 1,070,859 sf, 39.10% Impervious, Inflow Depth > 1.32" for 10-Year event
Inflow = 9.72 cfs @ 12.57 hrs, Volume= 117,436 cf
Primary = 9.72 cfs @ 12.57 hrs, Volume= 117,436 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node SP-2

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link SP-1: STUDY POINT #1



Summary for Subcatchment P-1A: PR. WATERSHED

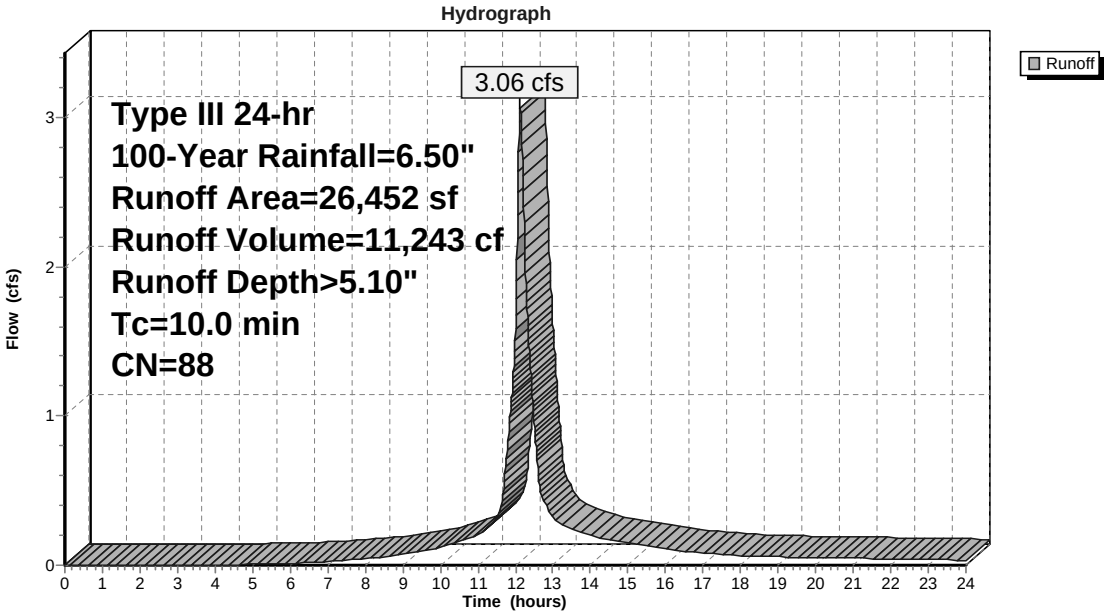
Runoff = 3.06 cfs @ 12.14 hrs, Volume= 11,243 cf, Depth> 5.10"
Routed to Pond ES : Offsite Swale to South Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
7,960	98	Paved parking, HSG C
3,795	98	Paved parking, HSG C
3,188	98	Paved parking, HSG D
11	98	Paved parking, HSG C
4,721	74	>75% Grass cover, Good, HSG C
6,286	74	>75% Grass cover, Good, HSG C
402	74	>75% Grass cover, Good, HSG C
88	74	>75% Grass cover, Good, HSG C
26,452	88	Weighted Average
11,497		43.46% Pervious Area
14,955		56.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment P-1A: PR. WATERSHED



Summary for Subcatchment P-1B: PR. WATERSHED

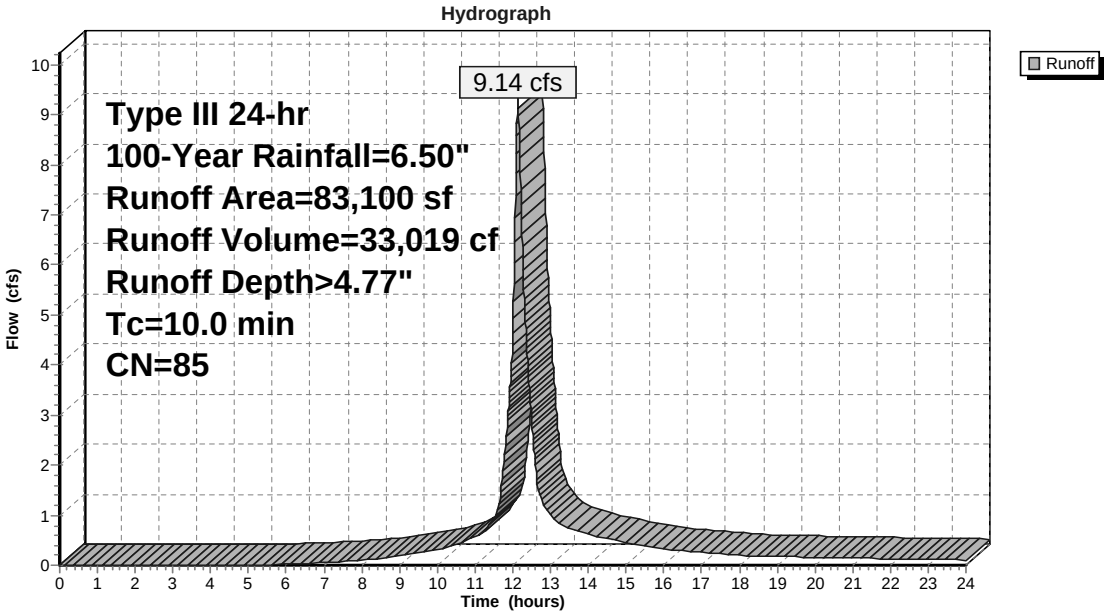
Runoff = 9.14 cfs @ 12.14 hrs, Volume= 33,019 cf, Depth> 4.77"
Routed to Pond ES : Offsite Swale to South Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
45	98	Paved parking, HSG C
0	98	Paved parking, HSG C
43	98	Paved parking, HSG C
0	98	Paved parking, HSG C
38,768	98	Paved parking, HSG C
1,827	74	>75% Grass cover, Good, HSG C
2,703	74	>75% Grass cover, Good, HSG C
679	74	>75% Grass cover, Good, HSG C
60	74	>75% Grass cover, Good, HSG C
30	74	>75% Grass cover, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
26	74	>75% Grass cover, Good, HSG C
14	74	>75% Grass cover, Good, HSG C
9,123	74	>75% Grass cover, Good, HSG C
2	74	>75% Grass cover, Good, HSG C
5,052	74	>75% Grass cover, Good, HSG C
8,899	74	>75% Grass cover, Good, HSG C
15,828	74	>75% Grass cover, Good, HSG C
83,100	85	Weighted Average
44,244		53.24% Pervious Area
38,856		46.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment P-1B: PR. WATERSHED



Summary for Subcatchment P-1C: PR. WATERSHED

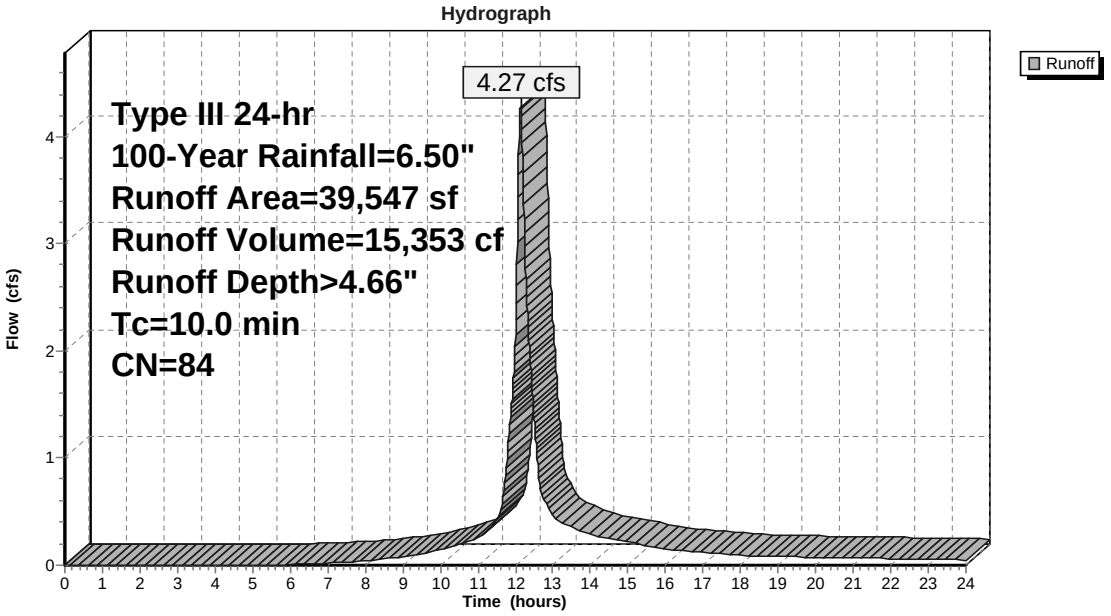
Runoff = 4.27 cfs @ 12.14 hrs, Volume= 15,353 cf, Depth> 4.66"
Routed to Pond ES : Offsite Swale to South Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
227	80	>75% Grass cover, Good, HSG D
16,521	98	Paved parking, HSG C
18	98	Paved parking, HSG C
2,500	74	>75% Grass cover, Good, HSG C
214	74	>75% Grass cover, Good, HSG C
68	74	>75% Grass cover, Good, HSG C
95	74	>75% Grass cover, Good, HSG C
3,398	74	>75% Grass cover, Good, HSG C
368	74	>75% Grass cover, Good, HSG C
16,138	74	>75% Grass cover, Good, HSG C
39,547	84	Weighted Average
23,007		58.18% Pervious Area
16,540		41.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment P-1C: PR. WATERSHED



Summary for Subcatchment P-1D: PR. WATERSHED

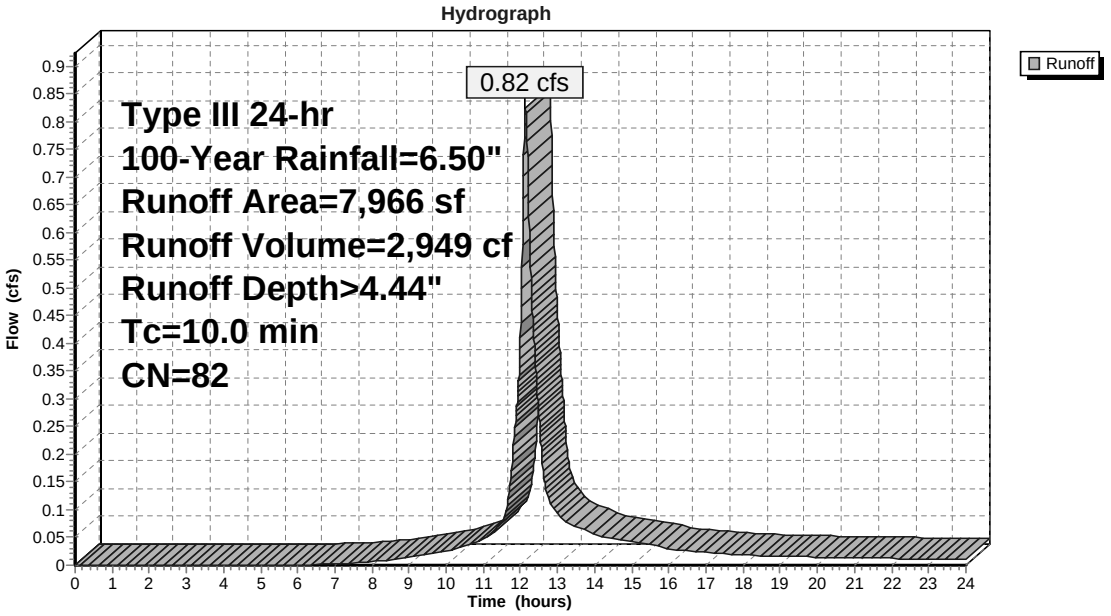
Runoff = 0.82 cfs @ 12.14 hrs, Volume= 2,949 cf, Depth> 4.44"
Routed to Pond P1B : BIO.RET. #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
240	98	Paved parking, HSG C
2,251	98	Paved parking, HSG C
81	98	Paved parking, HSG C
80	98	Paved parking, HSG C
80	98	Paved parking, HSG C
80	98	Paved parking, HSG C
1,810	74	>75% Grass cover, Good, HSG C
3,340	74	>75% Grass cover, Good, HSG C
4	74	>75% Grass cover, Good, HSG C
7,966	82	Weighted Average
5,154		64.70% Pervious Area
2,812		35.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment P-1D: PR. WATERSHED



Summary for Subcatchment P-1E: PR. WATERSHED

Runoff = 15.27 cfs @ 12.13 hrs, Volume= 57,725 cf, Depth> 5.55"
Routed to Pond UIS1 : UNDERGROUND CHAMBERS #1

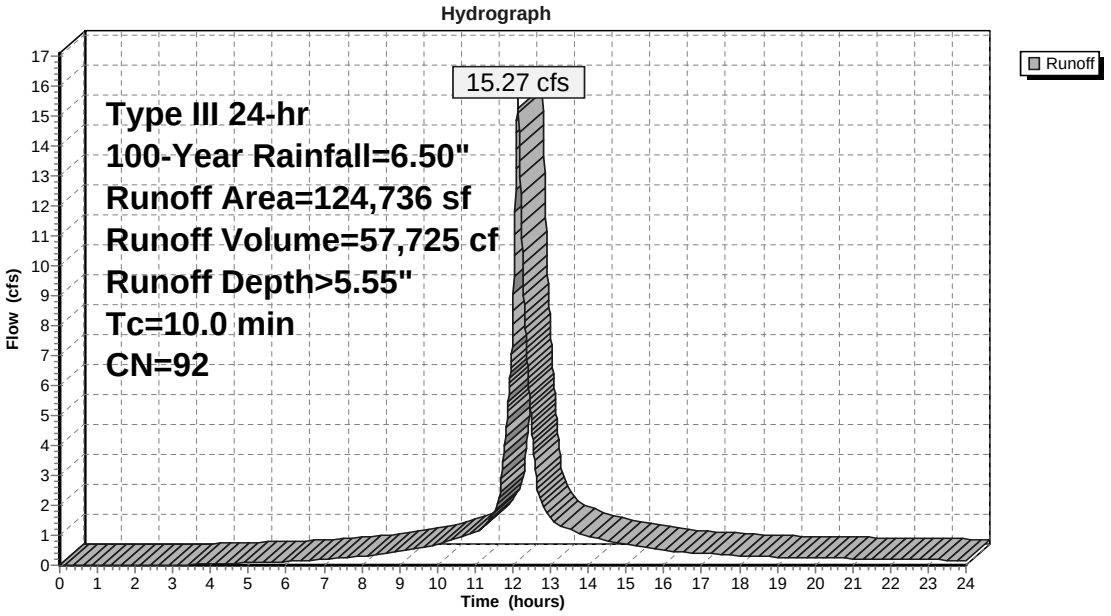
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
68	98	Paved parking, HSG C
6	98	Paved parking, HSG C
0	98	Paved parking, HSG C
0	98	Paved parking, HSG C
92,743	98	Paved parking, HSG C
0	98	Paved parking, HSG C
4,692	74	>75% Grass cover, Good, HSG C
1,328	74	>75% Grass cover, Good, HSG C
389	74	>75% Grass cover, Good, HSG C
73	74	>75% Grass cover, Good, HSG C
97	74	>75% Grass cover, Good, HSG C
73	74	>75% Grass cover, Good, HSG C
111	74	>75% Grass cover, Good, HSG C
123	74	>75% Grass cover, Good, HSG C
562	74	>75% Grass cover, Good, HSG C
6,210	74	>75% Grass cover, Good, HSG C
883	74	>75% Grass cover, Good, HSG C
721	74	>75% Grass cover, Good, HSG C
160	74	>75% Grass cover, Good, HSG C
140	74	>75% Grass cover, Good, HSG C
131	74	>75% Grass cover, Good, HSG C
172	74	>75% Grass cover, Good, HSG C
338	74	>75% Grass cover, Good, HSG C
61	74	>75% Grass cover, Good, HSG C
935	74	>75% Grass cover, Good, HSG C
77	74	>75% Grass cover, Good, HSG C
65	74	>75% Grass cover, Good, HSG C
148	74	>75% Grass cover, Good, HSG C
890	74	>75% Grass cover, Good, HSG C
158	74	>75% Grass cover, Good, HSG C
205	74	>75% Grass cover, Good, HSG C
205	74	>75% Grass cover, Good, HSG C
289	74	>75% Grass cover, Good, HSG C
223	74	>75% Grass cover, Good, HSG C
203	74	>75% Grass cover, Good, HSG C
231	74	>75% Grass cover, Good, HSG C

337	74	>75% Grass cover, Good, HSG C
2,324	74	>75% Grass cover, Good, HSG C
143	74	>75% Grass cover, Good, HSG C
141	74	>75% Grass cover, Good, HSG C
1,084	74	>75% Grass cover, Good, HSG C
799	74	>75% Grass cover, Good, HSG C
1,277	74	>75% Grass cover, Good, HSG C
959	74	>75% Grass cover, Good, HSG C
155	74	>75% Grass cover, Good, HSG C
126	74	>75% Grass cover, Good, HSG C
127	74	>75% Grass cover, Good, HSG C
94	74	>75% Grass cover, Good, HSG C
102	74	>75% Grass cover, Good, HSG C
133	74	>75% Grass cover, Good, HSG C
652	74	>75% Grass cover, Good, HSG C
86	74	>75% Grass cover, Good, HSG C
140	74	>75% Grass cover, Good, HSG C
43	74	>75% Grass cover, Good, HSG C
152	74	>75% Grass cover, Good, HSG C
27	74	>75% Grass cover, Good, HSG C
135	74	>75% Grass cover, Good, HSG C
502	74	>75% Grass cover, Good, HSG C
998	74	>75% Grass cover, Good, HSG C
125	74	>75% Grass cover, Good, HSG C
1,085	74	>75% Grass cover, Good, HSG C
280	74	>75% Grass cover, Good, HSG C
124,736	92	Weighted Average
31,919		25.59% Pervious Area
92,817		74.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment P-1E: PR. WATERSHED



Summary for Subcatchment P-1F: PR. WATERSHED

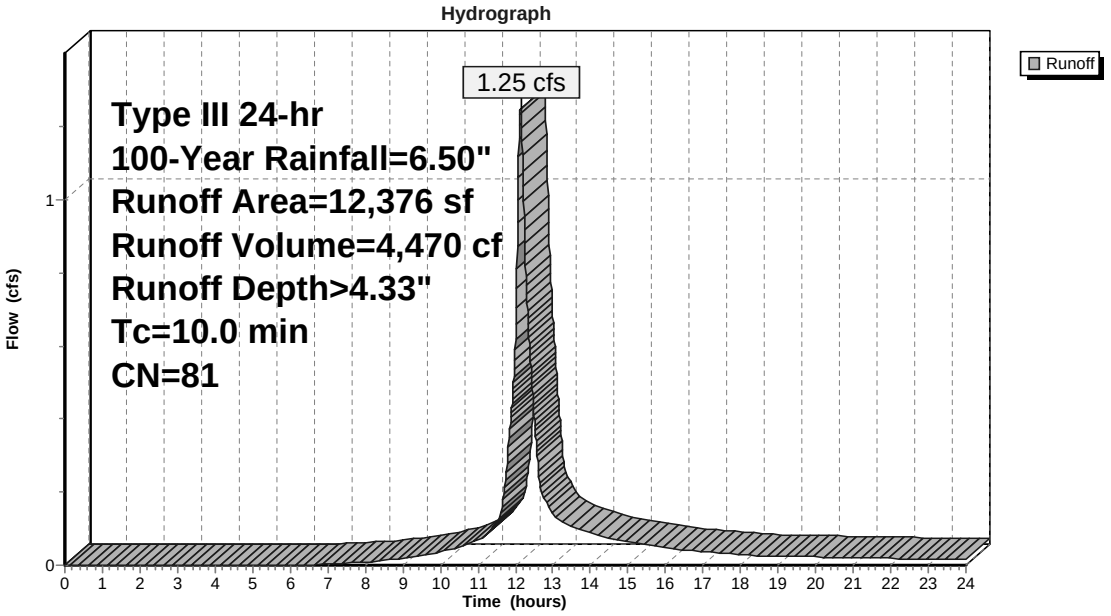
Runoff = 1.25 cfs @ 12.14 hrs, Volume= 4,470 cf, Depth> 4.33"
Routed to Pond P1C : BIO.RET. #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
379	98	Paved parking, HSG C
2,558	98	Paved parking, HSG C
80	98	Paved parking, HSG C
80	98	Paved parking, HSG C
81	98	Paved parking, HSG C
320	98	Paved parking, HSG C
80	98	Paved parking, HSG C
2,248	74	>75% Grass cover, Good, HSG C
1,849	74	>75% Grass cover, Good, HSG C
4,702	74	>75% Grass cover, Good, HSG C
12,376	81	Weighted Average
8,799		71.10% Pervious Area
3,577		28.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment P-1F: PR. WATERSHED



Summary for Subcatchment P-1G: PR. WATERSHED

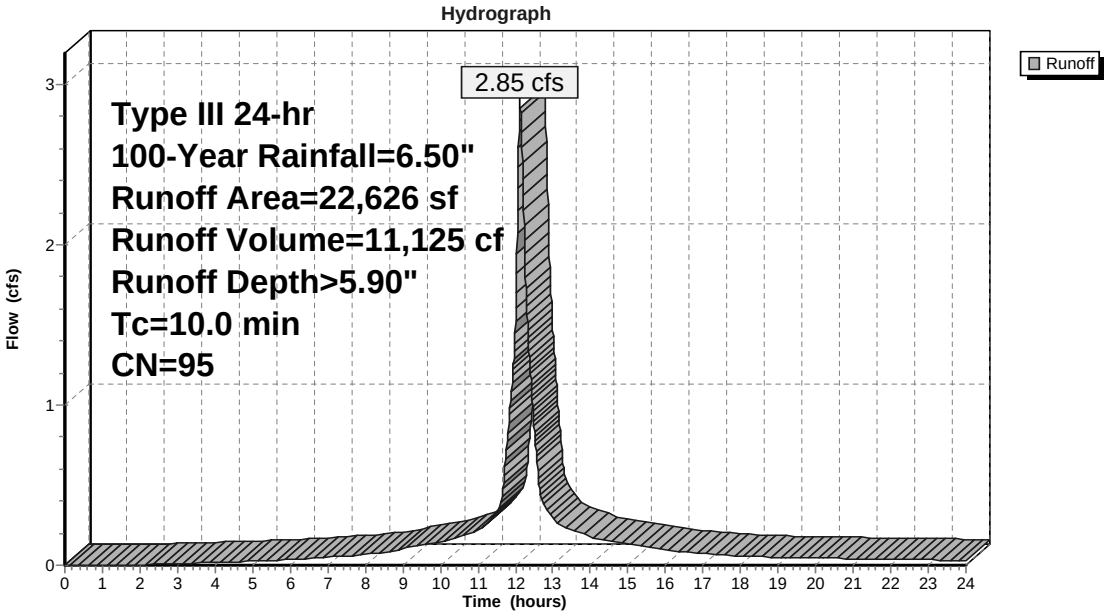
Runoff = 2.85 cfs @ 12.13 hrs, Volume= 11,125 cf, Depth> 5.90"
Routed to Pond P1A : BIO.RET. #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
19,703	98	Paved parking, HSG C
3	98	Paved parking, HSG C
75	74	>75% Grass cover, Good, HSG C
831	74	>75% Grass cover, Good, HSG C
906	74	>75% Grass cover, Good, HSG C
50	74	>75% Grass cover, Good, HSG C
1,057	74	>75% Grass cover, Good, HSG C
22,626	95	Weighted Average
2,919		12.90% Pervious Area
19,706		87.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment P-1G: PR. WATERSHED



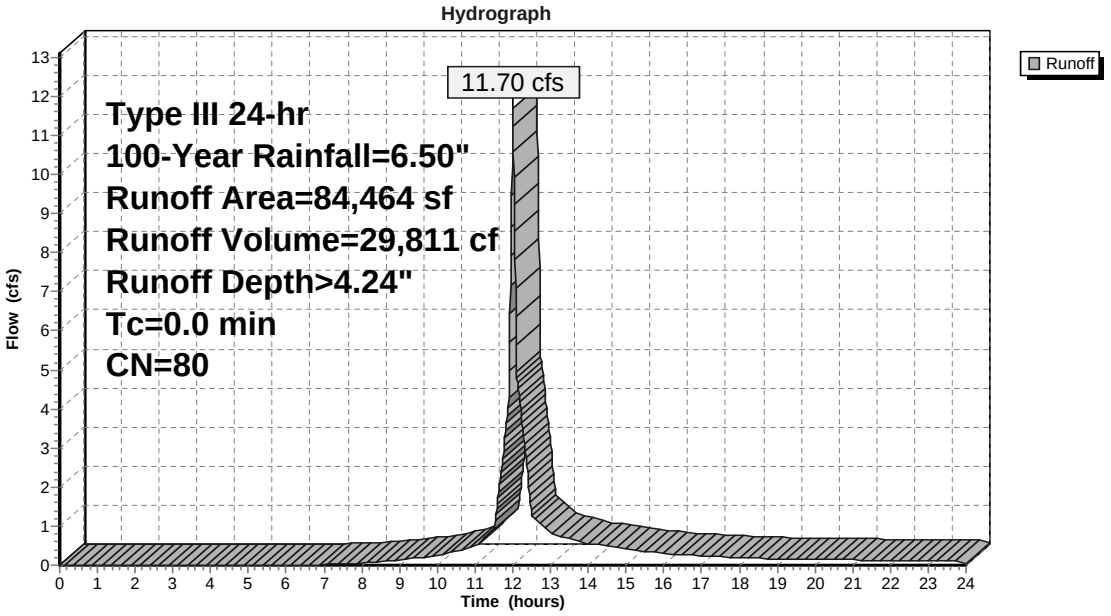
Summary for Subcatchment P-1H: Subcat P-1H

Runoff = 11.70 cfs @ 12.00 hrs, Volume= 29,811 cf, Depth> 4.24"
Routed to Pond P2 : SURFACE BASINS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
21,973	98	Paved parking, HSG C
687	98	Paved parking, HSG C
7,846	74	>75% Grass cover, Good, HSG C
12,808	74	>75% Grass cover, Good, HSG C
126	74	>75% Grass cover, Good, HSG C
149	74	>75% Grass cover, Good, HSG C
50	74	>75% Grass cover, Good, HSG C
200	74	>75% Grass cover, Good, HSG C
205	74	>75% Grass cover, Good, HSG C
13,065	74	>75% Grass cover, Good, HSG C
9,984	74	>75% Grass cover, Good, HSG C
17,371	74	>75% Grass cover, Good, HSG C
84,464	80	Weighted Average
61,803		73.17% Pervious Area
22,661		26.83% Impervious Area

Subcatchment P-1H: Subcat P-1H



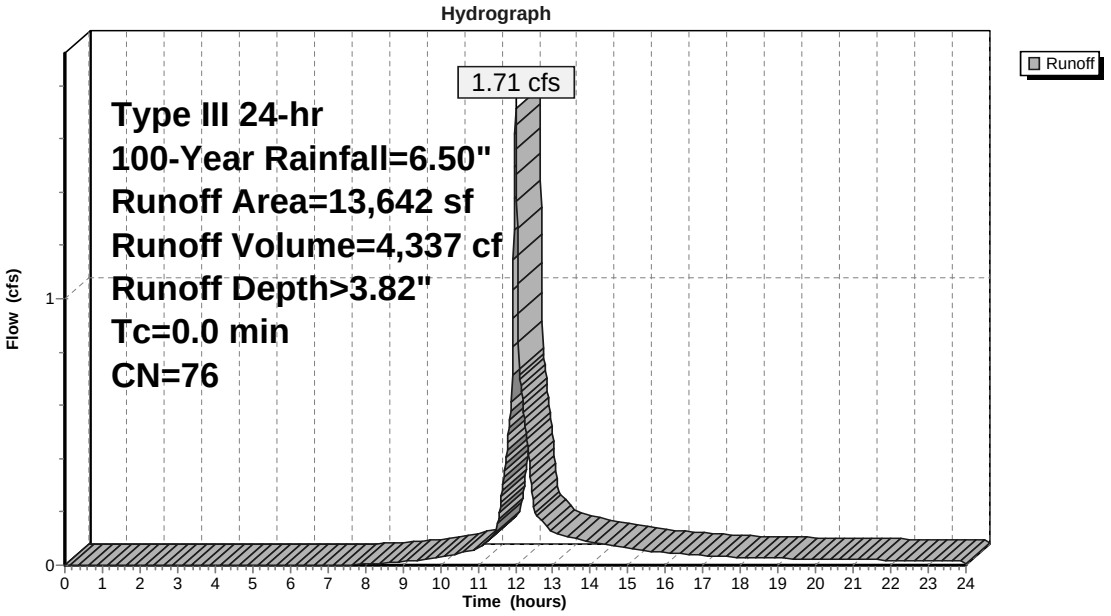
Summary for Subcatchment P-1I: Subcat P-1I

Runoff = 1.71 cfs @ 12.00 hrs, Volume= 4,337 cf, Depth> 3.82"
Routed to Link SP-1 : STUDY POINT #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
462	98	Paved parking, HSG C
537	98	Paved parking, HSG C
984	74	>75% Grass cover, Good, HSG C
2,558	74	>75% Grass cover, Good, HSG C
9,101	74	>75% Grass cover, Good, HSG C
13,642	76	Weighted Average
12,643		92.68% Pervious Area
999		7.32% Impervious Area

Subcatchment P-1I: Subcat P-1I



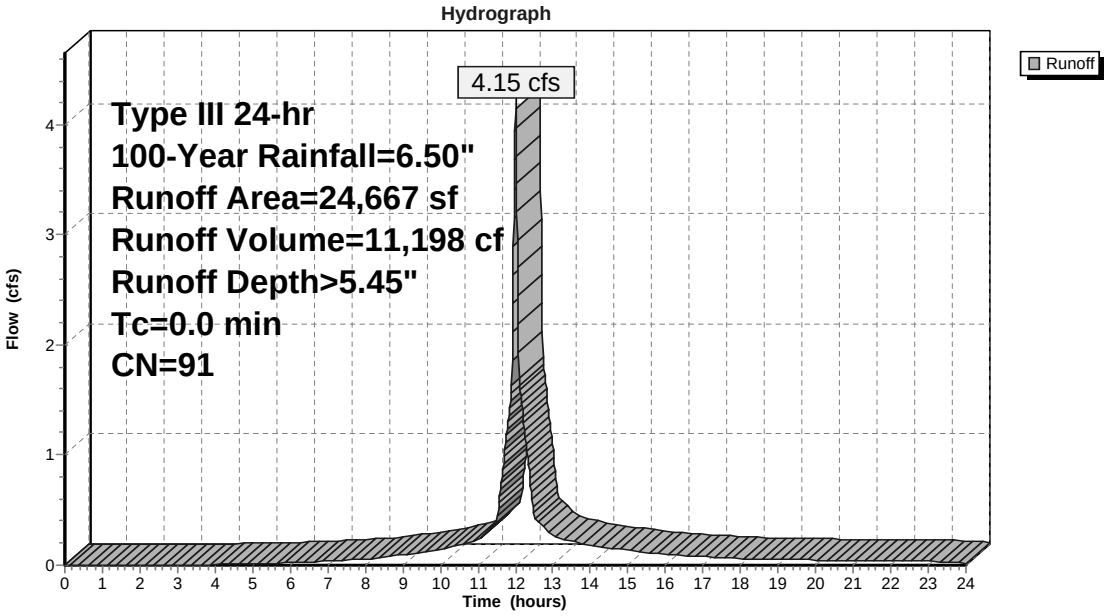
Summary for Subcatchment P-1J: Subcat P-1J

Runoff = 4.15 cfs @ 12.00 hrs, Volume= 11,198 cf, Depth> 5.45"
Routed to Pond EW : Wetland to East Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
9	74	>75% Grass cover, Good, HSG C
2,736	74	>75% Grass cover, Good, HSG C
17	80	>75% Grass cover, Good, HSG D
6	98	Paved parking, HSG C
0	98	Paved parking, HSG C
0	98	Paved parking, HSG C
2	98	Paved parking, HSG C
17,717	98	Paved parking, HSG C
834	74	>75% Grass cover, Good, HSG C
191	74	>75% Grass cover, Good, HSG C
2,512	74	>75% Grass cover, Good, HSG C
643	74	>75% Grass cover, Good, HSG C
24,667	91	Weighted Average
6,942		28.14% Pervious Area
17,725		71.86% Impervious Area

Subcatchment P-1J: Subcat P-1J



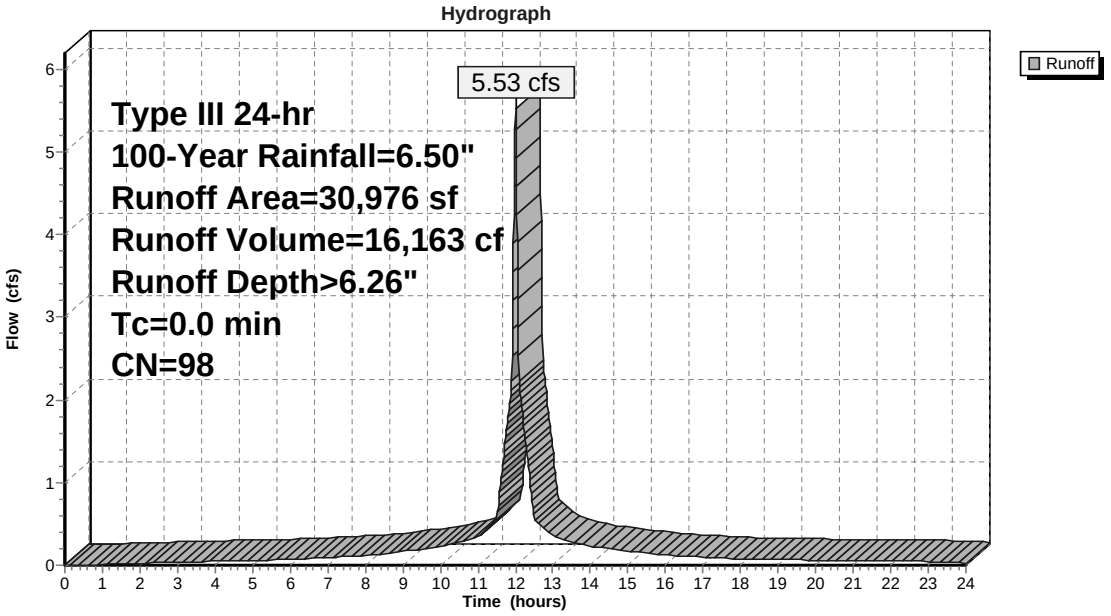
Summary for Subcatchment R-1: Subcat R-1

Runoff = 5.53 cfs @ 12.00 hrs, Volume= 16,163 cf, Depth> 6.26"
Routed to Pond P2 : SURFACE BASINS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
0	74	>75% Grass cover, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
30,976	98	Paved parking, HSG C
30,976	98	Weighted Average
0		0.00% Pervious Area
30,976		100.00% Impervious Area

Subcatchment R-1: Subcat R-1



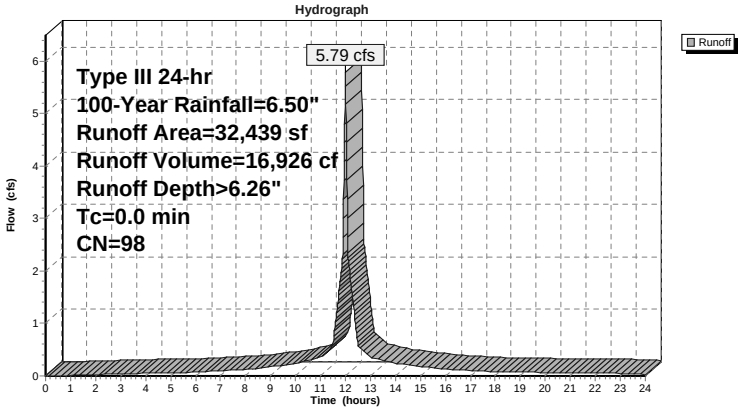
Summary for Subcatchment R-2: Subcat R-2

Runoff = 5.79 cfs @ 12.00 hrs, Volume= 16,926 cf, Depth> 6.26"
Routed to Pond P2 : SURFACE BASINS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
0	74	>75% Grass cover, Good, HSG C
32,439	98	Paved parking, HSG C
32,439	98	Weighted Average
0		0.00% Pervious Area
32,439		100.00% Impervious Area

Subcatchment R-2: Subcat R-2



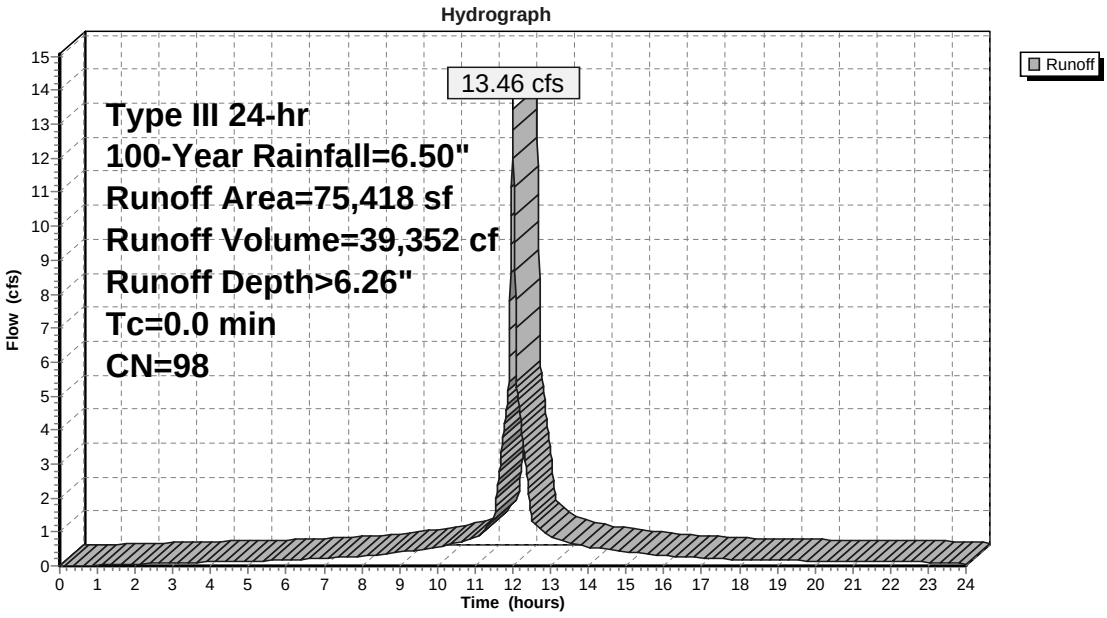
Summary for Subcatchment R-3A: Subcat R-3A

Runoff = 13.46 cfs @ 12.00 hrs, Volume= 39,352 cf, Depth> 6.26"
Routed to Pond UIS1 : UNDERGROUND CHAMBERS #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
0	74	>75% Grass cover, Good, HSG C
11,234	98	Paved parking, HSG C
0	74	>75% Grass cover, Good, HSG C
55,024	98	Paved parking, HSG C
9,161	98	Paved parking, HSG C
75,418	98	Weighted Average
0		0.00% Pervious Area
75,418		100.00% Impervious Area

Subcatchment R-3A: Subcat R-3A



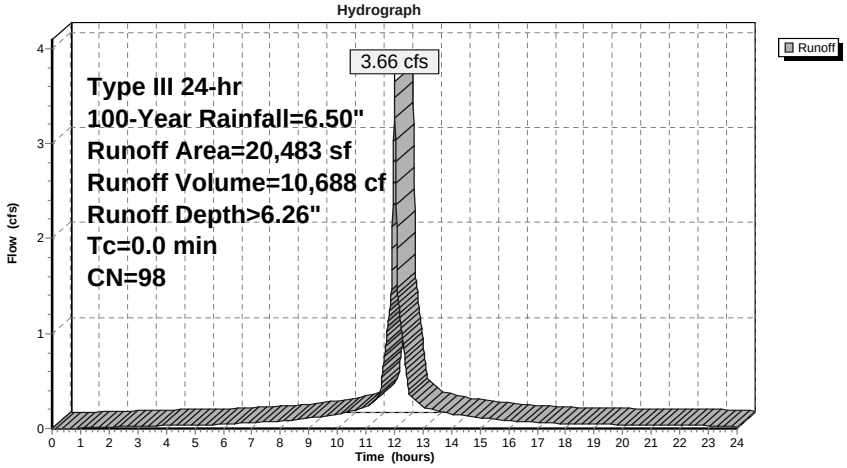
Summary for Subcatchment R-3B: Subcat R-3B

Runoff = 3.66 cfs @ 12.00 hrs, Volume= 10,688 cf, Depth> 6.26"
Routed to Pond P1B : BIO.RET. #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
20,483	98	Paved parking, HSG C
20,483		100.00% Impervious Area

Subcatchment R-3B: Subcat R-3B



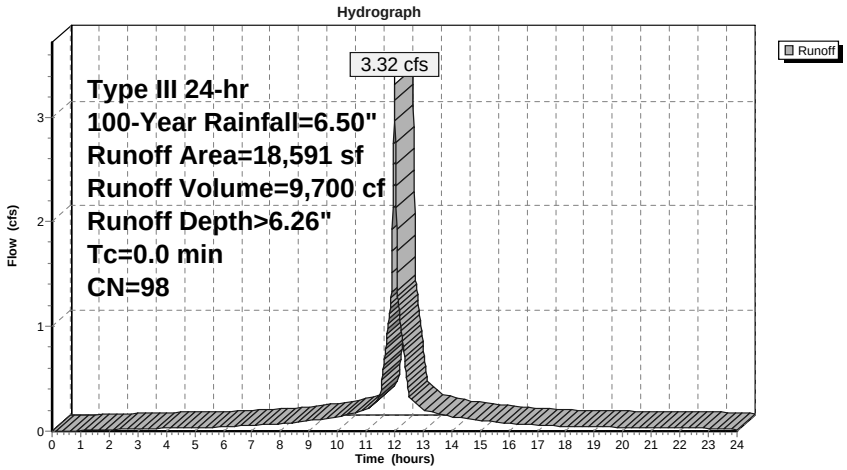
Summary for Subcatchment R-3C: Subcat R-3C

Runoff = 3.32 cfs @ 12.00 hrs, Volume= 9,700 cf, Depth> 6.26"
Routed to Pond P1C : BIO.RET. #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
18,591	98	Paved parking, HSG C
18,591		100.00% Impervious Area

Subcatchment R-3C: Subcat R-3C



Summary for Subcatchment W-1: Wetlands

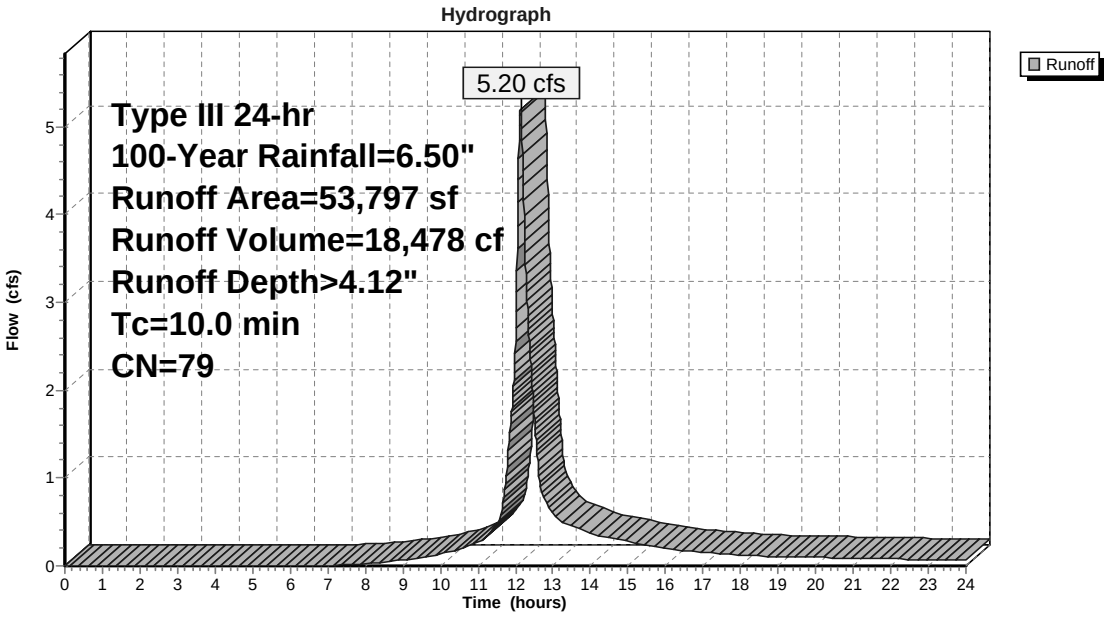
Runoff = 5.20 cfs @ 12.14 hrs, Volume= 18,478 cf, Depth> 4.12"
Routed to Pond ES : Offsite Swale to South Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
355	80	>75% Grass cover, Good, HSG D
13,345	79	Woods/grass comb., Good, HSG D
33,140	79	Woods/grass comb., Good, HSG D
2,541	74	>75% Grass cover, Good, HSG C
3,885	74	>75% Grass cover, Good, HSG C
532	98	Paved parking, HSG C
53,797	79	Weighted Average
53,265		99.01% Pervious Area
532		0.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, MIN. TC**

Subcatchment W-1: Wetlands



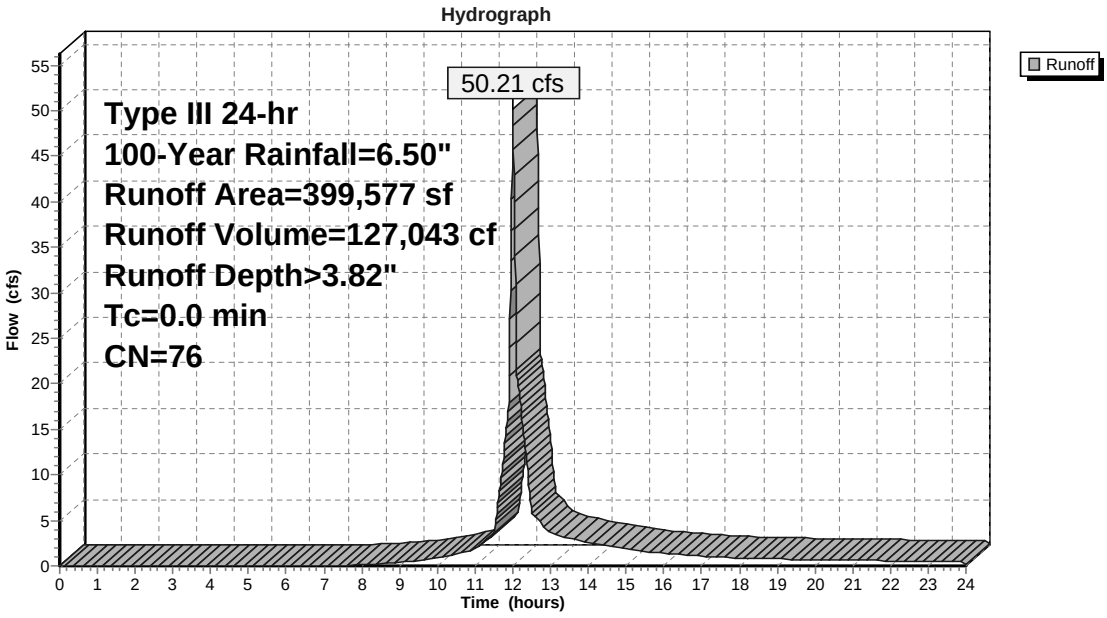
Summary for Subcatchment W-2: Subcat W-2

Runoff = 50.21 cfs @ 12.00 hrs, Volume= 127,043 cf, Depth> 3.82"
Routed to Pond EW : Wetland to East Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
21,123	79	Woods/grass comb., Good, HSG D
30,497	79	Woods/grass comb., Good, HSG D
184,072	79	Woods/grass comb., Good, HSG D
1	98	Paved parking, HSG C
9,619	98	Paved parking, HSG C
69,917	70	Woods, Good, HSG C
4,708	70	Woods, Good, HSG C
13,341	70	Woods, Good, HSG C
60,349	70	Woods, Good, HSG C
5,949	74	>75% Grass cover, Good, HSG C
399,577	76	Weighted Average
389,956		97.59% Pervious Area
9,621		2.41% Impervious Area

Subcatchment W-2: Subcat W-2



Summary for Pond ES: Offsite Swale to South Culvert

Inflow Area = 202,896 sf, 34.94% Impervious, Inflow Depth > 4.62" for 100-Year event
Inflow = 21.67 cfs @ 12.14 hrs, Volume= 78,092 cf
Outflow = 4.33 cfs @ 12.62 hrs, Volume= 52,714 cf, Atten= 80%, Lag= 29.0 min
Primary = 4.33 cfs @ 12.62 hrs, Volume= 52,714 cf
Routed to Link SP-1 : STUDY POINT #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 80.55' @ 12.62 hrs Surf.Area= 45,507 sf Storage= 41,669 cf

Plug-Flow detention time= 216.9 min calculated for 52,692 cf (67% of inflow)
Center-of-Mass det. time= 121.9 min (925.2 - 803.3)

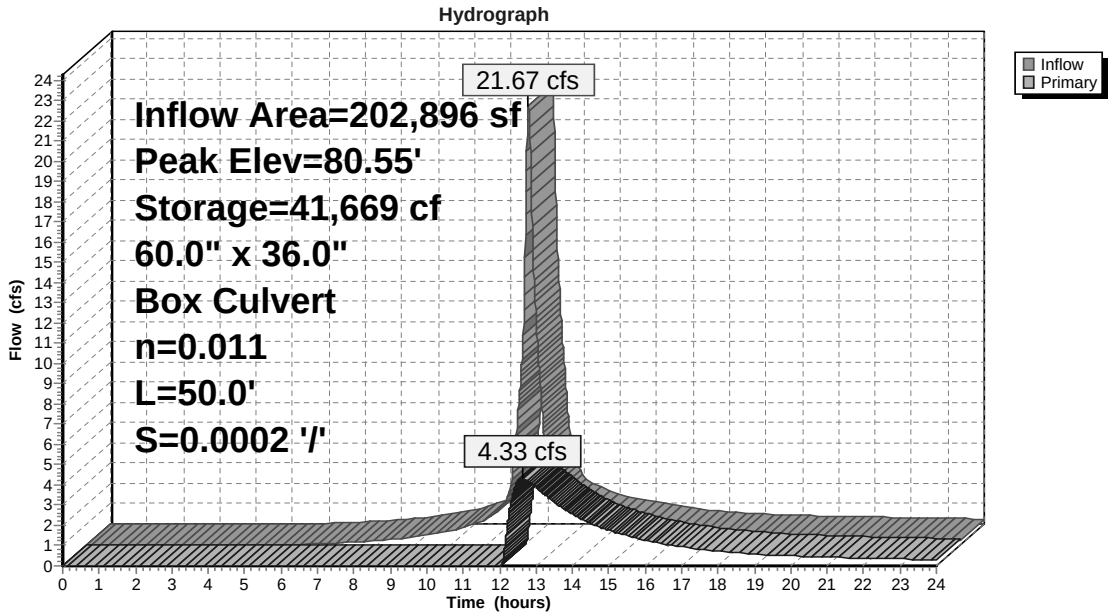
Volume	Invert	Avail.Storage	Storage Description
#1	79.00'	136,108 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
79.00	17,000	1,200.0	0	0	17,000
80.00	27,000	4,000.0	21,808	21,808	1,175,651
81.00	63,900	4,200.0	44,146	65,954	1,306,222
82.00	76,600	4,250.0	70,154	136,108	1,340,108

Device	Routing	Invert	Outlet Devices
#1	Primary	80.00'	**60.0" W x 36.0" H Box Culvert** L= 50.0' Box, headwall w/3 square edges, Ke= 0.500 Inlet / Outlet Invert= 80.00' / 79.99' S= 0.0002 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 15.00 sf

Primary OutFlow Max=4.33 cfs @ 12.62 hrs HW=80.55' TW=0.00' (Dynamic Tailwater)
1=Culvert (Barrel Controls 4.33 cfs @ 2.08 fps)

Pond ES: Offsite Swale to South Culvert



Summary for Pond EW: Wetland to East Culvert

Inflow Area = 424,244 sf, 6.45% Impervious, Inflow Depth > 3.91" for 100-Year event
Inflow = 54.37 cfs @ 12.00 hrs, Volume= 138,241 cf
Outflow = 1.59 cfs @ 15.74 hrs, Volume= 59,726 cf, Atten= 97%, Lag= 224.2 min
Primary = 1.59 cfs @ 15.74 hrs, Volume= 59,726 cf
Routed to Link SP-1 : STUDY POINT #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 80.99' @ 15.74 hrs Surf.Area= 148,194 sf Storage= 95,358 cf

Plug-Flow detention time= 381.3 min calculated for 59,726 cf (43% of inflow)
Center-of-Mass det. time= 261.3 min (1,072.9 - 811.6)

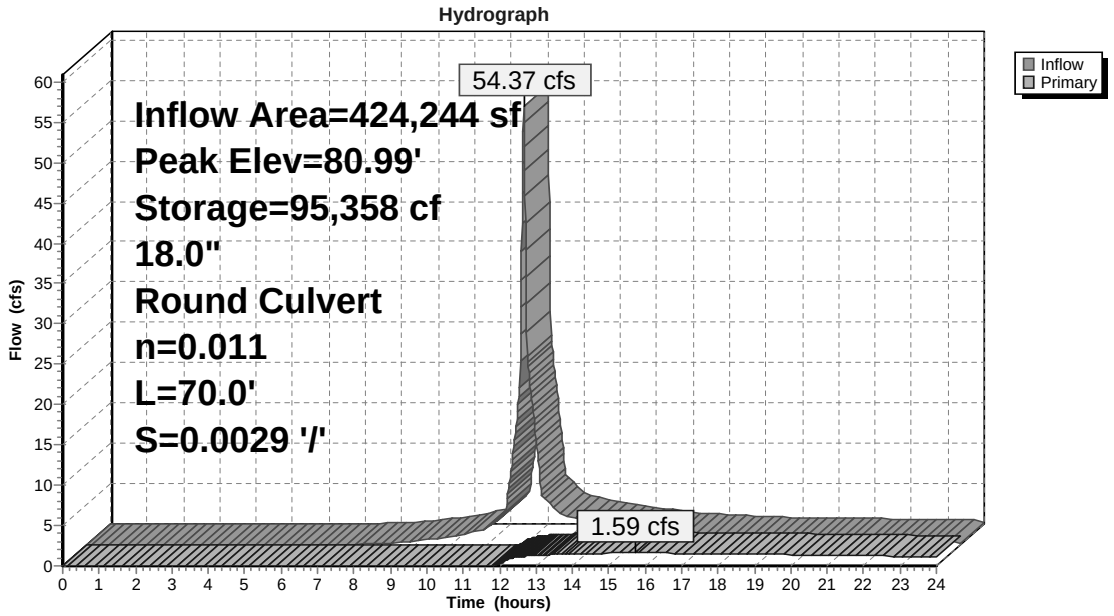
Volume	Invert	Avail.Storage	Storage Description
#1	80.00'	290,435 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
80.00	52,000	1,200.0	0	0	52,000
81.00	149,000	2,600.0	96,341	96,341	475,356
82.00	243,000	4,300.0	194,094	290,435	1,408,807

Device	Routing	Invert	Outlet Devices
#1	Primary	80.30'	**18.0" Round Culvert** L= 70.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 80.30' / 80.10' S= 0.0029 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.77 sf

Primary OutFlow Max=1.59 cfs @ 15.74 hrs HW=80.99' TW=0.00' (Dynamic Tailwater)
1=Culvert (Barrel Controls 1.59 cfs @ 2.93 fps)

Pond EW: Wetland to East Culvert



Summary for Pond OFFSITE: OFFSITE PONDING AREA IN GRASS

Inflow Area = 430,077 sf, 74.28% Impervious, Inflow Depth > 3.03" for 100-Year event
Inflow = 21.01 cfs @ 12.32 hrs, Volume= 108,718 cf
Outflow = 20.95 cfs @ 12.34 hrs, Volume= 108,466 cf, Atten= 0%, Lag= 1.6 min
Primary = 20.95 cfs @ 12.34 hrs, Volume= 108,466 cf
Routed to Link SP-1 : STUDY POINT #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 82.98' @ 12.34 hrs Surf.Area= 6,856 sf Storage= 3,121 cf

Plug-Flow detention time= 5.5 min calculated for 108,466 cf (100% of inflow)
Center-of-Mass det. time= 4.2 min (854.3 - 850.1)

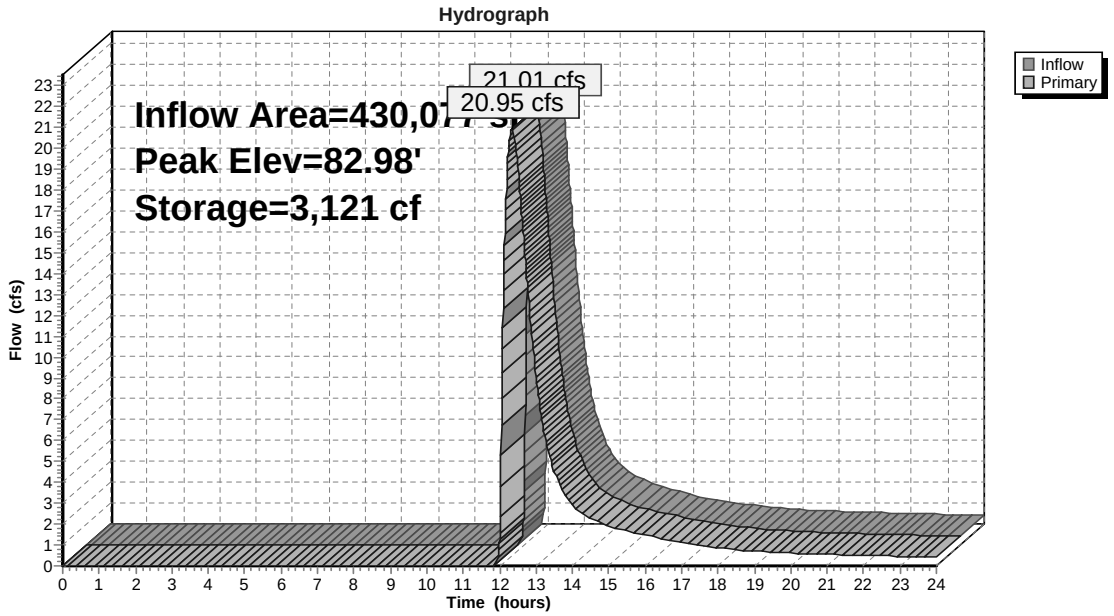
Volume	Invert	Avail.Storage	Storage Description
#1	82.10'	3,254 cf	**OFFSITE PONDING AREA (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
82.10	230	0	0
83.00	7,000	3,254	3,254

Device	Routing	Invert	Outlet Devices
#1	Primary	82.10'	**8.0" Round (3) 8" HDPE X 3.00** L= 21.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 82.10' / 81.40' S= 0.0333 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf
#2	Primary	82.60'	**30.0' long x 10.0' breadth WEIR FLOW OVER WALKING PATH** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=20.95 cfs @ 12.34 hrs HW=82.98' TW=0.00' (Dynamic Tailwater)
1=(3) 8" HDPE (Inlet Controls 2.95 cfs @ 2.81 fps)
2=WEIR FLOW OVER WALKING PATH (Weir Controls 18.00 cfs @ 1.58 fps)

Pond OFFSITE: OFFSITE PONDING AREA IN GRASS



Summary for Pond P1A: BIO.RET. #1

Inflow Area = 22,626 sf, 87.10% Impervious, Inflow Depth > 5.90" for 100-Year event
Inflow = 2.85 cfs @ 12.13 hrs, Volume= 11,125 cf
Outflow = 2.84 cfs @ 12.14 hrs, Volume= 10,930 cf, Atten= 0%, Lag= 0.6 min
Primary = 2.84 cfs @ 12.14 hrs, Volume= 10,930 cf
Routed to Pond UIS1 : UNDERGROUND CHAMBERS #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 86.52' @ 12.14 hrs Surf.Area= 1,980 sf Storage= 281 cf
Flood Elev= 86.40' Surf.Area= 606 sf Storage= 191 cf

Plug-Flow detention time= 20.8 min calculated for 10,930 cf (98% of inflow)
Center-of-Mass det. time= 9.7 min (774.2 - 764.5)

Volume	Invert	Avail.Storage	Storage Description
#1	86.00'	157 cf	**BIORETENTION #1 (Irregular)**Listed below (Recalc)
#2	86.00'	98 cf	**BIORETENTION #1 (Irregular)**Listed below (Recalc)
#3	86.50'	3,461 cf	**PARKING LOT (Irregular)**Listed below (Recalc)
		3,716 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
86.00	241	148.0	0	0	241
86.50	392	154.0	157	157	404

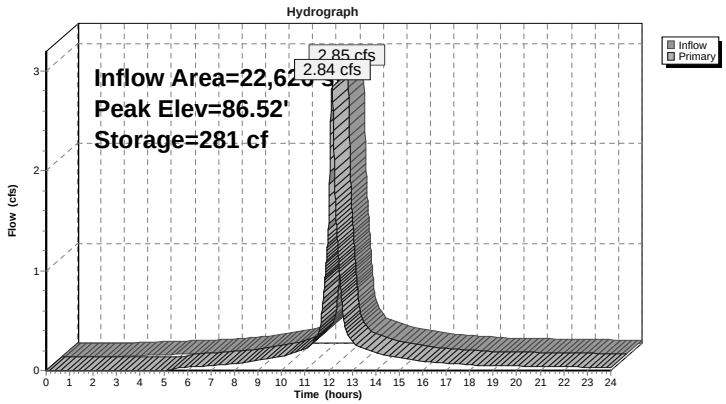
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
86.00	118	166.0	0	0	118
86.50	287	172.0	98	98	300

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
86.50	1,011	195.0	0	0	1,011
87.00	15,764	649.0	3,461	3,461	31,504

Device	Routing	Invert	Outlet Devices
#1	Primary	83.97'	**8.0" Round (2) 8" HDPE X 2.00** L= 28.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 83.97' / 83.83' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Device 1	86.40'	**8.0" Horiz. (2) 8" GRATES X 2.00** C= 0.600 Limited to weir flow at low heads
#3	Primary	83.97'	**12.0" Round (2) 12" HDPE X 2.00** L= 24.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 83.97' / 83.83' S= 0.0058 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#4	Device 3	86.40'	**24.0" x 24.0" Horiz. (2) 24" GRATES X 2.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.84 cfs @ 12.14 hrs HW=86.52' TW=85.48' (Dynamic Tailwater)
- **1=(2) 8" HDPE** (Passes 0.59 cfs of 3.30 cfs potential flow)
  - **2=(2) 8" GRATES** (Weir Controls 0.59 cfs @ 1.15 fps)
- **3=(2) 12" HDPE** (Passes 2.25 cfs of 7.73 cfs potential flow)
  - **4=(2) 24" GRATES** (Weir Controls 2.25 cfs @ 1.15 fps)

Pond P1A: BIO.RET. #1



Summary for Pond P1B: BIO.RET. #2

Inflow Area = 28,449 sf, 81.88% Impervious, Inflow Depth > 5.75" for 100-Year event
Inflow = 4.07 cfs @ 12.00 hrs, Volume= 13,636 cf
Outflow = 1.64 cfs @ 12.58 hrs, Volume= 11,572 cf, Atten= 60%, Lag= 34.5 min
Primary = 1.64 cfs @ 12.58 hrs, Volume= 11,572 cf
Routed to Pond UIS1 : UNDERGROUND CHAMBERS #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 86.92' @ 12.26 hrs Surf.Area= 4,551 sf Storage= 3,845 cf
Flood Elev= 86.50' Surf.Area= 4,230 sf Storage= 2,021 cf

Plug-Flow detention time= 128.4 min calculated for 11,572 cf (85% of inflow)
Center-of-Mass det. time= 62.8 min (816.3 - 753.6)

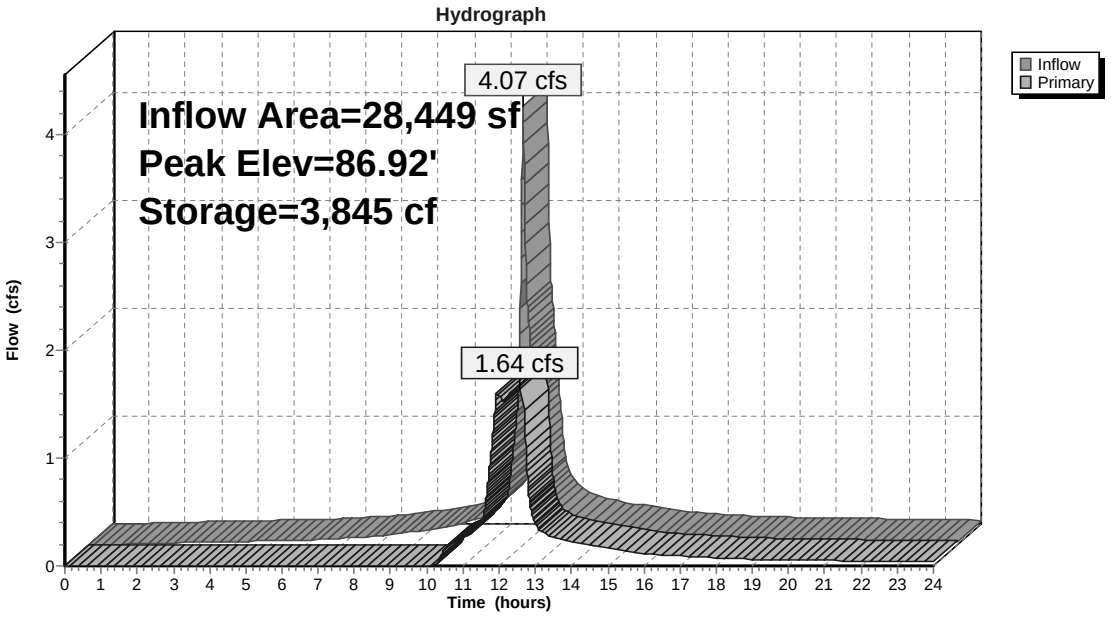
Volume	Invert	Avail.Storage	Storage Description
#1	86.00'	6,641 cf	**BIORETENTION #2 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
86.00	3,856	244.0	0	0	3,856
86.50	4,230	254.0	2,021	2,021	4,271
87.00	4,618	263.0	2,211	4,232	4,664
87.50	5,020	273.0	2,409	6,641	5,111

Device	Routing	Invert	Outlet Devices
#1	Primary	83.78'	**6.0" Round (2) 6" HDPE X 2.00** L= 56.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 83.78' / 83.50' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf
#2	Device 1	86.50'	**8.0" Horiz. (5) 8" OVERFLOW X 5.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.64 cfs @ 12.58 hrs HW=86.75' TW=85.08' (Dynamic Tailwater)
↑**1=(2) 6" HDPE** (Outlet Controls 1.64 cfs @ 4.19 fps)
↑**2=(5) 8" OVERFLOW** (Passes 1.64 cfs of 4.18 cfs potential flow)

Pond P1B: BIO.RET. #2



Summary for Pond P1C: BIO.RET. #3

Inflow Area = 30,967 sf, 71.58% Impervious, Inflow Depth > 5.49" for 100-Year event
Inflow = 3.94 cfs @ 12.00 hrs, Volume= 14,171 cf
Outflow = 1.65 cfs @ 12.53 hrs, Volume= 12,866 cf, Atten= 58%, Lag= 31.8 min
Primary = 1.65 cfs @ 12.53 hrs, Volume= 12,866 cf
Routed to Pond UIS1 : UNDERGROUND CHAMBERS #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 87.08' @ 12.29 hrs Surf.Area= 3,794 sf Storage= 3,183 cf
Flood Elev= 86.50' Surf.Area= 2,855 sf Storage= 1,269 cf

Plug-Flow detention time= 92.5 min calculated for 12,861 cf (91% of inflow)
Center-of-Mass det. time= 45.7 min (807.0 - 761.3)

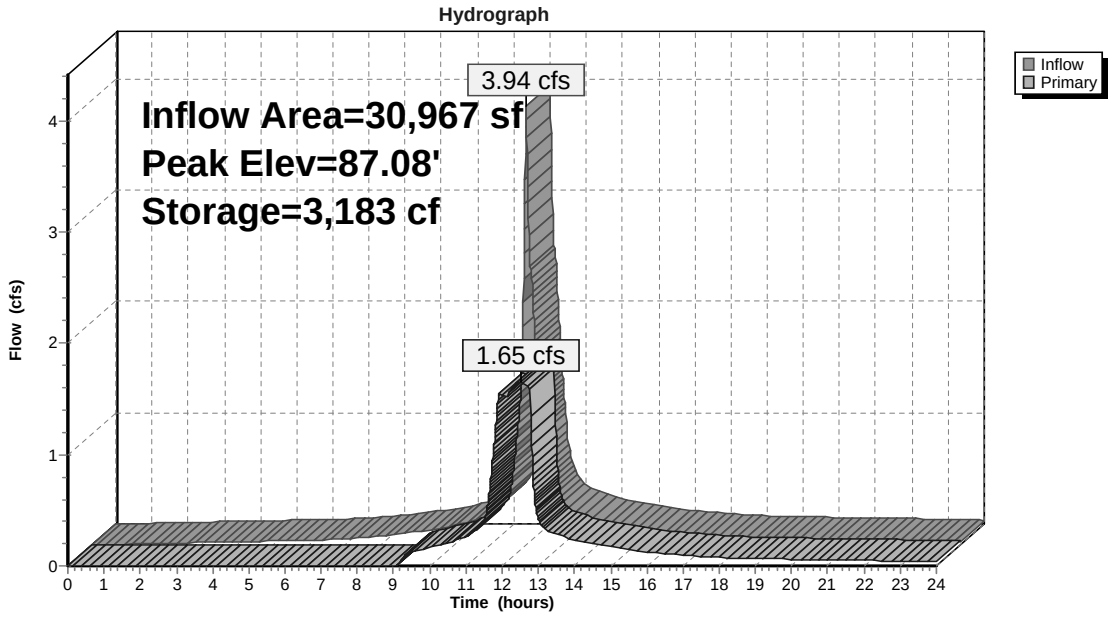
Volume	Invert	Avail.Storage	Storage Description
#1	86.00'	4,927 cf	**BIORETENTION #3 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
86.00	2,232	410.0	0	0	2,232
86.50	2,855	420.0	1,269	1,269	2,924
87.00	3,683	502.0	1,630	2,899	8,945
87.50	4,444	512.0	2,029	4,927	9,791

Device	Routing	Invert	Outlet Devices
#1	Primary	83.82'	**6.0" Round (2) 6" HDPE X 2.00** L= 63.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 83.82' / 83.50' S= 0.0051 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf
#2	Device 1	86.50'	**8.0" Horiz. (4) 8" OVERFLOW X 4.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.65 cfs @ 12.53 hrs HW=86.95' TW=85.12' (Dynamic Tailwater)
↑**1=(2) 6" HDPE** (Outlet Controls 1.65 cfs @ 4.20 fps)
↑**2=(4) 8" OVERFLOW** (Passes 1.65 cfs of 4.52 cfs potential flow)

Pond P1C: BIO.RET. #3



Summary for Pond P2: SURFACE BASINS

Inflow Area = 430,077 sf, 74.28% Impervious, Inflow Depth > 5.04" for 100-Year event
Inflow = 45.12 cfs @ 12.00 hrs, Volume= 180,758 cf
Outflow = 23.10 cfs @ 12.32 hrs, Volume= 138,877 cf, Atten= 49%, Lag= 18.7 min
Primary = 21.01 cfs @ 12.32 hrs, Volume= 108,718 cf
Routed to Pond OFFSITE : OFFSITE PONDING AREA IN GRASS
Secondary = 2.09 cfs @ 12.32 hrs, Volume= 30,159 cf
Routed to Link SP-1 : STUDY POINT #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 85.05' @ 12.32 hrs Surf.Area= 42,680 sf Storage= 69,179 cf
Flood Elev= 84.30' Surf.Area= 36,024 sf Storage= 39,786 cf

Plug-Flow detention time= 146.0 min calculated for 138,819 cf (77% of inflow)
Center-of-Mass det. time= 66.3 min (865.0 - 798.8)

Volume	Invert	Avail.Storage	Storage Description
#1	83.00'	90,039 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)
83.00	25,325	2,737.0	0	0	25,325
84.00	33,567	2,757.0	29,349	29,349	34,490
84.50	37,710	2,768.0	17,809	47,159	39,520
85.00	41,870	2,778.0	19,886	67,045	44,146
85.50	50,234	2,799.0	22,994	90,039	53,570

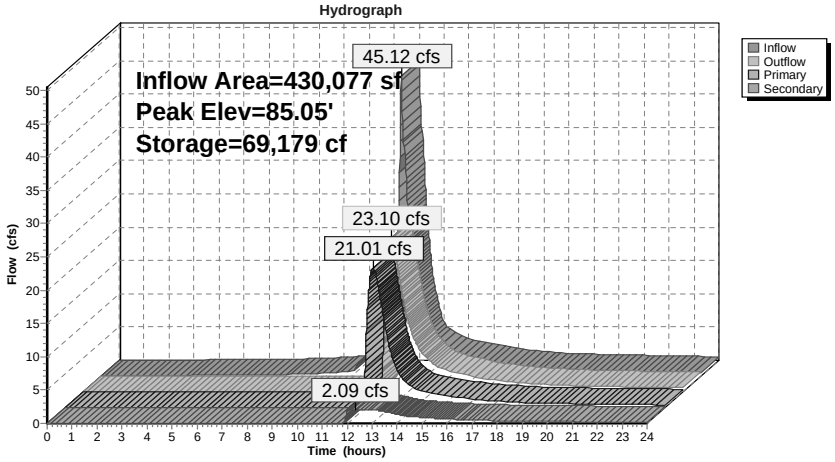
Device	Routing	Invert	Outlet Devices
#1	Secondary	82.40'	**6.0" Round (2) 6" PVC X 2.00** L= 140.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 82.40' / 81.00' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf
#2	Device 1	84.30'	**8.0" Horiz. (2) 8" OVERFLOW X 2.00** C= 0.600 Limited to weir flow at low heads
#3	Primary	83.30'	**50.0' long x 60.0' breadth GRASS/LAWN AREA** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#4	Device 3	84.30'	**12.0' long x 8.0' breadth EMERGENCY OVERFLOW**

Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50
Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=21.00 cfs @ 12.32 hrs HW=85.05' TW=82.98' (Dynamic Tailwater)
└─**3=GRASS/LAWN AREA** (Passes 21.00 cfs of 304.54 cfs potential flow)
└─**4=EMERGENCY OVERFLOW** (Weir Controls 21.00 cfs @ 2.33 fps)

Secondary OutFlow Max=2.09 cfs @ 12.32 hrs HW=85.05' TW=0.00' (Dynamic Tailwater)
└─**1=(2) 6" PVC** (Barrel Controls 2.09 cfs @ 5.33 fps)
└─**2=(2) 8" OVERFLOW** (Passes 2.09 cfs of 2.91 cfs potential flow)

Pond P2: SURFACE BASINS



Summary for Pond UIS1: UNDERGROUND CHAMBERS #1

Inflow Area = 282,197 sf, 82.71% Impervious, Inflow Depth > 5.63" for 100-Year event
Inflow = 26.14 cfs @ 12.13 hrs, Volume= 132,445 cf
Outflow = 26.01 cfs @ 12.13 hrs, Volume= 117,859 cf, Atten= 0%, Lag= 0.0 min
Primary = 26.01 cfs @ 12.13 hrs, Volume= 117,859 cf
Routed to Pond P2 : SURFACE BASINS

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 85.48' @ 12.15 hrs Surf.Area= 15,622 sf Storage= 19,868 cf
Flood Elev= 84.50' Surf.Area= 15,622 sf Storage= 14,159 cf

Plug-Flow detention time= 94.2 min calculated for 117,859 cf (89% of inflow)
Center-of-Mass det. time= 42.2 min (814.1 - 771.9)

Volume	Invert	Avail.Storage	Storage Description
#1B	83.00'	2,488 cf	**8.17'W x 416.16'L x 2.33'H Field B** 7,930 cf Overall - 1,710 cf Embedded = 6,220 cf x 40.0% Voids
#2B	83.50'	1,710 cf	**ADS_StormTech SC-310 +Cap** x 116 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 116 Chambers in 2 Rows
#3C	83.00'	3,040 cf	**8.17'W x 508.72'L x 2.33'H Field C** 9,694 cf Overall - 2,093 cf Embedded = 7,601 cf x 40.0% Voids
#4C	83.50'	2,093 cf	**ADS_StormTech SC-310 +Cap** x 142 Inside #3 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 142 Chambers in 2 Rows
#5D	83.00'	2,369 cf	**14.83'W x 223.92'L x 2.33'H Field D** 7,750 cf Overall - 1,828 cf Embedded = 5,922 cf x 40.0% Voids
#6D	83.50'	1,828 cf	**ADS_StormTech SC-310 +Cap** x 124 Inside #5 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 124 Chambers in 4 Rows
#7E	83.00'	3,182 cf	**21.50'W x 209.68'L x 2.33'H Field E** 10,519 cf Overall - 2,565 cf Embedded = 7,954 cf x 40.0% Voids
#8E	83.50'	2,565 cf	**ADS_StormTech SC-310 +Cap** x 174 Inside #7

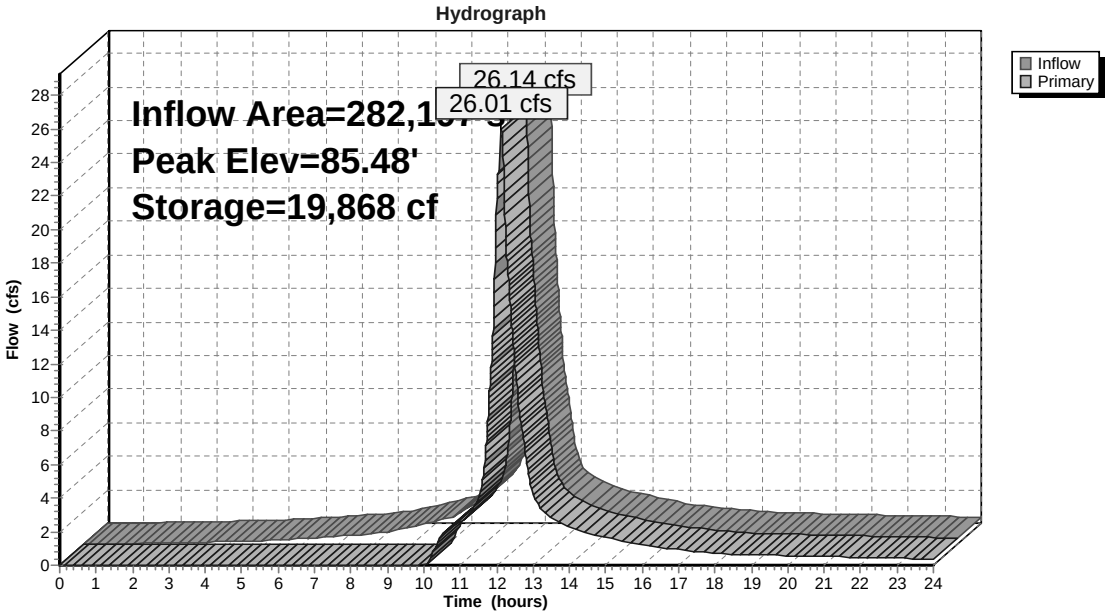
			Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 174 Chambers in 6 Rows
#9	83.00'	860 cf	**4.00'D x 3.60'H Vertical Cone/Cylinder** x 19
		20,135 cf	Total Available Storage

Storage Group B created with Chamber Wizard
Storage Group C created with Chamber Wizard
Storage Group D created with Chamber Wizard
Storage Group E created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	83.34'	**24.0" Round (3) 24" HDPE X 3.00** L= 130.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 83.34' / 83.00' S= 0.0026 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	84.50'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir X 3.00** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=26.01 cfs @ 12.13 hrs HW=85.46' TW=84.93' (Dynamic Tailwater)
↑**1=(3) 24" HDPE** (Inlet Controls 26.01 cfs @ 2.76 fps)
↑**2=Broad-Crested Rectangular Weir** (Passes 26.01 cfs of 32.66 cfs potential flow)

Pond UIS1: UNDERGROUND CHAMBERS #1

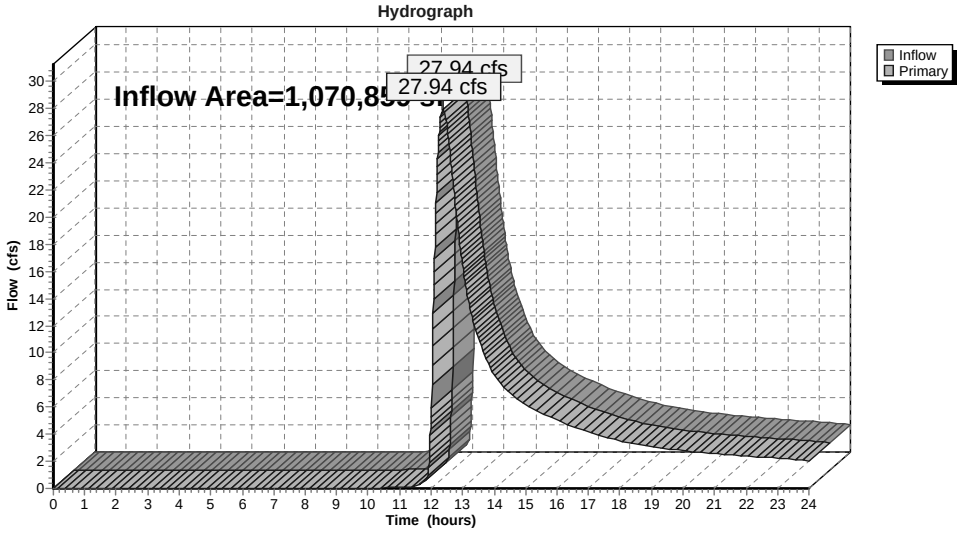


Summary for Link SP-1: STUDY POINT #1

Inflow Area = 1,070,859 sf, 39.10% Impervious, Inflow Depth > 2.86" for 100-Year event
Inflow = 27.94 cfs @ 12.38 hrs, Volume= 255,402 cf
Primary = 27.94 cfs @ 12.38 hrs, Volume= 255,402 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node SP-2

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link SP-1: STUDY POINT #1



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94 Pond P1A: BIO.RET. #1
96 Pond P1B: BIO.RET. #2
98 Pond P1C: BIO.RET. #3
100 Pond P2: SURFACE BASINS
102 Pond UIS1: UNDERGROUND CHAMBERS #1
105 Link SP-1: STUDY POINT #1

100-Year Event
106 Subcat P-1A: PR. WATERSHED
108 Subcat P-1B: PR. WATERSHED
110 Subcat P-1C: PR. WATERSHED
112 Subcat P-1D: PR. WATERSHED
114 Subcat P-1E: PR. WATERSHED
118 Subcat P-1F: PR. WATERSHED

120 Subcat P-1G: PR. WATERSHED
122 Subcat P-1H: Subcat P-1H
124 Subcat P-1I: Subcat P-1I
126 Subcat P-1J: Subcat P-1J
128 Subcat R-1: Subcat R-1
130 Subcat R-2: Subcat R-2
131 Subcat R-3A: Subcat R-3A
133 Subcat R-3B: Subcat R-3B
134 Subcat R-3C: Subcat R-3C
135 Subcat W-1: Wetlands
137 Subcat W-2: Subcat W-2
139 Pond ES: Offsite Swale to South Culvert
141 Pond EW: Wetland to East Culvert
143 Pond OFFSITE: OFFSITE PONDING AREA IN GRASS
145 Pond P1A: BIO.RET. #1
147 Pond P1B: BIO.RET. #2
149 Pond P1C: BIO.RET. #3
151 Pond P2: SURFACE BASINS
153 Pond UIS1: UNDERGROUND CHAMBERS #1
156 Link SP-1: STUDY POINT #1

SECTION 5.0 -
APPENDIX

Computation Sheet

Title	***MA DEP Standard Calculations***	
Project	*200 Quannapowitt*	
Location	200 Quannapowitt Pkwy Wakefield, MA	
Date	March 16, 2021	
Revised	February 7, 2022	

By NCD
Chk'd TJW
Apprv'd TJW

Stormwater Recharge/Water Quality Volume Table

$Rv = F*A_{IMP}$

$A_{WQ} = D_{WQ}*A_{IMP}$

Rv = *Required Recharge Volume, expressed in* ft^3, *cubic yards or acre-feet*

F = *Target Depth Factor associated with each Hydraulic Soil Group*

A_{WQ} = *Required Water Quality Treatment Volume, expressed in* ft^3

D_{WQ} = *Water Quality Depth*

A_{IMP} = *Impervious Area (pavement & rooftop area on site)*

Watershed	Area (Sq. Ft.)	Landscaped	Impervious Area (Square Feet)			Recharge Required			Water Quality Volume Required	
			HSG B (F=0.35)	HSG C (F=0.25)	HSG D (F=0.10)	*F Avg. (Inches)*	*Impervious Area (Feet)*	*Rv* (ft^3)	D_{WQ} *(Inch)*	A_{WQ}
P-1A	26,452	11,497	0	14,955	0	0.25	14,955	312	1.0	1,246
P-1B	81,643	42,013	0	39,630	0	0.25	39,630	826	1.0	3,303
P-1C	64,213	29,949	0	34,264	0	0.25	34,264	714	1.0	2,855
P-1D	7,966	5,154	0	2,812	0	0.25	2,812	59	1.0	234
P-1E	124,736	31,056	0	93,680	0	0.25	93,680	1,952	1.0	7,807
P-1F	12,376	8,799	0	3,577	0	0.25	3,577	75	1.0	298
P-1G	24,083	4,082	0	20,001	0	0.25	20,001	417	1.0	1,667
P-1H	84,464	61,803	0	22,661	0	0.25	22,661	472	1.0	1,888
P-1I	13,642	12,643	0	999	0	0.25	999	21	1.0	83
R-1	30,976	0	0	30,976	0	0.25	30,976	645	1.0	2,581
R-2	32,439	0	0	32,439	0	0.25	32,439	676	1.0	2,703
R-3A	75,418	0	0	75,418	0	0.25	75,418	1,571	1.0	6,285
R-3B	20,483	0	0	20,483	0	0.25	20,483	427	1.0	1,707
R-3C	18,591	0	0	18,591	0	0.25	18,591	387	1.0	1,549
W-1	53,797	53,265	0	532	0	0.25	532	11	1.0	44
W-2	399,580	389,959	0	9,621	0	0.25	9,621	200	1.0	802
Total	**1,070,859**	**650,220**	**0**	**420,639**	**0**		**420,639**	**8,763**		**35,053**

Computation Sheet

Title	***MA DEP Standard Calculations***	
Project	*200 Quannapowitt*	
Location	200 Quannapowitt Pkwy Wakefield, MA	
Date	March 16, 2021	

By NCD
Chk'd TJW
Apprv'd TJW

Stormwater Recharge Summary

	Required (cf)	*Provided (cf)*	
ARv =	***3,523***	***14,159***	***Infiltration Chambers #1 (Below Outlet Inv.=84.50) [P-1E, R-1A]***
ARv =	***417***	***191***	***Bioretention #1(Below Outlet Inv.=86.50) [P-1G]***
ARv =	***485***	***2,021***	***Bioretention #2(Below Outlet Inv.=86.50) [P-1D, R-3B]***
ARv =	***462***	***1,269***	***Bioretention #3 (Below Outlet Inv.=86.50) [P-1F, R-3C]***
ARv =	***1,793***	***39,786***	***Surface Infiltration Basin (Below Outlet Inv.=84.30) [P-1H, R-1, R-2]***
ARv =	***6,680***	***57,426***	***Total***
Capture Area Adjustment * =	***11,496***		

***Capture Area Adjustment**	
Total Impervious Area	420,639
Site Impervious area draining to Recharge BMPs	320,638
Ratio	1.31
Adjusted ARv	11,496

Water Quality Summary

	Required (cf)	*Provided (cf)*	
A_{WQ} =	***14,092***	***14,159***	***Infiltration Chambers #1 (Below Outlet Inv.=84.50) [P-1E, R-1A]***
A_{WQ} =	***1,667***	***191***	***Bioretention #1(Below Outlet Inv.=86.50) [P-1G]***
A_{WQ} =	***1,941***	***2,021***	***Bioretention #2(Below Outlet Inv.=86.50) [P-1D, R-3B]***
A_{WQ} =	***1,847***	***1,269***	***Bioretention #3 (Below Outlet Inv.=86.50) [P-1F, R-3C]***
A_{WQ} =	***7,173***	***39,786***	***Surface Infiltration Basin (Below Outlet Inv.=84.30) [P-1H, R-1, R-2]***
A_{WQ} =	***26,720***	***57,426***	***Total***
Capture Area Adjustment * =	***36,008***		

***Capture Area Adjustment**	
Total Impervious Area	420,639
Site Impervious area draining to Treatment BMPs	409,487
Ratio	1.03
Adjusted Awq	36,008

Computation Sheet

Title	***MA DEP Standard Calculations***	
Project	*200 Quannapowitt*	
Location	200 Quannapowitt Pkwy Wakefield, MA	
Date	March 16, 2021	

By NCD
Chk'd TJW
Apprv'd TJW

Draindown Within 72 Hours

$Time_{drawdown}$=(Rv) (1/Design Infiltration Rate in inches per hour) (Conversion for inches to feet) (1/bottom area in feet)

Infiltration Chambers #1 (HSG C - Silty Loam)	
Infiltration Rate (in/Hr)=	0.27
Bottom Area (ft^2) =	16,278
Infiltration Volume (ft^3) =	14,159
$Time_{drawdown}$ (Hours)=	38.66

Bioretention #1 (HSG C - Silty Loam)	
Infiltration Rate (in/Hr)=	0.27
Bottom Area (ft^2) =	359
Infiltration Volume (ft^3) =	191
$Time_{drawdown}$ (Hours)=	23.65

Bioretention #2 (HSG C - Silty Loam)	
Infiltration Rate (in/Hr)=	0.27
Bottom Area (ft^2) =	3,856
Infiltration Volume (ft^3) =	2,021
$Time_{drawdown}$ (Hours)=	23.29

Bioretention #3 (HSG C - Silty Loam)	
Infiltration Rate (in/Hr)=	0.27
Bottom Area (ft^2) =	2,232
Infiltration Volume (ft^3) =	1,269
$Time_{drawdown}$ (Hours)=	25.27

Surface Infiltration Basin (HSG C - Silty Loam)	
Infiltration Rate (in/Hr)=	0.27
Bottom Area (ft^2) =	25,324
Infiltration Volume (ft^3) =	39,786
$Time_{drawdown}$ (Hours)=	69.83

ALLEN & MAJOR ASSOCIATES, INC.

Project No. 1623-11 **Sheet:** 1 of 2
Project Description: 200 Quannapowitt Parkway
Calculated By: ND **Date**: 02/07/2022
Checked By: **Date:**

ESTIMATION FOR PHOSPHORUS REMOVAL

Existing Condition Phosphorus Loading			
Site Use	Phosphorus Load by Land Use (lbs/ac/yr)	Area (Acres)	Existing Phosphorus Load (lbs/yr)
Commercial	1.78	10.26	18.26
Open Space Soil Type C	0.21	4.24	0.89
Forest	0.13	10.08	1.31
	Total	**24.58**	**20.46**

Phosphorus Reduction Requirement				
Phosphorus Reduction Requirement =	Existing Phosphorus Load x 80%*			
=	20.46	x	0.8	
=	16.37	lbs/year		
Target Phosphorus Load	20.46	-	16.37	
(Post Construction) =	**4.09**	**(Target Phosphorus Load)**		

*Table F-2, Appendix F, MA MS4 General Permit

Proposed Condition Phosphorus Loading			
Site Use	Phosphorus Load by Land Use (lbs/ac/yr)	Area (Acres)	Proposed Phosphorus Load (lbs/yr)
High Density Residential	2.32	9.66	22.40
Open Space Soil Type B	0.12	0.00	0.00
Open Space Soil Type C	0.21	4.75	1.00
Open Space Soil Type D	0.37	0.00	0.00
Forest	0.13	10.18	1.32
	Total	**24.58**	**24.72**

Proposed Condition Phosphorus Loading Reduction				
BMP	BMP (Appendix F Category)	Total Phosphorous Load to BMP (lbs/yr)***	BMP Removal %**	Phosphorus Removed by BMPs (lbs/year)
Bioretention Area #1	Infiltration Basin	1.08	37%	0.40
Bioretention Area #2	Infiltration Basin	1.27	92%	1.16
Bioretention Area #3	Infiltration Basin	1.22	80%	0.98
Infiltration Chambers #1	Infiltration Trech	10.19	86%	8.76
Infiltration Basin #1	Infiltration Basin	8.85	99%	8.76
Note: See following pages for phosphorus removal calculations			**Total**	**20.07**

Proposed Load before reduction	**-**	**Loading Reduction**	**=Actual Constructed Phosphorus Load**	
Actual Constructed Phosphorus Load	24.72	-	20.07	**(Target Phosphorus Load)**
Actual Constructed Phosphorus Load	**4.65**	**lb/yr**	**compared to ----------->**	**4.10**	**BAD**

Percent Phosphorus Removed =	Loading Reduction / Proposed Load before reduction x 100			
Percent Phosphorus Removed =	**81%**	**>**	**80%**	**TARGET IS MET**

ALLEN & MAJOR ASSOCIATES, INC.

Project No. 1623-11 **Sheet:** 2 of 2
Project Description: 200 Quannapowitt Parkway
Calculated By: ND **Date: 02/07/2022**
Checked By: **Date:**

Phosphorus Calculations Per BMP

	Phosphorus Load by Land Use (lbs/ac/yr)	Area (Acres)	Proposed Phosphorus Load (lbs/yr)			
Bioretention Area #1			(per BMP)	Area to Bio #1	24,083	S.F.
High Density Residential	2.32	0.46	1.07	Volume Treated	191	C.F.
Open Space Soil Type B	0.12	0.00	0.00	Depth of runoff treated	0.1	IN.
Open Space Soil Type C	0.21	0.09	0.02	**BMP Removal %****	**37%**	
Open Space Soil Type D	0.37	0.00	0.00	**Table 3-13, Appendix F, MA MS4 General Permit		
Forest	0.13	0.00	0.00			
	total	**0.55**	**1.08**			

	Phosphorus Load by Land Use (lbs/ac/yr)	Area (Acres)	Proposed Phosphorus Load (lbs/yr)			
Bioretention Area #2			(per BMP)	Area to Bio #2	28,449	S.F.
High Density Residential	2.32	0.53	1.24	Volume Treated	2,021	C.F.
Open Space Soil Type B	0.12	0.00	0.00	Depth of runoff treated	0.9	IN.
Open Space Soil Type C	0.21	0.12	0.02	**BMP Removal %****	**92%**	
Open Space Soil Type D	0.37	0.00	0.00	**Table 3-13, Appendix F, MA MS4 General Permit		
Forest	0.13	0.00	0.00			
	total	**0.65**	**1.27**			

	Phosphorus Load by Land Use (lbs/ac/yr)	Area (Acres)	Proposed Phosphorus Load (lbs/yr)			
Bioretention Area #3			(per BMP)	Area to Bio #3	30,967	S.F.
High Density Residential	2.32	0.51	1.18	Volume Treated	1,269	C.F.
Open Space Soil Type B	0.12	0.00	0.00	Depth of runoff treated	0.5	IN.
Open Space Soil Type C	0.21	0.20	0.04	**BMP Removal %****	**80%**	
Open Space Soil Type D	0.37	0.00	0.00	**Table 3-13, Appendix F, MA MS4 General Permit		
Forest	0.13	0.00	0.00			
	total	**0.71**	**1.22**			

	Phosphorus Load by Land Use (lbs/ac/yr)	Area (Acres)	Proposed Phosphorus Load (lbs/yr)			
Infiltration Chambers #1			(per BMP)	Area to Chambers*	200,154	S.F.
High Density Residential	2.32	5.38	12.49	Volume Treated	14,159	C.F.
Open Space Soil Type B	0.12	0.00	0.00	Depth of runoff treated	0.8	IN.
Open Space Soil Type C	0.21	1.13	0.24	**BMP Removal %****	**86%**	
Open Space Soil Type D	0.37	0.00	0.00	*Area to Chambers reduced by area captured by Bioretention Basins		
Forest	0.13	0.00	0.00			
	total	**6.51**	**12.73**	**Table 3-7, Appendix F, MA MS4 General Permit		
Total after reduction provided by Bioretention Areas			**10.19**			

	Phosphorus Load by Land Use (lbs/ac/yr)	Area (Acres)	Proposed Phosphorus Load (lbs/yr)			
Infiltration Basin #1			(per BMP)	Area to Basin*	231,420	S.F.
High Density Residential	2.32	7.36	17.08	Volume Treated	39,786	C.F.
Open Space Soil Type B	0.12	0.00	0.00	Depth of runoff treated	2.1	IN.
Open Space Soil Type C	0.21	2.55	0.53	**BMP Removal %****	**99%**	
Open Space Soil Type D	0.37	0.00	0.00	*Area to Basin reduced by area captured by Infiltration Chambers		
Forest	0.13	0.00	0.00			
	total	**9.91**	**17.61**	**Table 3-13, Appendix F, MA MS4 General Permit		
Total after reduction provided by Infiltration Chambers			**8.85**			

ESTIMATION FOR TOTAL NUTRIENT REMOVAL

	Phosphorus Loading (lbs/yr)	***Nitrogen Loading (lbs/yr)***	***Total Nutrient Loading (lbs/yr)***
Existing Condition	20.46	169.08	189.54
Proposed Condition	4.66	24.57	29.23
Percent Reduction	**77%**	**85%**	**85%**

ALLEN & MAJOR ASSOCIATES, INC.

Project No.	1623-11	**Sheet:**	1 of 2
Project Description:	200 Quannapowitt Parkway		
Calculated By:	ND	**Date**:	02/07/2022
Checked By:		**Date:**	

ESTIMATION FOR NITROGEN REMOVAL

Existing Condition Nitrogen Loading			
Site Use	Nitrogen Load by Land Use (lbs/ac/yr)	Area (Acres)	Existing Nitrogen Load (lbs/yr)
Commercial	15.00	10.26	153.86
Open Space Soil Type C	2.40	4.24	10.19
Forest	0.50	10.08	5.04
	Total	**24.58**	**169.08**

Nitrogen Reduction Requirement				
Nitrogen Reduction Requirement =	Existing Nitrogen Load x 80%*			
=	169.08	x	0.8	
=	135.27	lbs/year		
Target Nitrogen Load	169.08	-	135.27	
(Post Construction) =	**33.82**	**(Target Nitrogen Load)**		

*Table F-2, Appendix F, MA MS4 General Permit

Proposed Condition Nitrogen Loading			
Site Use	Nitrogen Load by Land Use (lbs/ac/yr)	Area (Acres)	Proposed Nitrogen Load (lbs/yr)
High Density Residential	14.10	9.66	136.16
Open Space Soil Type B	1.20	0.00	0.00
Open Space Soil Type C	2.40	4.75	11.40
Open Space Soil Type D	3.60	0.00	0.00
Forest	0.50	10.18	5.09
	Total	**24.58**	**152.65**

Proposed Condition Nitrogen Loading Reduction				
BMP	BMP (Appendix F Category)	Total Nitrogen Load to BMP (lbs/yr)***	BMP Removal %**	Nitrogen Removed by BMPs (lbs/year)
Bioretention Area #1	Infiltration Basin	6.70	54%	3.62
Bioretention Area #2	Infiltration Basin	7.82	98%	7.67
Bioretention Area #3	Infiltration Basin	7.66	90%	6.89
Infiltration Chambers #1	Infiltration Trech	60.45	97%	58.64
Infiltration Basin #1	Infiltration Basin	51.26	100%	51.26
Note: See following pages for Nitrogen removal calculations			**Total**	**128.08**

Proposed Load before reduction		**-**	**Loading Reduction**	**=Actual Constructed Nitrogen Load**	
Actual Constructed Nitrogen Load	152.65	-	128.08	**(Target Nitrogen Load)**	
Actual Constructed Nitrogen Load	**24.57**	**lb/yr**	**compared to ---------->**	**33.82**	**TARGET IS MET**

Percent Nitrogen Removed =	Loading Reduction / Proposed Load before reduction x 100			
Percent Nitrogen Removed =	**84%**	**>**	**80%**	**TARGET IS MET**

ALLEN & MAJOR ASSOCIATES, INC.

Project No.	1623-11	**Sheet:**	2 of 2
Project Description:	200 Quannapowitt Parkway		
Calculated By:	ND	**Date:**	02/07/2022
Checked By:		**Date:**	

Nitrogen Calculations Per BMP

	Nitrogen Load by Land Use (lbs/ac/yr)	Area (Acres)	Proposed Nitrogen Load (lbs/yr)			
Bioretention Area #1			(per BMP)	Area to Bio #1	24,083	S.F.
High Density Residential	14.10	0.46	6.47	Volume Treated	191	C.F.
Open Space Soil Type B	1.20	0.00	0.00	Depth of runoff treated	0.1	IN.
Open Space Soil Type C	2.40	0.09	0.22	**BMP Removal %****	**54%**	
Open Space Soil Type D	3.60	0.00	0.00	**Table 3-13, Appendix F, MA MS4 General Permit		
Forest	0.50	0.00	0.00			
	total	**0.55**	**6.70**			

	Nitrogen Load by Land Use (lbs/ac/yr)	Area (Acres)	Proposed Nitrogen Load (lbs/yr)			
Bioretention Area #2			(per BMP)	Area to Bio #2	28,449	S.F.
High Density Residential	14.10	0.53	7.54	Volume Treated	2,021	C.F.
Open Space Soil Type B	1.20	0.00	0.00	Depth of runoff treated	0.9	IN.
Open Space Soil Type C	2.40	0.12	0.28	**BMP Removal %****	**98%**	
Open Space Soil Type D	3.60	0.00	0.00	**Table 3-13, Appendix F, MA MS4 General Permit		
Forest	0.50	0.00	0.00			
	total	**0.65**	**7.82**			

	Nitrogen Load by Land Use (lbs/ac/yr)	Area (Acres)	Proposed Nitrogen Load (lbs/yr)			
Bioretention Area #3			(per BMP)	Area to Bio #3	30,967	S.F.
High Density Residential	14.10	0.51	7.18	Volume Treated	1,269	C.F.
Open Space Soil Type B	1.20	0.00	0.00	Depth of runoff treated	0.5	IN.
Open Space Soil Type C	2.40	0.20	0.48	**BMP Removal %****	**90%**	
Open Space Soil Type D	3.60	0.00	0.00	**Table 3-13, Appendix F, MA MS4 General Permit		
Forest	0.50	0.00	0.00			
	total	**0.71**	**7.66**			

	Nitrogen Load by Land Use (lbs/ac/yr)	Area (Acres)	Proposed Nitrogen Load (lbs/yr)			
Infiltration Chambers #1			(per BMP)	Area to Chambers*	200,154	S.F.
High Density Residential	14.10	5.38	75.93	Volume Treated	14,159	C.F.
Open Space Soil Type B	1.20	0.00	0.00	Depth of runoff treated	0.8	IN.
Open Space Soil Type C	2.40	1.13	2.70	**BMP Removal %****	**97%**	
Open Space Soil Type D	3.60	0.00	0.00	*Area to Chambers reduced by area captured by Bioretention Basins		
Forest	0.50	0.00	0.00			
	total	**6.51**	**78.63**	**Table 3-7, Appendix F, MA MS4 General Permit		
Total after reduction provided by Bioretention Areas			**60.45**			

	Nitrogen Load by Land Use (lbs/ac/yr)	Area (Acres)	Proposed Nitrogen Load (lbs/yr)			
Infiltration Basin #1			(per BMP)	Area to Basin*	231,420	S.F.
High Density Residential	14.10	7.36	103.79	Volume Treated	39,786	C.F.
Open Space Soil Type B	1.20	0.00	0.00	Depth of runoff treated	2.1	IN.
Open Space Soil Type C	2.40	2.55	6.11	**BMP Removal %****	**100%**	
Open Space Soil Type D	3.60	0.00	0.00	*Area to Basin reduced by area captured by Infiltration Chambers		
Forest	0.50	0.00	0.00			
	total	**9.91**	**109.90**	**Table 3-13, Appendix F, MA MS4 General Permit		
Total after reduction provided by Infiltration Chambers			**51.26**			

ESTIMATION FOR TOTAL NUTRIENT REMOVAL

	Phosphorus Loading (lbs/yr)	***Nitrogen Loading (lbs/yr)***	***Total Nutrient Loading (lbs/yr)***
Existing Condition	20.46	169.08	189.54
Proposed Condition	4.66	24.57	29.23
Percent Reduction	**77%**	**85%**	**85%**

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

Version 1, Automated: Mar. 4, 2008

Location: 200 Quannapowitt Parkway Wakefield, MA

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Street Sweeping - 5%	**0.05**	**1.00**	**0.05**	**0.95**
Deep Sump and Hooded Catch Basin	**0.25**	**0.95**	**0.24**	**0.71**
Subsurface Infiltration Structure	**0.80**	**0.71**	**0.57**	**0.14**
	0.00	**0.14**	**0.00**	**0.14**
	0.00	**0.14**	**0.00**	**0.14**

Total TSS Removal = **86%**

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

Project: **200 Quannapowitt**
Prepared By: **NCD**
Date: **16-Mar-21**

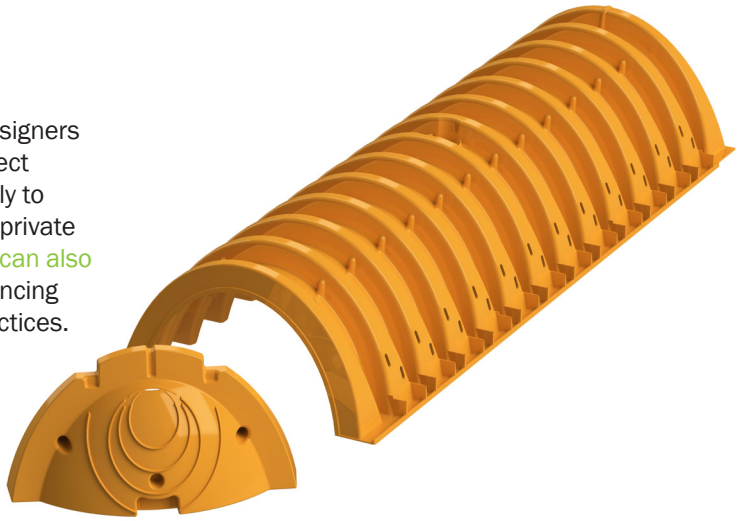
*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

SC-310 CHAMBER

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for private (commercial) and public applications. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending the service life of these practices.



STORMTECH SC-310 CHAMBER
(not to scale)

Nominal Chamber Specifications

Size (L x W x H)
85.4" x 34.0" x 16.0"
2,170 mm x 864 mm x 406 mm

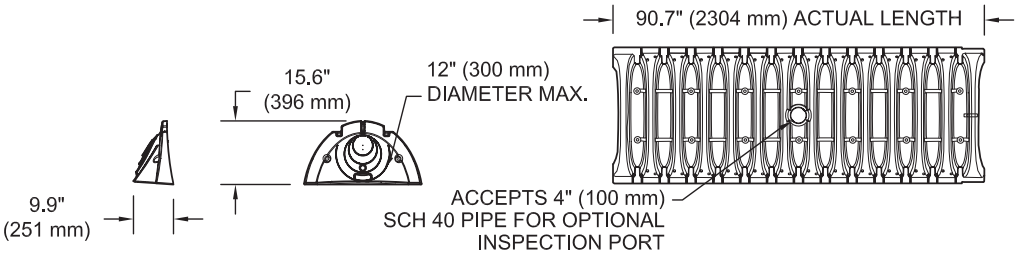
Chamber Storage
14.7 ft³ (0.42 m³)

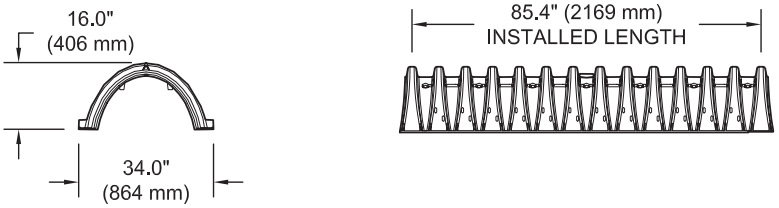
Min. Installed Storage*
31.0 ft³ (0.88 m³)

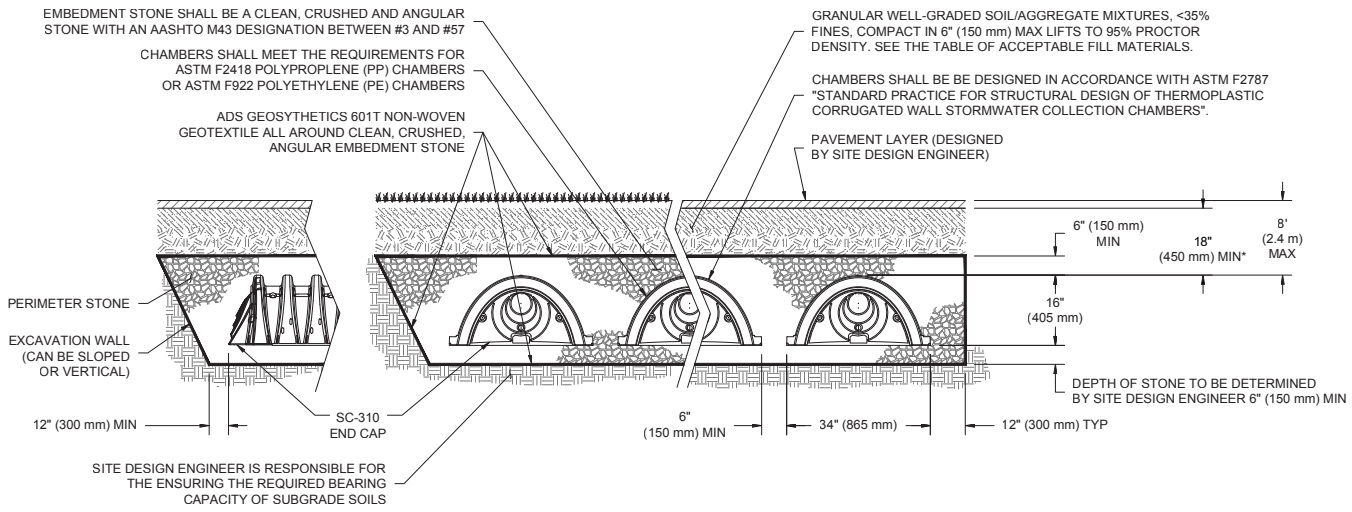
Weight
37.0 lbs (16.8 kg)

Shipping
41 chambers/pallet
108 end caps/pallet
18 pallets/truck

*Assumes 6" (150 mm) stone above and below chambers and 40% stone porosity.







*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24" (600 mm).

SC-310 CUMULATIVE STORAGE VOLUMES PER CHAMBER

Assumes 40% Stone Porosity. Calculations are Based Upon a 6" (150 mm) Stone Base Under Chambers.

Depth of Water in System Inches (mm)		Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
28 (711)		14.70 (0.416)	31.00 (0.878)
27 (686)		14.70 (0.416)	30.21 (0.855)
26 (680)	Stone	14.70 (0.416)	29.42 (0.833)
25 (610)	Cover	14.70 (0.416)	28.63 (0.811)
24 (609)		14.70 (0.416)	27.84 (0.788)
23 (584)		14.70 (0.416)	27.05 (0.766)
22 (559)		14.70 (0.416)	26.26 (0.748)
21 (533)		14.64 (0.415)	25.43 (0.720)
20 (508)		14.49 (0.410)	24.54 (0.695)
19 (483)		14.22 (0.403)	23.58 (0.668)
18 (457)		13.68 (0.387)	22.47 (0.636)
17 (432)		12.99 (0.368)	21.25 (0.602)
16 (406)		12.17 (0.345)	19.97 (0.566)
15 (381)		11.25 (0.319)	18.62 (0.528)
14 (356)		10.23 (0.290)	17.22 (0.488)
13 (330)		9.15 (0.260)	15.78 (0.447)
12 (305)		7.99 (0.227)	14.29 (0.425)
11 (279)		6.78 (0.192)	12.77 (0.362)
10 (254)		5.51 (0.156)	11.22 (0.318)
9 (229)		4.19 (0.119)	9.64 (0.278)
8 (203)		2.83 (0.081)	8.03 (0.227)
7 (178)		1.43 (0.041)	6.40 (0.181)
6 (152)		0	4.74 (0.134)
5 (127)		0	3.95 (0.112)
4(102)	Stone Foundation	0	3.16 (0.090)
3 (76)		0	2.37 (0.067)
2 (51)		0	1.58 (0.046)
1 (25)		0	0.79 (0.022)

Note: Add 0.79 ft³ (0.022 m³) of storage for each additional inch. (25 mm) of stone foundation.

STORAGE VOLUME PER CHAMBER FT³ (M³)

	Bare Chamber Storage ft³ (m³)	Chamber and Stone Foundation Depth in. (mm)		
		6 (150)	12 (300)	18 (450)
StormTech SC-310	14.7 (0.4)	31.0 (0.9)	35.7 (1.0)	40.4 (1.1)

Note: Assumes 6" (150 mm) of stone above chambers, 6" (150 mm) row spacing and 40% stone porosity.

AMOUNT OF STONE PER CHAMBER

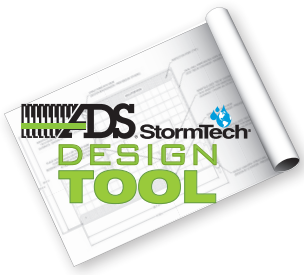
ENGLISH TONS (yds³)	Stone Foundation Depth		
	6"	12"	18"
StormTech SC-310	2.1 (1.5 yd³)	2.7 (1.9 yd³)	3.4 (2.4 yd³)
METRIC KILOGRAMS (m³)	**150 mm**	**300 mm**	**450 mm**
StormTech SC-310	1830 (1.1 m³)	2490 (1.5 m³)	2990 (1.8 m³)

Note: Assumes 6" (150 mm) of stone above, and between chambers.

VOLUME EXCAVATION PER CHAMBER YD³ (M³)

	Stone Foundation Depth		
	6" (150 mm)	12" (300 mm)	18" (450 mm)
StormTech SC-310	2.9 (2.2)	3.4 (2.6)	3.8 (2.9)

Note: Assumes 6" (150 mm) of row separation and 18" (450 mm) of cover. The volume of excavation will vary as the depth of the cover increases.



Working on a project?
Visit us at www.stormtech.com
and utilize the StormTech Design Tool

For more information on the StormTech SC-310 Chamber and other ADS products, please contact our Customer Service Representatives at 1-800-821-6710

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Division of ADS

STORMTECH ISOLATOR ROW SIZING CHART					
	SC-310	SC-740	DC-780	MC-3500	MC-4500
Chamber Area (Sq.Ft.)	20	27.8	27.8	43.2	30.1
Treated Flow Rate per chamber (CFS)	0.11	0.15	0.15	0.24	0.17

NOTE: *Testing of the Isolator Row completed by Tennesse Tech has been verified by NJCAT and it has shown to have a TSS removal efficiency of 84% for SIL-CO-SIL 250*

NJCAT verified Treated Flow Rate (GPM / Sq.Ft.) 2.5

StormTech®
Detention • Retention • Recharge
Subsurface Stormwater Management℠

Isolator Row™ Performance Test Results

as reported by Tennessee Technological University

StormTech chambers are the only chambers that meet stringent AASHTO safety factors for traffic load and deep burial applications.

Four SC-740 chambers in test apparatus at Tennessee Tech.

Uniform sediment distribution (US Silica OK-110 SG=2.65).

The Isolator Row is an innovative yet simple system that inexpensively removes total suspended solids (TSS) from storm water and provides easy access for inspection and maintenance. In the Isolator Row, StormTech chambers are completely enclosed by geotextile fabrics. Sediment is captured in the Isolator Row as storm water passes through the fabric to the stone and adjacent chambers.

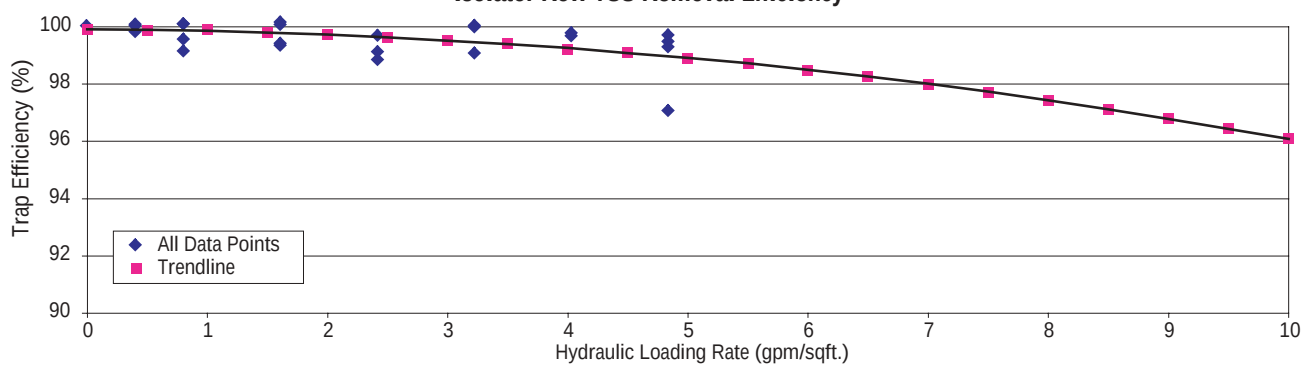
The recent completion of TSS removal testing at Tennessee Tech provides design engineers and regulators solid data that can be used to estimate the maintenance free interval and establishes the Isolator Row as a best management practice (BMP) for TSS removal.

For additional information on the Isolator Row (patent pending), contact StormTech at (888) 892-2694.

Performance Summary:

- 97% Overall TSS Removal
- 80% TSS Captured in the Isolator Row
- Estimated Maintenance Interval – 3 years

Isolator Row TSS Removal Efficiency



Another Success Story for the Isolator Row

After One Year of Operation, Harvey Industries Inspected and Cleaned Their Isolator Row in Portland, Maine

150 StormTech SC-740 chambers were installed in April, 2003. On July 7, 2004, after one year in service, StormTech inspected the Isolator Row and observed maintenance procedures.

Vactor trucks are typically equipped with both jetting and vacuum equipment.

During maintenance, the jetting nozzle propels itself down the Isolator Row scouring up sediment and washing it down to the access manhole where it is vacuumed into the truck.

After four passes of the jetting nozzle at pressures up to 1900 psi, the bottom fabric was scoured clean.

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860.529.8188 | 888.892.2694 | fax 866.328.8401 | www.stormtech.com

F-1. Rainfall Data for Massachusetts from *Rainfall Frequency Atlas of the United States* (TP-40)

- Users of this Handbook should note that current MA DEP written guidance (see DEP Waterlines newsletter -- Fall 2000) requires the use of TP-40 Rainfall Data for calculations under the Wetlands Protection Regulations and the Stormwater Management Policy. More stringent design storms may be used under a local bylaw or ordinance. However, DEP will continue to require the use of TP-40 in any case it reviews under the Wetlands Protection Act and Stormwater Management Policy.

Adjusted Technical Paper 40 Design Storms for 24-hour Event by County

County Name	1-yr 24-hr	2-yr 24-hr	5-yr 24-hr	10-yr 24-hr	25-yr 24-hr	50-yr 24-hr	100-yr 24-hr
Barnstable	2.5	3.6	4.5	4.8	5.7	6.4	7.1
Berkshire	2.5	2.9	3.8	4.4	5.1	5.9	6.4
Bristol	2.5	3.4	4.3	4.8	5.6	6.3	7.0
Dukes	2.5	3.6	4.6	4.9	5.8	6.5	7.2
Essex	2.5	3.1	3.9	4.5	5.4	5.9	6.5
Franklin	2.5	2.9	3.8	4.3	5.1	5.8	6.2
Hampden	2.5	3.0	4.0	4.6	5.3	6.0	6.5
Hampshire	2.5	3.0	3.9	4.5	5.2	5.9	6.4
Middlesex	2.5	3.1	4.0	4.5	5.3	5.9	6.5
Nantucket	2.5	3.6	4.6	4.9	5.8	6.5	7.2
Norfolk	2.5	3.2	4.1	4.7	5.5	6.1	6.7
Plymouth	2.5	3.4	4.3	4.7	5.6	6.2	7.0
Suffolk	2.5	3.2	4.0	4.6	5.5	6.0	6.6
Worcester	2.5	3.0	4.0	4.5	5.3	5.9	6.5

VALUES OF THE ROUGHNESS COEFFICIENT n
(Boldface figures are values generally recommended in design)

Type of channel and description	Minimum	Normal	Maximum
A. CLOSED CONDUITS FLOWING PARTLY FULL			
A-1. Metal			
a. Brass, smooth	0.009	**0.010**	0.013
b. Steel			
1. Lockbar and welded	0.010	0.012	0.014
2. Riveted and spiral	0.013	0.016	0.017
c. Cast iron			
1. Coated	0.010	0.013	0.014
2. Uncoated	0.011	0.014	0.016
d. Wrought iron			
1. Black	0.012	0.014	0.015
2. Galvanized	0.013	0.016	0.017
e. Corrugated metal			
1. Subdrain	0.017	0.019	0.021
2. Storm drain	0.021	**0.024**	0.030
A-2. Nonmetal			
a. Lucite	0.008	0.009	0.010
b. Glass	0.009	**0.010**	0.013
c. Cement			
1. Neat, surface	0.010	0.011	0.013
2. Mortar	0.011	0.013	0.015
d. Concrete			
1. Culvert, straight and free of debris	0.010	0.011	0.013
2. Culvert with bends, connections, and some debris	0.011	**0.013**	0.014
3. Finished	0.011	0.012	0.014
4. Sewer with manholes, inlet, etc., straight	0.013	0.015	0.017
5. Unfinished, steel form	0.012	0.013	0.014
6. Unfinished, smooth wood form	0.012	**0.014**	0.016
7. Unfinished, rough wood form	0.015	0.017	0.020
e. Wood			
1. Stave	0.010	0.012	0.014
2. Laminated, treated	0.015	0.017	0.020
f. Clay			
1. Common drainage tile	0.011	**0.013**	0.017
2. Vitrified sewer	0.011	0.014	0.017
3. Vitrified sewer with manholes, inlet, etc.	0.013	0.015	**0.017**
4. Vitrified subdrain with open joint	0.014	**0.016**	**0.018**
g. Brickwork			
1. Glazed	0.011	0.013	0.015
2. Lined with cement mortar	0.012	0.015	0.017
h. Sanitary sewers coated with sewage slimes, with bends and connections	0.012	0.013	0.016
i. Paved invert, sewer, smooth bottom	0.016	0.019	0.020
j. Rubble masonry, cemented	0.018	0.025	0.030

VALUES OF THE ROUGHNESS COEFFICIENT n (*continued*)

Type of channel and description	Minimum	Normal	Maximum
B. LINED OR BUILT-UP CHANNELS			
B-1. Metal			
a. Smooth steel surface			
1. Unpainted	0.011	**0.012**	0.014
2. Painted	0.012	0.013	0.017
b. Corrugated	0.021	0.025	0.030
B-2. Nonmetal			
a. Cement			
1. Neat, surface	0.010	0.011	0.013
2. Mortar	0.011	0.013	0.015
b. Wood			
1. Planed, untreated	0.010	0.012	0.014
2. Planed, creosoted	0.011	0.012	0.015
3. Unplaned	0.011	0.013	0.015
4. Plank with battens	0.012	0.015	0.018
5. Lined with roofing paper	0.010	0.014	0.017
c. Concrete			
1. Trowel finish	0.011	**0.013**	0.015
2. Float finish	0.013	0.015	0.016
3. Finished, with gravel on bottom	0.015	0.017	0.020
4. Unfinished	0.014	0.017	0.020
5. Gunite, good section	0.016	0.019	0.023
6. Gunite, wavy section	0.018	0.022	0.025
7. On good excavated rock	0.017	0.020	
8. On irregular excavated rock	0.022	0.027	
d. Concrete bottom float finished with sides of			
1. Dressed stone in mortar	0.015	0.017	0.020
2. Random stone in mortar	0.017	0.020	0.024
3. Cement rubble masonry, plastered	0.016	0.020	0.024
4. Cement rubble masonry	0.020	0.025	0.030
5. Dry rubble or riprap	0.020	0.030	0.035
e. Gravel bottom with sides of			
1. Formed concrete	0.017	0.020	0.025
2. Random stone in mortar	0.020	0.023	0.026
3. Dry rubble or riprap	0.023	0.033	0.036
f. Brick			
1. Glazed	0.011	**0.013**	0.015
2. In cement mortar	0.012	**0.015**	0.018
g. Masonry			
1. Cemented rubble	0.017	0.025	0.030
2. Dry rubble	0.023	0.032	0.035
h. Dressed ashlar	0.013	0.015	0.017
i. Asphalt			
1. Smooth	0.013	0.013	
2. Rough	0.016	0.016	
j. Vegetal lining	0.030	.....	0.500

VALUES OF THE ROUGHNESS COEFFICIENT n (*continued*)

Type of channel and description	Minimum	Normal	Maximum
C. EXCAVATED OR DREDGED			
a. Earth, straight and uniform			
1. Clean, recently completed	0.016	0.018	0.020
2. Clean, after weathering	0.018	0.022	0.025
3. Gravel, uniform section, clean	0.022	0.025	0.030
4. With short grass, few weeds	0.022	0.027	0.033
b. Earth, winding and sluggish			
1. No vegetation	0.023	0.025	0.030
2. Grass, some weeds	0.025	0.030	0.033
3. Dense weeds or aquatic plants in deep channels	0.030	0.035	0.040
4. Earth bottom and rubble sides	0.028	0.030	0.035
5. Stony bottom and weedy banks	0.025	0.035	0.040
6. Cobble bottom and clean sides	0.030	0.040	0.050
c. Dragline-excavated or dredged			
1. No vegetation	0.025	0.028	0.033
2. Light brush on banks	0.035	0.050	0.060
d. Rock cuts			
1. Smooth and uniform	0.025	0.035	0.040
2. Jagged and irregular	0.035	0.040	0.050
e. Channels not maintained, weeds and brush uncut			
1. Dense weeds, high as flow depth	0.050	0.080	0.120
2. Clean bottom, brush on sides	0.040	0.050	0.080
3. Same, highest stage of flow	0.045	0.070	0.110
4. Dense brush, high stage	0.080	0.100	0.140
D. NATURAL STREAMS			
D-1. Minor streams (top width at flood stage <100 ft)			
a. Streams on plain			
1. Clean, straight, full stage, no rifts or deep pools	0.025	0.030	0.033
2. Same as above, but more stones and weeds	0.030	0.035	0.040
3. Clean, winding, some pools and shoals	0.033	0.040	0.045
4. Same as above, but some weeds and stones	0.035	0.045	0.050
5. Same as above, lower stages, more ineffective slopes and sections	0.040	0.048	0.055
6. Same as 4, but more stones	0.045	0.050	0.060
7. Sluggish reaches, weedy, deep pools	0.050	0.070	0.080
8. Very weedy reaches, deep pools, or floodways with heavy stand of timber and underbrush	0.075	0.100	0.150

VALUES OF THE ROUGHNESS COEFFICIENT n (*continued*)

Type of channel and description	Minimum	Normal	Maximum
b. Mountain streams, no vegetation in channel, banks usually steep, trees and brush along banks submerged at high stages			
1. Bottom: gravels, cobbles, and few boulders	0.030	0.040	0.050
2. Bottom: cobbles with large boulders	0.040	0.050	0.070
D-2. Flood plains			
a. Pasture, no brush			
1. Short grass	0.025	0.030	0.035
2. High grass	0.030	0.035	0.050
b. Cultivated areas			
1. No crop	0.020	0.030	0.040
2. Mature row crops	0.025	0.035	0.045
3. Mature field crops	0.030	0.040	0.050
c. Brush			
1. Scattered brush, heavy weeds	0.035	0.050	0.070
2. Light brush and trees, in winter	0.035	0.050	0.060
3. Light brush and trees, in summer	0.040	0.060	0.080
4. Medium to dense brush, in winter	0.045	0.070	0.110
5. Medium to dense brush, in summer	0.070	0.100	0.160
d. Trees			
1. Dense willows, summer, straight	0.110	0.150	0.200
2. Cleared land with tree stumps, no sprouts	0.030	0.040	0.050
3. Same as above, but with heavy growth of sprouts	0.050	0.060	0.080
4. Heavy stand of timber, a few down trees, little undergrowth, flood stage below branches	0.080	0.100	0.120
5. Same as above, but with flood stage reaching branches	0.100	0.120	0.160
D-3. Major streams (top width at flood stage >100 ft). The n value is less than that for minor streams of similar description, because banks offer less effective resistance.			
a. Regular section with no boulders or brush	0.025	.....	0.060
b. Irregular and rough section	0.035	.....	0.100

Soil Map—Middlesex County, Massachusetts

Map Scale: 1:6,600 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 300 600 1200 1800

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

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

Special Point Features

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 18, Sep 7, 2018

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

Date(s) aerial images were photographed: Aug 10, 2014—Sep 19, 2014

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1	Water	59.1	32.5%
51A	Swansea muck, 0 to 1 percent slopes	7.5	4.1%
52A	Freetown muck, 0 to 1 percent slopes	25.9	14.3%
603	Urban land, wet substratum	1.0	0.5%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	12.7	7.0%
629C	Canton-Charlton-Urban land complex, 3 to 15 percent slopes	2.4	1.3%
652	Udorthents, refuse substratum	6.4	3.5%
656	Udorthents-Urban land complex	66.8	36.7%
Totals for Area of Interest		**181.8**	**100.0%**

National Flood Hazard Layer FIRMette

FEMA

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 — Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- 513 — Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 10/2/2018 at 9:24:28 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

HALEY ALDRICH

TEST PIT LOG

Test Pit No. TP-1

Project	200 QUANNAPOWITT PARKWAY REDEVELOPMENT
Location	WAKEFIELD, MA
Client	Cabot, Cabot, & Forbes
Contractor	EARTHWORK INDUSTRIES, INC.
Equipment Used	Doosan DX85R
File No.	134635-005
H&A Rep	S. Shay
Date	3 Jun 2021
Weather	Partly Cloudy 70's

Ground El.: 83.0 est. **El. Datum:** NAVD88 | **Location:** See Plan | **Groundwater depths/entry rates (in./min.):** Seepage 2' / Rapid infiltration at 7.2 ft

Depth (ft)	Sample ID	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests Dilatancy	Toughness	Plasticity	Strength
0				-ASPHALT-										
		0.3	SP- SM	Brown poorly graded SAND with silt (SP-SM), 2% oversized, mps 3.5 in., no structure, no odor, dry	5	10	20	20	35	10				
				-FILL-										
2														
4		4.0	SM	Gray silty SAND with gravel (SM), 10% oversized, mps 1.0 ft, appears to be placed layers of similar material in lifts 1.5 to 2.5 ft thick, no odor, moist	10	10	15	10	35	20				
				-FILL-										
6														
		7.6		Olive-gray poorly graded SAND (SP), no oversized, mps 1/16 in., single-grained structure, no odor, wet				20	80					
8				-GLACIOFLUVIAL DEPOSITS-										
		8.5		BOTTOM OF EXPLORATION 8.5 FT										

Obstructions: None

Remarks: Standard test tip backfill, full asphalt restore.

Field Tests

Dilatancy	R - Rapid S - Slow N - None
Toughness	L - Low M - Medium H - High
Plasticity	N - Nonplastic L - Low M - Medium H - High
Dry Strength	N - None L - Low M - Medium H - High V - Very High

Standing Water in Completed Pit

at depth	5.8	ft
measured after	0.25	hours elapsed

Boulders

Diameter (in.)	Number	Approx. Vol. (cu.ft)
12 to 24	2	= 2
over 24	1	=

Test Pit Dimensions (ft)

Pit Length x Width (ft) 12 X 4.2

Pit Depth (ft) 8.5

NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

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HALEY ALDRICH

TEST PIT LOG

Test Pit No. TP-2

Project	200 QUANNAPOWITT PARKWAY REDEVELOPMENT
Location	WAKEFIELD, MA
Client	Cabot, Cabot, & Forbes
Contractor	EARTHWORK INDUSTRIES, INC.
Equipment Used	Doosan DX85R
File No.	134635-005
H&A Rep	S. Shay
Date	3 Jun 2021
Weather	Partly Cloudy 70's

Ground El.: 83.5 est. **El. Datum:** NAVD88 | **Location:** See Plan | **Groundwater depths/entry rates (in./min.):** 7.0' / Rapidly

Depth (ft)	Sample ID	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests Dilatancy	Toughness	Plasticity	Strength
0				-ASPHALT-										
		0.3	SP- SM	Brown poorly graded SAND with silt and gravel (SP-SM), 5% oversized, mps 9.0 in., no structure, no odor, dry	10	10	15	15	40	10				
				-FILL-										
2														
		3.0	SM	Yellow-brown silty SAND (SM), no oversized, mps 1/8 in., no structure, no odor, dry, appear to be placed			5	5	60	30				
		3.3	SP	Brown poorly graded SAND (SP), no oversized, mps 1.0 in., single-grained structure, no odor, moist		10	20	40	25	5				
4		4.0	SM	Gray-brown silty SAND with gravel (SM), 15% oversized, mps 1.3 ft, no structure, no odor, moist	10	10	10	10	35	25				
6														
		7.0	OL/ OH	Dark brown ORGANIC SOIL (OL/OH), no oversized, mps 0.5 in., no structure, organic odor, wet, appears to be disturbed 15% fibers					10	90				
		7.4	SP	Olive-gray poorly graded SAND (SP), no oversized, mps 1/16 in., single-grain structure, no odor, wet				20	80					
				-GLACIOFLUVIAL DEPOSITS-										
8		8.0		BOTTOM OF EXPLORATION 8.0 FT										

Obstructions: None

Remarks: Standard test tip backfill, full asphalt restore.

Field Tests

Dilatancy R - Rapid S - Slow N - None
Toughness L - Low M - Medium H - High
Plasticity N - Nonplastic L - Low M - Medium H - High
Dry Strength N - None L - Low M - Medium H - High V - Very High

Standing Water in Completed Pit

at depth 4.9 ft
measured after 2.0 hours elapsed

Boulders

Diameter (in.)	Number		Approx. Vol. (cu.ft)
12 to 24	2	=	2.1
over 24	0	=	0

Test Pit Dimensions (ft)

Pit Length x Width (ft) 10 X 4
Pit Depth (ft) 8.0

NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

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HALEY ALDRICH

TEST PIT LOG

Test Pit No. TP-3

Project	200 QUANNAPOWITT PARKWAY REDEVELOPMENT
Location	WAKEFIELD, MA
Client	Cabot, Cabot, & Forbes
Contractor	EARTHWORK INDUSTRIES, INC.
Equipment Used	Doosan DX85R
File No.	134635-005
H&A Rep	S. Shay
Date	2 Jun 2021
Weather	Partly Cloudy 70's

Ground El.: 84 est. **El. Datum:** NAVD88 | **Location:** See Plan | **Groundwater depths/entry rates (in./min.):** 7.0' / Rapidly

Depth (ft)	Sample ID	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests Dilatancy	Toughness	Plasticity	Strength
0				-ASPHALT-										
		0.2		-GRAVEL BINDER BASE-										
		0.4	SP- SM	Brown poorly graded SAND with silt and gravel (SP-SM), 5% oversized, mps 6.0 in., no structure, no odor, moist	5	15	15	15	40	10				
				-FILL-										
2		2.0	SP	Olive-brown poorly graded SAND with gravel (SP), 5-8% oversized, mps 10.0 in., no structure, no odor, moist	5	10	10	40	30	5				
4		4.0	SM	Gray silty SAND with gravel (SM), 5% oversized, mps 8.0 ft, no structure, no odor, moist	5	10	10	15	40	20				
6				-FILL-										
			SM	Olive-gray silty SAND (SM), 2-4% oversized, mps 4.0 ft, no structure, slight organic odor, wet, trace fibers		10	10	35	30	15				
		6.7		-GLACIOFLUVIAL DEPOSITS-										
		7.5		BOTTOM OF EXPLORATION 7.5 FT										

Obstructions: None

Remarks: Standard test tip backfill, full asphalt restore.

Field Tests

Dilatancy	R - Rapid S - Slow N - None
Toughness	L - Low M - Medium H - High
Plasticity	N - Nonplastic L - Low M - Medium H - High
Dry Strength	N - None L - Low M - Medium H - High V - Very High

Standing Water in Completed Pit

at depth	7.0	ft
measured after	0.5	hours elapsed

Boulders

Diameter (in.)	Number		Approx. Vol. (cu.ft)
12 to 24	2	=	2
over 24	0	=	0

Test Pit Dimensions (ft)

Pit Length x Width (ft)	12 X 4.5
Pit Depth (ft)	7.5

NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

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HALEY ALDRICH

TEST PIT LOG

Test Pit No. TP-4

Project	200 QUANNAPOWITT PARKWAY REDEVELOPMENT
Location	WAKEFIELD, MA
Client	Cabot, Cabot, & Forbes
Contractor	EARTHWORK INDUSTRIES, INC.
Equipment Used	Doosan DX85R
File No.	134635-005
H&A Rep	S. Shay
Date	2 Jun 2021
Weather	Partly Cloudy 70's

Ground El.: 85.5 est. **El. Datum:** NAVD88 | **Location:** See Plan | **Groundwater depths/entry rates (in./min.):** Heavy seepage at 2 and 3 ft

Depth (ft)	Sample ID	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests Dilatancy	Toughness	Plasticity	Strength
0			OL/ OH	Dark brown sandy ORGANIC SOIL (OL/OH), no oversized, mps 2.0 in., no structure, no odor, moist, heavy root material					30	70				
1				-TOPSOIL/FILL-										
		1.2	SM	Light brown silty SAND (SM), no oversize, mps 2.5 in., no structure, no odor, moist	5	10	10	20	40	15				
		1.5	SP- SM	-FILL- Mixed layer of discontinuous pockets of dark brown to brown poorly graded SAND and silty SAND (SP-SM)	10	10	20	20	40					
2														
3														
		3.3	SM	Olive-brown silty SAND (SM), no oversized, mps 2.0 ft, no structure, no odor, wet	5	5	20	20	30	20				
4				Note: Encounter 0.5 in. copper pipe across the floor of the test pit.										
5		5.0		BOTTOM OF EXPLORATION 5.0 FT										

Obstructions: 0.5 in. copper pipe at 5 ft

Remarks: Standard test tip backfill, full asphalt restore.

Field Tests

Dilatancy R - Rapid S - Slow N - None
Toughness L - Low M - Medium H - High
Plasticity N - Nonplastic L - Low M - Medium H - High
Dry Strength N - None L - Low M - Medium H - High V - Very High

Standing Water in Completed Pit

at depth 3.6 ft
measured after 0.5 hours elapsed

Boulders

Diameter (in.)	Number	Approx. Vol. (cu.ft)
12 to 24	1	= 0.9
over 24	0	= 0

Test Pit Dimensions (ft)

Pit Length x Width (ft) 12 X 4
Pit Depth (ft) 5.0

NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST PIT LOG

Test Pit No. TP-5

Project	200 QUANNAPOWITT PARKWAY REDEVELOPMENT
Location	WAKEFIELD, MA
Client	Cabot, Cabot, & Forbes
Contractor	EARTHWORK INDUSTRIES, INC.
Equipment Used	Doosan DX85R
File No.	134635-005
H&A Rep	S. Shay
Date	2 Jun 2021
Weather	Partly Cloudy 70's

Ground El.: 84 est. **El. Datum:** NAVD88 | **Location:** See Plan | **Groundwater depths/entry rates (in./min.):** 2.0' / Rapidly

Depth (ft)	Sample ID	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests Dilatancy	Toughness	Plasticity	Strength
0				-ASPHALT-										
		0.2	SP- SM	Brown poorly graded SAND with silt and gravel (SP-SM), 10% oversized, mps 5.0 in., no structure, no odor, moist	5	15	20	20	30	10				
1				-FILL-										
		1.5	SP	Olive-brown poorly graded SAND with gravel (SP), no oversized, mps 2.0 in., no structure, no odor, moist		10	20	35	30	5				
		1.8	OL/ OH	Dark brown sandy ORGANIC SOIL (OL/OH), no oversized, mps 2.5 in., no structure, slight organic odor, wet, 20-30% fibers, appears to be disturbed				5	30	65				
2		2.5	SM	Gray-brown silty SAND with gravel (SM), 10% oversized, mps 9.0 in., no structure, no odor, wet	5	15	10	15	30	25				
3														
4				-FILL-										
5		5.0		BOTTOM OF EXPLORATION 5.0 FT										

Obstructions: None

Remarks: Standard test tip backfill, full asphalt restore.

Field Tests

Dilatancy R - Rapid S - Slow N - None
Toughness L - Low M - Medium H - High
Plasticity N - Nonplastic L - Low M - Medium H - High
Dry Strength N - None L - Low M - Medium H - High V - Very High

Standing Water in Completed Pit

at depth 4.3/3.6 ft
measured after 0.5/1.0 hours elapsed

Boulders

Diameter (in.)	Number		Approx. Vol. (cu.ft)
12 to 24	0	=	0
over 24	0	=	0

Test Pit Dimensions (ft)

Pit Length x Width (ft)
Pit Depth (ft) 5.0

NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

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HALEY ALDRICH

TEST PIT LOG

Test Pit No. TP-6

Project	200 QUANNAPOWITT PARKWAY REDEVELOPMENT
Location	WAKEFIELD, MA
Client	Cabot, Cabot, & Forbes
Contractor	EARTHWORK INDUSTRIES, INC.
Equipment Used	Doosan DX85R
File No.	134635-005
H&A Rep	S. Shay
Date	2 Jun 2021
Weather	Partly Cloudy 70's

Ground El.: 83.5 est. **El. Datum:** NAVD88 | **Location:** See Plan | **Groundwater depths/entry rates (in./min.):** 2.5' / Rapidly

Depth (ft)	Sample ID	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests Dilatancy	Toughness	Plasticity	Strength
0			OL/ OH	Dark brown sandy ORGANIC SOIL (OL/OH), no oversize, mps 1.0 in., no structure, no odor, wet, heavy root material					30	70				
				-TOPSOIL/FILL-										
		0.8	SP	Yellow-brown poorly graded SAND with silt and gravel (SP-SM), no oversized, mps 1/2 in., no structure, no odor, wet		5		45	45	5				
1														
		1.6	SM	Olive-gray silty SAND with gravel (SM), 10% oversized, mps 3.0 in., no structure, no odor, wet	10	10	10	15	25	30				
2		2.0	SM	Dark brown silty SAND with gravel (SM), 2% oversized, mps 4.0 in., no structure, no odor, wet	5	10	20	20	30	15				
		2.3	SP- SM	-FILL- Olive-brown poorly graded SAND with silt and gravel (SP-SM), 15% oversized, mps 6.0 in., no structure, no odor, wet	10	10	15	15	40	10				
3														
4				-GLACIOFLUVIAL DEPOSITS-										
		4.5	SM	Light gray-brown silty SAND (SM)	5	5	10	15	45	20				
5														
		5.5		BOTTOM OF EXPLORATION 5.5 FT										

Obstructions: None

Remarks: Standard test tip backfill, full asphalt restore.

Field Tests

Dilatancy R - Rapid S - Slow N - None
Toughness L - Low M - Medium H - High
Plasticity N - Nonplastic L - Low M - Medium H - High
Dry Strength N - None L - Low M - Medium H - High V - Very High

Standing Water in Completed Pit

at depth	3.5	ft
measured after	0.5	hours elapsed

Boulders

Diameter (in.)	Number	Approx. Vol. (cu.ft)
12 to 24	0	= 0
over 24	0	= 0

Test Pit Dimensions (ft)

Pit Length x Width (ft) 10 X 4
Pit Depth (ft) 5.5

NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

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HALEY ALDRICH

TEST PIT LOG

Test Pit No. TP-7

Project	200 QUANNAPOWITT PARKWAY REDEVELOPMENT
Location	WAKEFIELD, MA
Client	Cabot, Cabot, & Forbes
Contractor	EARTHWORK INDUSTRIES, INC.
Equipment Used	Doosan DX85R
File No.	134635-005
H&A Rep	S. Shay
Date	2 Jun 2021
Weather	Partly Cloudy 70's

Ground El.: 84 est. **El. Datum:** NAVD88 | **Location:** See Plan | **Groundwater depths/entry rates (in./min.):** 3.0' / Rapidly

Depth (ft)	Sample ID	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests Dilatancy	Toughness	Plasticity	Strength
0				-ASPHALT-										
		0.3	SM	Brown silty SAND with gravel (SM), 20% oversized, mps 6.5 in., no structure, no odor, dry	10	15	15	15	30	15				
1				-FILL-										
			SM	Gray silty SAND with gravel (SM), 10% oversized, mps 4.0 in., no structure, no odor, moist	5	15	15	15	35	15				
2														
			SM	Gray silty SAND with gravel (SM), 5% oversized, mps 1.0 in., no structure, no odor, moist	5	10	15	15	35	20				
3														
		3.2	SP- SM	Olive-brown poorly graded SAND with silt (SP-SM), 2% oversized, mps 3.5 in., no structure, no odor, wet, possible re-worked material	5	5	10	35	35	10				
4				-FILL-										
		4.2	SP	Olive-brown poorly graded SAND (SP), no oversized, mps 1/2 in., weak stratification, no odor, wet	5	5	15	35	35	5				
5				GLACIOFLUVIAL DEPOSITS-										
		5.5		BOTTOM OF EXPLORATION 5.5 FT										

Obstructions: None

Remarks: Standard test tip backfill, full asphalt restore.

Field Tests

Dilatancy R - Rapid S - Slow N - None
Toughness L - Low M - Medium H - High
Plasticity N - Nonplastic L - Low M - Medium H - High
Dry Strength N - None L - Low M - Medium H - High V - Very High

Standing Water in Completed Pit

at depth 4.2/3.7 ft
measured after 1.0/2.0 hours elapsed

Boulders

Diameter (in.)	Number		Approx. Vol. (cu.ft)
12 to 24	0	=	0
over 24	0	=	0

Test Pit Dimensions (ft)

Pit Length x Width (ft) 10 X 4
Pit Depth (ft) 5.5

NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

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HALEY ALDRICH

TEST PIT LOG

Test Pit No. TP-8

Project	200 QUANNAPOWITT PARKWAY REDEVELOPMENT
Location	WAKEFIELD, MA
Client	Cabot, Cabot, & Forbes
Contractor	EARTHWORK INDUSTRIES, INC.
Equipment Used	Doosan DX85R
File No.	134635-005
H&A Rep	S. Shay
Date	2 Jun 2021
Weather	Partly Cloudy 70's

Ground El.: 83 est. **El. Datum:** NAVD88 | **Location:** See Plan | **Groundwater depths/entry rates (in./min.):** Rapidly at 3.5 ', fast seepage pockets 1.0, 1.5, and 2.7'

Depth (ft)	Sample ID	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests Dilatancy	Toughness	Plasticity	Strength
0				-ASPHALT/GRAVEL BINDER BASE-										
		0.3	SP- SM	Brown poorly graded SAND with silt and gravel (SP-SM), 30% oversized, mps 6.0 in., no structure, no odor, moist to wet	10	20	10	15	35	10				
1				-FILL-										
2		1.9	SP	Olive-brown poorly graded SAND with gravel (SP), 20% oversized, mps 6.0 in., no structure, no odor, wet	5	15	10	40	25	5				
3		2.9	SM	Olive-gray silty SAND with gravel (SM), 2% oversized, mps 4.0 in., no structure, though difficult to fully characterize due to inflex of groundwater, no odor, wet	5	10	10	15	40	20				
4				-FILL-										
5		5.0		BOTTOM OF EXPLORATION 5.0 FT										

Obstructions: None

Remarks: Standard test tip backfill, full asphalt restore.

Field Tests

Dilatancy	R - Rapid S - Slow N - None
Toughness	L - Low M - Medium H - High
Plasticity	N - Nonplastic L - Low M - Medium H - High
Dry Strength	N - None L - Low M - Medium H - High V - Very High

Standing Water in Completed Pit

at depth	3.2/2.7	ft
measured after	0.5/1.0	hours elapsed

Boulders

Diameter (in.)	Number		Approx. Vol. (cu.ft)
12 to 24	0	=	0
over 24	0	=	0

Test Pit Dimensions (ft)

Pit Length x Width (ft)

Pit Depth (ft) 5.0

NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

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Commonwealth of Massachusetts
City/Town of

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: TP -1 (Hole #) 6/3/21 (Date)

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			
0 - 0.3	Asphalt										
0.3 - 4.0	Fill	Sandy loam	10 YR 4/4				20	10	Structureless	Friable	
4.0 - 7.6	Fill	Sandy loam	10 YR 4/1				25	15	Structureless	Friable	
7.6 - 8.5	C	Sand	5Y 4/1				0	0	Structureless	loose	Saturated

Additional Notes:
Rapid influx of water with organic odor at 7.2' during excavation

Standing water at 5.8' after 0.25 HR

Open pit viewed by W. Renault / Town Eng.

Commonwealth of Massachusetts
City/Town of

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: TP - 2 (Hole #) 6/3/21 (Date)

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			
0-0.3	Asphalt										
0.3 - 3.0	Fill	Sandy loam	10 YR 5.4				20	10		Friable	
3.0 - 3.3	Fill	Silt Loam	2.5Y 5/4	3.0	7.54R 5/6	10	2	0		Very friable	Variagated Not assoc. w/ SHW
3.3 - 4.0	Fill	Sandy loam	2.5Y 4/2				10	0		Friable	Dense
4.0 - 7.0	Fill	Sandy loam	10 YR 4/3				15	5		Friable	
7.0 - 7.4	Organic fill	Clay loam	2.5Y 2.5/1				0	0		Very friable	40% organic
7.4 - 8.0	C	Sand	2.5Y 5/2				0	0	single-grain	loose	saturated

Additional Notes:

Rapid influx of water at 7.0' with organic odor during excavation ESHW not apparent

Standing water at 4.9' after 20'

Open pit viewed by W. Renault / Town Eng

Commonwealth of Massachusetts
City/Town of

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: TP-3 (Hole #) 6/2/21 (Date)

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			
0 - 0.2	Asphalt										
0.2 - 0.4											0.2 - 0.4 coarse gravel binder base
0.4 - 2.0	Fill	Sandy loam	10 YR 4/3				30	5	Structureless	Friable	
2.0 - 4.0	Fill	Sandy loam	10 YR 5/4				25	2	Structureless	Friable	
4.0 - 6.5	Fill	Sandy loam	5Y 4/2				30	15	Structureless	Friable	trace roots
6.5 - 7.5	?	Sandy loam	7.5 YR 3/3				20	5	massive	Friable	10% saturated organic fibers

Additional Notes:
Standing water at 7.0' after 0.5 HR ESHW not apparent Photo of open pit sent via text to W. Renault / Town Eng.

Commonwealth of Massachusetts
City/Town of

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: TP-4 (Hole #) 6/2/21 (Date)

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			
0 - 1.2	(A) Topsoil / fill	Loam	7.5 YR 2.5 /1				15	4-5	Structureless	Friable	
1.2 - 1.5	Fill	Sandy loam	10YR 5/6				10	0	Structureless	very friable	
1.5 - 3.3	Fill	silt loam and sandy loam	7.5 YR 2.5/1 and 10 YR 5/2				20	10	Structureless	Friable	Mixed
3.3 - 5.0	B	sandy loam	2.5Y 5/2	4.5 - 5.0	7.5 YR 5/8	15	5	0	Structureless	Friable	May be variagated coloring

Additional Notes:
Standing water at 3.6 after 0.5 HR appears to be distinct mottles Heavy seepage at 2.0 and 3.0' Open pit viewed by W. Renault / town eng

Commonwealth of Massachusetts
City/Town of

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: TP-5 (Hole #) 6/2/21 (Date)

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			
0 - 0.2	Asphalt										
0.2 - 1.5	Fill	Sand	10 YR 4/4				15	5	Structureless	Very friable	
	Fill	Sand	2.5Y 4/4				10	0	Structureless	Very friable	similar as above except saturate
	Fill	Loam	7.5 YR 3/1				5	0	Structureless	Friable	
	Fill	Silt loam	5Y 4/2				25	10	Structureless	Friable	2 boulders

Additional Notes:
Water entering pit rapidly at 2.0' Standing water at 4.3' after 0.5HR / 3.6 after 1.0 HR Copper pipe at bottom of pit

Open pit viewed by W. Renault / Town Eng.

Commonwealth of Massachusetts
City/Town of

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: TP-6 (Hole #) 6/2/21 (Date)

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			
0 - 0.8	O	Loam	7.5 YR 2.5/1				0	0	Structureless	Loose	
0.8 - 1.6	Fill	Sandy loam	10 YR 5/4				10	0	Structureless	Friable	
1.6 - 2.0	Fill	Silt loam	7.5 YR 3/3				2	0	Structureless	very friable	disturbed
2.0 - 2.3	Fill	Sandy loam	7.5 YR 3/1				0	0	Structureless	very friable	disturbed
2.3 - 4.5	C1	Loamy sand	10 YR 5/3				12-15	2	massive	friable	Saturated
4.5 - 5.5	C2	Silt loam	2.5 Y 5/1				2	0	massive	friable	

Additional Notes:

Water entering pit at 2.5 rapidly / standing water at 3.5 after 0.5 HR

Open pit viewed by W. Renault / Town Eng

Unable to determine ESHW / mottling not apparent

Commonwealth of Massachusetts
City/Town of

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: TP-7 (Hole #) 6/2/21 (Date)

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			
0 - 0.3	Asphalt										
0.3 - 1.3	Fill	very gravelly sandy loam	5 Y 4/2				40	0	Structureless	Friable	
1.3 - 2.5	Fill	sandy loam	7.5 YR 4/4				15	0	Structureless	Friable	
2.5 - 3.2	Fill	silt loam	2.5Y 5/3				10	10	Structureless	Friable	Angular Cobbles
3.2 - 4.2	Fill	sandy loam	10 YR 4/3				5	2	Structureless	Friable	Re-worked Material
4.2 - 5.5	C	loamy sand	2.5Y 4/3				5	0	massive	Friable	

Additional Notes:
Standing water at 4.2' after 1.0 HR / 3.7' after 2.0 HR
Open pit viewed by W. Renault / Town Eng
Unable to determine ESHW / mottling not apparent

Commonwealth of Massachusetts
City/Town of

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: TP-8 (Hole #) 6/2/2021 (Date)

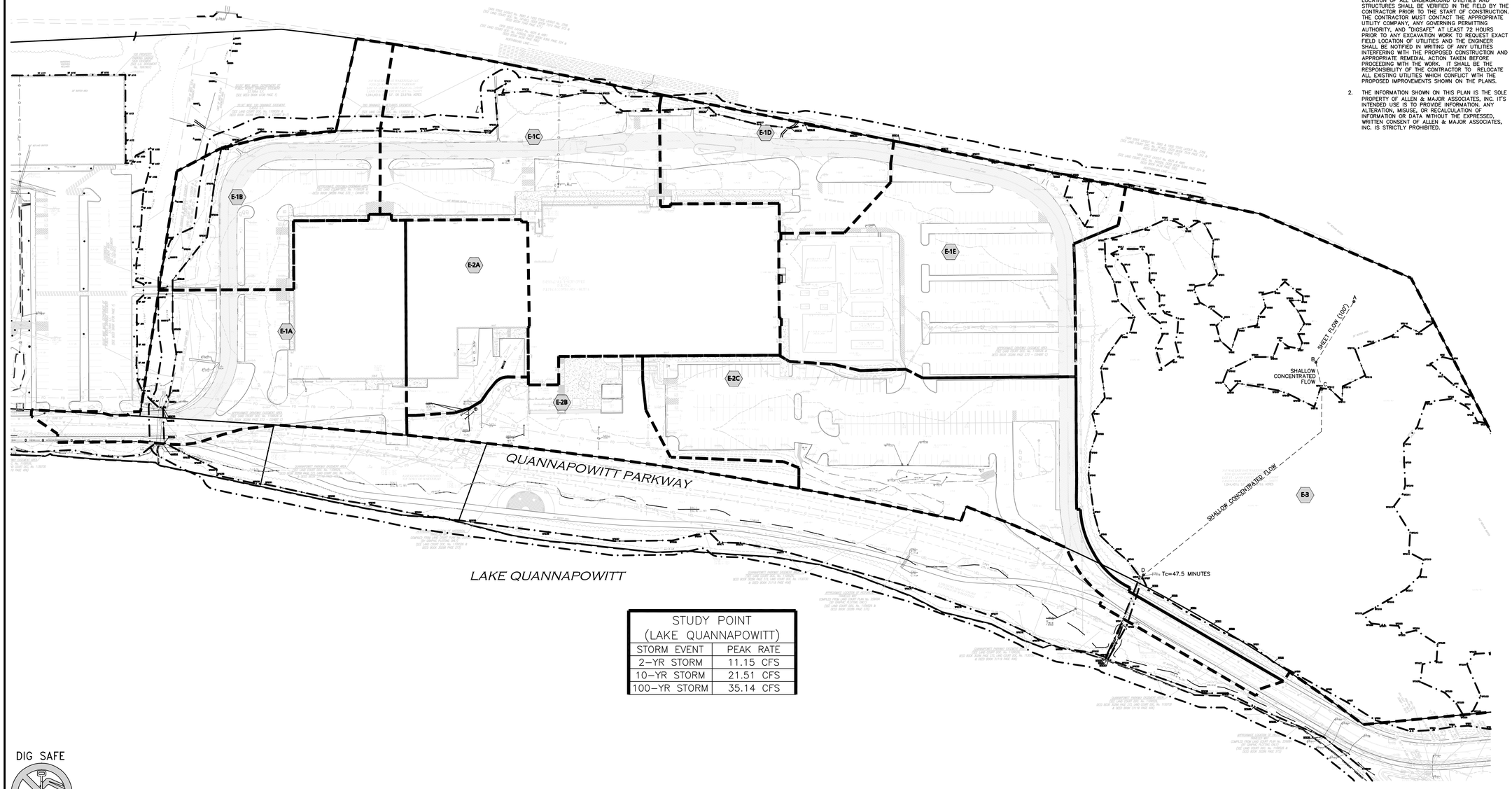
Soil Log

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			
0-0.3	Asphalt w/ gravel under base										
0.3-1.9	Fill	Sandy loam					40	20	Structureless	Friable	
1.9-2.9	Fill	Sandy loam					20	5	Structureless	Friable	Trace roots*
2.9-5.0	Fill	Silt loam	54 5/1				5	2	Structureless	Friable	

Additional Notes: Standing water at 3.2 after 0.5 HR/2.7 after 1.0 HR
Water seepage from various pockets in fill at 1.0, 1.5, and 2.7 ft
ES HW not apparent/ mottling at present
Upon pit viewed by W. Renault/Town Eng.

*Varigated 7.5 YR 1/1 discontinuous

SECTION 6.0 –
WATERSHED & TEST PIT LOCATION PLANS



LEGEND:

WATERSHED BOUNDARY	
REACH	
SUBCATCHMENT LABEL	E-1

NOTES:

1. THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AND STRUCTURES AS SHOWN ON THESE PLANS IS BASED ON RECORDS OF VARIOUS UTILITY COMPANIES AND WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THIS INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE LOCATION OF ALL UNDERGROUND UTILITIES AND STRUCTURES SHALL BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO THE START OF CONSTRUCTION. THE CONTRACTOR MUST CONTACT THE APPROPRIATE UTILITY COMPANY, ANY GOVERNING PERMITTING AUTHORITY, AND "DIGSAFE" AT LEAST 72 HOURS PRIOR TO ANY EXCAVATION WORK TO REQUEST EXACT FIELD LOCATION OF UTILITIES AND THE ENGINEER SHALL BE NOTIFIED IN WRITING OF ANY UTILITIES INTERFERING WITH THE PROPOSED CONSTRUCTION AND APPROPRIATE REMEDIAL ACTION TAKEN BEFORE PROCEEDING WITH THE WORK. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS.
2. THE INFORMATION SHOWN ON THIS PLAN IS THE SOLE PROPERTY OF ALLEN & MAJOR ASSOCIATES, INC. IT'S INTENDED USE IS TO PROVIDE INFORMATION. ANY ALTERATION, MISUSE, OR RECALCULATION OF INFORMATION OR DATA WITHOUT THE EXPRESSED, WRITTEN CONSENT OF ALLEN & MAJOR ASSOCIATES, INC. IS STRICTLY PROHIBITED.

STUDY POINT (LAKE QUANNAPOWITT)	
STORM EVENT	PEAK RATE
2-YR STORM	11.15 CFS
10-YR STORM	21.51 CFS
100-YR STORM	35.14 CFS

GRAPHIC SCALE

60 0 30 60 120 240

(IN FEET)
1 inch = 60 ft.

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1-888-344-7233

K:\PROJECTS\1623-11\CIVIL\DRAWINGS\CURRENT\C-1623-11 - EWS.DWG

ISSUED FOR DRAINAGE REPORT
JANUARY 5, 2022

PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

REV	DATE	DESCRIPTION
5	1/05/2022	Issued to Conservation Commission
4	11/11/2021	Re-Issued to ZBA
3	9/01/2021	Re-Issued to ZBA
2	8/03/2021	Issued to Conservation Commission
1	3/31/2021	Re-Issued to ZBA

APPLICANT:
CCF QUANNAPOWITT PROPERTY COMPANY, LLC
185 DARTMOUTH STREET
BOSTON, MA 02116

PROJECT:
200-400 QUANNAPOWITT PARKWAY
WAKEFIELD, MA 01880

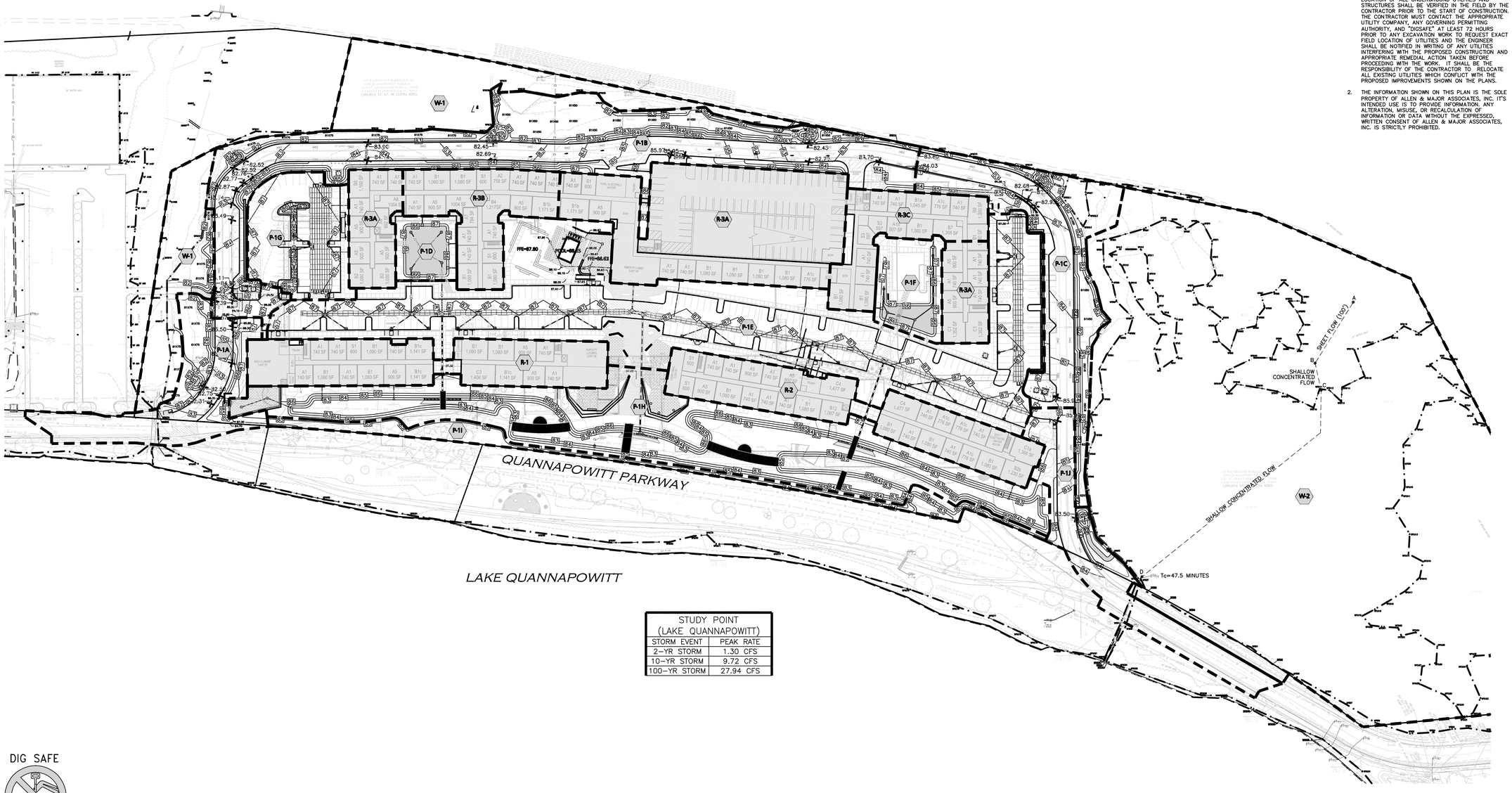
PROJECT NO.	1623-11	DATE:	MARCH 16, 2021
SCALE:	1"=60'	DWG. NAME:	C-1623-11.dwg
DESIGNED BY:	NCD	CHECKED BY:	TJW

PREPARED BY:

ALLEN & MAJOR ASSOCIATES, INC.
civil engineering ◆ land surveying
environmental consulting ◆ landscape architecture
www.allenmajor.com
100 COMMERCE WAY
WOBURN MA 01888-0118
TEL: (781) 935-6889
FAX: (781) 935-2896
WOBURN, MA ◆ LAKEVILLE, MA ◆ MANCHESTER, NH

DRAWING TITLE:
EXISTING WATERSHED PLAN

SHEET No.
EWS



STUDY POINT (LAKE QUANNAPOWITT)	
STORM EVENT	PEAK RATE
2-YR STORM	1.30 CFS
10-YR STORM	9.72 CFS
100-YR STORM	27.94 CFS

GRAPHIC SCALE

60 0 30 60 120 240

(IN FEET)
1 inch = 60 ft.

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1-888-344-7233

N:\PROJECTS\1623-11\CIVIL\DRAWINGS\CURRENT\C-1623-11 - PWS.DWG

LEGEND:

WATERSHED BOUNDARY	
REACH	
SUBCATCHMENT LABEL	P-1

NOTES:

1. THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AND STRUCTURES AS SHOWN ON THESE PLANS IS BASED ON RECORDS OF VARIOUS UTILITY COMPANIES AND WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THIS INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE LOCATION OF ALL UNDERGROUND UTILITIES AND STRUCTURES SHALL BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO THE START OF CONSTRUCTION. THE CONTRACTOR MUST CONTACT THE APPROPRIATE UTILITY COMPANY, ANY GOVERNING PERMITTING AUTHORITY, AND "DIGSAFE" AT LEAST 72 HOURS PRIOR TO ANY EXCAVATION WORK TO REQUEST EXACT FIELD LOCATION OF UTILITIES AND THE ENGINEER SHALL BE NOTIFIED IN WRITING OF ANY UTILITIES INTERFERING WITH THE PROPOSED CONSTRUCTION AND APPROPRIATE REMEDIAL ACTION TAKEN BEFORE PROCEEDING WITH THE WORK. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS.
2. THE INFORMATION SHOWN ON THIS PLAN IS THE SOLE PROPERTY OF ALLEN & MAJOR ASSOCIATES, INC. IT'S INTENDED USE IS TO PROVIDE INFORMATION. ANY ALTERATION, MISUSE, OR RECALCULATION OF INFORMATION OR DATA WITHOUT THE EXPRESSED, WRITTEN CONSENT OF ALLEN & MAJOR ASSOCIATES, INC. IS STRICTLY PROHIBITED.

ISSUED FOR DRAINAGE REPORT
APRIL 8, 2022

PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

REV	DATE	DESCRIPTION
7	04/08/2022	Re-Issued to Con.Com. & ZBA
6	2/07/2022	Re-Issued to Conservation Commission
5	1/05/2022	Re-Issued to Conservation Commission
4	11/11/2021	Re-Issued to ZBA
3	9/01/2021	Re-Issued to ZBA
2	8/03/2021	Issued to Conservation Commission
1	3/31/2021	Re-Issued to ZBA

APPLICANT:
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185 DARTMOUTH STREET
BOSTON, MA 02116

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WAKEFIELD, MA 01880

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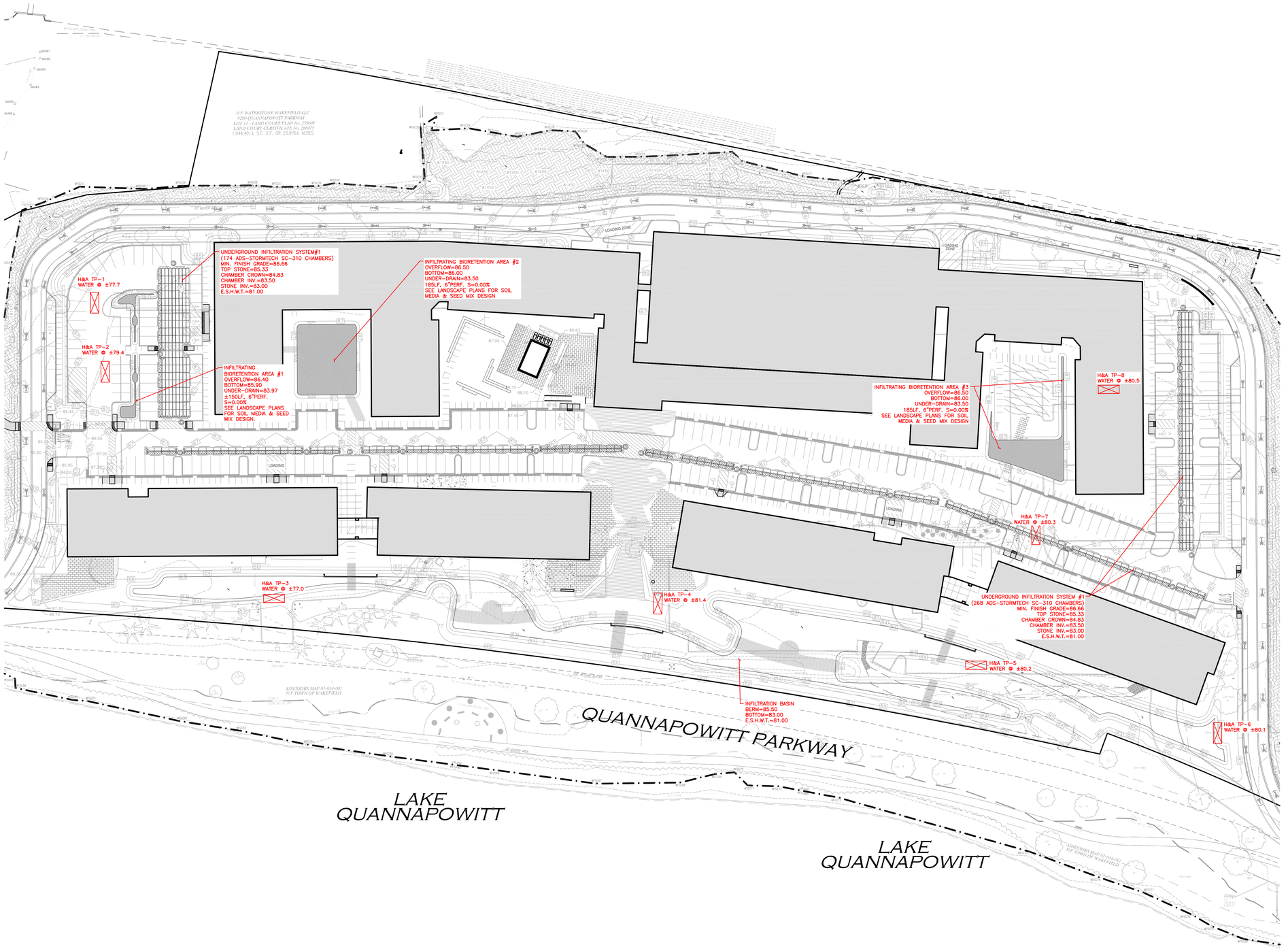
FAX: (781) 935-2896
WOBURN, MA ◆ LAKEVILLE, MA ◆ MANCHESTER, NH

DRAWING TITLE:
PROPOSED WATERSHED PLAN

SHEET No.
PWS



LEGEND:

TEST PIT	⊠
BIO/INFILTRATION BASIN	
INFILTRATION SYSTEM	

NOTES:

1. THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AND STRUCTURES AS SHOWN ON THESE PLANS IS BASED ON RECORDS OF VARIOUS UTILITY COMPANIES AND WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THIS INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE LOCATION OF ALL UNDERGROUND UTILITIES AND STRUCTURES SHALL BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO THE START OF CONSTRUCTION. THE CONTRACTOR MUST CONTACT THE APPROPRIATE UTILITY COMPANY, ANY GOVERNING PERMITTING AUTHORITY, AND "DIGSAFE" AT LEAST 72 HOURS PRIOR TO ANY EXCAVATION WORK TO REQUEST EXACT FIELD LOCATION OF UTILITIES AND THE ENGINEER SHALL BE NOTIFIED IN WRITING OF ANY UTILITIES INTERFERING WITH THE PROPOSED CONSTRUCTION AND APPROPRIATE REMEDIAL ACTION TAKEN BEFORE PROCEEDING WITH THE WORK. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS.
2. ALL ELEVATIONS REFER TO NAVD '88.
3. THE INFORMATION SHOWN ON THIS PLAN IS THE SOLE PROPERTY OF ALLEN & MAJOR ASSOCIATES, INC. IT'S INTENDED USE IS TO PROVIDE INFORMATION. ANY ALTERATION, MISUSE, OR RECALCULATION OF INFORMATION OR DATA WITHOUT THE EXPRESSED, WRITTEN CONSENT OF ALLEN & MAJOR ASSOCIATES, INC. IS STRICTLY PROHIBITED.
4. SPECIAL CONSIDERATION FOR SUPPORT OF EXCAVATION SHALL BE REQUIRED WHEN PASSING BELOW, OR DIRECTLY ADJACENT TO, EXISTING UTILITIES WHERE SUCH UTILITIES WILL POTENTIALLY BE ADVERSELY IMPACTED DURING EXCAVATION. SPECIAL SUPPORT OF EXCAVATION SHALL INCLUDE BUT IS NOT LIMITED TO STEEL SHEETING LEFT IN PLACE, SOLDIER PILES AND LAGGING LEFT IN PLACE, AND/OR AN EQUIVALENT SUPPORT OF EXCAVATION METHOD PRESENTED TO AND APPROVED BY THE ENGINEER AND WAKEFIELD DPW.
5. THE CONTRACTOR SHALL CONTACT "DIGSAFE" AT LEAST 72 HOURS PRIOR TO ANY EXCAVATION WORK TO REQUEST THE LOCATION OF THE EXISTING UTILITIES.

   DIGSAFE: 1-888-344-7233

DIG SAFE

BEFORE YOU DIG
CALL 811 OR
1-888-DIG-SAFE
1-888-344-7233

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

N:\PROJECTS\1623-11\CIVIL\DRAWINGS\CURRENT\C-1623-11 - TEST PIT LOCATION PLAN.DWG

ISSUED FOR DRAINAGE REPORT
APRIL 8, 2022

PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

REV	DATE	DESCRIPTION
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185 DARTMOUTH STREET
BOSTON, MA 02116

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WAKEFIELD, MA 01880

PROJECT NO.	1623-11	DATE:	MARCH 16, 2021
SCALE:	1"=40'	DWG. NAME:	C-1623-11.dwg
DESIGNED BY:	NCD	CHECKED BY:	TJW

PREPARED BY:

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TEL: (781) 935-6889
FAX: (781) 935-2896
WOBURN, MA ◆ LAKEVILLE, MA ◆ MANCHESTER, NH

DRAWING TITLE:
TEST PIT LOCATION PLAN

SHEET No.
TP-100