Stormwater Report

Holliston, Massachusetts

Sunraise Marshall Street Solar Project

December 18, 2019
Revised April 15, 2020

JOB NO: 2190903

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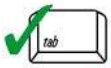
Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

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

4/6/2020
Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

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

Standard 1: No New Untreated Discharges

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☐ Soil Analysis provided.

☐ Required Recharge Volume calculation provided.

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

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

☐ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☐ An Illicit Discharge Compliance Statement is attached;

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

Stormwater Report

Applicant/Project Name:	Sunraise Marshall Street Solar Project
Project Location:	0 Marshall Street (Parcel 007.0-0003-0019.2), Holliston, MA
Application Prepared by:	
Firm:	Weston & Sampson, Inc.
Registered PE	James Pearson, P.E.

Our analysis of stormwater management for the site is based upon the standards from the MassDEP Stormwater Handbook. Following is a description of how the project is in compliance with these standards.

General:

The parcel (007.0-0003-0019.2) for the Marshall Street Solar Project is predominantly undeveloped site. The parcel is predominantly wooded, with some cleared areas. The applicant proposes construction of a ground mounted solar array on a portion of the site as depicted in the site plans submitted with this report.

The Holliston Solar Photovoltaic and Battery Storage Project is proposed as depicted on the enclosed site plans. The project includes panels connected to a pile driven/ballasted racking system. The project will consist of approximately ±19,960 individual panels rated at 400 watts each for a total system size of approximately 7,984 kW (DC) and 4,999 kW (AC). The intent is to use solar modules with high efficiency ratings, ensuring that the project uses the smallest area of land. There is a proposed 20-foot wide gravel access road that runs from Marshall Road along the eastern boundary of the project area, as depicted on the plan. The project is planned to have two concrete equipment pads for the inverter and transformers adjacent to the proposed gravel access road. The ground within the solar panel arrays will remain pervious, and will be seeded with a native grass mix. The project will be surrounded by a seven-foot chain link fence and accessed through a 24-foot wide access gate.

Standard 1: No New Untreated Discharges

The proposed project will create no new untreated discharges. The only new impervious areas that will be added to the site will be two relatively small equipment pads surrounded by vast expanses of grassed areas.

Standard 2: Peak Rate Attenuation

Through the use of stormwater detention basins, post-development peak discharge rates will not exceed pre-development peak discharge rates.

To ensure that the work incorporates the performance standards recommended in the DEP's Stormwater Management Policy, necessary erosion and sedimentation control

measures will be utilized during construction. These measures will include perimeter erosion control measures as depicted on the site plans.

Standard 3: Recharge

The site has been classified as a Disposal Site as defined under Massachusetts Contingency Plan (MCP - 310 CMR 40.0000). Soil impacted with regulated compounds (mostly polycyclic aromatic hydrocarbons and lead) at concentrations exceeding MCP Method 1 S-1 cleanup standards exists in areas throughout the property that will require placement of an Activity Use Limitation (AUL) on the property deed, and possible capping under a permeable soil cover. Under the Rules for Groundwater Recharge (Stormwater Handbook Volume 1, Page 8), the required recharge volume for the site must be infiltrated only to the maximum extent practicable for sites that fall within this classification.

Furthermore, test pits and site observations conducted throughout the site indicate that there is shallow ledge at or within a few feet below the ground surface, making the construction of dedicated infiltration stormwater BMPs impractical. This condition is similarly recognized by the above referenced Rules as a circumstance in which the recharge volume must be infiltrated to the maximum extent practicable.

The "maximum extent practicable" approach used by this project for purposes of meeting this standard consists of minimizing impervious areas and using the "country drainage approach of directing runoff to swales, grassed areas and stormwater basins instead of to curb and pipe conveyance systems. This will maximize the extent to which post-development hydrologic conditions will mimic pre-development conditions.

Standard 4: Water Quality

For similar reasons stated under Standard 3 above, the project does not create new impervious areas that require water quality treatment. There are therefore no post-construction water quality treatment measures proposed.

During the project, appropriate BMPs will be used to minimize sedimentation and soil erosion.

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

Not Applicable. There are no LUHPPLs in the work area.

Standard 6: Critical Areas

There will be no new discharge to critical areas.

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

This is not a re-development project, these standards do not apply.

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

A detailed Construction Period Pollution Prevention and Erosion and Sedimentation Control

Plan is included. To ensure that the work incorporates the performance standards recommended in the DEP's Stormwater Management Policy, necessary erosion and sedimentation control measures will be utilized during construction. These measures will include perimeter erosion controls as depicted on the site plans.

Standard 9: Operation and Maintenance Plan

The stormwater management system associated with this solar facility shall be maintained. An operations and maintenance plan is provided as an attachment to this report.

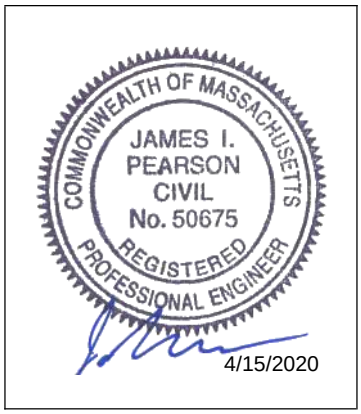
Standard 10: Prohibition of Illicit Discharges

An illicit discharge statement will be signed and provided by the applicant prior to the start of construction. A sample of this form is included as an attachment to this report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including any relevant soil evaluations, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan, the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement 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.

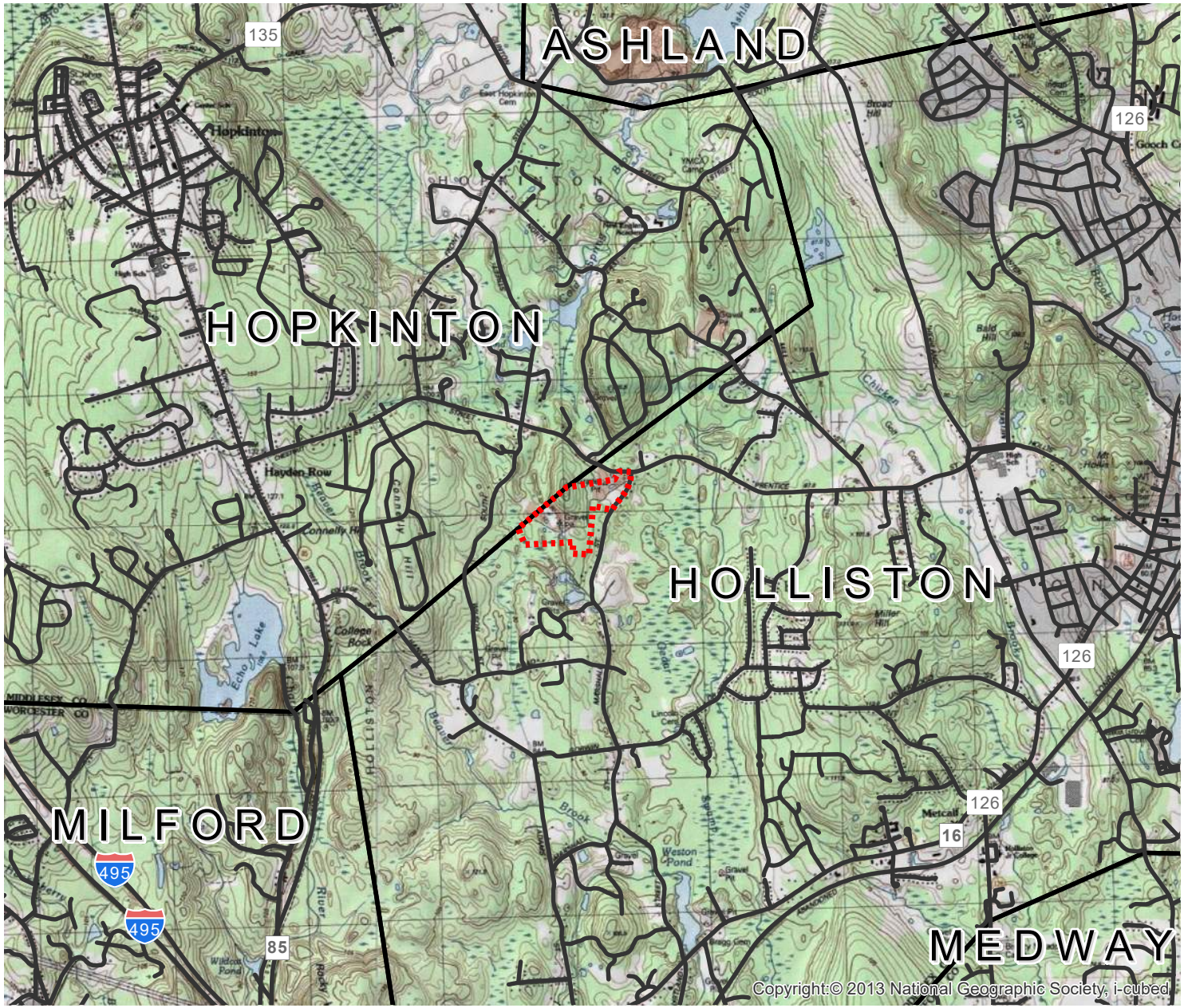
Registered Professional Engineer Block and Signature



4/15/2020

Signature and Date

Attachment A - Locus Map



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1,000 0 1,000
Feet

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

Investigation Area

Attachment A

Prentice Street
Holliston MA

USGS Topographic Map

Weston & Sampson

Attachment B - NRCS Soils Map, Soils Report, HSG Classifications and Test Pit Logs

Hydrologic Soil Group—Middlesex County, Massachusetts

Map Scale: 1:4,660 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 19, Sep 12, 2019

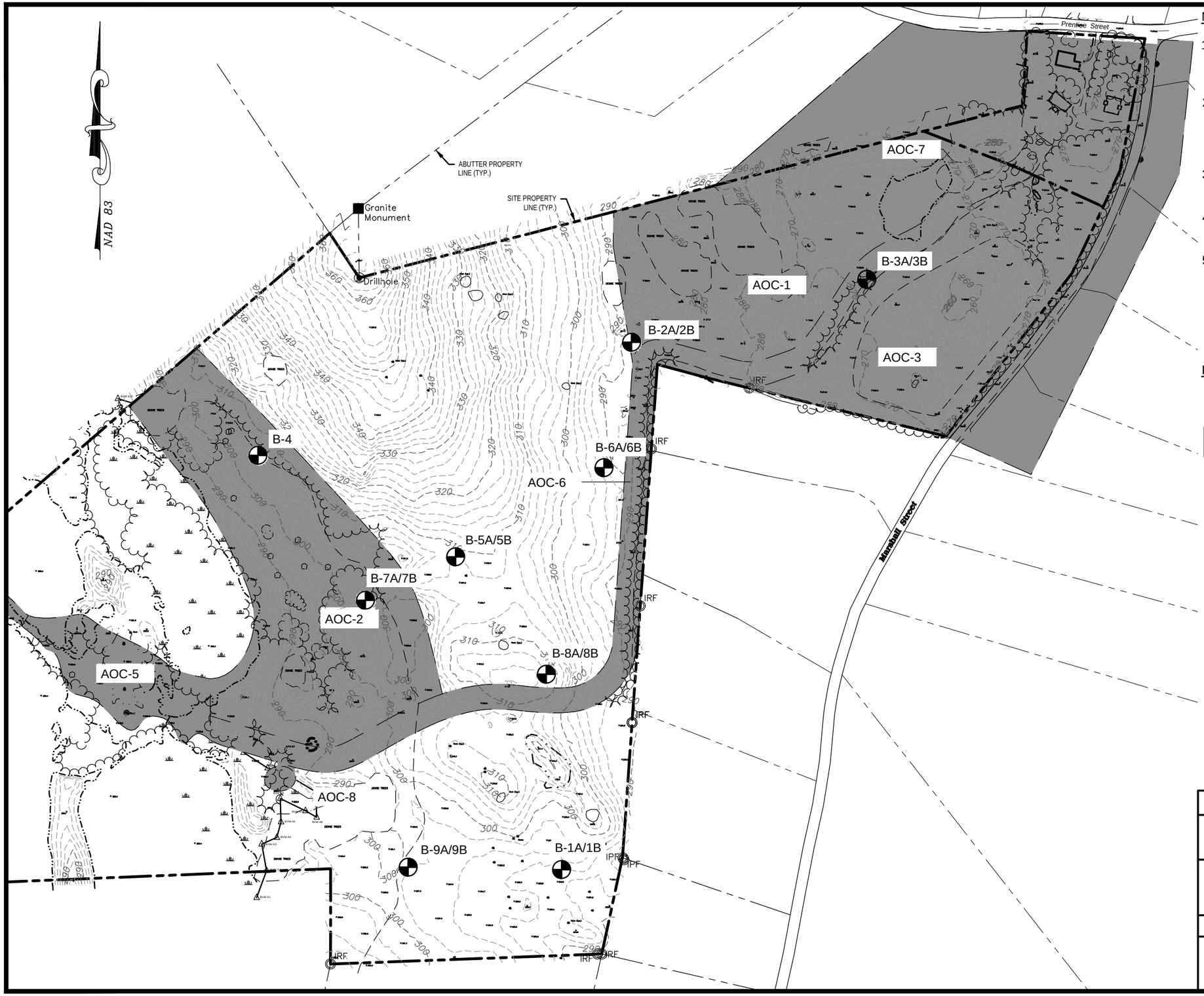
Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 28, 2019—Aug 15, 2019

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	A/D	0.2	0.4%
51A	Swansea muck, 0 to 1 percent slopes	B/D	1.1	2.2%
52A	Freetown muck, 0 to 1 percent slopes	B/D	7.6	15.1%
253B	Hinckley loamy sand, 3 to 8 percent slopes	A	0.8	1.7%
253D	Hinckley loamy sand, 15 to 25 percent slopes	A	0.5	1.0%
260B	Sudbury fine sandy loam, 3 to 8 percent slopes	B	0.4	0.7%
302B	Montauk fine sandy loam, 0 to 8 percent slopes, extremely stony	C	3.2	6.3%
302D	Montauk fine sandy loam, 15 to 35 percent slopes, extremely stony	C	5.0	9.8%
416B	Narragansett silt loam, 3 to 8 percent slopes, very stony	A	12.5	24.7%
653	Udorthents, sandy		8.8	17.3%
654	Udorthents, loamy		10.5	20.8%
Totals for Area of Interest			**50.7**	**100.0%**



NOTES:

1. THIS FIGURE IS BASED ON AN EXISTING CONDITIONS PLAN PREPARED BY WESTON & SAMPSON, LAST REVISED OCTOBER 16, 2019.
2. BORINGS WERE COMPLETED BY TECHNICAL DRILLING SERVICES OF STERLING, MA AND OBSERVED BY WESTON & SAMPSON ON SEPTEMBER 23 AND 24, 2019.
3. BORING LOCATIONS ARE APPROXIMATE AND BASED ON GPS INFORMATION FROM GOOGLE MAPS.
4. ELEVATIONS REFERENCE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
5. AREAS OF CONCERN (AOC) SHOWN ON THIS PLAN WERE IDENTIFIED BY COLER & COLANTANIO (C&C) AND DESCRIBED IN A REPORT TITLED "SUPPLEMENTAL INVESTIGATION & REVISED CONCEPTUAL REMEDIAL PLAN WITH ASSOCIATED COST ESTIMATES" DATED OCTOBER 31, 2005 AND PREPARED BY C&C.

LEGEND:

B-1A/1B - BORING NUMBER AND APPROXIMATE LOCATION

- AREA OF CONCERN (AOC)

200 100 0 200 400

SCALE: 1"=200'

FIGURE 1

MARSHALL STREET SOLAR
HOLLISTON, MA.

SITE PLAN – EXISTING CONDITIONS

DESIGNED BY: ADN	CHECKED BY: TJS	DATE: JANUARY 2020

Weston & Sampson

P:\Private\SunRaise\Holliston\Geotechnical\Plans\Site Plans for Report\SunRaise Solar Figure 1.dwg

NAD 83

Granite Monument

Drillhole

ABUTTER PROPERTY LINE (TYP.)

SITE PROPERTY LINE (TYP.)

Prentice Street

Marshall Street

AOC-1

AOC-2

AOC-3

AOC-5

AOC-6

AOC-7

AOC-8

B-1/B-1A

B-2A/2B

B-3A/3B

B-4

B-5A/5B

B-6A/6B

B-7A/7B

B-8A/8B

B-9A/9B

PROPOSED SOLAR ARRAY

IRF

IPF

NOTES:

1. THIS FIGURE IS BASED ON A PROPOSED SITE PLAN PREPARED BY WESTON & SAMPSON, LAST REVISED OCTOBER 16, 2019.
2. BORINGS WERE COMPLETED BY TECHNICAL DRILLING SERVICES OF STERLING, MA AND OBSERVED BY WESTON & SAMPSON ON SEPTEMBER 23 AND 24, 2019.
3. BORING LOCATIONS ARE APPROXIMATE AND BASED ON GPS INFORMATION FROM GOOGLE MAPS.
4. ELEVATIONS REFERENCE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
5. AREAS OF CONCERN (AOC) SHOWN ON THIS PLAN WERE IDENTIFIED BY COLER & COLANTANIO (C&C) AND DESCRIBED IN A REPORT TITLED "SUPPLEMENTAL INVESTIGATION & REVISED CONCEPTUAL REMEDIAL PLAN WITH ASSOCIATED COST ESTIMATES" DATED OCTOBER 31, 2005 AND PREPARED BY C&C.

LEGEND:

B-1/B-1A – BORING NUMBER AND APPROXIMATE LOCATION

– AREA OF CONCERN (AOC)

200 100 0 200 400

SCALE: 1"=200'

FIGURE 2

CRESCENT RIDGE SOLAR
HOLLISTON, MA.

SITE PLAN – PROPOSED CONDITIONS

DESIGNED BY: ADN	CHECKED BY: TJS	DATE: NOVEMBER 2019

Weston & Sampson℠

P:\Private\SunRaise\Holliston\Geotechnical\Plans\Site Plans for Report\ADN – SunRaise Solar Figure 2_1.dwg

Weston & Sampson

BORING NUMBER: **B-1A**

CLIENT: SunRaise Investments LLC
PROJECT: Marshall Street Solar
LOGGED BY: R. van der Heijden, EIT
PROJECT NUMBER: 2190903
LOCATION: Holliston, MA
CHECKED BY: T. Strike, PE

CONTRACTOR: Technical Drilling Services
DRILLING METHOD: Hollow Stem Auger
BORING LOCATION: See site plan.
FOREMAN/DRILLER: Brett Balyk
CASING/AUGER SIZE: 4.25 in. ID
GROUND ELEV: 294 ft. +/- (NAVD88)
DRILL RIG TYPE: Diedrich D-50 Turbo ATV
SAMPLING METHOD: Standard penetration test (SPT)
DATE STARTED: 9/23/2019
OTHER EQUIPMENT:
SAMPLER HAMMER: 140 lb. Automatic Hammer
DATE COMPLETED: 9/23/2019

Sample Description

General Format: Density/consistency, color, classification name (secondary PRIMARY, additional); moisture, additional information. [UNIT NAME and/or ORIGIN]

Soil Classification Name Guide based on Constituent Percentages

Mineral Soil		Organic Soils	
GRAVEL, SAND, SILT, CLAY	> 50%	PEAT	> 50%
gravelly, sandy, silty, clayey	35 - 50%	organic (soil name)	15 - 50%
some	20 - 35%	(soil name) with some organics	5 - 15%
little	10 - 20%	trace organics	< 5%
trace	0 - 10%		

Data Plots

Laboratory Test Data:
PL = Plastic Limit, %
MC = Moisture content, %
LL = Liquid Limit, %

In-Situ Test Data
SPT N-Value

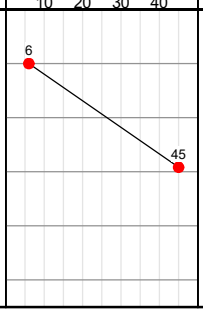
Remarks and Additional Tests

WOR = Weight of rods
WOH = Weight of hammer
P200 = Percent passing the #200 sieve (laborator value)
OC = Organic content, % (laboratory value)

Groundwater Observations

Date: 9/23/2019
Depth: Not observed

Depth Scale, ft.	Sample Type	Blows on Sampler/6" *Blows on Casing/12"*	N-Value, Blows/ft.	Sample Recovery, in. Sampler Penetration, in.	Strata Description and Graphic Log	Sample Description	Remarks and Additional Tests
1		4 3 3 2	6	7/24	SILTY SAND	2 in. TOPSOIL. Loose, orange-brown, fine silty SAND, trace organics (roots); moist.	
2		7 10 35 100/4"	45	10/22		Top 6" - Orange-brown, fine silty SAND; moist. Bottom 4" - Gray, gravelly fine to coarse SAND, trace silt; moist.	Cobble/gravel fragments in spoon.
3							
4		24 100/5"	-	8/11	SAND	Gray, gravelly fine to coarse SAND, little silt; moist.	Auger grinding on possible cobbles/boulders from approximately 3 to 3.5 ft. Cobble/gravel fragments in spoon.
5						Auger refusal at 5.5 ft. End of boring. Boring offset approximately 10 ft. east. Refer to log for B-1B.	



END OF BORING LOG

SAMPLE LEGEND

- Standard split spoon sampler driven w/ 140-lb. hammer (24" long, 2" OD, 1-3/8" ID)
- Thin-walled tube sampler pushed w/ rig hydraulics (30" long, 3" ID)
- NX rock core sampler advanced using rotary drilling methods (5' long, 3" ID)
- Modified split spoon sampler driven w/ 140-lb. hammer (24" long, 3" OD, 2-3/8" ID)

N-VALUE RELATIONSHIPS

N-VALUE BLOWS/FT.	DENSITY OF GRANULAR SOILS	N-VALUE BLOWS/FT.	CONSISTENCY OF COHESIVE SOILS
0 - 4	Very Loose	< 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: **B-1B**

CLIENT: SunRaise Investments LLC
PROJECT: Marshall Street Solar
LOGGED BY: R. van der Heijden, EIT
PROJECT NUMBER: 2190903
LOCATION: Holliston, MA
CHECKED BY: T. Strike, PE

CONTRACTOR: Technical Drilling Services
DRILLING METHOD: Hollow Stem Auger
BORING LOCATION: See site plan.
FOREMAN/DRILLER: Brett Balyk
CASING/AUGER SIZE: 4.25 in. ID
GROUND ELEV: 294 ft. +/- (NAVD88)
DRILL RIG TYPE: Diedrich D-50 Turbo ATV
SAMPLING METHOD: Standard penetration test (SPT)
DATE STARTED: 9/23/2019
OTHER EQUIPMENT:
SAMPLER HAMMER: 140 lb. Automatic Hammer
DATE COMPLETED: 9/23/2019

Depth Scale, ft.	Sample Type	Blows on Sampler/6" *Blows on Casing/12"*	N-Value, Blows/ft.	Sample Recovery, in. Sampler Penetration, in.	Strata Description and Graphic Log

Sample Description

General Format: Density/consistency, color, classification name (secondary PRIMARY, additional); moisture, additional information. [UNIT NAME and/or ORIGIN]

Soil Classification Name Guide based on Constituent Percentages

Mineral Soil	GRAVEL, SAND, SILT, CLAY	> 50%	Organic Soils	PEAT	> 50%
	gravelly, sandy, silty, clayey	35 - 50%		organic (soil name)	15 - 50%
	some	20 - 35%		(soil name) with some organics	5 - 15%
	little	10 - 20%			
	trace	0 - 10%		trace organics	< 5%

Data Plots

Laboratory Test Data:
PL = Plastic Limit, %
MC = Moisture content, %
LL = Liquid Limit, %

PL MC LL

In-Situ Test Data
SPT N-Value
10 20 30 40

Remarks and Additional Tests

WOR = Weight of rods
WOH = Weight of hammer
P200 = Percent passing the #200 sieve (laborator value)
OC = Organic content, % (laboratory value)

Groundwater Observations

Date: 9/23/2019
Depth: Not observed

1						Refer to log for B-10A for sample information from 0 to 5.5 ft.
2						
3						
4						
5						Auger grinding on possible cobbles/boulders from approximately 4 to 5.3 ft.

Auger refusal at 5.3 ft. End of boring.

END OF BORING LOG

SAMPLE LEGEND

- Standard split spoon sampler driven w/ 140-lb. hammer (24" long, 2" OD, 1-3/8" ID)
- Thin-walled tube sampler pushed w/ rig hydraulics (30" long, 3" ID)
- NX rock core sampler advanced using rotary drilling methods (5' long, 3" ID)
- Modified split spoon sampler driven w/ 140-lb. hammer (24" long, 3" OD, 2-3/8" ID)

N-VALUE RELATIONSHIPS

N-VALUE BLOWS/FT.	DENSITY OF GRANULAR SOILS	N-VALUE BLOWS/FT.	CONSISTENCY OF COHESIVE SOILS
0 - 4	Very Loose	< 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

Weston & Sampson

BORING NUMBER: **B-2A**

CLIENT: SunRaise Investments LLC
PROJECT: Marshall Street Solar
LOGGED BY: R. van der Heijden, EIT
PROJECT NUMBER: 2190903
LOCATION: Holliston, MA
CHECKED BY: T. Strike, PE

CONTRACTOR: Technical Drilling Services
DRILLING METHOD: Hollow Stem Auger
BORING LOCATION: See site plan.
FOREMAN/DRILLER: Brett Balyk
CASING/AUGER SIZE: 4.25 in. ID
GROUND ELEV: 290 ft. +/- (NAVD88)
DRILL RIG TYPE: Diedrich D-50 Turbo ATV
SAMPLING METHOD: Standard penetration test (SPT)
DATE STARTED: 9/24/2019
OTHER EQUIPMENT:
SAMPLER HAMMER: 140 lb. Automatic Hammer
DATE COMPLETED: 9/24/2019

Depth Scale, ft.	Sample Type	Blows on Sampler/6" *Blows on Casing/12"*	N-Value, Blows/ft.	Sample Recovery, in. Sampler Penetration, in.	Strata Description and Graphic Log	Sample Description
1		3 10 18 24	28	12/24	SILTY SAND	2 in. TOPSOIL Medium dense, orange-brown to gray-brown, fine to medium silty SAND, some gravel, trace silt; moist.
2 3		44 30 100/3"	-	14/15	SAND	Gray-brown, gravelly fine to corase SAND, trace silt; moist.

Auger refusal at 3.8 ft. End of boring.
Boring offset approximately 5 ft. south. Refer to log for B-2B.

Sample Description

General Format: Density/consistency, color, classification name (secondary PRIMARY, additional); moisture, additional information. [UNIT NAME and/or ORIGIN]

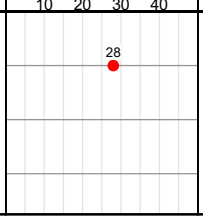
Soil Classification Name Guide based on Constituent Percentages

Mineral Soil			Organic Soils		
	GRAVEL, SAND, SILT, CLAY	> 50%		PEAT	> 50%
	gravelly, sandy, silty, clayey	35 - 50%		organic (soil name)	15 - 50%
	some	20 - 35%		(soil name) with some organics	5 - 15%
	little	10 - 20%			
	trace	0 - 10%		trace organics	< 5%

Data Plots

Laboratory Test Data:
PL = Plastic Limit, %
MC = Moisture content, %
LL = Liquid Limit, %

In-Situ Test Data
SPT N-Value



Remarks and Additional Tests

WOR = Weight of rods
WOH = Weight of hammer
P200 = Percent passing the #200 sieve (laborator value)
OC = Organic content, % (laboratory value)

Groundwater Observations

Date: 9/24/2019
Depth: Not observed

Auger grinding on possible cobbles/boulders from approximately 1.5 to 3.8 ft.
Cobble/gravel fragments in tip of spoon.

END OF BORING LOG

SAMPLE LEGEND

- Standard split spoon sampler driven w/ 140-lb. hammer (24" long, 2" OD, 1-3/8" ID)
- Thin-walled tube sampler pushed w/ rig hydraulics (30" long, 3" ID)
- NX rock core sampler advanced using rotary drilling methods (5' long, 3" ID)
- Modified split spoon sampler driven w/ 140-lb. hammer (24" long, 3" OD, 2-3/8" ID)

N-VALUE RELATIONSHIPS

N-VALUE BLOWS/FT.	DENSITY OF GRANULAR SOILS	N-VALUE BLOWS/FT.	CONSISTENCY OF COHESIVE SOILS
0 - 4	Very Loose	< 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

Weston & Sampson

BORING NUMBER: **B-2B**

CLIENT: SunRaise Investments LLC
PROJECT: Marshall Street Solar
LOGGED BY: R. van der Heijden, EIT
PROJECT NUMBER: 2190903
LOCATION: Holliston, MA
CHECKED BY: T. Strike, PE

CONTRACTOR: Technical Drilling Services
DRILLING METHOD: Hollow Stem Auger
BORING LOCATION: See site plan.
FOREMAN/DRILLER: Brett Balyk
CASING/AUGER SIZE: 4.25 in. ID
GROUND ELEV: 290 ft. +/- (NAVD88)
DRILL RIG TYPE: Diedrich D-50 Turbo ATV
SAMPLING METHOD: Standard penetration test (SPT)
DATE STARTED: 9/24/2019
OTHER EQUIPMENT:
SAMPLER HAMMER: 140 lb. Automatic Hammer
DATE COMPLETED: 9/24/2019

Sample Description

General Format: Density/consistency, color, classification name (secondary PRIMARY, additional); moisture, additional information. [UNIT NAME and/or ORIGIN]

Soil Classification Name Guide based on Constituent Percentages

Mineral Soil		Organic Soils	
GRAVEL, SAND, SILT, CLAY	> 50%	PEAT	> 50%
gravelly, sandy, silty, clayey	35 - 50%	organic (soil name)	15 - 50%
some	20 - 35%	(soil name) with some organics	5 - 15%
little	10 - 20%		
trace	0 - 10%	trace organics	< 5%

Data Plots

Laboratory Test Data:
PL = Plastic Limit, %
MC = Moisture content, %
LL = Liquid Limit, %

PL MC LL

In-Situ Test Data
SPT N-Value
10 20 30 40

Remarks and Additional Tests

WOR = Weight of rods
WOH = Weight of hammer
P200 = Percent passing the #200 sieve (laborator value)
OC = Organic content, % (laboratory value)

Groundwater Observations

Date: 9/24/2019
Depth: Not observed

Depth Scale, ft.	Sample Type	Blows on Sampler/6" *Blows on Casing/12"*	N-Value, Blows/ft.	Sample Recovery, in. Sampler Penetration, in.	Strata Description and Graphic Log	Sample Description
1						Refer to log for B-2A for sample information from 0 to 3 ft.
2						
3						
4						
5		25				
6		27 57	84	13/21	SAND	Very dense, gray-brown, gravelly fine to coarse SAND, trace silt; moist.
7		100/3"				Auger refusal at 7 ft. End of boring.

84

Auger grinding on possible cobbles/boulders from approximately 1 to 7 ft.

END OF BORING LOG

SAMPLE LEGEND

- Standard split spoon sampler driven w/ 140-lb. hammer (24" long, 2" OD, 1-3/8" ID)
- Thin-walled tube sampler pushed w/ rig hydraulics (30" long, 3" ID)
- NX rock core sampler advanced using rotary drilling methods (5' long, 3" ID)
- Modified split spoon sampler driven w/ 140-lb. hammer (24" long, 3" OD, 2-3/8" ID)

N-VALUE RELATIONSHIPS

N-VALUE BLOWS/FT.	DENSITY OF GRANULAR SOILS	N-VALUE BLOWS/FT.	CONSISTENCY OF COHESIVE SOILS
0 - 4	Very Loose	< 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

Weston & Sampson

BORING NUMBER: **B-3A**

CLIENT: SunRaise Investments LLC
PROJECT: Marshall Street Solar
LOGGED BY: R. van der Heijden, EIT
PROJECT NUMBER: 2190903
LOCATION: Holliston, MA
CHECKED BY: T. Strike, PE

CONTRACTOR: Technical Drilling Services
DRILLING METHOD: Hollow Stem Auger
BORING LOCATION: See site plan.
FOREMAN/DRILLER: Brett Balyk
CASING/AUGER SIZE: 4.25 in. ID
GROUND ELEV: 270 ft. +/- (NAVD88)
DRILL RIG TYPE: Diedrich D-50 Turbo ATV
SAMPLING METHOD: Standard penetration test (SPT)
DATE STARTED: 9/24/2019
OTHER EQUIPMENT:
SAMPLER HAMMER: 140 lb. Automatic Hammer
DATE COMPLETED: 9/24/2019

Sample Description

General Format: Density/consistency, color, classification name (secondary PRIMARY, additional); moisture, additional information. [UNIT NAME and/or ORIGIN]

Soil Classification Name Guide based on Constituent Percentages

Mineral Soil			Organic Soils		
	GRAVEL, SAND, SILT, CLAY	> 50%		PEAT	> 50%
	gravelly, sandy, silty, clayey	35 - 50%		organic (soil name)	15 - 50%
	some	20 - 35%		(soil name) with some organics	5 - 15%
	little	10 - 20%			
	trace	0 - 10%		trace organics	< 5%

Data Plots

Laboratory Test Data:
PL = Plastic Limit, %
MC = Moisture content, %
LL = Liquid Limit, %

In-Situ Test Data
SPT N-Value

Remarks and Additional Tests

WOR = Weight of rods
WOH = Weight of hammer
P200 = Percent passing the #200 sieve (laborator value)
OC = Organic content, % (laboratory value)

Groundwater Observations

Date: 9/24/2019
Depth: Not observed

Depth Scale, ft.	Sample Type	Blows on Sampler/6" *Blows on Casing/12"*	N-Value, Blows/ft.	Sample Recovery, in. Sampler Penetration, in.	Strata Description and Graphic Log	Sample Description	Data Plots	Remarks and Additional Tests
1		3 4 8 65	12	10/24	SILTY SAND	2 in. TOPSOIL. Medium dense, gray-brown, fine silty SAND, trace gravel; moist.	12	Gravel = 0% Sand = 93% Fines = 7%
2		100/5"	-	3/5	SAND	Gray-brown, fine to coarse SAND, trace gravel, trace silt; moist.		Auger grinding on possible cobbles/boulders from approximately 2 to 4 ft.
3								
4						Auger refusal at 4 ft. End of boring. Boring offset approximately 5 ft. west. Refer to log for B-3B.		

END OF BORING LOG

SAMPLE LEGEND

- Standard split spoon sampler driven w/ 140-lb. hammer (24" long, 2" OD, 1-3/8" ID)
- Thin-walled tube sampler pushed w/ rig hydraulics (30" long, 3" ID)
- NX rock core sampler advanced using rotary drilling methods (5' long, 3" ID)
- Modified split spoon sampler driven w/ 140-lb. hammer (24" long, 3" OD, 2-3/8" ID)

N-VALUE RELATIONSHIPS

N-VALUE BLOWS/FT.	DENSITY OF GRANULAR SOILS
0 - 4	Very Loose
4 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
> 50	Very Dense

N-VALUE BLOWS/FT.	CONSISTENCY OF COHESIVE SOILS
< 2	Very Soft
2 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very Stiff
> 30	Hard

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: **B-3B**

CLIENT: SunRaise Investments LLC
PROJECT: Marshall Street Solar
LOGGED BY: R. van der Heijden, EIT
PROJECT NUMBER: 2190903
LOCATION: Holliston, MA
CHECKED BY: T. Strike, PE

CONTRACTOR: Technical Drilling Services
DRILLING METHOD: Hollow Stem Auger
BORING LOCATION: See site plan.
FOREMAN/DRILLER: Brett Balyk
CASING/AUGER SIZE: 4.25 in. ID
GROUND ELEV: 270 ft. +/- (NAVD88)
DRILL RIG TYPE: Diedrich D-50 Turbo ATV
SAMPLING METHOD: Standard penetration test (SPT)
DATE STARTED: 9/24/2019
OTHER EQUIPMENT:
SAMPLER HAMMER: 140 lb. Automatic Hammer
DATE COMPLETED: 9/24/2019

Depth Scale, ft.	Sample Type	Blows on Sampler/6" *Blows on Casing/12"*	N-Value, Blows/ft.	Sample Recovery, in. Sampler Penetration, in.	Strata Description and Graphic Log

Sample Description

General Format: Density/consistency, color, classification name (secondary PRIMARY, additional); moisture, additional information. [UNIT NAME and/or ORIGIN]

Soil Classification Name Guide based on Constituent Percentages

Mineral Soil	GRAVEL, SAND, SILT, CLAY	> 50%	Organic Soils	PEAT	> 50%
	gravelly, sandy, silty, clayey	35 - 50%		organic (soil name)	15 - 50%
	some	20 - 35%		(soil name) with some organics	5 - 15%
	little	10 - 20%			
	trace	0 - 10%		trace organics	< 5%

Data Plots

Laboratory Test Data:
PL = Plastic Limit, %
MC = Moisture content, %
LL = Liquid Limit, %

PL MC LL

In-Situ Test Data
SPT N-Value
10 20 30 40

Remarks and Additional Tests

WOR = Weight of rods
WOH = Weight of hammer
P200 = Percent passing the #200 sieve (laborator value)
OC = Organic content, % (laboratory value)

Groundwater Observations

Date: 9/24/2019
Depth: Not observed

1						Refer to log for B-3A for sample information from 0 to 4 ft.
2						
3						
4						
5						Auger refusal at 5 ft. End of boring.

Auger grinding on possible cobbles/boulders from approximately 1 to 5 ft.

END OF BORING LOG

SAMPLE LEGEND

- Standard split spoon sampler driven w/ 140-lb. hammer (24" long, 2" OD, 1-3/8" ID)
- Thin-walled tube sampler pushed w/ rig hydraulics (30" long, 3" ID)
- NX rock core sampler advanced using rotary drilling methods (5' long, 3" ID)
- Modified split spoon sampler driven w/ 140-lb. hammer (24" long, 3" OD, 2-3/8" ID)

N-VALUE RELATIONSHIPS

N-VALUE BLOWS/FT.	DENSITY OF GRANULAR SOILS	N-VALUE BLOWS/FT.	CONSISTENCY OF COHESIVE SOILS
0 - 4	Very Loose	< 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: **B-4**

Weston & Sampson

CLIENT: SunRaise Investments LLC
PROJECT: Marshall Street Solar
LOGGED BY: R. van der Heijden, EIT
PROJECT NUMBER: 2190903
LOCATION: Holliston, MA
CHECKED BY: T. Strike, PE

CONTRACTOR: Technical Drilling Services
DRILLING METHOD: Hollow Stem Auger
BORING LOCATION: See site plan.
FOREMAN/DRILLER: Brett Balyk
CASING/AUGER SIZE: 4.25 in. ID
GROUND ELEV: 304 ft. +/- (NAVD88)
DRILL RIG TYPE: Diedrich D-50 Turbo ATV
SAMPLING METHOD: Standard penetration test (SPT)
DATE STARTED: 9/24/2019
OTHER EQUIPMENT:
SAMPLER HAMMER: 140 lb. Automatic Hammer
DATE COMPLETED: 9/24/2019

Sample Description

General Format: Density/consistency, color, classification name (secondary PRIMARY, additional); moisture, additional information. [UNIT NAME and/or ORIGIN]

Soil Classification Name Guide based on Constituent Percentages

Mineral Soil		Organic Soils	
GRAVEL, SAND, SILT, CLAY	> 50%	PEAT	> 50%
gravelly, sandy, silty, clayey	35 - 50%	organic (soil name)	15 - 50%
some	20 - 35%	(soil name) with some organics	5 - 15%
little	10 - 20%	trace organics	< 5%
trace	0 - 10%		

Data Plots

Laboratory Test Data:
PL = Plastic Limit, %
MC = Moisture content, %
LL = Liquid Limit, %

In-Situ Test Data
SPT N-Value

Remarks and Additional Tests

WOR = Weight of rods
WOH = Weight of hammer
P200 = Percent passing the #200 sieve (laborator value)
OC = Organic content, % (laboratory value)

Groundwater Observations

Date: 9/24/2019
Depth: Not observed

Depth Scale, ft.	Sample Type	Blows on Sampler/6" *Blows on Casing/12"*	N-Value, Blows/ft.	Sample Recovery, in. Sampler Penetration, in.	Strata Description and Graphic Log	Sample Description	Data Plots	Remarks and Additional Tests
1		2 3 5 7	8	13/24	FILL	2 in. TOPSOIL. Loose, black, fine to medium SAND, some silt, little gravel, little organics (roots), trace debris (brick); moist. [FILL]	8	Debris (metal, brick, concrete) observed near boring.
2		7 7 9 4	16	9/24		Medium dense, gray-brown, fine to coarse SAND, some gravel, little silt, trace organics (roots), trace debris (brick); moist. [FILL]	16	Auger grinding on possible cobbles/boulders from approximately 2.5 to 3.5 ft.
4		5 5 8 21	13	10/24		Medium dense, brown, fine to coarse SAND, some silt, trace gravel, trace organics (roots), little debris (brick); moist. [FILL]	13	
6		100/2"	-	0/2		No recovery.		Auger grinding on possible cobbles/boulders from approximately 5.5 to 7 ft.
8						Assumed stratum change based on drilling effort.		
9		5 8 11 14	19	11/24	SAND	Medium dense, gray-brown, fine to coarse SAND, trace gravel, trace silt; moist.	19	Cobble/gravel fragments in tip of spoon. Gravel = 8% Sand = 89% Fines = 3% Auger grinding on possible cobbles/boulders from approximately 11 to 14 ft.
14						Auger refusal at 14 ft. End of boring.		

END OF BORING LOG

SAMPLE LEGEND

- Standard split spoon sampler driven w/ 140-lb. hammer (24" long, 2" OD, 1-3/8" ID)
- Thin-walled tube sampler pushed w/ rig hydraulics (30" long, 3" ID)
- NX rock core sampler advanced using rotary drilling methods (5' long, 3" ID)
- Modified split spoon sampler driven w/ 140-lb. hammer (24" long, 3" OD, 2-3/8" ID)

N-VALUE RELATIONSHIPS

N-VALUE BLOWS/FT.	DENSITY OF GRANULAR SOILS	N-VALUE BLOWS/FT.	CONSISTENCY OF COHESIVE SOILS
0 - 4	Very Loose	< 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

Weston & Sampson

BORING NUMBER: **B-5A**

CLIENT: SunRaise Investments LLC
PROJECT: Marshall Street Solar
LOGGED BY: R. van der Heijden, EIT
PROJECT NUMBER: 2190903
LOCATION: Holliston, MA
CHECKED BY: T. Strike, PE

CONTRACTOR: Technical Drilling Services
DRILLING METHOD: Hollow Stem Auger
BORING LOCATION: See site plan.
FOREMAN/DRILLER: Brett Balyk
CASING/AUGER SIZE: 4.25 in. ID
GROUND ELEV: 308 ft. +/- (NAVD88)
DRILL RIG TYPE: Diedrich D-50 Turbo ATV
SAMPLING METHOD: Standard penetration test (SPT)
DATE STARTED: 9/24/2019
OTHER EQUIPMENT:
SAMPLER HAMMER: 140 lb. Automatic Hammer
DATE COMPLETED: 9/24/2019

Depth Scale, ft.	Sample Type	Blows on Sampler/6" *Blows on Casing/12"*	N-Value, Blows/ft.	Sample Recovery, in. Sampler Penetration, in.	Strata Description and Graphic Log	Sample Description
1		1 1 2 11	3	8/24	SILTY SAND	2 in. TOPSOIL. Bottom 7" - Very loose, orange-brown, fine sandy SILT, trace organics (roots); moist.
2		27 49 100/5"	-	14/17	SAND	Top 4" - Orange-brown, fine silty SAND; moist. Bottom 10" - Gray, fine to coarse SAND, little gravel, little silt; moist.
3						
4						Auger refusal at 4 ft. End of boring. Boring offset approximatelt 5 ft. north. Refer to log for B-5B

Sample Description

General Format: Density/consistency, color, classification name (secondary PRIMARY, additional); moisture, additional information. [UNIT NAME and/or ORIGIN]

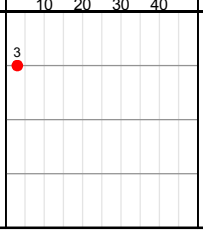
Soil Classification Name Guide based on Constituent Percentages

Mineral Soil			Organic Soils		
	GRAVEL, SAND, SILT, CLAY	> 50%		PEAT	> 50%
	gravelly, sandy, silty, clayey	35 - 50%		organic (soil name)	15 - 50%
	some	20 - 35%		(soil name) with some organics	5 - 15%
	little	10 - 20%			
	trace	0 - 10%		trace organics	< 5%

Data Plots

Laboratory Test Data:
PL = Plastic Limit, %
MC = Moisture content, %
LL = Liquid Limit, %

In-Situ Test Data
SPT N-Value



Remarks and Additional Tests

WOR = Weight of rods
WOH = Weight of hammer
P200 = Percent passing the #200 sieve (laborator value)
OC = Organic content, % (laboratory value)

Groundwater Observations

Date: 9/24/2019
Depth: Not observed

Gravel = 1%
Sand = 33%
Fines = 66%

Auger grinding on possible cobbles/boulder from approximately 2.5 to 4.5 ft.

END OF BORING LOG

SAMPLE LEGEND

- Standard split spoon sampler driven w/ 140-lb. hammer (24" long, 2" OD, 1-3/8" ID)
- Thin-walled tube sampler pushed w/ rig hydraulics (30" long, 3" ID)
- NX rock core sampler advanced using rotary drilling methods (5' long, 3" ID)
- Modified split spoon sampler driven w/ 140-lb. hammer (24" long, 3" OD, 2-3/8" ID)

N-VALUE RELATIONSHIPS

N-VALUE BLOWS/FT.	DENSITY OF GRANULAR SOILS	N-VALUE BLOWS/FT.	CONSISTENCY OF COHESIVE SOILS
0 - 4	Very Loose	< 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

Weston & Sampson

BORING NUMBER: **B-5B**

CLIENT: SunRaise Investments LLC
PROJECT: Marshall Street Solar
LOGGED BY: R. van der Heijden, EIT
PROJECT NUMBER: 2190903
LOCATION: Holliston, MA
CHECKED BY: T. Strike, PE

CONTRACTOR: Technical Drilling Services
DRILLING METHOD: Hollow Stem Auger
BORING LOCATION: See site plan.
FOREMAN/DRILLER: Brett Balyk
CASING/AUGER SIZE: 4.25 in. ID
GROUND ELEV: 308 ft. +/- (NAVD88)
DRILL RIG TYPE: Diedrich D-50 Turbo ATV
SAMPLING METHOD: Standard penetration test (SPT)
DATE STARTED: 9/24/2019
OTHER EQUIPMENT:
SAMPLER HAMMER: 140 lb. Automatic Hammer
DATE COMPLETED: 9/24/2019

Depth Scale, ft.	Sample Type	Blows on Sampler/6" *Blows on Casing/12"*	N-Value, Blows/ft.	Sample Recovery, in. Sampler Penetration, in.	Strata Description and Graphic Log

Sample Description

General Format: Density/consistency, color, classification name (secondary PRIMARY, additional); moisture, additional information. [UNIT NAME and/or ORIGIN]

Soil Classification Name Guide based on Constituent Percentages

Mineral Soil	GRAVEL, SAND, SILT, CLAY	> 50%	Organic Soils	PEAT	> 50%
	gravelly, sandy, silty, clayey	35 - 50%		organic (soil name)	15 - 50%
	some	20 - 35%		(soil name) with some organics	5 - 15%
	little	10 - 20%			
	trace	0 - 10%		trace organics	< 5%

Data Plots

Laboratory Test Data:
PL = Plastic Limit, %
MC = Moisture content, %
LL = Liquid Limit, %

PL MC LL

In-Situ Test Data
SPT N-Value
10 20 30 40

Remarks and Additional Tests

WOR = Weight of rods
WOH = Weight of hammer
P200 = Percent passing the #200 sieve (laborator value)
OC = Organic content, % (laboratory value)

Groundwater Observations

Date: 9/24/2019
Depth: Not observed

1					Refer to log for B-5A for sample information from 0 to 4 ft.
2					
3					
4					

Auger grinding on possible cobbles/boulders from approximately 2 to 4.3 ft.

Auger refusal at 4.3 ft. End of boring.

END OF BORING LOG

SAMPLE LEGEND

- Standard split spoon sampler driven w/ 140-lb. hammer (24" long, 2" OD, 1-3/8" ID)
- Thin-walled tube sampler pushed w/ rig hydraulics (30" long, 3" ID)
- NX rock core sampler advanced using rotary drilling methods (5' long, 3" ID)
- Modified split spoon sampler driven w/ 140-lb. hammer (24" long, 3" OD, 2-3/8" ID)

N-VALUE RELATIONSHIPS

N-VALUE BLOWS/FT.	DENSITY OF GRANULAR SOILS	N-VALUE BLOWS/FT.	CONSISTENCY OF COHESIVE SOILS
0 - 4	Very Loose	< 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

Weston & Sampson

BORING NUMBER: **B-6A**

CLIENT: SunRaise Investments LLC
PROJECT: Marshall Street Solar
LOGGED BY: R. van der Heijden, EIT
PROJECT NUMBER: 2190903
LOCATION: Holliston, MA
CHECKED BY: T. Strike, PE

CONTRACTOR: Technical Drilling Services
DRILLING METHOD: Hollow Stem Auger
BORING LOCATION: See site plan.
FOREMAN/DRILLER: Brett Balyk
CASING/AUGER SIZE: 4.25 in. ID
GROUND ELEV: 292 ft. +/- (NAVD88)
DRILL RIG TYPE: Diedrich D-50 Turbo ATV
SAMPLING METHOD: Standard penetration test (SPT)
DATE STARTED: 9/23/2019
OTHER EQUIPMENT:
SAMPLER HAMMER: 140 lb. Automatic Hammer
DATE COMPLETED: 9/23/2019

Sample Description

General Format: Density/consistency, color, classification name (secondary PRIMARY, additional); moisture, additional information. [UNIT NAME and/or ORIGIN]

Soil Classification Name Guide based on Constituent Percentages

Mineral Soil			Organic Soils		
	GRAVEL, SAND, SILT, CLAY	> 50%		PEAT	> 50%
	gravelly, sandy, silty, clayey	35 - 50%		organic (soil name)	15 - 50%
	some	20 - 35%		(soil name) with some organics	5 - 15%
	little	10 - 20%			
	trace	0 - 10%		trace organics	< 5%

Data Plots

Laboratory Test Data:
PL = Plastic Limit, %
MC = Moisture content, %
LL = Liquid Limit, %

PL MC LL

In-Situ Test Data
SPT N-Value
10 20 30 40

Remarks and Additional Tests

WOR = Weight of rods
WOH = Weight of hammer
P200 = Percent passing the #200 sieve (laborator value)
OC = Organic content, % (laboratory value)

Groundwater Observations

Date: 9/23/2019
Depth: Not observed

Depth Scale, ft.	Sample Type	Blows on Sampler/6" *Blows on Casing/12"*	N-Value, Blows/ft.	Sample Recovery, in. Sampler Penetration, in.	Strata Description and Graphic Log	Sample Description	Remarks and Additional Tests
1 2 3		5 13 100/3"	-	8/15	SAND	2 in. TOPSOIL Brown-gray, fine to coarse SAND, some gravel, little silt, trace organics (roots); moist.	Gravel = 34% Sand = 51% Fines = 15% Auger grinding on possible cobbles/boulders from approximately 1 to 3.5 ft.

Auger refusal at 3.5 ft. End of boring.
Boring offset approximately 5 ft. east. Refer to log for B-6B

END OF BORING LOG

SAMPLE LEGEND

- Standard split spoon sampler driven w/ 140-lb. hammer (24" long, 2" OD, 1-3/8" ID)
- Thin-walled tube sampler pushed w/ rig hydraulics (30" long, 3" ID)
- NX rock core sampler advanced using rotary drilling methods (5' long, 3" ID)
- Modified split spoon sampler driven w/ 140-lb. hammer (24" long, 3" OD, 2-3/8" ID)

N-VALUE RELATIONSHIPS

N-VALUE BLOWS/FT.	DENSITY OF GRANULAR SOILS	N-VALUE BLOWS/FT.	CONSISTENCY OF COHESIVE SOILS
0 - 4	Very Loose	< 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

Weston & Sampson

BORING NUMBER: **B-6B**

CLIENT: SunRaise Investments LLC
PROJECT: Marshall Street Solar
LOGGED BY: R. van der Heijden, EIT
PROJECT NUMBER: 2190903
LOCATION: Holliston, MA
CHECKED BY: T. Strike, PE

CONTRACTOR: Technical Drilling Services
DRILLING METHOD: Hollow Stem Auger
BORING LOCATION: See site plan.
FOREMAN/DRILLER: Brett Balyk
CASING/AUGER SIZE: 4.25 in. ID
GROUND ELEV: 292 ft. +/- (NAVD88)
DRILL RIG TYPE: Diedrich D-50 Turbo ATV
SAMPLING METHOD: Standard penetration test (SPT)
DATE STARTED: 9/23/2019
OTHER EQUIPMENT:
SAMPLER HAMMER: 140 lb. Automatic Hammer
DATE COMPLETED: 9/23/2019

Depth Scale, ft.	Sample Type	Blows on Sampler/6" *Blows on Casing/12"*	N-Value, Blows/ft.	Sample Recovery, in. Sampler Penetration, in.	Strata Description and Graphic Log

Sample Description

General Format: Density/consistency, color, classification name (secondary PRIMARY, additional); moisture, additional information. [UNIT NAME and/or ORIGIN]

Soil Classification Name Guide based on Constituent Percentages

Mineral Soil	GRAVEL, SAND, SILT, CLAY	> 50%	Organic Soils	PEAT	> 50%
	gravelly, sandy, silty, clayey	35 - 50%		organic (soil name)	15 - 50%
	some	20 - 35%		(soil name) with some organics	5 - 15%
	little	10 - 20%			
	trace	0 - 10%		trace organics	< 5%

Data Plots

Laboratory Test Data:
PL = Plastic Limit, %
MC = Moisture content, %
LL = Liquid Limit, %

PL MC LL

In-Situ Test Data
SPT N-Value
10 20 30 40

Remarks and Additional Tests

WOR = Weight of rods
WOH = Weight of hammer
P200 = Percent passing the #200 sieve (laborator value)
OC = Organic content, % (laboratory value)

Groundwater Observations

Date: 9/23/2019
Depth: Not observed

1
2
3
4

Refer to log for B-6A for sample information from 0 to 3.5 ft.

Auger grinding on possible cobbles/boulders from approximately 2 to 4 ft.

Auger refusal at 4 ft. End of boring.

END OF BORING LOG

SAMPLE LEGEND

- Standard split spoon sampler driven w/ 140-lb. hammer (24" long, 2" OD, 1-3/8" ID)
- Thin-walled tube sampler pushed w/ rig hydraulics (30" long, 3" ID)
- NX rock core sampler advanced using rotary drilling methods (5' long, 3" ID)
- Modified split spoon sampler driven w/ 140-lb. hammer (24" long, 3" OD, 2-3/8" ID)

N-VALUE RELATIONSHIPS

N-VALUE BLOWS/FT.	DENSITY OF GRANULAR SOILS	N-VALUE BLOWS/FT.	CONSISTENCY OF COHESIVE SOILS
0 - 4	Very Loose	< 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

Weston & Sampson

BORING NUMBER: **B-7A**

CLIENT: SunRaise Investments LLC
PROJECT: Marshall Street Solar
LOGGED BY: R. van der Heijden, EIT
PROJECT NUMBER: 2190903
LOCATION: Holliston, MA
CHECKED BY: T. Strike, PE

CONTRACTOR: Technical Drilling Services
DRILLING METHOD: Hollow Stem Auger
BORING LOCATION: See site plan.
FOREMAN/DRILLER: Brett Balyk
CASING/AUGER SIZE: 4.25 in. ID
GROUND ELEV: 298 ft. +/- (NAVD88)
DRILL RIG TYPE: Diedrich D-50 Turbo ATV
SAMPLING METHOD: Standard penetration test (SPT)
DATE STARTED: 9/24/2019
OTHER EQUIPMENT:
SAMPLER HAMMER: 140 lb. Automatic Hammer
DATE COMPLETED: 9/24/2019

Sample Description

General Format: Density/consistency, color, classification name (secondary PRIMARY, additional); moisture, additional information. [UNIT NAME and/or ORIGIN]

Soil Classification Name Guide based on Constituent Percentages

Mineral Soil			Organic Soils		
	GRAVEL, SAND, SILT, CLAY	> 50%		PEAT	> 50%
	gravelly, sandy, silty, clayey	35 - 50%		organic (soil name)	15 - 50%
	some	20 - 35%		(soil name) with some organics	5 - 15%
	little	10 - 20%			
	trace	0 - 10%		trace organics	< 5%

Data Plots

Laboratory Test Data:
PL = Plastic Limit, %
MC = Moisture content, %
LL = Liquid Limit, %

PL MC LL

In-Situ Test Data
SPT N-Value

10 20 30 40

Remarks and Additional Tests

WOR = Weight of rods
WOH = Weight of hammer
P200 = Percent passing the #200 sieve (laborator value)
OC = Organic content, % (laboratory value)

Groundwater Observations

Date: 9/24/2019
Depth: Not observed

Depth Scale, ft.	Sample Type	Blows on Sampler/6" *Blows on Casing/12"*	N-Value, Blows/ft.	Sample Recovery, in. Sampler Penetration, in.	Strata Description and Graphic Log	Sample Description	Data Plots	Remarks and Additional Tests
1		4 7 16 25	23	4/24	FILL	2 in. TOPSOIL Medium dense, gray-brown, fine to coarse SAND, some gravel, little silt, trace organics (roots), trace debris (brick); moist. [FILL]	23	Debris (brick, concrete) observed near boring.
2		11 38	-	8/17	SAND	Gray-brown, fine to coarse SAND, some gravel, little silt; moist. [FILL]		Auger grinding on possible cobbles/boulders from approximately 1 to 3.5 ft.
3		100/5"				Auger refusal at 3.5 ft. End of boring. Boring offset approximately 20 ft. west. Refer to log for B-7B.		

END OF BORING LOG

SAMPLE LEGEND

- Standard split spoon sampler driven w/ 140-lb. hammer (24" long, 2" OD, 1-3/8" ID)
- Thin-walled tube sampler pushed w/ rig hydraulics (30" long, 3" ID)
- NX rock core sampler advanced using rotary drilling methods (5' long, 3" ID)
- Modified split spoon sampler driven w/ 140-lb. hammer (24" long, 3" OD, 2-3/8" ID)

N-VALUE RELATIONSHIPS

N-VALUE BLOWS/FT.	DENSITY OF GRANULAR SOILS	N-VALUE BLOWS/FT.	CONSISTENCY OF COHESIVE SOILS
0 - 4	Very Loose	< 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: **B-7B**

CLIENT: SunRaise Investments LLC
PROJECT: Marshall Street Solar
LOGGED BY: R. van der Heijden, EIT
PROJECT NUMBER: 2190903
LOCATION: Holliston, MA
CHECKED BY: T. Strike, PE

CONTRACTOR: Technical Drilling Services
DRILLING METHOD: Hollow Stem Auger
BORING LOCATION: See site plan.
FOREMAN/DRILLER: Brett Balyk
CASING/AUGER SIZE: 4.25 in. ID
GROUND ELEV: 298 ft. +/- (NAVD88)
DRILL RIG TYPE: Diedrich D-50 Turbo ATV
SAMPLING METHOD: Standard penetration test (SPT)
DATE STARTED: 9/24/2019
OTHER EQUIPMENT:
SAMPLER HAMMER: 140 lb. Automatic Hammer
DATE COMPLETED: 9/24/2019

Sample Description
General Format: Density/consistency, color, classification name (secondary PRIMARY, additional); moisture, additional information. [UNIT NAME and/or ORIGIN]

Soil Classification Name Guide based on Constituent Percentages

Mineral Soil		Organic Soils	
GRAVEL, SAND, SILT, CLAY	> 50%	PEAT	> 50%
gravelly, sandy, silty, clayey	35 - 50%	organic (soil name)	15 - 50%
some	20 - 35%	(soil name) with some organics	5 - 15%
little	10 - 20%		
trace	0 - 10%	trace organics	< 5%

Data Plots
Laboratory Test Data:
PL = Plastic Limit, %
MC = Moisture content, %
LL = Liquid Limit, %
PL MC LL
In-Situ Test Data
SPT N-Value
10 20 30 40

Remarks and Additional Tests
WOR = Weight of rods
WOH = Weight of hammer
P200 = Percent passing the #200 sieve (laborator value)
OC = Organic content, % (laboratory value)

Groundwater Observations
Date: 9/24/2019
Depth: Not observed

Depth Scale, ft.	Sample Type	Blows on Sampler/6" *Blows on Casing/12"*	N-Value, Blows/ft.	Sample Recovery, in. Sampler Penetration, in.	Strata Description and Graphic Log	Description	Remarks
1						Refer to log for B-7A for sample information from 0 to 3.5 ft.	
2							Auger grinding on possible cobbles/boulders from approximately 0.5 to 1 ft.
3							
4							Auger on possible wood object from approximately 3.5 to 4.5 ft.
5		9					
6		25	44	10/24		Dense, gray-brown, fine to coarse SAND, some gravel, trace silt; moist. [FILL]	Auger grinding on possible cobbles/boulders from approximately 4.5 to 10.5 ft.
7		19					
8		21			SAND		Glass pieces in auger cuttings at 8 ft. (likely from fill layer above).
9		100/2"	-	0/2		No recovery.	
10						Auger refusal at 10.5 ft. End of boring.	

END OF BORING LOG

SAMPLE LEGEND

- Standard split spoon sampler driven w/ 140-lb. hammer (24" long, 2" OD, 1-3/8" ID)
- Thin-walled tube sampler pushed w/ rig hydraulics (30" long, 3" ID)
- NX rock core sampler advanced using rotary drilling methods (5' long, 3" ID)
- Modified split spoon sampler driven w/ 140-lb. hammer (24" long, 3" OD, 2-3/8" ID)

N-VALUE RELATIONSHIPS

N-VALUE BLOWS/FT.	DENSITY OF GRANULAR SOILS	N-VALUE BLOWS/FT.	CONSISTENCY OF COHESIVE SOILS
0 - 4	Very Loose	< 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

Weston & Sampson

BORING NUMBER: **B-8A**

CLIENT: SunRaise Investments LLC
PROJECT: Marshall Street Solar
LOGGED BY: R. van der Heijden, EIT
PROJECT NUMBER: 2190903
LOCATION: Holliston, MA
CHECKED BY: T. Strike, PE

CONTRACTOR: Technical Drilling Services
DRILLING METHOD: Hollow Stem Auger
BORING LOCATION: See site plan.
FOREMAN/DRILLER: Brett Balyk
CASING/AUGER SIZE: 4.25 in. ID
GROUND ELEV: 312 ft. +/- (NAVD88)
DRILL RIG TYPE: Diedrich D-50 Turbo ATV
SAMPLING METHOD: Standard penetration test (SPT)
DATE STARTED: 9/23/2019
OTHER EQUIPMENT:
SAMPLER HAMMER: 140 lb. Automatic Hammer
DATE COMPLETED: 9/23/2019

Depth Scale, ft.	Sample Type	Blows on Sampler/6" *Blows on Casing/12"*	N-Value, Blows/ft.	Sample Recovery, in. Sampler Penetration, in.	Strata Description and Graphic Log
1		8 13 12 7	25	7/24	SILTY SAND
2		10 5 6 7	11	12/24	
3					
4		38 43	-	8/14	SAND
5		100/2"			

Sample Description

General Format: Density/consistency, color, classification name (secondary PRIMARY, additional); moisture, additional information. [UNIT NAME and/or ORIGIN]

Soil Classification Name Guide based on Constituent Percentages

Mineral Soil		Organic Soils	
GRAVEL, SAND, SILT, CLAY	> 50%	PEAT	> 50%
gravelly, sandy, silty, clayey	35 - 50%	organic (soil name)	15 - 50%
some	20 - 35%	(soil name) with some organics	5 - 15%
little	10 - 20%		
trace	0 - 10%	trace organics	< 5%

2 in. TOPSOIL
Medium desnse, orange-brown, fine sandy SILT, trace organics (roots); moist.

Medium dense, yellow-brown, fine sandy SILT, trace gravel; moist.

Gray-brown, fine to coarse SAND, little gravel, little silt; dry.

Auger refusal at 5.5 ft. End of boring.
Boring offset approximately 5 ft. north-east. Refer to log for B-8B.

Data Plots

Laboratory Test Data:
PL = Plastic Limit, %
MC = Moisture content, %
LL = Liquid Limit, %

PL MC LL

In-Situ Test Data
SPT N-Value

10 20 30 40

25
11

Remarks and Additional Tests

WOR = Weight of rods
WOH = Weight of hammer
P200 = Percent passing the #200 sieve (laborator value)
OC = Organic content, % (laboratory value)

Groundwater Observations

Date: 9/23/2019
Depth: Not observed

Gravel = 0%
Sand = 35%
Fines = 65%
Auger grinding on possible cobbles/boulder from approximately 3 to 4 ft.
Cobble/gravel fragments in bottom 3" of spoon.
Auger grinding on possible cobbles/boulder from approximately 5 to 5.5 ft.

END OF BORING LOG

SAMPLE LEGEND

- Standard split spoon sampler driven w/ 140-lb. hammer (24" long, 2" OD, 1-3/8" ID)
- Thin-walled tube sampler pushed w/ rig hydraulics (30" long, 3" ID)
- NX rock core sampler advanced using rotary drilling methods (5' long, 3" ID)
- Modified split spoon sampler driven w/ 140-lb. hammer (24" long, 3" OD, 2-3/8" ID)

N-VALUE RELATIONSHIPS

N-VALUE BLOWS/FT.	DENSITY OF GRANULAR SOILS	N-VALUE BLOWS/FT.	CONSISTENCY OF COHESIVE SOILS
0 - 4	Very Loose	< 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

Weston & Sampson

BORING NUMBER: **B-8B**

CLIENT: SunRaise Investments LLC
PROJECT: Marshall Street Solar
LOGGED BY: R. van der Heijden, EIT
PROJECT NUMBER: 2190903
LOCATION: Holliston, MA
CHECKED BY: T. Strike, PE

CONTRACTOR: Technical Drilling Services
DRILLING METHOD: Hollow Stem Auger
BORING LOCATION: See site plan.
FOREMAN/DRILLER: Brett Balyk
CASING/AUGER SIZE: 4.25 in. ID
GROUND ELEV: 312 ft. +/- (NAVD88)
DRILL RIG TYPE: Diedrich D-50 Turbo ATV
SAMPLING METHOD: Standard penetration test (SPT)
DATE STARTED: 9/23/2019
OTHER EQUIPMENT:
SAMPLER HAMMER: 140 lb. Automatic Hammer
DATE COMPLETED: 9/23/2019

Depth Scale, ft.	Sample Type	Blows on Sampler/6" *Blows on Casing/12"*	N-Value, Blows/ft.	Sample Recovery, in. Sampler Penetration, in.	Strata Description and Graphic Log

Sample Description

General Format: Density/consistency, color, classification name (secondary PRIMARY, additional); moisture, additional information. [UNIT NAME and/or ORIGIN]

Soil Classification Name Guide based on Constituent Percentages

Mineral Soil	GRAVEL, SAND, SILT, CLAY	> 50%	Organic Soils	PEAT	> 50%
	gravelly, sandy, silty, clayey	35 - 50%		organic (soil name)	15 - 50%
	some	20 - 35%		(soil name) with some organics	5 - 15%
	little	10 - 20%			
	trace	0 - 10%		trace organics	< 5%

Data Plots

Laboratory Test Data:
PL = Plastic Limit, %
MC = Moisture content, %
LL = Liquid Limit, %

PL MC LL

In-Situ Test Data
SPT N-Value
10 20 30 40

Remarks and Additional Tests

WOR = Weight of rods
WOH = Weight of hammer
P200 = Percent passing the #200 sieve (laborator value)
OC = Organic content, % (laboratory value)

Groundwater Observations

Date: 9/23/2019
Depth: Not observed

1						Refer to log for B-8A for sample information from 0 to 5.5 ft.
2						
3						Auger grinding on possible cobbles/boulder from approximately 2 to 3 ft.
4						
5						Auger grinding on possible cobbles/boulder from approximately 5 to 5.5 ft.

Auger refusal at 5.5 ft. End of boring.

END OF BORING LOG

SAMPLE LEGEND

- Standard split spoon sampler driven w/ 140-lb. hammer (24" long, 2" OD, 1-3/8" ID)
- Thin-walled tube sampler pushed w/ rig hydraulics (30" long, 3" ID)
- NX rock core sampler advanced using rotary drilling methods (5' long, 3" ID)
- Modified split spoon sampler driven w/ 140-lb. hammer (24" long, 3" OD, 2-3/8" ID)

N-VALUE RELATIONSHIPS

N-VALUE BLOWS/FT.	DENSITY OF GRANULAR SOILS	N-VALUE BLOWS/FT.	CONSISTENCY OF COHESIVE SOILS
0 - 4	Very Loose	< 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

Weston & Sampson

BORING NUMBER: **B-9A**

CLIENT: SunRaise Investments LLC
PROJECT: Marshall Street Solar
LOGGED BY: R. van der Heijden, EIT
PROJECT NUMBER: 2190903
LOCATION: Holliston, MA
CHECKED BY: T. Strike, PE

CONTRACTOR: Technical Drilling Services
DRILLING METHOD: Hollow Stem Auger
BORING LOCATION: See site plan.
FOREMAN/DRILLER: Brett Balyk
CASING/AUGER SIZE: 4.25 in. ID
GROUND ELEV: 298 ft. +/- (NAVD88)
DRILL RIG TYPE: Diedrich D-50 Turbo ATV
SAMPLING METHOD: Standard penetration test (SPT)
DATE STARTED: 9/23/2019
OTHER EQUIPMENT:
SAMPLER HAMMER: 140 lb. Automatic Hammer
DATE COMPLETED: 9/23/2019

Sample Description
General Format: Density/consistency, color, classification name (secondary PRIMARY, additional); moisture, additional information. [UNIT NAME and/or ORIGIN]

Soil Classification Name Guide based on Constituent Percentages

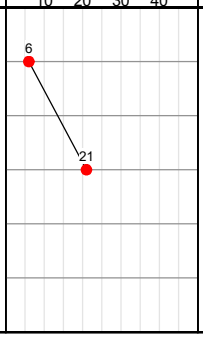
Mineral Soil			Organic Soils		
	GRAVEL, SAND, SILT, CLAY	> 50%		PEAT	> 50%
	gravelly, sandy, silty, clayey	35 - 50%		organic (soil name)	15 - 50%
	some	20 - 35%		(soil name) with some organics	5 - 15%
	little	10 - 20%			
	trace	0 - 10%		trace organics	< 5%

Data Plots
Laboratory Test Data:
PL = Plastic Limit, %
MC = Moisture content, %
LL = Liquid Limit, %
PL MC LL
In-Situ Test Data
SPT N-Value
10 20 30 40

Remarks and Additional Tests
WOR = Weight of rods
WOH = Weight of hammer
P200 = Percent passing the #200 sieve (laborator value)
OC = Organic content, % (laboratory value)

Groundwater Observations
Date: 9/23/2019
Depth: Not observed

Depth Scale, ft.	Sample Type	Blows on Sampler/6" *Blows on Casing/12"*	N-Value, Blows/ft.	Sample Recovery, in. Sampler Penetration, in.	Strata Description and Graphic Log	Sample Description
1		2 3 3 4	6	5/24	SILTY SAND	2 in. TOPSOIL. Loose, brown-gray, fine silty SAND, trace gravel, trace organics (roots); moist.
2		4 6 15 24	21	6/24		Medium dense, brown-gray, fine to coarse SAND, some gravel, little silt; moist.
3						
4		26 35 100/5"	-	12/17	SAND	Brown-gray, fine to coarse gravelly SAND, little silt; moist.
5						
6						Auger refusal at 6 ft. End of boring. Boring offset approximately 5 ft. east. Refer to log for B-9B



Auger grinding on possible cobbles/boulders from approximately 3 to 6 ft.
Cobble/gravel fragments in spoon.
Gravel = 46%
Sand = 37%
Fines = 17%

END OF BORING LOG

SAMPLE LEGEND

- Standard split spoon sampler driven w/ 140-lb. hammer (24" long, 2" OD, 1-3/8" ID)
- Thin-walled tube sampler pushed w/ rig hydraulics (30" long, 3" ID)
- NX rock core sampler advanced using rotary drilling methods (5' long, 3" ID)
- Modified split spoon sampler driven w/ 140-lb. hammer (24" long, 3" OD, 2-3/8" ID)

N-VALUE RELATIONSHIPS

N-VALUE BLOWS/FT.	DENSITY OF GRANULAR SOILS	N-VALUE BLOWS/FT.	CONSISTENCY OF COHESIVE SOILS
0 - 4	Very Loose	< 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: **B-9B**

CLIENT: SunRaise Investments LLC
PROJECT: Marshall Street Solar
LOGGED BY: R. van der Heijden, EIT
PROJECT NUMBER: 2190903
LOCATION: Holliston, MA
CHECKED BY: T. Strike, PE

CONTRACTOR: Technical Drilling Services
DRILLING METHOD: Hollow Stem Auger
BORING LOCATION: See site plan.
FOREMAN/DRILLER: Brett Balyk
CASING/AUGER SIZE: 4.25 in. ID
GROUND ELEV: 298 ft. +/- (NAVD88)
DRILL RIG TYPE: Diedrich D-50 Turbo ATV
SAMPLING METHOD: Standard penetration test (SPT)
DATE STARTED: 9/23/2019
OTHER EQUIPMENT:
SAMPLER HAMMER: 140 lb. Automatic Hammer
DATE COMPLETED: 9/23/2019

Depth Scale, ft.	Sample Type	Blows on Sampler/6" *Blows on Casing/12"*	N-Value, Blows/ft.	Sample Recovery, in. Sampler Penetration, in.	Strata Description and Graphic Log

Sample Description

General Format: Density/consistency, color, classification name (secondary PRIMARY, additional); moisture, additional information. [UNIT NAME and/or ORIGIN]

Soil Classification Name Guide based on Constituent Percentages

Mineral Soil	GRAVEL, SAND, SILT, CLAY	> 50%	Organic Soils	PEAT	> 50%
	gravelly, sandy, silty, clayey	35 - 50%		organic (soil name)	15 - 50%
	some	20 - 35%		(soil name) with some organics	5 - 15%
	little	10 - 20%			
	trace	0 - 10%		trace organics	< 5%

Data Plots

Laboratory Test Data:
PL = Plastic Limit, %
MC = Moisture content, %
LL = Liquid Limit, %

PL MC LL

In-Situ Test Data
SPT N-Value
10 20 30 40

Remarks and Additional Tests

WOR = Weight of rods
WOH = Weight of hammer
P200 = Percent passing the #200 sieve (laborator value)
OC = Organic content, % (laboratory value)

Groundwater Observations

Date: 9/23/2019
Depth: Not observed

1						Refer to log for B-9A for sample information from 0 to 6 ft.
2						
3						
4						
5						

Auger grinding on possible cobbles/boulder from approximately 3 to 5.5 ft.

Auger refusal at 5.5 ft. End of boring.

END OF BORING LOG

SAMPLE LEGEND

- Standard split spoon sampler driven w/ 140-lb. hammer (24" long, 2" OD, 1-3/8" ID)
- Thin-walled tube sampler pushed w/ rig hydraulics (30" long, 3" ID)
- NX rock core sampler advanced using rotary drilling methods (5' long, 3" ID)
- Modified split spoon sampler driven w/ 140-lb. hammer (24" long, 3" OD, 2-3/8" ID)

N-VALUE RELATIONSHIPS

N-VALUE BLOWS/FT.	DENSITY OF GRANULAR SOILS	N-VALUE BLOWS/FT.	CONSISTENCY OF COHESIVE SOILS
0 - 4	Very Loose	< 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.


Sunraise Solar
Test Pit Locations
Legend
TP
Ash St
Prentice St
TP 3-1
TP 2-2
TP 2-1
TP 4-1
Marshall St
TP 1-2
TP 1-1
Google Earth
© 2018 Google
N
1000 ft

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: 1-1

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-2	O	7.5YR2.5/1	-	-	-	-	0	0	-	-	
2-11	A	10YR5/6	-	-	-	Silt loam	0	0	Bl	Fr	
11-22	BW_1	10YR6/6	-	-	-	Silt loam	0	0	Bl	Fr	
22-32	BW_2	2.5Y7/2	30-32	10YR5/6	15%	Silt loam	0	10	Bl	Fr	
32+	C	10YR6/3	-	-	-	Very gravelly sand	50	20	Gr	Fr	

Additional Notes:

Roots in top 20", cobbles throughout, increasing horizon within C

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: 1-2

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-2	O	7.5YR2.5/1	-	-	-	Organic	0	0	-	-	
2-12	A	10YR5/6	-	-	-	Silt loam	0	10	Bl	Fr	
12-26	B_w	10YR6/6	-	-	-	Silt loam	0	10	Bl	Fr	
26+	C_d	10YR6/3	-	-	-	Gravelly sand	30	10	Gr	F	Till

Additional Notes:

Limited BW_2 horizon in select pit faces (silty f. sand, 20" BGS). No mottling or redox features encountered.
Machine chatter on till, refusal @ 5.5' due to 3'+ boulders

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: 2-1

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-2	O	7.5YR2.5/1	-	-	-	-	0	0	-	-	
2-11	A	10YR5/6	-	-	-	Silt loam	0	0	Bl	Fr	
11-22	BW_1	10YR6/6	-	-	-	Silt loam	0	0	Bl	Fr	
22-32	BW_2	2.5Y7/2	30-32	10YR5/6	15%	Silt loam	0	10	Bl	Fr	
32+	C	10YR6/3	-	-	-	Very gravelly sand	50	20	Gr	Fr	

Additional Notes:

Roots in top 20", cobbles throughout, increasing horizon within C

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: 2-2

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-3	O	10YR2.5/1	-	-	-	Organic	0	0	-	-	
3-17	A	10YR5/4	-	-	-	Sandy loam	0	<5	Bl	Fr	
17-36	B_1	10YR6/4	-	-	-	Sandy loam	0	0	Bl	Fr	
36-54	B_2	2.5Y6/2	44-48"	10YR5/6	15%	Sandy loam	5	10	Bl	Fr	
54+	C_D	2.5Y6/2	-	-	-	Gravelly sand	30	10	Gr	F	Till

Additional Notes:

Boulder on SW side of pit. Cobble @ 10-16". Less cobbly than TP 2-1.

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: 3-1

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-2	O	7.5YR2.5/1	-	-	-	Organic	0	0	-	-	
2-12	B_1	10YR6/4	12"	10YR5/6	<5%	Sandy loam (fill)	<5	0	Gr	L	
12-18	B_2	10YR5/4	-	-	-	Gravelly c. sand (fill)	30	5	Gr	L	
18-24	B_3	10YR6/3	-	-	-	Silty f. sand (fill)	0	0	Bl	MF	
24+	C_D	10YR6/3	-	-	-	Gravelly sand	20	10	Gr	L	

Additional Notes:

Likely fill/disturbed soil in top 24". Minor mottling in B_1 horizon. No distinct A horizon. Large boulder @ ~32" (3'+). Refusal @ 6'. Chatter on till and difficulty digging.

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

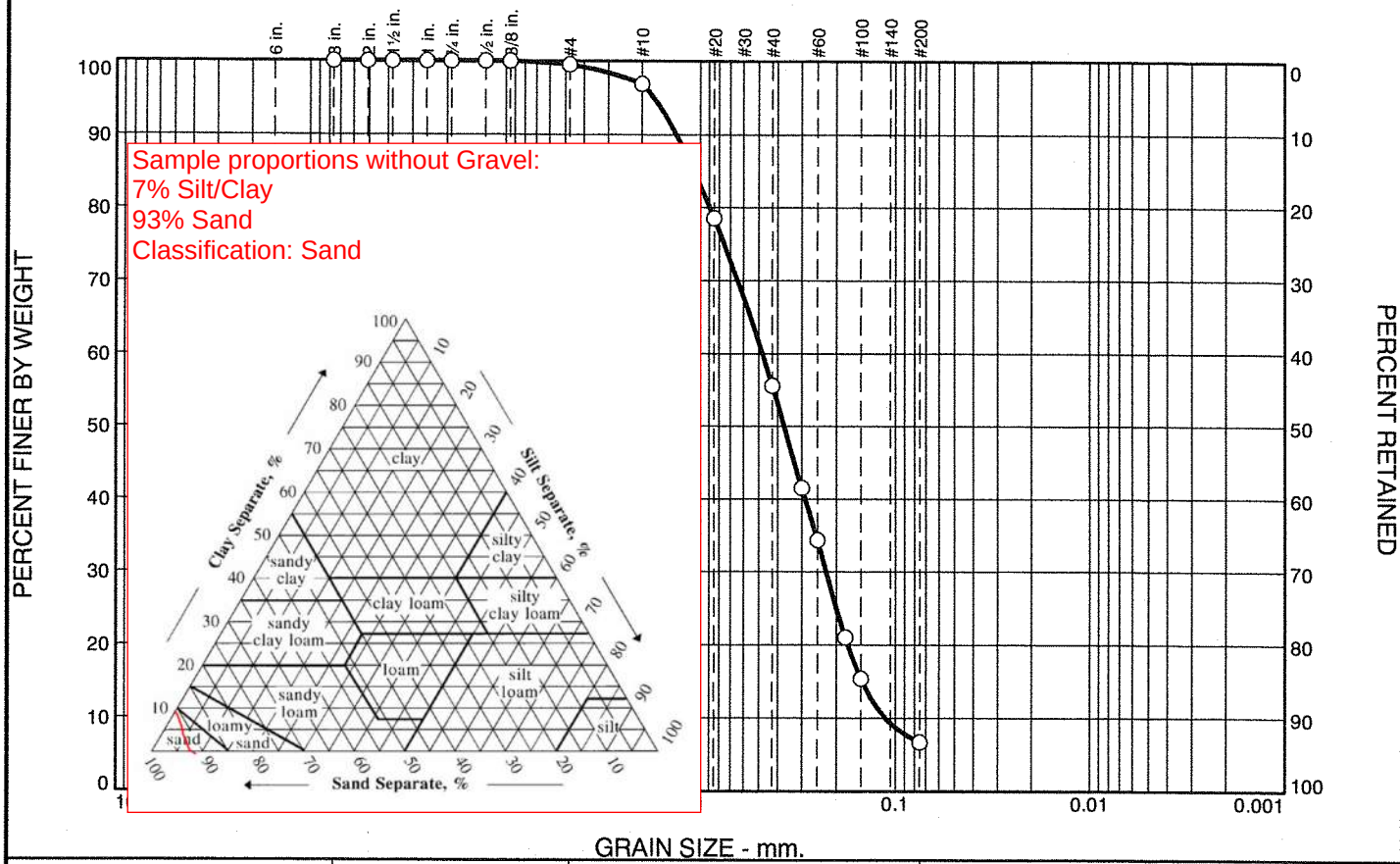
Deep Observation Hole Number: 4-1

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-4	Org.	10YR2.5/1	-	-	-	Organic	0	0	-	-	Trash @ 20%
4-12	Fill	10YR5/1	-	-	-	Sandy loam	<5	0	Gr	L	Trash @ 20%, reworked fill
12-36	Fill	-	-	-	-	Solid waste	10	0	-	-	
36-48	B_W	10YR7/2	-	-	-	Silt loam	<5	0	Bl	Fr	
48+	C_D	10YR6/3	-	-	-	Gravelly sand	30	10	Bl	F-VF	Till

Additional Notes:

Solid waste includes glass, plastic, fabric, metal, etc. Refusal @ 6', chatter & hard digging in till.

GRAINSIZE DISTRIBUTION REPORT - AGGREGATE GRADING



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	3	41	49	7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100		
2"	100		
1.5"	100		
1"	100		
.75"	100		
.5"	100		
.375"	100		
#4	100		
#10	97		
#20	79		
#40	56		
#50	42		
#60	34		
#80	21		
#100	15		
#200	6.7		

* (no specification provided)

Material Description

BORING JAR SAMPLE

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.3276 D_{85}= 1.0766 D_{60}= 0.4774
D_{50}= 0.3696 D_{30}= 0.2251 D_{15}= 0.1477
D_{10}= 0.1123 C_u= 4.25 C_c= 0.95

Classification

USCS= AASHTO=

Remarks

Source of Sample: B-3A S-1 **Depth:** 0-2'
Sample Number: L190493B

Date: 11-19-19

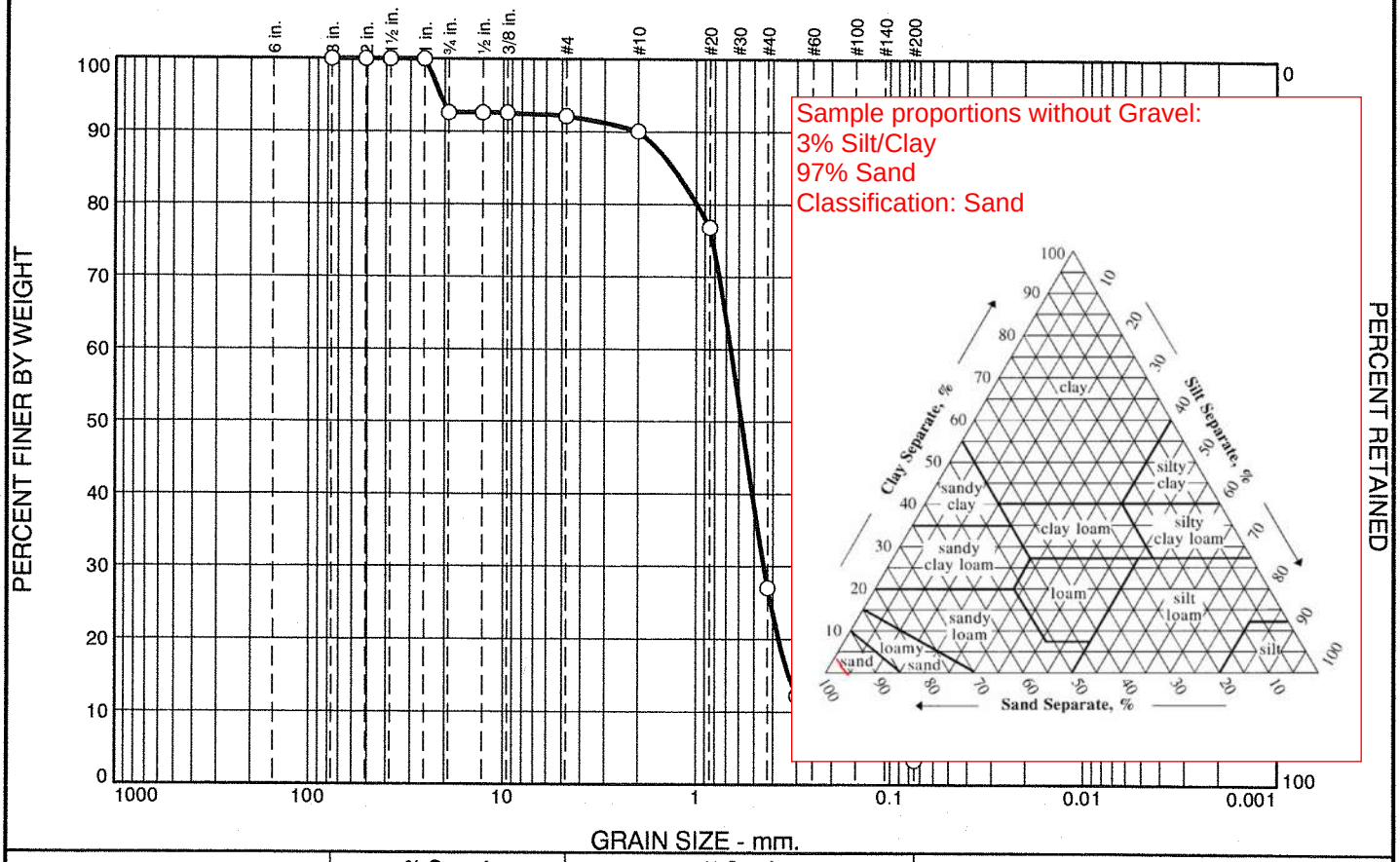
MILLER ENGINEERING & TESTING, INC.

Client:
Project: HOLLISTON SOLAR

Project No: 19.224.NH **Figure** L190493B

Tested By: DM/BM

GRAINSIZE DISTRIBUTION REPORT - AGGREGATE GRADING



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	7	1	2	63	24	3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100		
2"	100		
1.5"	100		
1"	100		
.75"	93		
.5"	93		
.375"	93		
#4	92		
#10	90		
#20	77		
#40	27		
#50	12		
#60	9		
#80	7		
#100	6		
#200	3.4		

* (no specification provided)

Material Description

BORING JAR SAMPLE.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.9787 D_{85}= 1.3138 D_{60}= 0.6593
D_{50}= 0.5803 D_{30}= 0.4447 D_{15}= 0.3306
D_{10}= 0.2616 C_u= 2.52 C_c= 1.15

Classification

USCS= SP AASHTO=

Remarks

Source of Sample: B-4 S-4 **Depth:** 9-11'
Sample Number: L190493C

Date: 11-19-19

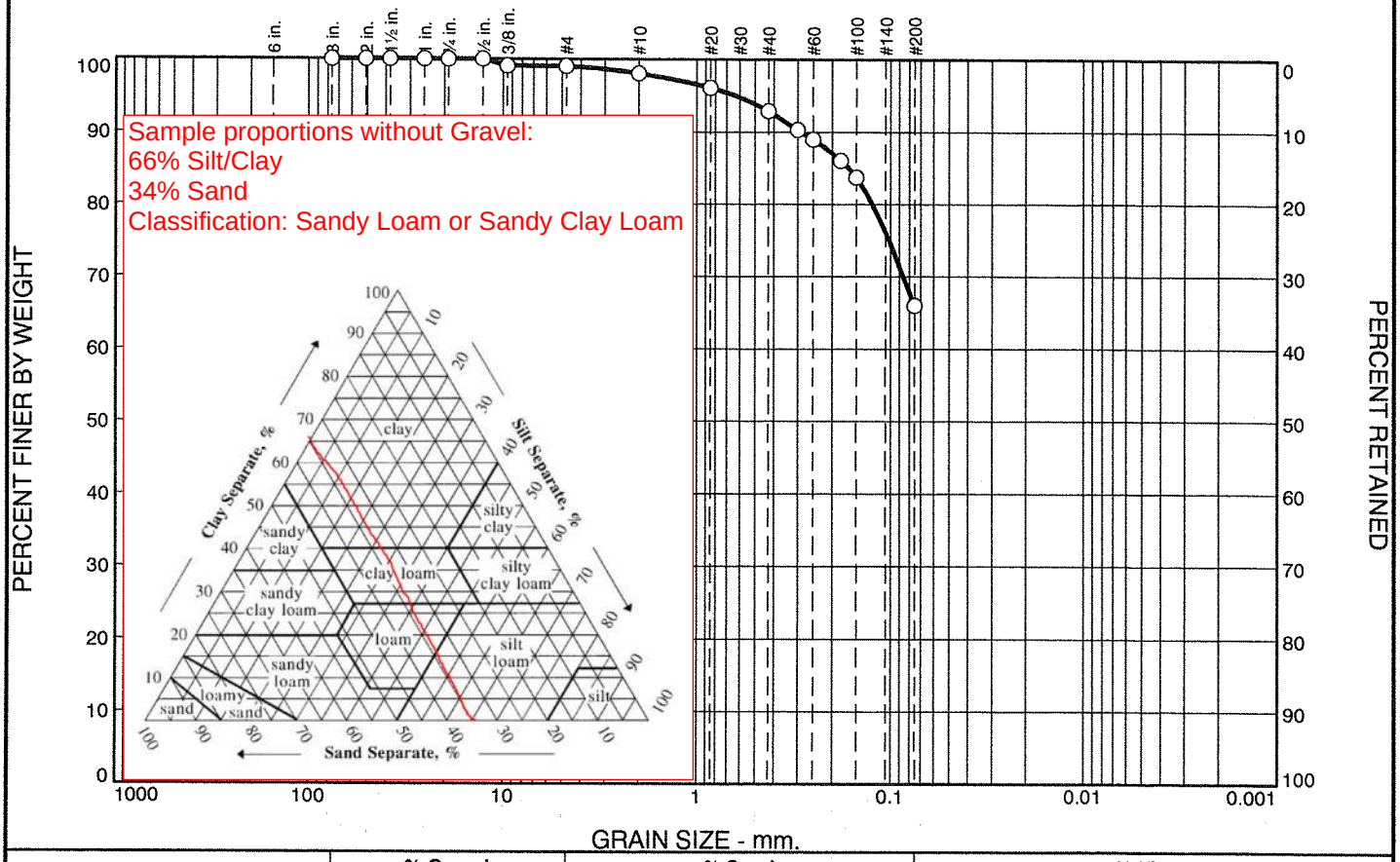
MILLER ENGINEERING & TESTING, INC.

Client:
Project: HOLLISTON SOLAR

Project No: 19.224.NH **Figure** L190493C

Tested By: DM/BM

GRAINSIZE DISTRIBUTION REPORT - AGGREGATE GRADING



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	1	1	5	27	66	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100		
2"	100		
1.5"	100		
1"	100		
.75"	100		
.5"	100		
.375"	99		
#4	99		
#10	98		
#20	96		
#40	93		
#50	90		
#60	89		
#80	86		
#100	84		
#200	66		

* (no specification provided)

Material Description

BORING JAR SAMPLE.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2867 D_{85}= 0.1636 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Source of Sample: B-5A S-1 **Depth:** 0-2'
Sample Number: L190493D

Date: 11-19-19

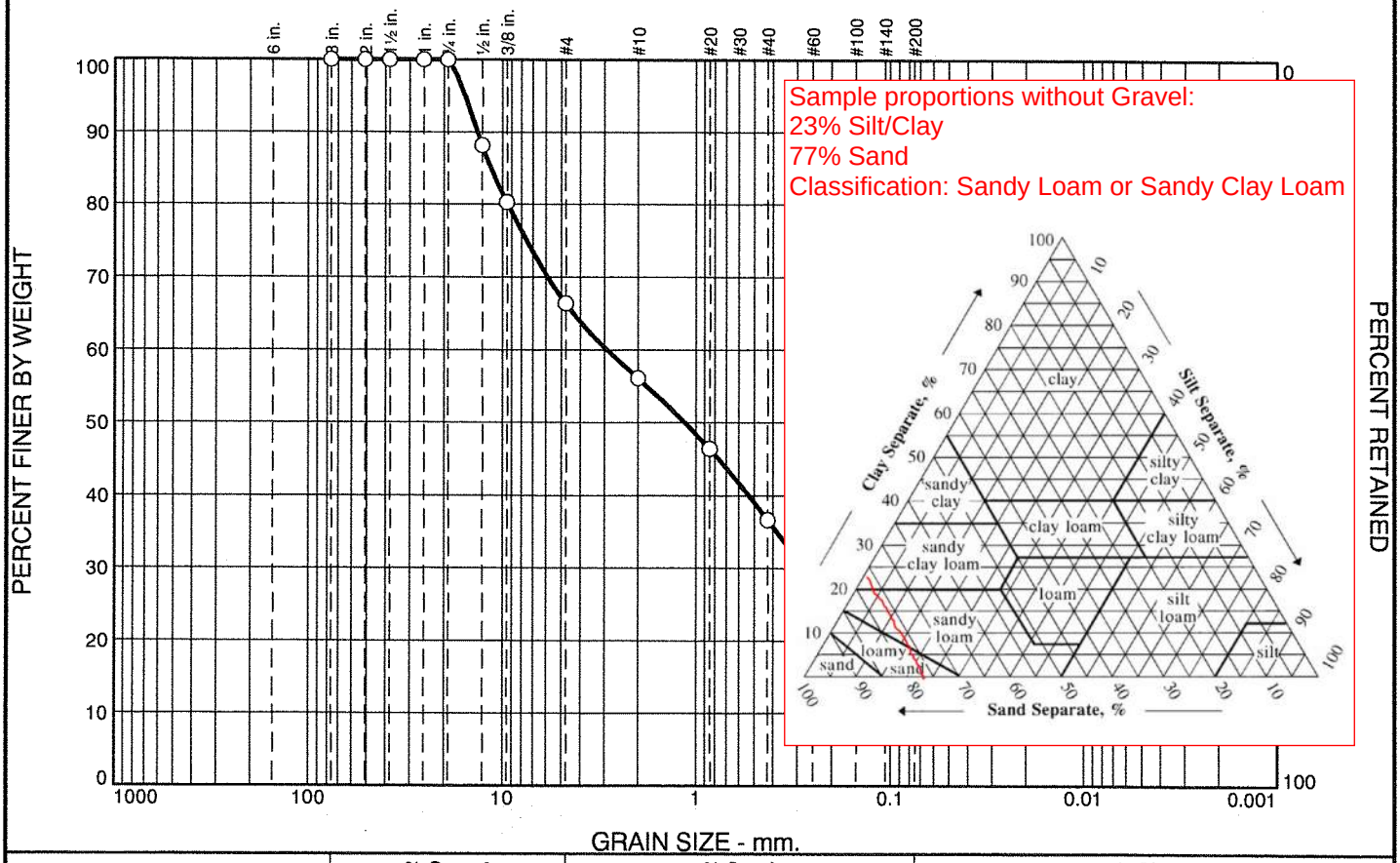
MILLER ENGINEERING & TESTING, INC.

Client:
Project: HOLLISTON SOLAR

Project No: 19.224.NH **Figure** L190493D

Tested By: DM/BM

GRAINSIZE DISTRIBUTION REPORT - AGGREGATE GRADING



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	34	10	19	22	15	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100		
2"	100		
1.5"	100		
1"	100		
.75"	100		
.5"	88		
.375"	80		
#4	66		
#10	56		
#20	46		
#40	37		
#50	31		
#60	29		
#80	24		
#100	22		
#200	15		

* (no specification provided)

Material Description

BORING JAR SAMPLE.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 13.4099 D_{85}= 11.4305 D_{60}= 2.8977
D_{50}= 1.1395 D_{30}= 0.2731 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Source of Sample: B-6A S-1 **Depth:** 0-2'
Sample Number: L190493E

Date: 11-19-19

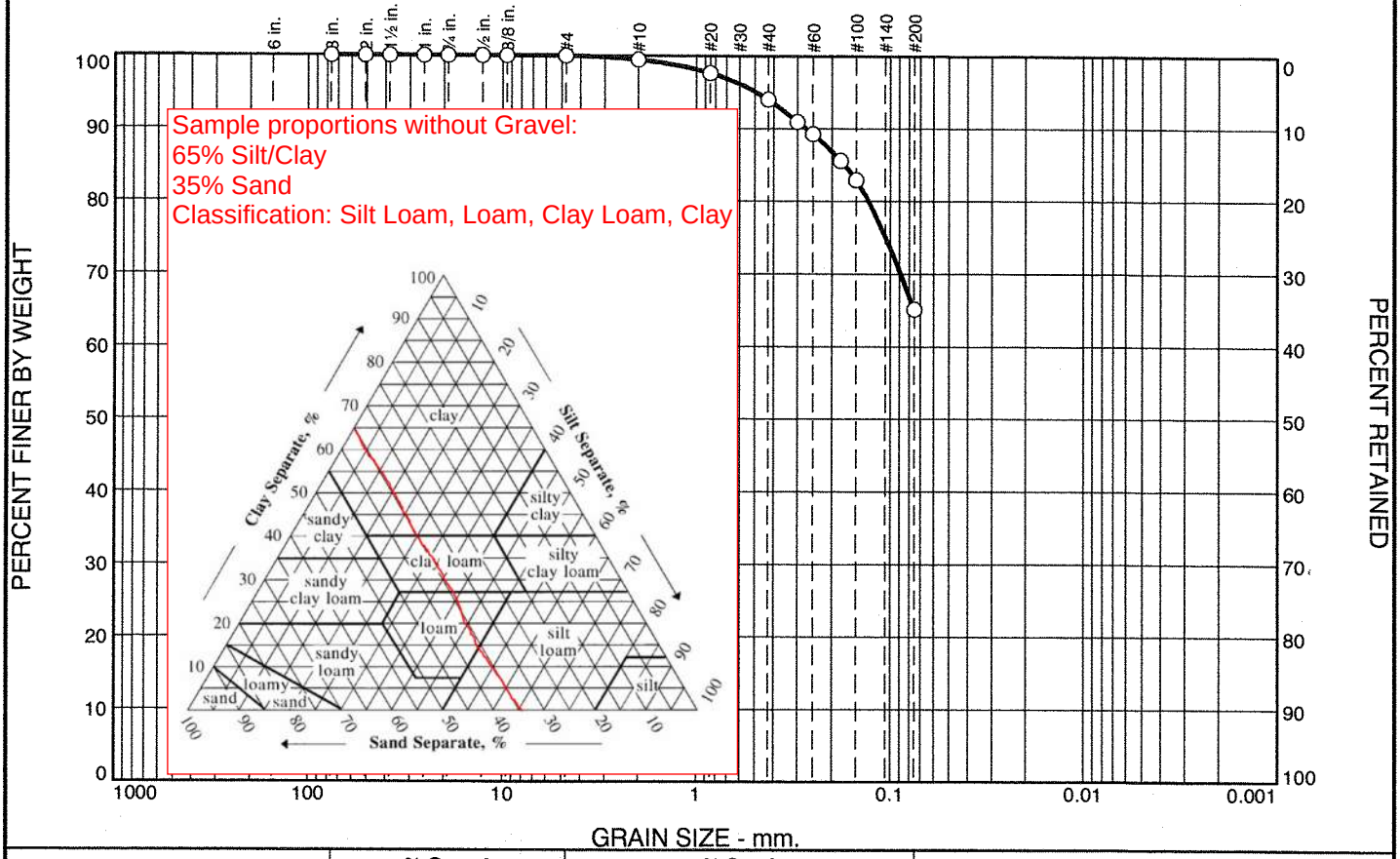
MILLER ENGINEERING & TESTING, INC.

Client:
Project: HOLLISTON SOLAR

Project No: 19.224.NH **Figure** L190493E

Tested By: DM/BM

GRAINSIZE DISTRIBUTION REPORT - AGGREGATE GRADING



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	1	5	29	65	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100		
2"	100		
1.5"	100		
1"	100		
.75"	100		
.5"	100		
.375"	100		
#4	100		
#10	99		
#20	98		
#40	94		
#50	91		
#60	89		
#80	86		
#100	83		
#200	65		

* (no specification provided)

Material Description

BORING JAR SAMPLE.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2701 D_{85}= 0.1720 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Source of Sample: B-8A S-2 **Depth:** 2-4'
Sample Number: L190493F

Date: 11-19-19

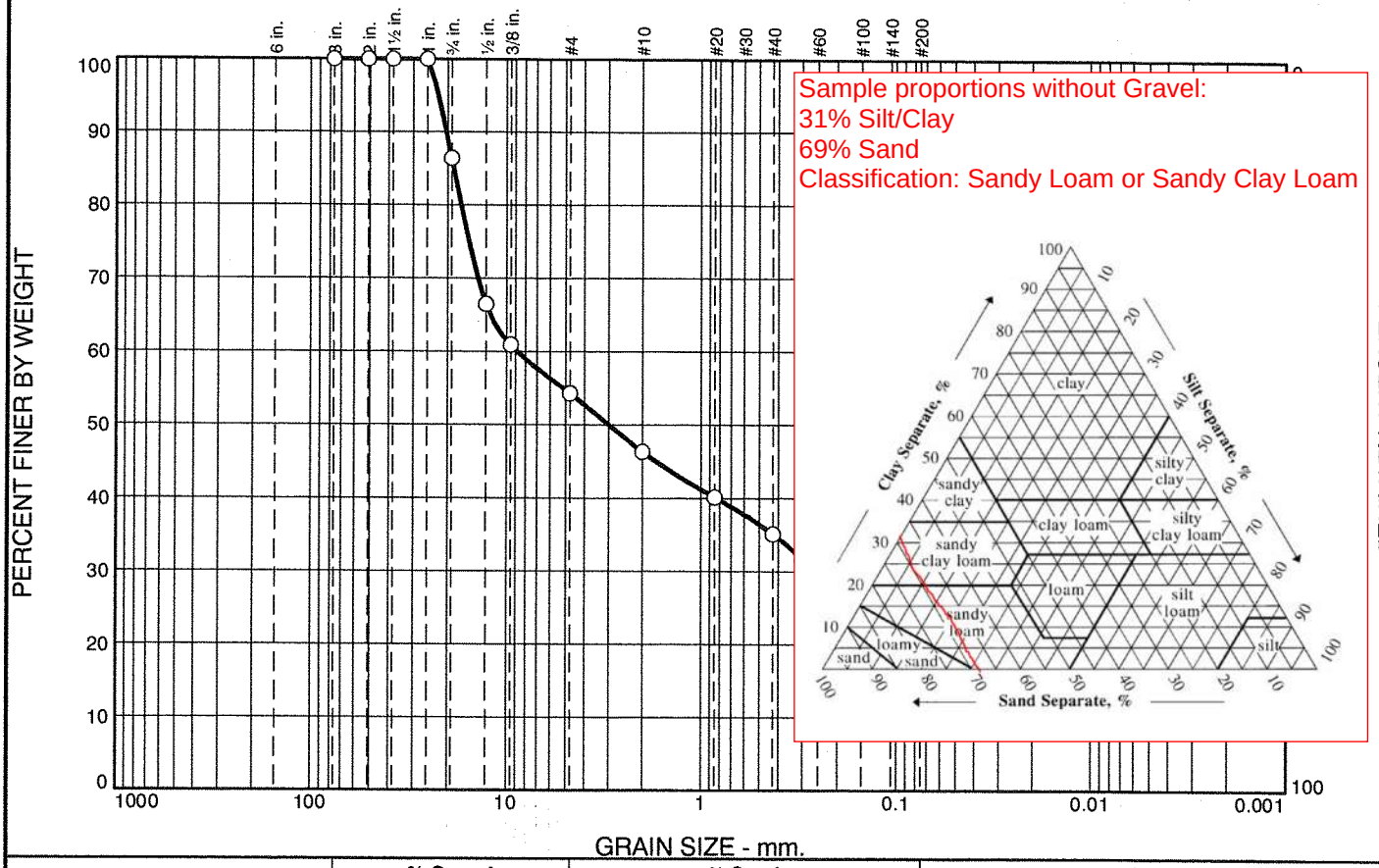
MILLER ENGINEERING & TESTING, INC.

Client:
Project: HOLLISTON SOLAR

Project No: 19.224.NH **Figure** L190493F

Tested By: DM/BM

GRAINSIZE DISTRIBUTION REPORT - AGGREGATE GRADING



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	14	32	8	11	18	17	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100		
2"	100		
1.5"	100		
1"	100		
.75"	86		
.5"	66		
.375"	61		
#4	54		
#10	46		
#20	40		
#40	35		
#50	32		
#60	30		
#80	26		
#100	23		
#200	17		

* (no specification provided)

Material Description

BORING JAR SAMPLE.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 20.2715 D_{85}= 18.5829 D_{60}= 8.7772
D_{50}= 2.9857 D_{30}= 0.2589 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Source of Sample: B-9 S-3 **Depth:** 4-6'
Sample Number: L190493G

Date: 11-19-19

MILLER ENGINEERING & TESTING, INC.

Client:
Project: HOLLISTON SOLAR

Project No: 19.224.NH **Figure** L190493G

Tested By: DM/BM

LEGEND

- AOC-7 — AREA OF CONCERN
- PROPERTY BOUNDARY
- SUBJECT PROPERTY BOUNDARY
- ZONE II PWS PROTECTION AREA
- MONITORING WELL
- TEST PIT
- SOIL SAMPLE
- SURFACE WATER SAMPLE
- SEDIMENT SAMPLE
- SUPPLY WELL

COLOR KEY
WEHRAN ENGINEERING
CLEAN HARBORS
WESTON
COLER & COLANTONIO

NOTES:

1. THIS FIGURE WAS BASED UPON AN APRIL 22, 2018 GOOGLE EARTH AERIAL PHOTOGRAPH, A FEBRUARY 8, 2005 FIGURE ENTITLED "FIGURE 4–HISTORIC TRICHLOROETHENE CONCENTRATIONS IN OVERBURDEN WELLS PREPARED BY COLER AND COLANTONIO INC OF NORWELL, MASSACHUSETTS, MASSDEP SITE ASSESSMENT MAP, AND GIS DATA FROM OLIVER, MASSGIS ONLINE MAPPING TOOL.

0 100 200
APPROX. SCALE IN FEET

PRENTICE STREET
HOPKINTON
HOLLISTON
MARSHALL STREET
30 MARSHALL ST
500-FOOT RADIUS
AOC-1
AOC-2
AOC-3
AOC-4
AOC-5
AOC-6
AOC-7
AOC-8
WE 91-8D
WE 91-8S
WE 4D
WE 4S
WE 91-2D
WE 91-2S
WE 91-5D
WE 91-5S
SS-9
SS-2
SS-1
CH-TP-4
SW-3
TP-119
WE 5S
WE 5D
WE-TP-10
WE-TP-9
SW-3/SD-3(GZA)
WE 91-3D
WE 91-3S
SS-5
GZA-1
TP-120
TP-22
WE 2D
WE 2S
WE 91-7S
WE 91-7D
TP-117
TP-26
GZA 1B
WE 1BS
SS-6
WE-TP-1
TP-23
WE 91-4S
WE 91-4D
SS-8
TP-115
WE-TP-8
TP-29
WE-TP-2
TP-21
WE-TP-7
TP-25
WE-TP-3
CH-TP-15
WE-TP-6
TP-27
WE 1S
WE 3D
WE 91-1S
TP-118
TP-24
SS-3
CH-TP-1
WE-TP-4
SS-7
WE 1D
WE 91-6D
SS-4
WE 91-1D
TP-28
GZA 2B
WE-TP-5
WE 2BS
TP-30 (WEST)
TP-116
TP-30 (NORTH)
TP-31
TP-30 (SOUTH)
WE 91-10D
WE 91-10S
WE 91-11M
WE 91-11S
WE 91-11D
SW-1
WE-TP-11
WE 91-12S
WE 91-12D
GZA-3
WE-TP-25
WE-TP-23
TP-101
TP-102
SED#7
WE-TP-14
BIR 09
BIR 03
BIR 10
SW-1/SD-1(GZA)
BIR 006
BIR 11
BIR 04
WE-8D
WE-8S
BIR 12
WE-TP-12
TP-103
BIR 13
BIR 05
TP-109
WE-9D
SW-2
WE-TP-24
BIR 14
BIR 15
SED#5/CSW-5
BIR 16
BIR 17
WE-9S
BIR 007
BIR 18
BIR 19
BIR 20
TP-110
TP-104
BIR 008
BIR 21
BIR 22
SED#6
TP-111
TP-112
WE-TP-22
WE-TP-13
BIR 23
TP-105
BIR 24
HA-2
WE-TP-21
HA-4
HA-3
WE-6D
WE-6S
WE-TP-16
TP-113
WE-TP-20
SED#4/CSW-4
TP-106
WE-TP-17
TP-107
WE-TP-15
TP-114
SED#1/CSW-1
SW-4/SD-2(GZA)
WE-TP-19
WE-TP-18
SED#2/CSW-2
TP-108
GZA-5
WE-7D
HA-1
SED#3
SW-5(GZA)
SW-7(GZA)
SW-2
SW-4
WE 91-9S
WE 91-9D

DRAFT

CLIENT: SUNRAISE INVESTMENTS, LLC			
PROJECT: FORMER BIRD PROPERTY HOLLISTON, MASSACHUSETTS			
TITLE: SITE PLAN			
DESIGNED: JEB	DRAWN: STM	CHECKED: MFD	APPROVED: BDK
SCALE: 1" = 200'	DATE: 08/28/19	FILE NO.: 9285D001	PROJECT NO.: 9285-000
			FIGURE NO.: 2

GeoInsight
Practical in Nature

PLOT DATE: 8-28-19
FILE C:\Users\jbrown\AppData\Local\Temp\AcPublish_18836\$\9285D002.dwg

WEHRAN ENGINEERING
CONSULTING ENGINEERS

PROJECT No. 51114.05

TEST PIT LOGS.

PROJECT: BIRD PROPERTY — SHEET 1 OF 1

CLIENT: Mass DEP

CONTRACTOR: CORE Environmental — EQUIPMENT: 555 B Ford Backhoe

OPERATOR: Paul Goutes — INSPECTOR: R. Wright

LOG OF TEST PIT No. TP1 — Date: 12/10/90 — Elevation:

WELL CONSTRUCTION	DEPTH FT.	SAMPLE No. DEPTH	CLASSIFICATION	Microtip	Comments
None Constructed	5		Brown, fine to coarse SAND and boulders (2' – 4' diam.). Drums, solidified black material, white unknown substance & trash.	Headspace (ppm)	Test pit terminated at end of visual evidence of drums. Groundwater was not encountered.
	10		End of Test Pit at 6'	None Detected	
	15				
Dimensions of Test Pit (LxWxD) (ft): 20x15x6	20				

LOG OF TEST PIT No TP2 — Date: 12/10/90 — Elevation

WELL CONSTRUCTION	DEPTH FT.	SAMPLE No. DEPTH	CLASSIFICATION	Microtip	Comments
None Constructed	5		Brown, fine to coarse SAND and GRAVEL (very cobbly Fill).	Headspace (ppm)	Swampy to sulfurous odor. Test Pit terminated at water table (7').
	▽		Burnt wood debris, tar shingles, sewer pipes, steel pipes.	18.6 – 100	
	10		End of Test Pit at 8'		
Dimensions of Test Pit (LxWxD) (ft): 25x4x8	15				
	20				

COMMENTS:

WEHRAN ENGINEERING
CONSULTING ENGINEERS

PROJECT No. 51114.05

TEST PIT LOGS

PROJECT: BIRD PROPERTY — SHEET 1 OF 1

CLIENT: Mass DEP

CONTRACTOR: CORE Environmental — EQUIPMENT: 555B FORD Backhoe

OPERATOR: Paul Goules — INSPECTOR: R. Wright

LOG OF TEST PIT No. TP 2B — Date: 12/10/90 — Elevation:

WELL CONSTRUCTION	DEPTH FT.	SAMPLE No. DEPTH	CLASSIFICATION	Microtip Headspace (ppm)	Comments
None Constructed			Half-Burnt woodfill.	19.7	Test Pit terminated at water table (10').
	5		Light Brown to Tan, fine to coarse SAND and GRAVEL, some cobbles.		
	▽				
	10		End of Test Pit at 10'		
Test Pit Dimensions (LXWxD) (ft): 35x20x10	15				
	20				

LOG OF TEST PIT No TP3 — Date: 12/11/90 — Elevation

WELL CONSTRUCTION	DEPTH FT.	SAMPLE No. DEPTH	CLASSIFICATION	Microtip Headspace (ppm)	Comments
			Loamy material at surface, organic detritus, Dark Brown SAND and GRAVEL.	None Detected	Test Pit was terminated at water table (3').
	▽		Rusty Red, coarse SAND and GRAVEL.		
	5		End of Test Pit at 3'		
Test Pit Dimensions (LxWxD) (ft): 37x3x3	10				
	15				
	20				

COMMENTS:

WEHRAN ENGINEERING
CONSULTING ENGINEERS

PROJECT No. 51114.05

TEST PIT LOGS

PROJECT: BIRD PROPERTY — SHEET 1 OF 1
CLIENT: Mass DEP
CONTRACTOR: CORE Environmental — EQUIPMENT: 555 B Ford Backhoe
OPERATOR: Paul Goules — INSPECTOR: R. Wright

LOG OF TEST PIT No. TP4 — Date: 12/11/90 — Elevation:

WELL CONSTRUCTION	DEPTH FT.	SAMPLE No. DEPTH	CLASSIFICATION	Microtip (ppm)	Comments
None constructed.	5 ▽		Tan, medium to coarse SAND and fine Gravel, Poorly sorted rounded Gravel	18 (ambient)	Test Pit terminated at water table (16') and when ambient HNU readings diminished in Test Pit.
			End of Test Pit at 6'		
	10				
Dimensions of Test Pit (LxWxD) (ft): 30x10x6	15				
	20				

LOG OF TEST PIT No TP5 — Date: 12/11/90 — Elevation

WELL CONSTRUCTION	DEPTH FT.	SAMPLE No. DEPTH	CLASSIFICATION	Microtip (ppm)	Comments
None constructed	5		Tan to Light Brown, fine to coarse SAND, some fine Gravel	< 5 (ambient)	Test Pit terminated at water table (12').
	10 ▽				
			End of Test Pit at 12'		
Dimensions of Test Pit (ft): 20x6x12	15				
	20				

COMMENTS:

WEHRAN ENGINEERING
CONSULTING ENGINEERS

PROJECT No. 51114.05

TEST PIT LOGS

PROJECT: BIRD PROPERTY — SHEET 1 OF 1
CLIENT: Mass DEP
CONTRACTOR: CORE Environmental — EQUIPMENT: 555 B Ford Backhoe
OPERATOR: Paul Goules — INSPECTOR: R. Wright

LOG OF TEST PIT No. TP6 — Date: 12/11/90 — Elevation:

WELL CONSTRUCTION	DEPTH FT.	SAMPLE No. DEPTH	CLASSIFICATION	Microtip	Comments
None Constructed			Brown, medium to coarse SAND and GRAVEL, little cobbles.	Headspace (ppm)	Test Pit terminated at water table (5').
	▽5		End of Test Pit at 5'	> 400	
	10				
Dimension of Test Pit (LxWxD) (ft): 30x4x5	15				
	20				

LOG OF TEST PIT No TP7 — Date: 12/11/90 — Elevation

WELL CONSTRUCTION	DEPTH FT.	SAMPLE No. DEPTH	CLASSIFICATION	Microtip	Comments
None Constructed			Brown, medium to coarse SAND and GRAVEL, little cobbles.	(ppm)	Test Pit terminated at water table (4').
	▽		End of Test Pit at 4'	< 5 (ambient)	
	5				
	10				
Dimension of Test Pit (LxWxD) (ft): 30x4x4	15				
	20				

COMMENTS:

WEHRAN ENGINEERING
CONSULTING ENGINEERS

PROJECT No. 51114.05

TEST PIT LOGS

PROJECT: BIRD PROPERTY — SHEET 1 OF 1
CLIENT: Mass DEP
CONTRACTOR: CORE Environmental — EQUIPMENT: 555 B Ford Backhoe
OPERATOR: Paul Goules — INSPECTOR: R. Wright

LOG OF TEST PIT No. TP8 — Date: 12/12/90 — Elevation:

WELL CONSTRUCTION	DEPTH FT.	SAMPLE No. DEPTH	CLASSIFICATION	Microtip	Comments
None Constructed			Alternating layers of brown, coarse SAND and GRAVEL, coarse to medium Sand and medium to fine Sand	Headspace (ppm)	Test Pit terminated at water table (10').
	5			None Collected	
			Large Boulders at bottom of pit.		
	▽10		End of Test Pit at 10'		
Dimensions of Test Pit (LxWxD) (ft):					
50x6x10	15				
	20				

LOG OF TEST PIT No TP9 — Date: 12/12/90 — Elevation

WELL CONSTRUCTION	DEPTH FT.	SAMPLE No. DEPTH	CLASSIFICATION	Microtip	Comments
None Constructed			Alternating layers of brown, coarse SAND and GRAVEL with coarse to medium Sand, medium to fine Sand	Headspace (ppm)	Test Pit terminated at boulders. Water table was not encountered.
	5			None Collected	
			Large Boulders at bottom of Test Pit		
Dimensions of Test Pit (LxWxD) (ft):			End of Test Pit at 8'		
12x5x8	10				
	15				
	20				

COMMENTS:

WEHRAN ENGINEERING
CONSULTING ENGINEERS

PROJECT No. 51114.05

TEST PIT LOGS

PROJECT: BIRD PROPERTY — SHEET 1 OF 1

CLIENT: Mass DEP

CONTRACTOR: CORE Environmental — EQUIPMENT: 555 B Ford Backhoe

OPERATOR: Paul Goules — INSPECTOR: R. Wright

LOG OF TEST PIT No. TP10 — Date: 12/12/90 — Elevation:

WELL CONSTRUCTION	DEPTH FT.	SAMPLE No. DEPTH	CLASSIFICATION	Microtip	Comments
None Constructed	5		Alternating layers of brown, coarse SAND and GRAVEL, coarse to medium Sand and medium to fine Sand	Headspace (ppm) None Collected	Test Pit terminated at boulders.
Test Pit Dimensions (LxWxD)(ft): 12x6x9	10		Boulders at bottom. End of Test Pit at 9'		
	15				
	20				

LOG OF TEST PIT No TP11 — Date: 12/13/90 — Elevation

WELL CONSTRUCTION	DEPTH FT.	SAMPLE No. DEPTH	CLASSIFICATION	Microtip	Comments
None Constructed	5		Loamy Fill with concrete form and foundation debris	Headspace (ppm) None Collected	Water table at 10.5'.
			Brown coarse SAND and GRAVEL, little cobbles. Interbedded with fine SAND and GRAVEL layers		
	▽10				
Test Pit Dimensions (LxWxD) (ft): 20x8x13	15		End of Test Pit at 13'		
	20				

COMMENTS:

WEHRAN ENGINEERING
CONSULTING ENGINEERS

PROJECT No.: 51114.05

TEST PIT LOGS

PROJECT: BIRD PROPERTY — SHEET 1 OF 1
CLIENT: Mass DEP
CONTRACTOR: CORE Environmental — EQUIPMENT: 555 B Ford Backhoe
OPERATOR: Paul Goules — INSPECTOR: R. Wright

LOG OF TEST PIT No. TP12 — Date: 12/13/90 — Elevation:

WELL CONSTRUCTION	DEPTH FT.	SAMPLE No. DEPTH	CLASSIFICATION	Microtip (ppm)	Comments
None Constructed Test Pit Dimensions (LxWxD) (ft): 20x4x7	5 10 15 20		Wood, brick and pipe Brown coarse to medium SAND and GRAVEL Boulders at bottom of pit. End of Test Pit at 7'	None Detected (ambient)	Test Pit terminated at boulders. Water table was not encountered.

LOG OF TEST PIT No TP14 — Date: 12/13/90 — Elevation

WELL CONSTRUCTION	DEPTH FT.	SAMPLE No. DEPTH	CLASSIFICATION	Microtip (ppm)	Comments
None Constructed Test Pit Dimensions (LxWXD) (ft): 15x5x8	5 10 15 20		Brown coarse to medium SAND and GRAVEL, some cobbles. End of Test Pit at 8'	None Detected (ambient)	Test Pit terminated at reach of equipment. Groundwater was not encountered.

COMMENTS:

WEHRAN ENGINEERING
CONSULTING ENGINEERS

PROJECT No. 51114.05

TEST PIT LOGS

PROJECT: BIRD PROPERTY — SHEET 1 OF 1
CLIENT: Mass DEP
CONTRACTOR: CORE Environmental — EQUIPMENT: 555 B Ford Backhoe
OPERATOR: Paul Goules — INSPECTOR: R. Wright

LOG OF TEST PIT No. TP13 — Date: 12/13/90 — Elevation:

WELL CONSTRUCTION	DEPTH FT.	SAMPLE No. DEPTH	CLASSIFICATION	Microtip (ppm)	Comments
None Constructed Test Pit Dimensions (LxWxD) (ft): 12x5x12	5 10 15 20		Wood, pipe, brick, (building debris). Brown, coarse to medium SAND and Boulders. End of Test Pit at 12'	None Detected (ambient)	Test Pit terminated at 12' due to close proximity of GZA-2B. Groundwater was not encountered.

LOG OF TEST PIT No TP15 — Date: 12/14/90 — Elevation

WELL CONSTRUCTION	DEPTH FT.	SAMPLE No. DEPTH	CLASSIFICATION	Microtip Headspace (ppm)	Comments
None Constructed Test Pit Dimensions (LxWxD) (ft): 30x30x6	5 10 15 20		Loamy fill, boulders, building debris, tires, shoe liners, process trains, and drums. End of Test Pit at 6'	None Collected	15 Drums encountered. Test Pit terminated due to health and safety reasons.

COMMENTS:

WEHRAN ENGINEERING
CONSULTING ENGINEERS

PROJECT No. 51114.05

TEST PIT LOGS

PROJECT: BIRD PROPERTY — SHEET 1 OF 1

CLIENT: Mass DEP

CONTRACTOR: CORE Environmental — EQUIPMENT: 555 B Ford Backhoe

OPERATOR: Paul Goules — INSPECTOR: R. Wright

LOG OF TEST PIT No. TP15A — Date: 12/14/90 — Elevation:

WELL CONSTRUCTION	DEPTH FT.	SAMPLE No. DEPTH	CLASSIFICATION	Microtip (ppm)	Comments
None Constructed			Brown medium sand and cobbles (Fill).	None Detected (ambient)	Test Pit terminated due to excessive amount of debris. Physical hazard imminent if debris could not be re-buried. Groundwater was not encountered.
			Tires, steel pipes, gym steel lockers, 2 safes, chain link fencing.		
	5		End of Test Pit at 6'		
Test Pit Dimensions (LxWxD) (ft): 12x12x6	10				
	15				
	20				

LOG OF TEST PIT No — Date: — Elevation

WELL CONSTRUCTION	DEPTH FT.	SAMPLE No. DEPTH	CLASSIFICATION	
	5			
	10			
	15			
	20			

COMMENTS:

WEHRAN ENGINEERING
CONSULING ENGINEERS

PROJECT No. 51114.05

TEST PIT LOGS

PROJECT: BIRD PROPERTY — SHEET 1 OF 1

CLIENT: Mass DEP

CONTRACTOR: CORE Environmental — EQUIPMENT: 555 B Ford Backhoe

OPERATOR: Paul Goules — INSPECTOR: R. Wright

LOG OF TEST PIT No. TP16 — Date: 12/14/90 — Elevation:

WELL CONSTRUCTION	DEPTH FT.	SAMPLE No. DEPTH	CLASSIFICATION	Microtip (ppm)	Comments
None Constructed Test Pit Dimensions (LxWxD) (ft): 10x5x12	5 10 15 20		Interbedded Brown coarse to medium SAND and brown, coarse SAND and GRAVEL. End of Test Pit at 12'	None Detected (ambient)	Test Pit terminated at end of reach of equipment. Groundwater was not encountered.

LOG OF TEST PIT No TP17 — Date: 12/14/90 — Elevation

WELL CONSTRUCTION	DEPTH FT.	SAMPLE No. DEPTH	CLASSIFICATION	Microtip (ppm)	Comments
None Constructed Test Pit Dimensions (LxWxD) (ft): 8x4x9	5 10 15 20		Brown cobbles and SAND overlying dark brown, medium to fine SAND, little organic detritus, roots (loam). Brown coarse to medium SAND and GRAVEL. End of Test Pit at 9'	None Detected (ambient)	Test Pit terminated at end of reach of equipment. Groundwater was not encountered.

COMMENTS:

WEHRAN ENGINEERING
CONSULTING ENGINEERS

PROJECT No. 51114.05

TEST PIT LOGS

PROJECT: BIRD PROPERTY — SHEET 1 OF 1

CLIENT: Mass DEP

CONTRACTOR: Core Environmental — EQUIPMENT: 555 B Ford Backhoe

OPERATOR: Paul Goules — INSPECTOR: R. Wright

LOG OF TEST PIT No. TP-18 — Date: 12/14/90 — Elevation:

WELL CONSTRUCTION	DEPTH FT.	SAMPLE No. DEPTH	CLASSIFICATION	Microtip / Comments
None Constructed	5, 10, 15, 20		Re-excavated test pit previously conducted during Wehran Phase II Investigation (1987).	Headspace (ppm): Not collected; Drums Encountered

LOG OF TEST PIT No — Date: — Elevation

WELL CONSTRUCTION	DEPTH FT.	SAMPLE No. DEPTH	CLASSIFICATION	
	5, 10, 15, 20			

COMMENTS:

WEHRAN ENGINEERING
CONSULTING ENGINEERS

PROJECT No. 51114.05

TEST PIT LOGS

PROJECT: BIRD PROPERTY — SHEET 1 OF 1

CLIENT: Mass DEP

CONTRACTOR: Clean Harbors — EQUIPMENT: 235 B Caterpillar Excavator

OPERATOR: Tony Sorrentino — INSPECTOR: R. Wright

LOG OF TEST PIT No. TP19 — Date: 1/25/91 — Elevation:

WELL CONSTRUCTION	DEPTH FT.	SAMPLE No. DEPTH	CLASSIFICATION	Microtip Headspace (ppm)	Comments
None Constructed Test Pit Dimensions (LxWxD) (ft): 25x6x6	▽ 5 10 15 20		Brick, wood, pipe, building debris. Black SILT and SAND, some Peat. End of Test Pit at 6'	None Collected	Groundwater encountered at 2'. Test Pit was extended approximately 5' into pond upon DEP request.

LOG OF TEST PIT No TP20 — Date: 1/25/91 — Elevation

WELL CONSTRUCTION	DEPTH FT.	SAMPLE No. DEPTH	CLASSIFICATION	Microtip Headspace (ppm)	Comments
None Constructed Test Pit Dimensions (LxWxD) (ft): 20x10x6	5 10 15 20		Brown medium to fine SAND overlain by cut wood debris. End of Test Pit at 6'	None Collected	Test Pit terminated upon DEP request. Groundwater was not encountered.

COMMENTS:

BORING LOG KEY

Well Construction Details


Concrete Plug


Bentonite Seal


Filter Sand Pack


Bentonite/ Cement Grout


2-inch OD Schedule 40 PVC Riser Pipe


2-inch OD Schedule 40 PVC Well Screen (.010 Slot)


Drill Cuttings

Geologic Materials


Bedrock (Granite)


Till


Sand and Gravel


Sand

NOTE: The N-Value is the total number of blows for the middle 12 inches of the 24 inch sampling interval (first and last 6 inches are not included)

Sample Type Details


Split-Spoon Sampler


3-inch OD NX Core

Wehran EnviroTech

BORING/WELL NO. WE-91-1S

SHEET 1 of

PROJECT: Bird Property Site
PROJECT NO: 51114.06
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling
RIG: CME-75

GS ELEV: 273.90ft.
N-S COORD:
E-W COORD:
VL REF ELEV: TOC 276.35ft
DATE STARTED: 03/15/91
DATE FINISHED: 03/15/91
OPERATOR: C. O'Donnell
GEOLOGIST: B. Wright

GROUNDWATER DATA (feet)

DATE	GW DEPTH	GW ELEV	INTAKE
07/02/91	17.39 TOC	258.96	259.4 - 264.4

	CASING	SAMPLE	TUBE	CORE
TYPE	ODEX	SS		
DIAM.	5"	2" OD		
WEIGHT		140 lbs.		
FALL		30"		

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS
	5						No samples taken Refer to WE-91-1D	
	10							
	15						END OF BORING AT 16' 5"	Silt Trap Installed
	20							
	25							

Wehran EnviroTech

BORING/WELL NO. ME-91-1D

SHEET 1 of 2

PROJECT: Bird Property Site
PROJECT NO: 51114.06
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling
RIG: CME-75

GS ELEV: 273.30ft.
N-S COORD:
E-W COORD:
ML REF ELEV: PVC 275.85ft
DATE STARTED: 02/27/91
DATE FINISHED: 03/06/91
OPERATOR: C. O'Donnell
GEOLOGIST: R. Wright

GROUNDWATER DATA (feet)

DATE	GW DEPTH	GW ELEV.	INTAKE
07/02/91	16.86 PVC	258.99	244.30 - 254.30

	CASING	SAMPLE	TUBE	CORE
TYPE	ODEX	SS		
DIAM.	5"	2" OD		
WEIGHT		140 lbs.		
FALL		30"		

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS MI
		S-1		7.5	58		Dense, gray, fine SAND and SILT, little coarse SAND, trace Gravel	0 ppm
							Cobbles (1 to 2 feet)	
							Boulder (3 feet to 11 feet 4 inches)	
	5							
	10	S-2		5	61.5		Dense, gray, fine SAND and SILT	4.7 moved hole
							Top of Bedrock at 13 feet (Granite)	
	15	S-3		10	100/0			23.3 ▼
	20							
	25	S-4		3	100/0		Weathered seam at 25 feet 2 inches	7

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BORING/WELL NO. ME-91-10

SHEET 2 of 2

PROJECT: Bird Property Site
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling

PROJECT NO: 51114.06
RIG: CME-75

GS ELEV: 273.30ft.
N-S COORD:
E-W COORD:

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG		FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS MT
	30							Weathered seam at 28.5 feet	
								END OF BORING AT 30 FEET	
	35							MT = Microtip reading (total volatile organic vapors, in parts per million)	
	40								
	45								
	50								
	55								
	60								

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BORING/WELL NO. WE-91-2S

SHEET 1 of 1

PROJECT: Bird Property Site
PROJECT NO: 51114.06
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling
RIG: CME-75

GS ELEV: 264.90ft.
N-S COORD:
E-W COORD:
HL REF ELEV: PVC 266.83ft
DATE STARTED: 03/08/91
DATE FINISHED: 03/08/91
OPERATOR: C. O'Donnell
GEOLOGIST: R. Wright

GROUNDWATER DATA (feet)

DATE	GW DEPTH	GW ELEV	INTAKE
07/02/91	8.14	258.69	253.4 - 258.4

	CASING	SAMPLE	TUBE	CORE
TYPE	ODEX	SS		
DIAM.	5"	2" OD		
WEIGHT		140 lbs.		
FALL		30"		

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS
	5						No samples taken Refer to WE-91-2D	
	10						END OF BORING AT 11' 6"	
	15							
	20							
	25							

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BORING/WELL NO. WE-91-20

SHEET 1 of

PROJECT: Bird Property Site — PROJECT NO: 51114.06
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling — RIG: CME-75

GS ELEV: 264.80ft.
N-S COORD:
E-W COORD:
WL REF ELEV: PVC 267.20ft
DATE STARTED: 03/07/91
DATE FINISHED: 03/08/91
OPERATOR: C. O'Donnell
GEOLOGIST: R. Wright

GROUNDWATER DATA (feet)

DATE	GW DEPTH	GW ELEV	INTAKE
07/02/91	8.54 PVC	258.66	236.80 - 246.80

	CASING	SAMPLE	TUBE	CORE
TYPE	ODEX	SS		
DIAM.	5"	2" OD		
WEIGHT		140 lbs.		
FALL		30"		

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	UNIFIED	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS: MI
		S-1		12	22.5			Brown, silty topsoil top 6" Brown, fine SAND and SILT, some Gravel Tan, medium to coarse SAND and GRAVEL (last foot)	5.3
		S-2		4	12			Light brown, gray, coarse Gravel and coarse SAND, little fine to medium SAND	8.2
	5	S-3		13	29.5			4'-4'9" brown, coarse, well sorted well Rounded SAND, some medium SAND, little fine SAND 4'9"-5'1" gray, fine SAND and Silt, little coarse SAND and Gravel	15
		S-4		18	28			Brown, medium to coarse SAND	5.1
		S-5		12	18.5				Broken Jar
	10	S-6		18	11			Brown, fine to coarse SAND and Gravel, coarse well sorted, rounded SAND at 11' (13" thick lens)	2.8
		S-7		18	58			Brown, fine to coarse SAND, brown, fine Sand and Silt in last 5" of spoon Top of Bedrock at 12'7"	2.0 Bedrock 12' 7" (Granite)
	15								
	20								
	25								

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BORING/WELL NO. WE-91-2D

SHEET 2 of 2

PROJECT: Bird Property Site
PROJECT NO: 51114.06
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling
RIG: CME-75

GS ELEV: 264.80ft.
N-S COORD:
E-W COORD:

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	UNIFIED	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS MT
								END OF BORING AT 28'	
	30							MT = Microtip reading (total volatile organic vapors, in parts per million)	
	35								
	40								
	45								
	50								
	55								
	60								

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BORING/WELL NO. WE-91-3S

SHEET 1 of

PROJECT: Bird Property Site
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling

PROJECT NO: 51114.06
RIG: CME-75

GS ELEV: 267.50ft.
N-S COORD:
E-W COORD:
ML REF ELEV: PVC 269.50ft
DATE STARTED: 03/12/91
DATE FINISHED: 03/12/91
OPERATOR: C. O'Donnell
GEOLOGIST: R. Wright

GROUNDWATER DATA (feet)			
DATE	GW DEPTH	GW ELEV	INTAKE
07/02/91	10.90 PVC	258.60	252.50 - 262.50

	CASING	SAMPLE	TUBE	CORE
TYPE	ODEX	SS		
DIAM.	5"	2" OD		
WEIGHT		140 lbs.		
FALL		30"		

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS
	5						No samples taken Refer to WE-91-3D	
	10							
	15						END OF BORING AT 14' 9.5"	
	20							
	25							

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BORING/WELL NO. WE-91-3D

SHEET 1 of 2

PROJECT: Bird Property Site
PROJECT NO: 51114.06
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling
RIG: CME-75

GS ELEV: 267.30ft.
N-S COORD:
E-W COORD:
WL REF ELEV: PVC 269.41ft
DATE STARTED: 03/11/91
DATE FINISHED: 03/12/91
OPERATOR: C. O'Donnell
GEOLOGIST: R. Wright

GROUNDWATER DATA (feet)

DATE	GW DEPTH	GW ELEV	INTAKE
07/02/91	10.77	258.64 PVC	236.30 - 246.30

	CASING	SAMPLE	TUBE	CORE
TYPE	ODEX	SS		
DIAM.	5"	2" OD		
WEIGHT		140 lbs.		
FALL		30"		

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	UNIFIED	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS MI	REMARKS Background
		S-1		6	3.0			Loose, brown, fine to coarse SAND, some Gravel, little Silt	17.9	1.3
		S-2		6	1.5			Loose, brown, fine to coarse SAND, trace Gravel	32.4	2.2
	5	S-3		8	4.0			Change at 5' to light gray, medium SAND, some fine SAND, little coarse SAND, wet at 5'6"	31.0	1.2
		S-4		20	23.0			Medium dense, gray, fine to coarse SAND and SILT, some Gravel	30.0	1.0
		S-5		10	27.5			Medium dense, brown-gray, fine to coarse SAND and GRAVEL, some Silt	9.0	0.2
	10	S-6		10	47.5			Dense, brown-gray, fine to coarse SAND, some SILT and Gravel (Till)	7.0	0.0
	15	S-7		2	60.0			Dense, brown-gray GRAVEL, trace fine to coarse SAND	30.0	3.0
	20							Top of Bedrock at 18' (Granite)		
	25									

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BORING/WELL NO. WE-91-30

SHEET 2 of

PROJECT: Bird Property Site
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling

PROJECT NO: 51114.06
RIG: CME-75

GS ELEV: 267.30ft.
N-S COORD:
E-W COORD:

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	UNIFIED	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS MT	Background
	30									
	35							END OF BORING AT 32' 6" MT = Microtip reading (total volatile organic vapors, in parts per million)		
	40									
	45									
	50									
	55									
	60									

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BORING/WELL NO. WE-91-4S

SHEET 1 of 1

PROJECT: Bird Property Site
PROJECT NO: 51114.06
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling
RIG: CME-75

GS ELEV: 261.6ft.
N-S COORD:
E-W COORD:
WL REF ELEV: PVC 263.7ft.
DATE STARTED: 03/14/91
DATE FINISHED: 03/14/91
OPERATOR: C. O'Donnell
GEOLOGIST: R. Wright

GROUNDWATER DATA (feet)

DATE	GW DEPTH	GW ELEV	INTAKE
07/02/91	10.28 PVC	253.42	247.6 - 255.6

	CASING	SAMPLE	TUBE	CORE
TYPE	ODEX	SS		
DIAM.	5"	2" OD		
WEIGHT		140 lbs.		
FALL		30"		

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS
							No samples taken Refer to WE-91-4D	
	5							
	10							
							END OF BORING AT 14'	
	15							
	20							
	25							

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BORING/WELL NO. WE-91-4D

SHEET 1 of 2

PROJECT: Bird Property Site
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling

PROJECT NO: 51114.06
RIG: CME-75

GS ELEV: 262.0ft.
N-S COORD:
E-W COORD:
ML REF ELEV: PVC 263.75ft
DATE STARTED: 03/13/91
DATE FINISHED: 03/13/91
OPERATOR: C. O'Donnell
GEOLOGIST: R. Wright

GROUNDWATER DATA (feet)

DATE	GW DEPTH	GW ELEV	INTAKE
07/02/91	10.32 PVC	253.43	233.5 - 243.5

	CASING	SAMPLE	TUBE	CORE
TYPE	ODEX	SS		
DIAM.	5"	2" OD		
WEIGHT		140 lbs.		
FALL		30"		

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS ML
		S-1		8	4.0		Loose, dark brown, moist, fine SAND and SILT, little medium to coarse SAND, trace Gravel (Topsoil)	0
	5	S-2		10	22.5		Medium dense, brown, wet, fine to coarse SAND and GRAVEL, some SILT	3
	10	S-3		14	15.5		Medium dense, brown, wet, fine to coarse SAND and SILT, little fine Gravel	7
	15	S-4		0	50.0		Top of Bedrock at 15'6" (Granite)	
	20							
	25							

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BORING/WELL NO. WE-91-4D

SHEET 2 of 2

PROJECT: Bird Property Site
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling

PROJECT NO: 51114.06
RIG: CME-75

GS ELEV: 262.0ft.
N-S COORD:
E-W COORD:

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG		FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS MI
	30							END OF BORING AT 32'	
	35							MT = Microtip reading (total volatile organic vapors, in parts per million)	
	40								
	45								
	50								
	55								
	60								

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BORING/WELL NO. WE-91-5S

SHEET 1 of 2

PROJECT: Bird Property Site
PROJECT NO: 51114.06
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling
RIG: CME-75

GS ELEV: 276.4ft.
N-S COORD:
E-W COORD:
WL REF ELEV: PVC 278.23ft
DATE STARTED: 3/26/91
DATE FINISHED: 4/1/91
OPERATOR: C. O'Donnell
GEOLOGIST: R. Wright

GROUNDWATER DATA (feet)

DATE	GW DEPTH	GW ELEV	INTAKE
07/02/91	20.07 PVC	258.16	237.4 - 247.4

	CASING	SAMPLE	TUBE	CORE
TYPE	ODEX	SS		
DIAM.	5"	2" OD		
WEIGHT		140 lbs.		
FALL		30"		

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	UNIFIED	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS
								No samples taken Refer to WE-91-5D	
	5								
	10								
	15	C-1						Granodiorite/Granite	3" casing seated at 15.5'
	20	C-2							
	25	C-3							

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BORING/WELL NO. WE-91-5S

PROJECT: Bird Property Site
PROJECT NO: 51114.06
GS ELEV: 276.4ft.
CLIENT: Mass. Dept. of Environmental Protection
N-S COORD:
CONTRACTOR: Guild Drilling
RIG: CME-75
E-W COORD:

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	UNIFIED	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS
	30	C-4						Vertical Fracture from 30' to 31.5'	
	35								
	40							END OF BORING AT 39.5 FEET	
	45								
	50								
	55								
	60								

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BORING/WELL NO. WE-91-50

SHEET 1 of 4

PROJECT: Bird Property Site
PROJECT NO: 51114.06
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling
RIG: CME-75

GS ELEV: 276.3ft.
N-S COORD:
E-W COORD:
WL REF ELEV: PVC 278.15ft
DATE STARTED: 3/18/91
DATE FINISHED: 3/22/91
OPERATOR: C. O'Donnell
GEOLOGIST: R. Wright

GROUNDWATER DATA (feet)

DATE	GW DEPTH	GW ELEV	INTAKE
07/02/91	20.61 PVC	257.54	184.3 - 194.3

	CASING	SAMPLE	TUBE	CORE
TYPE	ODEX	SS		
DIAM.	5"	2" OD		
WEIGHT		140 lbs.		
FALL		30"		

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS MI
		S-1		10	10.5		Medium dense, tan, medium to coarse SAND, some fine Sand, little Gravel	0
	5						Top of Bedrock at 3' (Granite)	
	10							
	15						Water bearing seam at 17' 8"	
	20							
	25							

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BORING/WELL NO. ME-91-5D

SHEET 2 of 4

PROJECT: Bird Property Site
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling

PROJECT NO: 51114.06
RIG: CME-75

GS ELEV: 276.3ft.
N-S COORD:
E-W COORD:

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS MI
	30							
	35						Water bearing seam at 34'	
	40							
	45							
	50							
	55							
	60							

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BORING/WELL NO. WE-91-5D

SHEET 3 of 4

PROJECT: Bird Property Site
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling

PROJECT NO: 51114.06
RIG: CME-75

GS ELEV: 276.3ft.
N-S COORD:
E-W COORD:

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS MI
	65							
	70							
	75							
	80							
	85						Water bearing seam at 87' 8"	
	90							

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BORING/WELL NO. ME-91-5D

SHEET 4 of 4

PROJECT: Bird Property Site
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling

PROJECT NO: 51114.06
RIG: CME-75

GS ELEV: 276.3ft.
N-S COORD:
E-W COORD:

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG		FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS MI
	95							END OF BORING AT 98'	
	100								
	105								
	110								
	115								
	120								

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BORING/WELL NO. ME-91-60

SHEET 1 of

PROJECT: Bird Property Site
PROJECT NO: 51114.06
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling
RIG: CME-75

GS ELEV: 289.10ft.
N-S COORD:
E-W COORD:
ML REF ELEV: PVC 291.32ft
DATE STARTED: 3/25/91
DATE FINISHED: 3/26/91
OPERATOR: C. O'Donnell
GEOLOGIST: R. Wright

GROUNDWATER DATA (feet)

DATE	GW DEPTH	GW ELEV	INTAKE
07/02/91	15.80 PVC	275.52	266.1 - 276.10

	CASING	SAMPLE	TUBE	CORE
TYPE	ODEX	SS		
DIAM.	5"	2" OD		
WEIGHT		140 lbs.		
FALL		30"		

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS
		S-1	X	10			Very dense, orange-brown Silt, trace fine SAND	0
	5						Boulder (1' 1" to 4' 4")	
							Boulder (5' 3" to 7' 6")	
	10						Top of Bedrock at 7'	
							Water yielding seam at 13' 3"	▼
	15							6 min/ft drilling rate below 15'
	20							
	25						END OF BORING AT 23'	

Wehran EnviroTech

BORING/WELL NO. WE-91-7S

SHEET 1 of 1

PROJECT: Bird Property Site
PROJECT NO: 51114.06
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling
RIG: CME-75

GS ELEV: 269.3ft.
N-S COORD:
E-W COORD:
WL REF ELEV: PVC 271.42ft
DATE STARTED: 04/04/91
DATE FINISHED: 04/04/91
OPERATOR: C. O'Donnell
GEOLOGIST: R. Wright

GROUNDWATER DATA (feet)

DATE	GW DEPTH	GW ELEV	INTAKE
07/02/91	12.13 PVC	259.29	252.3 - 261.3

	CASING	SAMPLE	TUBE	CORE
TYPE	ODEX	SS		
DIAM.	5"	2" OD		
WEIGHT		140 lbs.		
FALL		30"		

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS
	5						No samples taken	
	10							
	15						END OF BORING AT 17'	
	20							
	25							

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BORING/WELL NO. WE-91-7D

SHEET 1 of

PROJECT: Bird Property Site
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling

PROJECT NO: 51114.06
RIG: CME-75

GS ELEV: 269.3ft.
N-S COORD:
E-W COORD:
KL REF ELEV: PVC 271.35ft
DATE STARTED: 04/02/91
DATE FINISHED: 04/04/91
OPERATOR: C. O'Donnell
GEOLOGIST: R. Wright

GROUNDWATER DATA (feet)

DATE	GW DEPTH	GW ELEV	INTAKE
07/02/91	11.97 PVC	259.38	235.3 - 245.3

	CASING	SAMPLE	TUBE	CORE
TYPE	ODEX	SS		
DIAM.	5"	2" OD		
WEIGHT		140 lbs.		
FALL		30"		

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	UNIFIED	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS
								No Samples Taken	
								[(Cuttings: coarse SAND and Gravel 0-19')]	
	5								
	10								
	15								
	20							Top of Bedrock at 19' (Granite)	
	25								

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BORING/WELL NO. WE-91-70

SHEET 2 of 2

PROJECT: Bird Property Site
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling

PROJECT NO: 51114.06
RIG: CME-75

GS ELEV: 269.3ft.
N-S COORD:
E-W COORD:

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	UNIFIED	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS
	30								
								END OF BORING AT 34'	
	35								
	40								
	45								
	50								
	55								
	60								

Wehran EnviroTech

BORING/WELL NO. WE-91-BS

SHEET 1 of

PROJECT: Bird Property Site
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling

PROJECT NO: 51114.06
RIG: CME-75

GS ELEV: 267.1ft.
N-S COORD:
E-W COORD:
ML REF ELEV: PVC 269.35ft
DATE STARTED: 04/15/91
DATE FINISHED: 04/15/91
OPERATOR: C. O'Donnell
GEOLOGIST: R. Wright

GROUNDWATER DATA (feet)

DATE	GW DEPTH	GW ELEV	INTAKE
07/02/91	10.86 PVC	258.49	250.1 - 260.1

	CASING	SAMPLE	TUBE	CORE
TYPE	ODEX	SS		
DIAM.	5"	2" OD		
WEIGHT		300 lbs.		
FALL		30"		

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS
	5	S-1		2	NA		Brown, medium to coarse SAND and GRAVEL, little fine Sand	Push sample with 300 lb. hammer
							Boulder (8' 6" to 11')	
	10	S-2			NA		Brown, coarse SAND and GRAVEL, some medium to fine SAND, little Silt	Push sample with 300 lb. hammer
							Boulder (12' 6" to 15')	
	15	S-3			NA		Brown, very coarse SAND and GRAVEL, some fine Sand and Silt	Push sample with 300 lb. hammer
							END OF BORING AT 17'	
	20							
	25							

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BORING/WELL NO. WE-91-80

SHEET 1 of 2

PROJECT: Bird Property Site
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling

PROJECT NO: 51114.06
RIG: CME-75

GS ELEV: 265.77ft.
N-S COORD:
E-W COORD:
ML REF ELEV: 268.18ft.
DATE STARTED: 04/10/91
DATE FINISHED: 04/12/91
OPERATOR: C. O'Donnell
GEOLOGIST: R. Wright

GROUNDWATER DATA (feet)

DATE	GW DEPTH	GW ELEV	INTAKE
07/02/91	9.80 PVC	258.38	215.77 - 225.77

	CASING	SAMPLE	TUBE	CORE
TYPE	ODEX	SS		
DIAM.	5"	2" OD		
HEIGHT		140 lbs.		
FALL		30"		

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS MI
		S-1		6	2.5		Loose, dark brown, some Peat, change to orange-brown SILT, some fine SAND, trace coarse SAND	0ppm
		S-2		14	6.5			3
	5	S-3		21	19		Medium dense, orange-brown, fine SAND, some medium to coarse SAND, little Silt and Gravel	7
		S-4		14	12.5		Medium dense, brown, coarse SAND and GRAVEL, little medium to fine SAND, trace Silt	8
		S-5		16	20.5		Green tint, possibly algae from water moving through Gravel	12
	10	S-6		11	26.5		Medium dense, brown, coarse SAND and GRAVEL, little medium to fine SAND, trace Silt	8
		S-7		19	29.5		Medium dense, brown, coarse SAND and GRAVEL, little medium to fine SAND, trace Silt (orange tint)	10
	15	S-8		10	21		Medium dense, brown, coarse SAND and GRAVEL, little medium to fine SAND, trace Silt Gray-brown Silt lens end of spoon	10
		S-9		14	75		Very dense, gray, coarse SAND and SILT, some medium SAND, little Gravel (Till 16'2")	12
		S-10		0	100/0		No recovery	
	20						Boulder (Granite)	
		S-10		0	100/5		Wash	
	25						Bedrock at 23'9" (Granite)	

Wehran EnviroTech

BORING/WELL NO. WE-91-BD

SHEET 2 of 2

PROJECT: Bird Property Site
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling

PROJECT NO: 51114.06
RIG: CME-75

GS ELEV: 265.77ft.
N-S COORD:
E-W COORD:

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS MI
	30							
	35							
	40							
	45							
	50						END OF BORING AT 51'	
	55							
	60							

MT = Microtip reading (total volatile organic vapors, in parts per million)

Wehran EnviroTech

BORING/WELL NO. WE-91-9S

SHEET 1 of 1

PROJECT: Bird Property Site
PROJECT NO: 51114.06
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling
RIG: CME-75

GS ELEV: 263.5ft.
N-S COORD:
E-W COORD:
ML REF ELEV: PVC 265.96ft
DATE STARTED: 04/18/91
DATE FINISHED: 04/18/91
OPERATOR: C. O'Donnell
GEOLOGIST: R. Wright

GROUNDWATER DATA (feet)

DATE	GW DEPTH	GW ELEV	INTAKE
07/02/91	dry	---	247.5 - 252.5

	CASING	SAMPLE	TUBE	CORE
TYPE	ODEX	SS		
DIAM.	5"	2" OD		
WEIGHT		140 lbs.		
FALL		30"		

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS
	5						Cuttings similar to WE-91-9D	
	10	S-1		12	51		Very dense, tan, fine to coarse SAND, and Gravel	
	15	S-2		12	REF		- TILL - Very dense, gray, fine to coarse SAND and SILT. Some Gravel, little Silt	Top of Bedrock @ 16 below grade
							Bedrock (Granite)	
							END OF BORING AT 16'4"	
	20							
	25							

Wehran EnviroTech

BORING/WELL NO. ME-91-9D

SHEET 1 of

PROJECT: Bird Property Site
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling

PROJECT NO: 51114.06
RIG: CME-75

GS ELEV: 270.9ft.
N-S COORD:
E-W COORD:
ML REF ELEV: PVC 273.14ft
DATE STARTED: 04/15/91
DATE FINISHED: 04/18/91
OPERATOR: C. O'Donnell
GEOLOGIST: R. Wright

GROUNDWATER DATA (feet)

DATE	GW DEPTH	GW ELEV	INTAKE
07/02/91	25.20 PVC	247.94	234.9 - 244.9

	CASING	SAMPLE	TUBE	CORE
TYPE	ODEX	SS		
DIAM.	5"	2" OD		
WEIGHT		140 lbs.		
FALL		30"		

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS HNu
		S-1		9	2		Loose, brown SILT, little fine SAND (Loam)	3 ppm
	5	S-2		14	20.5		Medium dense, tan, medium to coarse SAND, little fine SAND, trace Gravel	0
	10	S-3		12	70.5		Very dense, tan, coarse to fine SAND and GRAVEL	0
	15							
	20	S-4		10	83.5		Very dense, brown, fine to coarse SAND, some fine to coarse Gravel, little SILT	4
	25						Top of Bedrock at 23'7" (Granite)	

Wehran EnviroTech

BORING/WELL NO. WE-91-9D

SHEET 2 of 2

PROJECT: Bird Property Site
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling

PROJECT NO: 51114.06
RIG: CME-75

GS ELEV: 270.9ft.
N-S COORD:
E-W COORD:

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG		FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS HNu
	30								
	35							END OF BORING AT 36'	
	40							HNu = HNu reading (total volatile organic vapors, in parts per million)	
	45								
	50								
	55								
	60								

Wehran EnviroTech

BORING/WELL NO. WE-91-10S

SHEET 1 o

PROJECT: Bird Property Site
PROJECT NO: 51114.06
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling
RIG: CME-75

GS ELEV: 250.9ft.
N-S COORD:
E-W COORD:
WL REF ELEV: PVC 253.23ft
DATE STARTED: 04/25/91
DATE FINISHED: 04/25/91
OPERATOR: C. O'Donnell
GEOLOGIST: R. Augustine

GROUNDWATER DATA (feet)

DATE	GW DEPTH	GW ELEV	INTAKE
07/02/91	12.05 PVC	241.18	235.9 - 245.9

	CASING	SAMPLE	TUBE	CORE
TYPE	ODEX	SS		
DIAM.	5"	2" OD		
WEIGHT		140 lbs.		
FALL		30"		

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS
							No samples taken Refer to WE-91-10D	
	5							
	10						Top of bedrock at 11' (Granite)	
	15						END OF BORING AT 15'	
	20							
	25							

Wehran EnviroTech

BORING/WELL NO.: WE-91-100

SHEET 1 of 2

PROJECT: Bird Property Site
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling

PROJECT NO: 51114.06
RIG: CME-75

GS ELEV: 251.3ft.
N-S COORD:
E-W COORD:
WL REF ELEV: PVC 253.49ft
DATE STARTED: 04/19/91
DATE FINISHED: 04/24/91
OPERATOR: C. O'Donnell
GEOLOGIST: R. Wright

GROUNDWATER DATA (feet)

DATE	GW DEPTH	GW ELEV	INTAKE
07/02/91	12.34 PVC	241.15	213.30 - 223.30

	CASING	SAMPLE	TUBE	CORE
TYPE	ODEX	SS		
DIAM.	5"	2" OD		
WEIGHT		140 lbs.		
FALL		30"		

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE TYPE	RECOVERY (inches)	N-VALUE	LOG	UNIFIED	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS HNu
		S-1		12	4			Loose, orange-borwn SAND, some Silt, Trace fine Sand, organics (Loam)	
	5	S-2		12	46			Medium dense, coarse to fine SAND and GRAVEL, little Silt, tan, fine Sand lens at 6.5'-6.75'	
	10	S-3		6	100/5			Very dense, gray, coarse to fine SAND and GRAVEL, some Silt	
								Top of Bedrock at 11' (weathered Granite)	
	15							TOP OF COMPETENT BEDROCK AT 16' (GRANITE)	
	20								
	25								

Wehran EnviroTech

BORING/WELL NO. WE-91-100

SHEET 2 of

PROJECT: Bird Property Site
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling

PROJECT NO: 51114.06
RIG: CME-75

GS ELEV: 251.3ft.
N-S COORD:
E-W COORD:

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	UNIFIED	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS HNu
	30							Seam at 30 to 30.5'	
	35							Seam at 34-35' Pink cuttings brought up with ODEX System	
	40							END OF BORING AT 39'	
	45								
	50								
	55								
	60								

Wehran EnviroTech

BORING/WELL NO. WE-91-11S

SHEET 1 of 1

PROJECT: Bird Property Site
PROJECT NO: 51114.06
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling
RIG: CME-75

GS ELEV: 247.04ft.
N-S COORD:
E-W COORD:
TOC REF ELEV: PVC 249.22ft
DATE STARTED: 05/03/91
DATE FINISHED: 05/06/91
OPERATOR: C. O'Donnell
GEOLOGIST: R. Wright

GROUNDWATER DATA (feet)

DATE	GW DEPTH	GW ELEV	INTAKE
07/02/91	6.94	242.28	234.54 - 244.54

	CASING	SAMPLE	TUBE	CORE
TYPE	ODEX	SS		
DIAM.	5"	2" OD		
WEIGHT		140 lbs.		
FALL		30"		

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	UNIFIED	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS
								No samples taken Refer to WE-91-11D	
	5								
	10								
	15							END OF BORING AT 17'	Lost ODEX bit in boulder hole caved in - only 12.5' remained open
	20							No ambient VOCs detected with microtip during drilling	
	25								

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BORING/WELL NO. WE-91-11M

SHEET 1 of 2

PROJECT: Bird Property Site
PROJECT NO: 51114.06
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling
RIG: CME-75

GS ELEV: 246.84ft.
N-S COORD:
E-W COORD:
KL REF ELEV: PVC 249.03ft
DATE STARTED: 05/07/91
DATE FINISHED: 05/08/91
OPERATOR: C. O'Donnell
GEOLOGIST: R. Wright

GROUNDWATER DATA (feet)

DATE	GW DEPTH	GW ELEV	INTAKE
07/02/91	6.95 PVC	242.08	203.34 - 213.34

	CASING	SAMPLE	TUBE	CORE
TYPE	ODEX	SS		
DIAM.	5"	2" OD		
WEIGHT		140 lbs.		
FALL		30"		

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS
							No samples taken Refer to WE-91-11D	
	5							
	10							
	15							
							Approximate top of Bedrock (Granite)	17' BG bedrock surface
	20						Water bearing seam at 19'	
	25							

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BORING/WELL NO. WE-91-11M

SHEET 2 of 2

PROJECT: Bird Property Site
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling

PROJECT NO: 51114.06
RIG: CME-75

GS ELEV: 246.84ft.
N-S COORD:
E-W COORD:

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS
	30							
	35							
	40						Water bearing seam at 41'	
							END OF BORING AT 43.5'	
	45						No ambient VOCs detected with microtip during drilling	
	50							
	55							
	60							

Wehran EnviroTech

BORING/WELL NO. WE-91-11D

SHEET 1 o

PROJECT: Bird Property Site
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling

PROJECT NO: 51114.06
RIG: CME-75

GS ELEV: 246.60ft.
N-S COORD:
E-W COORD:
WL REF ELEV: PVC 248.77ft
DATE STARTED: 05/01/91
DATE FINISHED: 05/02/91
OPERATOR: C. O'Donnell
GEOLOGIST: R. Wright

GROUNDWATER DATA (feet)

DATE	GW DEPTH	GW ELEV	INTAKE
07/02/91	6.68 PVC	242.09 PVC	145.60 - 155.60

	CASING	SAMPLE	TUBE	CORE
TYPE	ODEX	SS		
DIAM.	5"	2" OD		
WEIGHT		140 lbs.		
FALL		30"		

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	UNIFIED	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS
		S-1		6	2			Loose, brown, fine SAND and SILT (Loam)	
	5	S-2		16	43			Dense, orange/brown, coarse to medium SAND, little fine Sand	
	10	S-3		12	105			Very dense, gray, coarse to fine SAND and GRAVEL, little Silt	
								Very dense, gray, coarse to fine SAND and GRAVEL, little Silt	
	15	S-4		0	100/2"			Top of Bedrock at 14.5' (Granite)	
	20								
	25								

Wehran EnviroTech

BORING/WELL NO.: WE-91-110

SHEET 2 of 4

PROJECT: Bird Property Site
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling

PROJECT NO: 51114.06
RIG: CME-75

GS ELEV: 246.60ft.
N-S COORD:
E-W COORD:

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	UNIFIED	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS
	30								
	35								
	40								
								Seam (43 to 45')	
	45								
	50								
	55								
	60								

Wehran EnviroTech

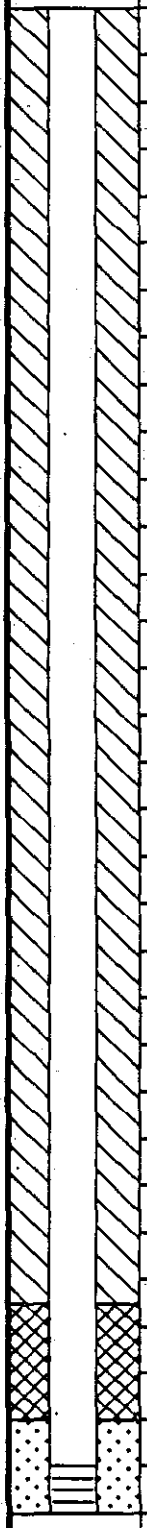
BORING/WELL NO. WE-91-11D

SHEET 3 of

PROJECT: Bird Property Site
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling

PROJECT NO: 51114.06
RIG: CME-75

GS ELEV: 246.60ft.
N-S COORD:
E-W COORD:

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	UNIFIED	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS
	65 70 75 80 85 90								

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BORING/WELL NO. WE-91-11D

PROJECT: Bird Property Site
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling

PROJECT NO: 51114.06
RIG: CME-75

GS ELEV: 246.60ft.
N-S COORD:
E-W COORD:

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	UNIFIED	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS
	95							Seam (97.5 to 103')	
	100								
	105							END OF BORING AT 104'	
	110								
	115								
	120								

Wehran EnviroTech

BORING/WELL NO. ME-91-12S

SHEET 1 of 1

PROJECT: Bird Property Site
PROJECT NO: 51114.06
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling
RIG: CME-75

GS ELEV: 283.5ft.
N-S COORD:
E-W COORD:
TOC REF ELEV: PVC 286.07ft
DATE STARTED: 05/15/91
DATE FINISHED: 05/15/91
OPERATOR: C. O'Donnell
GEOLOGIST: R. Wright

GROUNDWATER DATA (feet)

DATE	GW DEPTH	GW ELEV	INTAKE
07/02/91	dry	---	264 - 274

	CASING	SAMPLE	TUBE	CORE
TYPE	ODEX	SS		
DIAM.	5"	2" OD		
WEIGHT		140 lbs.		
FALL		30"		

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	UNIFIED	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS
								No samples taken	
	5							(Cuttings: Ten, fine to medium SAND to top of Boulder)	
	10								
	15							Boulder from 14' to 18' below grade	
	20							END OF BORING AT 19.5'	Approx. Bedrock surface 20'B.G.
	25								

Wehran EnviroTech

BORING/WELL NO. WE-91-12D

SHEET 1 of 2

PROJECT: Bird Property Site
PROJECT NO: 51114.06
CLIENT: Mass. Dept. of Environmental Protection
CONTRACTOR: Guild Drilling
RIG: CME-75

GS ELEV: 283.6ft.
N-S COORD:
E-W COORD:
TOC REF ELEV: PVC 286.07ft
DATE STARTED: 05/16/91
DATE FINISHED: 05/16/91
OPERATOR: C. O'Donnell
GEOLOGIST: R. Wright

GROUNDWATER DATA (feet)

DATE	GW DEPTH	GW ELEV	INTAKE
07/02/91	23.35 PVC	262.72	249.6 - 259.6

	CASING	SAMPLE	TUBE	CORE
TYPE	ODEX	SS		
DIAM.	5"	2" OD		
WEIGHT		140 lbs.		
FALL		30"		

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	UNIFIED	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS
								No samples taken Refer to WE-91-12S.	
	5								
	10								
	15							Approximate top of Bedrock surface	17' B.G. bedrock surface
	20								
	25								

Wehran EnviroTech

BORING/WELL NO. WE-91-120

SHEET 2 of 2

PROJECT: Bird Property Site
PROJECT NO: 51114.06
GS ELEV: 283.6ft.
CLIENT: Mass. Dept. of Environmental Protection
N-S COORD:
CONTRACTOR: Guild Drilling
RIG: CME-75
E-W COORD:

WELL CONSTRUCT	DEPTH (feet)	SAMPLE NUMBER	SAMPLE & TYPE	RECOVERY (inches)	N-VALUE	LOG	UNIFIED	FIELD DESCRIPTION (Modified Burmister Methodology)	REMARKS
	30							END OF BORING AT 34'	
	35							No ambient VOCs detected during drilling GC detected several compounds, "unknown" identification	
	40								
	45								
	50								
	55								
	60								

COLER & COLANTONIO INC
ENGINEERS AND SCIENTISTS

TEST PIT LOG

Test Pit ID No.: TP - 101
Page: 1 of 1

Client: R & C Trust and C & R Trust
Site: Bird Property
Date: October 5, 2004
Weather: sunny 55°
Equipment: Thermo 580B PID
GW Depth: not encountered

Project: 11-1113.10
Site Location: Marshall Street, Holliston, MA
Field Personnel: Bill Hoyerman & Lauren Gervais
Contractor: Northeast Tank

DEPTH (ft.)	Classification	SAMPLE ID	SAMPLE Depth (ft.)	SAMPLE Tests	PID READINGS TOV FS	PID READINGS TOV HST
	dry sand & gravel mixed with loam - FILL	TP - 101 (0-2)	0' - 2'	TPH, RCRA 8 metals, PCBs, cyanide, sulfide, pH, & flash point		1.2
1	sand & silt intermixed with burnt construction debris: glass, aluminum gas tank, wood, asphalt shingles, hoses, tires, metal, & cobbles - FILL					
2						
	native soils: light to medium brown, moist, fine to coarse sand & gravel - TILL	TP - 101 (2)	2	8260 VOCs		0.8
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						

NOTES:

PIT DIMENSIONS (FT):

LENGTH: 15
WIDTH: 4
HEIGHT: 6

COLER & COLANTONIO INC
ENGINEERS AND SCIENTISTS

TEST PIT LOG

Test Pit ID No.: TP - 102
Page: 1 of 1

Client: R & C Trust and C & R Trust
Site: Bird Property
Date: October 5, 2004
Weather: sunny 55°
Equipment: Thermo 580B PID
GW Depth: not encountered

Project: 11-1113.10
Site Location: Marshall Street, Holliston, MA
Field Personnel: Bill Hoyerman & Lauren Gervais
Contractor: Northeast Tank

DEPTH (ft.)	Classification	SAMPLE ID	SAMPLE Depth (ft.)	SAMPLE Tests	PID READINGS TOV FS	PID READINGS TOV HST
1	dry sand & gravel mixed with loam - FILL	TP - 102 (0-2)	0' - 2'	TPH & RCRA 8 metals	1	
2	sand & silt intermixed with burnt construction debris: asphalt shingles, tires, cable, fiberglass insulation, & wood - FILL				↓	
3		TP - 102 (3)	3	TPH, RCRA 8 metals, & PCBs	↓	
4	native soils: light to medium brown, moist, fine to coarse sand & gravel - TILL					
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						

NOTES:

PIT DIMENSIONS (FT):

LENGTH: 12
WIDTH: 4
HEIGHT: 6

COLER & COLANTONIO INC
ENGINEERS AND SCIENTISTS

TEST PIT LOG

Test Pit ID No.: TP - 103
Page: 1 of 1

Client:	R & C Trust and C & R Trust	**Project:**	11-1113.10
Site:	Bird Property	**Site Location:**	Marshall Street, Holliston, MA
Date:	October 5, 2004	**Field Personnel:**	Bill Hoyerman & Lauren Gervais
Weather:	sunny 55°	**Contractor:**	Northeast Tank
Equipment:	Thermo 580B PID		
GW Depth:	not encountered		

DEPTH (ft.)	Classification	SAMPLE ID	SAMPLE Depth (ft.)	SAMPLE Tests	PID READINGS TOV FS	PID READINGS TOV HST
1	dry sand & gravel mixed with loam - FILL					
2	sand & silt intermixed with burnt construction debris: pipes, rocks, steel, radiators, carpet, metal, bricks, wires, & wood - FILL	TP - 103 (1 - 12)	1' - 12'	TPH, RCRA 8 metals, PCBs, BNAs, pesticides, herbicides, cyanide, sulfide, pH, flash point, & asbestos	1	
3						
4						
5						
6						
7						
8						
9						
10		TP - 103 (10)	10'	8260 VOCs		
11						
12	native soils: light to medium brown, moist, fine to coarse sand & gravel - TILL					
13						
14						
15						
16						
17						
18						

NOTES:

PIT DIMENSIONS (FT):

LENGTH: 20

WIDTH: 4

HEIGHT: 12

COLER & COLANTONIO INC
ENGINEERS AND SCIENTISTS

TEST PIT LOG

Test Pit ID No.: TP - 104
Page: 1 of 1

Client: R & C Trust and C & R Trust
Site: Bird Property
Date: October 5, 2004
Weather: sunny 60°
Equipment: Thermo 580B PID
GW Depth: not encountered

Project: 11-1113.10
Site Location: Marshall Street, Holliston, MA
Field Personnel: Bill Hoyerman & Lauren Gervais
Contractor: Northeast Tank

DEPTH (ft.)	Classification	SAMPLE ID	SAMPLE Depth (ft.)	SAMPLE Tests	PID READINGS TOV FS	PID READINGS TOV HST
1	dry sand & gravel mixed with loam - FILL	TP - 104 (0-12)	0' - 12'	TPH, RCRA 8 metals, & asbestos	0	
2	sand & silt intermixed with burnt construction debris: tires, brick, concrete, metal, & wood - FILL					
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16	native soils: light to medium brown, moist, fine to coarse sand & gravel - TILL					
17						
18						

NOTES:

PIT DIMENSIONS (FT):

LENGTH: 20
WIDTH: 4
HEIGHT: 18

COLER & COLANTONIO INC
ENGINEERS AND SCIENTISTS

TEST PIT LOG

Test Pit ID No.: TP - 105
Page: 1 of 1

Client: R & C Trust and C & R Trust
Site: Bird Property
Date: October 5, 2004
Weather: sunny 60°
Equipment: Thermo 580B PID
GW Depth: not encountered

Project: 11-1113.10
Site Location: Marshall Street, Holliston, MA
Field Personnel: Bill Hoyerman & Lauren Gervais
Contractor: Northeast Tank

DEPTH (ft.)	Classification	SAMPLE ID	SAMPLE Depth (ft.)	SAMPLE Tests	PID READINGS TOV FS	PID READINGS TOV HST
	dry sand & gravel mixed with loam - FILL	TP - 105 (0-14)	0' - 14'	TPH, RCRA 8 metals, PCBs, BNAs, pesticides, herbicides, cyanide, sulfide, pH, flash point, & asbestos	<2	
1						
2						
3						
4						
5						
6	sand & silt intermixed with burnt construction debris: tires, brick, concrete, metal, & wood - FILL					
7						
8						
9						
10						
11						
12						
13						
		TP - 105 (14)	14'	8260 VOCs		
14	native soils (starting depth varies 10' - 14'): light to medium brown, moist, fine to coarse sand & gravel - TILL					
15						
16						
17						
18						

NOTES:

PIT DIMENSIONS (FT):

LENGTH: 25
WIDTH: 4
HEIGHT: 17

COLER & COLANTONIO INC
ENGINEERS AND SCIENTISTS

TEST PIT LOG

Test Pit ID No.: TP - 106
Page: 1 of 1

Client: R & C Trust and C & R Trust
Site: Bird Property
Date: October 5, 2004
Weather: sunny 60°
Equipment: Thermo 580B PID
GW Depth: not encountered

Project: 11-1113.10
Site Location: Marshall Street, Holliston, MA
Field Personnel: Bill Hoyerman & Lauren Gervais
Contractor: Northeast Tank

DEPTH (ft.)	Classification	SAMPLE ID	SAMPLE Depth (ft.)	SAMPLE Tests	PID READINGS TOV FS	PID READINGS TOV HST
	minimal dry sand & gravel mixed with loam - FILL	TP - 106 (0-4)	0' - 4'	TPH, RCRA 8 metals, & asbestos	0	
1						
	sand & silt intermixed with surface & subsurface construction debris: tires, brick, concrete, metal, broken asphalt, & wood - FILL				↓	
2						
3	native soils (starting depth varies 3' - 4'): light to medium brown, moist, fine to coarse sand & gravel - TILL					
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						

NOTES:

PIT DIMENSIONS (FT):

LENGTH: 6
WIDTH: 4
HEIGHT: 4

COLER & COLANTONIO INC
ENGINEERS AND SCIENTISTS

TEST PIT LOG

Test Pit ID No.: TP - 107
Page: 1 of 1

Client: R & C Trust and C & R Trust
Site: Bird Property
Date: October 5, 2004
Weather: sunny 60°
Equipment: Thermo 580B PID
GW Depth: not encountered

Project: 11-1113.10
Site Location: Marshall Street, Holliston, MA
Field Personnel: Bill Hoyerman & Lauren Gervais
Contractor: Northeast Tank

DEPTH (ft.)	Classification	SAMPLE ID	SAMPLE Depth (ft.)	SAMPLE Tests	PID READINGS TOV FS	PID READINGS TOV HST
	leaf litter & organic topsoil	TP - 107 (0-2)	0' - 2'	TPH, RCRA 8 metals, & asbestos	0	
1	native soils: light to medium brown, moist, fine to coarse sand & gravel, some cobbles - TILL				↓	
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						

NOTES:

PIT DIMENSIONS (FT):

LENGTH: 4
WIDTH: 4
HEIGHT: 2

COLER & COLANTONIO INC
ENGINEERS AND SCIENTISTS

TEST PIT LOG

Test Pit ID No.: TP - 108
Page: 1 of 1

Client: R & C Trust and C & R Trust
Site: Bird Property
Date: October 5, 2004
Weather: sunny 60°
Equipment: Thermo 580B PID
GW Depth: not encountered

Project: 11-1113.10
Site Location: Marshall Street, Holliston, MA
Field Personnel: Bill Hoyerman & Lauren Gervais
Contractor: Northeast Tank

DEPTH (ft.)	Classification	SAMPLE ID	SAMPLE Depth (ft.)	SAMPLE Tests	PID READINGS TOV FS	PID READINGS TOV HST
	leaf litter & organic topsoil	TP - 108 (0-2)	0' - 2'	TPH & RCRA 8 metals	0	
1	native soils: light to medium brown, moist, fine to coarse sand & gravel, some cobbles - TILL					
		TP - 108 (2)	2'	8260 VOCs	↓	
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						

NOTES: Near Gasoline Tanks

PIT DIMENSIONS (FT):

LENGTH: 4
WIDTH: 4
HEIGHT: 2

COLER & COLANTONIO INC
ENGINEERS AND SCIENTISTS

TEST PIT LOG

Test Pit ID No.: TP - 109
Page: 1 of 1

Client: R & C Trust and C & R Trust
Site: Bird Property
Date: October 5, 2004
Weather: sunny 60°
Equipment: Thermo 580B PID
GW Depth: not encountered

Project: 11-1113.10
Site Location: Marshall Street, Holliston, MA
Field Personnel: Bill Hoyerman & Lauren Gervais
Contractor: Northeast Tank

DEPTH (ft.)	Classification	SAMPLE ID	SAMPLE Depth (ft.)	SAMPLE Tests	PID READINGS TOV FS	PID READINGS TOV HST
1	sand & silt intermixed with construction debris: tires, brick, concrete, metal, & wood - FILL	TP - 109 (0-2)	0' - 2'	TPH, RCRA 8 metals, & asbestos	0	
2						
3	native soils: light to medium brown, moist, fine to coarse sand & gravel - TILL					
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						

NOTES:

PIT DIMENSIONS (FT):

LENGTH: 4
WIDTH: 4
HEIGHT: 4

COLER & COLANTONIO INC
ENGINEERS AND SCIENTISTS

TEST PIT LOG

Test Pit ID No.: TP - 110
Page: 1 of 1

Client: R & C Trust and C & R Trust
Site: Bird Property
Date: October 5, 2004
Weather: sunny 60°
Equipment: Thermo 580B PID
GW Depth: not encountered

Project: 11-1113.10
Site Location: Marshall Street, Holliston, MA
Field Personnel: Bill Hoyerman & Lauren Gervais
Contractor: Northeast Tank

DEPTH (ft.)	Classification	SAMPLE ID	SAMPLE Depth (ft.)	SAMPLE Tests	PID READINGS TOV FS	PID READINGS TOV HST
1	dry sand & gravel mixed with loam - FILL	TP - 110 (1-12)	1' - 12'	TPH, RCRA 8 metals, PCBs, BNAs, pesticides, herbicides, cyanide, sulfide, pH, flash point, & asbestos	0	
2						
3						
4						
5						
6						
7	sand & silt intermixed with construction debris: tires, brick, concrete, metal, & wood - FILL					
8						
9						
10						
11						
12		TP - 110 (12)	12'	8260 VOCs		
13						
14						
15						
16						
17						
18						

NOTE: Native Soils were observed under the road to depth (12'). Edge of FILL Material is edge of dirt road.

NOTES:
TP - 110 is located on edge of the road at the top of the fill area. Native soil is continuous beneath the road.

PIT DIMENSIONS (FT):

LENGTH: 15
WIDTH: 4
HEIGHT: 12

COLER & COLANTONIO INC
ENGINEERS AND SCIENTISTS

TEST PIT LOG

Test Pit ID No.: TP - 111
Page: 1 of 1

Client: R & C Trust and C & R Trust
Site: Bird Property
Date: October 5, 2004
Weather: sunny 55°
Equipment: Thermo 580B PID
GW Depth: not encountered

Project: 11-1113.10
Site Location: Marshall Street, Holliston, MA
Field Personnel: Bill Hoyerman & Lauren Gervais
Contractor: Northeast Tank

DEPTH (ft.)	Classification	SAMPLE ID	SAMPLE Depth (ft.)	SAMPLE Tests	PID READINGS TOV FS	PID READINGS TOV HST
1	sand & silt intermixed with surficial construction debris: tires, brick, concrete, metal, 5 gallon bucket, & wood - FILL	TP - 111 (0-4)	0' - 4'	TPH, RCRA 8 metals, PCBs, & asbestos	0	
2	native soils: light to medium brown, moist, fine to coarse sand & gravel - TILL					
3						
4		TP - 111 (4)	4'	8260 VOCs		
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						

NOTES:

PIT DIMENSIONS (FT):

LENGTH: 18
WIDTH: 4
HEIGHT: 4

COLER & COLANTONIO INC
ENGINEERS AND SCIENTISTS

TEST PIT LOG

Test Pit ID No.: TP - 112
Page: 1 of 1

Client: R & C Trust and C & R Trust
Site: Bird Property
Date: October 5, 2004
Weather: sunny 60°
Equipment: Thermo 580B PID
GW Depth: not encountered

Project: 11-1113.10
Site Location: Marshall Street, Holliston, MA
Field Personnel: Bill Hoyerman & Lauren Gervais
Contractor: Northeast Tank

DEPTH (ft.)	Classification	SAMPLE ID	SAMPLE Depth (ft.)	SAMPLE Tests	PID READINGS TOV FS	PID READINGS TOV HST
1	sand & silt intermixed with construction debris: tires, brick, concrete, metal, & wood - FILL				0	
2						
3						
4						
5						
6						
7	native soils: light to medium brown, moist, fine to coarse sand & gravel - TILL					
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						

NOTES:

PIT DIMENSIONS (FT):

LENGTH: 10
WIDTH: 4
HEIGHT: 8

COLER & COLANTONIO INC
ENGINEERS AND SCIENTISTS

TEST PIT LOG

Test Pit ID No.: TP - 113
Page: 1 of 1

Client: R & C Trust and C & R Trust
Site: Bird Property
Date: October 6, 2004
Weather: sunny 40°
Equipment: Thermo 580B PID
GW Depth: not encountered

Project: 11-1113.10
Site Location: Marshall Street, Holliston, MA
Field Personnel: Bill Hoyerman & Lauren Gervais
Contractor: Northeast Tank

DEPTH (ft.)	Classification	SAMPLE ID	SAMPLE Depth (ft.)	SAMPLE Tests	PID READINGS TOV FS	PID READINGS TOV HST
1	sand & silt intermixed with construction debris: tires, brick, concrete, metal, & wood - FILL	TP - 113 (0-6)	0' - 6'	TPH, RCRA 8 metals, PCBs, BNAs, pesticides, herbicides, cyanide, sulfide, pH, flash point, & asbestos	0.1	
2						
3						
4						
5						
6	native soils: light to medium brown, moist, fine to coarse sand, silt, & gravel - TILL	TP - 113 (6)	6'	8260 VOCs		
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						

NOTES:

PIT DIMENSIONS (FT):

LENGTH: 15
WIDTH: 4
HEIGHT: 6

COLER & COLANTONIO INC
ENGINEERS AND SCIENTISTS

TEST PIT LOG

Test Pit ID No.: TP - 114
Page: 1 of 1

Client: R & C Trust and C & R Trust
Site: Bird Property
Date: October 6, 2004
Weather: sunny 40°
Equipment: Thermo 580B PID
GW Depth: not encountered

Project: 11-1113.10
Site Location: Marshall Street, Holliston, MA
Field Personnel: Bill Hoyerman & Lauren Gervais
Contractor: Northeast Tank

DEPTH (ft.)	Classification	SAMPLE ID	SAMPLE Depth (ft.)	SAMPLE Tests	PID READINGS TOV FS	PID READINGS TOV HST
1	sand & silt intermixed with burnt construction debris: tires, brick, concrete, metal, & wood - FILL	TP - 114 (0-3)	0' - 3'	TPH, RCRA 8 metals, & asbestos	0.4 - 0.8	
2						
3	native soils: light to medium brown, moist, fine to coarse sand & gravel - TILL	TP - 114 (3)	3'	8260 VOCs		
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						

NOTES: VOCs were collected proximal to gas tanks

PIT DIMENSIONS (FT):

LENGTH: 20
WIDTH: 4
HEIGHT: 4

COLER & COLANTONIO INC
ENGINEERS AND SCIENTISTS

TEST PIT LOG

Test Pit ID No.: TP - 115
Page: 1 of 1

Client: R & C Trust and C & R Trust
Site: Bird Property
Date: October 6, 2004
Weather: sunny 45°
Equipment: Thermo 580B PID
GW Depth: not encountered

Project: 11-1113.10
Site Location: Marshall Street, Holliston, MA
Field Personnel: Bill Hoyerman & Lauren Gervais
Contractor: Northeast Tank

DEPTH (ft.)	Classification	SAMPLE ID	SAMPLE Depth (ft.)	SAMPLE Tests	PID READINGS TOV FS	PID READINGS TOV HST
	~ 2" of organic topsoil	TP - 115 (0-1)	0' - 1'	TPH & RCRA 8 metals	<1.1	
1	native soils: light to medium brown, moist, fine to coarse sand, silt, & gravel - TILL					
		TP - 115 (1)	1'	8260 VOCs		
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						

NOTES: 15' from presumed tank

PIT DIMENSIONS (FT):

LENGTH: 30
WIDTH: 4
HEIGHT: 1

COLER & COLANTONIO INC
ENGINEERS AND SCIENTISTS

TEST PIT LOG

Test Pit ID No.: TP - 116
Page: 1 of 1

Client: R & C Trust and C & R Trust
Site: Bird Property
Date: October 6, 2004
Weather: sunny 50°
Equipment: Thermo 580B PID
GW Depth: not encountered

Project: 11-1113.10
Site Location: Marshall Street, Holliston, MA
Field Personnel: Bill Hoyerman & Lauren Gervais
Contractor: Northeast Tank

DEPTH (ft.)	Classification	SAMPLE ID	SAMPLE Depth (ft.)	SAMPLE Tests	PID READINGS TOV FS	PID READINGS TOV HST
1	sand & silt intermixed with surficial construction debris: pipe, brick, concrete, metal, asphalt shingles, & painted wood - FILL	TP - 116 (0-1)	0' - 1'	TPH, RCRA 8 metals, & asbestos	1.1	
2	native soils: light to medium brown, moist, fine to coarse sand & gravel - TILL	TP - 116 (1)	1'	8260 VOCs		
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						

NOTES:

PIT DIMENSIONS (FT):

LENGTH: 5
WIDTH: 4
HEIGHT: 1

COLER & COLANTONIO INC
ENGINEERS AND SCIENTISTS

TEST PIT LOG

Test Pit ID No.: TP - 117
Page: 1 of 1

Client: R & C Trust and C & R Trust
Site: Bird Property
Date: October 6, 2004
Weather: sunny 55°
Equipment: Thermo 580B PID
GW Depth: not encountered

Project: 11-1113.10
Site Location: Marshall Street, Holliston, MA
Field Personnel: Bill Hoyerman & Lauren Gervais
Contractor: Northeast Tank

DEPTH (ft.)	Classification	SAMPLE ID	SAMPLE Depth (ft.)	SAMPLE Tests	PID READINGS TOV FS	PID READINGS TOV HST
1	native soils: light to medium brown, moist, fine to coarse sand, silt, & gravel, some cobbles - TILL - tire pieces on surface	TP - 117 (1)	1'	8260 VOCs	0.8 - 0.9	
2		TP - 117 (0-1)	0' - 1'	TPH, RCRA 8 metals, PCBs, pesticides, herbicides, cyanide, sulfide, pH, flash point, & asbestos		
3						
4						
5						
6						
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10						
11						
12						
13						
14						
15						
16						
17						
18						

NOTES: near shreaded tire pile

PIT DIMENSIONS (FT):

LENGTH: 15
WIDTH: 4
HEIGHT: 1

COLER & COLANTONIO INC
ENGINEERS AND SCIENTISTS

TEST PIT LOG

Test Pit ID No.: TP - 118
Page: 1 of 1

Client: R & C Trust and C & R Trust
Site: Bird Property
Date: October 6, 2004
Weather: sunny 55°
Equipment: Thermo 580B PID
GW Depth: not encountered

Project: 11-1113.10
Site Location: Marshall Street, Holliston, MA
Field Personnel: Bill Hoyerman & Lauren Gervais
Contractor: Northeast Tank

DEPTH (ft.)	Classification	SAMPLE ID	SAMPLE Depth (ft.)	SAMPLE Tests	PID READINGS TOV FS	PID READINGS TOV HST
1	sand & silt intermixed with surficial construction debris: pipe, brick, concrete, metal, & wood - FILL	TP - 118 (0-3)	0' - 3'	TPH, RCRA 8 metals, PCBs, pesticides, herbicides, cyanide, sulfide, pH, flash point, & asbestos	0.8 - 0.9	
2	native soils: light to medium brown, moist, fine to coarse sand & gravel - TILL					
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						

NOTES:

PIT DIMENSIONS (FT):

LENGTH: 7
WIDTH: 4
HEIGHT: 3

COLER & COLANTONIO INC
ENGINEERS AND SCIENTISTS

TEST PIT LOG

Test Pit ID No.: TP - 119
Page: 1 of 1

Client: R & C Trust and C & R Trust
Site: Bird Property
Date: October 6, 2004
Weather: sunny 55°
Equipment: Thermo 580B PID
GW Depth: not encountered

Project: 11-1113.10
Site Location: Marshall Street, Holliston, MA
Field Personnel: Bill Hoyerman & Lauren Gervais
Contractor: Northeast Tank

DEPTH (ft.)	Classification	SAMPLE ID	SAMPLE Depth (ft.)	SAMPLE Tests	PID READINGS TOV FS	PID READINGS TOV HST
1	sand & silt intermixed with surficial construction debris: pipe, brick, concrete, metal, PVC, & wood - FILL	TP - 119 (6")	6"	8260 VOCs	0.6 - 0.8	
2	native soils: light to medium brown, moist, fine to coarse sand & gravel - TILL	TP - 116 (0-1)	0' - 1'	TPH, RCRA 8 metals, PCBs, pesticides, & herbicides		
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						

NOTES: Near 13 drums in various states of disrepair (holes & rust)

PIT DIMENSIONS (FT):

LENGTH: 10
WIDTH: 4
HEIGHT: 1

COLER & COLANTONIO INC
ENGINEERS AND SCIENTISTS

TEST PIT LOG

Test Pit ID No.: TP - 120
Page: 1 of 1

Client: R & C Trust and C & R Trust
Site: Bird Property
Date: October 6, 2004
Weather: sunny 60°
Equipment: Thermo 580B PID
GW Depth: not encountered

Project: 11-1113.10
Site Location: Marshall Street, Holliston, MA
Field Personnel: Bill Hoyerman & Lauren Gervais
Contractor: Northeast Tank

DEPTH (ft.)	Classification	SAMPLE ID	SAMPLE Depth (ft.)	SAMPLE Tests	PID READINGS TOV FS	PID READINGS TOV HST
1	native soils: light to medium brown, moist, fine to coarse sand, silt, & gravel, some cobbles - TILL	TP - 117 (0-2)	0' - 2'	TPH, RCRA 8 metals, & asbestos	< 0.9	
2		TP - 117 (2)	2'	8260 VOCs		
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						

NOTES: VOC sample taken from south side of TP-120

PIT DIMENSIONS (FT):

LENGTH: 30
WIDTH: 4
HEIGHT: 2

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

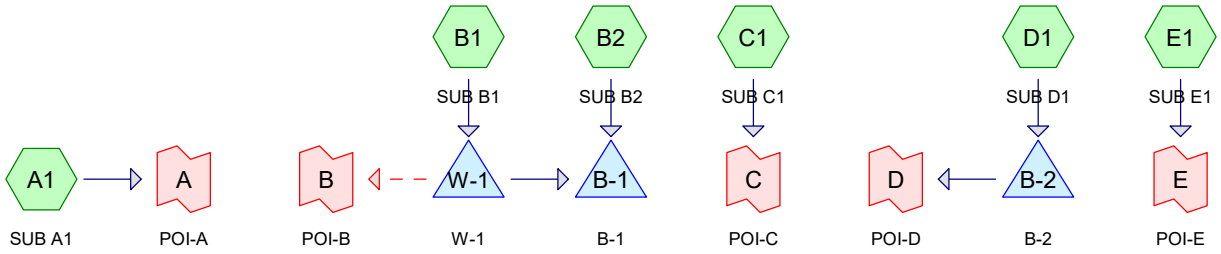
Component Percent Cutoff: None Specified

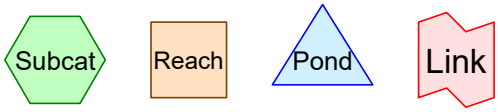
Tie-break Rule: Higher

Attachment C - HydroCAD Reports

Sunraise Solar Facility
Holliston, MA
Stormwater Discharge Summary Table

		Peak Discharge (cfs)	
Analysis Point	**24 Hr Storm**	**Pre-Development**	**Post-Development**
A	2yr	4.32	2.69
	10yr	11.19	5.47
	25yr	15.98	11.61
	100yr	23.88	15.69
B	2yr	0.00	0.00
	10yr	0.00	0.00
	25yr	0.00	0.00
	100yr	0.00	0.00
C	2yr	3.02	0.32
	10yr	7.77	0.73
	25yr	11.09	1.01
	100yr	16.51	1.46
D	2yr	0.00	0.00
	10yr	0.00	0.00
	25yr	0.00	0.00
	100yr	0.00	0.00
E	2yr	4.96	0.60
	10yr	12.80	1.38
	25yr	18.38	1.90
	100yr	27.37	2.74





Routing Diagram for HydroCAD-EX
Prepared by Weston & Sampson, Printed 4/3/2020

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
13,416	72	Dirt roads, HSG A (B1, B2, D1)
1,200	98	Roofs, HSG A (D1)
11,959	98	Water Surface, HSG A (B1)
605,758	30	Woods, Good, HSG A (A1, B1, B2, D1)
915,178	70	Woods, Good, HSG C (A1, B1, C1, E1)
53,332	32	Woods/grass comb., Good, HSG A (D1)
1,600,843	**54**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
685,665	HSG A	A1, B1, B2, D1
0	HSG B	
915,178	HSG C	A1, B1, C1, E1
0	HSG D	
0	Other	
1,600,843		**TOTAL AREA**

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	S N
13,416	0	0	0	0	13,416	Dirt roads	
1,200	0	0	0	0	1,200	Roofs	
11,959	0	0	0	0	11,959	Water Surface	
605,758	0	915,178	0	0	1,520,936	Woods, Good	
53,332	0	0	0	0	53,332	Woods/grass comb., Good	
685,665	**0**	**915,178**	**0**	**0**	**1,600,843**	**TOTAL AREA**	

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A1: SUB A1 Runoff Area=503,839 sf 0.00% Impervious Runoff Depth=0.50"
Flow Length=640' Tc=18.2 min CN=WQ Runoff=4.32 cfs 21,191 cf

Subcatchment B1: SUB B1 Runoff Area=332,199 sf 3.60% Impervious Runoff Depth=0.52"
Flow Length=1,115' Tc=22.4 min CN=WQ Runoff=2.71 cfs 14,525 cf

Subcatchment B2: SUB B2 Runoff Area=153,061 sf 0.00% Impervious Runoff Depth=0.04"
Flow Length=325' Tc=13.9 min CN=WQ Runoff=0.11 cfs 460 cf

Subcatchment C1: SUB C1 Runoff Area=210,935 sf 0.00% Impervious Runoff Depth=0.94"
Flow Length=450' Tc=24.1 min CN=70 Runoff=3.02 cfs 16,538 cf

Subcatchment D1: SUB D1 Runoff Area=106,782 sf 1.12% Impervious Runoff Depth=0.07"
Flow Length=305' Tc=7.5 min CN=WQ Runoff=0.17 cfs 622 cf

Subcatchment E1: SUB E1 Runoff Area=294,027 sf 0.00% Impervious Runoff Depth=0.94"
Flow Length=602' Tc=15.8 min CN=70 Runoff=4.96 cfs 23,053 cf

Pond B-1: B-1 Peak Elev=259.45' Storage=459 cf Inflow=0.11 cfs 460 cf
Outflow=0.00 cfs 0 cf

Pond B-2: B-2 Peak Elev=268.27' Storage=622 cf Inflow=0.17 cfs 622 cf
Outflow=0.00 cfs 0 cf

Pond W-1: W-1 Peak Elev=263.67' Storage=14,523 cf Inflow=2.71 cfs 14,525 cf
Primary=0.00 cfs 0 cf Secondary=0.00 cfs 0 cf Outflow=0.00 cfs 0 cf

Link A: POI-A Inflow=4.32 cfs 21,191 cf
Primary=4.32 cfs 21,191 cf

Link B: POI-B Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Link C: POI-C Inflow=3.02 cfs 16,538 cf
Primary=3.02 cfs 16,538 cf

Link D: POI-D Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Link E: POI-E Inflow=4.96 cfs 23,053 cf
Primary=4.96 cfs 23,053 cf

Total Runoff Area = 1,600,843 sf Runoff Volume = 76,390 cf Average Runoff Depth = 0.57"
99.18% Pervious = 1,587,684 sf 0.82% Impervious = 13,159 sf

Summary for Subcatchment A1: SUB A1

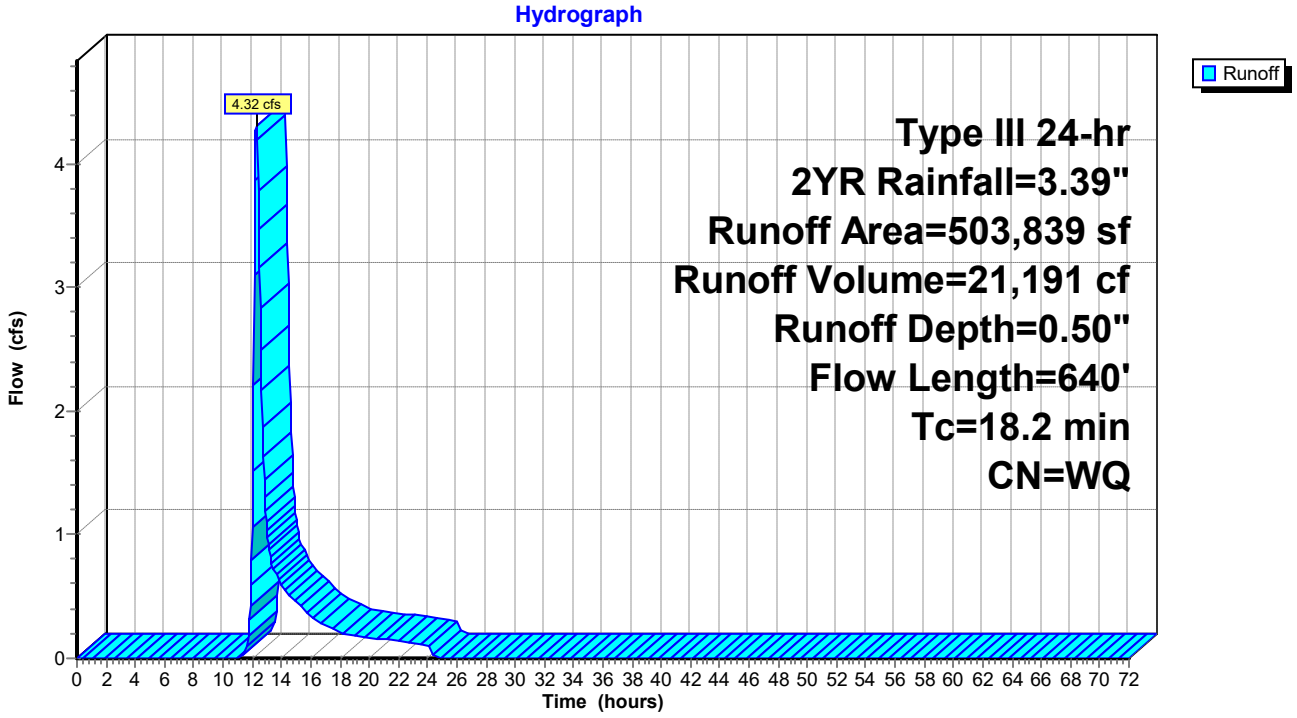
Runoff = 4.32 cfs @ 12.28 hrs, Volume= 21,191 cf, Depth= 0.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR Rainfall=3.39"

Area (sf)	CN	Description
233,563	30	Woods, Good, HSG A
270,276	70	Woods, Good, HSG C
503,839		Weighted Average
503,839		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0	50	0.0800	0.07		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.39"
6.2	590	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.2	640	Total			

Subcatchment A1: SUB A1



Summary for Subcatchment B1: SUB B1

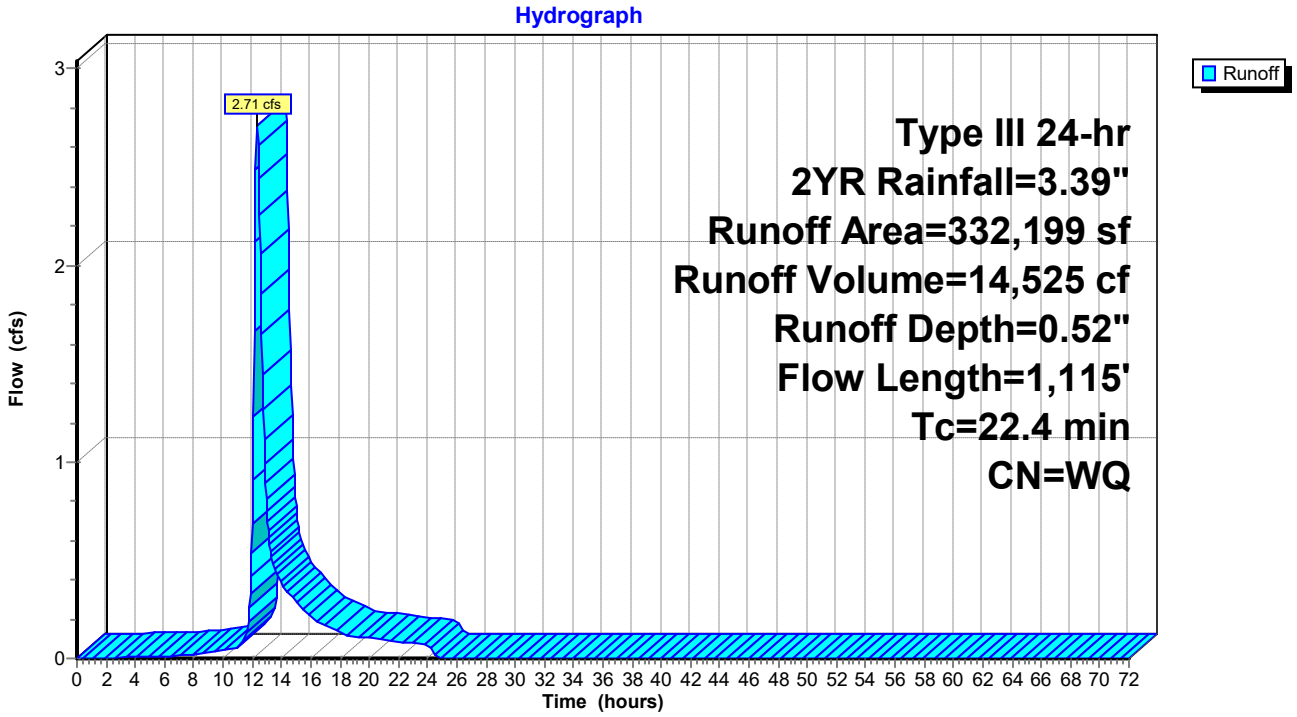
Runoff = 2.71 cfs @ 12.34 hrs, Volume= 14,525 cf, Depth= 0.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR Rainfall=3.39"

	Area (sf)	CN	Description
*	11,959	98	Water Surface, HSG A
	175,644	30	Woods, Good, HSG A
	139,940	70	Woods, Good, HSG C
	4,656	72	Dirt roads, HSG A
	332,199		Weighted Average
	320,240		96.40% Pervious Area
	11,959		3.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	50	0.1800	0.10		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.39"
2.2	270	0.1700	2.06		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.6	163	0.1200	1.73		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
9.9	632	0.0450	1.06		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
22.4	1,115	Total			

Subcatchment B1: SUB B1



Summary for Subcatchment B2: SUB B2

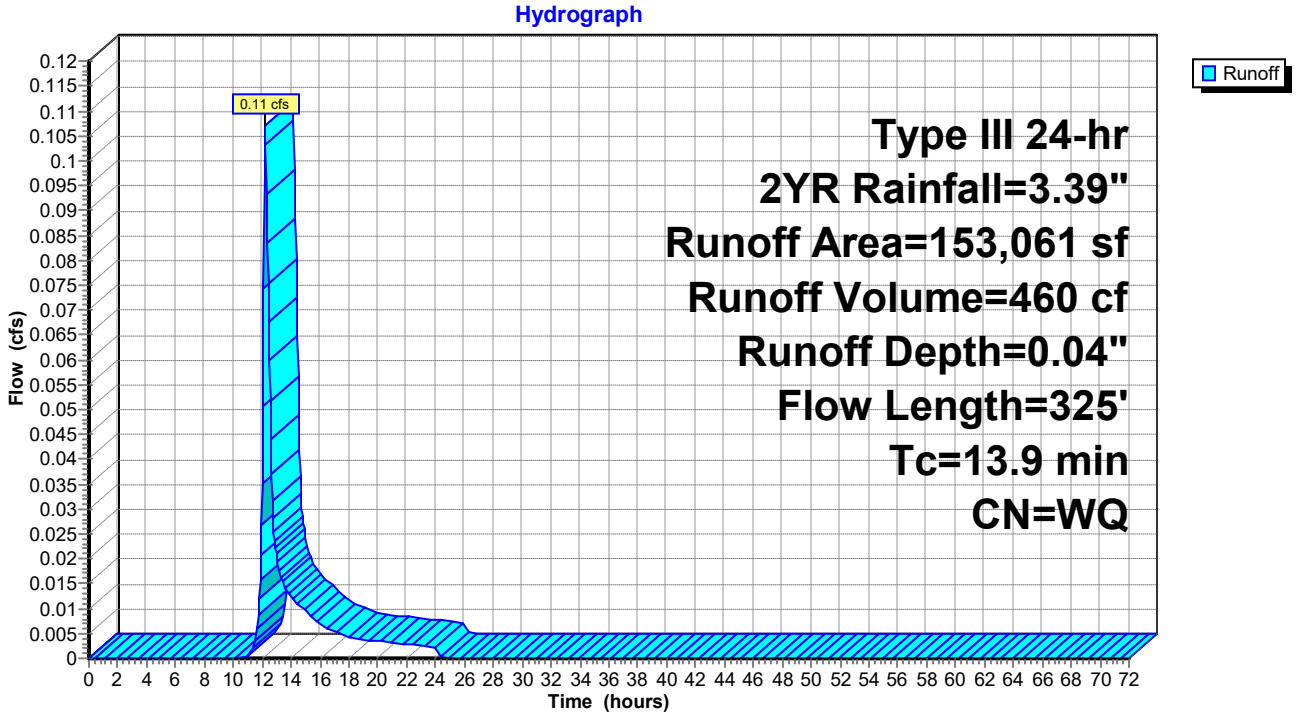
Runoff = 0.11 cfs @ 12.21 hrs, Volume= 460 cf, Depth= 0.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR Rainfall=3.39"

Area (sf)	CN	Description
147,805	30	Woods, Good, HSG A
5,256	72	Dirt roads, HSG A
153,061		Weighted Average
153,061		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	50	0.1600	0.09		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.39"
4.8	275	0.0360	0.95		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.9	325	Total			

Subcatchment B2: SUB B2



Summary for Subcatchment C1: SUB C1

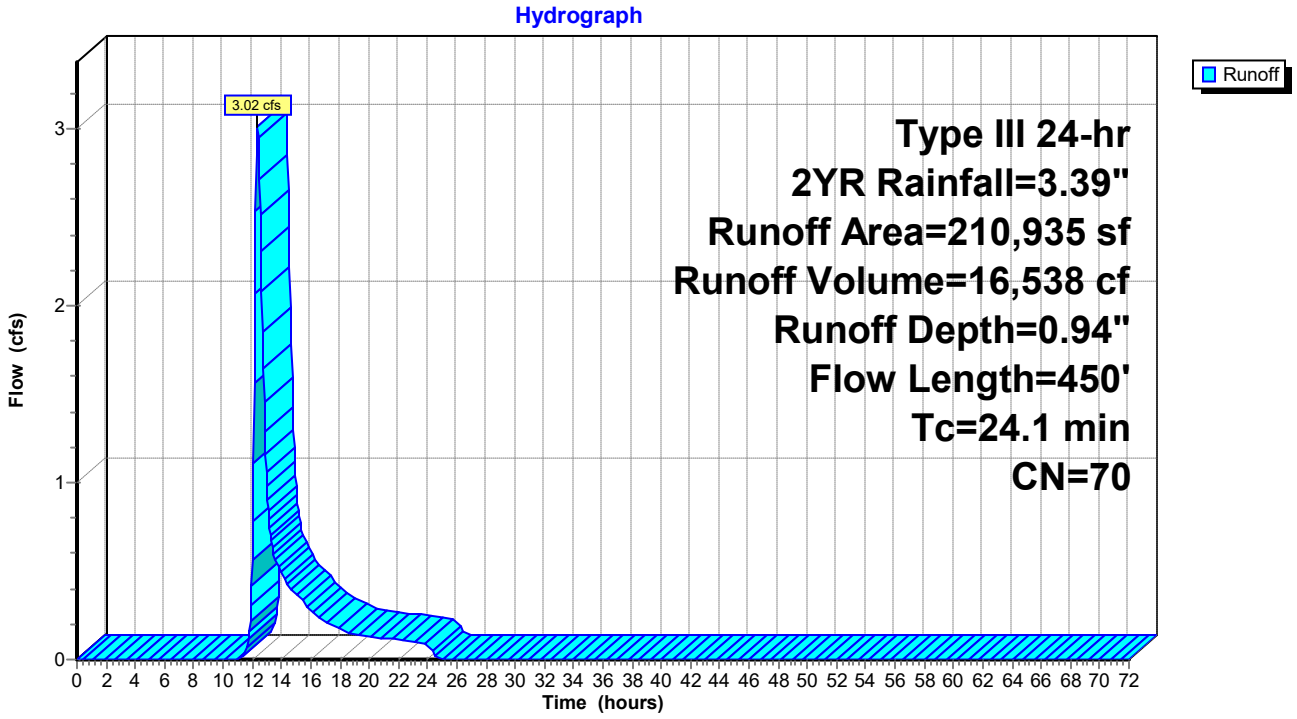
Runoff = 3.02 cfs @ 12.38 hrs, Volume= 16,538 cf, Depth= 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR Rainfall=3.39"

Area (sf)	CN	Description
210,935	70	Woods, Good, HSG C
210,935		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0400	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.39"
8.3	400	0.0260	0.81		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
24.1	450	Total			

Subcatchment C1: SUB C1



Summary for Subcatchment D1: SUB D1

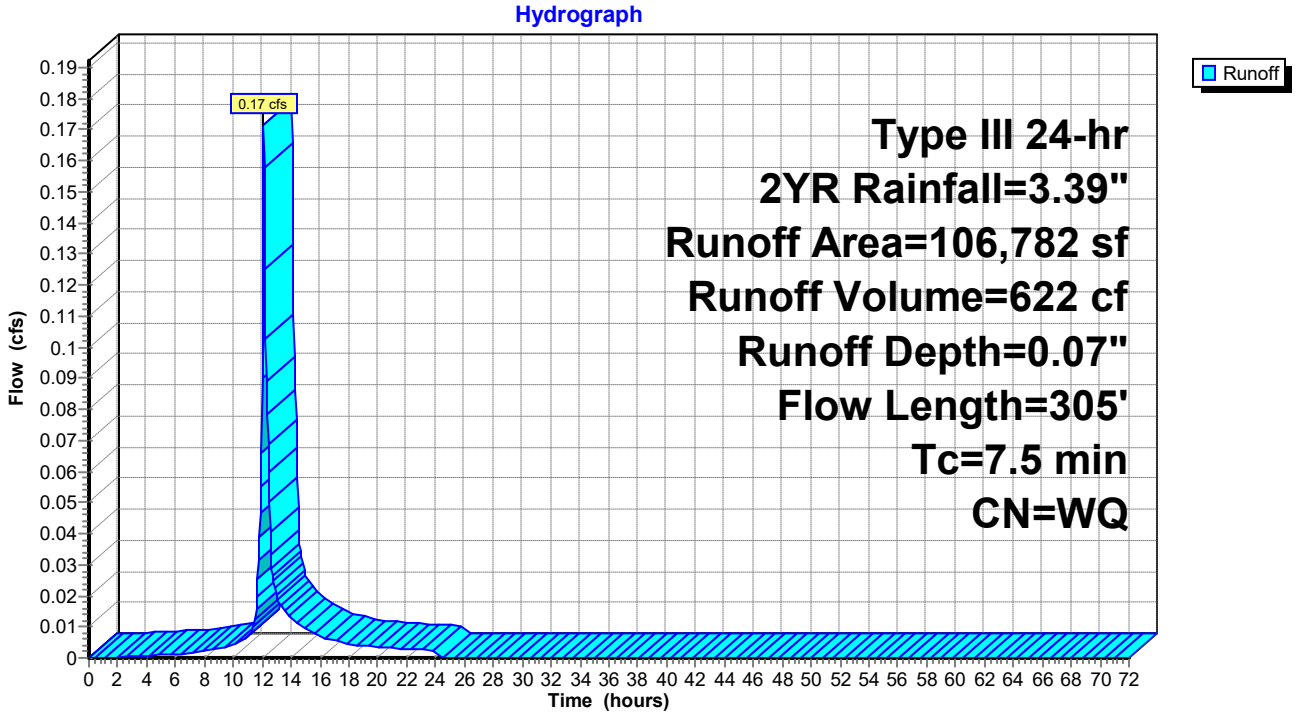
Runoff = 0.17 cfs @ 12.11 hrs, Volume= 622 cf, Depth= 0.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR Rainfall=3.39"

Area (sf)	CN	Description
48,746	30	Woods, Good, HSG A
53,332	32	Woods/grass comb., Good, HSG A
3,504	72	Dirt roads, HSG A
1,200	98	Roofs, HSG A
106,782		Weighted Average
105,582		98.88% Pervious Area
1,200		1.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	50	0.1000	0.29		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.39"
4.6	255	0.0340	0.92		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.5	305	Total			

Subcatchment D1: SUB D1



Summary for Subcatchment E1: SUB E1

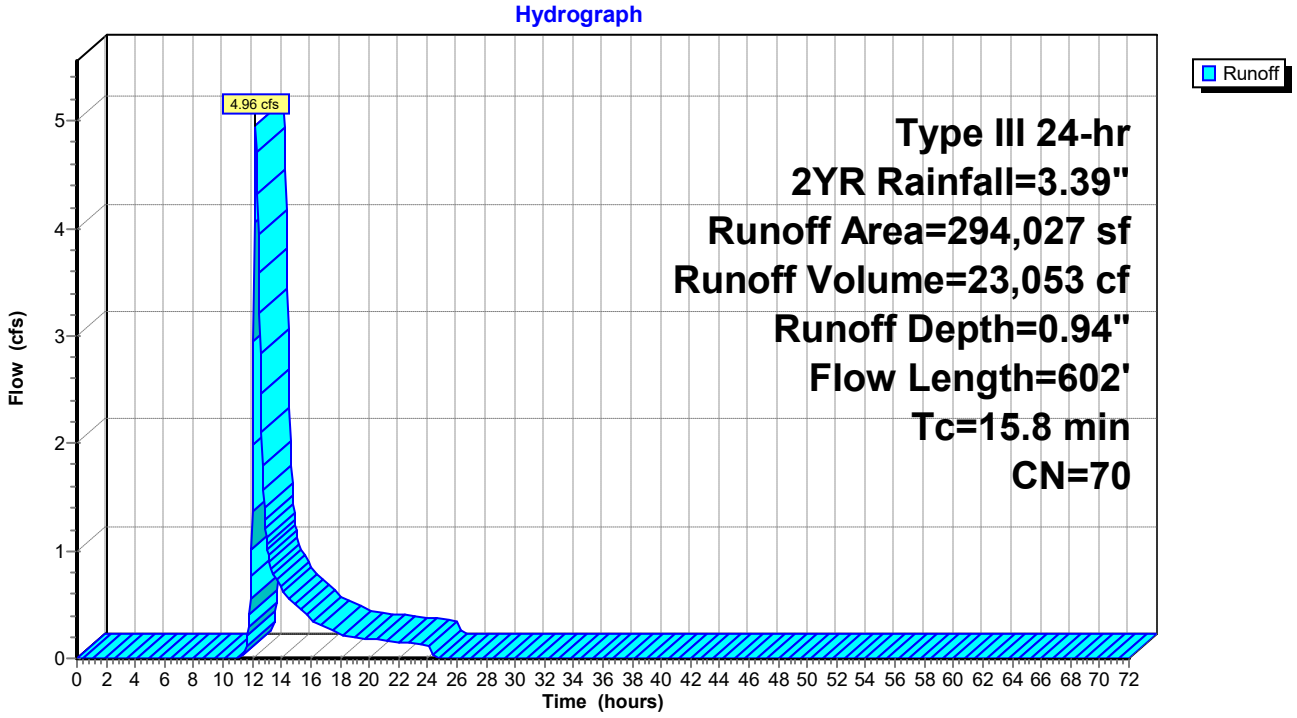
Runoff = 4.96 cfs @ 12.25 hrs, Volume= 23,053 cf, Depth= 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR Rainfall=3.39"

Area (sf)	CN	Description
294,027	70	Woods, Good, HSG C
294,027		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.2	50	0.1200	0.08		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.39"
2.2	260	0.1500	1.94		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.4	292	0.0820	1.43		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.8	602	Total			

Subcatchment E1: SUB E1



Summary for Pond B-1: B-1

Inflow Area = 485,260 sf, 2.46% Impervious, Inflow Depth = 0.01" for 2YR event
Inflow = 0.11 cfs @ 12.21 hrs, Volume= 460 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

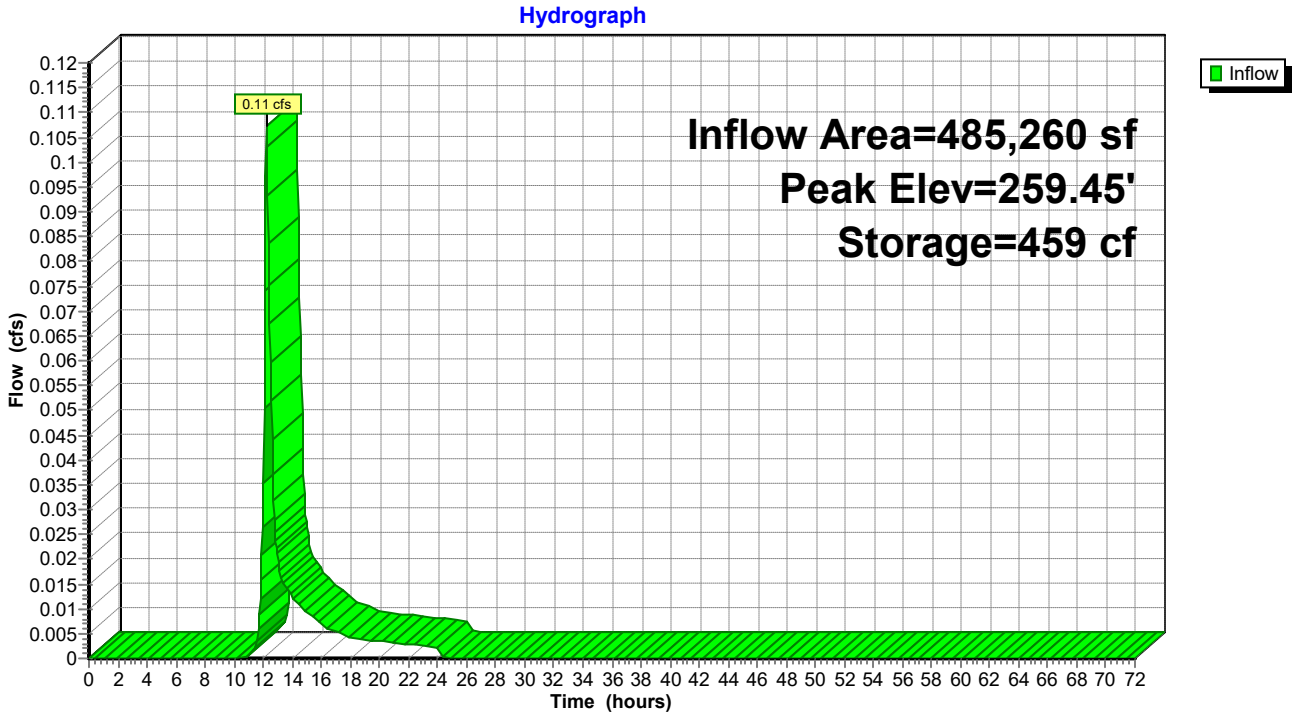
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 259.45' @ 24.80 hrs Surf.Area= 1,959 sf Storage= 459 cf

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

Volume	Invert	Avail.Storage	Storage Description
#1	259.00'	304,800 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
259.00	93	0	0
260.00	4,262	2,178	2,178
261.00	8,381	6,322	8,499
262.00	20,895	14,638	23,137
263.00	32,293	26,594	49,731
264.00	37,929	35,111	84,842
265.00	45,851	41,890	126,732
266.00	54,173	50,012	176,744
267.00	64,790	59,482	236,226
268.00	72,359	68,575	304,800

Pond B-1: B-1


Hydrograph
Inflow
0.11 cfs
Inflow Area=485,260 sf
Peak Elev=259.45'
Storage=459 cf
Flow (cfs)
0.12
0.115
0.11
0.105
0.1
0.095
0.09
0.085
0.08
0.075
0.07
0.065
0.06
0.055
0.05
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72
Time (hours)

Summary for Pond B-2: B-2

Inflow Area = 106,782 sf, 1.12% Impervious, Inflow Depth = 0.07" for 2YR event
Inflow = 0.17 cfs @ 12.11 hrs, Volume= 622 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 268.27' @ 24.45 hrs Surf.Area= 3,971 sf Storage= 622 cf

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

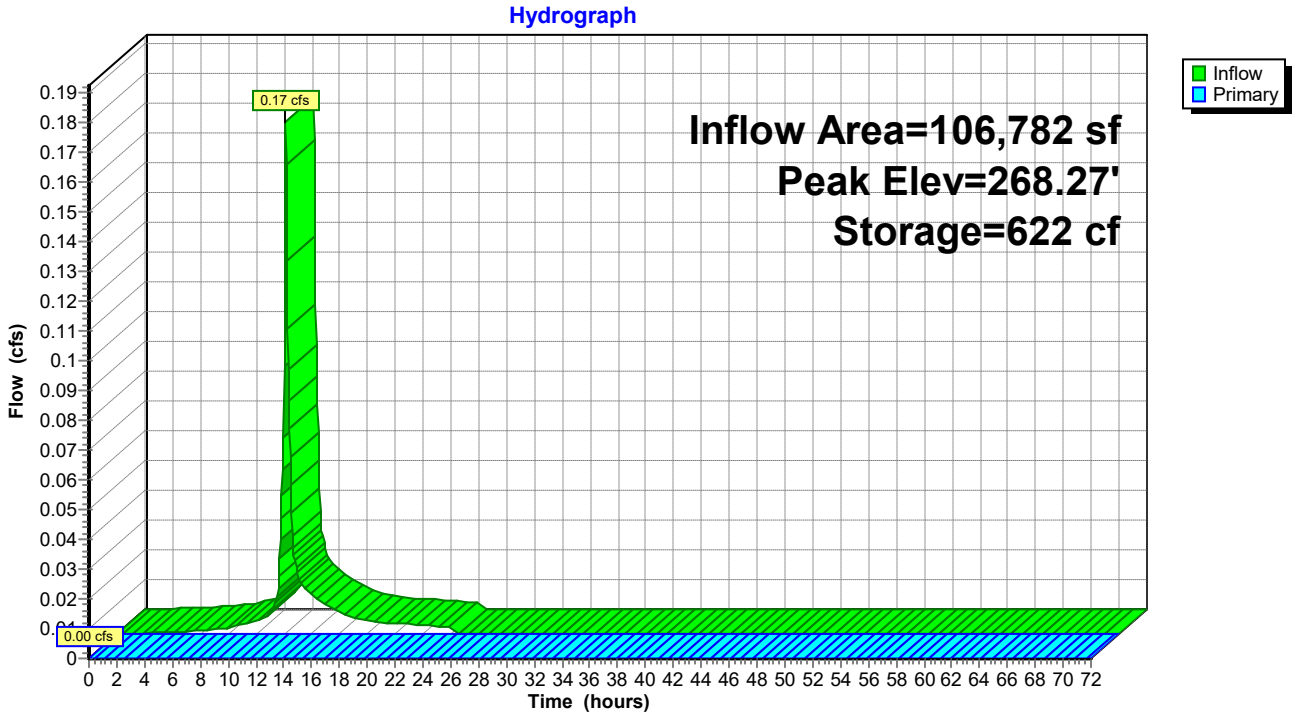
Volume	Invert	Avail.Storage	Storage Description
#1	268.00'	50,349 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
268.00	692	0	0
269.00	12,993	6,843	6,843
270.00	20,435	16,714	23,557
271.00	33,150	26,793	50,349

Device	Routing	Invert	Outlet Devices
#1	Primary	270.60'	**100.0' long x 12.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=268.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond B-2: B-2


Hydrograph
Inflow Area=106,782 sf
Peak Elev=268.27'
Storage=622 cf
0.17 cfs
0.00 cfs
Inflow
Primary
Flow (cfs)
Time (hours)

Summary for Pond W-1: W-1

Inflow Area = 332,199 sf, 3.60% Impervious, Inflow Depth = 0.52" for 2YR event
Inflow = 2.71 cfs @ 12.34 hrs, Volume= 14,525 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 263.67' @ 25.35 hrs Surf.Area= 20,438 sf Storage= 14,523 cf

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

Volume	Invert	Avail.Storage	Storage Description
#1	262.80'	195,884 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

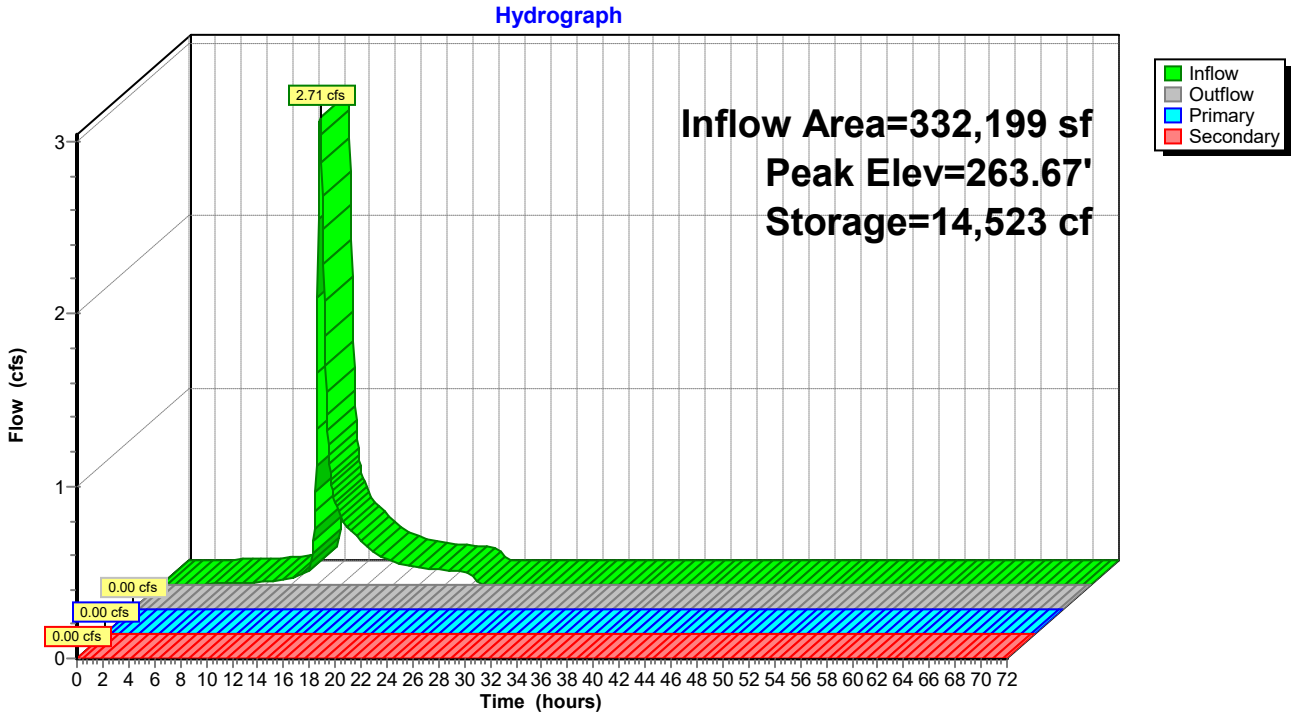
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
262.80	13,689	0	0
263.00	14,660	2,835	2,835
264.00	23,335	18,998	21,832
265.00	33,908	28,622	50,454
266.00	42,247	38,078	88,531
267.00	52,733	47,490	136,021
268.00	66,993	59,863	195,884

Device	Routing	Invert	Outlet Devices
#1	Primary	265.40'	**45.0' long x 16.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Secondary	267.40'	**4.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=262.80' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=262.80' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond W-1: W-1

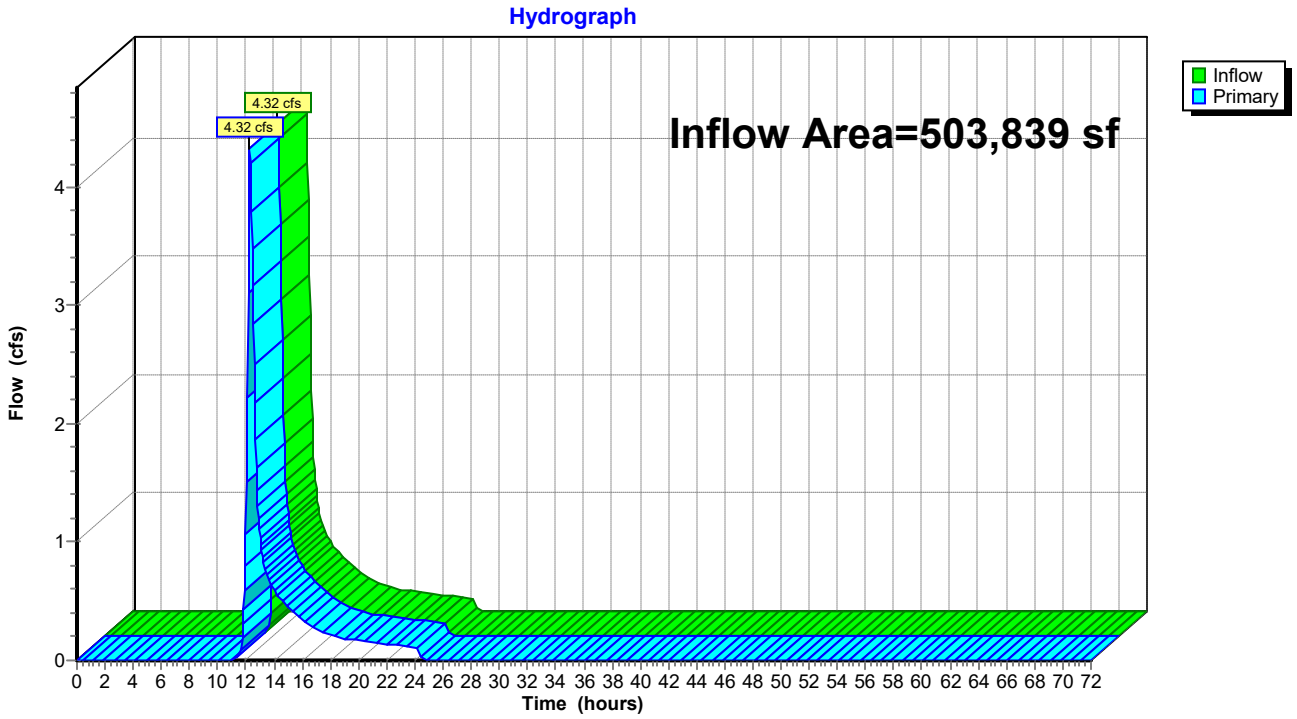

Hydrograph
Inflow Area=332,199 sf
Peak Elev=263.67'
Storage=14,523 cf
Inflow
Outflow
Primary
Secondary
2.71 cfs
0.00 cfs
0.00 cfs
0.00 cfs
Flow (cfs)
0
1
2
3
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72
Time (hours)

Summary for Link A: POI-A

Inflow Area = 503,839 sf, 0.00% Impervious, Inflow Depth = 0.50" for 2YR event
Inflow = 4.32 cfs @ 12.28 hrs, Volume= 21,191 cf
Primary = 4.32 cfs @ 12.28 hrs, Volume= 21,191 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link A: POI-A

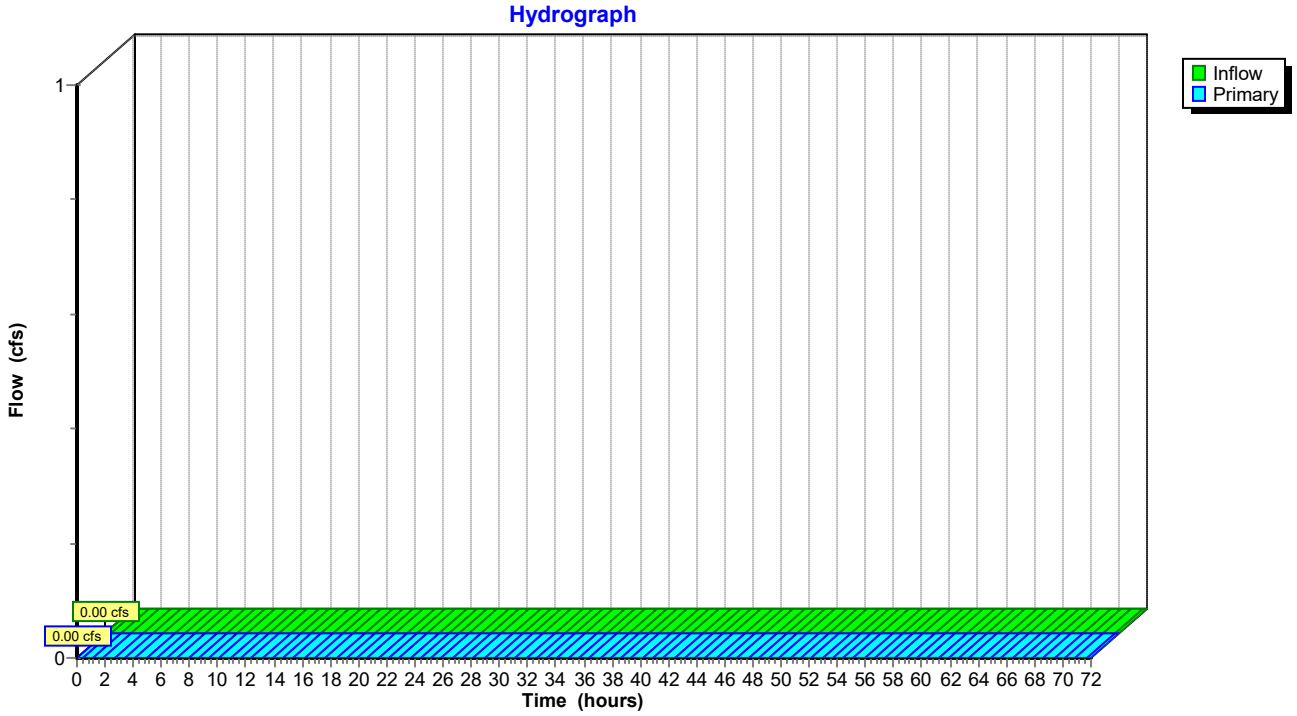


Summary for Link B: POI-B

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link B: POI-B

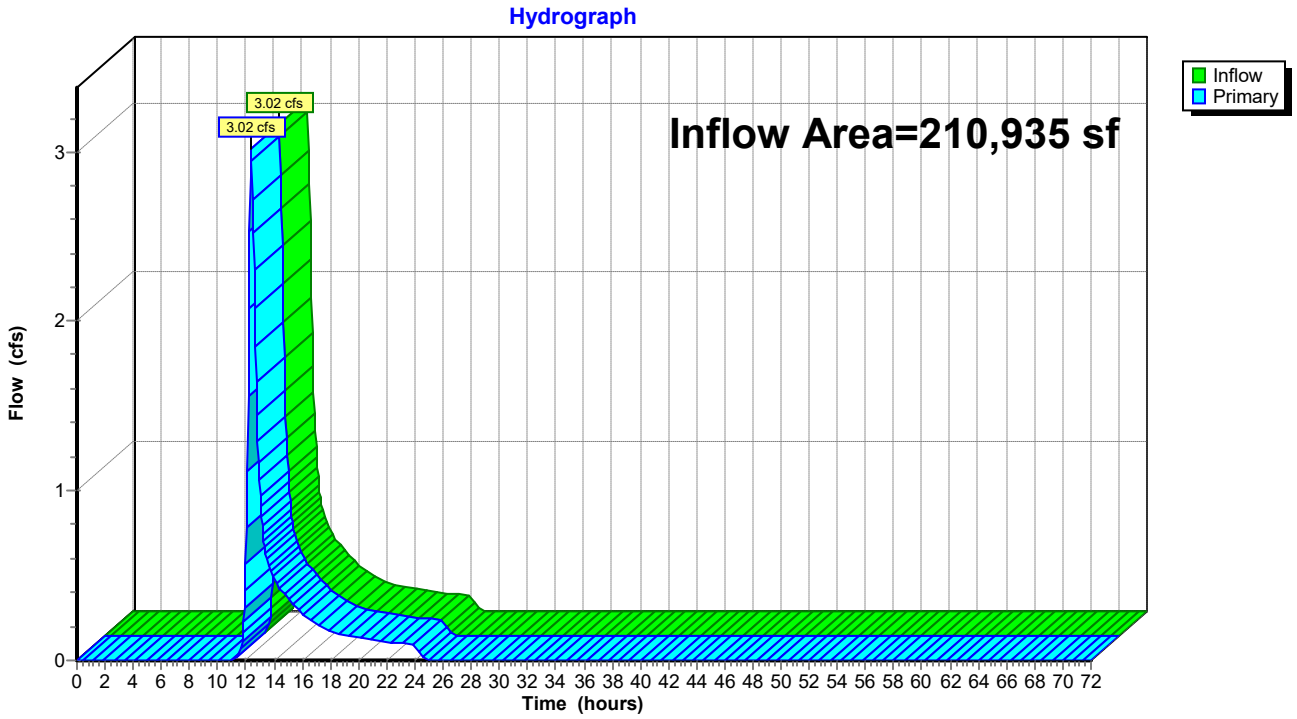


Summary for Link C: POI-C

Inflow Area = 210,935 sf, 0.00% Impervious, Inflow Depth = 0.94" for 2YR event
Inflow = 3.02 cfs @ 12.38 hrs, Volume= 16,538 cf
Primary = 3.02 cfs @ 12.38 hrs, Volume= 16,538 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link C: POI-C

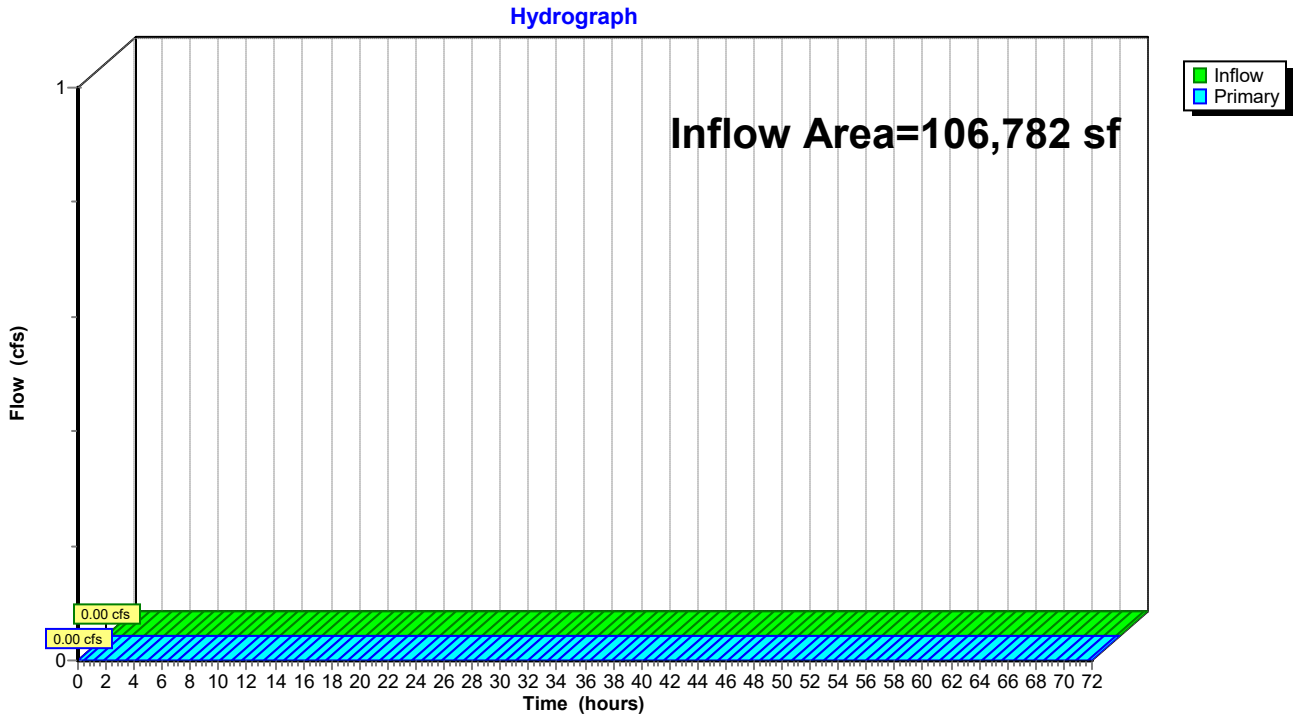


Summary for Link D: POI-D

Inflow Area = 106,782 sf, 1.12% Impervious, Inflow Depth = 0.00" for 2YR event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link D: POI-D

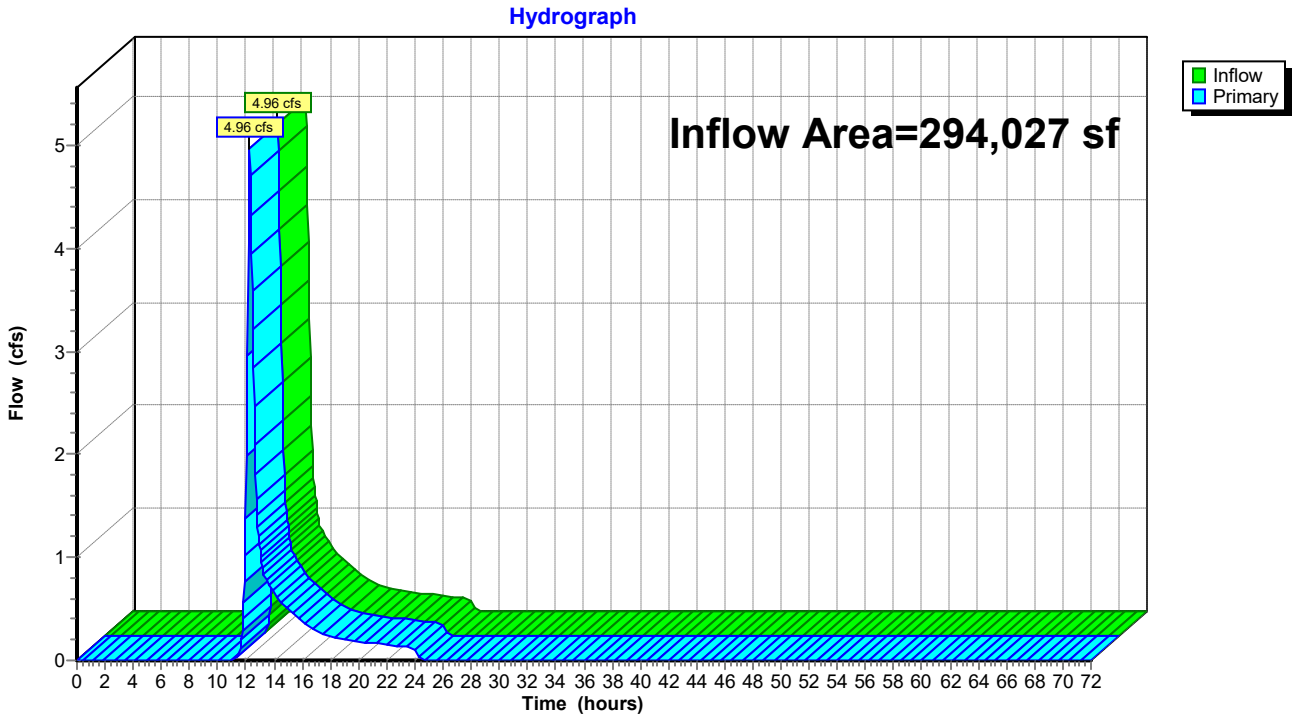


Summary for Link E: POI-E

Inflow Area = 294,027 sf, 0.00% Impervious, Inflow Depth = 0.94" for 2YR event
Inflow = 4.96 cfs @ 12.25 hrs, Volume= 23,053 cf
Primary = 4.96 cfs @ 12.25 hrs, Volume= 23,053 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link E: POI-E



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A1: SUB A1 Runoff Area=503,839 sf 0.00% Impervious Runoff Depth=1.21"
Flow Length=640' Tc=18.2 min CN=WQ Runoff=11.19 cfs 50,718 cf

Subcatchment B1: SUB B1 Runoff Area=332,199 sf 3.60% Impervious Runoff Depth=1.17"
Flow Length=1,115' Tc=22.4 min CN=WQ Runoff=6.42 cfs 32,279 cf

Subcatchment B2: SUB B2 Runoff Area=153,061 sf 0.00% Impervious Runoff Depth=0.10"
Flow Length=325' Tc=13.9 min CN=WQ Runoff=0.26 cfs 1,242 cf

Subcatchment C1: SUB C1 Runoff Area=210,935 sf 0.00% Impervious Runoff Depth=2.24"
Flow Length=450' Tc=24.1 min CN=70 Runoff=7.77 cfs 39,351 cf

Subcatchment D1: SUB D1 Runoff Area=106,782 sf 1.12% Impervious Runoff Depth=0.17"
Flow Length=305' Tc=7.5 min CN=WQ Runoff=0.34 cfs 1,476 cf

Subcatchment E1: SUB E1 Runoff Area=294,027 sf 0.00% Impervious Runoff Depth=2.24"
Flow Length=602' Tc=15.8 min CN=70 Runoff=12.80 cfs 54,853 cf

Pond B-1: B-1 Peak Elev=259.75' Storage=1,238 cf Inflow=0.26 cfs 1,242 cf
Outflow=0.00 cfs 0 cf

Pond B-2: B-2 Peak Elev=268.44' Storage=1,474 cf Inflow=0.34 cfs 1,476 cf
Outflow=0.00 cfs 0 cf

Pond W-1: W-1 Peak Elev=264.41' Storage=32,278 cf Inflow=6.42 cfs 32,279 cf
Primary=0.00 cfs 0 cf Secondary=0.00 cfs 0 cf Outflow=0.00 cfs 0 cf

Link A: POI-A Inflow=11.19 cfs 50,718 cf
Primary=11.19 cfs 50,718 cf

Link B: POI-B Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Link C: POI-C Inflow=7.77 cfs 39,351 cf
Primary=7.77 cfs 39,351 cf

Link D: POI-D Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Link E: POI-E Inflow=12.80 cfs 54,853 cf
Primary=12.80 cfs 54,853 cf

Total Runoff Area = 1,600,843 sf Runoff Volume = 179,919 cf Average Runoff Depth = 1.35"
99.18% Pervious = 1,587,684 sf 0.82% Impervious = 13,159 sf

Summary for Subcatchment A1: SUB A1

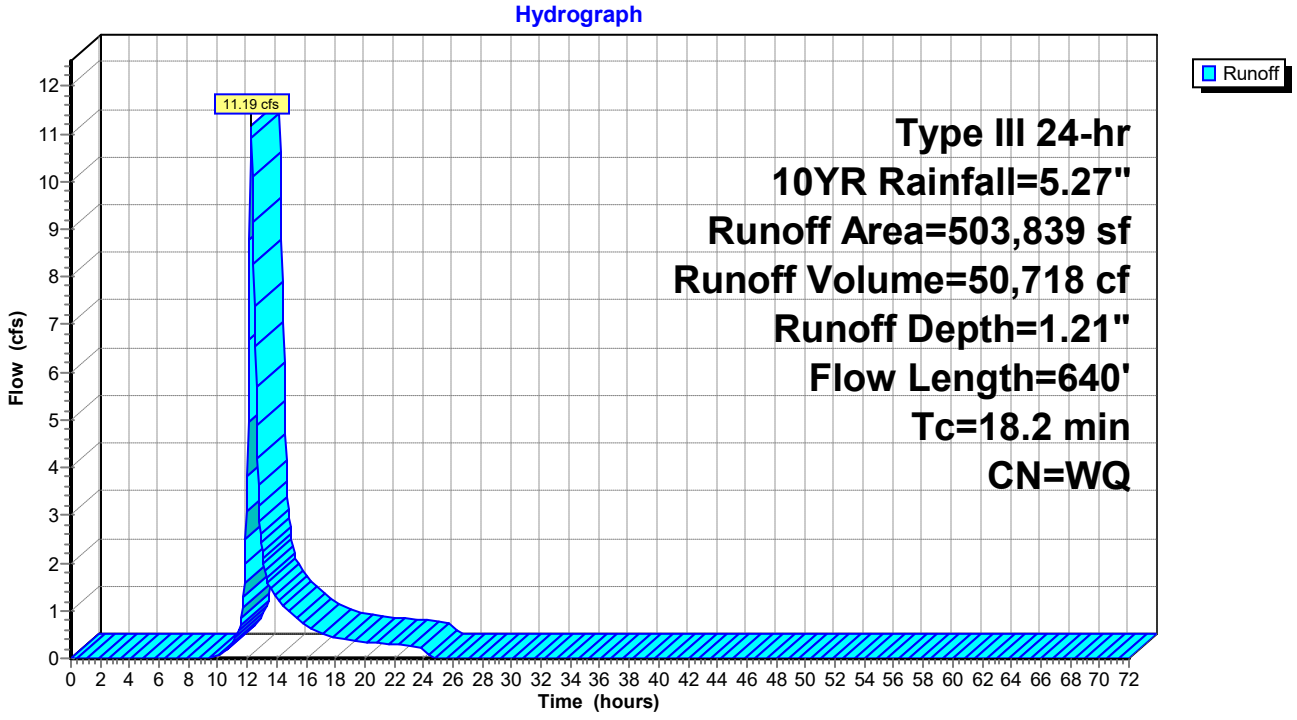
Runoff = 11.19 cfs @ 12.26 hrs, Volume= 50,718 cf, Depth= 1.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR Rainfall=5.27"

Area (sf)	CN	Description
233,563	30	Woods, Good, HSG A
270,276	70	Woods, Good, HSG C
503,839		Weighted Average
503,839		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0	50	0.0800	0.07		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.39"
6.2	590	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.2	640	Total			

Subcatchment A1: SUB A1



Summary for Subcatchment B1: SUB B1

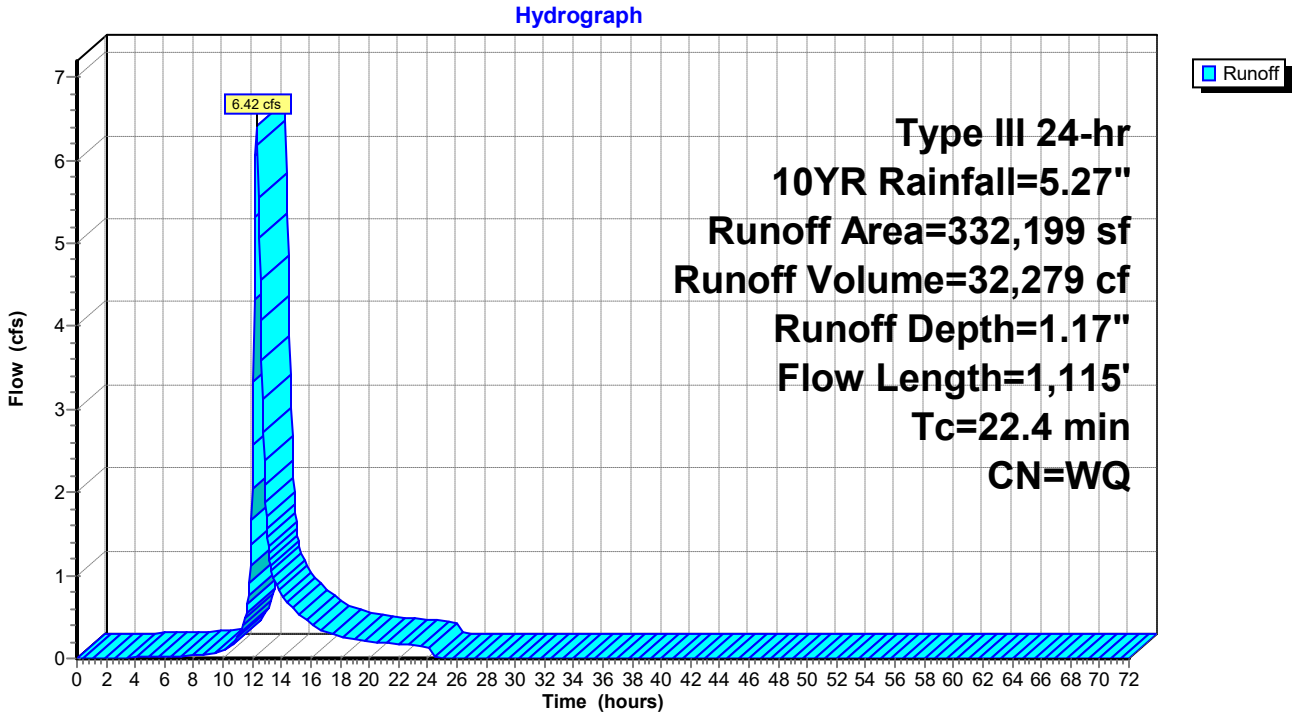
Runoff = 6.42 cfs @ 12.32 hrs, Volume= 32,279 cf, Depth= 1.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR Rainfall=5.27"

	Area (sf)	CN	Description
*	11,959	98	Water Surface, HSG A
	175,644	30	Woods, Good, HSG A
	139,940	70	Woods, Good, HSG C
	4,656	72	Dirt roads, HSG A
	332,199		Weighted Average
	320,240		96.40% Pervious Area
	11,959		3.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	50	0.1800	0.10		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.39"
2.2	270	0.1700	2.06		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.6	163	0.1200	1.73		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
9.9	632	0.0450	1.06		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
22.4	1,115	Total			

Subcatchment B1: SUB B1



Summary for Subcatchment B2: SUB B2

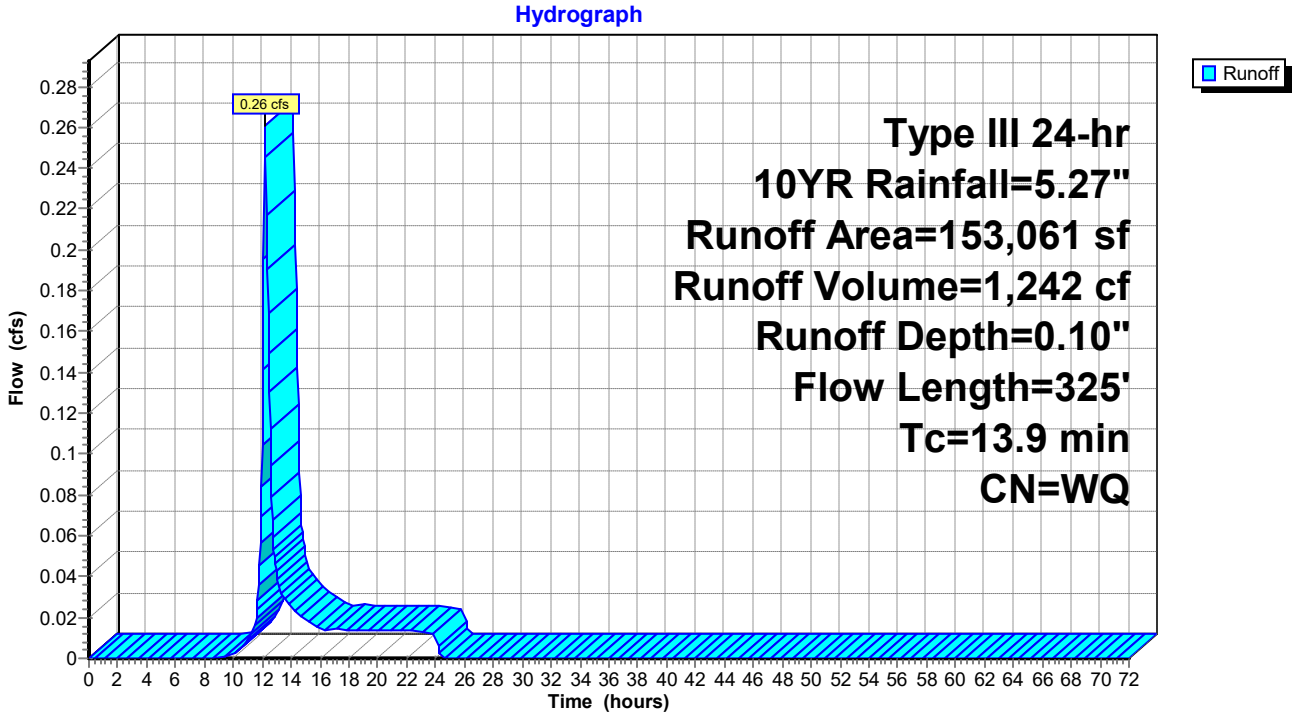
Runoff = 0.26 cfs @ 12.20 hrs, Volume= 1,242 cf, Depth= 0.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR Rainfall=5.27"

Area (sf)	CN	Description
147,805	30	Woods, Good, HSG A
5,256	72	Dirt roads, HSG A
153,061		Weighted Average
153,061		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	50	0.1600	0.09		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.39"
4.8	275	0.0360	0.95		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.9	325	Total			

Subcatchment B2: SUB B2



Summary for Subcatchment C1: SUB C1

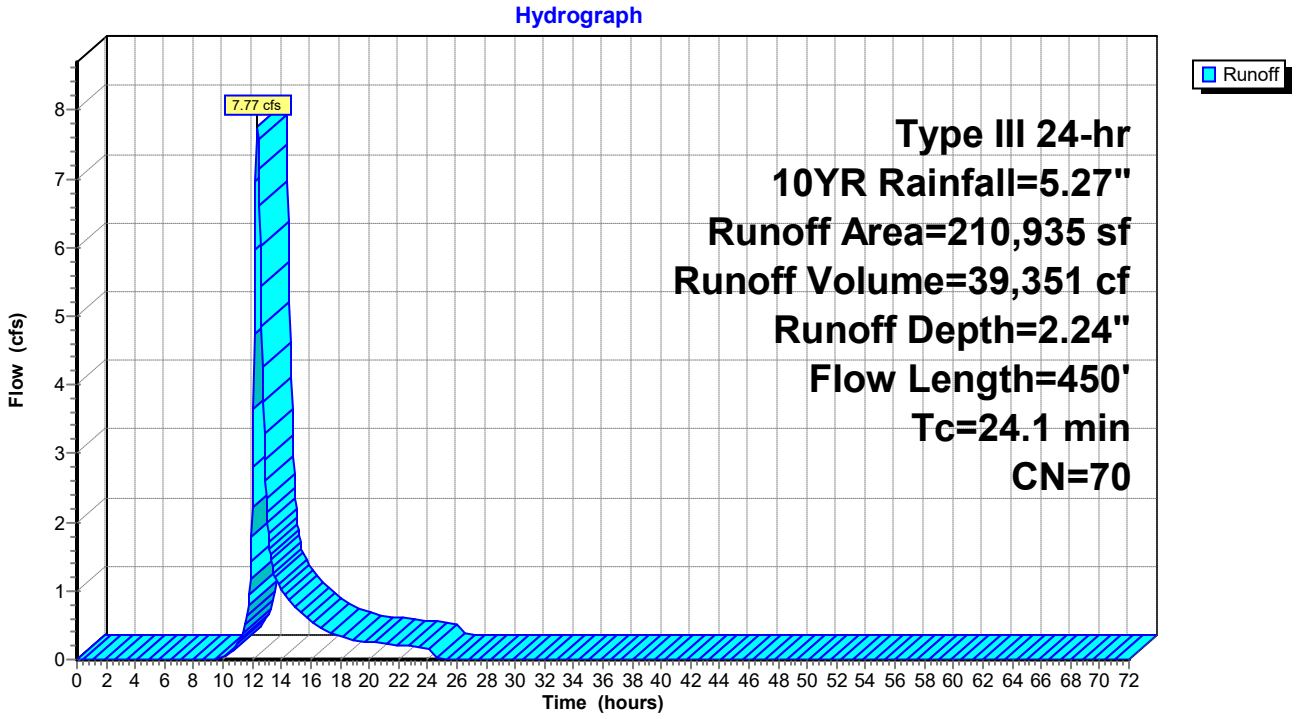
Runoff = 7.77 cfs @ 12.35 hrs, Volume= 39,351 cf, Depth= 2.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR Rainfall=5.27"

Area (sf)	CN	Description
210,935	70	Woods, Good, HSG C
210,935		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0400	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.39"
8.3	400	0.0260	0.81		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
24.1	450	Total			

Subcatchment C1: SUB C1



Summary for Subcatchment D1: SUB D1

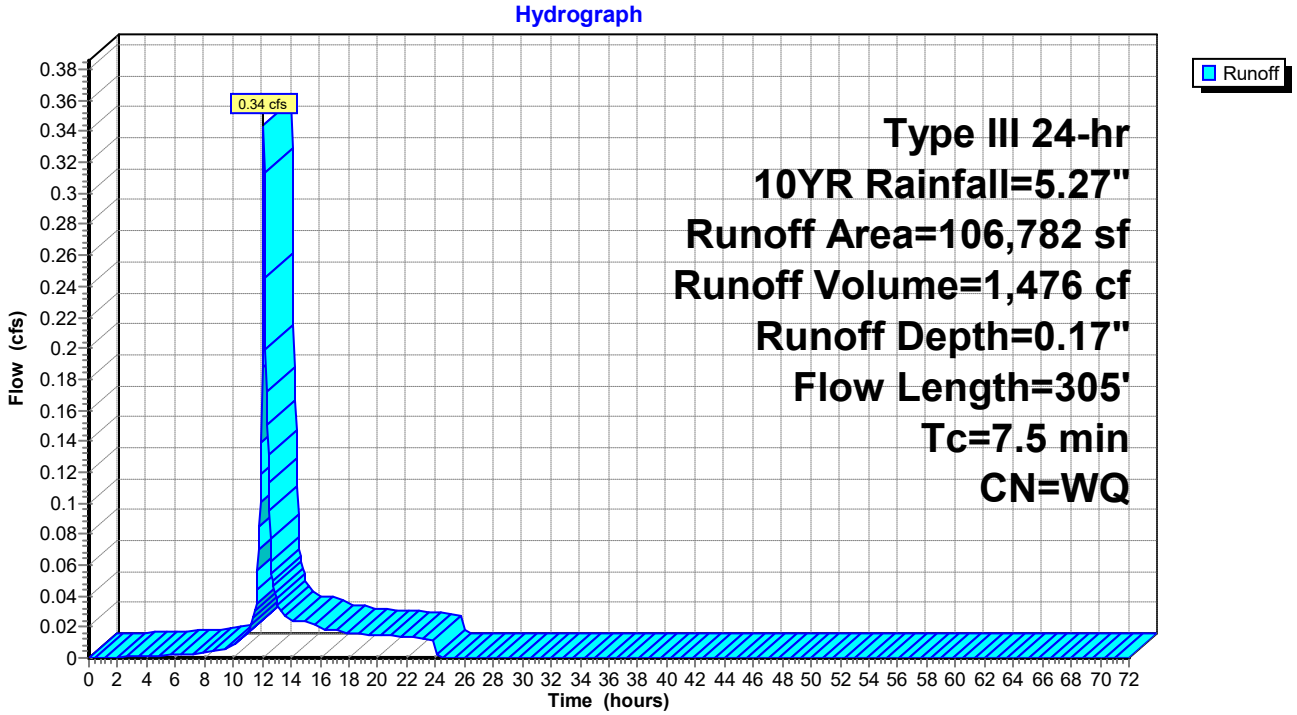
Runoff = 0.34 cfs @ 12.11 hrs, Volume= 1,476 cf, Depth= 0.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR Rainfall=5.27"

Area (sf)	CN	Description
48,746	30	Woods, Good, HSG A
53,332	32	Woods/grass comb., Good, HSG A
3,504	72	Dirt roads, HSG A
1,200	98	Roofs, HSG A
106,782		Weighted Average
105,582		98.88% Pervious Area
1,200		1.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	50	0.1000	0.29		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.39"
4.6	255	0.0340	0.92		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.5	305	Total			

Subcatchment D1: SUB D1



Summary for Subcatchment E1: SUB E1

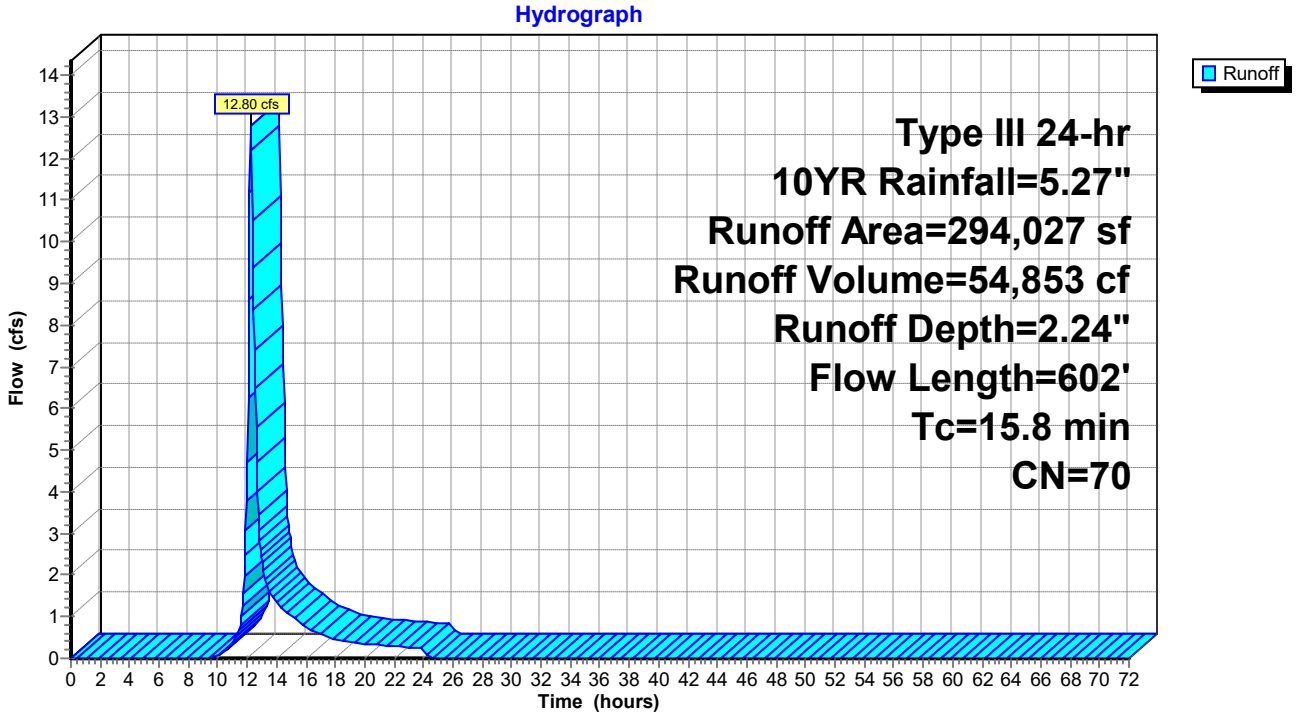
Runoff = 12.80 cfs @ 12.23 hrs, Volume= 54,853 cf, Depth= 2.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR Rainfall=5.27"

Area (sf)	CN	Description
294,027	70	Woods, Good, HSG C
294,027		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.2	50	0.1200	0.08		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.39"
2.2	260	0.1500	1.94		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.4	292	0.0820	1.43		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.8	602	Total			

Subcatchment E1: SUB E1



Summary for Pond B-1: B-1

Inflow Area = 485,260 sf, 2.46% Impervious, Inflow Depth = 0.03" for 10YR event
Inflow = 0.26 cfs @ 12.20 hrs, Volume= 1,242 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

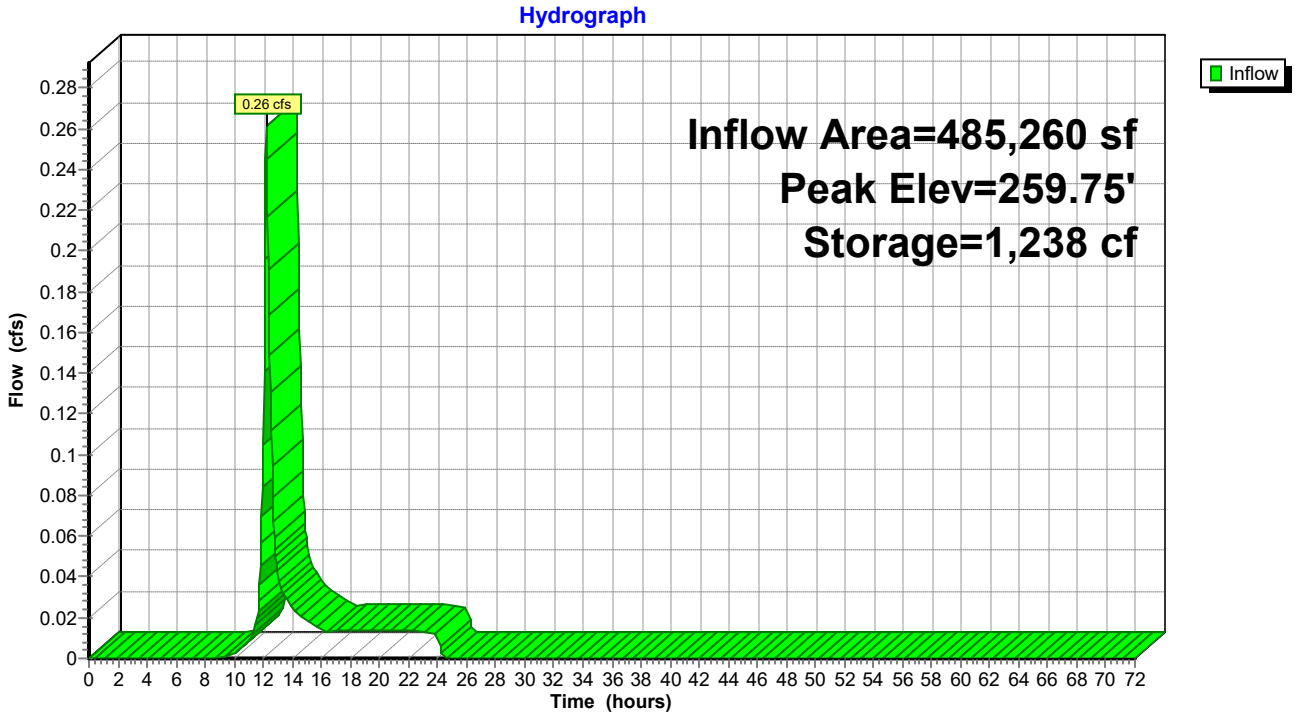
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 259.75' @ 24.80 hrs Surf.Area= 3,215 sf Storage= 1,238 cf

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

Volume	Invert	Avail.Storage	Storage Description
#1	259.00'	304,800 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
259.00	93	0	0
260.00	4,262	2,178	2,178
261.00	8,381	6,322	8,499
262.00	20,895	14,638	23,137
263.00	32,293	26,594	49,731
264.00	37,929	35,111	84,842
265.00	45,851	41,890	126,732
266.00	54,173	50,012	176,744
267.00	64,790	59,482	236,226
268.00	72,359	68,575	304,800

Pond B-1: B-1


Hydrograph
Inflow
0.26 cfs
Inflow Area=485,260 sf
Peak Elev=259.75'
Storage=1,238 cf
Flow (cfs)
0 0.02 0.04 0.06 0.08 0.1 0.12 0.14 0.16 0.18 0.2 0.22 0.24 0.26 0.28
Time (hours)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72

Summary for Pond B-2: B-2

Inflow Area = 106,782 sf, 1.12% Impervious, Inflow Depth = 0.17" for 10YR event
Inflow = 0.34 cfs @ 12.11 hrs, Volume= 1,476 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 268.44' @ 24.45 hrs Surf.Area= 6,062 sf Storage= 1,474 cf

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

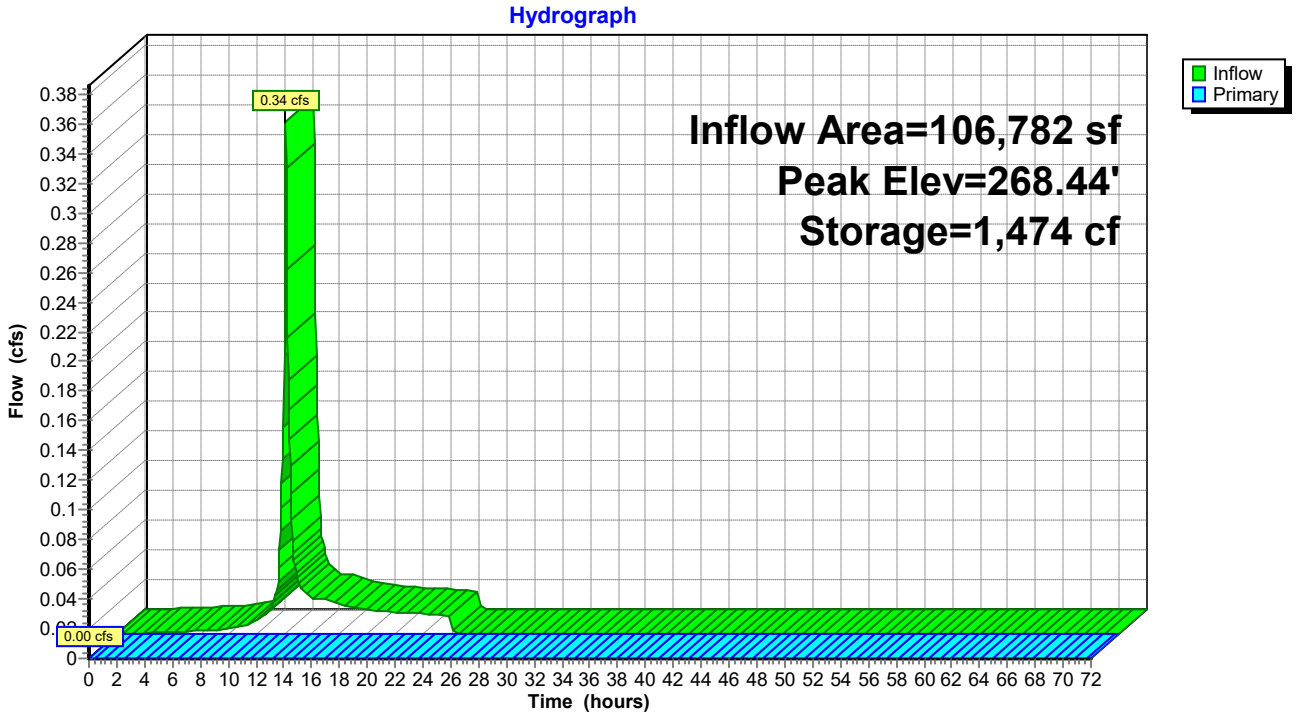
Volume	Invert	Avail.Storage	Storage Description
#1	268.00'	50,349 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
268.00	692	0	0
269.00	12,993	6,843	6,843
270.00	20,435	16,714	23,557
271.00	33,150	26,793	50,349

Device	Routing	Invert	Outlet Devices
#1	Primary	270.60'	**100.0' long x 12.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=268.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond B-2: B-2


Hydrograph
Inflow Area=106,782 sf
Peak Elev=268.44'
Storage=1,474 cf
0.34 cfs
0.00 cfs
Inflow
Primary
Flow (cfs)
Time (hours)
0 0.02 0.04 0.06 0.08 0.1 0.12 0.14 0.16 0.18 0.2 0.22 0.24 0.26 0.28 0.3 0.32 0.34 0.36 0.38
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72

Summary for Pond W-1: W-1

Inflow Area = 332,199 sf, 3.60% Impervious, Inflow Depth = 1.17" for 10YR event
Inflow = 6.42 cfs @ 12.32 hrs, Volume= 32,279 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 264.41' @ 25.35 hrs Surf.Area= 27,666 sf Storage= 32,278 cf

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

Volume	Invert	Avail.Storage	Storage Description
#1	262.80'	195,884 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

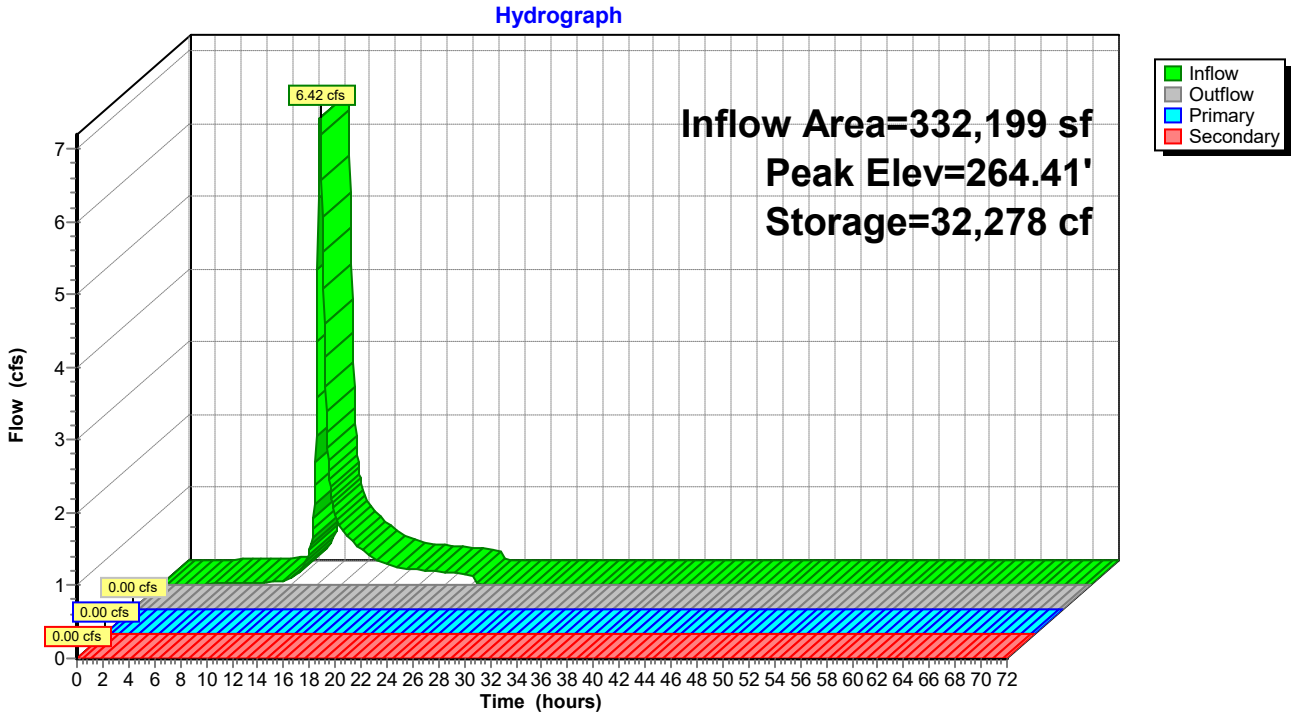
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
262.80	13,689	0	0
263.00	14,660	2,835	2,835
264.00	23,335	18,998	21,832
265.00	33,908	28,622	50,454
266.00	42,247	38,078	88,531
267.00	52,733	47,490	136,021
268.00	66,993	59,863	195,884

Device	Routing	Invert	Outlet Devices
#1	Primary	265.40'	**45.0' long x 16.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Secondary	267.40'	**4.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=262.80' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=262.80' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond W-1: W-1

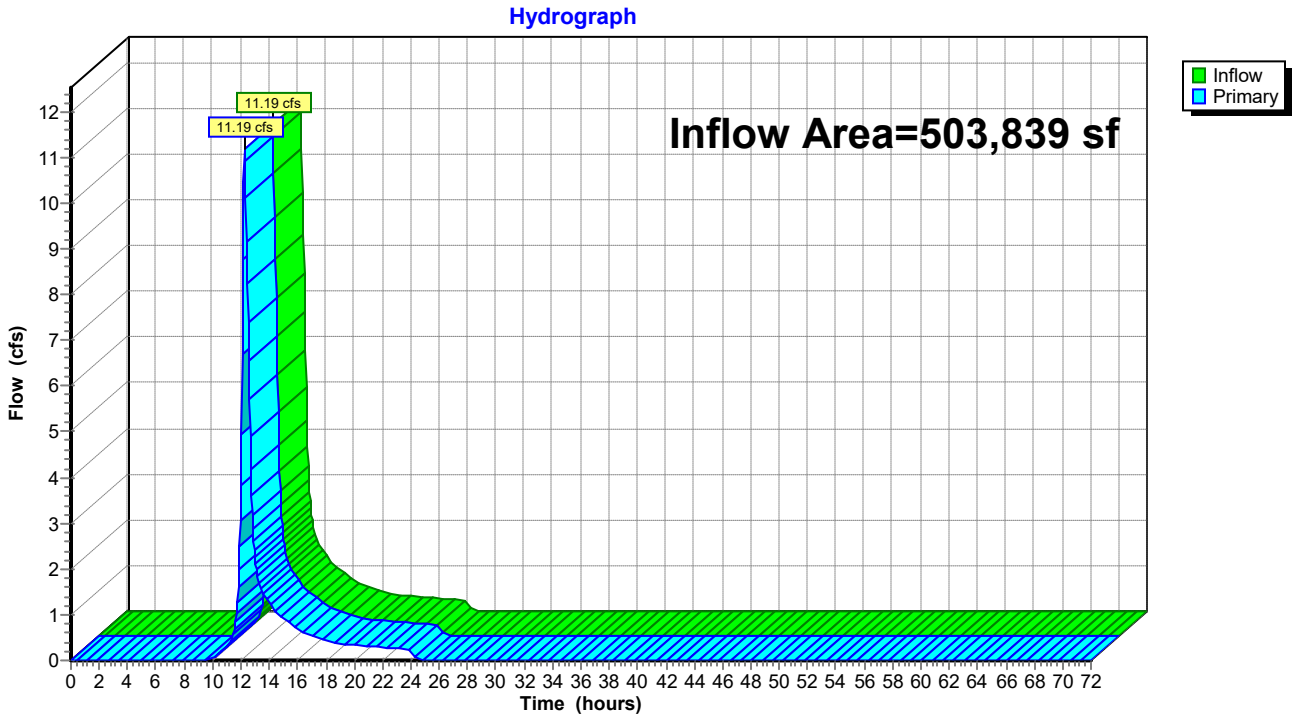

Hydrograph
Inflow Area=332,199 sf
Peak Elev=264.41'
Storage=32,278 cf
6.42 cfs
0.00 cfs
0.00 cfs
0.00 cfs
Inflow
Outflow
Primary
Secondary
Flow (cfs)
Time (hours)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72
0 1 2 3 4 5 6 7

Summary for Link A: POI-A

Inflow Area = 503,839 sf, 0.00% Impervious, Inflow Depth = 1.21" for 10YR event
Inflow = 11.19 cfs @ 12.26 hrs, Volume= 50,718 cf
Primary = 11.19 cfs @ 12.26 hrs, Volume= 50,718 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link A: POI-A

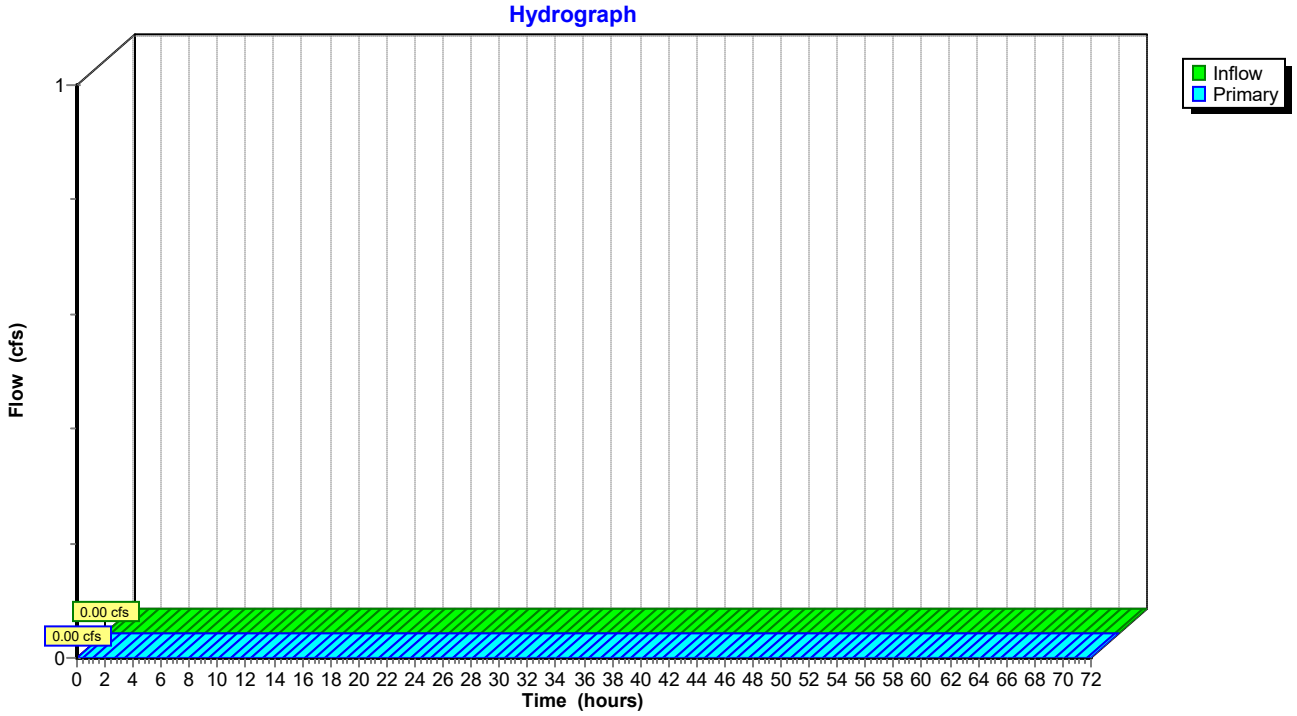


Summary for Link B: POI-B

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0 cf
Primary	=	0.00 cfs @	0.00 hrs, Volume=	0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link B: POI-B

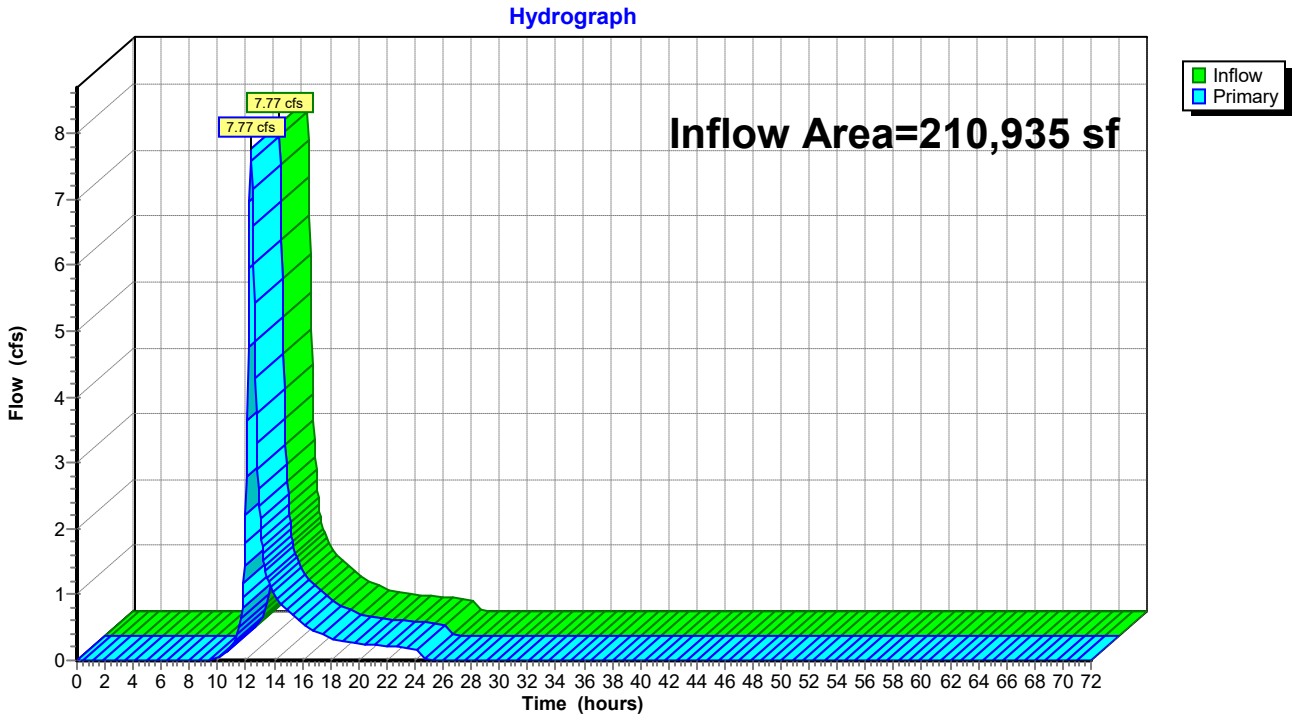


Summary for Link C: POI-C

Inflow Area = 210,935 sf, 0.00% Impervious, Inflow Depth = 2.24" for 10YR event
Inflow = 7.77 cfs @ 12.35 hrs, Volume= 39,351 cf
Primary = 7.77 cfs @ 12.35 hrs, Volume= 39,351 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link C: POI-C

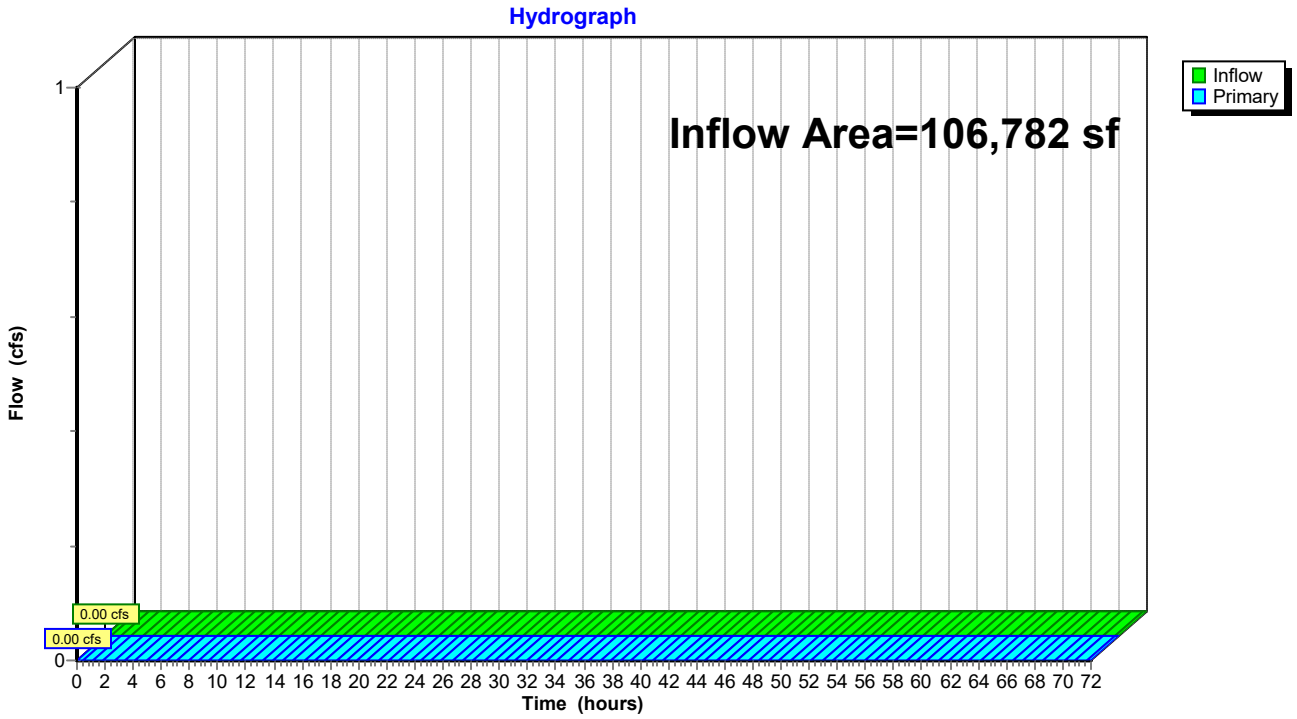


Summary for Link D: POI-D

Inflow Area = 106,782 sf, 1.12% Impervious, Inflow Depth = 0.00" for 10YR event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link D: POI-D

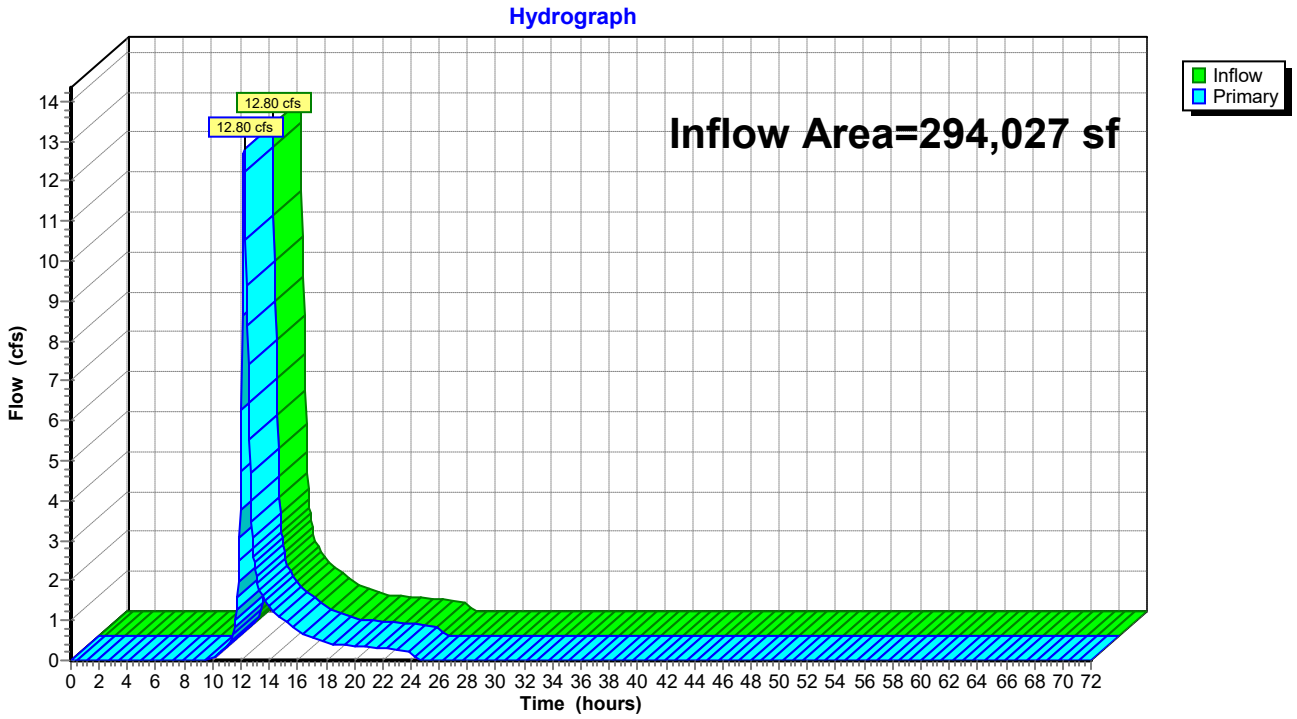


Summary for Link E: POI-E

Inflow Area = 294,027 sf, 0.00% Impervious, Inflow Depth = 2.24" for 10YR event
Inflow = 12.80 cfs @ 12.23 hrs, Volume= 54,853 cf
Primary = 12.80 cfs @ 12.23 hrs, Volume= 54,853 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link E: POI-E



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A1: SUB A1 Runoff Area=503,839 sf 0.00% Impervious Runoff Depth=1.75"
Flow Length=640' Tc=18.2 min CN=WQ Runoff=15.98 cfs 73,573 cf

Subcatchment B1: SUB B1 Runoff Area=332,199 sf 3.60% Impervious Runoff Depth=1.67"
Flow Length=1,115' Tc=22.4 min CN=WQ Runoff=8.99 cfs 46,147 cf

Subcatchment B2: SUB B2 Runoff Area=153,061 sf 0.00% Impervious Runoff Depth=0.24"
Flow Length=325' Tc=13.9 min CN=WQ Runoff=0.37 cfs 3,013 cf

Subcatchment C1: SUB C1 Runoff Area=210,935 sf 0.00% Impervious Runoff Depth=3.16"
Flow Length=450' Tc=24.1 min CN=70 Runoff=11.09 cfs 55,517 cf

Subcatchment D1: SUB D1 Runoff Area=106,782 sf 1.12% Impervious Runoff Depth=0.34"
Flow Length=305' Tc=7.5 min CN=WQ Runoff=0.46 cfs 3,018 cf

Subcatchment E1: SUB E1 Runoff Area=294,027 sf 0.00% Impervious Runoff Depth=3.16"
Flow Length=602' Tc=15.8 min CN=70 Runoff=18.38 cfs 77,386 cf

Pond B-1: B-1 Peak Elev=260.18' Storage=3,011 cf Inflow=0.37 cfs 3,013 cf
Outflow=0.00 cfs 0 cf

Pond B-2: B-2 Peak Elev=268.65' Storage=3,017 cf Inflow=0.46 cfs 3,018 cf
Outflow=0.00 cfs 0 cf

Pond W-1: W-1 Peak Elev=264.87' Storage=46,145 cf Inflow=8.99 cfs 46,147 cf
Primary=0.00 cfs 0 cf Secondary=0.00 cfs 0 cf Outflow=0.00 cfs 0 cf

Link A: POI-A Inflow=15.98 cfs 73,573 cf
Primary=15.98 cfs 73,573 cf

Link B: POI-B Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Link C: POI-C Inflow=11.09 cfs 55,517 cf
Primary=11.09 cfs 55,517 cf

Link D: POI-D Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Link E: POI-E Inflow=18.38 cfs 77,386 cf
Primary=18.38 cfs 77,386 cf

Total Runoff Area = 1,600,843 sf Runoff Volume = 258,656 cf Average Runoff Depth = 1.94"
99.18% Pervious = 1,587,684 sf 0.82% Impervious = 13,159 sf

Summary for Subcatchment A1: SUB A1

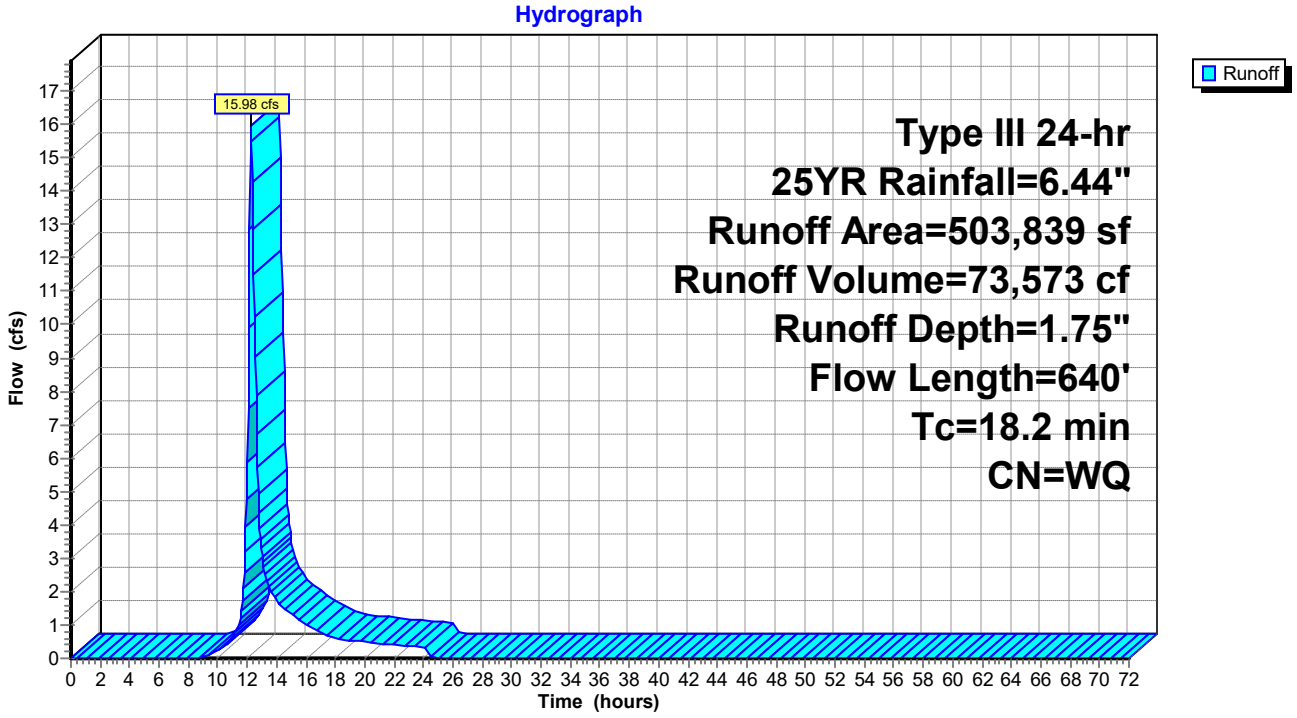
Runoff = 15.98 cfs @ 12.26 hrs, Volume= 73,573 cf, Depth= 1.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR Rainfall=6.44"

Area (sf)	CN	Description
233,563	30	Woods, Good, HSG A
270,276	70	Woods, Good, HSG C
503,839		Weighted Average
503,839		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0	50	0.0800	0.07		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.39"
6.2	590	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.2	640	Total			

Subcatchment A1: SUB A1



Summary for Subcatchment B1: SUB B1

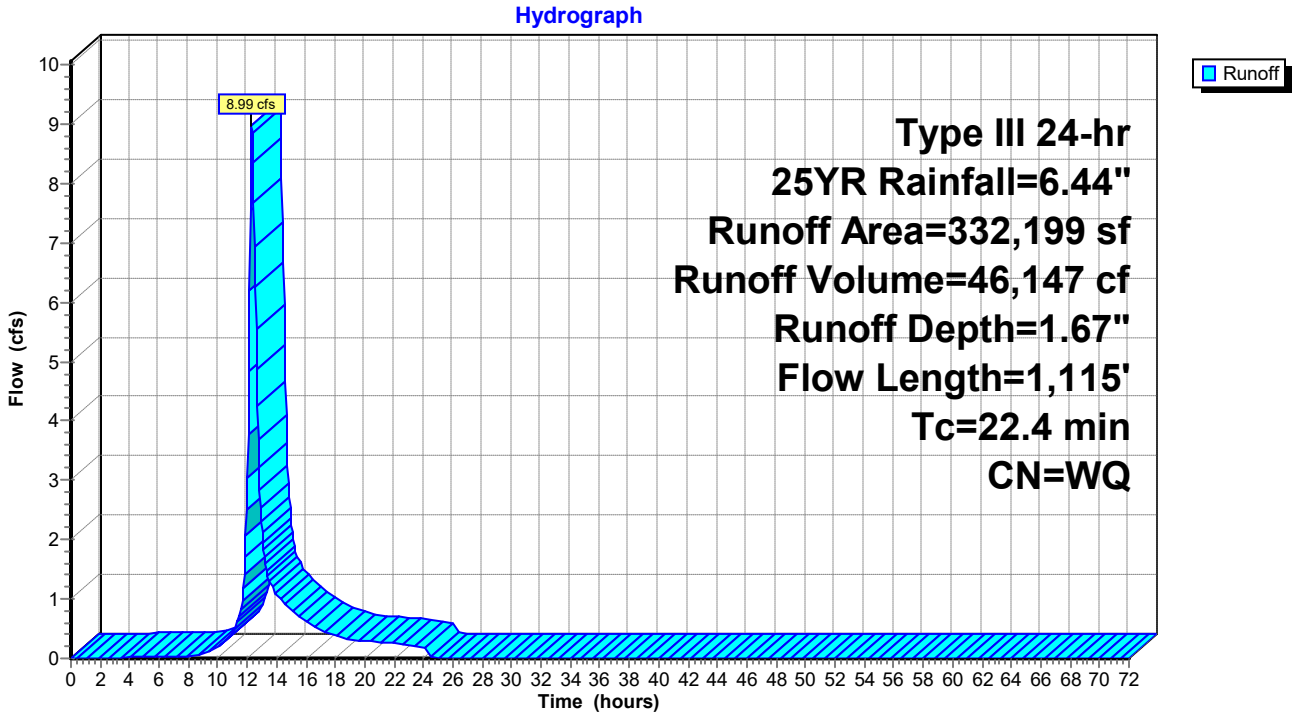
Runoff = 8.99 cfs @ 12.31 hrs, Volume= 46,147 cf, Depth= 1.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR Rainfall=6.44"

	Area (sf)	CN	Description
*	11,959	98	Water Surface, HSG A
	175,644	30	Woods, Good, HSG A
	139,940	70	Woods, Good, HSG C
	4,656	72	Dirt roads, HSG A
	332,199		Weighted Average
	320,240		96.40% Pervious Area
	11,959		3.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	50	0.1800	0.10		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.39"
2.2	270	0.1700	2.06		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.6	163	0.1200	1.73		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
9.9	632	0.0450	1.06		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
22.4	1,115	Total			

Subcatchment B1: SUB B1



Summary for Subcatchment B2: SUB B2

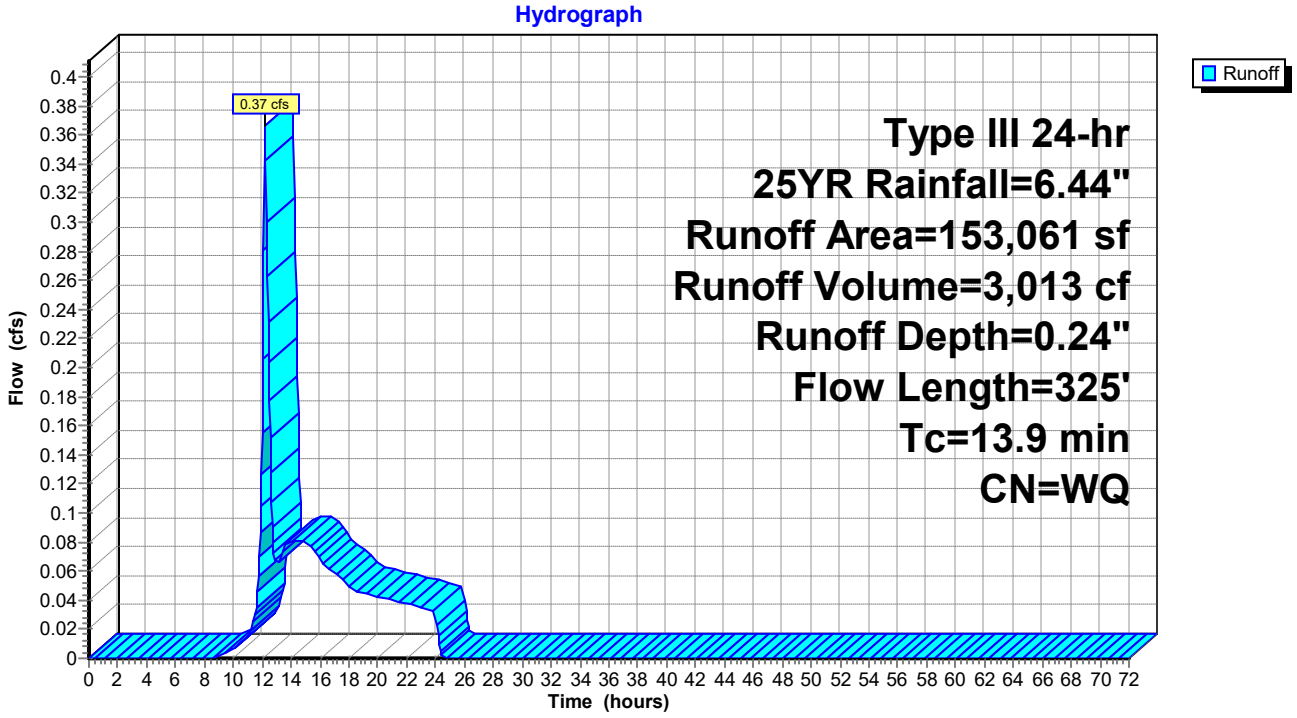
Runoff = 0.37 cfs @ 12.20 hrs, Volume= 3,013 cf, Depth= 0.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR Rainfall=6.44"

Area (sf)	CN	Description
147,805	30	Woods, Good, HSG A
5,256	72	Dirt roads, HSG A
153,061		Weighted Average
153,061		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	50	0.1600	0.09		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.39"
4.8	275	0.0360	0.95		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.9	325	Total			

Subcatchment B2: SUB B2



Summary for Subcatchment C1: SUB C1

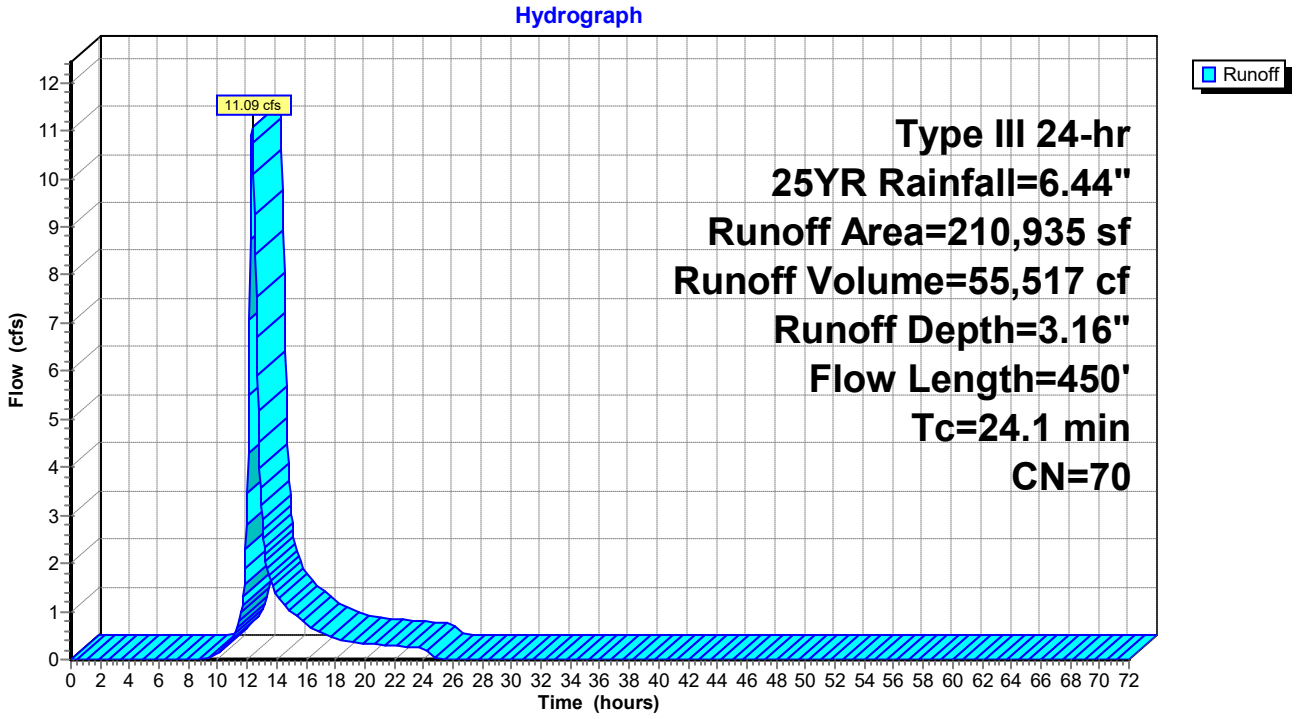
Runoff = 11.09 cfs @ 12.34 hrs, Volume= 55,517 cf, Depth= 3.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR Rainfall=6.44"

Area (sf)	CN	Description
210,935	70	Woods, Good, HSG C
210,935		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0400	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.39"
8.3	400	0.0260	0.81		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
24.1	450	Total			

Subcatchment C1: SUB C1



Summary for Subcatchment D1: SUB D1

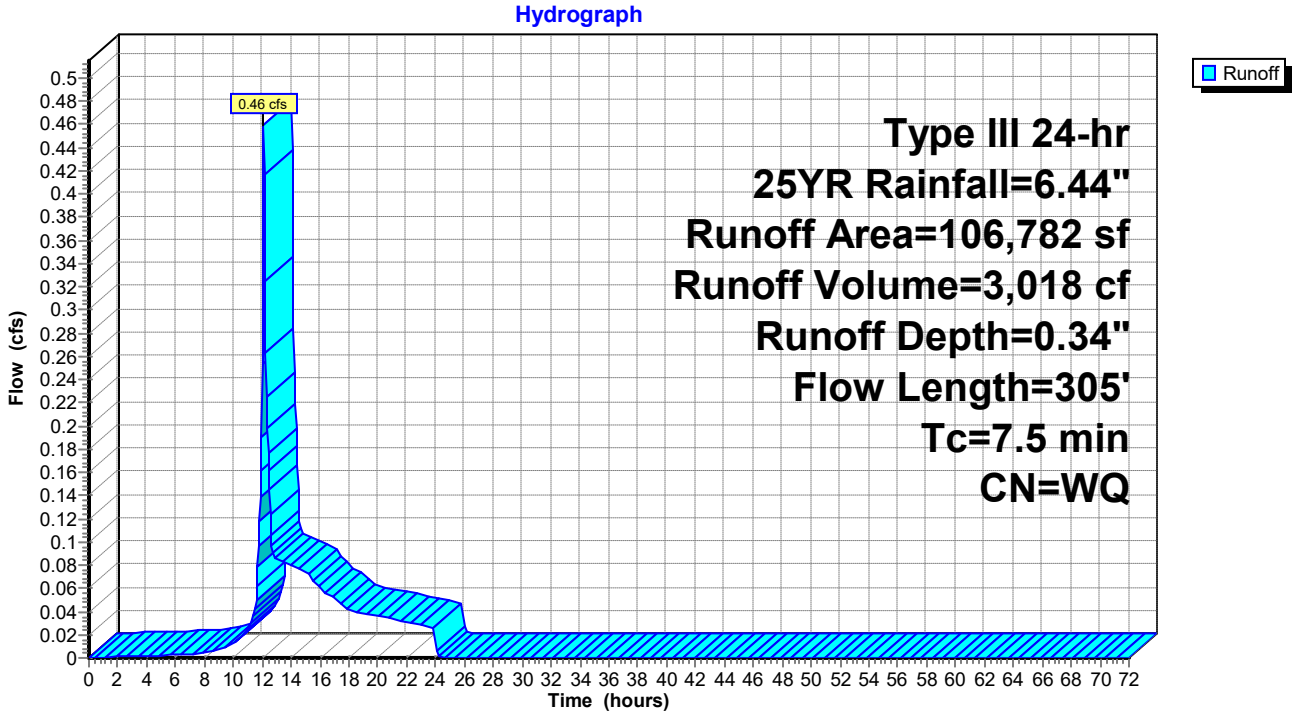
Runoff = 0.46 cfs @ 12.11 hrs, Volume= 3,018 cf, Depth= 0.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR Rainfall=6.44"

Area (sf)	CN	Description
48,746	30	Woods, Good, HSG A
53,332	32	Woods/grass comb., Good, HSG A
3,504	72	Dirt roads, HSG A
1,200	98	Roofs, HSG A
106,782		Weighted Average
105,582		98.88% Pervious Area
1,200		1.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	50	0.1000	0.29		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.39"
4.6	255	0.0340	0.92		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.5	305	Total			

Subcatchment D1: SUB D1



Summary for Subcatchment E1: SUB E1

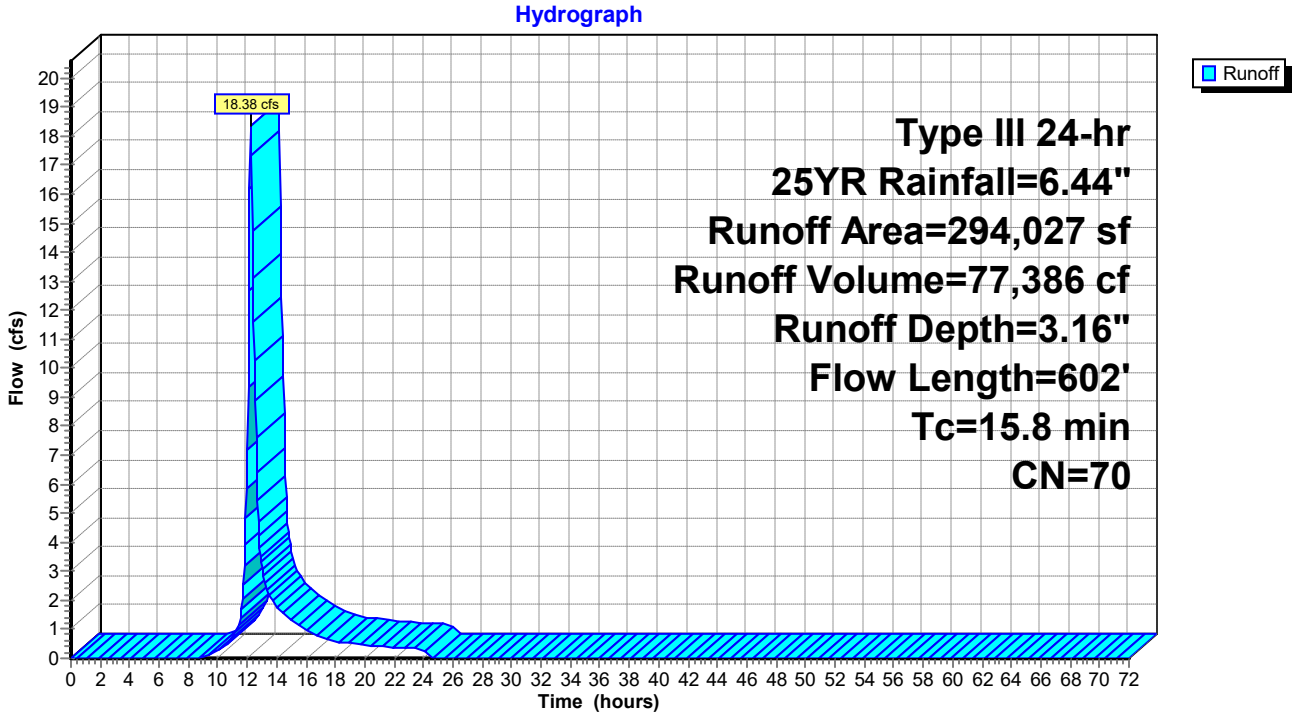
Runoff = 18.38 cfs @ 12.22 hrs, Volume= 77,386 cf, Depth= 3.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR Rainfall=6.44"

Area (sf)	CN	Description
294,027	70	Woods, Good, HSG C
294,027		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.2	50	0.1200	0.08		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.39"
2.2	260	0.1500	1.94		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.4	292	0.0820	1.43		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.8	602	Total			

Subcatchment E1: SUB E1



Summary for Pond B-1: B-1

Inflow Area = 485,260 sf, 2.46% Impervious, Inflow Depth = 0.07" for 25YR event
Inflow = 0.37 cfs @ 12.20 hrs, Volume= 3,013 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

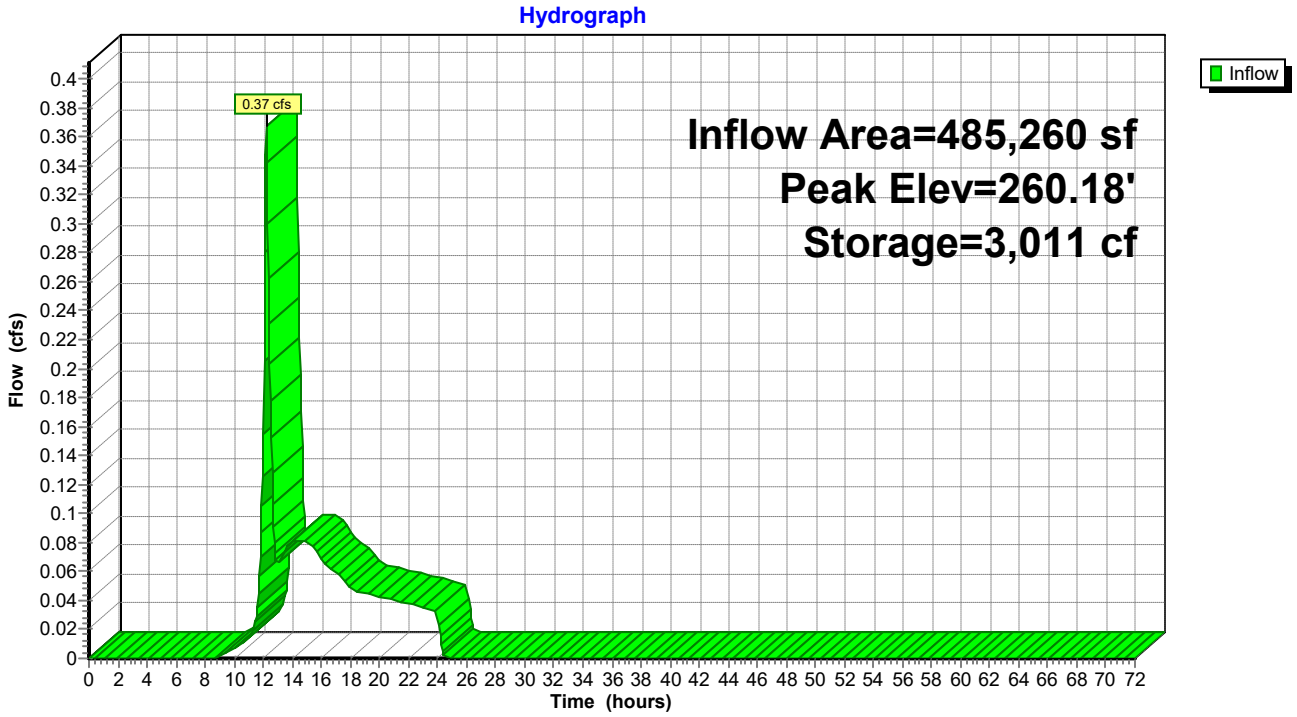
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 260.18' @ 24.80 hrs Surf.Area= 5,003 sf Storage= 3,011 cf

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

Volume	Invert	Avail.Storage	Storage Description
#1	259.00'	304,800 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
259.00	93	0	0
260.00	4,262	2,178	2,178
261.00	8,381	6,322	8,499
262.00	20,895	14,638	23,137
263.00	32,293	26,594	49,731
264.00	37,929	35,111	84,842
265.00	45,851	41,890	126,732
266.00	54,173	50,012	176,744
267.00	64,790	59,482	236,226
268.00	72,359	68,575	304,800

Pond B-1: B-1


Hydrograph
Inflow
0.37 cfs
Inflow Area=485,260 sf
Peak Elev=260.18'
Storage=3,011 cf
Flow (cfs)
0 0.02 0.04 0.06 0.08 0.1 0.12 0.14 0.16 0.18 0.2 0.22 0.24 0.26 0.28 0.3 0.32 0.34 0.36 0.38 0.4
Time (hours)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72

Summary for Pond B-2: B-2

Inflow Area = 106,782 sf, 1.12% Impervious, Inflow Depth = 0.34" for 25YR event
Inflow = 0.46 cfs @ 12.11 hrs, Volume= 3,018 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 268.65' @ 24.45 hrs Surf.Area= 8,643 sf Storage= 3,017 cf

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

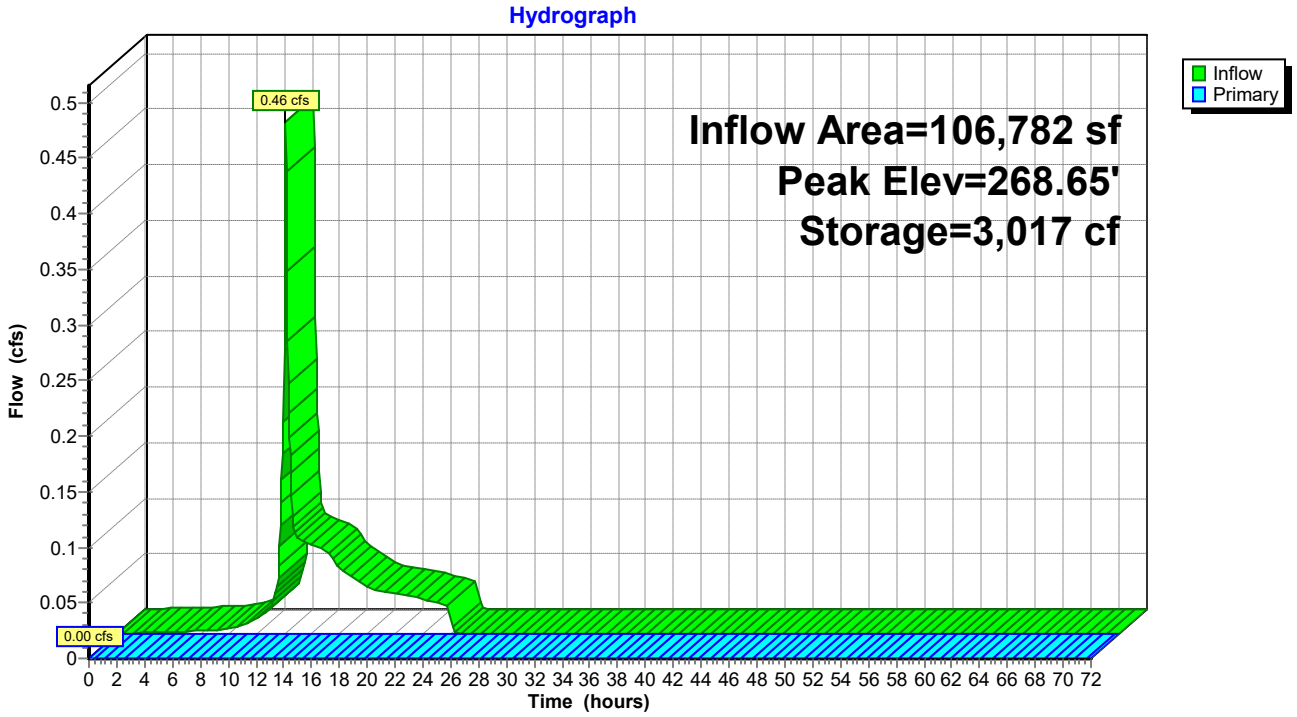
Volume	Invert	Avail.Storage	Storage Description
#1	268.00'	50,349 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
268.00	692	0	0
269.00	12,993	6,843	6,843
270.00	20,435	16,714	23,557
271.00	33,150	26,793	50,349

Device	Routing	Invert	Outlet Devices
#1	Primary	270.60'	**100.0' long x 12.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=268.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond B-2: B-2


Hydrograph
Inflow Area=106,782 sf
Peak Elev=268.65'
Storage=3,017 cf
0.46 cfs
0.00 cfs
Inflow
Primary
Flow (cfs)
0 0.05 0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45 0.5
Time (hours)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72

Summary for Pond W-1: W-1

Inflow Area = 332,199 sf, 3.60% Impervious, Inflow Depth = 1.67" for 25YR event
Inflow = 8.99 cfs @ 12.31 hrs, Volume= 46,147 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 264.87' @ 25.35 hrs Surf.Area= 32,537 sf Storage= 46,145 cf

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

Volume	Invert	Avail.Storage	Storage Description
#1	262.80'	195,884 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

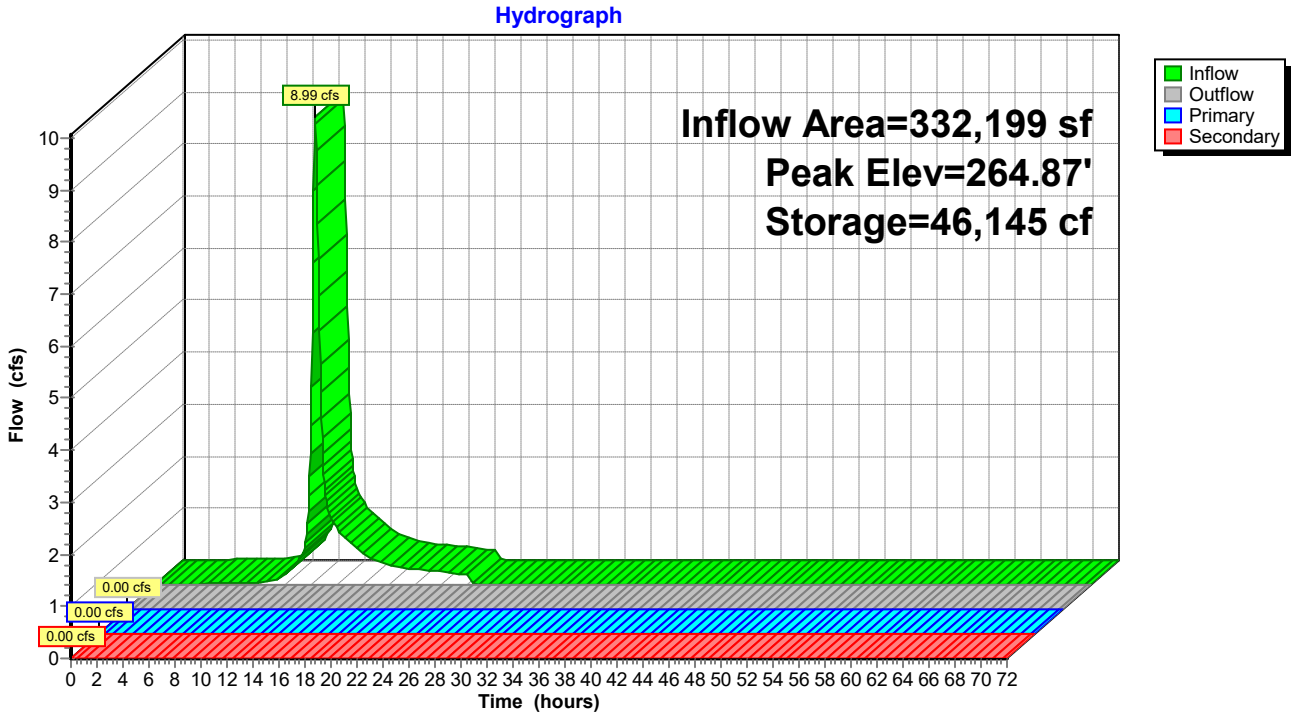
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
262.80	13,689	0	0
263.00	14,660	2,835	2,835
264.00	23,335	18,998	21,832
265.00	33,908	28,622	50,454
266.00	42,247	38,078	88,531
267.00	52,733	47,490	136,021
268.00	66,993	59,863	195,884

Device	Routing	Invert	Outlet Devices
#1	Primary	265.40'	**45.0' long x 16.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Secondary	267.40'	**4.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=262.80' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=262.80' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond W-1: W-1

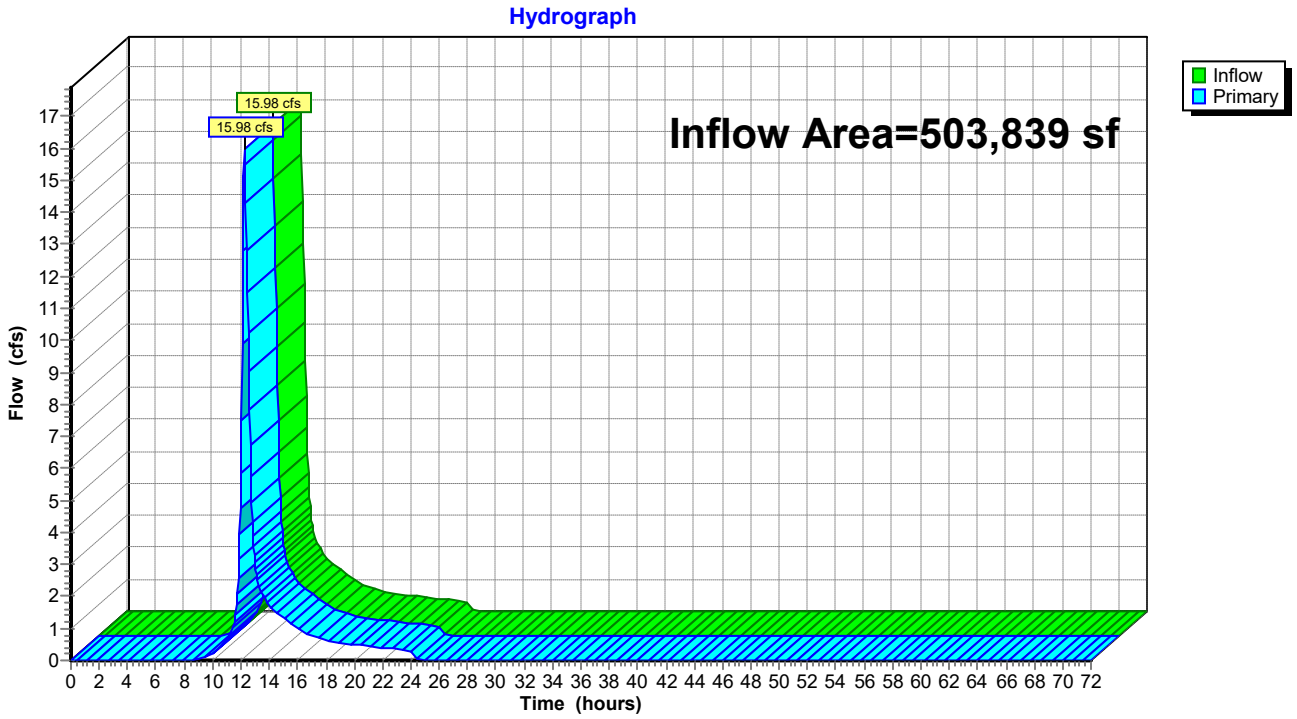

Hydrograph
Inflow Area=332,199 sf
Peak Elev=264.87'
Storage=46,145 cf
8.99 cfs
0.00 cfs
0.00 cfs
0.00 cfs
Inflow
Outflow
Primary
Secondary
Flow (cfs)
Time (hours)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72
0 1 2 3 4 5 6 7 8 9 10

Summary for Link A: POI-A

Inflow Area = 503,839 sf, 0.00% Impervious, Inflow Depth = 1.75" for 25YR event
Inflow = 15.98 cfs @ 12.26 hrs, Volume= 73,573 cf
Primary = 15.98 cfs @ 12.26 hrs, Volume= 73,573 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link A: POI-A

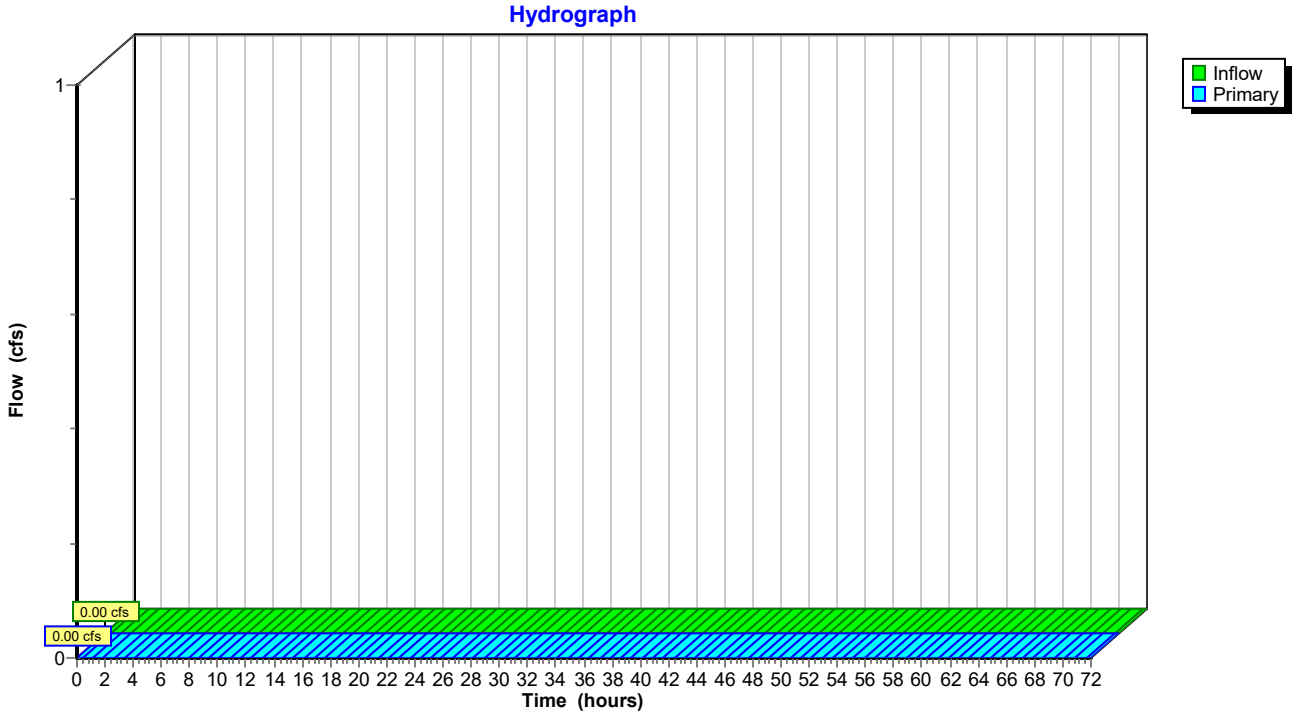


Summary for Link B: POI-B

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link B: POI-B

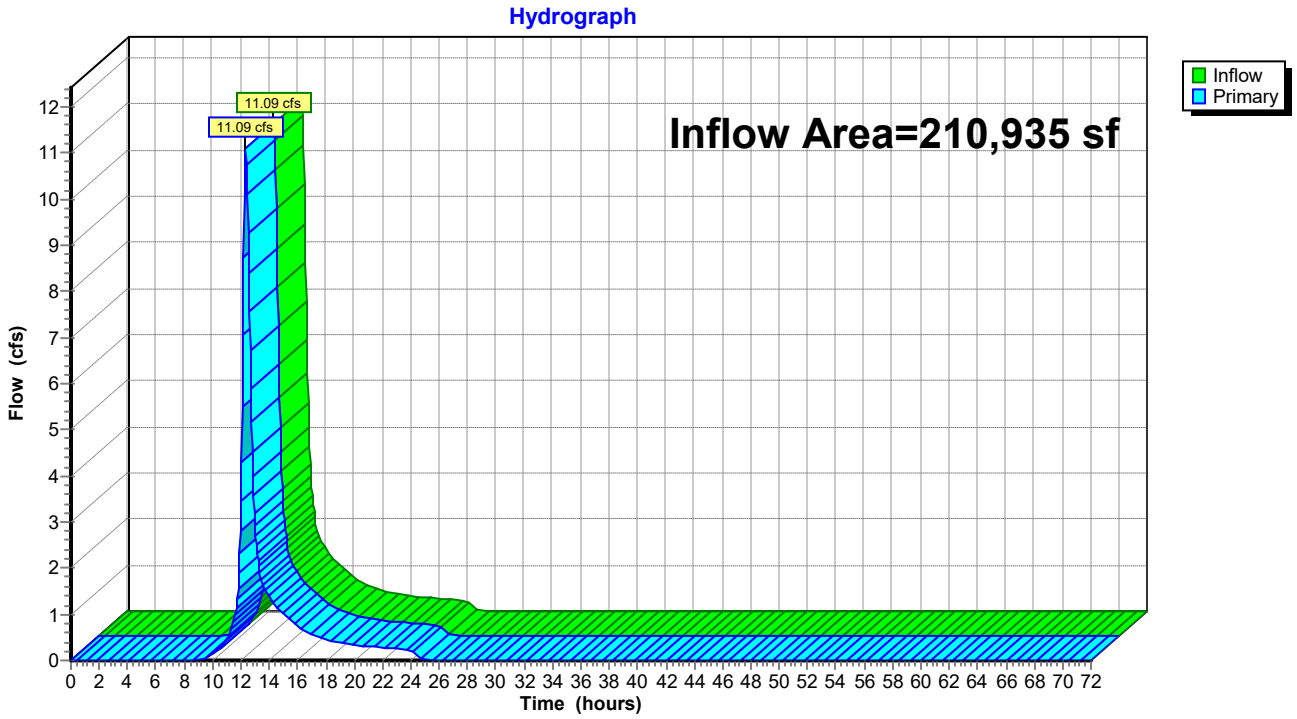


Summary for Link C: POI-C

Inflow Area = 210,935 sf, 0.00% Impervious, Inflow Depth = 3.16" for 25YR event
Inflow = 11.09 cfs @ 12.34 hrs, Volume= 55,517 cf
Primary = 11.09 cfs @ 12.34 hrs, Volume= 55,517 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link C: POI-C

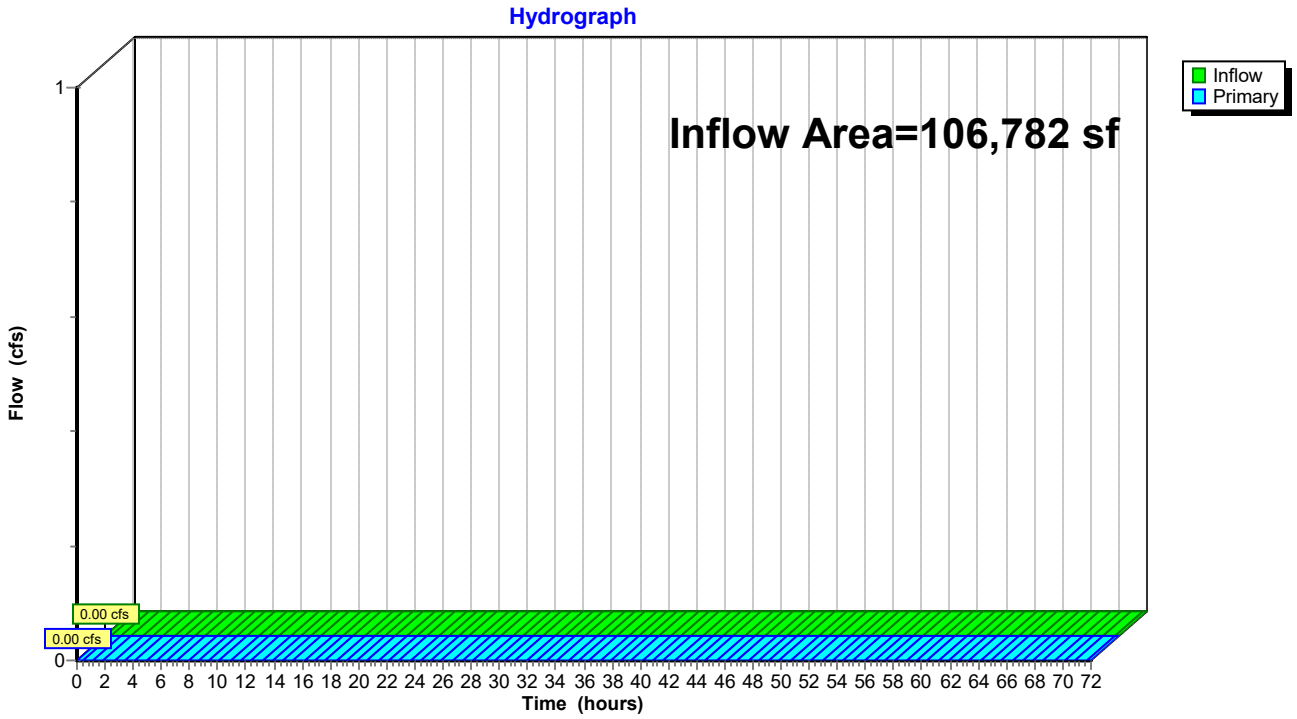


Summary for Link D: POI-D

Inflow Area = 106,782 sf, 1.12% Impervious, Inflow Depth = 0.00" for 25YR event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link D: POI-D

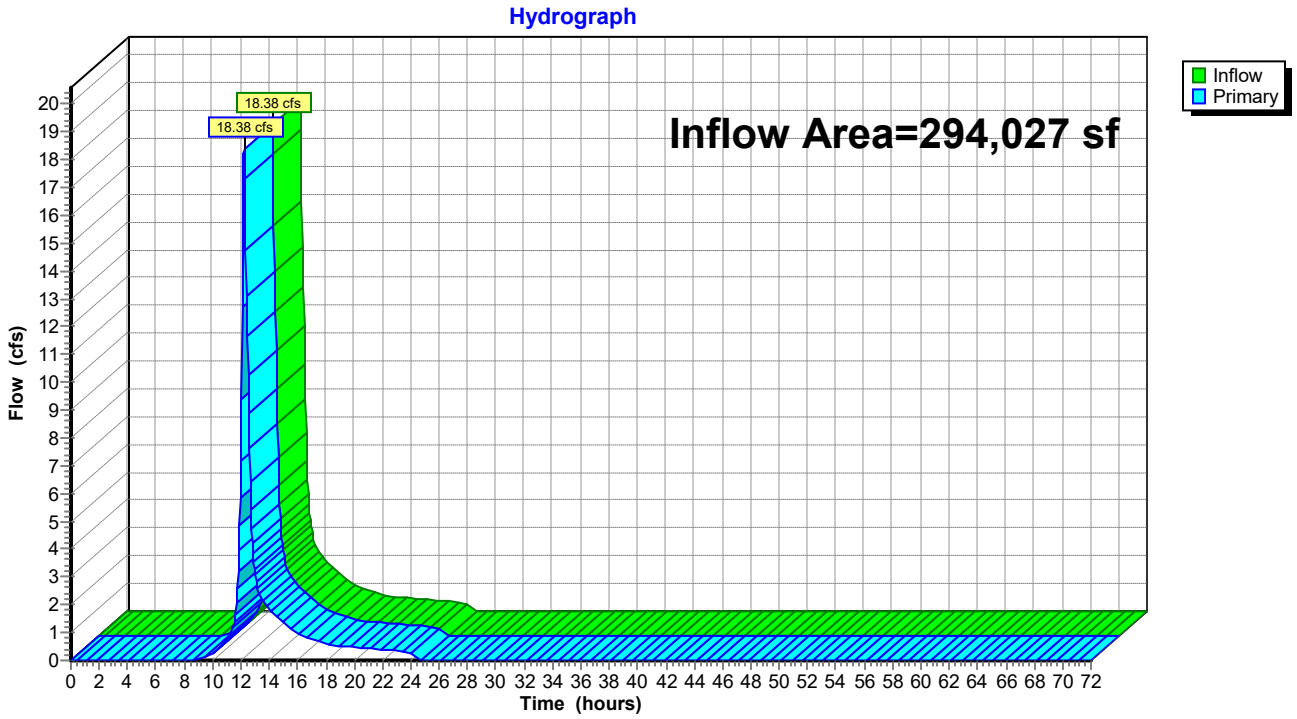


Summary for Link E: POI-E

Inflow Area = 294,027 sf, 0.00% Impervious, Inflow Depth = 3.16" for 25YR event
Inflow = 18.38 cfs @ 12.22 hrs, Volume= 77,386 cf
Primary = 18.38 cfs @ 12.22 hrs, Volume= 77,386 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link E: POI-E



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A1: SUB A1 Runoff Area=503,839 sf 0.00% Impervious Runoff Depth=2.73"
Flow Length=640' Tc=18.2 min CN=WQ Runoff=23.88 cfs 114,690 cf

Subcatchment B1: SUB B1 Runoff Area=332,199 sf 3.60% Impervious Runoff Depth=2.58"
Flow Length=1,115' Tc=22.4 min CN=WQ Runoff=13.24 cfs 71,447 cf

Subcatchment B2: SUB B2 Runoff Area=153,061 sf 0.00% Impervious Runoff Depth=0.63"
Flow Length=325' Tc=13.9 min CN=WQ Runoff=0.72 cfs 8,028 cf

Subcatchment C1: SUB C1 Runoff Area=210,935 sf 0.00% Impervious Runoff Depth=4.68"
Flow Length=450' Tc=24.1 min CN=70 Runoff=16.51 cfs 82,263 cf

Subcatchment D1: SUB D1 Runoff Area=106,782 sf 1.12% Impervious Runoff Depth=0.79"
Flow Length=305' Tc=7.5 min CN=WQ Runoff=0.75 cfs 6,990 cf

Subcatchment E1: SUB E1 Runoff Area=294,027 sf 0.00% Impervious Runoff Depth=4.68"
Flow Length=602' Tc=15.8 min CN=70 Runoff=27.37 cfs 114,668 cf

Pond B-1: B-1 Peak Elev=261.54' Storage=14,784 cf Inflow=0.72 cfs 14,791 cf
Outflow=0.00 cfs 0 cf

Pond B-2: B-2 Peak Elev=269.01' Storage=6,990 cf Inflow=0.75 cfs 6,990 cf
Outflow=0.00 cfs 0 cf

Pond W-1: W-1 Peak Elev=265.42' Storage=65,257 cf Inflow=13.24 cfs 71,447 cf
Primary=0.42 cfs 6,763 cf Secondary=0.00 cfs 0 cf Outflow=0.42 cfs 6,763 cf

Link A: POI-A Inflow=23.88 cfs 114,690 cf
Primary=23.88 cfs 114,690 cf

Link B: POI-B Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Link C: POI-C Inflow=16.51 cfs 82,263 cf
Primary=16.51 cfs 82,263 cf

Link D: POI-D Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Link E: POI-E Inflow=27.37 cfs 114,668 cf
Primary=27.37 cfs 114,668 cf

Total Runoff Area = 1,600,843 sf Runoff Volume = 398,086 cf Average Runoff Depth = 2.98"
99.18% Pervious = 1,587,684 sf 0.82% Impervious = 13,159 sf

Summary for Subcatchment A1: SUB A1

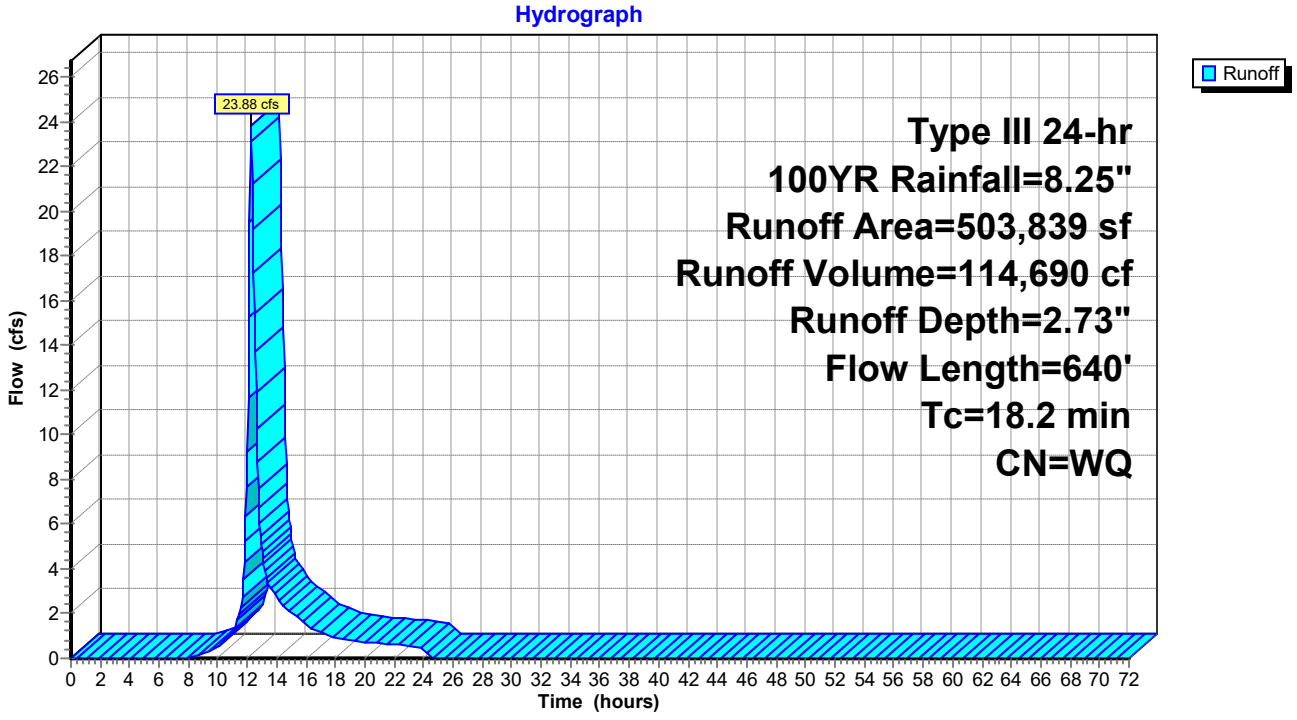
Runoff = 23.88 cfs @ 12.26 hrs, Volume= 114,690 cf, Depth= 2.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR Rainfall=8.25"

Area (sf)	CN	Description
233,563	30	Woods, Good, HSG A
270,276	70	Woods, Good, HSG C
503,839		Weighted Average
503,839		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0	50	0.0800	0.07		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.39"
6.2	590	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.2	640	Total			

Subcatchment A1: SUB A1



Summary for Subcatchment B1: SUB B1

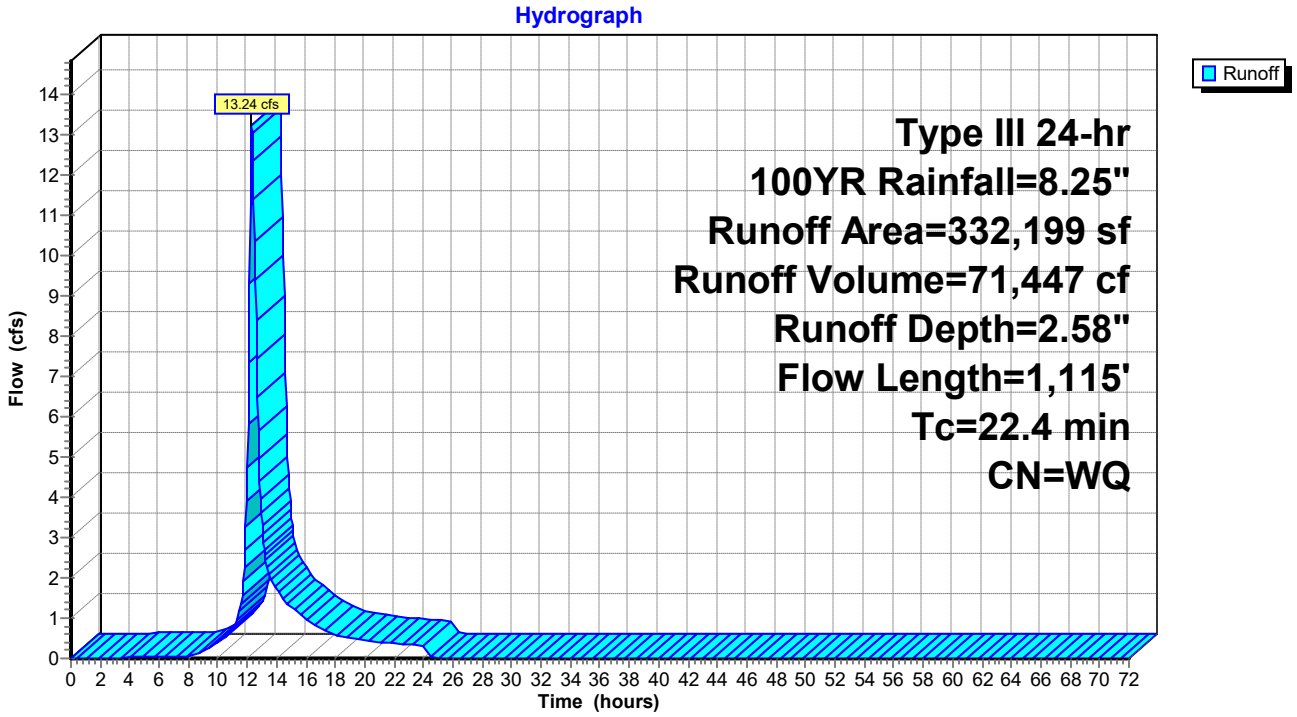
Runoff = 13.24 cfs @ 12.31 hrs, Volume= 71,447 cf, Depth= 2.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR Rainfall=8.25"

	Area (sf)	CN	Description
*	11,959	98	Water Surface, HSG A
	175,644	30	Woods, Good, HSG A
	139,940	70	Woods, Good, HSG C
	4,656	72	Dirt roads, HSG A
	332,199		Weighted Average
	320,240		96.40% Pervious Area
	11,959		3.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	50	0.1800	0.10		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.39"
2.2	270	0.1700	2.06		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.6	163	0.1200	1.73		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
9.9	632	0.0450	1.06		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
22.4	1,115	Total			

Subcatchment B1: SUB B1



Summary for Subcatchment B2: SUB B2

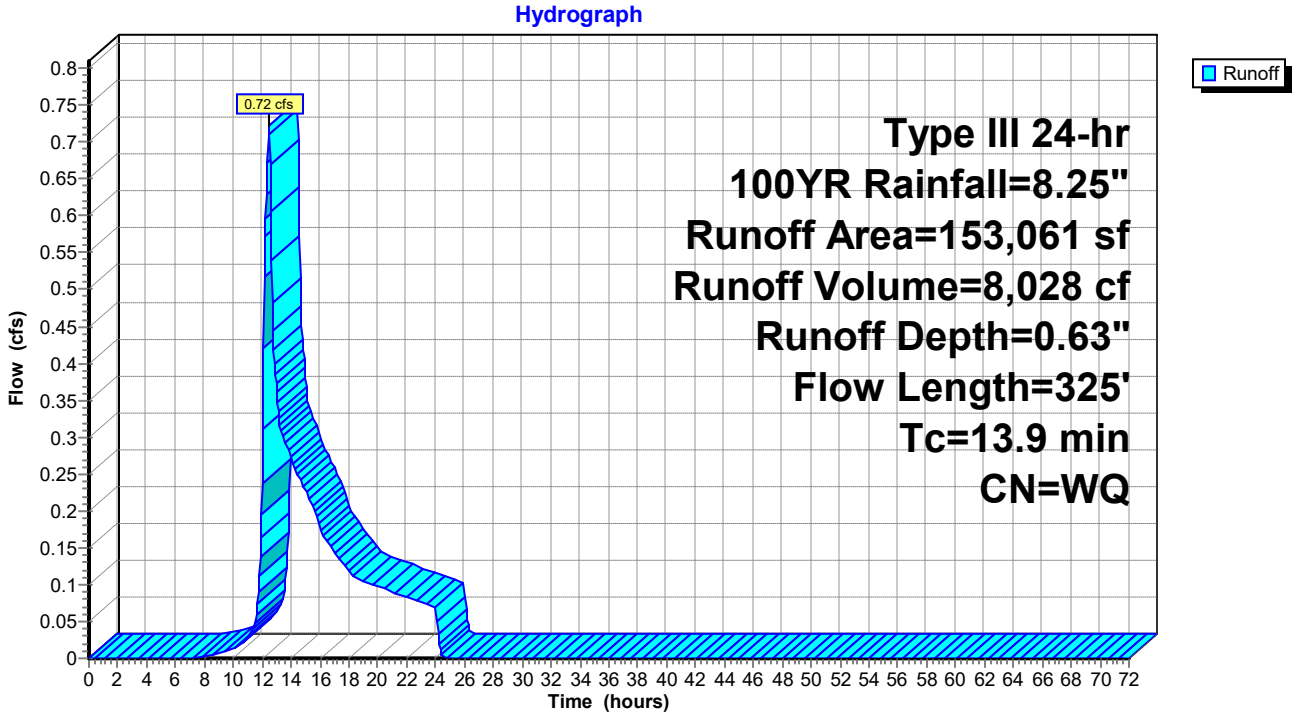
Runoff = 0.72 cfs @ 12.45 hrs, Volume= 8,028 cf, Depth= 0.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR Rainfall=8.25"

Area (sf)	CN	Description
147,805	30	Woods, Good, HSG A
5,256	72	Dirt roads, HSG A
153,061		Weighted Average
153,061		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	50	0.1600	0.09		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.39"
4.8	275	0.0360	0.95		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.9	325	Total			

Subcatchment B2: SUB B2



Summary for Subcatchment C1: SUB C1

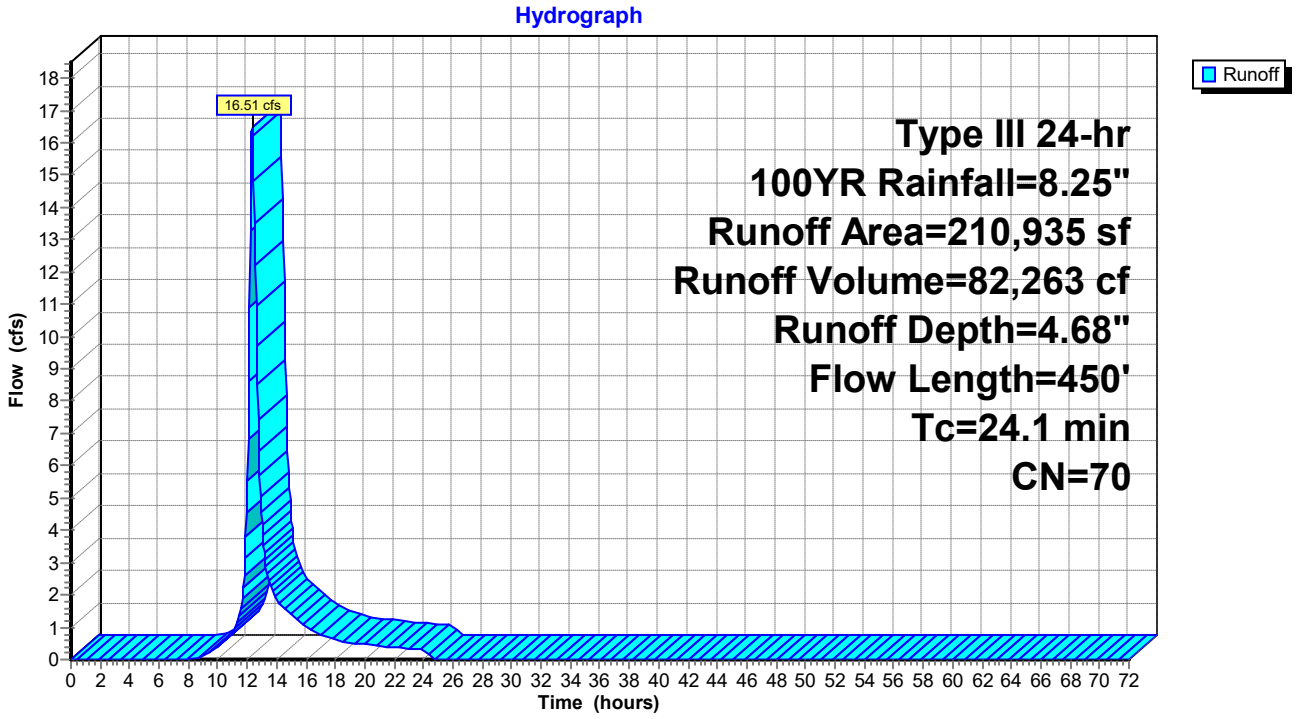
Runoff = 16.51 cfs @ 12.34 hrs, Volume= 82,263 cf, Depth= 4.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR Rainfall=8.25"

Area (sf)	CN	Description
210,935	70	Woods, Good, HSG C
210,935		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0400	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.39"
8.3	400	0.0260	0.81		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
24.1	450	Total			

Subcatchment C1: SUB C1



Summary for Subcatchment D1: SUB D1

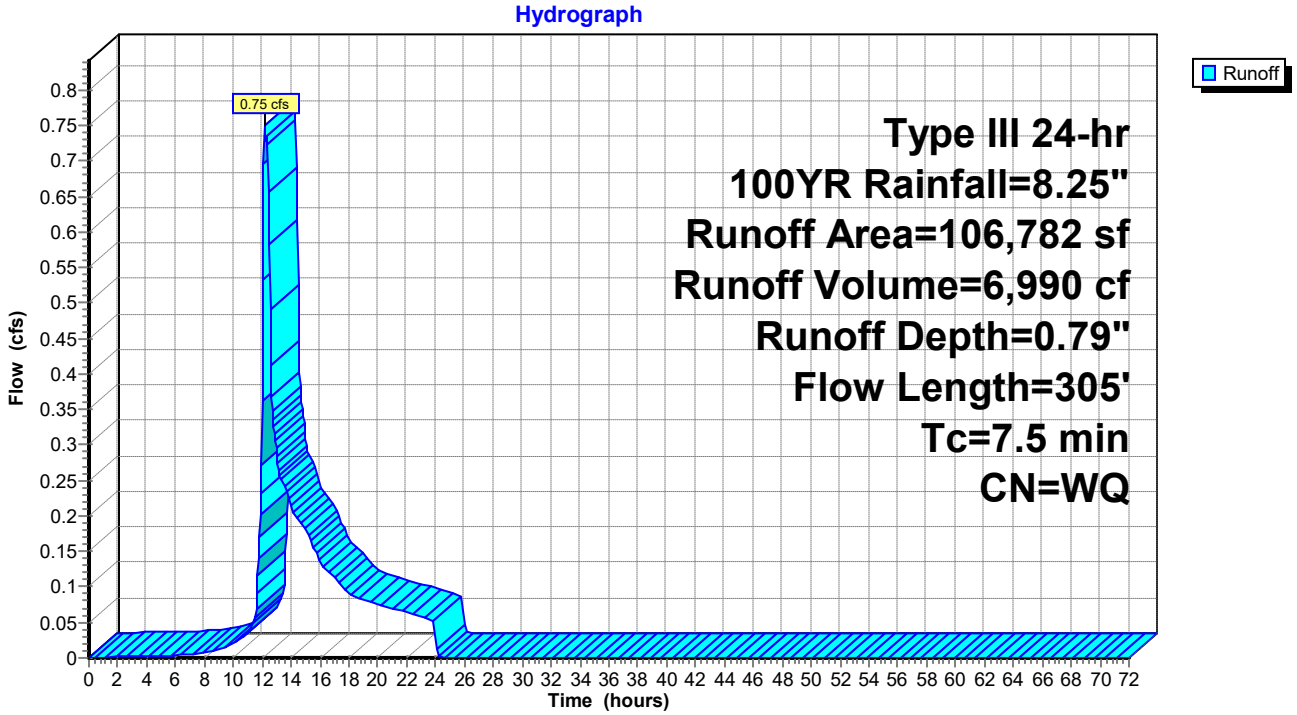
Runoff = 0.75 cfs @ 12.16 hrs, Volume= 6,990 cf, Depth= 0.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR Rainfall=8.25"

Area (sf)	CN	Description
48,746	30	Woods, Good, HSG A
53,332	32	Woods/grass comb., Good, HSG A
3,504	72	Dirt roads, HSG A
1,200	98	Roofs, HSG A
106,782		Weighted Average
105,582		98.88% Pervious Area
1,200		1.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	50	0.1000	0.29		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.39"
4.6	255	0.0340	0.92		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.5	305	Total			

Subcatchment D1: SUB D1



Summary for Subcatchment E1: SUB E1

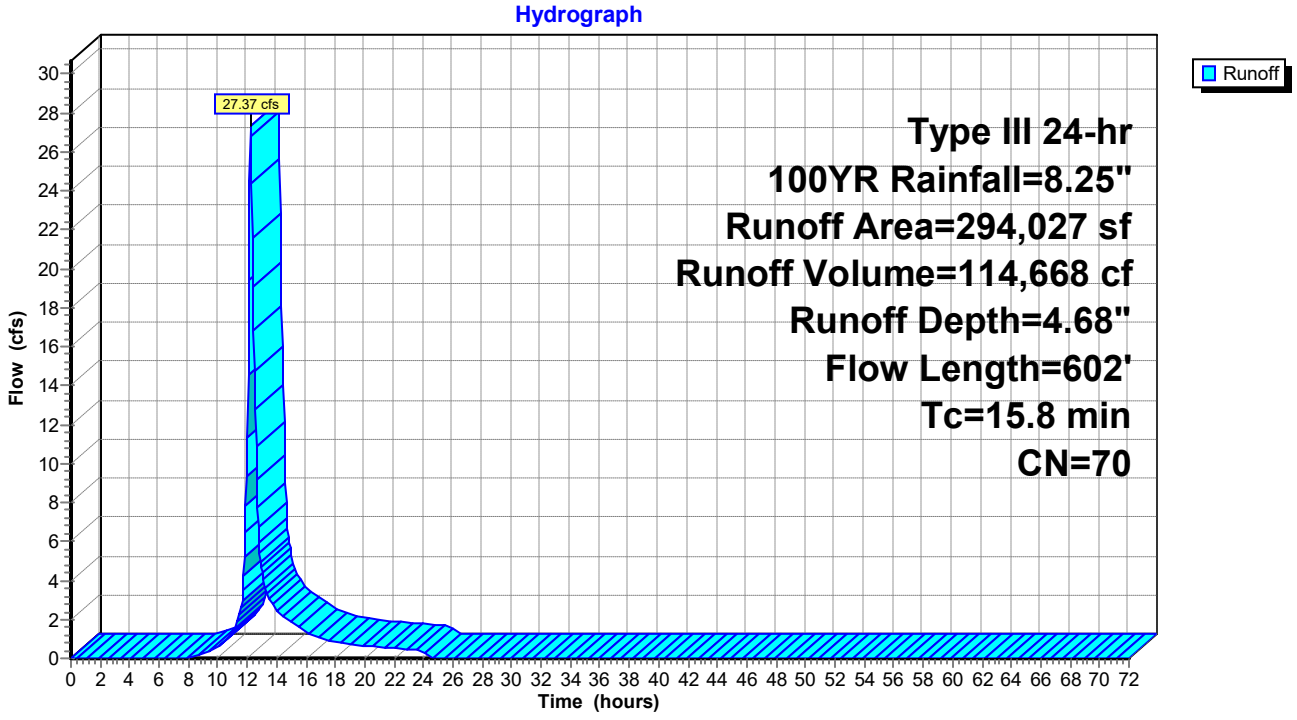
Runoff = 27.37 cfs @ 12.22 hrs, Volume= 114,668 cf, Depth= 4.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR Rainfall=8.25"

Area (sf)	CN	Description
294,027	70	Woods, Good, HSG C
294,027		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.2	50	0.1200	0.08		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.39"
2.2	260	0.1500	1.94		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.4	292	0.0820	1.43		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.8	602	Total			

Subcatchment E1: SUB E1



Summary for Pond B-1: B-1

Inflow Area = 485,260 sf, 2.46% Impervious, Inflow Depth = 0.37" for 100YR event
Inflow = 0.72 cfs @ 12.45 hrs, Volume= 14,791 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

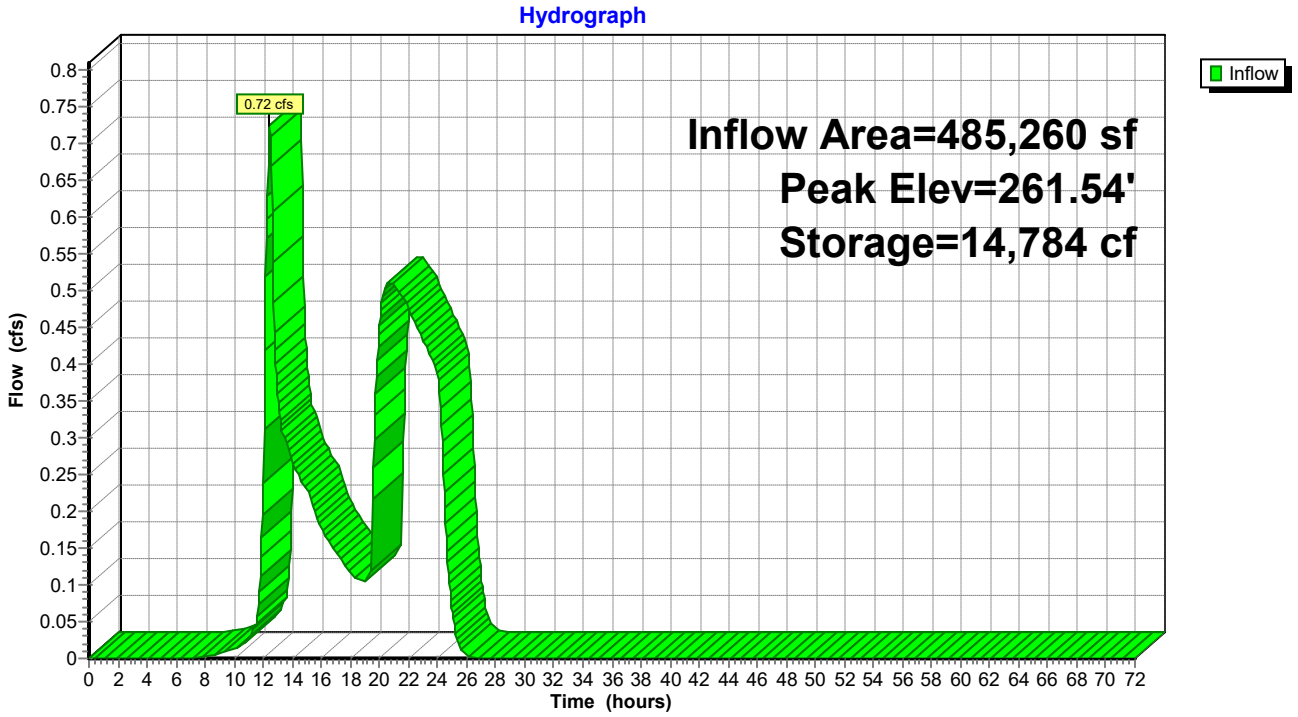
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 261.54' @ 71.10 hrs Surf.Area= 15,084 sf Storage= 14,784 cf

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

Volume	Invert	Avail.Storage	Storage Description
#1	259.00'	304,800 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
259.00	93	0	0
260.00	4,262	2,178	2,178
261.00	8,381	6,322	8,499
262.00	20,895	14,638	23,137
263.00	32,293	26,594	49,731
264.00	37,929	35,111	84,842
265.00	45,851	41,890	126,732
266.00	54,173	50,012	176,744
267.00	64,790	59,482	236,226
268.00	72,359	68,575	304,800

Pond B-1: B-1


Hydrograph
Inflow
0.72 cfs
Inflow Area=485,260 sf
Peak Elev=261.54'
Storage=14,784 cf
Flow (cfs)
0 0.05 0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45 0.5 0.55 0.6 0.65 0.7 0.75 0.8
Time (hours)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72

Summary for Pond B-2: B-2

Inflow Area = 106,782 sf, 1.12% Impervious, Inflow Depth = 0.79" for 100YR event
Inflow = 0.75 cfs @ 12.16 hrs, Volume= 6,990 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 269.01' @ 24.45 hrs Surf.Area= 13,077 sf Storage= 6,990 cf

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

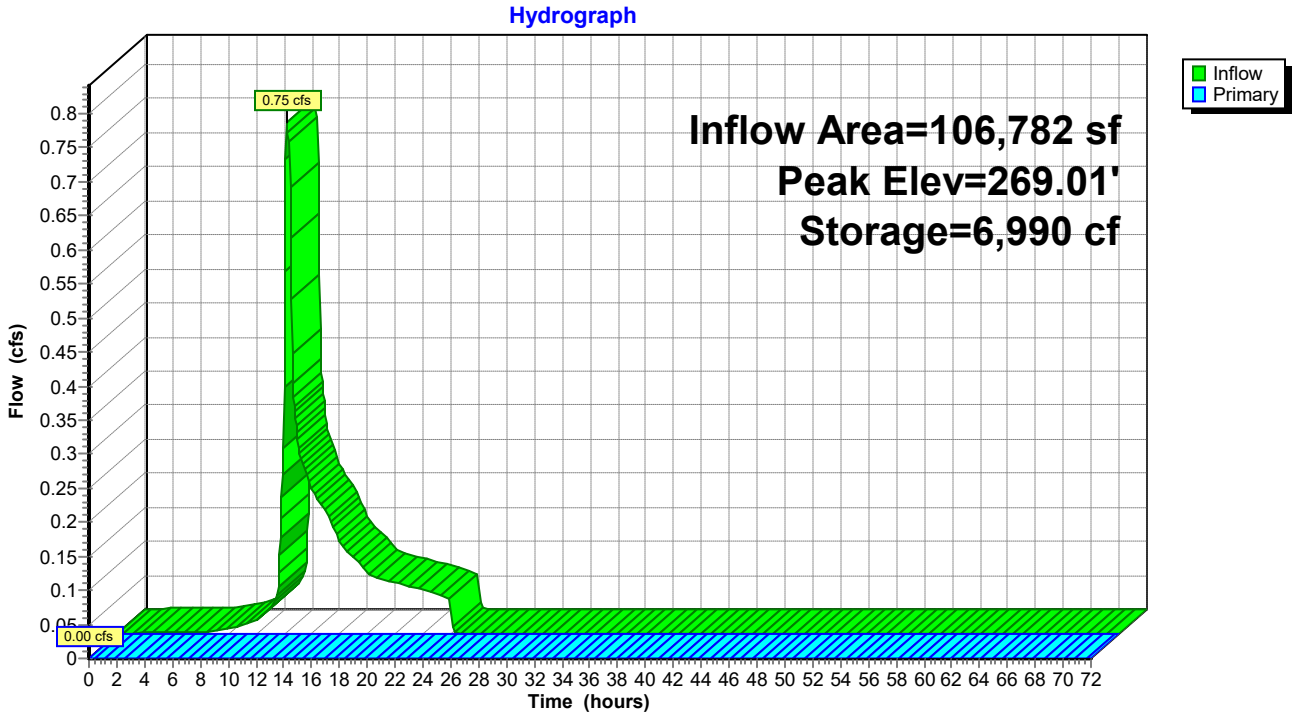
Volume	Invert	Avail.Storage	Storage Description
#1	268.00'	50,349 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
268.00	692	0	0
269.00	12,993	6,843	6,843
270.00	20,435	16,714	23,557
271.00	33,150	26,793	50,349

Device	Routing	Invert	Outlet Devices
#1	Primary	270.60'	**100.0' long x 12.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=268.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond B-2: B-2


Hydrograph
Inflow
Primary
Inflow Area=106,782 sf
Peak Elev=269.01'
Storage=6,990 cf
0.75 cfs
0.00 cfs
Flow (cfs)
Time (hours)
0 0.05 0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45 0.5 0.55 0.6 0.65 0.7 0.75 0.8
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72

Summary for Pond W-1: W-1

Inflow Area = 332,199 sf, 3.60% Impervious, Inflow Depth = 2.58" for 100YR event
Inflow = 13.24 cfs @ 12.31 hrs, Volume= 71,447 cf
Outflow = 0.42 cfs @ 20.78 hrs, Volume= 6,763 cf, Atten= 97%, Lag= 507.9 min
Primary = 0.42 cfs @ 20.78 hrs, Volume= 6,763 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 265.42' @ 20.78 hrs Surf.Area= 37,372 sf Storage= 65,257 cf

Plug-Flow detention time= 716.0 min calculated for 6,758 cf (9% of inflow)
Center-of-Mass det. time= 480.6 min (1,325.1 - 844.6)

Volume	Invert	Avail.Storage	Storage Description
#1	262.80'	195,884 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

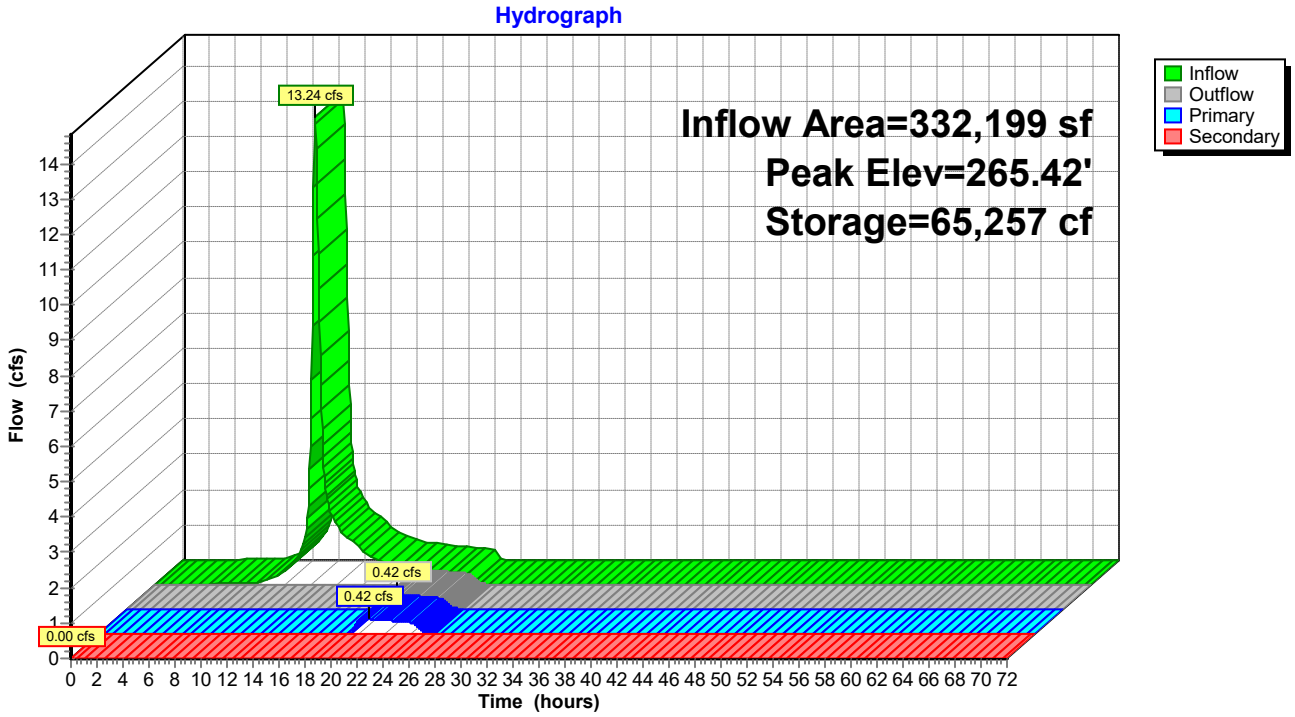
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
262.80	13,689	0	0
263.00	14,660	2,835	2,835
264.00	23,335	18,998	21,832
265.00	33,908	28,622	50,454
266.00	42,247	38,078	88,531
267.00	52,733	47,490	136,021
268.00	66,993	59,863	195,884

Device	Routing	Invert	Outlet Devices
#1	Primary	265.40'	**45.0' long x 16.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Secondary	267.40'	**4.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=0.23 cfs @ 20.78 hrs HW=265.42' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 0.23 cfs @ 0.33 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=262.80' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond W-1: W-1

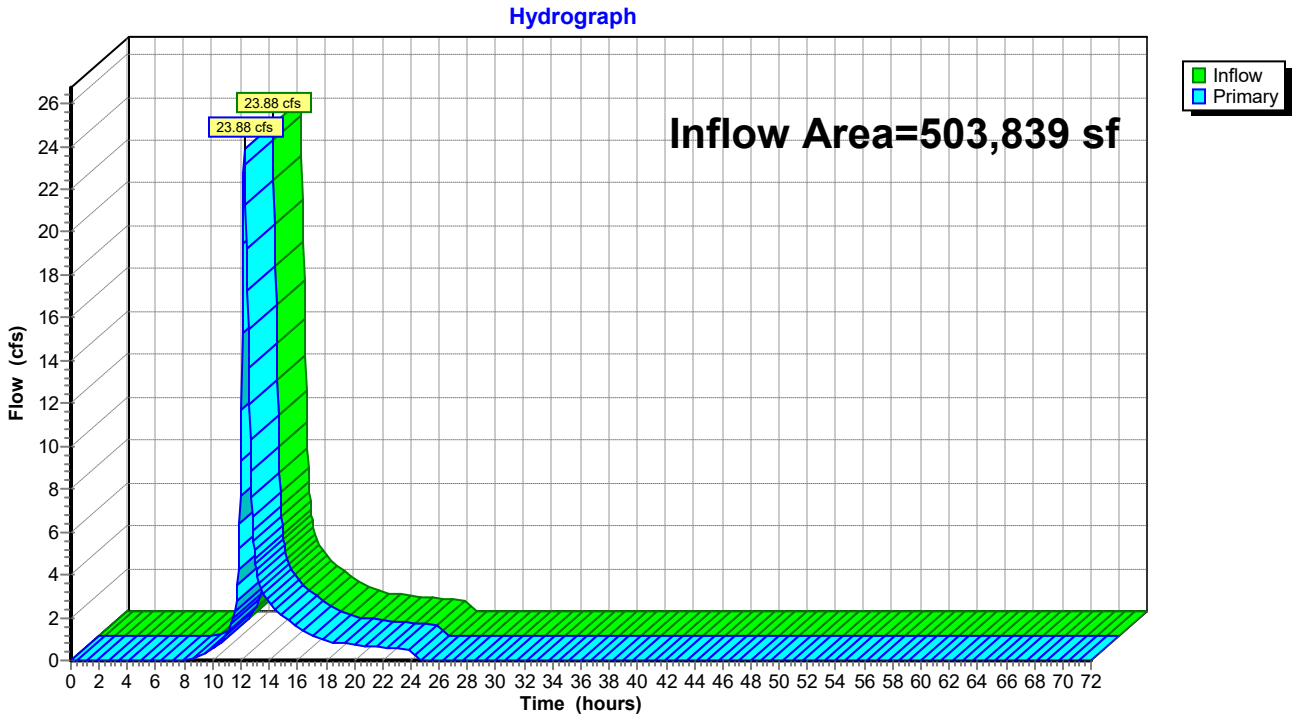

Hydrograph
Inflow Area=332,199 sf
Peak Elev=265.42'
Storage=65,257 cf
13.24 cfs
0.42 cfs
0.42 cfs
0.00 cfs
Inflow
Outflow
Primary
Secondary
Flow (cfs)
Time (hours)

Summary for Link A: POI-A

Inflow Area = 503,839 sf, 0.00% Impervious, Inflow Depth = 2.73" for 100YR event
Inflow = 23.88 cfs @ 12.26 hrs, Volume= 114,690 cf
Primary = 23.88 cfs @ 12.26 hrs, Volume= 114,690 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link A: POI-A

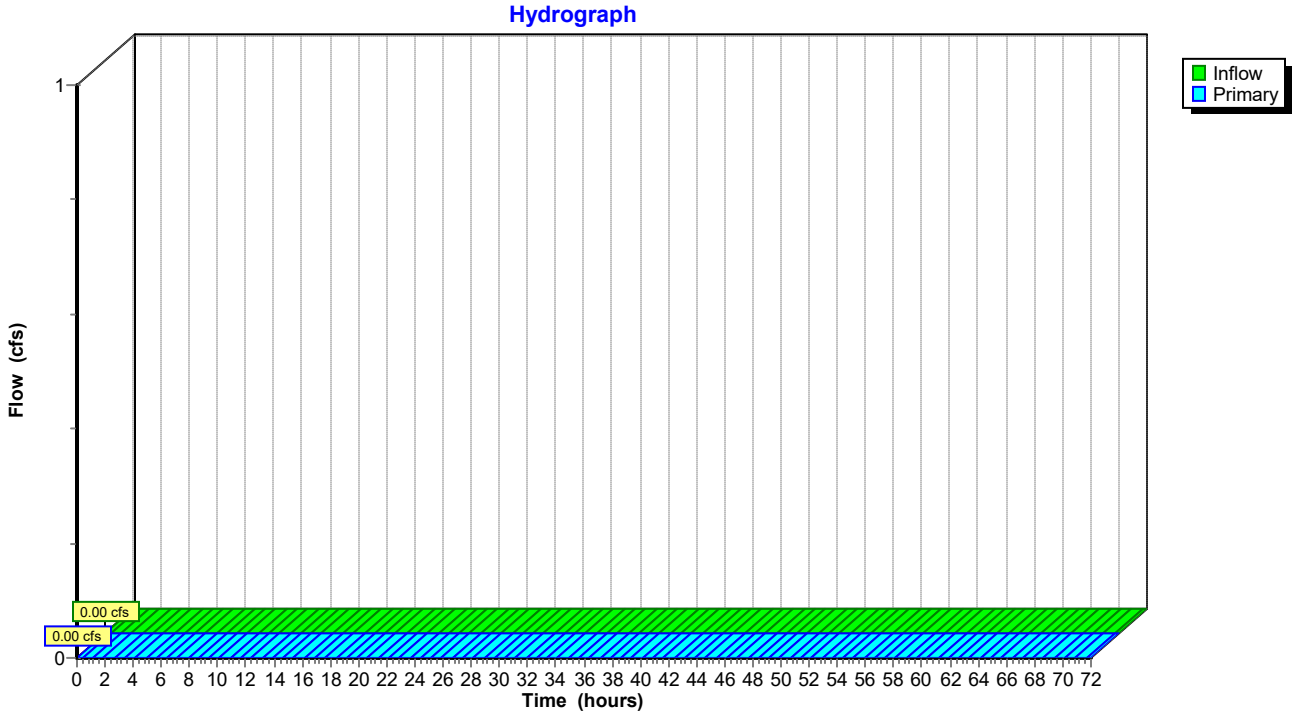


Summary for Link B: POI-B

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0 cf
Primary	=	0.00 cfs @	0.00 hrs, Volume=	0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link B: POI-B

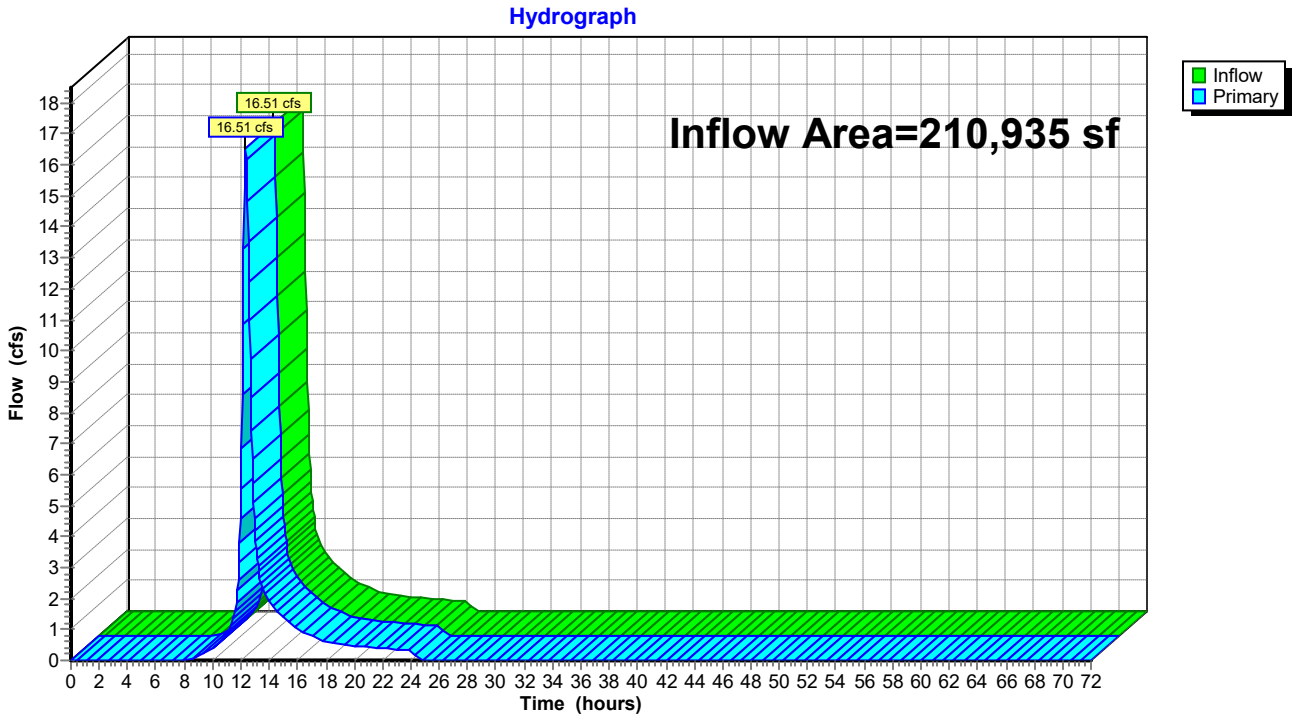


Summary for Link C: POI-C

Inflow Area = 210,935 sf, 0.00% Impervious, Inflow Depth = 4.68" for 100YR event
Inflow = 16.51 cfs @ 12.34 hrs, Volume= 82,263 cf
Primary = 16.51 cfs @ 12.34 hrs, Volume= 82,263 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link C: POI-C

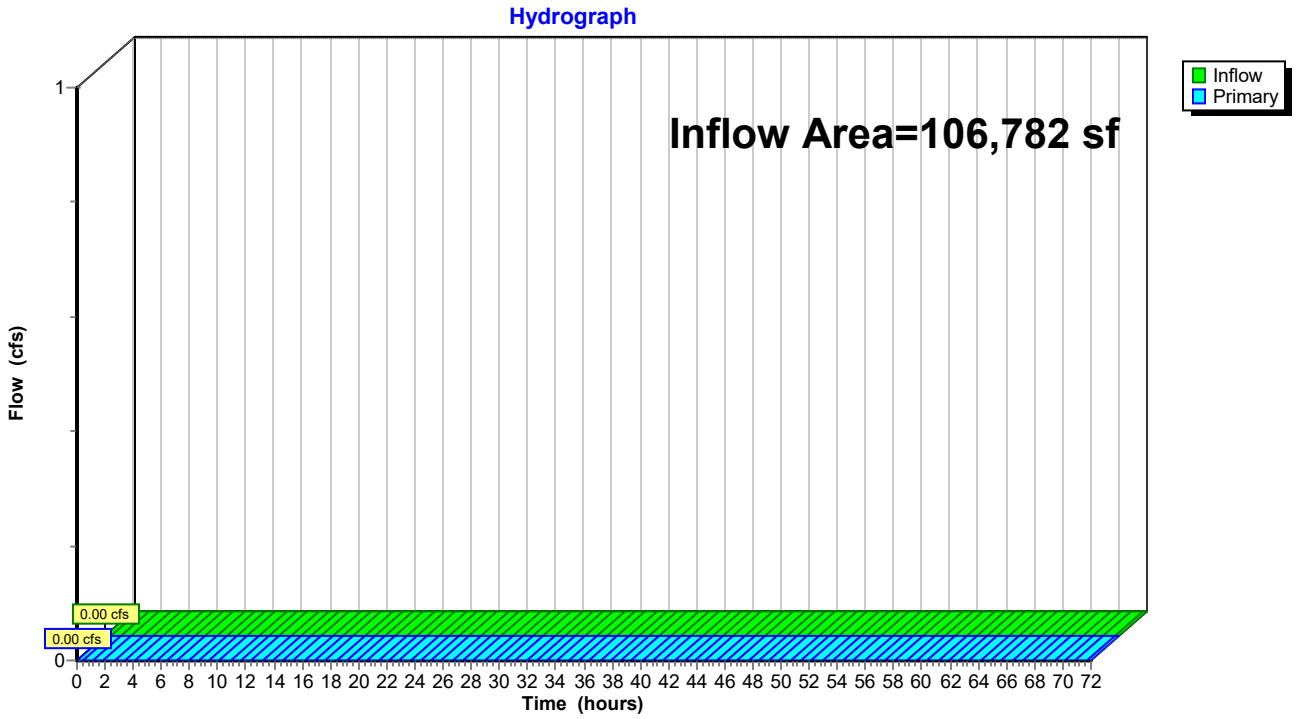


Summary for Link D: POI-D

Inflow Area = 106,782 sf, 1.12% Impervious, Inflow Depth = 0.00" for 100YR event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link D: POI-D

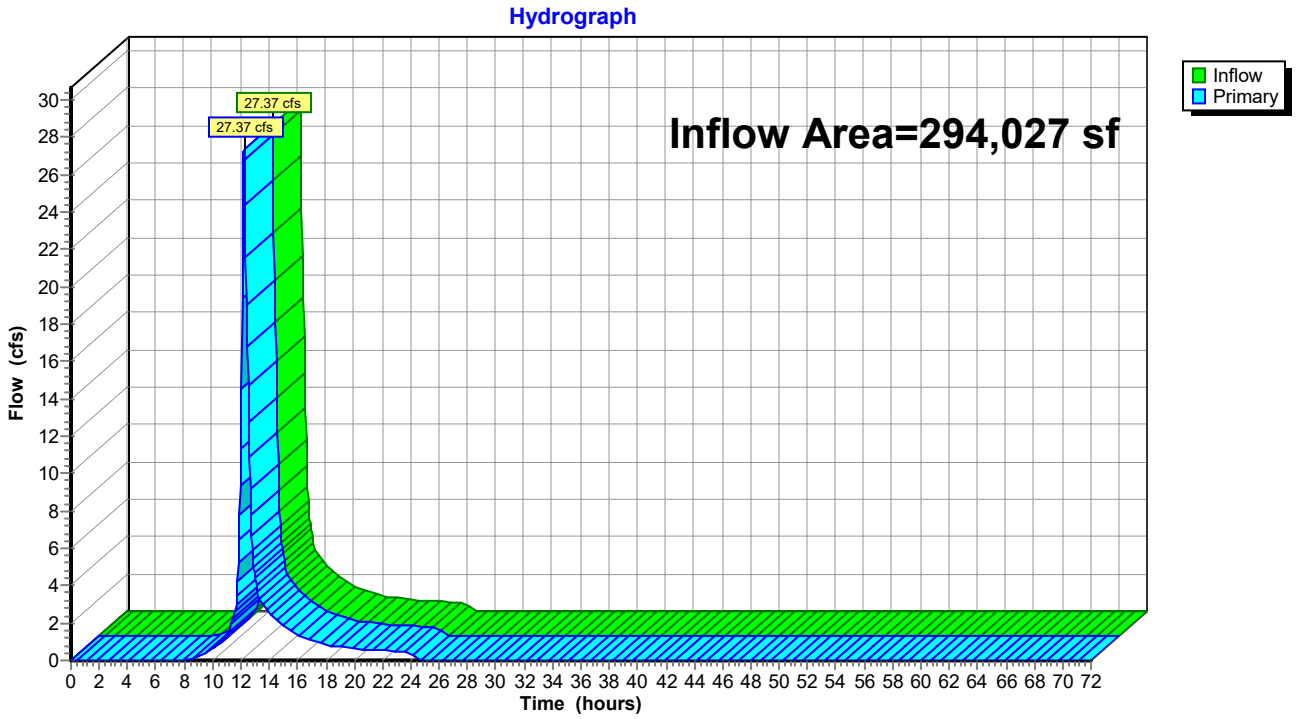


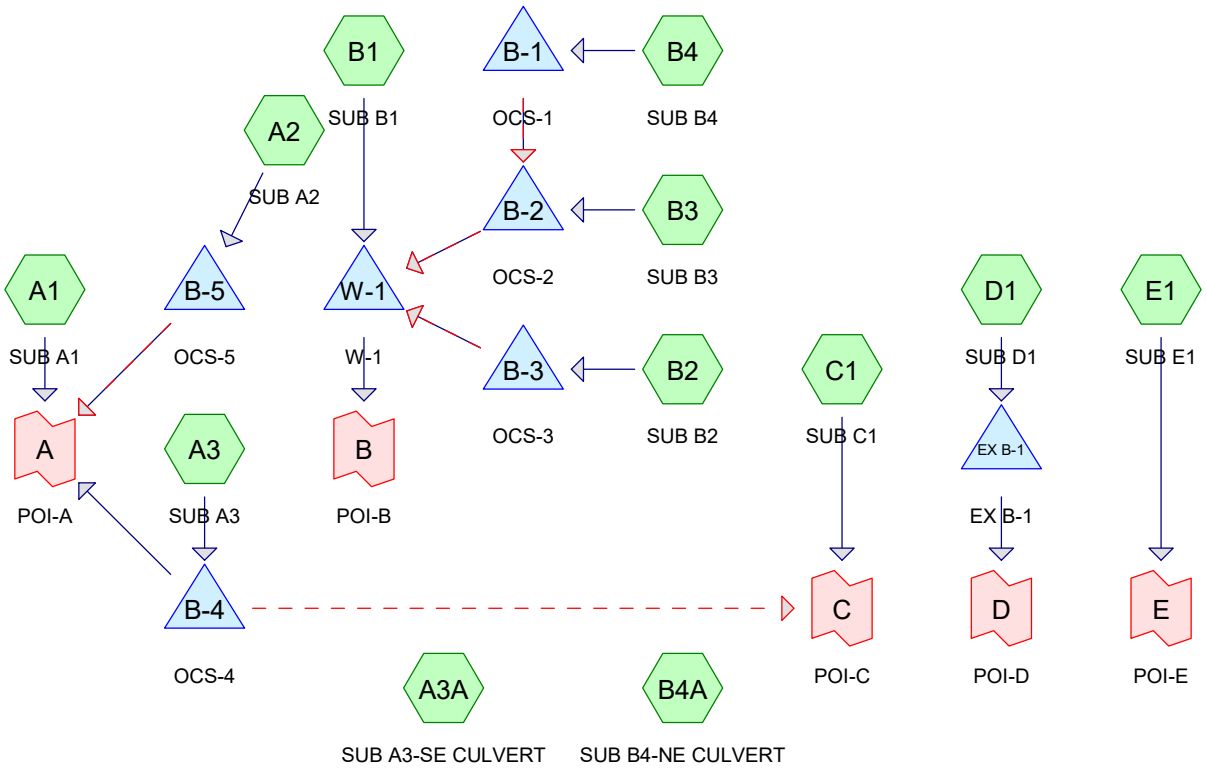
Summary for Link E: POI-E

Inflow Area = 294,027 sf, 0.00% Impervious, Inflow Depth = 4.68" for 100YR event
Inflow = 27.37 cfs @ 12.22 hrs, Volume= 114,668 cf
Primary = 27.37 cfs @ 12.22 hrs, Volume= 114,668 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link E: POI-E





Subcat Reach Pond Link

Routing Diagram for HydroCAD-PR
Prepared by Weston & Sampson, Printed 4/15/2020

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
532,313	39	>75% Grass cover, Good, HSG A (A2, B1, B2, B3, D1)
1,317,920	74	>75% Grass cover, Good, HSG C (A2, A3, A3A, B3, B4, B4A, C1, E1)
54,276	96	Gravel surface, HSG A (B1, B2, B3, B4, B4A, D1)
33,593	96	Gravel surface, HSG C (A3, A3A)
1,200	98	Roofs, HSG A (D1)
11,959	98	Water, HSG B (B1)
116,579	30	Woods, Good, HSG A (A1)
34,877	70	Woods, Good, HSG C (A1)
2,102,717	**64**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
704,368	HSG A	A1, A2, B1, B2, B3, B4, B4A, D1
11,959	HSG B	B1
1,386,390	HSG C	A1, A2, A3, A3A, B3, B4, B4A, C1, E1
0	HSG D	
0	Other	
2,102,717		**TOTAL AREA**

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	Su Nu
532,313	0	1,317,920	0	0	1,850,233	>75% Grass cover, Good	
54,276	0	33,593	0	0	87,869	Gravel surface	
1,200	0	0	0	0	1,200	Roofs	
0	11,959	0	0	0	11,959	Water	
116,579	0	34,877	0	0	151,456	Woods, Good	
704,368	**11,959**	**1,386,390**	**0**	**0**	**2,102,717**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	B-1	283.00	282.80	36.0	0.0056	0.013	18.0	0.0	0.0
2	B-2	264.00	263.80	30.0	0.0067	0.013	18.0	0.0	0.0
3	B-3	267.00	266.85	30.0	0.0050	0.013	12.0	0.0	0.0
4	B-4	288.50	287.00	360.0	0.0042	0.013	15.0	0.0	0.0
5	B-5	290.00	289.50	24.0	0.0208	0.012	12.0	0.0	0.0

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A1: SUB A1 Runoff Area=151,456 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=100' Slope=0.1700 '/' Tc=9.3 min CN=WQ Runoff=0.00 cfs 13 cf

Subcatchment A2: SUB A2 Runoff Area=352,383 sf 0.00% Impervious Runoff Depth=0.02"
Flow Length=625' Tc=7.2 min CN=WQ Runoff=0.02 cfs 455 cf

Subcatchment A3: SUB A3 Runoff Area=267,611 sf 0.00% Impervious Runoff Depth=0.07"
Flow Length=850' Tc=16.0 min CN=WQ Runoff=0.25 cfs 1,521 cf

Subcatchment A3A: SUB A3-SE CULVERT Runoff Area=185,457 sf 0.00% Impervious Runoff Depth=0.07"
Flow Length=850' Tc=16.0 min CN=WQ Runoff=0.17 cfs 1,054 cf

Subcatchment B1: SUB B1 Runoff Area=118,742 sf 10.07% Impervious Runoff Depth=0.09"
Flow Length=270' Slope=0.0200 '/' Tc=9.2 min CN=WQ Runoff=0.24 cfs 886 cf

Subcatchment B2: SUB B2 Runoff Area=137,910 sf 0.00% Impervious Runoff Depth=0.08"
Flow Length=200' Slope=0.0200 '/' Tc=8.0 min CN=WQ Runoff=0.27 cfs 917 cf

Subcatchment B3: SUB B3 Runoff Area=146,778 sf 0.00% Impervious Runoff Depth=0.02"
Flow Length=300' Slope=0.0600 '/' Tc=5.9 min CN=WQ Runoff=0.07 cfs 277 cf

Subcatchment B4: SUB B4 Runoff Area=316,407 sf 0.00% Impervious Runoff Depth=0.05"
Flow Length=720' Tc=8.8 min CN=WQ Runoff=0.22 cfs 1,362 cf

Subcatchment B4A: SUB B4-NE CULVERT Runoff Area=316,407 sf 0.00% Impervious Runoff Depth=0.05"
Flow Length=720' Tc=8.8 min CN=WQ Runoff=0.22 cfs 1,362 cf

Subcatchment C1: SUB C1 Runoff Area=10,539 sf 0.00% Impervious Runoff Depth=0.02"
Tc=5.0 min CN=74 Runoff=0.00 cfs 20 cf

Subcatchment D1: SUB D1 Runoff Area=79,169 sf 1.52% Impervious Runoff Depth=0.02"
Flow Length=240' Slope=0.0400 '/' Tc=6.4 min CN=WQ Runoff=0.04 cfs 137 cf

Subcatchment E1: SUB E1 Runoff Area=19,858 sf 0.00% Impervious Runoff Depth=0.02"
Tc=5.0 min CN=74 Runoff=0.00 cfs 38 cf

Pond B-1: OCS-1 Peak Elev=283.11' Storage=356 cf Inflow=0.22 cfs 1,362 cf
Primary=0.04 cfs 1,362 cf Secondary=0.00 cfs 0 cf Outflow=0.04 cfs 1,362 cf

Pond B-2: OCS-2 Peak Elev=265.07' Storage=311 cf Inflow=0.08 cfs 1,639 cf
Primary=0.04 cfs 1,638 cf Secondary=0.00 cfs 0 cf Outflow=0.04 cfs 1,638 cf

Pond B-3: OCS-3 Peak Elev=267.13' Storage=455 cf Inflow=0.27 cfs 917 cf
Primary=0.04 cfs 916 cf Secondary=0.00 cfs 0 cf Outflow=0.04 cfs 916 cf

Pond B-4: OCS-4 Peak Elev=288.57' Storage=1,059 cf Inflow=0.25 cfs 1,521 cf
Primary=0.01 cfs 1,205 cf Secondary=0.00 cfs 0 cf Outflow=0.01 cfs 1,205 cf

Pond B-5: OCS-5 Peak Elev=292.04' Storage=291 cf Inflow=0.02 cfs 455 cf
Primary=0.01 cfs 446 cf Secondary=0.00 cfs 0 cf Outflow=0.01 cfs 446 cf

Pond EX B-1: EX B-1 Peak Elev=268.10' Storage=136 cf Inflow=0.04 cfs 137 cf
Outflow=0.00 cfs 0 cf

Pond W-1: W-1 Peak Elev=263.04' Storage=3,440 cf Inflow=0.27 cfs 3,441 cf
Outflow=0.00 cfs 0 cf

Link A: POI-A Inflow=0.02 cfs 1,665 cf
Primary=0.02 cfs 1,665 cf

Link B: POI-B Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Link C: POI-C Inflow=0.00 cfs 20 cf
Primary=0.00 cfs 20 cf

Link D: POI-D Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Link E: POI-E Inflow=0.00 cfs 38 cf
Primary=0.00 cfs 38 cf

Total Runoff Area = 2,102,717 sf Runoff Volume = 8,043 cf Average Runoff Depth = 0.05"
99.37% Pervious = 2,089,558 sf 0.63% Impervious = 13,159 sf

Summary for Subcatchment A1: SUB A1

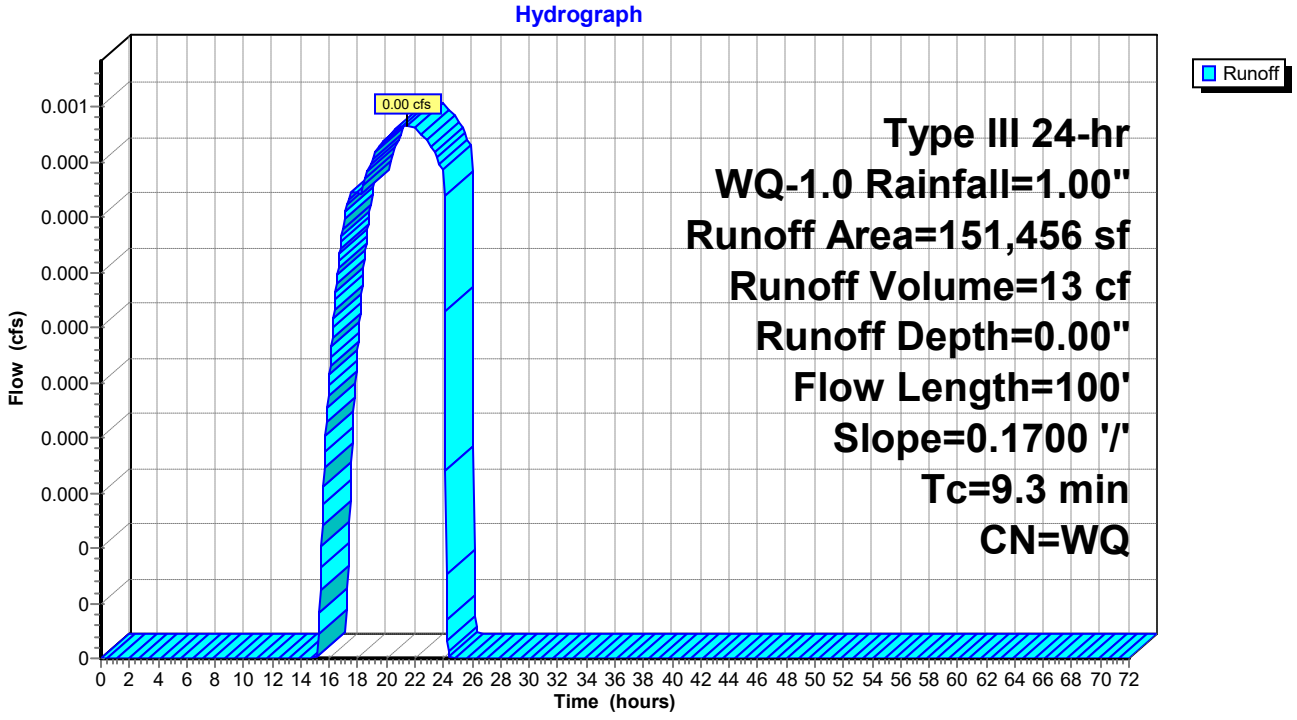
Runoff = 0.00 cfs @ 21.40 hrs, Volume= 13 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr WQ-1.0 Rainfall=1.00"

Area (sf)	CN	Description
116,579	30	Woods, Good, HSG A
34,877	70	Woods, Good, HSG C
151,456		Weighted Average
151,456		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.9	50	0.1700	0.09		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.39"
0.4	50	0.1700	2.06		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
9.3	100	Total			

Subcatchment A1: SUB A1



Summary for Subcatchment A2: SUB A2

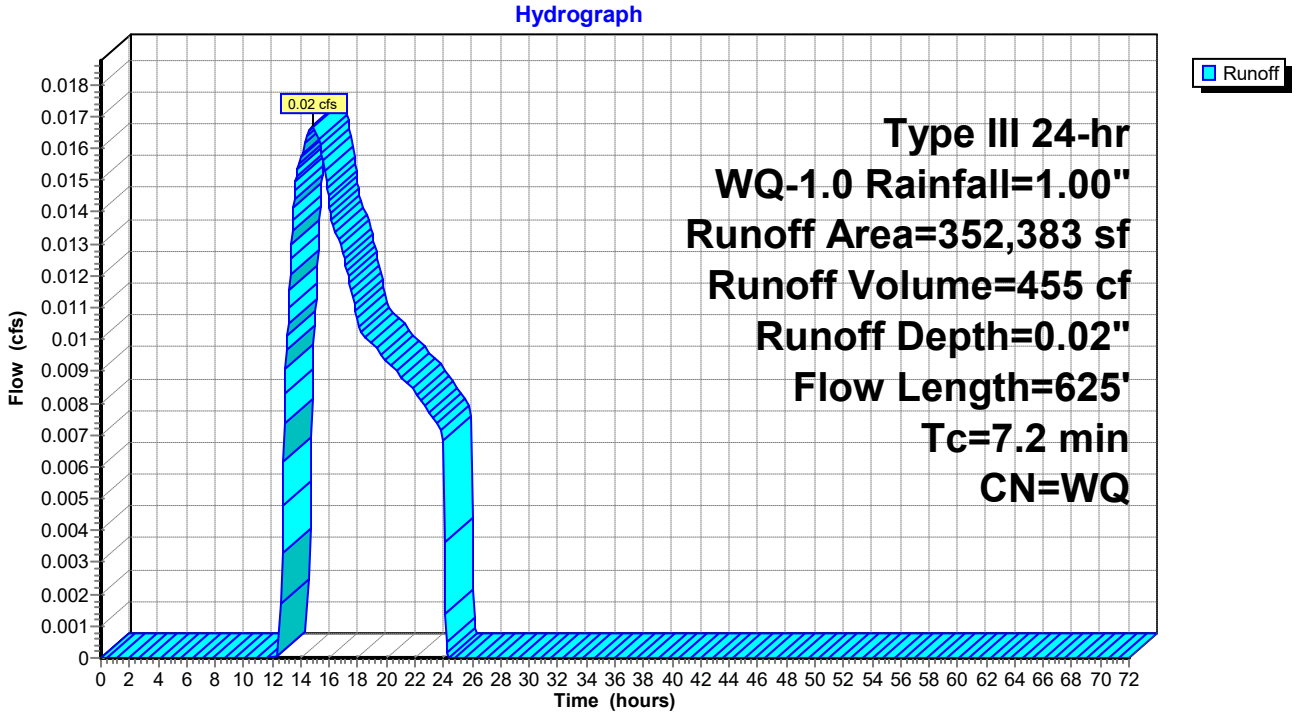
Runoff = 0.02 cfs @ 14.79 hrs, Volume= 455 cf, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr WQ-1.0 Rainfall=1.00"

Area (sf)	CN	Description
235,398	74	>75% Grass cover, Good, HSG C
116,985	39	>75% Grass cover, Good, HSG A
352,383		Weighted Average
352,383		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	50	0.1600	0.35		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.39"
4.5	505	0.0700	1.85		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	70	0.0200	4.50	14.85	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=1.00' Z= 0.3 '/' Top.W=3.60' n= 0.035
7.2	625	Total			

Subcatchment A2: SUB A2



Summary for Subcatchment A3: SUB A3

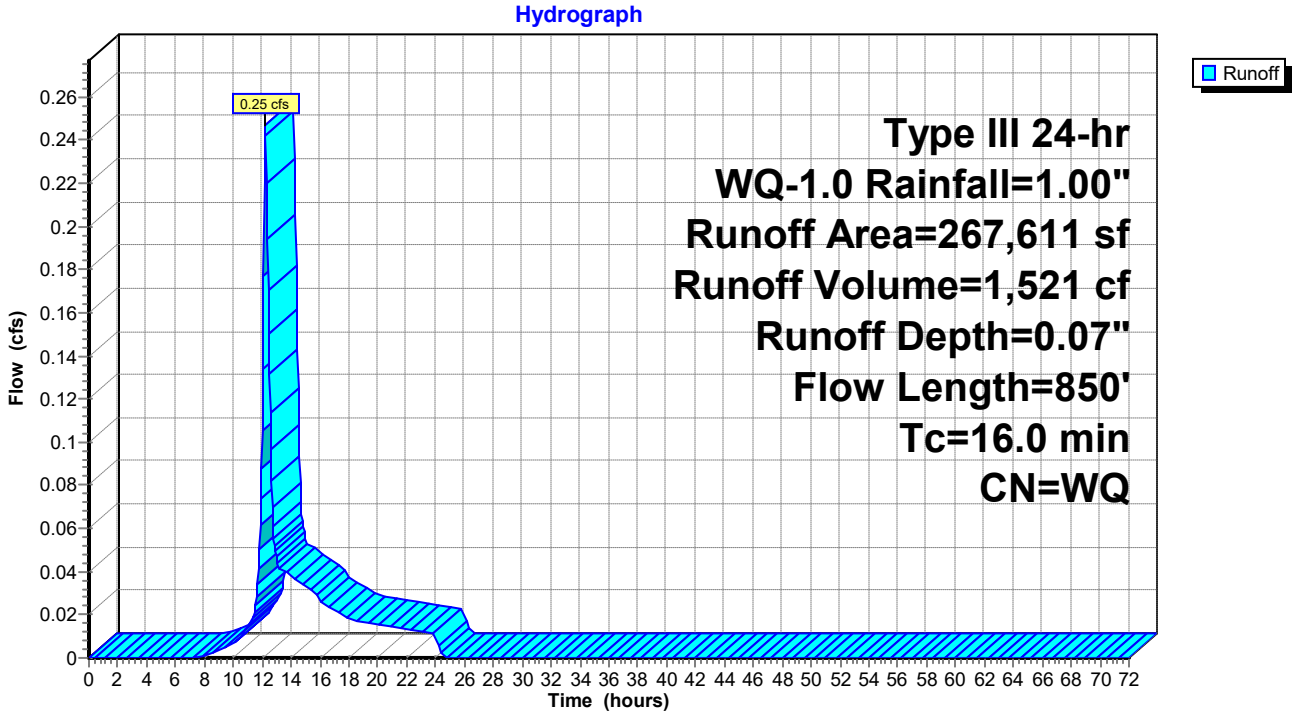
Runoff = 0.25 cfs @ 12.22 hrs, Volume= 1,521 cf, Depth= 0.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr WQ-1.0 Rainfall=1.00"

Area (sf)	CN	Description
247,764	74	>75% Grass cover, Good, HSG C
19,847	96	Gravel surface, HSG C
267,611		Weighted Average
267,611		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	50	0.0600	0.24		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.39"
1.2	170	0.1200	2.42		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
11.3	630	0.0008	0.93	6.49	**Trap/Vee/Rect Channel Flow,** Bot.W=4.00' D=1.00' Z= 3.0 '/' Top.W=10.00' n= 0.035
16.0	850	Total			

Subcatchment A3: SUB A3



Summary for Subcatchment A3A: SUB A3-SE CULVERT

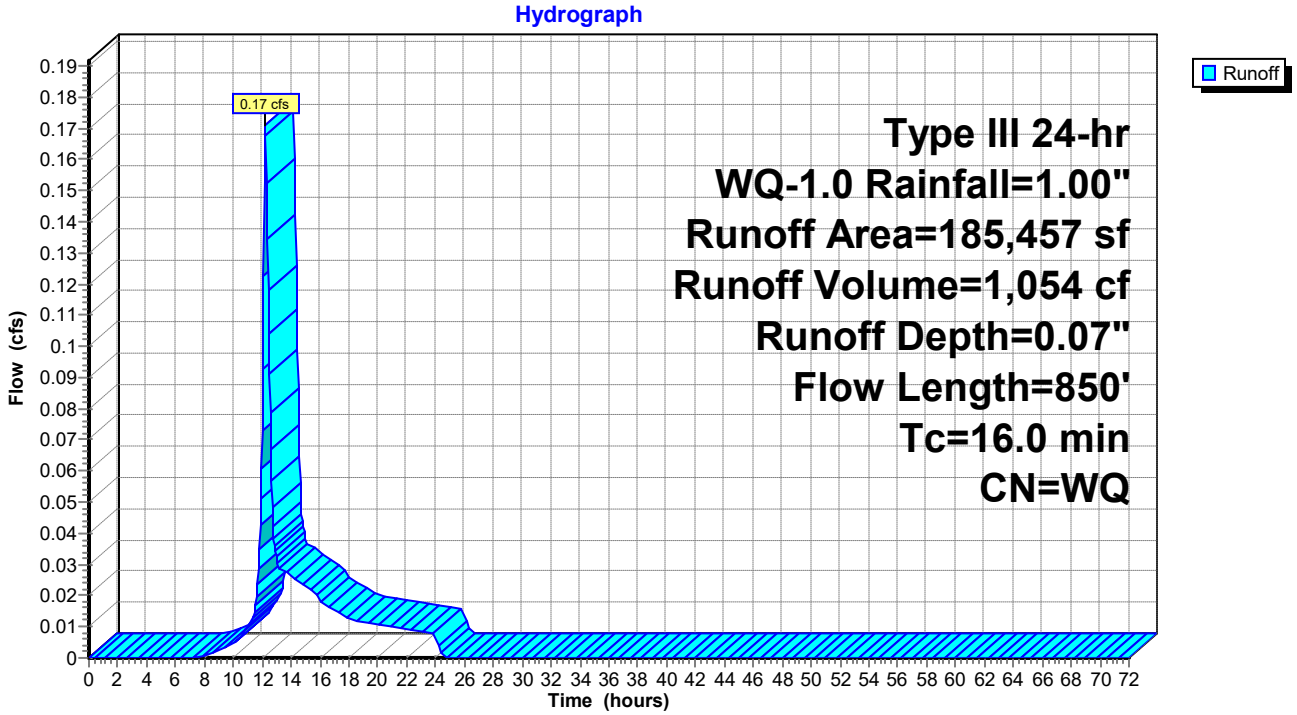
Runoff = 0.17 cfs @ 12.22 hrs, Volume= 1,054 cf, Depth= 0.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr WQ-1.0 Rainfall=1.00"

Area (sf)	CN	Description
171,711	74	>75% Grass cover, Good, HSG C
13,746	96	Gravel surface, HSG C
185,457		Weighted Average
185,457		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	50	0.0600	0.24		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.39"
1.2	170	0.1200	2.42		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
11.3	630	0.0008	0.93	6.49	**Trap/Vee/Rect Channel Flow,** Bot.W=4.00' D=1.00' Z= 3.0 '/' Top.W=10.00' n= 0.035
16.0	850	Total			

Subcatchment A3A: SUB A3-SE CULVERT



Summary for Subcatchment B1: SUB B1

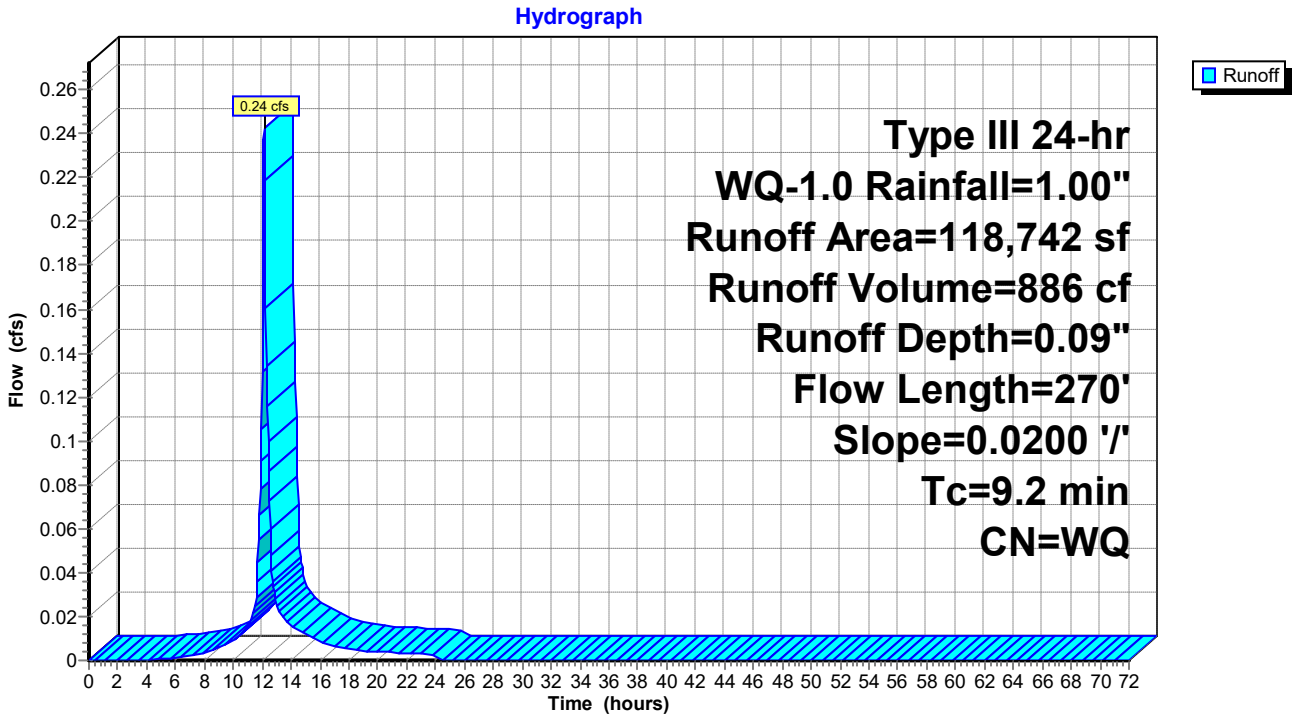
Runoff = 0.24 cfs @ 12.13 hrs, Volume= 886 cf, Depth= 0.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr WQ-1.0 Rainfall=1.00"

	Area (sf)	CN	Description
	104,915	39	>75% Grass cover, Good, HSG A
*	11,959	98	Water, HSG B
	1,868	96	Gravel surface, HSG A
	118,742		Weighted Average
	106,783		89.93% Pervious Area
	11,959		10.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.39"
3.7	220	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
9.2	270	Total			

Subcatchment B1: SUB B1



Summary for Subcatchment B2: SUB B2

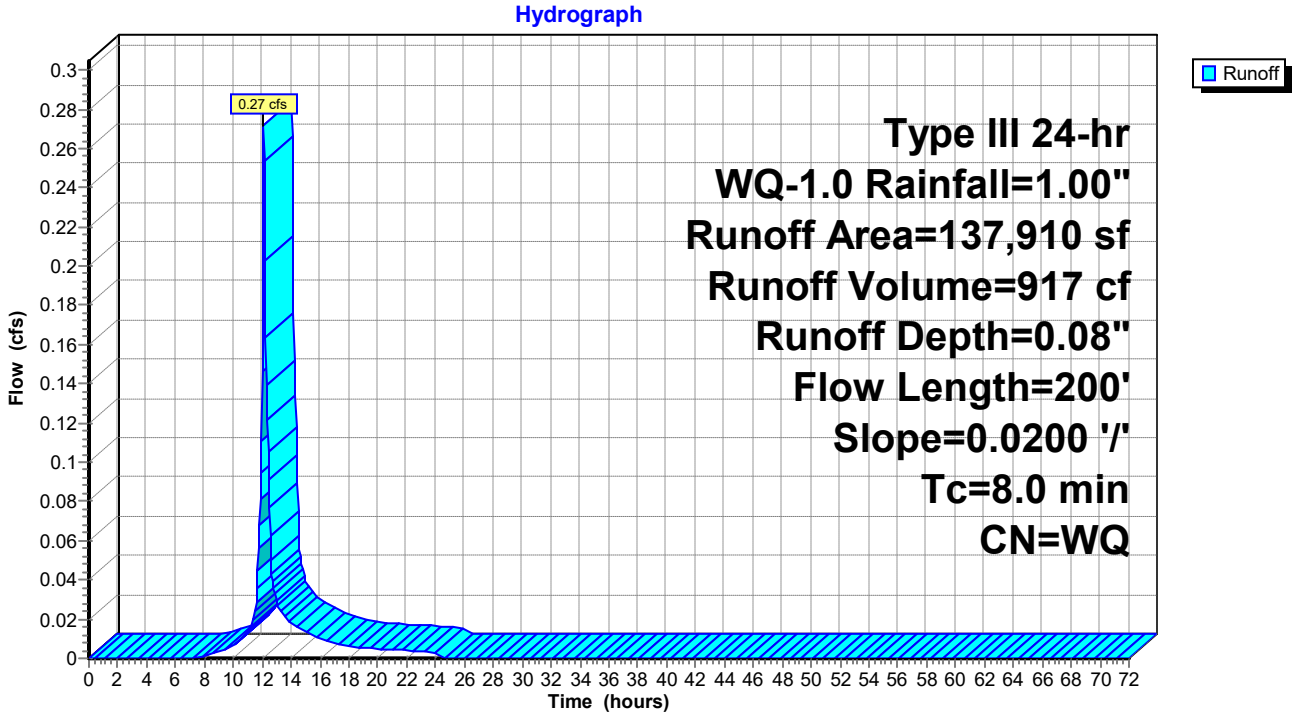
Runoff = 0.27 cfs @ 12.11 hrs, Volume= 917 cf, Depth= 0.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr WQ-1.0 Rainfall=1.00"

Area (sf)	CN	Description
120,448	39	>75% Grass cover, Good, HSG A
17,462	96	Gravel surface, HSG A
137,910		Weighted Average
137,910		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.39"
2.5	150	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
8.0	200	Total			

Subcatchment B2: SUB B2



Summary for Subcatchment B3: SUB B3

[49] Hint: Tc<2dt may require smaller dt

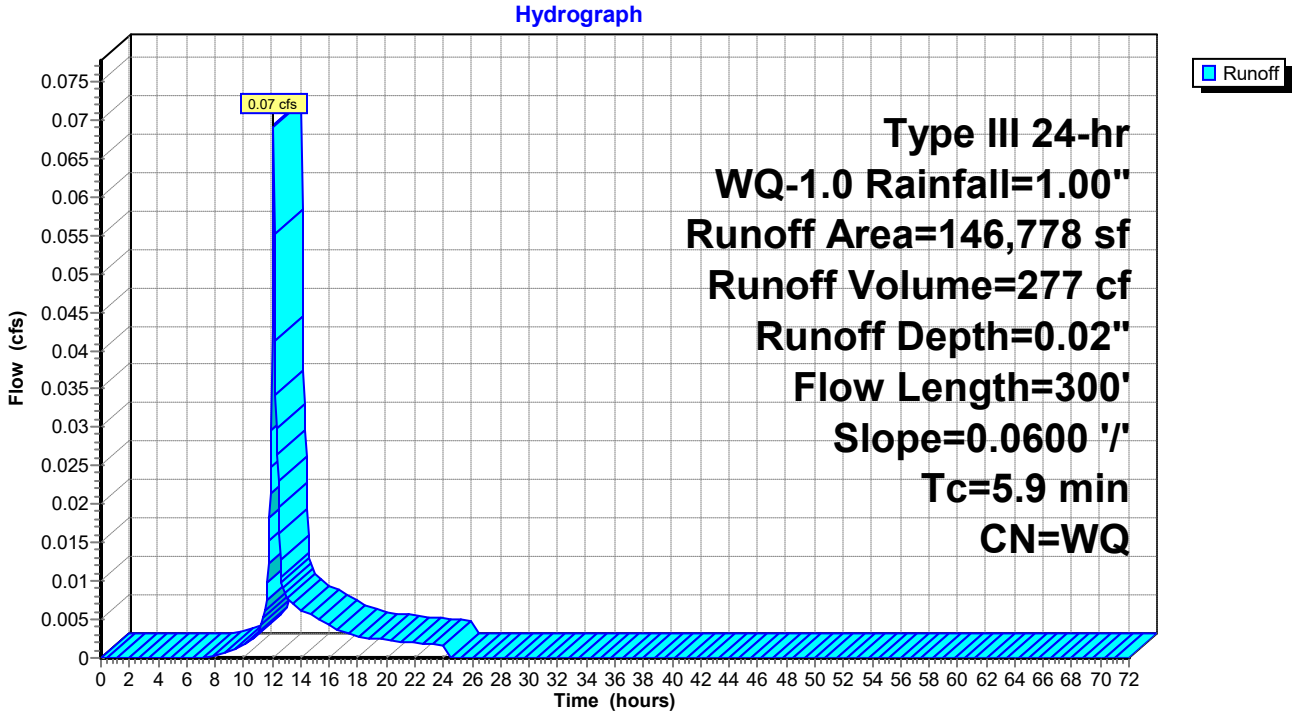
Runoff = 0.07 cfs @ 12.09 hrs, Volume= 277 cf, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr WQ-1.0 Rainfall=1.00"

Area (sf)	CN	Description
113,099	39	>75% Grass cover, Good, HSG A
29,492	74	>75% Grass cover, Good, HSG C
4,187	96	Gravel surface, HSG A
146,778		Weighted Average
146,778		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	50	0.0600	0.24		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.39"
2.4	250	0.0600	1.71		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
5.9	300	Total			

Subcatchment B3: SUB B3



Summary for Subcatchment B4: SUB B4

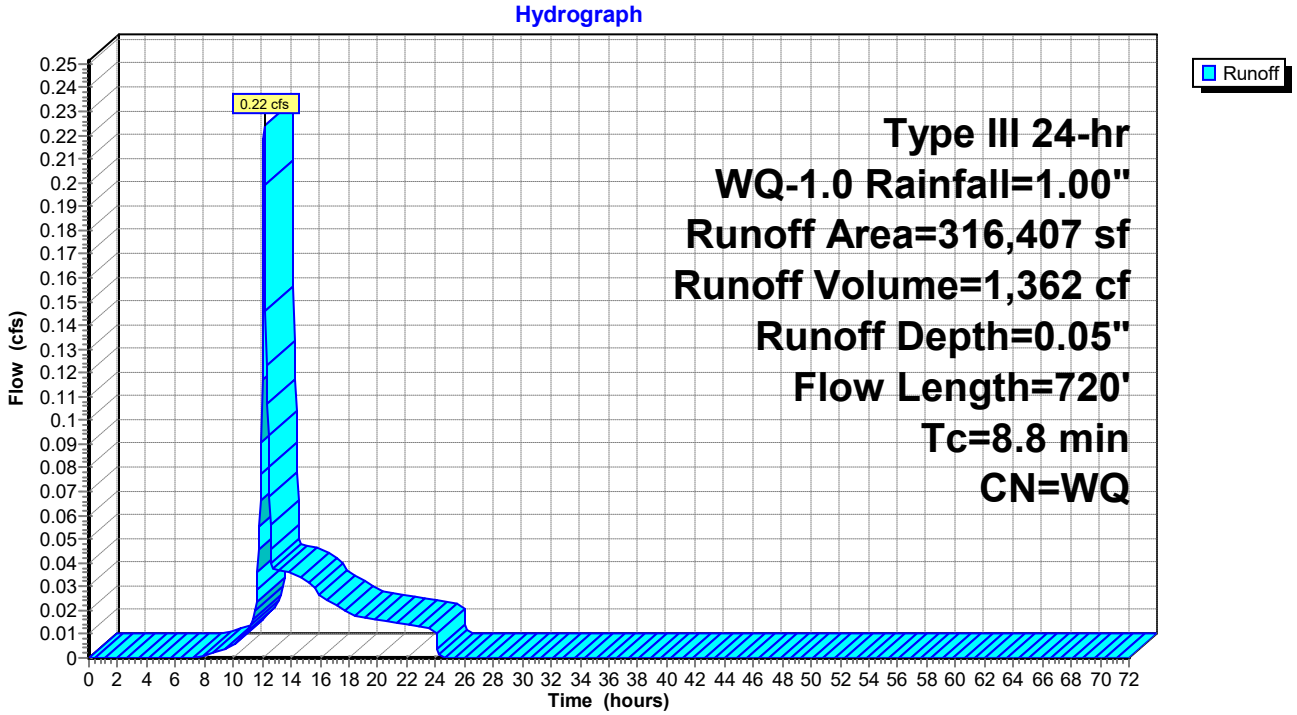
Runoff = 0.22 cfs @ 12.12 hrs, Volume= 1,362 cf, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr WQ-1.0 Rainfall=1.00"

Area (sf)	CN	Description
301,579	74	>75% Grass cover, Good, HSG C
14,828	96	Gravel surface, HSG A
316,407		Weighted Average
316,407		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.0400	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.39"
1.4	170	0.0800	1.98		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.3	500	0.0060	2.54	17.77	**Trap/Vee/Rect Channel Flow,** Bot.W=4.00' D=1.00' Z= 3.0 '/' Top.W=10.00' n= 0.035
8.8	720	Total			

Subcatchment B4: SUB B4



Summary for Subcatchment B4A: SUB B4-NE CULVERT

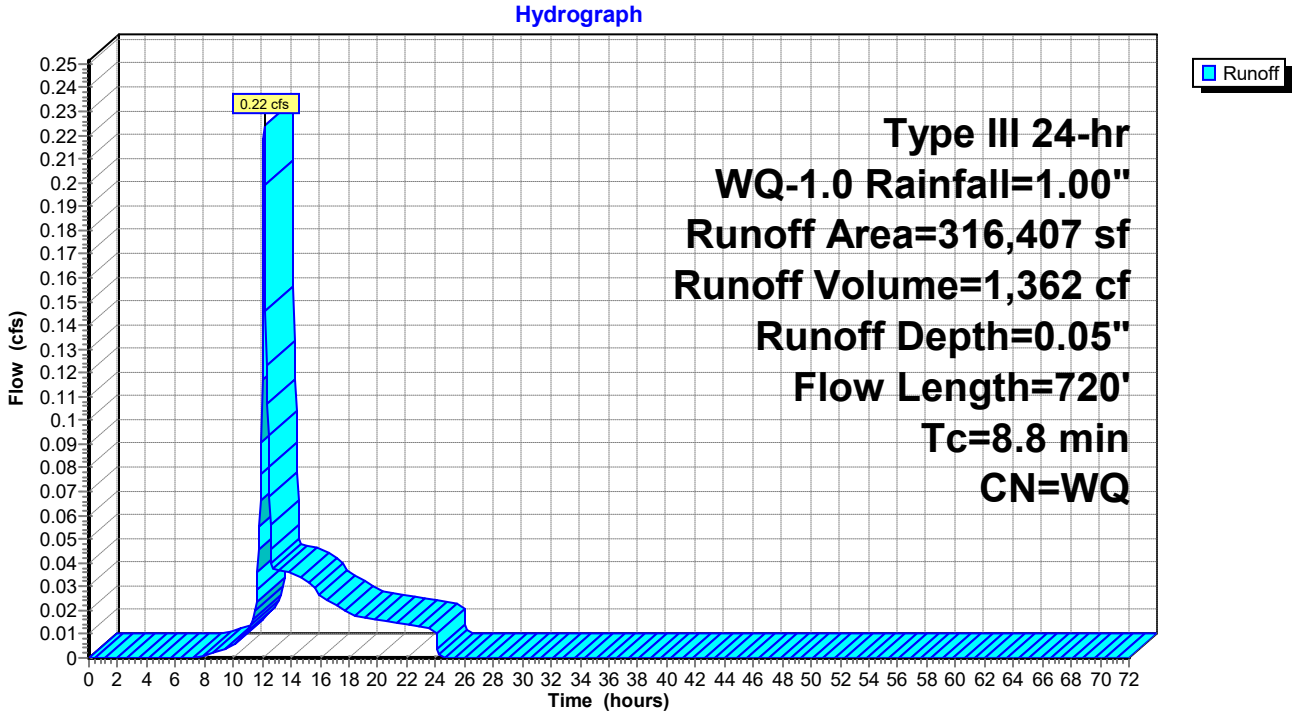
Runoff = 0.22 cfs @ 12.12 hrs, Volume= 1,362 cf, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr WQ-1.0 Rainfall=1.00"

Area (sf)	CN	Description
301,579	74	>75% Grass cover, Good, HSG C
14,828	96	Gravel surface, HSG A
316,407		Weighted Average
316,407		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.0400	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.39"
1.4	170	0.0800	1.98		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.3	500	0.0060	2.54	17.77	**Trap/Vee/Rect Channel Flow,** Bot.W=4.00' D=1.00' Z= 3.0 '/' Top.W=10.00' n= 0.035
8.8	720	Total			

Subcatchment B4A: SUB B4-NE CULVERT



Summary for Subcatchment C1: SUB C1

[49] Hint: Tc<2dt may require smaller dt

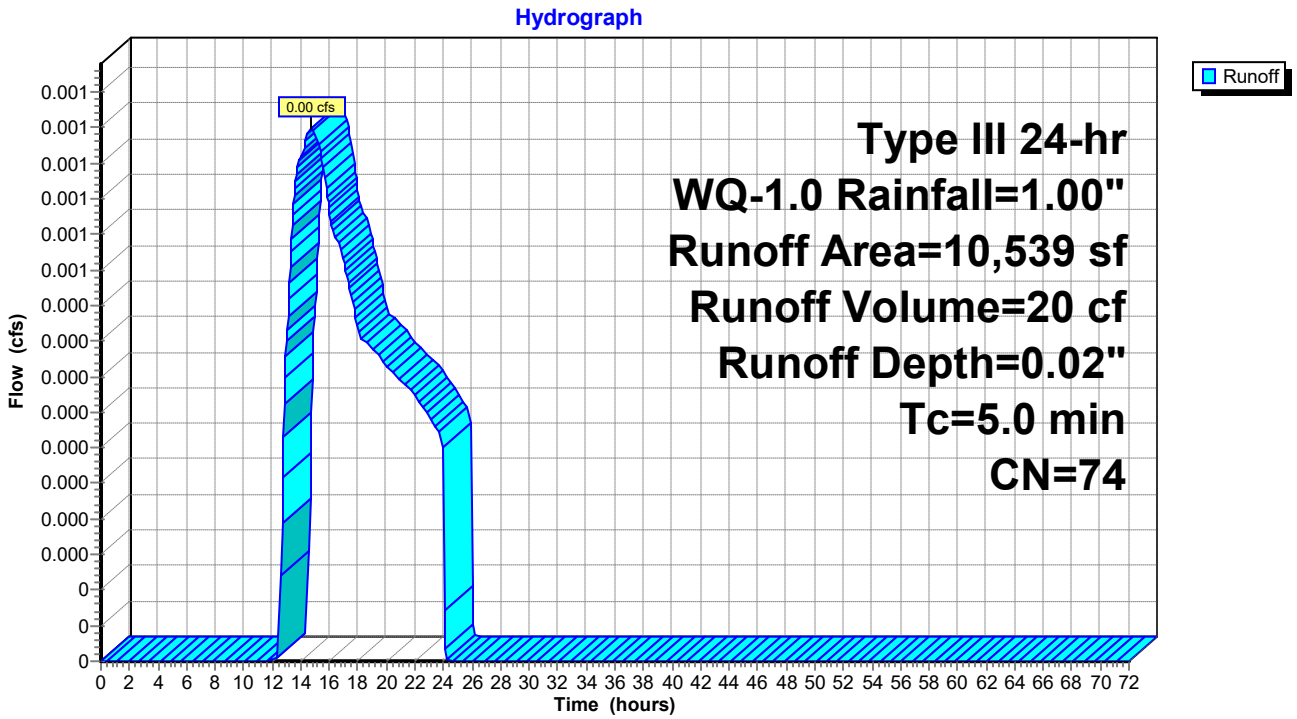
Runoff = 0.00 cfs @ 14.76 hrs, Volume= 20 cf, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr WQ-1.0 Rainfall=1.00"

Area (sf)	CN	Description
10,539	74	>75% Grass cover, Good, HSG C
10,539		100.00% Pervious Area

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

Subcatchment C1: SUB C1



Summary for Subcatchment D1: SUB D1

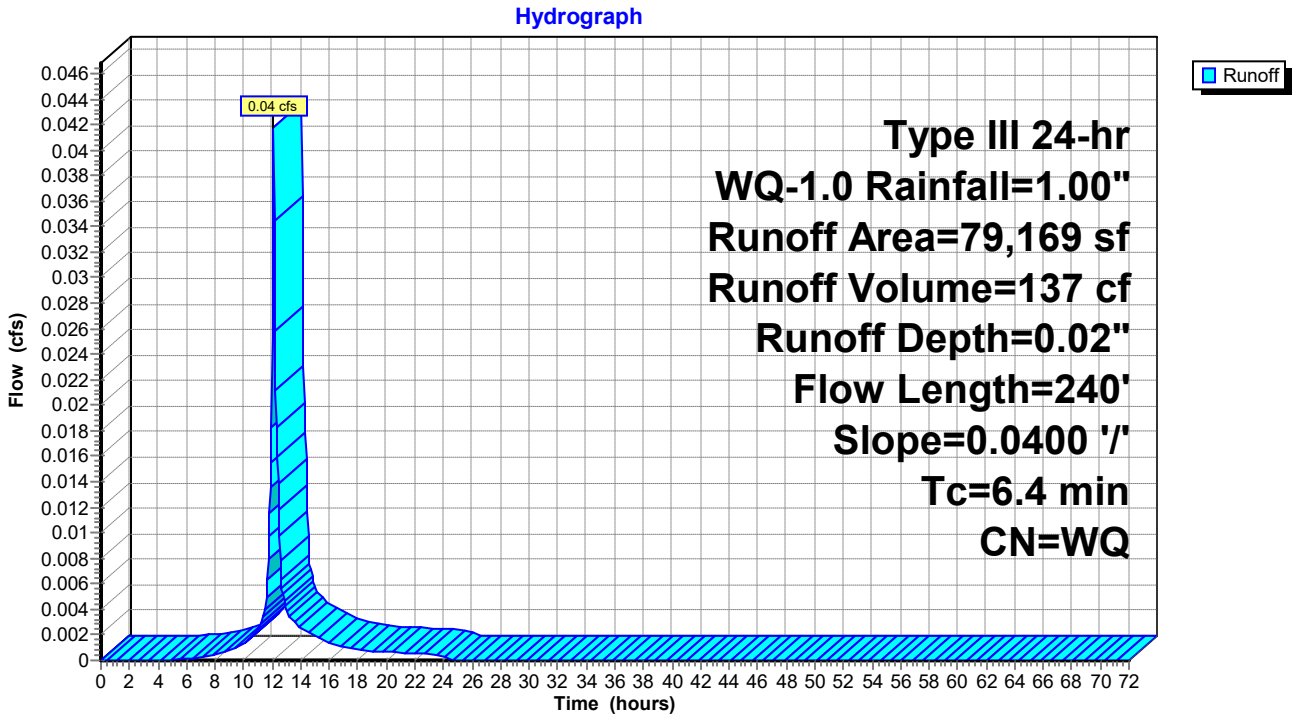
Runoff = 0.04 cfs @ 12.09 hrs, Volume= 137 cf, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr WQ-1.0 Rainfall=1.00"

Area (sf)	CN	Description
76,866	39	>75% Grass cover, Good, HSG A
1,103	96	Gravel surface, HSG A
1,200	98	Roofs, HSG A
79,169		Weighted Average
77,969		98.48% Pervious Area
1,200		1.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.0400	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.39"
2.3	190	0.0400	1.40		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.4	240	Total			

Subcatchment D1: SUB D1



Summary for Subcatchment E1: SUB E1

[49] Hint: Tc<2dt may require smaller dt

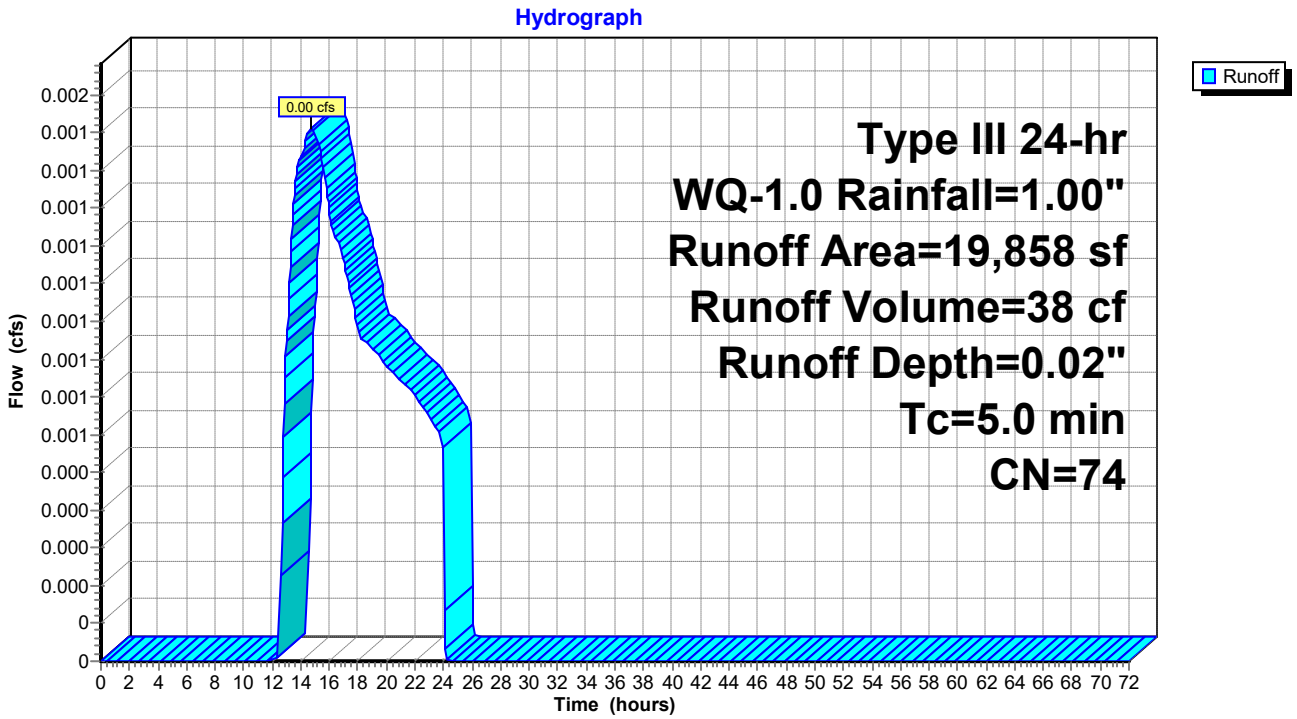
Runoff = 0.00 cfs @ 14.76 hrs, Volume= 38 cf, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr WQ-1.0 Rainfall=1.00"

Area (sf)	CN	Description
19,858	74	>75% Grass cover, Good, HSG C
19,858		100.00% Pervious Area

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

Subcatchment E1: SUB E1



Summary for Pond B-1: OCS-1

Inflow Area = 316,407 sf, 0.00% Impervious, Inflow Depth = 0.05" for WQ-1.0 event
Inflow = 0.22 cfs @ 12.12 hrs, Volume= 1,362 cf
Outflow = 0.04 cfs @ 12.62 hrs, Volume= 1,362 cf, Atten= 80%, Lag= 29.6 min
Primary = 0.04 cfs @ 12.62 hrs, Volume= 1,362 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 283.11' @ 12.62 hrs Surf.Area= 3,409 sf Storage= 356 cf

Plug-Flow detention time= 188.0 min calculated for 1,362 cf (100% of inflow)
Center-of-Mass det. time= 187.7 min (1,109.3 - 921.6)

Volume	Invert	Avail.Storage	Storage Description
#1	283.00'	40,823 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

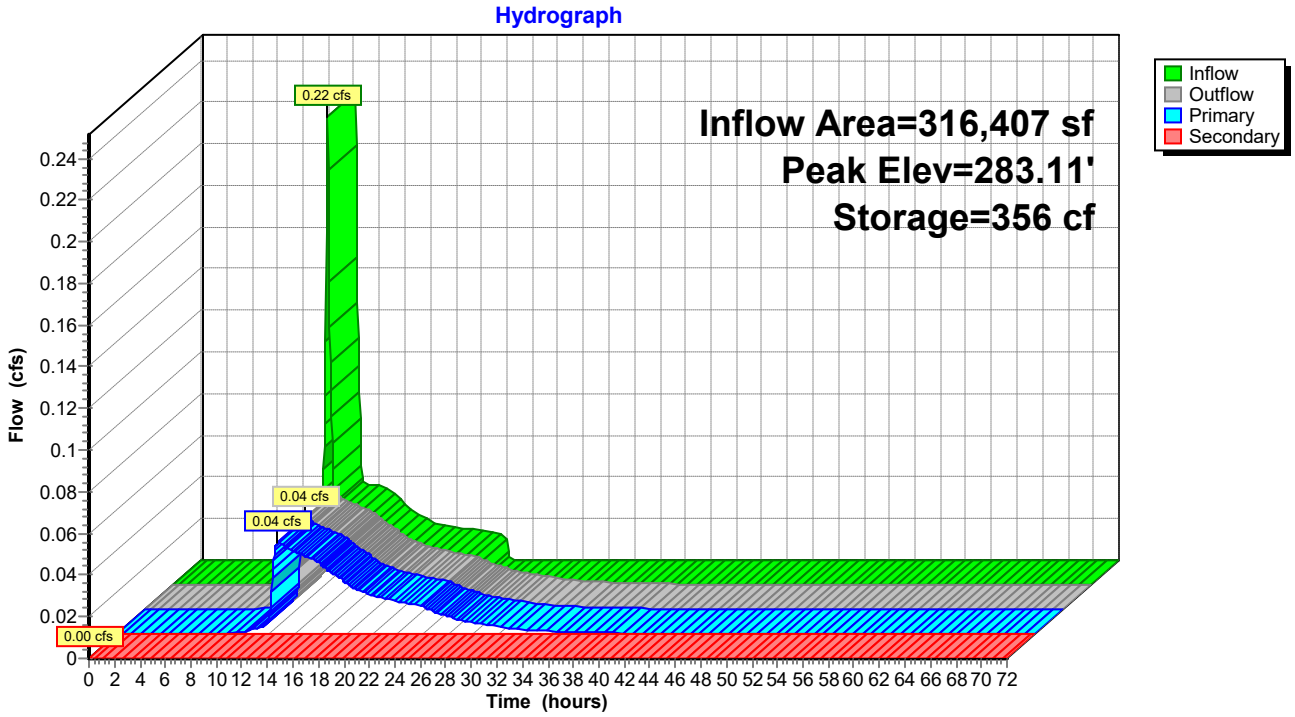
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
283.00	3,294	0	0
284.00	4,378	3,836	3,836
285.00	5,518	4,948	8,784
286.00	6,714	6,116	14,900
287.00	7,967	7,341	22,241
288.00	9,277	8,622	30,863
289.00	10,643	9,960	40,823

Device	Routing	Invert	Outlet Devices
#1	Primary	283.00'	**18.0" Round Culvert** L= 36.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 283.00' / 282.80' S= 0.0056 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	283.00'	**10.0" Vert. Orifice/Grate X 2.00** C= 0.600
#3	Device 1	287.90'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	288.50'	**40.0' long x 6.0' breadth Broad-Crested Rectangular Weir** 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) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=0.04 cfs @ 12.62 hrs HW=283.11' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.04 cfs @ 1.15 fps)
  ├**2=Orifice/Grate** (Passes 0.04 cfs of 0.09 cfs potential flow)
  └**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=283.00' (Free Discharge)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond B-1: OCS-1


Hydrograph
Inflow Area=316,407 sf
Peak Elev=283.11'
Storage=356 cf
Inflow
Outflow
Primary
Secondary
0.22 cfs
0.04 cfs
0.04 cfs
0.00 cfs
Flow (cfs)
0 0.02 0.04 0.06 0.08 0.1 0.12 0.14 0.16 0.18 0.2 0.22 0.24
Time (hours)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72

Summary for Pond B-2: OCS-2

Inflow Area = 463,185 sf, 0.00% Impervious, Inflow Depth = 0.04" for WQ-1.0 event
Inflow = 0.08 cfs @ 12.10 hrs, Volume= 1,639 cf
Outflow = 0.04 cfs @ 15.37 hrs, Volume= 1,638 cf, Atten= 51%, Lag= 196.2 min
Primary = 0.04 cfs @ 15.37 hrs, Volume= 1,638 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 265.07' @ 15.37 hrs Surf.Area= 4,564 sf Storage= 311 cf

Plug-Flow detention time= 168.2 min calculated for 1,637 cf (100% of inflow)
Center-of-Mass det. time= 168.4 min (1,236.3 - 1,067.9)

Volume	Invert	Avail.Storage	Storage Description
#1	265.00'	27,703 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

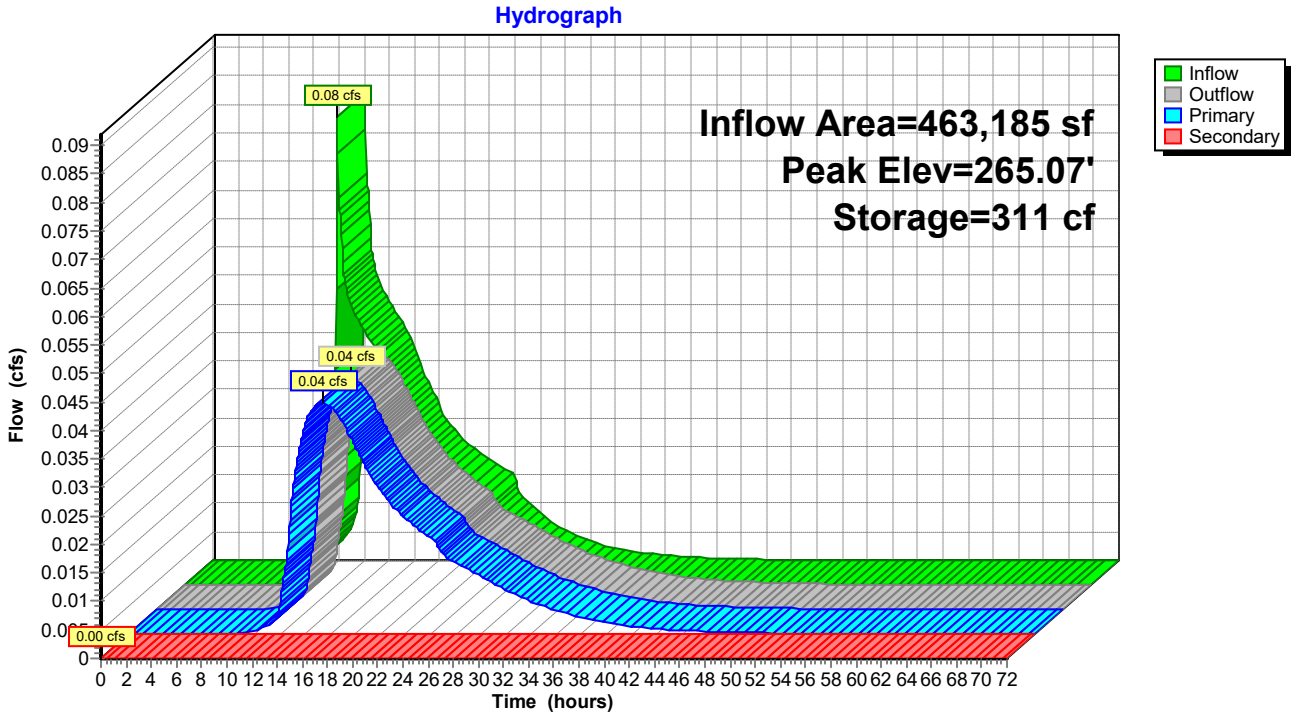
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
265.00	4,484	0	0
266.00	5,655	5,070	5,070
267.00	6,883	6,269	11,339
268.00	8,168	7,526	18,864
269.00	9,510	8,839	27,703

Device	Routing	Invert	Outlet Devices
#1	Primary	264.00'	**18.0" Round Culvert** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 264.00' / 263.80' S= 0.0067 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	265.00'	**10.0" Vert. Orifice/Grate X 2.00** C= 0.600
#3	Device 1	267.50'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	268.50'	**40.0' long x 6.0' breadth Broad-Crested Rectangular Weir** 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) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=0.04 cfs @ 15.37 hrs HW=265.07' (Free Discharge)
└**1=Culvert** (Passes 0.04 cfs of 3.39 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.04 cfs @ 0.89 fps)
  └**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=265.00' (Free Discharge)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond B-2: OCS-2


Hydrograph
Inflow Area=463,185 sf
Peak Elev=265.07'
Storage=311 cf
0.08 cfs
0.04 cfs
0.04 cfs
0.00 cfs
Inflow
Outflow
Primary
Secondary
Flow (cfs)
Time (hours)

Summary for Pond B-3: OCS-3

Inflow Area = 137,910 sf, 0.00% Impervious, Inflow Depth = 0.08" for WQ-1.0 event
Inflow = 0.27 cfs @ 12.11 hrs, Volume= 917 cf
Outflow = 0.04 cfs @ 12.69 hrs, Volume= 916 cf, Atten= 85%, Lag= 34.8 min
Primary = 0.04 cfs @ 12.69 hrs, Volume= 916 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 267.13' @ 12.69 hrs Surf.Area= 3,544 sf Storage= 455 cf

Plug-Flow detention time= 312.3 min calculated for 916 cf (100% of inflow)
Center-of-Mass det. time= 313.4 min (1,129.4 - 816.0)

Volume	Invert	Avail.Storage	Storage Description
#1	267.00'	25,096 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

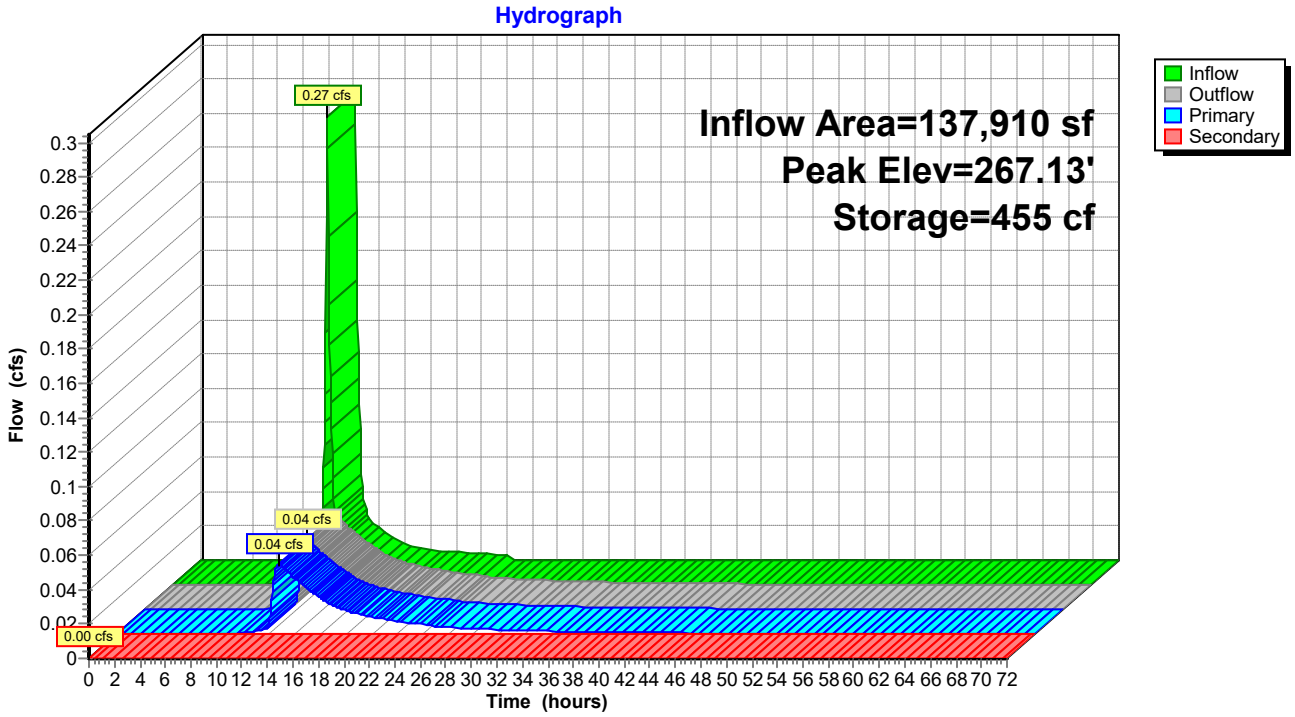
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
267.00	3,358	0	0
268.00	4,766	4,062	4,062
269.00	6,232	5,499	9,561
270.00	7,753	6,993	16,554
271.00	9,332	8,543	25,096

Device	Routing	Invert	Outlet Devices
#1	Primary	267.00'	**12.0" Round Culvert** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 267.00' / 266.85' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	267.00'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	269.75'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	270.00'	**40.0' long x 6.0' breadth Broad-Crested Rectangular Weir** 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) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=0.04 cfs @ 12.69 hrs HW=267.13' (Free Discharge)
└**1=Culvert** (Passes 0.04 cfs of 0.05 cfs potential flow)
  └**2=Orifice/Grate** (Orifice Controls 0.04 cfs @ 1.24 fps)
  └**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=267.00' (Free Discharge)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond B-3: OCS-3


Hydrograph
Inflow Area=137,910 sf
Peak Elev=267.13'
Storage=455 cf
Inflow
Outflow
Primary
Secondary
0.27 cfs
0.04 cfs
0.04 cfs
0.00 cfs
Flow (cfs)
Time (hours)

Summary for Pond B-4: OCS-4

Inflow Area = 267,611 sf, 0.00% Impervious, Inflow Depth = 0.07" for WQ-1.0 event
Inflow = 0.25 cfs @ 12.22 hrs, Volume= 1,521 cf
Outflow = 0.01 cfs @ 22.50 hrs, Volume= 1,205 cf, Atten= 95%, Lag= 617.1 min
Primary = 0.01 cfs @ 22.50 hrs, Volume= 1,205 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 288.57' @ 22.50 hrs Surf.Area= 15,882 sf Storage= 1,059 cf

Plug-Flow detention time= 1,104.0 min calculated for 1,204 cf (79% of inflow)
Center-of-Mass det. time= 1,012.4 min (1,912.9 - 900.5)

Volume	Invert	Avail.Storage	Storage Description
#1	288.50'	70,710 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

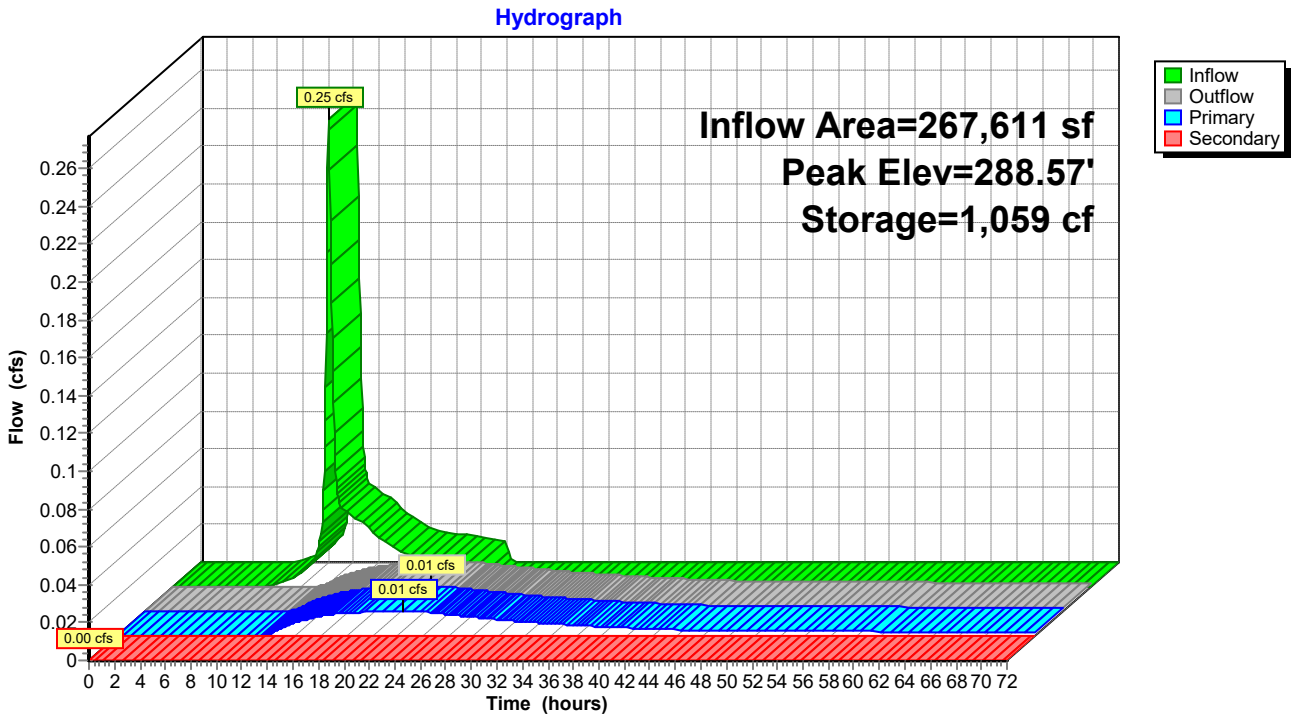
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
288.50	15,713	0	0
289.00	16,970	8,171	8,171
290.00	19,522	18,246	26,417
291.00	22,132	20,827	47,244
292.00	24,800	23,466	70,710

Device	Routing	Invert	Outlet Devices
#1	Primary	288.50'	**15.0" Round Culvert** L= 360.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 288.50' / 287.00' S= 0.0042 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	288.50'	**6.0" Vert. Orifice/Grate X 3.00** C= 0.600
#3	Device 1	290.75'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	291.30'	**40.0' long x 6.0' breadth Broad-Crested Rectangular Weir** 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) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=0.01 cfs @ 22.50 hrs HW=288.57' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.01 cfs @ 0.76 fps)
  └**2=Orifice/Grate** (Passes 0.01 cfs of 0.04 cfs potential flow)
  └**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=288.50' (Free Discharge)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond B-4: OCS-4


Hydrograph
Inflow Area=267,611 sf
Peak Elev=288.57'
Storage=1,059 cf
0.25 cfs
0.01 cfs
0.01 cfs
0.00 cfs
Inflow
Outflow
Primary
Secondary
Flow (cfs)
0 0.02 0.04 0.06 0.08 0.1 0.12 0.14 0.16 0.18 0.2 0.22 0.24 0.26
Time (hours)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72

Summary for Pond B-5: OCS-5

Inflow Area = 352,383 sf, 0.00% Impervious, Inflow Depth = 0.02" for WQ-1.0 event
Inflow = 0.02 cfs @ 14.79 hrs, Volume= 455 cf
Outflow = 0.01 cfs @ 24.05 hrs, Volume= 446 cf, Atten= 65%, Lag= 555.2 min
Primary = 0.01 cfs @ 24.05 hrs, Volume= 446 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 292.04' @ 24.05 hrs Surf.Area= 8,303 sf Storage= 291 cf

Plug-Flow detention time= 762.4 min calculated for 446 cf (98% of inflow)
Center-of-Mass det. time= 755.0 min (1,815.2 - 1,060.2)

Volume	Invert	Avail.Storage	Storage Description
#1	292.00'	55,470 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

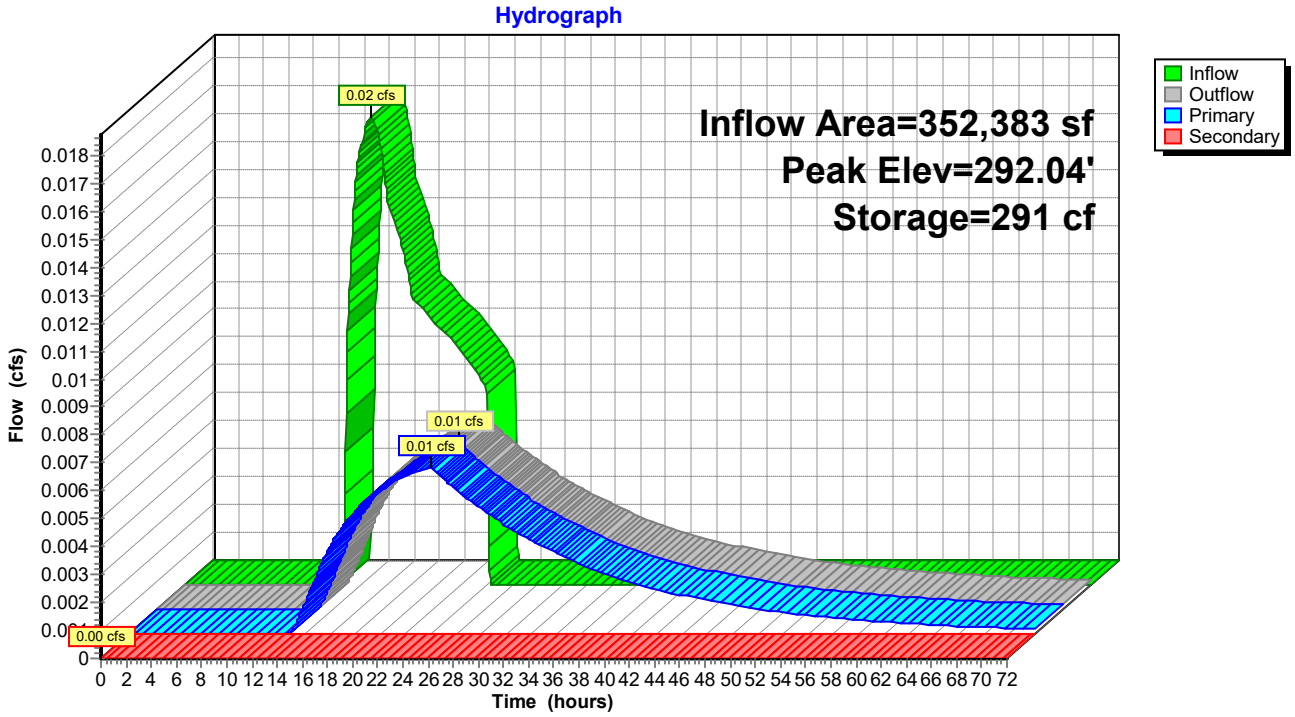
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
292.00	8,266	0	0
293.00	9,328	8,797	8,797
294.00	10,446	9,887	18,684
295.00	11,620	11,033	29,717
296.00	12,852	12,236	41,953
297.00	14,182	13,517	55,470

Device	Routing	Invert	Outlet Devices
#1	Secondary	296.00'	**40.0' long x 6.0' breadth Broad-Crested Rectangular Weir** 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) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83
#2	Primary	290.00'	**12.0" Round Culvert** L= 24.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 290.00' / 289.50' S= 0.0208 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#3	Device 2	292.00'	**7.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	294.75'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 24.05 hrs HW=292.04' (Free Discharge)
└**2=Culvert** (Passes 0.00 cfs of 4.69 cfs potential flow)
  ├**3=Orifice/Grate** (Orifice Controls 0.00 cfs @ 0.64 fps)
  └**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=292.00' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond B-5: OCS-5


Hydrograph
Inflow Area=352,383 sf
Peak Elev=292.04'
Storage=291 cf
0.02 cfs
0.01 cfs
0.01 cfs
0.00 cfs
Inflow
Outflow
Primary
Secondary
Flow (cfs)
Time (hours)

Summary for Pond EX B-1: EX B-1

Inflow Area = 79,169 sf, 1.52% Impervious, Inflow Depth = 0.02" for WQ-1.0 event
Inflow = 0.04 cfs @ 12.09 hrs, Volume= 137 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 268.10' @ 24.40 hrs Surf.Area= 1,954 sf Storage= 136 cf

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

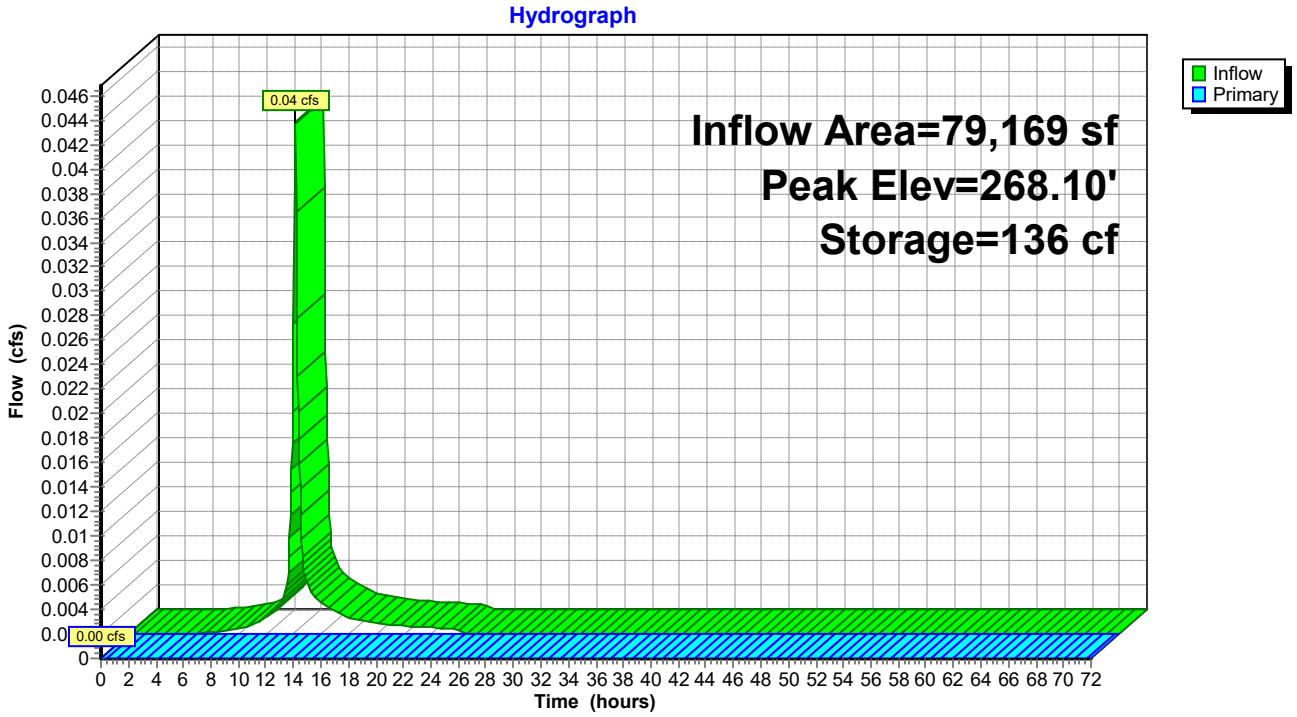
Volume	Invert	Avail.Storage	Storage Description
#1	268.00'	50,349 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
268.00	692	0	0
269.00	12,993	6,843	6,843
270.00	20,435	16,714	23,557
271.00	33,150	26,793	50,349

Device	Routing	Invert	Outlet Devices
#1	Primary	270.60'	**100.0' long x 12.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=268.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond EX B-1: EX B-1



Summary for Pond W-1: W-1

Inflow Area = 719,837 sf, 1.66% Impervious, Inflow Depth > 0.06" for WQ-1.0 event
Inflow = 0.27 cfs @ 12.13 hrs, Volume= 3,441 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 263.04' @ 72.00 hrs Surf.Area= 15,018 sf Storage= 3,440 cf

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

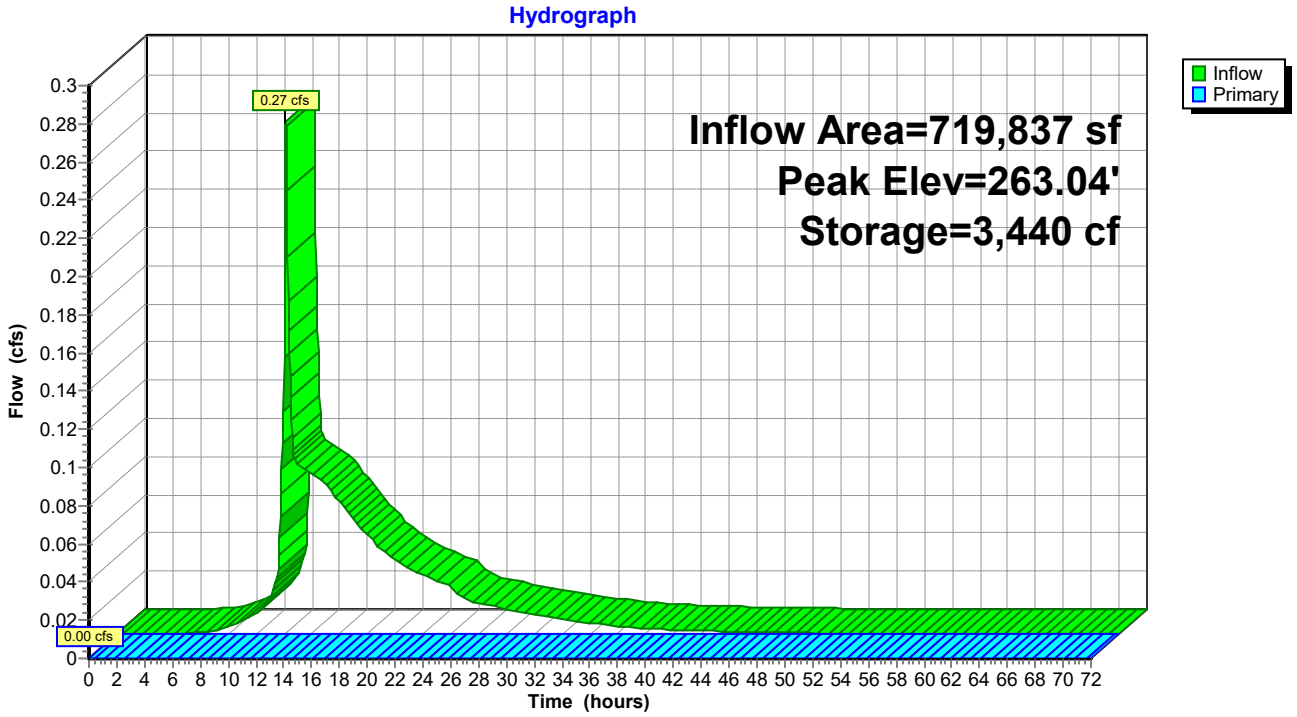
Volume	Invert	Avail.Storage	Storage Description
#1	262.80'	290,974 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
262.80	13,689	0	0
263.00	14,660	2,835	2,835
264.00	23,434	19,047	21,882
265.00	33,093	28,264	50,145
266.00	52,774	42,934	93,079
267.00	61,584	57,179	150,258
268.00	67,631	64,608	214,865
269.00	84,587	76,109	290,974

Device	Routing	Invert	Outlet Devices
#1	Primary	268.00'	**4.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=262.80' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond W-1: W-1

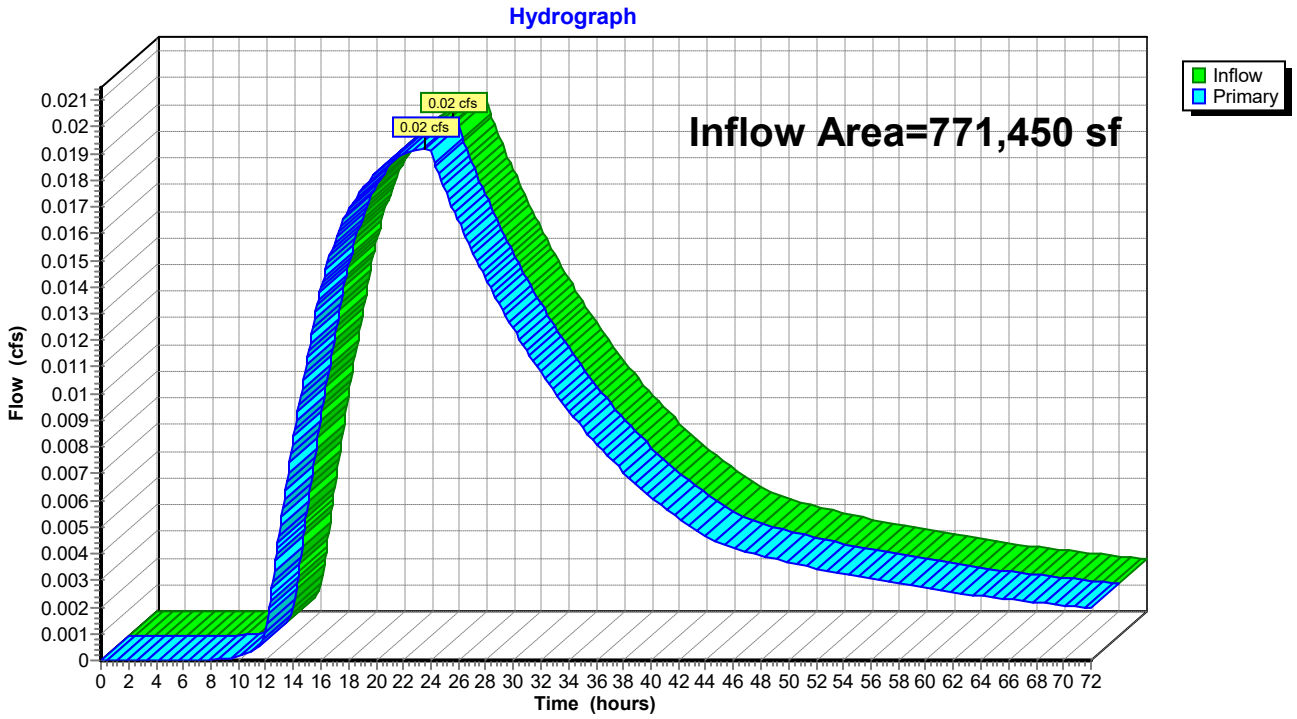

Hydrograph
Inflow Area=719,837 sf
Peak Elev=263.04'
Storage=3,440 cf
0.27 cfs
0.00 cfs
Inflow
Primary
Flow (cfs)
Time (hours)
0 0.02 0.04 0.06 0.08 0.1 0.12 0.14 0.16 0.18 0.2 0.22 0.24 0.26 0.28 0.3
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72

Summary for Link A: POI-A

Inflow Area = 771,450 sf, 0.00% Impervious, Inflow Depth > 0.03" for WQ-1.0 event
Inflow = 0.02 cfs @ 23.55 hrs, Volume= 1,665 cf
Primary = 0.02 cfs @ 23.55 hrs, Volume= 1,665 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link A: POI-A

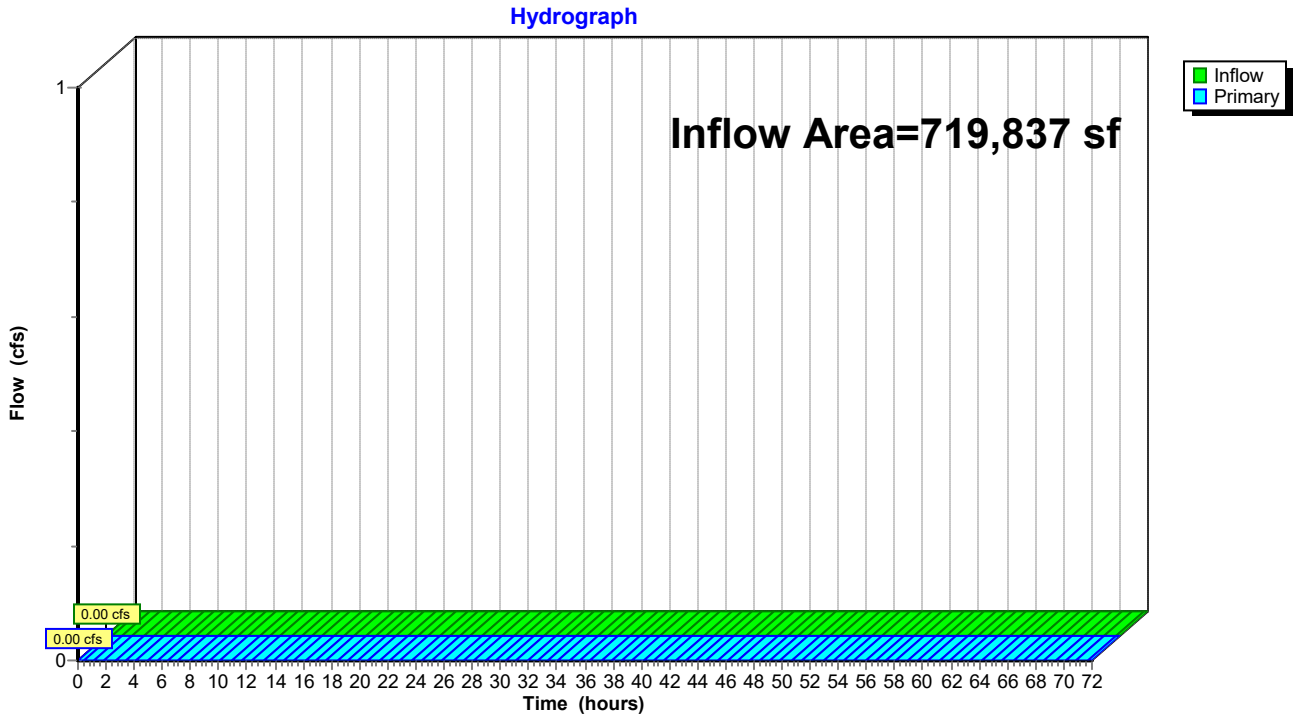


Summary for Link B: POI-B

Inflow Area = 719,837 sf, 1.66% Impervious, Inflow Depth = 0.00" for WQ-1.0 event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link B: POI-B

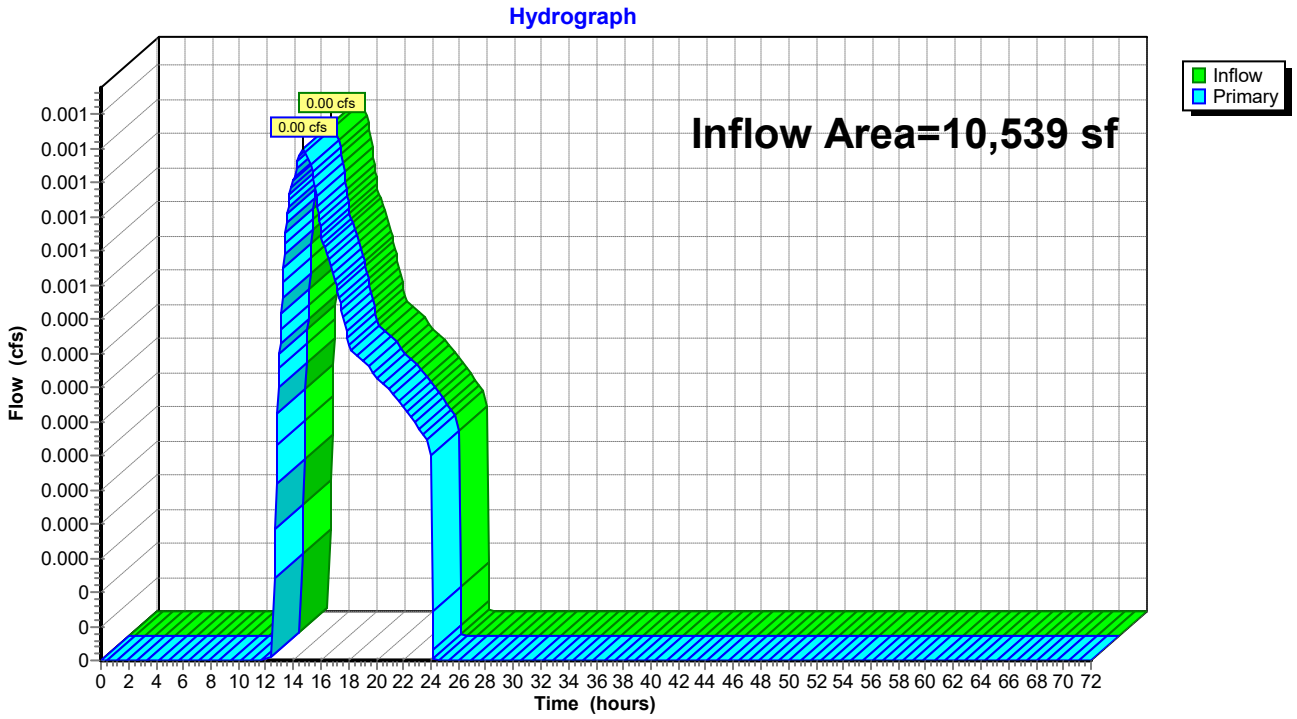


Summary for Link C: POI-C

Inflow Area = 10,539 sf, 0.00% Impervious, Inflow Depth = 0.02" for WQ-1.0 event
Inflow = 0.00 cfs @ 14.76 hrs, Volume= 20 cf
Primary = 0.00 cfs @ 14.76 hrs, Volume= 20 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link C: POI-C

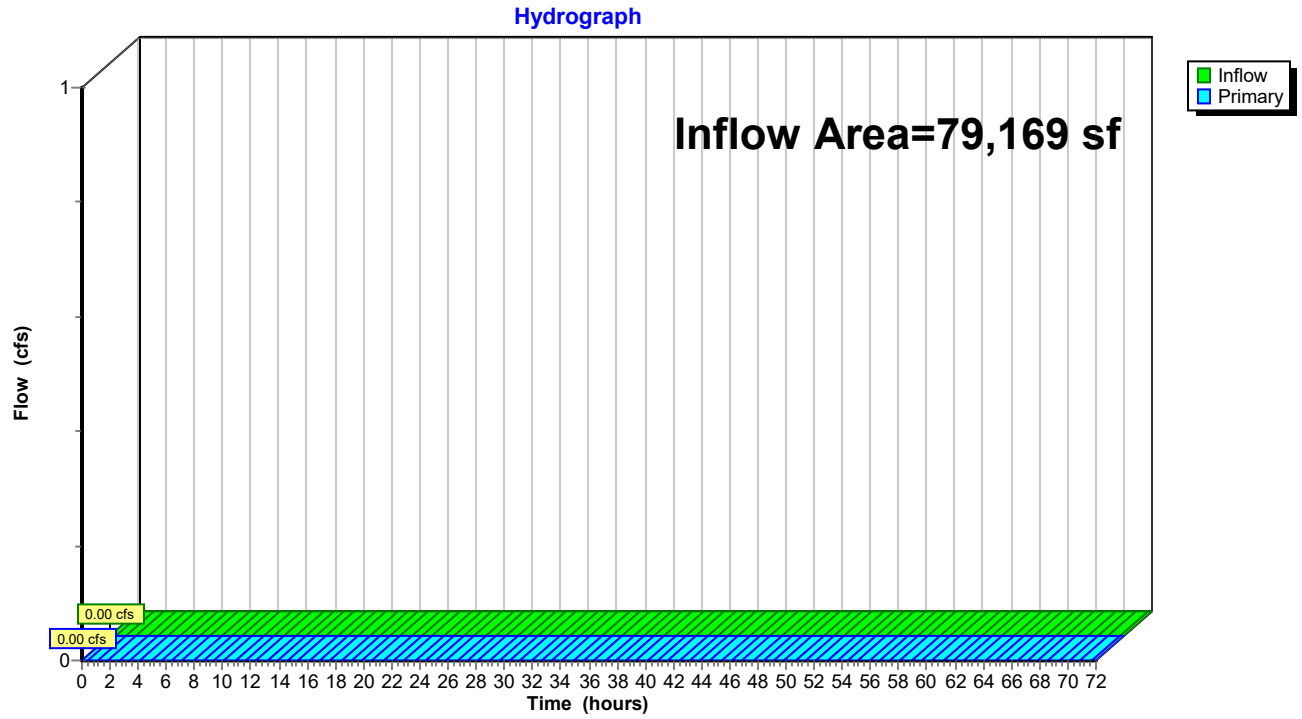


Summary for Link D: POI-D

Inflow Area = 79,169 sf, 1.52% Impervious, Inflow Depth = 0.00" for WQ-1.0 event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link D: POI-D

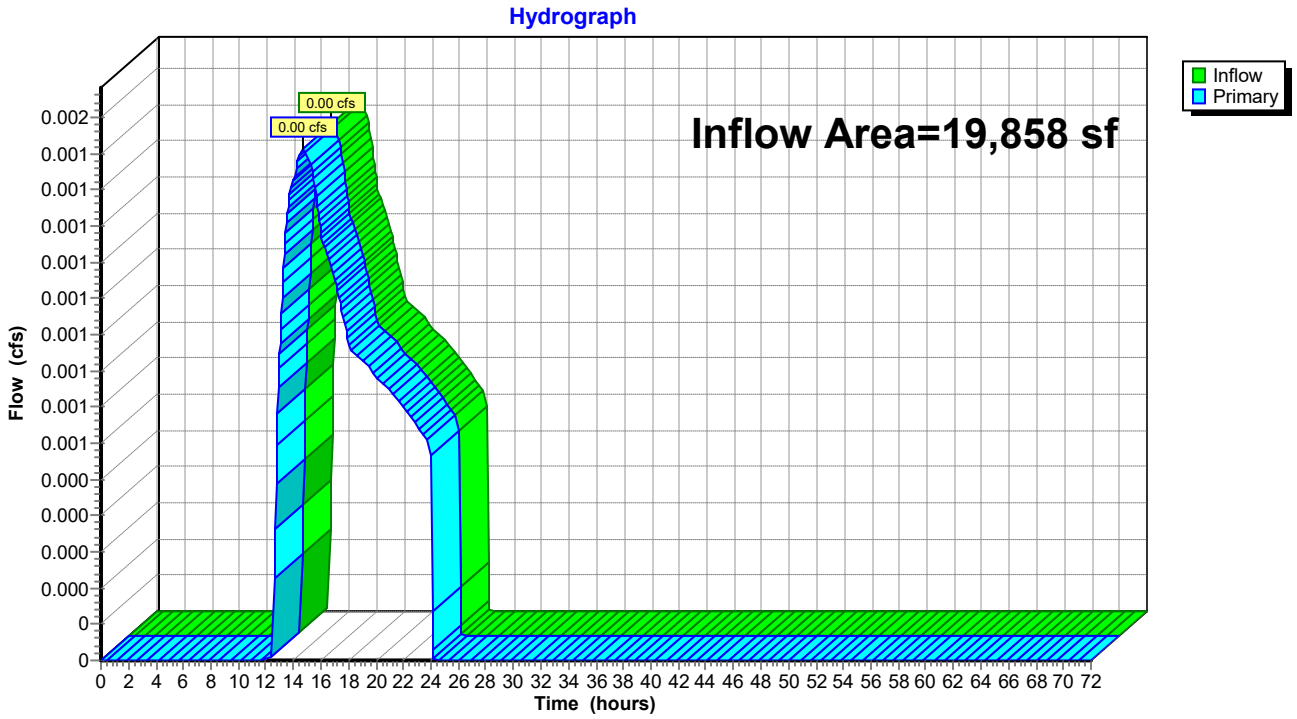


Summary for Link E: POI-E

Inflow Area = 19,858 sf, 0.00% Impervious, Inflow Depth = 0.02" for WQ-1.0 event
Inflow = 0.00 cfs @ 14.76 hrs, Volume= 38 cf
Primary = 0.00 cfs @ 14.76 hrs, Volume= 38 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link E: POI-E



Swale and Riprap Apron Sizing Calculations Summary

1) Swale Downstream of Basin 1:
   A calculation is included showing the flow depth and velocity in this swale for 100-year discharge from proposed Basin 1.

2) Northwest Swale-Downstream End:
   A calculation is included showing the flow depth and velocity in the steeper downstream end of this swale for 100-year discharge from the tributary area.

3) Northwest Swale-Upstream End:
   A calculation is included showing the flow depth and velocity in the steeper downstream end of this swale for 100-year discharge from the tributary area.

4) Culvert-Northeast
   Due to the flatness of the swale upstream of this culvert, the swale is presumed to function as a pond with negligible velocity, and the outflow is controlled by the culvert at its downstream end. A culvert calculation is included, the velocity of which is used for riprap apron sizing calcs.

5) Culvert-Northeast
   Due to the flatness of the swale upstream of this culvert, the swale is presumed to function as a pond with negligible velocity, and the outflow is controlled by the culvert at its downstream end. A culvert calculation is included, the velocity of which is used for riprap apron sizing calcs.

6) Riprap Apron Sizing Calculations
   Flow rates and velocities were taken from HydroCAD for purposes of these calculations.

For reference, the attached table is included (taken from the Massachusetts Stormwater Handbook, Volume 3, Chapter 1, Page 3. The table indicates that grassed covers are generally acceptable for velocities at 5 ft/s or lower (Tall fescue/Kentucky bluegrass). Only one swale (Northwest Swale-Downstream End) exceeds 5 ft/s. This is mitigated by the fact that the proposed design exceeds these standards, as swale details call for loam and seed plus a turf reinforcement mat.

Channel Slope	Lining[1]	Permissible Velocity (feet/second)
0 - 5%	Tall fescue Kentucky bluegrass	5
	Grass-legume mixture	4
	Red fescue Redtop Sericea lespedeza Annual lespedeza Small grains	2.5
5 - 10%	Tall fescue Kentucky bluegrass	4
	Grass-legume mixture	3
Greater Than 10%	Tall fescue Kentucky bluegrass	3

Table 2.3.1: Example of Permissible Velocity Table, Modified from Soil and Water Conservation Engineering, 1992, Schwab et al, John Wiley and Sons

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Apr 3 2020

Swale Downstream of Basin 1

Trapezoidal

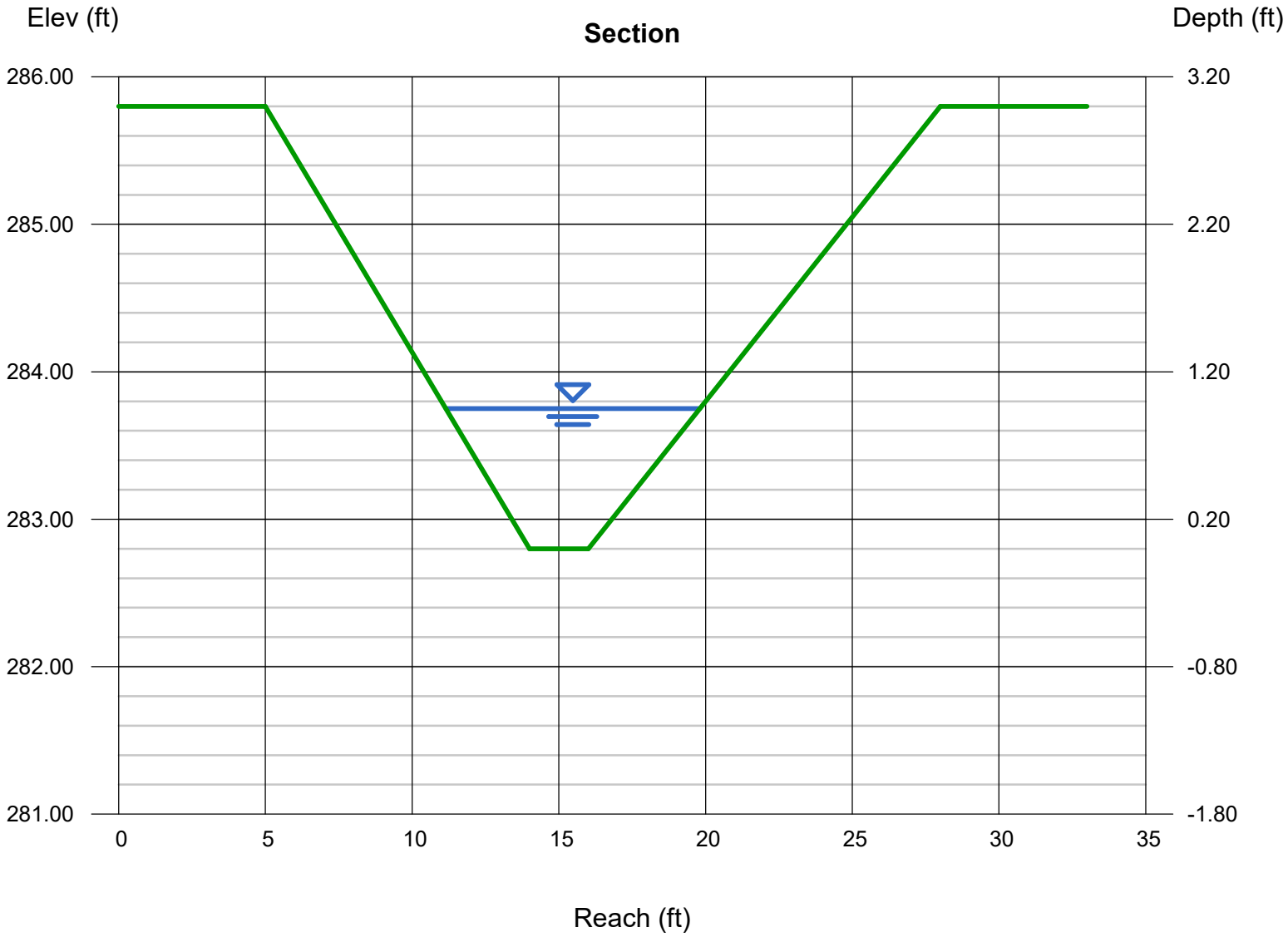
Bottom Width (ft)	= 2.00
Side Slopes (z:1)	= 3.00, 4.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 282.80
Slope (%)	= 1.00
N-Value	= 0.035

Calculations

Compute by:	Known Q
Known Q (cfs)	= 14.61

Highlighted

Depth (ft)	= 0.95
Q (cfs)	= 14.61
Area (sqft)	= 5.06
Velocity (ft/s)	= 2.89
Wetted Perim (ft)	= 8.92
Crit Depth, Yc (ft)	= 0.78
Top Width (ft)	= 8.65
EGL (ft)	= 1.08



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Apr 3 2020

Northwest swale-Downstream End

Trapezoidal

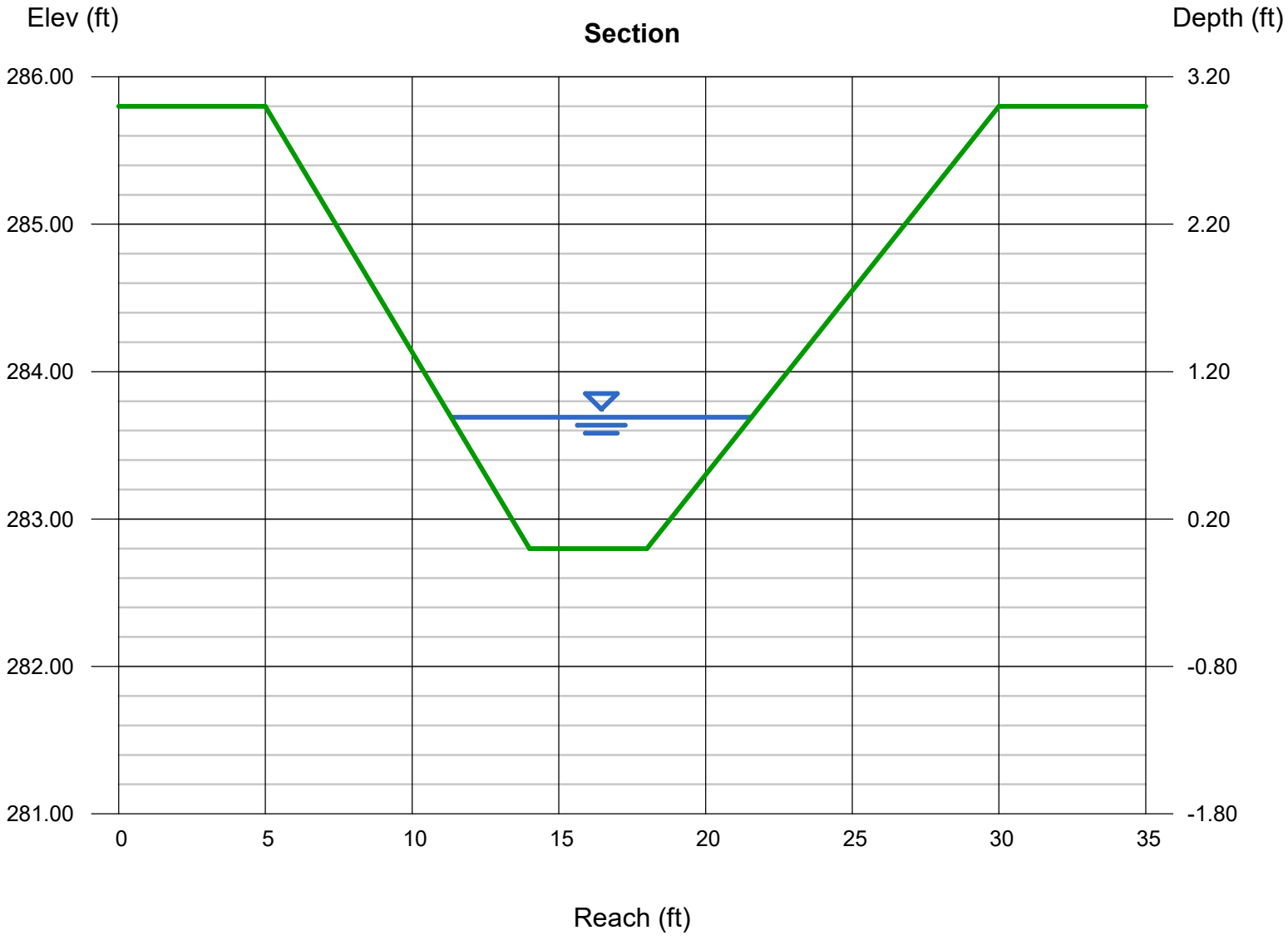
Bottom Width (ft)	= 4.00
Side Slopes (z:1)	= 3.00, 4.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 282.80
Slope (%)	= 3.00
N-Value	= 0.035

Calculations

Compute by:	Known Q
Known Q (cfs)	= 33.20

Highlighted

Depth (ft)	= 0.89
Q (cfs)	= 33.20
Area (sqft)	= 6.33
Velocity (ft/s)	= 5.24
Wetted Perim (ft)	= 10.48
Crit Depth, Yc (ft)	= 0.98
Top Width (ft)	= 10.23
EGL (ft)	= 1.32



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Apr 3 2020

Northwest swale-Upstream End

Trapezoidal

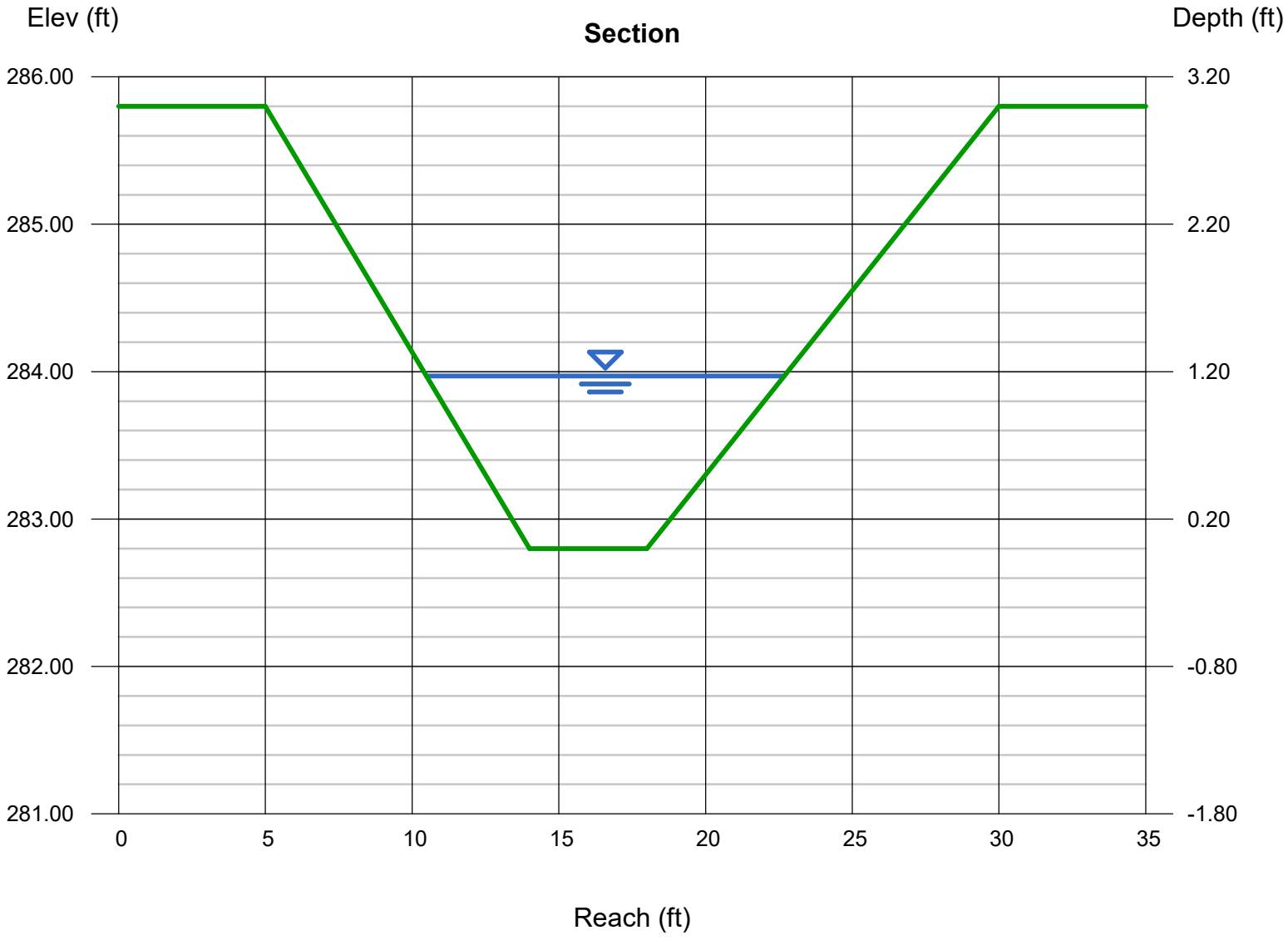
Bottom Width (ft)	= 4.00
Side Slopes (z:1)	= 3.00, 4.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 282.80
Slope (%)	= 1.00
N-Value	= 0.035

Calculations

Compute by:	Known Q
Known Q (cfs)	= 33.20

Highlighted

Depth (ft)	= 1.17
Q (cfs)	= 33.20
Area (sqft)	= 9.47
Velocity (ft/s)	= 3.51
Wetted Perim (ft)	= 12.52
Crit Depth, Yc (ft)	= 0.98
Top Width (ft)	= 12.19
EGL (ft)	= 1.36



Culvert Report

Culvert-Northeast

Invert Elev Dn (ft)	=	285.00
Pipe Length (ft)	=	70.00
Slope (%)	=	1.43
Invert Elev Up (ft)	=	286.00
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	2
n-Value	=	0.012
Culvert Type	=	Circular Culvert
Culvert Entrance	=	Smooth tapered inlet throat
Coeff. K,M,c,Y,k	=	0.534, 0.555, 0.0196, 0.9, 0.2

Embankment

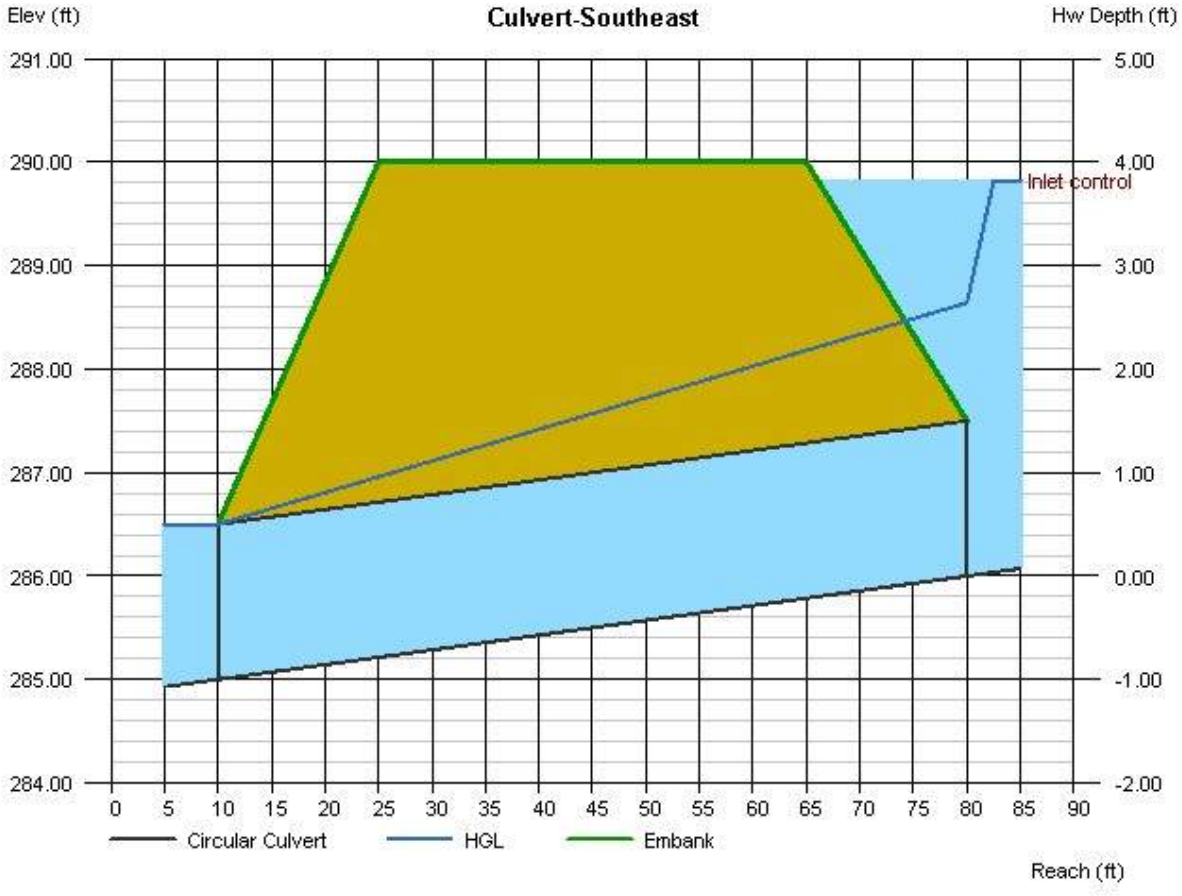
Top Elevation (ft)	=	290.00
Top Width (ft)	=	40.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	39.78
Qmax (cfs)	=	39.78
Tailwater Elev (ft)	=	Crown

Highlighted

Qtotal (cfs)	=	39.78
Qpipe (cfs)	=	39.78
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	11.26
Veloc Up (ft/s)	=	11.26
HGL Dn (ft)	=	286.50
HGL Up (ft)	=	288.64
Hw Elev (ft)	=	289.82
Hw/D (ft)	=	2.55
Flow Regime	=	Inlet Control



Culvert Report

Culvert-Southeast

Invert Elev Dn (ft)	=	288.50
Pipe Length (ft)	=	67.00
Slope (%)	=	2.24
Invert Elev Up (ft)	=	290.00
Rise (in)	=	15.0
Shape	=	Circular
Span (in)	=	15.0
No. Barrels	=	2
n-Value	=	0.012
Culvert Type	=	Circular Culvert
Culvert Entrance	=	Smooth tapered inlet throat
Coeff. K,M,c,Y,k	=	0.534, 0.555, 0.0196, 0.9, 0.2

Embankment

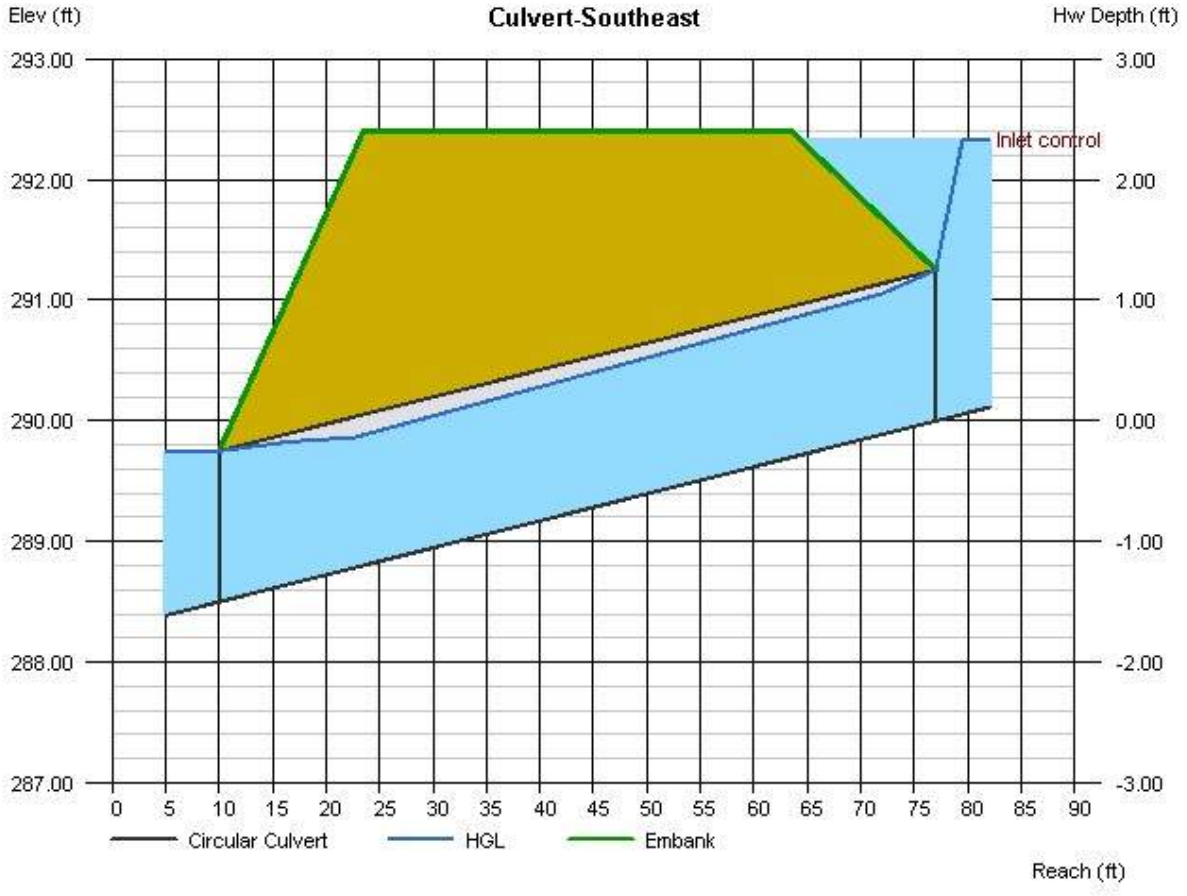
Top Elevation (ft)	=	292.40
Top Width (ft)	=	40.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	19.37
Qmax (cfs)	=	19.37
Tailwater Elev (ft)	=	Crown

Highlighted

Qtotal (cfs)	=	19.37
Qpipe (cfs)	=	19.37
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	7.89
Veloc Up (ft/s)	=	8.09
HGL Dn (ft)	=	289.75
HGL Up (ft)	=	291.18
Hw Elev (ft)	=	292.33
Hw/D (ft)	=	1.87
Flow Regime	=	Inlet Control



PYRAMAT® WOVEN PRODUCT LINE CARD[1]

	Property	Test Method	Value	Unit	PYRAMAT® 25	PYRAMAT® 50	PYRAMAT® 75
PHYSICAL	Mass/Unit Area	ASTM D-6566	MARV	oz/yd^2 g/m^2	8.0 271	11.0 373	14.0 475
	Thickness	ASTM D-6525	MARV	in mm	0.25 6.35	0.30 7.62	0.40 10.16
	Light Penetration	ASTM D-6567	MARV	% Passing	35%	25%	10%
	Color	Visual	-	-	Green or Tan	Green or Tan	Green or Tan
MECHANICAL	Grab Tensile Strength	ASTM D-6818	MARV	lb/ft kN/m	2000 x 1800 29.2 x 26.3	3200 x 3000 46.7 x 43.8	4000 x 3000 58.4 x 43.8
	Grab Elongation	ASTM D-6818	MARV	%	20 x 20	30 x 30	40 x 35
	Resiliency	ASTM D-6524	MARV	%	70%	70%	80%
	Flexibility	ASTM D-6575	MARV	in-lb mg-cm	0.195 225,000	0.195 225,000	0.534 616,154
ENDURANCE	UV Resistance	ASTM D-4355	MARV	% Retained @ 1,000 hrs	90%	-	-
				% Retained @ 3,000 hrs	90%	90%	90%
				% Retained @ 6,000 hrs	-	90%	90%
PERFORMANCE	Velocity (Vegetated)	Large Scale	MARV	ft/sec m/sec	20 6.1	22 6.7	25 7.6
	Shear Stress (Vegetated)	Large Scale	MARV	lb/ft^2 Pa	12 575	14 670	16 766
	Manning's "n" (Unvegetated)	Calculated	MARV	N/A	0.028	0.028	0.028
	Seedling Emergence	ASTM D-7322	Typical	%	255%	-	296%
	Roll Sizes	Measured	Typical		8.5 ft x 120 ft	8.5 ft x 120 ft 15.0 ft x 120 ft	8.5 ft x 120 ft 15.0 ft x 120 ft

NOTES:

1. The property values listed above are effective 03/09/2018 and are subject to change without notice. Values represent testing at time of manufacture.

PYRAMAT®

Product Data

PYRAMAT® 25 TRM

PYRAMAT® 25 turf reinforcement mat (TRM) is a three-dimensional, lofty, woven polypropylene geotextile that is available in green which is specially designed for erosion control applications on steep slopes and vegetated waterways. The matrix is composed of polypropylene monofilament yarns featuring X3® technology woven into a uniform configuration of resilient pyramid-like projections. The material exhibits very high interlock and reinforcement capacity with both soil and root systems, demonstrates superior UV resistance, and enhances seedling emergence. The expected design life of PYRAMAT® 25 is up to 25 years because of its superior UV resistance, resistance to corrosion, strength, and durability in the most demanding environments.

PYRAMAT® 25 conforms to the property values listed below[1] and is manufactured at a Propex facility having achieved ISO 9001:2008 certification. Propex performs internal Manufacturing Quality Control (MQC) tests that have been accredited by the Geosynthetic Accreditation Institute – Laboratory Accreditation Program (GAI-LAP).

PROPERTY	TEST METHOD	ENGLISH	METRIC
ORIGIN OF MATERIALS			
% U.S. Manufactured Inputs		100%	100%
% U.S. Manufactured		100%	100%
PHYSICAL			
Mass/Unit Area [4]	ASTM D-6566	8.0 oz/yd²	271 g/m²
Thickness [2]	ASTM D-6525	0.25 in	6.4 mm
Light Penetration (% Passing) [3]	ASTM D-6567	35%	35%
Color	Visual	Green or Tan	
MECHANICAL			
Tensile Strength [2]	ASTM D-6818	2000 x 1800 lbs/ft	29.2 x 26.3 kN/m
Elongation [2]	ASTM D-6818	20 x 20 %	20 x 20 %
Resiliency [2]	ASTM D-6524	70%	70%
Flexibility [4]	ASTM D-6575	0.195 in-lb	225,000 mg-cm
ENDURANCE			
UV Resistance % Retained at 1,000 hrs [4]	ASTM D-4355	90%	90%
UV Resistance % Retained at 3,000 hrs [4]	ASTM D-4355	90%	90%
PERFORMANCE			
Velocity (Vegetated) [4, 5]	Large Scale	20 ft/sec	6.1 m/sec
Shear Stress (Vegetated) [4, 5]	Large Scale	12 lb/ft²	575 Pa
Manning's n (Unvegetated) [4, 6]	Calculated	0.028	0.028
Seedling Emergence [4]	ASTM D-7322	255%	255%
ROLL SIZES		8.5 ft x 120 ft	2.6 m x 36.6 m

NOTES:

1. The property values listed above are effective 01/01/2019 and are subject to change without notice. Values represent testing at time of manufacture.
2. Minimum average roll values (MARV) are calculated as the typical minus two standard deviations. Statistically, it yields a 97.7% degree of confidence that any samples taken from quality assurance testing will exceed the value reported.
3. Maximum Average Roll Value (MaxARV), calculated as the typical plus two standard deviations. Statistically, it yields a 97.7% degree of confidence that any sample taken during quality assurance testing will meet to the value reported.
4. Typical Value.
5. Maximum permissible velocity and shear stress has been obtained through vegetated testing programs featuring specific soil types, vegetation classes, flow conditions, and failure criteria. These conditions may not be relevant to every project nor are they replicated by other manufacturers. Please contact Propex for further information.
6. Calculated as typical values from large-scale flexible channel lining test programs with a flow depth of 6 to 12 inches.

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PYRAMAT®

Product Data

PYRAMAT® 50 HPTRM

PYRAMAT® 50 high performance turf reinforcement mat (HPTRM) is a three-dimensional, lofty, woven polypropylene geotextile that is available in green which is specially designed for erosion control applications on steep slopes and vegetated waterways. The matrix is composed of polypropylene monofilament yarns featuring X3® technology woven into a uniform configuration of resilient pyramid-like projections. The material exhibits very high interlock and reinforcement capacity with both soil and root systems, demonstrates superior UV resistance, and enhances seedling emergence.

PYRAMAT® 50 conforms to the property values listed below[1] and is manufactured at a Propex facility having achieved ISO 9001:2008 certification. Propex performs internal Manufacturing Quality Control (MQC) tests that have been accredited by the Geosynthetic Accreditation Institute – Laboratory Accreditation Program (GAI-LAP).

PROPERTY	TEST METHOD	ENGLISH	METRIC
ORIGIN OF MATERIALS			
% U.S. Manufactured		100%	100%
PHYSICAL			
Mass/Unit Area [4]	ASTM D-6566	11.0 oz/yd²	373 g/m²
Thickness [2]	ASTM D-6525	0.30 in	7.6 mm
Light Penetration (% Passing) [3]	ASTM D-6567	25%	25%
Color	Visual	Green or Tan	
MECHANICAL			
Tensile Strength [2]	ASTM D-6818	3200 x 3000 lbs/ft	46.7 x 43.8 kN/m
Elongation [2]	ASTM D-6818	30 x 30 %	30 x 30 %
Resiliency [2]	ASTM D-6524	70%	70%
Flexibility [4]	ASTM D-6575	0.195 in-lb	225,000 mg-cm
ENDURANCE			
UV Resistance % Retained at 3,000 hrs [4]	ASTM D-4355	90%	90%
UV Resistance % Retained at 6,000 hrs [4]	ASTM D-4355	90%	90%
PERFORMANCE			
Velocity (Vegetated) [4, 5]	Large Scale	22 ft/sec	6.7 m/sec
Shear Stress (Vegetated) [4, 5]	Large Scale	14 lb/ft²	670 Pa
Manning's n (Unvegetated) [4, 6]	Calculated	0.028	0.028
Seedling Emergence [4]	ASTM D-7322	-	-
ROLL SIZES		8.5 ft x 120 ft 15.0 ft x 120 ft	2.6 m x 36.6 m 4.6 m x 36.6 m

NOTES:

1. The property values listed above are effective 03/09/2018 and are subject to change without notice. Values represent testing at time of manufacture.
2. Minimum average roll values (MARV) are calculated as the typical minus two standard deviations. Statistically, it yields a 97.7% degree of confidence that any samples taken from quality assurance testing will exceed the value reported.
3. Maximum Average Roll Value (MaxARV), calculated as the typical plus two standard deviations. Statistically, it yields a 97.7% degree of confidence that any sample taken during quality assurance testing will meet to the value reported.
4. Typical Value.
5. Maximum permissible velocity and shear stress has been obtained through vegetated testing programs featuring specific soil types, vegetation classes, flow conditions, and failure criteria. These conditions may not be relevant to every project nor are they replicated by other manufacturers. Please contact Propex for further information.
6. Calculated as typical values from large-scale flexible channel lining test programs with a flow depth of 6 to 12 inches.

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PYRAMAT®

Product Data

PYRAMAT® 75 HPTRM

PYRAMAT® 75 high performance turf reinforcement mat (HPTRM) is a three-dimensional, lofty, woven polypropylene geotextile that is available in green or tan which is specially designed for erosion control applications on steep slopes and vegetated waterways. The matrix is composed of polypropylene monofilament yarns featuring X3® technology woven into a uniform configuration of resilient pyramid-like projections. The material exhibits very high interlock and reinforcement capacity with both soil and root systems, demonstrates superior UV resistance, and enhances seedling emergence. The expected design life of PYRAMAT® 75 is up to 75 years because of its superior UV resistance, resistance to corrosion, strength, and durability in the most demanding environments.

PYRAMAT® 75 conforms to the property values listed below[1] and is manufactured at a Propex facility having achieved ISO 9001:2008 and ISO 14001:2015 certifications. Propex performs internal Manufacturing Quality Control (MQC) tests that have been accredited by the Geosynthetic Accreditation Institute – Laboratory Accreditation Program (GAI-LAP).

PROPERTY	TEST METHOD	ENGLISH	METRIC
ORIGIN OF MATERIALS			
% U.S. Manufactured		100%	100%
ENVIRONMENTAL IMPACT			
Carbon Footprint	GHG Protocol ISO 14064:2006 PAS 2050:2011	2.7 kg $CO2e/m^2$	
PHYSICAL			
Mass/Unit Area [4]	ASTM D-6566	14.0 oz/yd^2	475 g/m^2
Thickness [2]	ASTM D-6525	0.40 in	10.2 mm
Light Penetration (% Passing) [3]	ASTM D-6567	10%	10%
Color	Visual	Green or Tan	
MECHANICAL			
Tensile Strength [2]	ASTM D-6818	4000 x 3000 lbs/ft	58.4 x 43.8 kN/m
Elongation [2]	ASTM D-6818	40 x 35 %	40 x 35 %
Resiliency [2]	ASTM D-6524	80%	80%
Flexibility [4]	ASTM D-6575	0.534 in-lb	616,154 mg-cm
ENDURANCE			
UV Resistance % Retained at 3,000 hrs [4]	ASTM D-4355	90%	90%
UV Resistance % Retained at 6,000 hrs [4]	ASTM D-4355	90%	90%
PERFORMANCE			
Velocity (Vegetated) [4, 5]	Large Scale	25 ft/sec	7.6 m/sec
Shear Stress (Vegetated) [4, 5]	Large Scale	16 lb/ft^2	766 Pa
Manning's n (Unvegetated) [4, 6]	Calculated	0.028	0.028
Seedling Emergence [4]	ASTM D-7322	619%	619%
ROLL SIZES		8.5 ft x 120 ft 15.0 ft x 120 ft	2.6 m x 36.6 m 4.6 m x 36.6 m

NOTES:

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2. Minimum average roll values (MARV) are calculated as the typical minus two standard deviations. Statistically, it yields a 97.7% degree of confidence that any samples taken from quality assurance testing will exceed the value reported.
3. Maximum Average Roll Value (MaxARV), calculated as the typical plus two standard deviations. Statistically, it yields a 97.7% degree of confidence that any sample taken during quality assurance testing will meet to the value reported.
4. Typical Value.
5. Maximum permissible velocity and shear stress has been obtained through vegetated testing programs featuring specific soil types, vegetation classes, flow conditions, and failure criteria. These conditions may not be relevant to every project nor are they replicated by other manufacturers. Please contact Propex for further information.
6. Calculated as typical values from large-scale flexible channel lining test programs with a flow depth of 6 to 12 inches.

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Project: Marshall Street Solar Project

Prepared By: JIP
Checked By: JIP
Date: 03/30/20

OUTLET PROTECTION SIZING CALCULATION SHEET

Design Criteria

$$L_A = \frac{1.8Q}{Do^{1.5}} + 7Do$$

$$W_1 = 3Do$$

$$W_2 = 3Do + L_A$$

$$d_{50} = \frac{0.02}{Tw} \times \frac{Q^{1.33}}{Do}$$

Where,

L_A = the length of the apron (Ft.)
W_1 = the width of apron at outlet of the pipe or width of channel (Ft.)
W_2 = the width of the downstream end of the apron (Ft.)
d_{50} = the median stone diameter (Ft.)
Q = the discharge from the pipe during the 10-year storm event (CFS)
Do = the diameter of the pipe of width of the box culvert (FT)
Tw = the tailwater depth above the invert of the pipe (Ft.)

Outlet	Q (100 Yr) (CFS)	Do (Ft.)	Barrels	Min. L_A (Ft.)	Min. W_1 (Ft.)	Min. W_2 (Ft.)	Tw (Ft.)	Min.d_{50} (Ft.)	Velocity (FPS)	Req'd V>2.5 fps
FE-01	**14.61**	**1.5**	**1**	24.8	4.5	29.3	**1.00**	0.47	8.27	Yes
FE-02	**13.01**	**1.5**	**1**	23.2	4.5	27.7	**1.00**	0.40	7.36	Yes
FE-03	**0.57**	**1.0**	**1**	8.0	3.0	11.0	**1.00**	0.01	0.73	No
FE-04	**5.32**	**1.5**	**1**	15.7	4.5	20.2	**1.00**	0.12	3.01	Yes
FE-05	**8.85**	**1.0**	**1**	22.9	3.0	25.9	**1.00**	0.36	11.27	Yes
FE-06	**19.37**	**1.3**	**2**	21.2	3.8	25.0	**1.00**	0.33	7.89	Yes
FE-07	**39.78**	**1.3**	**2**	34.4	3.8	38.1	**1.00**	0.85	16.21	Yes

Notes:

1. The velocity for each outlet was generated using HydroCAD
2. Where there are multiple barrels, Q was divided by number of barrels prior to entering into equations

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: Swale, Forebay and Basin

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)
Grass Channel	0.50	1.00	0.50	0.50
Sediment Forebay	0.25	0.50	0.13	0.38
Extended Dry Detention Basin	0.50	0.38	0.19	0.19
	0.00	0.19	0.00	0.19
	0.00	0.19	0.00	0.19

Total TSS Removal = 81%

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

Project: Holliston-Marshall Street Solar
Prepared By: James Pearson
Date: 4/15/2020

*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

Sediment Forebay Sizing: Basin 1

Forebay Volume:

Min. Required Volume = 0.1 Inch x Impervious Area

Impervious Area	14,828	sqft
Min. Required Volume	124	cuft
Volume Provided	1170	cuft

Volume Provided Worksheet:

Contour El. (ft)	Area (sqft)	Inc. Volume (cuft)	Cum. Volume (cuft)
283	386	0	0
284	557	472	472
285	839	698	**1170**

Check Dam Sizing:

Min. Required Length (ft) = 6 x Drainage Area (acres)

Drainage Area	7.3	acres
Min. Required Check Dam Length	43.6	ft
Length Provided	44	ft

Sediment Forebay Sizing: Basin 4

Forebay Volume:

Min. Required Volume = 0.1 Inch x Impervious Area

Impervious Area	13,746	sqft
Min. Required Volume	115	cuft
Volume Provided	1298	cuft

Volume Provided Worksheet:

Contour El. (ft)	Area (sqft)	Inc. Volume (cuft)	Cum. Volume (cuft)
288.5	570	0	0
289	760	333	333
290	1,170	965	**1298**

Check Dam Sizing:

Min. Required Length (ft) = 6 x Drainage Area (acres)

Drainage Area	4.3	acres
Min. Required Check Dam Length	25.5	ft
Length Provided	26	ft

Attachment D - Construction Period Pollution and Erosion and Sedimentation Control Plan

Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan

SECTION 1: Introduction

This plan has been developed in support of the proposed development of the Marshall Street solar project. As part of this project, this "Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan" has been created to ensure that no further disturbance to the wetland resource is created during the project.

SECTION 2: Construction Period Pollution Prevention Measures

Best Management Practices (BMPs) will be utilized as Construction Period Pollution Prevention Measures to reduce potential pollutants and prevent any off-site discharge. The objectives of the BMPs for construction activity are to minimize the disturbed areas, stabilize any disturbed areas, control the site perimeter and retain sediment. Both erosion and sedimentation controls and non-stormwater best management measures will be used to minimize site disturbance and ensure compliance with the performance standards of the WPA and Stormwater Standards. Measures will be taken to minimize the area disturbed by construction activities to reduce the potential for soil erosion and stormwater pollution problems. In addition, good housekeeping measures will be followed for the day-to-day operation of the construction site under the control of the contractor to minimize the impact of construction. This section describes the control practices that will be in place during construction activities. Recommended control practices will comply with the standards set in the MA DEP Stormwater Policy Handbook.

2.1 Minimize Disturbed Area and Protect Natural Features and Soil

In order to minimize disturbed areas, work will be completed within well-defined work limits. These work limits are shown on the construction plans. The Contractor shall not disturb native vegetation in the undisturbed wetland area without prior approval from the Engineer. The Contractor will be responsible to make sure that all their workers and any subcontractors know the proper work limits and do not extend their work into the undisturbed areas. The protective measures are described in more detail in the following sections.

2.2 Control Stormwater Flowing onto and through the project

Construction areas adjacent to wetland resources will be lined with compost filter tubes. The tubes will be inspected daily, and accumulated silt will be removed as needed.

2.3 Stabilize Soils

The Contractor shall limit the area of land which is exposed and free from vegetation during construction. In areas where the period of exposure will be greater than two (2) months, mulching, the use of erosion control mats, or other protective measures shall be provided as specified.

The Contractor shall take account of the conditions of the soil where erosion control seeding will take place to ensure that materials used for re-vegetation are adaptive to the sediment control.

2.4 Proper Storage and Cover of Any Stockpiles

The location of the Contractor's storage areas for equipment and/or materials shall be upon cleared portions of the job site or areas to be cleared as a part of this project and shall require written approval of the Engineer.

Adequate measures for erosion and sediment control such as the placement of compost filter tubes around the downstream perimeter of stockpiles shall be employed to protect any downstream areas from siltation.

There shall be no storage of equipment or materials in areas designated as wetlands.

The Engineer may designate a particular area or areas where the Contractor may store materials used in his operations.

2.5 Perimeter Controls and Sediment Barriers

Erosion control lines as described in Section 5 will be utilized to ensure that sedimentation does not occur outside the perimeter of the work area.

2.6 Storm Drain Inlet Protection

There are no storm drains in the work area.

2.7 Retain Sediment On-Site

The Contractor will be responsible to monitor erosion control measures. Whenever necessary the Contractor will clear sediment from the compost filter tube that have been silted up during construction. Daily monitoring should be conducted using the attached Monitoring Form.

The following good housekeeping practices will be followed on-site during the construction project:

2.8 Material Handling and Waste Management

Materials stored on-site will be stored in a neat, orderly manner in appropriate containers. Materials will be kept in their original containers with the original manufacturer’s label. Substances will not be mixed with one another unless recommended by the manufacturer.

Waste materials will be collected and stored in a securely lidded metal container from a licensed management company. The waste and any construction debris from the site will be hauled off-site daily and disposed of properly. The contractor will be responsible for waste removal. Manufacturer’s recommendations for proper use and disposal will be followed for materials. Sanitary waste will be collected from the portable units a minimum of once a week, by a licensed sanitary waste management contractor.

2.9 Designated Washout Areas

The Contractor shall use washout facilities at their own facilities, unless otherwise directed by the Engineer.

2.10 Proper Equipment/Vehicle Fueling and Maintenance Practices

On-site vehicles will be monitored for leaks and receive regular preventative maintenance to reduce the risk of leakage. To ensure that leaks on stored equipment do not contaminate the site, oil-absorbing mats will be placed under oil-containing equipment during storage. Regular fueling and service of the equipment may be performed using approved methods and with care taken to minimize chance of spills. Repair of equipment or machinery within the 100' water resources area shall not be allowed without the prior approval of the Engineer. Any petroleum products will be stored in tightly sealed containers that are clearly labeled with spill control pads/socks placed under/around their perimeters.

2.11 Equipment/Vehicle Washing

The Contractor will be responsible to ensure that no equipment is washed on-site.

SECTION 3: Spill Prevention and Control Plan

The Contractor will be responsible for preventing spills in accordance with the project specifications and applicable federal, state and local regulations. The Contractor will identify a properly trained site employee, involved with the day-to-day site operations to be the spill prevention and cleanup coordinator. The name(s) of the responsible spill personnel will be posted on-site. Each employee will be instructed that all spills are to be reported to the spill prevention and cleanup coordinator.

3.1 Spill Control Equipment

Spill control/containment equipment will be kept in the Work Area. Materials and equipment necessary for spill cleanup will be kept either in the Work Area or in an otherwise accessible on-site location. Equipment and materials will include, but not be limited to, absorbent booms/mats, brooms, dust pans, mops, rags, gloves, goggles, sand, plastic and metal containers specifically for this purpose. It is the responsibility of the Contractor to ensure the inventory will be readily accessible and maintained.

3.2 Notification

Workers will be directed to inform the on-site supervisor of a spill event. The supervisor will assess the incident and initiate proper containment and response procedures immediately upon notification. Workers should avoid direct contact with spilled materials during the containment procedures. Primary notification of a spill should be made to the local Fire Department and Police Departments. Secondary Notification will be to the certified cleanup contractor if deemed necessary by Fire and/or Police personnel. The third level of notification (within 1 hour) is to the DEP or municipality's Licensed Site Professional (LSP). The specific cleanup contractor to be used will be identified by the Contractor prior to commencement of construction activities.

3.3 Spill Containment and Clean-Up Measures

Spills will be contained with granular sorbent material, sand, sorbent pads, booms or all of the above to prevent spreading. Certified cleanup contractors should complete spill cleanup. The material manufacturer's recommended methods for spill cleanup will be clearly posted and on-site personnel will be made aware of the procedures and the location of the information and cleanup supplies.

3.4 Hazardous Materials Spill Report

The Contractor will report and record any spill. The spill report will present a description of the release, including the quantity and type of material, date of the spill, circumstances leading to the release, location of spill, response actions and personnel, documentation of notifications and corrective measures implemented to prevent reoccurrence.

This document does not relieve the Contractor of the Federal reporting requirements of 40 CFR Part 110, 40 CFR Part 117, 40 CFR Part 302 and the State requirements specified under the Massachusetts Contingency Plan (M.C.P) relating to spills or other releases of oils or hazardous substances. Where a release containing a hazardous substance or oil in an amount equal to or in excess of a reportable quantity established under either 40 CFR Part 110, 40 CFR Part 117 or 40 CFR Part 302, occurs during a twenty-four (24) hour period, the Contractor is required to comply with the response requirements of the above mentioned regulations. Spills of oil or hazardous material in excess of the reportable quantity will be reported to the National Response Center (NRC).

SECTION 4: Contact Information/Responsible Parties

Owner/Operator:
Sunraise Development LLC
26 Market Square
Portsmouth, NH 03801
(603) 969-8492

Engineer:
James I. Pearson, PE
Weston & Sampson Engineers, Inc.
55 Walkers Brook Drive, Suite 100
Reading, MA 01867
978-532-1900

Site Inspector:
TBD

Contractor:
TBD

SECTION 5: Erosion and Sedimentation Control

Erosion and Sedimentation Control Drawings can be found in the attached project plans.

SECTION 6: Site Development Plan

The Site Development Plan is included in the attached plans.

SECTION 7: Operation and Maintenance of Erosion Control

The erosion control measures will be installed as detailed in this plan and in the attached specification section 01570. If there is a failure to the controls the Contractor, under the supervision of the Engineer, will be required to stop work until the failure is repaired.

Periodically throughout the work, whenever the Engineer deems it necessary, the sediment that has been deposited against the controls will be removed to ensure that the controls are working properly.

SECTION 8: Inspection Schedule

During construction, the erosion and sedimentation controls will be inspected daily. Once the Contractor is selected, an onsite inspector will be selected to work closely with the Engineer to ensure that erosion and sedimentation controls are in place and working properly. An Inspection Form is included.

SECTION 01570

ENVIRONMENTAL PROTECTION

PART 1 – GENERAL

1.01 DESCRIPTION:

A. The work covered by this section of the specifications consists of furnishing all labor, materials, tools and equipment and performing all work required for the prevention of environmental pollution during and as a result of construction operations under this contract.

B. The requirements set forth in this section of the specifications apply to cross-country areas, river and stream crossings, and construction in and adjacent to wetlands, unless otherwise specifically stated.

C. All work under this Contract shall be in accordance with the Conservation Commissions' Orders of Conditions as well as any conditional requirements applied, all of which are attached to Section 00890, PERMITS.

D. Prior to commencement of work, the Contractor shall meet with representatives of the Engineer to develop mutual understandings relative to compliance of the environmental protection program.

1.02 RELATED WORK:

A. Section 00890, PERMITS

B. Section 01330, SUBMITTALS

C. Section 01562, DUST CONTROL

D. Section 02230, CLEARING AND GRUBBING

E. Section 02240, DEWATERING

F. Section 02252, SUPPORT OF EXCAVATION

G. Section 02300, EARTHWORK

H. Section 02347, BENTONITE DAMS

I. Section 02921, SURFACE RESTORATION OF CROSS COUNTRY AREAS

1.03 SUBMITTALS:

A. The Contractor shall submit for approval six sets of details and literature fully describing environmental protection methods to be employed in carrying out construction activities within 100 feet of wetlands or across areas designated as wetlands.

PART 2 - PRODUCTS

2.01 SILT FENCE:

A. The silt fence shall consist of a 3-foot wide continuous length sediment control fabric, stitched to a mesh backing, and stapled to pre-weathered oak posts installed as shown on the drawings. The oak posts shall be 1-1/4-inches by 1-1/4-inches (Minimum Dimension) by 48-inches and shall be tapered. The bottom edge of the silt fence shall be buried as shown on the drawings.

B. The silt fence shall be DOT Silt Fence PPDM3611, as manufactured by U.S. Silt & Site Supply/Getsco, Concord, NH, or approved equal.

C. Silt fence properties:

Physical Properties	**Test Method**	**Minimum Value**
Grab Strength, lbs.	ASTM-D-4632	124
Grab Elongation, %	ASTM-D-4632	15
Mullen burst, psi	ASTM-D-3786	300
Puncture, lbs.	ASTM-D-4833	65
Trapezoidal Tear, lbs.	ASTM-D-4833	65
UV Resistance2, %3	ASTM-D-4355	80@500 hrs.
AOS, US Sieve No.	ASTM-D-4751	30
Flow Rate, gal/min/sq ft	ASTM-D-4491	10
Permittivity, (1/sec) gal/min/sq ft	ASTM-D-4491	0.05 sec^{-1}

2.02 STRAW BALES:

A. Straw bales shall consist of certified seed free stems of agricultural grain and cereal crops and shall be free of grasses and legumes. Standard bales shall be 14-inches high, 18- inches wide and 36- to 40-inches long tied with polypropylene twine and weigh within 5 percent of 7 lbs. per cubic ft.

2.03 COMPOST FILTER TUBES:

A. Compost filter tubes shall consist of a 100% biodegradable exterior jute or coir netting with 100% biodegradable interior filling as manufactured by Filtrexx©, Akron, Ohio (Phone: 877-542-7699; website: www.filtrexx.com), or approved equal.

2.04 SILT CURTAIN:

A. The silt curtain shall be a Type-1-Silt-Barrier consisting of 18-ounce vinyl fabric skirt with a 6-inch marine quality floatation device. The skirt shall be ballasted to hang vertical in the water column by a minimum 3/16-inch galvanized chain. The silt curtain shall extend into the water as shown on the drawings. If necessary, join adjacent ends of the silt curtain by connecting the reinforcing grommets and shackling ballast lines.

2.05 CATCH BASIN PROTECTION:

A. To trap sediment and to prevent sediment from clogging drainage systems, catch basin protection in the form of a siltation sack (Siltsack as manufactured by ACF Environmental, Inc. or approved equal) shall be provided as approved by the Engineer.

PART 3- EXECUTION

3.01 NOTIFICATION AND STOPPAGE OF WORK:

A. The Engineer will notify the Contractor in writing of any non-compliance with the provisions of the Order of Conditions. The Contractor shall, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the Contractor or his authorized representative at the site of the work, shall be deemed sufficient for the purpose. If the Contractor fails to act promptly, the Owner may order stoppage of all or part of the work through the Engineer until satisfactory corrective action has been taken. No claim for an extension of time or for excess costs or damage incurred by the Contractor as a result of time lost due to any stop work orders shall be made unless it was later determined that the Contractor was in compliance.

3.02 AREA OF CONSTRUCTION ACTIVITY:

A. Insofar as possible, the Contractor shall confine his construction activities to those areas defined by the plans and specifications. All land resources within the project boundaries and outside the limits of permanent work performed under this contract shall be preserved in their present condition or be restored to a condition after completion of construction at least equal to that which existed prior to work under this contract.

3.03 PROTECTION OF WATER RESOURCES:

A. The Contractor shall not pollute streams, lakes or reservoirs with fuels, oils, bitumens, calcium chloride, acids or other harmful materials. It is the Contractor's responsibility to comply with all applicable Federal, State, County and Municipal laws regarding pollution of rivers and streams.

B. Special measures should be taken to insure against spillage of any pollutants into public waters.

3.04 CONSTRUCTION IN AREAS DESIGNATED AS WETLANDS ON THE DRAWINGS:

A. Insofar as possible, the Contractor shall make every effort to minimize disturbance within areas designated as wetlands or within 100-feet of wetland resource areas. Total easement widths shall be limited to the widths shown.

B. The Contractor shall perform his work in such a way that these areas are left in the condition existing prior to construction.

C. The elevations of areas designated as wetlands shall not be unduly disturbed by the Contractor's operations outside of the trench limits. If such disturbance does occur, the Contractor shall take all measures necessary to return these areas to the elevations which existed prior to construction.

D. In areas designated as wetlands, the Contractor shall carefully remove and stockpile the top 24 inches of soil. This topsoil material shall be used as backfill for the trench excavation top layer. The elevation of the trench shall be restored to the preconstruction elevations wherever disturbed by the Contractor's operation.

E. The Contractor shall use a trench box, sheeting or bracing to support the excavation in areas designated as wetlands.

F. Excavated materials shall not be permanently placed or temporarily stored in areas designated as wetlands. Temporary storage areas for excavated material shall be as required by the Engineer.

G. The use of a temporary gravel roadway to construct the pipeline in the wetlands area is not acceptable. The Contractor will be required to utilize timber or rubber matting to support his equipment in these areas. The timber or rubber matting shall be constructed in such a way that it is capable of supporting all equipment necessary to install the pipeline. The timber or rubber matting shall be constructed of materials and placed in such a way that when removed the material below the matting will not be unduly disturbed, mixed or compacted so as to adversely affect recovery of the existing plant life.

H. Bentonite dams shall be placed in wetlands to prevent drainage. Locations for dams are as indicated on the drawings or as required by the Engineer.

I. During construction, easements within wetlands shall be lined with a continuous straw wattles (aka compost filter tube, silt/filter sock).

3.05 PROTECTING AND MINIMIZING EXPOSED AREAS:

A. The Contractor shall limit the area of land which is exposed and free from vegetation during construction. In areas where the period of exposure will be greater than two (2) months, temporary vegetation, mulching or other protective measures shall be provided as specified.

B. The Contractor shall take account of the conditions of the soil where temporary cover crop will be used to insure that materials used for temporary vegetation are adaptive to the sediment control. Materials to be used for temporary vegetation shall be approved by the Engineer.

3.06 LOCATION OF STORAGE AREAS:

A. The location of the Contractor's storage areas for equipment and/or materials shall be upon cleared portions of the job site or areas to be cleared as a part of this project, and shall require written approval of the Engineer. Plans showing storage facilities for equipment and materials shall be submitted for approval of the Engineer.

B. No excavated materials or materials used in backfill operations shall be deposited within a minimum distance of one hundred (100) feet of any watercourse or any drainage facility. Adequate measures for erosion and sediment control such as the placement of straw wattles around the downstream perimeter of stockpiles shall be employed to protect any downstream areas from siltation.

C. There shall be no storage of equipment or materials in areas designated as wetlands.

D. The Engineer may designate a particular area or areas where the Contractor may store materials used in his operations.

E. Storage areas in cross-country locations shall be restored to pre-construction conditions with the planting of native species of trees and shrubs.

3.07 PROTECTION OF LANDSCAPE:

A. The Contractor shall not deface, injure, or destroy trees or shrubs nor remove or cut them without written authority from the Owner. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorages unless specifically authorized by the Engineer. Excavating machinery and cranes shall be of suitable type and be operated with care to prevent injury to trees which are not to be removed, particularly overhanging branches and limbs. The Contractor shall, in any event, be responsible for any damage resulting from such use.

B. Branches, limbs, and roots shall not be cut except by permission of the Engineer. All cutting shall be smoothly and neatly done without splitting or crushing. When there is unavoidable injury to branches, limbs and trunks of trees, the injured portions shall be neatly trimmed and covered with an application of grafting wax or tree healing paint as directed.

C. Where, in the opinion of the Engineer, trees may possibly be defaced, bruised, injured, or otherwise damaged by the Contractor's equipment or by his blasting or other operations, the Engineer may require the Contractor to adequately protect such trees by placing boards, planks, poles or fencing around them. Any trees or landscape feature scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the expense of the Contractor. The Engineer will decide what method of restoration shall be used, and whether damaged trees shall be treated and healed or removed and disposed of under the provisions of Section 02230, CLEARING AND GRUBBING.

D. Cultivated hedges, shrubs, and plants which could be injured by the Contractor's operations shall be protected by suitable means or shall be dug up, balled and temporarily replanted and maintained. After construction operations have been substantially completed, they shall be replanted in their original positions and cared for until growth is re-established. If cultivated hedges, shrubs, and plants are injured to such a degree as to affect their growth or diminish their beauty or usefulness, they shall be replaced by items of a kind and quality at least equal to that existing at the start of the work.

3.08 CLEARING AND GRUBBING:

A. The Contractor shall clear and grub only on the Owner's land or the Owner's easements, and only the area required for construction operations, as approved by the Engineer. Removal of mature trees (4 inches or greater DBH) will not be allowed on temporary easements.

B. The Contractor shall not remove trees in the Owner's temporary easements without permission of the Engineer.

3.09 DISCHARGE OF DEWATERING OPERATIONS:

A. Any water that is pumped and discharged from the trench and/or excavation as part of the Contractor's water handling shall be filtered by an approved method prior to its discharge into a receiving water or drainage system.

B. Under no circumstances shall the Contractor discharge water to the areas designated as wetlands. When constructing in a wetlands area, the Contractor shall discharge water from dewatering operations directly to the nearest drainage system, stream, or waterway after filtering by an approved method.

C. The pumped water shall be filtered through filter fabric and baled straw, a vegetative filter strip or a vegetated channel to trap sediment occurring as a result of the construction operations. The vegetated channel shall be constructed such that the discharge flow rate shall not exceed a velocity of more than 1 foot per second. Accumulated sediment shall be cleared from the channel periodically.

3.10 DUST CONTROL:

A. During the progress of the work, the Contractor shall conduct his operations and maintain the area of his activities, including sweeping and sprinkling of streets as necessary, to minimize creation and dispersion of dust. If the Engineer decides it is necessary to use calcium chloride for more effective dust control, the Contractor shall furnish and spread the material, as directed. Calcium chloride shall be as specified under Section 01562, DUST CONTROL.

B. Calcium Chloride shall not be used for dust control within a drainage basin or in the vicinity of any source of potable water.

3.11 SEPARATION AND REPLACEMENT OF TOPSOIL:

A. Topsoil shall be carefully removed from cross-country areas where excavations are to be made, and separately stored to be used again as directed. The topsoil shall be stored in an area acceptable to the Engineer and adequate measures shall be employed to prevent erosion of said material.

3.12 COMPOST FILTER TUBES:

A. To trap sediment and to prevent sediment from clogging drainage systems, compost filter tubes shall be used where shown on the drawings. Care shall be taken to keep the tubes from breaking apart. The tubes should be securely staked to prevent overturning, flotation, or displacement. All deposited sediment shall be removed periodically. Compost filter tubes shall not be placed within a waterway during construction of the pipeline crossing.

3.13 ERECTION AND MAINTENANCE OF SILT FENCE:

A. Where indicated on the drawings or where required by the Engineer, the Contractor shall erect and maintain a temporary silt fence. In areas designated as wetlands, the Contractor shall line the limits of the construction easement with a silt fence. The silt fence shall be used specifically to contain sediment from runoff water and to minimize environmental damage caused by construction.

3.14 CATCH BASIN PROTECTION:

A. Catch basin protection shall be used for every catch basin, shown on the plans or as required by the Engineer, to trap sediment and prevent it from clogging drainage systems and entering wetlands. Siltation sacks shall be securely installed under the catch basin grate. Care shall be taken to keep the siltation sacks from breaking apart or clogging. All deposited sediment shall be removed periodically and at times prior to predicted precipitation to allow free drainage flow. Prior to working in areas where catch basins are to be protected, each catch basin sump shall be cleaned of all debris and protected. The contractor shall properly dispose of all debris at no additional cost to the Owner.

3.15 COMPOST FILTER TUBES:

A. The compost filter tubes will be placed in a shallow trench (2-3 inches deep) and staked in the ground using wooden stakes driven at 4-foot intervals. The wooden stakes will be placed at a minimum depth of 24-inches into the ground.

END OF SECTION

Inspection Form

Inspected By: _____ Date: _____Time:_____

YES	NO	DOES NOT APPLY	ITEM
			Do any erosion/siltation control measures require repair or clean out to maintain adequate function?
			Is there any evidence that sediment is leaving the site and entering the wetlands?
			Are any temporary soil stockpiles or construction materials located in non-approved areas?
			Are on-site construction traffic routes, parking, and storage of equipment and supplies located in areas not specifically designed for them?

Specific location, current weather conditions, and action to be taken:

_____

_____

_____

_____

_____

Other Comments:

_____

_____

Pending the actions noted above I certify that the site is in compliance with the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan.

Signature: _____ Date: _____

Attachment E - Long Term Pollution Prevention Plan

Long Term Pollution Prevention Plan
Sunraise Solar Project
Holliston, MA

To meet the requirements of Standard 4 of the Massachusetts Stormwater Handbook, this Long Term Pollution Prevention Plan is provided to identify the proper procedures of practices for source control and pollution prevention.

Storage and Handling of Oil and other Hazardous Materials

Oil or hazardous materials are not expected to be stored at this site.

Vehicle Storage and Washing

Vehicle storage or washing will not be performed at this site.

Landscaping

At a minimum, vegetation will be mowed/managed two to three times per year, May through September, or when vegetation reaches a height of 2 feet or more October through April. It is not expected that fertilizers will be stored or used on site. Please see the Operations & Maintenance memorandum, dated January 21, 2019 for additional information.

Septic System

There will be no onsite septic facilities.

Prohibition of Illicit Discharges

Due to the nature of the development and the lack of storm drain infrastructure, illicit discharges are not expected to occur.

Snow Disposal

If access to the solar facility is required in winter months, the gravel access drives will be plowed. Snow will be pushed to either side of the access drives.

Attachment F - Operations & Maintenance Plan

1.0 Introduction

The following document has been written to comply with the stormwater guidelines set forth by the Massachusetts Department of Environmental Protection (MassDEP). The intent of these guidelines is to encourage Low Impact Development techniques to improve the quality of the stormwater runoff. These techniques, also known as Best Management Practices (BMPs) collect, store, and treat the runoff before discharging to adjacent environmental resources.

2.0 Purpose

This Operation and Maintenance Plan (O&M Plan) is intended to provide a mechanism for the consistent inspection and maintenance of each BMP installed on the project site. Included in this O&M Plan is a description of each BMP type and an inspection form for each BMP. Sunraise Development is the owner and operator of the system and is responsible for its upkeep and maintenance. This work will be funded on an annual basis through the owner's operating budget.

In the event the Owner sells the property, it is the Owner's responsibility to transfer this plan as well as the past three years of operation and maintenance records to the new property owner.

3.0 Vegetation and BMPs Description and Locations

3.1 Detention Basins

There are five detention basins on the project site. The purpose of the detention basins are to mitigate peak discharges.

3.2 Outlet Control Structures

There are five outlet control structures, one at each detention basin. The outlet control structures control stormwater flows out of each basin and release it in a controlled manner.

3.3 Vegetative Cover

The land area under the solar array will be seeded with a pasture grass and shall be maintained within the proposed lease area to prevent soil erosion. This area includes the fenced-in PV array area, gravel access roads, and a portion of the surrounding slopes.

3.4 Grassed Swales

Grassed swales are located adjacent to the gravel road at the site. Grassed swales serve as a natural filtering device to remove sediment from stormwater.

3.5 Sediment Forebays

There are two sediment forebays at the site, located at stormwater basins no. 1 and 4. Forebays serve as settling basins for sediment.

3.6 Riprap Aprons

There are riprap aprons at each pipe outfall. Riprap Aprons are intended to slow and spread stormwater leaving a pipe in order to prevent erosion.

3.7 Gravel Roadway

There is a gravel roadway along the eastern portions of the site. The gravel roadway is intended to provide occasional access for maintenance vehicles. The gravel roadway is pitched into the site to prevent runoff from going toward abutting properties.

4.0 Inspection, Maintenance Checklist and Schedule

4.1 Detention Basins

Inspect the detention basins quarterly in the first year and annually each spring thereafter. The detention basins must be mowed and all grass clippings & debris shall be removed as necessary.

4.2 Outlet Control Structure

Inspect the outlet control structures whenever the basins are inspected. All orifices and outlets of the control structure must be kept clear and free to flow. Keep the inlet orifice clear of debris and trash and remove sediments and debris from the structure as necessary. Inspect the outlet pipe as well and remove all debris as necessary.

4.3 Vegetative Control

The operator of the solar facility shall conduct vegetation control within the lease area limits (including within the limits of the detention basin). In general, no pesticides, herbicides or other chemical products are expected

to be used. Vegetation control by mechanical means shall be done between normal working hours, which are 7:00 AM and 7:00 PM Monday through Friday and Saturdays between 8:00 AM and 4:00 PM.

Vegetation control inside array area will be maintained by use of conventional mowers, cutters, weed whacker to maintain optimal performance of PV system and visual perception of the site. The lower elevation of the panels is on the order of two to three feet from the ground, so the grass may be allowed to grow until cutting is needed. The grass species to be planted will generally require cutting once to three times per year, depending on the weather. Where the operator may elect to clean the panels if soiling is excessive due to birds or other unforeseen activities, the panels are generally considered self-cleaning during normal rainfall events and very little cleaning is expected.

Operator will perform general landscape maintenance, including topping off of fill or gravel areas with matching gravel as may become necessary. This may also include pruning of trees and bushes on site that may overhang and cause shading of the PV panels or potential damage to fencing or equipment. In general, the operator will maintain compliance with the final plan approved by the Town.

4.4 Grassed Swales

Mowing: Set the mower blades no lower than 3 to 4 inches above the ground. Do not mow beneath the depth of the design flow during the storm associated with the water quality event (e.g., if the design flow is no more than 4 inches, do not cut the grass shorter than 4 inches). Mow on an as-needed basis during the growing season so that the grass height does not exceed 6 inches.

Inspection: Inspect semi-annually the first year, and at least once a year thereafter. Inspect the grass for growth and the side slopes for signs of erosion and formation of rills and gullies. Plant an alternative grass species if the original grass cover is not successfully established. If grass growth is impaired by winter road salt or other deicer use, re-establish the grass in the spring.

Trash/Debris Removal: Remove accumulated trash and debris prior to mowing.

Sediment Removal: Check on a yearly basis and clean as needed. Use hand methods (i.e., a person with a shovel) when cleaning to minimize disturbance to vegetation and underlying soils. Sediment build-up in the

grass channel reduces its capacity to treat and convey the water quality event, 2-year and 10-year 24-hour storm.

4.5 Sediment Forebays

Sediments and associated pollutants are removed only when sediment forebays are actually cleaned out, so regular maintenance is essential. Frequently removing accumulated sediments will make it less likely that sediments will be resuspended. At a minimum, inspect sediment forebays monthly and clean them out at least four times per year. Stabilize the floor and sidewalls of the sediment forebay before making it operational, otherwise the practice will discharge excess amounts of suspended sediments. When mowing grasses, keep the grass height no greater than 6 inches. Set mower blades no lower than 3 to 4 inches. Check for signs of rilling and gullying and repair as needed. After removing the sediment, replace any vegetation damaged during the clean-out by either reseeding or re-sodding. When reseeding, incorporate practices such as hydroseeding with a tackifier, blanket, or similar practice to ensure that no scour occurs in the forebay, while the seeds germinate and develop roots.

4.6 Riprap Aprons

Inspect riprap aprons regularly, especially after large rainfall events, but at least annually. Note and repair any erosion or low spots in the apron. Inspect areas adjacent to and/or downstream of the apron for signs of erosion. Provide additional riprap as needed to protect areas that are experiencing erosion.

4.7 Gravel Roadway

Inspect the gravel roadway each spring for potholes, rutting, or signs of erosion. Place and compact new gravel as needed in any areas where these defects are noted. Maintain a cross-pitch to direct runoff away from abutting properties.

4.8 Inspections and Record Keeping

- An inspection form should be filled out each, and every time maintenance work is performed.
- A binder should be kept that contains all of the completed inspection forms and any other related materials.
- A review of Operation & Maintenance actions should take place annually such that the Stormwater BMPs and vegetative cover are being taken care of in the manner illustrated in this Operation & Maintenance Plan.

- Operation & Maintenance log forms for the last three years, at a minimum, shall be kept on site.
- The inspection and maintenance schedule may be refined in the future based on the findings and results of this Operation & Maintenance program or policy.

5 Contacts

The solar project being developed at 0 Marshall Street is being developed under a long-term lease agreement between the landowner and the solar developer. The solar developer will be responsible for construction, operation and maintenance of the solar project, including associated stormwater management systems. The landowner and developer (responsible party) information are as follows:

5.1 Property Owner

J. Michael Norton, Trustee
Greenview Reality Collateral Trust, LLC
165 Main Street, Suite 206A
Medway, MA 02053

5.2 Developer/Responsible Party for Site Operation & Maintenance

Marshall Street Solar, LLC
Mr. Joe Harrison
26 Market Street
Portsmouth, NH 03801
Phone (207) 432-1317
e-mail: joe@sunraiseinvestments.com

6 Public Safety

6.1 The site is situated in a rural location with very limited potential for public access. Perimeter fencing will be provided around the site to limit incidental access.

6.2 In the event of an emergency at the site, the following are the local Emergency Contacts:

Town of Holliston Police Department
550 Washington Street
Holliston, MA 01746
Phone: (508) 429-1212 (Non-emergency)
Emergency: 911

Town of Holliston Fire Department
Holliston Town Hall
703 Washington Street
Holliston, MA 01746
Phone: (508) 429-4631 (Non-emergency)
Emergency: 911

INSPECTION CHECKLIST SHEETS

Detention Basin:

Frequency: Inspect the detention basin four times (quarterly) in the first year and then annually during the spring each year after

Inspected By: _____ Date: _____
Observations: _____
_____
_____

Actions Taken: _____
_____
_____

Instructions: Remove accumulated sediments from the floor of the basin along with trash and debris. Check basin slopes for signs or rilling or cracking and repair as necessary. Mow the basin floor and sides, and remove clippings.

Outlet Control Structure:

Frequency: Inspect the structure four times (quarterly) in the first year and then annually during the spring each year or whenever inspecting the detention basin.

Inspected By: _____ Date: _____
Observations: _____
_____
_____

Actions Taken: _____
_____
_____

Instructions: Remove accumulated sediments and debris from the structure. Ensure the inlet orifice and grate are free from debris and are not blocked. Check the outlet pipe for obstructions and remove any debris as necessary.

Vegetative Cover:

Frequency: Mow grassed areas weekly during the growing season. Inspect the vegetative cover four times (quarterly) in the first year and then annually during the spring each year after

Inspected By: _____ Date: _____
Observations: _____
_____
_____

Actions Taken: _____
_____
_____

Instructions: Maintain vegetative control by use of conventional mowers, cutters, and weed whacker. Aerate and dethatch grass as needed on a seasonal basis. Particular attention shall be made to address vegetative growth that encroaches upon the lower limit of the solar panels. Operator will perform general landscape maintenance, including topping off of fill or gravel areas with matching gravel as may become necessary. This may also include pruning of trees and bushes on site that may overhang and cause shading of the PV panels or potential damage to fencing or equipment.

Grassed Swales:

Frequency: Mow on an as-needed basis during the growing season so that the grass height does not exceed 6 inches. Inspect semi-annually the first year, and at least once a year thereafter.

Inspected By: _____ Date: _____
Observations: _____
_____
_____

Actions Taken: _____
_____
_____

Instructions: Mowing: Set the mower blades no lower than 3 to 4 inches above the ground. Do not mow beneath the depth of the design flow during the storm associated with the water quality event (e.g., if the design flow is no more than 4 inches, do not cut the grass shorter than 4 inches).

Inspection: Inspect the grass for growth and the side slopes for signs of erosion and formation of rills and gullies. Plant an alternative grass species if the original grass cover is not successfully established. If grass growth is impaired by winter road salt or other deicer use, re-establish the grass in the spring.

Trash/Debris Removal: Remove accumulated trash and debris prior to mowing.

Sediment Removal: Use hand methods (i.e., a person with a shovel) when cleaning to minimize disturbance to vegetation and underlying soils. Sediment build-up in the grass channel reduces its capacity to treat and convey the water quality event, 2-year and 10-year 24-hour storm.

Sediment Forebays:

Frequency: At a minimum, inspect sediment forebays monthly and clean them out at least four times per year.

Inspected By: _____ Date: _____
Observations: _____
_____
_____

Actions Taken: _____
_____
_____

Instructions: Sediments and associated pollutants are removed only when sediment forebays are actually cleaned out, so regular maintenance is essential. Frequently removing accumulated sediments will make it less likely that sediments will be resuspended. Stabilize the floor and sidewalls of the sediment forebay before making it operational, otherwise the practice will discharge excess amounts of suspended sediments. When mowing grasses, keep the grass height no greater than 6 inches. Set mower blades no lower than 3 to 4 inches. Check for signs of rilling and gullying and repair as needed. After removing the sediment, replace any vegetation damaged during the clean-out by either reseeding or re-sodding. When reseeding, incorporate practices such as hydroseeding with a tackifier, blanket, or similar practice to ensure that no scour occurs in the forebay, while the seeds germinate and develop roots.

Riprap Aprons:

Frequency: Inspect riprap aprons regularly, especially after large rainfall events, but at least annually.

Inspected By: _____ Date: _____
Observations: _____
_____
_____

Actions Taken: _____
_____
_____

Instructions: Note and repair any erosion or low spots in the apron. Inspect areas adjacent to and/or downstream of the apron for signs of erosion. Provide additional riprap as needed to protect areas that are experiencing erosion.

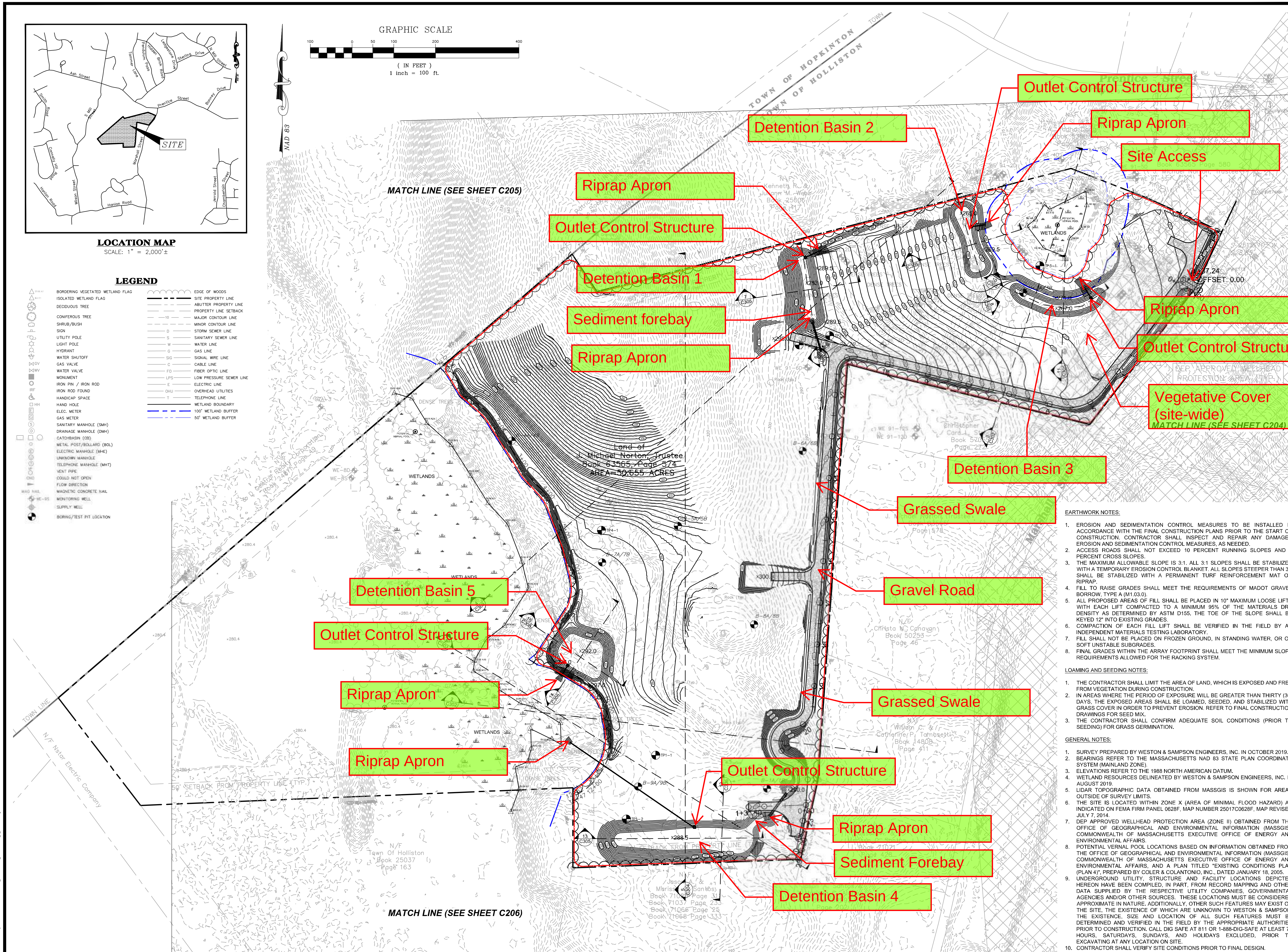
Gravel Roadway:

Frequency: Inspect the gravel roadway each spring.

Inspected By: _____ Date: _____
Observations: _____
_____
_____

Actions Taken: _____
_____
_____

Instructions: Inspect for potholes, rutting, or signs of erosion. Place and compact new gravel as needed in any areas where these defects are noted. Maintain a cross-pitch to direct runoff away from abutting properties.



EARTHWORK NOTES:

1. EROSION AND SEDIMENTATION CONTROL MEASURES TO BE INSTALLED IN ACCORDANCE WITH THE FINAL CONSTRUCTION PLANS PRIOR TO THE START OF CONSTRUCTION. CONTRACTOR SHALL INSPECT AND REPAIR ANY DAMAGED EROSION AND SEDIMENTATION CONTROL MEASURES, AS NEEDED.
2. ACCESS ROADS SHALL NOT EXCEED 10 PERCENT RUNNING SLOPES AND 2 PERCENT CROSS SLOPES.
3. THE MAXIMUM ALLOWABLE SLOPE IS 3:1. ALL 3:1 SLOPES SHALL BE STABILIZED WITH A TEMPORARY EROSION CONTROL BLANKET. ALL SLOPES STEEPER THAN 3:1 SHALL BE STABILIZED WITH A PERMANENT TURF REINFORCEMENT MAT OR RIPRAP.
4. FILL TO RAISE GRADES SHALL MEET THE REQUIREMENTS OF MADOT GRAVEL BORROW, TYPE A (M1.03.0).
5. ALL PROPOSED AREAS OF FILL SHALL BE PLACED IN 10" MAXIMUM LOOSE LIFTS WITH EACH LIFT COMPACTED TO A MINIMUM 95% OF THE MATERIALS DRY DENSITY AS DETERMINED BY ASTM D155. THE TOE OF THE SLOPE SHALL BE KEYED 12" INTO EXISTING GRADES.
6. COMPACTION OF EACH FILL LIFT SHALL BE VERIFIED IN THE FIELD BY AN INDEPENDENT MATERIALS TESTING LABORATORY.
7. FILL SHALL NOT BE PLACED ON FROZEN GROUND, IN STANDING WATER, OR ON SOFT UNSTABLE SUBGRADES.
8. FINAL GRADES WITHIN THE ARRAY FOOTPRINT SHALL MEET THE MINIMUM SLOPE REQUIREMENTS ALLOWED FOR THE RACKING SYSTEM.

LOAMING AND SEEDING NOTES:

1. THE CONTRACTOR SHALL LIMIT THE AREA OF LAND, WHICH IS EXPOSED AND FREE FROM VEGETATION DURING CONSTRUCTION.
2. IN AREAS WHERE THE PERIOD OF EXPOSURE WILL BE GREATER THAN THIRTY (30) DAYS, THE EXPOSED AREAS SHALL BE LOAMED, SEEDED, AND STABILIZED WITH GRASS COVER IN ORDER TO PREVENT EROSION. REFER TO FINAL CONSTRUCTION DRAWINGS FOR SEED MIX.
3. THE CONTRACTOR SHALL CONFIRM ADEQUATE SOIL CONDITIONS (PRIOR TO SEEDING) FOR GRASS GERMINATION.

GENERAL NOTES:

1. SURVEY PREPARED BY WESTON & SAMPSON ENGINEERS, INC. IN OCTOBER 2019.
2. BEARINGS REFER TO THE MASSACHUSETTS NAD 83 STATE PLAN COORDINATE SYSTEM (MAINLAND ZONE).
3. ELEVATIONS REFER TO THE 1988 NORTH AMERICAN DATUM.
4. WETLAND RESOURCES DELINEATED BY WESTON & SAMPSON ENGINEERS, INC. IN AUGUST 2019.
5. LIDAR TOPOGRAPHIC DATA OBTAINED FROM MASSGIS IS SHOWN FOR AREAS OUTSIDE OF SURVEY LIMITS.
6. THE SITE IS LOCATED WITHIN ZONE X (AREA OF MINIMAL FLOOD HAZARD) AS INDICATED ON FEMA FIRM PANEL 0628F, MAP NUMBER 25017C0628F, MAP REVISED JULY 7, 2014.
7. DEP APPROVED WELLHEAD PROTECTION AREA (ZONE II) OBTAINED FROM THE OFFICE OF GEOGRAPHICAL AND ENVIRONMENTAL INFORMATION (MASSGIS), COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS.
8. POTENTIAL VERNAL POOL LOCATIONS BASED ON INFORMATION OBTAINED FROM THE OFFICE OF GEOGRAPHICAL AND ENVIRONMENTAL INFORMATION (MASSGIS), COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS, AND A PLAN TITLED "EXISTING CONDITIONS PLAN (PLAN 4)", PREPARED BY COLER & COLANTONIO, INC., DATED JANUARY 18, 2005.
9. UNDERGROUND UTILITY, STRUCTURE AND FACILITY LOCATIONS DEPICTED HEREON HAVE BEEN COMPILED, IN PART, FROM RECORD MAPPING AND OTHER DATA SUPPLIED BY THE RESPECTIVE UTILITY COMPANIES, GOVERNMENTAL AGENCIES AND/OR OTHER SOURCES. THESE LOCATIONS MUST BE CONSIDERED APPROXIMATE IN NATURE. ADDITIONALLY, OTHER SUCH FEATURES MAY EXIST ON THE SITE, THE EXISTENCE OF WHICH ARE UNKNOWN TO WESTON & SAMPSON. THE EXISTENCE, SIZE AND LOCATION OF ALL SUCH FEATURES MUST BE DETERMINED AND VERIFIED IN THE FIELD BY THE APPROPRIATE AUTHORITIES PRIOR TO CONSTRUCTION. CALL DIG SAFE AT 811 OR 1-888-DIG-SAFE AT LEAST 72 HOURS, SATURDAYS, SUNDAYS, AND HOLIDAYS EXCLUDED, PRIOR TO EXCAVATING AT ANY LOCATION ON SITE.
10. CONTRACTOR SHALL VERIFY SITE CONDITIONS PRIOR TO FINAL DESIGN.
11. NOTHING SHOWN OR OMITTED FROM THE DOCUMENTS PROVIDED SHALL RELIVE THE CONTRACTOR FROM FULL COMPLIANCE WITH ALL APPLICABLE CODES, REGULATIONS, BYLAWS, AND ORDINANCES.

Project:

MARSHALL STREET
SOLAR PROJECT

MARSHALL STREET
HOLLISTON, MA 01746

Weston & Sampson

Weston & Sampson Engineers, Inc.
55 Walkers Brook Drive, Suite 100
Reading, MA 01867
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Consultants:
Sunraise Investments, LLC
26 Market Square, Portsmouth, NH 03801
207.432.1317

Power Engineers, LLC
37 Fox Den Road, Kingston, MA 02364-2150
508.612.0382

GeoInsight, Inc.
186 Granite Street, Suite 3A, Manchester, NH 03101
603.314.0820

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39 Kingsley Avenue, Haydenville, MA 01039
413.687.1135

Revisions:

No.	Date	Description
0	10/09/2019	30% DESIGN PLANS
1	10/16/2019	60% DESIGN PLANS
2	11/18/2019	90% DESIGN PLANS
3	12/19/2019	PLANNING, ZONING, AND NOI
4	04/06/2020	PLAN MODIFICATIONS

Seal:

COA:

Issued For:

PLANNING, ZONING, AND NOTICE OF INTENT APPROVAL

Scale: AS SHOWN

Date: 04/06/2020
Drawn By: RWG
Reviewed By: SPW
Approved By: JIP

W&S Project No.: 2190903.F
W&S File No.: 090_DESTEC

Drawing Title:

PROPOSED GRADING AND DRAINAGE PLAN OVERVIEW

Sheet Number:

C203

Attachment G - Illicit Discharge Compliance Statementp

Illicit Discharge Compliance Statement

Section I – Purpose/Intent

The purpose of this document is to provide for the health, safety, and general welfare of the citizens of Holliston, Massachusetts through the regulation of non-stormwater discharges into existing outstanding resource areas near the site to the maximum extent practicable, as required by federal and state law. This document establishes methods for controlling the introduction of pollutants into existing outstanding resource areas to comply with requirements of the National Pollutant Discharge Elimination System (NPDES) permit process.

Section II - Definitions

For the purposes of this statement, the following shall apply:

Best Management Practices (BMPs): Schedules of activities, prohibitions of practices, general good housekeeping practices, pollution prevention and educational practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants directly or indirectly to stormwater, receiving waters, or stormwater conveyance systems. BMPs also include treatment practices, operating procedures, and practices to control site runoff, spillage or leaks, sludge or water disposal, or drainage from raw materials storage.

Clean Water Act: The federal Water Pollution Control Act (33 U.S.C § 1251 et seq.), and any subsequent amendments thereto.

Construction Activity: Activities subject to the Massachusetts Erosion and Sedimentation Control Act or NPDES Construction Permits. Such activities include but are not limited to clearing and grubbing, grading, excavating, and demolition.

Hazardous Materials: Any material, including any substance, waste, or combination thereof, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause, or significantly contribute to, a substantial present or potential hazard to human health, safety, property, or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

Illegal Connection: An illegal connection is defined as either of the following:

a. Any pipe, open channel, drain or conveyance, whether on the surface or subsurface, which allows an illicit discharge to enter the outstanding resource area including but not limited to any conveyances which allow any non-stormwater discharge including sewage, process wastewater, and wash water, regardless of whether said drain or connection has been previously allowed, permitted, or approved by an authorized enforcement agency; or

b. Any pipe, open channel, drain or conveyance connected to the Town of Holliston storm water treatment system which has not been documented in plans, maps, or equivalent records and approved by an authorized enforcement agency.

Illicit Discharge: Any direct or indirect non-stormwater discharge to the City of Peabody stormwater treatment system, except as exempted in Section II of this ordinance.

Industrial Activity: Activities subject to NPDES Industrial Permits as defined in 40CFR, Section 122.26 (b) (14).

National Pollutant Discharge Elimination System (NPDES) Stormwater Discharge Permit: A permit issued by MassDEP under authority delegated pursuant to 33 USC § 1342 (b) that authorizes the discharge of pollutants to waters of the United States, whether the permit is applicable on an individual, group, or general area-wide basis.

City of Peabody Stormwater Treatment System: Any facility, owned or maintained by the City, designed or used for collecting and/or conveying stormwater, including but not limited to roads with drainage systems, Town of Holliston streets, curbs, gutters, inlets, catch basins, piped storm drains, pumping facilities, infiltration, retention and detention basins, natural and man-made or altered drainage channels, reservoirs, and other drainage structures.

Non-Stormwater Discharge: Any discharge to the storm drain system that is not composed entirely of stormwater.

Person: Any individual, association, organization, partnership, firm, joint venture, public or private corporation, trust, estate, commission, board, public or private institution, utility, cooperative, city, county or other political subdivision of the State, interstate body, or any other legal entity.

Pollutant: Anything which causes or contributes to pollution. Pollutants may include, but are not limited to: paints, varnishes, and solvents; petroleum hydrocarbons; automotive fluids; cooking grease; detergents (biodegradable or otherwise); degreasers; cleaning chemicals; non-hazardous liquid and solid wastes; refuse, rubbish, garbage, litter, or other discarded or abandoned objects and accumulations, so that same may cause or contribute to pollution; floatables; pesticides, herbicides, and fertilizers; liquid and solid wastes; sewage, fecal coliform and pathogens; dissolved and particulate metals; animal wastes; wastes and residues that result from constructing a building or structure; concrete and cement; and noxious or offensive matter of any kind.

Pollution: Contamination or other alteration of any water's physical, chemical, or biological properties by addition of any constituent including but not limited to a change in temperature, taste, color, turbidity, or odor of such waters, or the discharge of any liquid, gaseous, solid, radioactive, or other substance into any such waters as will or is likely to create a nuisance or render such waters harmful, detrimental, or injurious to the public health, safety, welfare, or environment, or to domestic, commercial, industrial,

agricultural, recreational, or other legitimate beneficial uses, or to livestock, wild animals, birds, fish or other aquatic life.

Premises: Any building, lot, parcel of land, or portion of land whether improved or unimproved including adjacent sidewalks and parking strips.

Stormwater: Any surface flow, runoff, and drainage consisting entirely of water from any form of natural precipitation, and resulting from such precipitation.

Wastewater: Any water or other liquid discharged from a facility, that has been used, as for washing, flushing, or in a manufacturing process, and so contains waste products.

Section III - Prohibitions

Prohibition of Illicit Discharges:

No person shall throw, drain, or otherwise discharge, cause or allow others under its control to throw, drain, or otherwise discharge into the Town of Holliston stormwater treatment system or watercourses any materials, including but not limited to, any pollutants or waters containing any pollutants, other than stormwater. The commencement, conduct, or continuance of any illicit discharge to the storm drain system is prohibited except as described as follows:

1. Water line flushing performed by a government agency, other potable water sources, landscape irrigation or lawn watering, diverted stream flows, rising ground water, ground water infiltration to storm drains, uncontaminated pumped ground water, foundation or footing drains (not including active groundwater dewatering systems), crawl space pumps, air conditioning condensation, springs, natural riparian habitat or wetland flows, and any other water source not containing pollutants;

2. Discharges or flows from fire fighting, and other discharges specified in writing by the Town of Holliston as being necessary to protect public health and safety;

3. Dye testing is an allowable discharge, but requires a verbal notification to the Town of Holliston prior to the time of the test;

4. Any non-stormwater discharge permitted under an NPDES permit, waiver, or waste discharge order issued to the discharger and administered under the authority of the Federal Environmental Protection Agency, provided that the discharger is in full compliance with all requirements of the permit, waiver, or order and other applicable laws and regulations, and provided that written approval has been granted for a discharge to the Town of Holliston stormwater treatment system.

Section IV - Industrial or Construction Activity Discharges

Any person subject to an industrial or construction activity NPDES stormwater discharge permit shall comply with all provisions of such permit. Proof of compliance with said permit may be required in a form acceptable to the Town of Holliston Department of Public Works prior to allowing discharges to the Holliston stormwater treatment system.

Section V - Notification of Spills and Accidental Discharges

Notwithstanding other requirements of law, as soon as any person responsible for a facility, activity or operation, or responsible for emergency response for a facility, activity or operation has information of any known or suspected release of pollutants or non-stormwater discharges from that facility, activity, or operation which are resulting or may result in illicit discharges or pollutants discharging into stormwater, the Town of Holliston stormwater treatment system, State Waters, or Waters of the U.S., said person shall take all necessary steps to ensure the discovery, containment, and cleanup of such release so as to minimize the effects of the discharge. In the event of such a release of hazardous materials, said person shall immediately notify emergency response agencies of the occurrence via emergency dispatch services. In the event of a release of non-hazardous materials, said person shall notify the Town of Holliston Public Services Department in person or by phone no later than the next business day, including the nature, quantity and time of occurrence of the discharge. Notifications in person or by phone shall be confirmed by written notice, via certified mail return receipt requested addressed to the Town of Holliston Public Services Department within three (3) business days of the initial notice. If the discharge of prohibited materials emanates from a commercial or industrial establishment, the owner or operator of such establishment shall also retain an on-site written record of the discharge and the actions taken to prevent its recurrence. Such records shall be retained for at least three years.

IN WITNESS WHEREOF the parties hereto have executed copies of this Agreement on the _____ day of **_____, _____.**

_____

Joe Harrison
Director of Project Development
SunRaise Investments llc
PO Box 1320
Portsmouth NH 03802