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Stormwater Management System Report

CEC SOLAR #1056 LLC

PROPOSED SOLAR PANEL ARRAY INSTALLATION

**207 PROVIDENCE ROAD
GRAFTON, MASSACHUSETTS**

Prepared for:

Clean Energy Collective, LLC
146 W Boylston Drive
Worcester, Massachusetts 01606

Prepared by:

Field Engineering Co., Inc.
11D Industrial Drive
PO Box 1178
Mattapoisett, Massachusetts 02739

August 12, 2015
Project No. 2035

FIELD
ENGINEERING CO., INC.
CONSULTING ENGINEERS

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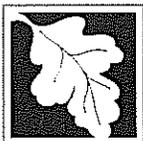
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Preface

Stormwater Management Standards Compliance Checklist



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 8²
- 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.



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.

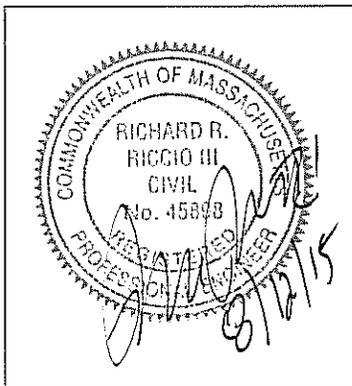
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



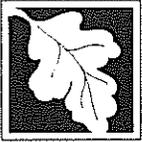
[Handwritten Signature] 8/12/15

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): Minimal Impervious Area. Development will consists of grassed and gravel surfaces.

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)

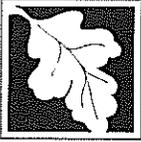
Standard 2: Peak Rate Attenuation

- 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 (N/A as there is minimal new impervious areas being proposed)

- 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 Field¹
- 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 (TSS REMOVAL NOT APPLICABLE)

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) NOT APPLICABLE

- 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 NOT APPLICABLE

- 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 NOT APPLICABLE

- The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:
 - Limited Project
 - Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
 - Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
 - Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
 - Bike Path and/or Foot Path
 - Redevelopment Project
 - Redevelopment portion of mix of new and redevelopment.
- Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.
- The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

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

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

- Narrative;
 - Construction Period Operation and Maintenance Plan;
 - Names of Persons or Entity Responsible for Plan Compliance;
 - Construction Period Pollution Prevention Measures;
 - Erosion and Sedimentation Control Plan Drawings;
 - Detail drawings and specifications for erosion control BMPs, including sizing calculations;
 - Vegetation Planning;
 - Site Development Plan;
 - Construction Sequencing Plan;
 - Sequencing of Erosion and Sedimentation Controls;
 - Operation and Maintenance of Erosion and Sedimentation Controls;
 - Inspection Schedule;
 - Maintenance Schedule;
 - Inspection and Maintenance Log Form.
- A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

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

- The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has **not** been included in the Stormwater Report but will be submitted **before** land disturbance begins.
- The project is **not** covered by a NPDES Construction General Permit.
- The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
- The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

- The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
 - Name of the stormwater management system owners;
 - Party responsible for operation and maintenance;
 - Schedule for implementation of routine and non-routine maintenance tasks;
 - Plan showing the location of all stormwater BMPs maintenance access areas;
 - Description and delineation of public safety features;
 - Estimated operation and maintenance budget; and
 - Operation and Maintenance Log Form.
- The responsible party is **not** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:
 - A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
 - A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

- The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- An Illicit Discharge Compliance Statement is attached;
- NO Illicit Discharge Compliance Statement is attached but will be submitted **prior to** the discharge of any stormwater to post-construction BMPs.

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Section 1

Hydrologic Overview

1.0 INTRODUCTION

1.1 Project Description

The applicant is proposing to construct a fixed-array photovoltaic ("PV") power generation facility on an existing vacant parcel of land located behind 207 Providence Road in the Town of Grafton, Massachusetts. The project will consist of construction of multiple fixed solar panels on an above ground mounting system. Approximately 4,500 solar panels are proposed to be constructed over the area, producing approximately 990 kW-DC of power. The disturbed areas beneath the solar panel arrays will be loamed and seeded following installation of the solar panel foundations and structures. There will be a gravel access driveway off Providence Road through an existing power line easement to access the site and also a gravel access drive running along the westerly and northerly sides of the site to provide emergency access to the facility. As this site will be an unmanned installation, there will be no water or sewer utilities required at the facility. The proposed installation will be tied into the existing power lines along Providence Road via underground connection from the proposed equipment pads to a series of new utility poles.

The site will be serviced by an on-site stormwater management system to attenuate the increase in rates of runoff that will be seen due to the change in ground cover characteristics from the installation of the solar panels. Stormwater runoff will flow unattenuated overland to proposed detention basins to be located at the low areas of the site prior to discharge at a controlled rate off the property. The stormwater management system has been designed to accept and treat the projected stormwater flows from the development in accordance with the current DEP Stormwater Management Standards. As part of the new DEP Stormwater Management Standards and Regulations, the DEP is requiring Low Impact Development (LID) measures to be considered in the design of the project. The project, as proposed, does make use of certain LID measures including minimizing the amount of impervious area on the site with the use of the gravel roads and the use of crushed stone edge drain trenches to minimize the potential for erosion off the site.

1.2 Hydrologic Overview

A hydrologic analysis for the pre and post developed conditions for the project site has been prepared and is submitted in the following sections of this report. The primary goal of this analysis is to evaluate and mitigate the potential impacts of the proposed development to the adjacent properties. Particular consideration has been given to stormwater quantity and quality at the westerly property line and southerly boundary with the power line easement.

The analysis of the present condition and the proposed condition hydrology includes a calculated estimation of the runoff volume and peak storm flow rates from the site for each individual drainage area. The HydroCAD hydrologic program, developed by Applied Microcomputer Systems, was utilized in the preparation of the stormwater runoff models. The HydroCAD software is based upon the Soil Conservation Service, "Technical Release 20 – Urban Hydrology for Small Watersheds" and is a generally accepted industry standard methodology.

An analysis was performed for the 2, 10, 25, and 100-year frequency rainfall events. These events were based on a 24-hour duration storm with a SCS Type III storm distribution curve using the NRCC-Cornell rainfall data for the project site. Time of Concentration (Tc) values and runoff curve numbers (CN) were developed for each of the calculated existing and proposed drainage areas based upon prevalent topographic patterns, ground cover conditions, and SCS Hydrologic Soil Group classifications.

The hydrologic study area in the pre-developed condition consists of two (2) watershed area with two corresponding analysis points located at the westerly and southerly boundary of the proposed site development. The hydrologic study area in the post-developed condition consists of four (4) watershed areas and the same corresponding analysis

points. The pre and post development watershed areas and corresponding analysis point are described in the following sections and shown on the Watershed Plans submitted in Appendix A.

The Worcester County Soil Conservation Service (SCS) mapping for this area indicates two predominant soil classifications on the project site. The predominant soil classifications are as follows:

- Paxton fine sandy loam, extremely stony, 3 to 8 percent slopes – Hydrologic Soil Group C.
- Paxton fine sandy loam, extremely stony, 8 to 15 percent slopes – Hydrologic Soil Group C.

1.3 Pre-Development Hydrologic Summary

In the present condition, the site is comprised of two (2) watershed areas with one corresponding Analysis Point as shown on the attached Pre Development Watershed Plan and described below. The watershed designation and corresponding analysis point are as follows:

- Subcatchment PRE 1 is a 2.40-acre watershed area consisting of a portion of the proposed developable area on the property which currently flows unattenuated from a ridge on the northeastern side of the property to the westerly property. The westerly property line is taken as Analysis Point 1 (AP-1) in the hydrologic calculations. The Time of Concentration for Subcatchment PRE 1 was estimated at 10.4 minutes and the CN was estimated to be 71.
- Subcatchment PRE 2 is a 5.68-acre watershed area consisting of the proposed developable area on the property which currently flows unattenuated from a ridge on the northeastern side of the property to the existing power line easement located to the south of the proposed development. The boundary of the easement is taken as Analysis Point 2 (AP-2) in the hydrologic calculations. The Time of Concentration for Subcatchment PRE 1 was estimated at 16.7 minutes and the CN was estimated to be 70.

A summary of the pre development hydrologic conditions for the 2, 10, 25, and 100-year storm events is submitted in Table 1.3 below.

Table 1.3 – Pre Development Hydrologic Summary

Storm Event	Analysis Point AP-1 Rate of Flow (c.f.s.)	Analysis Point AP-2 Rate of Flow (c.f.s.)
2-year storm	1.99	3.66
10-year storm	4.85	9.22
25-year storm	7.37	14.18
100-year storm	12.92	25.16

1.4 Post Development Hydrologic Summary

In the developed condition, the site is comprised of four (4) watershed areas as shown on the attached Post Development Watershed Plan. The designated post development analysis points correspond to the previously described pre development analysis points. The watershed designations and corresponding analysis points for each of the post development watersheds are as follows:

- Subcatchment POST 1 is a 4.08-acre portion of the overall watershed area which flows overland to a series of crushed stone edge drain trenches which will convey the flow to a proposed detention area (POND WEST) which will discharge at a controlled rate to the westerly property line being taken as Analysis Point 1 (AP-1)
- Subcatchment POST 1A is a 0.27-acre portion of the overall watershed area which will continue to flow unattenuated to the westerly property line being taken as Analysis Point 1 (AP-1)
- Subcatchment POST 2 is a 3.36-acre portion of the overall watershed area which flows overland to a series of crushed stone edge drain trenches which will convey the flow to a proposed detention area (POND EAST) which will discharge at a controlled rate to the southerly limits of the project site being taken as Analysis Point 2 (AP-2)
- Subcatchment POST 2A is a 0.36-acre portion of the overall watershed area which will continue to flow unattenuated to the westerly property line being taken as Analysis Point 1 (AP-1)

A summary of the post-development hydrologic conditions for the 2, 10, and 100-year storm events is submitted in Table 1.4 below.

Table 1.4 – Post Development Hydrologic Summary

Storm Event	Analysis Point AP-1 Rate of Flow (c.f.s.)	Analysis Point AP-2 Rate of Flow (c.f.s.)
2-year storm	1.75	1.45
10-year storm	4.78	6.38
25-year storm	5.73	11.75
100-year storm	12.19	20.64

A summary of the pre and post-development hydrologic conditions for the 2, 10, 25, and 100-year storm events is submitted in Table 1.5 below. Results shown as a "negative" represent a decrease in post development condition rates of runoff.

Table 1.5 – Pre-Post Development Hydrologic Results

Storm Event	Analysis Point AP-1 Rate of Flow	Analysis Point AP-2 Rate of Flow
2-year storm	-12.1%	-60.4%
10-year storm	-1.4%	-30.8%
25-year storm	-22.3%	-17.1%
100-year storm	-5.7%	-18.0%

The hydrologic analysis indicates that the stormwater management system design for the site meets or reduces peak runoff rates for the 2, 10, 25, and 100 year, 24 hour, Type III storm events from the pre developed levels at the

subject analysis points. The analysis shows the proposed development of this project area will not result in an increase in the rates of runoff from the project site.

1.5 Stormwater Management System Summary

The proposed stormwater management system incorporates a number of Best Management Practices (BMPs), as prescribed in the Department of Environmental Protection (DEP) Stormwater Management Handbook. These practices include structural and non-structural measures providing stormwater quantity and quality management. These BMPs will function to minimize potential adverse water quality impacts to the surrounding wetland ecosystem. The following sections describe the temporary and permanent stormwater BMPs proposed for the site development.

The proposed stormwater management plan has been developed based on the projected site conditions and the present condition of the water resource areas that receive stormwater runoff from the site. The proposed BMPs have been designed to comply with the Massachusetts Stormwater Management Handbook.

There is minimal impervious area being proposed for this project as the project simply consists of gravel access driveways with above ground solar panels mounted on a racking system supported by driven (or drilled) posts. The main goal of the proposed stormwater management system is to attenuate the increases in the rates of runoff from the site due to the change in surface characteristics due to the installation of the solar panels. Runoff from portions of the project areas will flow overland to detention areas located on the low sides of the site. The proposed detention areas will serve to attenuate the flows to below pre-development numbers, as necessary. Calculations have been provided to show that the proposed stormwater management system will provide more than adequate attenuation to meet the requirements of the Stormwater Management Handbook. As the attached calculations show, the areas of the panels have been modeled as "unconnected impervious" surface to conservatively estimate the rates of runoff generated by the facility. This methodology has recently been requested by the DEP in their review of the stormwater management systems servicing solar arrays.

1.6 Select Structural Best Management Practices (BMP's)

Extended Detention Basin

Runoff from portions of the solar panel array locations and gravel driveways will be conveyed overland to a series of extended detention basins located at the lower elevations of the site, in advance of the discharge of site. The detention basin will serve to attenuate flow rates and, through extended detention time, provide for additional treatment and pollutant removal. Storage volume is provided in the extended detention basin above the outlet "low-flow" culverts to provide attenuation of the runoff for larger storm events.

Crushed Stone Infiltration Trenches

Runoff from the portions of the solar panel array locations and gravel (or grassed) access aisles within the fenced portion of the site will be conveyed overland to crushed stone infiltration trenches located along the perimeter of the array. While we have not accounted for recharge and exfiltration from these trenches in our hydrologic calculations, these trenches will serve as a conduit to facilitate recharge into the subsurface soils as well as provide a means to slow the runoff down prior to discharge either to the proposed detention basins or off-site. These trenches will help to minimize the effects of erosion and sedimentation towards the adjacent properties during and following construction of the proposed array.

1.7 Select Non-Structural Best Management Practices (BMP's)

Stormwater Management System Maintenance Program

All structural components of the stormwater management system will be inspected and maintained on a regular basis in accordance with the requirements of the Stormwater Management Policy. A detailed Stormwater Management System Operation and Maintenance Plan has been prepared in accordance with the newly promulgated Stormwater Management Standards and Stormwater Management Handbook prepared by the Massachusetts Department of Environmental Protection.

1.8 Regulatory Compliance

The Massachusetts Stormwater Handbook, Volume 3 (February, 2008), has been used as the primary guidance for the selection and design of permanent non-structural and structural BMPs for the long-term protection of existing wetland and water resources. The Stormwater Management Plan developed for this project incorporates water quantity and quality controls that will protect surface and groundwater resources, wetlands and adjacent properties from potential impacts due to increased impervious areas on the site. The Stormwater Management Plan also incorporates select LID measures in accordance with the new Stormwater Management Policies.

The stormwater performance standards developed by the DEP and a brief discussion on how the proposed project will achieve the standards are provided below. The Stormwater Management System Compliance Certification and Checklist has been included as the Preface to this Report.

Standard 1. No new stormwater conveyances may discharge untreated stormwater directly to, or cause erosion in wetlands or waters of the Commonwealth.

- No proposed site stormwater conveyance system will discharge untreated stormwater runoff directly to wetlands. Stormwater runoff from developed areas will run overland to proposed detention basins located at the lower elevations of the project site. Riprap pads and level spreader spillways will be installed where necessary at the point of discharge of the detention system outfall to eliminate potential erosive flow velocities and dissipate the energy of the discharged stormwater, thereby avoiding sedimentation to the downgradient areas.

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

- The storage volume above the culvert outlets at the bottom of the proposed detention basins will serve to limit the peak rates of stormwater runoff at or below pre development levels for the 2-, 10-, 25- and 100-year storm events. Refer to the Calculations in Sections 2 & 3 for additional information.

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

- As there is minimal new impervious area being provided as part of this project, recharge characteristics of the site will remain unchanged. Additional recharge may be accomplished within the bottom area of the detention

basins as well as through the grassed surfaces beneath the solar panels and within the crushed stone trenches along the perimeter of the site.

- Standard 4.** Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This standard is met when:
- a) Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;
 - b) Structural stormwater best management practices are sized to capture the required water quality volume as determined in accordance with the Massachusetts Stormwater Handbook; and
 - c) Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.
- The 80 percent TSS removal rate is not applicable as there are no new impervious areas being proposed on the project. The areas beneath the solar panels will be grassed and we are proposing gravel access roads which will not provide increased TSS loads to the wetlands. The runoff from the developed areas of the site will be directed to detention basins as necessary located at the lower elevations on the site which shall provide attenuation and some treatment.

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

- The proposed project is not considered a high intensity use with higher potential pollutant loads.

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

- The project does not discharge stormwater to any designated critical areas as defined in the Massachusetts Stormwater Handbook.

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

- This standard is not applicable as this is not a redevelopment of a previously developed site.

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

- The proposed development will incorporate erosion and sedimentation controls to minimize the potential for sedimentation in down gradient resources. These controls will include hay bales/silt fence barriers, and slope stabilization measures such as hay/straw blankets and jute matting. The proponent along with their chosen site contractor will complete a Stormwater Pollution Prevention Plan in accordance with the NPDES General Permit for Stormwater Discharges associated with Construction Projects and this SWPPP will also be used as the plan to meet this standard. A draft SWPPP is included with this report.

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

- The Stormwater Management Plan for this project has been developed in full compliance with the DEP Stormwater Management Policy. The Plan is based on a multi-dimensional approach to stormwater management that recognizes the need for proper site planning, source control of potential contaminants, and implementation of structural and non-structural treatment methods to ensure the protection of water resources in the vicinity of the site and adjacent properties. The Stormwater Operation and Maintenance Plan is provided on the construction drawings. A more detailed Long-Term Operation and Maintenance Plan is also included in the in the following sections.

Standard 10. Illicit Discharges to the Stormwater Management System are prohibited.

- An Illicit Discharge Compliance Statement has been completed and is included as an Appendix to this Report.

1.9 Post Construction Operation and Maintenance Plan

Name and current address of the Applicant

CEC Solar #1056 LLC
c/o Clean Energy Collective
146 W Boylston Drive
Worcester, MA 01606

Name and address of the Contractor of Record

The Contractor for this project has not been selected yet. Upon Selection of the Contractor, their contact information will be provided to the Planning Board and Conservation Commission for their records.

Plans of Record

Refer to Site Development Plans prepared for CEC Solar #1056 LLC by Field Engineering and last dated 8/12/15 for locations of all BMP's on site as well as construction details of all BMP's. Refer to the Site Plan Review/Special Permit Decision issued by the Grafton Planning Board and Stormwater Permit issues by the Grafton Conservation Commission for additional information regarding the operation and maintenance of the stormwater management BMP's on site.

1. The contractor shall be responsible for the proper inspection and maintenance of all stormwater management facilities including the continued stabilization of the site until such time as the project is accepted by the owner. Thereafter, the owner shall be responsible for the proper inspection and maintenance of any stormwater facilities in accordance with this operation and maintenance plan.
2. All Structural Best Management Practices (BMP's) including the siltation control should be inspected after every major rainfall event exceeding 1.0-inch for the first 6 months after construction to ensure proper stabilization and construction.
3. Thereafter, regular BMP inspections should be conducted according to the following schedule:

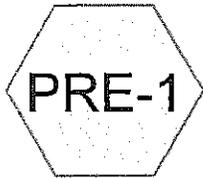
<u>BMP Structure</u>	<u>Inspections per Year</u>
Detention Basins	2
Crushed Stone Edge Drains	2

4. Accumulated silt and sediment ahead of the siltation controls should be removed if the accumulated depth of sediment exceeds one half of the height of the structure. Any accumulated silt within the detention basins should be removed once the accumulated depth of silt exceeds three inches.
5. All removed sediments are to be properly disposed of at a location to be approved by the Board of Health. Transportation and disposal of sediments shall comply with all local, state and federal regulations.
6. The access driveway into the facility shall be plowed after all snow events to maintain emergency access to the facility. Snow shall be stockpiled within the fenced area and allowed to melt on-site and flow overland following natural drainage patterns.

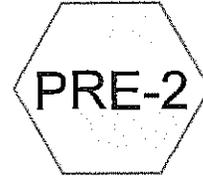
7. The access driveway shall be monitored on a regular basis to insure its suitability for access. Gravel along the access driveway shall be replaced as necessary to maintain suitable access to the array. In addition, the entire facility shall be monitored on a regular basis for any signs of erosion due to stormwater runoff. Eroded areas shall be stabilized as soon as possible.
8. The site shall be monitored to insure proposed drainage patterns are maintained following construction. Should channel flow from runoff develop within the site that requires corrective measures, these measures shall be reviewed with the Planning Board prior to their implementation.
9. Side slopes and bottom areas of any grassed swales and detention basins should be mowed to a minimum height of four inches at least once a year. Remove all grass clippings and organic matter from all drainage ways as necessary.
10. The detention basin should be inspected for trash on a regular basis. Any accumulated trash, litter, and discarded materials should be removed.
11. The contractor and the owner shall maintain a BMP Inspection Report following each site inspection as recommended above. The BMP Inspection Report shall identify the date of inspection, the name and contact number of the responsible party, specific structures inspected, specific maintenance require and observations. At a minimum, inspection reports should address the following conditions where applicable:
 1. Embankment Subsidence
 2. Erosion
 3. Cracking of Containment Berm
 4. Inlet/Outlet Conditions
 5. Sediment Accumulations
 6. Slope Stability

Section 2

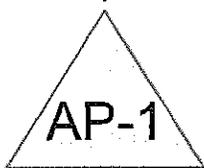
Pre Development Hydrologic Analysis



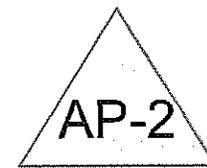
Pre Development Area 1



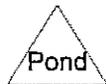
Pre Development Area 2



Westerly Property Line



Easement Line



2035-PreDevelopmentAnalysis-R1

Type III 24-hr 2 YR-Cornell Rainfall=3.24"

Prepared by Field Engineering Co. Inc.

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Page 2

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PRE-1: Pre Development Runoff Area=104,706 sf 0.00% Impervious Runoff Depth>0.90"
Flow Length=750' Tc=10.4 min CN=71 Runoff=1.99 cfs 0.180 af

Subcatchment PRE-2: Pre Development Runoff Area=247,604 sf 0.00% Impervious Runoff Depth>0.85"
Flow Length=760' Tc=16.7 min CN=70 Runoff=3.66 cfs 0.401 af

Pond AP-1: Westerly Property Line Inflow=1.99 cfs 0.180 af
Primary=1.99 cfs 0.180 af

Pond AP-2: Easement Line Inflow=3.66 cfs 0.401 af
Primary=3.66 cfs 0.401 af

Total Runoff Area = 8.088 ac Runoff Volume = 0.582 af Average Runoff Depth = 0.86"
100.00% Pervious = 8.088 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment PRE-1: Pre Development Area 1

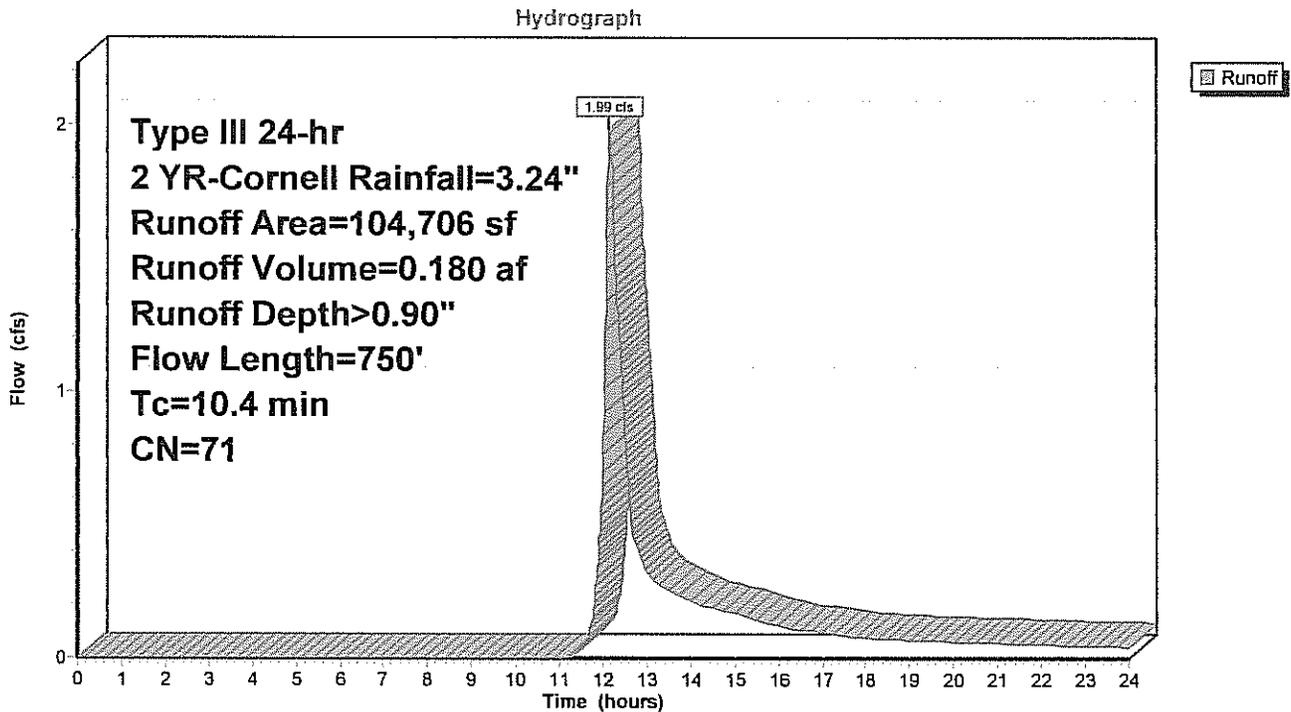
Runoff = 1.99 cfs @ 12.16 hrs, Volume= 0.180 af, Depth> 0.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2 YR-Cornell Rainfall=3.24"

Area (sf)	CN	Description
99,084	70	Woods, Good, HSG C
5,622	89	Gravel roads, HSG C
104,706	71	Weighted Average
104,706		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.0900	0.12		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.24"
1.2	120	0.1100	1.66		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
1.3	460	0.1300	5.80		Shallow Concentrated Flow, C-D Unpaved Kv= 16.1 fps
1.2	120	0.1200	1.73		Shallow Concentrated Flow, D-E Woodland Kv= 5.0 fps
10.4	750	Total			

Subcatchment PRE-1: Pre Development Area 1



Summary for Subcatchment PRE-2: Pre Development Area 2

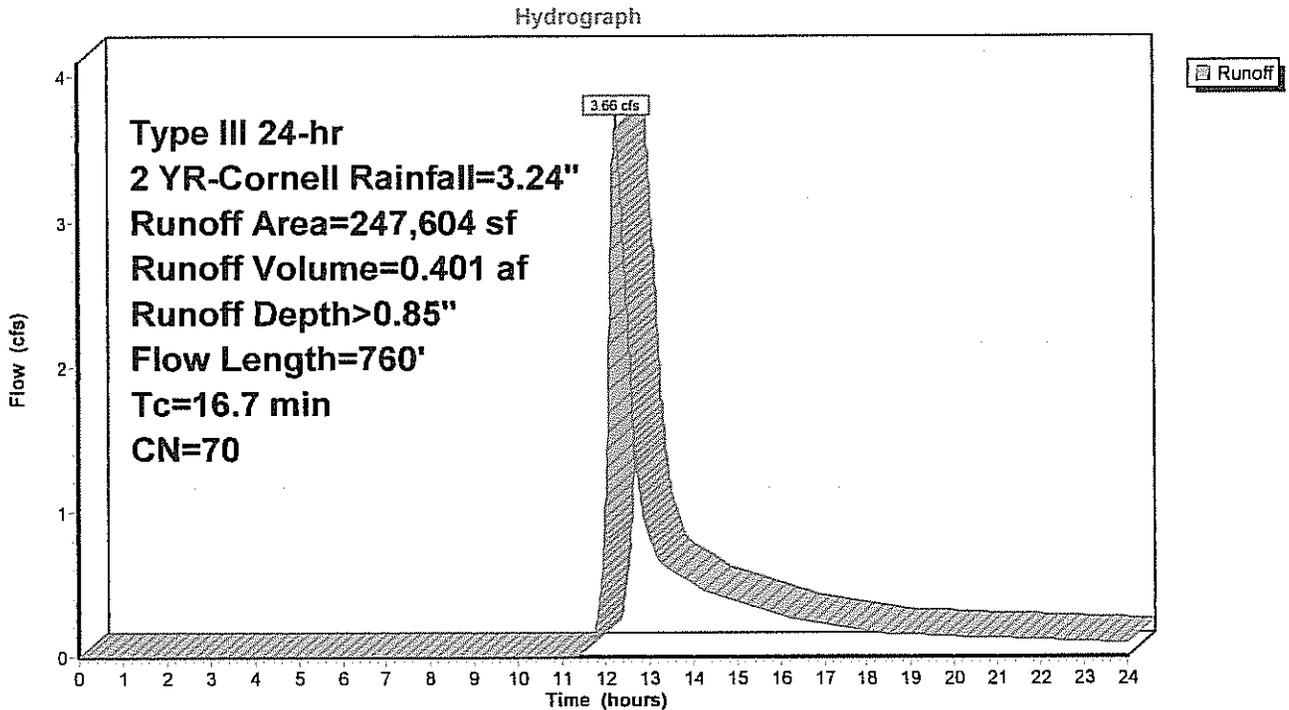
Runoff = 3.66 cfs @ 12.26 hrs, Volume= 0.401 af, Depth> 0.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2 YR-Cornell Rainfall=3.24"

Area (sf)	CN	Description
243,947	70	Woods, Good, HSG C
3,657	89	Gravel roads, HSG C
247,604	70	Weighted Average
247,604		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.24"
3.6	337	0.0949	1.54		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
0.9	126	0.2380	2.44		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
2.9	247	0.0810	1.42		Shallow Concentrated Flow, D-E Woodland Kv= 5.0 fps
16.7	760	Total			

Subcatchment PRE-2: Pre Development Area 2



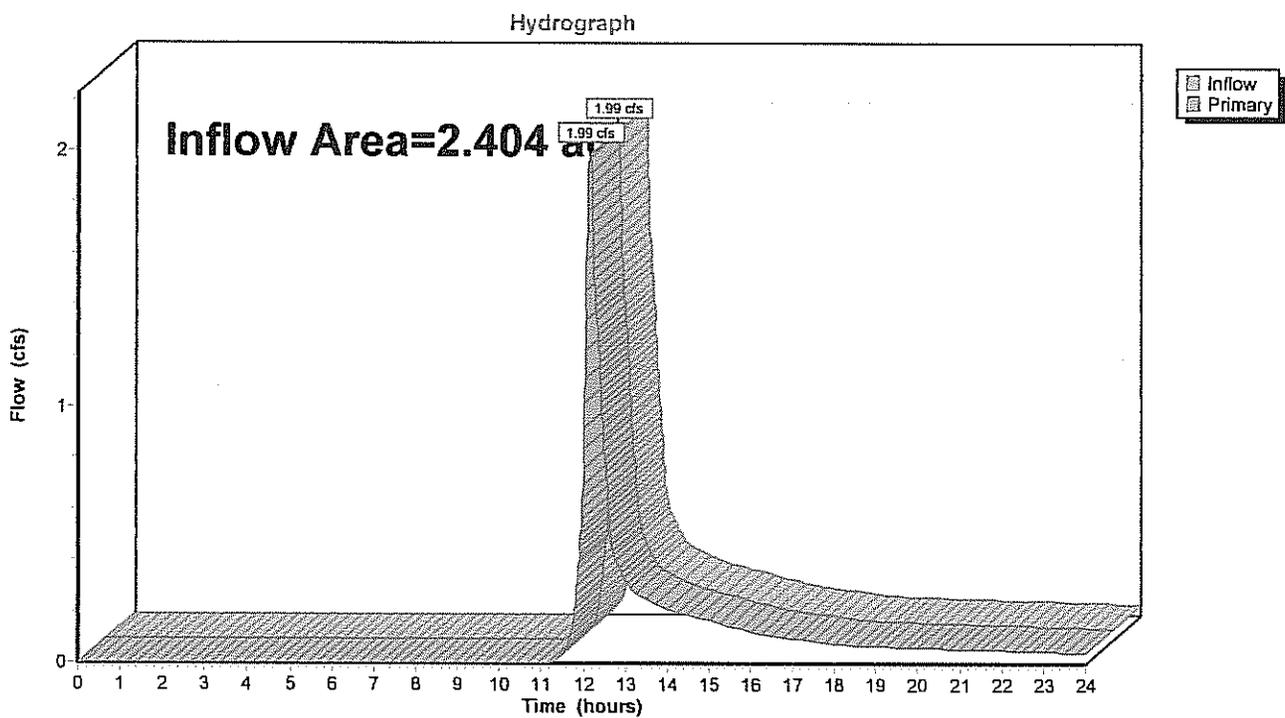
Summary for Pond AP-1: Westerly Property Line

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

Inflow Area = 2.404 ac, 0.00% Impervious, Inflow Depth > 0.90" for 2 YR-Cornell event
Inflow = 1.99 cfs @ 12.16 hrs, Volume= 0.180 af
Primary = 1.99 cfs @ 12.16 hrs, Volume= 0.180 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Pond AP-1: Westerly Property Line



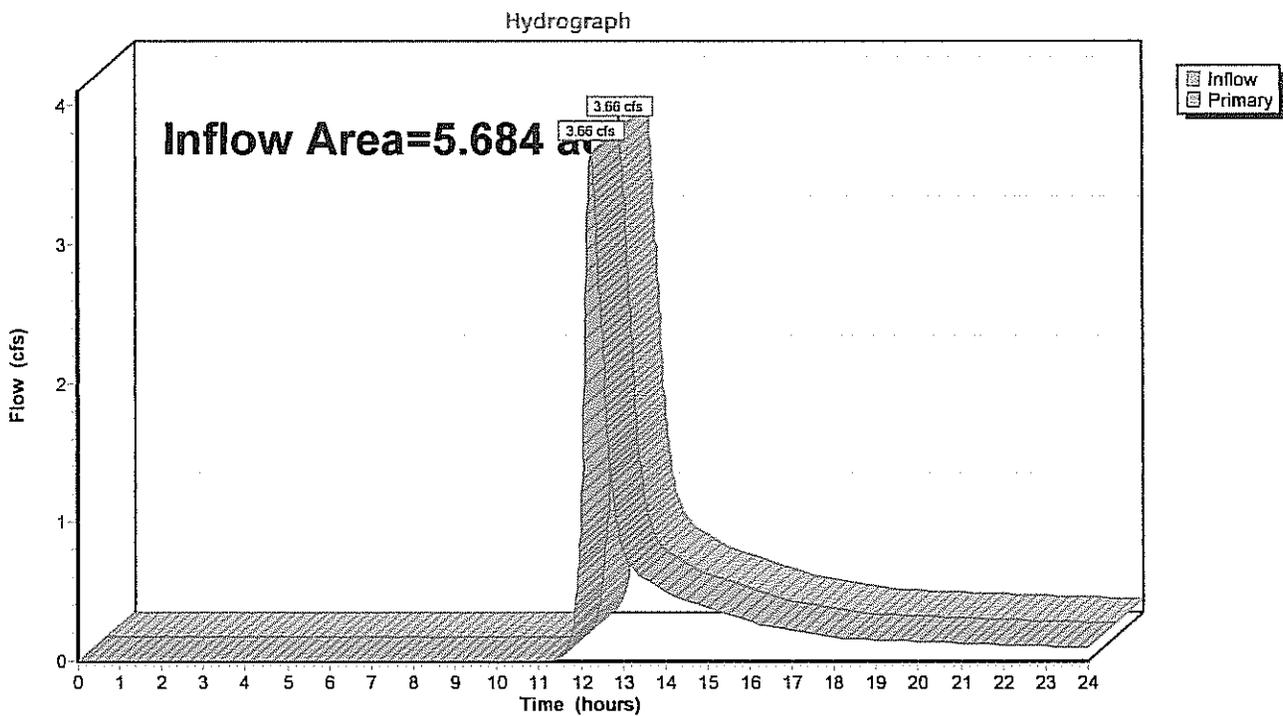
Summary for Pond AP-2: Easement Line

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

Inflow Area = 5.684 ac, 0.00% Impervious, Inflow Depth > 0.85" for 2 YR-Cornell event
Inflow = 3.66 cfs @ 12.26 hrs, Volume= 0.401 af
Primary = 3.66 cfs @ 12.26 hrs, Volume= 0.401 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Pond AP-2: Easement Line



Summary for Subcatchment PRE-1: Pre Development Area 1

Runoff = 4.85 cfs @ 12.15 hrs, Volume= 0.406 af, Depth> 2.03"

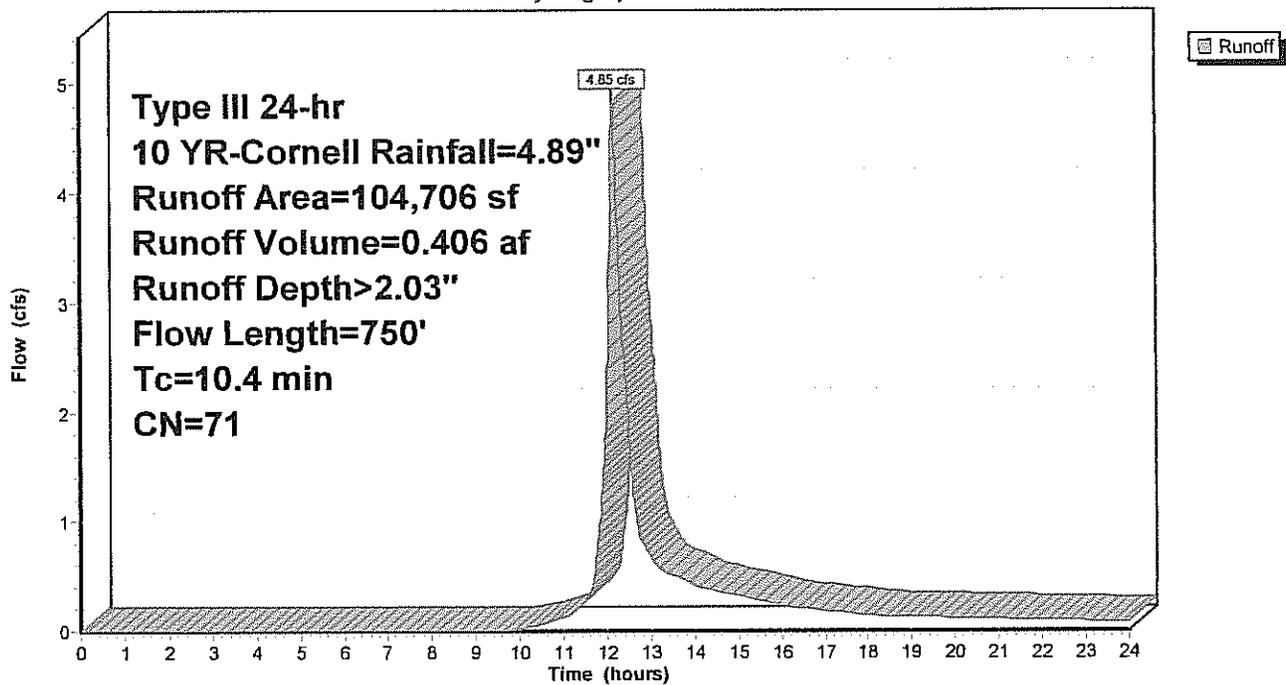
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10 YR-Cornell Rainfall=4.89"

Area (sf)	CN	Description
99,084	70	Woods, Good, HSG C
5,622	89	Gravel roads, HSG C
104,706	71	Weighted Average
104,706		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.0900	0.12		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.24"
1.2	120	0.1100	1.66		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
1.3	460	0.1300	5.80		Shallow Concentrated Flow, C-D Unpaved Kv= 16.1 fps
1.2	120	0.1200	1.73		Shallow Concentrated Flow, D-E Woodland Kv= 5.0 fps
10.4	750	Total			

Subcatchment PRE-1: Pre Development Area 1

Hydrograph



Summary for Subcatchment PRE-2: Pre Development Area 2

Runoff = 9.22 cfs @ 12.23 hrs, Volume= 0.922 af, Depth> 1.95"

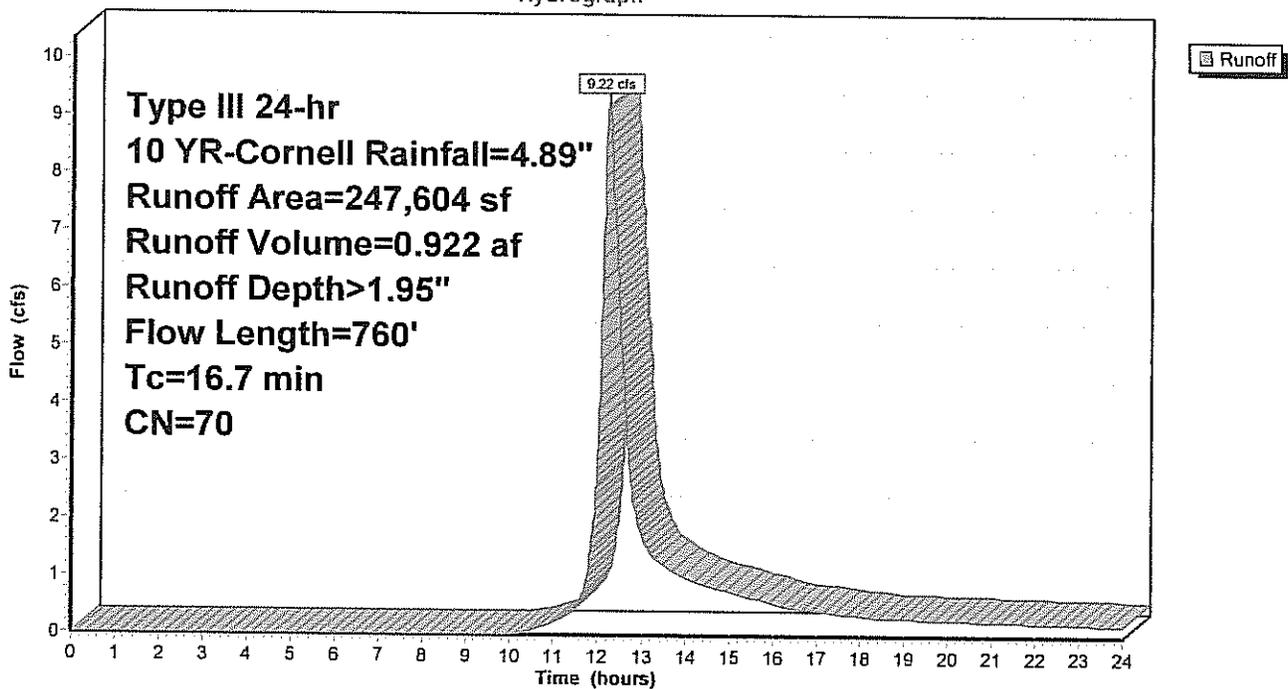
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10 YR-Cornell Rainfall=4.89"

Area (sf)	CN	Description
243,947	70	Woods, Good, HSG C
3,657	89	Gravel roads, HSG C
247,604	70	Weighted Average
247,604		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		Sheet Flow, A-B
					Woods: Light underbrush n= 0.400 P2= 3.24"
3.6	337	0.0949	1.54		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
0.9	126	0.2380	2.44		Shallow Concentrated Flow, C-D
					Woodland Kv= 5.0 fps
2.9	247	0.0810	1.42		Shallow Concentrated Flow, D-E
					Woodland Kv= 5.0 fps
16.7	760	Total			

Subcatchment PRE-2: Pre Development Area 2

Hydrograph



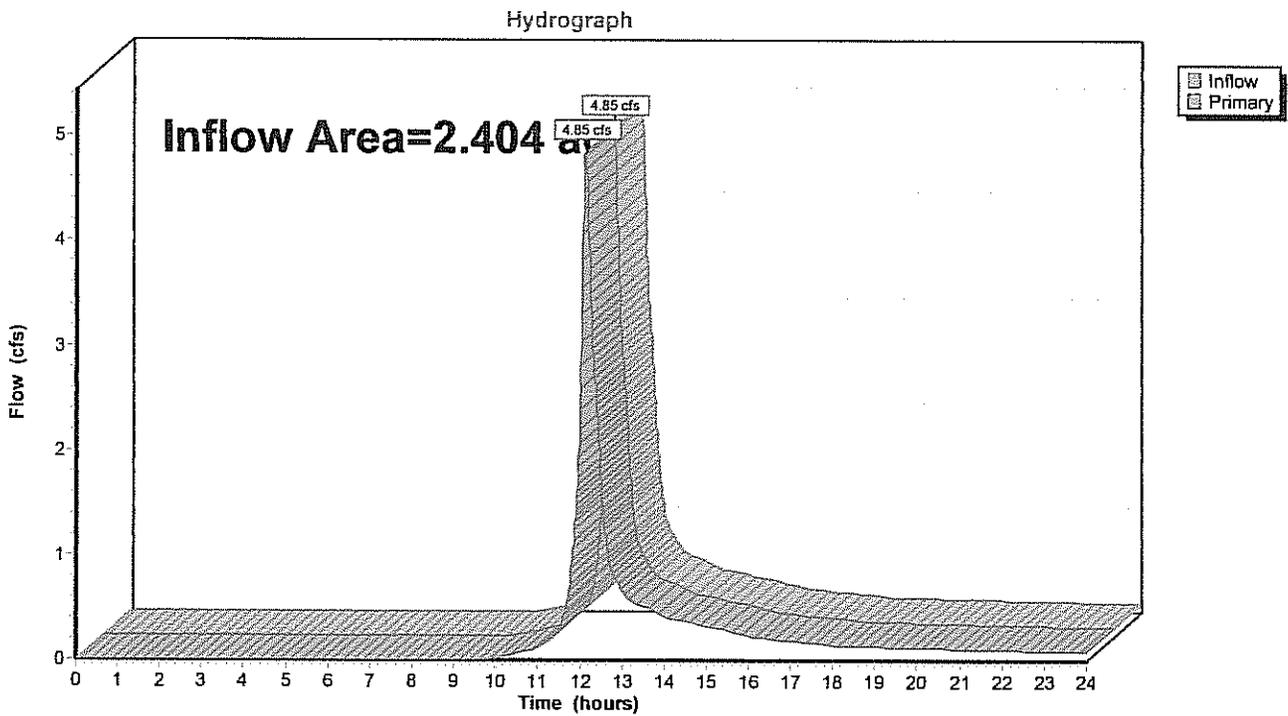
Summary for Pond AP-1: Westerly Property Line

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

Inflow Area = 2.404 ac, 0.00% Impervious, Inflow Depth > 2.03" for 10 YR-Cornell event
Inflow = 4.85 cfs @ 12.15 hrs, Volume= 0.406 af
Primary = 4.85 cfs @ 12.15 hrs, Volume= 0.406 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Pond AP-1: Westerly Property Line



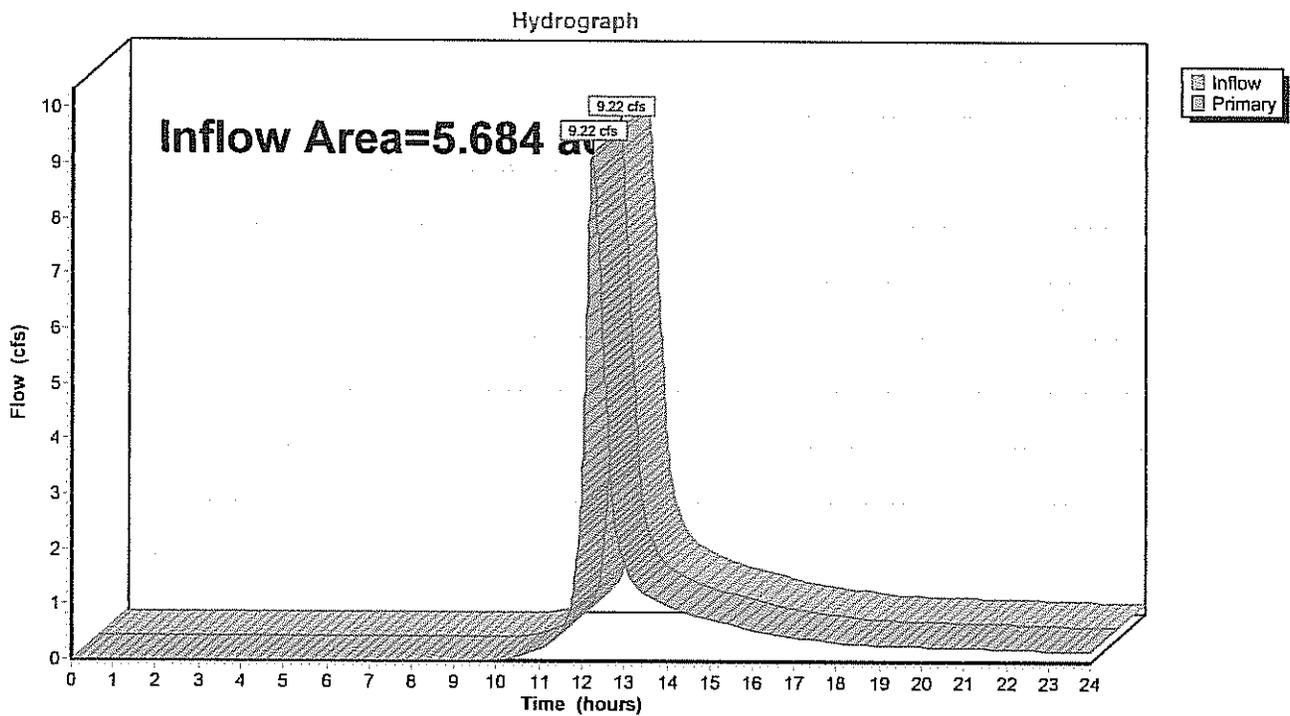
Summary for Pond AP-2: Easement Line

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

Inflow Area = 5.684 ac, 0.00% Impervious, Inflow Depth > 1.95" for 10 YR-Cornell event
Inflow = 9.22 cfs @ 12.23 hrs, Volume= 0.922 af
Primary = 9.22 cfs @ 12.23 hrs, Volume= 0.922 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Pond AP-2: Easement Line



2035-PreDevelopmentAnalysis-R1

Type III 24-hr 25 YR-Cornell Rainfall=6.18"

Prepared by Field Engineering Co. Inc.

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PRE-1: Pre Development Runoff Area=104,706 sf 0.00% Impervious Runoff Depth>3.04"
Flow Length=750' Tc=10.4 min CN=71 Runoff=7.37 cfs 0.608 af

Subcatchment PRE-2: Pre Development Runoff Area=247,604 sf 0.00% Impervious Runoff Depth>2.94"
Flow Length=760' Tc=16.7 min CN=70 Runoff=14.18 cfs 1.392 af

Pond AP-1: Westerly Property Line Inflow=7.37 cfs 0.608 af
Primary=7.37 cfs 0.608 af

Pond AP-2: Easement Line Inflow=14.18 cfs 1.392 af
Primary=14.18 cfs 1.392 af

Total Runoff Area = 8.088 ac Runoff Volume = 2.000 af Average Runoff Depth = 2.97"
100.00% Pervious = 8.088 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment PRE-1: Pre Development Area 1

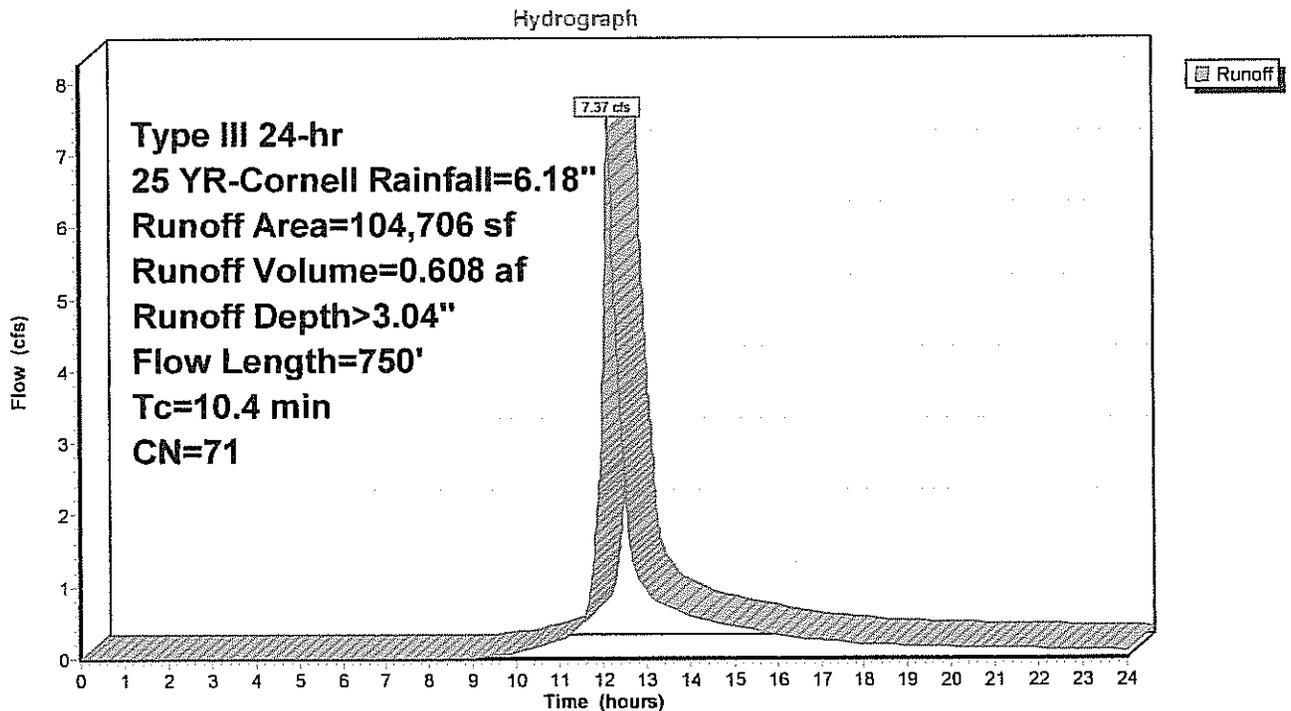
Runoff = 7.37 cfs @ 12.15 hrs, Volume= 0.608 af, Depth> 3.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25 YR-Cornell Rainfall=6.18"

Area (sf)	CN	Description
99,084	70	Woods, Good, HSG C
5,622	89	Gravel roads, HSG C
104,706	71	Weighted Average
104,706		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.0900	0.12		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.24"
1.2	120	0.1100	1.66		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
1.3	460	0.1300	5.80		Shallow Concentrated Flow, C-D Unpaved Kv= 16.1 fps
1.2	120	0.1200	1.73		Shallow Concentrated Flow, D-E Woodland Kv= 5.0 fps
10.4	750	Total			

Subcatchment PRE-1: Pre Development Area 1



Summary for Subcatchment PRE-2: Pre Development Area 2

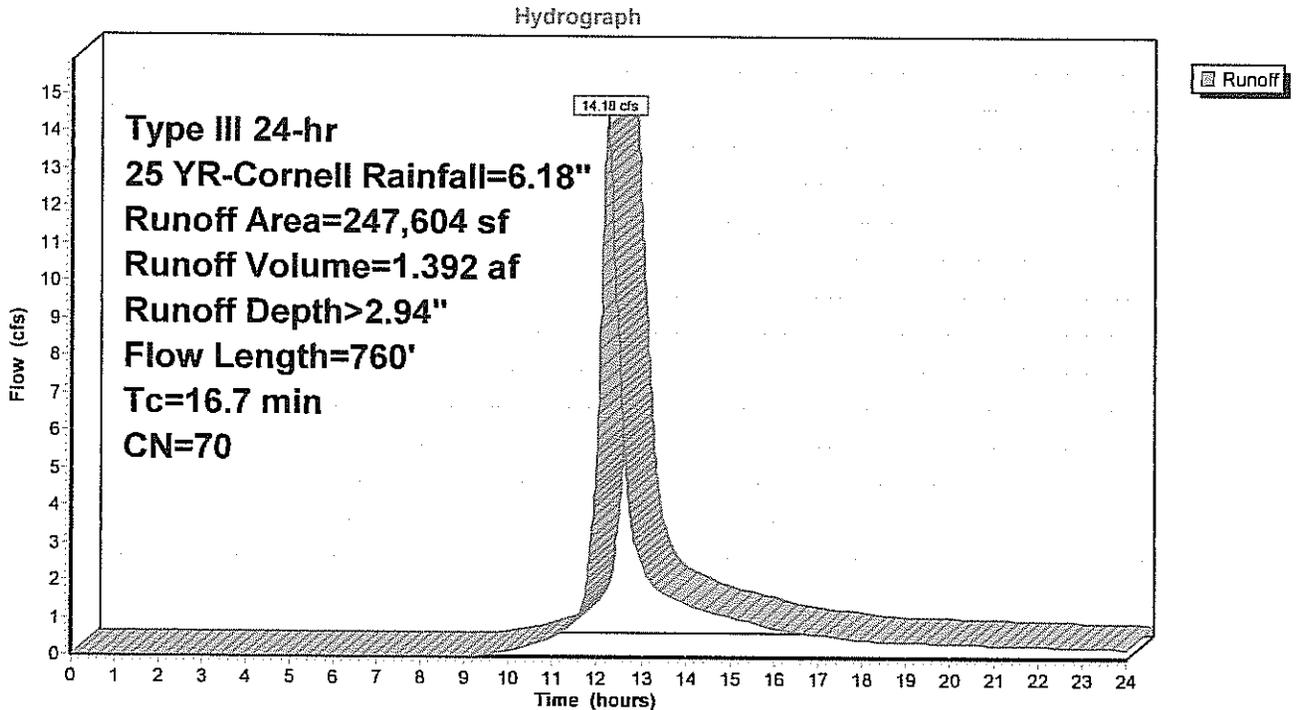
Runoff = 14.18 cfs @ 12.23 hrs, Volume= 1.392 af, Depth> 2.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25 YR-Cornell Rainfall=6.18"

Area (sf)	CN	Description
243,947	70	Woods, Good, HSG C
3,657	89	Gravel roads, HSG C
247,604	70	Weighted Average
247,604		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.24"
3.6	337	0.0949	1.54		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
0.9	126	0.2380	2.44		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
2.9	247	0.0810	1.42		Shallow Concentrated Flow, D-E Woodland Kv= 5.0 fps
16.7	760	Total			

Subcatchment PRE-2: Pre Development Area 2



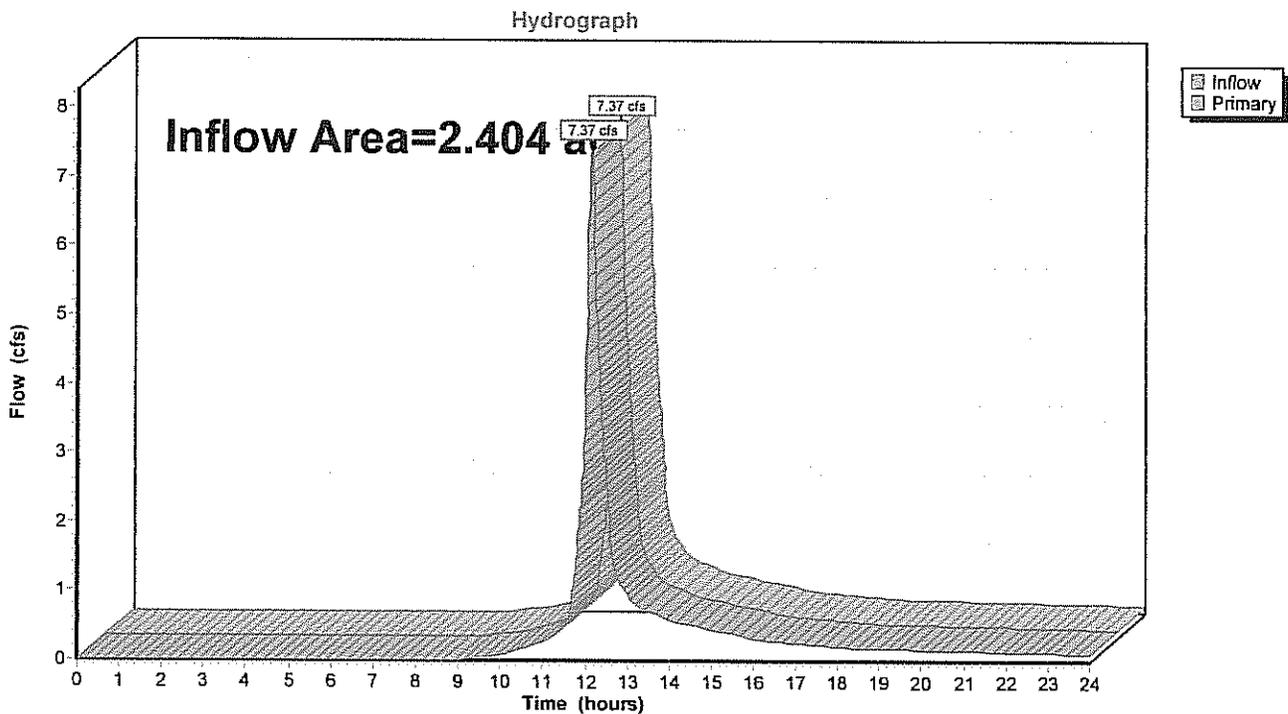
Summary for Pond AP-1: Westerly Property Line

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

Inflow Area = 2.404 ac, 0.00% Impervious, Inflow Depth > 3.04" for 25 YR-Cornell event
Inflow = 7.37 cfs @ 12.15 hrs, Volume= 0.608 af
Primary = 7.37 cfs @ 12.15 hrs, Volume= 0.608 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Pond AP-1: Westerly Property Line



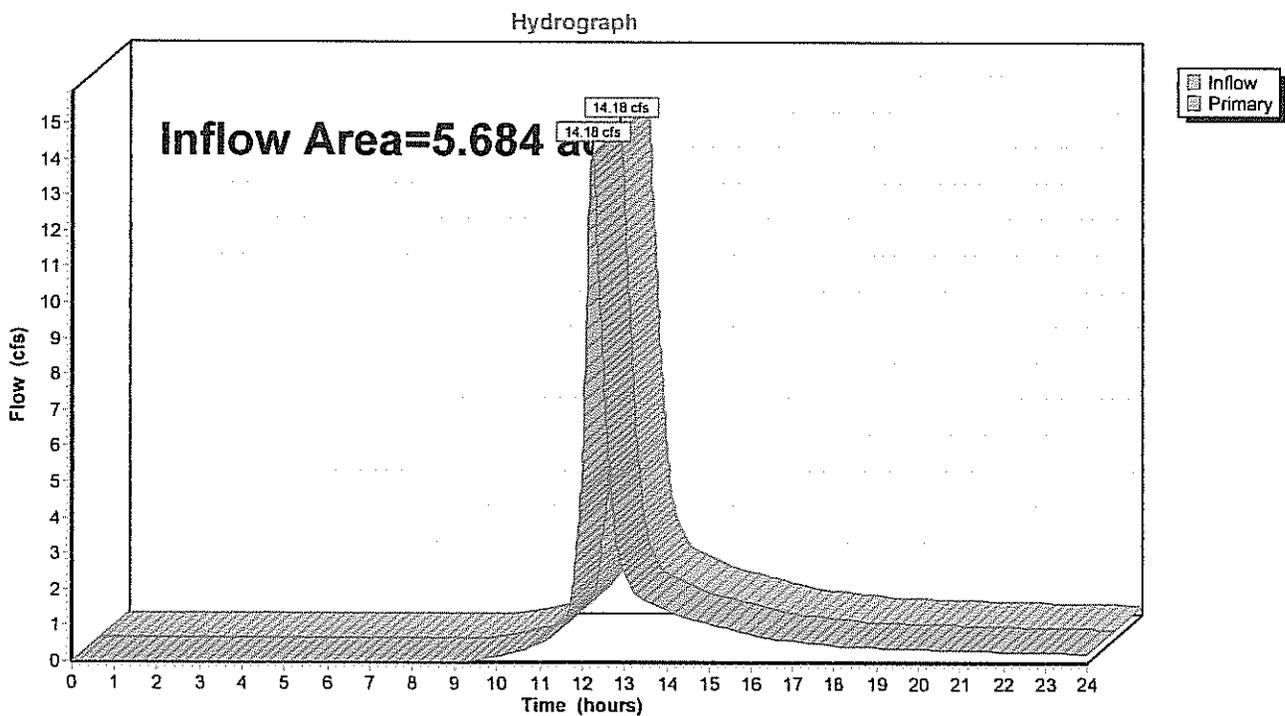
Summary for Pond AP-2: Easement Line

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

Inflow Area = 5.684 ac, 0.00% Impervious, Inflow Depth > 2.94" for 25 YR-Cornell event
Inflow = 14.18 cfs @ 12.23 hrs, Volume= 1.392 af
Primary = 14.18 cfs @ 12.23 hrs, Volume= 1.392 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Pond AP-2: Easement Line



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PRE-1: Pre Development Runoff Area=104,706 sf 0.00% Impervious Runoff Depth>5.31"
Flow Length=750' Tc=10.4 min CN=71 Runoff=12.92 cfs 1.063 af

Subcatchment PRE-2: Pre Development Runoff Area=247,604 sf 0.00% Impervious Runoff Depth>5.18"
Flow Length=760' Tc=16.7 min CN=70 Runoff=25.16 cfs 2.452 af

Pond AP-1: Westerly Property Line Inflow=12.92 cfs 1.063 af
Primary=12.92 cfs 1.063 af

Pond AP-2: Easement Line Inflow=25.16 cfs 2.452 af
Primary=25.16 cfs 2.452 af

Total Runoff Area = 8.088 ac Runoff Volume = 3.515 af Average Runoff Depth = 5.22"
100.00% Pervious = 8.088 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment PRE-1: Pre Development Area 1

Runoff = 12.92 cfs @ 12.14 hrs, Volume= 1.063 af, Depth> 5.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100 YR-Cornell Rainfall=8.84"

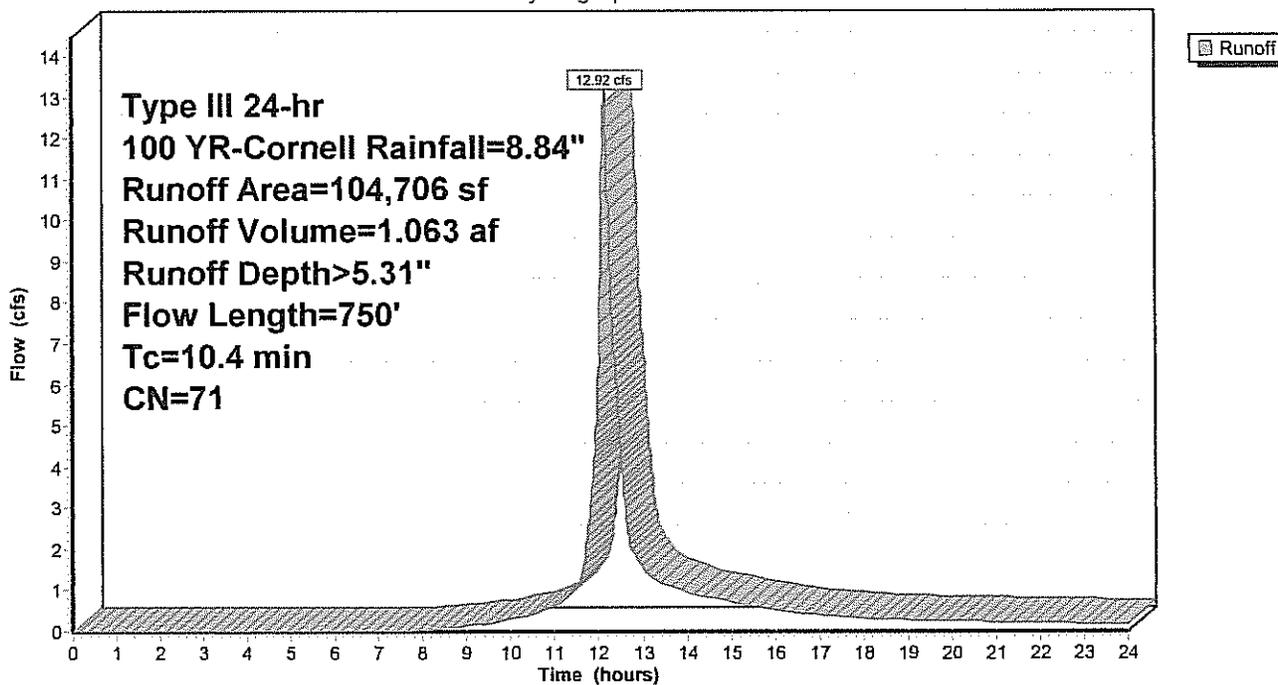
Area (sf)	CN	Description
99,084	70	Woods, Good, HSG C
5,622	89	Gravel roads, HSG C
104,706	71	Weighted Average
104,706		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.0900	0.12		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.24"
1.2	120	0.1100	1.66		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
1.3	460	0.1300	5.80		Shallow Concentrated Flow, C-D Unpaved Kv= 16.1 fps
1.2	120	0.1200	1.73		Shallow Concentrated Flow, D-E Woodland Kv= 5.0 fps

10.4 750 Total

Subcatchment PRE-1: Pre Development Area 1

Hydrograph



Summary for Subcatchment PRE-2: Pre Development Area 2

Runoff = 25.16 cfs @ 12.23 hrs, Volume= 2.452 af, Depth> 5.18"

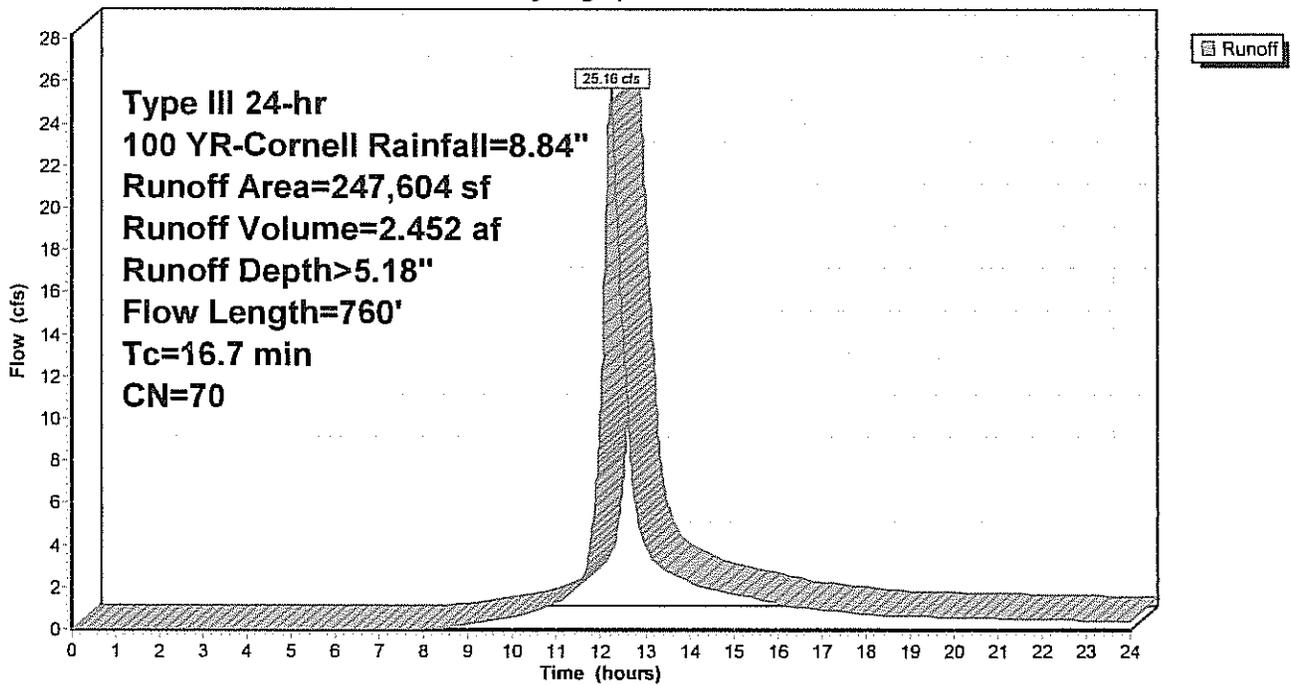
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100 YR-Cornell Rainfall=8.84"

Area (sf)	CN	Description
243,947	70	Woods, Good, HSG C
3,657	89	Gravel roads, HSG C
247,604	70	Weighted Average
247,604		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.24"
3.6	337	0.0949	1.54		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
0.9	126	0.2380	2.44		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
2.9	247	0.0810	1.42		Shallow Concentrated Flow, D-E Woodland Kv= 5.0 fps
16.7	760	Total			

Subcatchment PRE-2: Pre Development Area 2

Hydrograph



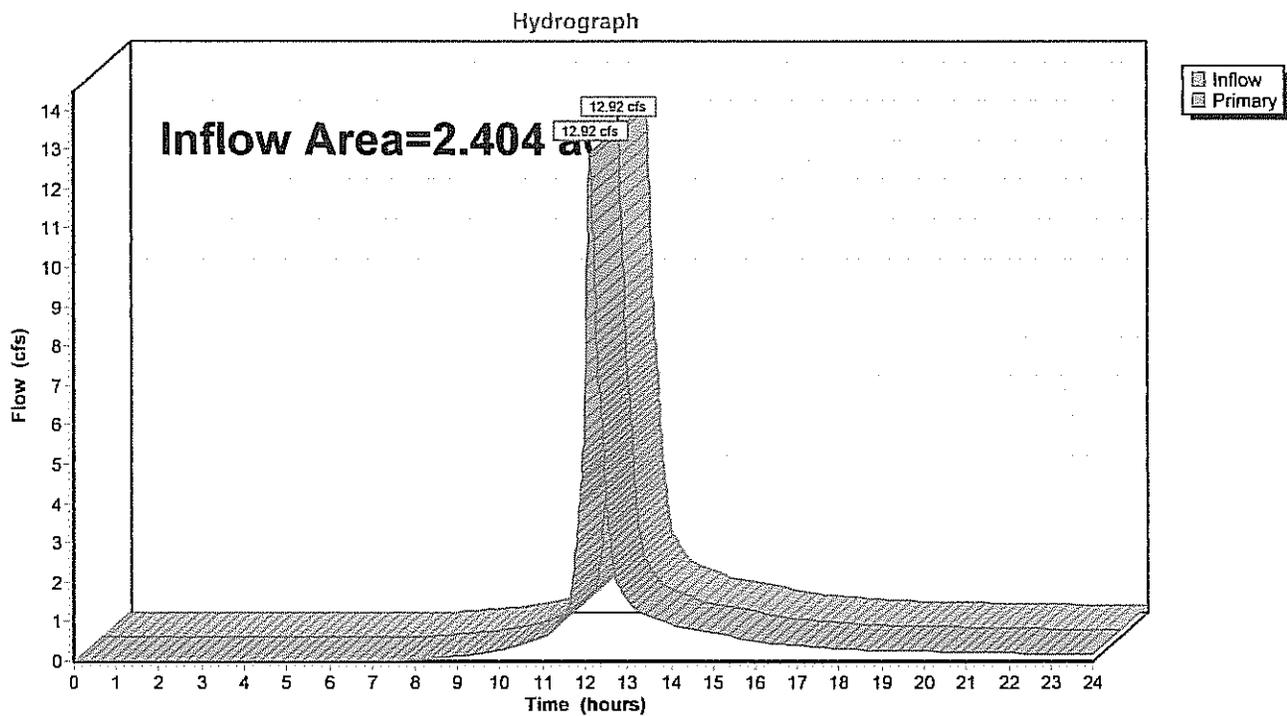
Summary for Pond AP-1: Westerly Property Line

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

Inflow Area = 2.404 ac, 0.00% Impervious, Inflow Depth > 5.31" for 100 YR-Cornell event
Inflow = 12.92 cfs @ 12.14 hrs, Volume= 1.063 af
Primary = 12.92 cfs @ 12.14 hrs, Volume= 1.063 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Pond AP-1: Westerly Property Line



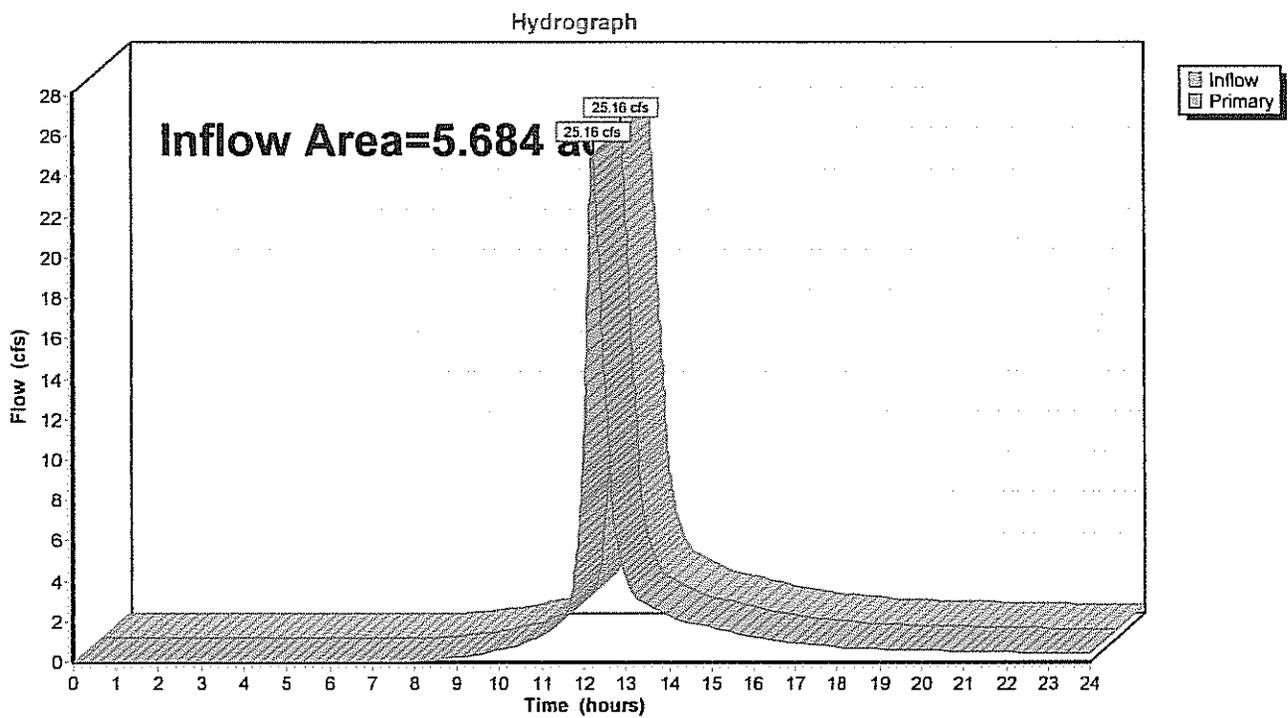
Summary for Pond AP-2: Easement Line

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

Inflow Area = 5.684 ac, 0.00% Impervious, Inflow Depth > 5.18" for 100 YR-Cornell event
Inflow = 25.16 cfs @ 12.23 hrs, Volume= 2.452 af
Primary = 25.16 cfs @ 12.23 hrs, Volume= 2.452 af, Atten= 0%, Lag= 0.0 min

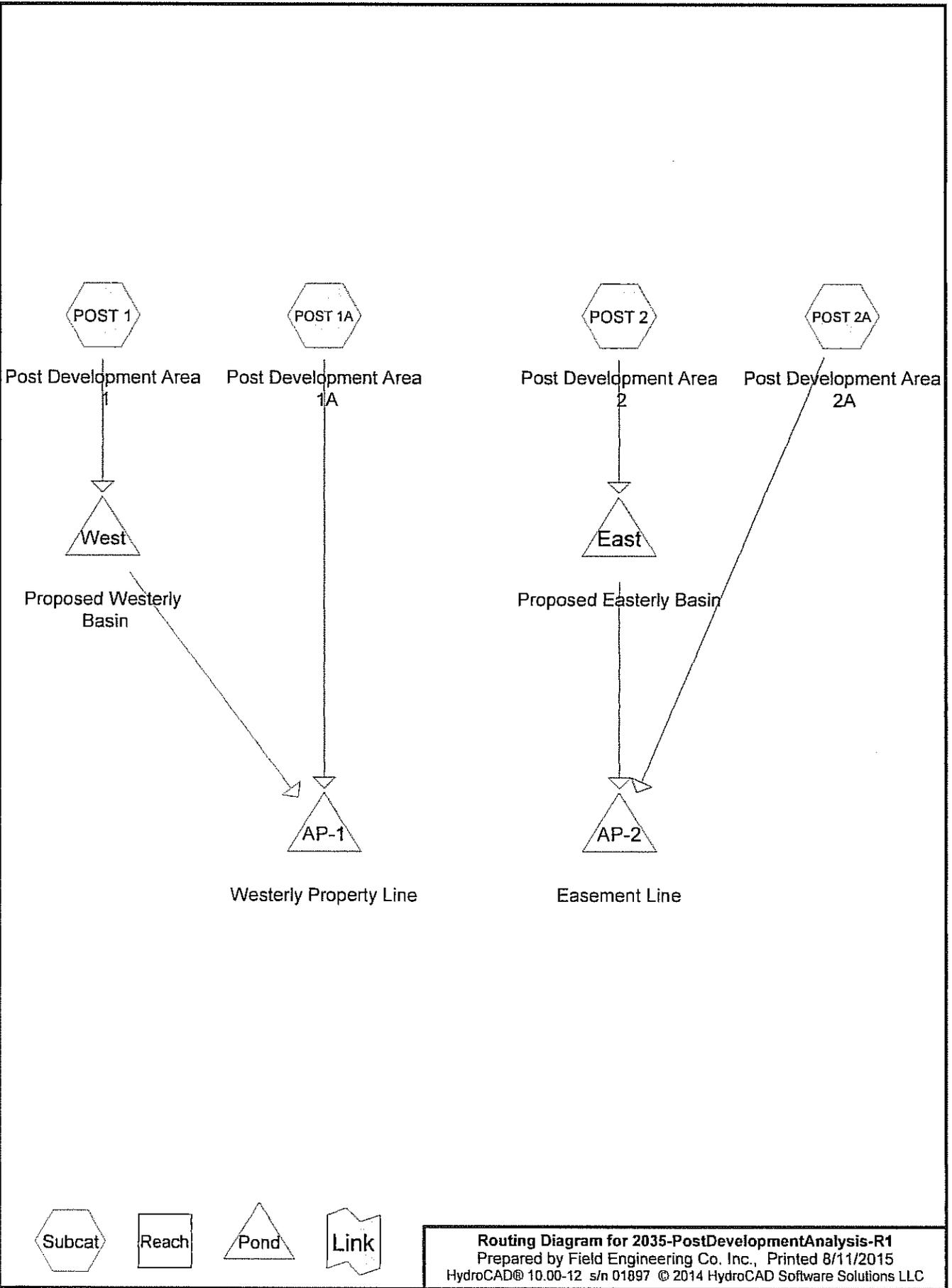
Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Pond AP-2: Easement Line



Section 3

Post Development Hydrologic Analysis



2035-PostDevelopmentAnalysis-R1

Type III 24-hr 2 YR-Cornell Rainfall=3.24"

Prepared by Field Engineering Co. Inc.

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Page 2

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment POST 1: Post Runoff Area=177,668 sf 30.91% Impervious Runoff Depth>1.57"
 Flow Length=800' Tc=12.4 min CN=82 Runoff=6.07 cfs 0.532 af

Subcatchment POST 1A: Post Development Runoff Area=11,953 sf 0.00% Impervious Runoff Depth>1.06"
 Tc=6.0 min CN=74 Runoff=0.33 cfs 0.024 af

Subcatchment POST 2: Post Runoff Area=146,510 sf 27.76% Impervious Runoff Depth>1.36"
 Flow Length=600' Tc=12.5 min UI Adjusted CN=79 Runoff=4.29 cfs 0.382 af

Subcatchment POST 2A: Post Development Runoff Area=15,851 sf 0.00% Impervious Runoff Depth>1.06"
 Tc=6.0 min CN=74 Runoff=0.43 cfs 0.032 af

Pond AP-1: Westerly Property Line Inflow=1.75 cfs 0.536 af
 Primary=1.75 cfs 0.536 af

Pond AP-2: Easement Line Inflow=1.45 cfs 0.401 af
 Primary=1.45 cfs 0.401 af

Pond East: Proposed Easterly Basin Peak Elev=188.35' Storage=5,351 cf Inflow=4.29 cfs 0.382 af
 Primary=1.34 cfs 0.368 af Secondary=0.00 cfs 0.000 af Outflow=1.34 cfs 0.368 af

Pond West: Proposed Westerly Basin Peak Elev=162.34' Storage=8,177 cf Inflow=6.07 cfs 0.532 af
 Primary=1.69 cfs 0.511 af Secondary=0.00 cfs 0.000 af Outflow=1.69 cfs 0.511 af

Total Runoff Area = 8.080 ac Runoff Volume = 0.971 af Average Runoff Depth = 1.44"
72.84% Pervious = 5.886 ac 27.16% Impervious = 2.194 ac

Summary for Subcatchment POST 1: Post Development Area 1

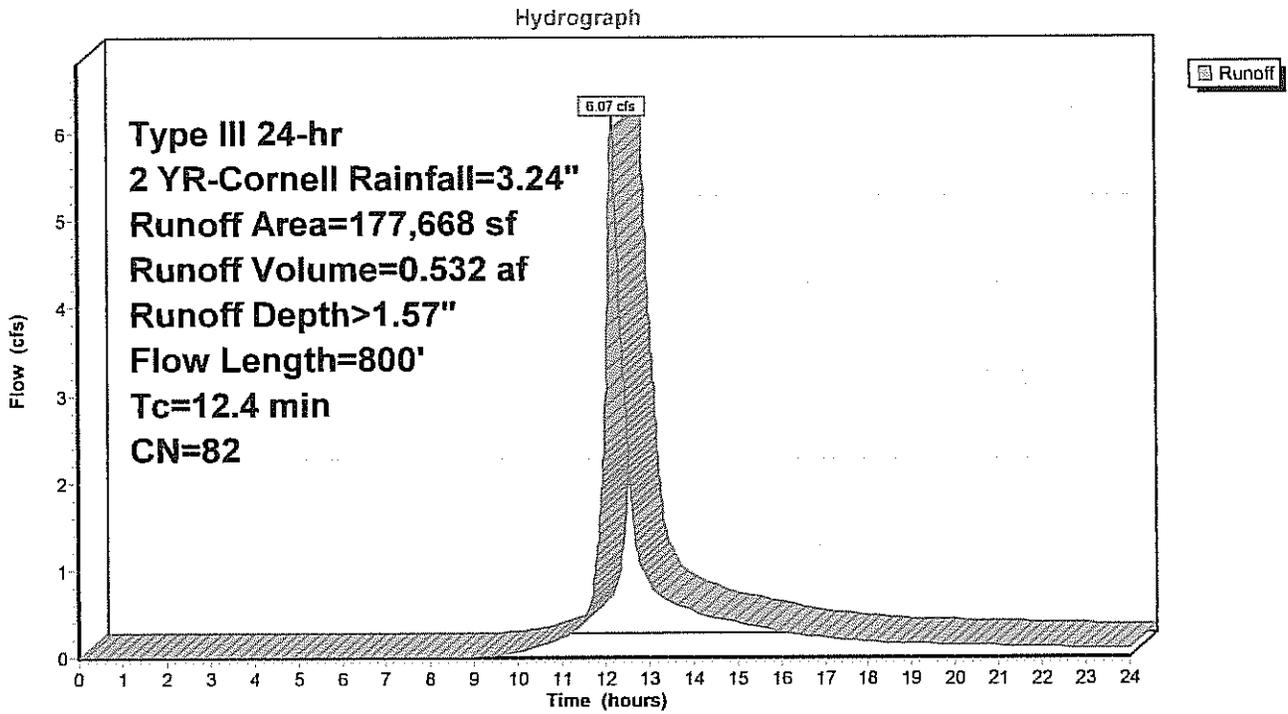
Runoff = 6.07 cfs @ 12.17 hrs, Volume= 0.532 af, Depth> 1.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2 YR-Cornell Rainfall=3.24"

Area (sf)	CN	Description
13,060	89	Gravel roads, HSG C
8,168	72	Woods/grass comb., Good, HSG C
101,525	74	Pasture/grassland/range, Good, HSG C
54,087	98	Unconnected pavement, HSG C
* 828	98	Concrete Equipment Pads
177,668	82	Weighted Average
122,753		69.09% Pervious Area
54,915		30.91% Impervious Area
54,087		98.49% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.24"
2.5	350	0.1100	2.32		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
0.6	400	0.1200	11.99	4.19	Pipe Channel, C-D 8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.013 Corrugated PE, smooth interior
12.4	800	Total			

Subcatchment POST 1: Post Development Area 1



Summary for Subcatchment POST 1A: Post Development Area 1A

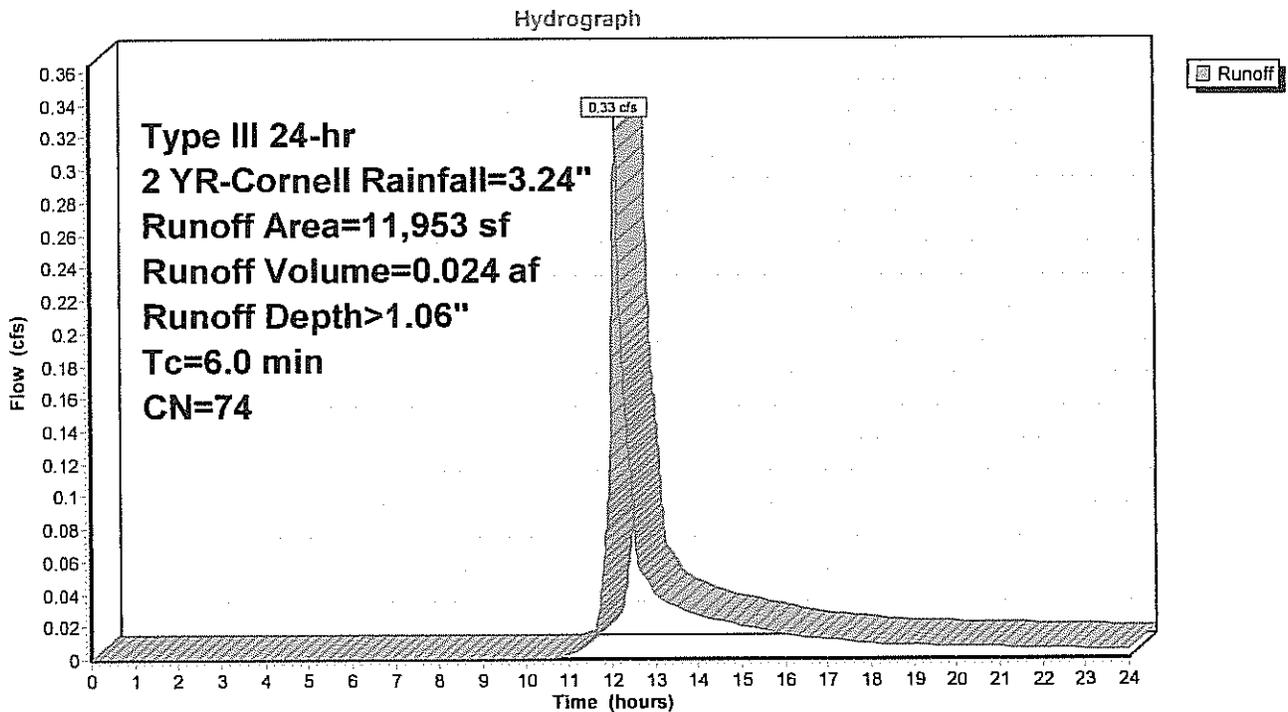
Runoff = 0.33 cfs @ 12.10 hrs, Volume= 0.024 af, Depth> 1.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2 YR-Cornell Rainfall=3.24"

Area (sf)	CN	Description
285	89	Gravel roads, HSG C
11,668	74	>75% Grass cover, Good, HSG C
11,953	74	Weighted Average
11,953		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Assume 6.0 Minutes-Min Tc

Subcatchment POST 1A: Post Development Area 1A



Summary for Subcatchment POST 2: Post Development Area 2

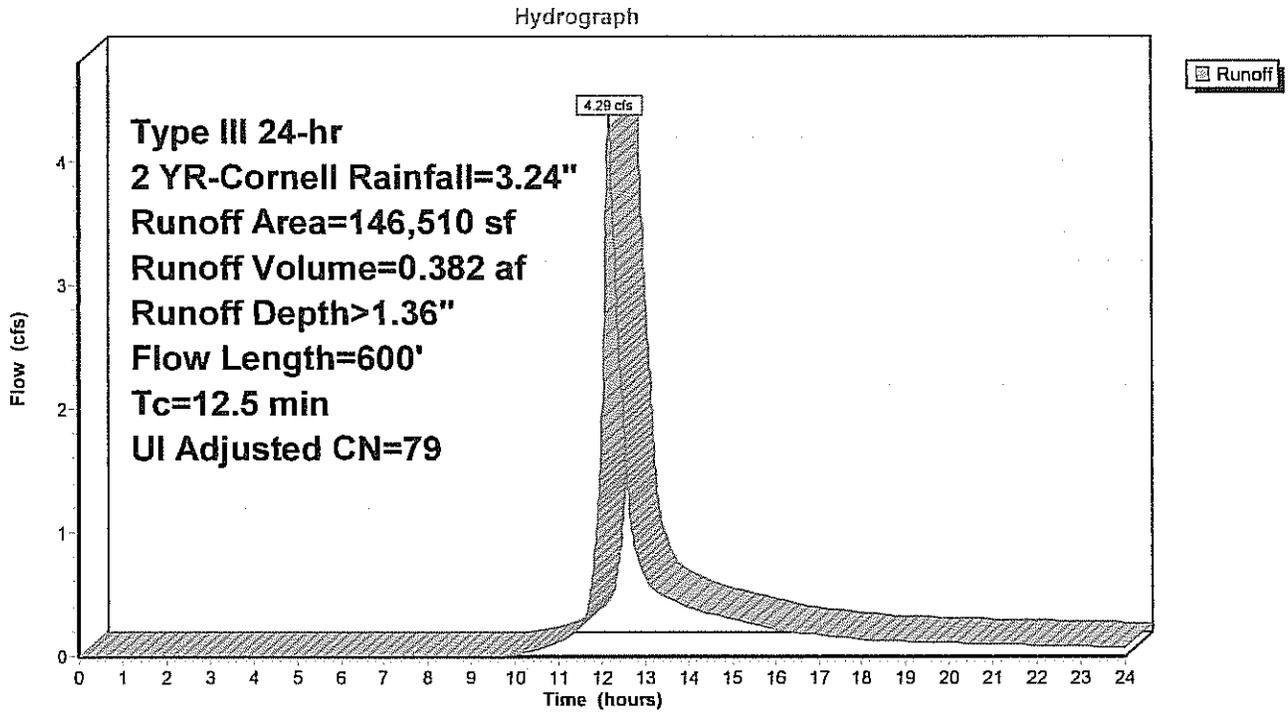
Runoff = 4.29 cfs @ 12.18 hrs, Volume= 0.382 af, Depth> 1.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR-Cornell Rainfall=3.24"

Area (sf)	CN	Adj	Description
82,761	74		Pasture/grassland/range, Good, HSG C
* 40,677	98		Unconnected pavement, HSG C (Panels)
16,922	89		Gravel roads, HSG C
6,150	70		Woods, Good, HSG C
146,510	82	79	Weighted Average, UI Adjusted
105,833			72.24% Pervious Area
40,677			27.76% Impervious Area
40,677			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.24"
2.9	350	0.0850	2.04		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
0.3	200	0.1400	12.95	4.52	Pipe Channel, C-D 8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.013 Corrugated PE, smooth interior
12.5	600	Total			

Subcatchment POST 2: Post Development Area 2



Summary for Subcatchment POST 2A: Post Development Area 2A

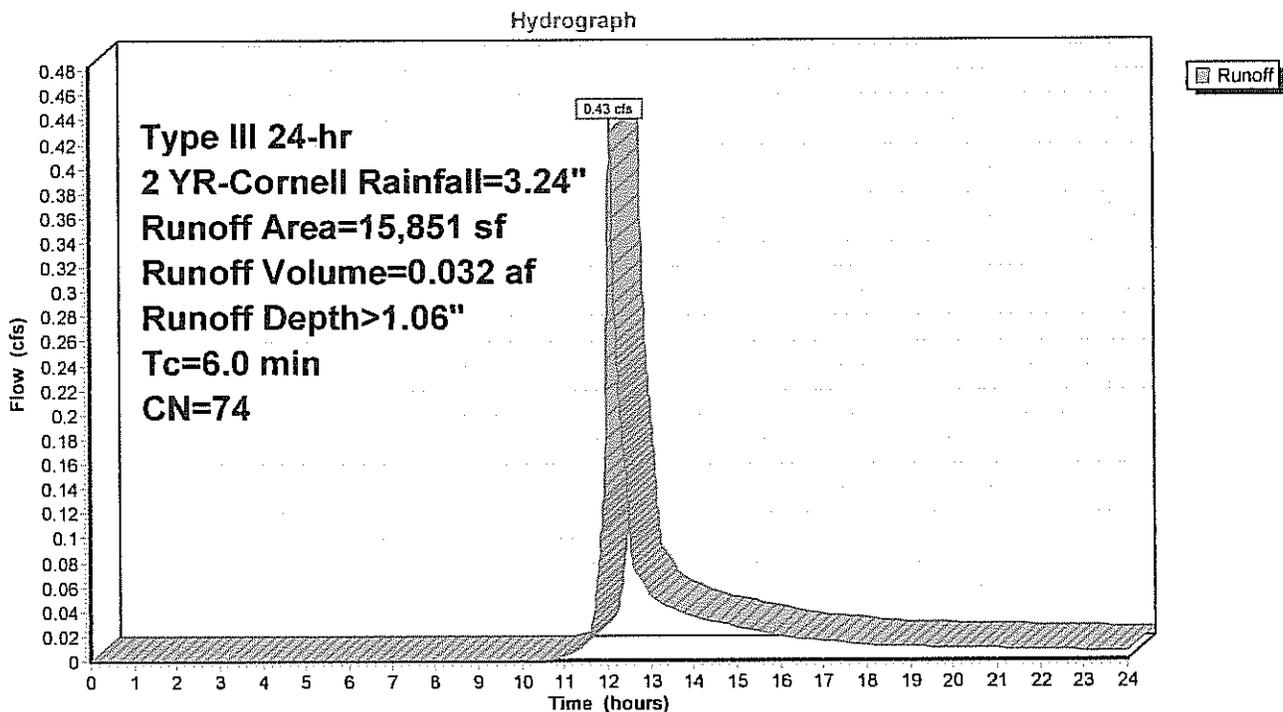
Runoff = 0.43 cfs @ 12.10 hrs, Volume= 0.032 af, Depth> 1.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2 YR-Cornell Rainfall=3.24"

Area (sf)	CN	Description
15,851	74	>75% Grass cover, Good, HSG C
15,851		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Assume 6.0 Minutes-Min Tc

Subcatchment POST 2A: Post Development Area 2A



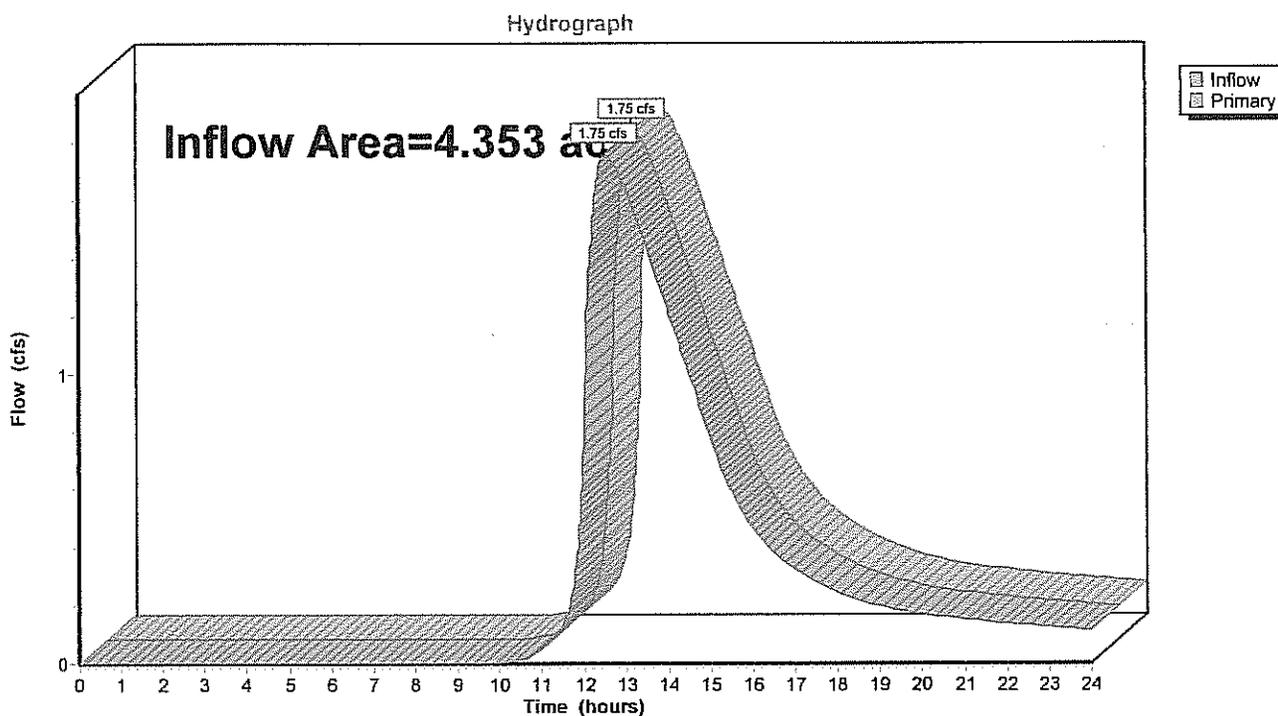
Summary for Pond AP-1: Westerly Property Line

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

Inflow Area = 4.353 ac, 28.96% Impervious, Inflow Depth > 1.48" for 2 YR-Cornell event
Inflow = 1.75 cfs @ 12.51 hrs, Volume= 0.536 af
Primary = 1.75 cfs @ 12.51 hrs, Volume= 0.536 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Pond AP-1: Westerly Property Line



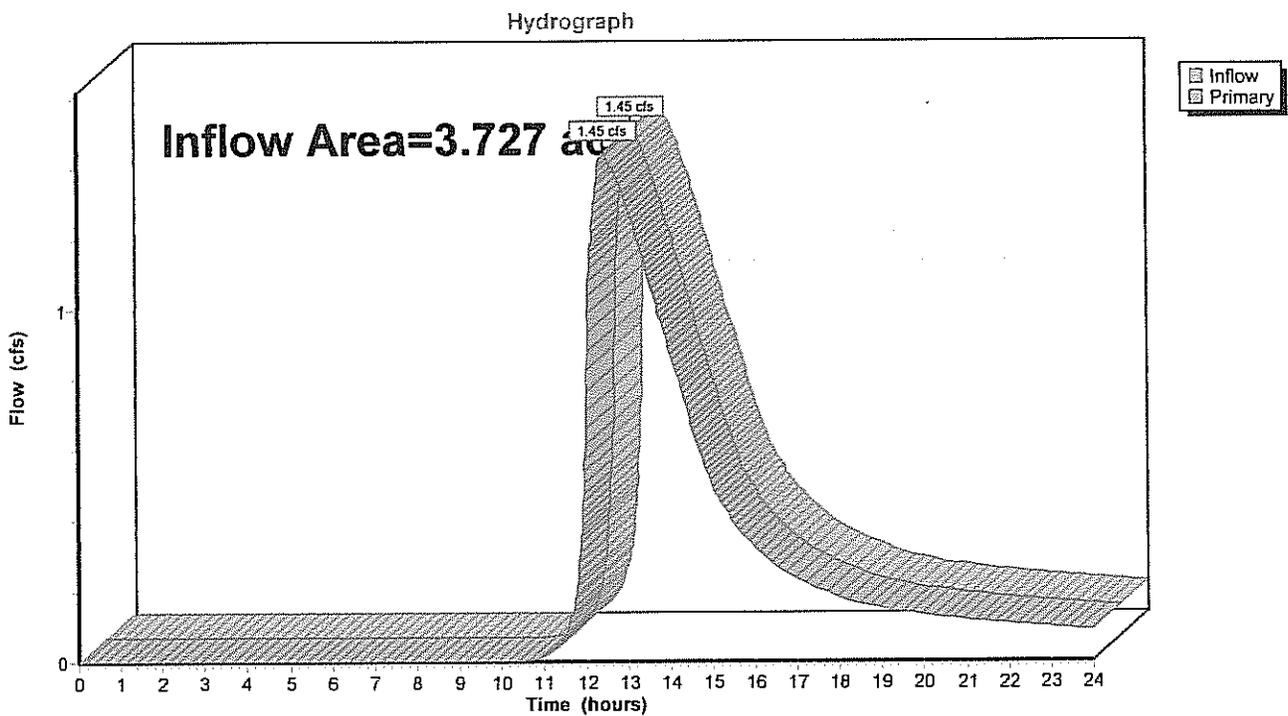
Summary for Pond AP-2: Easement Line

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

Inflow Area = 3.727 ac, 25.05% Impervious, Inflow Depth > 1.29" for 2 YR-Cornell event
Inflow = 1.45 cfs @ 12.46 hrs, Volume= 0.401 af
Primary = 1.45 cfs @ 12.46 hrs, Volume= 0.401 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Pond AP-2: Easement Line



Summary for Pond East: Proposed Easterly Basin

Inflow Area = 3.363 ac, 27.76% Impervious, Inflow Depth > 1.36" for 2 YR-Cornell event
 Inflow = 4.29 cfs @ 12.18 hrs, Volume= 0.382 af
 Outflow = 1.34 cfs @ 12.61 hrs, Volume= 0.368 af, Atten= 69%, Lag= 26.0 min
 Primary = 1.34 cfs @ 12.61 hrs, Volume= 0.368 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 4
 Peak Elev= 188.35' @ 12.61 hrs Surf.Area= 4,608 sf Storage= 5,351 cf

Plug-Flow detention time= 67.0 min calculated for 0.368 af (96% of inflow)
 Center-of-Mass det. time= 47.5 min (897.1 - 849.6)

Volume #1	Invert 187.00'	Avail.Storage 14,321 cf	Storage Description
Custom Stage Data (Prismatic) Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
187.00	3,324	0	0
188.00	4,259	3,792	3,792
189.00	5,250	4,755	8,546
190.00	6,299	5,775	14,321

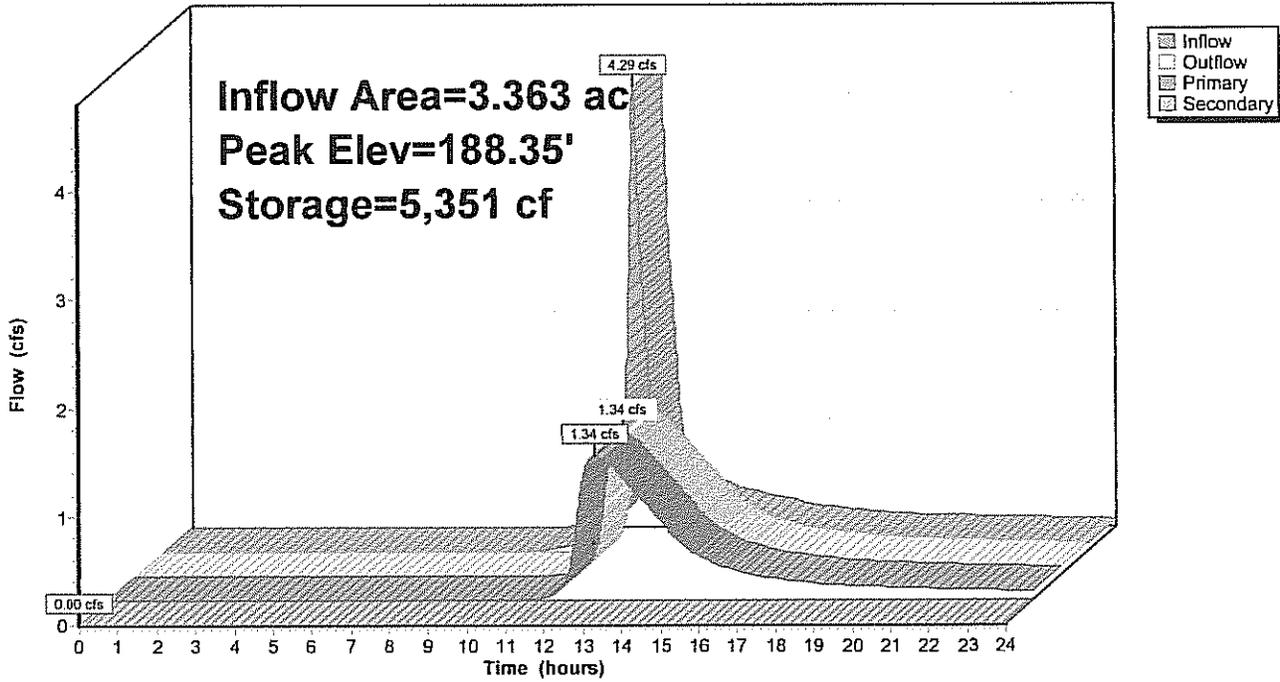
Device	Routing	Invert	Outlet Devices
#1	Primary	187.00'	8.0" Round Culvert L= 35.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 187.00' / 185.00' S= 0.0571 ' /' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Secondary	188.75'	15.0' long x 5.0' breadth Broad-Crested 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=1.34 cfs @ 12.61 hrs HW=188.35' (Free Discharge)
 ↑1=Culvert (Inlet Controls 1.34 cfs @ 3.84 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=187.00' (Free Discharge)
 ↑2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond East: Proposed Easterly Basin

Hydrograph



Summary for Pond West: Proposed Westerly Basin

Inflow Area = 4.079 ac, 30.91% Impervious, Inflow Depth > 1.57" for 2 YR-Cornell event
 Inflow = 6.07 cfs @ 12.17 hrs, Volume= 0.532 af
 Outflow = 1.69 cfs @ 12.63 hrs, Volume= 0.511 af, Atten= 72%, Lag= 27.3 min
 Primary = 1.69 cfs @ 12.63 hrs, Volume= 0.511 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 162.34' @ 12.63 hrs Surf.Area= 7,221 sf Storage= 8,177 cf

Plug-Flow detention time= 79.1 min calculated for 0.511 af (96% of inflow)
 Center-of-Mass det. time= 57.5 min (897.5 - 840.0)

Volume	Invert	Avail.Storage	Storage Description
#1	161.00'	33,550 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
161.00	4,989	0	0
162.00	6,639	5,814	5,814
163.00	8,345	7,492	13,306
164.00	10,108	9,227	22,533
165.00	11,927	11,018	33,550

Device	Routing	Invert	Outlet Devices
#1	Primary	160.00'	12.0" Round Culvert L= 40.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 160.00' / 157.00' S= 0.0750 ' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#2	Device 1	161.00'	8.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	162.90'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Secondary	164.25'	5.0' long x 5.0' 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=1.69 cfs @ 12.63 hrs HW=162.34' (Free Discharge)

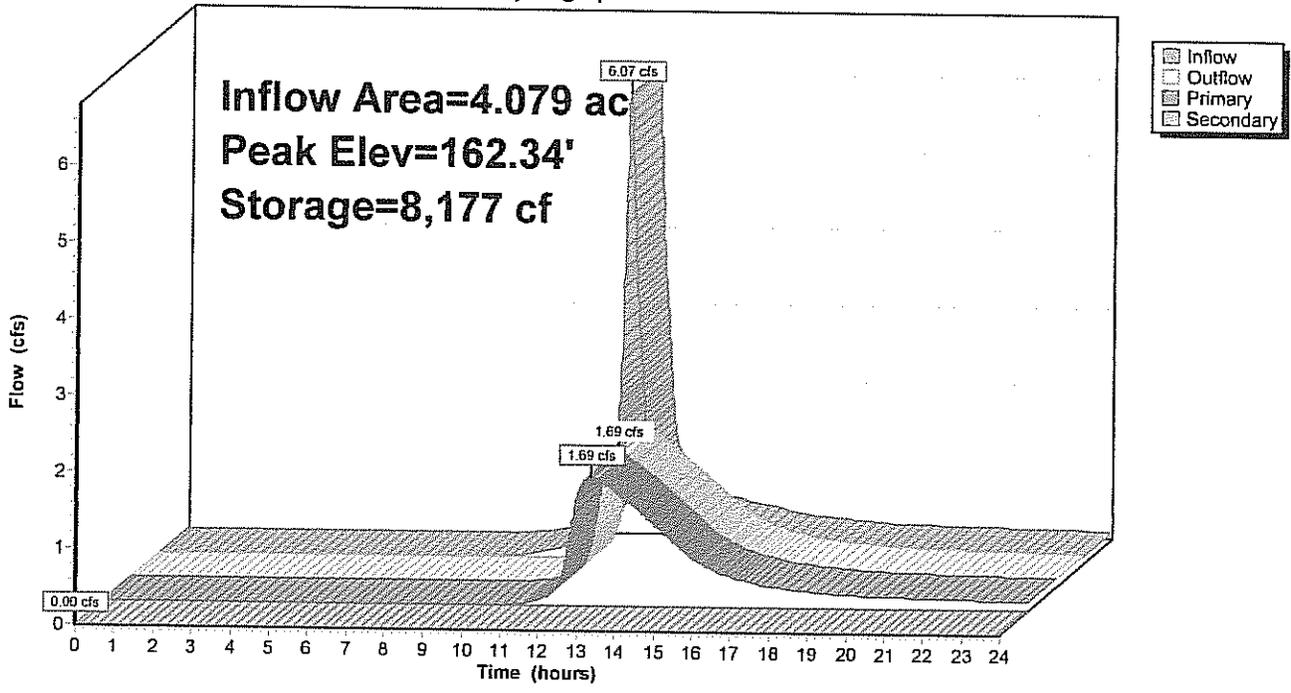
- ↑ 1=Culvert (Passes 1.69 cfs of 4.05 cfs potential flow)
- ↑ 2=Orifice/Grate (Orifice Controls 1.69 cfs @ 4.83 fps)
- ↑ 3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=161.00' (Free Discharge)

- ↑ 4=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond West: Proposed Westerly Basin

Hydrograph



2035-PostDevelopmentAnalysis-R1

Type III 24-hr 10 YR-Cornell Rainfall=4.89"

Prepared by Field Engineering Co. Inc.

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment POST 1: Post Runoff Area=177,668 sf 30.91% Impervious Runoff Depth>2.97"
Flow Length=800' Tc=12.4 min CN=82 Runoff=11.57 cfs 1.011 af

Subcatchment POST 1A: Post Development Runoff Area=11,953 sf 0.00% Impervious Runoff Depth>2.27"
Tc=6.0 min CN=74 Runoff=0.73 cfs 0.052 af

Subcatchment POST 2: Post Runoff Area=146,510 sf 27.76% Impervious Runoff Depth>2.70"
Flow Length=600' Tc=12.5 min UI Adjusted CN=79 Runoff=8.64 cfs 0.757 af

Subcatchment POST 2A: Post Development Runoff Area=15,851 sf 0.00% Impervious Runoff Depth>2.27"
Tc=6.0 min CN=74 Runoff=0.97 cfs 0.069 af

Pond AP-1: Westerly Property Line Inflow=4.78 cfs 1.035 af
Primary=4.78 cfs 1.035 af

Pond AP-2: Easement Line Inflow=6.38 cfs 0.808 af
Primary=6.38 cfs 0.808 af

Pond East: Proposed Easterly Basin Peak Elev=188.99' Storage=8,506 cf Inflow=8.64 cfs 0.757 af
Primary=1.71 cfs 0.624 af Secondary=4.25 cfs 0.115 af Outflow=5.96 cfs 0.739 af

Pond West: Proposed Westerly Basin Peak Elev=163.22' Storage=15,151 cf Inflow=11.57 cfs 1.011 af
Primary=4.60 cfs 0.983 af Secondary=0.00 cfs 0.000 af Outflow=4.60 cfs 0.983 af

Total Runoff Area = 8.080 ac Runoff Volume = 1.889 af Average Runoff Depth = 2.80"
72.84% Pervious = 5.886 ac 27.16% Impervious = 2.194 ac

Summary for Subcatchment POST 1: Post Development Area 1

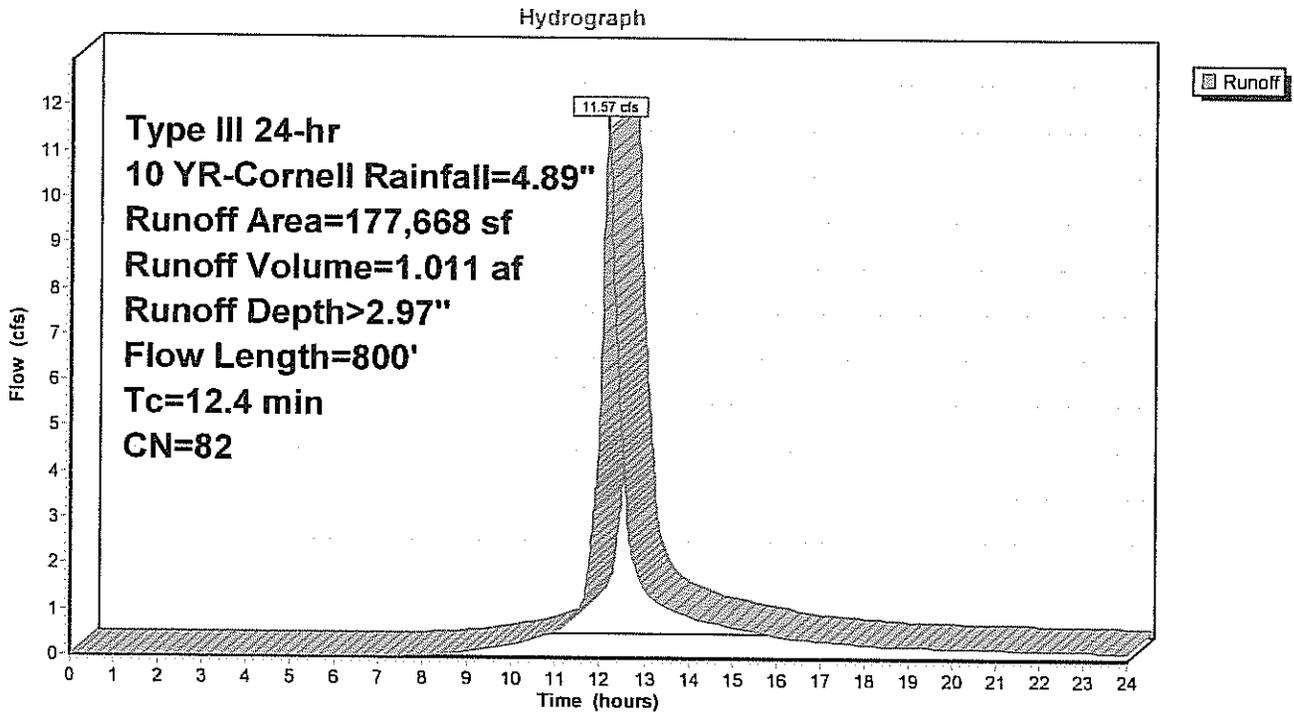
Runoff = 11.57 cfs @ 12.17 hrs, Volume= 1.011 af, Depth> 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR-Cornell Rainfall=4.89"

Area (sf)	CN	Description
13,060	89	Gravel roads, HSG C
8,168	72	Woods/grass comb., Good, HSG C
101,525	74	Pasture/grassland/range, Good, HSG C
54,087	98	Unconnected pavement, HSG C
* 828	98	Concrete Equipment Pads
177,668	82	Weighted Average
122,753		69.09% Pervious Area
54,915		30.91% Impervious Area
54,087		98.49% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		Sheet Flow, A-B
					Woods: Light underbrush n= 0.400 P2= 3.24"
2.5	350	0.1100	2.32		Shallow Concentrated Flow, B-C
					Short Grass Pasture Kv= 7.0 fps
0.6	400	0.1200	11.99	4.19	Pipe Channel, C-D
					8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17'
					n= 0.013 Corrugated PE, smooth interior
12.4	800	Total			

Subcatchment POST 1: Post Development Area 1



Summary for Subcatchment POST 1A: Post Development Area 1A

Runoff = 0.73 cfs @ 12.09 hrs, Volume= 0.052 af, Depth> 2.27"

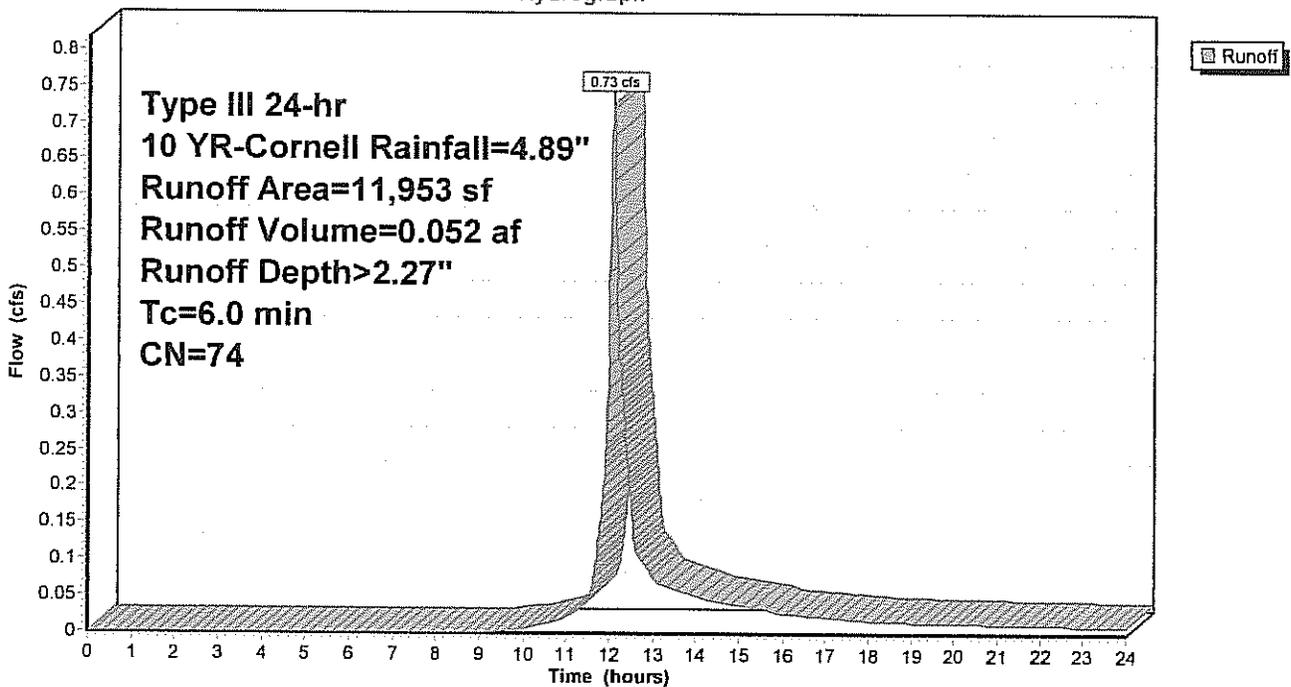
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10 YR-Cornell Rainfall=4.89"

Area (sf)	CN	Description
285	89	Gravel roads, HSG C
11,668	74	>75% Grass cover, Good, HSG C
11,953	74	Weighted Average
11,953		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Assume 6.0 Minutes-Min Tc

Subcatchment POST 1A: Post Development Area 1A

Hydrograph



Summary for Subcatchment POST 2: Post Development Area 2

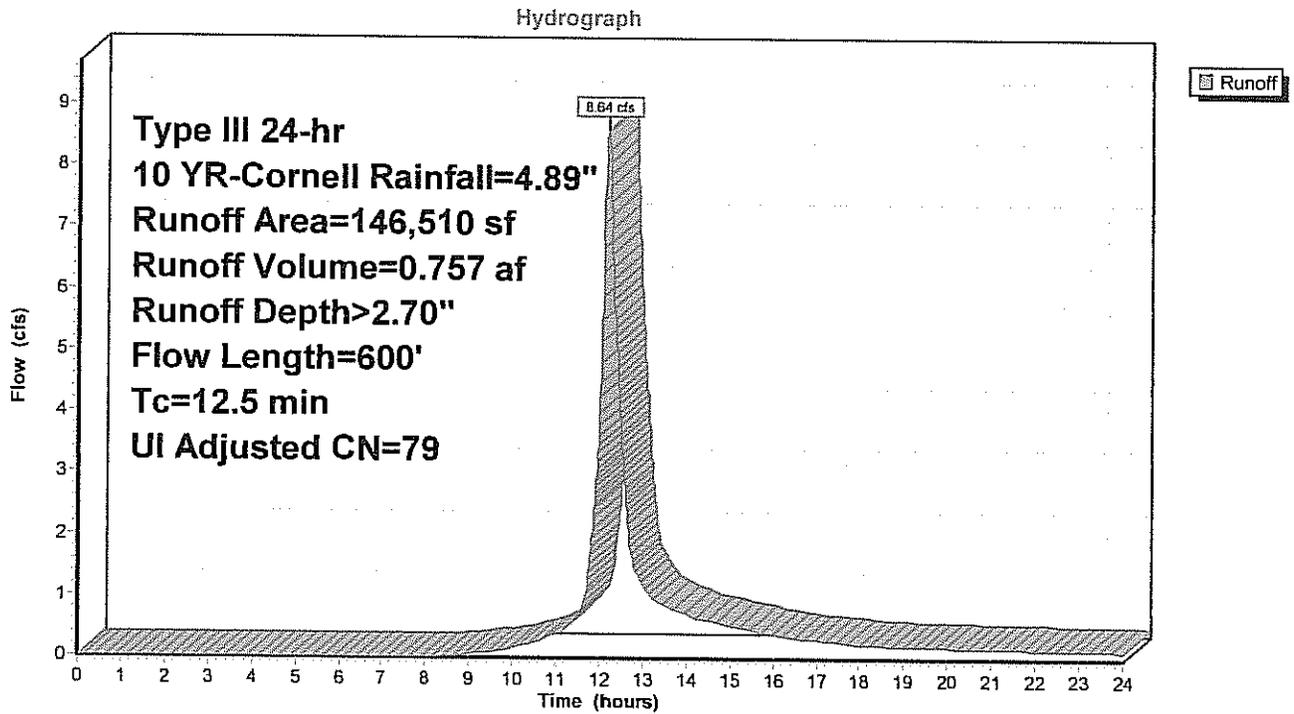
Runoff = 8.64 cfs @ 12.17 hrs, Volume= 0.757 af, Depth> 2.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10 YR-Cornell Rainfall=4.89"

Area (sf)	CN	Adj	Description
82,761	74		Pasture/grassland/range, Good, HSG C
* 40,677	98		Unconnected pavement, HSG C (Panels)
16,922	89		Gravel roads, HSG C
6,150	70		Woods, Good, HSG C
146,510	82	79	Weighted Average, UI Adjusted
105,833			72.24% Pervious Area
40,677			27.76% Impervious Area
40,677			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.24"
2.9	350	0.0850	2.04		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
0.3	200	0.1400	12.95	4.52	Pipe Channel, C-D 8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.013 Corrugated PE, smooth interior
12.5	600	Total			

Subcatchment POST 2: Post Development Area 2



Summary for Subcatchment POST 2A: Post Development Area 2A

Runoff = 0.97 cfs @ 12.09 hrs, Volume= 0.069 af, Depth> 2.27"

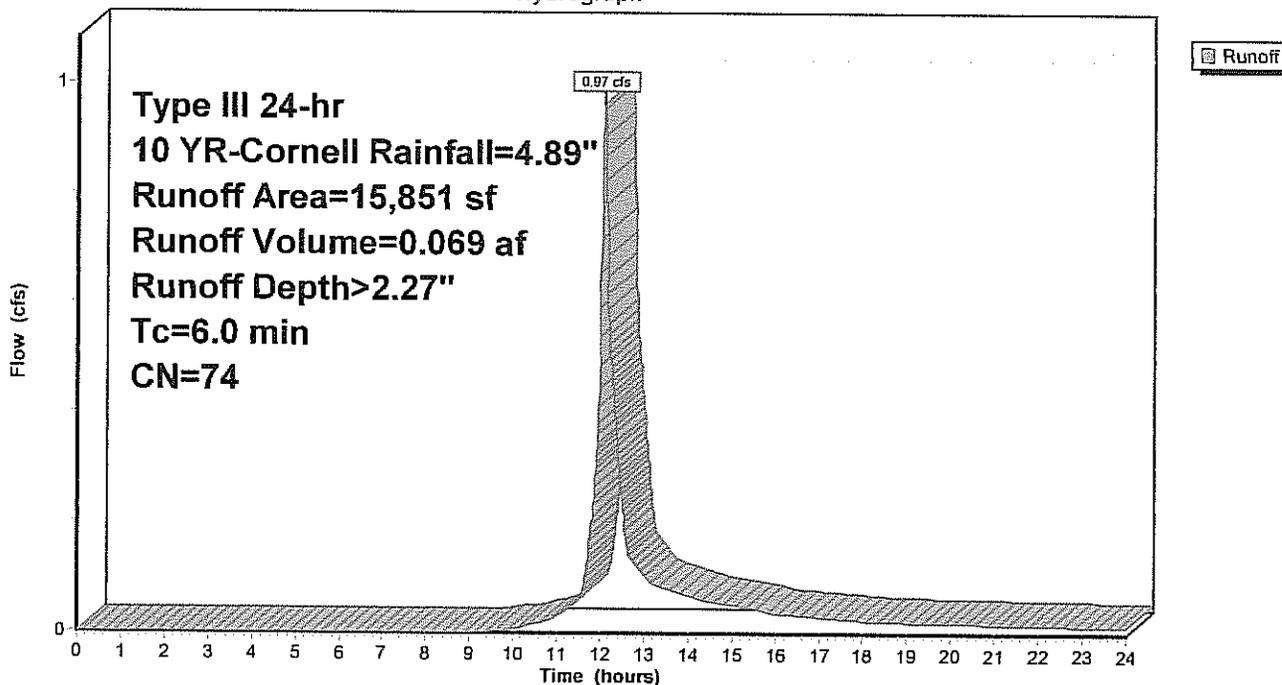
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10 YR-Cornell Rainfall=4.89"

Area (sf)	CN	Description
15,851	74	>75% Grass cover, Good, HSG C
15,851		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Assume 6.0 Minutes-Min Tc

Subcatchment POST 2A: Post Development Area 2A

Hydrograph



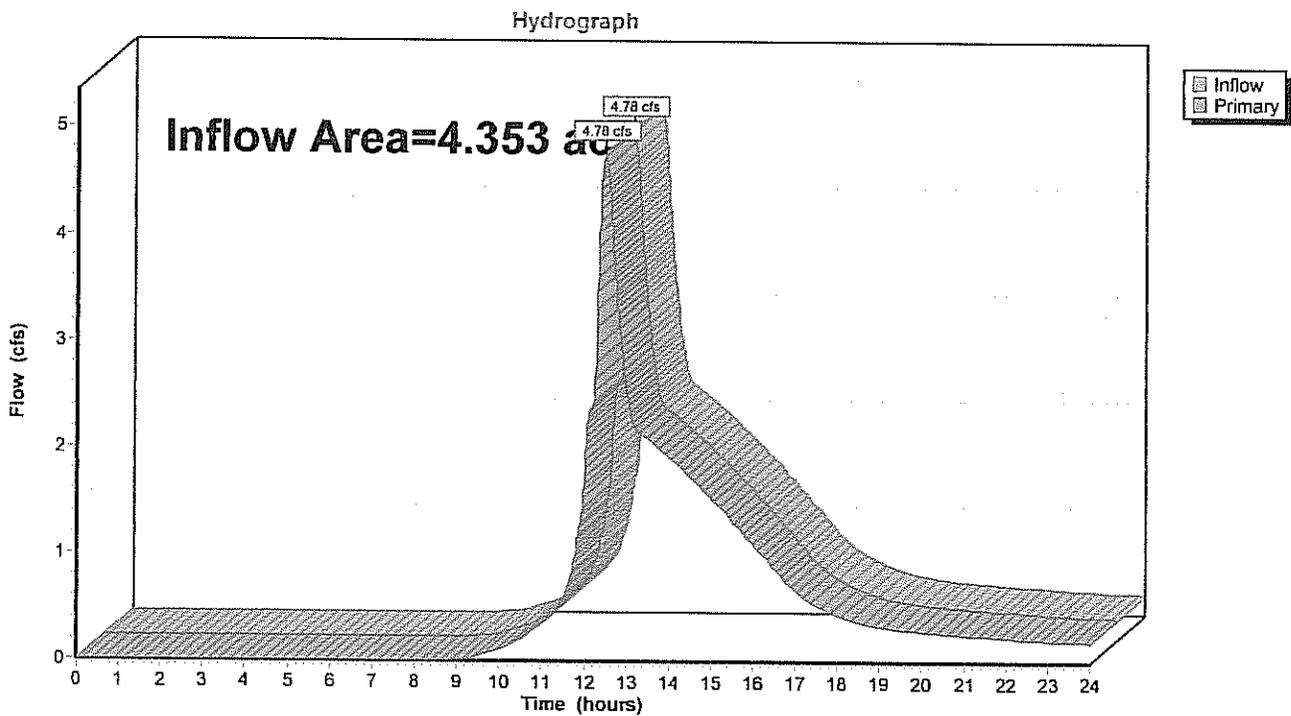
Summary for Pond AP-1: Westerly Property Line

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

Inflow Area = 4.353 ac, 28.96% Impervious, Inflow Depth > 2.85" for 10 YR-Cornell event
Inflow = 4.78 cfs @ 12.50 hrs, Volume= 1.035 af
Primary = 4.78 cfs @ 12.50 hrs, Volume= 1.035 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Pond AP-1: Westerly Property Line



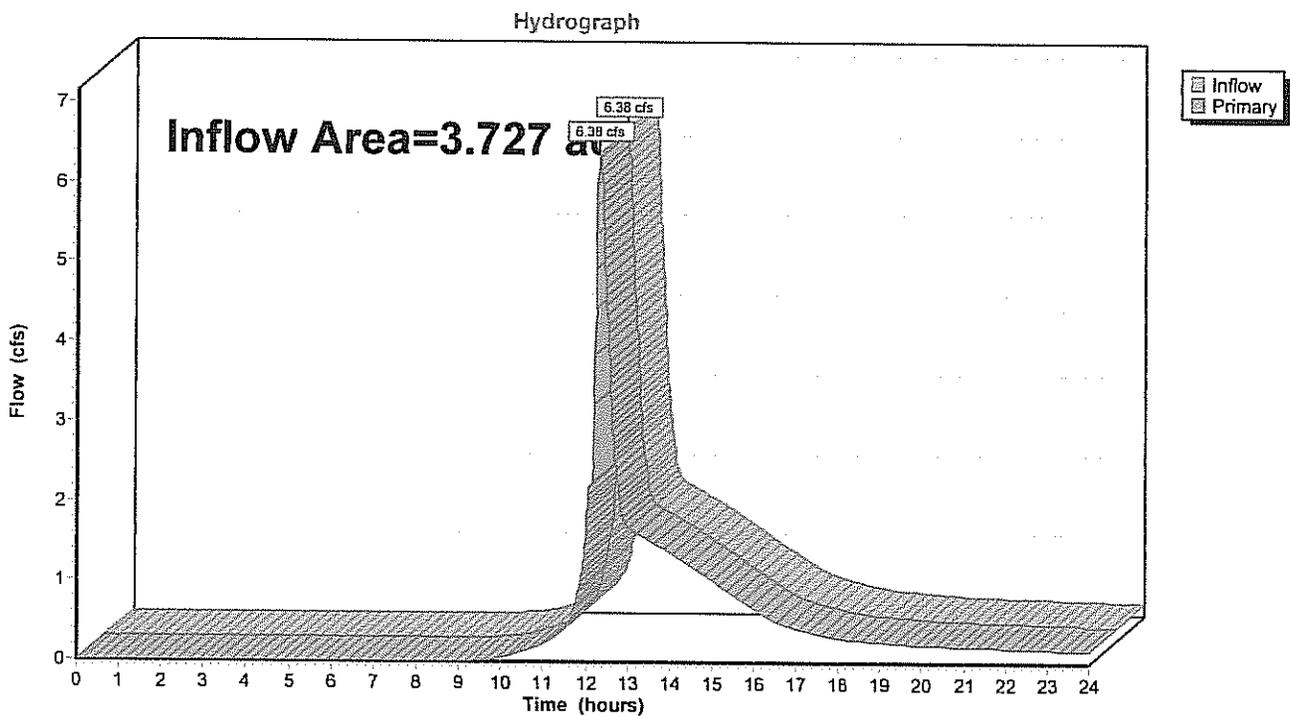
Summary for Pond AP-2: Easement Line

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

Inflow Area = 3.727 ac, 25.05% Impervious, Inflow Depth > 2.60" for 10 YR-Cornell event
Inflow = 6.38 cfs @ 12.32 hrs, Volume= 0.808 af
Primary = 6.38 cfs @ 12.32 hrs, Volume= 0.808 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Pond AP-2: Easement Line



Summary for Pond East: Proposed Easterly Basin

Inflow Area = 3.363 ac, 27.76% Impervious, Inflow Depth > 2.70" for 10 YR-Cornell event
 Inflow = 8.64 cfs @ 12.17 hrs, Volume= 0.757 af
 Outflow = 5.96 cfs @ 12.32 hrs, Volume= 0.739 af, Atten= 31%, Lag= 8.9 min
 Primary = 1.71 cfs @ 12.32 hrs, Volume= 0.624 af
 Secondary = 4.25 cfs @ 12.32 hrs, Volume= 0.115 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 4
 Peak Elev= 188.99' @ 12.32 hrs Surf.Area= 5,243 sf Storage= 8,506 cf

Plug-Flow detention time= 57.6 min calculated for 0.739 af (98% of inflow)
 Center-of-Mass det. time= 43.9 min (873.9 - 829.9)

Volume	Invert	Avail.Storage	Storage Description
#1	187.00'	14,321 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
187.00	3,324	0	0
188.00	4,259	3,792	3,792
189.00	5,250	4,755	8,546
190.00	6,299	5,775	14,321

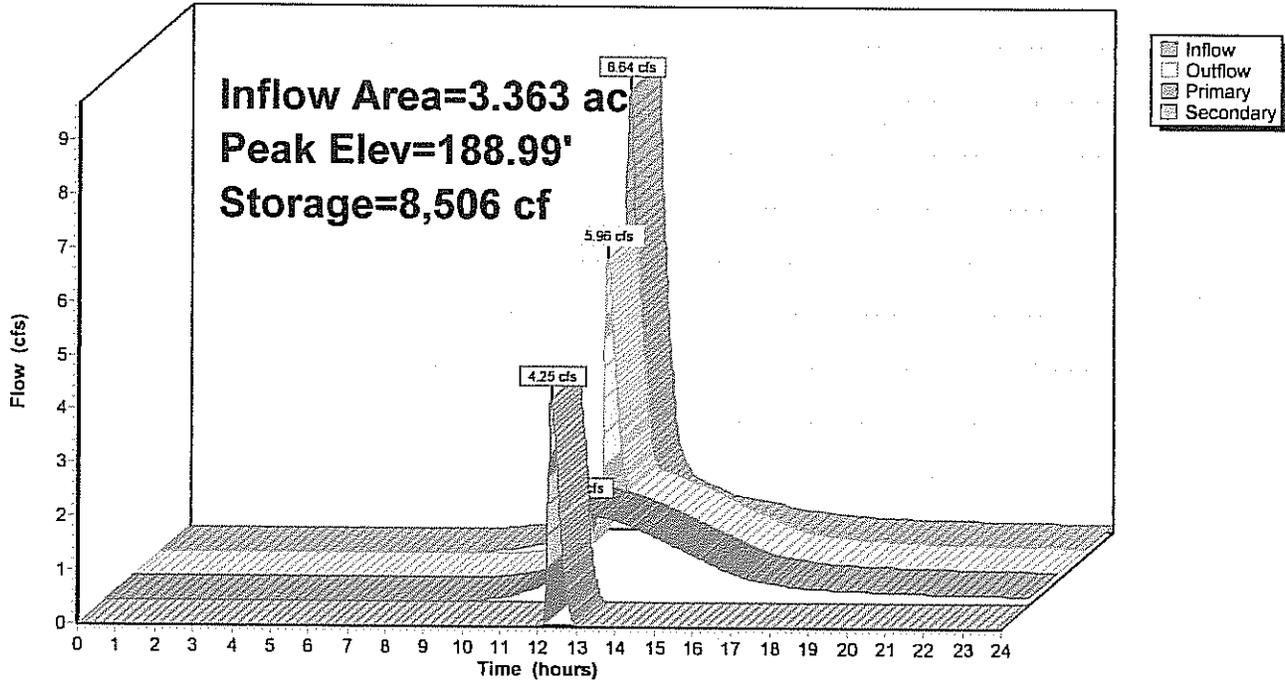
Device	Routing	Invert	Outlet Devices
#1	Primary	187.00'	8.0" Round Culvert L= 35.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 187.00' / 185.00' S= 0.0571 ' / Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Secondary	188.75'	15.0' long x 5.0' breadth Broad-Crested 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=1.71 cfs @ 12.32 hrs HW=188.99' (Free Discharge)
 ↑1=Culvert (Inlet Controls 1.71 cfs @ 4.90 fps)

Secondary OutFlow Max=4.25 cfs @ 12.32 hrs HW=188.99' (Free Discharge)
 ↑2=Broad-Crested Rectangular Weir (Weir Controls 4.25 cfs @ 1.17 fps)

Pond East: Proposed Easterly Basin

Hydrograph



Summary for Pond West: Proposed Westerly Basin

Inflow Area = 4.079 ac, 30.91% Impervious, Inflow Depth > 2.97" for 10 YR-Cornell event
 Inflow = 11.57 cfs @ 12.17 hrs, Volume= 1.011 af
 Outflow = 4.60 cfs @ 12.51 hrs, Volume= 0.983 af, Atten= 60%, Lag= 20.5 min
 Primary = 4.60 cfs @ 12.51 hrs, Volume= 0.983 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 163.22' @ 12.51 hrs Surf.Area= 8,726 sf Storage= 15,151 cf

Plug-Flow detention time= 78.0 min calculated for 0.983 af (97% of inflow)
 Center-of-Mass det. time= 62.3 min (884.0 - 821.7)

Volume	Invert	Avail.Storage	Storage Description
#1	161.00'	33,550 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
161.00	4,989	0	0
162.00	6,639	5,814	5,814
163.00	8,345	7,492	13,306
164.00	10,108	9,227	22,533
165.00	11,927	11,018	33,550

Device	Routing	Invert	Outlet Devices
#1	Primary	160.00'	12.0" Round Culvert L= 40.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 160.00' / 157.00' S= 0.0750 '/ Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#2	Device 1	161.00'	8.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	162.90'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Secondary	164.25'	5.0' long x 5.0' 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=4.59 cfs @ 12.51 hrs HW=163.22' (Free Discharge)

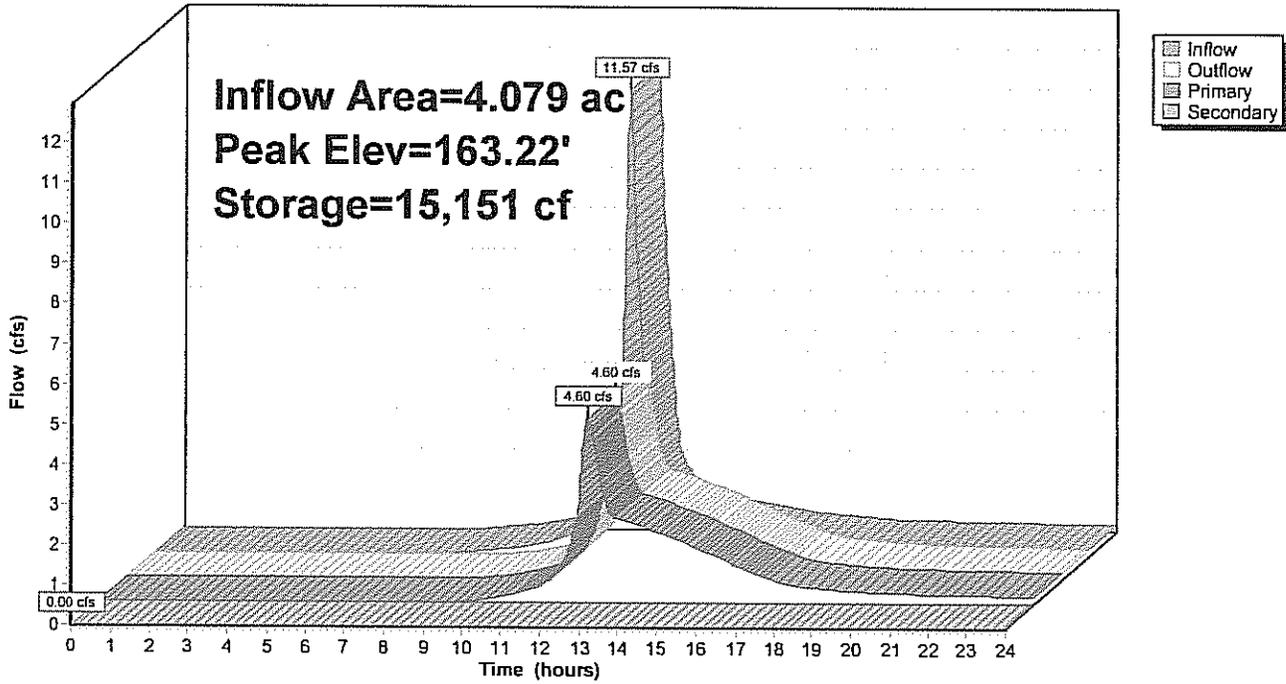
- ↑ 1=Culvert (Passes 4.59 cfs of 4.92 cfs potential flow)
- ↑ 2=Orifice/Grate (Orifice Controls 2.31 cfs @ 6.61 fps)
- ↑ 3=Sharp-Crested Rectangular Weir (Weir Controls 2.29 cfs @ 1.84 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=161.00' (Free Discharge)

- ↑ 4=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond West: Proposed Westerly Basin

Hydrograph



2035-PostDevelopmentAnalysis-R1

Type III 24-hr 25 YR-Cornell Rainfall=6.18"

Prepared by Field Engineering Co. Inc.

Printed 8/11/2015

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment POST 1: Post Runoff Area=177,668 sf 30.91% Impervious Runoff Depth>4.14"
Flow Length=800' Tc=12.4 min CN=82 Runoff=16.02 cfs 1.408 af

Subcatchment POST 1A: Post Development Runoff Area=11,953 sf 0.00% Impervious Runoff Depth>3.33"
Tc=6.0 min CN=74 Runoff=1.07 cfs 0.076 af

Subcatchment POST 2: Post Runoff Area=146,510 sf 27.76% Impervious Runoff Depth>3.83"
Flow Length=600' Tc=12.5 min UI Adjusted CN=79 Runoff=12.24 cfs 1.074 af

Subcatchment POST 2A: Post Development Runoff Area=15,851 sf 0.00% Impervious Runoff Depth>3.33"
Tc=6.0 min CN=74 Runoff=1.42 cfs 0.101 af

Pond AP-1: Westerly Property Line Inflow=5.73 cfs 1.453 af
Primary=5.73 cfs 1.453 af

Pond AP-2: Easement Line Inflow=11.75 cfs 1.154 af
Primary=11.75 cfs 1.154 af

Pond East: Proposed Easterly Basin Peak Elev=189.14' Storage=9,305 cf Inflow=12.24 cfs 1.074 af
Primary=1.78 cfs 0.776 af Secondary=9.21 cfs 0.277 af Outflow=11.00 cfs 1.053 af

Pond West: Proposed Westerly Basin Peak Elev=163.81' Storage=20,644 cf Inflow=16.02 cfs 1.408 af
Primary=5.43 cfs 1.377 af Secondary=0.00 cfs 0.000 af Outflow=5.43 cfs 1.377 af

Total Runoff Area = 8.080 ac Runoff Volume = 2.660 af Average Runoff Depth = 3.95"
72.84% Pervious = 5.886 ac 27.16% Impervious = 2.194 ac

Summary for Subcatchment POST 1: Post Development Area 1

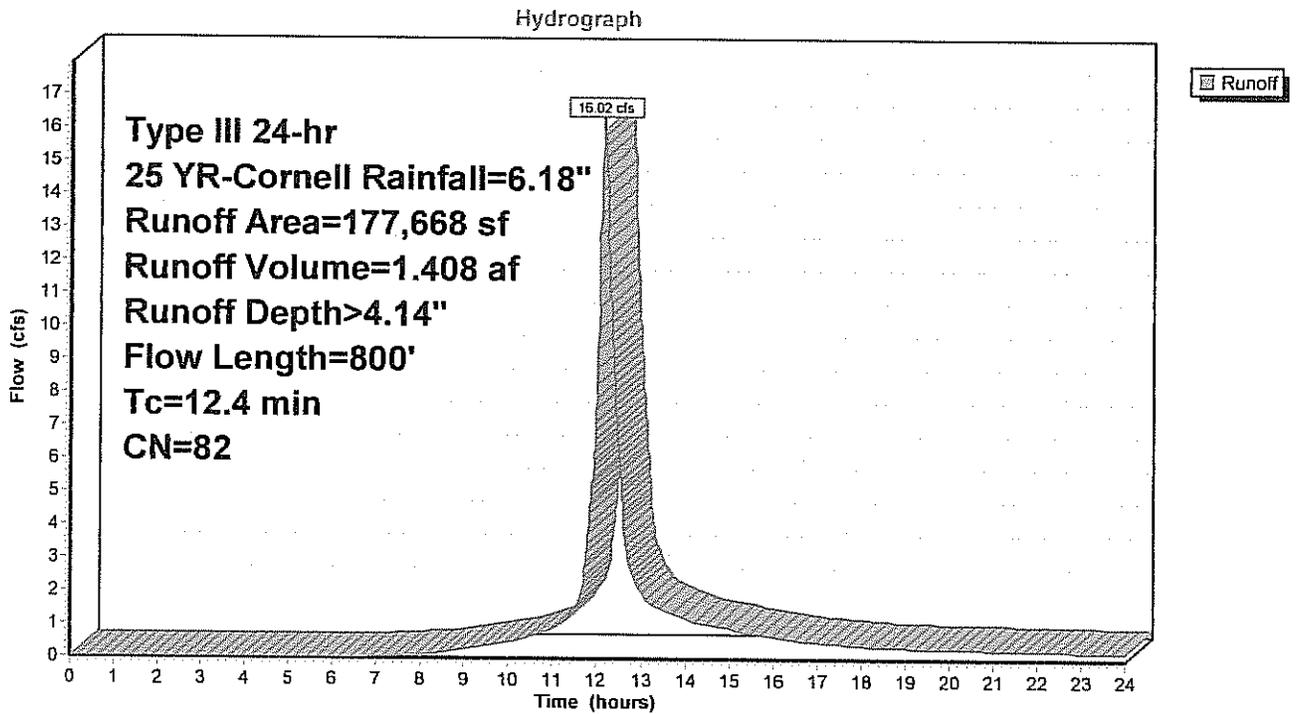
Runoff = 16.02 cfs @ 12.17 hrs, Volume= 1.408 af, Depth> 4.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25 YR-Cornell Rainfall=6.18"

Area (sf)	CN	Description
13,060	89	Gravel roads, HSG C
8,168	72	Woods/grass comb., Good, HSG C
101,525	74	Pasture/grassland/range, Good, HSG C
54,087	98	Unconnected pavement, HSG C
* 828	98	Concrete Equipment Pads
177,668	82	Weighted Average
122,753		69.09% Pervious Area
54,915		30.91% Impervious Area
54,087		98.49% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		Sheet Flow, A-B
					Woods: Light underbrush n= 0.400 P2= 3.24"
2.5	350	0.1100	2.32		Shallow Concentrated Flow, B-C
					Short Grass Pasture Kv= 7.0 fps
0.6	400	0.1200	11.99	4.19	Pipe Channel, C-D
					8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17'
					n= 0.013 Corrugated PE, smooth interior
12.4	800	Total			

Subcatchment POST 1: Post Development Area 1



Summary for Subcatchment POST 1A: Post Development Area 1A

Runoff = 1.07 cfs @ 12.09 hrs, Volume= 0.076 af, Depth> 3.33"

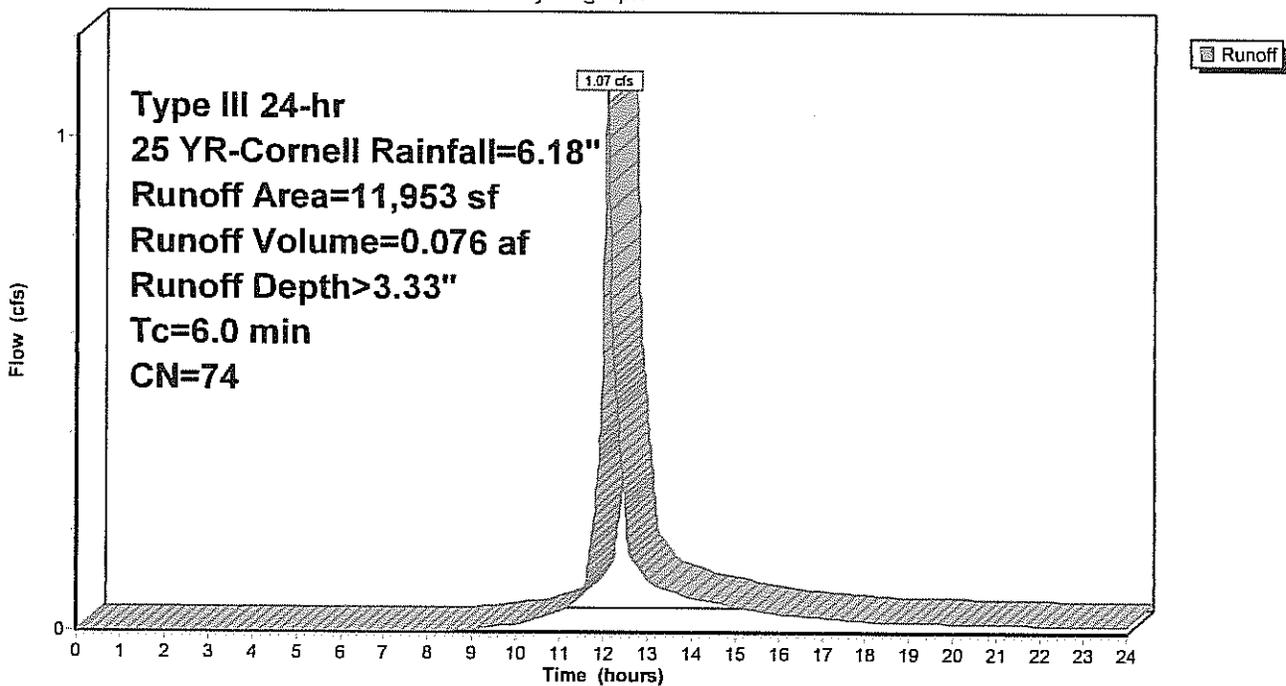
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25 YR-Cornell Rainfall=6.18"

Area (sf)	CN	Description
285	89	Gravel roads, HSG C
11,668	74	>75% Grass cover, Good, HSG C
11,953	74	Weighted Average
11,953		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Assume 6.0 Minutes-Min Tc

Subcatchment POST 1A: Post Development Area 1A

Hydrograph



Summary for Subcatchment POST 2: Post Development Area 2

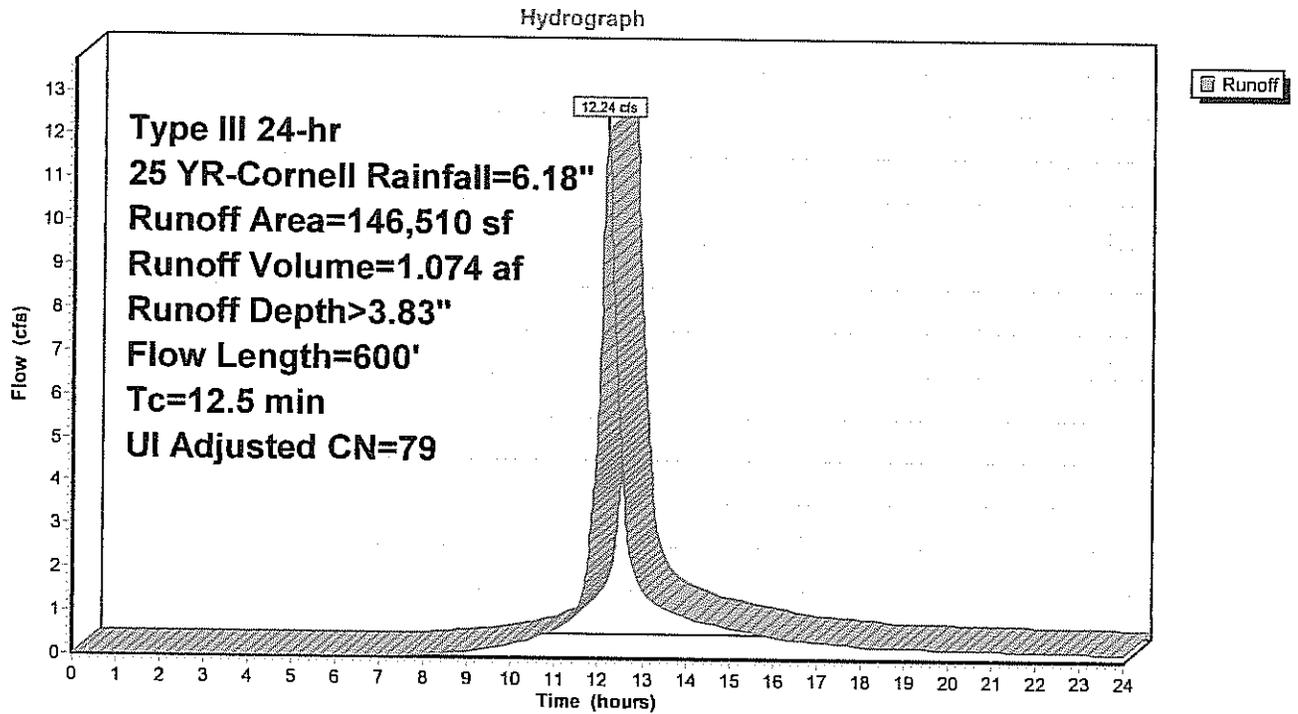
Runoff = 12.24 cfs @ 12.17 hrs, Volume= 1.074 af, Depth> 3.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25 YR-Cornell Rainfall=6.18"

Area (sf)	CN	Adj	Description
82,761	74		Pasture/grassland/range, Good, HSG C
* 40,677	98		Unconnected pavement, HSG C (Panels)
16,922	89		Gravel roads, HSG C
6,150	70		Woods, Good, HSG C
146,510	82	79	Weighted Average, UI Adjusted
105,833			72.24% Pervious Area
40,677			27.76% Impervious Area
40,677			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		Sheet Flow, A-B
					Woods: Light underbrush n= 0.400 P2= 3.24"
2.9	350	0.0850	2.04		Shallow Concentrated Flow, B-C
					Short Grass Pasture Kv= 7.0 fps
0.3	200	0.1400	12.95	4.52	Pipe Channel, C-D
					8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17'
					n= 0.013 Corrugated PE, smooth interior
12.5	600	Total			

Subcatchment POST 2: Post Development Area 2



Summary for Subcatchment POST 2A: Post Development Area 2A

Runoff = 1.42 cfs @ 12.09 hrs, Volume= 0.101 af, Depth> 3.33"

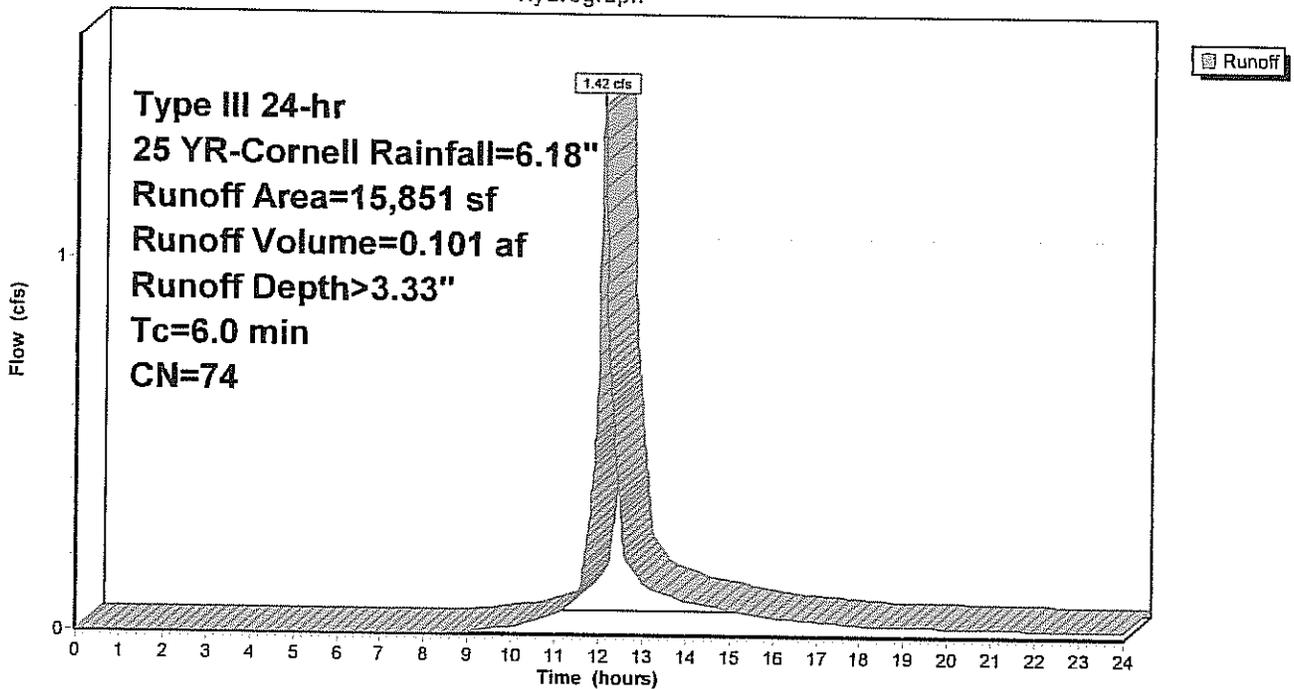
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25 YR-Cornell Rainfall=6.18"

Area (sf)	CN	Description
15,851	74	>75% Grass cover, Good, HSG C
15,851		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Assume 6.0 Minutes-Min Tc

Subcatchment POST 2A: Post Development Area 2A

Hydrograph



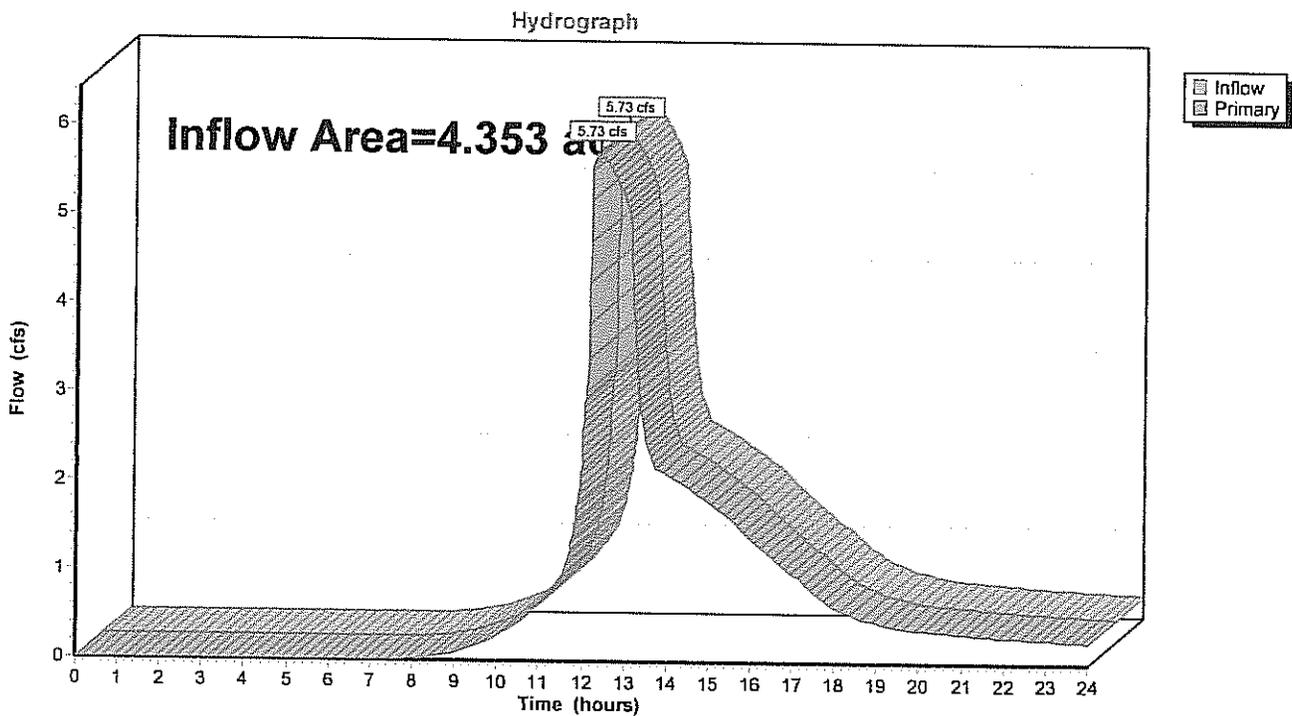
Summary for Pond AP-1: Westerly Property Line

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

Inflow Area = 4.353 ac, 28.96% Impervious, Inflow Depth > 4.00" for 25 YR-Cornell event
Inflow = 5.73 cfs @ 12.39 hrs, Volume= 1.453 af
Primary = 5.73 cfs @ 12.39 hrs, Volume= 1.453 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Pond AP-1: Westerly Property Line



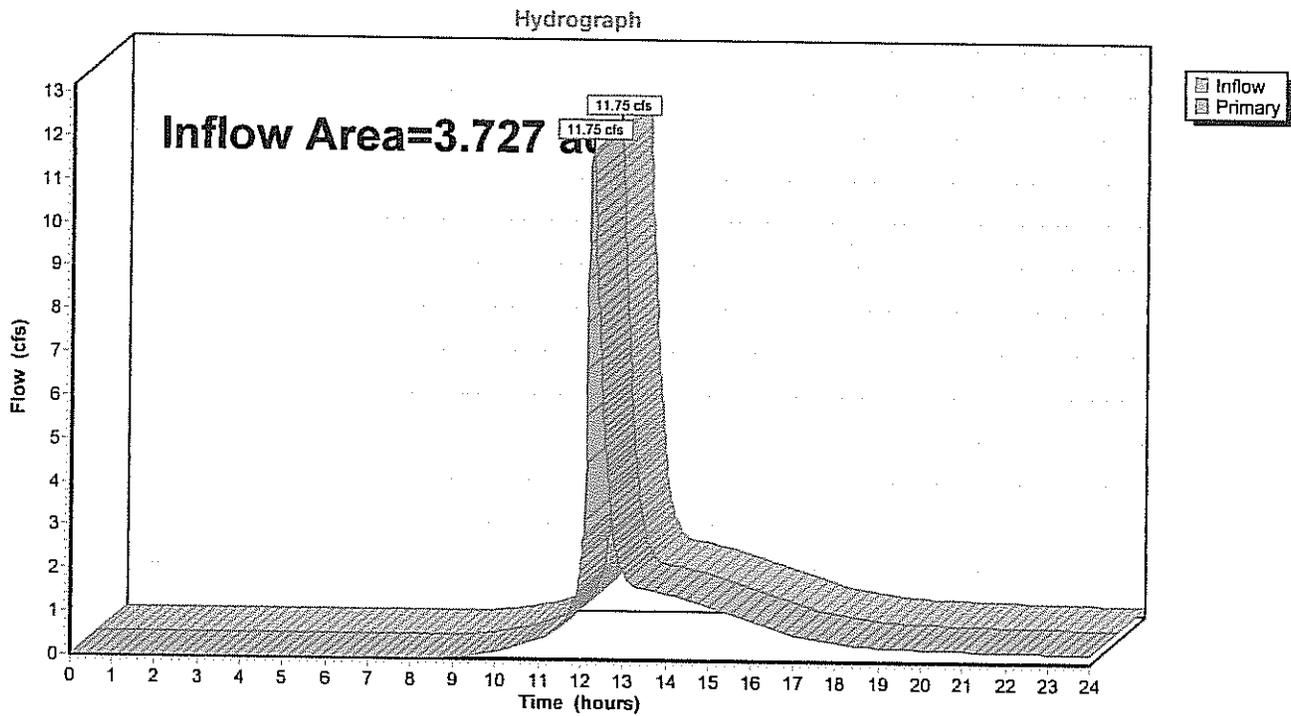
Summary for Pond AP-2: Easement Line

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

Inflow Area = 3.727 ac, 25.05% Impervious, Inflow Depth > 3.72" for 25 YR-Cornell event
Inflow = 11.75 cfs @ 12.23 hrs, Volume= 1.154 af
Primary = 11.75 cfs @ 12.23 hrs, Volume= 1.154 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Pond AP-2: Easement Line



Summary for Pond East: Proposed Easterly Basin

Inflow Area = 3.363 ac, 27.76% Impervious, Inflow Depth > 3.83" for 25 YR-Cornell event
 Inflow = 12.24 cfs @ 12.17 hrs, Volume= 1.074 af
 Outflow = 11.00 cfs @ 12.23 hrs, Volume= 1.053 af, Atten= 10%, Lag= 3.7 min
 Primary = 1.78 cfs @ 12.23 hrs, Volume= 0.776 af
 Secondary = 9.21 cfs @ 12.23 hrs, Volume= 0.277 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 4
 Peak Elev= 189.14' @ 12.23 hrs Surf.Area= 5,400 sf Storage= 9,305 cf

Plug-Flow detention time= 50.0 min calculated for 1.053 af (98% of inflow)
 Center-of-Mass det. time= 38.5 min (858.5 - 820.0)

Volume	Invert	Avail.Storage	Storage Description
#1	187.00'	14,321 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
187.00	3,324	0	0
188.00	4,259	3,792	3,792
189.00	5,250	4,755	8,546
190.00	6,299	5,775	14,321

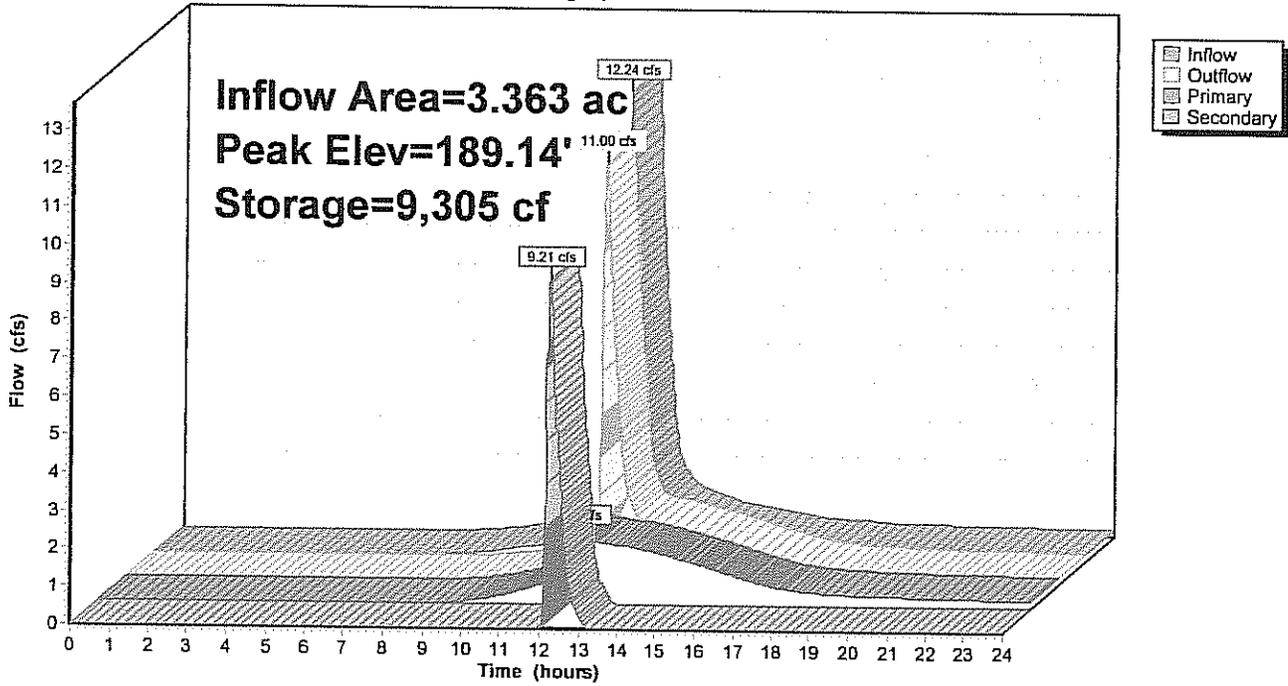
Device	Routing	Invert	Outlet Devices
#1	Primary	187.00'	8.0" Round Culvert L= 35.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 187.00' / 185.00' S= 0.0571 ' / Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Secondary	188.75'	15.0' long x 5.0' breadth Broad-Crested 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=1.78 cfs @ 12.23 hrs HW=189.14' (Free Discharge)
 ↳ **1=Culvert** (Inlet Controls 1.78 cfs @ 5.11 fps)

Secondary OutFlow Max=9.19 cfs @ 12.23 hrs HW=189.14' (Free Discharge)
 ↳ **2=Broad-Crested Rectangular Weir** (Weir Controls 9.19 cfs @ 1.56 fps)

Pond East: Proposed Easterly Basin

Hydrograph



Summary for Pond West: Proposed Westerly Basin

Inflow Area = 4.079 ac, 30.91% Impervious, Inflow Depth > 4.14" for 25 YR-Cornell event
 Inflow = 16.02 cfs @ 12.17 hrs, Volume= 1.408 af
 Outflow = 5.43 cfs @ 12.55 hrs, Volume= 1.377 af, Atten= 66%, Lag= 22.9 min
 Primary = 5.43 cfs @ 12.55 hrs, Volume= 1.377 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 163.81' @ 12.55 hrs Surf.Area= 9,773 sf Storage= 20,644 cf

Plug-Flow detention time= 72.8 min calculated for 1.377 af (98% of inflow)
 Center-of-Mass det. time= 59.5 min (871.8 - 812.3)

Volume	Invert	Avail.Storage	Storage Description
#1	161.00'	33,550 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
161.00	4,989	0	0
162.00	6,639	5,814	5,814
163.00	8,345	7,492	13,306
164.00	10,108	9,227	22,533
165.00	11,927	11,018	33,550

Device	Routing	Invert	Outlet Devices
#1	Primary	160.00'	12.0" Round Culvert L= 40.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 160.00' / 157.00' S= 0.0750 ' / ' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#2	Device 1	161.00'	8.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	162.90'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Secondary	164.25'	5.0' long x 5.0' 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=5.43 cfs @ 12.55 hrs HW=163.81' (Free Discharge)

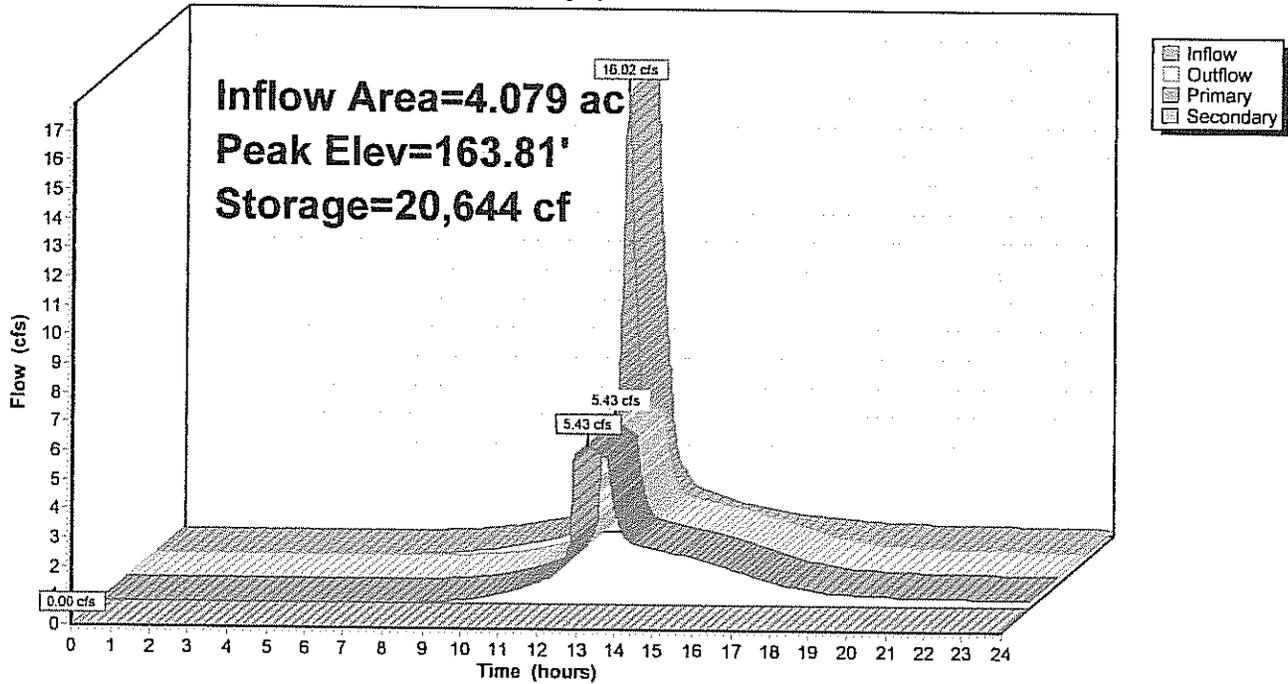
- ↑ 1=Culvert (Inlet Controls 5.43 cfs @ 6.92 fps)
- ↑ 2=Orifice/Grate (Passes < 2.65 cfs potential flow)
- ↑ 3=Sharp-Crested Rectangular Weir (Passes < 10.84 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=161.00' (Free Discharge)

- ↑ 4=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond West: Proposed Westerly Basin

Hydrograph



2035-PostDevelopmentAnalysis-R1

Type III 24-hr 100 YR-Cornell Rainfall=8.84"

Prepared by Field Engineering Co. Inc.

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment POST 1: Post Runoff Area=177,668 sf 30.91% Impervious Runoff Depth>6.65"
Flow Length=800' Tc=12.4 min CN=82 Runoff=25.25 cfs 2.259 af

Subcatchment POST 1A: Post Development Runoff Area=11,953 sf 0.00% Impervious Runoff Depth>5.68"
Tc=6.0 min CN=74 Runoff=1.82 cfs 0.130 af

Subcatchment POST 2: Post Runoff Area=146,510 sf 27.76% Impervious Runoff Depth>6.28"
Flow Length=600' Tc=12.5 min UI Adjusted CN=79 Runoff=19.80 cfs 1.760 af

Subcatchment POST 2A: Post Development Runoff Area=15,851 sf 0.00% Impervious Runoff Depth>5.68"
Tc=6.0 min CN=74 Runoff=2.41 cfs 0.172 af

Pond AP-1: Westerly Property Line Inflow=12.19 cfs 2.349 af
Primary=12.19 cfs 2.349 af

Pond AP-2: Easement Line Inflow=20.64 cfs 1.906 af
Primary=20.64 cfs 1.906 af

Pond East: Proposed Easterly Basin Peak Elev=189.32' Storage=10,290 cf Inflow=19.80 cfs 1.760 af
Primary=1.87 cfs 1.067 af Secondary=17.34 cfs 0.667 af Outflow=19.21 cfs 1.734 af

Pond West: Proposed Westerly Basin Peak Elev=164.80' Storage=31,250 cf Inflow=25.25 cfs 2.259 af
Primary=6.19 cfs 2.038 af Secondary=5.48 cfs 0.182 af Outflow=11.67 cfs 2.219 af

Total Runoff Area = 8.080 ac Runoff Volume = 4.322 af Average Runoff Depth = 6.42"
72.84% Pervious = 5.886 ac 27.16% Impervious = 2.194 ac

Summary for Subcatchment POST 1: Post Development Area 1

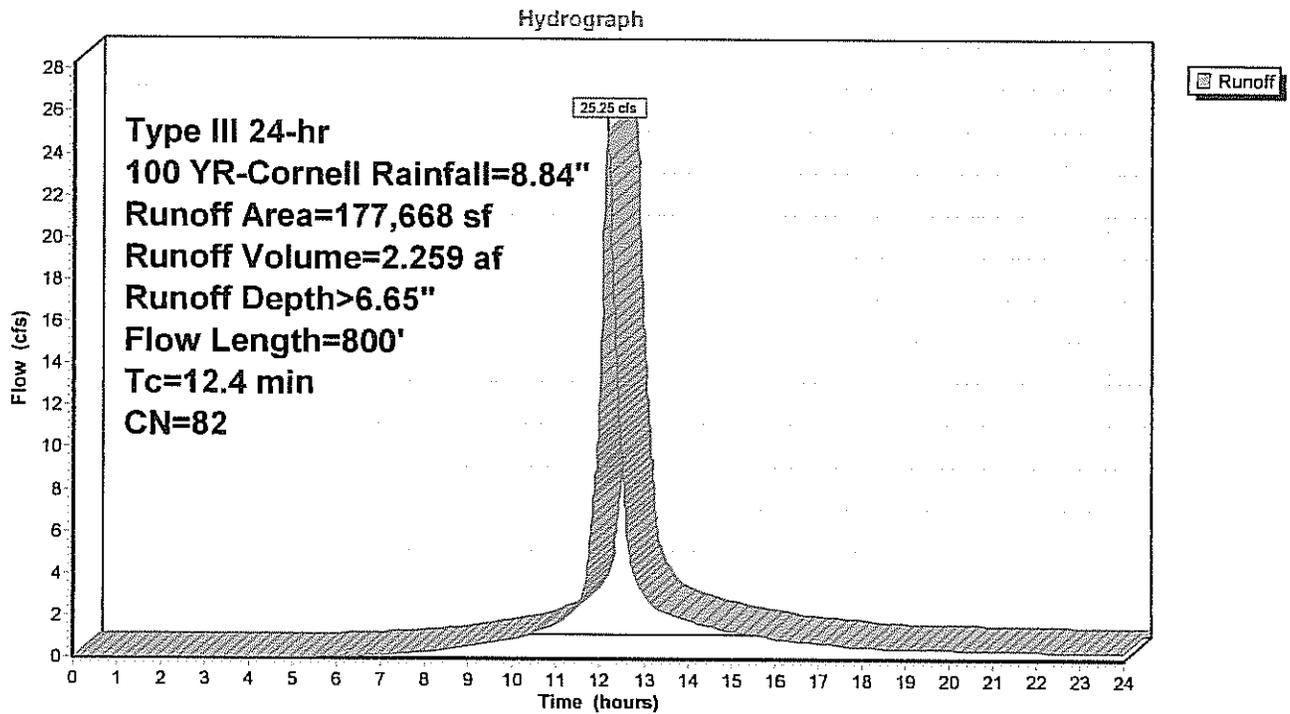
Runoff = 25.25 cfs @ 12.17 hrs, Volume= 2.259 af, Depth> 6.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100 YR-Cornell Rainfall=8.84"

Area (sf)	CN	Description
13,060	89	Gravel roads, HSG C
8,168	72	Woods/grass comb., Good, HSG C
101,525	74	Pasture/grassland/range, Good, HSG C
54,087	98	Unconnected pavement, HSG C
* 828	98	Concrete Equipment Pads
177,668	82	Weighted Average
122,753		69.09% Pervious Area
54,915		30.91% Impervious Area
54,087		98.49% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		Sheet Flow, A-B
					Woods: Light underbrush n= 0.400 P2= 3.24"
2.5	350	0.1100	2.32		Shallow Concentrated Flow, B-C
					Short Grass Pasture Kv= 7.0 fps
0.6	400	0.1200	11.99	4.19	Pipe Channel, C-D
					8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17'
					n= 0.013 Corrugated PE, smooth interior
12.4	800	Total			

Subcatchment POST 1: Post Development Area 1



Summary for Subcatchment POST 1A: Post Development Area 1A

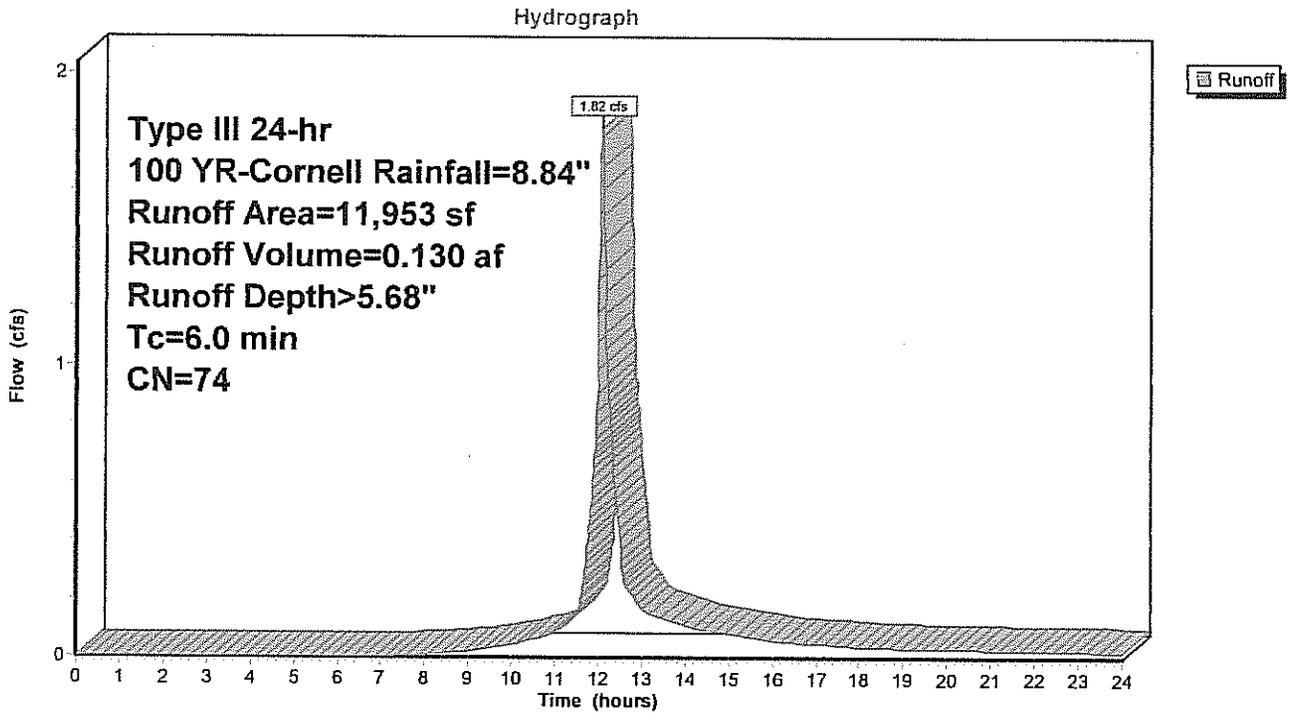
Runoff = 1.82 cfs @ 12.09 hrs, Volume= 0.130 af, Depth> 5.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100 YR-Cornell Rainfall=8.84"

Area (sf)	CN	Description
285	89	Gravel roads, HSG C
11,668	74	>75% Grass cover, Good, HSG C
11,953	74	Weighted Average
11,953		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Assume 6.0 Minutes-Min Tc

Subcatchment POST 1A: Post Development Area 1A



Summary for Subcatchment POST 2: Post Development Area 2

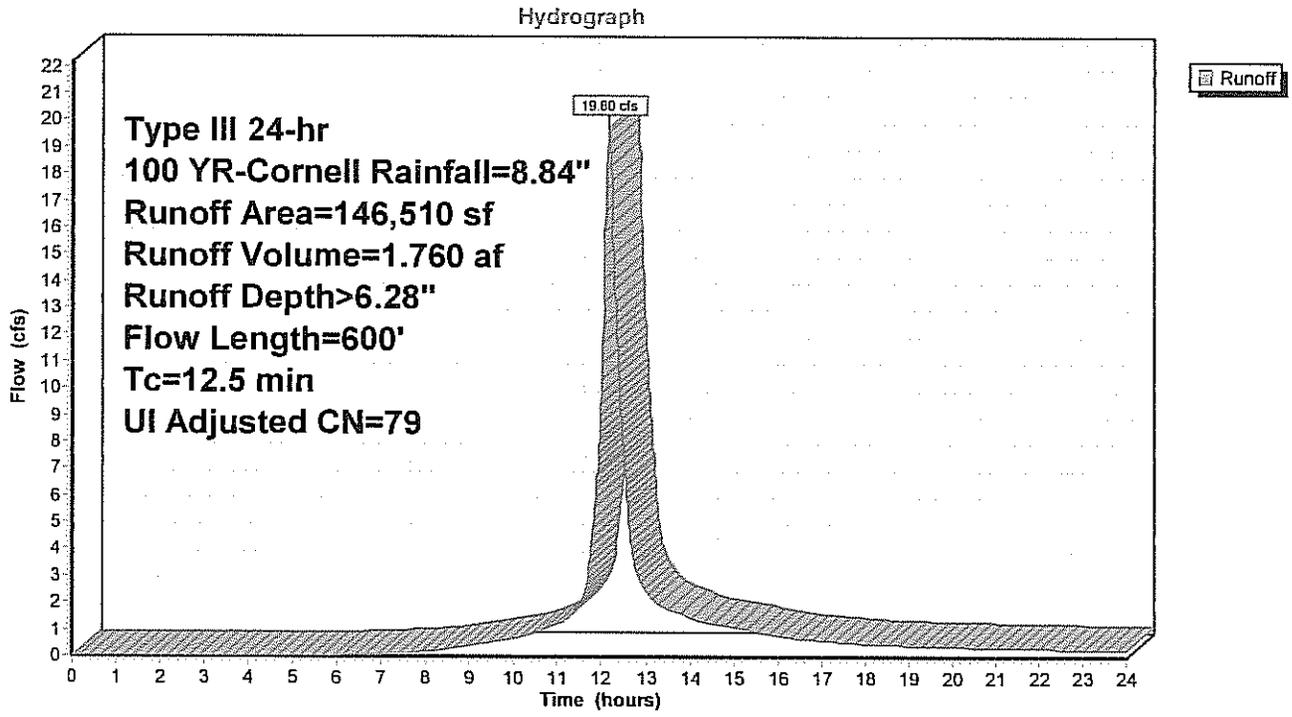
Runoff = 19.80 cfs @ 12.17 hrs, Volume= 1.760 af, Depth> 6.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR-Cornell Rainfall=8.84"

Area (sf)	CN	Adj	Description
82,761	74		Pasture/grassland/range, Good, HSG C
* 40,677	98		Unconnected pavement, HSG C (Panels)
16,922	89		Gravel roads, HSG C
6,150	70		Woods, Good, HSG C
146,510	82	79	Weighted Average, UI Adjusted
105,833			72.24% Pervious Area
40,677			27.76% Impervious Area
40,677			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		Sheet Flow, A-B
					Woods: Light underbrush n= 0.400 P2= 3.24"
2.9	350	0.0850	2.04		Shallow Concentrated Flow, B-C
					Short Grass Pasture Kv= 7.0 fps
0.3	200	0.1400	12.95	4.52	Pipe Channel, C-D
					8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17'
					n= 0.013 Corrugated PE, smooth interior
12.5	600	Total			

Subcatchment POST 2: Post Development Area 2



Summary for Subcatchment POST 2A: Post Development Area 2A

Runoff = 2.41 cfs @ 12.09 hrs, Volume= 0.172 af, Depth> 5.68"

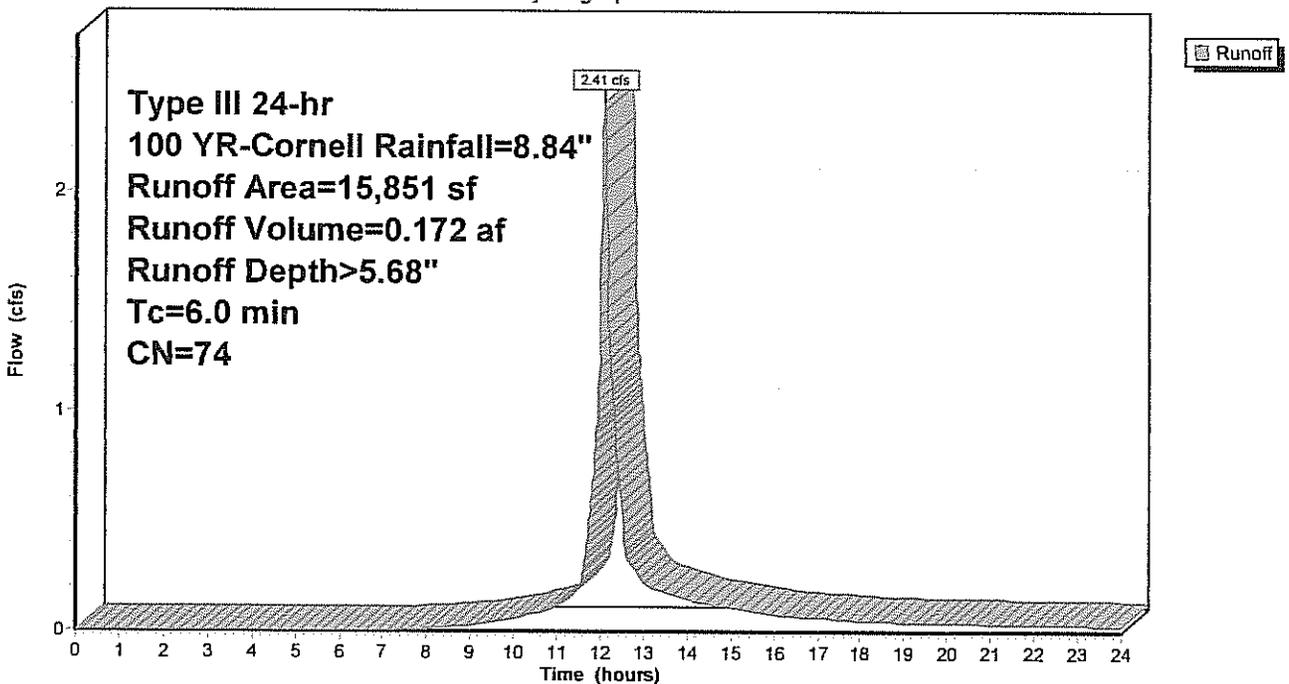
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100 YR-Cornell Rainfall=8.84"

Area (sf)	CN	Description
15,851	74	>75% Grass cover, Good, HSG C
15,851		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Assume 6.0 Minutes-Min Tc

Subcatchment POST 2A: Post Development Area 2A

Hydrograph



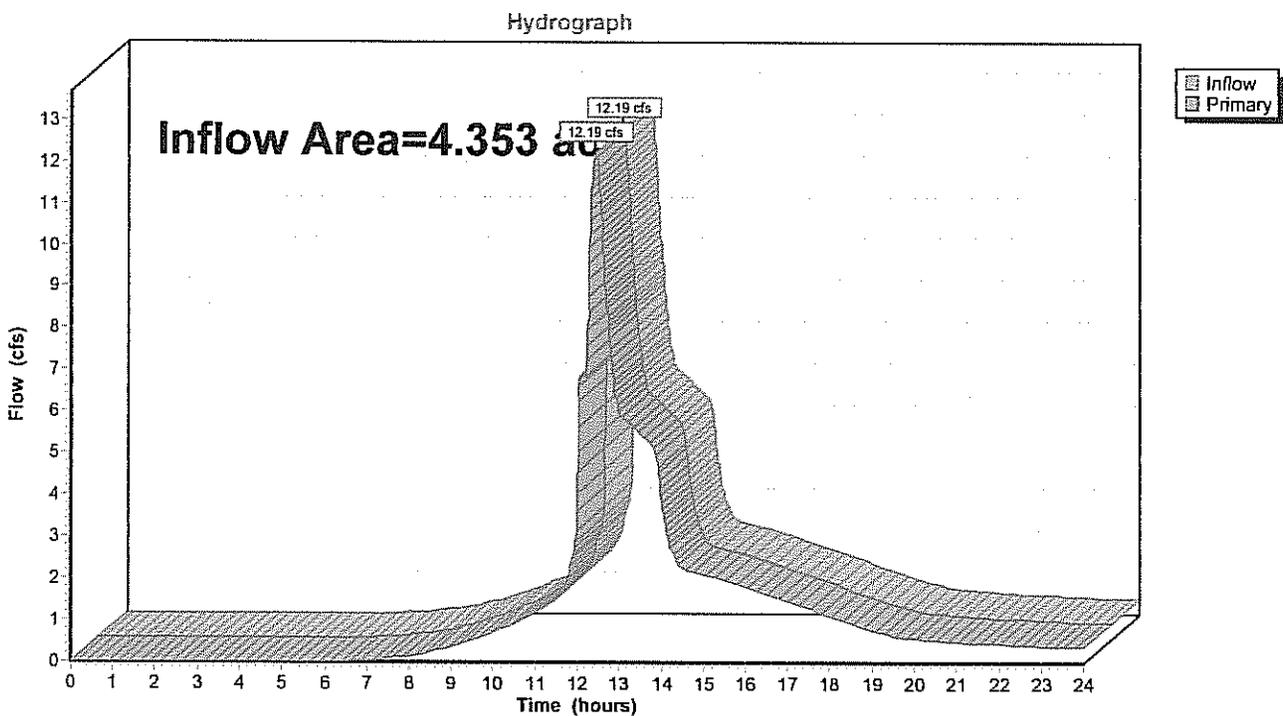
Summary for Pond AP-1: Westerly Property Line

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

Inflow Area = 4.353 ac, 28.96% Impervious, Inflow Depth > 6.48" for 100 YR-Cornell event
Inflow = 12.19 cfs @ 12.43 hrs, Volume= 2.349 af
Primary = 12.19 cfs @ 12.43 hrs, Volume= 2.349 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Pond AP-1: Westerly Property Line



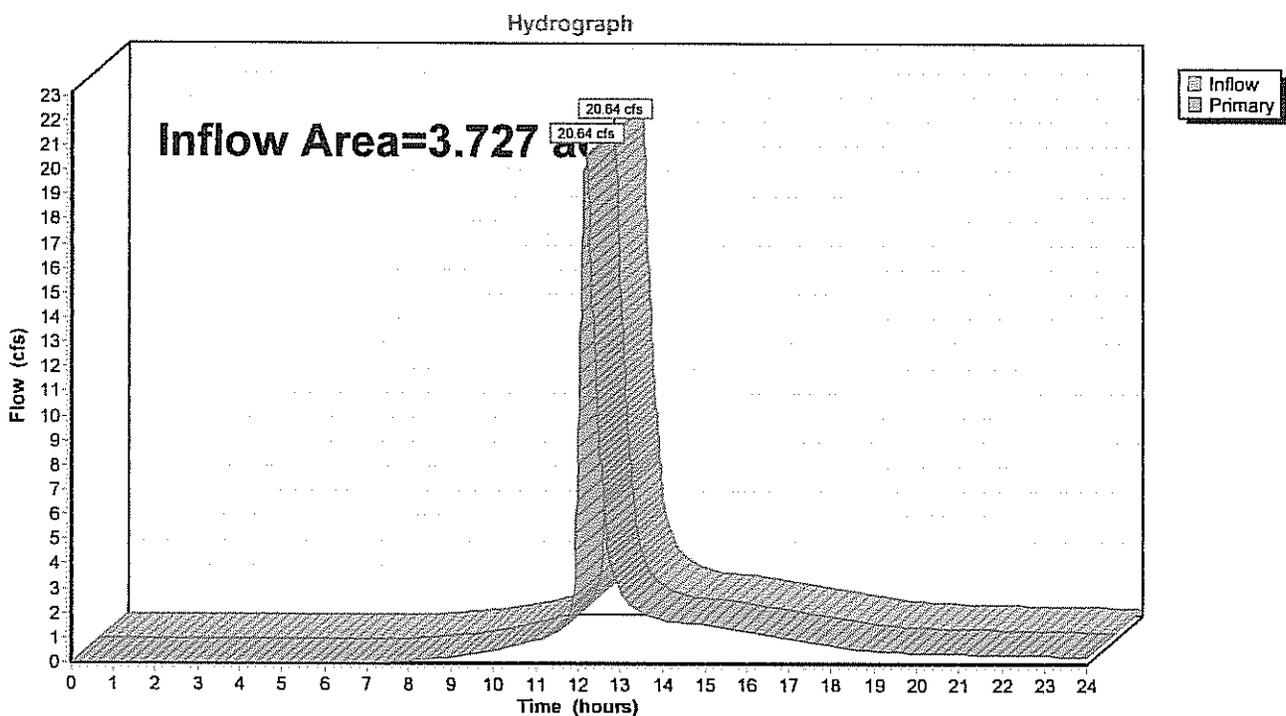
Summary for Pond AP-2: Easement Line

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

Inflow Area = 3.727 ac, 25.05% Impervious, Inflow Depth > 6.14" for 100 YR-Cornell event
Inflow = 20.64 cfs @ 12.19 hrs, Volume= 1.906 af
Primary = 20.64 cfs @ 12.19 hrs, Volume= 1.906 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Pond AP-2: Easement Line



Summary for Pond East: Proposed Easterly Basin

Inflow Area = 3.363 ac, 27.76% Impervious, Inflow Depth > 6.28" for 100 YR-Cornell event
 Inflow = 19.80 cfs @ 12.17 hrs, Volume= 1.760 af
 Outflow = 19.21 cfs @ 12.20 hrs, Volume= 1.734 af, Atten= 3%, Lag= 1.8 min
 Primary = 1.87 cfs @ 12.20 hrs, Volume= 1.067 af
 Secondary = 17.34 cfs @ 12.20 hrs, Volume= 0.667 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 4
 Peak Elev= 189.32' @ 12.20 hrs Surf.Area= 5,588 sf Storage= 10,290 cf

Plug-Flow detention time= 41.8 min calculated for 1.734 af (98% of inflow)
 Center-of-Mass det. time= 32.7 min (838.8 - 806.1)

Volume	Invert	Avail.Storage	Storage Description
#1	187.00'	14,321 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
187.00	3,324	0	0
188.00	4,259	3,792	3,792
189.00	5,250	4,755	8,546
190.00	6,299	5,775	14,321

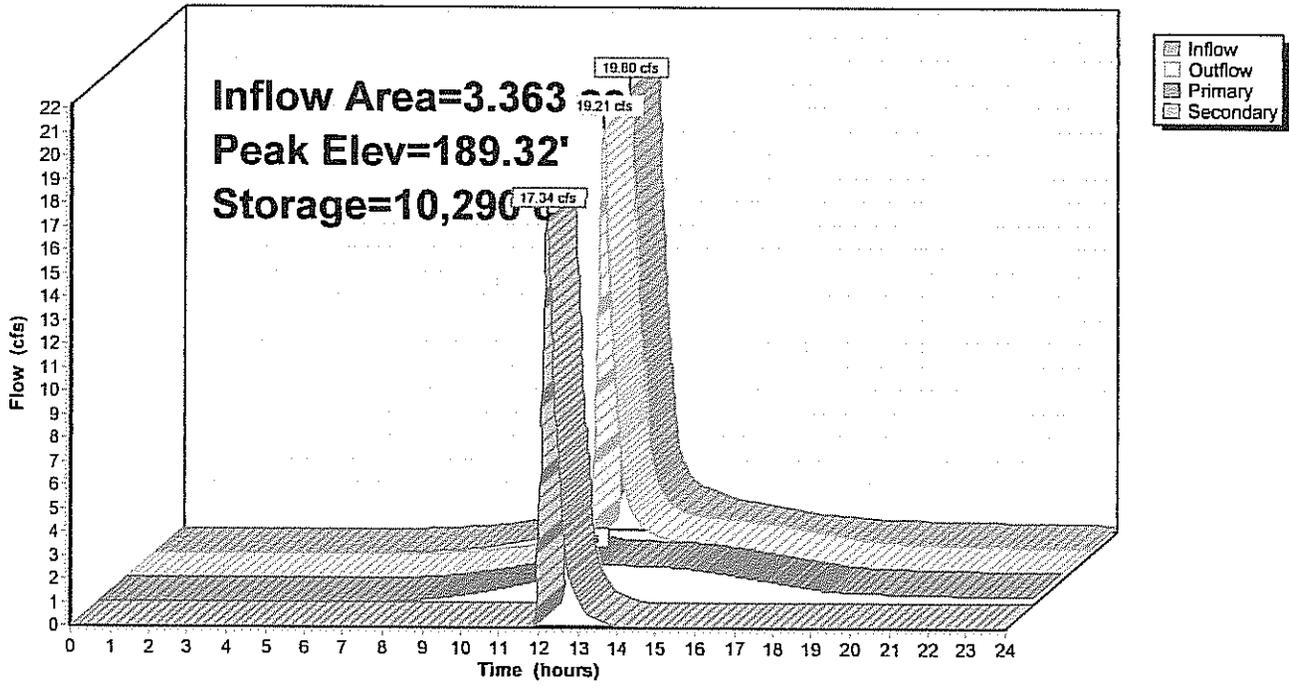
Device	Routing	Invert	Outlet Devices
#1	Primary	187.00'	8.0" Round Culvert L= 35.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 187.00' / 185.00' S= 0.0571 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Secondary	188.75'	15.0' long x 5.0' breadth Broad-Crested 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=1.87 cfs @ 12.20 hrs HW=189.32' (Free Discharge)
 ↑1=Culvert (Inlet Controls 1.87 cfs @ 5.36 fps)

Secondary OutFlow Max=17.32 cfs @ 12.20 hrs HW=189.32' (Free Discharge)
 ↑2=Broad-Crested Rectangular Weir (Weir Controls 17.32 cfs @ 2.02 fps)

Pond East: Proposed Easterly Basin

Hydrograph



Summary for Pond West: Proposed Westerly Basin

Inflow Area = 4.079 ac, 30.91% Impervious, Inflow Depth > 6.65" for 100 YR-Cornell event
 Inflow = 25.25 cfs @ 12.17 hrs, Volume= 2.259 af
 Outflow = 11.67 cfs @ 12.44 hrs, Volume= 2.219 af, Atten= 54%, Lag= 16.6 min
 Primary = 6.19 cfs @ 12.44 hrs, Volume= 2.038 af
 Secondary = 5.48 cfs @ 12.44 hrs, Volume= 0.182 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 164.80' @ 12.44 hrs Surf.Area= 11,571 sf Storage= 31,250 cf

Plug-Flow detention time= 68.0 min calculated for 2.219 af (98% of inflow)
 Center-of-Mass det. time= 57.4 min (856.5 - 799.2)

Volume #1	Invert 161.00'	Avail.Storage 33,550 cf	Storage Description Custom Stage Data (Prismatic) Listed below (Recalc)
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Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
161.00	4,989	0	0
162.00	6,639	5,814	5,814
163.00	8,345	7,492	13,306
164.00	10,108	9,227	22,533
165.00	11,927	11,018	33,550

Device #1	Routing Primary	Invert 160.00'	Outlet Devices 12.0" Round Culvert
			L= 40.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 160.00' / 157.00' S= 0.0750 1' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#2	Device 1	161.00'	8.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	162.90'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Secondary	164.25'	5.0' long x 5.0' 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

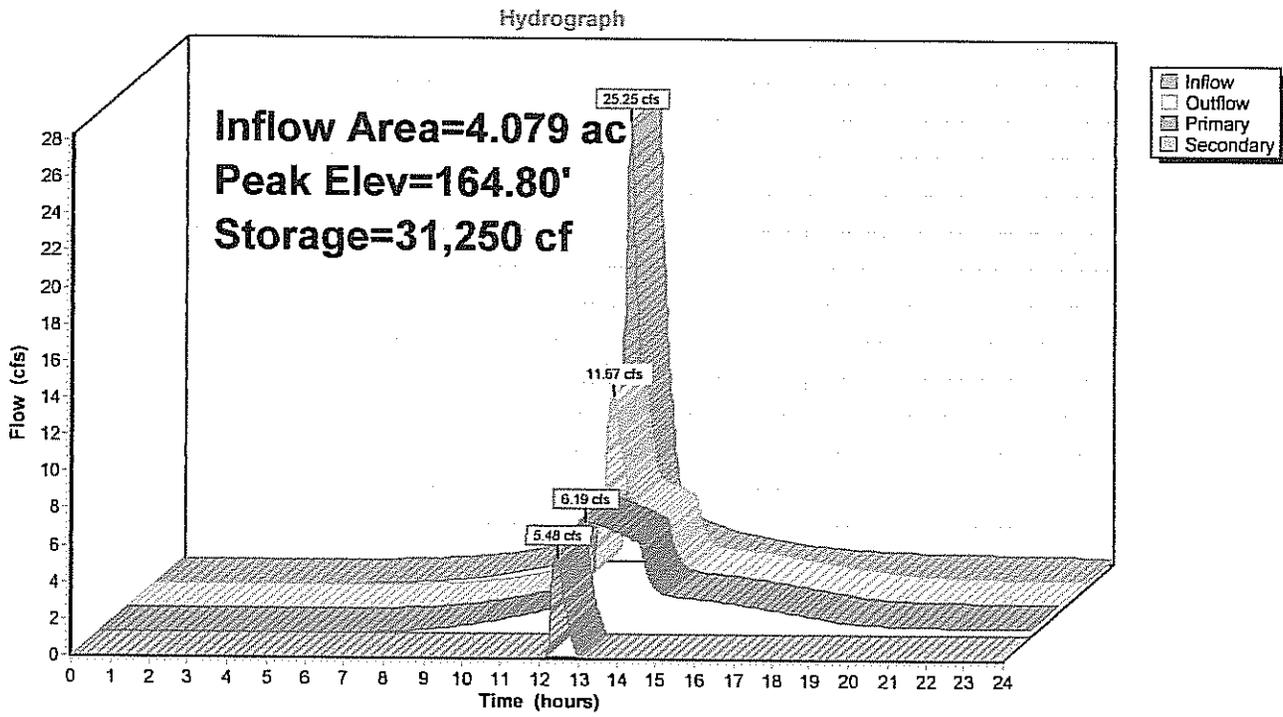
Primary OutFlow Max=6.19 cfs @ 12.44 hrs HW=164.80' (Free Discharge)

- ↑ 1=Culvert (Inlet Controls 6.19 cfs @ 7.89 fps)
- ↑ 2=Orifice/Grate (Passes < 3.13 cfs potential flow)
- ↑ 3=Sharp-Crested Rectangular Weir (Passes < 31.09 cfs potential flow)

Secondary OutFlow Max=5.47 cfs @ 12.44 hrs HW=164.80' (Free Discharge)

- ↑ 4=Broad-Crested Rectangular Weir (Weir Controls 5.47 cfs @ 1.98 fps)

Pond West: Proposed Westerly Basin



Section 4

Supplemental Data

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Smoothing	Yes
State	Massachusetts
Location	
Longitude	71.686 degrees West
Latitude	42.186 degrees North
Elevation	0 feet
Date/Time	Wed, 12 Aug 2015 10:59:12 -0400

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.43	0.54	0.71	0.88	1.12	1yr	0.76	1.07	1.29	1.64	2.08	2.65	2.90	1yr	2.35	2.79	3.20	3.88	4.47	1yr
2yr	0.35	0.54	0.67	0.89	1.11	1.40	2yr	0.96	1.28	1.62	2.04	2.57	3.24	3.52	2yr	2.87	3.39	3.89	4.60	5.24	2yr
5yr	0.41	0.64	0.81	1.08	1.38	1.76	5yr	1.19	1.60	2.05	2.59	3.25	4.09	4.48	5yr	3.62	4.31	4.94	5.79	6.49	5yr
10yr	0.46	0.73	0.92	1.25	1.63	2.10	10yr	1.41	1.88	2.45	3.10	3.90	4.89	5.38	10yr	4.32	5.17	5.92	6.89	7.64	10yr
25yr	0.55	0.87	1.11	1.53	2.03	2.64	25yr	1.75	2.33	3.09	3.92	4.94	6.18	6.86	25yr	5.47	6.60	7.54	8.67	9.49	25yr
50yr	0.62	0.99	1.27	1.78	2.40	3.15	50yr	2.07	2.75	3.71	4.71	5.93	7.39	8.25	50yr	6.54	7.93	9.05	10.33	11.18	50yr
100yr	0.71	1.15	1.48	2.09	2.84	3.75	100yr	2.45	3.25	4.42	5.63	7.09	8.84	9.92	100yr	7.82	9.54	10.86	12.30	13.17	100yr
200yr	0.80	1.31	1.70	2.44	3.36	4.47	200yr	2.90	3.83	5.29	6.75	8.49	10.58	11.94	200yr	9.36	11.48	13.05	14.65	15.53	200yr
500yr	0.97	1.59	2.07	3.01	4.21	5.64	500yr	3.63	4.78	6.69	8.56	10.78	13.42	15.27	500yr	11.88	14.68	16.63	18.47	19.31	500yr

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.22	0.34	0.42	0.56	0.69	0.95	1yr	0.59	0.93	1.10	1.44	1.88	2.45	2.65	1yr	2.17	2.55	2.71	3.49	4.17	1yr
2yr	0.34	0.53	0.65	0.88	1.08	1.27	2yr	0.93	1.24	1.45	1.91	2.44	3.15	3.41	2yr	2.79	3.28	3.78	4.44	5.07	2yr
5yr	0.38	0.59	0.74	1.01	1.29	1.51	5yr	1.11	1.48	1.72	2.25	2.87	3.77	4.16	5yr	3.34	4.00	4.59	5.28	5.98	5yr
10yr	0.43	0.65	0.81	1.13	1.46	1.72	10yr	1.26	1.68	1.95	2.55	3.23	4.33	4.82	10yr	3.83	4.63	5.32	6.00	6.76	10yr
25yr	0.49	0.75	0.93	1.33	1.75	2.05	25yr	1.51	2.00	2.31	3.03	3.80	5.20	5.86	25yr	4.61	5.64	6.48	7.05	7.93	25yr
50yr	0.55	0.83	1.04	1.49	2.01	2.33	50yr	1.73	2.28	2.63	3.44	4.28	5.98	6.84	50yr	5.29	6.58	7.55	7.98	8.97	50yr
100yr	0.61	0.93	1.16	1.68	2.30	2.65	100yr	1.99	2.60	2.99	3.91	4.85	6.89	8.00	100yr	6.10	7.70	8.84	9.04	10.15	100yr
200yr	0.68	1.03	1.30	1.89	2.63	3.04	200yr	2.27	2.97	3.40	4.47	5.50	7.93	9.36	200yr	7.02	9.00	10.35	10.21	11.50	200yr
500yr	0.80	1.19	1.53	2.22	3.15	3.62	500yr	2.72	3.54	4.04	5.33	6.51	9.63	11.60	500yr	8.52	11.15	12.79	11.96	13.58	500yr

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.32	0.49	0.60	0.80	0.99	1.20	1yr	0.85	1.17	1.38	1.77	2.31	2.96	3.26	1yr	2.62	3.14	3.52	4.28	4.82	1yr
2yr	0.36	0.56	0.69	0.94	1.15	1.36	2yr	1.00	1.33	1.56	2.03	2.59	3.37	3.67	2yr	2.99	3.53	4.04	4.81	5.44	2yr
5yr	0.44	0.69	0.85	1.17	1.48	1.77	5yr	1.28	1.73	2.02	2.60	3.27	4.39	4.83	5yr	3.89	4.64	5.31	6.30	7.04	5yr
10yr	0.52	0.80	1.00	1.39	1.80	2.16	10yr	1.55	2.11	2.47	3.14	3.91	5.37	5.98	10yr	4.75	5.75	6.53	7.76	8.58	10yr
25yr	0.66	1.00	1.24	1.77	2.33	2.82	25yr	2.01	2.75	3.20	4.01	4.95	7.04	7.91	25yr	6.23	7.61	8.58	10.25	11.15	25yr
50yr	0.78	1.18	1.47	2.11	2.84	3.45	50yr	2.45	3.37	3.92	4.83	5.90	8.62	9.76	50yr	7.63	9.39	10.54	12.65	13.62	50yr
100yr	0.92	1.40	1.75	2.53	3.47	4.22	100yr	2.99	4.13	4.79	5.84	7.06	10.56	12.06	100yr	9.34	11.59	12.95	15.62	16.64	100yr
200yr	1.10	1.65	2.09	3.03	4.23	5.17	200yr	3.65	5.06	5.87	7.04	8.43	12.92	14.87	200yr	11.43	14.29	15.90	19.31	20.22	200yr
500yr	1.39	2.07	2.66	3.87	5.50	6.77	500yr	4.75	6.62	7.66	9.02	10.66	16.87	19.59	500yr	14.93	18.84	20.83	25.57	26.28	500yr

Soil Map—Worcester County, Massachusetts, Southern Part



MAP LEGEND

- Area of Interest (AOI)
- Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points
- Special Point Features**
 - Blowout
 - Borrow Pit
 - Clay Spot
 - Closed Depression
 - Gravel Pit
 - Gravelly Spot
 - Landfill
 - Lava Flow
 - Marsh or swamp
 - Mine or Quarry
 - Miscellaneous Water
 - Perennial Water
 - Rock Outcrop
 - Saline Spot
 - Sandy Spot
 - Severely Eroded Spot
 - Sinkhole
 - Slide or Slip
 - Sodic Spot
- Water Features**
 - Streams and Canals
- Transportation**
 - Rails
 - Interstate Highways
 - US Routes
 - Major Roads
 - Local Roads
- Background**
 - Aerial Photography
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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: <http://websoilsurvey.nrcs.usda.gov>
 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: Worcester County, Massachusetts, Southern Part
 Survey Area Data: Version 7, Sep 22, 2014

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

Date(s) aerial images were photographed: Sep 12, 2014—Sep 28, 2014

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

Map Unit Legend

Worcester County, Massachusetts, Southern Part (MA615)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
305B	Paxton fine sandy loam, 3 to 8 percent slopes	1.9	8.9%
305C	Paxton fine sandy loam, 8 to 15 percent slopes	0.1	0.4%
307B	Paxton fine sandy loam, 3 to 8 percent slopes, extremely stony	5.7	27.0%
307C	Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony	13.4	63.2%
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	0.1	0.5%
Totals for Area of Interest		21.2	100.0%

Appendix A

Pre and Post Development Watershed Plans

Appendix B

Construction Period Stormwater Pollution Prevention Plan (Draft NPDES-SWPPP)

DRAFT
Stormwater Pollution Prevention Plan (SWPPP)

For Construction Activities At:

CEC Solar #1056 LLC
Solar Panel Array Installation
207 Providence Road
Grafton, Massachusetts

SWPPP Prepared For:

Clean Energy Collective, LLC
146 W Boylston Drive
Worcester, Massachusetts 01606
Attn: Mr. Greg Carey

SWPPP Prepared By:

Field Engineering Co. Inc.
11D Industrial Drive, P.O. Box 1178
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Attn: Mr. Richard R. Riccio III, P.E., Project Manager

SWPPP Preparation Date:

8/12/15

Estimated Project Dates:

Project Start Date: TBD
Project Completion Date: TBD

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SECTION 1: CONTACT INFORMATION/RESPONSIBLE PARTIES

1.1 Operator(s) / Subcontractor(s)

Instructions (see definition of "operator" at CGP Part 1.1.a):

- Identify the operator(s) who will be engaged in construction activities at the site. Indicate respective responsibilities, where appropriate. Also include the 24-hour emergency contact.
- List subcontractors expected to work on-site. Notify subcontractors of stormwater requirements applicable to their work.
- Consider using Subcontractor Agreements such as the type included as a sample in Appendix G of the Template.

Operator(s):

CEC Solar#1056 LLC
C/O Clean Energy Collective LLC
146 W Boylston Drive
Worcester, Massachusetts 01606
Phone: 617-834-8567
Attn: Mr. Greg Carey

Control over construction plans and specifications

Subcontractor(s):

TBD

Emergency 24-Hour Contact:

TBD

1.2 Stormwater Team

Instructions (see CGP Part 7.2.1):

- Identify the staff members (by name or position) that comprise the project's stormwater team as well as their individual responsibilities. At a minimum the stormwater team is comprised of individuals who are responsible for overseeing the development of the SWPPP, any later modifications to it, and for compliance with the requirements in this permit (i.e., installing and maintaining stormwater controls, conducting site inspections, and taking corrective actions where required).
- Each member of the stormwater team must have ready access to either an electronic or paper copy of applicable portions of the 2012 CGP and your SWPPP.

SWPPP Preparer

Field Engineering Co. Inc.

Richard R. Riccio III, P.E.

Phone: 508-758-2749

Email: RRICCIO@FIELDENGRG.COM

Site Superintendent

TBD

Insert Role or Responsibility:

Insert Position:

Insert Name:

Insert Telephone Number:

Insert Email:

[Repeat as necessary.]

SECTION 2: SITE EVALUATION, ASSESSMENT, AND PLANNING

2.1 Project/Site Information

Instructions (see "Project/Site Information" section of Appendix J – NOI form):

- In this section, you are asked to compile basic site information that will be helpful to you when you file your NOI.
- Detailed information on determining your site's latitude and longitude can be found at www.epa.gov/npdes/stormwater/latlong

Project Name and Address

Project/Site Name: **Proposed Solar Panel Array Installation**

Project Street/Location: **207 Providence Road**

City: **Grafton**

State: **Massachusetts**

ZIP Code: **01519**

County or Similar Subdivision: **Worcester**

Project Latitude/Longitude

(Use **one** of three possible formats, and specify method)

Latitude:

1. N (degrees, minutes, seconds)

2. $__^\circ _.' \text{ N}$ (degrees, minutes, decimal)

3. 42.186° N (decimal)

Longitude:

1. (degrees, minutes, seconds)

2. $__^\circ _.' \text{ W}$ (degrees, minutes, decimal)

3. 71.686° W (decimal)

Method for determining latitude/longitude:

USGS topographic map (specify scale: _____)

EPA Web site

GPS

Other (please specify): Google Earth _____

Horizontal Reference Datum:

NAD 27

NAD 83 or WGS 84

Unknown

If you used a U.S.G.S topographic map, what was the scale? _____

Additional Project Information

Is the project/site located on Indian country lands, or located on a property of religious or cultural significance to an Indian tribe? Yes No

If yes, provide the name of the Indian tribe associated with the area of Indian country (including the name of Indian reservation if applicable), or if not in Indian country, provide the name of the Indian tribe associated with the property: INSERT TEXT HERE

If you are conducting earth-disturbing activities in response to a public emergency, document the cause of the public emergency (e.g., *natural disaster, extreme flooding conditions*), information substantiating its occurrence (e.g., *state disaster declaration*), and a description of the construction necessary to reestablish effective public services: INSERT TEXT HERE

Are you applying for permit coverage as a "federal operator" as defined in Appendix A of the 2012 CGP? Yes No

2.2 Discharge Information

Instructions (see "Discharge Information" section of Appendix J – NOI form):

- In this section, include information relating to your site's discharge. This information corresponds to the "Discharge Information" section of the NOI form. Because you may be using EPA's mapping tool to answer some of these questions, and the tool is accessed in the eNOI system, you may find it necessary to leave some questions unanswered until you have completed that portion of the NOI.
- For Table 1, list the name of the first surface water that receives discharges from your site. If your site has discharges to multiple surface waters, indicate the names of all such waters.
- For Table 2, if any of the surface waters you listed out in Table 1 are listed as impaired by the applicable State or Tribe, provide specified information about pollutants causing the impairment and whether or not a Total Maximum Daily Load (TMDL) has been completed for the surface water. For more information on TMDLs and impaired waters, including a list of TMDL contacts and links by state, visit www.epa.gov/npdes/stormwater/tmdl.
- For Table 3, indicate whether any of the surface waters you listed out in Table 1 are designated as Tier 2, 2.5, or 3 waters by your State or Tribe. See Appendix F for more information.

Does your project/site discharge stormwater into a Municipal Separate Storm Sewer System (MS4)? Yes No

Are there any surface waters that are located within 50 feet of your construction disturbances? Yes No

Table 1 – Names of Receiving Waters

Name(s) of the first surface water that receives stormwater directly from your site and/or from the MS4 (note: multiple rows provided where your site has more than one point of discharge that flows to different surface waters)	
1.	Unnamed Weirlands
2.	
3.	
4.	
5.	
6.	

[Include additional rows as necessary.]

Table 2 – Impaired Waters / TMDLs (Answer the following for each surface water listed in Table 1 above)

	Is this surface water listed as "impaired"?	What pollutant(s) are causing the impairment?	If you answered yes, then answer the following:		Pollutant(s) for which there is a TMDL
			Has a TMDL been completed?	Title of the TMDL document	
1.	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		Has a TMDL been completed?	<input type="checkbox"/> YES <input type="checkbox"/> NO	
2.	<input type="checkbox"/> YES <input type="checkbox"/> NO			<input type="checkbox"/> YES <input type="checkbox"/> NO	
3.	<input type="checkbox"/> YES <input type="checkbox"/> NO			<input type="checkbox"/> YES <input type="checkbox"/> NO	
4.	<input type="checkbox"/> YES <input type="checkbox"/> NO			<input type="checkbox"/> YES <input type="checkbox"/> NO	

Describe the method(s) you used to determine whether or not your project/site discharges to an impaired water: INSERT TEXT HERE

Table 3 – Tier 2, 2.5, or 3 Waters (Answer the following for each surface water listed in Table 1 above)

	Is this surface water designated as a Tier 2, Tier 2.5, or Tier 3 water? (see Appendix F)	If you answered yes, specify which Tier (2, 2.5, or 3) the surface water is designated as?
2.	<input type="checkbox"/> YES <input type="checkbox"/> NO	INSERT "Tier 2", "Tier 2.5", or "Tier 3"
3.	<input type="checkbox"/> YES <input type="checkbox"/> NO	INSERT "Tier 2", "Tier 2.5", or "Tier 3"
4.	<input type="checkbox"/> YES <input type="checkbox"/> NO	INSERT "Tier 2", "Tier 2.5", or "Tier 3"
5.	<input type="checkbox"/> YES <input type="checkbox"/> NO	INSERT "Tier 2", "Tier 2.5", or "Tier 3"
6.	<input type="checkbox"/> YES <input type="checkbox"/> NO	INSERT "Tier 2", "Tier 2.5", or "Tier 3"

2.3 Nature of the Construction Activity

Instructions (see CGP Parts 1.3.c and 7.2.2):

- Provide a general description of the nature of the construction activities at your project.
- Describe the size of the property (in acres) and the total area expected to be disturbed by the construction activities (in acres), construction support activities covered by this permit (see Part 1.3.c of the permit), and the maximum area expected to be disturbed at any one time.

General Description of Project

Provide a general description of the construction project:

The applicant is proposing to construct a fixed-array photovoltaic ("PV") power generation facility on an existing vacant parcel of land located behind 207 Providence Road in the Town of Grafton, Massachusetts. The project will consist of construction of multiple fixed solar panels on an above ground mounting system. Approximately 4,500 solar panels are proposed to be constructed over the area, producing approximately 990 kW-DC of power. The disturbed areas beneath the solar panel arrays will be loamed and seeded following installation of the solar panel foundations and structures. There will be a gravel access driveway off Providence Road through an existing power line easement to access the site and also a gravel access drive running along the westerly and northerly sides of the site to provide emergency access to the facility. As this site will be an unmanned installation, there will be no water or sewer utilities required at the facility. The proposed installation will be tied into the existing power lines along Providence Road via underground connection from the proposed equipment pads to a series of new utility poles.

The site will be serviced by an on-site stormwater management system to attenuate the increase in rates of runoff that will be seen due to the change in ground cover characteristics from the installation of the solar panels. Stormwater runoff will flow unattenuated overland to proposed detention basins to be located at the low areas of the site prior to discharge at a controlled rate off the property. The stormwater management system has been designed to accept and treat the projected stormwater flows from the development in accordance with the current DEP Stormwater Management Standards. As part of the new DEP Stormwater Management Standards and Regulations, the DEP is requiring Low Impact Development (LID) measures to be considered in the design of the project. The project, as proposed, does make use of certain LID measures including minimizing the amount of impervious area on the site with the use of the gravel roads and the use of crushed stone edge drain trenches to minimize the potential for erosion off the site.

Size of Construction Project

What is the size of the property (in acres), the total area expected to be disturbed by the

construction activities (in acres), and the maximum area expected to be disturbed at any one time?

INSERT SIZE OF PROPERTY **33 +/- Acres**

INSERT TOTAL AREA OF CONSTRUCTION DISTURBANCES **7 +/- Acres**

INSERT MAXIMUM AREA TO BE DISTURBED AT ANY ONE TIME **7 +/- Acres**

Construction Support Activities (only provide if applicable)

Describe any construction support activities for the project (e.g., concrete or asphalt batch plants, equipment staging yards, material storage areas, excavated material disposal areas, borrow areas)

INSERT DESCRIPTION OF CONSTRUCTION SUPPORT ACTIVITY

INSERT CONTACT INFORMATION FOR CONSTRUCTION SUPPORT ACTIVITY (Name, Telephone No., Email Address)

INSERT LOCATION INFORMATION FOR CONSTRUCTION SUPPORT ACTIVITY (Address and/or Latitude/Longitude)

Construction support activities may consist of excavated material stockpile areas, staging areas, and materials storage areas. These areas will be controlled by the site contractor during initial site construction activities. Contact information shall be provided in the final SWPPP to be completed prior to construction.

2.4 Sequence and Estimated Dates of Construction Activities

Instructions (see CGP Part 7.2.5):

- Describe the intended construction sequence and timing of major activities.
- For each phase of construction, include the following information:
 - ✓ Installation of stormwater controls, and when they will be made operational;
 - ✓ Commencement and duration of earth-disturbing activities, including clearing and grubbing, mass grading, site preparation (i.e., excavating, cutting and filling), final grading, and creation of soil and vegetation stockpiles requiring stabilization;
 - ✓ Cessation, temporarily or permanently, of construction activities on the site, or in designated portions of the site;
 - ✓ Final or temporary stabilization of areas of exposed soil. The dates for stabilization must reflect the applicable deadlines to which you are subject to in Part 2.2.1; and
 - ✓ Removal of temporary stormwater conveyances/channels and other stormwater control measures, removal of construction equipment and vehicles, and cessation of any pollutant-generating activities.
- The construction sequence must reflect the following requirements:
 - ✓ Part 2.1.1.1 (area of disturbance);
 - ✓ Part 2.1.1.3.a (installation of stormwater controls); and
 - ✓ Parts 2.2.1.1, 2.2.1.2, 2.2.1.3 (stabilization deadlines).
- Also, see EPA's *Construction Sequencing BMP Fact Sheet* at http://www.epa.gov/npdes/stormwater/menuofbmps/construction/cons_seq

The site work is scheduled to begin in Late Summer, Early Fall 2013 and will take place in one phase.

The entire project will be following the following general schedule of construction:

- Install proposed siltation control measures.
- Clear and grub entire site.
- Rough grade array locations in sections and construct detention basins and swales at low elevations on the site as shown on the plans.
- Construct gravel access drives between array locations.
- Install solar panels on array foundations
- Install array foundations and loam and seed beneath arrays.
- Connect solar panel arrays to existing power lines via underground conduit and overhead wires.
- Stabilize all remaining disturbed surfaces.
- Clean constructed stormwater management basin and swales.
- Remove siltation controls upon full stabilization of finished surfaces.

2.5 Allowable Non-Stormwater Discharges

Instructions (see CGP Parts 1.3.d and 7.2.8):

- Identify all allowable sources of non-stormwater discharges. The allowable non-stormwater discharges identified in Part 1.3.d of the 2012 CGP include:
 - ✓ Discharges from emergency fire-fighting activities;
 - ✓ Fire hydrant flushings;
 - ✓ Landscape irrigation;
 - ✓ Waters used to wash vehicles and equipment, provided that there is no discharge of soaps, solvents, or detergents used for such purposes;
 - ✓ Water used to control dust;
 - ✓ Potable water including uncontaminated water line flushings;
 - ✓ Routine external building wash down that does not use detergents;
 - ✓ Pavement wash waters provided spills or leaks of toxic or hazardous materials have not occurred (unless all spilled material has been removed) and detergents are not used. You are prohibited from directing pavement wash waters directly into any surface water, storm drain inlet, or stormwater conveyance, unless the conveyance is connected to a sediment basin, sediment trap, or similarly effective control;
 - ✓ Uncontaminated air conditioning or compressor condensate;
 - ✓ Uncontaminated, non-turbid discharges of ground water or spring water;
 - ✓ Foundation or footing drains where flows are not contaminated with process materials such as solvents or contaminated ground water; and
 - ✓ Construction dewatering water that has been treated by an appropriate control.

List of Allowable Non-Stormwater Discharges Present at the Site

Type of Allowable Non-Stormwater Discharge	Likely to be Present at Your Site?
Discharges from emergency fire-fighting activities	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
Fire hydrant flushings	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
Landscape irrigation	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
Waters used to wash vehicles and equipment	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
Water used to control dust	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
Potable water including uncontaminated water line flushings	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
Routine external building wash down	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
Pavement wash waters	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
Uncontaminated air conditioning or compressor condensate	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
Uncontaminated, non-turbid discharges of ground water or spring water	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
Foundation or footing drains	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
Construction dewatering water	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO

(Note: You are reminded of the requirement to identify the likely locations of these allowable non-stormwater discharges on your site map. See Section 2.6, below, of the SWPPP Template.)

2.6 Site Maps

Instructions (see CGP Part 7.2.6):

- Attach site maps in Appendix A of the Template. For most projects, a series of site maps is necessary and recommended. The first should show the undeveloped site and its current features. An additional map or maps should be created to show the developed site or, for more complicated sites, show the major phases of development.

These maps must include the following features:

- Boundaries of the property and of the locations where construction will occur, including:
 - ✓ Locations where earth-disturbing activities will occur, noting any phasing of construction activities;
 - ✓ Approximate slopes before and after major grading activities. Note areas of steep slopes, as defined in Appendix A;
 - ✓ Locations where sediment, soil, or other construction materials will be stockpiled;
 - ✓ Locations of any crossings of surface waters;
 - ✓ Designated points on the site where vehicles will exit onto paved roads;
 - ✓ Locations of structures and other impervious surfaces upon completion of construction; and
 - ✓ Locations of construction support activity areas covered by this permit.
- Locations of all surface waters, including wetlands, that exists on or near your site. Indicate which waterbodies are listed as impaired, and which are identified by your state, tribe, or EPA as Tier 2, Tier 2.5, or Tier 3 waters.
- The boundary lines of any natural buffer areas. See CGP Part 2.1.2.1.a.
- Areas of federally-listed critical habitat for endangered or threatened species.
- Topography of the site, existing vegetative cover (e.g., forest, pasture, pavement, structures), and drainage pattern(s) of stormwater and allowable non-stormwater flow onto, over, and from the site property before and after major grading activities.
- Stormwater and allowable non-stormwater discharge locations, including:
 - ✓ Locations of any storm drain inlets on the site and in the immediate vicinity of the site; and
 - ✓ Locations where stormwater or allowable non-stormwater will be discharged to surface waters (including wetlands).
- Locations of all potential pollutant-generating activities.
- Locations of stormwater control measures.
- Locations where polymers, flocculants, or other treatment chemicals will be used and stored.

SECTION 3: DOCUMENTATION OF COMPLIANCE WITH OTHER FEDERAL REQUIREMENTS

3.1 Endangered Species Protection

Instructions (see CGP Parts 1.1.e, 7.2.14.1, Appendix D, and the "Endangered Species Protection" section of the Appendix J – NOI form):

Follow the process in Appendix D of the permit for determining which eligibility criterion (A-E) you have met with respect to the protection of endangered species. You will

- Include documentation supporting your determination of eligibility.
- Additional information on Endangered Species Act (ESA) provisions for EPA's Construction General Permit is at www.epa.gov/npdes/stormwater/esa

Eligibility Criterion

Under which criterion listed in Appendix D are you eligible for coverage under this permit?

A B C D E

For reference purposes, the eligibility criteria listed in Appendix D are as follows:

- Criterion A.** No federally-listed threatened or endangered species or their designated critical habitat(s) are likely to occur in your site's "action area" as defined in Appendix A of this permit.
- Criterion B.** The construction site's discharges and discharge-related activities were already addressed in another operator's valid certification of eligibility for your action area under eligibility Criterion A, C, D, E, or F and there is no reason to believe that federally-listed species or federally-designated critical habitat not considered in the prior certification may be present or located in the "action area". To certify your eligibility under this Criterion, there must be no lapse of NPDES permit coverage in the other operator's certification. By certifying eligibility under this Criterion, you agree to comply with any effluent limitations or conditions upon which the other operator's certification was based. You must include in your NOI the tracking number from the other operator's notification of authorization under this permit. If your certification is based on another operator's certification under Criterion C, you must provide EPA with the relevant supporting information required of existing dischargers in Criterion C in your NOI form.
- Criterion C.** Federally-listed threatened or endangered species or their designated critical habitat(s) are likely to occur in or near your site's "action area," and your site's discharges and discharge-related activities are not likely to adversely affect listed threatened or endangered species or critical habitat. This determination may include consideration of any stormwater controls and/or management practices you will adopt to ensure that your discharges and discharge-related activities are not likely to adversely affect listed species and critical habitat. To make this certification, you must include the following in your NOI: 1) any federally listed species and/or designated habitat located in your "action area"; and 2) the distance between your site and the listed species or designated critical habitat (in miles). You must also include a copy of your site map with your NOI.

Criterion D. Coordination between you and the Services has been concluded. The coordination must have addressed the effects of your site's discharges and discharge-related activities on federally-listed threatened or endangered species and federally-designated critical habitat, and must have resulted in a written concurrence from the relevant Service(s) that your site's discharges and discharge-related activities are not likely to adversely affect listed species or critical habitat. You must include copies of the correspondence between yourself and the Services in your SWPPP and your NOI.

Criterion E. Consultation between a Federal Agency and the U.S. Fish and Wildlife Service and/or the National Marine Fisheries Service under section 7 of the ESA has been concluded. The consultation must have addressed the effects of the construction site's discharges and discharge-related activities on federally-listed threatened or endangered species and federally-designated critical habitat. The result of this consultation must be either:

- i. a biological opinion that concludes that the action in question (taking into account the effects of your site's discharges and discharge-related activities) is not likely to jeopardize the continued existence of listed species, nor the destruction or adverse modification of critical habitat; or
- ii. written concurrence from the applicable Service(s) with a finding that the site's discharges and discharge-related activities are not likely to adversely affect federally-listed species or federally-designated habitat.

You must include copies of the correspondence between yourself and the Services in your SWPPP and your NOI.

Criterion F. Your construction activities are authorized through the issuance of a permit under section 10 of the ESA, and this authorization addresses the effects of the site's discharges and discharge-related activities on federally-listed species and federally-designated critical habitat. You must include copies of the correspondence between yourself and the Services in your SWPPP and your NOI.

Supporting Documentation

Provide documentation for the applicable eligibility criterion you select in Appendix D, as follows:

For criterion A, indicate the basis for your determination that no federally-listed threatened or endangered species or their designated critical habitat(s) are likely to occur in your site's action area (as defined in Appendix A of the permit). Check the applicable source of information you relied upon:

- Specific communication with staff of the U.S. Fish & Wildlife Service or National Marine Fisheries Service. INSERT DATE OF COMMUNICATION AND WHO YOU SPOKE WITH
- Publicly available species list. INSERT SPECIFIC DOCUMENT AND/OR WEBSITE RELIED UPON
- Other source: **NHESP Mapping, See Attachment**

For criterion B, provide the Tracking Number from the other operator's notification of permit authorization: INSERT AUTHORIZATION TRACKING NUMBER FROM OTHER OPERATOR'S NOTIFICATION LETTER/EMAIL

Provide a brief summary of the basis used by the other operator for selecting criterion A, B, C, D, E, or F: INSERT TEXT HERE

For **critterion C**, provide the following information:

- INSERT LIST OF FEDERALLY-LISTED SPECIES OR FEDERALLY-DESIGNATED CRITICAL HABITAT LOCATED IN YOUR ACTION AREA
- INSERT DISTANCE BETWEEN YOUR SITE AND THE LISTED SPECIES OR CRITICAL HABITAT (in miles)

Also, provide a brief summary of the basis used for determining that your site's discharges and discharge-related activities are not likely to adversely affect listed species or critical habitat:
INSERT TEXT HERE

For **critterion D, E, or F**, attach copies of any letters or other communication between you and the U.S. Fish & Wildlife Service or National Marine Fisheries Service concluding consultation or coordination activities. INSERT COPIES OF LETTERS OR OTHER COMMUNICATIONS HERE

3.2 Historic Preservation

Instructions (see CGP Part 1.1.f, 7.2.14.2, Appendix E, and the "Historic Preservation" section of the Appendix J – NOI form):

Follow the screening process in Appendix E of the permit for determining whether your installation of subsurface earth-disturbing stormwater controls will have an effect on historic properties.

- Include documentation supporting your determination of eligibility.
- To contact your applicable state or tribal historic preservation office, information is available at www.achp.gov/programs/html.

Appendix E, Step 1

Do you plan on installing any of the following stormwater controls at your site? Check all that apply below, and proceed to Appendix E, Step 2.

- Dike
- Berm
- Catch Basin
- Pond
- Stormwater Conveyance Channel (e.g., ditch, trench, perimeter drain, swale, etc.)
- Culvert
- Other type of ground-disturbing stormwater control: INSERT SPECIFIC TYPE OF STORMWATER CONTROL

(Note: If you will not be installing any ground-disturbing stormwater controls, no further documentation is required for Section 3.2 of the Template.)

Appendix E, Step 2

If you answered yes in Step 1, have prior surveys or evaluations conducted on the site already

determined that historic properties do not exist, or that prior disturbances at the site have precluded the existence of historic properties? YES NO

- If yes, no further documentation is required for Section 3.2 of the Template.
- If no, proceed to Appendix E, Step 3.

Appendix E, Step 3

If you answered no in Step 2, have you determined that your installation of subsurface earth-disturbing stormwater controls will have no effect on historic properties? YES NO

If yes, provide documentation of the basis for your determination. INSERT REFERENCES TO DOCUMENTS, STUDIES, OR OTHER SOURCES RELIED UPON

If no, proceed to Appendix E, Step 4.

Appendix E, Step 4

If you answered no in Step 3, did the State Historic Preservation Officer (SHPO), Tribal Historic Preservation Office (THPO), or other tribal representative (whichever applies) respond to you within 15 calendar days to indicate whether the subsurface earth disturbances caused by the installation of stormwater controls affect historic properties? YES NO

If no, no further documentation is required for Section 3.2 of the Template.

If yes, describe the nature of their response:

- Written indication that adverse effects to historic properties from the installation of stormwater controls can be mitigated by agreed upon actions. INSERT COPIES OF LETTERS, EMAILS, OR OTHER COMMUNICATION BETWEEN YOU AND THE APPLICABLE SHPO, THPO, OR OTHER TRIBAL REPRESENTATIVE
- No agreement has been reached regarding measures to mitigate effects to historic properties from the installation of stormwater controls. INSERT COPIES OF LETTERS, EMAILS, OR OTHER COMMUNICATION BETWEEN YOU AND THE APPLICABLE SHPO, THPO, OR OTHER TRIBAL REPRESENTATIVE
- Other: INSERT COPIES OF LETTERS, EMAILS, OR OTHER COMMUNICATION BETWEEN YOU AND THE APPLICABLE SHPO, THPO, OR OTHER TRIBAL REPRESENTATIVE

3.3 Safe Drinking Water Act Underground Injection Control Requirements

Instructions (see CGP Part 7.2.14.3):

- If you will use any of the identified controls in this section, include documentation of contact between you and the applicable state agency or EPA Regional Office responsible for implementing the requirements for underground injection wells in the Safe Drinking Water Act and EPA's implementing regulations at 40 CFR Parts 144-147.
- For state UIC program contacts, refer to the following EPA website:
<http://water.epa.gov/type/groundwater/uic/whereyoulive.cfm>.

Do you plan to install any of the following controls? Check all that apply below.

- Infiltration trenches (if stormwater is directed to any bored, drilled, driven shaft or dug hole that is deeper than its widest surface dimension, or has a subsurface fluid distribution system)
- Commercially manufactured pre-cast or pre-built proprietary subsurface detention vaults, chambers, or other devices designed to capture and infiltrate stormwater flow
- Drywells, seepage pits, or improved sinkholes (if stormwater is directed to any bored, drilled, driven shaft or dug hole that is deeper than its widest surface dimension, or has a subsurface fluid distribution system)

If yes, INSERT COPIES OF LETTERS, EMAILS, OR OTHER COMMUNICATION BETWEEN YOU AND THE STATE AGENCY OR EPA REGIONAL OFFICE

SECTION 4: EROSION AND SEDIMENT CONTROLS

General Instructions (See CGP Parts 2.1 and 7.2.10):

- Describe the erosion and sediment controls that will be installed and maintained at your site.
- For more information or ideas on BMPs, see EPA's National Menu of BMPs <http://www.epa.gov/npdes/stormwater/menuofbmps>

4.1 Natural Buffers or Equivalent Sediment Controls

Instructions (see CGP Parts 2.1.2.1 and 7.2.9, and Appendix G):

This section only applies to you if a surface water is located within 50 feet your construction activities. If this is the case, consult CGP Part 2.1.2.1 and Appendix G for information on how to comply with the buffer requirements.

- Describe the compliance alternative (CGP Part 2.1.2.1.a.i, ii, or iii) that was chosen to meet the buffer requirements, and include any required documentation supporting the alternative selected. The compliance alternative selected must be maintained throughout the duration of permit coverage. However, if you select a different compliance alternative during your period of permit coverage, you must modify your SWPPP to reflect this change.
- If you qualify for one of the exceptions in CGP Part 2.1.2.1.e, include documentation related to your qualification for such exceptions.

Buffer Compliance Alternatives

Are there any surface waters within 50 feet of your project's earth disturbances? YES NO
(Note: If no, no further documentation is required for the SWPPP Template.)

Check the compliance alternative that you have chosen:

- I will provide and maintain a 50-foot undisturbed natural buffer.
(Note (1): You must show the 50-foot boundary line of the natural buffer on your site map.)
(Note (2): You must show on your site map how all discharges from your construction disturbances through the natural buffer area will first be treated by the site's erosion and sediment controls. Also, show on the site map any velocity dissipation devices used to prevent erosion within the natural buffer area.)
- I will provide and maintain an undisturbed natural buffer that is less than 50 feet and is supplemented by additional erosion and sediment controls, which in combination achieves the sediment load reduction equivalent to a 50-foot undisturbed natural buffer.
(Note (1): You must show the boundary line of the natural buffer on your site map.)

(Note (2): You must show on your site map how all discharges from your construction disturbances through the natural buffer area will first be treated by the site's erosion and sediment controls. Also, show on the site map any velocity dissipation devices used to prevent erosion within the natural buffer area.)

- INSERT WIDTH OF NATURAL BUFFER TO BE RETAINED
- INSERT EITHER ONE OF THE FOLLOWING:
 - (1) THE ESTIMATED SEDIMENT REMOVAL FROM A 50-FOOT BUFFER USING APPLICABLE TABLES IN APP. G, ATTACHMENT 1. INCLUDE INFORMATION ABOUT THE BUFFER VEGETATION AND SOIL TYPE THAT PREDOMINATE AT YOUR SITE
- OR
- (2) IF YOU CONDUCTED A SITE-SPECIFIC CALCULATION FOR THE ESTIMATED SEDIMENT REMOVAL OF A 50-FOOT BUFFER, PROVIDE THE SPECIFIC REMOVAL EFFICIENCY, AND INFORMATION YOU RELIED UPON TO MAKE YOUR SITE-SPECIFIC CALCULATION.
- INSERT DESCRIPTION OF ADDITIONAL EROSION AND SEDIMENT CONTROLS TO BE USED IN COMBINATION WITH NATURAL BUFFER AREA
- INSERT THE FOLLOWING INFORMATION:
 - (1) SPECIFY THE MODEL OR OTHER TOOL USED TO ESTIMATE SEDIMENT LOAD REDUCTIONS FROM THE COMBINATION OF THE BUFFER AREA AND ADDITIONAL EROSION AND SEDIMENT CONTROLS INSTALLED AT YOUR SITE, AND
 - (2) INCLUDE THE RESULTS OF CALCULATIONS SHOWING THAT THE COMBINATION OF YOUR BUFFER AREA AND THE ADDITIONAL EROSION AND SEDIMENT CONTROLS INSTALLED AT YOUR SITE WILL MEET OR EXCEED THE SEDIMENT REMOVAL EFFICIENCY OF A 50-FOOT BUFFER

It is infeasible to provide and maintain an undisturbed natural buffer of any size, therefore I will implement erosion and sediment controls that achieve the sediment load reduction equivalent to a 50-foot undisturbed natural buffer.

- INSERT RATIONALE FOR CONCLUDING THAT IT IS INFEASIBLE TO PROVIDE AND MAINTAIN A NATURAL BUFFER OF ANY SIZE
- INSERT EITHER ONE OF THE FOLLOWING:
 - (1) THE ESTIMATED SEDIMENT REMOVAL FROM A 50-FOOT BUFFER USING APPLICABLE TABLES IN APP. G, ATTACHMENT 1. INCLUDE INFORMATION ABOUT THE BUFFER VEGETATION AND SOIL TYPE THAT PREDOMINATE AT YOUR SITE
- OR
- (2) IF YOU CONDUCTED A SITE-SPECIFIC CALCULATION FOR THE ESTIMATED SEDIMENT REMOVAL OF A 50-FOOT BUFFER, PROVIDE THE SPECIFIC REMOVAL EFFICIENCY, AND INFORMATION YOU RELIED UPON TO MAKE YOUR SITE-SPECIFIC CALCULATION.
- INSERT DESCRIPTION OF ADDITIONAL EROSION AND SEDIMENT CONTROLS TO BE USED IN COMBINATION WITH NATURAL BUFFER AREA
- INSERT THE FOLLOWING INFORMATION:
 - (1) SPECIFY THE MODEL OR OTHER TOOL USED TO ESTIMATE SEDIMENT LOAD REDUCTIONS FROM THE EROSION AND SEDIMENT CONTROLS INSTALLED AT YOUR SITE, AND

- (2) INCLUDE THE RESULTS OF CALCULATIONS SHOWING THAT THE ADDITIONAL EROSION AND SEDIMENT CONTROLS INSTALLED AT YOUR SITE WILL MEET OR EXCEED THE SEDIMENT REMOVAL EFFICIENCY OF A 50-FOOT BUFFER

I qualify for one of the exceptions in Part 2.1.2.1.e. (If you have checked this box, provide information on the applicable buffer exception that applies, below.)

Buffer Exceptions

Which of the following exceptions to the buffer requirements applies to your site?

There is no discharge of stormwater to the surface water that is located 50 feet from my construction disturbances.

(Note: If this exception applies, no further documentation is required for Section 4.1 of the Template.)

No natural buffer exists due to preexisting development disturbances that occurred prior to the initiation of planning for this project.

(Note (1): If this exception applies, no further documentation is required for Section 4.1 of the Template.)

(Note (2): Where some natural buffer exists but portions of the area within 50 feet of the surface water are occupied by preexisting development disturbances, you must still comply with the one of the CGP Part 2.1.2.1.a compliance alternatives.)

For a "linear project" (defined in Appendix A), site constraints (e.g., limited right-of-way) make it infeasible for me to meet any of the CGP Part 2.1.2.1.a compliance alternatives. INCLUDE DOCUMENTATION HERE OF THE FOLLOWING: (1) WHY IT IS INFEASIBLE FOR YOU TO MEET ONE OF THE BUFFER COMPLIANCE ALTERNATIVES, AND (2) BUFFER WIDTH RETAINED AND/OR SUPPLEMENTAL EROSION AND SEDIMENT CONTROLS TO TREAT DISCHARGES TO THE SURFACE WATER

The project qualifies as "small residential lot" construction (defined in Part 2.1.2.1.e.iv and in Appendix A).

For Alternative 1 (see Appendix G, Part G.2.3.2.a):

- INSERT WIDTH OF NATURAL BUFFER TO BE RETAINED
- INSERT APPLICABLE REQUIREMENTS BASED ON TABLE G-1
- INSERT DESCRIPTION OF HOW YOU WILL COMPLY WITH THESE REQUIREMENTS

For Alternative 2 (see Appendix G, Part G.2.3.2.b):

- INSERT (1) THE ASSIGNED RISK LEVEL BASED ON APPLICABLE TABLE IN APP. G, PART G.2.3.2.b, AND (2) THE PREDOMINANT SOIL TYPE AND AVERAGE SLOPE AT YOUR SITE
- INSERT APPLICABLE REQUIREMENTS BASED ON APP. G, TABLE G-7
- INSERT DESCRIPTION OF HOW YOU WILL COMPLY WITH THESE REQUIREMENTS

Buffer disturbances are authorized under a CWA Section 404 permit. INSERT DESCRIPTION OF ANY EARTH DISTURBANCES THAT WILL OCCUR WITHIN THE BUFFER AREA

(Note (1): If this exception applies, no further documentation is required for Section 4.1 of the Template.)

(Note (2): This exception only applies to the limits of disturbance authorized under the Section 404 permit, and does not apply to any upland portion of the construction project.)

- Buffer disturbances will occur for the construction of a water-dependent structure or water access area (e.g., pier, boat ramp, and trail). INSERT DESCRIPTION OF ANY EARTH DISTURBANCES THAT WILL OCCUR WITHIN THE BUFFER AREA
- (Note (1): If this exception applies, no further documentation is required for Section 4.1 of the Template.)

4.2 Perimeter Controls

Instructions (see CGP Parts 2.1.2.2 and 7.2.10):

- Describe sediment controls that will be used (e.g., silt fences, filter berms, temporary diversion dikes, or fiber rolls) to meet the Part 2.1.2.2 requirement to "install sediment controls along those perimeter areas of your site that will receive stormwater from earth-disturbing activities."
- For linear projects, where you have determined that the use of perimeter controls in portions of the site is impracticable, document why you believe this is to be the case.
- Also see, EPA's *Silt Fence BMP Fact Sheet* at www.epa.gov/npdes/stormwater/menuofbmps/construction/silt_fences or *Fiber Rolls BMP Fact Sheet* at www.epa.gov/npdes/stormwater/menuofbmps/construction/fiber_rolls

General

- Hay Bales/Silt fence will be provided along the entire project perimeter to serve as erosion control as well as a limit of work line.

Specific Perimeter Controls

Perimeter Control # 1

Perimeter Control Description

- Hay Bales/Silt Fence

Installation

- To be installed prior to construction

Maintenance Requirements

- Regular inspections and removal of sediment is required when accumulated sediment reaches ½ the height of the silt fence. Silt fence shall be repaired as necessary if any issues are encountered during the regular inspections.

[Repeat as needed for individual perimeter controls.]

4.3 Sediment Track-Out

Instructions (see CGP Parts 2.1.2.3 and 7.2.10):

- Describe stormwater controls that will be used to "minimize the track-out of sediment onto off-site streets, other paved areas, and sidewalks from vehicles exiting your construction site."
- Describe location(s) of vehicle exit(s), procedures to remove accumulated sediment off-site (e.g., vehicle tracking), and stabilization practices (e.g., stone pads or wash racks or both) to minimize off-site vehicle tracking of sediment. Also include the design, installation, and maintenance specifications for each control.
- Also, see EPA's *Construction Entrances BMP Fact Sheet* at www.epa.gov/npdes/stormwater/menuofbmps/construction/cons_entrance

General

- **Crushed stone tracking pad**

Specific Track-Out Controls

Track-Out Control # 1

Track-Out Control Description

- **Crushed stone tracking pads will be installed at all construction access points.**

Installation

- **Crushed stone tracking pads will be installed at the beginning of construction.**

Maintenance Requirements

- **Crushed stone tracking pads are inspected and maintained on a regular basis. When they become clogged with silt, the dirty stone is to be removed and replaced with fresh crushed stone.**

(Note: At a minimum, you must provide for maintenance that meets the following requirement in CGP Part 2.1.2.3.d: "Where sediment has been tracked-out from your site onto the surface of off-site streets, other paved areas, and sidewalks, you must remove the deposited sediment by the end of the same work day in which the track-out occurs or by the end of the next work day if track-out occurs on a non-work day. You must remove the track-out by sweeping, shoveling, or vacuuming these surfaces, or by using other similarly effective means of sediment removal. You are prohibited from hosing or sweeping tracked-out sediment into any stormwater conveyance (unless it is connected to a sediment basin, sediment trap, or similarly effective control), storm drain inlet, or surface water.")

[Repeat as needed for individual track-out controls.]

4.4 Stockpiled Sediment or Soil

Instructions (see CGP Parts 2.1.2.4 and 7.2.10):

- Describe stormwater controls and other measures you will take to minimize the discharge of sediment or soil particles from stockpiled sediment or soil. Include a description of structural practices (e.g., diversions, berms, ditches, storage basins), including design, installation, and maintenance specifications, used to divert flows from stockpiled sediment or soil, retain or detain flows, or otherwise limit exposure and the discharge of pollutants from stockpiled sediment or soil.
- Also, describe any controls or procedures used to minimize exposure resulting from adding to or removing materials from the pile.

General

- All soil will be stockpiled upgradient of the perimeter controls or removed off-site.

Specific Stockpile Controls

Stockpile Control # 1

Stockpiled Sediment/Soil Control Description

- INSERT DESCRIPTION OF STOCKPILE CONTROL TO BE INSTALLED
- INCLUDE COPIES OF DESIGN SPECIFICATIONS HERE

Installation

- INSERT APPROXIMATE DATE OF INSTALLATION

Maintenance Requirements

- INSERT MAINTENANCE REQUIREMENTS FOR THE STOCKPILE CONTROL.
(Note: At a minimum, you must comply with following requirement in CGP Part 2.1.2.4.d: Do not hose down or sweep soil or sediment accumulated on pavement or other impervious surfaces into any stormwater conveyance (unless connected to a sediment basin, sediment trap, or similarly effective control), storm drain inlet, or surface water.)

[Repeat as needed for individual stockpile controls.]

4.5 Minimize Dust

Instructions (see CGP Parts 2.1.2.5 and 7.2.10):

Describe controls and procedures you will use at your project/site to minimize the generation of dust.

General

- Dust will be minimized with water until such time that the surfaces are stabilized.

Specific Dust Controls

Dust Control # 1

Dust Control Description

- **Water truck as necessary**

Installation

- **N/A**

Maintenance Requirements

- **Apply water on dry surfaces as necessary to minimize dust migration off site.**

[Repeat as needed for individual dust controls.]

4.6 Minimize the Disturbance of Steep Slopes

Instructions (see CGP Parts 2.1.2.6 and 7.2.10):

- Describe how you will minimize the disturbance to steep slopes (as defined by CGP Appendix A).
- Describe controls (e.g., erosion control blankets, tackifiers), including design, installation and maintenance specifications, that will be implemented to minimize sediment discharges from slope disturbances.
- Also, see EPA's *Geotextiles BMP Fact Sheet* at www.epa.gov/npdes/stormwater/menuofbmps/construction/geotextiles

General

- **There are no steep slopes to be maintained on-site. All slopes are at a minimum 3:1 and can be controlled via normal measures. Erosion Control Blankets may be used on the 3:1 slopes to minimize potential for erosion.**

Specific Steep Slope Controls

Steep Slope Control # 1

Steep Slope Control Description

- **Erosion Control Blankets**

Installation

- **Following Grading**

Maintenance Requirements

- **N/A**

[Repeat as needed for individual steep slope controls.]

4.7 Topsoil

Instructions (see CGP Parts 2.1.2.7 and 7.2.10):

- Describe how topsoil will be preserved and identify these areas and associated control measures on your site map(s).
- If it is infeasible for you to preserve topsoil on your site, provide an explanation for why this is the case.

General

- Top soil will be preserved via stock-piles on site and re-spread under all solar panels and over all disturbed areas.

Specific Topsoil Controls

Topsoil Control # 1

Topsoil Control Description

- Stock piled on-site and re-used/re-spread on all disturbed areas

Installation

- N/A

Maintenance Requirements

- N/A

[Repeat as needed for individual topsoil controls.]

4.8 Soil Compaction

Instructions (see CGP Parts 2.1.2.8 and 7.2.10):

- In areas where final vegetative stabilization will occur or where infiltration practices will be installed, describe the controls, including design, installation, and maintenance specifications that will be used to restrict vehicle or equipment access or condition the soil for seeding or planting.

General

- Gravel access roads have been provided over the site to provide adequate access and minimize the need for intrusion of vehicles or equipment onto seeded and/or planted areas.

Specific Soil Compaction Controls

Soil Compaction Control # 1

Soil Compaction Control Description

- N/A

Installation

- N/A

Maintenance Requirements

- N/A

[Repeat as needed for individual soil compaction controls.]

4.9 Storm Drain Inlets

Instructions (see CGP Parts 2.1.2.9 and 7.2.10):

- Describe controls (e.g., inserts, rock-filled bags, or block and gravel) including design, installation, and maintenance specifications that will be implemented to protect all inlets that will receive stormwater from your construction activities, and that you have authority to access.
- Also, see EPA's *Storm Drain Inlet Protection BMP Fact Sheet* at www.epa.gov/npdes/stormwater/menuofbmps/construction/storm_drain

General

- Existing catch basins.

Specific Storm Drain Inlet Controls

Storm Drain Inlet Control # 1

Storm Drain Inlet Control Description

- **Silt Sacs in existing catch basins**

Installation

- **At start of construction**

Maintenance Requirements

- **Inspect silt fence on a regular basis and remove sediment once it reaches ½ the height of the silt fence.**

(Note: At a minimum, you must comply with following requirement in CGP Part 2.1.2.9.b: "Clean, or remove and replace, the protection measures as sediment accumulates, the filter becomes clogged, and/or performance is compromised. Where there is evidence of sediment accumulation adjacent to the inlet protection measure, you must remove the deposited sediment by the end of the same work day in which it is found or by the end of the following work day if removal by the same work day is not feasible.")

[Repeat as needed for individual storm drain inlet controls.]

4.10 Constructed Stormwater Conveyance Channels

Instructions (see CGP Parts 2.1.3.1 and 7.2.10):

If you will be installing a stormwater conveyance channel, describe control practices (e.g., velocity dissipation devices), including design specifications and details (volume, dimensions, outlet structure), that will be implemented at the construction site.

General

- **Crushed Stone Edge Drains**

Specific Conveyance Channel Controls

Stormwater Conveyance Channel Control # 1

Stormwater Conveyance Channel Control Description

- **Crushed Stone Edge Drains will be constructed to direct runoff to two detention basins**

Installation

- **Will be installed during initial grading.**

Maintenance Requirements

- **Maintain swale by removing accumulated sediment.**

[Repeat as needed for individual stormwater conveyance channel controls.]

4.11 Sediment Basins

Instructions (see CGP Parts 2.1.3.2 and 7.2.10):

If you will install a sediment basin, include design specifications and other details (volume, dimensions, outlet structure) that will be implemented at in conformance with CGP Part 2.1.3.2.

- At a minimum, sediment ponds must provide storage for either (1) the calculated volume of runoff from the 2-year, 24-hour storm (see CGP App. H), or (2) 3,600 cubic feet per acre drained
- Sediment ponds must also utilize outlet structures that withdraw water from the surface, unless infeasible
- Also, see EPA's *Sediment Basin BMP Fact Sheet* at www.epa.gov/npdes/stormwater/menuofbmps/construction/sediment_basins

General

- **The two detention basins shall be used as temporary sediment basins and will be cleaned following construction prior to final loaming and seeding.**

Specific Sediment Basin Controls

Sediment Basin Control # 1

Sediment Basin Control Description

- INSERT DESCRIPTION OF SEDIMENT BASIN CONTROL TO BE INSTALLED
- INCLUDE COPIES OF DESIGN SPECIFICATIONS HERE

Installation

- INSERT APPROXIMATE DATE OF INSTALLATION

Maintenance Requirements

- INSERT MAINTENANCE REQUIREMENTS FOR THE SEDIMENT BASIN CONTROL
(Note: At a minimum, you must comply with following requirement in CGP Part 2.1.3.2.b:
"Keep in effective operating condition and remove accumulated sediment to maintain at least ½ of the design capacity of the sediment basin at all times.")

[Repeat as needed for individual sediment basin controls.]

4.12 Chemical Treatment

Instructions (see CGP Parts 2.1.3.3 and 7.2.10.2):

If you are using treatment chemicals at your site, provide details for each of the items below. This information is required as part of the SWPPP requirements in CGP Part 7.2.10.2.

Soil Types

- List all the soil types (including soil types expected to be found in fill material) that are expected to be exposed during construction and that will be discharged to locations where chemicals will be applied: **N/A**

Treatment Chemicals

- List all treatment chemicals that will be used at the site and explain why these chemicals are suited to the soil characteristics: **N/A**
- Describe the dosage of all treatment chemicals you will use at the site or the methodology you will use to determine dosage: **N/A**
- Provide information from any applicable Material Safety Data Sheets (MSDS): **N/A**
- Describe how each of the chemicals will stored: **N/A**

- Include references to applicable state or local requirements affecting the use of treatment chemicals, and copies of applicable manufacturer's specifications regarding the use of your specific treatment chemicals and/or chemical treatment systems: **N/A**

Special Controls for Cationic Treatment Chemicals (if applicable)

- If you have been authorized by your applicable Regional Office to use cationic treatment chemicals, include the official EPA authorization letter or other communication, and identify the specific controls and implementation procedures you are required to implement to ensure that your use of cationic treatment chemicals will not lead to a violation of water quality standards: **N/A**

Schematic Drawings of Stormwater Controls/Chemical Treatment Systems

- Provide schematic drawings of any chemically-enhanced stormwater controls or chemical treatment systems to be used for application of treatment chemicals: **N/A**

Training

- Describe the training that personnel who handle and apply chemicals have received prior to permit coverage, or will receive prior to the use of treatment chemicals: **N/A**

4.13 Dewatering Practices

Instructions (see CGP Parts 2.1.3.4 and 7.2.10):

If you will be discharging stormwater that is removed from excavations, trenches, foundations, vaults, or other similar points of accumulation, include design specifications and details of all dewatering practices that are installed and maintained to comply with CGP Part 2.1.3.4.

General

- **N/A**

Specific Dewatering Practices

Dewatering Practice # 1

Dewatering Practice Description

- **N/A**
- **N/A**

Installation

- **N/A**

Maintenance Requirements

- **N/A**

(Note: At a minimum, you must comply with following requirement in CGP Part 2.1.3.4: "With backwash water, either haul it away for disposal or return it to the beginning of the treatment process; and replace and clean the filter media used in dewatering devices when the pressure differential equals or exceeds the manufacturer's specifications.")

[Repeat as needed for individual dewatering practices.]

4.14 Other Stormwater Controls

Instructions:

- Describe any other stormwater controls that do not fit into the above categories.

General

- INSERT GENERAL DESCRIPTION OF THE PROBLEM THIS CONTROL IS DESIGNED TO ADDRESS

Specific Stormwater Control Practices

Stormwater Control Practice # 1

Description

- INSERT DESCRIPTION OF PRACTICE TO BE INSTALLED
- IF APPLICABLE INCLUDE COPIES OF DESIGN SPECIFICATIONS HERE

Installation

- INSERT APPROXIMATE DATE OF INSTALLATION

Maintenance Requirements

- INSERT MAINTENANCE REQUIREMENTS FOR THE STORMWATER CONTROL PRACTICE

[Repeat as needed.]

4.15 Site Stabilization

Instructions (see CGP Parts 2.2 and 7.2.10):

The CGP requires you to immediately initiate stabilization when work in an area of your site has permanently or temporarily stopped, and to complete certain stabilization activities within prescribed deadlines. See CGP Part 2.2.1. The CGP also requires that stabilization measures meet certain minimum criteria. See CGP Part 2.2.2. For your SWPPP, you must include the following:

- Describe the specific vegetative and/or non-vegetative practices that will be used to stabilize exposed soils where construction activities have temporarily or permanently ceased. Avoid using impervious surfaces for stabilization whenever possible.
- Also, see EPA's *Seeding BMP Fact Sheet* at www.epa.gov/npdes/stormwater/menuofbmps/construction/seeding
- Once you begin construction, consider using the Grading/Stabilization Activities log in Appendix H of the Template to document your compliance with the stabilization requirements in CGP Part 2.2

Site Stabilization Practice (only use this if you are not located in an arid, semi-arid, or drought-stricken area)

Vegetative Non-Vegetative
 Temporary Permanent

Description of Practice

- Install seed, tackifier, and mulch over all disturbed surfaces

Installation

- To begin following installation of the solar panels and foundations
- INSERT APPROXIMATE COMPLETION DATE CONSISTENT WITH CGP PART 2.2.1.2

Maintenance Requirements

Water as necessary

[Repeat as needed for additional stabilization practices.]

Site Stabilization Practice (only use this if you are located in an arid, semi-arid, or drought-stricken area)

Vegetative Non-Vegetative
 Temporary Permanent

Description of Practice

- INSERT DESCRIPTION OF STABILIZATION PRACTICE TO BE INSTALLED
- NOTE HOW DESIGN WILL MEET REQUIREMENTS OF PART 2.2.2.1 OR 2.2.2.2, WHICHEVER APPLIES
- INCLUDE COPIES OF DESIGN SPECIFICATIONS HERE

Installation

- FOR VEGETATIVE STABILIZATION IN ARID OR SEMI-ARID AREAS, INDICATE THE BEGINNING AND ENDING DATES OF THE SEASONALLY DRY PERIOD AND DESCRIBE YOUR SITE CONDITIONS
- INSERT APPROXIMATE DATE OF INSTALLATION
- INSERT APPROXIMATE COMPLETION DATE CONSISTENT WITH CGP PART 2.2.1.3

Maintenance Requirements

INSERT MAINTENANCE REQUIREMENTS FOR THE STABILIZATION PRACTICE

[Repeat as needed for additional stabilization practices.]

Site Stabilization Practice (only use this if uncontrollable circumstances have delayed the initiation or completion of stabilization)

(Note: You will not be able to include this information in your initial SWPPP. If you are affected by circumstances such as those described in CGP Part 2.2.1.3.b, you will need to modify your SWPPP to include this information.)

Vegetative Non-Vegetative
 Temporary Permanent

Justification

- INSERT DESCRIPTION OF CIRCUMSTANCES THAT PREVENT YOU FROM MEETING THE DEADLINES REQUIRED IN CGP PARTS 2.2.1.1 AND/OR 2.2.1.2 AND THE SCHEDULE YOU WILL FOLLOW FOR INITIATING AND COMPLETING STABILIZATION

Description of Practice

- INSERT DESCRIPTION OF STABILIZATION PRACTICE TO BE INSTALLED
- NOTE HOW DESIGN WILL MEET REQUIREMENTS OF PART 2.2.2.1 OR 2.2.2.2, WHICHEVER APPLIES
- INCLUDE COPIES OF DESIGN SPECIFICATIONS HERE

Installation

- INSERT DATES OF INITIATION AND COMPLETION OF NON-VEGETATIVE STABILIZATION CONTROLS (must be completed within 14 days of the cessation of construction)

Maintenance Requirements

INSERT MAINTENANCE REQUIREMENTS FOR THE STABILIZATION PRACTICE

[Repeat as needed for additional stabilization practices.]

5.2 Spill Prevention and Response

Instructions (see CGP Parts 2.3 and 7.2.11):

- Describe procedures you will use to prevent and respond to leaks, spills, and other releases. You must implement the following at a minimum:
 - ✓ Procedures for expeditiously stopping, containing, and cleaning up spills, leaks, and other releases. Identify the name or title of the employee(s) responsible for detection and response of spills or leaks; and
 - ✓ Procedures for notification of appropriate facility personnel, emergency response agencies, and regulatory agencies where a leak, spill, or other release containing a hazardous substance or oil in an amount equal to or in excess of a reportable quantity consistent with Part 2.3.3.4c and established under either 40 CFR Part 110, 40 CFR Part 117, or 40 CFR Part 302, occurs during a 24-hour period. Contact information must be in locations that are readily accessible and available.
- Some projects/site may be required to develop a Spill Prevention Control and Countermeasure (SPCC) plan under a separate regulatory program (40 CFR 112). If you are required to develop an SPCC plan, or you already have one, you should include references to the relevant requirements from your plan.

- Refueling Operations shall be performed by Qualified Staff that carry Spill Kits.

5.3 Fueling and Maintenance of Equipment or Vehicles

Instructions (see CGP Parts 2.3.3.1 and 7.2.11):

- Describe equipment/vehicle fueling and maintenance practices that will be implemented to eliminate the discharge of spilled or leaked chemicals (e.g., providing secondary containment (examples: spill berms, decks, spill containment pallets) and cover where appropriate, and/or having spill kits readily available.
- Also, see EPA's *Vehicle Maintenance and Washing Areas BMP Fact Sheet* at www.epa.gov/npdes/stormwater/menuofbmps/construction/vehicile_maintain

General

- Refueling Operations shall be performed by Qualified Staff that carry Spill Kits.

Specific Pollution Prevention Practices

Pollution Prevention Practice # 1

Description

- **Spill Kits on-site**

Installation

- **N/A**

Maintenance Requirements

- **N/A**

[Repeat as needed.]

5.4 Washing of Equipment and Vehicles

Instructions (see CGP Parts 2.3.3.2 and 7.2.11):

- Describe equipment/vehicle washing practices that will be used to minimize the discharge of pollutants from equipment and vehicle washing, wheel wash water, and other types of washing (e.g., locating activities away from surface waters and stormwater inlets or conveyances and directing wash waters to a sediment basin or sediment trap, using filtration devices, such as filter bags or sand filters, or using other similarly effective controls).
- Describe how you will prevent the discharge of soaps, detergents, or solvents by providing either (1) cover (examples: plastic sheeting or temporary roofs) to prevent these detergents from coming into contact with rainwater, or (2) a similarly effective means designed to prevent the discharge of pollutants from these areas.
- Also, see EPA's *Vehicle Maintenance and Washing Areas BMP Fact Sheet* at www.epa.gov/npdes/stormwater/menuofbmps/construction/vehicle_maintain

General

- **It is not anticipated that any vehicles or equipment will be washed on-site during construction.**

Specific Pollution Prevention Practices

Pollution Prevention Practice # 1

Description

- **N/A**
- **N/A**

Installation

- **N/A**

Maintenance Requirements

- **N/A**

[Repeat as needed.]

5.5 Storage, Handling, and Disposal of Construction Products, Materials, and Wastes

Instructions (see CGP Parts 2.3.3.3 and 7.2.11):

- For any of the types of construction products, materials, and wastes below in Sections 5.5.1-5.5.6 below that are expected to be used or stored at your site, provide the information on how you will comply with the corresponding CGP provision and the specific practices that will be employed.
- Also, see EPA's *General Construction Site Waste Management BMP Fact Sheet* at www.epa.gov/npdes/stormwater/menuofbmps/construction/cons_wasteman

5.5.1 Building Products

(Note: Examples include asphalt sealants, copper flashing, roofing materials, adhesives, concrete admixtures.)

General

- Any construction products to be disposed will be placed in dumpsters on-site. Dumpsters will be removed from the site and emptied at the appropriate locations.

Specific Pollution Prevention Practices

Pollution Prevention Practice # 1

Description

- Designated Trash Containers

Installation

- Placed at Mobilization

Maintenance Requirements

- Emptied on a regular basis

[Repeat as needed.]

5.5.2 Pesticides, Herbicides, Insecticides, Fertilizers, and Landscape Materials

General

- It is not anticipated that any commercial grade pesticides, herbicides, insecticides, fertilizers, or landscape materials will be used on-site. Any chemicals to be used on-site will need to meet the requirements of the existing cranberry bog operation.

Specific Pollution Prevention Practices

Pollution Prevention Practice # 1

Description

- N/A

Installation

- N/A

Maintenance Requirements

- N/A

[Repeat as needed.]

5.5.3 Diesel Fuel, Oil, Hydraulic Fluids, Other Petroleum Products, and Other Chemicals

General

- Spill Kits on-site with at times of re-fueling.

Specific Pollution Prevention Practices

Pollution Prevention Practice # 1

Description

- N/A
- N/A

Installation

- N/A

Maintenance Requirements

- N/A

[Repeat as needed.]

5.5.4 Hazardous or Toxic Waste

(Note: Examples include paints, solvents, petroleum-based products, wood preservatives, additives, curing compounds, acids.)

General

- N/A

Specific Pollution Prevention Practices

Pollution Prevention Practice # 1

Description

- N/A
- N/A

Installation

- N/A

Maintenance Requirements

- N/A

[Repeat as needed.]

5.5.5 Construction and Domestic Waste

(Note: Examples include packaging materials, scrap construction materials, masonry products, timber, pipe and electrical cuttings, plastics, styrofoam, concrete, and other trash or building materials.)

General

- **Packaging materials and any scrap materials will be placed in dumpsters on-site and disposed of properly.**

Specific Pollution Prevention Practices

Pollution Prevention Practice # 1

Description

- **Designated Trash Containers**

Installation

- **At Mobilization**

Maintenance Requirements

- **Emptied as necessary**

[Repeat as needed.]

5.5.6 Sanitary Waste

General

- **Portable toilets will be placed on-site for use by workers during time of construction. Since this is an unmanned operation, no sanitary facilities will be required on-site following construction of the project.**

Specific Pollution Prevention Practices

Pollution Prevention Practice # 1

Description

- **Portable Toilets**

Installation

- **At Mobilization**

Maintenance Requirements

- **Cleaned as necessary**

[Repeat as needed.]

5.6 *Washing of Applicators and Containers used for Paint, Concrete or Other Materials*

Instructions (see CGP Parts 2.3.3.4 and 7.2.11):

- Describe how you will comply with the CGP Part 2.3.3.4 requirement to "provide an effective means of eliminating the discharge of water from the washout and cleanout of stucco, paint, concrete, form release oils, curing compounds, and other construction materials."
- Also, see EPA's *Concrete Washout BMP Fact Sheet* at www.epa.gov/npdes/stormwater/menuofbmps/construction/concrete_wash

General

- N/A

Specific Pollution Prevention Practices

Pollution Prevention Practice # 1

Description

- N/A
- N/A

Installation

- N/A

Maintenance Requirements

- N/A

[Repeat as needed.]

5.7 *Fertilizers*

Instructions (CGP Parts 2.3.5 and 7.2.11):

Describe how you will comply with the CGP Part 2.3.5 requirement to "minimize discharges of fertilizers containing nitrogen or phosphorus"

General

- It is not anticipated that any commercial grade fertilizers will be used on site.

Specific Pollution Prevention Practices

Pollution Prevention Practice # 1

Description

- N/A

Installation

- N/A

Maintenance Requirements

- N/A

[Repeat as needed for individual fertilizer practices.]

5.8 Other Pollution Prevention Practices

Instructions:

Describe any additional pollution prevention practices that do not fit into the above categories.

General

- INSERT GENERAL DESCRIPTION OF THE PROBLEM THIS CONTROL IS DESIGNED TO ADDRESS

Specific Pollution Prevention Practices

Pollution Prevention Practice # 1

Description

- INSERT DESCRIPTION OF PRACTICE TO BE INSTALLED
- IF APPLICABLE INCLUDE COPIES OF DESIGN SPECIFICATIONS HERE

Installation

- INSERT APPROXIMATE DATE OF INSTALLATION

Maintenance Requirements

- INSERT MAINTENANCE REQUIREMENTS FOR THE POLLUTION PREVENTION PRACTICE

[Repeat as needed.]

SECTION 6: INSPECTION AND CORRECTIVE ACTION

6.1 Inspection Personnel and Procedures

Instructions (see CGP Parts 2.1.1.4, 2.3.2, 3.3.2, 4, 5, and 7.2.12):

Describe the procedures you will follow for conducting inspections in accordance with CGP Parts 2.1.1.4, 2.3.2, 3.3.2, 4, 5, and 7.2.12.

Personnel Responsible for Inspections

- **To be determined**

Note: All personnel conducting inspections must be considered a "qualified person." CGP Part 4.1.1 clarifies that a "qualified person" is a person knowledgeable in the principles and practices of erosion and sediment controls and pollution prevention, who possesses the skills to assess conditions at the construction site that could impact stormwater quality, and the skills to assess the effectiveness of any stormwater controls selected and installed to meet the requirements of this permit.

Inspection Schedule

Specific Inspection Frequency

Inspections will be conducted every once every 7 days, and more frequently in the event of heavy rain falls.

Rain Gauge Location (if applicable)

Worcester Airport

Reductions in Inspection Frequency (if applicable)

- For the reduction in inspections resulting from stabilization: SPECIFY (1) LOCATIONS WHERE STABILIZATION STEPS HAVE BEEN COMPLETED AND (2) DATE THAT THEY WERE COMPLETED
(Note: It is likely that you will not be able to include this in your initial SWPPP. If you qualify for this reduction (see CGP Part 4.1.4.1), you will need to modify your SWPPP to include this information.)
- For the reduction in inspections in arid, semi-arid, or drought-stricken areas: INSERT BEGINNING AND ENDING DATES OF THE SEASONALLY-DEFINED ARID PERIOD FOR YOUR AREA OR THE VALID PERIOD OF DROUGHT
- For reduction in inspections due fo frozen conditions: INSERT BEGINNING AND ENDING DATES OF FROZEN CONDITIONS ON YOUR SITE

Inspection Report Forms

- **See Appendix D**

6.2 Corrective Action

Instructions (CGP Parts 5 and 7.2.12):

- Describe the procedures for taking corrective action in compliance with CGP Part 5.

Personnel Responsible for Corrective Actions

- TBD

Corrective Action Forms

- See Appendix E.

6.3 Delegation of Authority

Instructions:

- Identify the individual(s) or positions within the company who have been delegated authority to sign inspection reports.
- Attach a copy of the signed delegation of authority (see example in Appendix J of the Template).
- For more on this topic, see Appendix I, Subsection 11 of EPA's CGP.

Duly Authorized Representative(s) or Position(s):

Insert Company or Organization Name: **TBD**

Insert Name:

Insert Position:

Insert Address:

Insert City, State, Zip Code:

Insert Telephone Number:

Insert Fax/Email:

SECTION 8: CERTIFICATION AND NOTIFICATION

Instructions (CGP Appendix I, Part I.11.b):

- The following certification statement must be signed and dated by a person who meets the requirements of Appendix I, Part I.11.b.
- This certification must be re-signed in the event of a SWPPP Modification.

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

Name: _____ Title: _____

Signature: _____ Date: _____

[Repeat as needed for multiple construction operators at the site.]

SWPPP APPENDICES

Attach the following documentation to the SWPPP: (Attachments shall be provided on Final SWPPP)

Appendix A – Site Maps

Appendix B – Copy of 2012 CGP

Appendix C – NOI and EPA Authorization Email

Appendix D – Inspection Form

(Note: EPA is in the process of developing a sample inspection form for use by CGP permittees. The form will be made available at <http://cfpub.epa.gov/npdes/stormwater/cgp.cfm>.)

Appendix E – Corrective Action Form

(Note: EPA is in the process of developing a sample corrective action form for use by CGP permittees. The form will be made available at <http://cfpub.epa.gov/npdes/stormwater/cgp.cfm>.)

Appendix F – SWPPP Amendment Log

Appendix G – Subcontractor Certifications/Agreements

Appendix H – Grading and Stabilization Activities Log

Appendix I – Training Log

Appendix J – Endangered Species Documentation

Appendix K – Erosion and Sedimentation Control Program

Appendix L – Soils Map and Soil Logs

Stormwater Pollution Prevention Plan (SWPPP)
CEC Solar #1056 LLC
207 Providence Road
Grafton, Massachusetts

Appendix A – Site Maps

See Site Plans prepared by Field Engineering Co. Inc.

Stormwater Pollution Prevention Plan (SWPPP)
CEC Salar #1056 LLC
207 Providence Road
Grafton, Massachusetts

**Appendix B – Copy of 2012 CGP
(TO BE PROVIDED IN FINAL SWPPP)**

Stormwater Pollution Prevention Plan (SWPPP)
CEC Solar #1056 LLC
207 Providence Road
Grafton, Massachusetts

**Appendix C – Copy of NOI and EPA Authorization email
(TO BE PROVIDED IN FINAL SWPPP)**

Stormwater Pollution Prevention Plan (SWPPP)
CEC Solar #1056 LLC
207 Providence Road
Grafton, Massachusetts

Appendix D – Copy of Inspection Form

(TO BE PROVIDED IN FINAL SWPPP)

Stormwater Pollution Prevention Plan (SWPPP)
CEC Solar #1056 LLC
207 Providence Road
Grafton, Massachusetts

Appendix E – Copy of Corrective Action Form

Appendix F –SWPPP Amendment Log

Instructions (see CGP Part 7.4):

- Create a log here of changes and updates to the SWPPP. You may use the table below to track these modifications.
- SWPPP modifications are required pursuant to CGP Part 7.4.1 in the following circumstances:
 - ✓ Whenever new operators become active in construction activities on your site, or you make changes to your construction plans, stormwater control measures, pollution prevention measures, or other activities at your site that are no longer accurately reflected in your SWPPP;
 - ✓ To reflect areas on your site map where operational control has been transferred (and the date of transfer) since initiating permit coverage;
 - ✓ If inspections or investigations determine that SWPPP modifications are necessary for compliance with this permit;
 - ✓ Where EPA determines it is necessary to impose additional requirements on your discharge; and
 - ✓ To reflect any revisions to applicable federal, state, tribal, or local requirements that affect the stormwater control measures implemented at the site.
- If applicable, if a change in chemical treatment systems or chemically-enhanced stormwater control is made, including use of a different treatment chemical, different dosage rate, or different area of application.

No.	Description of the Amendment	Date of Amendment	Amendment Prepared by [Name(s) and Title]

Appendix G –Subcontractor Certifications/Agreements

SUBCONTRACTOR CERTIFICATION
STORMWATER POLLUTION PREVENTION PLAN

Project Number: _____

Project Title: _____

Operator(s): _____

As a subcontractor, you are required to comply with the Stormwater Pollution Prevention Plan (SWPPP) for any work that you perform on-site. Any person or group who violates any condition of the SWPPP may be subject to substantial penalties or loss of contract. You are encouraged to advise each of your employees working on this project of the requirements of the SWPPP. A copy of the SWPPP is available for your review at the office trailer.

Each subcontractor engaged in activities at the construction site that could impact stormwater must be identified and sign the following certification statement:

I certify under the penalty of law that I have read and understand the terms and conditions of the SWPPP for the above designated project and agree to follow the practices described in the SWPPP.

This certification is hereby signed in reference to the above named project:

Company: _____

Address: _____

Telephone Number: _____

Type of construction service to be provided: _____

Signature: _____

Title: _____

Date: _____

Appendix I –SWPPP Training Log

Stormwater Pollution Prevention Training Log

Project Name: _____

Project Location: _____

Instructor's Name(s): _____

Instructor's Title(s): _____

Course Location: _____ Date: _____

Course Length (hours): _____

Stormwater Training Topic: *(check as appropriate)*

- Sediment and Erosion Controls**
- Emergency Procedures**
- Stabilization Controls**
- Inspections/Corrective Actions**
- Pollution Prevention Measures**

Specific Training Objective: _____

Attendee Roster: *(attach additional pages as necessary)*

No.	Name of Attendee	Company
1		
2		
3		
4		
5		
6		
7		
8		

Appendix J – Endangered Species Documentation

(TO BE PROVIDED IN FINAL SWPPP)

Stormwater Pollution Prevention Plan (SWPPP)
CEC Solar #1056 LLC
207 Providence Road
Grafton, Massachusetts

Appendix K – Erosion and Sedimentation Control Program

(TO BE PROVIDED IN FINAL SWPPP)

Appendix L – Soils Maps

(TO BE PROVIDED IN FINAL SWPPP)

Appendix C

Long Term Pollution Prevention Plan

Long Term Pollution Prevention Plan
Proposed Solar Panel Array Installation
CEC SOLAR #1056 LLC
207 Providence Road
Grafton, Massachusetts

1.0 Introduction

This Long Term Pollution Prevention Plan has been prepared in accordance with the Massachusetts Stormwater Handbook for Compliance with Stormwater Standards 4-6.

2.0 Good Housekeeping Practices/Storage Provisions

Good housekeeping practices including periodic inspections of stormwater management system components will be performed in accordance with the Stormwater Management System Operation and Maintenance Plan. It is not anticipated that any high pollutant materials would be stored on site in areas that would discharge directly to the wetland systems. Additionally, this will not be a manned facility. It would be anticipated that maintenance personnel would make routine visits to the property to perform periodic inspections to the facility and stormwater management system components.

3.0 Vehicle Washing Controls

It is not anticipated that any vehicle washing would be taking place on site. The proposed use is a solar power generating facility and there will only be routine visits by maintenance personnel to the facility.

4.0 Routine Maintenance of Stormwater BMP's

The Stormwater BMP's including the detention basin and grassed swales will all be operated and maintained in accordance with the Stormwater Management System Operation and Maintenance Plan which is discussed on the Site Development Plans.

5.0 Spill Prevention and Response Plans

This is an unmanned facility which will simply be visited on a routine basis for maintenance purposes, therefore it is not anticipated that there would be any potential for spills of hazardous materials. Emergency contact numbers will be posted through the facility that may occupy the building with a 24-hour contact number in the event of any spills on-site.

6.0 Landscaping Provisions

Landscaping on-site will consist strictly of loam and seeded areas. It is anticipated that the grassed areas will be mowed once or twice annually. Disposal of lawn and garden waste will be prohibited from any areas being used for stormwater management as well as in any wetland resource areas. Additionally, provisions shall be made to minimize the amount of fertilizers and other materials that will be allowed to be discharged within the landscaped areas on the site.

7.0 Pet Waste Management Provisions

It is not anticipated that there would be any pets on site at solar power generating facility.

8.0 Provisions for Solid Waste Management

Since this will be an unmanned location, there is not anticipated to be any solid waste generated at this facility.

9.0 Snow Disposal Guidelines

Plowing directly into any wetland resource areas or buffer zones will not be permitted. All snow stored on site will melt and flow through the stormwater management system.

10.0 Winter Road Salt and Sand Use

The use of road salt will not be allowed on the site. Sand will be used wherever possible. It is not anticipated that large quantities of road salt and/or sand will be stored on site.

11.0 Illicit Discharge Prevention

Illicit connections to the stormwater management system will be strictly prohibited. Any contractors performing work at the site will be notified of the prohibition of any illicit connections to the stormwater management system. All work done on site shall be per the approved design plans.

12.0 Training for Staff

It is expected that a Property Management Company would be contracted to manage the site property as a whole. Included in this contract would be the operation and maintenance of the Stormwater Management System. Any Site Management Staff would be properly trained in the operation and maintenance of the Stormwater Management System.

13.0 Emergency Contacts

The applicants for the project, CEC Solar #1056 LLC, would be the emergency contacts for any implementation measures that may be required on this Long-Term Pollution Prevention Plan. It would be anticipated that emergency contact numbers would be posted throughout the site and facilities should any emergency situations arise.

Appendix D

Illicit Discharge Compliance Statement

Illicit Discharge Compliance Statement
Proposed Solar Panel Array Installation
CEC SOLAR #1056 LLC
207 Providence Road
Grafton, Massachusetts

1.0 Description of Illicit Discharges

Illicit discharges are discharges to the stormwater management system that are not entirely composed of stormwater. Illicit discharges include (but are not limited to) wastewater discharges and discharges of stormwater contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, oil, or grease.

2.0 Illicit Discharge Prevention

The project, as designed, does not provide for any illicit connections to the proposed stormwater management system. As part of the long-term pollution prevention plan that will be on file at the Town and with the Owners, illicit connections to the stormwater management system will be strictly prohibited. Any contractors performing work at the site will be notified of the prohibition of any illicit connections to the stormwater management system.

3.0 Training for Staff

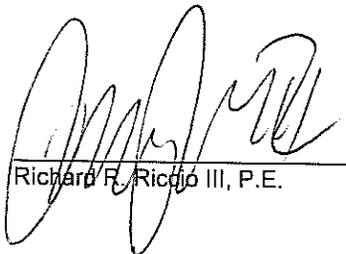
The property owner/managers responsible for the maintenance of the stormwater management system will be properly trained as required to detect any unauthorized illicit discharges to the stormwater management system and eliminate them as soon as possible. It is anticipated that staff will be performing routine maintenance on the stormwater management system and at this time would be able to detect any unauthorized illicit discharges.

4.0 Site Map

Refer to Proposed Site Development Plans prepared for CEC Solar #1056 LLC by Field Engineering for locations and information on the proposed stormwater management system associated with this project.

5.0 Certification

As the design plans show, there are no provisions for illicit discharges to the stormwater management system being proposed. Additionally, there are no proposed connections between any stormwater and wastewater management systems. Illicit discharges will be prohibited to the new stormwater management system associated with the proposed project and the property owners have been notified to not allow any unauthorized illicit discharges.



Richard F. Riccio III, P.E.