STORMWATER MANAGEMENT REPORT

PROJECT SITE:
SALMON HEALTH AND RETIREMENT COMMUNITY
ARCPUD SPECIAL PERMIT
VILLAGE STREET
MEDWAY, MASSACHUSETTS 02053

PREPARED FOR:
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Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

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

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

The Stormwater Report must include:

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

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

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

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

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

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

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

COMMONWEALTH OF MASSACHUSETTS
TRACY L. DUARTE
CIVIL
No. 48660
REGISTERED
PROFESSIONAL ENGINEER

Tracy L. Duarte 6/12/15
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 (continued)

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

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

Standard 1: No New Untreated Discharges

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

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☐ Static ☒ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

  ☐ is within the Zone II or Interim Wellhead Protection Area

  ☐ is near or to other critical areas

  ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)

  ☐ involves runoff from land uses with higher potential pollutant loads.

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

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

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist (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.

INTRODUCTION

Coneco Engineers & Scientists, Incorporated (Coneco) has completed a drainage analysis of the subject site, located at 259, 261, 261R, and 263 Village Street in Medway, Massachusetts, the results of which are contained herein. The purpose of this analysis is to quantitatively understand the impacts of the proposed development of the project site on the existing hydrologic conditions and to mitigate said impacts through the implementation of a stormwater management system that utilizes best management practices and is supported by an operations and maintenance plan as well as a long term pollution prevention plan.

STORMWATER MANAGEMENT SYSTEM OVERVIEW

The proposed stormwater management system consists of conventional curb and gutter drainage for the roadways including a series of catch basins, drain manholes and pipe which convey stormwater runoff from the roadway areas to a water quality device before entering the proposed infiltration system which will ultimately discharge any remaining runoff upstream of the bordering vegetated wetlands. Roof runoff from the proposed campus building, residential units, and medical building will be recharged through individual subsurface infiltration chambers. These chambers have been designed to accommodate flows from the 100-year storm event.

As previously mentioned the proposed roadway drainage discharges upstream of the bordering vegetated wetlands via a flared end and level spreader. The catch basins will have 4 foot deep sumps and oil/gas hoods. The deep sumps are intended to remove sediment, and the hoods are intended to remove oil and gas from the stormwater prior to release. The level spreaders have flared end inlets, a depressed center and a level outer rim. The depressed center promotes the removal of any residual sediment while the level outer rim dissipates the energy of the effluent by diminishing the velocity and eliminating the point discharge.

From an environmentally sensitive perspective, the aforementioned measures result in a low impact design that enhances the introduction of surface water into the ground while preserving the natural hydrologic conditions.

METHODOLOGY

Drainage calculations are performed to demonstrate that there is no increase in the rate of runoff from the subject site due to the proposed project. The rate of runoff is compared at a common point, referred to as the design point, for both the pre and post development condition (or the existing and proposed condition in the case of a redevelopment project). The hydrologic and hydraulic model created to analyze the pre and post development condition was developed using the Soil Conservation Service (SCS) Technical Release No. 20 (TR 20, SCS unit hydrograph procedures), SCS Technical Release No. 55 (TR 55, Time of Concentration (T_c) and Curve Number (CN)), SCS Technical Release No. 40 (TR 40, rainfall intensity) and the stormwater detention facilities were modeled using the SCS Storage Indication Method.

Time of Concentration (T_c) - is the time required for stormwater runoff to travel from the most hydraulically distant point in a drainage area or subcatchment to the design point. The T_c is calculated based upon slope, distance, surface cover and type of flow. A longer time of concentration will generally result in a smaller rate of runoff.

Curve Number (CN) - represents the amount of runoff expected from a particular segment of the drainage area. A higher curve number will be less permeable and therefore a larger rate of runoff. The CN is based upon three factors: soil type, soil cover, and cover condition. The soil type is graded A to D; A soil is the post permeable, D is the least. The soil cover (e.g. - vegetated, developed, farmland or impervious) ranges from 30-98, with more permeable soil covers having a lower value. The final factor is the condition of the vegetated soil cover (good, fair or poor), where vegetated cover in good condition is the most permeable and allows the least runoff.

The Hydrologic Soil Group (HSG) for the drainage areas was determined from the Soil Conservation Service Soil Survey of Norfolk County, Massachusetts. The soil survey contains maps which depict the extent of the various soil types. A soil type overlay plan is attached as Figure 6.

Design Software - To assist in the analysis, software entitled HydroCAD, Version 10.0 (developed by HydroCAD Software Solutions, L.L.C.) was utilized. The HydroCAD program calculates the runoff based on rainfall events and watershed characteristics, and produces a runoff hydrograph (a runoff rate versus time curve). If applicable, stage-storage-discharge curves for a specific detention facility are calculated.

Peak Attenuation - The peak rate of runoff at the design points was calculated for the existing and proposed conditions for the 2, 10, 25 and 100-year, 24-hour storm events. The peak rate of runoff was compared for each storm event to determine if there was an increase from the pre to post development condition.

Runoff Volume - The total volume of runoff for the entire site was calculated for the existing and proposed conditions for the 2, 10, 25 and 100-year, 24-hour storm events. The volume of runoff was compared for each storm event to determine if there was an increase from the pre to post development condition.

EXISTING CONDITIONS

Coneco compiled existing and proposed drainage areas from an existing topographic survey. A site visit was conducted to evaluate the existing drainage patterns and watershed areas for the site and the areas surrounding the site, which is located at 259, 261, 261R, and 263 Village Street in Medway, Massachusetts (Assessors Map 69 Lots 13-1, 14, 15-1, and 21). The site is situated on the south side of Village Street between Brookside Road and Charles River Road and is bounded on the west and south by the Charles River. The site is approximately 56.9 acres in size and consists of undeveloped land. Topography generally slopes from northeast to southwest at grades of approximately 0.5 to 10 percent.

There are no Areas of Critical Environmental Concern, Estimated Habitats of Rare Wildlife, or Priority Habitats of Rare Species located on-site. Two Certified Vernal Pools are found near the Charles River on the western side of the site. There are four Bordering Vegetated Wetlands totaling 13.0 acres of land found on site. The total length of Bordering Vegetated Wetlands line is approximately 10,344 linear feet. The site also contains 2,992 linear feet of the bank along the Charles River. The smaller of the two Certified Vernal Pools encompasses 6,055 s.f. of land area, has a 378 linear foot edge and is located approximately 600 feet south of Village Street and 320 feet east of the Charles River. The larger of the two Certified Vernal Pools encompasses 11,436 s.f. of land area, has a 462 linear foot edge and is located approximately 830 feet south of Village Street and 440 feet east of the Charles River. The wetlands lines were delineated by BSC Group on December 11, 12, and 18, 2014. These resource areas were identified in an ANRAD dated February 12, 2015, last revised May 5, 2015 by Coneco and approved via ORAD issued by the Medway Conservation Commission dated 5/21/2015. Both the ANRAD and ORAD are associated with the MassDEP File Number 2016-0845.

The Soil Conservation Service map for the area indicates that the site is made of seven soil types. Please refer to Table 1 for a summary of these soils.

Table 1

Existing Soil Classifications

SOIL MAP UNIT	*NORFOLK COUNTY SOIL SURVEY MAP UNIT NAME AND DESCRIPTION*	*HYDROLOGIC SOIL GROUP*
4	Rippowam silt loam, 0 to 3 percent slopes	D
5	Saco silt loam, 0 to 3 percent slopes	D
31A	Walpole sandy loam, 0 to 3 percent slopes	D
70A	Ridgebury fine sandy loam, 0 to 5 percent slopes	D
245B	Merrimac fine sandy loam, 3 to 8 percent slopes	A
260B	Sudbury fine sandy loam, 2 to 8 percent slopes	B
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	C

PROPOSED CONDITIONS

The proposed development consists of the construction of an Adult Retirement Community Planned Residential District (ARCPUD) consisting of a four story main residence building which has 40 memory care, 60 assisted living and 54 independent living residential units and 15 attached cottages (two bedroom) as well as 48 two bedroom and 8 three bedroom detached cottages, a two story medical office building, and a pavilion. The associated roadways, parking, site utilities, lighting, grading and drainage are also part of the project.

These changes significantly increase the overall impervious area found at the site. However, the proposed stormwater management system has been designed to capture, treat and infiltrate the generated stormwater runoff and meet all 10 of the stormwater standards.

STORMWATER MANAGEMENT STANDARDS REVIEW

As part of this drainage analysis, Coneco has performed an in-depth review of the subject site for conformance with the Massachusetts Department of Environmental Protection's Stormwater Management Standards. The following is a summary of our findings relative to our review of each of the standards. Please note that the actual text of each standard is italicized for clarity.

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

The stormwater runoff from the roadway system shall be treated prior to release with deep sump catch basins with hoods. The deep sump will provide an area for sediment to settle out and the hood will provide oil and gas separation. Prior to discharge to the basins, the stormwater runoff will be directed through water quality units. Outlets have been designed to reduce erosion and eliminate scouring within the wetland areas. A plunge pool shall be installed at each discharge point. The plunge pool and level spreader will spread out the runoff over a larger area which slows down the velocity and therefore reduces scour. The plunge pool will be lined with riprap and be depressed to form a pool which will enhance sediment removal prior to discharge.

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

The existing and proposed site conditions were analyzed for the 2, 10, 25 and 100-year 24-hour storm events using the aforementioned methodology (please refer to appendices A and B of this report for HydroCAD output support data). Based on these results, there is no increase in peak discharges for all storm events (refer to Table 2).

Table 2

Peak Rate of Runoff

Storm Frequency (in years)	Offsite West		Charles River		Percent Decrease From Existing	
	Existing Peak Runoff (CFS)	Proposed Peak Runoff (CFS)	Existing Peak Runoff (CFS)	Proposed Peak Runoff (CFS)	Offsite West	Charles River
2	0.46	0.40	27.64	25.59	13.0%	7.4%
10	1.51	1.12	65.88	56.82	25.8%	13.8%
25	2.18	1.57	88.84	87.02	28.0%	2.0%
100	3.29	2.29	125.32	122.95	30.4%	1.9%

CLOSED DRAINAGE SYSTEM CALCULATIONS

Rational Method – Sizing pipes for the 25 year storm

The closed drainage system calculations determine the rate of runoff, the time of concentration and the rainfall intensity for the drainage subcatchment. The calculations were performed for a 25-year storm event. The following standards were used:

1. The Rational Formula (Q =CIA) was used to determine the flow to each structure.

   Q = Flow cubic feet per second (CFS)
   C = Runoff coefficients
   I = Rainfall Intensity (inches per hour)
   A = Drainage Area (acres)

2. The runoff coefficients used are as follows:

   Impervious (pavement and roofs) = 0.85
   Grassed/Landscape = 0.40

3. The intensity for each area was determined by the Steel Formula for a 25-year frequency storm. The Steel Formula is:

   I = k/(t+b)
   I = Intensity
   k = 230 (25 yr)
   t = Time of Concentration
   b = 30 (25 yr)

4. The times of concentration were calculated using a spreadsheet which calculates flow time in the pipe with the Manning equation. A minimum time of concentration of five (5) minutes was utilized.

5. The Manning's formula was utilized to calculate the capacity of the individual pipes in the closed drainage system. The Manning's formula is:

   $Q = (Ap)\ (1.486/n)\ (s^{1/2})\ (h^{2/3})$
   Q = Flow in CFS
   Ap = Cross-sectional area of the pipe (square feet)
   n = Roughness coefficient
   s = slope of the pipe (ft/ft)
   h = hydraulic radius = area/wetted perimeter (sf/ft)

The closed drainage system as designed is capable of handling the design flow as calculated, as well as maintaining a design velocity of between 2.0 feet per second (fps) and 10.0 fps. Two feet per second is considered "self cleansing velocity", and will prevent the pipes from accumulating sediment. Ten feet per second is considered a safe maximum velocity, to reduce scouring of the pipes. Please refer to Appendix C for the closed drainage system pipe sizing calculation spreadsheet.

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

Standard 3 requires that a certain volume of water be recharged to the site depending on existing soil types and square feet of total impervious area over each soil type. Please refer to Table 3 for a summary of the required recharge.

Table 3

Recharge to Groundwater

Hydrologic Group	*Volume of Recharge (inches/SF)*	*Total Impervious Area (SF)*	*Required Recharge Volume (CF)*
A	0.60	57,688	2,884
B	0.35	301,626	8,797
C	0.25	50,370	1,049
D	0.10	114,789	957
		Total Volume to Recharge on Site:	**13,688 CF**

Therefore, the on-site infiltration system must be designed with a minimum infiltration capacity of 13,688 cubic feet. As shown in the attached recharge calculations, this volume is provided by a single recharge system containing 90 Cultec 330's. Through the variety of infiltration systems proposed on the site, a total of 85,057 cubic feet is provided on the site in just the underground infiltration systems. An additional storage volume of 16,692± cf (Basin #1), 12,014± cf (Basin #2), and 7,898± cf (Basin #3), provides of storage between the bottoms of the basins and the invert of the outlet orifice.

Coneco has used the Simple Dynamic method for analyzing the infiltration BMPs. Please refer to Appendix C for this information as well as 72 hour drawdown calculation.

It should be noted that the proposed Infiltration BMPs do not adversely impact nearby wetland resource areas.

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 determined in accordance with the Massachusetts Stormwater Handbook; and

c) Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.

TREATMENT OF SUSPENDED SOLIDS:

Catch basins will be equipped with hoods and four-foot sumps to limit sediment, oils, and grease from being discharged to the drainage system. The Water Quality Units will further reduce total suspended solids (TSS) entering the vegetated detention basins, achieving an 80% removal rate. Please refer to Table 4 – Total Suspended Solids Removal worksheet attached herein for this information.

Runoff from roofs will be considered clean which require no treatment. All other impervious areas will be collected in the closed drainage system which is routed through the proprietary treatment device and detention basin.

Please refer to Table 4 for a TSS removal summary.

Please note that a Long Term Pollution Prevention Plan has been developed as part of the analysis and can be found in Appendix D.

Table 4

Total Suspended Solids Removal

BMP	*TSS Removal Rate*	*Starting TSS Load*	*TSS Removed*	*Remaining TSS Load*
Deep Sump Hooded Catch Basins	0.25	1.00	0.25	0.75
Stormceptor	0.75	0.75	0.56	0.19
Infiltration	0.80	0.19	0.80	0.15
		Total Suspended Solids Removed:		**85%**

WATER QUALITY VOLUME:

See Appendix C for required water quality volume calculations based on impervious area.

Water Quality Volume = Total impervious area of post-development project x 0.5 inches.

Water Quality Volume = 524,473 sf impervious area x0.5 inches/12 inches per foot = 21,853 cubic feet

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 project site is not a land use with higher potential pollutant loads, per the regulations.

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. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.

The project site is not within the Zone II or Interim Wellhead Protection Area of a public water supply and does not discharge near or to any other critical area. See Figure 5, Critical Areas.

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 best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

The project is not considered a redevelopment project per the regulations and is therefore required to meet all 10 Stormwater Management Standards.

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.

Please refer to Appendix E for the Erosion & Sedimentation Control Plan for to be implemented during the construction phase of this project.

A Stormwater Pollution Prevention Plan (SWPPP) will be prepared before the disturbance of any earth commences on the project site. The SWPPP will be prepared by others per EPA NPDES NOI guidelines and submitted under a separate cover.

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

Please refer to Appendix F for the Operation and Maintenance Plan for the proposed Stormwater Management System.

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

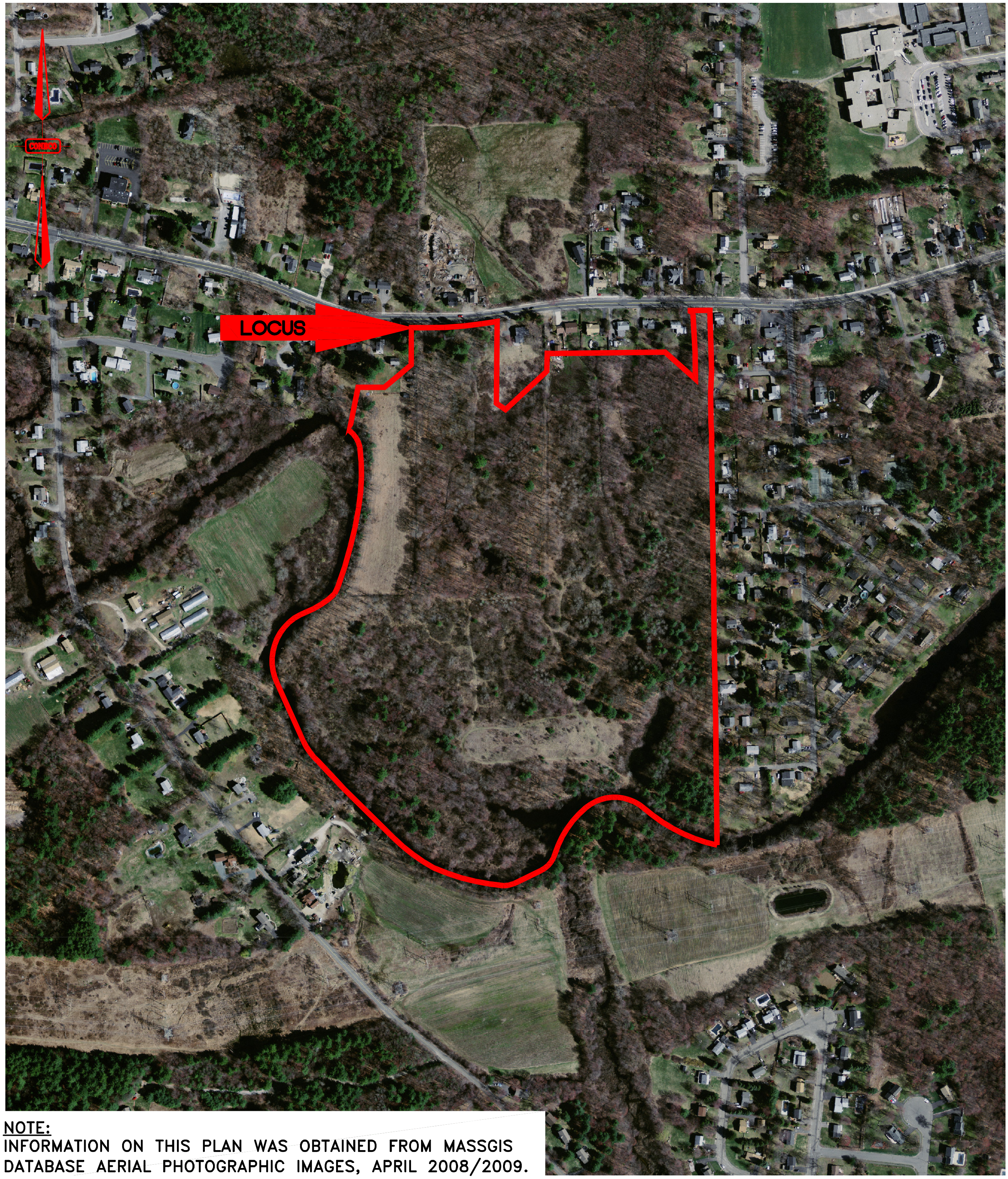
To our knowledge, no illicit discharges are made to the stormwater management system. Please refer to Appendix G for the Illicit Discharge Compliance Statement.

CONCLUSION/SUMMARY:

Based on the HydroCAD analysis for the 2, 10, 25 and 100-year storm events, the peak rate of runoff have decreased from the existing to the proposed condition. Furthermore, effluent water quality has been enhanced and widespread infiltration has been introduced to previously uncontrolled areas thereby promoting/preserving the natural hydrologic conditions. In addition to these improvements, all 10 of the DEP Stormwater Standards have been met.

FIGURE 1

AERIAL MAP



NOTE:
INFORMATION ON THIS PLAN WAS OBTAINED FROM MASSGIS DATABASE AERIAL PHOTOGRAPHIC IMAGES, APRIL 2008/2009.

259, 261, 261R, AND 263 VILLAGE STREET, MEDWAY, MA 02053

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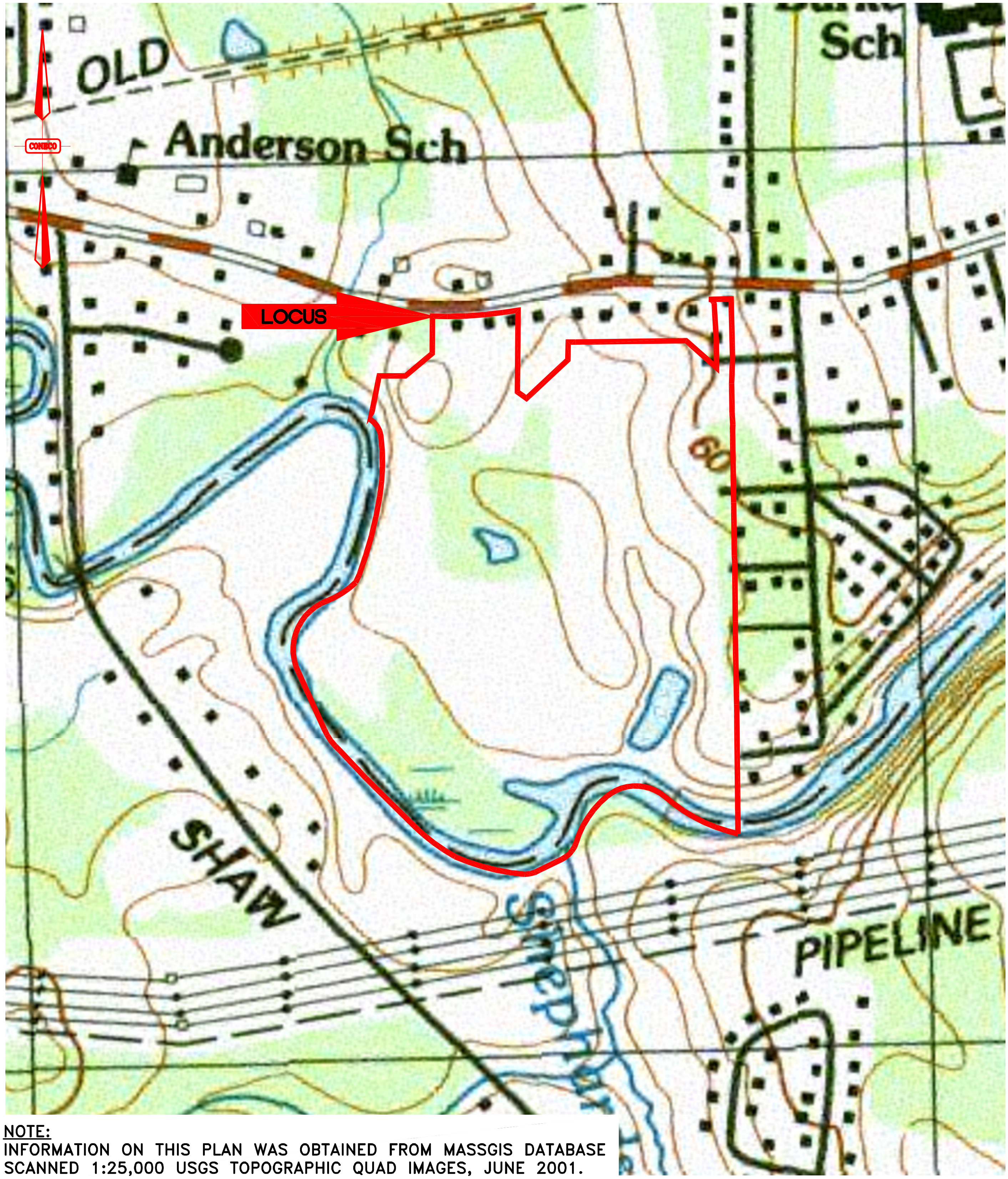
PREPARED FOR: CONTINUING CARE MANAGEMENT, LLC		PLAN SET: REPORT FIGURES	
SCALE 1" = 500'	DATE 6/12/2015	PROJECT NO. 8548.0	TITLE: FIGURE 1 AERIAL MAP

FIGURE 2

USGS TOPOGRAPHIC MAP



NOTE:
INFORMATION ON THIS PLAN WAS OBTAINED FROM MASSGIS DATABASE SCANNED 1:25,000 USGS TOPOGRAPHIC QUAD IMAGES, JUNE 2001.

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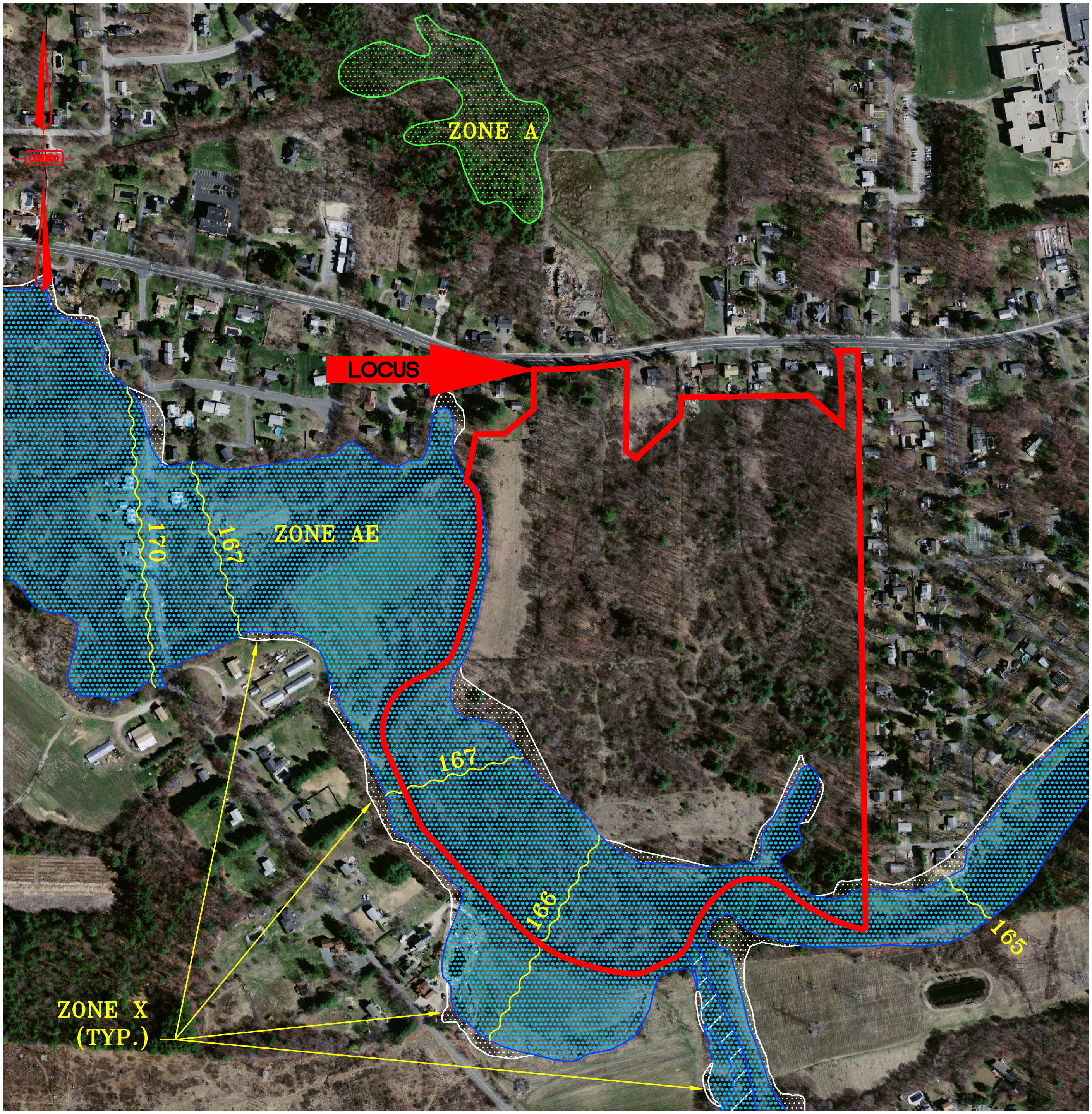
SCALE 1" = 500'	DATE 6/12/2015	PROJECT NO. 8548.0	TITLE: FIGURE 2 USGS TOPOGRAPHIC MAP

FIGURE 3

FIRM – FLOOD INSURANCE RATE MAP



FLOOD ZONE X, AREAS BETWEEN THE LIMITS OF 100–YEAR AND 500–YEAR FLOODS

FLOODWAY AREAS IN ZONE AE

FLOOD ZONE AE, AREAS OF 100–YEAR FLOOD, BASE FLOOD ELEVATIONS DETERMINED

FLOOD ZONE A, AREAS OF 100–YEAR FLOOD, BASE FLOOD ELEVATIONS NOT DETERMINED

NOTE:
FLOOD BOUNDARY INFORMATION ON THIS PLAN WAS FOUND ON FEMA FLOOD INSURANCE RATE MAP NORFOLK COMMUNITY MAP NO. 25021C0143E, EFFECTIVE JULY 17, 2012.

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PREPARED FOR: CONTINUING CARE MANAGEMENT, LLC

PLAN SET: REPORT FIGURES

SCALE 1" = 500'

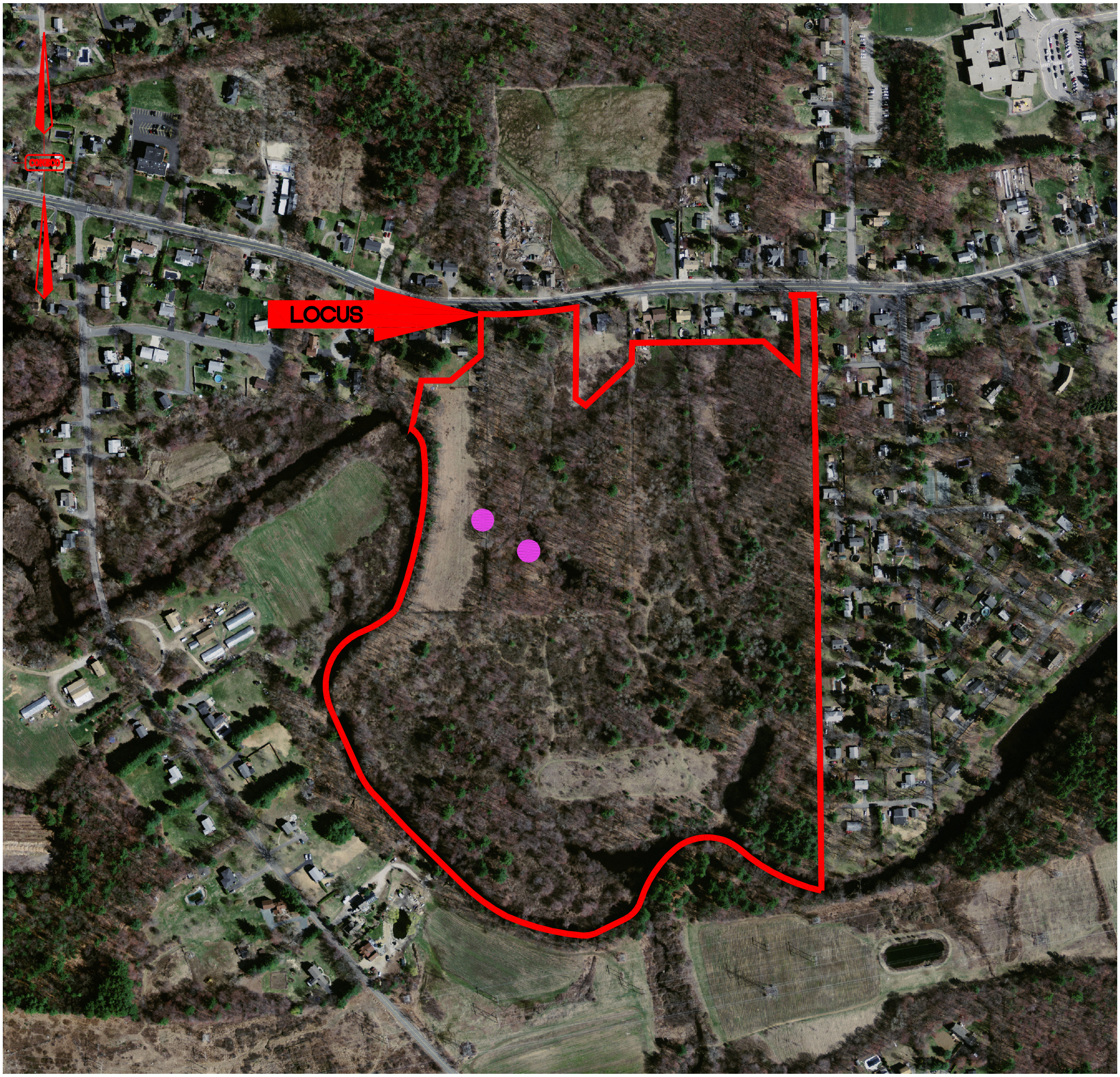
DATE 6/12/2015

PROJECT NO. 8548.0

TITLE: FIGURE 3 FLOOD INSURANCE RATE MAP

FIGURE 4

NATURAL HERITAGE & ENDANGERED SPECIES HABITATS



PRIORITY HABITAT OF RARE SPECIES

CERTIFIED VERNAL POOLS

ESTIMATED HABITATS OF RARE WILDLIFE

NOTES:

1. AREAS OF ESTIMATED AND PRIORITY HABITATS OF RARE WILDLIFE CAME FROM MASSGIS DATABASE LAST UPDATED OCTOBER 2008.
2. CERTIFIED VERNAL POOL LOCATIONS WERE TAKEN FROM MASSGIS DATABASE ON FEBRUARY 5, 2015. THIS DATA IS UPDATED CONTINUALLY AND SHOWN CONDITIONS MAY VARY FROM THIS DATA.
3. THERE ARE NO AREAS ESTIMATED OR PRIORITY HABITATS OF RARE WILDLIFE ON THE PROJECT SITE.

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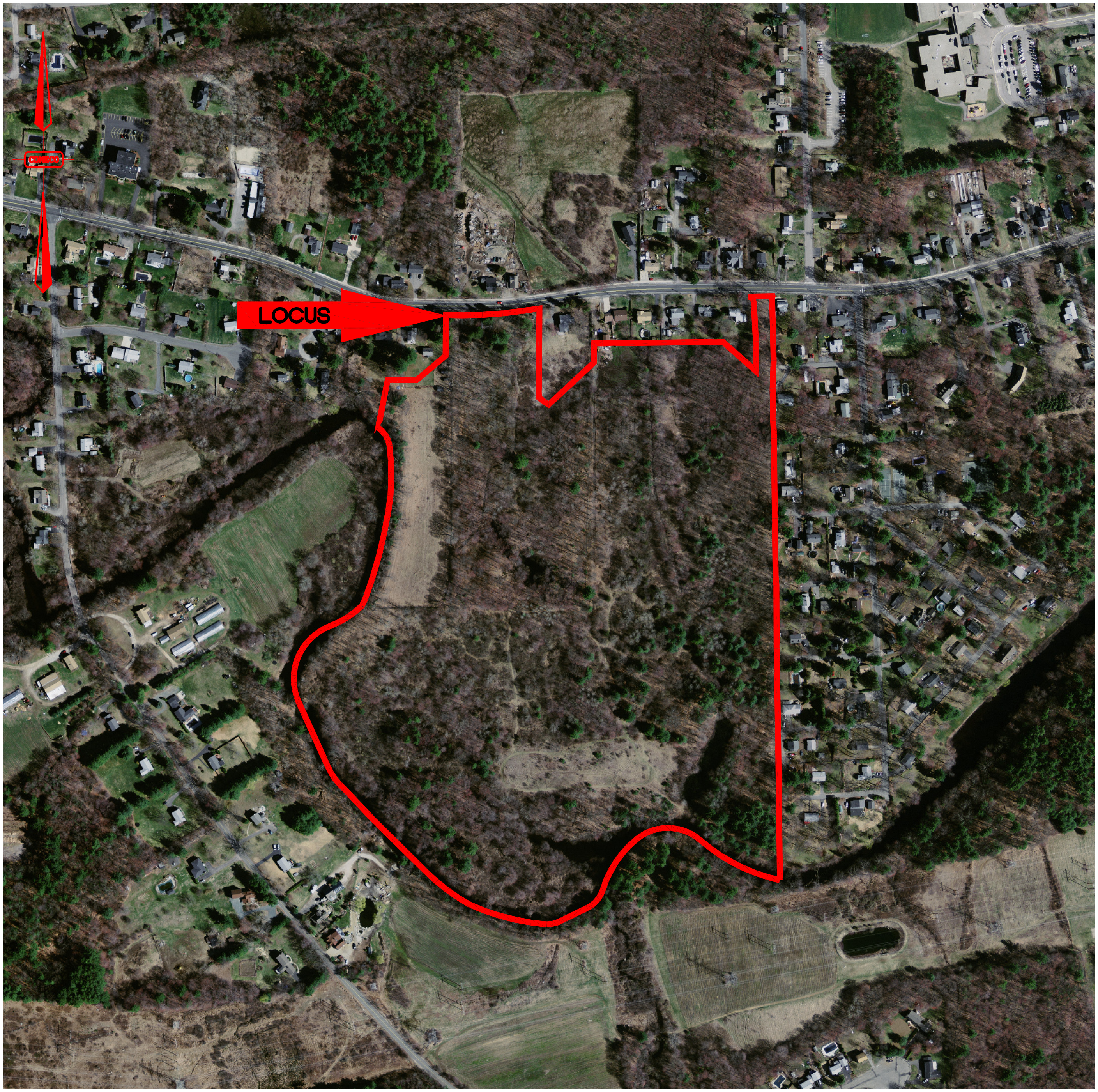
PREPARED FOR: CONTINUING CARE MANAGEMENT, LLC	PLAN SET: REPORT FIGURES

SCALE 1" = 500'	DATE 6/12/2015	PROJECT NO. 8548.0	TITLE: FIGURE 4 NATURAL HERITAGE & ENDANGERED SPECIES HABITATS

FIGURE 5

CRITICAL AREAS



AREAS OF CRITICAL ENVIRONMENTAL CONCERN

WELLHEAD PROTECTION AREAS(ZONE II & IWPA)

NOTES:
1. AREAS OF CRITICAL ENVIRONMENTAL CONCERN WERE TAKEN FROM MASSGIS DATABASE, LAST UPDATED APRIL 2009.
2. THERE ARE NO AREAS OF CRTICAL ENVIRONMENTAL CONCERN ON THE PROJECT SITE.
3. WELLHEAD PROTECTION AREAS WERE TAKEN FROM MASSGIS DATEBASE, LAST UPDATED JULY 2014.
4. THERE ARE NO WELLHEAD PROTECTION AREAS ON THIS PROJECT SITE.

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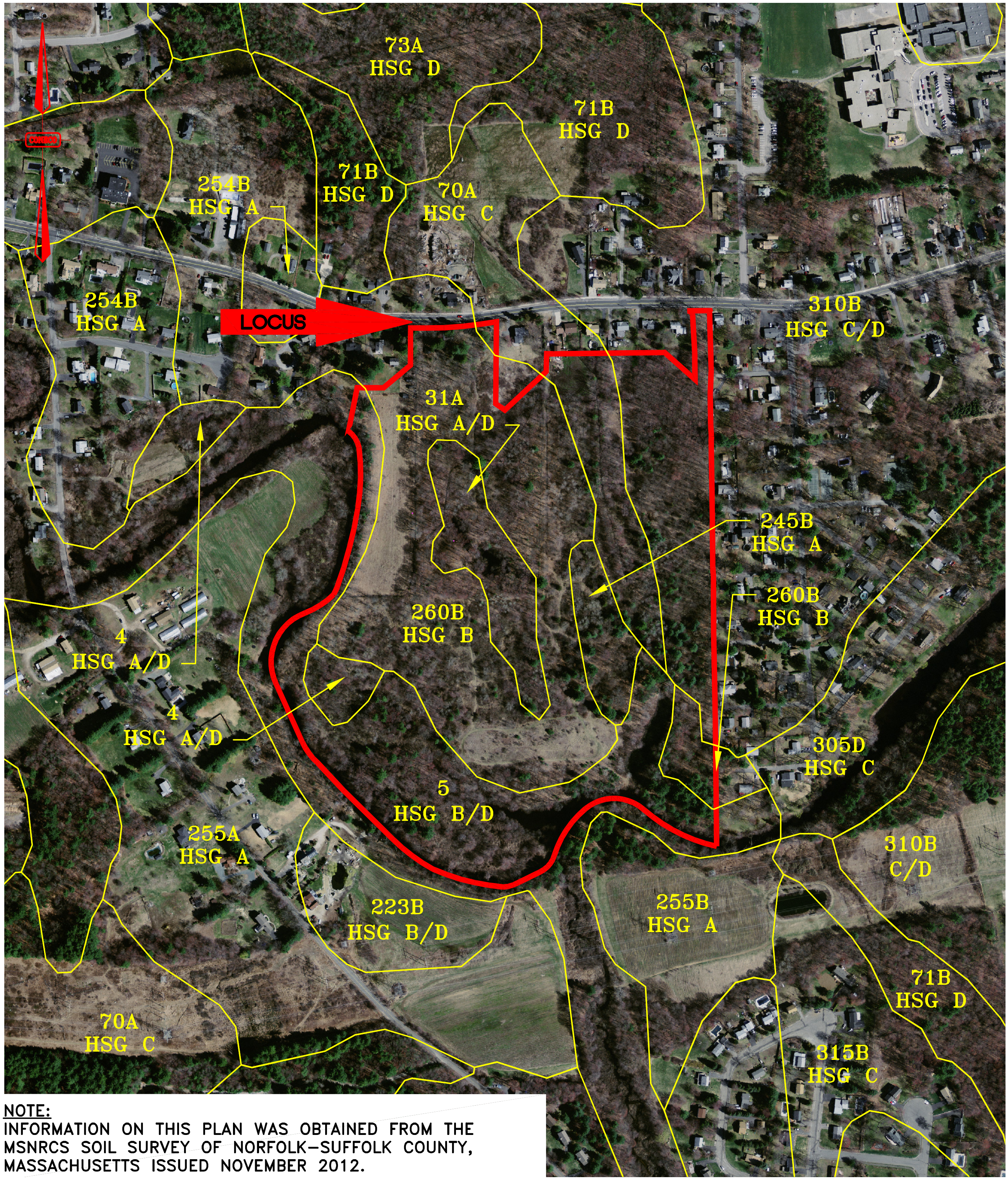
PREPARED FOR: CONTINUING CARE MANAGEMENT, LLC

PLAN SET: REPORT FIGURES

SCALE	DATE	PROJECT NO.	TITLE:
1" = 500'	6/12/2015	8548.0	FIGURE 5 CRITICAL AREAS

FIGURE 6

SOIL SURVEY MAP – NORFOLK COUNTY



NOTE:
INFORMATION ON THIS PLAN WAS OBTAINED FROM THE MSNRCS SOIL SURVEY OF NORFOLK-SUFFOLK COUNTY, MASSACHUSETTS ISSUED NOVEMBER 2012.

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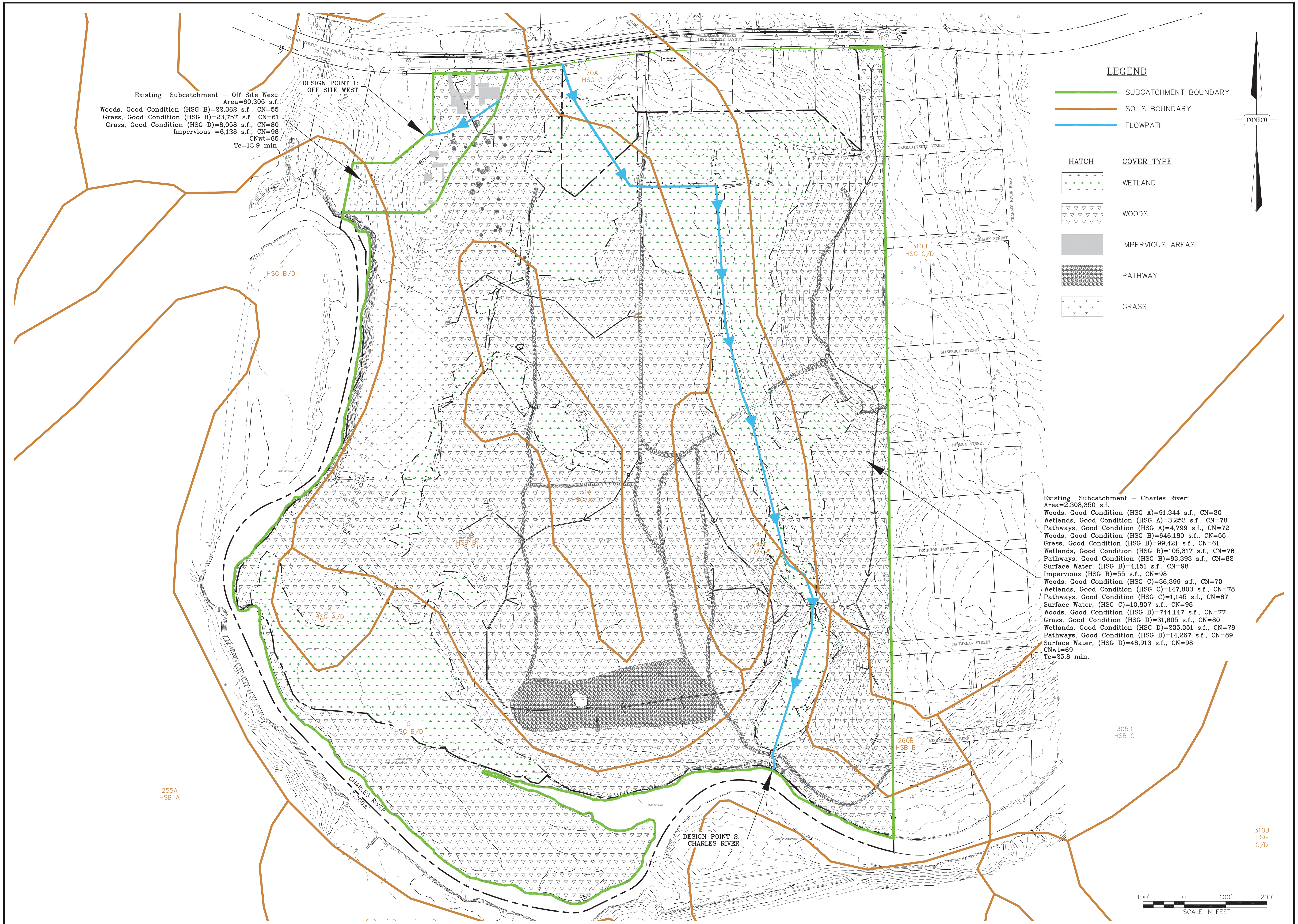
PREPARED FOR: CONTINUING CARE MANAGEMENT, LLC		PLAN SET: REPORT FIGURES	
SCALE 1" = 500'	DATE 6/12/2015	PROJECT NO. 8548.0	TITLE: FIGURE 6 SOIL SURVEY MAP

FIGURE 7

EXISTING DRAINAGE AREAS



REVISIONS

NO.	DATE	DESCRIPTION	DR/CK

PREPARED FOR:
CONTINUING CARE MANAGEMENT, LLC
1 LYMAN STREET
WESTBOROUGH, MASSACHUSETTS 01581

DRAWING:
EXISTING CONDITIONS

PROJECT:
SALMON HEALTH AND
RETIREMENT COMMUNITY
VILLAGE STREET
MEDWAY, MASSACHUSETTS 02053

PLAN SET:
REPORT FIGURES

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WEBSITE: www.coneco.com

DATE	6/12/2015
DESIGNED: JEN	CHECKED: TLD
DRAFTED: DJD	IN CHARGE: SMO
SCALE:	1"=100'
PROJECT NO.	8548.0
SHEET NO.	7 OF 08

FIGURE 8

PROPOSED DRAINAGE AREAS

REVISIONS

NO.	DATE	DESCRIPTION	DR/CK

PREPARED FOR:
CONTINUING CARE MANAGEMENT, LLC
1 LYMAN STREET
WESTBOROUGH, MASSACHUSETTS 01581

DRAWING:
PROPOSED CONDITIONS

PROJECT:
SALMON HEALTH AND RETIREMENT COMMUNITY
VILLAGE STREET
MEDWAY, MASSACHUSETTS 02053

PLAN SET:
REPORT FIGURES

CONECO
Engineers & Scientists
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WEBSITE: www.coneco.com

DATE	6/12/2015
DESIGNED: JEN	CHECKED: TLD
DRAFTED: DJD	IN CHARGE: SMO
SCALE:	1" = 1200'_XREF
PROJECT NO.	8548.0
SHEET NO.	8 OF 08

APPENDIX A

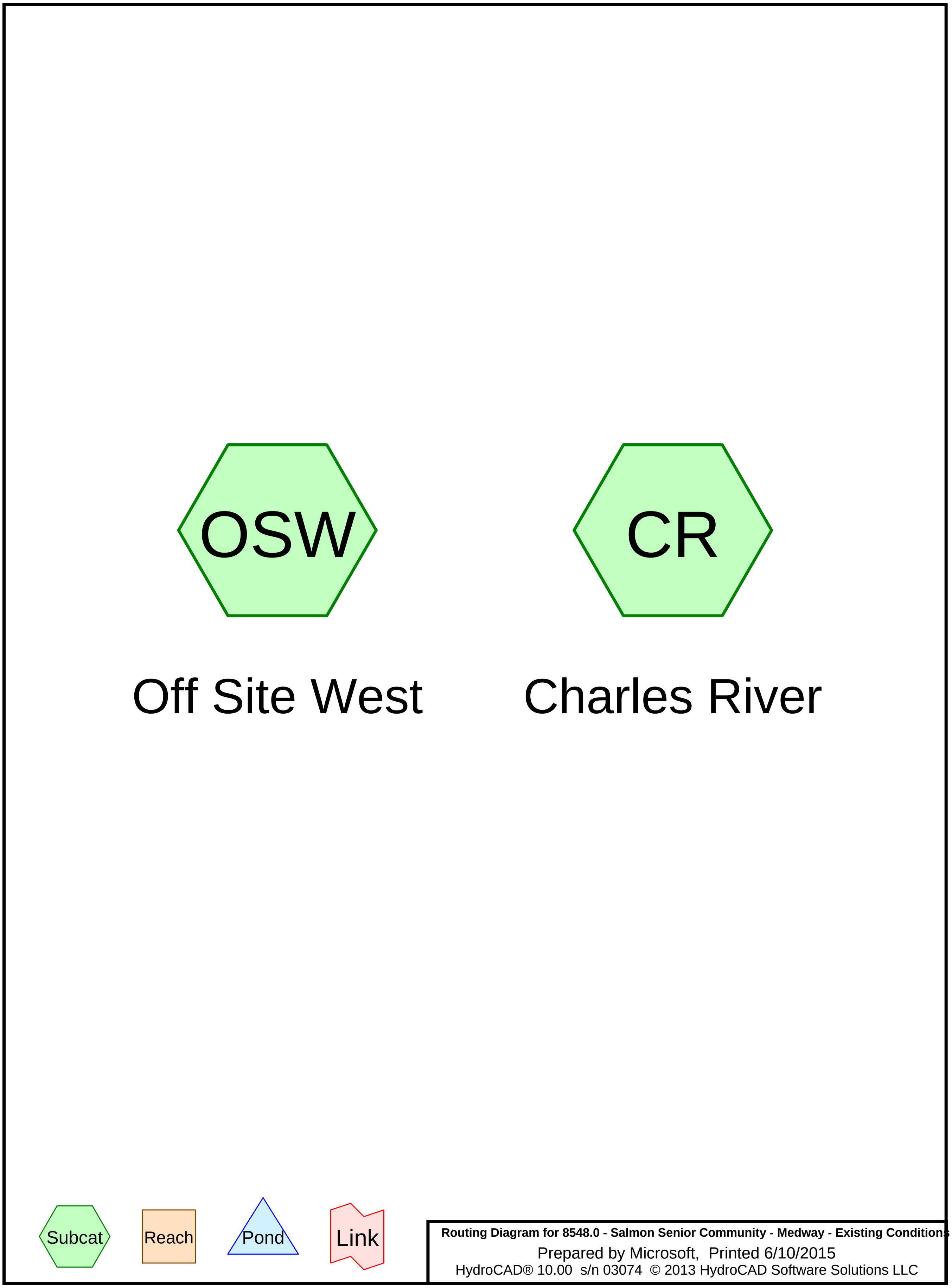
EXISTING HYDROLOGICAL CONDITIONS

2-YEAR STORM EVENT

10-YEAR STORM EVENT

25-YEAR STORM EVENT

100-YEAR STORM EVENT



Routing Diagram for 8548.0 - Salmon Senior Community - Medway - Existing Conditions
Prepared by Microsoft, Printed 6/10/2015
HydroCAD® 10.00 s/n 03074 © 2013 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.459	70	1/2 acre lots, 25% imp, HSG B (CR)
1.256	80	1/2 acre lots, 25% imp, HSG C (CR)
1.398	85	1/2 acre lots, 25% imp, HSG D (CR)
2.828	61	>75% Grass cover, Good, HSG B (CR, OSW)
0.911	80	>75% Grass cover, Good, HSG D (CR, OSW)
0.110	72	Path, HSG A (CR)
1.914	82	Path, HSG B (CR)
0.026	87	Path, HSG C (CR)
0.328	89	Path, HSG D (CR)
0.142	98	Unconnected pavement, HSG B (CR, OSW)
0.095	98	Water Surface, HSG B (CR)
0.248	98	Water Surface, HSG C (CR)
1.123	98	Water Surface, HSG D (CR)
0.075	78	Wetland, HSG A (CR)
2.418	78	Wetland, HSG B (CR)
3.393	78	Wetlands, HSG C (CR)
5.403	78	Wetlands, HSG D (CR)
2.097	30	Woods, Good, HSG A (CR)
15.348	55	Woods, Good, HSG B (CR, OSW)
0.836	70	Woods, Good, HSG C (CR)
17.083	77	Woods, Good, HSG D (CR)
57.491	**70**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
2.282	HSG A	CR
23.204	HSG B	CR, OSW
5.759	HSG C	CR
26.246	HSG D	CR, OSW
0.000	Other	
57.491		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.459	1.256	1.398	0.000	3.114	1/2 acre lots, 25% imp	CR
0.000	2.828	0.000	0.911	0.000	3.738	>75% Grass cover, Good	CR, OSW
0.110	1.914	0.026	0.328	0.000	2.378	Path	CR
0.000	0.142	0.000	0.000	0.000	0.142	Unconnected pavement	CR, OSW
0.000	0.095	0.248	1.123	0.000	1.466	Water Surface	CR
0.075	2.418	0.000	0.000	0.000	2.492	Wetland	CR
0.000	0.000	3.393	5.403	0.000	8.796	Wetlands	CR
2.097	15.348	0.836	17.083	0.000	35.363	Woods, Good	CR, OSW
2.282	**23.204**	**5.759**	**26.246**	**0.000**	**57.491**	**TOTAL AREA**	

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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 CR: Charles River Runoff Area=2,444,000 sf 4.00% Impervious Runoff Depth>0.74"
Flow Length=2,023' Tc=29.7 min CN=70 Runoff=27.64 cfs 3.454 af

Subcatchment OSW: Off Site West Runoff Area=60,305 sf 10.16% Impervious Runoff Depth>0.46"
Flow Length=200' Tc=13.9 min UI Adjusted CN=63 Runoff=0.46 cfs 0.053 af

Total Runoff Area = 57.491 ac Runoff Volume = 3.507 af Average Runoff Depth = 0.73"
95.85% Pervious = 55.104 ac 4.15% Impervious = 2.387 ac

Summary for Subcatchment CR: Charles River

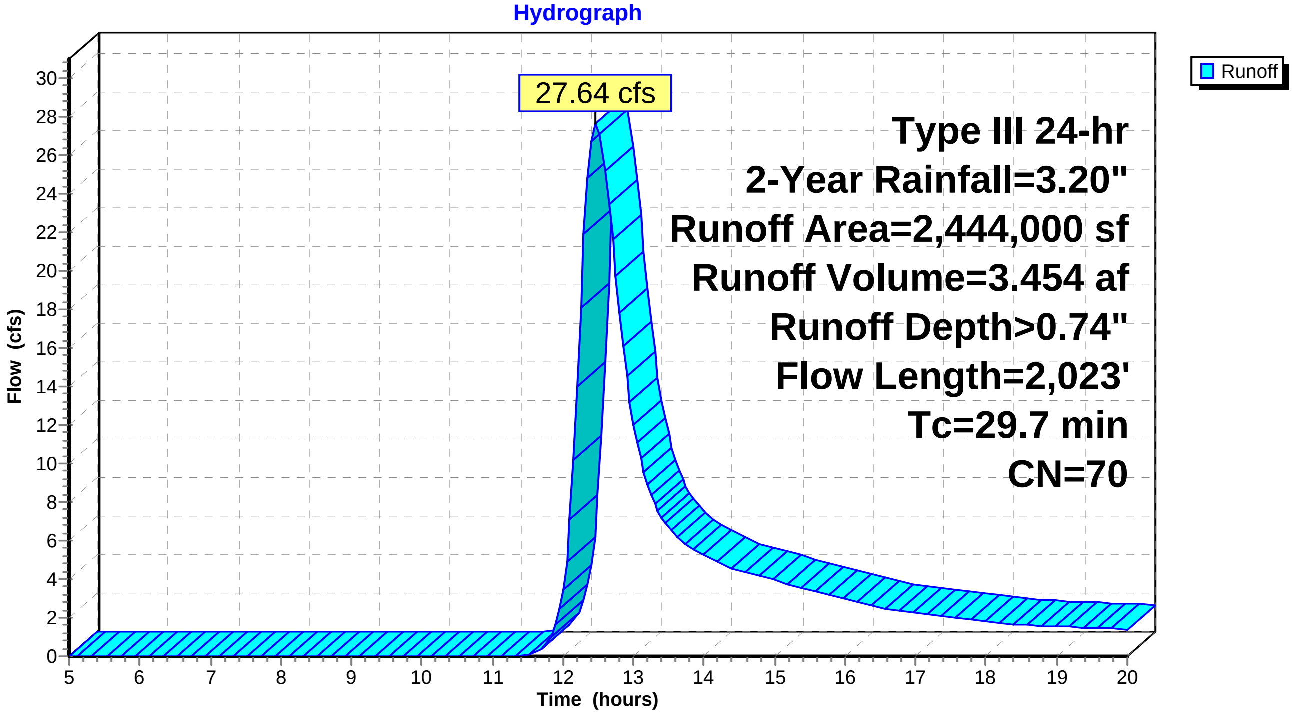
Runoff = 27.64 cfs @ 12.47 hrs, Volume= 3.454 af, Depth> 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

	Area (sf)	CN	Description
	91,344	30	Woods, Good, HSG A
*	3,253	78	Wetland, HSG A
*	4,799	72	Path, HSG A
	646,180	55	Woods, Good, HSG B
	99,421	61	>75% Grass cover, Good, HSG B
*	105,317	78	Wetland, HSG B
*	83,393	82	Path, HSG B
	4,151	98	Water Surface, HSG B
	55	98	Unconnected pavement, HSG B
	36,399	70	Woods, Good, HSG C
*	147,803	78	Wetlands, HSG C
*	1,145	87	Path, HSG C
	10,807	98	Water Surface, HSG C
	744,147	77	Woods, Good, HSG D
	31,605	80	>75% Grass cover, Good, HSG D
*	235,351	78	Wetlands, HSG D
*	14,267	89	Path, HSG D
	48,913	98	Water Surface, HSG D
	20,004	70	1/2 acre lots, 25% imp, HSG B
	54,729	80	1/2 acre lots, 25% imp, HSG C
	60,917	85	1/2 acre lots, 25% imp, HSG D
	2,444,000	70	Weighted Average
	2,346,162		96.00% Pervious Area
	97,839		4.00% Impervious Area
	55		0.06% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0600	0.10		**Sheet Flow, Sheet A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
3.1	330	0.0120	1.76		**Shallow Concentrated Flow, Wooded B-C** Unpaved Kv= 16.1 fps
18.5	1,599	0.0080	1.44		**Shallow Concentrated Flow, Wetland/Stream/Pond C-D** Unpaved Kv= 16.1 fps
0.2	44	0.0900	4.83		**Shallow Concentrated Flow, Pond to River D-E** Unpaved Kv= 16.1 fps
29.7	2,023	Total			

Subcatchment CR: Charles River



Summary for Subcatchment OSW: Off Site West

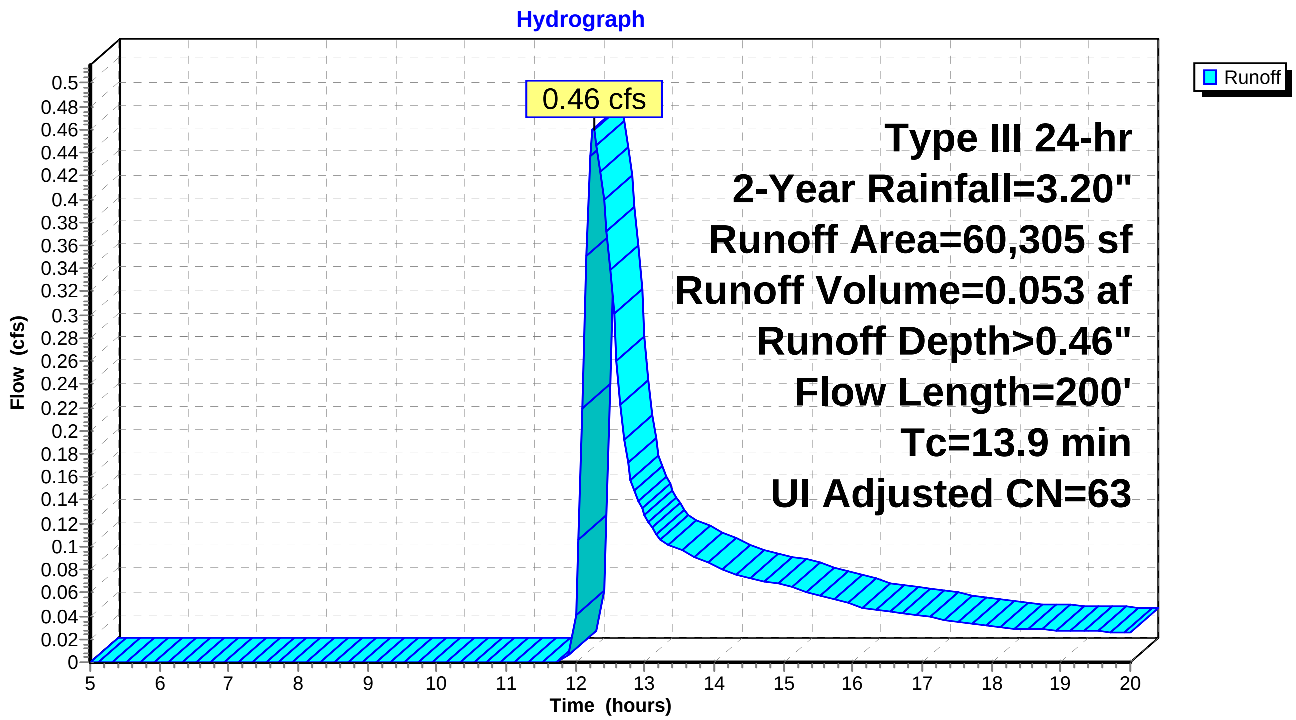
Runoff = 0.46 cfs @ 12.26 hrs, Volume= 0.053 af, Depth> 0.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Adj	Description
22,362	55		Woods, Good, HSG B
23,757	61		>75% Grass cover, Good, HSG B
6,128	98		Unconnected pavement, HSG B
8,058	80		>75% Grass cover, Good, HSG D
60,305	65	63	Weighted Average, UI Adjusted
54,177			89.84% Pervious Area
6,128			10.16% Impervious Area
6,128			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		**Sheet Flow, Sheet A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
1.4	98	0.0050	1.14		**Shallow Concentrated Flow, Wooded B-C** Unpaved Kv= 16.1 fps
0.2	52	0.0500	3.60		**Shallow Concentrated Flow, Wooded C-D** Unpaved Kv= 16.1 fps
13.9	200	Total			

Subcatchment OSW: Off Site West



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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 CR: Charles River Runoff Area=2,444,000 sf 4.00% Impervious Runoff Depth>1.65"
Flow Length=2,023' Tc=29.7 min CN=70 Runoff=65.88 cfs 7.728 af

Subcatchment OSW: Off Site West Runoff Area=60,305 sf 10.16% Impervious Runoff Depth>1.19"
Flow Length=200' Tc=13.9 min UI Adjusted CN=63 Runoff=1.51 cfs 0.138 af

Total Runoff Area = 57.491 ac Runoff Volume = 7.866 af Average Runoff Depth = 1.64"
95.85% Pervious = 55.104 ac 4.15% Impervious = 2.387 ac

Summary for Subcatchment CR: Charles River

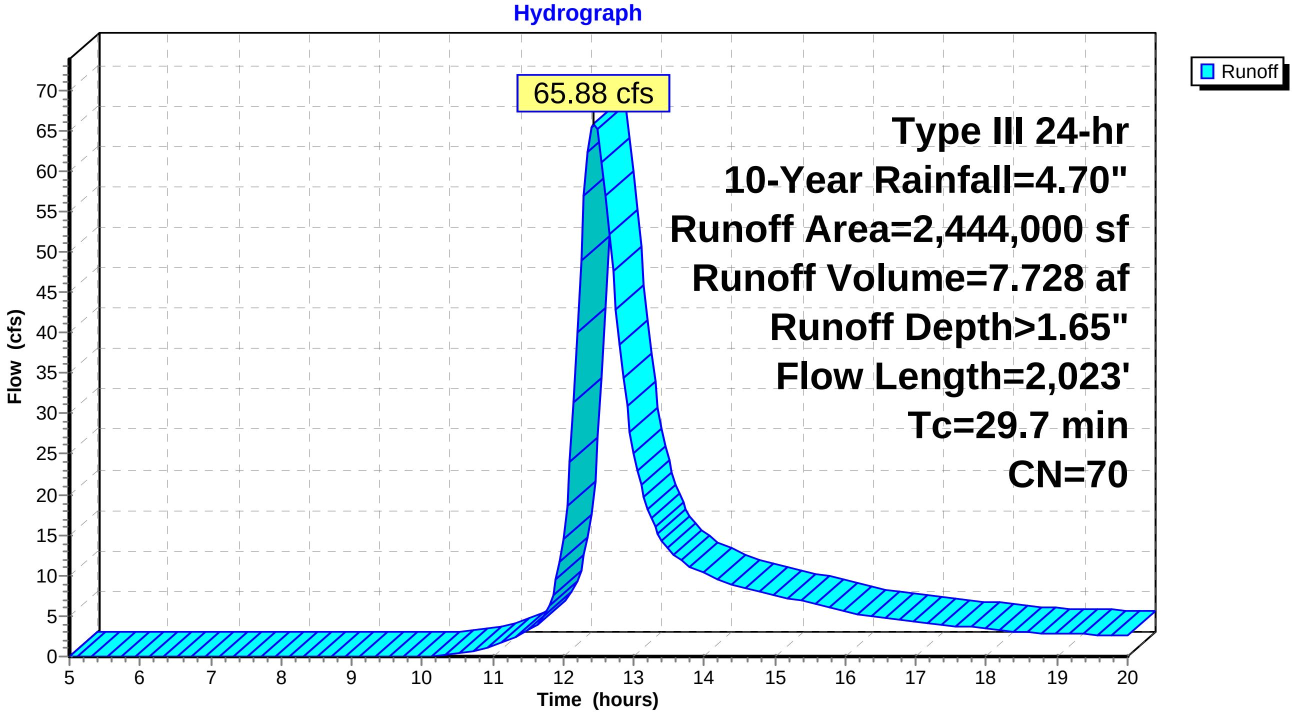
Runoff = 65.88 cfs @ 12.44 hrs, Volume= 7.728 af, Depth> 1.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

	Area (sf)	CN	Description
	91,344	30	Woods, Good, HSG A
*	3,253	78	Wetland, HSG A
*	4,799	72	Path, HSG A
	646,180	55	Woods, Good, HSG B
	99,421	61	>75% Grass cover, Good, HSG B
*	105,317	78	Wetland, HSG B
*	83,393	82	Path, HSG B
	4,151	98	Water Surface, HSG B
	55	98	Unconnected pavement, HSG B
	36,399	70	Woods, Good, HSG C
*	147,803	78	Wetlands, HSG C
*	1,145	87	Path, HSG C
	10,807	98	Water Surface, HSG C
	744,147	77	Woods, Good, HSG D
	31,605	80	>75% Grass cover, Good, HSG D
*	235,351	78	Wetlands, HSG D
*	14,267	89	Path, HSG D
	48,913	98	Water Surface, HSG D
	20,004	70	1/2 acre lots, 25% imp, HSG B
	54,729	80	1/2 acre lots, 25% imp, HSG C
	60,917	85	1/2 acre lots, 25% imp, HSG D
	2,444,000	70	Weighted Average
	2,346,162		96.00% Pervious Area
	97,839		4.00% Impervious Area
	55		0.06% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0600	0.10		**Sheet Flow, Sheet A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
3.1	330	0.0120	1.76		**Shallow Concentrated Flow, Wooded B-C** Unpaved Kv= 16.1 fps
18.5	1,599	0.0080	1.44		**Shallow Concentrated Flow, Wetland/Stream/Pond C-D** Unpaved Kv= 16.1 fps
0.2	44	0.0900	4.83		**Shallow Concentrated Flow, Pond to River D-E** Unpaved Kv= 16.1 fps
29.7	2,023	Total			

Subcatchment CR: Charles River



Summary for Subcatchment OSW: Off Site West

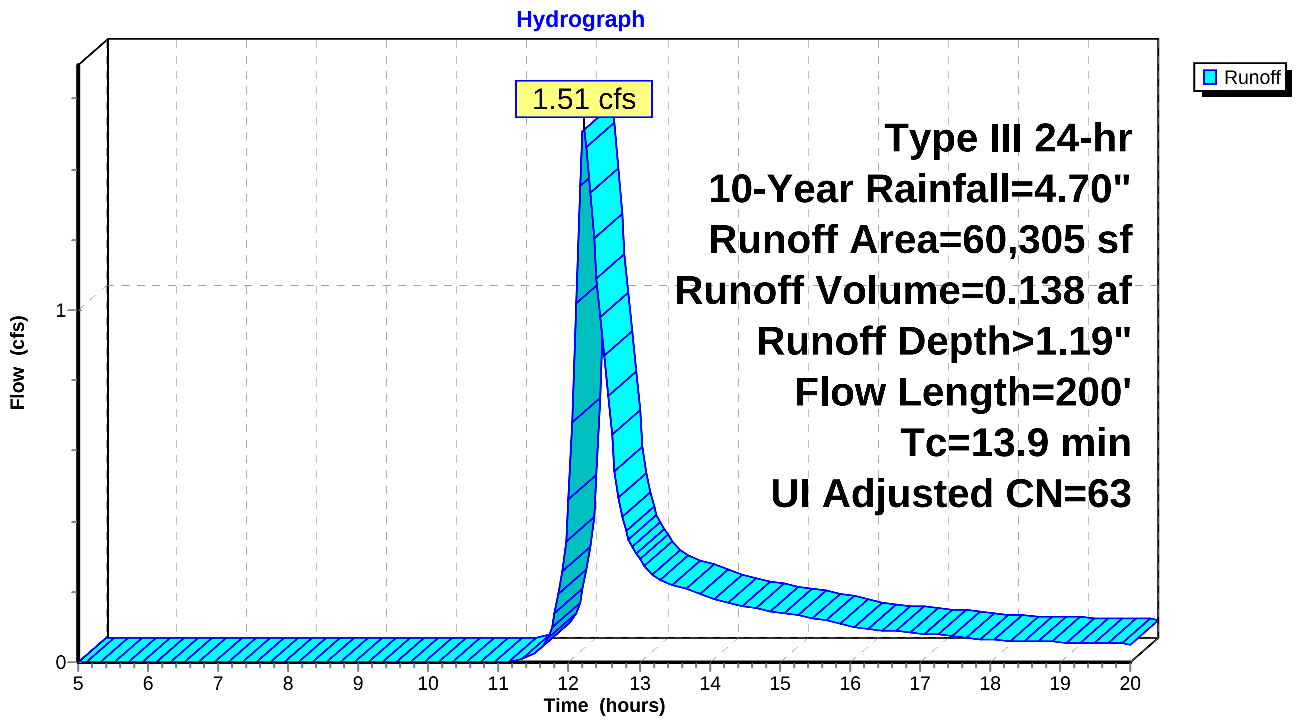
Runoff = 1.51 cfs @ 12.21 hrs, Volume= 0.138 af, Depth> 1.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Adj	Description
22,362	55		Woods, Good, HSG B
23,757	61		>75% Grass cover, Good, HSG B
6,128	98		Unconnected pavement, HSG B
8,058	80		>75% Grass cover, Good, HSG D
60,305	65	63	Weighted Average, UI Adjusted
54,177			89.84% Pervious Area
6,128			10.16% Impervious Area
6,128			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		**Sheet Flow, Sheet A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
1.4	98	0.0050	1.14		**Shallow Concentrated Flow, Wooded B-C** Unpaved Kv= 16.1 fps
0.2	52	0.0500	3.60		**Shallow Concentrated Flow, Wooded C-D** Unpaved Kv= 16.1 fps
13.9	200	Total			

Subcatchment OSW: Off Site West



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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 CR: Charles River Runoff Area=2,444,000 sf 4.00% Impervious Runoff Depth>2.21"
Flow Length=2,023' Tc=29.7 min CN=70 Runoff=88.84 cfs 10.331 af

Subcatchment OSW: Off Site West Runoff Area=60,305 sf 10.16% Impervious Runoff Depth>1.67"
Flow Length=200' Tc=13.9 min UI Adjusted CN=63 Runoff=2.18 cfs 0.193 af

Total Runoff Area = 57.491 ac Runoff Volume = 10.524 af Average Runoff Depth = 2.20"
95.85% Pervious = 55.104 ac 4.15% Impervious = 2.387 ac

Summary for Subcatchment CR: Charles River

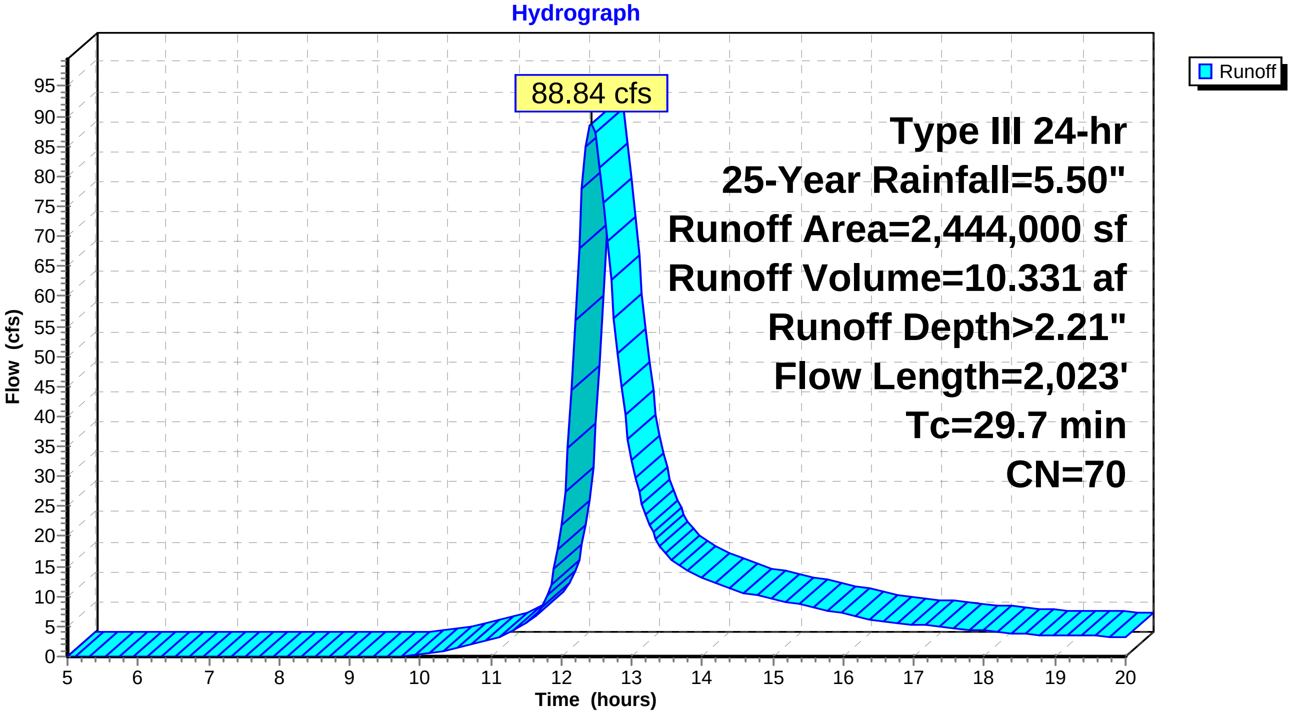
Runoff = 88.84 cfs @ 12.43 hrs, Volume= 10.331 af, Depth> 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (sf)	CN	Description
	91,344	30	Woods, Good, HSG A
*	3,253	78	Wetland, HSG A
*	4,799	72	Path, HSG A
	646,180	55	Woods, Good, HSG B
	99,421	61	>75% Grass cover, Good, HSG B
*	105,317	78	Wetland, HSG B
*	83,393	82	Path, HSG B
	4,151	98	Water Surface, HSG B
	55	98	Unconnected pavement, HSG B
	36,399	70	Woods, Good, HSG C
*	147,803	78	Wetlands, HSG C
*	1,145	87	Path, HSG C
	10,807	98	Water Surface, HSG C
	744,147	77	Woods, Good, HSG D
	31,605	80	>75% Grass cover, Good, HSG D
*	235,351	78	Wetlands, HSG D
*	14,267	89	Path, HSG D
	48,913	98	Water Surface, HSG D
	20,004	70	1/2 acre lots, 25% imp, HSG B
	54,729	80	1/2 acre lots, 25% imp, HSG C
	60,917	85	1/2 acre lots, 25% imp, HSG D
	2,444,000	70	Weighted Average
	2,346,162		96.00% Pervious Area
	97,839		4.00% Impervious Area
	55		0.06% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0600	0.10		**Sheet Flow, Sheet A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
3.1	330	0.0120	1.76		**Shallow Concentrated Flow, Wooded B-C** Unpaved Kv= 16.1 fps
18.5	1,599	0.0080	1.44		**Shallow Concentrated Flow, Wetland/Stream/Pond C-D** Unpaved Kv= 16.1 fps
0.2	44	0.0900	4.83		**Shallow Concentrated Flow, Pond to River D-E** Unpaved Kv= 16.1 fps
29.7	2,023	Total			

Subcatchment CR: Charles River



Summary for Subcatchment OSW: Off Site West

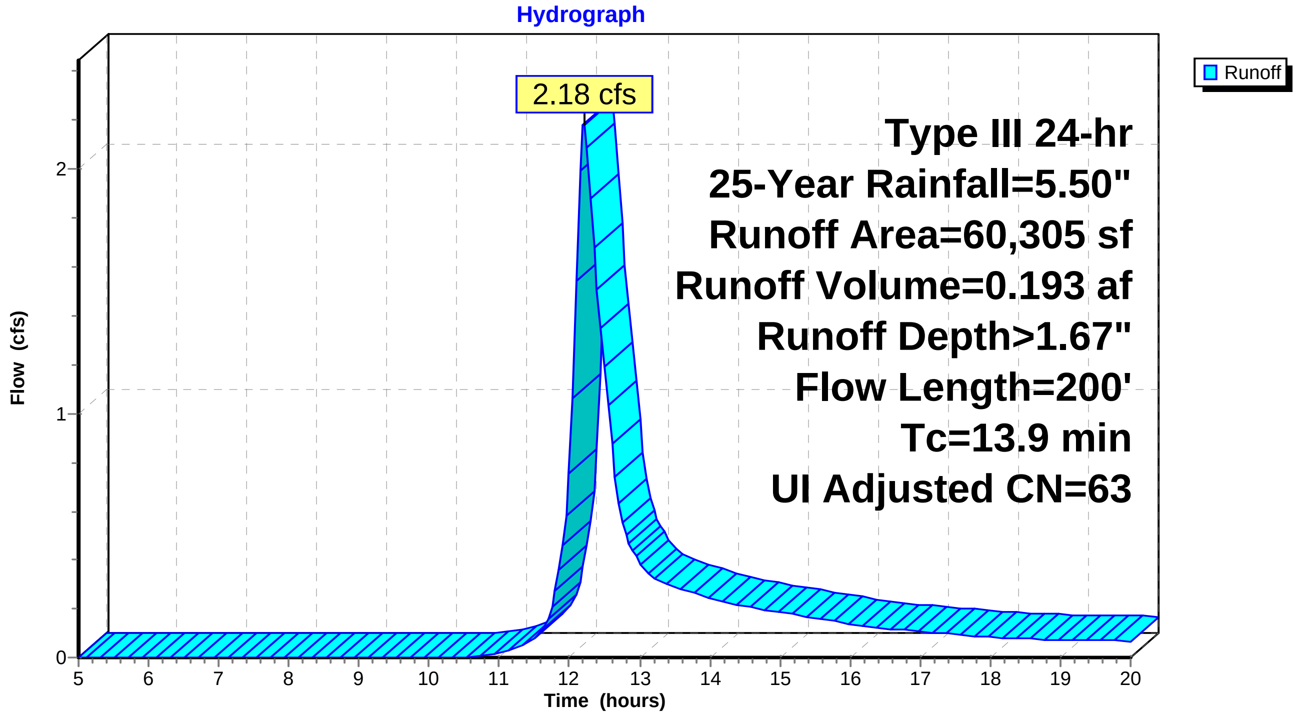
Runoff = 2.18 cfs @ 12.21 hrs, Volume= 0.193 af, Depth> 1.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Adj	Description
22,362	55		Woods, Good, HSG B
23,757	61		>75% Grass cover, Good, HSG B
6,128	98		Unconnected pavement, HSG B
8,058	80		>75% Grass cover, Good, HSG D
60,305	65	63	Weighted Average, UI Adjusted
54,177			89.84% Pervious Area
6,128			10.16% Impervious Area
6,128			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		**Sheet Flow, Sheet A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
1.4	98	0.0050	1.14		**Shallow Concentrated Flow, Wooded B-C** Unpaved Kv= 16.1 fps
0.2	52	0.0500	3.60		**Shallow Concentrated Flow, Wooded C-D** Unpaved Kv= 16.1 fps
13.9	200	Total			

Subcatchment OSW: Off Site West



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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 CR: Charles River Runoff Area=2,444,000 sf 4.00% Impervious Runoff Depth>3.10"
Flow Length=2,023' Tc=29.7 min CN=70 Runoff=125.32 cfs 14.513 af

Subcatchment OSW: Off Site West Runoff Area=60,305 sf 10.16% Impervious Runoff Depth>2.46"
Flow Length=200' Tc=13.9 min UI Adjusted CN=63 Runoff=3.29 cfs 0.283 af

Total Runoff Area = 57.491 ac Runoff Volume = 14.796 af Average Runoff Depth = 3.09"
95.85% Pervious = 55.104 ac 4.15% Impervious = 2.387 ac

Summary for Subcatchment CR: Charles River

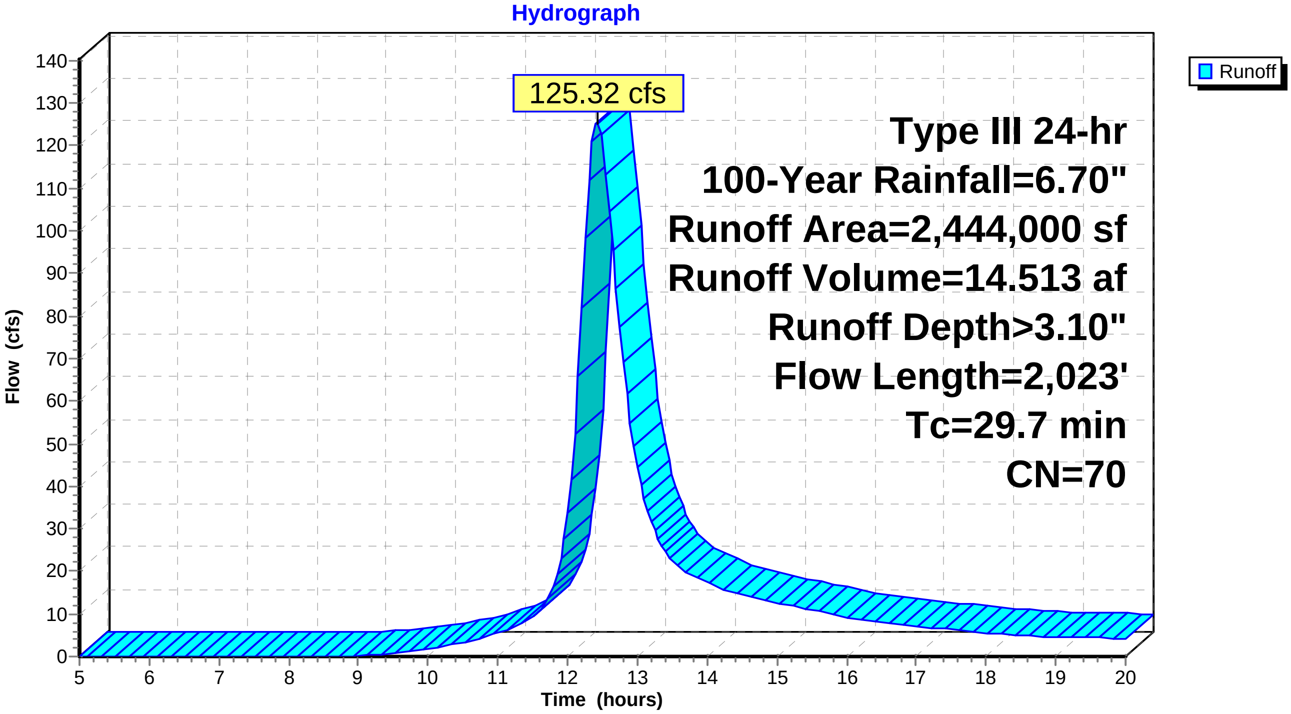
Runoff = 125.32 cfs @ 12.42 hrs, Volume= 14.513 af, Depth> 3.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

	Area (sf)	CN	Description
	91,344	30	Woods, Good, HSG A
*	3,253	78	Wetland, HSG A
*	4,799	72	Path, HSG A
	646,180	55	Woods, Good, HSG B
	99,421	61	>75% Grass cover, Good, HSG B
*	105,317	78	Wetland, HSG B
*	83,393	82	Path, HSG B
	4,151	98	Water Surface, HSG B
	55	98	Unconnected pavement, HSG B
	36,399	70	Woods, Good, HSG C
*	147,803	78	Wetlands, HSG C
*	1,145	87	Path, HSG C
	10,807	98	Water Surface, HSG C
	744,147	77	Woods, Good, HSG D
	31,605	80	>75% Grass cover, Good, HSG D
*	235,351	78	Wetlands, HSG D
*	14,267	89	Path, HSG D
	48,913	98	Water Surface, HSG D
	20,004	70	1/2 acre lots, 25% imp, HSG B
	54,729	80	1/2 acre lots, 25% imp, HSG C
	60,917	85	1/2 acre lots, 25% imp, HSG D
	2,444,000	70	Weighted Average
	2,346,162		96.00% Pervious Area
	97,839		4.00% Impervious Area
	55		0.06% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0600	0.10		**Sheet Flow, Sheet A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
3.1	330	0.0120	1.76		**Shallow Concentrated Flow, Wooded B-C** Unpaved Kv= 16.1 fps
18.5	1,599	0.0080	1.44		**Shallow Concentrated Flow, Wetland/Stream/Pond C-D** Unpaved Kv= 16.1 fps
0.2	44	0.0900	4.83		**Shallow Concentrated Flow, Pond to River D-E** Unpaved Kv= 16.1 fps
29.7	2,023	Total			

Subcatchment CR: Charles River



Summary for Subcatchment OSW: Off Site West

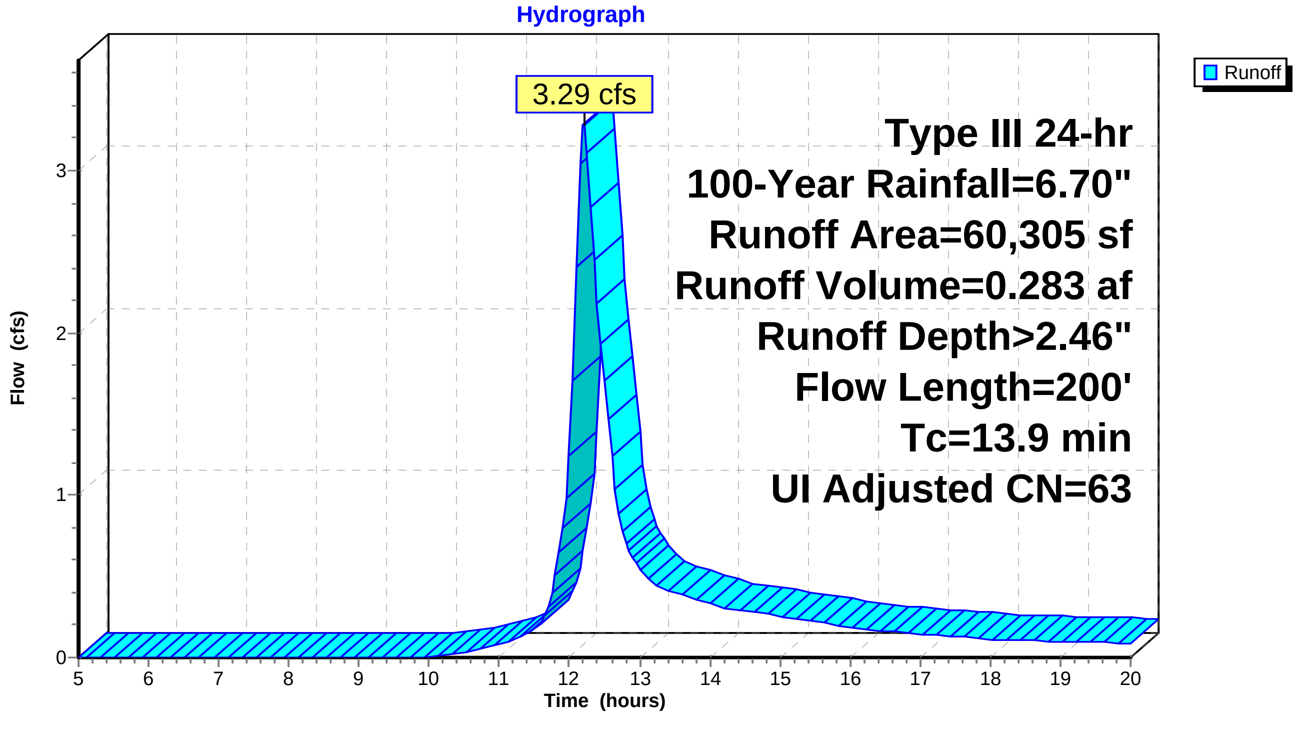
Runoff = 3.29 cfs @ 12.20 hrs, Volume= 0.283 af, Depth> 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Adj	Description
22,362	55		Woods, Good, HSG B
23,757	61		>75% Grass cover, Good, HSG B
6,128	98		Unconnected pavement, HSG B
8,058	80		>75% Grass cover, Good, HSG D
60,305	65	63	Weighted Average, UI Adjusted
54,177			89.84% Pervious Area
6,128			10.16% Impervious Area
6,128			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		**Sheet Flow, Sheet A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
1.4	98	0.0050	1.14		**Shallow Concentrated Flow, Wooded B-C** Unpaved Kv= 16.1 fps
0.2	52	0.0500	3.60		**Shallow Concentrated Flow, Wooded C-D** Unpaved Kv= 16.1 fps
13.9	200	Total			

Subcatchment OSW: Off Site West



APPENDIX B

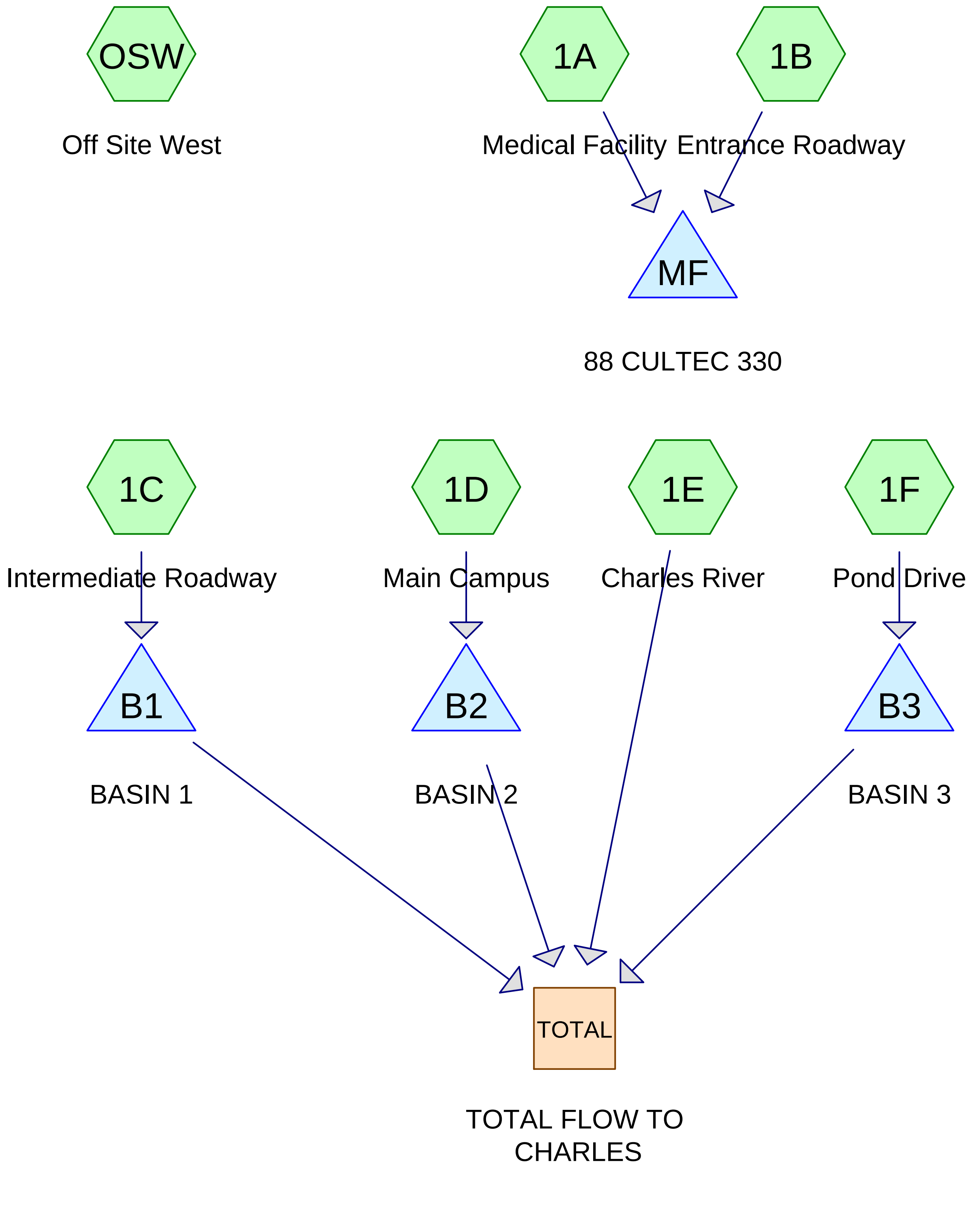
PROPOSED HYDROLOGICAL CONDITIONS

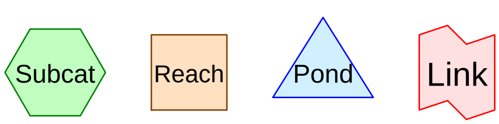
2-YEAR STORM EVENT

10-YEAR STORM EVENT

25-YEAR STORM EVENT

100-YEAR STORM EVENT





Routing Diagram for 8548.0 - Salmon Senior Community - Medway - Proposed Conditions
Prepared by Microsoft, Printed 6/11/2015
HydroCAD® 10.00 s/n 03074 © 2013 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
20,004	70	1/2 acre lots, 25% imp, HSG B (1E)
54,729	80	1/2 acre lots, 25% imp, HSG C (1E)
60,917	85	1/2 acre lots, 25% imp, HSG D (1E)
28,093	39	>75% Grass cover, Good, HSG A (1D, 1E)
332,383	61	>75% Grass cover, Good, HSG B (1A, 1B, 1C, 1D, 1E, 1F, OSW)
758	74	>75% Grass cover, Good, HSG C (1E)
120,996	80	>75% Grass cover, Good, HSG D (1C, 1D, 1E, 1F, OSW)
2,704	80	Path in Resource, HSG B (1E)
6,129	80	Path in Resource, HSG C (1E)
9,556	80	Path in Resource, HSG D (1E)
1,048	80	Path(cover unknown) (OSW)
205	72	Path, HSG A (1E)
9,990	82	Path, HSG B (1E)
3,310	87	Path, HSG C (1E)
27,701	89	Path, HSG D (1E, 1F)
328	82	Pathway, Dirt roads, HSG B (1B)
30,503	98	Paved roads w/curbs & sewers, HSG A (1D)
153,660	98	Paved roads w/curbs & sewers, HSG B (1A, 1B, 1C, 1D, 1F)
87,268	98	Paved roads w/curbs & sewers, HSG D (1C, 1D, 1F)
185	98	Unconnected pavement, HSG B (OSW)
4,112	98	Water Surface, HSG B (1E)
10,807	98	Water Surface, HSG C (1E)
45,917	98	Water Surface, HSG D (1E)
3,253	78	Wetland, HSG A (1E)
103,465	78	Wetlands, HSG B (1E)
141,675	78	Wetlands, HSG C (1E)
227,701	78	Wetlands, HSG D (1E)
10,067	30	Woods, Good, HSG A (1E)
206,096	55	Woods, Good, HSG B (1E, OSW)
33,426	70	Woods, Good, HSG C (1E)
483,730	77	Woods, Good, HSG D (1E, 1F)
2,220,716	**76**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
72,121	HSG A	1D, 1E
832,927	HSG B	1A, 1B, 1C, 1D, 1E, 1F, OSW
250,834	HSG C	1E
1,063,786	HSG D	1C, 1D, 1E, 1F, OSW
1,048	Other	OSW
2,220,716		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
0	20,004	54,729	60,917	0	135,650	1/2 acre lots, 25% imp
28,093	332,383	758	120,996	0	482,230	>75% Grass cover, Good
205	9,990	3,310	27,701	0	41,206	Path
0	2,704	6,129	9,556	0	18,389	Path in Resource
0	0	0	0	1,048	1,048	Path(cover unknown)
0	328	0	0	0	328	Pathway, Dirt roads
30,503	153,660	0	87,268	0	271,431	Paved roads w/curbs & sewers
0	185	0	0	0	185	Unconnected pavement
0	4,112	10,807	45,917	0	60,836	Water Surface
3,253	0	0	0	0	3,253	Wetland
0	103,465	141,675	227,701	0	472,841	Wetlands
10,067	206,096	33,426	483,730	0	733,319	Woods, Good
72,121	**832,927**	**250,834**	**1,063,786**	**1,048**	**2,220,716**	**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	1A	0.00	0.00	90.0	0.0050	0.013	8.0	0.0	0.0
2	1B	0.00	0.00	101.0	0.0050	0.013	8.0	0.0	0.0
3	1C	0.00	0.00	593.0	0.0050	0.013	12.0	0.0	0.0
4	1C	0.00	0.00	46.0	0.0050	0.013	4.0	0.0	0.0
5	1D	0.00	0.00	211.0	0.0050	0.013	12.0	0.0	0.0
6	1D	0.00	0.00	397.0	0.0050	0.013	18.0	0.0	0.0
7	1D	0.00	0.00	490.0	0.0050	0.013	24.0	0.0	0.0
8	1D	0.00	0.00	42.0	0.0050	0.013	4.0	0.0	0.0
9	1F	0.00	0.00	1,006.0	0.0050	0.013	18.0	0.0	0.0
10	1F	0.00	0.00	197.0	0.0050	0.013	24.0	0.0	0.0
11	1F	0.00	0.00	62.0	0.0050	0.013	6.0	0.0	0.0
12	B1	177.00	176.50	25.0	0.0200	0.010	4.0	0.0	0.0
13	B2	172.00	173.50	25.0	-0.0600	0.010	4.0	0.0	0.0
14	B3	174.00	173.50	24.0	0.0208	0.010	6.0	0.0	0.0

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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 1A: Medical Facility Runoff Area=15,461 sf 81.20% Impervious Runoff Depth>2.13"
Flow Length=239' Tc=6.8 min CN=91 Runoff=0.89 cfs 2,740 cf

Subcatchment 1B: Entrance Roadway Runoff Area=19,840 sf 52.68% Impervious Runoff Depth>1.36"
Flow Length=267' Tc=6.9 min CN=81 Runoff=0.75 cfs 2,247 cf

Subcatchment 1C: Intermediate Roadway Runoff Area=55,472 sf 66.11% Impervious Runoff Depth>1.71"
Flow Length=1,790' Tc=17.9 min CN=86 Runoff=1.93 cfs 7,890 cf

Subcatchment 1D: Main Campus Runoff Area=267,248 sf 56.20% Impervious Runoff Depth>1.36"
Flow Length=1,577' Tc=12.0 min CN=81 Runoff=8.55 cfs 30,208 cf

Subcatchment 1E: Charles River Runoff Area=1,709,098 sf 5.54% Impervious Runoff Depth>0.94"
Flow Length=2,022' Tc=29.7 min CN=74 Runoff=25.57 cfs 133,328 cf

Subcatchment 1F: Pond Drive Runoff Area=122,569 sf 50.22% Impervious Runoff Depth>1.87"
Flow Length=1,773' Tc=16.0 min CN=88 Runoff=4.84 cfs 19,053 cf

Subcatchment OSW: Off Site West Runoff Area=31,028 sf 0.60% Impervious Runoff Depth>0.57"
Flow Length=178' Tc=7.7 min CN=66 Runoff=0.40 cfs 1,481 cf

Reach TOTAL: TOTAL FLOW TO CHARLES Inflow=25.59 cfs 136,735 cf
Outflow=25.59 cfs 136,735 cf

Pond B1: BASIN 1 Peak Elev=176.78' Storage=3,371 cf Inflow=1.93 cfs 7,890 cf
Discarded=0.26 cfs 7,816 cf Primary=0.00 cfs 0 cf Outflow=0.26 cfs 7,816 cf

Pond B2: BASIN 2 Peak Elev=172.92' Storage=18,311 cf Inflow=8.55 cfs 30,208 cf
Discarded=0.48 cfs 14,669 cf Primary=0.00 cfs 0 cf Outflow=0.48 cfs 14,669 cf

Pond B3: BASIN 3 Peak Elev=177.75' Storage=10,905 cf Inflow=4.84 cfs 19,053 cf
Discarded=0.24 cfs 7,659 cf Primary=0.19 cfs 3,407 cf Outflow=0.43 cfs 11,066 cf

Pond MF: 88 CULTEC 330 Peak Elev=1.22' Storage=1,913 cf Inflow=1.63 cfs 4,986 cf
Outflow=0.18 cfs 4,978 cf

Total Runoff Area = 2,220,716 sf Runoff Volume = 196,947 cf Average Runoff Depth = 1.06"
83.50% Pervious = 1,854,352 sf 16.50% Impervious = 366,365 sf

Summary for Subcatchment 1A: Medical Facility

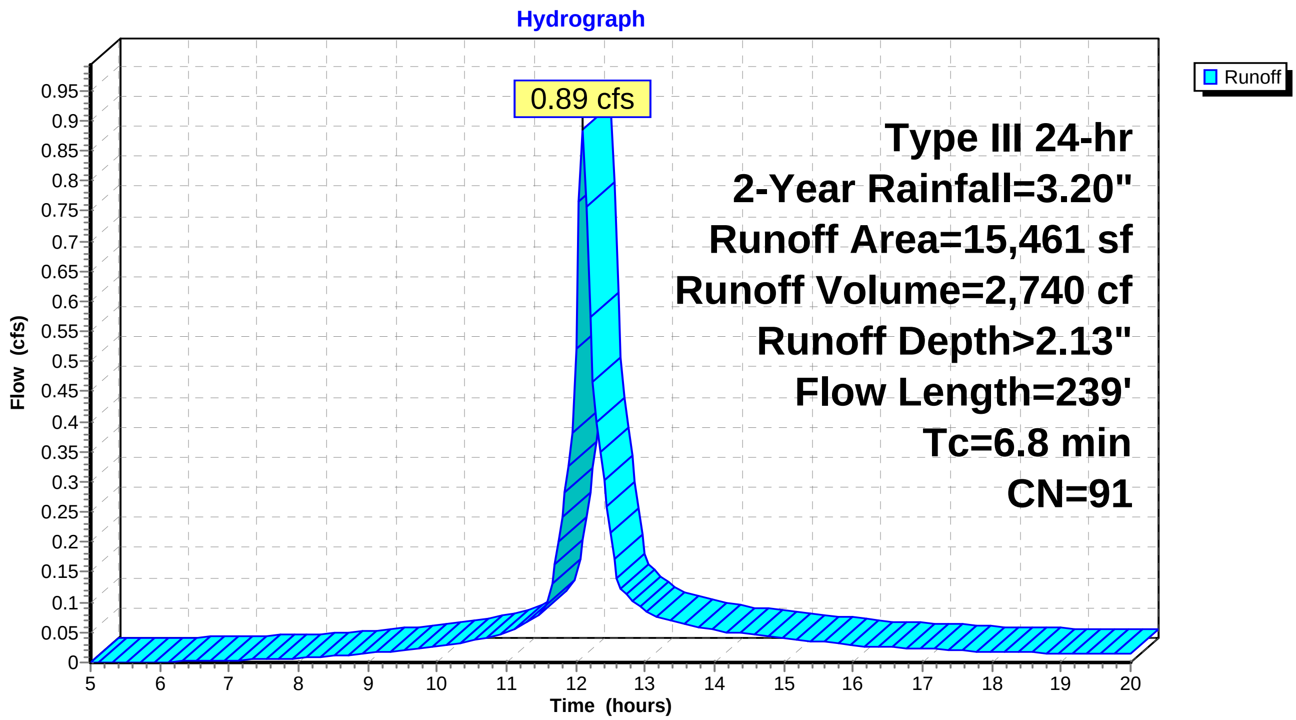
Runoff = 0.89 cfs @ 12.10 hrs, Volume= 2,740 cf, Depth> 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
2,907	61	>75% Grass cover, Good, HSG B
12,554	98	Paved roads w/curbs & sewers, HSG B
15,461	91	Weighted Average
2,907		18.80% Pervious Area
12,554		81.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, Sheet A-B** Grass: Short n= 0.150 P2= 3.20"
0.1	14	0.0200	2.28		**Shallow Concentrated Flow, Grass B-C** Unpaved Kv= 16.1 fps
0.5	85	0.0200	2.87		**Shallow Concentrated Flow, Pavement C-D** Paved Kv= 20.3 fps
0.6	90	0.0050	2.45	0.85	**Pipe Channel, Pipe D-E** 8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.013 Corrugated PE, smooth interior
6.8	239	Total			

Subcatchment 1A: Medical Facility



Summary for Subcatchment 1B: Entrance Roadway

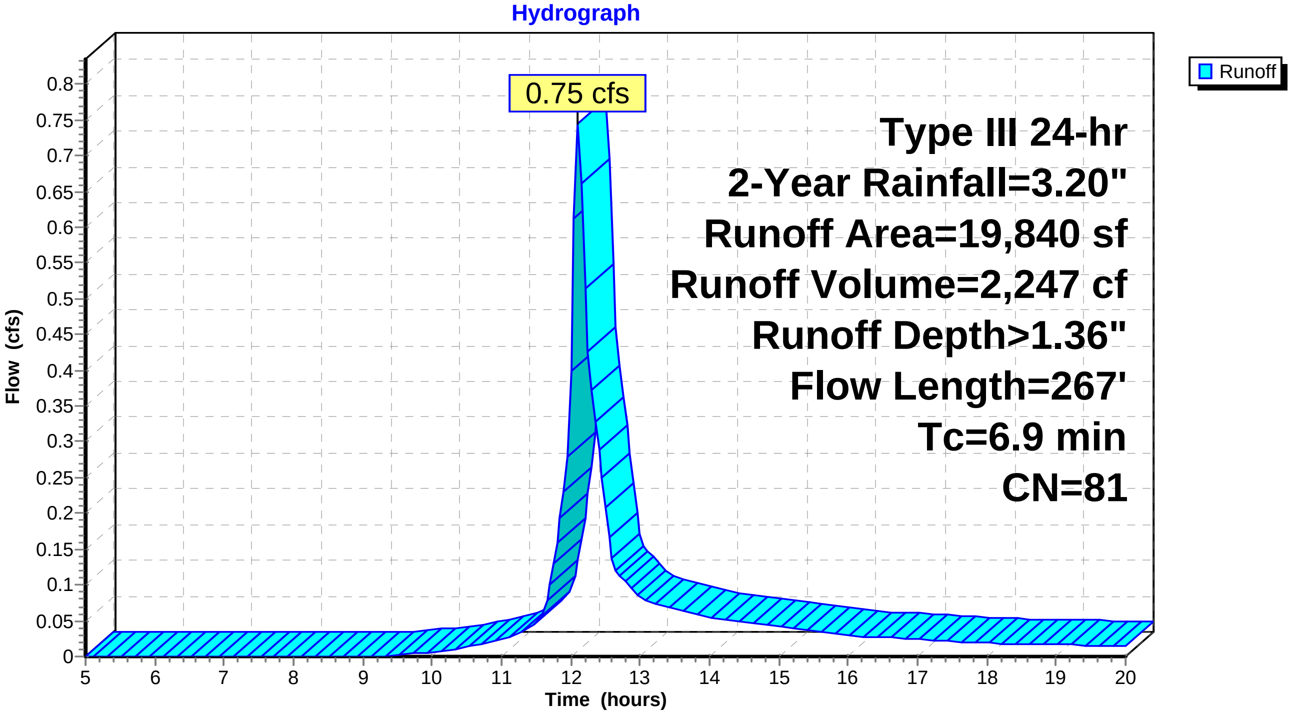
Runoff = 0.75 cfs @ 12.11 hrs, Volume= 2,247 cf, Depth> 1.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

	Area (sf)	CN	Description
	9,061	61	>75% Grass cover, Good, HSG B
*	328	82	Pathway, Dirt roads, HSG B
	10,451	98	Paved roads w/curbs & sewers, HSG B
	19,840	81	Weighted Average
	9,389		47.32% Pervious Area
	10,451		52.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, Sheet A-B** Grass: Short n= 0.150 P2= 3.20"
0.1	12	0.0200	2.28		**Shallow Concentrated Flow, Grass B-C** Unpaved Kv= 16.1 fps
0.5	104	0.0300	3.52		**Shallow Concentrated Flow, Street C-D** Paved Kv= 20.3 fps
0.7	101	0.0050	2.45	0.85	**Pipe Channel, Pipe D-E** 8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.013 Corrugated PE, smooth interior
6.9	267	Total			

Subcatchment 1B: Entrance Roadway



Summary for Subcatchment 1C: Intermediate Roadway

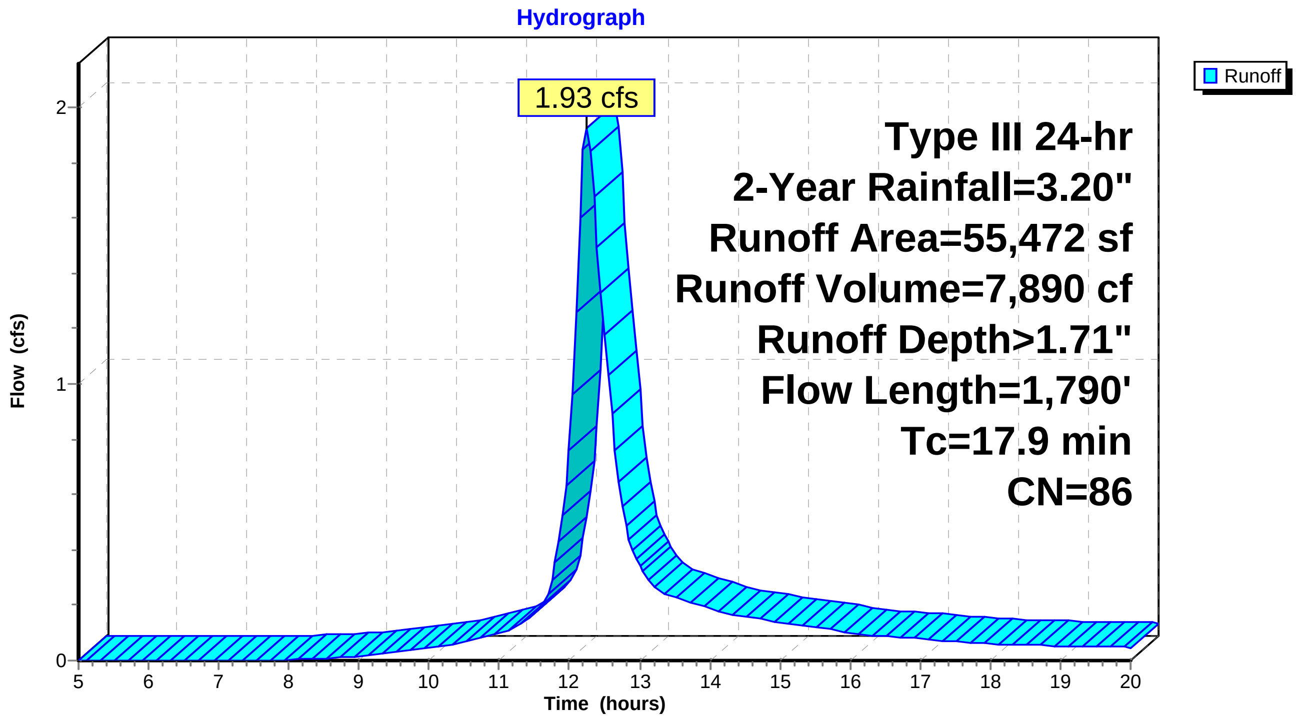
Runoff = 1.93 cfs @ 12.25 hrs, Volume= 7,890 cf, Depth> 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
17,093	61	>75% Grass cover, Good, HSG B
1,704	80	>75% Grass cover, Good, HSG D
28,466	98	Paved roads w/curbs & sewers, HSG B
8,209	98	Paved roads w/curbs & sewers, HSG D
55,472	86	Weighted Average
18,797		33.89% Pervious Area
36,675		66.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, Sheet A-B** Grass: Short n= 0.150 P2= 3.20"
0.1	9	0.0200	2.28		**Shallow Concentrated Flow, Grass B-C** Unpaved Kv= 16.1 fps
0.3	47	0.0200	2.87		**Shallow Concentrated Flow, Paved C-D** Paved Kv= 20.3 fps
3.1	593	0.0050	3.21	2.52	**Pipe Channel, Pipe D-E** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.3	153		8.02		**Lake or Reservoir, Basin E-F** Mean Depth= 2.00'
0.5	46	0.0050	1.54	0.13	**Pipe Channel, Pipe F-E** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.013 Corrugated PE, smooth interior
1.4	149	0.0130	1.84		**Shallow Concentrated Flow, Unpaved** Unpaved Kv= 16.1 fps
2.4	333	0.0200	2.28		**Shallow Concentrated Flow, Unpaved** Unpaved Kv= 16.1 fps
4.2	410	0.0100	1.61		**Shallow Concentrated Flow, Unpaved** Unpaved Kv= 16.1 fps
17.9	1,790	Total			

Subcatchment 1C: Intermediate Roadway



Summary for Subcatchment 1D: Main Campus

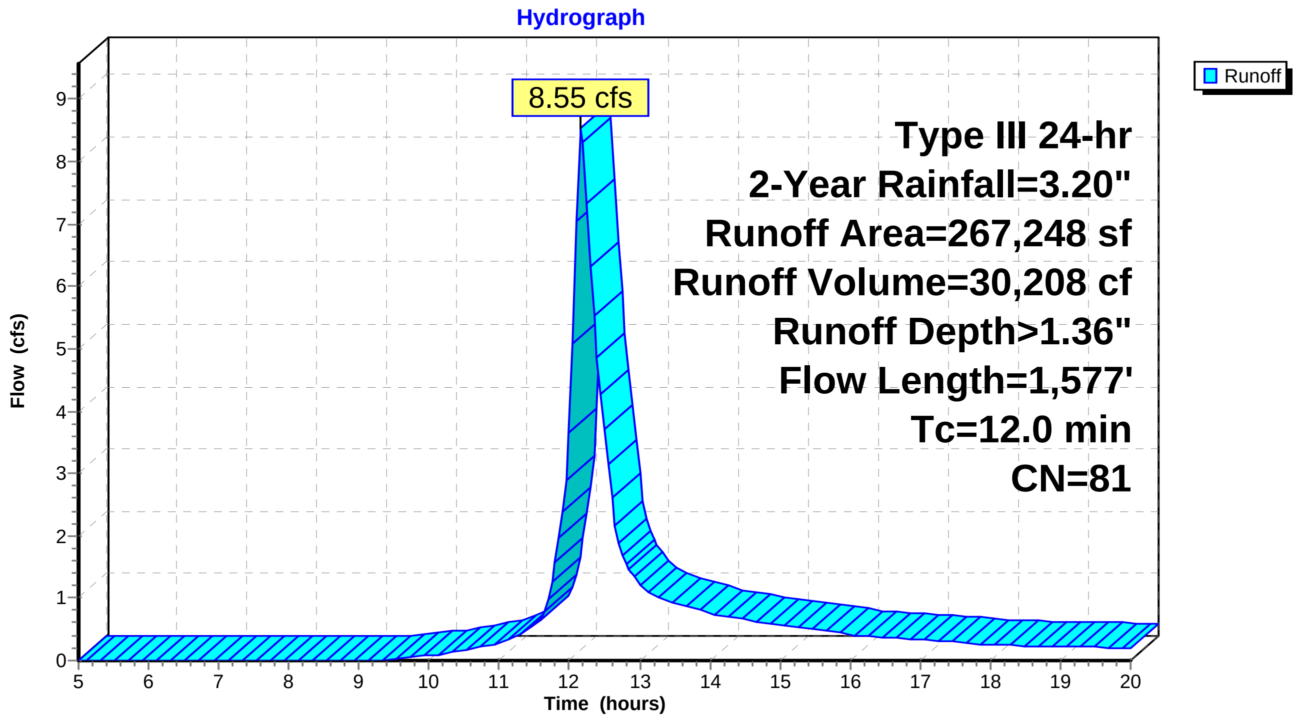
Runoff = 8.55 cfs @ 12.17 hrs, Volume= 30,208 cf, Depth> 1.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
22,404	39	>75% Grass cover, Good, HSG A
82,752	61	>75% Grass cover, Good, HSG B
11,890	80	>75% Grass cover, Good, HSG D
30,503	98	Paved roads w/curbs & sewers, HSG A
96,592	98	Paved roads w/curbs & sewers, HSG B
23,107	98	Paved roads w/curbs & sewers, HSG D
267,248	81	Weighted Average
117,046		43.80% Pervious Area
150,202		56.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	43	0.0200	0.14		**Sheet Flow, Sheet Grass A-B** Grass: Short n= 0.150 P2= 3.20"
0.1	7	0.0200	0.81		**Sheet Flow, Sheet-Pave B-C** Smooth surfaces n= 0.011 P2= 3.20"
1.3	217	0.0200	2.87		**Shallow Concentrated Flow, Paved C-D** Paved Kv= 20.3 fps
1.1	211	0.0050	3.21	2.52	**Pipe Channel, Pipe D-E** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
1.6	397	0.0050	4.20	7.43	**Pipe Channel, Pipe E-F** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
1.6	490	0.0050	5.09	16.00	**Pipe Channel, Pipe F-G** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Corrugated PE, smooth interior
0.0	24		8.97		**Lake or Reservoir, Lake G-H** Mean Depth= 2.50'
0.5	42	0.0050	1.54	0.13	**Pipe Channel, Pipe F-G** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.013 Corrugated PE, smooth interior
0.8	146	0.0400	3.22		**Shallow Concentrated Flow, Unpaved I-J** Unpaved Kv= 16.1 fps
12.0	1,577	Total			

Subcatchment 1D: Main Campus



Summary for Subcatchment 1E: Charles River

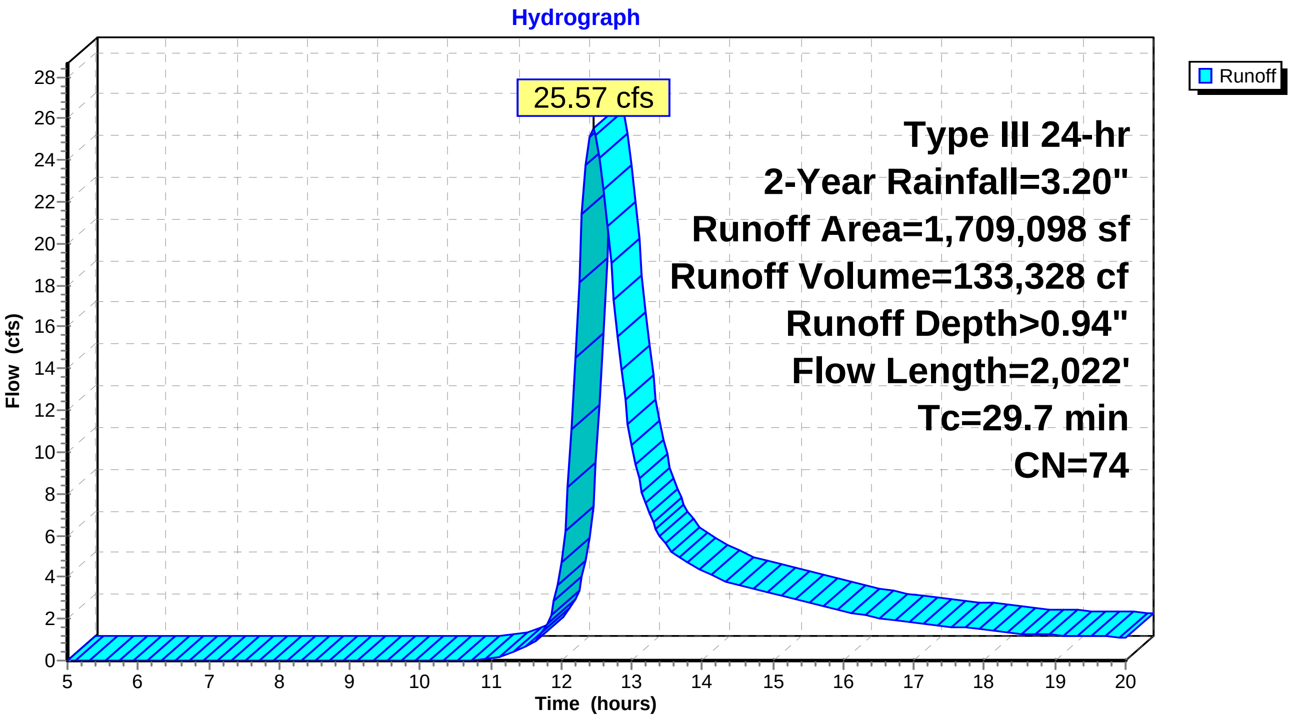
Runoff = 25.57 cfs @ 12.45 hrs, Volume= 133,328 cf, Depth> 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

	Area (sf)	CN	Description
	10,067	30	Woods, Good, HSG A
	5,689	39	>75% Grass cover, Good, HSG A
*	3,253	78	Wetland, HSG A
*	205	72	Path, HSG A
	203,113	55	Woods, Good, HSG B
	199,852	61	>75% Grass cover, Good, HSG B
*	103,465	78	Wetlands, HSG B
*	9,990	82	Path, HSG B
*	2,704	80	Path in Resource, HSG B
	4,112	98	Water Surface, HSG B
	33,426	70	Woods, Good, HSG C
	758	74	>75% Grass cover, Good, HSG C
*	141,675	78	Wetlands, HSG C
*	3,310	87	Path, HSG C
*	6,129	80	Path in Resource, HSG C
	10,807	98	Water Surface, HSG C
	458,293	77	Woods, Good, HSG D
	65,768	80	>75% Grass cover, Good, HSG D
*	227,701	78	Wetlands, HSG D
*	27,658	89	Path, HSG D
*	9,556	80	Path in Resource, HSG D
	45,917	98	Water Surface, HSG D
	20,004	70	1/2 acre lots, 25% imp, HSG B
	54,729	80	1/2 acre lots, 25% imp, HSG C
	60,917	85	1/2 acre lots, 25% imp, HSG D
	1,709,098	74	Weighted Average
	1,614,350		94.46% Pervious Area
	94,749		5.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0600	0.10		**Sheet Flow, Sheet A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
3.1	329	0.0120	1.76		**Shallow Concentrated Flow, Wetland B-C** Unpaved Kv= 16.1 fps
18.5	1,599	0.0080	1.44		**Shallow Concentrated Flow, Wetland/Stream/Pond C-D** Unpaved Kv= 16.1 fps
0.2	44	0.0900	4.83		**Shallow Concentrated Flow, Pond to River D-E** Unpaved Kv= 16.1 fps
29.7	2,022	Total			

Subcatchment 1E: Charles River



Summary for Subcatchment 1F: Pond Drive

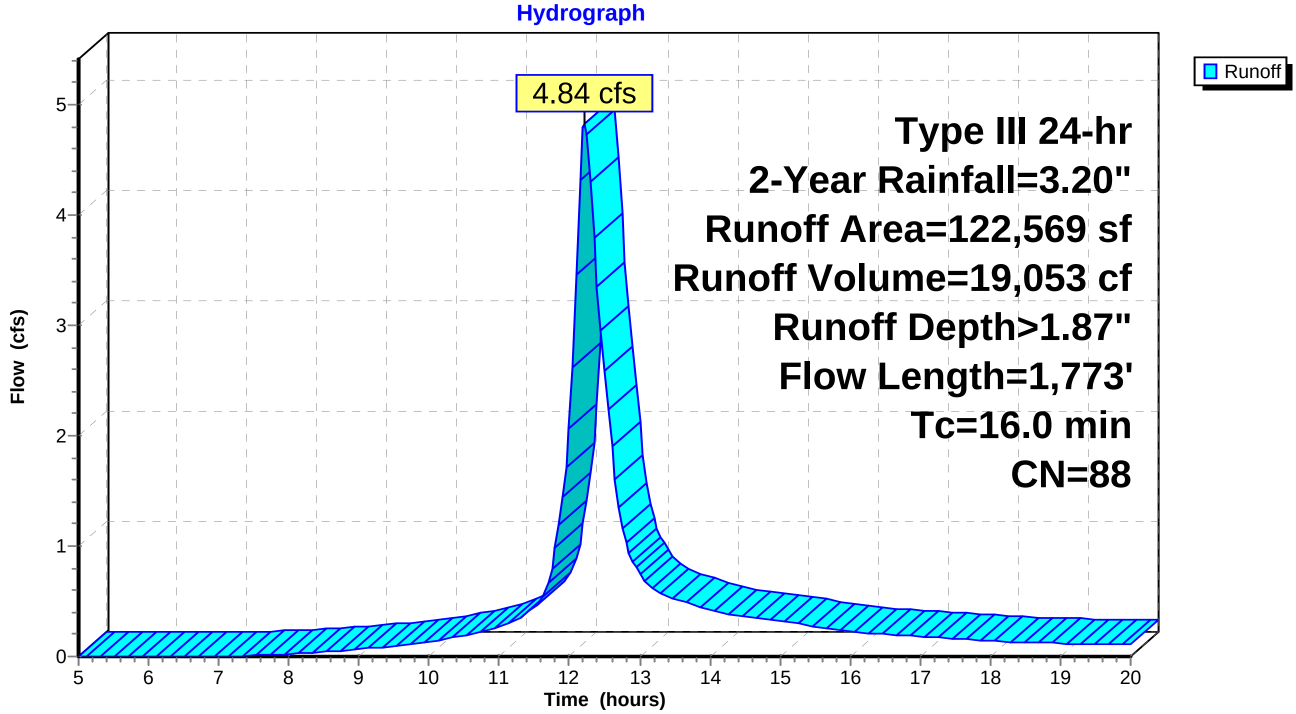
Runoff = 4.84 cfs @ 12.22 hrs, Volume= 19,053 cf, Depth> 1.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

	Area (sf)	CN	Description
	1,964	61	>75% Grass cover, Good, HSG B
	5,597	98	Paved roads w/curbs & sewers, HSG B
	25,437	77	Woods, Good, HSG D
	33,576	80	>75% Grass cover, Good, HSG D
*	43	89	Path, HSG D
	55,952	98	Paved roads w/curbs & sewers, HSG D
	122,569	88	Weighted Average
	61,020		49.78% Pervious Area
	61,549		50.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0600	0.10		**Sheet Flow, Sheet A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.3	55	0.0400	3.22		**Shallow Concentrated Flow, Grass B-C** Unpaved Kv= 16.1 fps
0.8	136	0.0200	2.87		**Shallow Concentrated Flow, Paved C-D** Paved Kv= 20.3 fps
4.0	1,006	0.0050	4.20	7.43	**Pipe Channel, Pipe D-E** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
0.6	197	0.0050	5.09	16.00	**Pipe Channel, Pipe E-F** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Corrugated PE, smooth interior
0.2	77		8.02		**Lake or Reservoir, Basin F-G** Mean Depth= 2.00'
0.5	62	0.0050	2.02	0.40	**Pipe Channel, Pipe G-H** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.013 Corrugated PE, smooth interior
0.7	89	0.0200	2.28		**Shallow Concentrated Flow, Unpaved H-I** Unpaved Kv= 16.1 fps
0.8	57	0.0050	1.14		**Shallow Concentrated Flow, Unpaved I-J** Unpaved Kv= 16.1 fps
0.2	44	0.0900	4.83		**Shallow Concentrated Flow, Upaved J-K** Unpaved Kv= 16.1 fps
16.0	1,773	Total			

Subcatchment 1F: Pond Drive



Summary for Subcatchment OSW: Off Site West

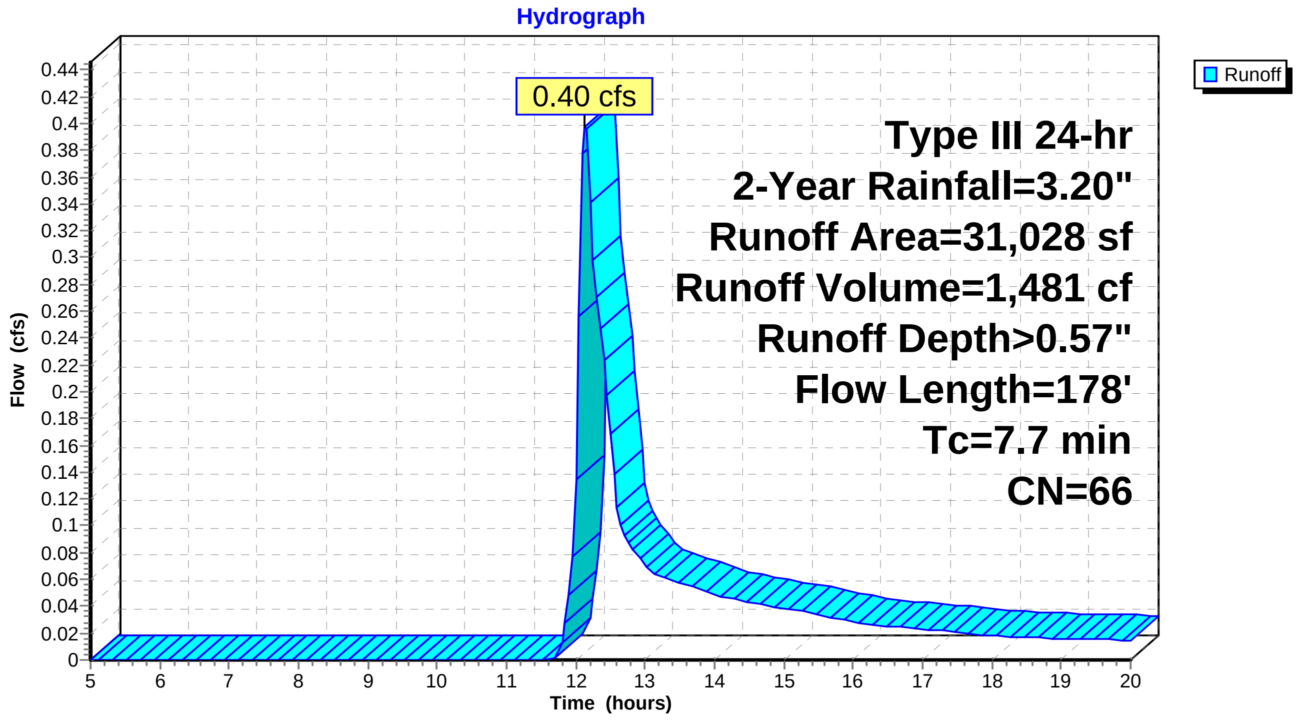
Runoff = 0.40 cfs @ 12.14 hrs, Volume= 1,481 cf, Depth> 0.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

	Area (sf)	CN	Description
	2,983	55	Woods, Good, HSG B
	18,754	61	>75% Grass cover, Good, HSG B
*	1,048	80	Path(cover unknown)
	185	98	Unconnected pavement, HSG B
	8,058	80	>75% Grass cover, Good, HSG D
	31,028	66	Weighted Average
	30,843		99.40% Pervious Area
	185		0.60% Impervious Area
	185		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0800	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.6	128	0.0540	3.74		**Shallow Concentrated Flow, Wooded/Path/Wooded B-C** Unpaved Kv= 16.1 fps
7.7	178	Total			

Subcatchment OSW: Off Site West

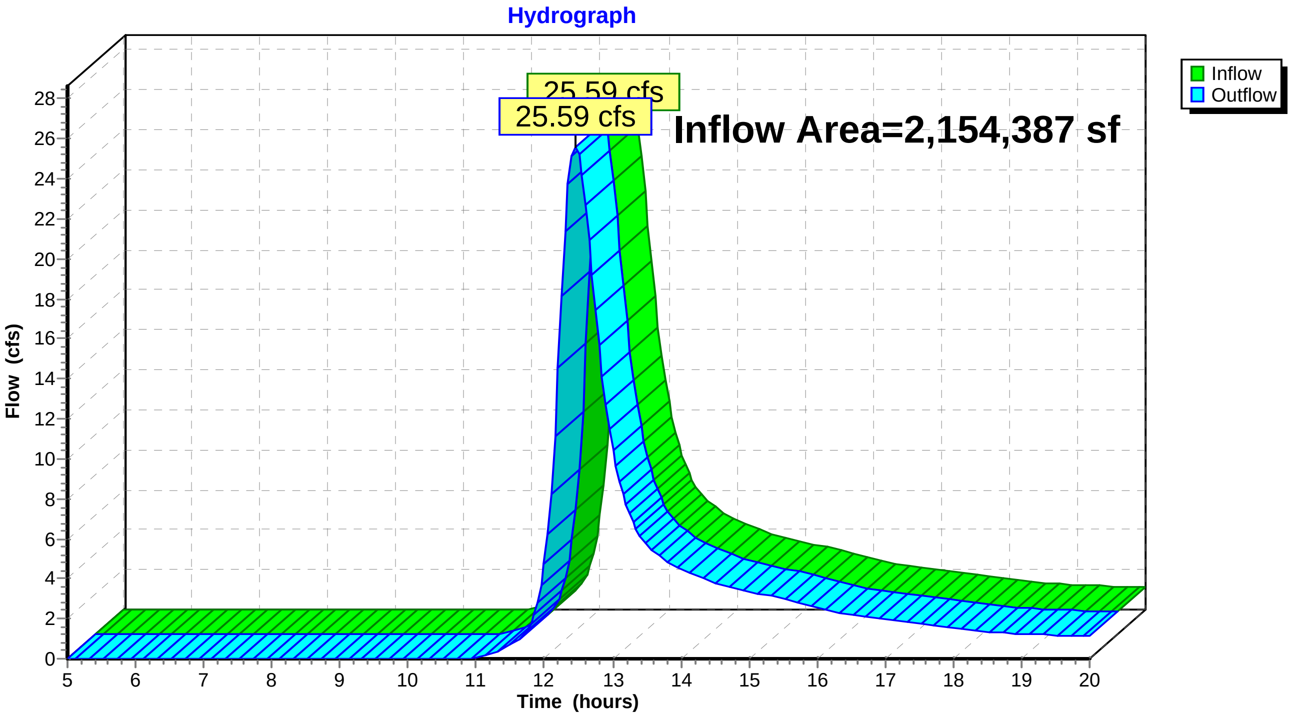


Summary for Reach TOTAL: TOTAL FLOW TO CHARLES

Inflow Area = 2,154,387 sf, 15.93% Impervious, Inflow Depth > 0.76" for 2-Year event
Inflow = 25.59 cfs @ 12.45 hrs, Volume= 136,735 cf
Outflow = 25.59 cfs @ 12.45 hrs, Volume= 136,735 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach TOTAL: TOTAL FLOW TO CHARLES



Summary for Pond B1: BASIN 1

Inflow Area = 55,472 sf, 66.11% Impervious, Inflow Depth > 1.71" for 2-Year event
Inflow = 1.93 cfs @ 12.25 hrs, Volume= 7,890 cf
Outflow = 0.26 cfs @ 13.23 hrs, Volume= 7,816 cf, Atten= 86%, Lag= 58.9 min
Discarded = 0.26 cfs @ 13.23 hrs, Volume= 7,816 cf
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 176.78' @ 13.23 hrs Surf.Area= 4,734 sf Storage= 3,371 cf

Plug-Flow detention time= 126.5 min calculated for 7,790 cf (99% of inflow)
Center-of-Mass det. time= 122.4 min (919.5 - 797.0)

Volume	Invert	Avail.Storage	Storage Description
#1	176.00'	34,190 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

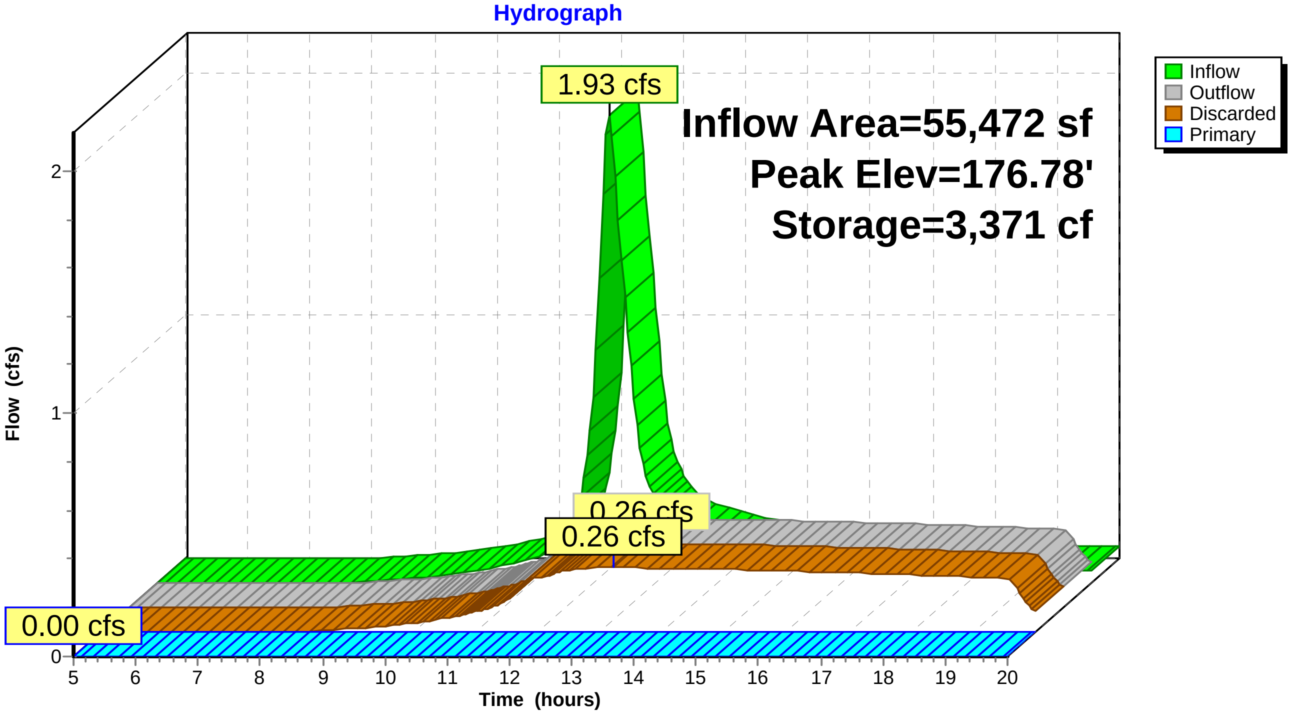
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
176.00	3,879	0	0
177.00	4,971	4,425	4,425
178.00	6,119	5,545	9,970
179.00	7,324	6,722	16,692
180.00	8,586	7,955	24,647
181.00	10,500	9,543	34,190

Device	Routing	Invert	Outlet Devices
#1	Primary	177.00'	**4.0" Round Culvert** L= 25.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 177.00' / 176.50' S= 0.0200 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.09 sf
#2	Device 1	179.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	179.25'	**1.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	179.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Primary	179.90'	**20.0' 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
#6	Discarded	176.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.26 cfs @ 13.23 hrs HW=176.78' (Free Discharge)
└─**6=Exfiltration** (Exfiltration Controls 0.26 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=176.00' (Free Discharge)
├─**1=Culvert** (Controls 0.00 cfs)
│ ├─**2=Orifice/Grate** (Controls 0.00 cfs)
│ ├─**3=Orifice/Grate** (Controls 0.00 cfs)
│ └─**4=Orifice/Grate** (Controls 0.00 cfs)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond B1: BASIN 1



Summary for Pond B2: BASIN 2

Inflow Area = 267,248 sf, 56.20% Impervious, Inflow Depth > 1.36" for 2-Year event
Inflow = 8.55 cfs @ 12.17 hrs, Volume= 30,208 cf
Outflow = 0.48 cfs @ 15.60 hrs, Volume= 14,669 cf, Atten= 94%, Lag= 205.7 min
Discarded = 0.48 cfs @ 15.60 hrs, Volume= 14,669 cf
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 172.92' @ 15.60 hrs Surf.Area= 8,667 sf Storage= 18,311 cf

Plug-Flow detention time= 214.2 min calculated for 14,669 cf (49% of inflow)
Center-of-Mass det. time= 129.6 min (935.4 - 805.8)

Volume	Invert	Avail.Storage	Storage Description
#1	170.00'	25,498 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2A	166.00'	4,027 cf	**35.33'W x 136.50'L x 3.54'H Field A** 17,081 cf Overall - 7,015 cf Embedded = 10,066 cf x 40.0% Voids
#3A	166.50'	7,015 cf	**Cultec R-330XL** x 133 Inside #2 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 7 rows
		36,539 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
170.00	1,209	0	0
171.00	2,057	1,633	1,633
172.00	2,961	2,509	4,142
173.00	3,922	3,442	7,584
174.00	4,939	4,431	12,014
175.00	6,014	5,477	17,491
176.00	10,000	8,007	25,498

Device	Routing	Invert	Outlet Devices
#1	Primary	173.50'	**4.0" Round Culvert** L= 25.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 172.00' / 173.50' S= -0.0600 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.09 sf
#2	Device 1	174.00'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	173.50'	**3.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	174.50'	**24.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Primary	174.90'	**20.0' 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
#6	Discarded	166.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.48 cfs @ 15.60 hrs HW=172.92' (Free Discharge)
└─**6=Exfiltration** (Exfiltration Controls 0.48 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=166.00' (Free Discharge)
├─**1=Culvert** (Controls 0.00 cfs)
│ ├─**2=Orifice/Grate** (Controls 0.00 cfs)
│ ├─**3=Orifice/Grate** (Controls 0.00 cfs)
│ └─**4=Orifice/Grate** (Controls 0.00 cfs)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond B2: BASIN 2 - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 7 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

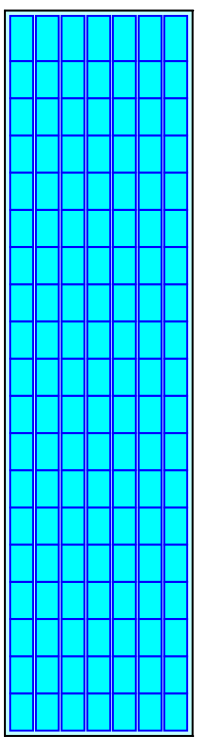
19 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 134.50' Row Length +12.0" End Stone x 2 = 136.50' Base Length
7 Rows x 52.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 35.33' Base Width
6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

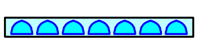
133 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 7 Rows = 7,015.1 cf Chamber Storage

17,081.5 cf Field - 7,015.1 cf Chambers = 10,066.3 cf Stone x 40.0% Voids = 4,026.5 cf Stone Storage

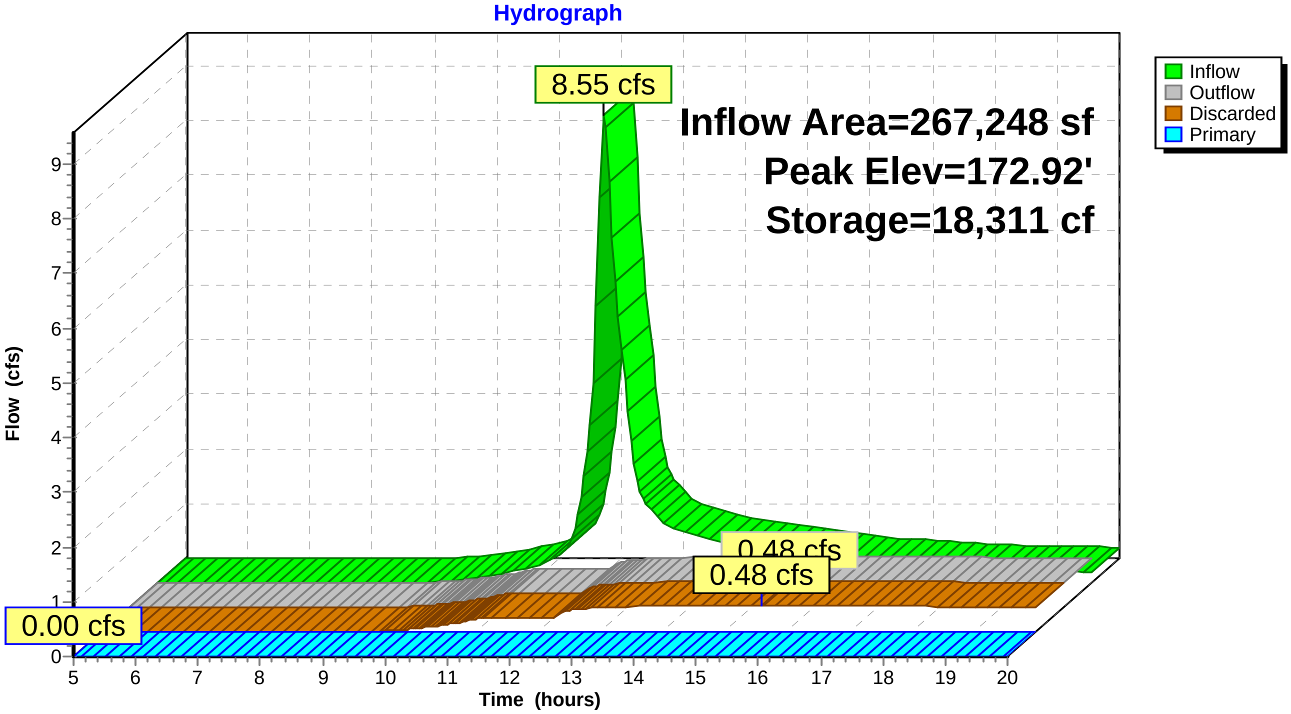
Chamber Storage + Stone Storage = 11,041.7 cf = 0.253 af
Overall Storage Efficiency = 64.6%

133 Chambers
632.6 cy Field
372.8 cy Stone





Pond B2: BASIN 2



Summary for Pond B3: BASIN 3

Inflow Area = 122,569 sf, 50.22% Impervious, Inflow Depth > 1.87" for 2-Year event
Inflow = 4.84 cfs @ 12.22 hrs, Volume= 19,053 cf
Outflow = 0.43 cfs @ 14.01 hrs, Volume= 11,066 cf, Atten= 91%, Lag= 107.3 min
Discarded = 0.24 cfs @ 14.01 hrs, Volume= 7,659 cf
Primary = 0.19 cfs @ 14.01 hrs, Volume= 3,407 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 177.75' @ 14.01 hrs Surf.Area= 4,324 sf Storage= 10,905 cf

Plug-Flow detention time= 197.6 min calculated for 11,029 cf (58% of inflow)
Center-of-Mass det. time= 122.7 min (912.1 - 789.4)

Volume	Invert	Avail.Storage	Storage Description
#1	174.00'	22,625 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

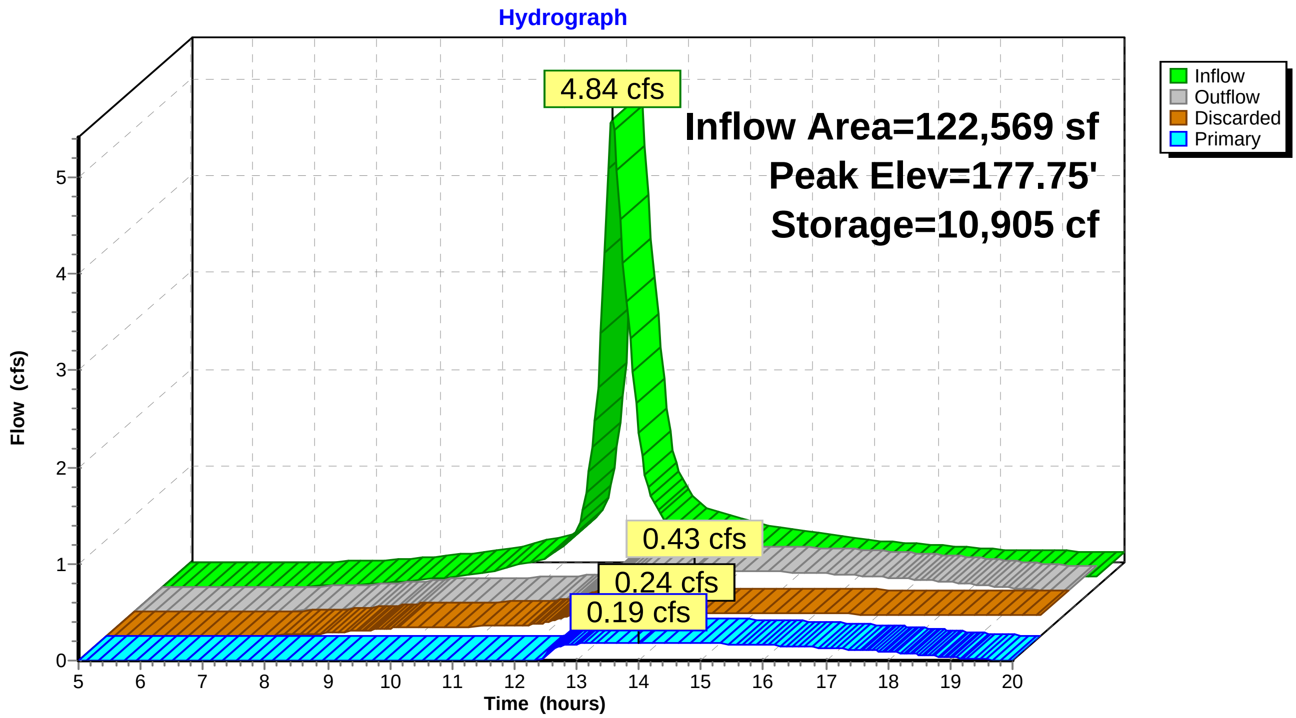
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
174.00	1,623	0	0
175.00	2,265	1,944	1,944
176.00	2,963	2,614	4,558
177.00	3,717	3,340	7,898
178.00	4,528	4,123	12,021
179.00	5,396	4,962	16,983
180.00	5,888	5,642	22,625

Device	Routing	Invert	Outlet Devices
#1	Primary	174.00'	**6.0" Round Culvert** L= 24.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 174.00' / 173.50' S= 0.0208 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf
#2	Device 1	177.00'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	178.50'	**24.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	178.90'	**20.0' 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
#5	Discarded	174.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.24 cfs @ 14.01 hrs HW=177.75' (Free Discharge)
└─**5=Exfiltration** (Exfiltration Controls 0.24 cfs)

Primary OutFlow Max=0.19 cfs @ 14.01 hrs HW=177.75' (Free Discharge)
├─**1=Culvert** (Passes 0.19 cfs of 1.56 cfs potential flow)
│ ├─**2=Orifice/Grate** (Orifice Controls 0.19 cfs @ 3.80 fps)
│ └─**3=Orifice/Grate** (Controls 0.00 cfs)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond B3: BASIN 3



Summary for Pond MF: 88 CULTEC 330

Inflow Area = 35,301 sf, 65.17% Impervious, Inflow Depth > 1.70" for 2-Year event
Inflow = 1.63 cfs @ 12.10 hrs, Volume= 4,986 cf
Outflow = 0.18 cfs @ 11.70 hrs, Volume= 4,978 cf, Atten= 89%, Lag= 0.0 min
Discarded = 0.18 cfs @ 11.70 hrs, Volume= 4,978 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 1.22' @ 12.94 hrs Surf.Area= 3,253 sf Storage= 1,913 cf

Plug-Flow detention time= 90.5 min calculated for 4,961 cf (99% of inflow)
Center-of-Mass det. time= 89.5 min (874.7 - 785.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	3,373 cf	**54.67'W x 59.50'L x 4.04'H Field A** 13,146 cf Overall - 4,713 cf Embedded = 8,433 cf x 40.0% Voids
#2A	1.00'	4,713 cf	**Cultec R-330XL** x 88 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 11 rows
		8,086 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.18 cfs @ 11.70 hrs HW=0.04' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.18 cfs)

Pond MF: 88 CULTEC 330 - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 11 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

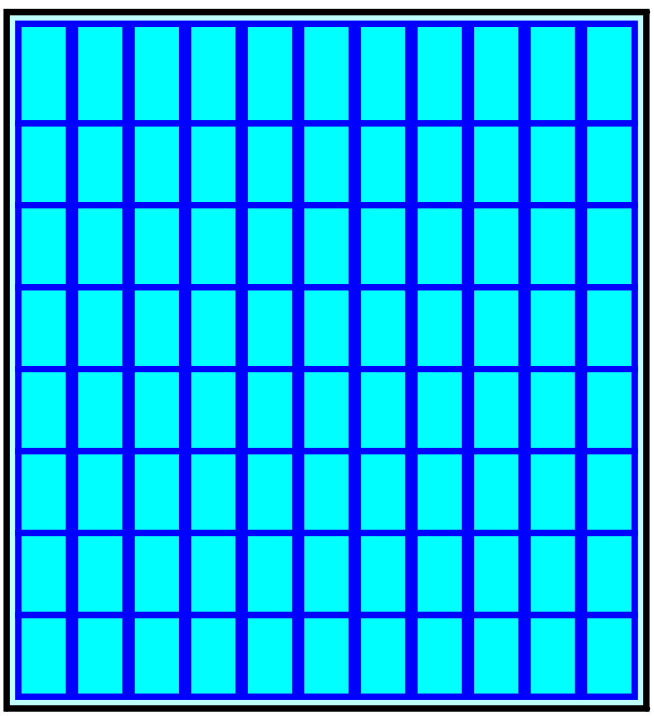
8 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 57.50' Row Length +12.0" End Stone x 2 = 59.50' Base Length
11 Rows x 52.0" Wide + 6.0" Spacing x 10 + 12.0" Side Stone x 2 = 54.67' Base Width
12.0" Base + 30.5" Chamber Height + 6.0" Cover = 4.04' Field Height

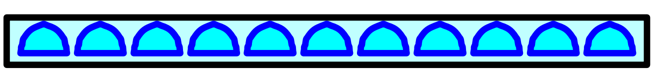
88 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 11 Rows = 4,712.8 cf Chamber Storage

13,146.2 cf Field - 4,712.8 cf Chambers = 8,433.4 cf Stone x 40.0% Voids = 3,373.4 cf Stone Storage

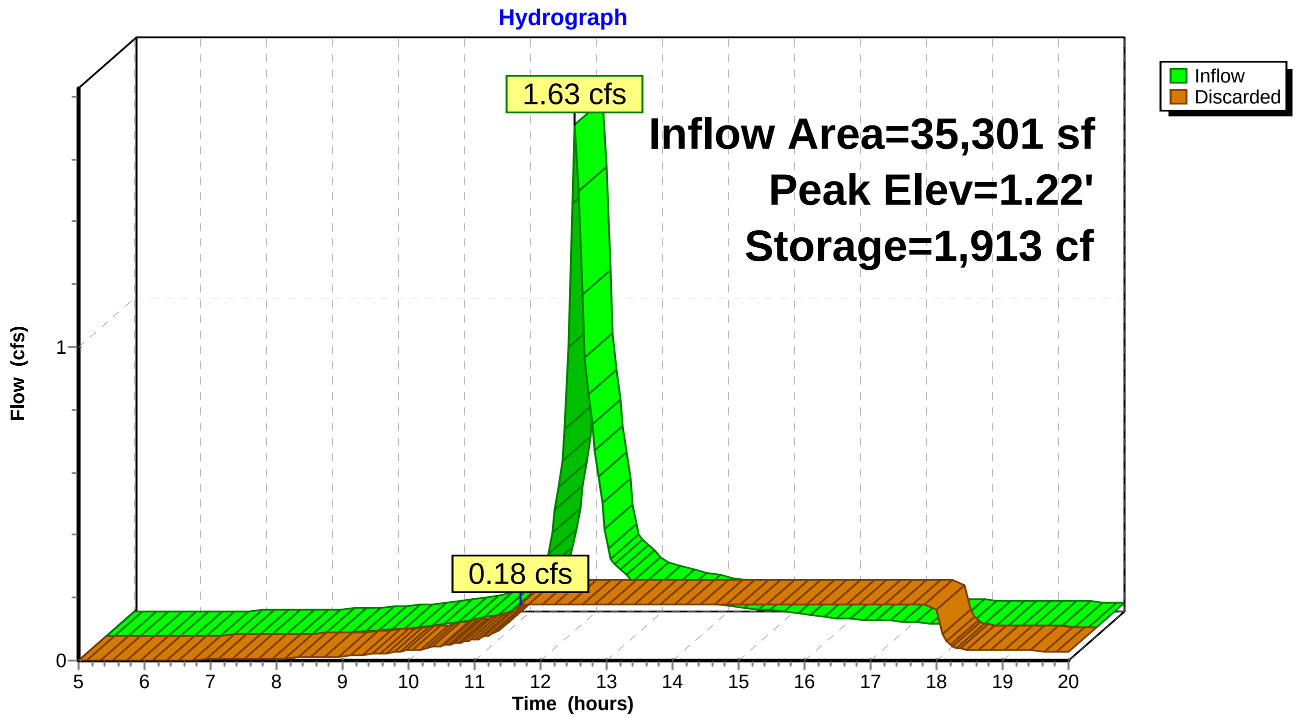
Chamber Storage + Stone Storage = 8,086.1 cf = 0.186 af
Overall Storage Efficiency = 61.5%

88 Chambers
486.9 cy Field
312.3 cy Stone





Pond MF: 88 CULTEC 330



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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 1A: Medical Facility Runoff Area=15,461 sf 81.20% Impervious Runoff Depth>3.49"
Flow Length=239' Tc=6.8 min CN=91 Runoff=1.42 cfs 4,494 cf

Subcatchment 1B: Entrance Roadway Runoff Area=19,840 sf 52.68% Impervious Runoff Depth>2.54"
Flow Length=267' Tc=6.9 min CN=81 Runoff=1.39 cfs 4,203 cf

Subcatchment 1C: Intermediate Roadway Runoff Area=55,472 sf 66.11% Impervious Runoff Depth>2.99"
Flow Length=1,790' Tc=17.9 min CN=86 Runoff=3.32 cfs 13,807 cf

Subcatchment 1D: Main Campus Runoff Area=267,248 sf 56.20% Impervious Runoff Depth>2.54"
Flow Length=1,577' Tc=12.0 min CN=81 Runoff=15.99 cfs 56,516 cf

Subcatchment 1E: Charles River Runoff Area=1,709,098 sf 5.54% Impervious Runoff Depth>1.95"
Flow Length=2,022' Tc=29.7 min CN=74 Runoff=54.89 cfs 277,690 cf

Subcatchment 1F: Pond Drive Runoff Area=122,569 sf 50.22% Impervious Runoff Depth>3.18"
Flow Length=1,773' Tc=16.0 min CN=88 Runoff=8.09 cfs 32,494 cf

Subcatchment OSW: Off Site West Runoff Area=31,028 sf 0.60% Impervious Runoff Depth>1.39"
Flow Length=178' Tc=7.7 min CN=66 Runoff=1.12 cfs 3,598 cf

Reach TOTAL: TOTAL FLOW TO CHARLES Inflow=56.82 cfs 305,349 cf
Outflow=56.82 cfs 305,349 cf

Pond B1: BASIN 1 Peak Elev=177.46' Storage=6,856 cf Inflow=3.32 cfs 13,807 cf
Discarded=0.31 cfs 10,161 cf Primary=0.00 cfs 0 cf Outflow=0.31 cfs 10,161 cf

Pond B2: BASIN 2 Peak Elev=175.04' Storage=28,782 cf Inflow=15.99 cfs 56,516 cf
Discarded=0.61 cfs 19,419 cf Primary=3.02 cfs 15,057 cf Outflow=3.64 cfs 34,476 cf

Pond B3: BASIN 3 Peak Elev=178.87' Storage=16,286 cf Inflow=8.09 cfs 32,494 cf
Discarded=0.29 cfs 9,519 cf Primary=1.79 cfs 12,602 cf Outflow=2.09 cfs 22,121 cf

Pond MF: 88 CULTEC 330 Peak Elev=2.02' Storage=4,106 cf Inflow=2.80 cfs 8,696 cf
Outflow=0.18 cfs 6,664 cf

Total Runoff Area = 2,220,716 sf Runoff Volume = 392,801 cf Average Runoff Depth = 2.12"
83.50% Pervious = 1,854,352 sf 16.50% Impervious = 366,365 sf

Summary for Subcatchment 1A: Medical Facility

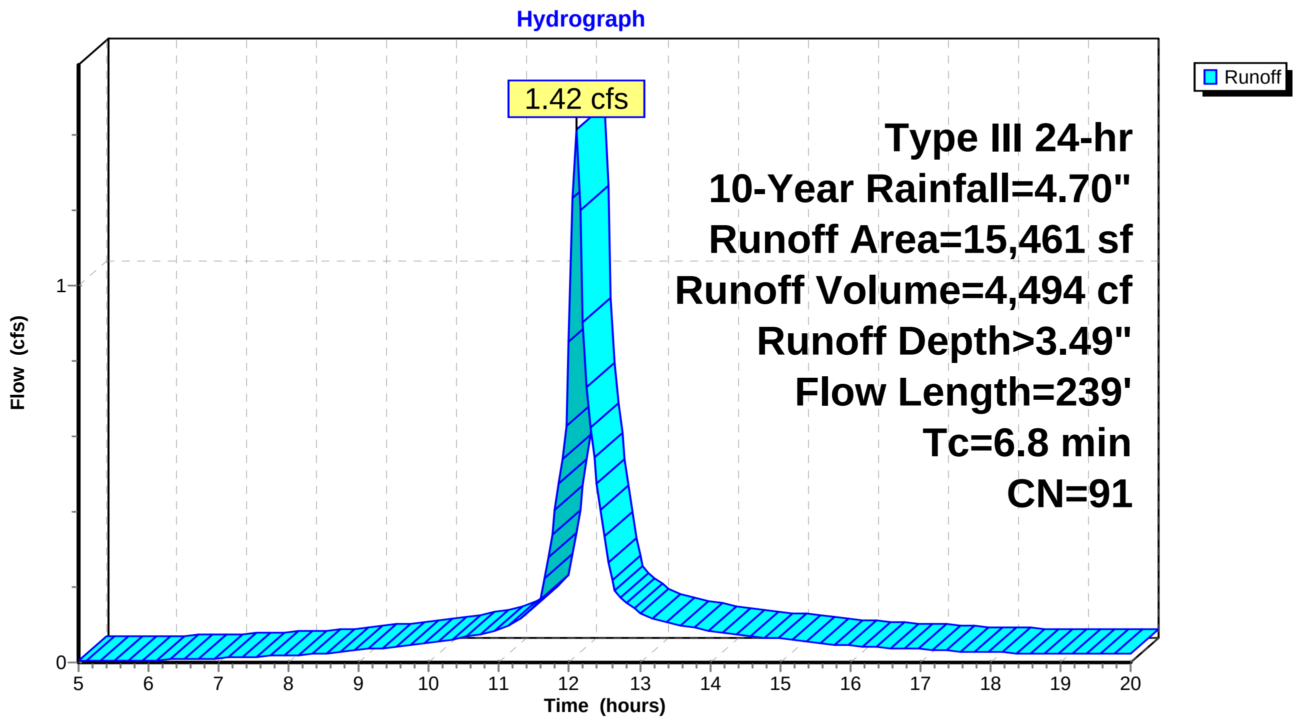
Runoff = 1.42 cfs @ 12.10 hrs, Volume= 4,494 cf, Depth> 3.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
2,907	61	>75% Grass cover, Good, HSG B
12,554	98	Paved roads w/curbs & sewers, HSG B
15,461	91	Weighted Average
2,907		18.80% Pervious Area
12,554		81.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, Sheet A-B** Grass: Short n= 0.150 P2= 3.20"
0.1	14	0.0200	2.28		**Shallow Concentrated Flow, Grass B-C** Unpaved Kv= 16.1 fps
0.5	85	0.0200	2.87		**Shallow Concentrated Flow, Pavement C-D** Paved Kv= 20.3 fps
0.6	90	0.0050	2.45	0.85	**Pipe Channel, Pipe D-E** 8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.013 Corrugated PE, smooth interior
6.8	239	Total			

Subcatchment 1A: Medical Facility



Summary for Subcatchment 1B: Entrance Roadway

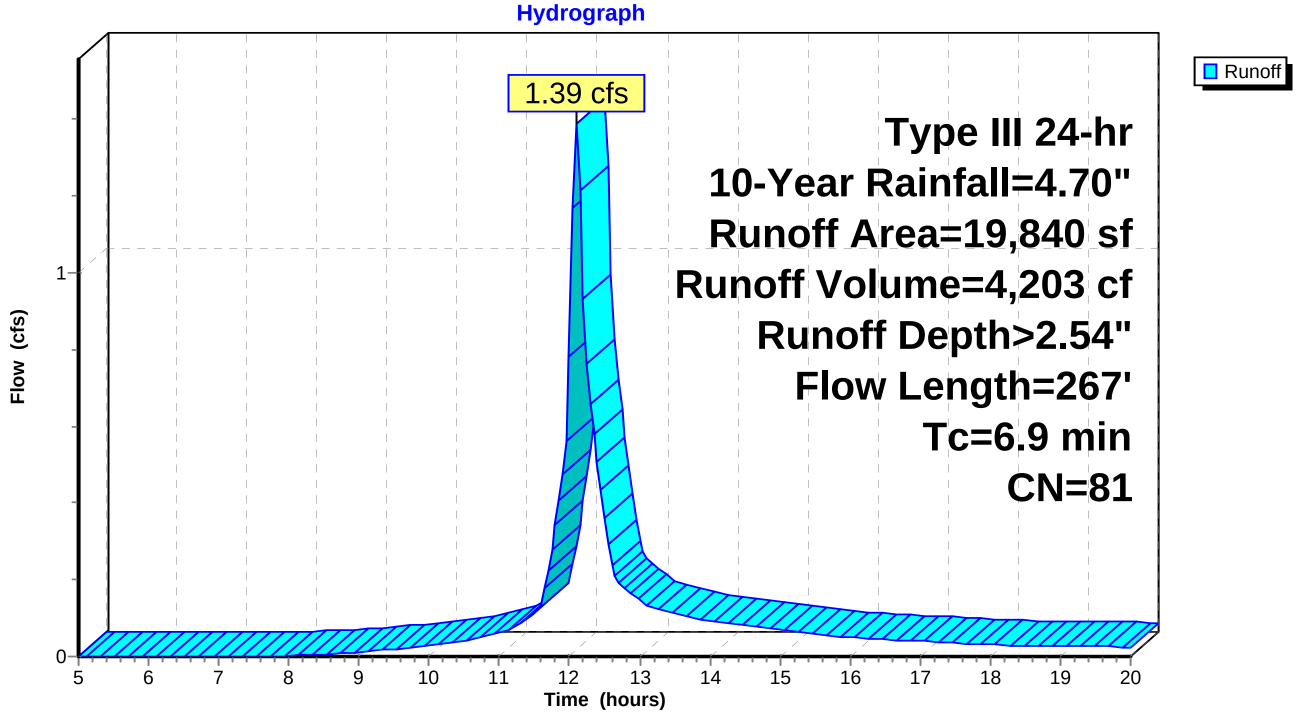
Runoff = 1.39 cfs @ 12.10 hrs, Volume= 4,203 cf, Depth> 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

	Area (sf)	CN	Description
	9,061	61	>75% Grass cover, Good, HSG B
*	328	82	Pathway, Dirt roads, HSG B
	10,451	98	Paved roads w/curbs & sewers, HSG B
	19,840	81	Weighted Average
	9,389		47.32% Pervious Area
	10,451		52.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, Sheet A-B** Grass: Short n= 0.150 P2= 3.20"
0.1	12	0.0200	2.28		**Shallow Concentrated Flow, Grass B-C** Unpaved Kv= 16.1 fps
0.5	104	0.0300	3.52		**Shallow Concentrated Flow, Street C-D** Paved Kv= 20.3 fps
0.7	101	0.0050	2.45	0.85	**Pipe Channel, Pipe D-E** 8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.013 Corrugated PE, smooth interior
6.9	267	Total			

Subcatchment 1B: Entrance Roadway



Summary for Subcatchment 1C: Intermediate Roadway

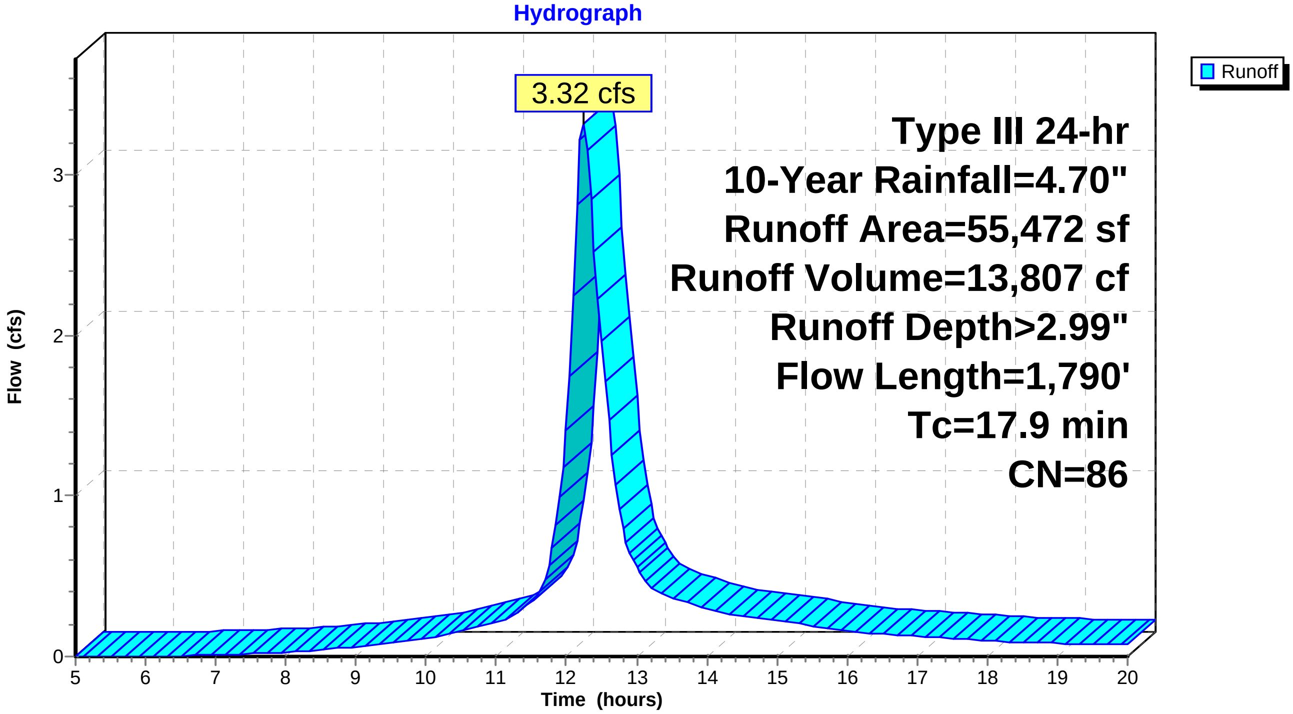
Runoff = 3.32 cfs @ 12.24 hrs, Volume= 13,807 cf, Depth> 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
17,093	61	>75% Grass cover, Good, HSG B
1,704	80	>75% Grass cover, Good, HSG D
28,466	98	Paved roads w/curbs & sewers, HSG B
8,209	98	Paved roads w/curbs & sewers, HSG D
55,472	86	Weighted Average
18,797		33.89% Pervious Area
36,675		66.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, Sheet A-B** Grass: Short n= 0.150 P2= 3.20"
0.1	9	0.0200	2.28		**Shallow Concentrated Flow, Grass B-C** Unpaved Kv= 16.1 fps
0.3	47	0.0200	2.87		**Shallow Concentrated Flow, Paved C-D** Paved Kv= 20.3 fps
3.1	593	0.0050	3.21	2.52	**Pipe Channel, Pipe D-E** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.3	153		8.02		**Lake or Reservoir, Basin E-F** Mean Depth= 2.00'
0.5	46	0.0050	1.54	0.13	**Pipe Channel, Pipe F-E** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.013 Corrugated PE, smooth interior
1.4	149	0.0130	1.84		**Shallow Concentrated Flow, Unpaved** Unpaved Kv= 16.1 fps
2.4	333	0.0200	2.28		**Shallow Concentrated Flow, Unpaved** Unpaved Kv= 16.1 fps
4.2	410	0.0100	1.61		**Shallow Concentrated Flow, Unpaved** Unpaved Kv= 16.1 fps
17.9	1,790	Total			

Subcatchment 1C: Intermediate Roadway



Summary for Subcatchment 1D: Main Campus

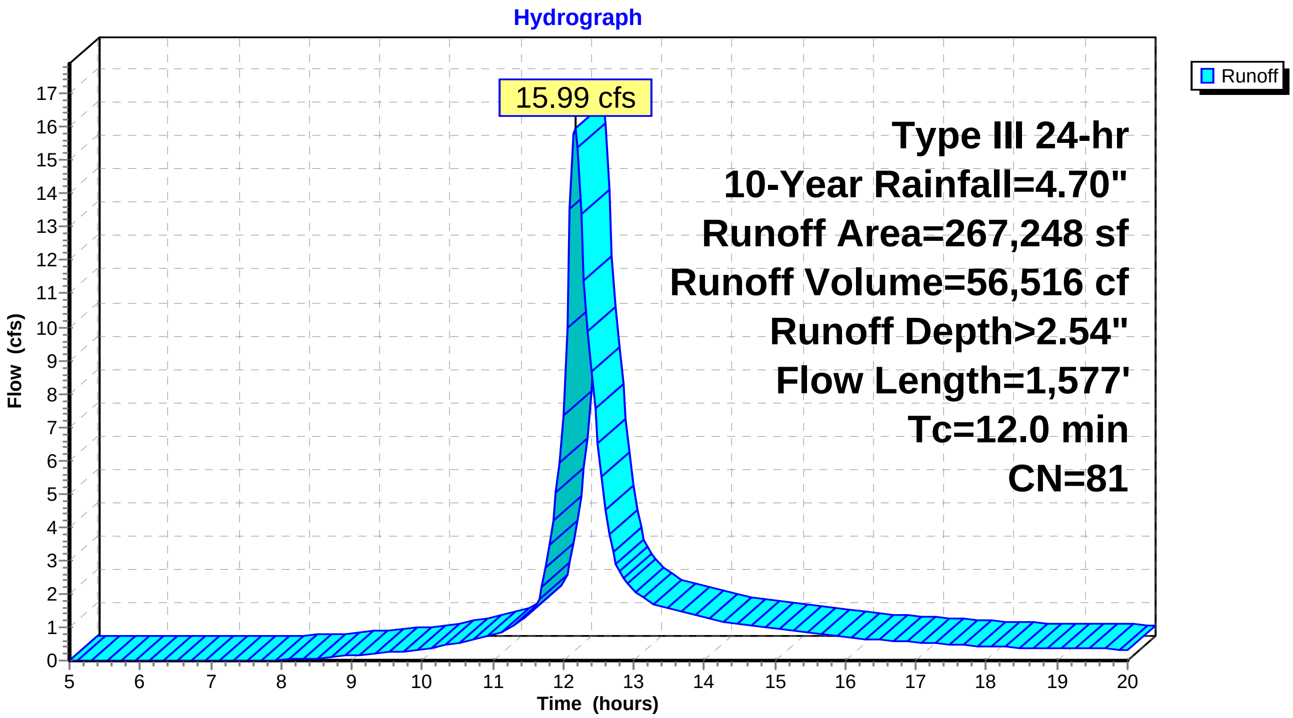
Runoff = 15.99 cfs @ 12.17 hrs, Volume= 56,516 cf, Depth> 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
22,404	39	>75% Grass cover, Good, HSG A
82,752	61	>75% Grass cover, Good, HSG B
11,890	80	>75% Grass cover, Good, HSG D
30,503	98	Paved roads w/curbs & sewers, HSG A
96,592	98	Paved roads w/curbs & sewers, HSG B
23,107	98	Paved roads w/curbs & sewers, HSG D
267,248	81	Weighted Average
117,046		43.80% Pervious Area
150,202		56.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	43	0.0200	0.14		**Sheet Flow, Sheet Grass A-B** Grass: Short n= 0.150 P2= 3.20"
0.1	7	0.0200	0.81		**Sheet Flow, Sheet-Pave B-C** Smooth surfaces n= 0.011 P2= 3.20"
1.3	217	0.0200	2.87		**Shallow Concentrated Flow, Paved C-D** Paved Kv= 20.3 fps
1.1	211	0.0050	3.21	2.52	**Pipe Channel, Pipe D-E** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
1.6	397	0.0050	4.20	7.43	**Pipe Channel, Pipe E-F** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
1.6	490	0.0050	5.09	16.00	**Pipe Channel, Pipe F-G** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Corrugated PE, smooth interior
0.0	24		8.97		**Lake or Reservoir, Lake G-H** Mean Depth= 2.50'
0.5	42	0.0050	1.54	0.13	**Pipe Channel, Pipe F-G** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.013 Corrugated PE, smooth interior
0.8	146	0.0400	3.22		**Shallow Concentrated Flow, Unpaved I-J** Unpaved Kv= 16.1 fps
12.0	1,577	Total			

Subcatchment 1D: Main Campus



Summary for Subcatchment 1E: Charles River

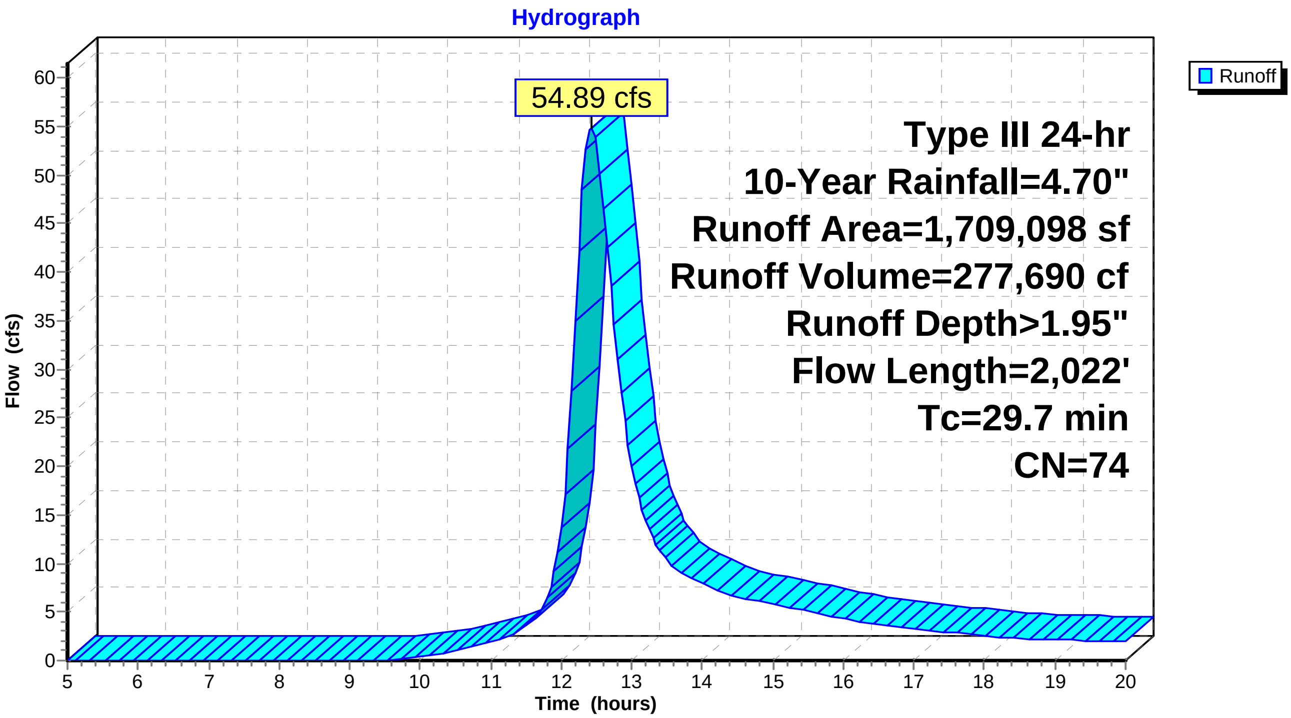
Runoff = 54.89 cfs @ 12.43 hrs, Volume= 277,690 cf, Depth> 1.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

	Area (sf)	CN	Description
	10,067	30	Woods, Good, HSG A
	5,689	39	>75% Grass cover, Good, HSG A
*	3,253	78	Wetland, HSG A
*	205	72	Path, HSG A
	203,113	55	Woods, Good, HSG B
	199,852	61	>75% Grass cover, Good, HSG B
*	103,465	78	Wetlands, HSG B
*	9,990	82	Path, HSG B
*	2,704	80	Path in Resource, HSG B
	4,112	98	Water Surface, HSG B
	33,426	70	Woods, Good, HSG C
	758	74	>75% Grass cover, Good, HSG C
*	141,675	78	Wetlands, HSG C
*	3,310	87	Path, HSG C
*	6,129	80	Path in Resource, HSG C
	10,807	98	Water Surface, HSG C
	458,293	77	Woods, Good, HSG D
	65,768	80	>75% Grass cover, Good, HSG D
*	227,701	78	Wetlands, HSG D
*	27,658	89	Path, HSG D
*	9,556	80	Path in Resource, HSG D
	45,917	98	Water Surface, HSG D
	20,004	70	1/2 acre lots, 25% imp, HSG B
	54,729	80	1/2 acre lots, 25% imp, HSG C
	60,917	85	1/2 acre lots, 25% imp, HSG D
	1,709,098	74	Weighted Average
	1,614,350		94.46% Pervious Area
	94,749		5.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0600	0.10		**Sheet Flow, Sheet A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
3.1	329	0.0120	1.76		**Shallow Concentrated Flow, Wetland B-C** Unpaved Kv= 16.1 fps
18.5	1,599	0.0080	1.44		**Shallow Concentrated Flow, Wetland/Stream/Pond C-D** Unpaved Kv= 16.1 fps
0.2	44	0.0900	4.83		**Shallow Concentrated Flow, Pond to River D-E** Unpaved Kv= 16.1 fps
29.7	2,022	Total			

Subcatchment 1E: Charles River



Summary for Subcatchment 1F: Pond Drive

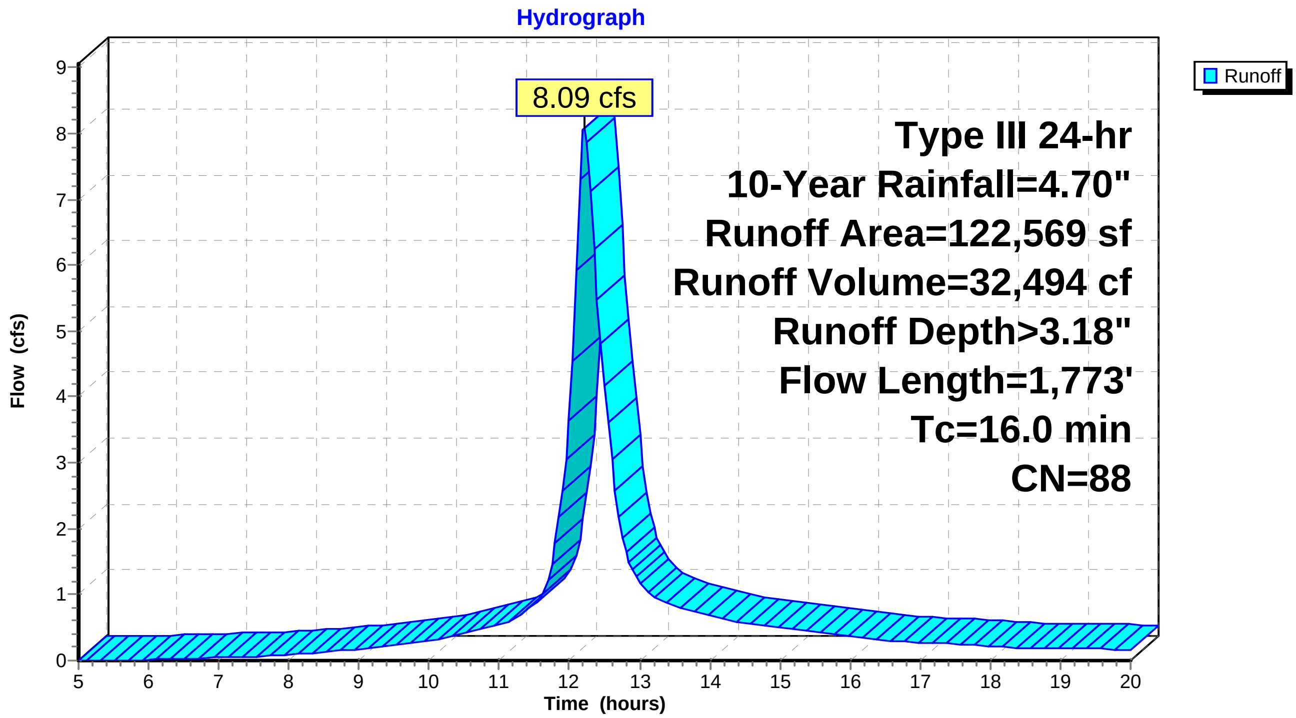
Runoff = 8.09 cfs @ 12.22 hrs, Volume= 32,494 cf, Depth> 3.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

	Area (sf)	CN	Description
	1,964	61	>75% Grass cover, Good, HSG B
	5,597	98	Paved roads w/curbs & sewers, HSG B
	25,437	77	Woods, Good, HSG D
	33,576	80	>75% Grass cover, Good, HSG D
*	43	89	Path, HSG D
	55,952	98	Paved roads w/curbs & sewers, HSG D
	122,569	88	Weighted Average
	61,020		49.78% Pervious Area
	61,549		50.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0600	0.10		**Sheet Flow, Sheet A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.3	55	0.0400	3.22		**Shallow Concentrated Flow, Grass B-C** Unpaved Kv= 16.1 fps
0.8	136	0.0200	2.87		**Shallow Concentrated Flow, Paved C-D** Paved Kv= 20.3 fps
4.0	1,006	0.0050	4.20	7.43	**Pipe Channel, Pipe D-E** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
0.6	197	0.0050	5.09	16.00	**Pipe Channel, Pipe E-F** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Corrugated PE, smooth interior
0.2	77		8.02		**Lake or Reservoir, Basin F-G** Mean Depth= 2.00'
0.5	62	0.0050	2.02	0.40	**Pipe Channel, Pipe G-H** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.013 Corrugated PE, smooth interior
0.7	89	0.0200	2.28		**Shallow Concentrated Flow, Unpaved H-I** Unpaved Kv= 16.1 fps
0.8	57	0.0050	1.14		**Shallow Concentrated Flow, Unpaved I-J** Unpaved Kv= 16.1 fps
0.2	44	0.0900	4.83		**Shallow Concentrated Flow, Upaved J-K** Unpaved Kv= 16.1 fps
16.0	1,773	Total			

Subcatchment 1F: Pond Drive



Summary for Subcatchment OSW: Off Site West

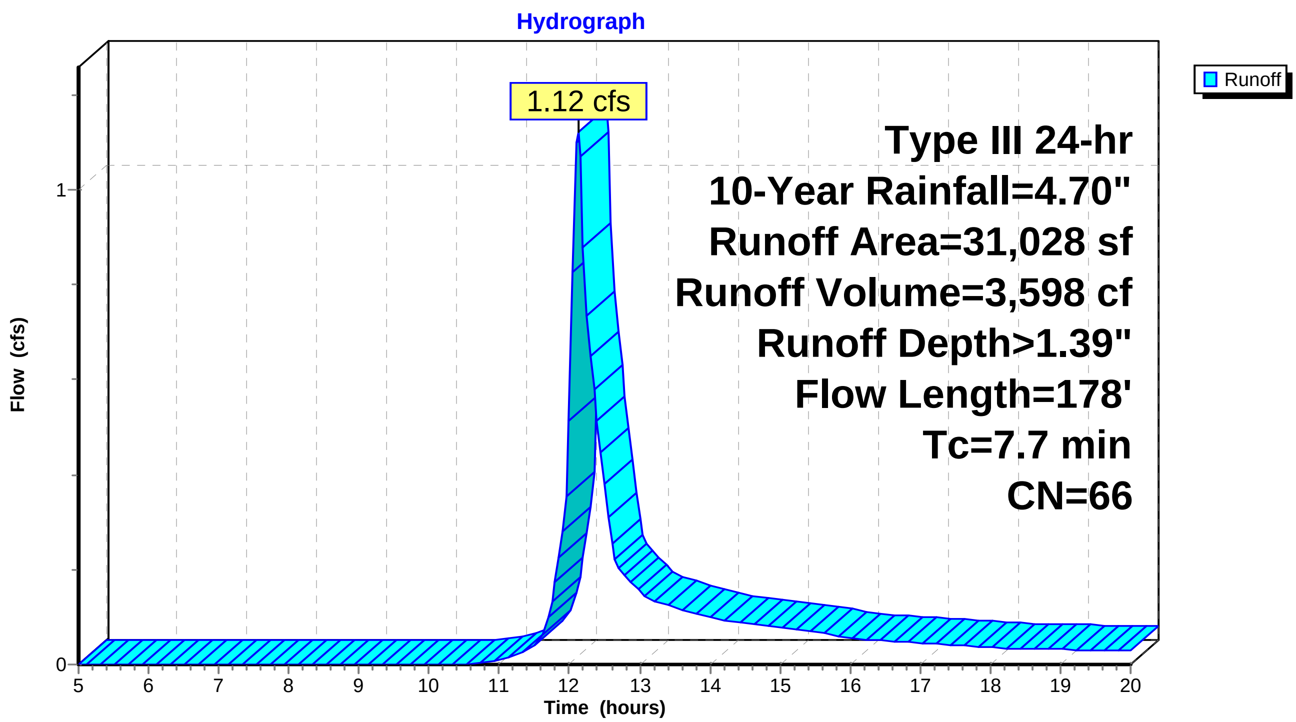
Runoff = 1.12 cfs @ 12.12 hrs, Volume= 3,598 cf, Depth> 1.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

	Area (sf)	CN	Description
	2,983	55	Woods, Good, HSG B
	18,754	61	>75% Grass cover, Good, HSG B
*	1,048	80	Path(cover unknown)
	185	98	Unconnected pavement, HSG B
	8,058	80	>75% Grass cover, Good, HSG D
	31,028	66	Weighted Average
	30,843		99.40% Pervious Area
	185		0.60% Impervious Area
	185		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0800	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.6	128	0.0540	3.74		**Shallow Concentrated Flow, Wooded/Path/Wooded B-C** Unpaved Kv= 16.1 fps
7.7	178	Total			

Subcatchment OSW: Off Site West

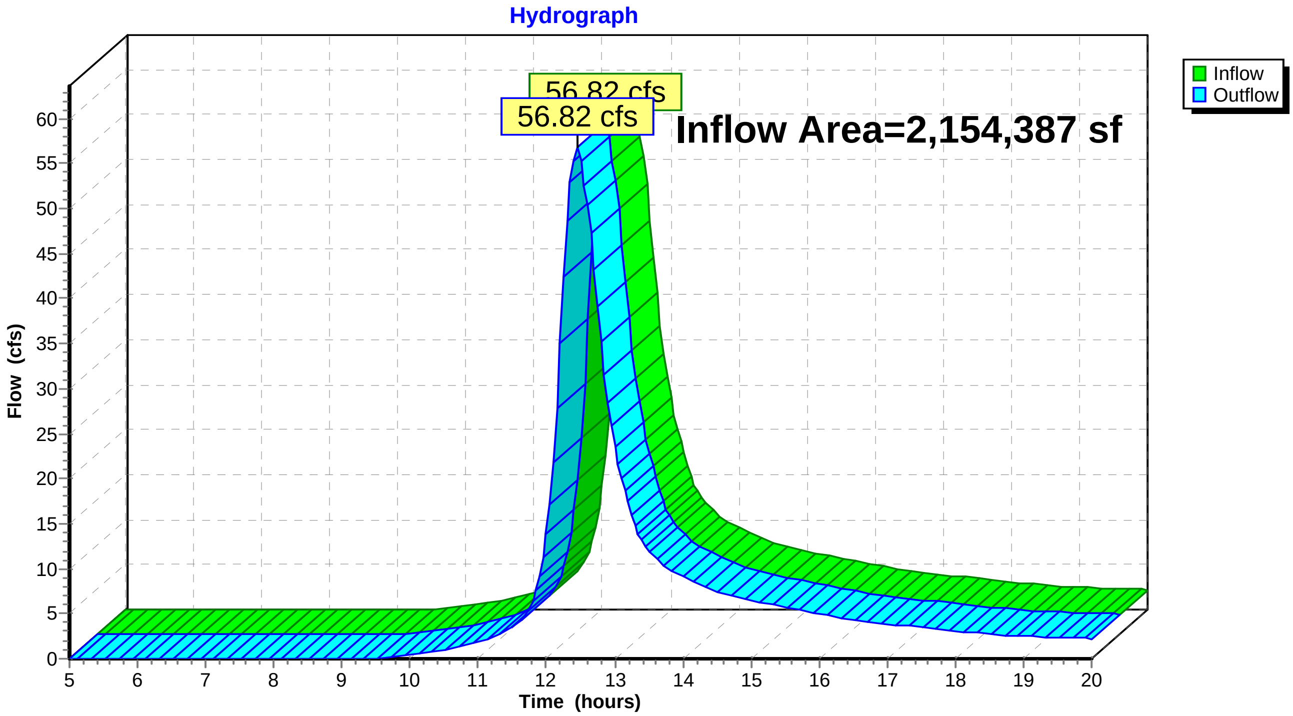


Summary for Reach TOTAL: TOTAL FLOW TO CHARLES

Inflow Area = 2,154,387 sf, 15.93% Impervious, Inflow Depth > 1.70" for 10-Year event
Inflow = 56.82 cfs @ 12.45 hrs, Volume= 305,349 cf
Outflow = 56.82 cfs @ 12.45 hrs, Volume= 305,349 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach TOTAL: TOTAL FLOW TO CHARLES



Summary for Pond B1: BASIN 1

Inflow Area = 55,472 sf, 66.11% Impervious, Inflow Depth > 2.99" for 10-Year event
Inflow = 3.32 cfs @ 12.24 hrs, Volume= 13,807 cf
Outflow = 0.31 cfs @ 13.95 hrs, Volume= 10,161 cf, Atten= 91%, Lag= 102.4 min
Discarded = 0.31 cfs @ 13.95 hrs, Volume= 10,161 cf
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 177.46' @ 13.95 hrs Surf.Area= 5,504 sf Storage= 6,856 cf

Plug-Flow detention time= 179.7 min calculated for 10,161 cf (74% of inflow)
Center-of-Mass det. time= 118.6 min (902.6 - 784.0)

Volume	Invert	Avail.Storage	Storage Description
#1	176.00'	34,190 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

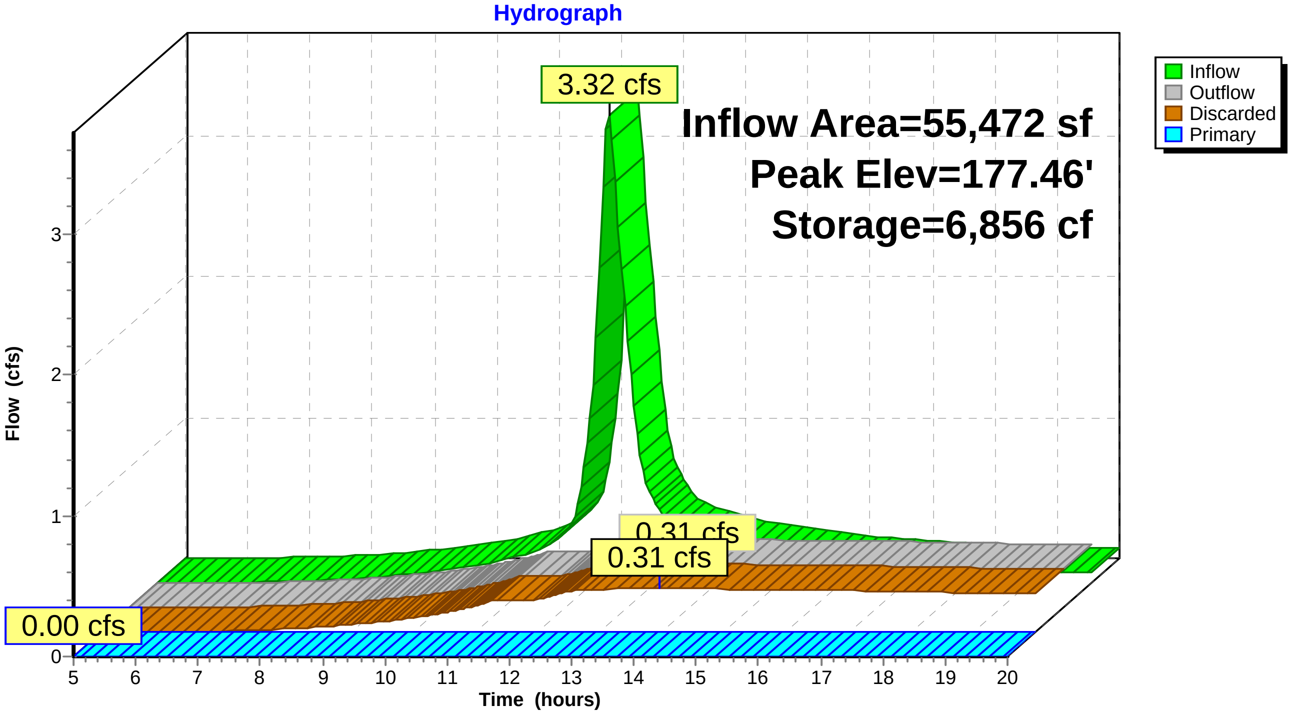
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
176.00	3,879	0	0
177.00	4,971	4,425	4,425
178.00	6,119	5,545	9,970
179.00	7,324	6,722	16,692
180.00	8,586	7,955	24,647
181.00	10,500	9,543	34,190

Device	Routing	Invert	Outlet Devices
#1	Primary	177.00'	**4.0" Round Culvert** L= 25.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 177.00' / 176.50' S= 0.0200 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.09 sf
#2	Device 1	179.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	179.25'	**1.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	179.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Primary	179.90'	**20.0' 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
#6	Discarded	176.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.31 cfs @ 13.95 hrs HW=177.46' (Free Discharge)
└─**6=Exfiltration** (Exfiltration Controls 0.31 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=176.00' (Free Discharge)
├─**1=Culvert** (Controls 0.00 cfs)
│ ├─**2=Orifice/Grate** (Controls 0.00 cfs)
│ ├─**3=Orifice/Grate** (Controls 0.00 cfs)
│ └─**4=Orifice/Grate** (Controls 0.00 cfs)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond B1: BASIN 1



Summary for Pond B2: BASIN 2

Inflow Area = 267,248 sf, 56.20% Impervious, Inflow Depth > 2.54" for 10-Year event
Inflow = 15.99 cfs @ 12.17 hrs, Volume= 56,516 cf
Outflow = 3.64 cfs @ 12.67 hrs, Volume= 34,476 cf, Atten= 77%, Lag= 30.4 min
Discarded = 0.61 cfs @ 12.67 hrs, Volume= 19,419 cf
Primary = 3.02 cfs @ 12.67 hrs, Volume= 15,057 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 175.04' @ 12.67 hrs Surf.Area= 11,000 sf Storage= 28,782 cf

Plug-Flow detention time= 177.5 min calculated for 34,361 cf (61% of inflow)
Center-of-Mass det. time= 103.9 min (895.6 - 791.7)

Volume	Invert	Avail.Storage	Storage Description
#1	170.00'	25,498 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
#2A	166.00'	4,027 cf	**35.33'W x 136.50'L x 3.54'H Field A** 17,081 cf Overall - 7,015 cf Embedded = 10,066 cf x 40.0% Voids
#3A	166.50'	7,015 cf	**Cultec R-330XL** x 133 Inside #2 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 7 rows
		36,539 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
170.00	1,209	0	0
171.00	2,057	1,633	1,633
172.00	2,961	2,509	4,142
173.00	3,922	3,442	7,584
174.00	4,939	4,431	12,014
175.00	6,014	5,477	17,491
176.00	10,000	8,007	25,498

Device	Routing	Invert	Outlet Devices
#1	Primary	173.50'	**4.0" Round Culvert** L= 25.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 172.00' / 173.50' S= -0.0600 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.09 sf
#2	Device 1	174.00'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	173.50'	**3.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	174.50'	**24.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Primary	174.90'	**20.0' 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
#6	Discarded	166.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.61 cfs @ 12.67 hrs HW=175.04' (Free Discharge)
└─**6=Exfiltration** (Exfiltration Controls 0.61 cfs)

Primary OutFlow Max=2.81 cfs @ 12.67 hrs HW=175.04' (Free Discharge)
├─**1=Culvert** (Inlet Controls 0.43 cfs @ 4.97 fps)
│ ├─**2=Orifice/Grate** (Passes < 0.23 cfs potential flow)
│ ├─**3=Orifice/Grate** (Passes < 0.28 cfs potential flow)
│ └─**4=Orifice/Grate** (Passes < 15.45 cfs potential flow)
└─**5=Broad-Crested Rectangular Weir** (Weir Controls 2.38 cfs @ 0.87 fps)

Pond B2: BASIN 2 - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 7 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

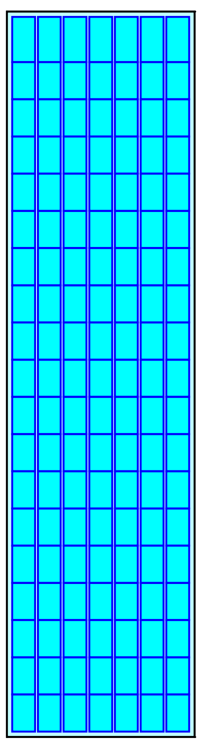
19 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 134.50' Row Length +12.0" End Stone x 2 = 136.50' Base Length
7 Rows x 52.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 35.33' Base Width
6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

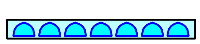
133 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 7 Rows = 7,015.1 cf Chamber Storage

17,081.5 cf Field - 7,015.1 cf Chambers = 10,066.3 cf Stone x 40.0% Voids = 4,026.5 cf Stone Storage

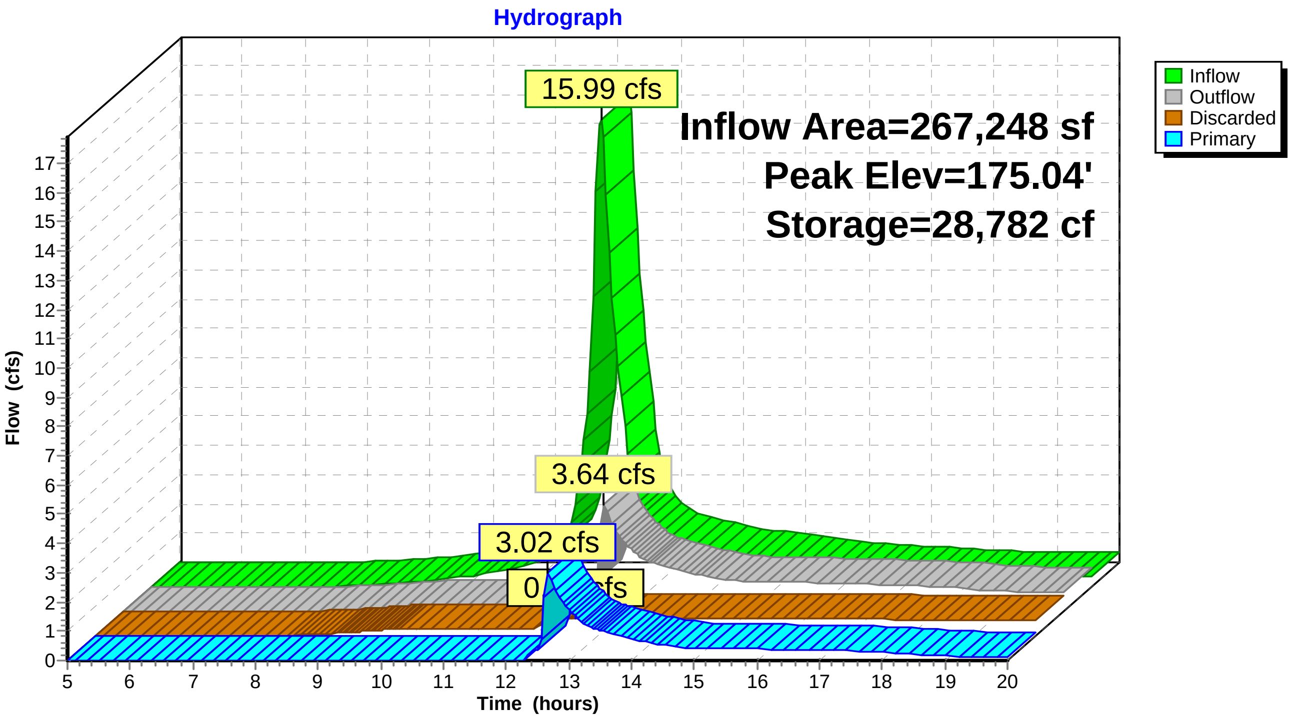
Chamber Storage + Stone Storage = 11,041.7 cf = 0.253 af
Overall Storage Efficiency = 64.6%

133 Chambers
632.6 cy Field
372.8 cy Stone





Pond B2: BASIN 2



Summary for Pond B3: BASIN 3

Inflow Area = 122,569 sf, 50.22% Impervious, Inflow Depth > 3.18" for 10-Year event
Inflow = 8.09 cfs @ 12.22 hrs, Volume= 32,494 cf
Outflow = 2.09 cfs @ 12.72 hrs, Volume= 22,121 cf, Atten= 74%, Lag= 30.0 min
Discarded = 0.29 cfs @ 12.72 hrs, Volume= 9,519 cf
Primary = 1.79 cfs @ 12.72 hrs, Volume= 12,602 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 178.87' @ 12.72 hrs Surf.Area= 5,283 sf Storage= 16,286 cf

Plug-Flow detention time= 168.6 min calculated for 22,121 cf (68% of inflow)
Center-of-Mass det. time= 101.3 min (878.2 - 776.8)

Volume	Invert	Avail.Storage	Storage Description
#1	174.00'	22,625 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

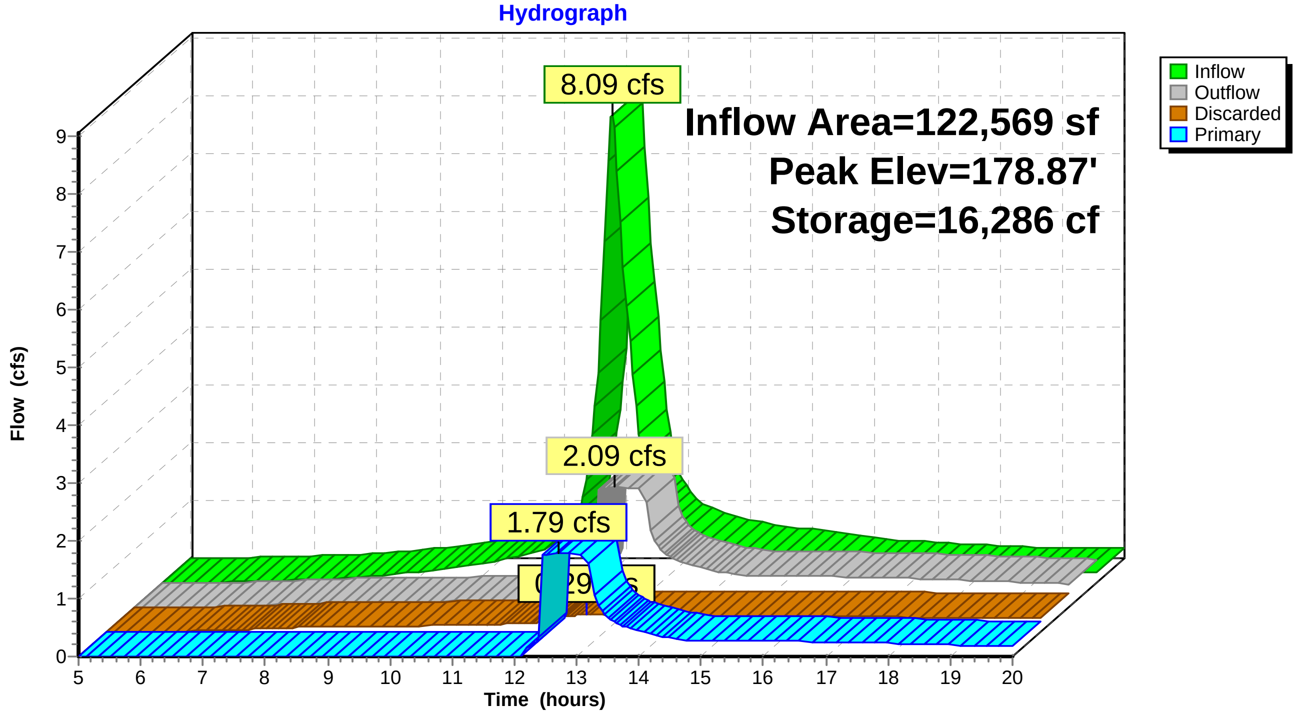
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
174.00	1,623	0	0
175.00	2,265	1,944	1,944
176.00	2,963	2,614	4,558
177.00	3,717	3,340	7,898
178.00	4,528	4,123	12,021
179.00	5,396	4,962	16,983
180.00	5,888	5,642	22,625

Device	Routing	Invert	Outlet Devices
#1	Primary	174.00'	**6.0" Round Culvert** L= 24.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 174.00' / 173.50' S= 0.0208 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf
#2	Device 1	177.00'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	178.50'	**24.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	178.90'	**20.0' 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
#5	Discarded	174.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.29 cfs @ 12.72 hrs HW=178.87' (Free Discharge)
└─**5=Exfiltration** (Exfiltration Controls 0.29 cfs)

Primary OutFlow Max=1.79 cfs @ 12.72 hrs HW=178.87' (Free Discharge)
├─**1=Culvert** (Inlet Controls 1.79 cfs @ 9.13 fps)
│ ├─**2=Orifice/Grate** (Passes < 0.31 cfs potential flow)
│ └─**3=Orifice/Grate** (Passes < 8.77 cfs potential flow)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond B3: BASIN 3



Summary for Pond MF: 88 CULTEC 330

Inflow Area = 35,301 sf, 65.17% Impervious, Inflow Depth > 2.96" for 10-Year event
Inflow = 2.80 cfs @ 12.10 hrs, Volume= 8,696 cf
Outflow = 0.18 cfs @ 11.30 hrs, Volume= 6,664 cf, Atten= 94%, Lag= 0.0 min
Discarded = 0.18 cfs @ 11.30 hrs, Volume= 6,664 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 2.02' @ 13.92 hrs Surf.Area= 3,253 sf Storage= 4,106 cf

Plug-Flow detention time= 174.7 min calculated for 6,663 cf (77% of inflow)
Center-of-Mass det. time= 116.0 min (889.4 - 773.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	3,373 cf	**54.67'W x 59.50'L x 4.04'H Field A** 13,146 cf Overall - 4,713 cf Embedded = 8,433 cf x 40.0% Voids
#2A	1.00'	4,713 cf	**Cultec R-330XL** x 88 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 11 rows
		8,086 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.18 cfs @ 11.30 hrs HW=0.04' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.18 cfs)

Pond MF: 88 CULTEC 330 - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 11 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

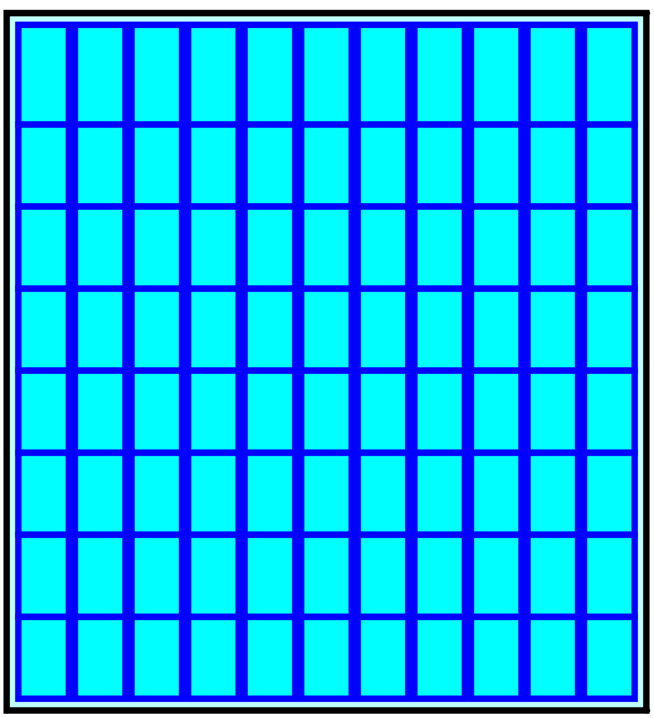
8 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 57.50' Row Length +12.0" End Stone x 2 = 59.50' Base Length
11 Rows x 52.0" Wide + 6.0" Spacing x 10 + 12.0" Side Stone x 2 = 54.67' Base Width
12.0" Base + 30.5" Chamber Height + 6.0" Cover = 4.04' Field Height

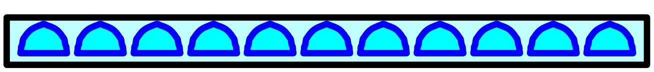
88 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 11 Rows = 4,712.8 cf Chamber Storage

13,146.2 cf Field - 4,712.8 cf Chambers = 8,433.4 cf Stone x 40.0% Voids = 3,373.4 cf Stone Storage

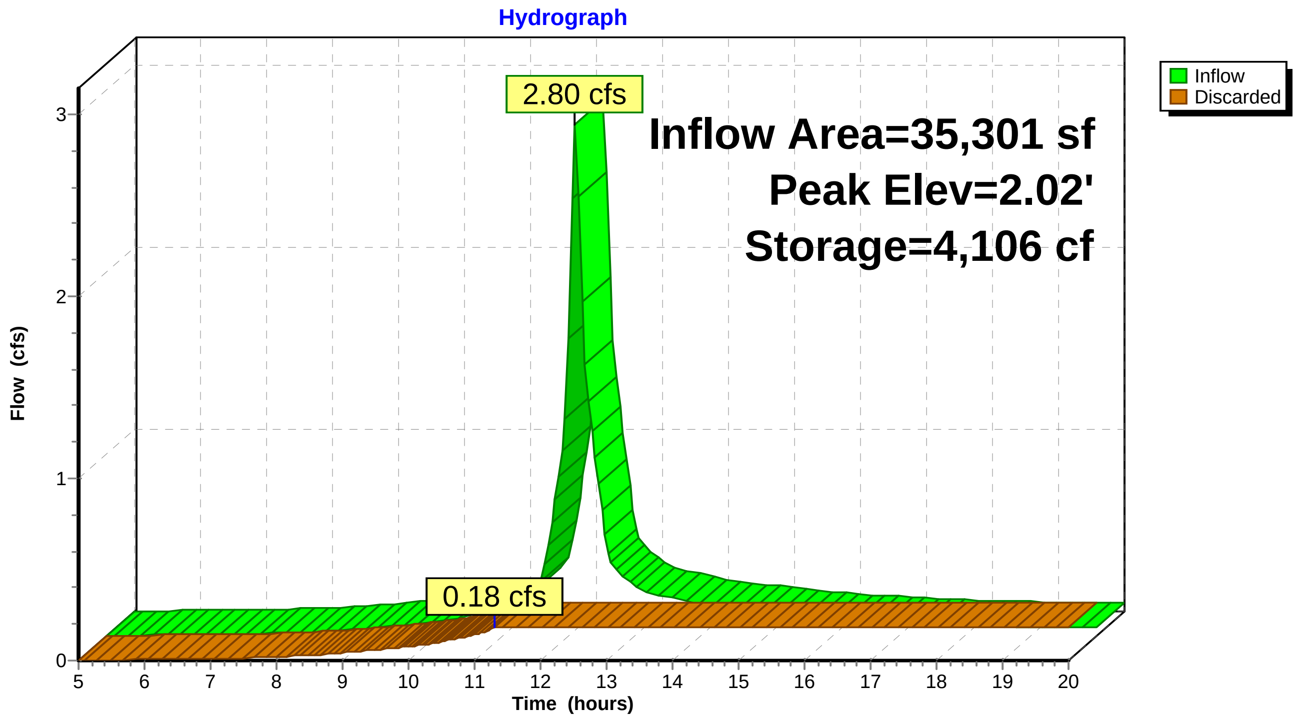
Chamber Storage + Stone Storage = 8,086.1 cf = 0.186 af
Overall Storage Efficiency = 61.5%

88 Chambers
486.9 cy Field
312.3 cy Stone





Pond MF: 88 CULTEC 330



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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 1A: Medical Facility Runoff Area=15,461 sf 81.20% Impervious Runoff Depth>4.22"
Flow Length=239' Tc=6.8 min CN=91 Runoff=1.70 cfs 5,441 cf

Subcatchment 1B: Entrance Roadway Runoff Area=19,840 sf 52.68% Impervious Runoff Depth>3.21"
Flow Length=267' Tc=6.9 min CN=81 Runoff=1.75 cfs 5,314 cf

Subcatchment 1C: Intermediate Roadway Runoff Area=55,472 sf 66.11% Impervious Runoff Depth>3.70"
Flow Length=1,790' Tc=17.9 min CN=86 Runoff=4.07 cfs 17,087 cf

Subcatchment 1D: Main Campus Runoff Area=267,248 sf 56.20% Impervious Runoff Depth>3.21"
Flow Length=1,577' Tc=12.0 min CN=81 Runoff=20.11 cfs 71,465 cf

Subcatchment 1E: Charles River Runoff Area=1,709,098 sf 5.54% Impervious Runoff Depth>2.55"
Flow Length=2,022' Tc=29.7 min CN=74 Runoff=72.00 cfs 363,220 cf

Subcatchment 1F: Pond Drive Runoff Area=122,569 sf 50.22% Impervious Runoff Depth>3.90"
Flow Length=1,773' Tc=16.0 min CN=88 Runoff=9.83 cfs 39,876 cf

Subcatchment OSW: Off Site West Runoff Area=31,028 sf 0.60% Impervious Runoff Depth>1.90"
Flow Length=178' Tc=7.7 min CN=66 Runoff=1.57 cfs 4,925 cf

Reach TOTAL: TOTAL FLOW TO CHARLES Inflow=87.02 cfs 410,128 cf
Outflow=87.02 cfs 410,128 cf

Pond B1: BASIN 1 Peak Elev=177.83' Storage=8,947 cf Inflow=4.07 cfs 17,087 cf
Discarded=0.33 cfs 11,311 cf Primary=0.00 cfs 0 cf Outflow=0.33 cfs 11,311 cf

Pond B2: BASIN 2 Peak Elev=175.24' Storage=30,089 cf Inflow=20.11 cfs 71,465 cf
Discarded=0.66 cfs 20,371 cf Primary=10.29 cfs 28,087 cf Outflow=10.94 cfs 48,458 cf

Pond B3: BASIN 3 Peak Elev=179.08' Storage=17,420 cf Inflow=9.83 cfs 39,876 cf
Discarded=0.30 cfs 10,046 cf Primary=5.47 cfs 18,820 cf Outflow=5.77 cfs 28,866 cf

Pond MF: 88 CULTEC 330 Peak Elev=2.56' Storage=5,485 cf Inflow=3.44 cfs 10,755 cf
Outflow=0.18 cfs 6,996 cf

Total Runoff Area = 2,220,716 sf Runoff Volume = 507,329 cf Average Runoff Depth = 2.74"
83.50% Pervious = 1,854,352 sf 16.50% Impervious = 366,365 sf

Summary for Subcatchment 1A: Medical Facility

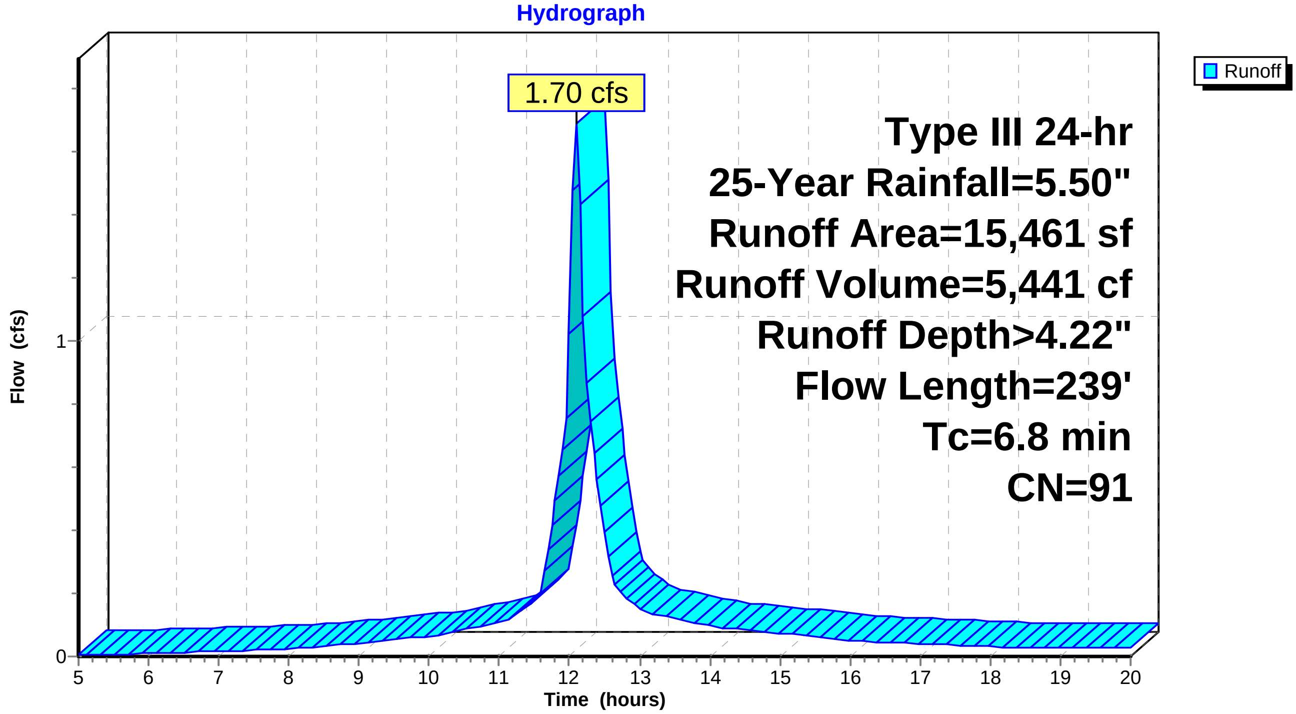
Runoff = 1.70 cfs @ 12.10 hrs, Volume= 5,441 cf, Depth> 4.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
2,907	61	>75% Grass cover, Good, HSG B
12,554	98	Paved roads w/curbs & sewers, HSG B
15,461	91	Weighted Average
2,907		18.80% Pervious Area
12,554		81.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, Sheet A-B** Grass: Short n= 0.150 P2= 3.20"
0.1	14	0.0200	2.28		**Shallow Concentrated Flow, Grass B-C** Unpaved Kv= 16.1 fps
0.5	85	0.0200	2.87		**Shallow Concentrated Flow, Pavement C-D** Paved Kv= 20.3 fps
0.6	90	0.0050	2.45	0.85	**Pipe Channel, Pipe D-E** 8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.013 Corrugated PE, smooth interior
6.8	239	Total			

Subcatchment 1A: Medical Facility



Summary for Subcatchment 1B: Entrance Roadway

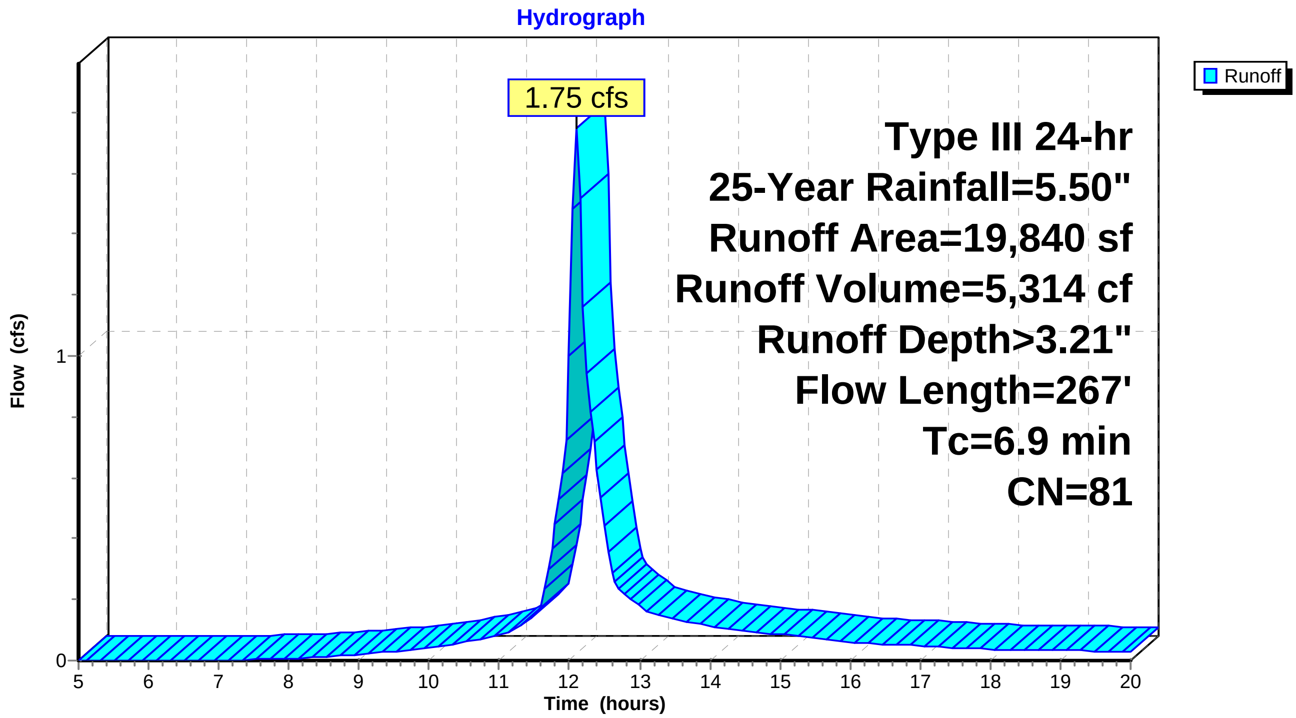
Runoff = 1.75 cfs @ 12.10 hrs, Volume= 5,314 cf, Depth> 3.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (sf)	CN	Description
	9,061	61	>75% Grass cover, Good, HSG B
*	328	82	Pathway, Dirt roads, HSG B
	10,451	98	Paved roads w/curbs & sewers, HSG B
	19,840	81	Weighted Average
	9,389		47.32% Pervious Area
	10,451		52.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, Sheet A-B** Grass: Short n= 0.150 P2= 3.20"
0.1	12	0.0200	2.28		**Shallow Concentrated Flow, Grass B-C** Unpaved Kv= 16.1 fps
0.5	104	0.0300	3.52		**Shallow Concentrated Flow, Street C-D** Paved Kv= 20.3 fps
0.7	101	0.0050	2.45	0.85	**Pipe Channel, Pipe D-E** 8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.013 Corrugated PE, smooth interior
6.9	267	Total			

Subcatchment 1B: Entrance Roadway



Summary for Subcatchment 1C: Intermediate Roadway

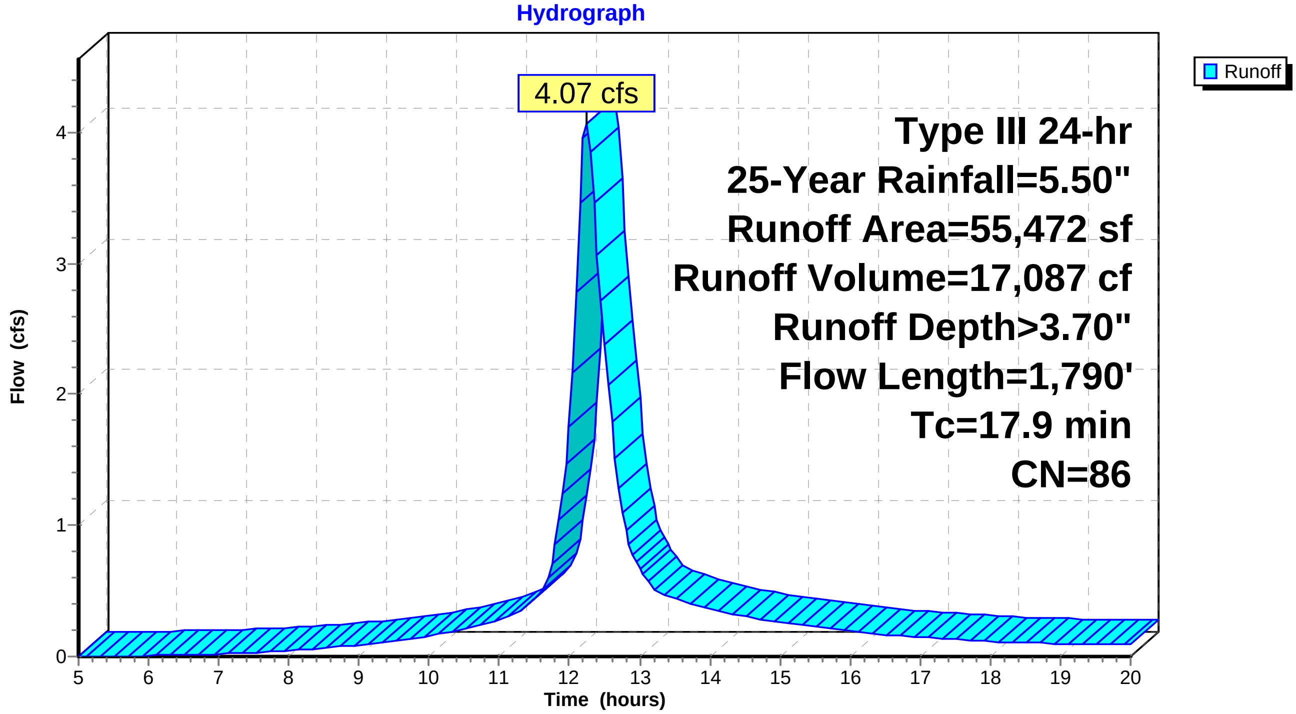
Runoff = 4.07 cfs @ 12.24 hrs, Volume= 17,087 cf, Depth> 3.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
17,093	61	>75% Grass cover, Good, HSG B
1,704	80	>75% Grass cover, Good, HSG D
28,466	98	Paved roads w/curbs & sewers, HSG B
8,209	98	Paved roads w/curbs & sewers, HSG D
55,472	86	Weighted Average
18,797		33.89% Pervious Area
36,675		66.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, Sheet A-B** Grass: Short n= 0.150 P2= 3.20"
0.1	9	0.0200	2.28		**Shallow Concentrated Flow, Grass B-C** Unpaved Kv= 16.1 fps
0.3	47	0.0200	2.87		**Shallow Concentrated Flow, Paved C-D** Paved Kv= 20.3 fps
3.1	593	0.0050	3.21	2.52	**Pipe Channel, Pipe D-E** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.3	153		8.02		**Lake or Reservoir, Basin E-F** Mean Depth= 2.00'
0.5	46	0.0050	1.54	0.13	**Pipe Channel, Pipe F-E** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.013 Corrugated PE, smooth interior
1.4	149	0.0130	1.84		**Shallow Concentrated Flow, Unpaved** Unpaved Kv= 16.1 fps
2.4	333	0.0200	2.28		**Shallow Concentrated Flow, Unpaved** Unpaved Kv= 16.1 fps
4.2	410	0.0100	1.61		**Shallow Concentrated Flow, Unpaved** Unpaved Kv= 16.1 fps
17.9	1,790	Total			

Subcatchment 1C: Intermediate Roadway



Summary for Subcatchment 1D: Main Campus

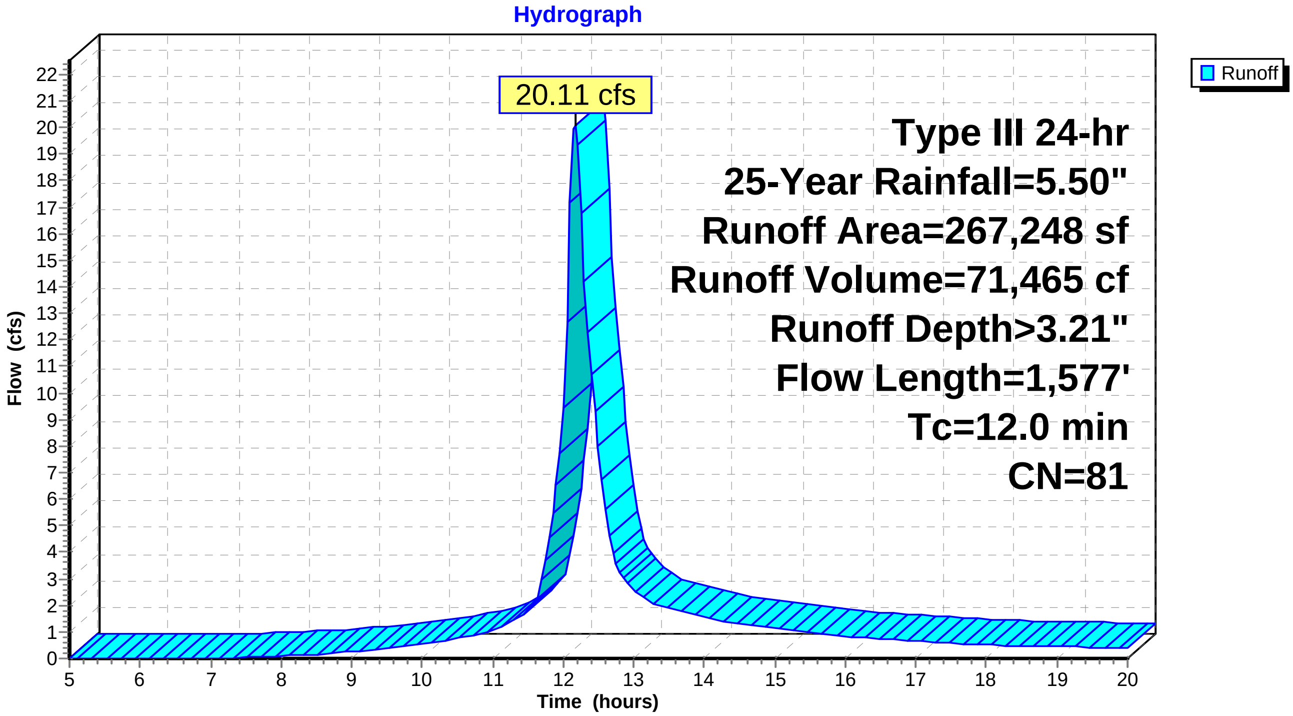
Runoff = 20.11 cfs @ 12.17 hrs, Volume= 71,465 cf, Depth> 3.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
22,404	39	>75% Grass cover, Good, HSG A
82,752	61	>75% Grass cover, Good, HSG B
11,890	80	>75% Grass cover, Good, HSG D
30,503	98	Paved roads w/curbs & sewers, HSG A
96,592	98	Paved roads w/curbs & sewers, HSG B
23,107	98	Paved roads w/curbs & sewers, HSG D
267,248	81	Weighted Average
117,046		43.80% Pervious Area
150,202		56.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	43	0.0200	0.14		**Sheet Flow, Sheet Grass A-B** Grass: Short n= 0.150 P2= 3.20"
0.1	7	0.0200	0.81		**Sheet Flow, Sheet-Pave B-C** Smooth surfaces n= 0.011 P2= 3.20"
1.3	217	0.0200	2.87		**Shallow Concentrated Flow, Paved C-D** Paved Kv= 20.3 fps
1.1	211	0.0050	3.21	2.52	**Pipe Channel, Pipe D-E** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
1.6	397	0.0050	4.20	7.43	**Pipe Channel, Pipe E-F** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
1.6	490	0.0050	5.09	16.00	**Pipe Channel, Pipe F-G** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Corrugated PE, smooth interior
0.0	24		8.97		**Lake or Reservoir, Lake G-H** Mean Depth= 2.50'
0.5	42	0.0050	1.54	0.13	**Pipe Channel, Pipe F-G** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.013 Corrugated PE, smooth interior
0.8	146	0.0400	3.22		**Shallow Concentrated Flow, Unpaved I-J** Unpaved Kv= 16.1 fps
12.0	1,577	Total			

Subcatchment 1D: Main Campus



Summary for Subcatchment 1E: Charles River

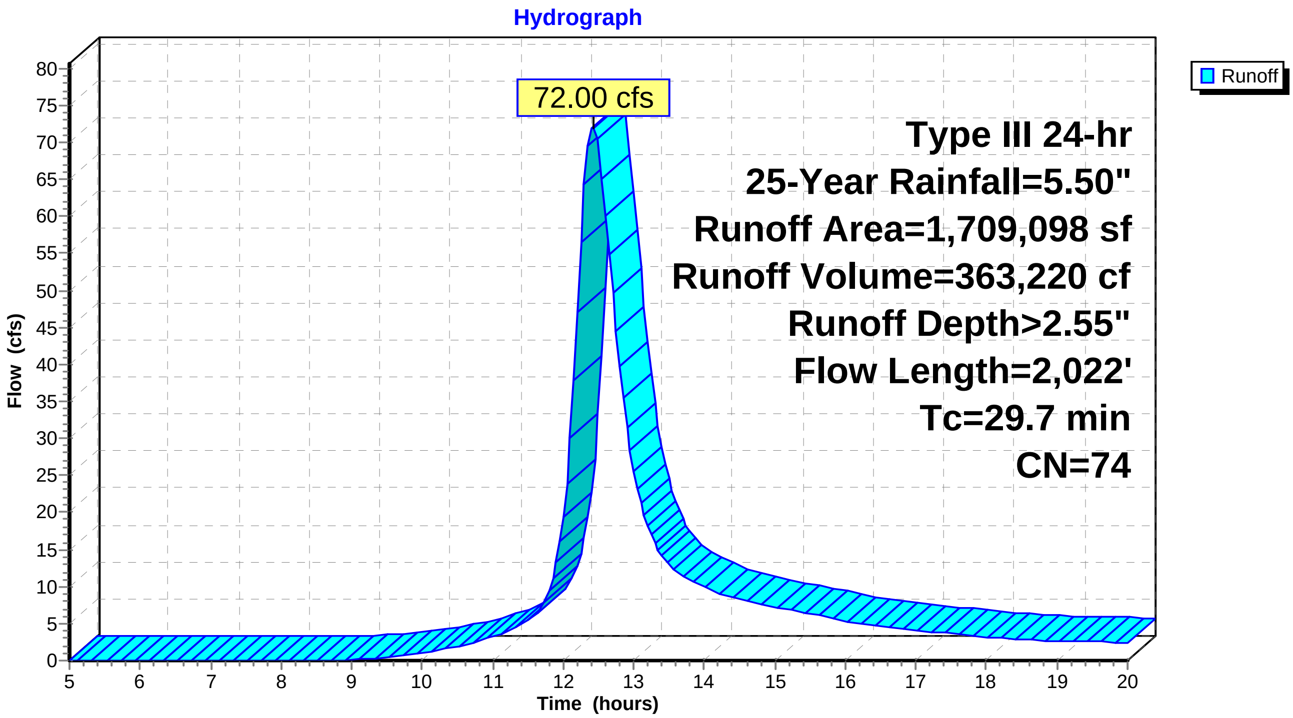
Runoff = 72.00 cfs @ 12.42 hrs, Volume= 363,220 cf, Depth> 2.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (sf)	CN	Description
	10,067	30	Woods, Good, HSG A
	5,689	39	>75% Grass cover, Good, HSG A
*	3,253	78	Wetland, HSG A
*	205	72	Path, HSG A
	203,113	55	Woods, Good, HSG B
	199,852	61	>75% Grass cover, Good, HSG B
*	103,465	78	Wetlands, HSG B
*	9,990	82	Path, HSG B
*	2,704	80	Path in Resource, HSG B
	4,112	98	Water Surface, HSG B
	33,426	70	Woods, Good, HSG C
	758	74	>75% Grass cover, Good, HSG C
*	141,675	78	Wetlands, HSG C
*	3,310	87	Path, HSG C
*	6,129	80	Path in Resource, HSG C
	10,807	98	Water Surface, HSG C
	458,293	77	Woods, Good, HSG D
	65,768	80	>75% Grass cover, Good, HSG D
*	227,701	78	Wetlands, HSG D
*	27,658	89	Path, HSG D
*	9,556	80	Path in Resource, HSG D
	45,917	98	Water Surface, HSG D
	20,004	70	1/2 acre lots, 25% imp, HSG B
	54,729	80	1/2 acre lots, 25% imp, HSG C
	60,917	85	1/2 acre lots, 25% imp, HSG D
	1,709,098	74	Weighted Average
	1,614,350		94.46% Pervious Area
	94,749		5.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0600	0.10		**Sheet Flow, Sheet A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
3.1	329	0.0120	1.76		**Shallow Concentrated Flow, Wetland B-C** Unpaved Kv= 16.1 fps
18.5	1,599	0.0080	1.44		**Shallow Concentrated Flow, Wetland/Stream/Pond C-D** Unpaved Kv= 16.1 fps
0.2	44	0.0900	4.83		**Shallow Concentrated Flow, Pond to River D-E** Unpaved Kv= 16.1 fps
29.7	2,022	Total			

Subcatchment 1E: Charles River



Summary for Subcatchment 1F: Pond Drive

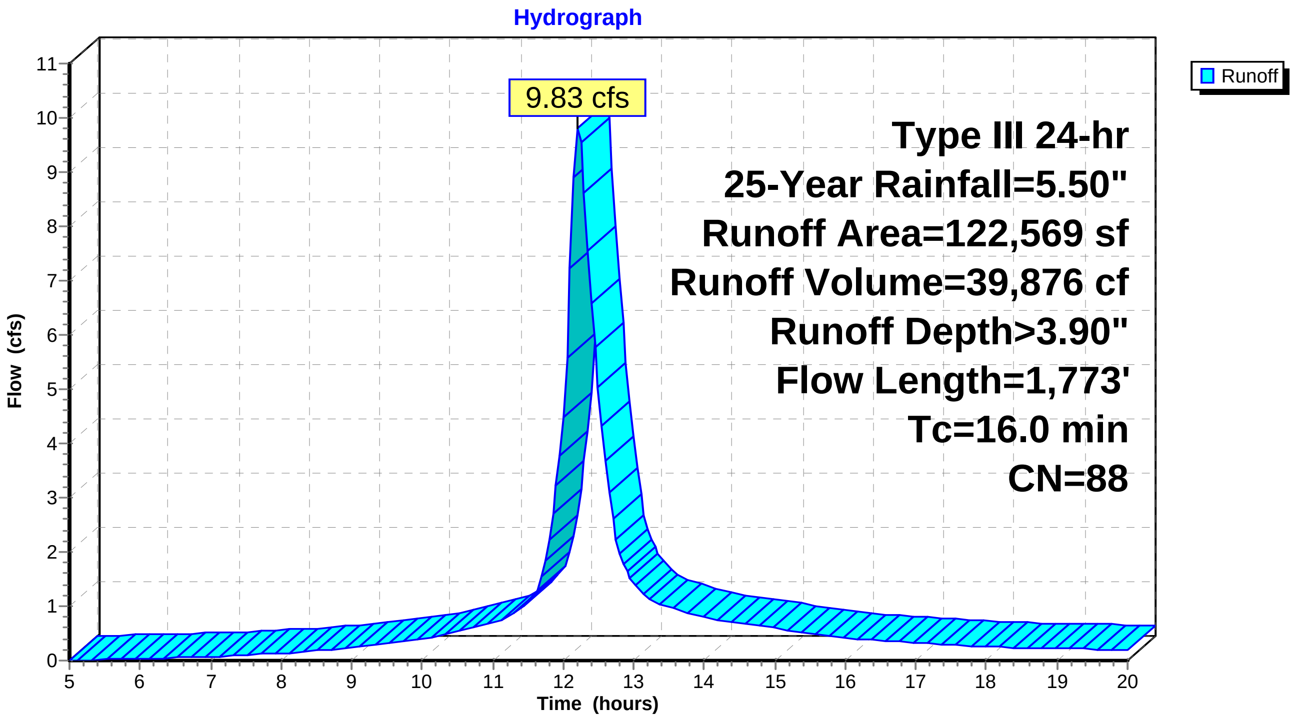
Runoff = 9.83 cfs @ 12.21 hrs, Volume= 39,876 cf, Depth> 3.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (sf)	CN	Description
	1,964	61	>75% Grass cover, Good, HSG B
	5,597	98	Paved roads w/curbs & sewers, HSG B
	25,437	77	Woods, Good, HSG D
	33,576	80	>75% Grass cover, Good, HSG D
*	43	89	Path, HSG D
	55,952	98	Paved roads w/curbs & sewers, HSG D
	122,569	88	Weighted Average
	61,020		49.78% Pervious Area
	61,549		50.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0600	0.10		**Sheet Flow, Sheet A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.3	55	0.0400	3.22		**Shallow Concentrated Flow, Grass B-C** Unpaved Kv= 16.1 fps
0.8	136	0.0200	2.87		**Shallow Concentrated Flow, Paved C-D** Paved Kv= 20.3 fps
4.0	1,006	0.0050	4.20	7.43	**Pipe Channel, Pipe D-E** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
0.6	197	0.0050	5.09	16.00	**Pipe Channel, Pipe E-F** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Corrugated PE, smooth interior
0.2	77		8.02		**Lake or Reservoir, Basin F-G** Mean Depth= 2.00'
0.5	62	0.0050	2.02	0.40	**Pipe Channel, Pipe G-H** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.013 Corrugated PE, smooth interior
0.7	89	0.0200	2.28		**Shallow Concentrated Flow, Unpaved H-I** Unpaved Kv= 16.1 fps
0.8	57	0.0050	1.14		**Shallow Concentrated Flow, Unpaved I-J** Unpaved Kv= 16.1 fps
0.2	44	0.0900	4.83		**Shallow Concentrated Flow, Upaved J-K** Unpaved Kv= 16.1 fps
16.0	1,773	Total			

Subcatchment 1F: Pond Drive



Summary for Subcatchment OSW: Off Site West

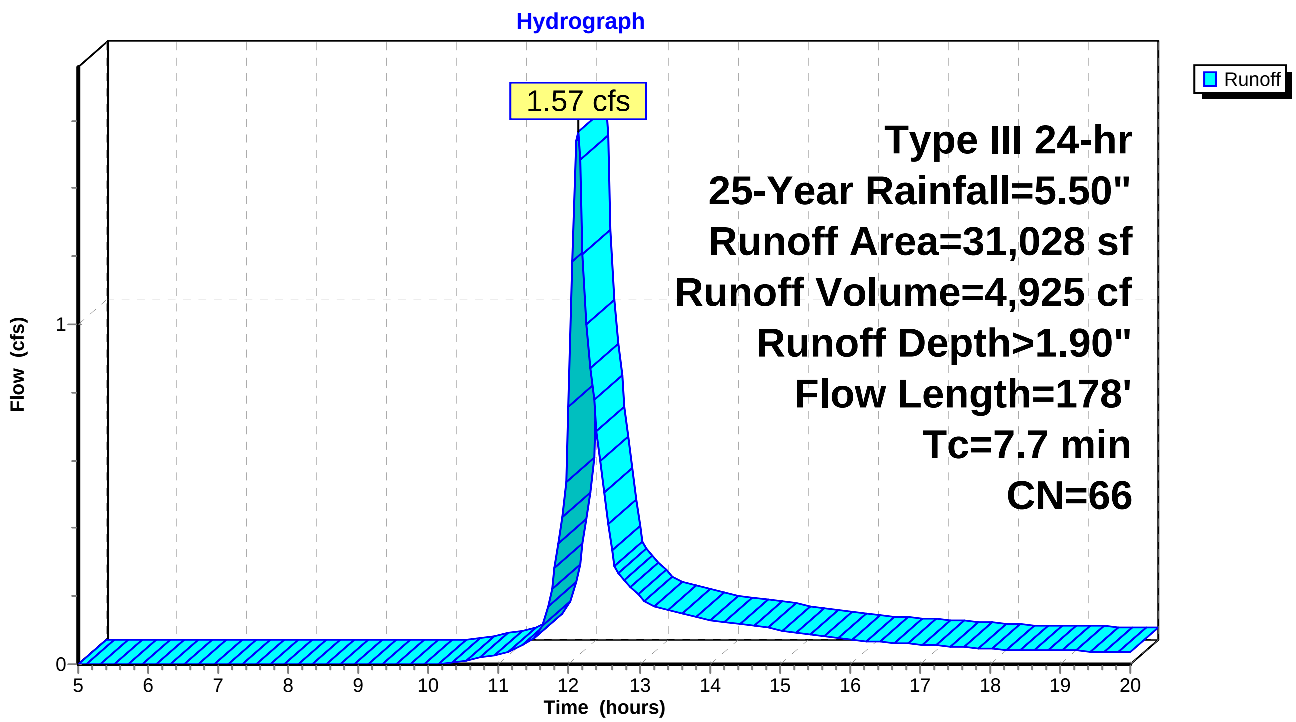
Runoff = 1.57 cfs @ 12.12 hrs, Volume= 4,925 cf, Depth> 1.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (sf)	CN	Description
	2,983	55	Woods, Good, HSG B
	18,754	61	>75% Grass cover, Good, HSG B
*	1,048	80	Path(cover unknown)
	185	98	Unconnected pavement, HSG B
	8,058	80	>75% Grass cover, Good, HSG D
	31,028	66	Weighted Average
	30,843		99.40% Pervious Area
	185		0.60% Impervious Area
	185		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0800	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.6	128	0.0540	3.74		**Shallow Concentrated Flow, Wooded/Path/Wooded B-C** Unpaved Kv= 16.1 fps
7.7	178	Total			

Subcatchment OSW: Off Site West

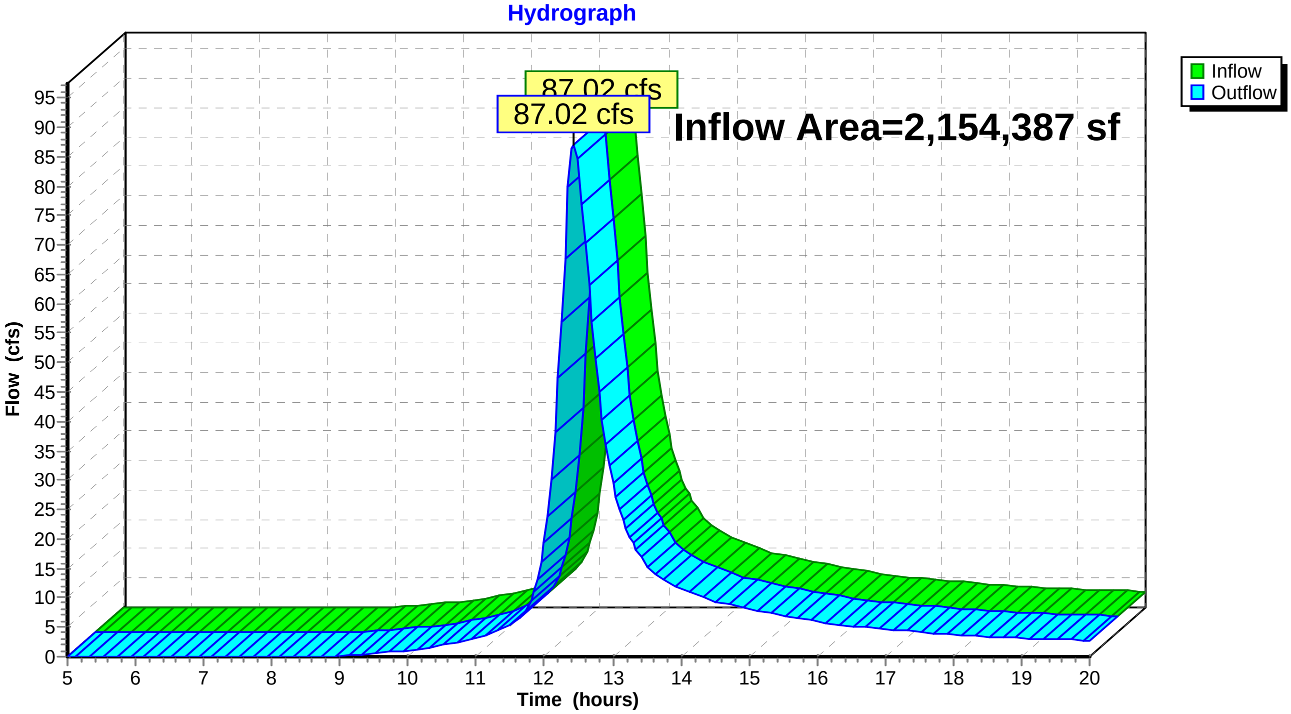


Summary for Reach TOTAL: TOTAL FLOW TO CHARLES

Inflow Area = 2,154,387 sf, 15.93% Impervious, Inflow Depth > 2.28" for 25-Year event
Inflow = 87.02 cfs @ 12.43 hrs, Volume= 410,128 cf
Outflow = 87.02 cfs @ 12.43 hrs, Volume= 410,128 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach TOTAL: TOTAL FLOW TO CHARLES



Summary for Pond B1: BASIN 1

Inflow Area = 55,472 sf, 66.11% Impervious, Inflow Depth > 3.70" for 25-Year event
Inflow = 4.07 cfs @ 12.24 hrs, Volume= 17,087 cf
Outflow = 0.33 cfs @ 14.21 hrs, Volume= 11,311 cf, Atten= 92%, Lag= 118.0 min
Discarded = 0.33 cfs @ 14.21 hrs, Volume= 11,311 cf
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 177.83' @ 14.21 hrs Surf.Area= 5,924 sf Storage= 8,947 cf

Plug-Flow detention time= 183.7 min calculated for 11,311 cf (66% of inflow)
Center-of-Mass det. time= 114.8 min (893.8 - 779.0)

Volume	Invert	Avail.Storage	Storage Description
#1	176.00'	34,190 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

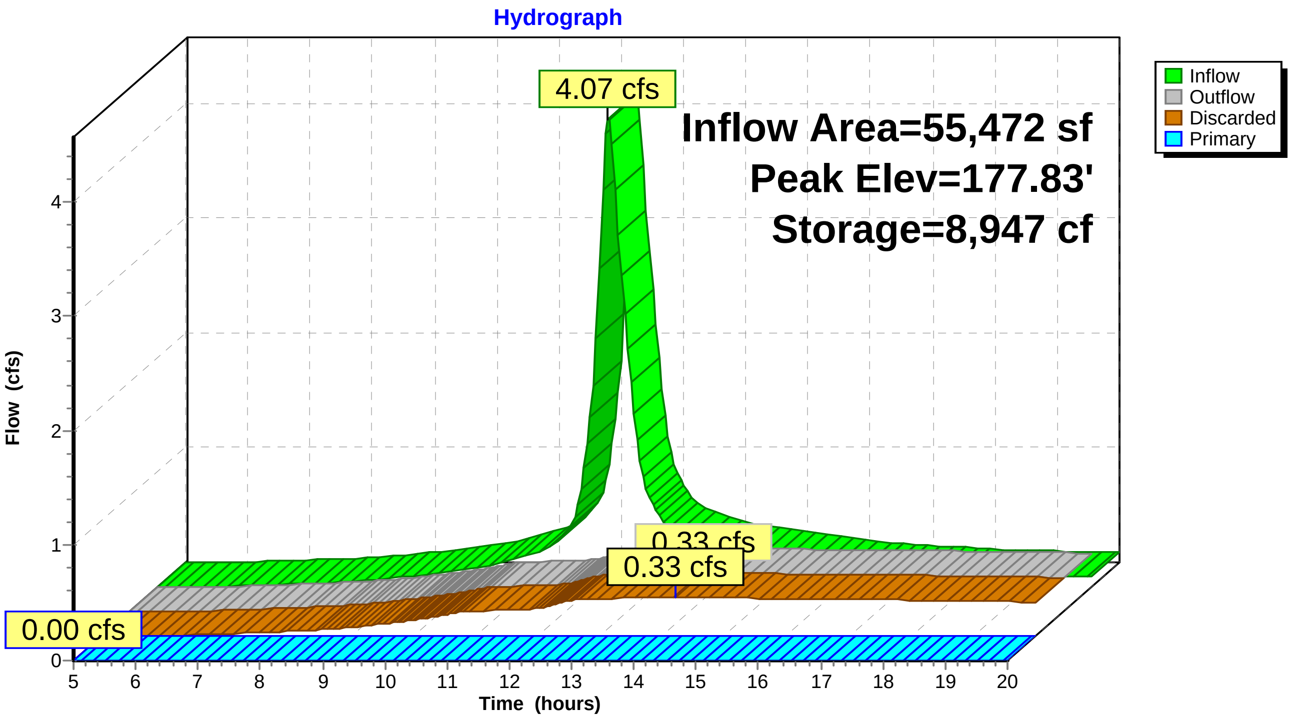
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
176.00	3,879	0	0
177.00	4,971	4,425	4,425
178.00	6,119	5,545	9,970
179.00	7,324	6,722	16,692
180.00	8,586	7,955	24,647
181.00	10,500	9,543	34,190

Device	Routing	Invert	Outlet Devices
#1	Primary	177.00'	**4.0" Round Culvert** L= 25.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 177.00' / 176.50' S= 0.0200 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.09 sf
#2	Device 1	179.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	179.25'	**1.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	179.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Primary	179.90'	**20.0' 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
#6	Discarded	176.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.33 cfs @ 14.21 hrs HW=177.83' (Free Discharge)
└─**6=Exfiltration** (Exfiltration Controls 0.33 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=176.00' (Free Discharge)
├─**1=Culvert** (Controls 0.00 cfs)
│ ├─**2=Orifice/Grate** (Controls 0.00 cfs)
│ ├─**3=Orifice/Grate** (Controls 0.00 cfs)
│ └─**4=Orifice/Grate** (Controls 0.00 cfs)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond B1: BASIN 1



Summary for Pond B2: BASIN 2

Inflow Area = 267,248 sf, 56.20% Impervious, Inflow Depth > 3.21" for 25-Year event
Inflow = 20.11 cfs @ 12.17 hrs, Volume= 71,465 cf
Outflow = 10.94 cfs @ 12.41 hrs, Volume= 48,458 cf, Atten= 46%, Lag= 14.8 min
Discarded = 0.66 cfs @ 12.41 hrs, Volume= 20,371 cf
Primary = 10.29 cfs @ 12.41 hrs, Volume= 28,087 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 175.24' @ 12.41 hrs Surf.Area= 11,793 sf Storage= 30,089 cf

Plug-Flow detention time= 143.7 min calculated for 48,458 cf (68% of inflow)
Center-of-Mass det. time= 75.5 min (861.8 - 786.3)

Volume	Invert	Avail.Storage	Storage Description
#1	170.00'	25,498 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2A	166.00'	4,027 cf	**35.33'W x 136.50'L x 3.54'H Field A** 17,081 cf Overall - 7,015 cf Embedded = 10,066 cf x 40.0% Voids
#3A	166.50'	7,015 cf	**Cultec R-330XL** x 133 Inside #2 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 7 rows
		36,539 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
170.00	1,209	0	0
171.00	2,057	1,633	1,633
172.00	2,961	2,509	4,142
173.00	3,922	3,442	7,584
174.00	4,939	4,431	12,014
175.00	6,014	5,477	17,491
176.00	10,000	8,007	25,498

Device	Routing	Invert	Outlet Devices
#1	Primary	173.50'	**4.0" Round Culvert** L= 25.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 172.00' / 173.50' S= -0.0600 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.09 sf
#2	Device 1	174.00'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	173.50'	**3.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	174.50'	**24.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Primary	174.90'	**20.0' 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
#6	Discarded	166.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.66 cfs @ 12.41 hrs HW=175.23' (Free Discharge)
└─**6=Exfiltration** (Exfiltration Controls 0.66 cfs)

Primary OutFlow Max=9.95 cfs @ 12.41 hrs HW=175.23' (Free Discharge)
├─**1=Culvert** (Inlet Controls 0.46 cfs @ 5.32 fps)
│ ├─**2=Orifice/Grate** (Passes < 0.25 cfs potential flow)
│ ├─**3=Orifice/Grate** (Passes < 0.30 cfs potential flow)
│ └─**4=Orifice/Grate** (Passes < 24.72 cfs potential flow)
└─**5=Broad-Crested Rectangular Weir** (Weir Controls 9.49 cfs @ 1.42 fps)

Pond B2: BASIN 2 - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 7 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

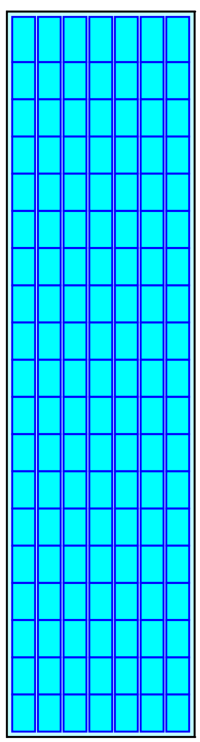
19 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 134.50' Row Length +12.0" End Stone x 2 = 136.50' Base Length
7 Rows x 52.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 35.33' Base Width
6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

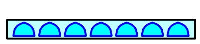
133 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 7 Rows = 7,015.1 cf Chamber Storage

17,081.5 cf Field - 7,015.1 cf Chambers = 10,066.3 cf Stone x 40.0% Voids = 4,026.5 cf Stone Storage

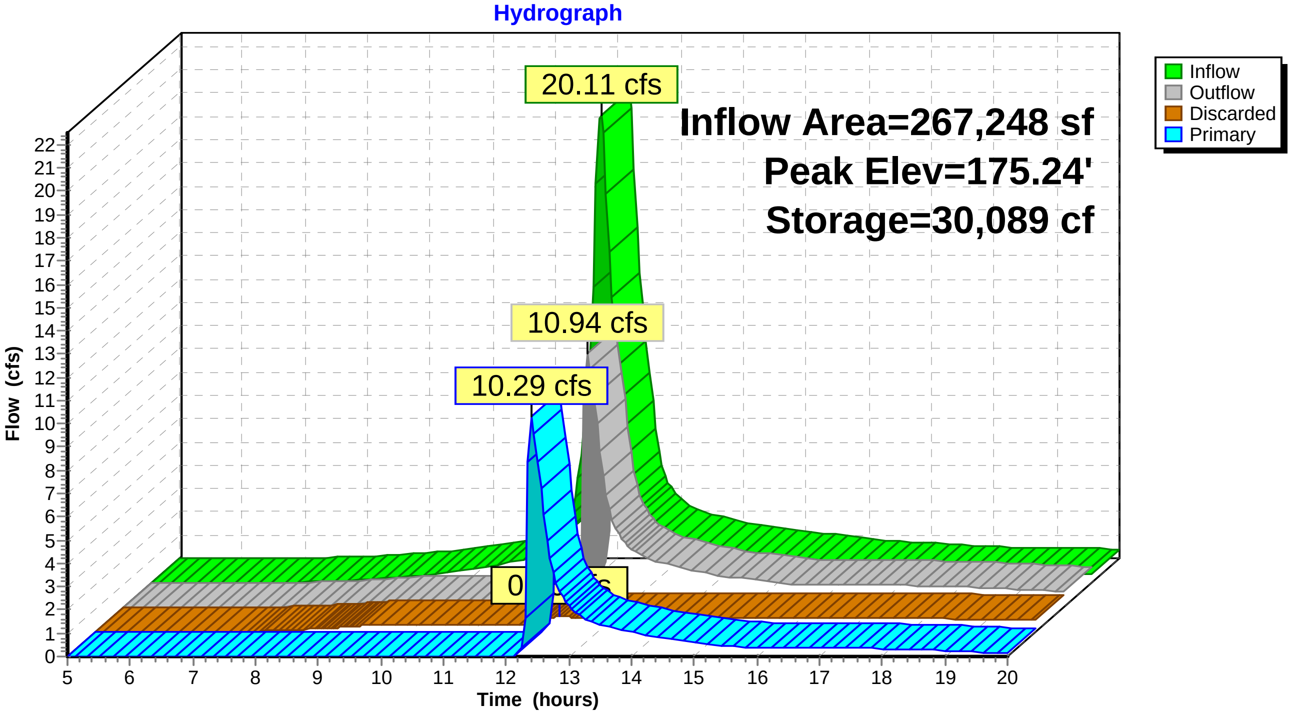
Chamber Storage + Stone Storage = 11,041.7 cf = 0.253 af
Overall Storage Efficiency = 64.6%

133 Chambers
632.6 cy Field
372.8 cy Stone





Pond B2: BASIN 2



Summary for Pond B3: BASIN 3

Inflow Area = 122,569 sf, 50.22% Impervious, Inflow Depth > 3.90" for 25-Year event
Inflow = 9.83 cfs @ 12.21 hrs, Volume= 39,876 cf
Outflow = 5.77 cfs @ 12.47 hrs, Volume= 28,866 cf, Atten= 41%, Lag= 15.1 min
Discarded = 0.30 cfs @ 12.47 hrs, Volume= 10,046 cf
Primary = 5.47 cfs @ 12.47 hrs, Volume= 18,820 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 179.08' @ 12.47 hrs Surf.Area= 5,436 sf Storage= 17,420 cf

Plug-Flow detention time= 142.8 min calculated for 28,770 cf (72% of inflow)
Center-of-Mass det. time= 80.8 min (852.7 - 771.9)

Volume	Invert	Avail.Storage	Storage Description
#1	174.00'	22,625 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

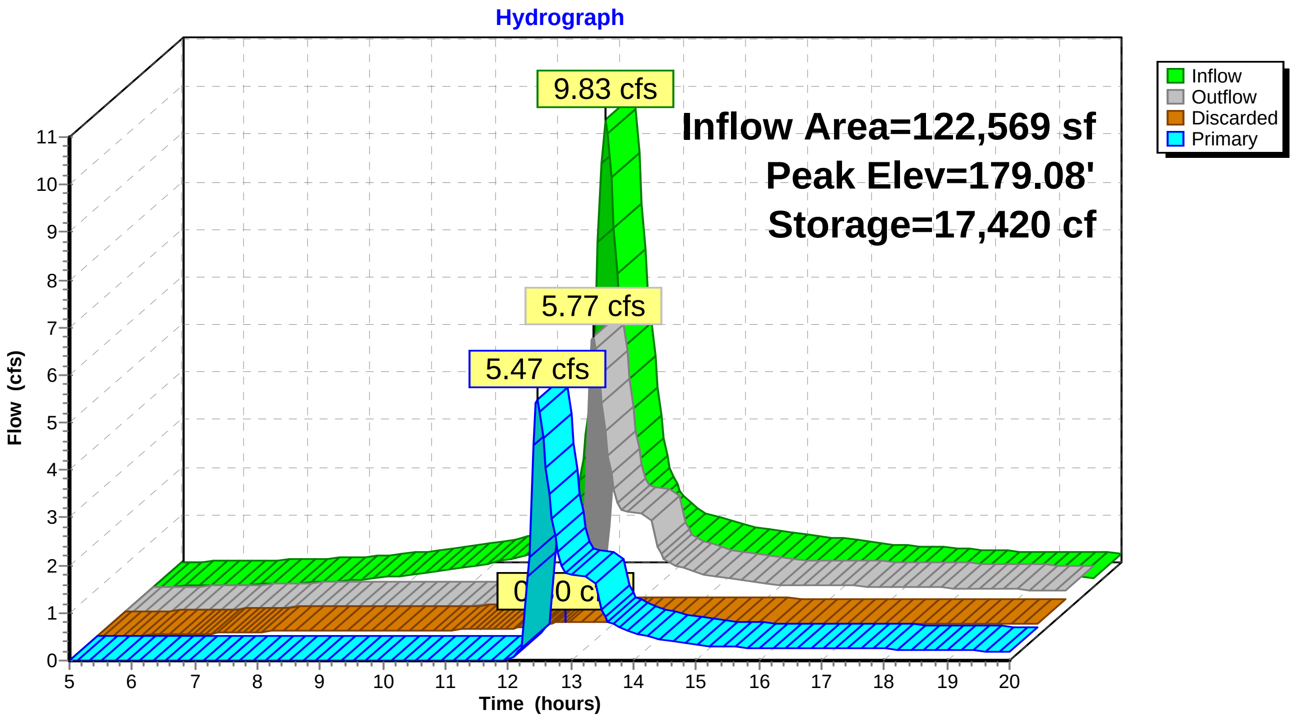
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
174.00	1,623	0	0
175.00	2,265	1,944	1,944
176.00	2,963	2,614	4,558
177.00	3,717	3,340	7,898
178.00	4,528	4,123	12,021
179.00	5,396	4,962	16,983
180.00	5,888	5,642	22,625

Device	Routing	Invert	Outlet Devices
#1	Primary	174.00'	**6.0" Round Culvert** L= 24.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 174.00' / 173.50' S= 0.0208 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf
#2	Device 1	177.00'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	178.50'	**24.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	178.90'	**20.0' 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
#5	Discarded	174.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.30 cfs @ 12.47 hrs HW=179.08' (Free Discharge)
└─**5=Exfiltration** (Exfiltration Controls 0.30 cfs)

Primary OutFlow Max=5.31 cfs @ 12.47 hrs HW=179.08' (Free Discharge)
├─**1=Culvert** (Inlet Controls 1.83 cfs @ 9.33 fps)
│ ├─**2=Orifice/Grate** (Passes < 0.33 cfs potential flow)
│ └─**3=Orifice/Grate** (Passes < 17.19 cfs potential flow)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 3.48 cfs @ 0.98 fps)

Pond B3: BASIN 3



Summary for Pond MF: 88 CULTEC 330

Inflow Area = 35,301 sf, 65.17% Impervious, Inflow Depth > 3.66" for 25-Year event
Inflow = 3.44 cfs @ 12.10 hrs, Volume= 10,755 cf
Outflow = 0.18 cfs @ 11.00 hrs, Volume= 6,996 cf, Atten= 95%, Lag= 0.0 min
Discarded = 0.18 cfs @ 11.00 hrs, Volume= 6,996 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 2.56' @ 14.51 hrs Surf.Area= 3,253 sf Storage= 5,485 cf

Plug-Flow detention time= 175.9 min calculated for 6,973 cf (65% of inflow)
Center-of-Mass det. time= 105.1 min (874.1 - 769.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	3,373 cf	**54.67'W x 59.50'L x 4.04'H Field A** 13,146 cf Overall - 4,713 cf Embedded = 8,433 cf x 40.0% Voids
#2A	1.00'	4,713 cf	**Cultec R-330XL** x 88 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 11 rows
		8,086 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.18 cfs @ 11.00 hrs HW=0.04' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.18 cfs)

Pond MF: 88 CULTEC 330 - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 11 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

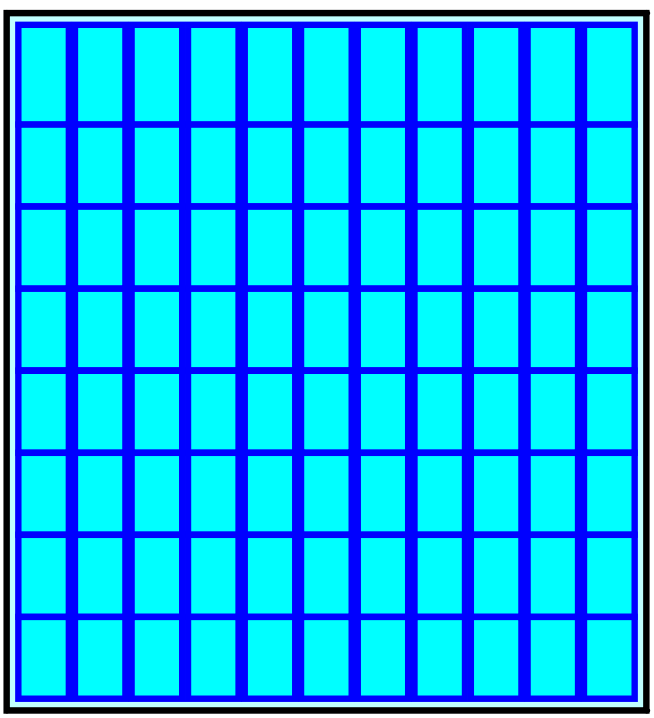
8 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 57.50' Row Length +12.0" End Stone x 2 = 59.50' Base Length
11 Rows x 52.0" Wide + 6.0" Spacing x 10 + 12.0" Side Stone x 2 = 54.67' Base Width
12.0" Base + 30.5" Chamber Height + 6.0" Cover = 4.04' Field Height

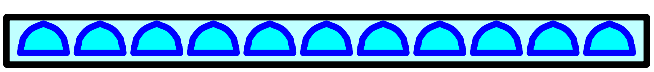
88 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 11 Rows = 4,712.8 cf Chamber Storage

13,146.2 cf Field - 4,712.8 cf Chambers = 8,433.4 cf Stone x 40.0% Voids = 3,373.4 cf Stone Storage

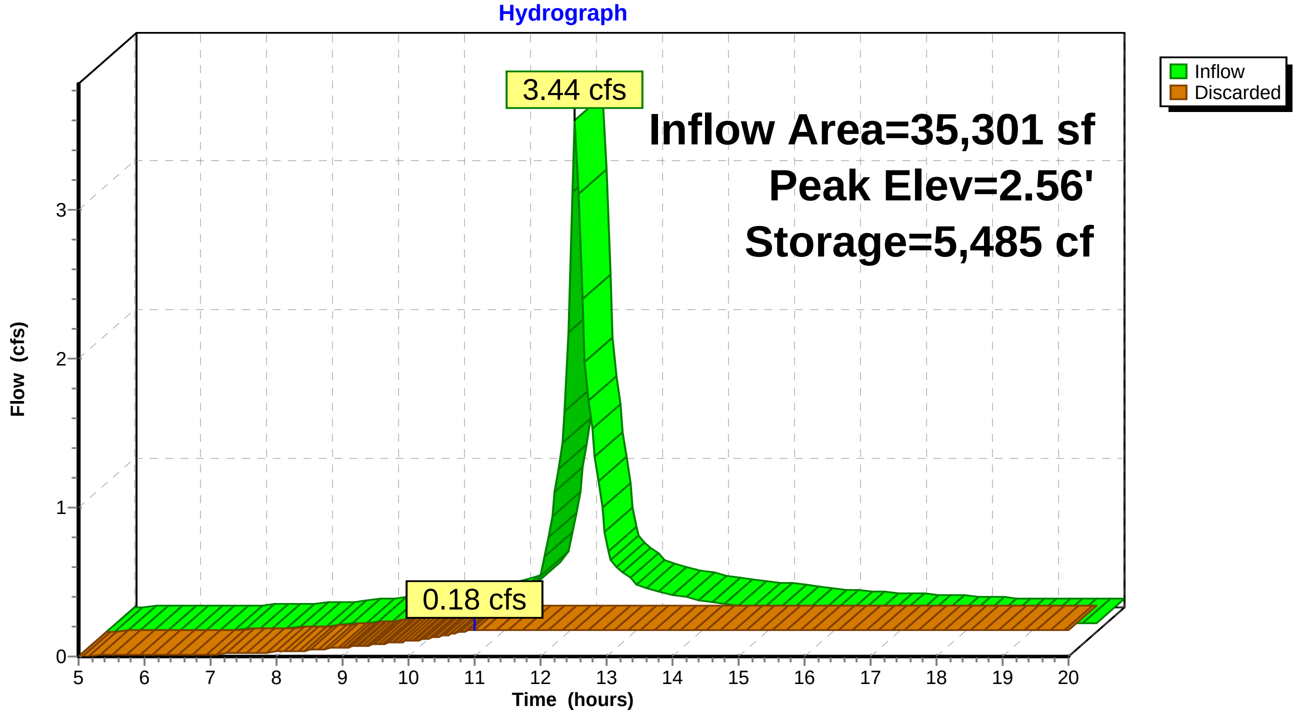
Chamber Storage + Stone Storage = 8,086.1 cf = 0.186 af
Overall Storage Efficiency = 61.5%

88 Chambers
486.9 cy Field
312.3 cy Stone





Pond MF: 88 CULTEC 330



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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 1A: Medical Facility Runoff Area=15,461 sf 81.20% Impervious Runoff Depth>5.33"
Flow Length=239' Tc=6.8 min CN=91 Runoff=2.11 cfs 6,866 cf

Subcatchment 1B: Entrance Roadway Runoff Area=19,840 sf 52.68% Impervious Runoff Depth>4.25"
Flow Length=267' Tc=6.9 min CN=81 Runoff=2.29 cfs 7,034 cf

Subcatchment 1C: Intermediate Roadway Runoff Area=55,472 sf 66.11% Impervious Runoff Depth>4.78"
Flow Length=1,790' Tc=17.9 min CN=86 Runoff=5.20 cfs 22,097 cf

Subcatchment 1D: Main Campus Runoff Area=267,248 sf 56.20% Impervious Runoff Depth>4.25"
Flow Length=1,577' Tc=12.0 min CN=81 Runoff=26.36 cfs 94,604 cf

Subcatchment 1E: Charles River Runoff Area=1,709,098 sf 5.54% Impervious Runoff Depth>3.50"
Flow Length=2,022' Tc=29.7 min CN=74 Runoff=98.64 cfs 498,615 cf

Subcatchment 1F: Pond Drive Runoff Area=122,569 sf 50.22% Impervious Runoff Depth>5.00"
Flow Length=1,773' Tc=16.0 min CN=88 Runoff=12.42 cfs 51,067 cf

Subcatchment OSW: Off Site West Runoff Area=31,028 sf 0.60% Impervious Runoff Depth>2.74"
Flow Length=178' Tc=7.7 min CN=66 Runoff=2.29 cfs 7,093 cf

Reach TOTAL: TOTAL FLOW TO CHARLES Inflow=122.95 cfs 575,908 cf
Outflow=122.95 cfs 575,908 cf

Pond B1: BASIN 1 Peak Elev=178.37' Storage=12,295 cf Inflow=5.20 cfs 22,097 cf
Discarded=0.37 cfs 12,946 cf Primary=0.00 cfs 0 cf Outflow=0.37 cfs 12,946 cf

Pond B2: BASIN 2 Peak Elev=175.45' Storage=31,627 cf Inflow=26.36 cfs 94,604 cf
Discarded=0.70 cfs 21,592 cf Primary=22.08 cfs 48,731 cf Outflow=22.78 cfs 70,323 cf

Pond B3: BASIN 3 Peak Elev=179.22' Storage=18,186 cf Inflow=12.42 cfs 51,067 cf
Discarded=0.31 cfs 10,685 cf Primary=10.71 cfs 28,562 cf Outflow=11.02 cfs 39,247 cf

Pond MF: 88 CULTEC 330 Peak Elev=3.82' Storage=7,793 cf Inflow=4.40 cfs 13,900 cf
Outflow=0.18 cfs 7,436 cf

Total Runoff Area = 2,220,716 sf Runoff Volume = 687,376 cf Average Runoff Depth = 3.71"
83.50% Pervious = 1,854,352 sf 16.50% Impervious = 366,365 sf

Summary for Subcatchment 1A: Medical Facility

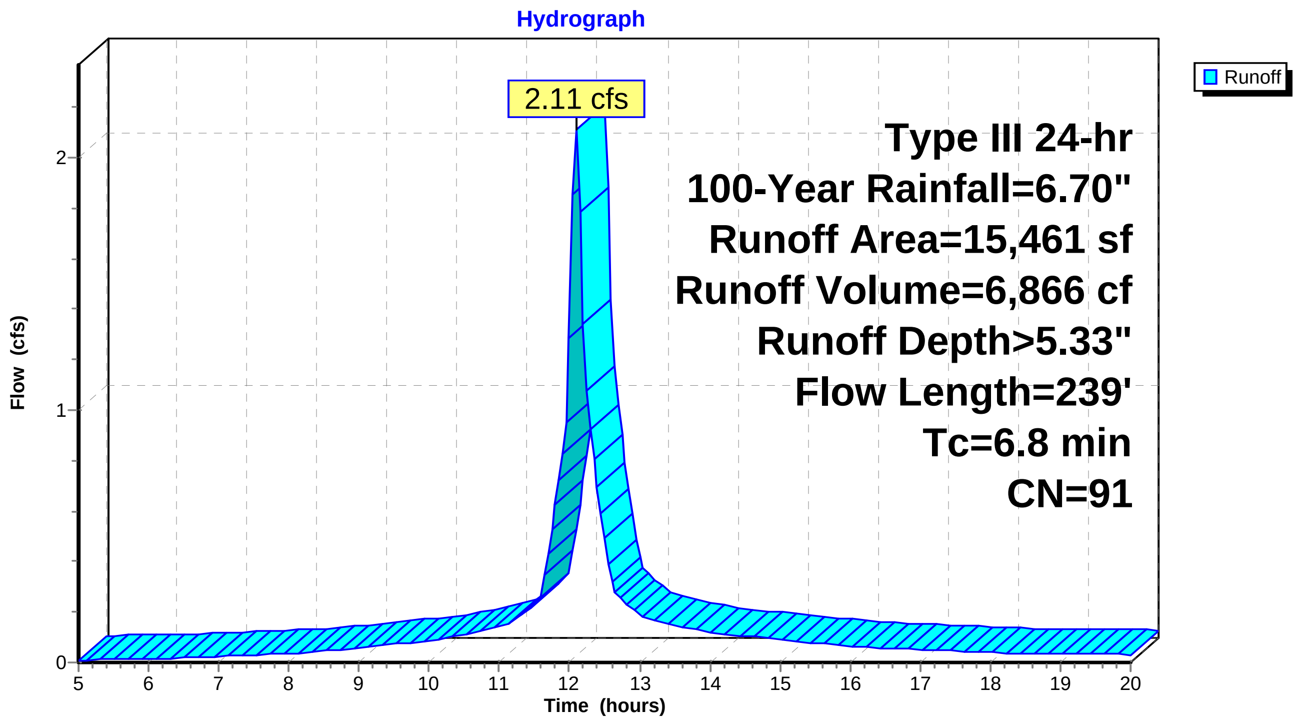
Runoff = 2.11 cfs @ 12.10 hrs, Volume= 6,866 cf, Depth> 5.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
2,907	61	>75% Grass cover, Good, HSG B
12,554	98	Paved roads w/curbs & sewers, HSG B
15,461	91	Weighted Average
2,907		18.80% Pervious Area
12,554		81.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, Sheet A-B** Grass: Short n= 0.150 P2= 3.20"
0.1	14	0.0200	2.28		**Shallow Concentrated Flow, Grass B-C** Unpaved Kv= 16.1 fps
0.5	85	0.0200	2.87		**Shallow Concentrated Flow, Pavement C-D** Paved Kv= 20.3 fps
0.6	90	0.0050	2.45	0.85	**Pipe Channel, Pipe D-E** 8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.013 Corrugated PE, smooth interior
6.8	239	Total			

Subcatchment 1A: Medical Facility



Summary for Subcatchment 1B: Entrance Roadway

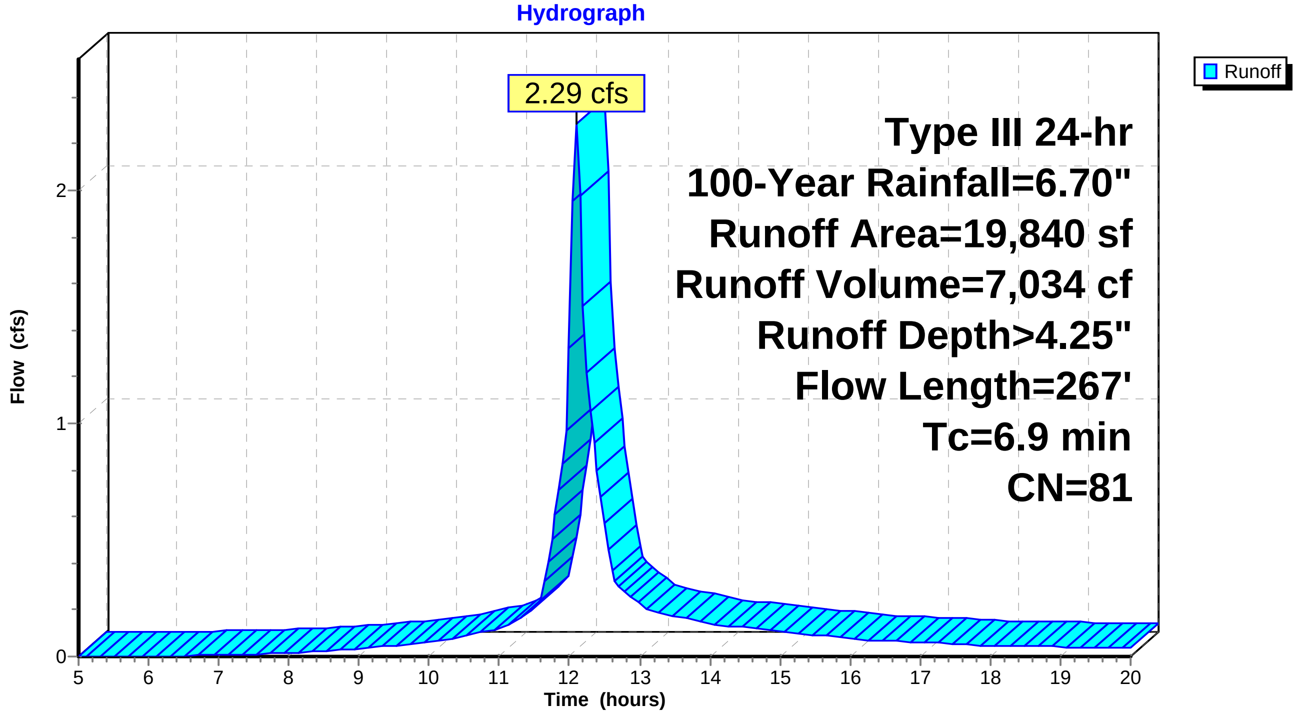
Runoff = 2.29 cfs @ 12.10 hrs, Volume= 7,034 cf, Depth> 4.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

	Area (sf)	CN	Description
	9,061	61	>75% Grass cover, Good, HSG B
*	328	82	Pathway, Dirt roads, HSG B
	10,451	98	Paved roads w/curbs & sewers, HSG B
	19,840	81	Weighted Average
	9,389		47.32% Pervious Area
	10,451		52.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, Sheet A-B** Grass: Short n= 0.150 P2= 3.20"
0.1	12	0.0200	2.28		**Shallow Concentrated Flow, Grass B-C** Unpaved Kv= 16.1 fps
0.5	104	0.0300	3.52		**Shallow Concentrated Flow, Street C-D** Paved Kv= 20.3 fps
0.7	101	0.0050	2.45	0.85	**Pipe Channel, Pipe D-E** 8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.013 Corrugated PE, smooth interior
6.9	267	Total			

Subcatchment 1B: Entrance Roadway



Summary for Subcatchment 1C: Intermediate Roadway

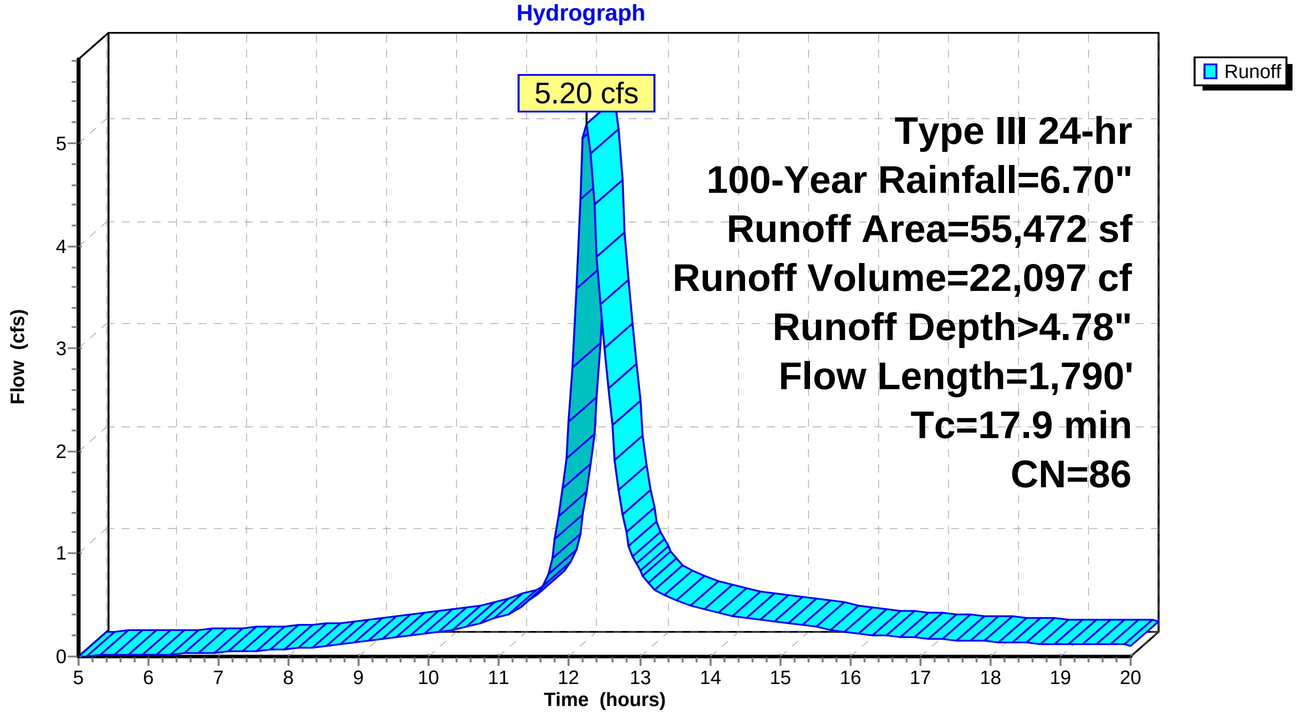
Runoff = 5.20 cfs @ 12.24 hrs, Volume= 22,097 cf, Depth> 4.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
17,093	61	>75% Grass cover, Good, HSG B
1,704	80	>75% Grass cover, Good, HSG D
28,466	98	Paved roads w/curbs & sewers, HSG B
8,209	98	Paved roads w/curbs & sewers, HSG D
55,472	86	Weighted Average
18,797		33.89% Pervious Area
36,675		66.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, Sheet A-B** Grass: Short n= 0.150 P2= 3.20"
0.1	9	0.0200	2.28		**Shallow Concentrated Flow, Grass B-C** Unpaved Kv= 16.1 fps
0.3	47	0.0200	2.87		**Shallow Concentrated Flow, Paved C-D** Paved Kv= 20.3 fps
3.1	593	0.0050	3.21	2.52	**Pipe Channel, Pipe D-E** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.3	153		8.02		**Lake or Reservoir, Basin E-F** Mean Depth= 2.00'
0.5	46	0.0050	1.54	0.13	**Pipe Channel, Pipe F-E** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.013 Corrugated PE, smooth interior
1.4	149	0.0130	1.84		**Shallow Concentrated Flow, Unpaved** Unpaved Kv= 16.1 fps
2.4	333	0.0200	2.28		**Shallow Concentrated Flow, Unpaved** Unpaved Kv= 16.1 fps
4.2	410	0.0100	1.61		**Shallow Concentrated Flow, Unpaved** Unpaved Kv= 16.1 fps
17.9	1,790	Total			

Subcatchment 1C: Intermediate Roadway



Summary for Subcatchment 1D: Main Campus

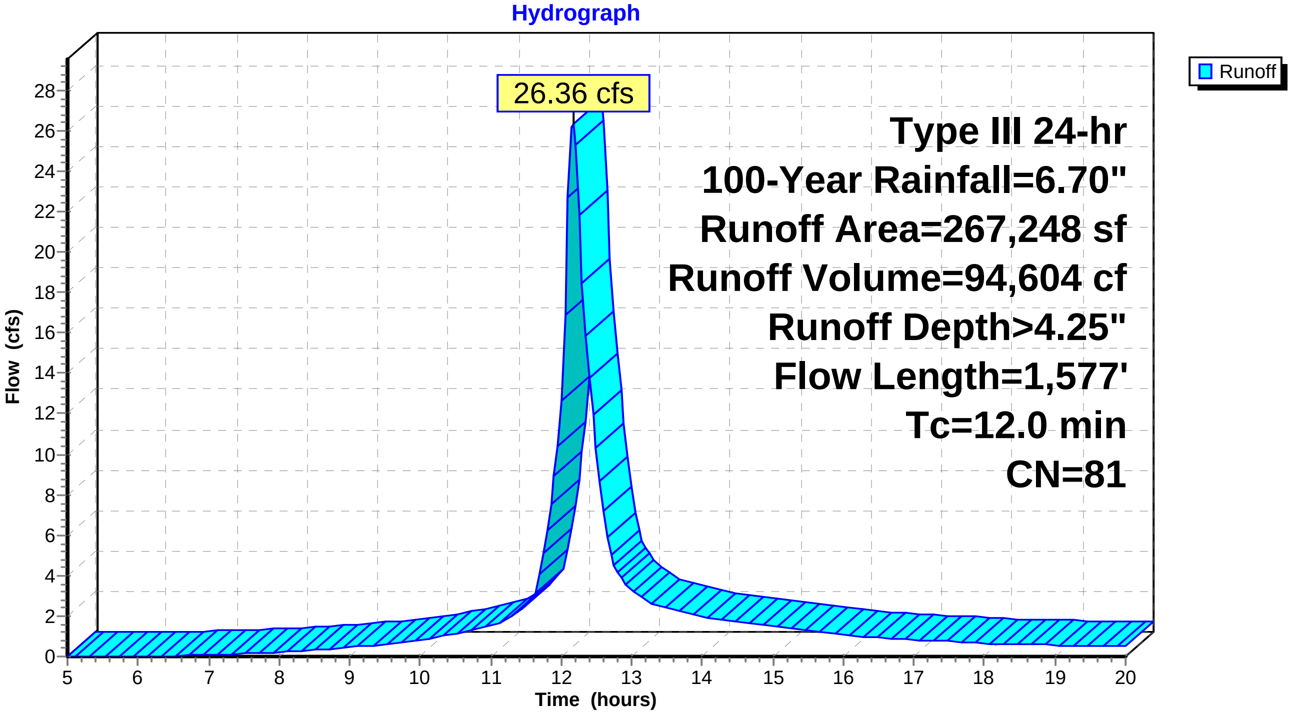
Runoff = 26.36 cfs @ 12.16 hrs, Volume= 94,604 cf, Depth> 4.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
22,404	39	>75% Grass cover, Good, HSG A
82,752	61	>75% Grass cover, Good, HSG B
11,890	80	>75% Grass cover, Good, HSG D
30,503	98	Paved roads w/curbs & sewers, HSG A
96,592	98	Paved roads w/curbs & sewers, HSG B
23,107	98	Paved roads w/curbs & sewers, HSG D
267,248	81	Weighted Average
117,046		43.80% Pervious Area
150,202		56.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	43	0.0200	0.14		**Sheet Flow, Sheet Grass A-B** Grass: Short n= 0.150 P2= 3.20"
0.1	7	0.0200	0.81		**Sheet Flow, Sheet-Pave B-C** Smooth surfaces n= 0.011 P2= 3.20"
1.3	217	0.0200	2.87		**Shallow Concentrated Flow, Paved C-D** Paved Kv= 20.3 fps
1.1	211	0.0050	3.21	2.52	**Pipe Channel, Pipe D-E** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
1.6	397	0.0050	4.20	7.43	**Pipe Channel, Pipe E-F** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
1.6	490	0.0050	5.09	16.00	**Pipe Channel, Pipe F-G** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Corrugated PE, smooth interior
0.0	24		8.97		**Lake or Reservoir, Lake G-H** Mean Depth= 2.50'
0.5	42	0.0050	1.54	0.13	**Pipe Channel, Pipe F-G** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.013 Corrugated PE, smooth interior
0.8	146	0.0400	3.22		**Shallow Concentrated Flow, Unpaved I-J** Unpaved Kv= 16.1 fps
12.0	1,577	Total			

Subcatchment 1D: Main Campus



Summary for Subcatchment 1E: Charles River

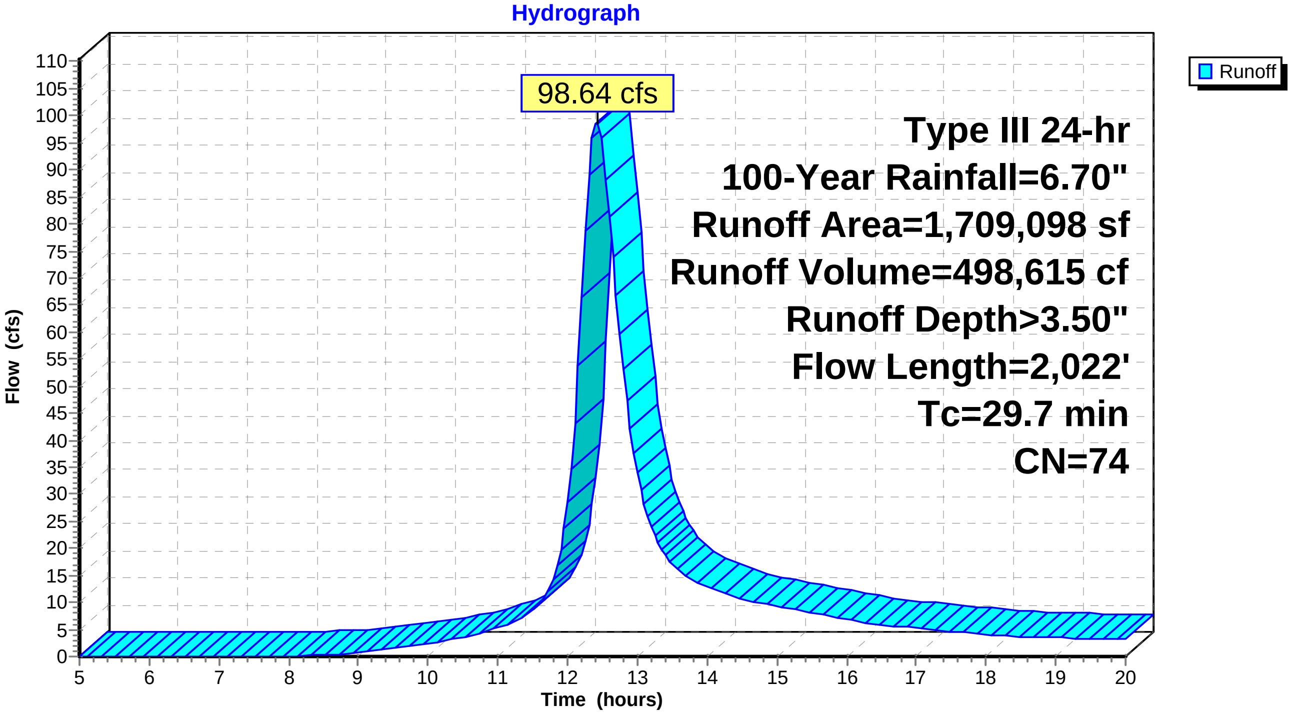
Runoff = 98.64 cfs @ 12.41 hrs, Volume= 498,615 cf, Depth> 3.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

	Area (sf)	CN	Description
	10,067	30	Woods, Good, HSG A
	5,689	39	>75% Grass cover, Good, HSG A
*	3,253	78	Wetland, HSG A
*	205	72	Path, HSG A
	203,113	55	Woods, Good, HSG B
	199,852	61	>75% Grass cover, Good, HSG B
*	103,465	78	Wetlands, HSG B
*	9,990	82	Path, HSG B
*	2,704	80	Path in Resource, HSG B
	4,112	98	Water Surface, HSG B
	33,426	70	Woods, Good, HSG C
	758	74	>75% Grass cover, Good, HSG C
*	141,675	78	Wetlands, HSG C
*	3,310	87	Path, HSG C
*	6,129	80	Path in Resource, HSG C
	10,807	98	Water Surface, HSG C
	458,293	77	Woods, Good, HSG D
	65,768	80	>75% Grass cover, Good, HSG D
*	227,701	78	Wetlands, HSG D
*	27,658	89	Path, HSG D
*	9,556	80	Path in Resource, HSG D
	45,917	98	Water Surface, HSG D
	20,004	70	1/2 acre lots, 25% imp, HSG B
	54,729	80	1/2 acre lots, 25% imp, HSG C
	60,917	85	1/2 acre lots, 25% imp, HSG D
	1,709,098	74	Weighted Average
	1,614,350		94.46% Pervious Area
	94,749		5.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0600	0.10		**Sheet Flow, Sheet A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
3.1	329	0.0120	1.76		**Shallow Concentrated Flow, Wetland B-C** Unpaved Kv= 16.1 fps
18.5	1,599	0.0080	1.44		**Shallow Concentrated Flow, Wetland/Stream/Pond C-D** Unpaved Kv= 16.1 fps
0.2	44	0.0900	4.83		**Shallow Concentrated Flow, Pond to River D-E** Unpaved Kv= 16.1 fps
29.7	2,022	Total			

Subcatchment 1E: Charles River



Summary for Subcatchment 1F: Pond Drive

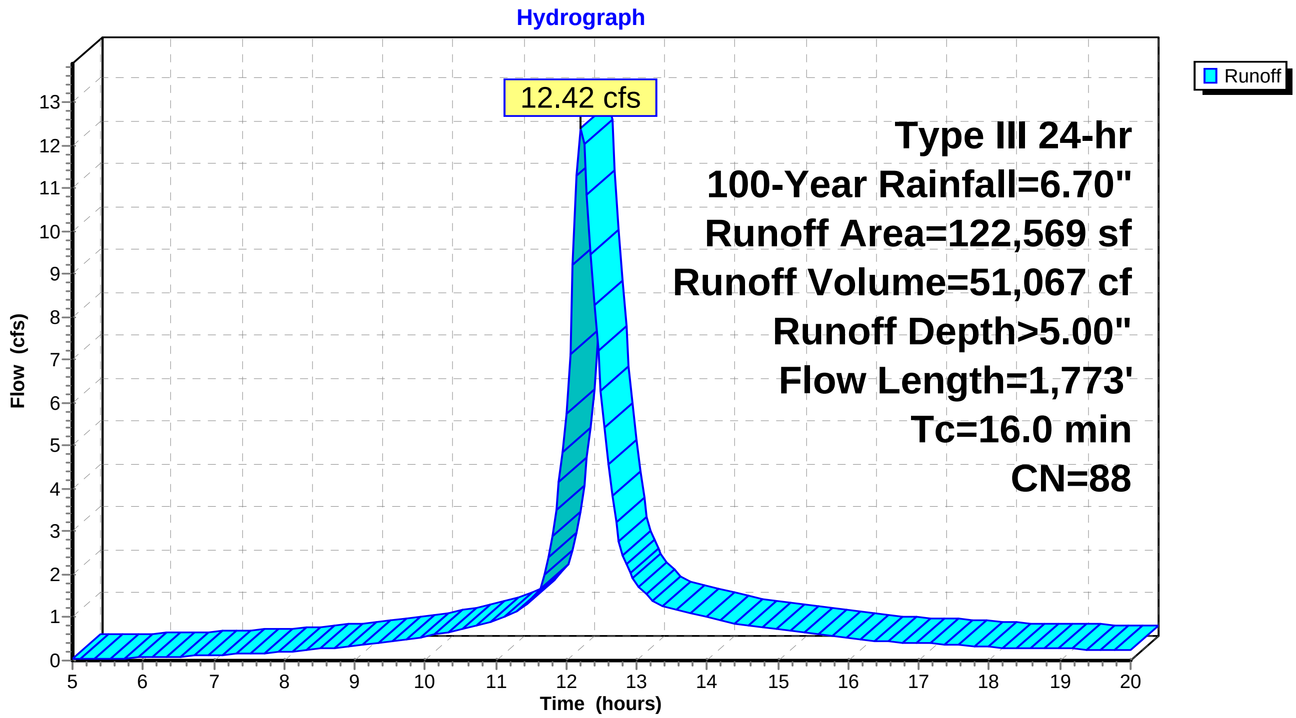
Runoff = 12.42 cfs @ 12.21 hrs, Volume= 51,067 cf, Depth> 5.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

	Area (sf)	CN	Description
	1,964	61	>75% Grass cover, Good, HSG B
	5,597	98	Paved roads w/curbs & sewers, HSG B
	25,437	77	Woods, Good, HSG D
	33,576	80	>75% Grass cover, Good, HSG D
*	43	89	Path, HSG D
	55,952	98	Paved roads w/curbs & sewers, HSG D
	122,569	88	Weighted Average
	61,020		49.78% Pervious Area
	61,549		50.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0600	0.10		**Sheet Flow, Sheet A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.3	55	0.0400	3.22		**Shallow Concentrated Flow, Grass B-C** Unpaved Kv= 16.1 fps
0.8	136	0.0200	2.87		**Shallow Concentrated Flow, Paved C-D** Paved Kv= 20.3 fps
4.0	1,006	0.0050	4.20	7.43	**Pipe Channel, Pipe D-E** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
0.6	197	0.0050	5.09	16.00	**Pipe Channel, Pipe E-F** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Corrugated PE, smooth interior
0.2	77		8.02		**Lake or Reservoir, Basin F-G** Mean Depth= 2.00'
0.5	62	0.0050	2.02	0.40	**Pipe Channel, Pipe G-H** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.013 Corrugated PE, smooth interior
0.7	89	0.0200	2.28		**Shallow Concentrated Flow, Unpaved H-I** Unpaved Kv= 16.1 fps
0.8	57	0.0050	1.14		**Shallow Concentrated Flow, Unpaved I-J** Unpaved Kv= 16.1 fps
0.2	44	0.0900	4.83		**Shallow Concentrated Flow, Upaved J-K** Unpaved Kv= 16.1 fps
16.0	1,773	Total			

Subcatchment 1F: Pond Drive



Summary for Subcatchment OSW: Off Site West

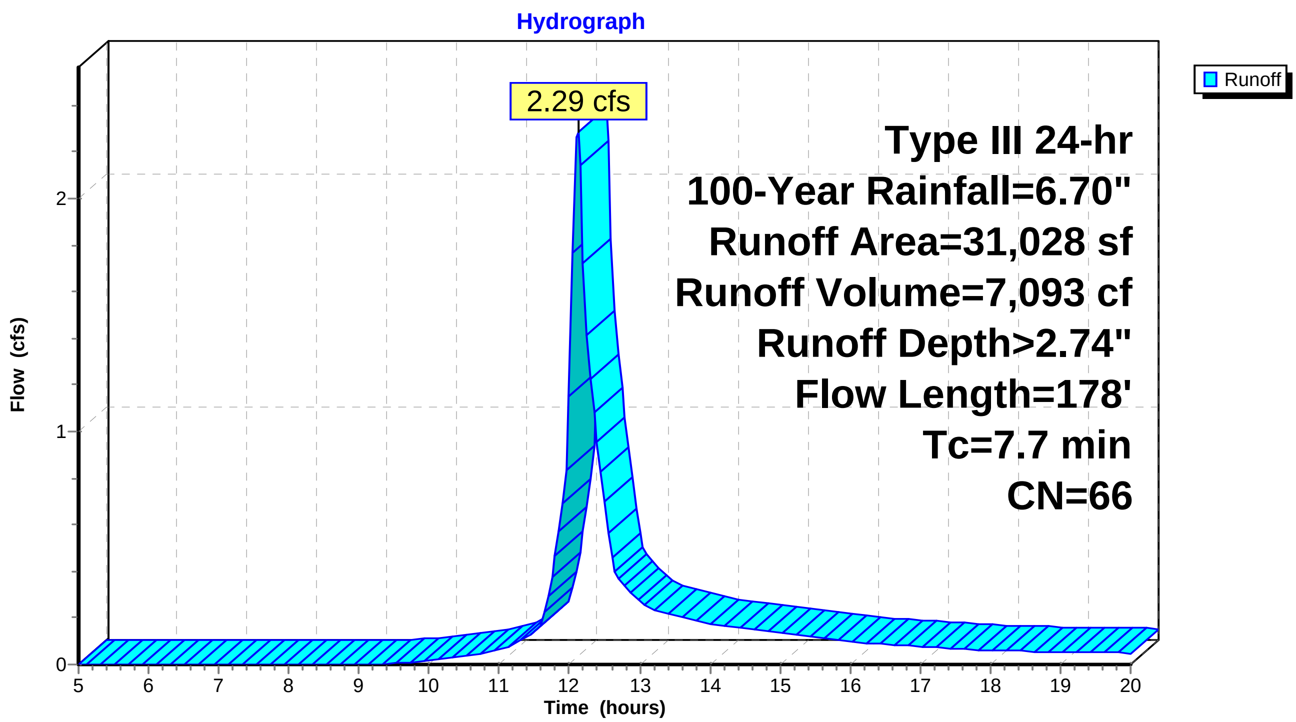
Runoff = 2.29 cfs @ 12.12 hrs, Volume= 7,093 cf, Depth> 2.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

	Area (sf)	CN	Description
	2,983	55	Woods, Good, HSG B
	18,754	61	>75% Grass cover, Good, HSG B
*	1,048	80	Path(cover unknown)
	185	98	Unconnected pavement, HSG B
	8,058	80	>75% Grass cover, Good, HSG D
	31,028	66	Weighted Average
	30,843		99.40% Pervious Area
	185		0.60% Impervious Area
	185		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0800	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.6	128	0.0540	3.74		**Shallow Concentrated Flow, Wooded/Path/Wooded B-C** Unpaved Kv= 16.1 fps
7.7	178	Total			

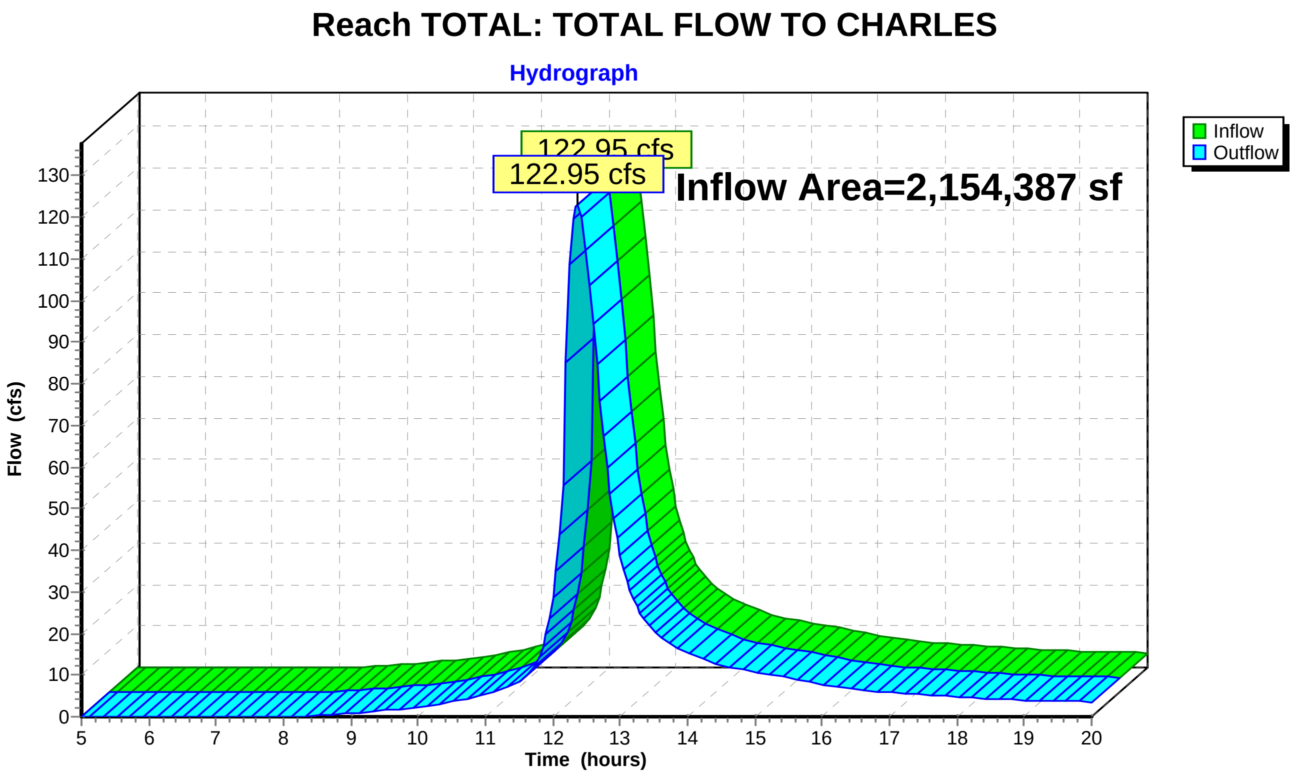
Subcatchment OSW: Off Site West



Summary for Reach TOTAL: TOTAL FLOW TO CHARLES

Inflow Area = 2,154,387 sf, 15.93% Impervious, Inflow Depth > 3.21" for 100-Year event
Inflow = 122.95 cfs @ 12.37 hrs, Volume= 575,908 cf
Outflow = 122.95 cfs @ 12.37 hrs, Volume= 575,908 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



Summary for Pond B1: BASIN 1

Inflow Area = 55,472 sf, 66.11% Impervious, Inflow Depth > 4.78" for 100-Year event
Inflow = 5.20 cfs @ 12.24 hrs, Volume= 22,097 cf
Outflow = 0.37 cfs @ 14.62 hrs, Volume= 12,946 cf, Atten= 93%, Lag= 142.7 min
Discarded = 0.37 cfs @ 14.62 hrs, Volume= 12,946 cf
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 178.37' @ 14.62 hrs Surf.Area= 6,561 sf Storage= 12,295 cf

Plug-Flow detention time= 185.6 min calculated for 12,903 cf (58% of inflow)
Center-of-Mass det. time= 110.2 min (883.1 - 772.9)

Volume	Invert	Avail.Storage	Storage Description
#1	176.00'	34,190 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

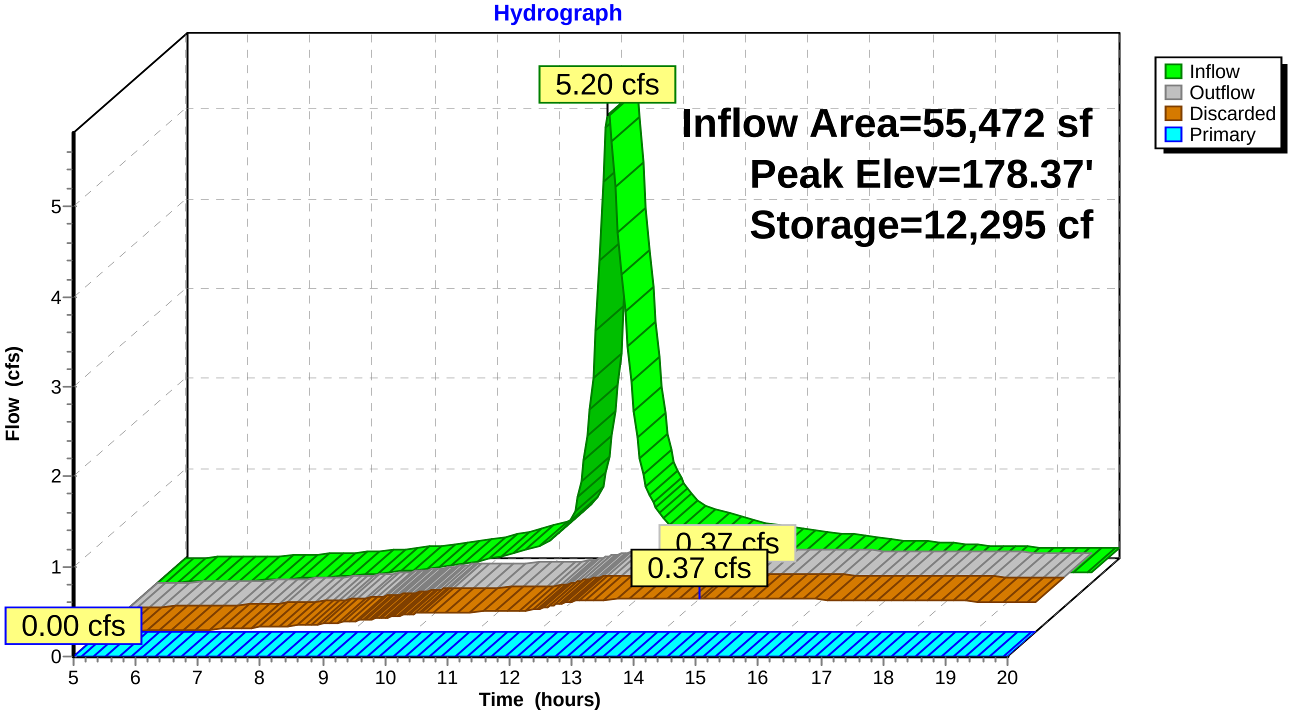
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
176.00	3,879	0	0
177.00	4,971	4,425	4,425
178.00	6,119	5,545	9,970
179.00	7,324	6,722	16,692
180.00	8,586	7,955	24,647
181.00	10,500	9,543	34,190

Device	Routing	Invert	Outlet Devices
#1	Primary	177.00'	**4.0" Round Culvert** L= 25.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 177.00' / 176.50' S= 0.0200 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.09 sf
#2	Device 1	179.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	179.25'	**1.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	179.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Primary	179.90'	**20.0' 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
#6	Discarded	176.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.37 cfs @ 14.62 hrs HW=178.37' (Free Discharge)
└─**6=Exfiltration** (Exfiltration Controls 0.37 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=176.00' (Free Discharge)
├─**1=Culvert** (Controls 0.00 cfs)
│ ├─**2=Orifice/Grate** (Controls 0.00 cfs)
│ ├─**3=Orifice/Grate** (Controls 0.00 cfs)
│ └─**4=Orifice/Grate** (Controls 0.00 cfs)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond B1: BASIN 1



Summary for Pond B2: BASIN 2

Inflow Area = 267,248 sf, 56.20% Impervious, Inflow Depth > 4.25" for 100-Year event
Inflow = 26.36 cfs @ 12.16 hrs, Volume= 94,604 cf
Outflow = 22.78 cfs @ 12.26 hrs, Volume= 70,323 cf, Atten= 14%, Lag= 5.7 min
Discarded = 0.70 cfs @ 12.26 hrs, Volume= 21,592 cf
Primary = 22.08 cfs @ 12.26 hrs, Volume= 48,731 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 175.45' @ 12.26 hrs Surf.Area= 12,623 sf Storage= 31,627 cf

Plug-Flow detention time= 114.1 min calculated for 70,323 cf (74% of inflow)
Center-of-Mass det. time= 53.4 min (833.0 - 779.7)

Volume	Invert	Avail.Storage	Storage Description
#1	170.00'	25,498 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2A	166.00'	4,027 cf	**35.33'W x 136.50'L x 3.54'H Field A** 17,081 cf Overall - 7,015 cf Embedded = 10,066 cf x 40.0% Voids
#3A	166.50'	7,015 cf	**Cultec R-330XL** x 133 Inside #2 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 7 rows
		36,539 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
170.00	1,209	0	0
171.00	2,057	1,633	1,633
172.00	2,961	2,509	4,142
173.00	3,922	3,442	7,584
174.00	4,939	4,431	12,014
175.00	6,014	5,477	17,491
176.00	10,000	8,007	25,498

Device	Routing	Invert	Outlet Devices
#1	Primary	173.50'	**4.0" Round Culvert** L= 25.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 172.00' / 173.50' S= -0.0600 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.09 sf
#2	Device 1	174.00'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	173.50'	**3.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	174.50'	**24.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Primary	174.90'	**20.0' 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
#6	Discarded	166.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.70 cfs @ 12.26 hrs HW=175.44' (Free Discharge)
└─**6=Exfiltration** (Exfiltration Controls 0.70 cfs)

Primary OutFlow Max=21.37 cfs @ 12.26 hrs HW=175.44' (Free Discharge)
├─**1=Culvert** (Inlet Controls 0.49 cfs @ 5.66 fps)
│ ├─**2=Orifice/Grate** (Passes < 0.27 cfs potential flow)
│ ├─**3=Orifice/Grate** (Passes < 0.32 cfs potential flow)
│ └─**4=Orifice/Grate** (Passes < 35.70 cfs potential flow)
└─**5=Broad-Crested Rectangular Weir** (Weir Controls 20.88 cfs @ 1.94 fps)

Pond B2: BASIN 2 - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 7 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

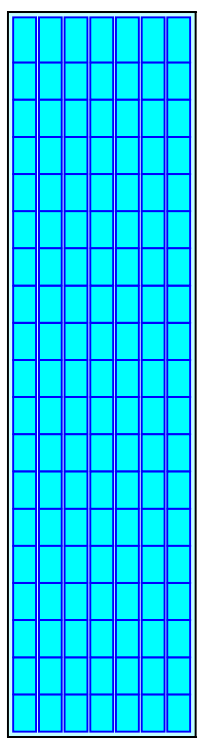
19 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 134.50' Row Length +12.0" End Stone x 2 = 136.50' Base Length
7 Rows x 52.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 35.33' Base Width
6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

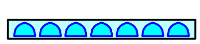
133 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 7 Rows = 7,015.1 cf Chamber Storage

17,081.5 cf Field - 7,015.1 cf Chambers = 10,066.3 cf Stone x 40.0% Voids = 4,026.5 cf Stone Storage

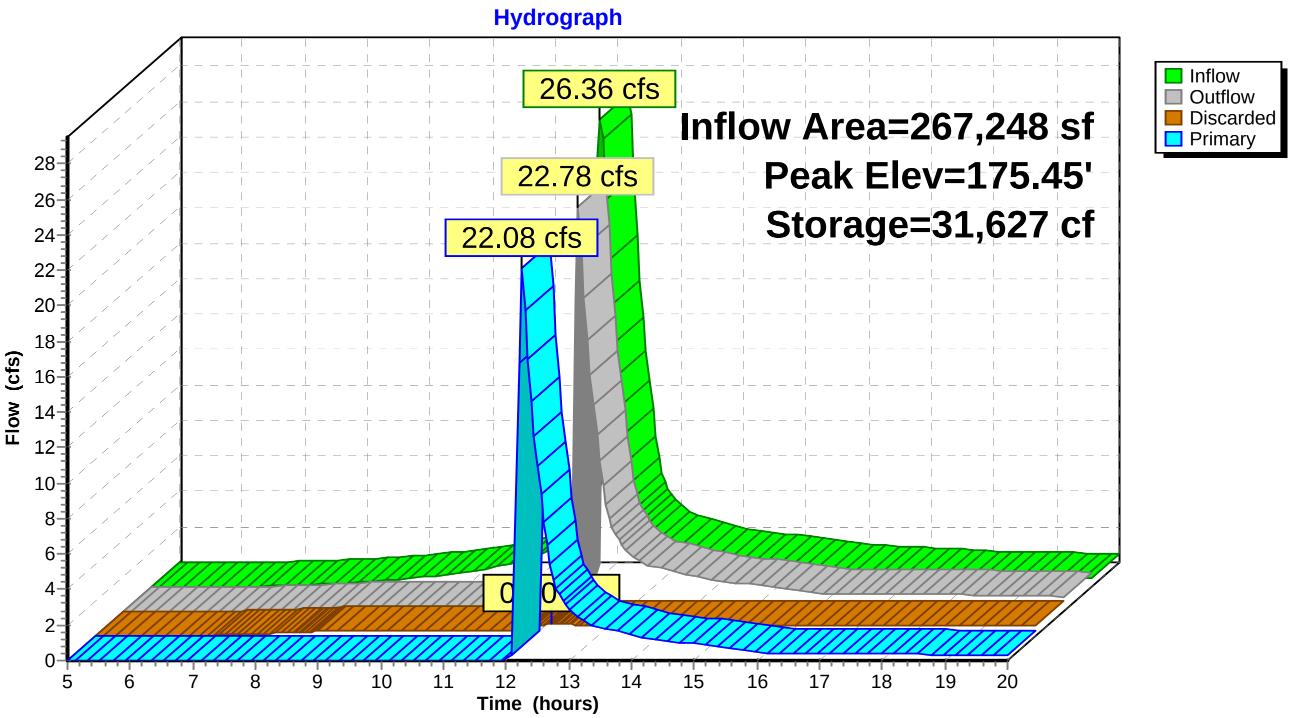
Chamber Storage + Stone Storage = 11,041.7 cf = 0.253 af
Overall Storage Efficiency = 64.6%

133 Chambers
632.6 cy Field
372.8 cy Stone





Pond B2: BASIN 2



Summary for Pond B3: BASIN 3

Inflow Area = 122,569 sf, 50.22% Impervious, Inflow Depth > 5.00" for 100-Year event
Inflow = 12.42 cfs @ 12.21 hrs, Volume= 51,067 cf
Outflow = 11.02 cfs @ 12.32 hrs, Volume= 39,247 cf, Atten= 11%, Lag= 6.2 min
Discarded = 0.31 cfs @ 12.32 hrs, Volume= 10,685 cf
Primary = 10.71 cfs @ 12.32 hrs, Volume= 28,562 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 179.22' @ 12.32 hrs Surf.Area= 5,505 sf Storage= 18,186 cf

Plug-Flow detention time= 119.8 min calculated for 39,245 cf (77% of inflow)
Center-of-Mass det. time= 62.4 min (828.8 - 766.4)

Volume	Invert	Avail.Storage	Storage Description
#1	174.00'	22,625 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

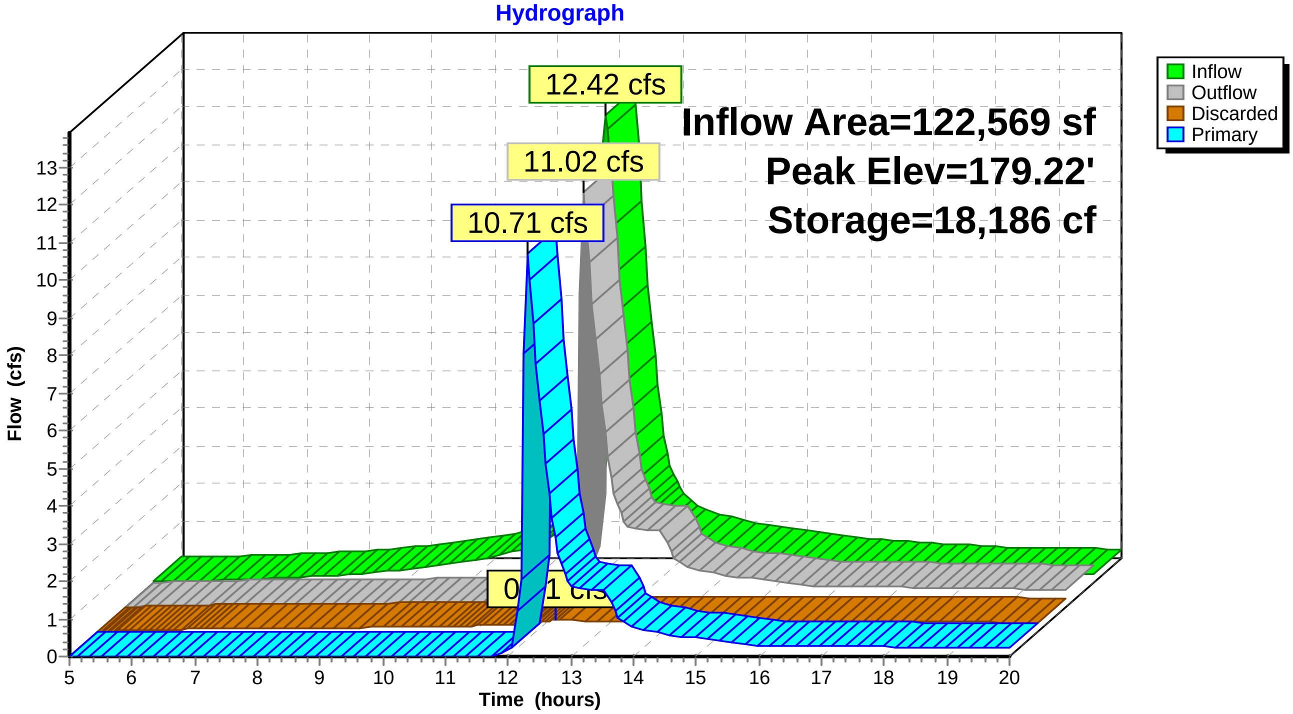
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
174.00	1,623	0	0
175.00	2,265	1,944	1,944
176.00	2,963	2,614	4,558
177.00	3,717	3,340	7,898
178.00	4,528	4,123	12,021
179.00	5,396	4,962	16,983
180.00	5,888	5,642	22,625

Device	Routing	Invert	Outlet Devices
#1	Primary	174.00'	**6.0" Round Culvert** L= 24.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 174.00' / 173.50' S= 0.0208 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf
#2	Device 1	177.00'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	178.50'	**24.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	178.90'	**20.0' 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
#5	Discarded	174.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.31 cfs @ 12.32 hrs HW=179.21' (Free Discharge)
└─**5=Exfiltration** (Exfiltration Controls 0.31 cfs)

Primary OutFlow Max=10.36 cfs @ 12.32 hrs HW=179.21' (Free Discharge)
├─**1=Culvert** (Inlet Controls 1.86 cfs @ 9.46 fps)
│ ├─**2=Orifice/Grate** (Passes < 0.34 cfs potential flow)
│ └─**3=Orifice/Grate** (Passes < 23.61 cfs potential flow)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 8.50 cfs @ 1.36 fps)

Pond B3: BASIN 3



Summary for Pond MF: 88 CULTEC 330

Inflow Area = 35,301 sf, 65.17% Impervious, Inflow Depth > 4.73" for 100-Year event
Inflow = 4.40 cfs @ 12.10 hrs, Volume= 13,900 cf
Outflow = 0.18 cfs @ 10.45 hrs, Volume= 7,436 cf, Atten= 96%, Lag= 0.0 min
Discarded = 0.18 cfs @ 10.45 hrs, Volume= 7,436 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 3.82' @ 15.29 hrs Surf.Area= 3,253 sf Storage= 7,793 cf

Plug-Flow detention time= 172.0 min calculated for 7,411 cf (53% of inflow)
Center-of-Mass det. time= 90.4 min (854.2 - 763.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	3,373 cf	**54.67'W x 59.50'L x 4.04'H Field A** 13,146 cf Overall - 4,713 cf Embedded = 8,433 cf x 40.0% Voids
#2A	1.00'	4,713 cf	**Cultec R-330XL** x 88 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 11 rows
		8,086 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.18 cfs @ 10.45 hrs HW=0.04' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.18 cfs)

Pond MF: 88 CULTEC 330 - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 11 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

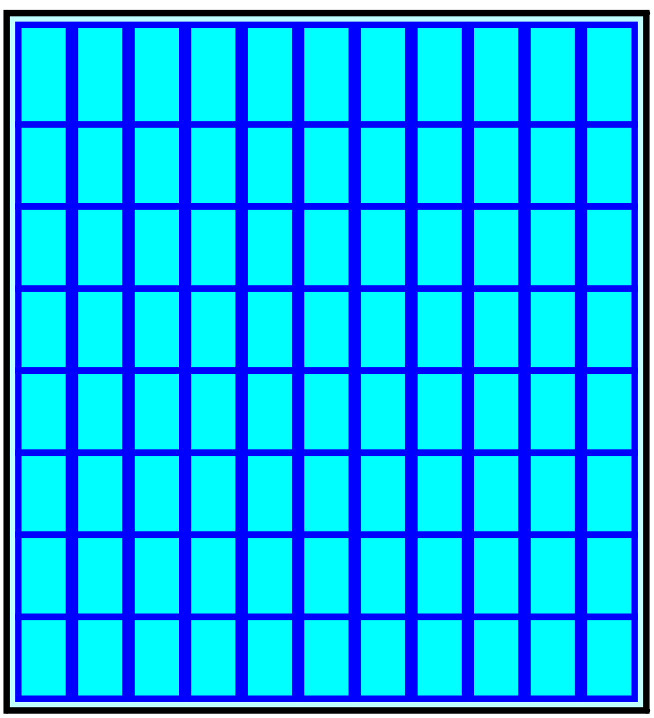
8 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 57.50' Row Length +12.0" End Stone x 2 = 59.50' Base Length
11 Rows x 52.0" Wide + 6.0" Spacing x 10 + 12.0" Side Stone x 2 = 54.67' Base Width
12.0" Base + 30.5" Chamber Height + 6.0" Cover = 4.04' Field Height

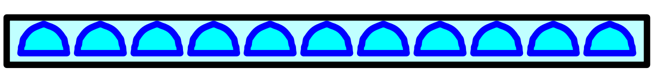
88 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 11 Rows = 4,712.8 cf Chamber Storage

13,146.2 cf Field - 4,712.8 cf Chambers = 8,433.4 cf Stone x 40.0% Voids = 3,373.4 cf Stone Storage

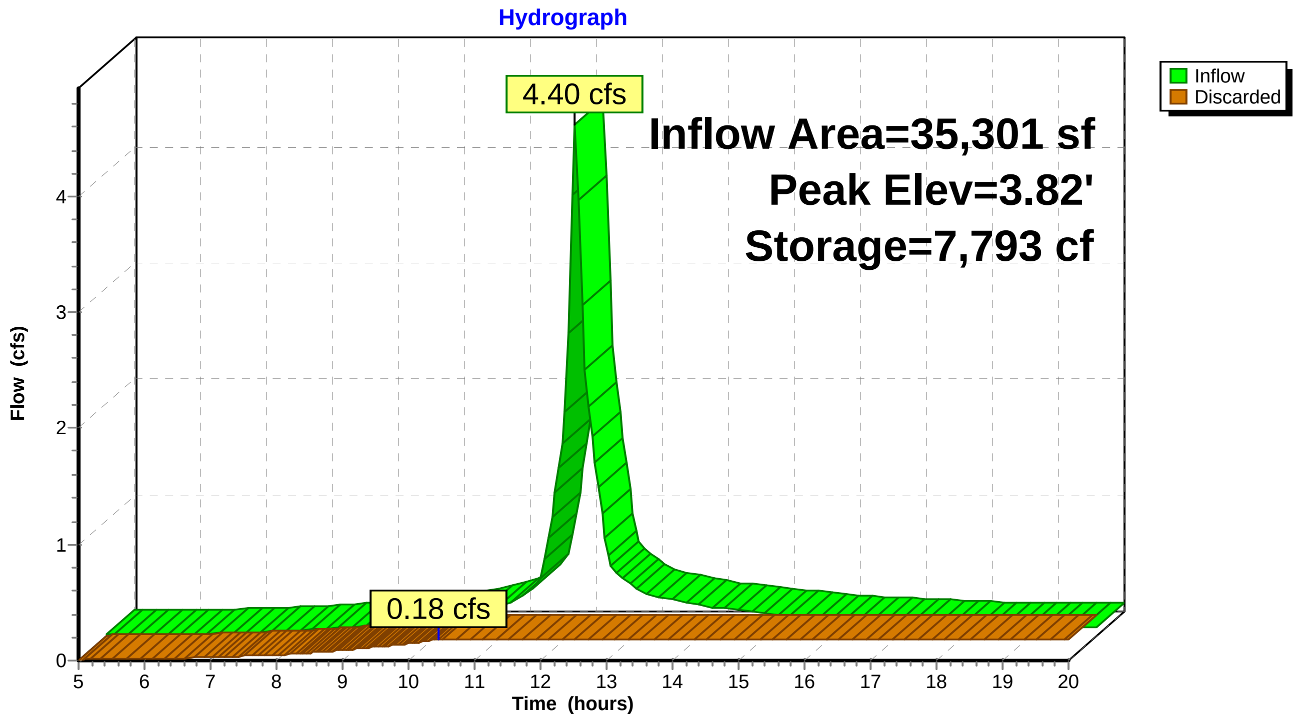
Chamber Storage + Stone Storage = 8,086.1 cf = 0.186 af
Overall Storage Efficiency = 61.5%

88 Chambers
486.9 cy Field
312.3 cy Stone





Pond MF: 88 CULTEC 330

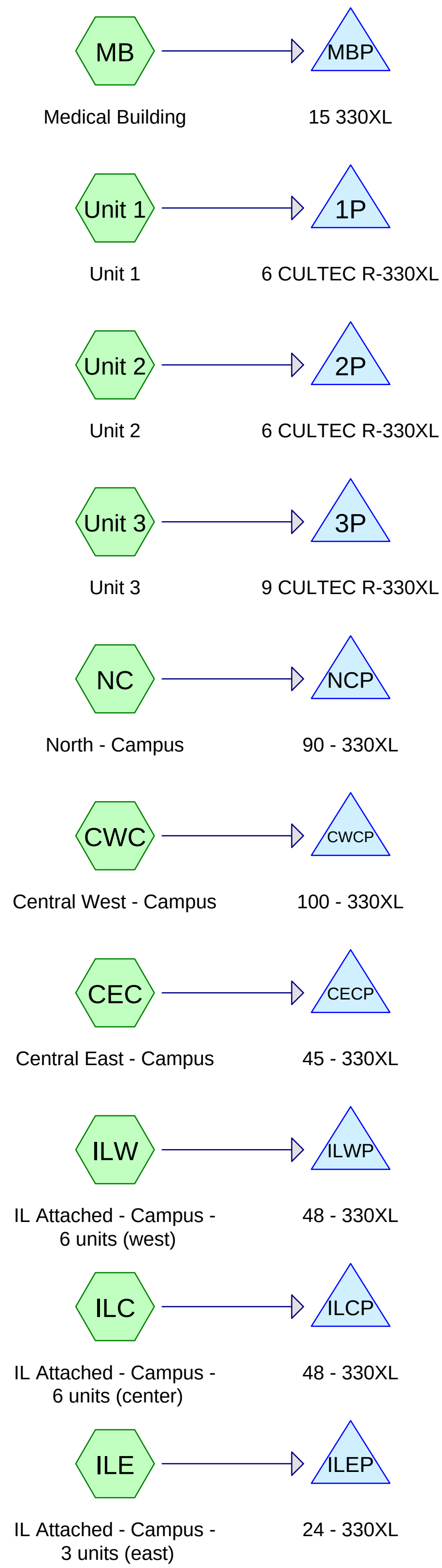


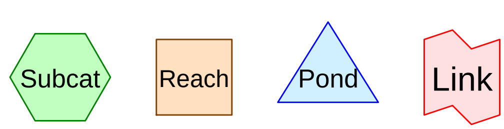
APPENDIX C

STORMWATER MANAGEMENT SYSTEM

CLOSED DRAINAGE SYSTEM/PIPE SIZING CALCULATIONS

DRAINAGE SYSTEM CALCULATIONS





Routing Diagram for 8548.0 - Salmon Senior Community - Medway - Proposed Unit Infiltration systems

Prepared by Microsoft, Printed 6/10/2015

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Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
3.261	98	Roofs, HSG A (CEC, CWC, ILC, ILE, ILW, MB, NC, Unit 1, Unit 2, Unit 3)
3.261	**98**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
3.261	HSG A	CEC, CWC, ILC, ILE, ILW, MB, NC, Unit 1, Unit 2, Unit 3
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
3.261		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
3.261	0.000	0.000	0.000	0.000	3.261	Roofs	CEC, CWC, ILC, ILE, ILW, MB, NC, Unit 1, Unit 2, Unit 3
3.261	**0.000**	**0.000**	**0.000**	**0.000**	**3.261**	**TOTAL AREA**	

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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 CEC: Central East - Runoff Area=17,152 sf 100.00% Impervious Runoff Depth>5.97"
Tc=5.0 min CN=98 Runoff=2.60 cfs 0.196 af

Subcatchment CWC: Central West - Runoff Area=36,000 sf 100.00% Impervious Runoff Depth>5.97"
Tc=5.0 min CN=98 Runoff=5.47 cfs 0.411 af

Subcatchment ILC: IL Attached - Campus Runoff Area=17,150 sf 100.00% Impervious Runoff Depth>5.97"
Tc=5.0 min CN=98 Runoff=2.60 cfs 0.196 af

Subcatchment ILE: IL Attached - Campus - Runoff Area=8,575 sf 100.00% Impervious Runoff Depth>5.97"
Tc=5.0 min CN=98 Runoff=1.30 cfs 0.098 af

Subcatchment ILW: IL Attached - Campus Runoff Area=17,000 sf 100.00% Impervious Runoff Depth>5.97"
Tc=5.0 min CN=98 Runoff=2.58 cfs 0.194 af

Subcatchment MB: Medical Building Runoff Area=6,375 sf 100.00% Impervious Runoff Depth>5.97"
Tc=5.0 min CN=98 Runoff=0.97 cfs 0.073 af

Subcatchment NC: North - Campus Runoff Area=31,750 sf 100.00% Impervious Runoff Depth>5.97"
Tc=5.0 min CN=98 Runoff=4.82 cfs 0.362 af

Subcatchment Unit 1: Unit 1 Runoff Area=2,400 sf 100.00% Impervious Runoff Depth>5.97"
Tc=5.0 min CN=98 Runoff=0.36 cfs 0.027 af

Subcatchment Unit 2: Unit 2 Runoff Area=2,640 sf 100.00% Impervious Runoff Depth>5.97"
Tc=5.0 min CN=98 Runoff=0.40 cfs 0.030 af

Subcatchment Unit 3: Unit 3 Runoff Area=3,000 sf 100.00% Impervious Runoff Depth>5.97"
Tc=5.0 min CN=98 Runoff=0.46 cfs 0.034 af

Pond 1P: 6 CULTEC R-330XL Peak Elev=2.95' Storage=539 cf Inflow=0.36 cfs 0.027 af
Outflow=0.03 cfs 0.022 af

Pond 2P: 6 CULTEC R-330XL Peak Elev=3.56' Storage=606 cf Inflow=0.40 cfs 0.030 af
Outflow=0.03 cfs 0.024 af

Pond 3P: 9 CULTEC R-330XL Peak Elev=2.45' Storage=658 cf Inflow=0.46 cfs 0.034 af
Outflow=0.03 cfs 0.029 af

Pond CECP: 45 - 330XL Peak Elev=3.76' Storage=4,212 cf Inflow=2.60 cfs 0.196 af
Outflow=0.14 cfs 0.134 af

Pond CWCP: 100 - 330XL Peak Elev=3.61' Storage=8,956 cf Inflow=5.47 cfs 0.411 af
Outflow=0.27 cfs 0.269 af

Pond ILCP: 48 - 330XL Peak Elev=3.32' Storage=4,137 cf Inflow=2.60 cfs 0.196 af
Outflow=0.14 cfs 0.137 af

Pond ILEP: 24 - 330XL Peak Elev=3.02' Storage=1,990 cf Inflow=1.30 cfs 0.098 af
Outflow=0.08 cfs 0.074 af

Pond ILWP: 48 - 330XL Peak Elev=3.27' Storage=4,087 cf Inflow=2.58 cfs 0.194 af
Outflow=0.14 cfs 0.137 af

Pond MBP: 15 330XL Peak Elev=3.96' Storage=1,526 cf Inflow=0.97 cfs 0.073 af
Outflow=0.06 cfs 0.053 af

Pond NCP: 90 - 330XL Peak Elev=3.54' Storage=7,859 cf Inflow=4.82 cfs 0.362 af
Outflow=0.25 cfs 0.240 af

Total Runoff Area = 3.261 ac Runoff Volume = 1.621 af Average Runoff Depth = 5.97"
0.00% Pervious = 0.000 ac 100.00% Impervious = 3.261 ac

Summary for Subcatchment CEC: Central East - Campus

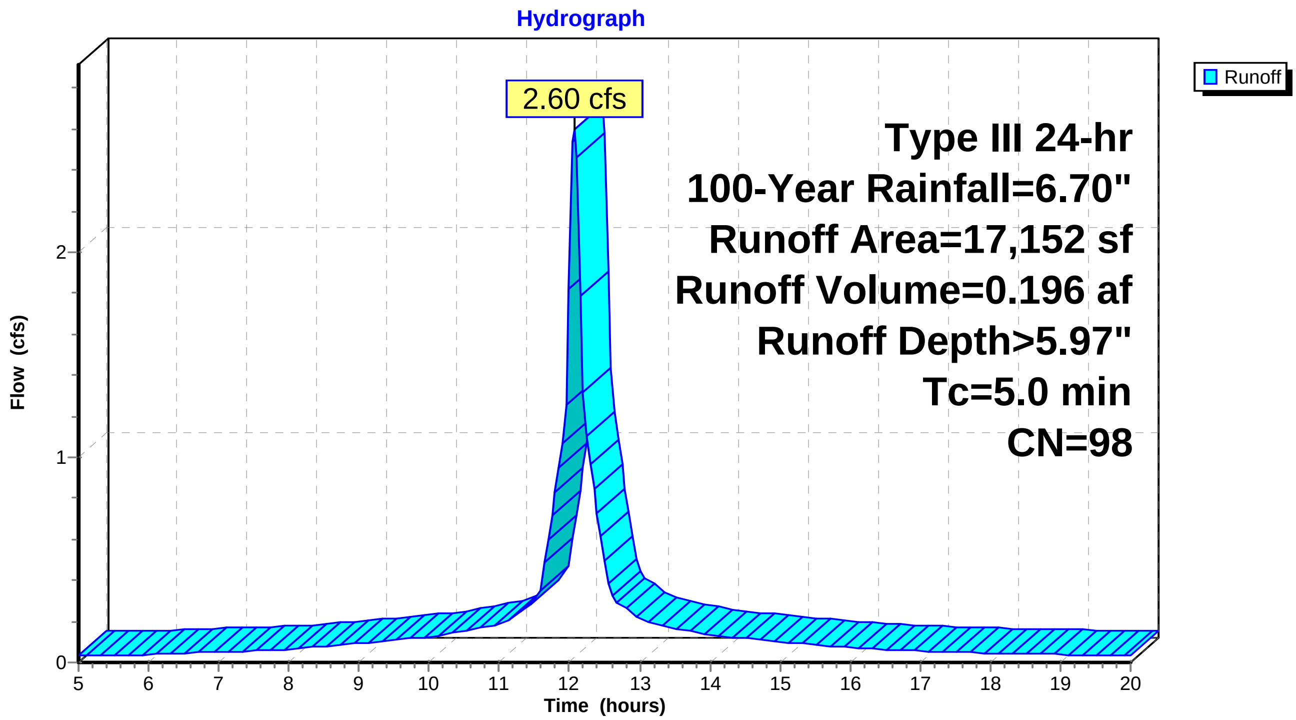
Runoff = 2.60 cfs @ 12.07 hrs, Volume= 0.196 af, Depth> 5.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
17,152	98	Roofs, HSG A
17,152		100.00% Impervious Area

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

Subcatchment CEC: Central East - Campus



Summary for Subcatchment CWC: Central West - Campus

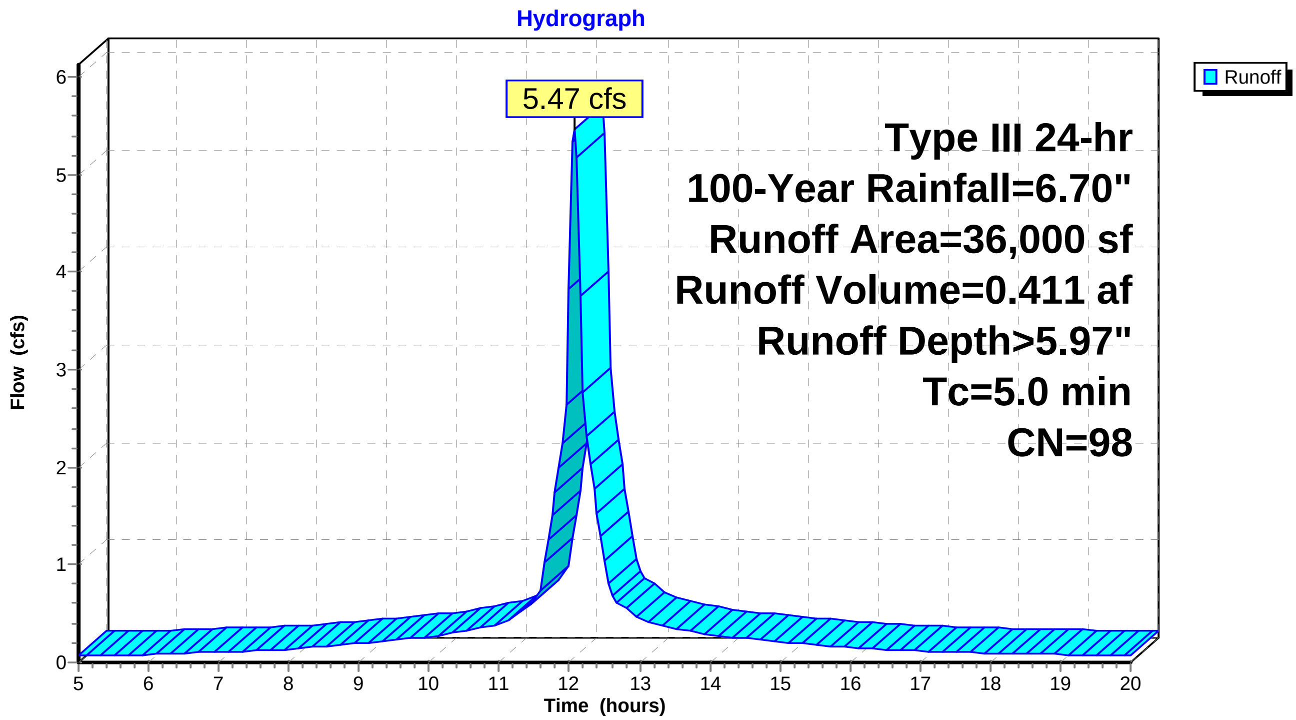
Runoff = 5.47 cfs @ 12.07 hrs, Volume= 0.411 af, Depth> 5.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
36,000	98	Roofs, HSG A
36,000		100.00% Impervious Area

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

Subcatchment CWC: Central West - Campus



Summary for Subcatchment ILC: IL Attached - Campus - 6 units (center)

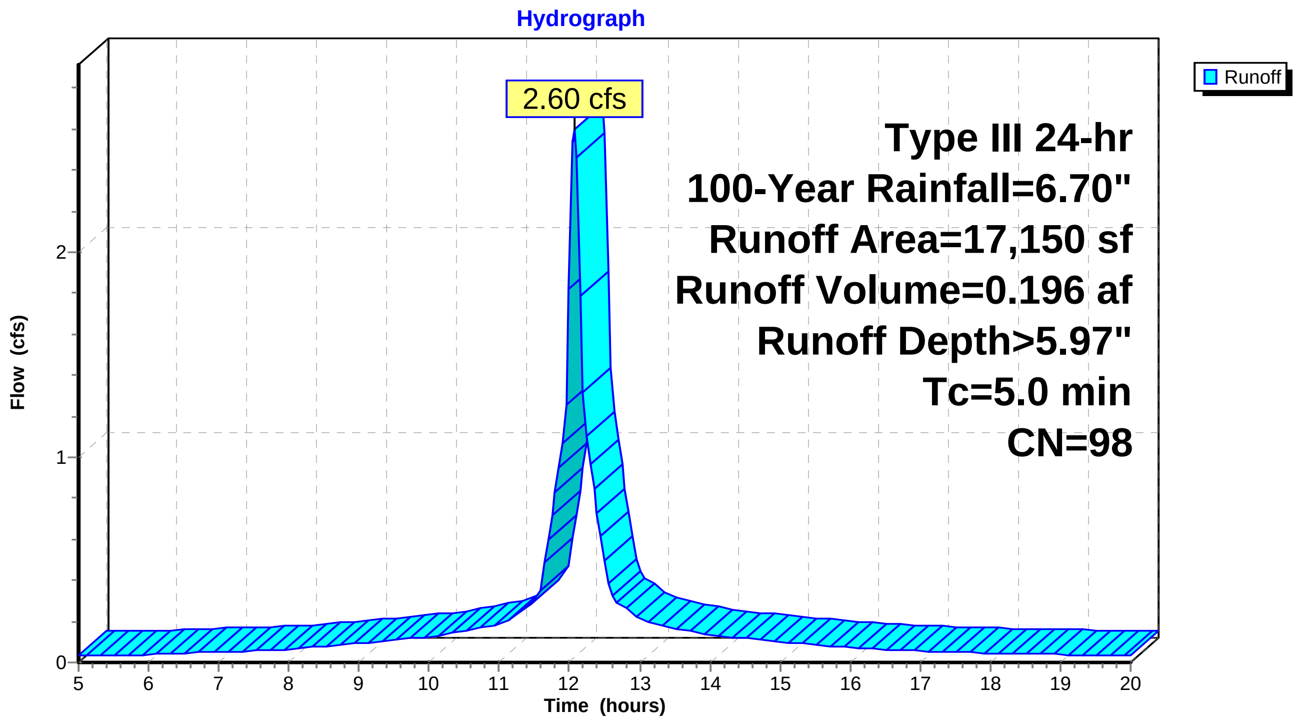
Runoff = 2.60 cfs @ 12.07 hrs, Volume= 0.196 af, Depth> 5.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
17,150	98	Roofs, HSG A
17,150		100.00% Impervious Area

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

Subcatchment ILC: IL Attached - Campus - 6 units (center)



Summary for Subcatchment ILE: IL Attached - Campus - 3 units (east)

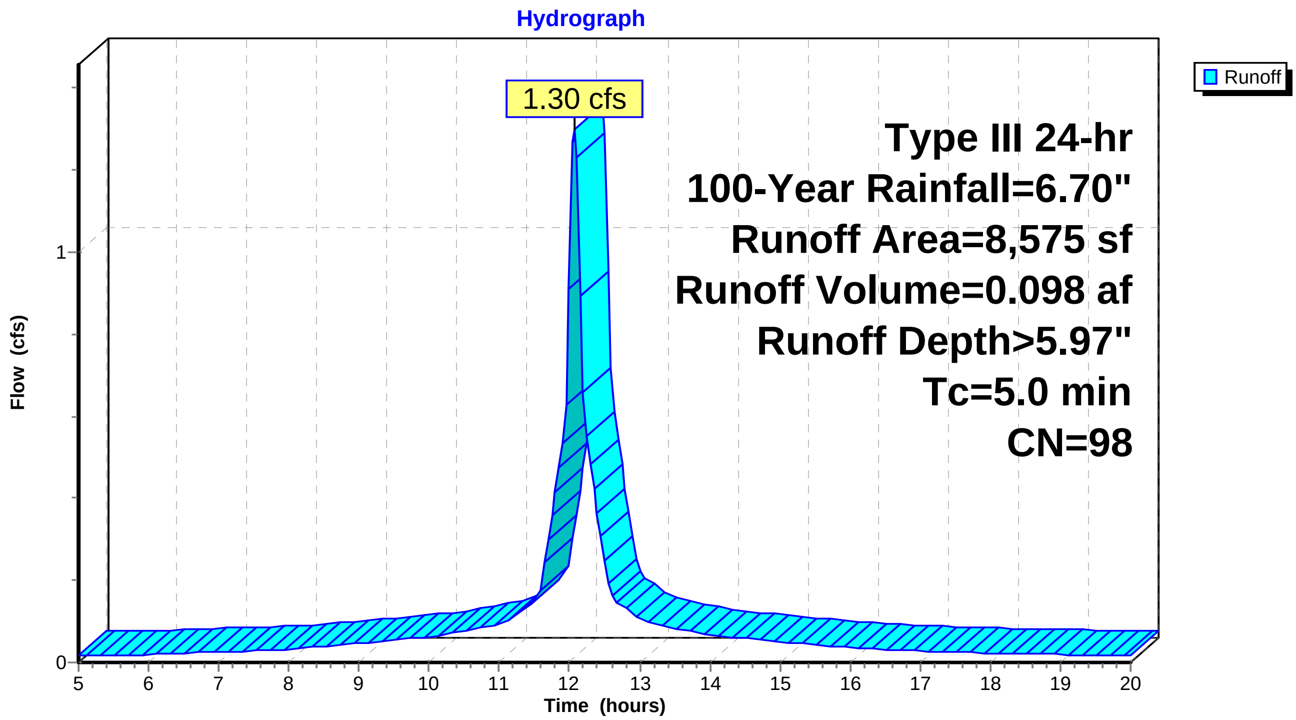
Runoff = 1.30 cfs @ 12.07 hrs, Volume= 0.098 af, Depth> 5.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
8,575	98	Roofs, HSG A
8,575		100.00% Impervious Area

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

Subcatchment ILE: IL Attached - Campus - 3 units (east)



Summary for Subcatchment ILW: IL Attached - Campus - 6 units (west)

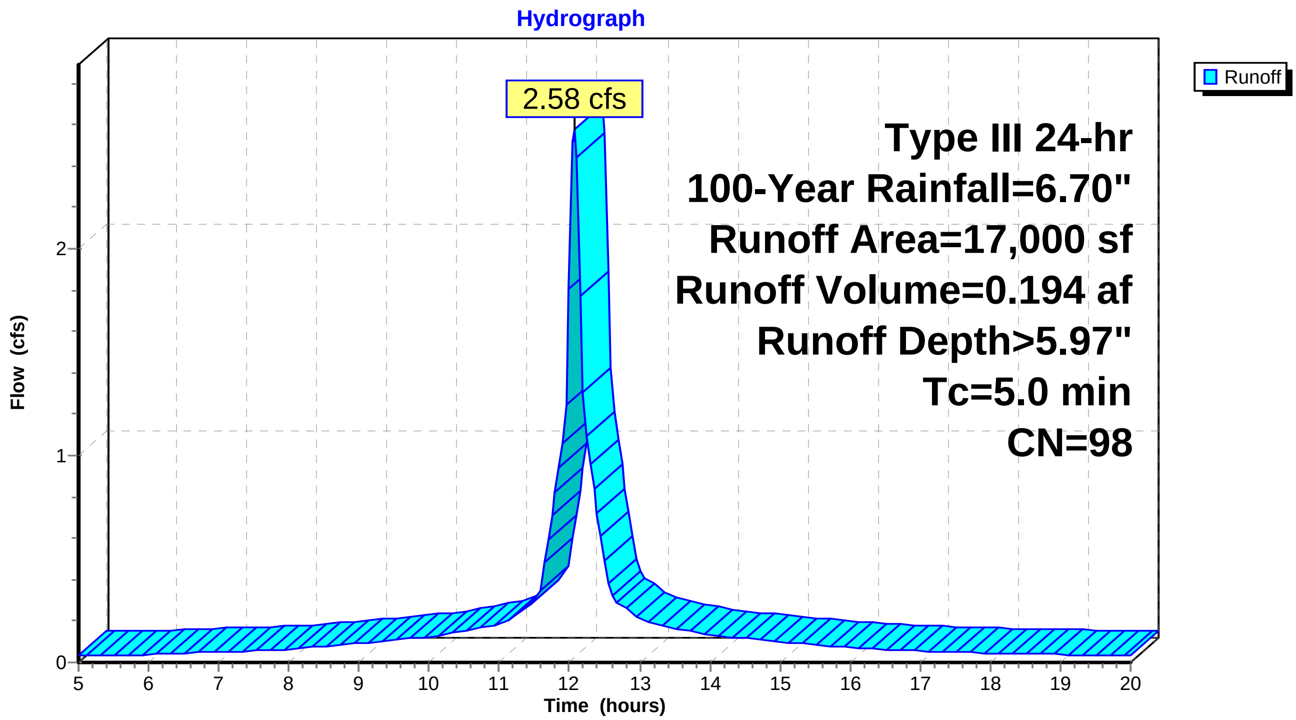
Runoff = 2.58 cfs @ 12.07 hrs, Volume= 0.194 af, Depth> 5.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
17,000	98	Roofs, HSG A
17,000		100.00% Impervious Area

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

Subcatchment ILW: IL Attached - Campus - 6 units (west)



Summary for Subcatchment MB: Medical Building

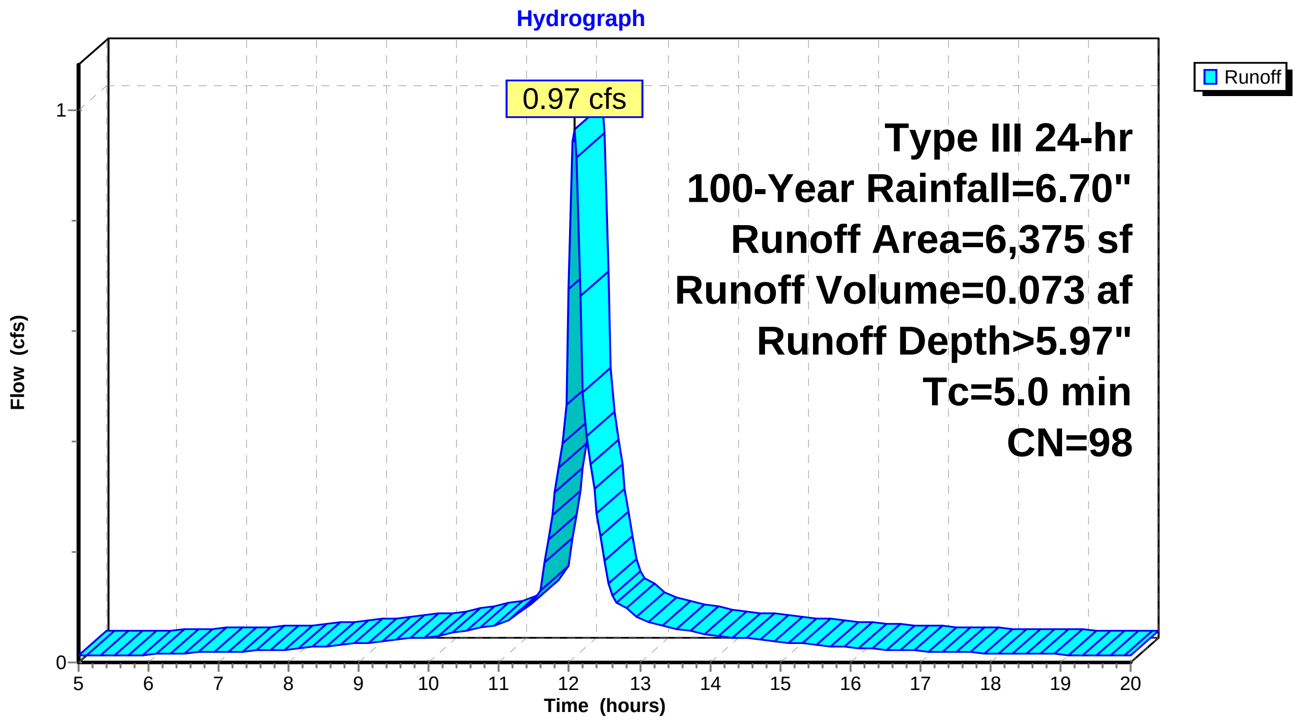
Runoff = 0.97 cfs @ 12.07 hrs, Volume= 0.073 af, Depth> 5.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
6,375	98	Roofs, HSG A
6,375		100.00% Impervious Area

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

Subcatchment MB: Medical Building



Summary for Subcatchment NC: North - Campus

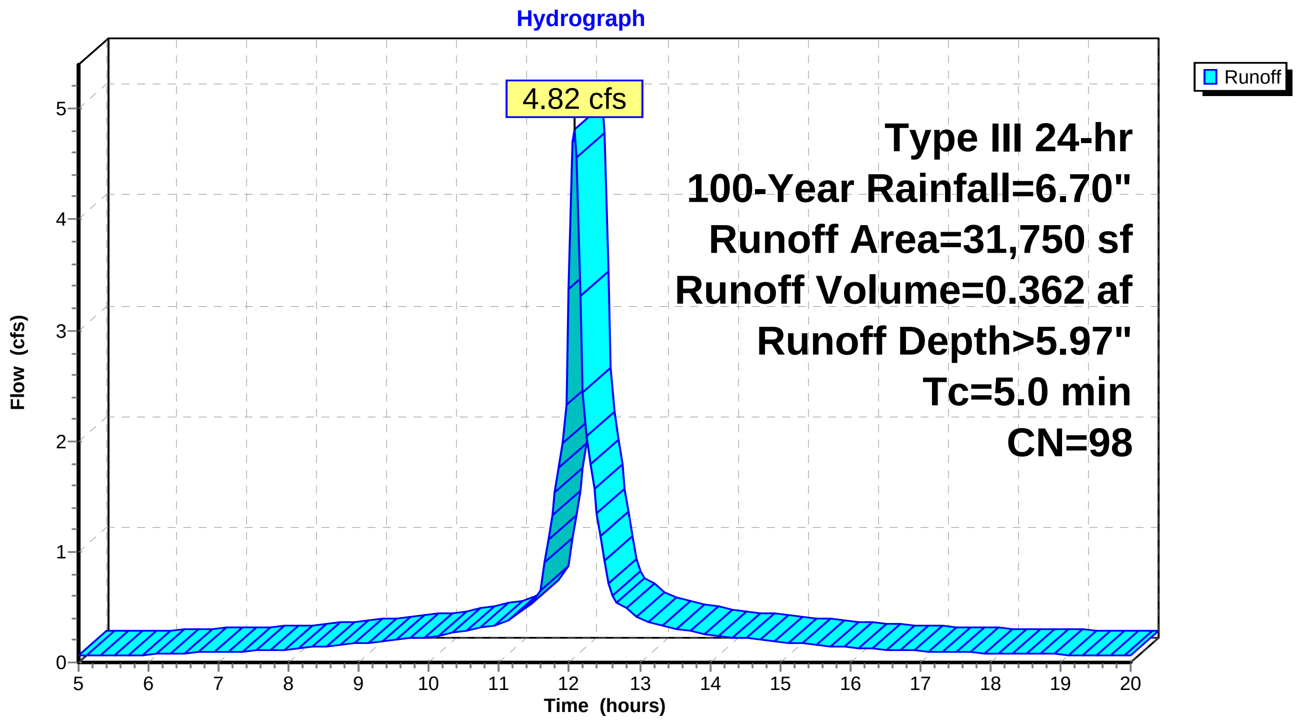
Runoff = 4.82 cfs @ 12.07 hrs, Volume= 0.362 af, Depth> 5.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
31,750	98	Roofs, HSG A
31,750		100.00% Impervious Area

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

Subcatchment NC: North - Campus



Summary for Subcatchment Unit 1: Unit 1

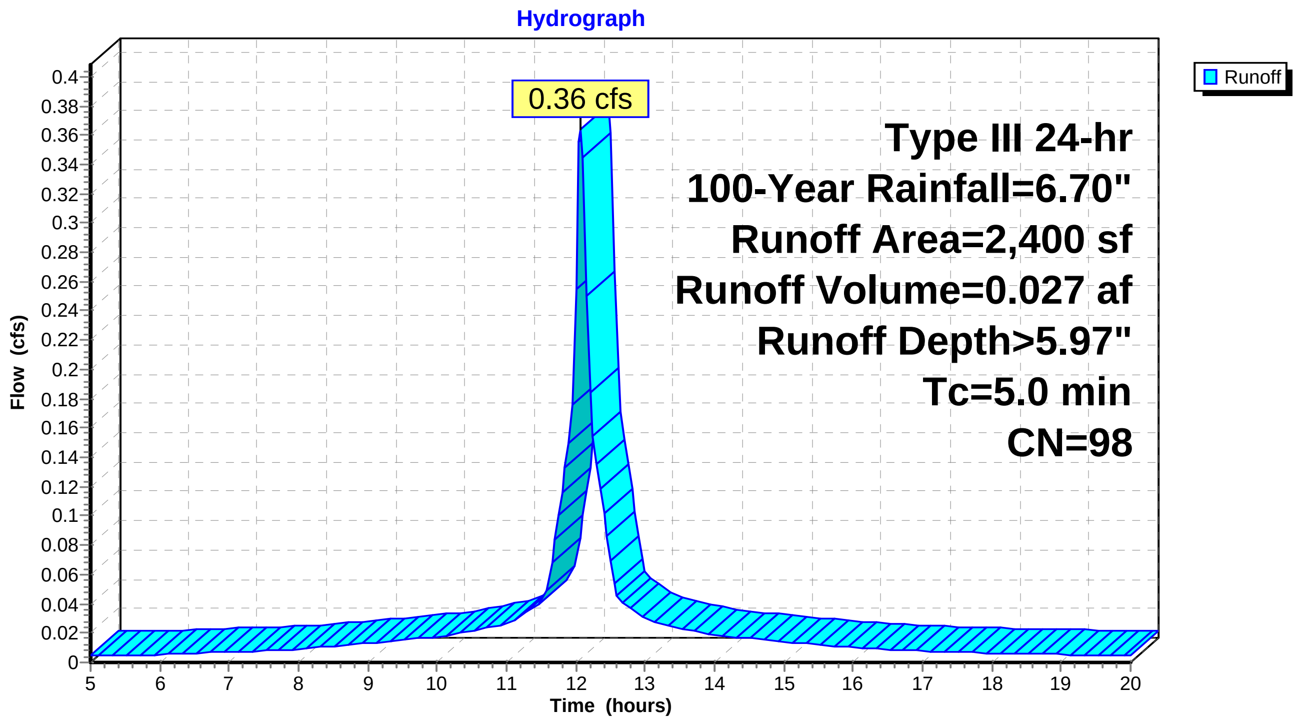
Runoff = 0.36 cfs @ 12.07 hrs, Volume= 0.027 af, Depth> 5.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
2,400	98	Roofs, HSG A
2,400		100.00% Impervious Area

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

Subcatchment Unit 1: Unit 1



Summary for Subcatchment Unit 2: Unit 2

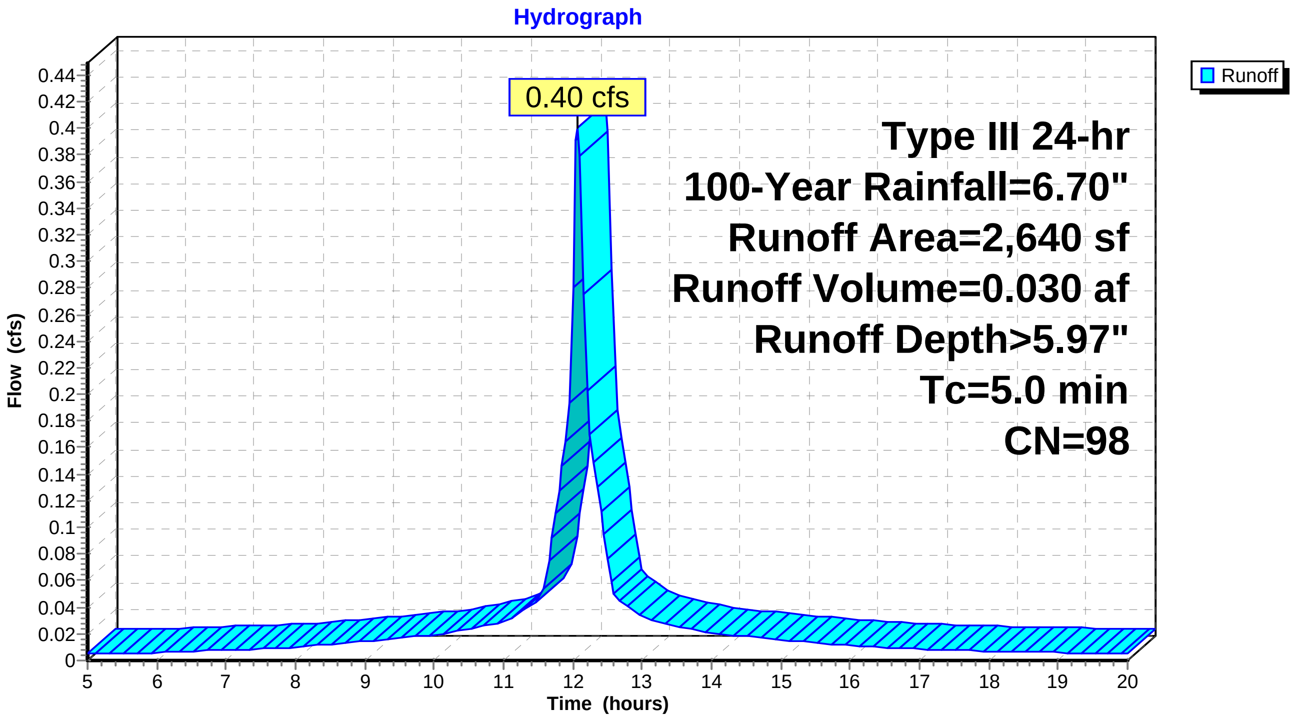
Runoff = 0.40 cfs @ 12.07 hrs, Volume= 0.030 af, Depth> 5.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
2,640	98	Roofs, HSG A
2,640		100.00% Impervious Area

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

Subcatchment Unit 2: Unit 2



Summary for Subcatchment Unit 3: Unit 3

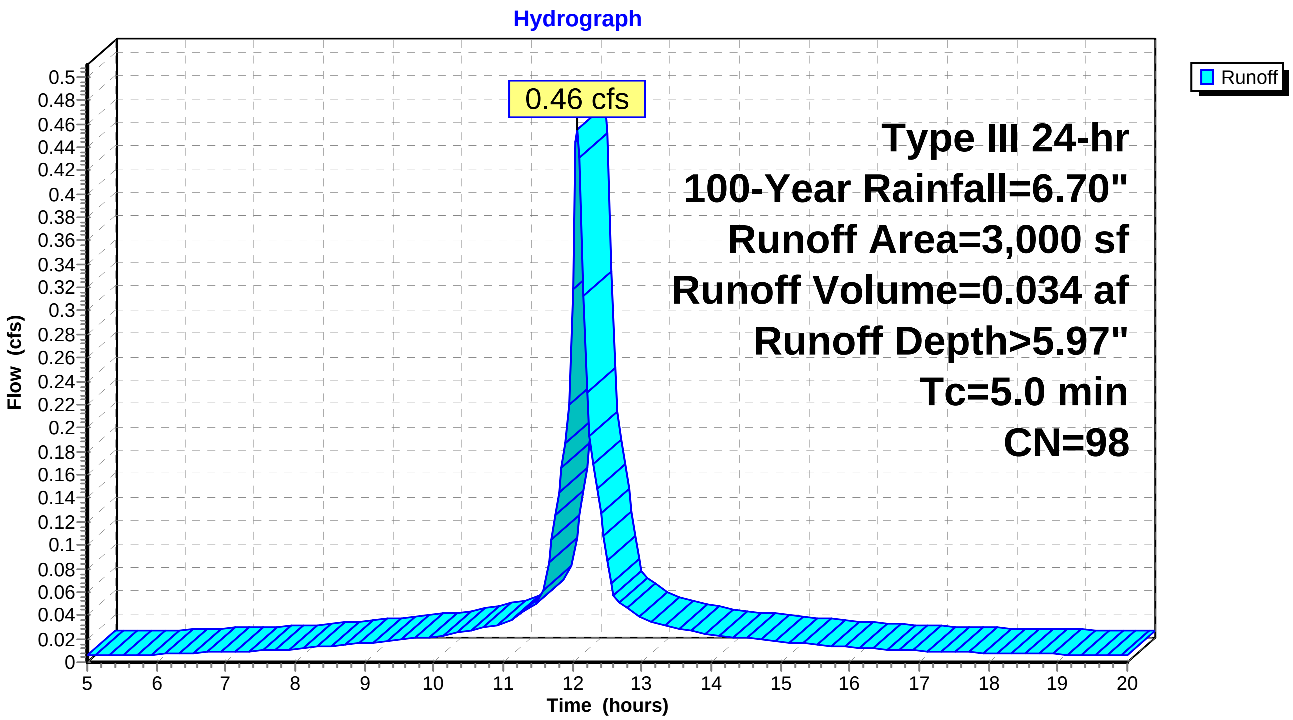
Runoff = 0.46 cfs @ 12.07 hrs, Volume= 0.034 af, Depth> 5.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
3,000	98	Roofs, HSG A
3,000		100.00% Impervious Area

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

Subcatchment Unit 3: Unit 3



Summary for Pond 1P: 6 CULTEC R-330XL

Inflow Area = 0.055 ac,100.00% Impervious, Inflow Depth > 5.97" for 100-Year event
Inflow = 0.36 cfs @ 12.07 hrs, Volume= 0.027 af
Outflow = 0.03 cfs @ 13.14 hrs, Volume= 0.022 af, Atten= 93%, Lag= 64.2 min
Discarded = 0.03 cfs @ 13.14 hrs, Volume= 0.022 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 2.95' @ 13.14 hrs Surf.Area= 280 sf Storage= 539 cf

Plug-Flow detention time= 157.9 min calculated for 0.022 af (82% of inflow)
Center-of-Mass det. time= 105.5 min (838.5 - 733.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	258 cf	**16.00'W x 17.50'L x 3.54'H Field A**
			992 cf Overall - 346 cf Embedded = 645 cf x 40.0% Voids
#2A	0.50'	346 cf	**Cultec R-330XL** x 6 Inside #1
			Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
			Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
			Row Length Adjustment= +1.50' x 7.45 sf x 3 rows
		605 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.410 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.03 cfs @ 13.14 hrs HW=2.95' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Pond 1P: 6 CULTEC R-330XL - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 3 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

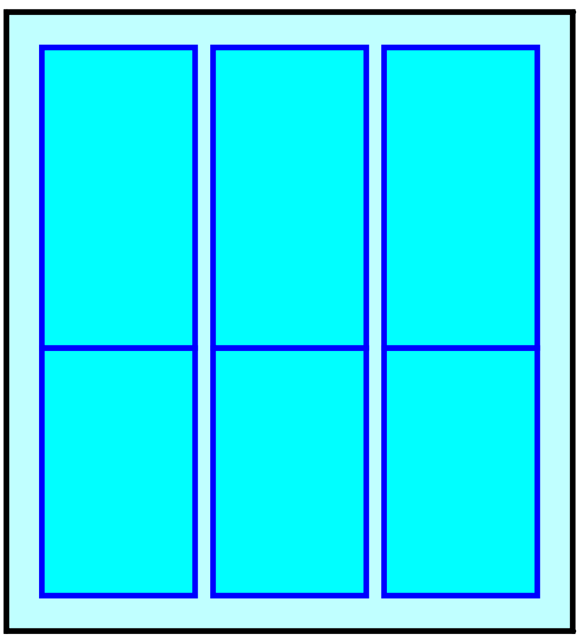
2 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 15.50' Row Length +12.0" End Stone x 2 = 17.50' Base Length
3 Rows x 52.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 16.00' Base Width
6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

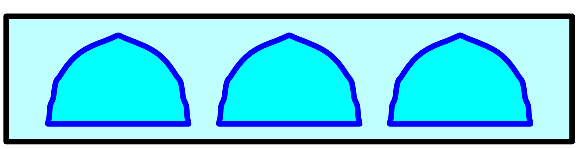
6 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 3 Rows = 346.5 cf Chamber Storage

991.7 cf Field - 346.5 cf Chambers = 645.2 cf Stone x 40.0% Voids = 258.1 cf Stone Storage

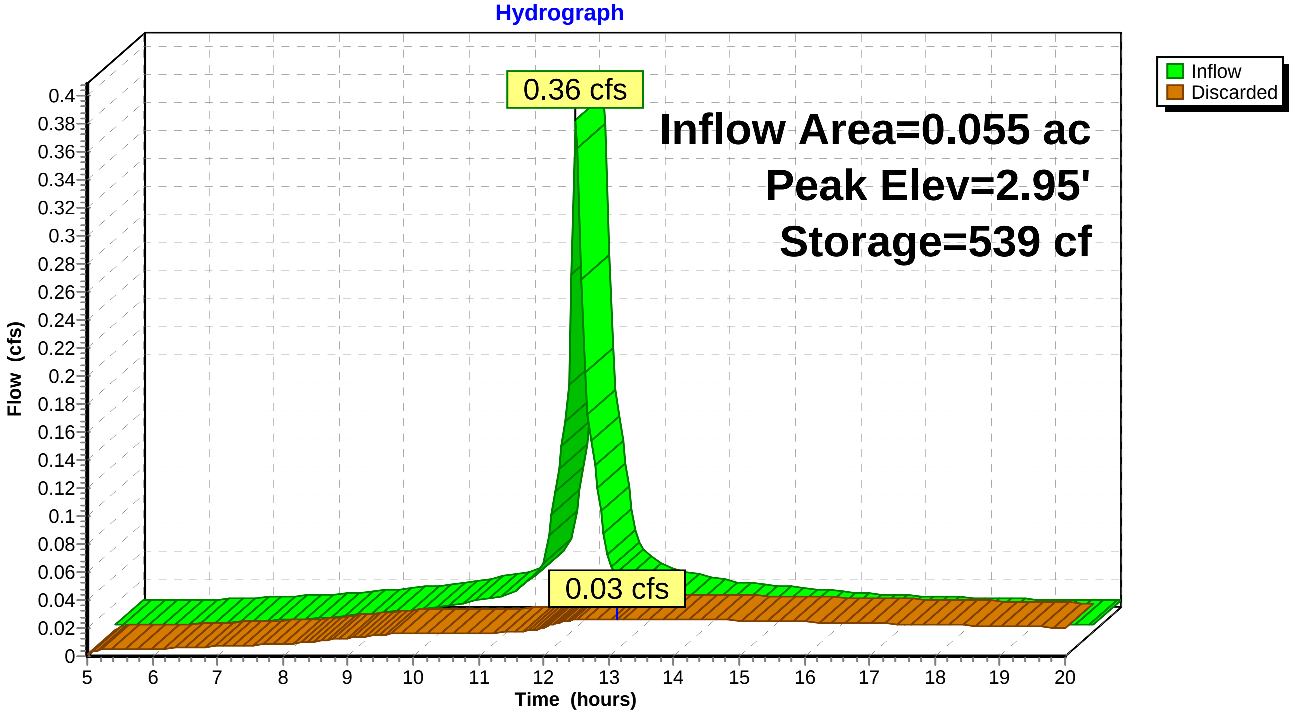
Chamber Storage + Stone Storage = 604.5 cf = 0.014 af
Overall Storage Efficiency = 61.0%

6 Chambers
36.7 cy Field
23.9 cy Stone





Pond 1P: 6 CULTEC R-330XL



Summary for Pond 2P: 6 CULTEC R-330XL

Inflow Area = 0.061 ac,100.00% Impervious, Inflow Depth > 5.97" for 100-Year event
Inflow = 0.40 cfs @ 12.07 hrs, Volume= 0.030 af
Outflow = 0.03 cfs @ 13.17 hrs, Volume= 0.024 af, Atten= 93%, Lag= 66.3 min
Discarded = 0.03 cfs @ 13.17 hrs, Volume= 0.024 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 3.56' @ 13.17 hrs Surf.Area= 280 sf Storage= 606 cf

Plug-Flow detention time= 162.1 min calculated for 0.024 af (80% of inflow)
Center-of-Mass det. time= 106.6 min (839.6 - 733.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	314 cf	**16.00'W x 17.50'L x 4.04'H Field A** 1,132 cf Overall - 346 cf Embedded = 785 cf x 40.0% Voids
#2A	1.00'	346 cf	**Cultec R-330XL** x 6 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 3 rows
		661 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.410 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.03 cfs @ 13.17 hrs HW=3.56' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Pond 2P: 6 CULTEC R-330XL - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 3 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

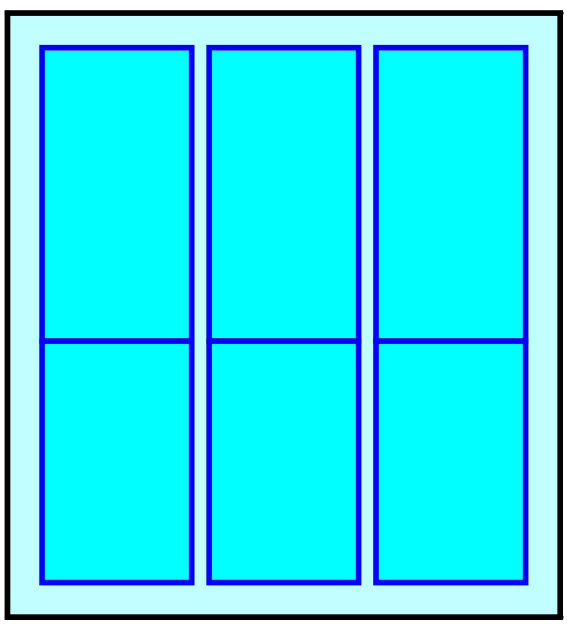
2 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 15.50' Row Length +12.0" End Stone x 2 = 17.50' Base Length
3 Rows x 52.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 16.00' Base Width
12.0" Base + 30.5" Chamber Height + 6.0" Cover = 4.04' Field Height

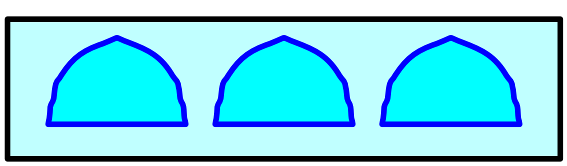
6 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 3 Rows = 346.5 cf Chamber Storage

1,131.7 cf Field - 346.5 cf Chambers = 785.2 cf Stone x 40.0% Voids = 314.1 cf Stone Storage

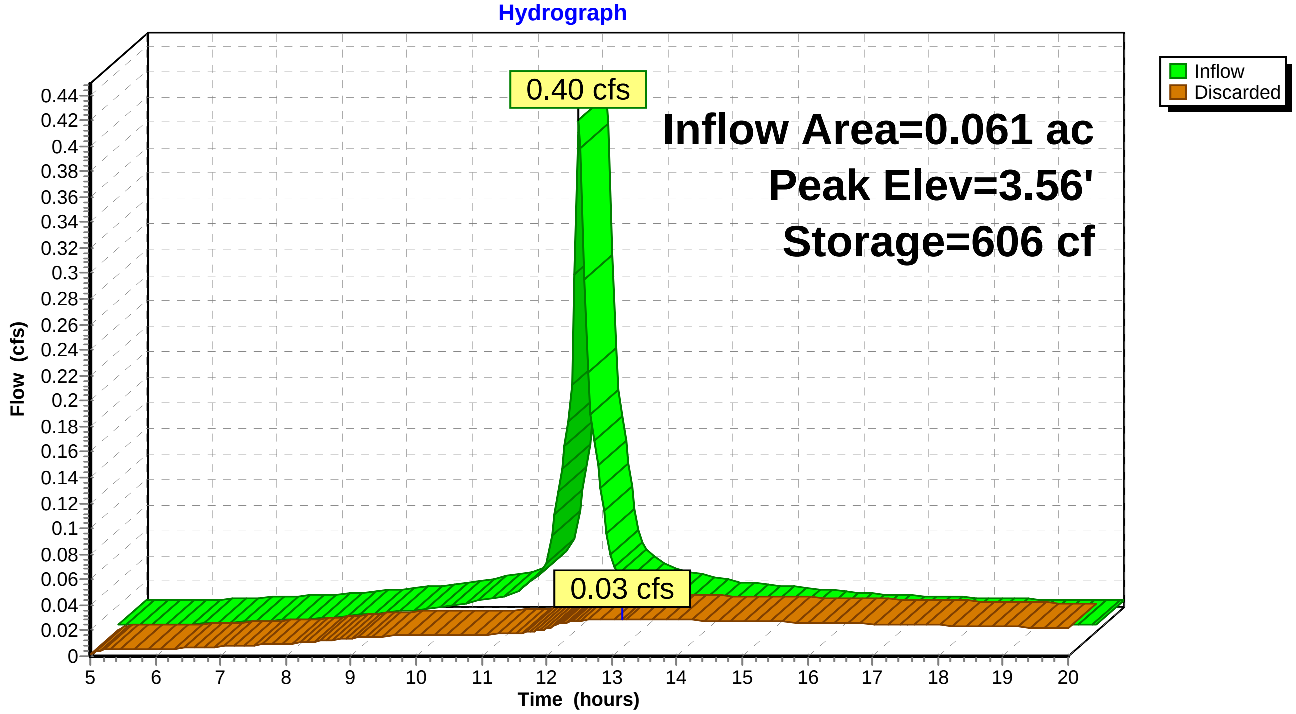
Chamber Storage + Stone Storage = 660.5 cf = 0.015 af
Overall Storage Efficiency = 58.4%

6 Chambers
41.9 cy Field
29.1 cy Stone





Pond 2P: 6 CULTEC R-330XL



Summary for Pond 3P: 9 CULTEC R-330XL

Inflow Area = 0.069 ac,100.00% Impervious, Inflow Depth > 5.97" for 100-Year event
Inflow = 0.46 cfs @ 12.07 hrs, Volume= 0.034 af
Outflow = 0.03 cfs @ 13.17 hrs, Volume= 0.029 af, Atten= 93%, Lag= 65.9 min
Discarded = 0.03 cfs @ 13.17 hrs, Volume= 0.029 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 2.45' @ 13.17 hrs Surf.Area= 392 sf Storage= 658 cf

Plug-Flow detention time= 154.9 min calculated for 0.029 af (83% of inflow)
Center-of-Mass det. time= 105.9 min (838.9 - 733.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	354 cf	**16.00'W x 24.50'L x 3.54'H Field A** 1,388 cf Overall - 503 cf Embedded = 885 cf x 40.0% Voids
#2A	0.50'	503 cf	**Cultec R-330XL** x 9 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 3 rows
		857 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.410 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.03 cfs @ 13.17 hrs HW=2.45' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Pond 3P: 9 CULTEC R-330XL - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 3 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

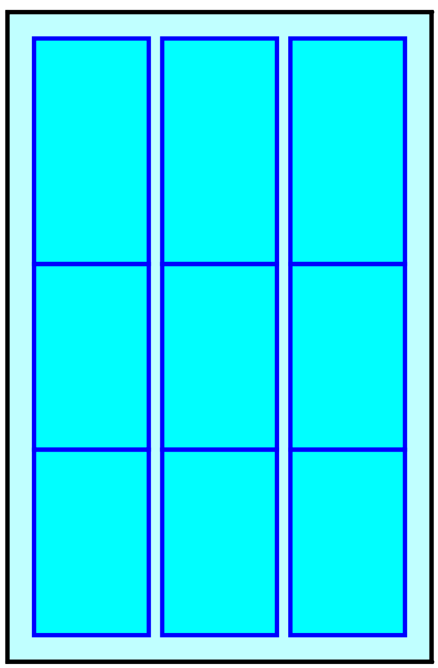
3 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 22.50' Row Length +12.0" End Stone x 2 = 24.50' Base Length
3 Rows x 52.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 16.00' Base Width
6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

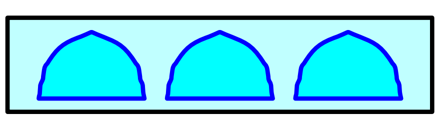
9 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 3 Rows = 502.9 cf Chamber Storage

1,388.3 cf Field - 502.9 cf Chambers = 885.4 cf Stone x 40.0% Voids = 354.2 cf Stone Storage

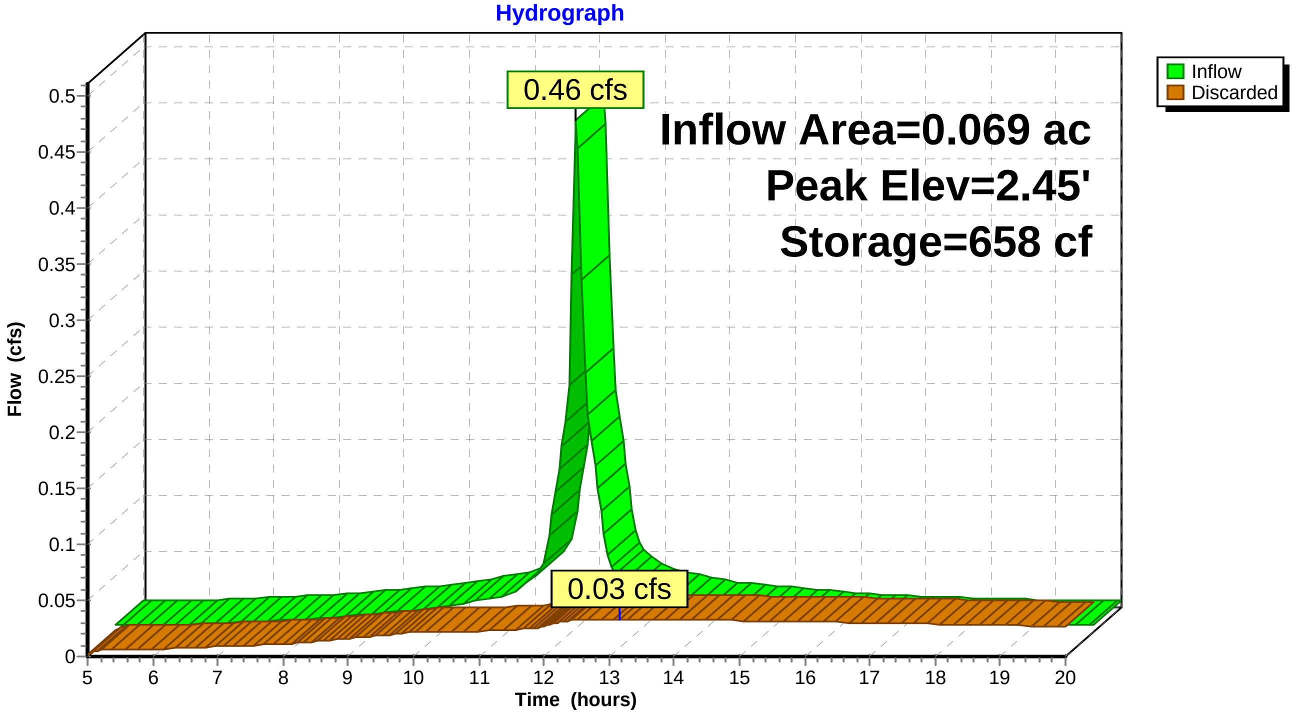
Chamber Storage + Stone Storage = 857.1 cf = 0.020 af
Overall Storage Efficiency = 61.7%

9 Chambers
51.4 cy Field
32.8 cy Stone





Pond 3P: 9 CULTEC R-330XL



Summary for Pond CECP: 45 - 330XL

Inflow Area = 0.394 ac,100.00% Impervious, Inflow Depth > 5.97" for 100-Year event
Inflow = 2.60 cfs @ 12.07 hrs, Volume= 0.196 af
Outflow = 0.14 cfs @ 13.89 hrs, Volume= 0.134 af, Atten= 95%, Lag= 109.1 min
Discarded = 0.14 cfs @ 13.89 hrs, Volume= 0.134 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 3.76' @ 13.89 hrs Surf.Area= 1,840 sf Storage= 4,212 cf

Plug-Flow detention time= 164.2 min calculated for 0.133 af (68% of inflow)
Center-of-Mass det. time= 94.2 min (827.1 - 733.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	2,013 cf	**27.67'W x 66.50'L x 4.04'H Field A** 7,436 cf Overall - 2,403 cf Embedded = 5,033 cf x 40.0% Voids
#2A	1.00'	2,403 cf	**Cultec R-330XL** x 45 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 5 rows
		4,416 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.410 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.14 cfs @ 13.89 hrs HW=3.76' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.14 cfs)

Pond CECP: 45 - 330XL - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 5 rows

52.0" Wide + 12.0" Spacing = 64.0" C-C Row Spacing

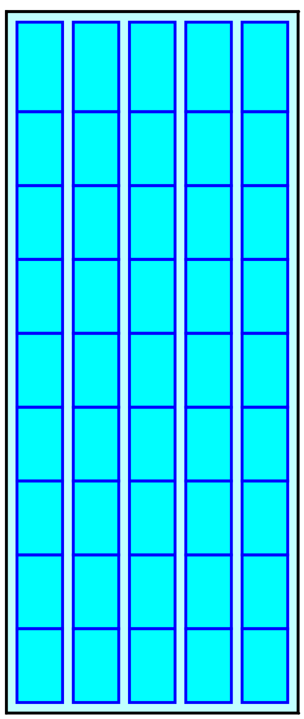
9 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 64.50' Row Length +12.0" End Stone x 2 = 66.50' Base Length
5 Rows x 52.0" Wide + 12.0" Spacing x 4 + 12.0" Side Stone x 2 = 27.67' Base Width
12.0" Base + 30.5" Chamber Height + 6.0" Cover = 4.04' Field Height

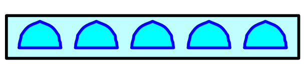
45 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 5 Rows = 2,402.9 cf Chamber Storage

7,436.0 cf Field - 2,402.9 cf Chambers = 5,033.0 cf Stone x 40.0% Voids = 2,013.2 cf Stone Storage

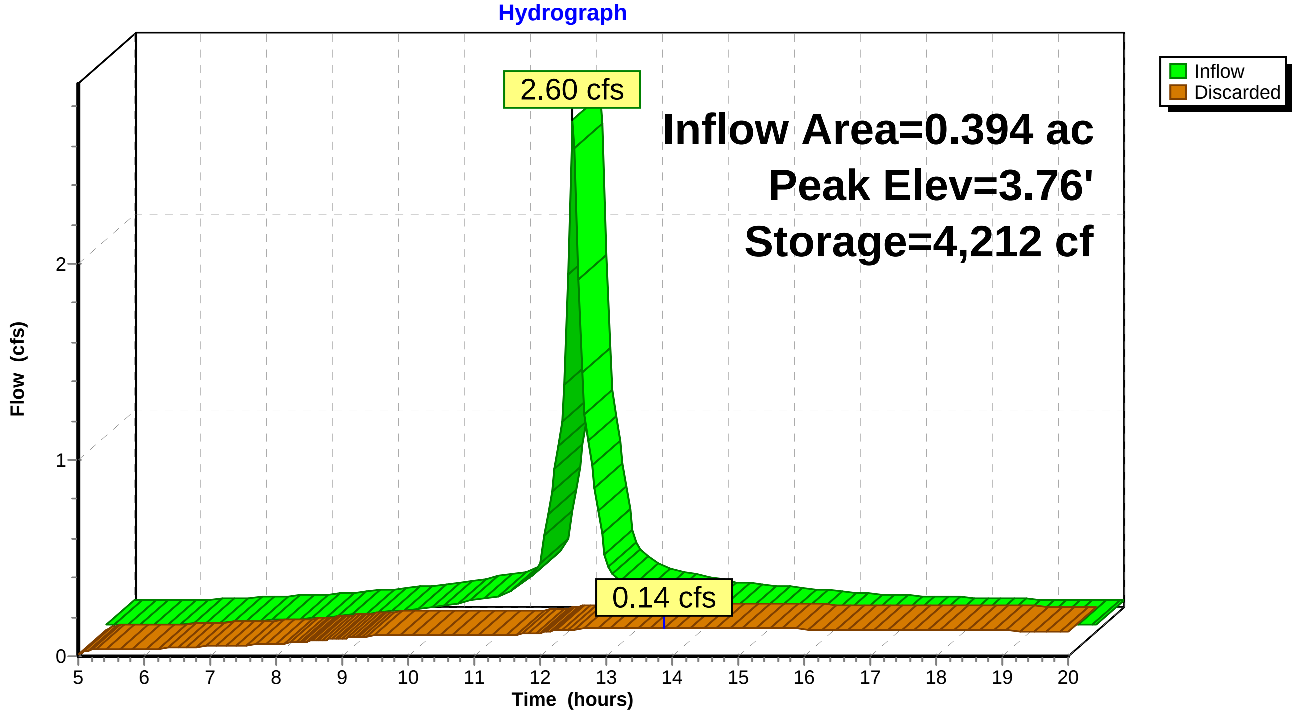
Chamber Storage + Stone Storage = 4,416.2 cf = 0.101 af
Overall Storage Efficiency = 59.4%

45 Chambers
275.4 cy Field
186.4 cy Stone





Pond CECP: 45 - 330XL



Summary for Pond CWCP: 100 - 330XL

Inflow Area = 0.826 ac,100.00% Impervious, Inflow Depth > 5.97" for 100-Year event
Inflow = 5.47 cfs @ 12.07 hrs, Volume= 0.411 af
Outflow = 0.27 cfs @ 14.08 hrs, Volume= 0.269 af, Atten= 95%, Lag= 120.6 min
Discarded = 0.27 cfs @ 14.08 hrs, Volume= 0.269 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 3.61' @ 14.08 hrs Surf.Area= 3,994 sf Storage= 8,956 cf

Plug-Flow detention time= 162.1 min calculated for 0.268 af (65% of inflow)
Center-of-Mass det. time= 88.8 min (821.7 - 733.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	4,325 cf	**54.33'W x 73.50'L x 4.04'H Field A**
			16,140 cf Overall - 5,327 cf Embedded = 10,813 cf x 40.0% Voids
#2A	1.00'	5,327 cf	**Cultec R-330XL** x 100 Inside #1
			Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
			Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
			Row Length Adjustment= +1.50' x 7.45 sf x 10 rows
		9,653 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.410 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.27 cfs @ 14.08 hrs HW=3.61' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.27 cfs)

Pond CWCP: 100 - 330XL - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 10 rows

52.0" Wide + 12.0" Spacing = 64.0" C-C Row Spacing

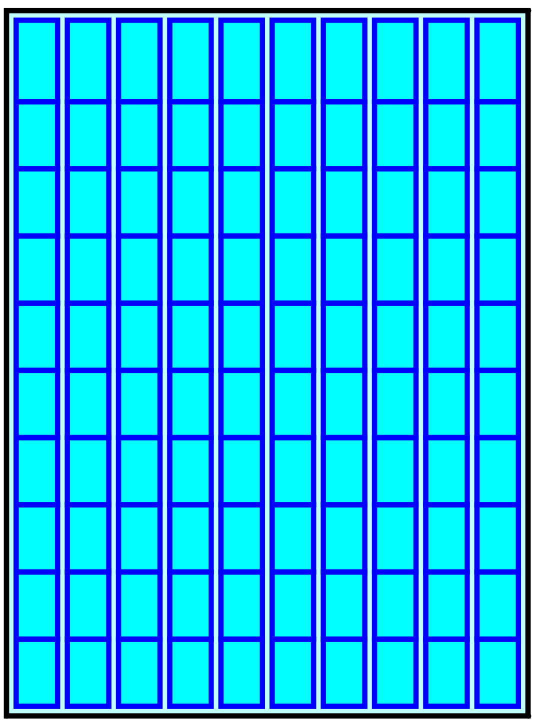
10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +12.0" End Stone x 2 = 73.50' Base Length
10 Rows x 52.0" Wide + 12.0" Spacing x 9 + 12.0" Side Stone x 2 = 54.33' Base Width
12.0" Base + 30.5" Chamber Height + 6.0" Cover = 4.04' Field Height

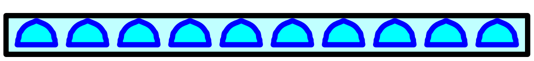
100 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 10 Rows = 5,327.5 cf Chamber Storage

16,140.4 cf Field - 5,327.5 cf Chambers = 10,812.9 cf Stone x 40.0% Voids = 4,325.2 cf Stone Storage

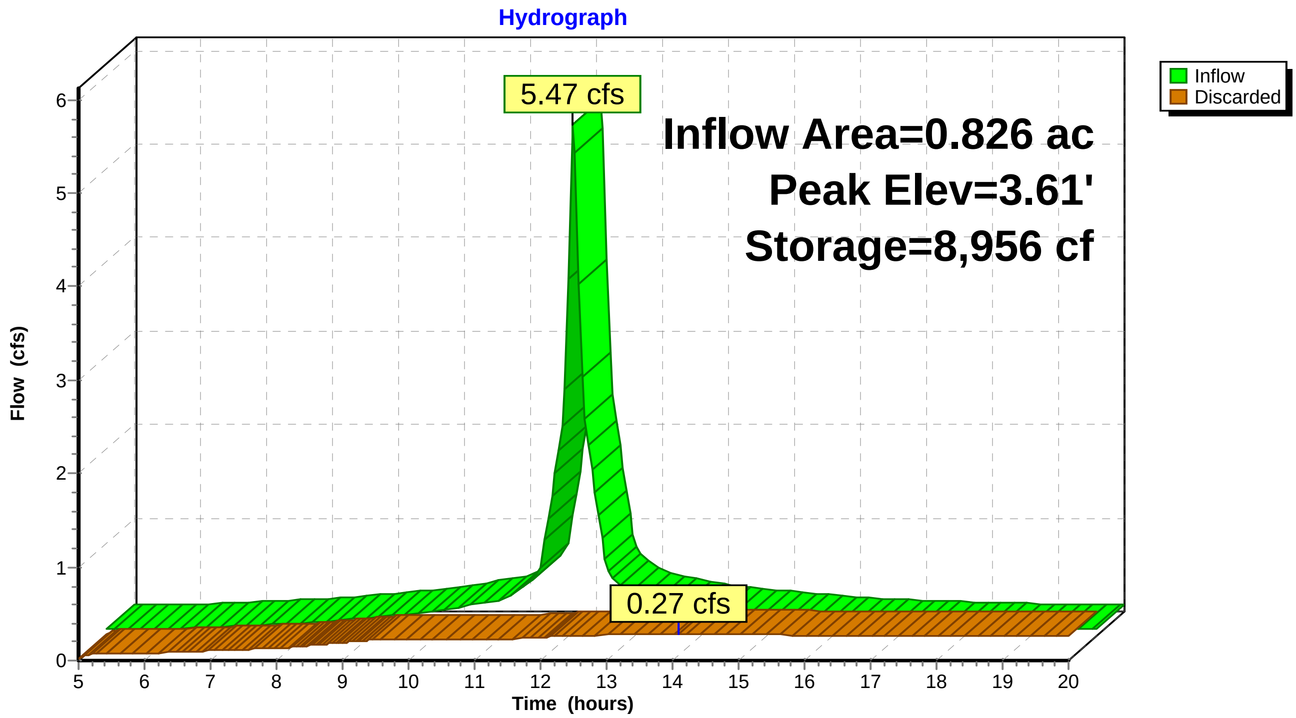
Chamber Storage + Stone Storage = 9,652.6 cf = 0.222 af
Overall Storage Efficiency = 59.8%

100 Chambers
597.8 cy Field
400.5 cy Stone





Pond CWCP: 100 - 330XL



Summary for Pond ILCP: 48 - 330XL

Inflow Area = 0.394 ac,100.00% Impervious, Inflow Depth > 5.97" for 100-Year event
Inflow = 2.60 cfs @ 12.07 hrs, Volume= 0.196 af
Outflow = 0.14 cfs @ 13.86 hrs, Volume= 0.137 af, Atten= 94%, Lag= 107.5 min
Discarded = 0.14 cfs @ 13.86 hrs, Volume= 0.137 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 3.32' @ 13.86 hrs Surf.Area= 1,964 sf Storage= 4,137 cf

Plug-Flow detention time= 163.6 min calculated for 0.137 af (70% of inflow)
Center-of-Mass det. time= 94.7 min (827.7 - 733.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	2,146 cf	**33.00'W x 59.50'L x 4.04'H Field A**
			7,936 cf Overall - 2,571 cf Embedded = 5,365 cf x 40.0% Voids
#2A	1.00'	2,571 cf	**Cultec R-330XL** x 48 Inside #1
			Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
			Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
			Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
		4,717 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.410 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.14 cfs @ 13.86 hrs HW=3.32' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.14 cfs)

Pond ILCP: 48 - 330XL - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 6 rows

52.0" Wide + 12.0" Spacing = 64.0" C-C Row Spacing

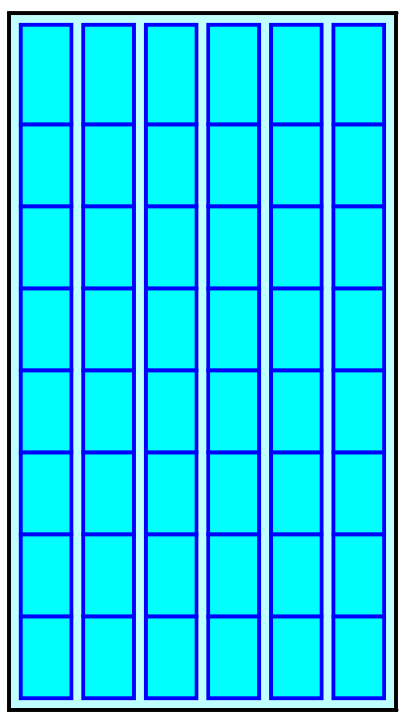
8 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 57.50' Row Length +12.0" End Stone x 2 = 59.50' Base Length
6 Rows x 52.0" Wide + 12.0" Spacing x 5 + 12.0" Side Stone x 2 = 33.00' Base Width
12.0" Base + 30.5" Chamber Height + 6.0" Cover = 4.04' Field Height

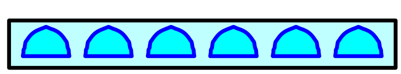
48 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 6 Rows = 2,570.6 cf Chamber Storage

7,935.8 cf Field - 2,570.6 cf Chambers = 5,365.2 cf Stone x 40.0% Voids = 2,146.1 cf Stone Storage

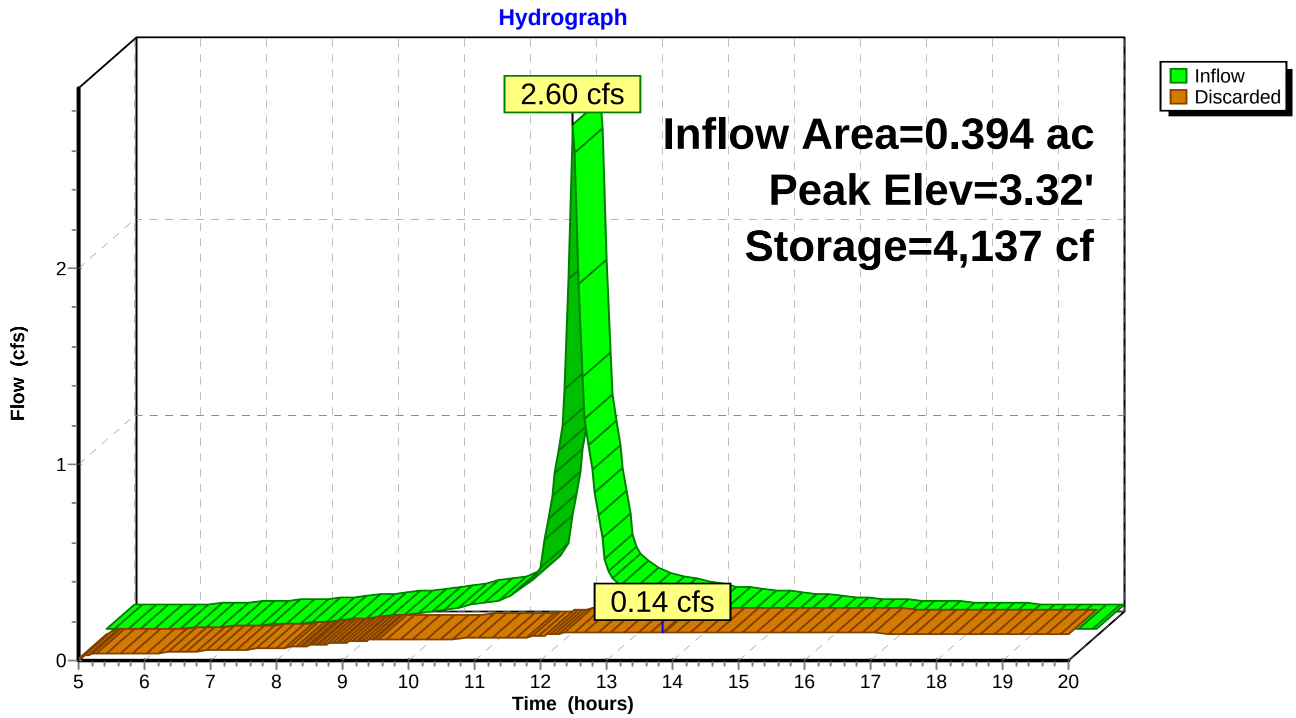
Chamber Storage + Stone Storage = 4,716.7 cf = 0.108 af
Overall Storage Efficiency = 59.4%

48 Chambers
293.9 cy Field
198.7 cy Stone





Pond ILCP: 48 - 330XL



Summary for Pond ILEP: 24 - 330XL

Inflow Area = 0.197 ac,100.00% Impervious, Inflow Depth > 5.97" for 100-Year event
Inflow = 1.30 cfs @ 12.07 hrs, Volume= 0.098 af
Outflow = 0.08 cfs @ 13.62 hrs, Volume= 0.074 af, Atten= 94%, Lag= 92.8 min
Discarded = 0.08 cfs @ 13.62 hrs, Volume= 0.074 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 3.02' @ 13.62 hrs Surf.Area= 1,040 sf Storage= 1,990 cf

Plug-Flow detention time= 162.3 min calculated for 0.074 af (75% of inflow)
Center-of-Mass det. time= 100.2 min (833.2 - 733.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	1,153 cf	**33.00'W x 31.50'L x 4.04'H Field A** 4,201 cf Overall - 1,319 cf Embedded = 2,882 cf x 40.0% Voids
#2A	1.00'	1,319 cf	**Cultec R-330XL** x 24 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
		2,472 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.410 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.08 cfs @ 13.62 hrs HW=3.02' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Pond ILEP: 24 - 330XL - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 6 rows

52.0" Wide + 12.0" Spacing = 64.0" C-C Row Spacing

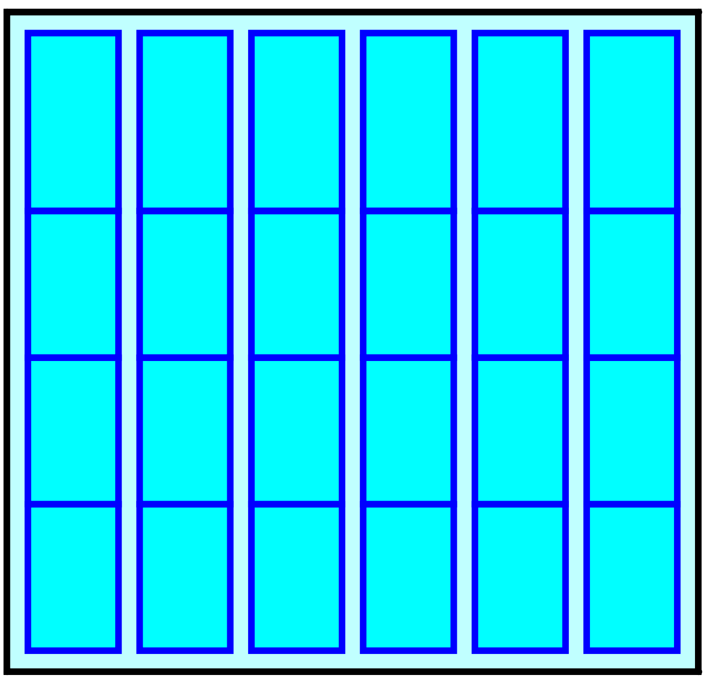
4 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 29.50' Row Length +12.0" End Stone x 2 = 31.50' Base Length
6 Rows x 52.0" Wide + 12.0" Spacing x 5 + 12.0" Side Stone x 2 = 33.00' Base Width
12.0" Base + 30.5" Chamber Height + 6.0" Cover = 4.04' Field Height

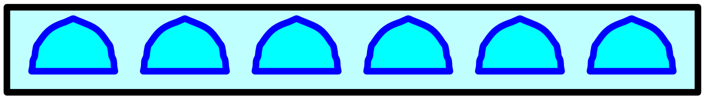
24 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 6 Rows = 1,318.8 cf Chamber Storage

4,201.3 cf Field - 1,318.8 cf Chambers = 2,882.5 cf Stone x 40.0% Voids = 1,153.0 cf Stone Storage

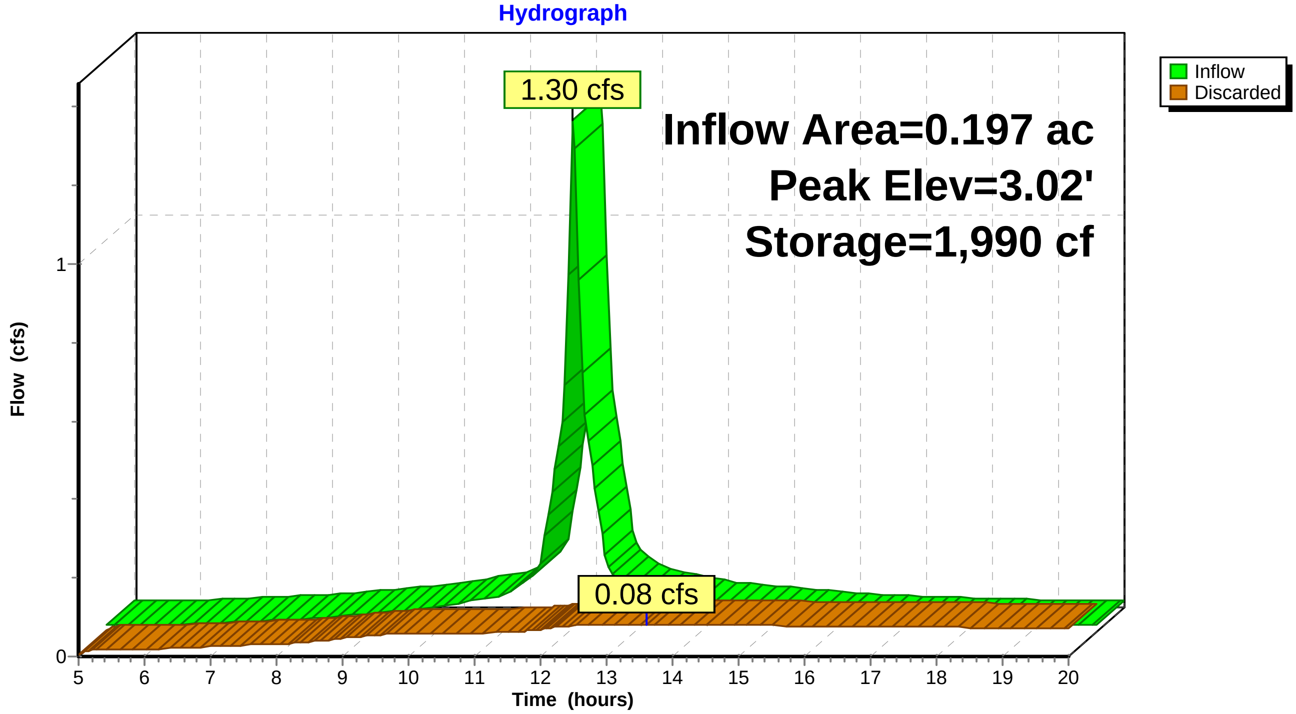
Chamber Storage + Stone Storage = 2,471.8 cf = 0.057 af
Overall Storage Efficiency = 58.8%

24 Chambers
155.6 cy Field
106.8 cy Stone





Pond ILEP: 24 - 330XL



Summary for Pond ILWP: 48 - 330XL

Inflow Area = 0.390 ac,100.00% Impervious, Inflow Depth > 5.97" for 100-Year event
Inflow = 2.58 cfs @ 12.07 hrs, Volume= 0.194 af
Outflow = 0.14 cfs @ 13.85 hrs, Volume= 0.137 af, Atten= 94%, Lag= 106.8 min
Discarded = 0.14 cfs @ 13.85 hrs, Volume= 0.137 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 3.27' @ 13.85 hrs Surf.Area= 1,964 sf Storage= 4,087 cf

Plug-Flow detention time= 162.5 min calculated for 0.136 af (70% of inflow)
Center-of-Mass det. time= 95.0 min (828.0 - 733.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	2,146 cf	**33.00'W x 59.50'L x 4.04'H Field A** 7,936 cf Overall - 2,571 cf Embedded = 5,365 cf x 40.0% Voids
#2A	1.00'	2,571 cf	**Cultec R-330XL** x 48 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
		4,717 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.410 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.14 cfs @ 13.85 hrs HW=3.27' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.14 cfs)

Pond ILWP: 48 - 330XL - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 6 rows

52.0" Wide + 12.0" Spacing = 64.0" C-C Row Spacing

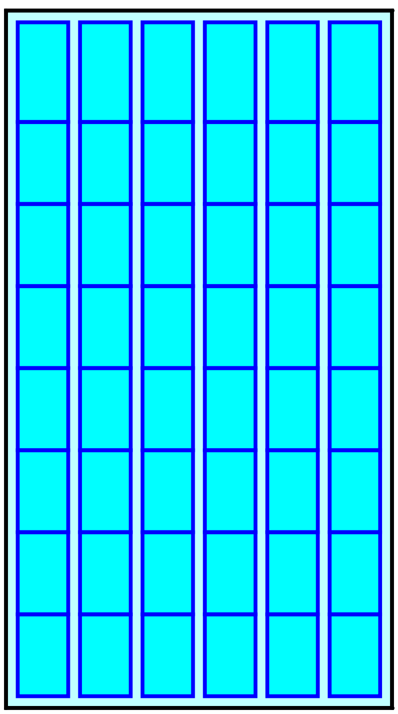
8 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 57.50' Row Length +12.0" End Stone x 2 = 59.50' Base Length
6 Rows x 52.0" Wide + 12.0" Spacing x 5 + 12.0" Side Stone x 2 = 33.00' Base Width
12.0" Base + 30.5" Chamber Height + 6.0" Cover = 4.04' Field Height

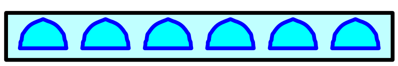
48 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 6 Rows = 2,570.6 cf Chamber Storage

7,935.8 cf Field - 2,570.6 cf Chambers = 5,365.2 cf Stone x 40.0% Voids = 2,146.1 cf Stone Storage

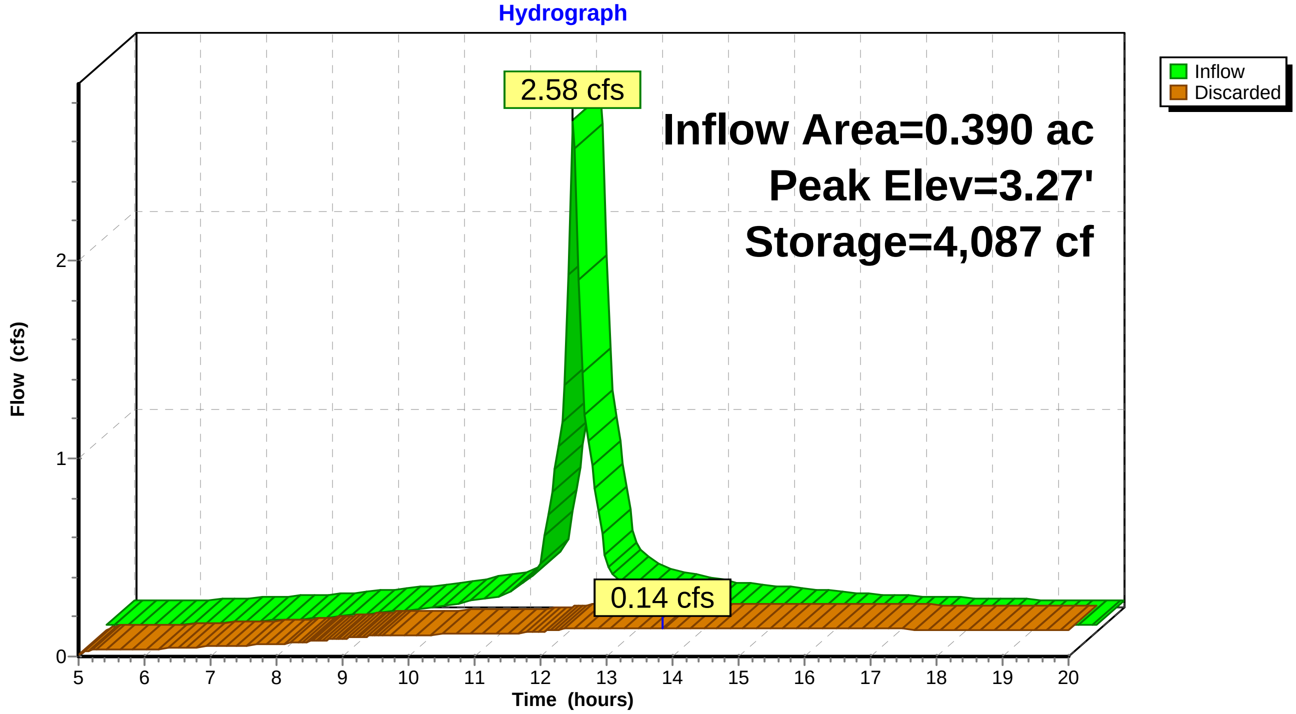
Chamber Storage + Stone Storage = 4,716.7 cf = 0.108 af
Overall Storage Efficiency = 59.4%

48 Chambers
293.9 cy Field
198.7 cy Stone





Pond ILWP: 48 - 330XL



Summary for Pond MBP: 15 330XL

Inflow Area = 0.146 ac,100.00% Impervious, Inflow Depth > 5.97" for 100-Year event
Inflow = 0.97 cfs @ 12.07 hrs, Volume= 0.073 af
Outflow = 0.06 cfs @ 13.54 hrs, Volume= 0.053 af, Atten= 94%, Lag= 88.4 min
Discarded = 0.06 cfs @ 13.54 hrs, Volume= 0.053 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 3.96' @ 13.54 hrs Surf.Area= 655 sf Storage= 1,526 cf

Plug-Flow detention time= 165.3 min calculated for 0.053 af (73% of inflow)
Center-of-Mass det. time= 101.4 min (834.3 - 733.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	732 cf	**17.00'W x 38.50'L x 4.04'H Field A**
			2,645 cf Overall - 816 cf Embedded = 1,829 cf x 40.0% Voids
#2A	1.00'	816 cf	**Cultec R-330XL** x 15 Inside #1
			Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
			Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
			Row Length Adjustment= +1.50' x 7.45 sf x 3 rows
		1,548 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.410 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.06 cfs @ 13.54 hrs HW=3.96' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Pond MBP: 15 330XL - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 3 rows

52.0" Wide + 12.0" Spacing = 64.0" C-C Row Spacing

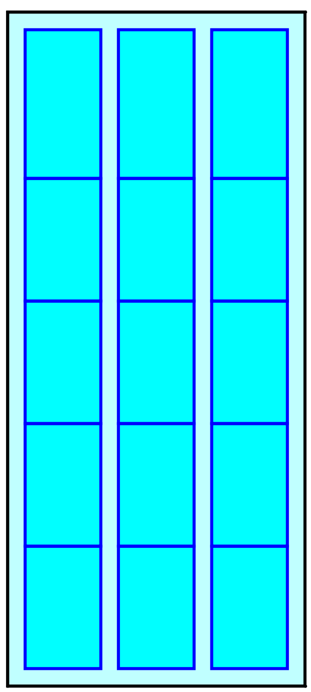
5 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 36.50' Row Length +12.0" End Stone x 2 = 38.50' Base Length
3 Rows x 52.0" Wide + 12.0" Spacing x 2 + 12.0" Side Stone x 2 = 17.00' Base Width
12.0" Base + 30.5" Chamber Height + 6.0" Cover = 4.04' Field Height

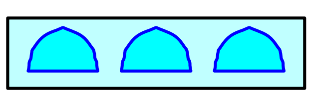
15 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 3 Rows = 815.9 cf Chamber Storage

2,645.3 cf Field - 815.9 cf Chambers = 1,829.4 cf Stone x 40.0% Voids = 731.8 cf Stone Storage

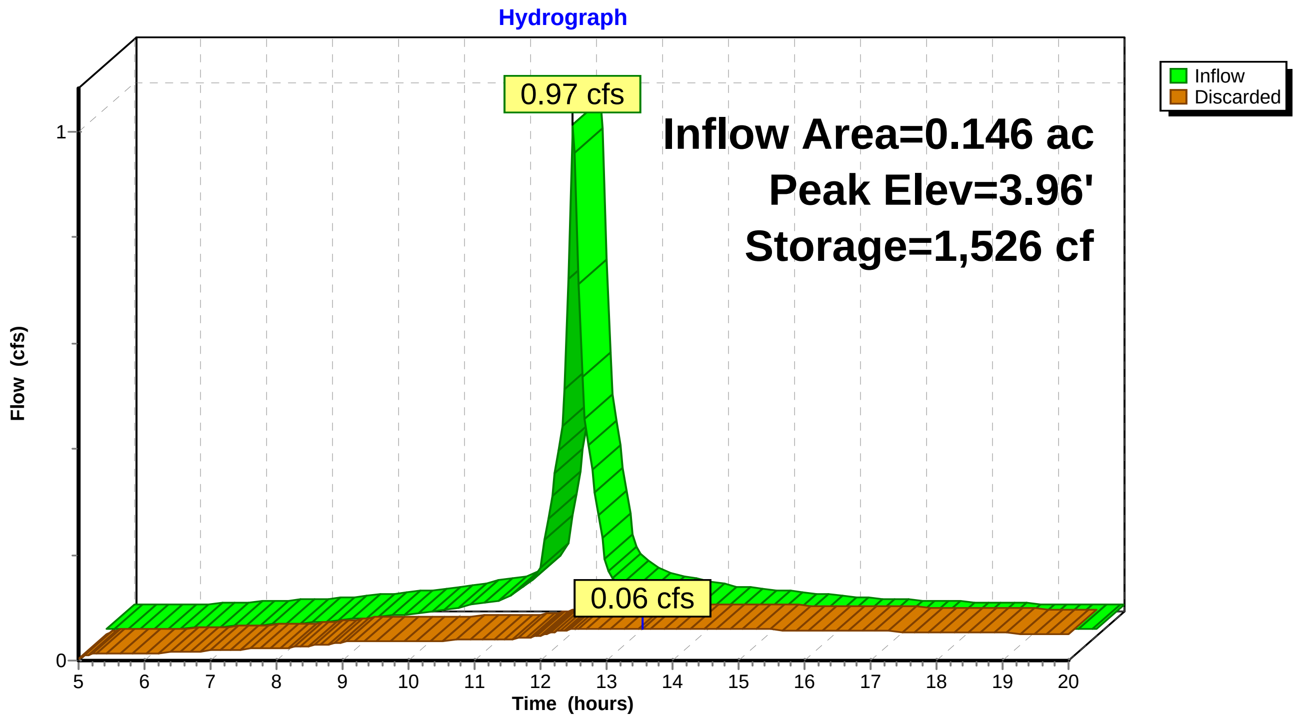
Chamber Storage + Stone Storage = 1,547.6 cf = 0.036 af
Overall Storage Efficiency = 58.5%

15 Chambers
98.0 cy Field
67.8 cy Stone





Pond MBP: 15 330XL



Summary for Pond NCP: 90 - 330XL

Inflow Area = 0.729 ac,100.00% Impervious, Inflow Depth > 5.97" for 100-Year event
Inflow = 4.82 cfs @ 12.07 hrs, Volume= 0.362 af
Outflow = 0.25 cfs @ 14.05 hrs, Volume= 0.240 af, Atten= 95%, Lag= 118.6 min
Discarded = 0.25 cfs @ 14.05 hrs, Volume= 0.240 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 3.54' @ 14.05 hrs Surf.Area= 3,550 sf Storage= 7,859 cf

Plug-Flow detention time= 162.2 min calculated for 0.239 af (66% of inflow)
Center-of-Mass det. time= 89.6 min (822.6 - 733.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	3,854 cf	**59.67'W x 59.50'L x 4.04'H Field A** 14,349 cf Overall - 4,713 cf Embedded = 9,636 cf x 40.0% Voids
#2A	1.00'	4,713 cf	**Cultec R-330XL** x 88 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 11 rows
		8,567 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.410 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.25 cfs @ 14.05 hrs HW=3.54' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.25 cfs)

Pond NCP: 90 - 330XL - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 11 rows

52.0" Wide + 12.0" Spacing = 64.0" C-C Row Spacing

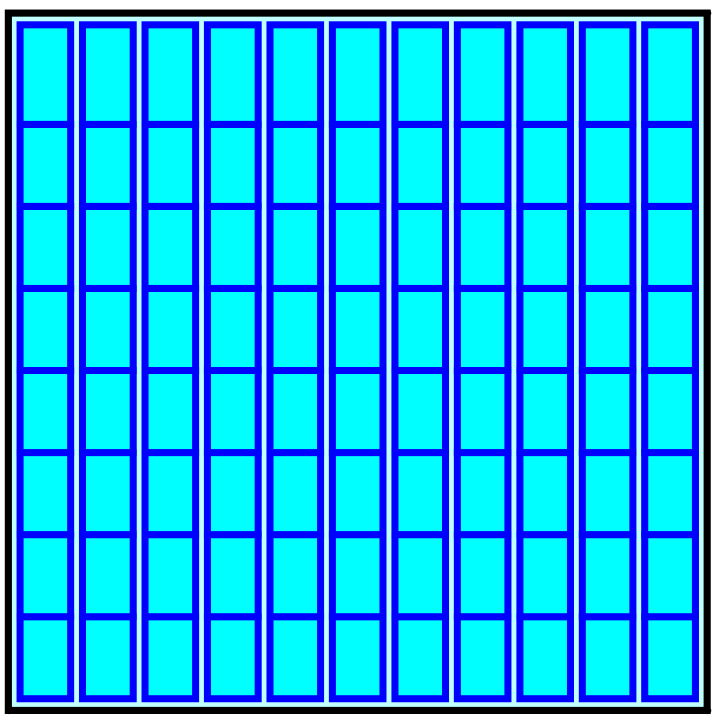
8 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 57.50' Row Length +12.0" End Stone x 2 = 59.50' Base Length
11 Rows x 52.0" Wide + 12.0" Spacing x 10 + 12.0" Side Stone x 2 = 59.67' Base Width
12.0" Base + 30.5" Chamber Height + 6.0" Cover = 4.04' Field Height

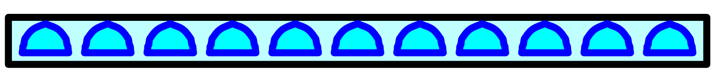
88 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 11 Rows = 4,712.8 cf Chamber Storage

14,348.6 cf Field - 4,712.8 cf Chambers = 9,635.8 cf Stone x 40.0% Voids = 3,854.3 cf Stone Storage

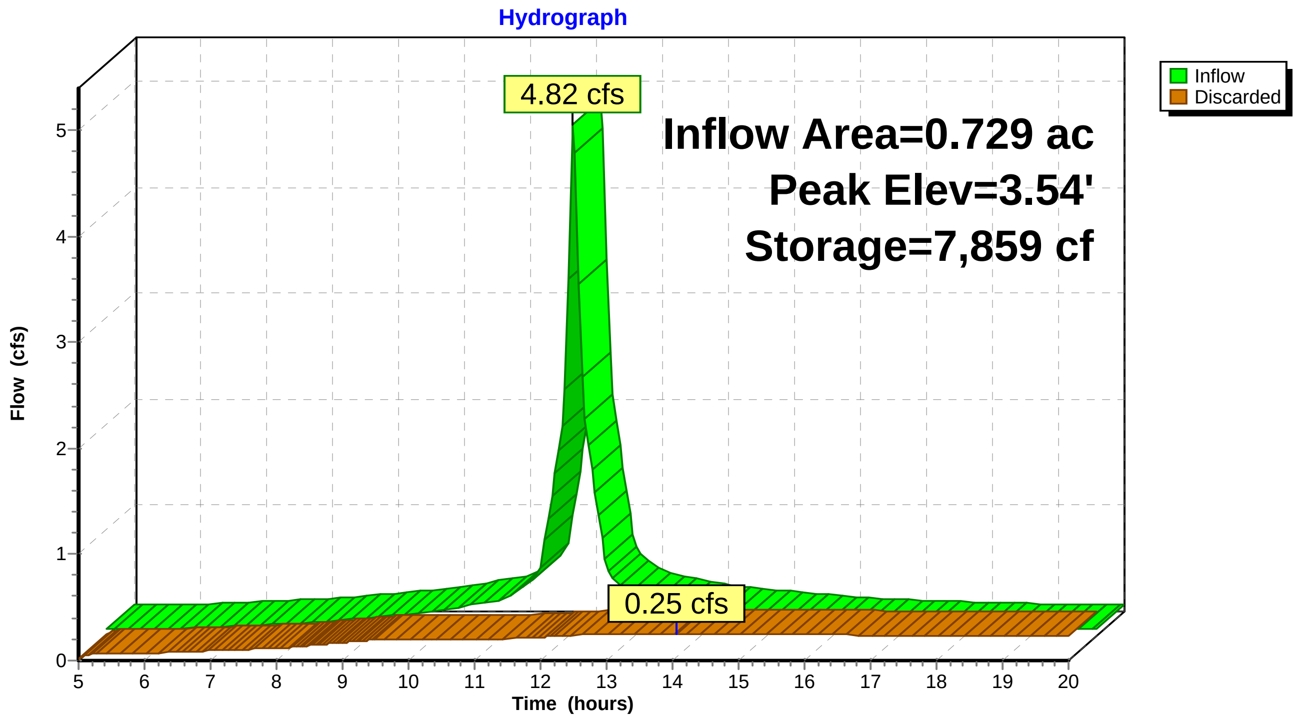
Chamber Storage + Stone Storage = 8,567.1 cf = 0.197 af
Overall Storage Efficiency = 59.7%

88 Chambers
531.4 cy Field
356.9 cy Stone





Pond NCP: 90 - 330XL



Project Number:	8548.0	**Date:**	June 10, 2015
Project Name:	Salmon Health ARCPUD	**Calculations by:**	JEN
Project Address:	Village Street, Medway, MA	**Calculations date:**	June 10, 2015
Client:	Continuing Care Management	**Checked by:**	TLD
Location:	Westborough, MA	**Checked Date:**	June 11, 2015

STORMWATER MANAGEMENT STANDARD 2 - PEAK RATE OF RUNOFF

Offsite West

DESIGN STORM (YEAR)	EXISTING PEAK RUNOFF (CFS)	PROPOSEDPEAK RUNOFF (CFS)	REDUCTION IN PEAK RUNOFF
2	0.46	0.4	13.0%
10	1.51	1.12	25.8%
20	2.18	1.57	28.0%
100	3.29	2.29	30.4%

Charles River

DESIGN STORM (YEAR)	EXISTING PEAK RUNOFF (CFS)	PROPOSEDPEAK RUNOFF (CFS)	REDUCTION IN PEAK RUNOFF
2	27.64	25.59	7.4%
10	65.88	56.82	13.8%
25	88.84	87.02	2.0%
100	125.32	122.95	1.9%

Project Number:	8548	**Date:**	June 10, 2015
Project Name:	Salmon Health ARCPUD	**Calculations by:**	JEN
Project Address:	Village Street, Medway, MA	**Calculations date:**	June 10, 2015
Client:	Continuing Care Management	**Checked by:**	TLD
Location:	Westborough, MA	**Checked Date:**	June 11, 2015

STORMWATER MANAGEMENT STANDARD 3 - RECHARGE VOLUME

	HYDROLOGIC SOIL GROUP				TOTAL
	A	B	C	D	
IMPERVIOUS AREA (S.F.)	57,688	301,626	50,370	114,789	524,473
INCHES OF RUNOFF TO BE RECHARGED	0.60	0.35	0.25	0.10	
REQUIRED RECHARGE VOLUME (FT^3)	2,884	8,797	1,049	957	**13,688**

CAPTURE AREA ADJUSTMENT - ADJUSTED MINIMUM REQUIRED RECHARGE VOLUME

MINIMUM OF 65% OF IMPERVIOUS AREA MUST BE DIRECTED TO THE RECHARGE BMP; 65 % IS =	340,907	SF		
IMPERVIOUS SITE AREA DRAINING TO BMP =	524,473	SF	100.0%	PERCENTAGE OF IMPERVIOUS AREA DIVERTED TO INFILTRATION FACILITY
RATIO OF TOTAL IMPERVIOUS AREA TO IMPERVIOUS AREA DRAINING TO RECHARGE BMP =	1.00		= $\frac{\text{TOTAL IMPERVIOUS AREA}}{\text{IMPERVIOUS AREA DRAINING TO THE RECHARGE AREA}}$	
ADJUSTED REQUIRED RECHARGE VOLUME=	**13,688**	CF	= RATIO OF IMPERVIOUS AREA x REQUIRED RECHARGE VOLUME	
PROPOSED RECHARGE VOLUME	**121,661**	CF	TOTAL AVAILABLE RECHARGE VOLUME	

SIMPLE DYNAMIC METHOD TO ESTIMATE STORAGE AREA VOLUME FOR RECHARGE

BOTTOM AREA FOR PROPOSED RECHARGE STRUCTURE

A = REQUIRED BOTTOM AREA OF PROPOSED LEACHING STRUCTURE

Rv = REQUIRED RECHARGE VOLUME =	13,688	CU. FT.
D = DEPTH OF INFILTRATION FACILITY =	4.04	FEET
K= SATURATED HYDRAULIC CONDUCTIVITY (RAWLS RATE) = VALUE IS BASED ON C HYDRAULIC SOIL GROUP	1	INCHES/HOUR
T = ALLOWABLE DRAWDOWN DURING PEAK (USE 2 HRS) =	2	HRS

$$A = \frac{Rv}{(D+KT)} = \textbf{3,254} \text{ SQUARE FEET}$$

REQUIRED STORAGE VOLUME

V=A x D = **13,145** CU FT REQUIRED STORAGE VOLUME

PROPOSED STORAGE VOLUME

A = PROPOSED BOTTOM AREA OF PROPOSED LEACHING STRUCTURE = 3,308 SQ. FT.
D = DEPTH OF INFILTRATION FACILITY = 4.04 FEET

V=A x D = **13,362** CU FT PROPOSED STORAGE VOLUME

CHECK DRAWDOWN IN 72 HOURS

DRAWDOWN TIME $T = \frac{Rv}{K \times A}$ = **49.7** HOURS TO EMPTY THE RECHARGE BMP

<72 HOURS, SO DRAWDOWN IS OK

Project Number:	8548.0	**Date:**	June 10, 2015
Project Name:	Salmon Health ARCPUD	**Calculations by:**	JEN
Project Address:	Village Street, Medway, MA	**Calculations date:**	June 10, 2015
Client:	Continuing Care Management	**Checked by:**	TLD
Location:	Westborough, MA	**Checked Date:**	June 11, 2015

STORMWATER MANAGEMENT STANDARD 4 - WATER QUALITY VOLUME

	DEPTH TO TREAT (IN.)	IMPERVIOUS AREA (SF)	WATER VOLUME (CF)
WATER QUALITY VOLUME	0.5	524,473	21,853
NET WATER QUALITY VOLUME			**21,853**

Project Number: 8548.0
Client: Continuing Care Management
Project Name: Salmon Health ARCPUD
Project Address: Village Street
Location: Medway, MA

Calculations by: DJD
Calculations Date: 06/10/15
Checked By: JEN
Checked Date: 06/10/15

WILLOW POND CIRCLE -25 YEAR STORM- CLOSED SYSTEM PIPE SIZING

WATERSHED CHARACTERISTICS												PIPE CHARACTERISTICS											FLOW CHARACTERISTICS			
LOCATION				LAND USE			FLOW TIME			FLOW		R = hydraulic radius = area/wetted perimeter														Tc
Description	Cover	Increm. (ACRE)	Total_A (ACRE)	C	CA	Total CA	To Inlet (MIN)	In Pipe (MIN)	Tc (MIN)	I (IPH)	Q (CFS)	Structure	Invert	Pipe	Size (IN)	Length (FT)	Area (SF)	R (FT)	Slope	n	Qf (CFS)	Vf (FT/S)	Q/Qf	V/Vf	V (FT/S)	L/V (MIN)
WS CB-1	LANDSCAPED	0.096		0.400								From: CB-1	Out:													
	IMPERVIOUS	0.123		0.850										HDPE	12	20	0.79	0.250	0.005	0.013	**2.52**	**3.21**	0.37	0.79	2.52	0.13
			0.219	0.653	0.143		5.00	NONE	5.00	6.57	**0.94**	To: DMH-1	In:													
WS CB-2	LANDSCAPED	0.100		0.400								From: CB-2	Out:													
	IMPERVIOUS	0.065		0.850										HDPE	12	23	0.79	0.250	0.005	0.013	**2.52**	**3.21**	0.25	0.70	2.24	0.17
			0.165	0.577	0.095		5.00	NONE	5.00	6.57	**0.63**	To: DMH-1	In:													
DMH-1 TO	**DMH-2**					0.238	5.00	0.13	5.13	6.55	**1.56**	From: DMH-1	Out:													
														HDPE	12	70	0.79	0.250	0.005	0.013	**2.52**	**3.21**	**0.62**	**0.91**	**2.92**	**0.40**
												To: DMH-2	In:													
WS CB-3	LANDSCAPED	0.037		0.400								From: CB-3	Out:													
	IMPERVIOUS	0.078		0.850										HDPE	12	21	0.79	0.250	0.010	0.013	**3.56**	**4.54**	0.15	0.60	2.74	0.13
			0.115	0.705	0.081		5.00	NONE	5.00	6.57	**0.53**	To: DMH-2	In:													
DMH-2 TO	**DMH-3**					0.319	5.13	0.40	5.53	6.47	**2.07**	From: DMH-2	Out:													
														HDPE	12	55	0.79	0.250	0.005	0.013	**2.52**	**3.21**	**0.82**	**0.99**	**3.17**	**0.29**
												To: DMH-3	In:													
DMH-3 TO	**DMH-4**					0.319	5.53	0.29	5.82	6.42	2.05	From: DMH-3	Out:													
														HDPE	12	36	0.79	0.25	0.005	0.013	2.52	3.21	0.81	0.99	3.16	0.19
												To: DMH-4	In:													
WS CB-4	LANDSCAPED	0.005		0.400								From: CB-4	Out:													
	IMPERVIOUS	0.129		0.850										HDPE	12	25	0.79	0.250	0.010	0.013	**3.56**	**4.54**	0.21	0.66	3.00	0.14
			0.134	0.833	0.112		5.00	NONE	5.00	6.57	**0.73**	To: DMH-4	In:													
WS CB-5	LANDSCAPED	0.011		0.400								From: CB-5	Out:													
	IMPERVIOUS	0.074		0.850										HDPE	12	25	0.79	0.250	0.010	0.013	**3.56**	**4.54**	0.12	0.57	2.59	0.16
			0.085	0.792	0.067		5.00	NONE	5.00	6.57	**0.44**	To: DMH-4	In:													
DMH-4 TO	**CHAMBER-1**					0.498	5.82	0.14	5.96	6.40	**3.19**	From: DMH-4	Out:													
														HDPE	18	4	1.77	0.375	0.005	0.013	**7.43**	**4.20**	**0.43**	**0.82**	**3.44**	**0.02**
												To: CHAMBER-1	In:													

CONECO Engineers & Scientists

Project Number: 8548.0
Client: Continuing Care Management
Project Name: Salmon Health ARCPUD
Project Address: Village Street
Location: Medway, MA

Calculations by: DJD
Calculations Date: 06/10/15
Checked By: JEN
Checked Date: 06/10/15

WILLOW POND CIRCLE -25 YEAR STORM- CLOSED SYSTEM PIPE SIZING

WATERSHED CHARACTERISTICS												PIPE CHARACTERISTICS											FLOW CHARACTERISTICS			
LOCATION				LAND USE			FLOW TIME			FLOW		R = hydraulic radius = area/wetted perimeter														Tc
Description	Cover	Increm. (ACRE)	Total_A (ACRE)	C	CA	Total CA	To Inlet (MIN)	In Pipe (MIN)	Tc (MIN)	I (IPH)	Q (CFS)	Structure	Invert	Pipe	Size (IN)	Length (FT)	Area (SF)	R (FT)	Slope	n	Qf (CFS)	Vf (FT/S)	Q/Qf	V/Vf	V (FT/S)	L/V (MIN)
WS CB-8	LANDSCAPED	0.086		0.400								From: CB-8	Out:													
	IMPERVIOUS	0.110		0.850										HDPE	12	16	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.17	0.62	4.00	0.07
			0.196	0.653	0.128		5.00	NONE	5.00	6.57	**0.84**	To: DMH-11	In:													
WS CB-9	LANDSCAPED	0.069		0.400								From: CB-9	Out:													
	IMPERVIOUS	0.153		0.850										HDPE	12	19	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.21	0.66	4.25	0.07
			0.222	0.710	0.158		5.00	NONE	5.00	6.57	**1.04**	To: DMH-11	In:													
DMH-11 TO	**DMH-10**					0.286	5.00	0.07	5.07	6.56	**1.87**	From: DMH-11	Out:													
														HDPE	12	90	0.79	0.250	0.005	0.013	**2.52**	**3.21**	**0.74**	**0.96**	**3.08**	**0.49**
												To: DMH-10	In:													
DMH-10 TO	**DMH-9**					0.286	5.07	0.49	5.56	6.47	**1.85**	From: DMH-10	Out:													
														HDPE	12	129	0.79	0.250	0.005	0.013	**2.52**	**3.21**	**0.73**	**0.96**	**3.07**	**0.70**
												To: DMH-9	In:													
DMH-9 TO	**DMH-8**					0.286	5.56	0.70	6.26	6.34	1.81	From: DMH-9	Out:													
														HDPE	12	78	0.79	0.25	0.005	0.013	2.52	3.21	0.72	0.95	3.05	0.43
												To: DMH-8	In:													
DMH-8 TO	**DMH-5**					0.286	6.26	0.43	6.69	6.27	1.79	From: DMH-8	Out:													
														HDPE	12	97	0.79	0.25	0.005	0.013	2.52	3.21	0.71	0.95	3.04	0.53
												To: DMH-5	In:													

CONECO
Engineers & Scientists

Project Number: 8548.0
Client: Continuing Care Management
Project Name: Salmon Health ARCPUD
Project Address: Village Street
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Calculations by: DJD
Calculations Date: 06/10/15
Checked By: JEN
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WILLOW POND CIRCLE -25 YEAR STORM- CLOSED SYSTEM PIPE SIZING

WATERSHED CHARACTERISTICS												PIPE CHARACTERISTICS											FLOW CHARACTERISTICS			
LOCATION				LAND USE			FLOW TIME			FLOW		R = hydraulic radius = area/wetted perimeter														Tc
Description	Cover	Increm. (ACRE)	Total_A (ACRE)	C	CA	Total CA	To Inlet (MIN)	In Pipe (MIN)	Tc (MIN)	I (IPH)	Q (CFS)	Structure	Invert	Pipe	Size (IN)	Length (FT)	Area (SF)	R (FT)	Slope	n	Qf (CFS)	Vf (FT/S)	Q/Qf	V/Vf	V (FT/S)	L/V (MIN)
WS CB-6	LANDSCAPED	0.117		0.400								From: CB-6	Out:													
	IMPERVIOUS	0.224		0.850										HDPE	12	13	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.31	0.75	4.78	0.05
			0.341	0.696	0.237		5.00	NONE	5.00	6.57	**1.56**	To: DMH-5	In:													
WS CB-7	LANDSCAPED	0.162		0.400								From: CB-7	Out:													
	IMPERVIOUS	0.346		0.850										HDPE	12	6	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.47	0.84	5.39	0.02
			0.508	0.706	0.359		5.00	NONE	5.00	6.57	**2.36**	To: DMH-5	In:													
DMH-5 TO DMH-6						0.882	6.69	0.53	7.22	6.18	**5.45**	From: DMH-5	Out:													
														HDPE	18	66	1.77	0.375	0.005	0.013	**7.43**	**4.20**	**0.73**	**0.96**	**4.02**	**0.27**
												To: DMH-6	In:													
DMH-6 TO DMH-7						0.882	7.22	0.27	7.49	6.13	5.41	From: DMH-6	Out:													
														HDPE	18	27	1.77	0.375	0.005	0.013	7.43	4.20	0.73	0.95	4.01	0.11
												To: DMH-7	In:													
DMH-7 TO STC-2						0.882	7.49	0.11	7.60	6.12	5.39	From: DMH-7	Out:													
														HDPE	18	42	1.77	0.375	0.005	0.013	7.43	4.20	0.73	0.95	4.01	0.17
												To: STC-2	In:													
STC-2 TO FES-1						0.882	7.60	0.17	7.78	6.09	5.37	From: STC-2	Out:													
														HDPE	18	17	1.77	0.375	0.005	0.013	7.43	4.20	0.72	0.95	4.01	0.07
												To: FES-1	In:													

Project Number: 8548.0
Client: Continuing Care Management
Project Name: Salmon Health ARCPUD
Project Address: Village Street
Location: Medway, MA

Calculations by: DJD
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Checked By: JEN
Checked Date: 06/10/15

CONECO Engineers & Scientists

WILLOW POND CIRCLE -25 YEAR STORM- CLOSED SYSTEM PIPE SIZING

WATERSHED CHARACTERISTICS												PIPE CHARACTERISTICS											FLOW CHARACTERISTICS			
LOCATION				LAND USE			FLOW TIME			FLOW		R = hydraulic radius = area/wetted perimeter														Tc
Description	Cover	Increm. (ACRE)	Total_A (ACRE)	C	CA	Total CA	To Inlet (MIN)	In Pipe (MIN)	Tc (MIN)	I (IPH)	Q (CFS)	Structure	Invert	Pipe	Size (IN)	Length (FT)	Area (SF)	R (FT)	Slope	n	Qf (CFS)	Vf (FT/S)	Q/Qf	V/Vf	V (FT/S)	L/V (MIN)
WS CB-34	LANDSCAPED	0.023		0.400								From: CB-34	Out:													
	IMPERVIOUS	0.048		0.850										HDPE	12	15	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.07	0.47	3.04	0.08
			0.071	0.704	0.050		5.00	NONE	5.00	6.57	**0.33**	To: DMH-36	In:													
WS CB-35	LANDSCAPED	0.026		0.400								From: CB-35	Out:													
	IMPERVIOUS	0.047		0.850										HDPE	12	9	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.07	0.48	3.05	0.05
			0.073	0.690	0.050		5.00	NONE	5.00	6.57	**0.33**	To: DMH-36	In:													
DMH-36 TO	**DMH-34**					0.100	5.00	0.08	5.08	6.56	**0.66**	From: DMH-36	Out:													
														HDPE	12	84	0.79	0.250	0.005	0.013	**2.52**	**3.21**	**0.26**	**0.71**	**2.28**	**0.62**
												To: DMH-34	In:													
WS CB-36	LANDSCAPED	0.021		0.400								From: CB-36	Out:													
	IMPERVIOUS	0.054		0.850										HDPE	12	15	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.07	0.49	3.12	0.08
			0.075	0.724	0.054		5.00	NONE	5.00	6.57	**0.36**	To: DMH-35	In:													
WS CB-37	LANDSCAPED	0.056		0.400								From: CB-37	Out:													
	IMPERVIOUS	0.106		0.850										HDPE	12	9	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.15	0.60	3.85	0.04
			0.162	0.694	0.113		5.00	NONE	5.00	6.57	**0.74**	To: DMH-35	In:													
DMH-35 TO	**DMH-34**					0.267	5.08	0.62	5.70	6.44	**1.72**	From: DMH-35	Out:													
														HDPE	12	19	0.79	0.250	0.005	0.013	**2.52**	**3.21**	**0.68**	**0.94**	**3.01**	**0.11**
												To: DMH-34	In:													
WS CB-33	LANDSCAPED	0.014		0.400								From: CB-33	Out:													
	IMPERVIOUS	0.021		0.850										HDPE	12	14	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.03	0.38	2.44	0.10
			0.035	0.670	0.023		5.00	NONE	5.00	6.57	**0.15**	To: DMH-34	In:													
DMH-34 TO	**DMH-33**					0.391	5.70	0.11	5.80	6.42	**2.51**	From: DMH-34	Out:													
														HDPE	12	101	0.79	0.250	0.005	0.013	**2.52**	**3.21**	**1.00**	**1.05**	**3.36**	**0.50**
												To: DMH-33	In:													
WS CB-40	LANDSCAPED	0.110		0.400								From: CB-40	Out:													
	IMPERVIOUS	0.188		0.850										HDPE	12	24	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.27	0.71	4.57	0.09
			0.298	0.684	0.204		5.00	NONE	5.00	6.57	**1.34**	To: DMH-40	In:													
WS CB-41	LANDSCAPED	0.163		0.400								From: CB-41	Out:													
	IMPERVIOUS	0.096		0.850										HDPE	12	20	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.19	0.65	4.16	0.08
			0.259	0.567	0.147		5.00	NONE	5.00	6.57	**0.96**	To: DMH-40	In:													
DMH-40 TO	**DMH-39**					0.351	5.00	0.09	5.09	6.56	**2.30**	From: DMH-40	Out:													
														HDPE	12	100	0.79	0.250	0.005	0.013	**2.52**	**3.21**	**0.91**	**1.02**	**3.27**	**0.51**
												To: DMH-39	In:													
DMH-39 TO	**DMH-38**					0.351	5.09	0.51	5.60	6.46	**2.27**	From: DMH-39	Out:													
														HDPE	12	82	0.79	0.250	0.005	0.013	**2.52**	**3.21**	**0.90**	**1.02**	**3.26**	**0.42**
												To: DMH-38	In:													

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Project Number: 8548.0
Client: Continuing Care Management
Project Name: Salmon Health ARCPUD
Project Address: Village Street
Location: Medway, MA

Calculations by: DJD
Calculations Date: 06/10/15
Checked By: JEN
Checked Date: 06/10/15

WILLOW POND CIRCLE -25 YEAR STORM- CLOSED SYSTEM PIPE SIZING

WATERSHED CHARACTERISTICS												PIPE CHARACTERISTICS											FLOW CHARACTERISTICS			
LOCATION				LAND USE			FLOW TIME			FLOW		R = hydraulic radius = area/wetted perimeter														Tc
Description	Cover	Increm. (ACRE)	Total_A (ACRE)	C	CA	Total CA	To Inlet (MIN)	In Pipe (MIN)	Tc (MIN)	I (IPH)	Q (CFS)	Structure	Invert	Pipe	Size (IN)	Length (FT)	Area (SF)	R (FT)	Slope	n	Qf (CFS)	Vf (FT/S)	Q/Qf	V/Vf	V (FT/S)	L/V (MIN)
WS CB-38	LANDSCAPED	0.031		0.400								From: CB-38	Out:													
	IMPERVIOUS	0.108		0.850										HDPE	12	18	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.14	0.59	3.77	0.08
			0.139	0.750	0.104		5.00	NONE	5.00	6.57	**0.68**	To: DMH-38	In:													
WS CB-39	LANDSCAPED	0.153		0.400								From: CB-39	Out:													
	IMPERVIOUS	0.223		0.850										HDPE	12	14	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.33	0.76	4.86	0.05
			0.376	0.667	0.251		5.00	NONE	5.00	6.57	**1.65**	To: DMH-38	In:													
DMH-38 TO DMH-37						0.706	5.60	0.42	6.02	6.39	**4.51**	From: DMH-38	Out:													
														HDPE	18	85	1.77	0.375	0.005	0.013	**7.43**	**4.20**	**0.61**	**0.91**	**3.81**	**0.37**
												To: DMH-37	In:													
DMH-37 TO DMH-33						0.706	6.02	0.37	6.39	6.32	**4.46**	From: DMH-37	Out:													
														HDPE	18	57	1.77	0.375	0.005	0.013	**7.43**	**4.20**	**0.60**	**0.90**	**3.80**	**0.25**
												To: DMH-33	In:													
DMH-33 TO DMH-32						1.097	6.39	0.50	6.89	6.23	6.84	From: DMH-33	Out:													
														HDPE	18	53	1.77	0.375	0.005	0.013	7.43	4.20	0.92	1.02	4.30	0.21
												To: DMH-32	In:													
DMH-32 TO DMH-31						1.097	6.89	0.21	7.10	6.20	**6.80**	From: DMH-32	Out:													
														HDPE	18	94	1.77	0.375	0.005	0.013	**7.43**	**4.20**	**0.92**	**1.02**	**4.29**	**0.37**
												To: DMH-31	In:													
WS CB-31	LANDSCAPED	0.059		0.400								From: CB-31	Out:													
	IMPERVIOUS	0.057		0.850										HDPE	12	34	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.09	0.53	3.38	0.17
			0.116	0.621	0.072		5.00	NONE	5.00	6.57	**0.47**	To: DMH-31	In:													
WS CB-32	LANDSCAPED	0.106		0.400								From: CB-32	Out:													
	IMPERVIOUS	0.121		0.850										HDPE	12	26	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.19	0.65	4.15	0.10
			0.227	0.640	0.145		5.00	NONE	5.00	6.57	**0.95**	To: DMH-31	In:													
DMH-31 TO DMH-30						1.314	7.10	0.37	7.46	6.14	**8.07**	From: DMH-31	Out:													
														HDPE	24	83	3.14	0.500	0.005	0.013	**16.00**	**5.09**	**0.50**	**0.86**	**4.37**	**0.32**
												To: DMH-30	In:													
WS CB-29	LANDSCAPED	0.086		0.400								From: CB-29	Out:													
	IMPERVIOUS	0.152		0.850										HDPE	12	10	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.21	0.67	4.29	0.04
			0.238	0.687	0.164		5.00	NONE	5.00	6.57	**1.08**	To: DMH-30	In:													
WS CB-30	LANDSCAPED	0.017		0.400								From: CB-30	Out:													
	IMPERVIOUS	0.113		0.850										HDPE	12	25	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.13	0.58	3.75	0.11
			0.130	0.791	0.103		5.00	NONE	5.00	6.57	**0.68**	To: DMH-30	In:													
DMH-30 TO DMH-29						1.580	7.46	0.32	7.78	6.09	**9.62**	From: DMH-30	Out:													
														HDPE	24	119	3.14	0.500	0.005	0.013	**16.00**	**5.09**	**0.60**	**0.90**	**4.60**	**0.43**
												To: DMH-29	In:													

CONECO
Engineers & Scientists

Project Number: 8548.0
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Project Name: Salmon Health ARCPUD
Project Address: Village Street
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WILLOW POND CIRCLE -25 YEAR STORM- CLOSED SYSTEM PIPE SIZING

WATERSHED CHARACTERISTICS												PIPE CHARACTERISTICS											FLOW CHARACTERISTICS			
LOCATION				LAND USE			FLOW TIME			FLOW					R = hydraulic radius = area/wetted perimeter											Tc
Description	Cover	Increm. (ACRE)	Total_A (ACRE)	C	CA	Total CA	To Inlet (MIN)	In Pipe (MIN)	Tc (MIN)	I (IPH)	Q (CFS)	Structure	Invert	Pipe	Size (IN)	Length (FT)	Area (SF)	R (FT)	Slope	n	Qf (CFS)	Vf (FT/S)	Q/Qf	V/Vf	V (FT/S)	L/V (MIN)
DMH-29 TO	**DMH-28**					1.580	7.78	0.43	8.21	6.02	**9.51**	From: DMH-29	Out:	HDPE	24	74	3.14	0.500	0.005	0.013	**16.00**	**5.09**	**0.59**	**0.90**	**4.59**	**0.27**
												To: DMH-28	In:													
DMH-28 TO	**DMH-27**					1.580	8.21	0.27	8.48	5.98	**9.45**	From: DMH-28	Out:	HDPE	24	58	3.14	0.500	0.005	0.013	**16.00**	**5.09**	**0.59**	**0.90**	**4.58**	**0.21**
												To: DMH-27	In:													
WS CB-27	LANDSCAPED	0.222		0.400								From: CB-27	Out:													
	IMPERVIOUS	0.101		0.850										HDPE	12	14	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.23	0.68	4.37	0.05
			0.323	0.541	0.175		5.00	NONE	5.00	6.57	**1.15**	To: DMH-27	In:													
WS CB-28	LANDSCAPED	0.014		0.400								From: CB-28	Out:													
	IMPERVIOUS	0.121		0.850										HDPE	12	15	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.14	0.59	3.81	0.07
			0.135	0.803	0.108		5.00	NONE	5.00	6.57	**0.71**	To: DMH-27	In:													
DMH-27 TO	**DMH-26**					1.863	8.48	0.07	8.54	5.97	**11.12**	From: DMH-27	Out:	HDPE	24	95	3.14	0.500	0.005	0.013	**16.00**	**5.09**	**0.70**	**0.94**	**4.80**	**0.33**
												To: DMH-26	In:													
DMH-26 TO	**STC-3**					1.863	8.54	0.33	8.87	5.92	**11.02**	From: DMH-26	Out:	HDPE	24	57	3.14	0.500	0.005	0.013	**16.00**	**5.09**	**0.69**	**0.94**	**4.79**	**0.20**
												To: STC-3	In:													
WS CB-10	LANDSCAPED	0.150		0.400								From: CB-10	Out:													
	IMPERVIOUS	0.175		0.850										HDPE	12	9	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.27	0.72	4.61	0.03
			0.325	0.642	0.209		5.00	NONE	5.00	6.57	**1.37**	To: DMH-12	In:													
DMH-12 TO	**DMH-13**					0.209	5.00	0.03	5.03	6.57	**1.37**	From: DMH-12	Out:	HDPE	12	194	0.79	0.250	0.005	0.013	**2.52**	**3.21**	**0.54**	**0.88**	**2.81**	**1.15**
												To: DMH-13	In:													
WS CB-11	LANDSCAPED	0.232		0.400								From: CB-11	Out:													
	IMPERVIOUS	0.078		0.850										HDPE	12	10	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.21	0.66	4.26	0.04
			0.310	0.513	0.159		5.00	NONE	5.00	6.57	**1.05**	To: DMH-13	In:													
WS CB-12	LANDSCAPED	0.057		0.400								From: CB-12	Out:													
	IMPERVIOUS	0.083		0.850										HDPE	12	13	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.12	0.57	3.65	0.06
			0.140	0.667	0.093		5.00	NONE	5.00	6.57	**0.61**	To: DMH-13	In:													
DMH-13 TO	**DMH-14**					0.461	5.03	1.15	6.18	6.36	**2.93**	From: DMH-13	Out:	HDPE	18	58	1.77	0.375	0.005	0.013	**7.43**	**4.20**	**0.39**	**0.80**	**3.36**	**0.29**
												To: DMH-14	In:													
DMH-14 TO	**DMH-18**					0.461	6.18	0.29	6.47	6.31	**2.91**	From: DMH-14	Out:	HDPE	18	97	1.77	0.375	0.005	0.013	**7.43**	**4.20**	**0.39**	**0.80**	**3.35**	**0.48**
												To: DMH-18	In:													

CONECO
Engineers & Scientists

Project Number: 8548.0
Client: Continuing Care Management
Project Name: Salmon Health ARCPUD
Project Address: Village Street
Location: Medway, MA

Calculations by: DJD
Calculations Date: 06/10/15
Checked By: JEN
Checked Date: 06/10/15

WILLOW POND CIRCLE -25 YEAR STORM- CLOSED SYSTEM PIPE SIZING

WATERSHED CHARACTERISTICS												PIPE CHARACTERISTICS											FLOW CHARACTERISTICS			
LOCATION				LAND USE			FLOW TIME			FLOW						R = hydraulic radius = area/wetted perimeter										Tc
Description	Cover	Increm. (ACRE)	Total_A (ACRE)	C	CA	Total CA	To Inlet (MIN)	In Pipe (MIN)	Tc (MIN)	I (IPH)	Q (CFS)	Structure	Invert	Pipe	Size (IN)	Length (FT)	Area (SF)	R (FT)	Slope	n	Qf (CFS)	Vf (FT/S)	Q/Qf	V/Vf	V (FT/S)	L/V (MIN)
DMH-18 TO DMH-19						0.461	6.47	0.48	6.95	6.22	**2.87**	From: DMH-18	Out:													
														HDPE	18	63	1.77	0.375	0.005	0.013	**7.43**	**4.20**	**0.39**	**0.79**	**3.34**	**0.31**
												To: DMH-19	In:													
WS CB-13	LANDSCAPED	0.015		0.400								From: CB-13	Out:													
	IMPERVIOUS	0.042		0.850										HDPE	12	12	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.05	0.45	2.89	0.07
			0.057	0.732	0.042		5.00	NONE	5.00	6.57	**0.27**	To: DMH-15	In:													
WS CB-14	LANDSCAPED	0.089		0.400								From: CB-14	Out:													
	IMPERVIOUS	0.122		0.850										HDPE	12	10	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.18	0.64	4.10	0.04
			0.211	0.660	0.139		5.00	NONE	5.00	6.57	**0.92**	To: DMH-15	In:													
DMH-15 TO DMH-16						0.181	5.00	0.31	5.31	6.51	**1.18**	From: DMH-15	Out:													
														HDPE	12	52	0.79	0.250	0.005	0.013	**2.52**	**3.21**	**0.47**	**0.84**	**2.69**	**0.32**
												To: DMH-16	In:													
WS CB-15	LANDSCAPED	0.011		0.400								From: CB-15	Out:													
	IMPERVIOUS	0.070		0.850										HDPE	12	47	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.08	0.51	3.27	0.24
			0.081	0.789	0.064		5.00	NONE	5.00	6.57	**0.42**	To: DMH-16	In:													
WS CB-16	LANDSCAPED	0.023		0.400								From: CB-16	Out:													
	IMPERVIOUS	0.166		0.850										HDPE	12	11	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.20	0.65	4.19	0.04
			0.189	0.795	0.150		5.00	NONE	5.00	6.57	**0.99**	To: DMH-16	In:													
DMH-16 TO DMH-17						0.395	5.31	0.32	5.64	6.45	**2.55**	From: DMH-16	Out:													
														HDPE	18	101	1.77	0.375	0.005	0.013	**7.43**	**4.20**	**0.34**	**0.77**	**3.23**	**0.52**
												To: DMH-17	In:													
WS CB-17	LANDSCAPED	0.018		0.400								From: CB-17	Out:													
	IMPERVIOUS	0.090		0.850										HDPE	12	45	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.11	0.55	3.53	0.21
			0.108	0.775	0.084		5.00	NONE	5.00	6.57	**0.55**	To: DMH-17	In:													
WS CB-18	LANDSCAPED	0.000		0.400								From: CB-18	Out:													
	IMPERVIOUS	0.072		0.850										HDPE	12	9	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.08	0.50	3.23	0.05
			0.072	0.850	0.061		5.00	NONE	5.00	6.57	**0.40**	To: DMH-17	In:													
DMH-17 TO DMH-19						0.540	6.95	0.52	7.47	6.14	**3.32**	From: DMH-17	Out:													
														HDPE	18	39	1.77	0.375	0.005	0.013	**7.43**	**4.20**	**0.45**	**0.83**	**3.48**	**0.19**
												To: DMH-19	In:													
DMH-19 TO DMH-21						1.001	7.47	0.31	7.79	6.09	**6.09**	From: DMH-19	Out:													
														HDPE	18	61	1.77	0.375	0.005	0.013	**7.43**	**4.20**	**0.82**	**0.99**	**4.16**	**0.24**
												To: DMH-21	In:													
WS CB-19	LANDSCAPED	0.008		0.400								From: CB-19	Out:													
	IMPERVIOUS	0.046		0.850										HDPE	12	11	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.06	0.45	2.90	0.06
			0.054	0.783	0.042		5.00	NONE	5.00	6.57	**0.28**	To: DMH-20	In:													
WS CB-20	LANDSCAPED	0.020		0.400								From: CB-20	Out:													
	IMPERVIOUS	0.089		0.850										HDPE	12	15	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.11	0.55	3.53	0.07

Engineers & Scientists

Project Number: 8548.0
Client: Continuing Care Management
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Checked By: JEN
Checked Date: 06/10/15

WILLOW POND CIRCLE -25 YEAR STORM- CLOSED SYSTEM PIPE SIZING

WATERSHED CHARACTERISTICS												PIPE CHARACTERISTICS											FLOW CHARACTERISTICS			
LOCATION				LAND USE			FLOW TIME			FLOW		R = hydraulic radius = area/wetted perimeter														Tc
Description	Cover	Increm. (ACRE)	Total_A (ACRE)	C	CA	Total CA	To Inlet (MIN)	In Pipe (MIN)	Tc (MIN)	I (IPH)	Q (CFS)	Structure	Invert	Pipe	Size (IN)	Length (FT)	Area (SF)	R (FT)	Slope	n	Qf (CFS)	Vf (FT/S)	Q/Qf	V/Vf	V (FT/S)	L/V (MIN)
			0.109	0.767	0.084		5.00	NONE	5.00	6.57	**0.55**	To: DMH-20	In:													
DMH-20 TO	**DMH-21**					0.126	5.00	0.07	5.07	6.56	**0.83**	From: DMH-20	Out:													
														HDPE	12	28	0.79	0.250	0.005	0.013	**2.52**	**3.21**	**0.33**	**0.76**	**2.43**	**0.19**
												To: DMH-21	In:													
DMH-21 TO	**DMH-22**					1.127	7.79	0.24	8.03	6.05	**6.82**	From: DMH-21	Out:													
														HDPE	18	100	1.77	0.375	0.005	0.013	**7.43**	**4.20**	**0.92**	**1.02**	**4.29**	**0.39**
												To: DMH-22	In:													
WS CB-21	LANDSCAPED	0.140		0.400								From: CB-21	Out:													
	IMPERVIOUS	0.192		0.850										HDPE	12	14	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.29	0.73	4.67	0.05
			0.332	0.660	0.219		5.00	NONE	5.00	6.57	**1.44**	To: DMH-22	In:													
WS CB-22	LANDSCAPED	0.012		0.400								From: CB-22	Out:													
	IMPERVIOUS	0.084		0.850										HDPE	12	19	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.10	0.54	3.44	0.09
			0.096	0.794	0.076		5.00	NONE	5.00	6.57	**0.50**	To: DMH-22	In:													
DMH-22 TO	**DMH-23**					1.423	8.03	0.39	8.42	5.99	**8.52**	From: DMH-22	Out:													
														HDPE	24	67	3.14	0.500	0.005	0.013	**16.00**	**5.09**	**0.53**	**0.87**	**4.44**	**0.25**
												To: DMH-23	In:													
DMH-23 TO	**DMH-24**					1.423	8.42	0.25	8.67	5.95	**8.46**	From: DMH-23	Out:													
														HDPE	24	162	3.14	0.500	0.005	0.013	**16.00**	**5.09**	**0.53**	**0.87**	**4.43**	**0.61**
												To: DMH-24	In:													
WS CB-23	LANDSCAPED	0.235		0.400								From: CB-23	Out:													
	IMPERVIOUS	0.081		0.850										HDPE	12	10	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.21	0.67	4.29	0.04
			0.316	0.515	0.163		5.00	NONE	5.00	6.57	**1.07**	To: DMH-24	In:													
WS CB-24	LANDSCAPED	0.010		0.400								From: CB-24	Out:													
	IMPERVIOUS	0.108		0.850										HDPE	12	28	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.12	0.57	3.67	0.13
			0.118	0.812	0.096		5.00	NONE	5.00	6.57	**0.63**	To: DMH-24	In:													
DMH-24 TO	**DMH-25**					1.681	8.67	0.61	9.28	5.86	**9.84**	From: DMH-24	Out:													
														HDPE	24	141	3.14	0.500	0.005	0.013	**16.00**	**5.09**	**0.62**	**0.91**	**4.63**	**0.51**
												To: DMH-25	In:													
WS CB-25	LANDSCAPED	0.238		0.400								From: CB-25	Out:													
	IMPERVIOUS	0.081		0.850										HDPE	12	19	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.21	0.67	4.29	0.07
			0.319	0.514	0.164		5.00	NONE	5.00	6.57	**1.08**	To: DMH-25	In:													
WS CB-26	LANDSCAPED	0.009		0.400								From: CB-26	Out:													
	IMPERVIOUS	0.112		0.850										HDPE	12	18	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.13	0.58	3.71	0.08
			0.121	0.817	0.099		5.00	NONE	5.00	6.57	**0.65**	To: DMH-25	In:													
DMH-25 TO	**STC-3**					1.944	9.28	0.51	9.79	5.78	**11.24**	From: DMH-25	Out:													
														HDPE	24	57	3.14	0.500	0.005	0.013	**16.00**	**5.09**	**0.70**	**0.95**	**4.81**	**0.20**
												To: STC-3	In:													

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Project Number: 8548.0
Client: Continuing Care Management
Project Name: Salmon Health ARCPUD
Project Address: Village Street
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Calculations by: DJD
Calculations Date: 06/10/15
Checked By: JEN
Checked Date: 06/10/15

WILLOW POND CIRCLE -25 YEAR STORM- CLOSED SYSTEM PIPE SIZING

WATERSHED CHARACTERISTICS												PIPE CHARACTERISTICS											FLOW CHARACTERISTICS			
LOCATION				LAND USE			FLOW TIME			FLOW		R = hydraulic radius = area/wetted perimeter														Tc
Description	Cover	Increm. (ACRE)	Total_A (ACRE)	C	CA	Total CA	To Inlet (MIN)	In Pipe (MIN)	Tc (MIN)	I (IPH)	Q (CFS)	Structure	Invert	Pipe	Size (IN)	Length (FT)	Area (SF)	R (FT)	Slope	n	Qf (CFS)	Vf (FT/S)	Q/Qf	V/Vf	V (FT/S)	L/V (MIN)
STC-3 TO FES-3						3.808	9.79	0.20	9.99	5.75	**21.90**	From: STC-3 To: FES-3	Out: In:	HDPE	30	47	4.91	0.625	0.005	0.013	**29.00**	**5.91**	**0.76**	**0.97**	**5.70**	**0.14**

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Location: Medway, MA

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WATERSIDE RUN -25 YEAR STORM- CLOSED SYSTEM PIPE SIZING

WATERSHED CHARACTERISTICS												PIPE CHARACTERISTICS											FLOW CHARACTERISTICS			
LOCATION				LAND USE			FLOW TIME			FLOW		R = hydraulic radius = area/wetted perimeter														Tc
Description	Cover	Increm. (ACRE)	Total_A (ACRE)	C	CA	Total CA	To Inlet (MIN)	In Pipe (MIN)	Tc (MIN)	I (IPH)	Q (CFS)	Structure	Invert	Pipe	Size (IN)	Length (FT)	Area (SF)	R (FT)	Slope	n	Qf (CFS)	Vf (FT/S)	Q/Qf	V/Vf	V (FT/S)	L/V (MIN)
WS CB-42	LANDSCAPED	0.000		0.400								From: CB-42	Out:													
	IMPERVIOUS	0.007		0.850										HDPE	12	10	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.01	0.26	1.64	0.10
			0.007	0.850	0.006		5.00	NONE	5.00	6.57	**0.04**	To: DMH-41	In:													
WS CB-43	LANDSCAPED	0.006		0.400								From: CB-43	Out:													
	IMPERVIOUS	0.029		0.850										HDPE	12	13	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.04	0.40	2.55	0.09
			0.035	0.773	0.027		5.00	NONE	5.00	6.57	**0.18**	To: DMH-41	In:													
DMH-41 TO	**DMH-42**					0.033	5.00	0.10	5.10	6.55	**0.22**	From: DMH-41	Out:													
														HDPE	12	147	0.79	0.250	0.020	0.013	**5.04**	**6.42**	**0.04**	**0.42**	**2.70**	**0.91**
												To: DMH-42	In:													
DMH-42 TO	**DMH-43**					0.033	5.10	0.91	6.01	6.39	**0.21**	From: DMH-42	Out:													
														HDPE	12	74	0.79	0.250	0.020	0.013	**5.04**	**6.42**	**0.04**	**0.42**	**2.68**	**0.46**
												To: DMH-43	In:													
DMH-43 TO	**DMH-44**					0.033	6.01	0.46	6.47	6.31	0.21	From: DMH-43	Out:													
														HDPE	12	57	0.79	0.25	0.020	0.013	5.04	6.42	0.04	0.42	2.67	0.36
												To: DMH-44	In:													
WS CB-44	LANDSCAPED	0.052		0.400								From: CB-44	Out:													
	IMPERVIOUS	0.083		0.850										HDPE	12	13	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.12	0.56	3.62	0.06
			0.135	0.677	0.091		5.00	NONE	5.00	6.57	**0.60**	To: DMH-44	In:													
WS CB-45	LANDSCAPED	0.010		0.400								From: CB-45	Out:													
	IMPERVIOUS	0.055		0.850										HDPE	12	17	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.07	0.48	3.06	0.09
			0.065	0.781	0.051		5.00	NONE	5.00	6.57	**0.33**	To: DMH-44	In:													
DMH-44 TO	**DMH-45**					0.175	6.47	0.36	6.83	6.25	**1.09**	From: DMH-44	Out:													
														HDPE	12	144	0.79	0.250	0.020	0.013	**5.04**	**6.42**	**0.22**	**0.67**	**4.31**	**0.56**
												To: DMH-45	In:													
DMH-45 TO	**DMH-46**					0.175	6.83	0.56	7.38	6.15	1.08	From: DMH-45	Out:													
														HDPE	12	129	0.79	0.25	0.020	0.013	5.04	6.42	0.21	0.67	4.29	0.50
												To: DMH-46	In:													
WS CB-46	LANDSCAPED	0.058		0.400								From: CB-46	Out:													
	IMPERVIOUS	0.175		0.850										HDPE	12	12	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.22	0.68	4.35	0.05
			0.233	0.738	0.172		5.00	NONE	5.00	6.57	**1.13**	To: DMH-46	In:													
WS CB-47	LANDSCAPED	0.140		0.400								From: CB-47	Out:													
	IMPERVIOUS	0.161		0.850										HDPE	12	16	0.79	0.250	0.020	0.013	**5.04**	**6.42**	0.25	0.70	4.50	0.06
			0.301	0.641	0.193		5.00	NONE	5.00	6.57	**1.27**	To: DMH-46	In:													
DMH-46 TO	**DMH-47**					0.540	7.38	0.50	7.89	6.07	**3.28**	From: DMH-46	Out:													
														HDPE	18	145	1.77	0.375	0.005	0.013	**7.43**	**4.20**	**0.44**	**0.83**	**3.47**	**0.70**
												To: DMH-47	In:													

CONECO
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WATERSIDE RUN -25 YEAR STORM- CLOSED SYSTEM PIPE SIZING

WATERSHED CHARACTERISTICS												PIPE CHARACTERISTICS											FLOW CHARACTERISTICS			
LOCATION				LAND USE			FLOW TIME			FLOW		R = hydraulic radius = area/wetted perimeter														Tc
Description	Cover	Increm. (ACRE)	Total_A (ACRE)	C	CA	Total CA	To Inlet (MIN)	In Pipe (MIN)	Tc (MIN)	I (IPH)	Q (CFS)	Structure	Invert	Pipe	Size (IN)	Length (FT)	Area (SF)	R (FT)	Slope	n	Qf (CFS)	Vf (FT/S)	Q/Qf	V/Vf	V (FT/S)	L/V (MIN)
DMH-47 TO DMH-48						0.540	7.89	0.70	8.58	5.96	3.22	From: DMH-47	Out:													
														HDPE	18	37	1.77	0.375	0.005	0.013	7.43	4.20	0.43	0.82	3.45	0.18
												To: DMH-48	In:													
DMH-48 TO DMH-49						0.540	8.58	0.18	8.76	5.93	3.20	From: DMH-48	Out:													
														HDPE	18	100	1.77	0.375	0.005	0.013	7.43	4.20	0.43	0.82	3.45	0.48
												To: DMH-49	In:													
WS CB-48	LANDSCAPED	0.261		0.400								From: CB-48	Out:													
	IMPERVIOUS	0.137		0.850										HDPE	12	8	0.79	0.250	0.02	0.013	**5.04**	**6.42**	0.29	0.73	4.68	0.03
			0.398	0.555	0.221		5.00	NONE	5.00	6.57	**1.45**	To: DMH-49	In:													
WS CB-49	LANDSCAPED	0.070		0.400								From: CB-49	Out:													
	IMPERVIOUS	0.137		0.850										HDPE	12	14	0.79	0.250	0.02	0.013	**5.04**	**6.42**	0.19	0.65	4.14	0.06
			0.207	0.698	0.144		5.00	NONE	5.00	6.57	**0.95**	To: DMH-49	In:													
DMH-49 TO DMH-50						0.905	8.76	0.48	9.24	5.86	**5.31**	From: DMH-49	Out:													
														HDPE	18	30	1.77	0.375	0.005	0.013	**7.43**	**4.20**	**0.71**	**0.95**	**3.99**	**0.13**
												To: DMH-50	In:													
DMH-50 TO DMH-51						0.905	9.24	0.13	9.37	5.84	5.29	From: DMH-50	Out:													
														HDPE	18	176	1.77	0.375	0.005	0.013	7.43	4.20	0.71	0.95	3.99	0.74
												To: DMH-51	In:													
DMH-51 TO DMH-52						0.905	9.37	0.74	10.10	5.74	5.19	From: DMH-51	Out:													
														HDPE	18	89	1.77	0.375	0.005	0.013	7.43	4.20	0.70	0.94	3.97	0.37
												To: DMH-52	In:													
WS CB-50	LANDSCAPED	0.008		0.400								From: CB-50	Out:													
	IMPERVIOUS	0.066		0.850										HDPE	12	9	0.79	0.250	0.02	0.013	**5.04**	**6.42**	0.08	0.50	3.20	0.05
			0.074	0.801	0.059		5.00	NONE	5.00	6.57	**0.39**	To: DMH-52	In:													
WS CB-51	LANDSCAPED	0.058		0.400								From: CB-51	Out:													
	IMPERVIOUS	0.064		0.850										HDPE	12	12	0.79	0.250	0.02	0.013	**5.04**	**6.42**	0.10	0.54	3.46	0.06
			0.122	0.636	0.078		5.00	NONE	5.00	6.57	**0.51**	To: DMH-52	In:													
DMH-52 TO DMH-53						1.042	10.10	0.37	10.48	5.68	**5.92**	From: DMH-52	Out:													
														HDPE	18	32	1.77	0.375	0.005	0.013	**7.43**	**4.20**	**0.80**	**0.98**	**4.12**	**0.13**
												To: DMH-53	In:													
DMH-53 TO DMH-54						1.042	10.48	0.13	10.61	5.66	5.90	From: DMH-53	Out:													
														HDPE	18	114	1.77	0.375	0.005	0.013	7.43	4.20	0.79	0.98	4.12	0.46
												To: DMH-54	In:													

CONECO Engineers & Scientists

Project Number: 8548.0
Client: Continuing Care Management
Project Name: Salmon Health ARCPUD
Project Address: Village Street
Location: Medway, MA

Calculations by: DJD
Calculations Date: 06/10/15
Checked By: JEN
Checked Date: 06/10/15

WATERSIDE RUN -25 YEAR STORM- CLOSED SYSTEM PIPE SIZING

WATERSHED CHARACTERISTICS												PIPE CHARACTERISTICS											FLOW CHARACTERISTICS			
LOCATION				LAND USE			FLOW TIME			FLOW		R = hydraulic radius = area/wetted perimeter														Tc
Description	Cover	Increm. (ACRE)	Total_A (ACRE)	C	CA	Total CA	To Inlet (MIN)	In Pipe (MIN)	Tc (MIN)	I (IPH)	Q (CFS)	Structure	Invert	Pipe	Size (IN)	Length (FT)	Area (SF)	R (FT)	Slope	n	Qf (CFS)	Vf (FT/S)	Q/Qf	V/Vf	V (FT/S)	L/V (MIN)
WS CB-52	LANDSCAPED	0.045		0.400								From: CB-52	Out:													
	IMPERVIOUS	0.091		0.850										HDPE	12	14	0.79	0.250	0.02	0.013	5.04	6.42	0.12	0.57	3.67	0.06
			0.136	0.701	0.095		5.00	NONE	5.00	6.57	0.63	To: DMH-54	In:													
WS CB-53	LANDSCAPED	0.073		0.400								From: CB-53	Out:													
	IMPERVIOUS	0.120		0.850										HDPE	12	18	0.79	0.250	0.02	0.013	5.04	6.42	0.17	0.63	4.03	0.07
			0.193	0.680	0.131		5.00	NONE	5.00	6.57	0.86	To: DMH-54	In:													
DMH-54 TO	DMH-55					1.269	10.61	0.46	11.07	5.60	7.10	From: DMH-54	Out:													
														HDPE	18	66	1.77	0.375	0.005	0.013	7.43	4.20	0.96	1.03	4.34	0.25
												To: DMH-55	In:													
WS CB-54	LANDSCAPED	0.008		0.400								From: CB-54	Out:													
	IMPERVIOUS	0.020		0.850										HDPE	12	9	0.79	0.250	0.02	0.013	5.04	6.42	0.03	0.36	2.34	0.06
			0.028	0.721	0.020		5.00	NONE	5.00	6.57	0.13	To: DMH-56	In:													
WS CB-55	LANDSCAPED	0.006		0.400								From: CB-55	Out:													
	IMPERVIOUS	0.005		0.850										HDPE	12	16	0.79	0.250	0.02	0.013	5.04	6.42	0.01	0.26	1.70	0.16
			0.011	0.605	0.007		5.00	NONE	5.00	6.57	0.04	To: DMH-56	In:													
DMH-56 TO	DMH-55					0.027	5.00	0.16	5.16	6.54	0.18	From: DMH-56	Out:													
														HDPE	12	25	0.79	0.250	0.005	0.013	2.52	3.21	0.07	0.48	1.55	0.27
												To: DMH-55	In:													
DMH-55 TO	DMH-57					1.296	11.07	0.25	11.32	5.57	7.21	From: DMH-55	Out:													
														HDPE	18	71	1.77	0.375	0.005	0.013	7.43	4.20	0.97	1.04	4.36	0.27
												To: DMH-57	In:													
WS CB-56	LANDSCAPED	0.015		0.400								From: CB-56	Out:													
	IMPERVIOUS	0.036		0.850										HDPE	12	49	0.79	0.250	0.020	0.013	5.04	6.42	0.05	0.43	2.78	0.29
			0.051	0.718	0.037		5.00	NONE	5.00	6.57	0.24	To: DMH-57	In:													
DMH-57 TO	DMH-58					1.332	11.32	0.27	11.59	5.53	7.37	From: DMH-57	Out:													
														HDPE	18	91	1.77	0.375	0.005	0.013	7.43	4.20	0.99	1.04	4.39	0.35
												To: DMH-58	In:													
WS CB-57	LANDSCAPED	0.038		0.400								From: CB-57	Out:													
	IMPERVIOUS	0.103		0.850										HDPE	12	27	0.79	0.250	0.020	0.013	5.04	6.42	0.13	0.58	3.75	0.12
			0.141	0.729	0.103		5.00	NONE	5.00	6.57	0.68	To: DMH-58	In:													
WS CB-58	LANDSCAPED	0.004		0.400								From: CB-58	Out:													
	IMPERVIOUS	0.028		0.850										HDPE	12	10	0.79	0.250	0.020	0.013	5.04	6.42	0.03	0.39	2.50	0.07
			0.032	0.794	0.025		5.00	NONE	5.00	6.57	0.17	To: DMH-58	In:													
DMH-58 TO	DMH-59					1.460	11.59	0.35	11.94	5.48	8.01	From: DMH-58	Out:													
														HDPE	24	42	3.14	0.500	0.005	0.013	16.00	5.09	0.50	0.86	4.36	0.16
												To: DMH-59	In:													

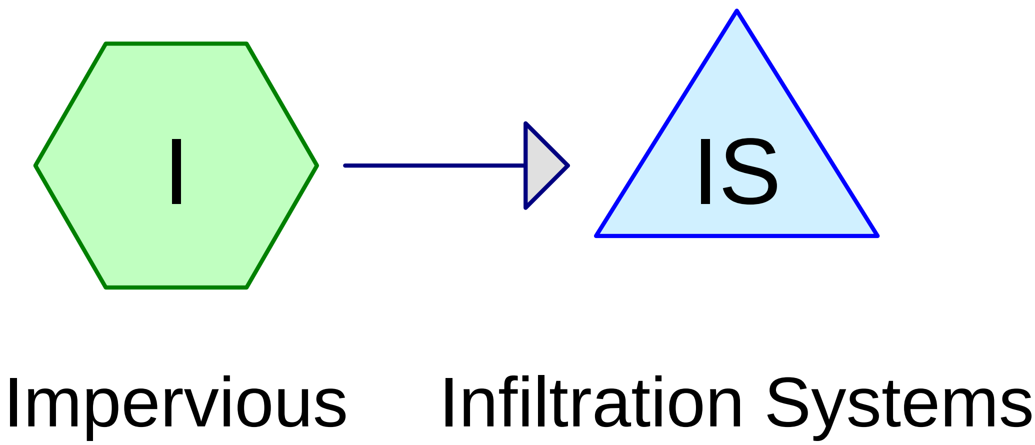
CONECO
Engineers & Scientists

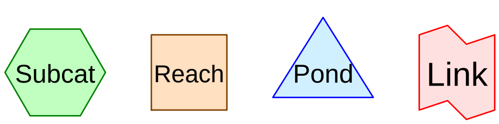
Project Number: 8548.0
Client: Continuing Care Management
Project Name: Salmon Health ARCPUD
Project Address: Village Street
Location: Medway, MA

Calculations by: DJD
Calculations Date: 06/10/15
Checked By: JEN
Checked Date: 06/10/15

WATERSIDE RUN -25 YEAR STORM- CLOSED SYSTEM PIPE SIZING

WATERSHED CHARACTERISTICS												PIPE CHARACTERISTICS											FLOW CHARACTERISTICS			
LOCATION				LAND USE			FLOW TIME			FLOW		R = hydraulic radius = area/wetted perimeter														
Description	Cover	Increm. (ACRE)	Total_A (ACRE)	C	CA	Total CA	To Inlet (MIN)	In Pipe (MIN)	Tc (MIN)	I (IPH)	Q (CFS)	Structure	Invert	Pipe	Size (IN)	Length (FT)	Area (SF)	R (FT)	Slope	n	Qf (CFS)	Vf (FT/S)	Q/Qf	V/Vf	V (FT/S)	Tc L/V (MIN)
DMH-59 TO STC-4						1.460	11.94	0.16	12.10	5.46	7.98	From: DMH-59 To: STC-4	Out: In:	HDPE	24	113	3.14	0.5	0.005	0.013	16.00	5.09	0.50	0.86	4.36	0.43
STC-4 TO FES-5						1.460	12.10	0.43	12.53	5.41	7.90	From: STC-4 To: FES-5	Out: In:	HDPE	24	32	3.14	0.5	0.005	0.013	16.00	5.09	0.49	0.85	4.34	0.12





Routing Diagram for 8548.0 - Salmon Senior Community - Medway - Simple Dynamic Sizing
Prepared by Microsoft, Printed 6/10/2015
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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
524,473	98	Impervious (I)
524,473	**98**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
0	HSG C	
0	HSG D	
524,473	Other	I
524,473		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatchment Numbers
0	0	0	0	524,473	524,473	Impervious	I
0	**0**	**0**	**0**	**524,473**	**524,473**	**TOTAL AREA**	

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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 I: Impervious Runoff Area=524,473 sf 100.00% Impervious Runoff Depth>0.32"
Tc=0.0 min CN=98 Runoff=5.41 cfs 13,807 cf

Pond IS: Infiltration Systems Peak Elev=3.85' Storage=7,975 cf Inflow=5.41 cfs 13,807 cf
Outflow=0.18 cfs 7,089 cf

Total Runoff Area = 524,473 sf Runoff Volume = 13,807 cf Average Runoff Depth = 0.32"
0.00% Pervious = 0 sf 100.00% Impervious = 524,473 sf

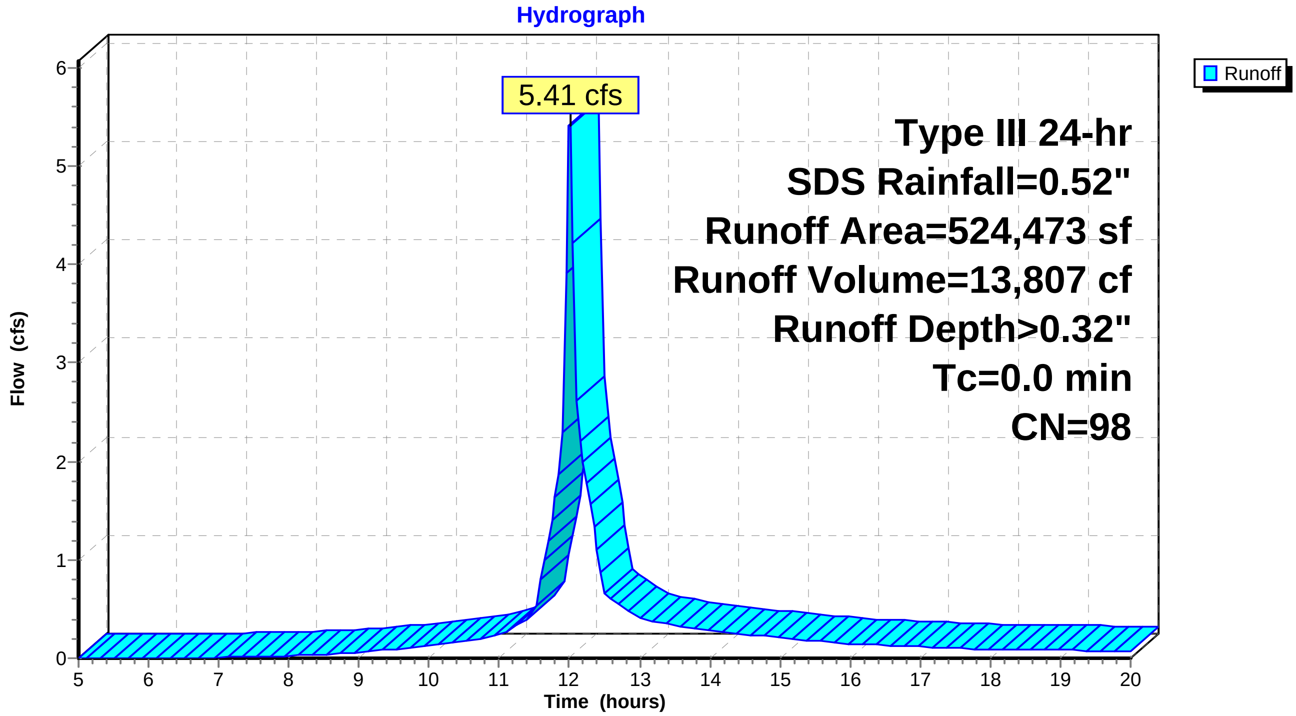
Summary for Subcatchment I: Impervious

Runoff = 5.41 cfs @ 12.00 hrs, Volume= 13,807 cf, Depth> 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr SDS Rainfall=0.52"

	Area (sf)	CN	Description
*	524,473	98	Impervious
	524,473		100.00% Impervious Area

Subcatchment I: Impervious



Summary for Pond IS: Infiltration Systems

Inflow Area = 524,473 sf,100.00% Impervious, Inflow Depth > 0.32" for SDS event
Inflow = 5.41 cfs @ 12.00 hrs, Volume= 13,807 cf
Outflow = 0.18 cfs @ 10.70 hrs, Volume= 7,089 cf, Atten= 97%, Lag= 0.0 min
Discarded = 0.18 cfs @ 10.70 hrs, Volume= 7,089 cf

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 3.85' @ 15.40 hrs Surf.Area= 3,308 sf Storage= 7,975 cf

Plug-Flow detention time= 185.5 min calculated for 7,066 cf (51% of inflow)
Center-of-Mass det. time= 104.3 min (878.1 - 773.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	3,429 cf	**45.00'W x 73.50'L x 4.04'H Field A** 13,368 cf Overall - 4,795 cf Embedded = 8,573 cf x 40.0% Voids
#2A	1.00'	4,795 cf	**Cultec R-330XL** x 90 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 9 rows
		8,224 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.18 cfs @ 10.70 hrs HW=0.04' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.18 cfs)

Pond IS: Infiltration Systems - Chamber Wizard Field A

Chamber Model = Cultec R-330XL
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 9 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

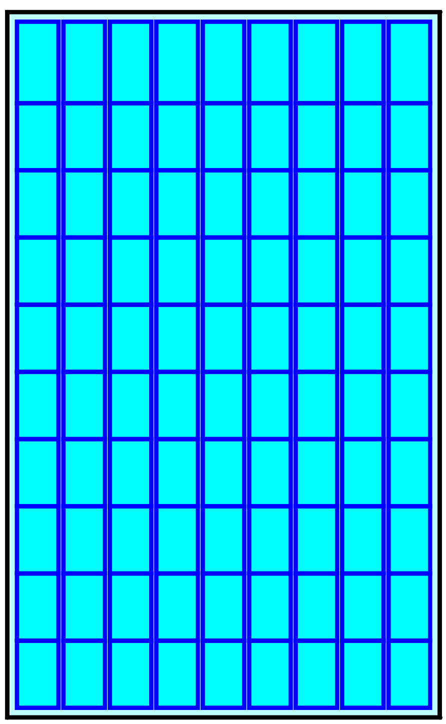
10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +12.0" End Stone x 2 = 73.50' Base Length
9 Rows x 52.0" Wide + 6.0" Spacing x 8 + 12.0" Side Stone x 2 = 45.00' Base Width
12.0" Base + 30.5" Chamber Height + 6.0" Cover = 4.04' Field Height

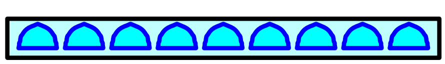
90 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 9 Rows = 4,794.7 cf Chamber Storage

13,367.8 cf Field - 4,794.7 cf Chambers = 8,573.1 cf Stone x 40.0% Voids = 3,429.2 cf Stone Storage

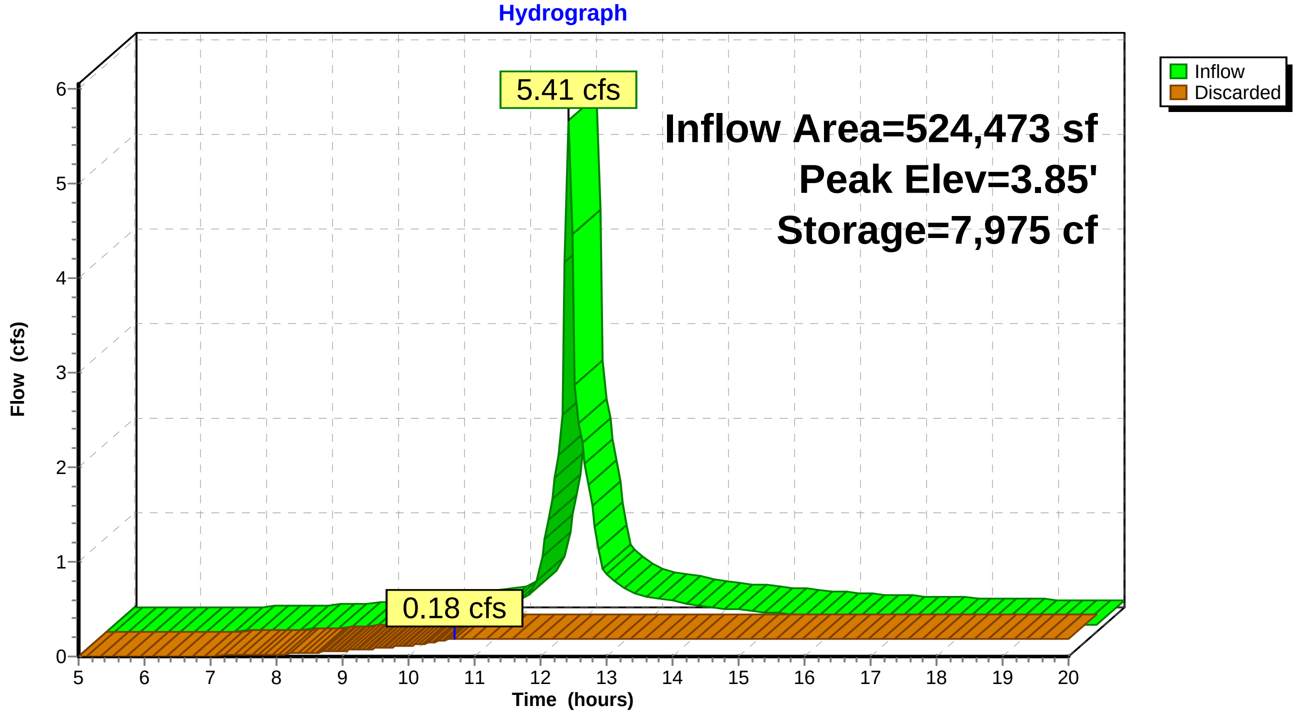
Chamber Storage + Stone Storage = 8,224.0 cf = 0.189 af
Overall Storage Efficiency = 61.5%

90 Chambers
495.1 cy Field
317.5 cy Stone





Pond IS: Infiltration Systems



APPENDIX D

LONG TERM POLLUTION PREVENTION PLAN – REQUIRED BY STANDARDS 4-6

LONG TERM POLLUTION PREVENTION PLAN

To keep the Stormwater Management System (SMS) functioning properly and to ensure that the stormwater Total Suspended Solids (TSS) are reduced, a long term pollution prevention is required. Continuing Care Management, LLC, the owner/operator of the facility, is responsible for the adherence to this long term plan. The following is a guideline of the specific requirements of the plan to maintain the long term viability of the stormwater management system.

The Stormwater Pollution Prevention Plan for the site addresses many of the items in the Long Term Pollution Prevention Plan.

Good Housekeeping Practices

Employees shall be instructed in the importance of not spilling fluids and chemicals such as oil, antifreeze, etc. onto the bare ground. All areas exposed to the weather shall be kept clean

Provisions for Storing Materials and Waste Products Inside or Under Cover

Liquid waste products shall be captured when draining from vehicles, and stored in sealed containers under cover until they are disposed of. Waste products shall be disposed of in a legal manner, at a state licensed recycling center or landfill.

Vehicle washing controls;

Vehicles shall be washed on the concrete pad which is served by the proposed trench drain and oil/grit separator. Vehicles shall not be washed if there are known contaminants being washed into the trench drain.

Requirements for routine inspections and maintenance of stormwater BMPs;

BMPs shall be inspected on a monthly basis. BMPs shall be maintained per the operations and

Spill prevention and response plans;

First responders	Phone Numbers
• Medway Fire Department	911 if emergency or 508) 533-3213
• Medway Police Department	911 if emergency or (508) 533-3212
• Mass Department of Environmental Protection	
Emergency Response	1-888-304-1133

Requirements for storage and use of fertilizers, herbicides, and pesticides;

Fertilizers shall not be used within 100 feet of the wetland resource areas. Excess fertilizers shall be swept up from all impervious surfaces and not allowed to run into the drainage system.

All fertilizer, herbicides, and pesticides shall be stored at least 100 feet away from the wetland line. If stored on site, these materials should be kept in a wrapped or sealed container, and kept under cover out of the rain and snow.

Provisions for solid waste management;

Solid waste shall be collected at a minimum of once per week and disposed of in an appropriate dumpster or garbage truck. Waste shall be disposed of in a legal manner, at a state licensed recycling center or landfill.

Routine Inspections and Maintenance of SMS BMP's

Routine inspections and maintenance shall be performed in accordance with the Operations and Maintenance Plan

Spill Prevention, Control and Countermeasures

Continuing Care Management, LLC and its subsidiaries have in place a SPCC plan for all of their assets. The plan is updated periodically and/or when necessary due to changes to the existing facility. A copy is kept onsite at all times in the event of a spill.

Illicit Discharges

All non-allowable, non-stormwater discharges are prohibited from being directed to the drainage system. The following list of non-stormwater discharges are allowed to drain to the closed drainage system and has been taken from the "NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) GENERAL PERMIT FOR STORM WATER DISCHARGES FROM SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS".

"Part I, Section F. Allowable Non-Storm Water Discharges
The following non-storm water discharges are authorized provided it has been determined by the permittee that they are not significant contributors of pollutants to the MS4. If these discharges are identified as significant contributors to the MS4, they must be addressed in the Illicit Discharge Detection and Elimination minimum control measure described in Parts II, III, IV and V.

1. Water line flushing,
2. Landscape irrigation,
3. Diverted stream flows,
4. Rising ground waters,
5. Uncontaminated ground water infiltration (as defined at 40 cfr 35.2005(20)),
6. Uncontaminated pumped ground water,
7. Discharge from potable water sources,
8. Foundation drains,
9. Air conditioning condensation,
10. Irrigation water, springs,
11. Water from crawl space pumps,
12. Footing drains,
13. Lawn watering,
14. Individual resident car washing,
15. Flows from riparian habitats and wetlands,
16. Dechlorinated swimming pool discharges,
17. Street wash water, and
18. Residential building wash waters, without detergents.

Discharges or flows from fire fighting activities occur during emergency situations. The permittee is not expected to evaluate fire fighting discharges with regard to pollutant contributions. Therefore, these discharges are authorized as allowable non-storm water discharges, unless identified, by EPA, as significant sources of pollutants to Waters of the U.S..”

APPENDIX E

CONSTRUCTION PERIOD POLLUTION PREVENTION AND EROSION AND SEDIMENTATION CONTROL PLAN - REQUIRED BY STANDARD 8

CONSTRUCTION PERIOD POLLUTION PREVENTION PLAN & EROSION & SEDIMENTATION CONTROL PLAN

The proposed development at Village Street consists of the construction of an Adult Retirement Community Planned Residential District (ARCPUD) consisting of a four story main residence building which has 40 memory care, 60 assisted living and 54 independent living residential units and 15 attached cottages (two bedroom) as well as 48 two bedroom and 8 three bedroom detached cottages, a two story medical office building, and a pavilion.

The proposed Stormwater Management system consists of a series of deep sump catch basins, roof leaders, pipes, and manholes to collect stormwater; and a series of infiltration trenches, water quality units, vegetated detention basins, and outlet control structures which both treat and control the proposed flows. Each detention basin is sized to slow down the peak flow from the 100-year storm.

Soils, Slopes, Vegetation, and Current Drainage Patterns

The Soil Conservation Service map for the area indicates that the site is made of seven soil types which include 4 – Rippowam silt loam, 0 to 3 percent slopes (Hydrologic Soil Group D), 5 – Saco silt loam, 0 to 3 percent slopes (Hydrologic Soil Group D), 31A – Walpole sandy loam, 0 to 3 percent slopes (Hydrologic Soil Group D), 70A – Ridgebury fine sandy loam, 0 to 5 percent slopes (Hydrologic Soil Group D), 245B – Merrimac fine sandy loam, 3 to 8 percent slopes (Hydrologic Soil Group A), 260B – Sudbury fine sandy loam, 2 to 8 percent slopes (Hydrologic Soil Group B), and 310B – Udorthents, Woodbridge fine sandy loam, 3 to 8 percent slopes (Hydrologic Soil Group C). The site currently consists of a wooded lot with open areas. Topography generally slopes to the southwest towards the Charles River.

Minimize Disturbed Area and Protect Natural Features and Soil

The silt fence line defines the limit of work and that all areas outside of the clearing line are to be protected and remain undisturbed. The silt fence line shall be installed prior to the start of construction. The silt fence line shall be inspected and maintained on a weekly basis and/or within 12 hours of a storm event >0.5”.

Phase Construction Activity

Construction will occur in a single phase.

Stabilize Soils

Soils will be stabilized by seeding. Stockpiled soils, such as top soil, will be stabilized with temporary seed no later than 14 days from the last construction activity in that area.

Permanent Seeding/ Sodding: Shall be performed upon completion of the area. These areas shall be inspected and maintained on a monthly basis and/or within 12 hours of a storm event >0.5”.

Temporary Seeding/ Sodding: Shall be performed within 14 days of last construction activity in the area. These areas shall be inspected and maintained on a weekly basis and/or within 12 hours of a storm event >0.5”.

Protect Slopes

Maximum allowable slopes on the project are 3:1 and these slopes will be stabilized using the methods described in the previous section.

Establish Perimeter Controls and Sediment Barriers

A silt fence erosion control barrier will be installed along the down gradient portions of project site that are to be disturbed by construction related activities. Installation will occur prior to the start of these activities and the contractor shall be aware that areas outside the erosion control barrier are to remain undisturbed. The silt fence line shall be inspected and maintained on a weekly basis and/or within 12 hours of a storm event >0.5”.

Retain Sediment On-Site

Sediment is retained on site via the aforementioned erosion control barrier. Sediment that builds up along the silt fence line is manually removed during the inspection. Completed slopes are stabilized immediately as described above to avoid the on-going deposition of sediment against the erosion control barrier.

Establish Stabilized Construction Exits

A stabilized construction site exit is proposed for the project site and will be put in place upon completion of the silt fence installation. Please refer to the Comprehensive Permit Plans for proposed location and installation details. In addition to the stabilized construction exit, dump trucks hauling material to and from the site will be covered with a tarpaulin and the paved street adjacent to the site entrance will be manually swept as required to remove excess mud, dirt, or rock tracked from the site. The construction exit will be inspected and maintained on a weekly basis.

Material Handling and Waste Management

All solid waste materials will be collected at a minimum of once per week and stored in a covered metal dumpster rented from a licensed solid waste management company. All trash and construction debris from the site will be deposited in the dumpster. The dumpster will be emptied as needed and the trash will be hauled to an appropriate landfill. No construction materials or stumps will be buried on-site. All personnel will be instructed regarding the correct procedure for waste disposal. All sanitary waste will be collected from the portable units a minimum of once per week by a licensed waste hauling company. More specifically, the following guidelines will be followed:

- Fertilizers will be applied only in the minimum amounts recommended by the manufacturer.
- Fertilizers will be worked into the soil to limit exposure to stormwater.
- Fertilizers shall not be used within 25 feet of the wetland resource areas. Excess fertilizers shall be swept up from all impervious surfaces and not allowed to run into the drainage system.
- Fertilizers will be stored in a covered shed and partially used bags will be transferred to a sealable bin to avoid spills.
- Any asphalt substances used onsite will be applied according to the manufacturer’s recommendation.
- Sanitary waste will be collected from portable toilets a minimum of once a week to avoid overfilling.
- A covered dumpster will be used for all waste materials.
- Salt will be applied only in the minimum amounts recommended by the manufacturer.

- Salt shall not be used within 25 feet of the wetland resource areas.

Establish Proper Building Material Staging Areas

Construction materials will be stored on-site in designated material staging areas that minimize the exposure of the materials to stormwater.

Designate Concrete Truck Washout Areas

Concrete trucks will be directed to a washout area to be established outside of the 100 foot wetland buffer. Washout areas shall consist of a layer of polyurethane sheeting draped over a rectangular area built out of haybales.

Establish Proper Equipment/Vehicle Fueling and Maintenance Practices

The following equipment/vehicle fueling and maintenance practice(s) will be implemented to control pollutants to stormwater:

- Petroleum products related to the operation of said equipment will be stored in tightly sealed containers, which will be clearly labeled.

- Spray guns will be cleaned on a disposable tarp.

Spill Prevention and Control Plan

The following guidelines will be followed to aid in the prevention and control of unanticipated spills on-site:

- Spill kits will be included with all fueling sources and maintenance activities.

- Materials and equipment necessary for spill cleanup will be kept onsite. Equipment will include, but not be limited to, brooms, dust pans, mops, rags, gloves, goggles, kitty litter, sand, saw dust, and plastic and metal trash containers.

- All spills will be cleaned up immediately upon discovery. Spills large enough to reach the storm system will be reported to the Massachusetts DEP or National Response Center at 1-800-424-8802.

APPENDIX F

OPERATION AND MAINTENANCE PLAN - REQUIRED BY STANDARD 9

OPERATION AND MAINTENANCE PLAN

To keep the Stormwater Management System (SMS) functioning properly and to ensure that the Total Suspended Solids (TSS) are reduced, periodic maintenance is required. The owner/operator of the facility is responsible for the periodic maintenance requirements of the SMS. Continuing Care Management is the owner and will be the party responsible for the maintenance of the SMS. The following is a guideline of the specific maintenance schedules and tasks required to keep the SMS functioning properly.

Unscheduled Maintenance

The following inspections and maintenance activities must be completed after each rain event in excess of two-inches (2”), or after any snow or rain event accompanied by high winds:

1. Inspect the vegetated detention basins for debris. Remove any branches, trash or other large debris that could interfere with the proper operation of the inlet or outlet of the basins.

General Maintenance

The following inspections and maintenance activities must be completed on a regular basis as conditions warrant:

1. Maintain the grassy side slopes of the vegetated detention basins through regular mowing. Keep the grass between three and six inches (3”-6”) in length. Remove the grass clippings to prevent them from impeding the flow of stormwater from the inlets or outlets.

2. During the fall and the spring remove any accumulated leaves from the catch basin and outlet control structure grates, rip-rap inlet and outlet aprons including flared end sections, detention basin(s), plunge pools, and level spreaders.

Quarterly Maintenance

The following inspections and maintenance activities must be completed quarterly (January 15, April 15, July 15, October 15 or other acceptable quarterly dates):

1. Sweep, vacuum, or clean the roadway area to reduce the amount of sediment entering the SMS.

2. Inspect the catch basin sumps for debris. Remove any branches, trash or other large debris that could interfere with the proper operation of the outlet of the catch basin. Remove accumulated sediment, by use of a clamshell bucket or vacuum truck, when it reaches a height of 18-inches but not less than annually.

3. Inspect the vegetated detention basins, outlet control structures, flared ends, and plunge pools and level spreaders for debris. Remove any branches, trash or other large debris that could interfere with the proper operation of the inlet or outlet of the basin. Remove any accumulated sediment, by the use of hand tools (shovels, rakes, wheelbarrows, etc.) when it exceeds three-inches (3”) but not less than annually.

Annual Maintenance

The following inspections and maintenance activities must be completed annually (April 15 or another acceptable date):

1. Sweep, vacuum or clean the roadway area to reduce the amount of sediment entering the SMS.

2. Remove accumulated sediment from the catch basin sumps by use of a clamshell bucket or vacuum truck. Inspect the hood to ensure that it is properly secured. If excessive sediment is encountered in the catch basin sump and or the inlet to the catch basin, spot inspect infiltration systems. If more than ½" of sediment is encountered in an infiltration system, jet wash system and then remove any additional sediment from catch basin sumps.

3. Remove any accumulated sediment from plunge pools by the use of a clamshell bucket or by the use of hand tools (shovels, rakes, wheelbarrows, etc.). Reset any displaced rip-rap.

4. Remove any accumulated sediment from the vegetated detention basins, by the use of hand tools (shovels, rakes, wheelbarrows, etc.).

Water Quality Unit Maintenance

Refer to Stormceptor® Owner's Manual found on the following pages for operational and maintenance information on the water quality units found on site.

Continuing Care Management, LLC

SALMON HEALTH AND RETIREMENT COMMUNITY

VILLAGE STREET, MEDWAY, MASSACHUSETTS

Stormwater Management System Operation & Maintenance Checklist

Unscheduled Maintenance

The following inspections and maintenance activities must be completed after each rain event in excess of two-inches (2”), or after any snow or rain event accompanied by high winds

- Inspect the detention basins for debris. Remove any branches, trash or other large debris that could interfere with the proper operation of the inlets or outlets of the basins.

General Maintenance

- Mow the grass side slopes of the detention basins through regular mowing. Keep the grass between three and six inches (3”-6”) in length. Remove the grass clippings to prevent them from impeding the flow of stormwater from the inlets or outlets
- During the fall and the spring remove leaves from the catch basin and inlet control structure grates, rip-rap inlet and outlet aprons including flared end sections, detention basin(s), and plunge pools.

Quarterly Maintenance

- Sweep, vacuum, or clean the roadway area
- Inspect the catch basin sumps for debris. Remove any branches, trash or other large debris that could interfere with the proper operation of the outlet of the catch basin. Remove accumulated sediment, by use of a clamshell bucket or vacuum truck, when it reaches a height of 18-inches but not less than annually.
- Inspect the detention basins, inlet structures, flared ends, and plunge pools for debris. Remove any branches, trash or other large debris that could interfere with the proper operation of the inlet or outlet of the basin. Remove any accumulated sediment, by the use of hand tools (shovels, rakes, wheelbarrows, etc.) when it exceeds three-inches (3”) but not less than annually.

Annual Maintenance

- Sweep, vacuum, or clean the roadway area.
- Remove sediment from the catch basin sumps by use of a clamshell bucket or vacuum truck. Inspect the hood to ensure that it is properly secured. If excessive sediment is encountered in the catch basin sump and or the inlet to the catch basin, spot inspect the infiltration system. If more than ½” of sediment is encountered in infiltration system, jet wash system and then remove any additional sediment from catch basin sumps.
- Remove sediment from plunge pools by the use of a clamshell bucket or by the use of hand tools (shovels, rakes, wheelbarrows, etc.). Reset any displaced rip-rap.
- Remove sediment from the detention basins with the use of hand tools (shovels, rakes, wheelbarrows, etc.).

Water Quality Unit Maintenance

- Refer to the Stormceptor® Owner’s Manual (Appendox I) for operational and maintenance information on the water quality units found on site.

CONTINUING CARE MANAGEMENT, LLC			
SALMON HEALTH AND RETIREMENT COMMUNITY			
VILLAGE STREET, MEDWAY, MASSACHUSETTS			
STORMWATER MANAGEMENT SYSTEM OPERATION & MAINTENANCE LOG			
DATE	**TIME**	**MAINTENANCE ACTIVITY**	**MAINTENANCE PERFORMED, OBSERVATIONS**

APPENDIX G

ILLICIT DISCHARGE COMPLIANCE STATEMENT- REQUIRED BY STANDARD 10

June 10, 2015

Mr. Davod Travalini, Chair
Medway Conservation Commission
Town Hall
155 Village Street
Medway, Massachusetts, 02053

Re: 259, 261, 261R, and 263 Village Street, Medway, Massachusetts
Illicit Discharge Compliance Statement

Dear Mr. Travalini & Members of the Commission:

Coneco Engineers & Scientists, Incorporated (Coneco), on behalf of our client Continuing Care Management, LLC, is submitting this Illicit Discharge Compliance Statement for the above referenced property.

This Illicit Discharge Compliance Statement is to verify that to the best of our knowledge, no illicit discharges exist on the site presently, nor will they after the proposed development has been completed. The proposed stormwater management system consists of conventional curb and gutter drainage for the roadways including a series of catch basins, drain manholes and pipe which convey stormwater runoff from the roadway areas to a water quality device before entering the proposed infiltration system which will ultimately discharge any remaining runoff upstream of the bordering vegetated wetlands. Roof runoff from the proposed campus building, residential units, and medical building will be recharged through individual subsurface infiltration chambers. These chambers have been designed to accommodate flows from the 100-year storm event. Please refer to “arcpud Special Permit Site Plans” prepared by Coneco dated June 12, 2015 for plans showing the proposed stormwater management system. Additionally, the Long Term Pollution Prevention Plan contained herein contains measures to prevent illicit discharges.

Please don’t hesitate to contact me at 508-697-3191 (extension 123) should you have any questions and/or comments pertaining to the information contained herein or require additional information and/or further action. Thank you for your time and consideration regarding this matter.

Best Regards,
Coneco Engineers & Scientists, Incorporated

Tracy L. Duarte

COMMONWEALTH OF MASSACHUSETTS
TRACY L.
DUARTE
CIVIL
No. 48660
REGISTERED
PROFESSIONAL ENGINEER

Tracy L. Duarte, P.E.
Civil Engineer

APPENDIX H

SOIL LOGS

Job No.: 8548

Client: Continuing Care Management LLC

Site Location: Village Street, Medway

Land Use:

Parent Material:

Soil Evaluator: Tracy L. Duarte

Witness: N/A

Excavator: Mobile Excavating

Date: April 8, 2015

Weather: Rain/ Hail 34ºF

Water Resource Conditions: Normal: ____ Above: X Below: ____

TP #15-1 Edge of Woods

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-13	A	SL	10YR 3/2		Depth	24"	Mottling	26"
13-25	B	LS	10YR 5/6		0-15 Min.	1/2"		
25-58	C	M-C LS	2.5Y 5/3		15-30 Min.	1/2"	Weeping	N/A
					30-45 Min.	1/2"		
					45-60 Min.		Standing	30"
					60-75 Min.			
					Rate	**2**	"/hr	

TP #15-2 Open

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-10	A	SL	10YR 3/2	Roots	Depth	18"	Mottling	18"
10-18	B	SL	10YR 4/6		0-15 Min.	3/4"		
18-84	C	V. Fine LS	2.5Y 5/3		15-30 Min.	1/2"	Weeping	68"
					30-45 Min.	1/2"		
					45-60 Min.	1/2"	Standing	78"
					60-75 Min.			
					Rate	**2**	"/hr	

TP #15-3 Open

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-12	A	SL	10YR 3/4		Depth	18"	Mottling	N/A
12-18	B	Sand	10YR 4/6		0-15 Min.	2 3/4"		
18-74	C	Sand	2.5Y 5/3		15-30 Min.	2 1/2"	Weeping	N/A
					30-45 Min.	2 1/4"		
					45-60 Min.	2 1/4"	Standing	N/A
					60-75 Min.	2 1/4"		
					Rate	**9**	"/hr	

TP #15-4 Open

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-12	A	SL	10YR 3/2		Depth	14"	Mottling	26"
12-24	B	LS	10YR 4/6		0-15 Min.	3/8"		
24-68	C	LS	2.5Y 5/3	Heavy mottling throughout	15-30 Min.	3/8"	Weeping	28"
					30-45 Min.	1/4"		
					45-60 Min.	1/4"	Standing	45"
					60-75 Min.	1/4"		
					Rate	**1**	"/hr	

Job No.: 8548

Client: Continuing Care Management LLC

Site Location: Village Street, Medway

Land Use:

Parent Material:

Soil Evaluator: Tracy L. Duarte

Witness: N/A

Excavator: Mobile Excavating

Date: April 8, 2015

Weather: Rain/ Hail 34°F

Water Resource Conditions: Normal: ____ Above: X Below: ____

TP #15-5 Wooded

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-16	A	SL	10YR 2/2	Roots	Depth	30"	Mottling	30"
16-30	B	SL	10YR 4/6		0-15 Min.	1/8"		
30-72	C	V. Fine SL	2.5Y 5/3	Platey, heavy mottling throughout	15-30 Min.	1/16"	Weeping	36"
					30-45 Min.	1/16"		
					45-60 Min.	1/16"	Standing	60"
					60-75 Min.			
					Rate	**0.25**	"/hr	

TP #15-11 Wooded

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-16	A	SL	10YR 2/2	Roots	Depth	24"	Mottling	26"
16-24	B	M-C LS	10YR 5/6		0-15 Min.	3/4"		
24-70	C	Sand	2.5Y 5/3	Gravelly	15-30 Min.	3/4"	Weeping	N/A
					30-45 Min.	1/2"		
					45-60 Min.	1/2"	Standing	30"
					60-75 Min.	1/2"		
					Rate	**2**	"/hr	

TP #15-12 Brush

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-16	A	SL	10YR 2/2	Roots	Depth	18"	Mottling	N/A
16-22	B	M-C LS	10YR 5/6		0-15 Min.	4 1/2"		
22-58	C	Sand	2.5Y 5/3	Gravelly	15-30 Min.	2 1/2"	Weeping	N/A
					30-45 Min.	2 1/2"		
					45-60 Min.	2 1/2"	Standing	26"
					60-75 Min.			
					Rate	**10**	"/hr	

TP #15-14 Open

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-8	A	SL	10YR 3/4		Depth	18"	Mottling	N/A
8-18	B	Fine SL	10YR 5/6		0-15 Min.	1/2"		
18-48	C1	M-C LS	2.5Y 5/2	Gravelly	15-30 Min.	1/4"	Weeping	N/A
48-50	C2	V. Fine SL	2.5Y 5/2	Platey	30-45 Min.	1/4"		
					45-60 Min.	1/4"	Standing	26"
					60-75 Min.			
					Rate	**1**	"/hr	

Job No.:	8548	Soil Evaluator:	Tracy L. Duarte
Client:	Continuing Care Management LLC	Witness:	N/A
Site Location:	Village Street, Medway	Excavator:	Mobile Excavating
Land Use:		Date:	April 8, 2015
Parent Material:		Weather:	Rain/ Hail 34°F

Water Resource Conditions: Normal: ______ Above: X Below: ______

TP #15-15 Wooded

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-10	A	SL	10YR 3/2		Depth	6"	Mottling	24"
10-24	B	Fine SL	10YR 5/6		0-15 Min.	3/4"		
24-36	C1	M-C LS	2.5Y 5/2	Gravelly	15-30 Min.	3/4"	Weeping	16"
36-70	C2	V. Fine SL	2.5Y 5/2	Platey	30-45 Min.	3/4"		
					45-60 Min.		Standing	36"
					60-75 Min.			
					Rate	**3**	"/hr	

TP #

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
					Depth		Mottling	
					0-15 Min.			
					15-30 Min.		Weeping	
					30-45 Min.			
					45-60 Min.		Standing	
					60-75 Min.			
					Rate		"/hr	

TP #

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
					Depth		Mottling	
					0-15 Min.			
					15-30 Min.		Weeping	
					30-45 Min.			
					45-60 Min.		Standing	
					60-75 Min.			
					Rate		"/hr	

TP #

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
					Depth		Mottling	
					0-15 Min.			
					15-30 Min.		Weeping	
					30-45 Min.			
					45-60 Min.		Standing	
					60-75 Min.			
					Rate		"/hr	

Job No.:	8548	Soil Evaluator:	Tracy L. Duarte
Client:	Continuing Care Management LLC	Witness:	N/A
Site Location:	Village Street, Medway	Excavator:	Mobile Excavating
Land Use:		Date:	April 9, 2015
Parent Material:		Weather:	Rain/ 38ºF

Water Resource Conditions: Normal: ______ Above: X Below: ______

TP #15-6 Woods

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-14	A	SL	10YR 3/2	Leaf litter/ roots	Depth	32"	Mottling	32"
14-32	B	LS	10YR 5/6		0-15 Min.	3"		
32-56	C1	M-C LS	2.5Y 5/3	Heavy mottling ring at C1/C2	15-30 Min.	3"	Weeping	40"
56-82	C2	V. Fine SL	2.5Y 5/3	interface	30-45 Min.	3"		
					45-60 Min.		Standing	62"
					60-75 Min.			
					Rate	**12**	"/hr	

TP #15-7 Woods

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-12	A	SL	10YR 2/2		Depth	20"	Mottling	18"
12-26	B	LS	10YR 5/6		0-15 Min.	3/8"		
26-66	C1	M-C LS	2.5Y 5/3	Heavy mottling/ weeping	15-30 Min.	3/8"	Weeping	42"
66-92	C2	V. Fine SL	2.5Y 5/3	Platey	30-45 Min.	3/8"		
					45-60 Min.		Standing	82"
					60-75 Min.			
					Rate	**1.33"**	"/hr	

TP #15-8 Woods

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-18	A	SL	10YR 3/2		Depth	28"	Mottling	30"
18-30	B	LS	10YR 5/6		0-15 Min.	1/2"		
30-54	C1	M-C LS	2.5Y 5/3	Heavy mottling/ weeping	15-30 Min.	1/2"	Weeping	30"
54-90	C2	V. Fine SL	2.5Y 5/3		30-45 Min.	1/2"		
					45-60 Min.		Standing	84"
					60-75 Min.			
					Rate	**2**	"/hr	

TP #15-9 Woods

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-14	A	SL	10YR 3/2	Roots	Depth	26"	Mottling	26"
14-26	B	LS	10YR 5/6		0-15 Min.	1/2"		
26-44	C1	V. Fine SL	2.5Y 5/2	Heavy mottling/ weeping	15-30 Min.	1/2"	Weeping	30"
44-88	C2	M-C LS	2.5Y 5/3	V. Gravelly	30-45 Min.	1/2"		
					45-60 Min.		Standing	70"
					60-75 Min.			
					Rate	**2**	"/hr	

Job No.:	8548	Soil Evaluator:	Tracy L. Duarte
Client:	Continuing Care Management LLC	Witness:	N/A
Site Location:	Village Street, Medway	Excavator:	Mobile Excavating
Land Use:		Date:	April 9, 2015
Parent Material:		Weather:	Rain/ 38ºF

Water Resource Conditions: Normal: ____ Above: X Below: ____

TP #15-10 Woods

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-12	A	SL	10YR 3/2	Roots	Depth	24"	Mottling	36"
12-24	B	LS	10YR 4/6		0-15 Min.			
24-36	C1	M-C LS	2.5Y 5/3		15-30 Min.		Weeping	36"
36-60	C2	M-C Sand	2.5Y 5/3	Heavy mottling, 5% gravel	30-45 Min.			
60-92	C3	LS	2.5Y 5/3		45-60 Min.		Standing	80"
					60-75 Min.			
					Rate	**N/A**	"/hr	

Note: Unable to Saturate >1"/min.

TP #15-13

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-12	A	SL	10YR 3/2		Depth	20"	Mottling	26"
12-24	B	LS	10YR 5/6		0-15 Min.	5/8"		
24-53	C1	M-C LS	2.5Y 5/2	Heavy mottling, platey	15-30 Min.	5/8"	Weeping	40"
53-66	C2	V. Fine SL	2.5Y 5/3		30-45 Min.	5/8"		
					45-60 Min.		Standing	54"
					60-75 Min.			
					Rate	**2.5**	"/hr	

TP #15-16 Open

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-12	A	SL	10YR 3/2		Depth	16"	Mottling	22"
12-20	B	F. Sand	10YR 5/6		0-15 Min.	1"		
20-76	C	V. Fine SL	2.5Y 5/2	Heavy mottling/ firm in place	15-30 Min.	1"	Weeping	40"
					30-45 Min.	1"		
					45-60 Min.	1"	Standing	68"
					60-75 Min.			
					Rate	**4"**	"/hr	

TP #15-17 Woods

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-12	A	SL	10YR 3/2	Leaf litter/ roots	Depth	16"	Mottling	N/A
12-28	B	Fine LS	10YR 4/6		0-15 Min.	2 1/2"		
28-96	C	Fine LS	2.5Y 5/2	Platey	15-30 Min.	2 1/2"	Weeping	88"
					30-45 Min.	2 1/2"		
					45-60 Min.		Standing	94"
					60-75 Min.			
					Rate	**10**	"/hr	

Job No.: 8548

Client: Continuing Care Management LLC

Site Location: Village Street, Medway

Land Use:

Parent Material:

Soil Evaluator: Tracy L. Duarte

Witness: N/A

Excavator: Mobile Excavating

Date: April 9, 2015

Weather: Rain/ 38ºF

Water Resource Conditions: Normal: ____ Above: X Below: ____

TP #15-18 Woods

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-12	A	SL	10YR 3/2	Leaf litter/ roots	Depth	18"	Mottling	N/A
12-24	B	M. Sand	10YR 4/6		0-15 Min.			
24-100	C	M. Sand	2.5Y 5/3		15-30 Min.		Weeping	N/A
					30-45 Min.			
					45-60 Min.		Standing	N/A
					60-75 Min.			

Rate **N/A** "/hr

Note: Unable to Saturate >1.25"/min.

TP #

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
					Depth		Mottling	
					0-15 Min.			
					15-30 Min.		Weeping	
					30-45 Min.			
					45-60 Min.		Standing	
					60-75 Min.			

Rate "/hr

TP #

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
					Depth		Mottling	
					0-15 Min.			
					15-30 Min.		Weeping	
					30-45 Min.			
					45-60 Min.		Standing	
					60-75 Min.			

Rate "/hr

TP #

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
					Depth		Mottling	
					0-15 Min.			
					15-30 Min.		Weeping	
					30-45 Min.			
					45-60 Min.		Standing	
					60-75 Min.			

Rate "/hr

Job No.:	8548	Soil Evaluator:	Tracy L. Duarte
Client:	Continuing Care Management LLC	Witness:	N/A
Site Location:	Village Street, Medway	Excavator:	Mobile Excavating
Land Use:		Date:	April 10, 2015
Parent Material:		Weather:	Rain/ 46°F

Water Resource Conditions: Normal: ____ Above: X Below: ____

TP #15-19 Woods

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-12	A	SL	10YR 3/3		Depth	16"/32"	Mottling	N/A
12-22	B	LS	10YR 4/6		0-15 Min.	1.5" / .75"		
22-39	C1	M-C LS	2.5Y 5/2		15-30 Min.	1" / .75"	Weeping	68"
39-86	C2	Fine LS	2.5Y 5/3	5% gravel	30-45 Min.	1" / .75"		
					45-60 Min.	1" / .75"	Standing	84"
					60-75 Min.			
					Rate	**4 / 3**	"/hr	

TP #15-20 Woods

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-12	A	SL	10YR 3/3	Roots, leaf litter	Depth	24"	Mottling	N/A
12-24	B	M-C LS	10YR 4/6		0-15 Min.			
24-48	C1	M-C LS	2.5Y 5/4		15-30 Min.		Weeping	N/A
48-72	C2	Sand	2.5Y 5/2		30-45 Min.			
					45-60 Min.		Standing	N/A
					60-75 Min.			
					Rate	**N/A**	"/hr	

TP #15-21 Woods

Note: Unable to Saturate >2.75"/min.

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-14	A	SL	10YR 3/2		Depth	20"	Mottling	14"
14-22	B	Fine SL	10YR 5/6	Heavy weeping	0-15 Min.	1/4"		
22-38	C1	Fine SL	2.5Y 4/4	super saturated from 22" and below	15-30 Min.	1/8"	Weeping	14"
38-60	C2	Fine SL	2.5Y 5/4	5% gravel	30-45 Min.	1/8"		
				Note: Pocket of fill in east corner	45-60 Min.	1/8"	Standing	55"
				from 0-36"	60-75 Min.			
					Rate	**0.5**	"/hr	

TP #15-27 Woods

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-14	A	SL	10YR 2/2	Roots, leaf litter	Depth	18"	Mottling	26"
14-26	B	M-C LS	10YR 4/6	super saturated from 24" and below	0-15 Min.	1/4"		
26-68	C	M-C LS	2.5Y 5/4	10% gravel, heavy mottling at B/C interface	15-30 Min.	1/4"	Weeping	26"
					30-45 Min.	1/4"		
					45-60 Min.		Standing	56"
					60-75 Min.			
					Rate	**1**	"/hr	

APPENDIX I

STORMCEPTOR SIZING DETAILED REPORT AND OWNER'S MANUAL

Stormceptor Sizing Detailed Report
PCSWMM for Stormceptor

Project Information

Date	6/10/2015
Project Name	Salmon ARCPUD
Project Number	8548
Location	Medwawy, MA

Stormwater Quality Objective

This report outlines how Stormceptor System can achieve a defined water quality objective through the removal of total suspended solids (TSS). Attached to this report is the Stormceptor Sizing Summary.

Stormceptor System Recommendation

The Stormceptor System model STC 450i achieves the water quality objective removing 83% TSS for a Fine (organics, silts and sand) particle size distribution.

The Stormceptor System

The Stormceptor oil and sediment separator is sized to treat stormwater runoff by removing pollutants through gravity separation and flotation. Stormceptor's patented design generates positive TSS removal for all rainfall events, including large storms. Significant levels of pollutants such as heavy metals, free oils and nutrients are prevented from entering natural water resources and the re-suspension of previously captured sediment (scour) does not occur.

Stormceptor provides a high level of TSS removal for small frequent storm events that represent the majority of annual rainfall volume and pollutant load. Positive treatment continues for large infrequent events, however, such events have little impact on the average annual TSS removal as they represent a small percentage of the total runoff volume and pollutant load.

Stormceptor is the only oil and sediment separator on the market sized to remove TSS for a wide range of particle sizes, including fine sediments (clays and silts), that are often overlooked in the design of other stormwater treatment devices.

Small storms dominate hydrologic activity, US EPA reports

"*Early efforts in stormwater management focused on flood events ranging from the 2-yr to the 100-yr storm. Increasingly stormwater professionals have come to realize that small storms (i.e. < 1 in. rainfall) dominate watershed hydrologic parameters typically associated with water quality management issues and BMP design. These small storms are responsible for most annual urban runoff and groundwater recharge. Likewise, with the exception of eroded sediment, they are responsible for most pollutant washoff from urban surfaces. Therefore, the small storms are of most concern for the stormwater management objectives of ground water recharge, water quality resource protection and thermal impacts control.*"

"*Most rainfall events are much smaller than design storms used for urban drainage models. In any given area, most frequently recurrent rainfall events are small (less than 1 in. of daily rainfall).*"

"Continuous simulation offers possibilities for designing and managing BMPs on an individual site-by-site basis that are not provided by other widely used simpler analysis methods. Therefore its application and use should be encouraged."

– US EPA Stormwater Best Management Practice Design Guide, Volume 1 – General Considerations, 2004

Design Methodology

Each Stormceptor system is sized using PCSWMM for Stormceptor, a continuous simulation model based on US EPA SWMM. The program calculates hydrology from up-to-date local historical rainfall data and specified site parameters. With US EPA SWMM's precision, every Stormceptor unit is designed to achieve a defined water quality objective.

The TSS removal data presented follows US EPA guidelines to reduce the average annual TSS load. Stormceptor's unit process for TSS removal is settling. The settling model calculates TSS removal by analyzing (summary of analysis presented in Appendix 2):

- Site parameters
- Continuous historical rainfall, including duration, distribution, peaks (Figure 1)
- Interevent periods
- Particle size distribution
- Particle settling velocities (Stokes Law, corrected for drag)
- TSS load (Figure 2)
- Detention time of the system

The Stormceptor System maintains continuous positive TSS removal for all influent flow rates. Figure 3 illustrates the continuous treatment by Stormceptor throughout the full range of storm events analyzed. It is clear that large events do not significantly impact the average annual TSS removal. There is no decline in cumulative TSS removal, indicating scour does not occur as the flow rate increases.

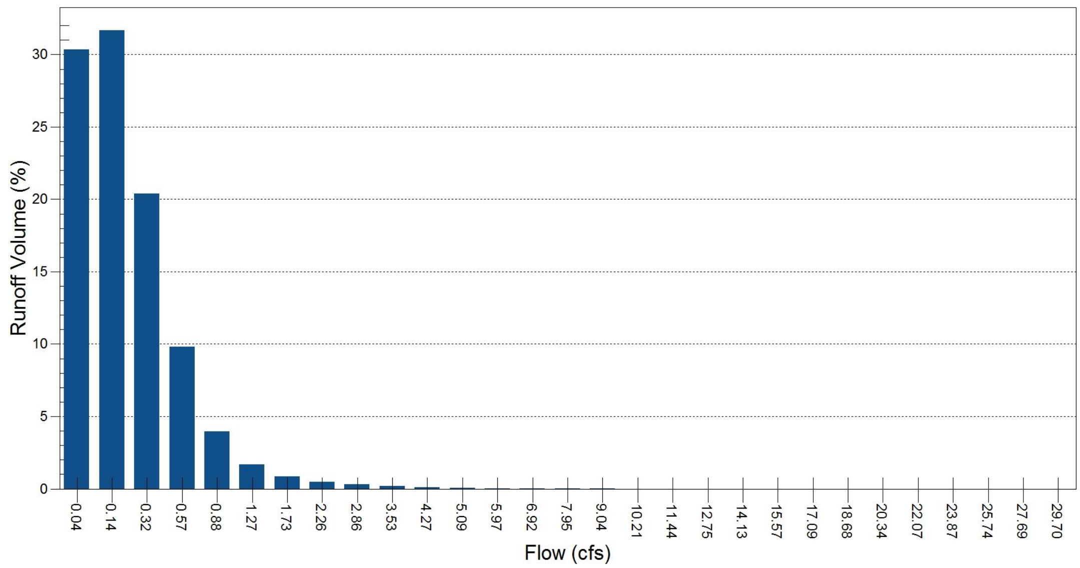


Figure 1. Runoff Volume by Flow Rate for BLUE HILL – MA 736, 1948 to 2005 for 0.81 ac, 65.2% impervious. Small frequent storm events represent the majority of annual rainfall volume. Large infrequent events have little impact on the average annual TSS removal, as they represent a small percentage of the total annual volume of runoff.

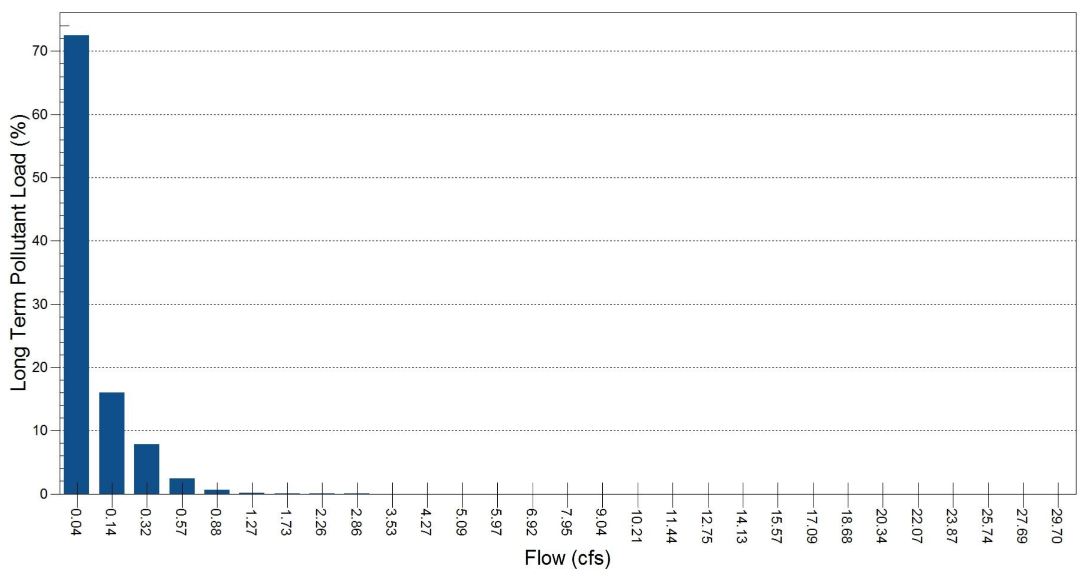
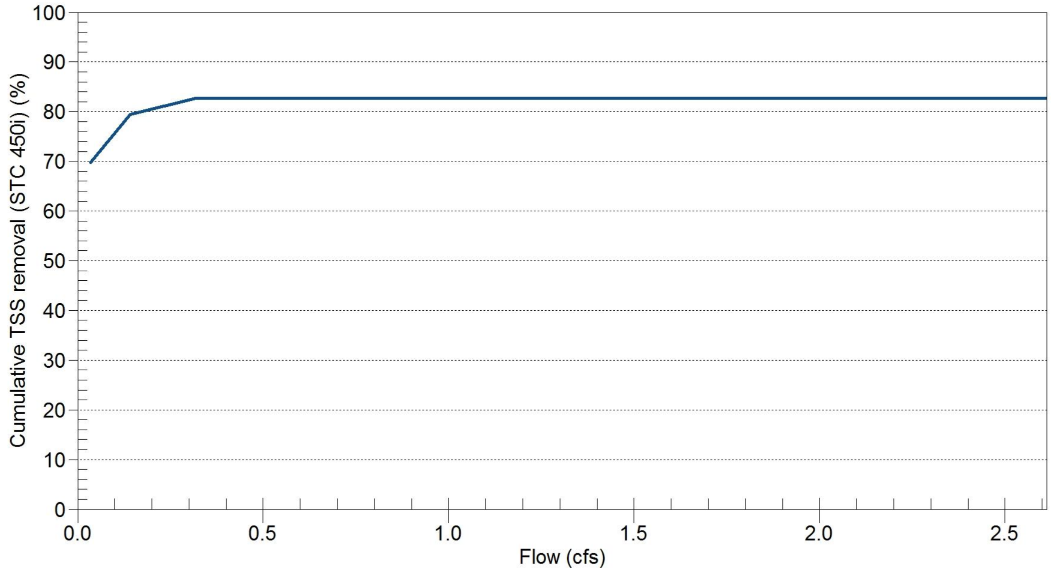


Figure 2. Long Term Pollutant Load by Flow Rate for BLUE HILL – 736, 1948 to 2005 for 0.81 ac, 65.2% impervious. The majority of the annual pollutant load is transported by small frequent storm

events. Conversely, large infrequent events carry an insignificant percentage of the total annual pollutant load.



Stormceptor Model	STC 450i	Drainage Area (ac)	0.81
TSS Removal (%)	83	Impervious (%)	65.2

Figure 3. Cumulative TSS Removal by Flow Rate for BLUE HILL – 736, 1948 to 2005. Stormceptor continuously removes TSS throughout the full range of storm events analyzed.   Note that large events do not significantly impact the average annual TSS removal. Therefore no decline in cumulative TSS removal indicates scour does not occur as the flow rate increases.

Appendix 1
Stormceptor Design Summary

Project Information

Date	6/10/2015
Project Name	Salmon ARCPUD
Project Number	8548
Location	Medwawy, MA

Designer Information

Company	Coneco Engineers & Scientist
Contact	N/A

Notes

N/A

Drainage Area

Total Area (ac)	0.81
Imperviousness (%)	65.2

The Stormceptor System model STC 450i achieves the water quality objective removing 83% TSS for a Fine (organics, silts and sand) particle size distribution.

Rainfall

Name	BLUE HILL
State	MA
ID	736
Years of Records	1948 to 2005
Latitude	42°12'44"N
Longitude	71°6'53"W

Water Quality Objective

TSS Removal (%)	80

Upstream Storage

Storage (ac-ft)	Discharge (cfs)
0	0

Stormceptor Sizing Summary

Stormceptor Model	TSS Removal %
STC 450i	**83**
STC 900	89
STC 1200	89
STC 1800	89
STC 2400	92
STC 3600	92
STC 4800	94
STC 6000	94
STC 7200	95
STC 11000	97
STC 13000	97
STC 16000	97

Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

Fine (organics, silts and sand)

Particle Size µm	Distribution %	Specific Gravity	Settling Velocity ft/s		Particle Size µm	Distribution %	Specific Gravity	Settling Velocity ft/s
20	20	1.3	0.0013					
60	20	1.8	0.0051					
150	20	2.2	0.0354					
400	20	2.65	0.2123					
2000	20	2.65	0.9417					

Stormceptor Design Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
- Only the STC 450i is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 450i to STC 7200 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

Inlet and Outlet Pipe Invert Elevations Differences

Inlet Pipe Configuration	STC 450i	STC 900 to STC 7200	STC 11000 to STC 16000
Single inlet pipe	3 in.	1 in.	3 in.
Multiple inlet pipes	3 in.	3 in.	Only one inlet pipe.

- Design estimates are based on stable site conditions only, after construction is completed.
- Design estimates assume that the storm drain is not submerged during zero flows. For submerged applications, please contact your local Stormceptor representative.
- Design estimates may be modified for specific spills controls. Please contact your local Stormceptor representative for further assistance.
- For pricing inquiries or assistance, please contact Rinker Materials 1 (800) 909-7763 www.rinkerstormceptor.com

Appendix 2
Summary of Design Assumptions

SITE DETAILS

Site Drainage Area

Total Area (ac)	0.81	Imperviousness (%)	65.2

Surface Characteristics

Width (ft)	376
Slope (%)	2
Impervious Depression Storage (in.)	0.02
Pervious Depression Storage (in.)	0.2
Impervious Manning's n	0.015
Pervious Manning's n	0.25

Infiltration Parameters

Horton's equation is used to estimate infiltration	
Max. Infiltration Rate (in/hr)	2.44
Min. Infiltration Rate (in/hr)	0.4
Decay Rate (s^{-1})	0.00055
Regeneration Rate (s^{-1})	0.01

Evaporation

Daily Evaporation Rate (inches/day)	0.1

Maintenance Frequency

Sediment build-up reduces the storage volume for sedimentation. Frequency of maintenance is assumed for TSS removal calculations.	
Maintenance Frequency (months)	12

Dry Weather Flow

Dry Weather Flow (cfs)	No

Upstream Attenuation

Stage-storage and stage-discharge relationship used to model attenuation upstream of the Stormceptor System is identified in the table below.

Storage ac-ft	Discharge cfs
0	0

PARTICLE SIZE DISTRIBUTION

Particle Size Distribution

Removing fine particles from runoff ensures the majority of pollutants, such as heavy metals, hydrocarbons, free oils and nutrients are not discharged into natural water resources. The table below identifies the particle size distribution selected to define TSS removal for the design of the Stormceptor System.

Fine (organics, silts and sand)								
Particle Size µm	Distribution %	Specific Gravity	Settling Velocity ft/s		Particle Size µm	Distribution %	Specific Gravity	Settling Velocity ft/s
20	20	1.3	0.0013					
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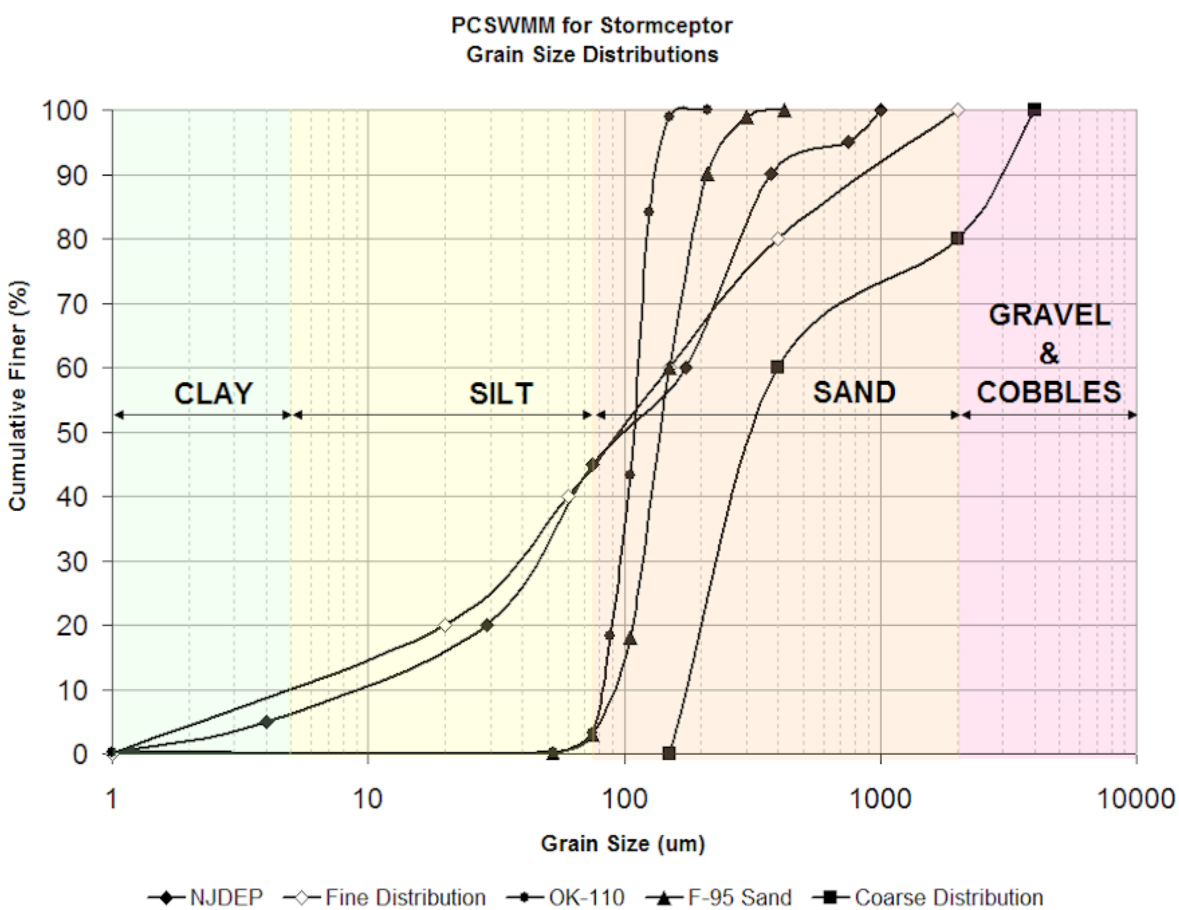


Figure 1. PCSWMM for Stormceptor standard design grain size distributions.

TSS LOADING

TSS Loading Parameters

TSS Loading Function	Buildup / Washoff

Parameters

Target Event Mean Concentration (EMC) (mg/L)	125
Exponential Buildup Power	0.4
Exponential Washoff Exponential	0.2

HYDROLOGY ANALYSIS

PCSWMM for Stormceptor calculates annual hydrology with the US EPA SWMM and local continuous historical rainfall data. Performance calculations of the Stormceptor System are based on the average annual removal of TSS for the selected site parameters. The Stormceptor System is engineered to capture fine particles (silts and sands) by focusing on average annual runoff volume ensuring positive removal efficiency is maintained during all rainfall events, while preventing the opportunity for negative removal efficiency (scour).

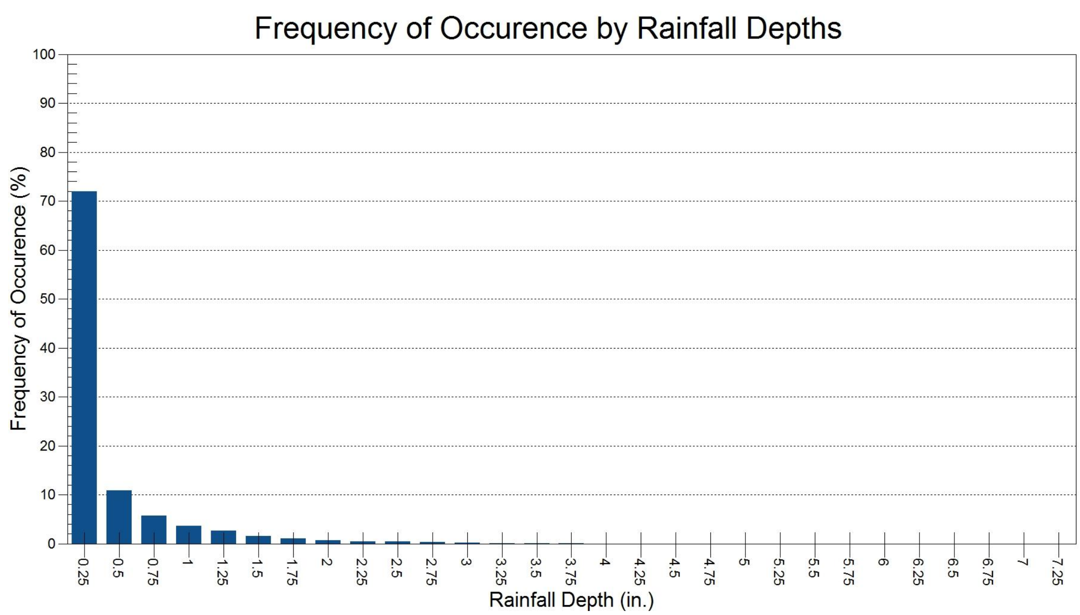
Smaller recurring storms account for the majority of rainfall events and average annual runoff volume, as observed in the historical rainfall data analyses presented in this section.

Rainfall Station

Rainfall Station	BLUE HILL		
Rainfall File Name	MA736.NDC	Total Number of Events	9865
Latitude	42°12'44"N	Total Rainfall (in.)	2849.7
Longitude	71°6'53"W	Average Annual Rainfall (in.)	49.1
Elevation (ft)	630	Total Evaporation (in.)	163.2
Rainfall Period of Record (y)	58	Total Infiltration (in.)	975.9
Total Rainfall Period (y)	58	Percentage of Rainfall that is Runoff (%)	62.4

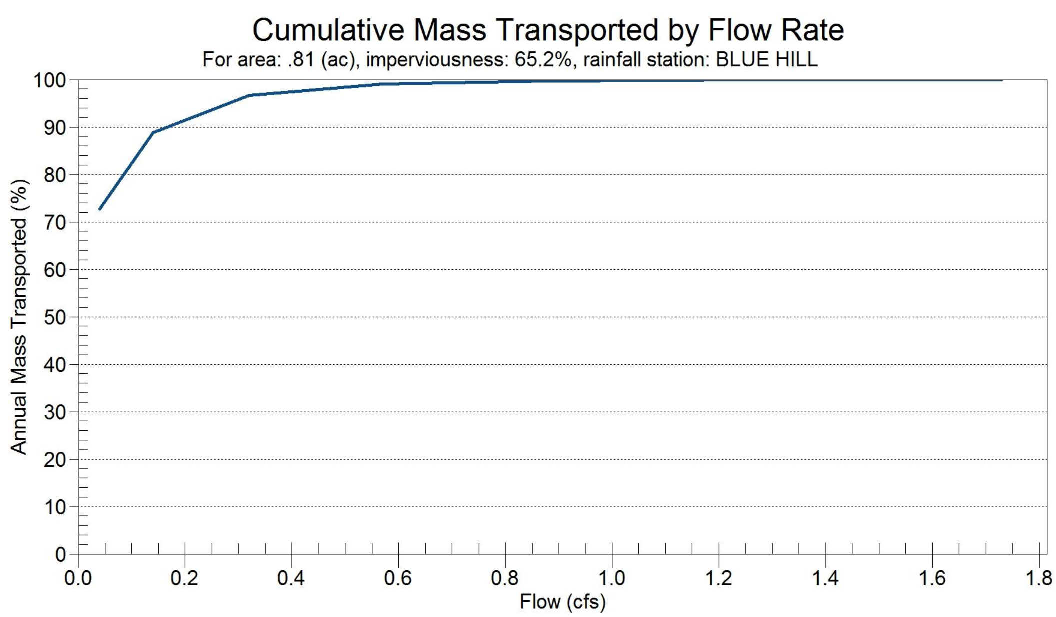
Rainfall Event Analysis

Rainfall Depth in.	No. of Events	Percentage of Total Events %	Total Volume in.	Percentage of Annual Volume %
0.25	7098	72.0	431	15.1
0.50	1076	10.9	393	13.8
0.75	563	5.7	350	12.3
1.00	360	3.6	311	10.9
1.25	257	2.6	288	10.1
1.50	151	1.5	207	7.3
1.75	102	1.0	165	5.8
2.00	70	0.7	130	4.6
2.25	42	0.4	89	3.1
2.50	41	0.4	98	3.4
2.75	27	0.3	71	2.5
3.00	21	0.2	61	2.1
3.25	13	0.1	40	1.4
3.50	10	0.1	34	1.2
3.75	5	0.1	18	0.6
4.00	2	0.0	8	0.3
4.25	1	0.0	4	0.1
4.50	4	0.0	18	0.6
4.75	4	0.0	18	0.6
5.00	0	0.0	0	0.0
5.25	1	0.0	5	0.2
5.50	3	0.0	16	0.6
5.75	2	0.0	11	0.4
6.00	4	0.0	23	0.8
6.25	0	0.0	0	0.0
6.50	0	0.0	0	0.0
6.75	1	0.0	7	0.2
7.00	1	0.0	7	0.2
7.25	2	0.0	14	0.5
7.50	0	0.0	0	0.0
7.75	1	0.0	8	0.3
8.00	1	0.0	8	0.3
8.25	0	0.0	0	0.0
>8.25	2	0.0	17	0.6



Pollutograph

Flow Rate cfs	Cumulative Mass %
0.035	72.7
0.141	88.8
0.318	96.6
0.565	99.1
0.883	99.7
1.271	99.9
1.73	100.0
2.26	100.0
2.86	100.0
3.531	100.0
4.273	100.0
5.085	100.0
5.968	100.0
6.922	100.0
7.946	100.0
9.041	100.0
10.206	100.0
11.442	100.0
12.749	100.0
14.126	100.0
15.574	100.0
17.092	100.0
18.681	100.0
20.341	100.0
22.072	100.0
23.873	100.0
25.744	100.0
27.687	100.0
29.7	100.0
31.783	100.0



Stormceptor Sizing Detailed Report
PCSWMM for Stormceptor

Project Information

Date	6/10/2015
Project Name	Salmon ARCPUD
Project Number	8548
Location	Medwawy, MA

Stormwater Quality Objective

This report outlines how Stormceptor System can achieve a defined water quality objective through the removal of total suspended solids (TSS). Attached to this report is the Stormceptor Sizing Summary.

Stormceptor System Recommendation

The Stormceptor System model STC 900 achieves the water quality objective removing 86% TSS for a Fine (organics, silts and sand) particle size distribution.

The Stormceptor System

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- Particle size distribution
- Particle settling velocities (Stokes Law, corrected for drag)
- TSS load (Figure 2)
- Detention time of the system

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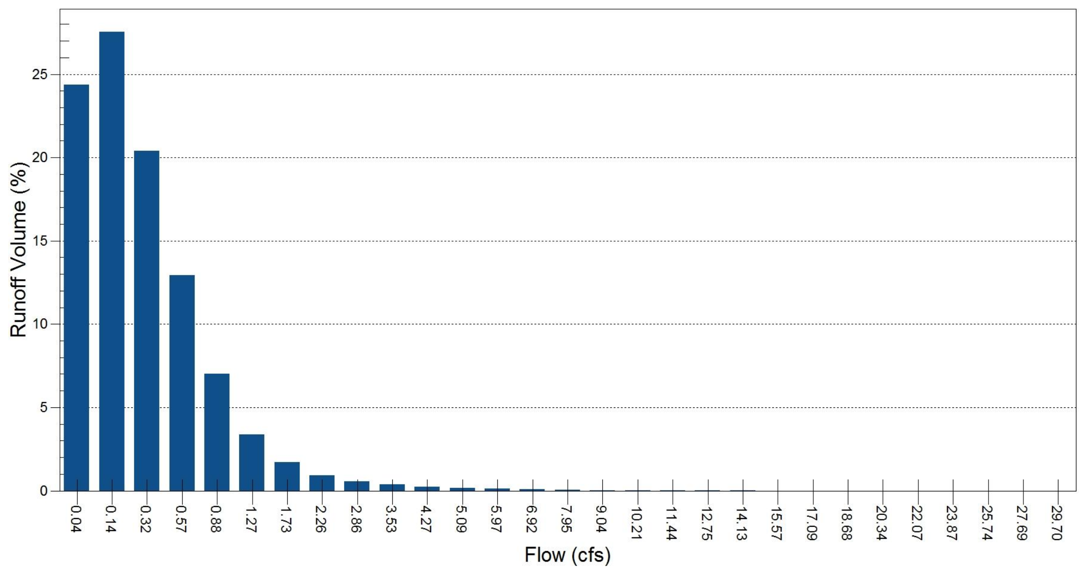


Figure 1. Runoff Volume by Flow Rate for BLUE HILL – MA 736, 1948 to 2005 for 1.27 ac, 66.1% impervious. Small frequent storm events represent the majority of annual rainfall volume. Large infrequent events have little impact on the average annual TSS removal, as they represent a small percentage of the total annual volume of runoff.

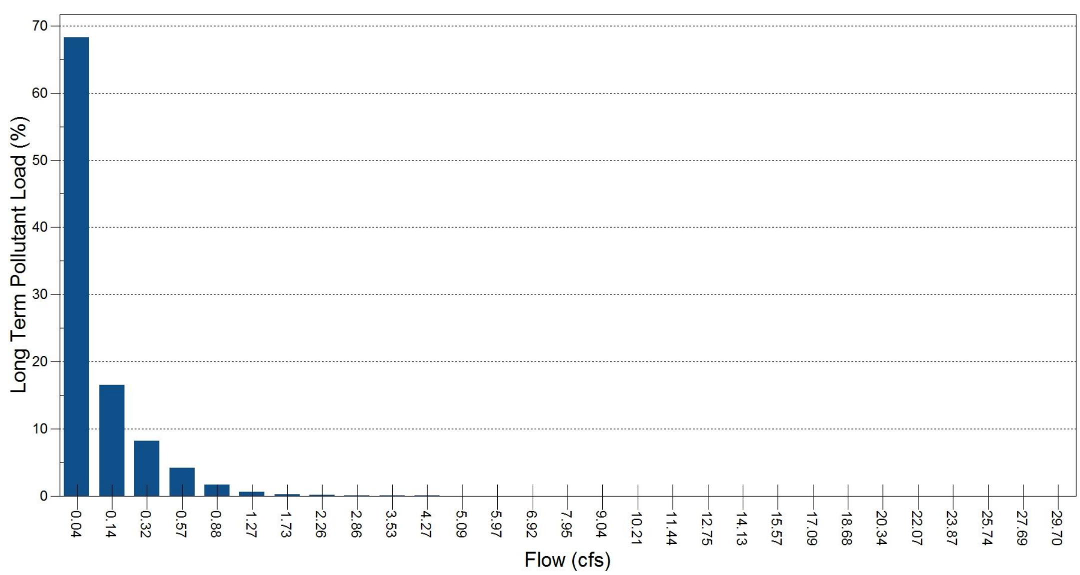
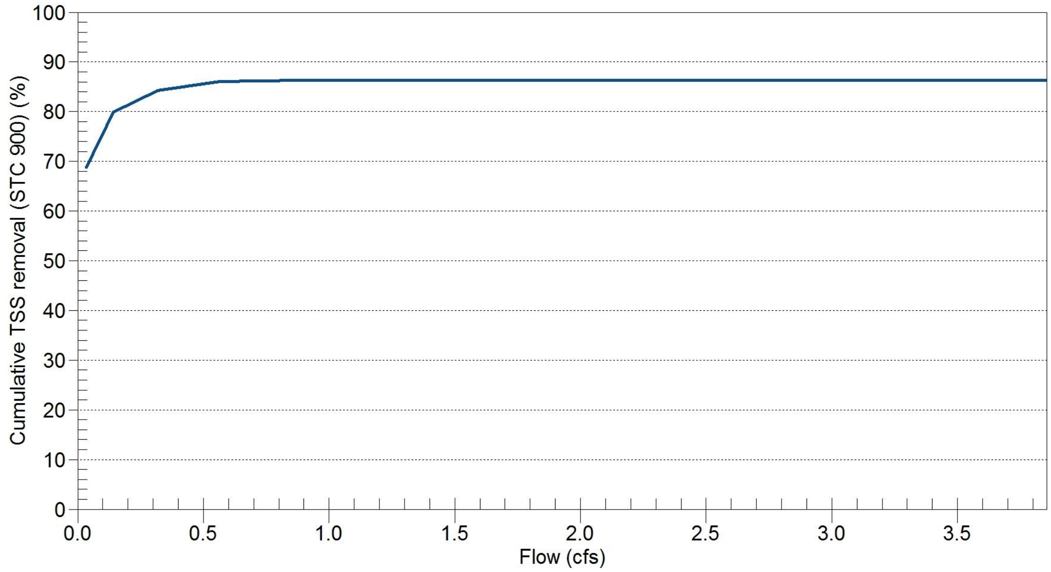


Figure 2. Long Term Pollutant Load by Flow Rate for BLUE HILL – 736, 1948 to 2005 for 1.27 ac, 66.1% impervious. The majority of the annual pollutant load is transported by small frequent storm

events. Conversely, large infrequent events carry an insignificant percentage of the total annual pollutant load.



Stormceptor Model	STC 900	Drainage Area (ac)	1.27
TSS Removal (%)	86	Impervious (%)	66.1

Figure 3. Cumulative TSS Removal by Flow Rate for BLUE HILL – 736, 1948 to 2005. Stormceptor continuously removes TSS throughout the full range of storm events analyzed.   Note that large events do not significantly impact the average annual TSS removal. Therefore no decline in cumulative TSS removal indicates scour does not occur as the flow rate increases.

Stormceptor®

Appendix 1
Stormceptor Design Summary

Project Information

Date	6/10/2015
Project Name	Salmon ARCPUD
Project Number	8548
Location	Medwawy, MA

Designer Information

Company	Coneco Engineers & Scientist
Contact	N/A

Notes

N/A

Drainage Area

Total Area (ac)	1.27
Imperviousness (%)	66.1

The Stormceptor System model STC 900 achieves the water quality objective removing 86% TSS for a Fine (organics, silts and sand) particle size distribution.

Rainfall

Name	BLUE HILL
State	MA
ID	736
Years of Records	1948 to 2005
Latitude	42°12'44"N
Longitude	71°6'53"W

Water Quality Objective

TSS Removal (%)	80

Upstream Storage

Storage (ac-ft)	Discharge (cfs)
0	0

Stormceptor Sizing Summary

Stormceptor Model	TSS Removal %
STC 450i	79
STC 900	**86**
STC 1200	86
STC 1800	86
STC 2400	89
STC 3600	90
STC 4800	92
STC 6000	92
STC 7200	94
STC 11000	95
STC 13000	95
STC 16000	96

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Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

Fine (organics, silts and sand)								
Particle Size µm	Distribution %	Specific Gravity	Settling Velocity ft/s		Particle Size µm	Distribution %	Specific Gravity	Settling Velocity ft/s
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Stormceptor Design Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
- Only the STC 450i is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 450i to STC 7200 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

Inlet and Outlet Pipe Invert Elevations Differences

Inlet Pipe Configuration	STC 450i	STC 900 to STC 7200	STC 11000 to STC 16000
Single inlet pipe	3 in.	1 in.	3 in.
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Stormceptor®

Appendix 2
Summary of Design Assumptions

SITE DETAILS

Site Drainage Area

Total Area (ac)	1.27	Imperviousness (%)	66.1

Surface Characteristics

Width (ft)	470
Slope (%)	2
Impervious Depression Storage (in.)	0.02
Pervious Depression Storage (in.)	0.2
Impervious Manning's n	0.015
Pervious Manning's n	0.25

Infiltration Parameters

Horton's equation is used to estimate infiltration

Max. Infiltration Rate (in/hr)	2.44
Min. Infiltration Rate (in/hr)	0.4
Decay Rate (s^{-1})	0.00055
Regeneration Rate (s^{-1})	0.01

Maintenance Frequency

Sediment build-up reduces the storage volume for sedimentation. Frequency of maintenance is assumed for TSS removal calculations.

Maintenance Frequency (months)	12

Evaporation

Daily Evaporation Rate (inches/day)	0.1

Dry Weather Flow

Dry Weather Flow (cfs)	No

Upstream Attenuation

Stage-storage and stage-discharge relationship used to model attenuation upstream of the Stormceptor System is identified in the table below.

Storage ac-ft	Discharge cfs
0	0

Rinker MATERIALS™

PARTICLE SIZE DISTRIBUTION

Particle Size Distribution

Removing fine particles from runoff ensures the majority of pollutants, such as heavy metals, hydrocarbons, free oils and nutrients are not discharged into natural water resources. The table below identifies the particle size distribution selected to define TSS removal for the design of the Stormceptor System.

Fine (organics, silts and sand)								
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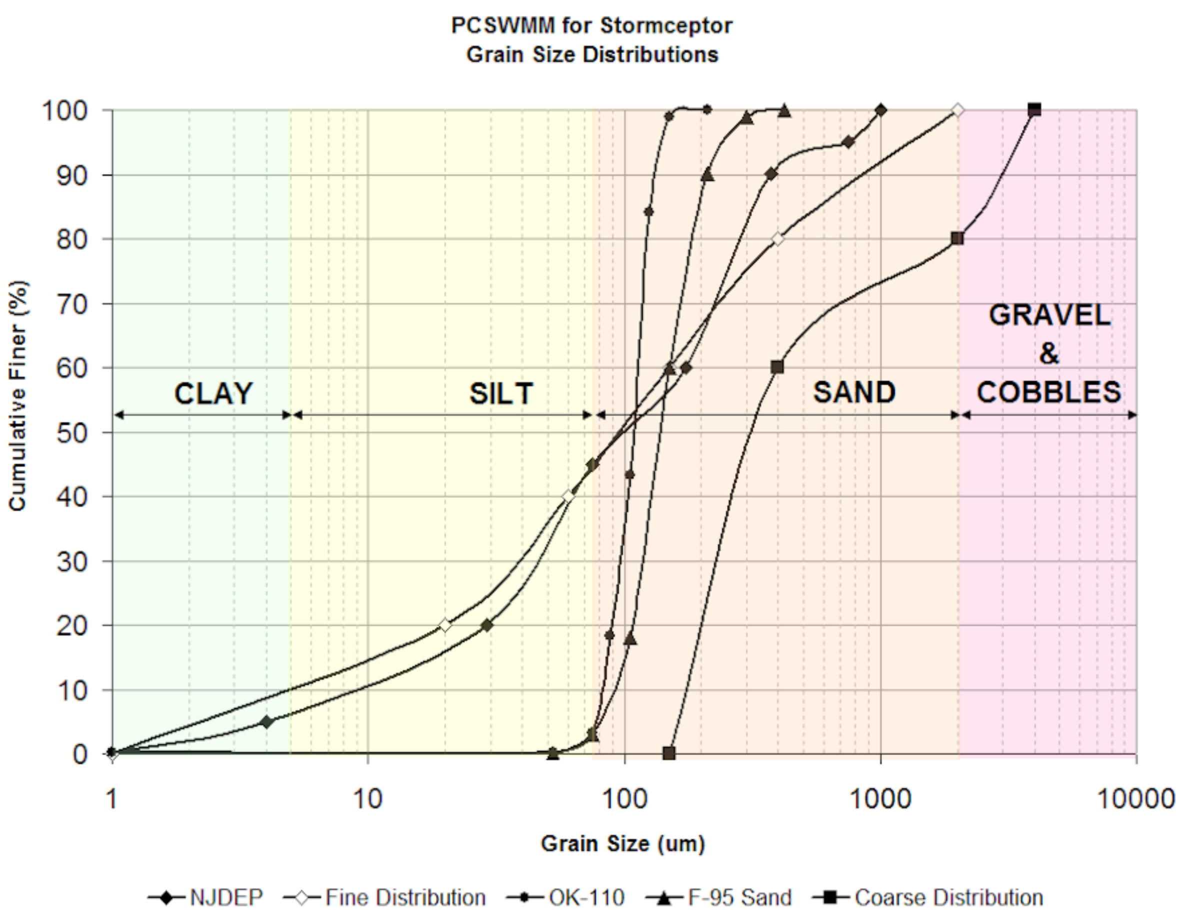


Figure 1. PCSWMM for Stormceptor standard design grain size distributions.

TSS LOADING

TSS Loading Parameters

TSS Loading Function	Buildup / Washoff

Parameters

Target Event Mean Concentration (EMC) (mg/L)	125
Exponential Buildup Power	0.4
Exponential Washoff Exponential	0.2

HYDROLOGY ANALYSIS

PCSWMM for Stormceptor calculates annual hydrology with the US EPA SWMM and local continuous historical rainfall data. Performance calculations of the Stormceptor System are based on the average annual removal of TSS for the selected site parameters. The Stormceptor System is engineered to capture fine particles (silts and sands) by focusing on average annual runoff volume ensuring positive removal efficiency is maintained during all rainfall events, while preventing the opportunity for negative removal efficiency (scour).

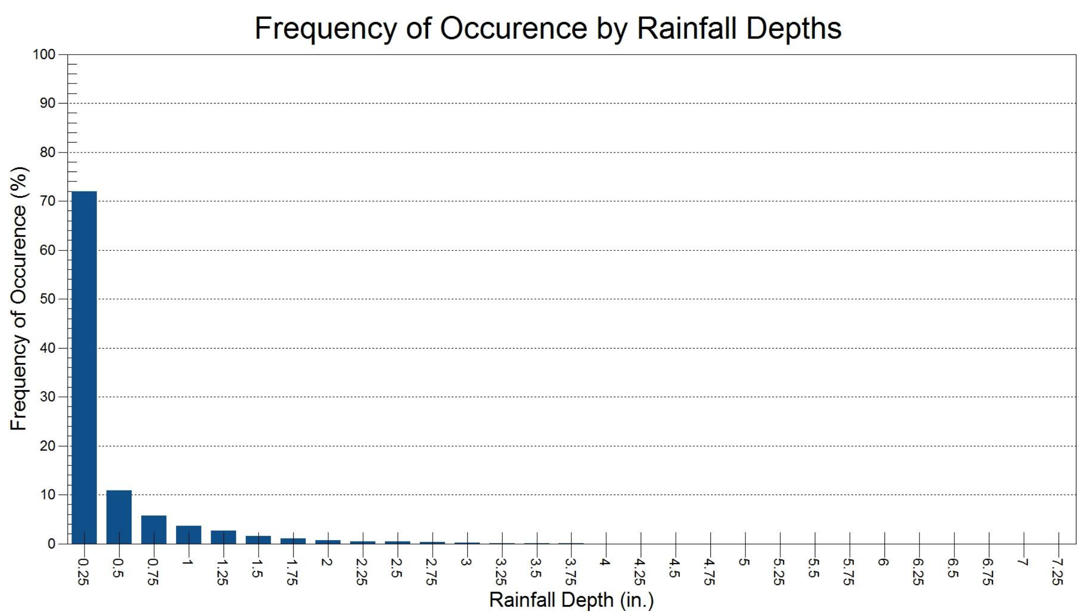
Smaller recurring storms account for the majority of rainfall events and average annual runoff volume, as observed in the historical rainfall data analyses presented in this section.

Rainfall Station

Rainfall Station	BLUE HILL		
Rainfall File Name	MA736.NDC	Total Number of Events	9865
Latitude	42°12'44"N	Total Rainfall (in.)	2849.7
Longitude	71°6'53"W	Average Annual Rainfall (in.)	49.1
Elevation (ft)	630	Total Evaporation (in.)	168.1
Rainfall Period of Record (y)	58	Total Infiltration (in.)	951.3
Total Rainfall Period (y)	58	Percentage of Rainfall that is Runoff (%)	63.0

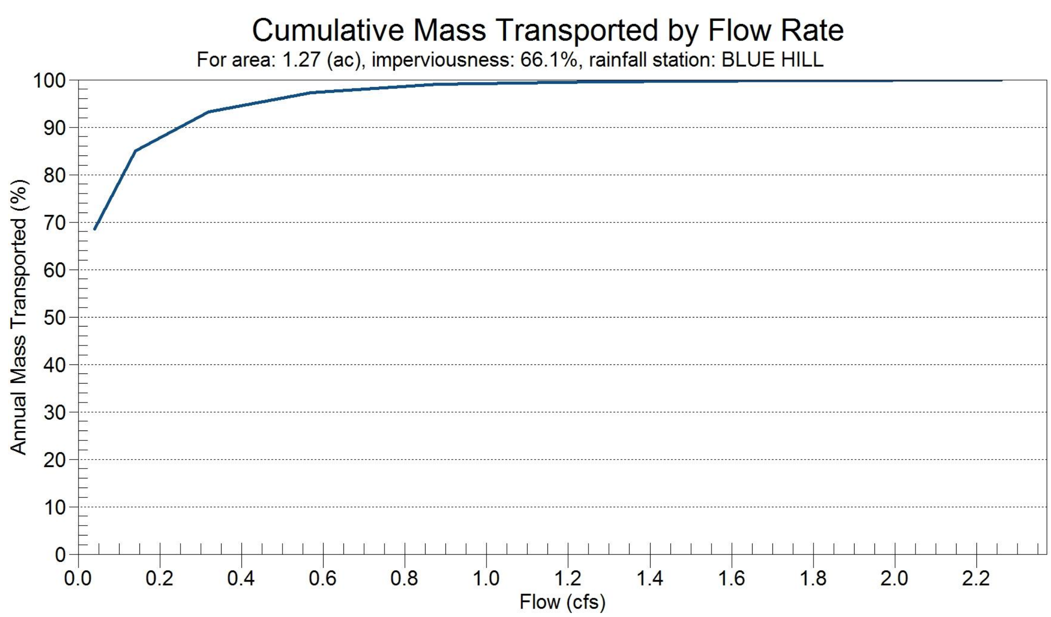
Rainfall Event Analysis

Rainfall Depth in.	No. of Events	Percentage of Total Events %	Total Volume in.	Percentage of Annual Volume %
0.25	7098	72.0	431	15.1
0.50	1076	10.9	393	13.8
0.75	563	5.7	350	12.3
1.00	360	3.6	311	10.9
1.25	257	2.6	288	10.1
1.50	151	1.5	207	7.3
1.75	102	1.0	165	5.8
2.00	70	0.7	130	4.6
2.25	42	0.4	89	3.1
2.50	41	0.4	98	3.4
2.75	27	0.3	71	2.5
3.00	21	0.2	61	2.1
3.25	13	0.1	40	1.4
3.50	10	0.1	34	1.2
3.75	5	0.1	18	0.6
4.00	2	0.0	8	0.3
4.25	1	0.0	4	0.1
4.50	4	0.0	18	0.6
4.75	4	0.0	18	0.6
5.00	0	0.0	0	0.0
5.25	1	0.0	5	0.2
5.50	3	0.0	16	0.6
5.75	2	0.0	11	0.4
6.00	4	0.0	23	0.8
6.25	0	0.0	0	0.0
6.50	0	0.0	0	0.0
6.75	1	0.0	7	0.2
7.00	1	0.0	7	0.2
7.25	2	0.0	14	0.5
7.50	0	0.0	0	0.0
7.75	1	0.0	8	0.3
8.00	1	0.0	8	0.3
8.25	0	0.0	0	0.0
>8.25	2	0.0	17	0.6



Pollutograph

Flow Rate cfs	Cumulative Mass %
0.035	68.5
0.141	85.0
0.318	93.2
0.565	97.3
0.883	99.0
1.271	99.6
1.73	99.8
2.26	99.9
2.86	100.0
3.531	100.0
4.273	100.0
5.085	100.0
5.968	100.0
6.922	100.0
7.946	100.0
9.041	100.0
10.206	100.0
11.442	100.0
12.749	100.0
14.126	100.0
15.574	100.0
17.092	100.0
18.681	100.0
20.341	100.0
22.072	100.0
23.873	100.0
25.744	100.0
27.687	100.0
29.7	100.0
31.783	100.0



Stormceptor Sizing Detailed Report

PCSWMM for Stormceptor

Project Information

Date	6/10/2015
Project Name	Salmon ARCPUD
Project Number	8548
Location	Medwawy, MA

Stormwater Quality Objective

This report outlines how Stormceptor System can achieve a defined water quality objective through the removal of total suspended solids (TSS). Attached to this report is the Stormceptor Sizing Summary.

Stormceptor System Recommendation

The Stormceptor System model STC 4800 achieves the water quality objective removing 80% TSS for a Fine (organics, silts and sand) particle size distribution.

The Stormceptor System

The Stormceptor oil and sediment separator is sized to treat stormwater runoff by removing pollutants through gravity separation and flotation. Stormceptor's patented design generates positive TSS removal for all rainfall events, including large storms. Significant levels of pollutants such as heavy metals, free oils and nutrients are prevented from entering natural water resources and the re-suspension of previously captured sediment (scour) does not occur.

Stormceptor provides a high level of TSS removal for small frequent storm events that represent the majority of annual rainfall volume and pollutant load. Positive treatment continues for large infrequent events, however, such events have little impact on the average annual TSS removal as they represent a small percentage of the total runoff volume and pollutant load.

Stormceptor is the only oil and sediment separator on the market sized to remove TSS for a wide range of particle sizes, including fine sediments (clays and silts), that are often overlooked in the design of other stormwater treatment devices.

Small storms dominate hydrologic activity, US EPA reports

"*Early efforts in stormwater management focused on flood events ranging from the 2-yr to the 100-yr storm. Increasingly stormwater professionals have come to realize that small storms (i.e. < 1 in. rainfall) dominate watershed hydrologic parameters typically associated with water quality management issues and BMP design. These small storms are responsible for most annual urban runoff and groundwater recharge. Likewise, with the exception of eroded sediment, they are responsible for most pollutant washoff from urban surfaces. Therefore, the small storms are of most concern for the stormwater management objectives of ground water recharge, water quality resource protection and thermal impacts control.*"

"*Most rainfall events are much smaller than design storms used for urban drainage models. In any given area, most frequently recurrent rainfall events are small (less than 1 in. of daily rainfall).*"

"Continuous simulation offers possibilities for designing and managing BMPs on an individual site-by-site basis that are not provided by other widely used simpler analysis methods. Therefore its application and use should be encouraged."

– US EPA Stormwater Best Management Practice Design Guide, Volume 1 – General Considerations, 2004

Design Methodology

Each Stormceptor system is sized using PCSWMM for Stormceptor, a continuous simulation model based on US EPA SWMM. The program calculates hydrology from up-to-date local historical rainfall data and specified site parameters. With US EPA SWMM's precision, every Stormceptor unit is designed to achieve a defined water quality objective.

The TSS removal data presented follows US EPA guidelines to reduce the average annual TSS load. Stormceptor's unit process for TSS removal is settling. The settling model calculates TSS removal by analyzing (summary of analysis presented in Appendix 2):

- Site parameters
- Continuous historical rainfall, including duration, distribution, peaks (Figure 1)
- Interevent periods
- Particle size distribution
- Particle settling velocities (Stokes Law, corrected for drag)
- TSS load (Figure 2)
- Detention time of the system

The Stormceptor System maintains continuous positive TSS removal for all influent flow rates. Figure 3 illustrates the continuous treatment by Stormceptor throughout the full range of storm events analyzed. It is clear that large events do not significantly impact the average annual TSS removal. There is no decline in cumulative TSS removal, indicating scour does not occur as the flow rate increases.

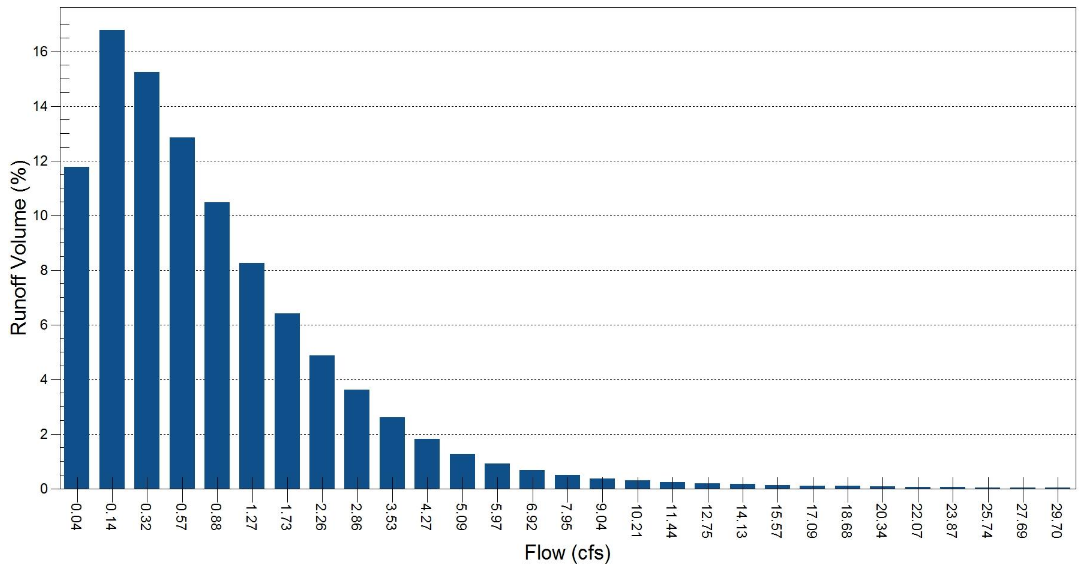


Figure 1. Runoff Volume by Flow Rate for BLUE HILL – MA 736, 1948 to 2005 for 6.14 ac, 56.2% impervious. Small frequent storm events represent the majority of annual rainfall volume. Large infrequent events have little impact on the average annual TSS removal, as they represent a small percentage of the total annual volume of runoff.

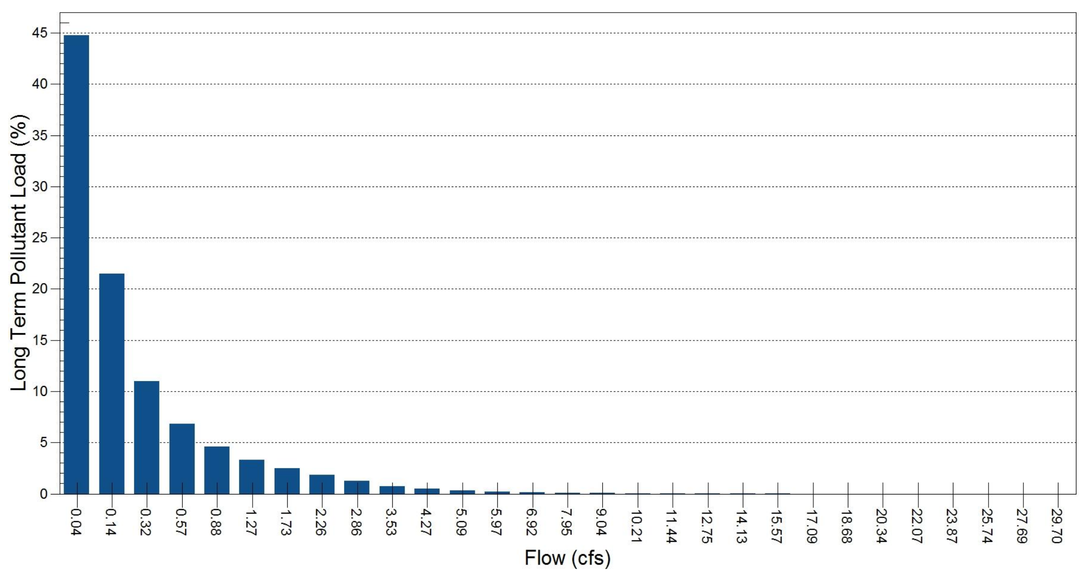
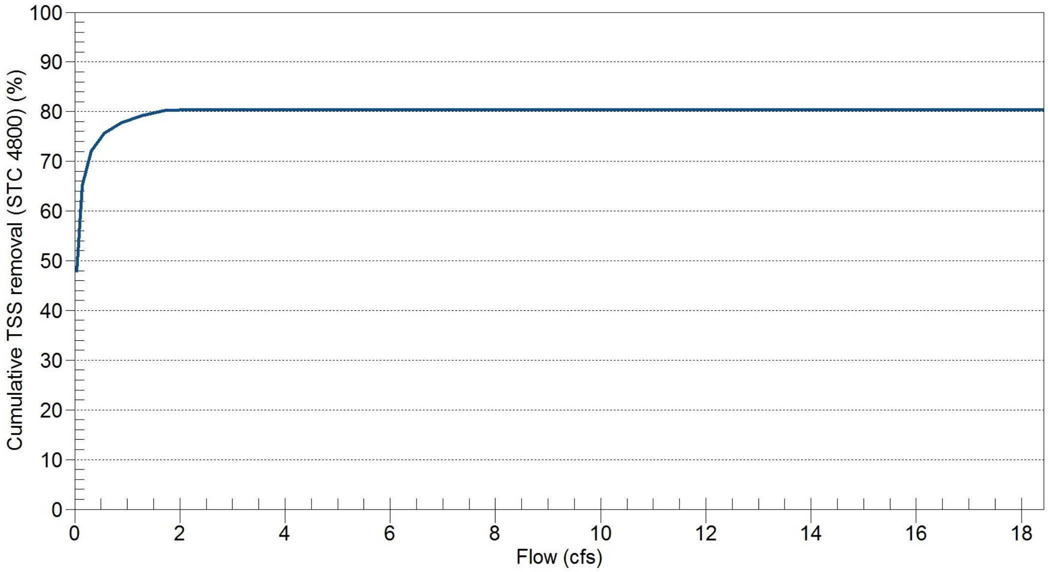


Figure 2. Long Term Pollutant Load by Flow Rate for BLUE HILL – 736, 1948 to 2005 for 6.14 ac, 56.2% impervious. The majority of the annual pollutant load is transported by small frequent storm

events. Conversely, large infrequent events carry an insignificant percentage of the total annual pollutant load.



Stormceptor Model	STC 4800	Drainage Area (ac)	6.14
TSS Removal (%)	80	Impervious (%)	56.2

Figure 3. Cumulative TSS Removal by Flow Rate for BLUE HILL – 736, 1948 to 2005. Stormceptor continuously removes TSS throughout the full range of storm events analyzed. Note that large events do not significantly impact the average annual TSS removal. Therefore no decline in cumulative TSS removal indicates scour does not occur as the flow rate increases.

Appendix 1
Stormceptor Design Summary

Project Information

Date	6/10/2015
Project Name	Salmon ARCPUD
Project Number	8548
Location	Medwawy, MA

Designer Information

Company	Coneco Engineers & Scientist
Contact	N/A

Notes

N/A

Drainage Area

Total Area (ac)	6.14
Imperviousness (%)	56.2

The Stormceptor System model STC 4800 achieves the water quality objective removing 80% TSS for a Fine (organics, silts and sand) particle size distribution.

Rainfall

Name	BLUE HILL
State	MA
ID	736
Years of Records	1948 to 2005
Latitude	42°12'44"N
Longitude	71°6'53"W

Water Quality Objective

TSS Removal (%)	80

Upstream Storage

Storage (ac-ft)	Discharge (cfs)
0	0

Stormceptor Sizing Summary

Stormceptor Model	TSS Removal %
STC 450i	61
STC 900	71
STC 1200	71
STC 1800	71
STC 2400	76
STC 3600	76
STC 4800	**80**
STC 6000	81
STC 7200	84
STC 11000	87
STC 13000	88
STC 16000	89

Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

Fine (organics, silts and sand)

Particle Size µm	Distribution %	Specific Gravity	Settling Velocity ft/s		Particle Size µm	Distribution %	Specific Gravity	Settling Velocity ft/s
20	20	1.3	0.0013					
60	20	1.8	0.0051					
150	20	2.2	0.0354					
400	20	2.65	0.2123					
2000	20	2.65	0.9417					

Stormceptor Design Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
- Only the STC 450i is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 450i to STC 7200 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

Inlet and Outlet Pipe Invert Elevations Differences

Inlet Pipe Configuration	STC 450i	STC 900 to STC 7200	STC 11000 to STC 16000
Single inlet pipe	3 in.	1 in.	3 in.
Multiple inlet pipes	3 in.	3 in.	Only one inlet pipe.

- Design estimates are based on stable site conditions only, after construction is completed.
- Design estimates assume that the storm drain is not submerged during zero flows. For submerged applications, please contact your local Stormceptor representative.
- Design estimates may be modified for specific spills controls. Please contact your local Stormceptor representative for further assistance.
- For pricing inquiries or assistance, please contact Rinker Materials 1 (800) 909-7763 www.rinkerstormceptor.com

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Appendix 2
Summary of Design Assumptions

SITE DETAILS

Site Drainage Area

Total Area (ac)	6.14	Imperviousness (%)	56.2

Surface Characteristics

Width (ft)	1034
Slope (%)	2
Impervious Depression Storage (in.)	0.02
Pervious Depression Storage (in.)	0.2
Impervious Manning's n	0.015
Pervious Manning's n	0.25

Infiltration Parameters

Horton's equation is used to estimate infiltration	
Max. Infiltration Rate (in/hr)	2.44
Min. Infiltration Rate (in/hr)	0.4
Decay Rate (s^{-1})	0.00055
Regeneration Rate (s^{-1})	0.01

Maintenance Frequency

Sediment build-up reduces the storage volume for sedimentation. Frequency of maintenance is assumed for TSS removal calculations.	
Maintenance Frequency (months)	12

Evaporation

Daily Evaporation Rate (inches/day)	0.1

Dry Weather Flow

Dry Weather Flow (cfs)	No

Upstream Attenuation

Stage-storage and stage-discharge relationship used to model attenuation upstream of the Stormceptor System is identified in the table below.

Storage ac-ft	Discharge cfs
0	0

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PARTICLE SIZE DISTRIBUTION

Particle Size Distribution

Removing fine particles from runoff ensures the majority of pollutants, such as heavy metals, hydrocarbons, free oils and nutrients are not discharged into natural water resources. The table below identifies the particle size distribution selected to define TSS removal for the design of the Stormceptor System.

Fine (organics, silts and sand)								
Particle Size µm	Distribution %	Specific Gravity	Settling Velocity ft/s		Particle Size µm	Distribution %	Specific Gravity	Settling Velocity ft/s
20	20	1.3	0.0013					
60	20	1.8	0.0051					
150	20	2.2	0.0354					
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2000	20	2.65	0.9417					

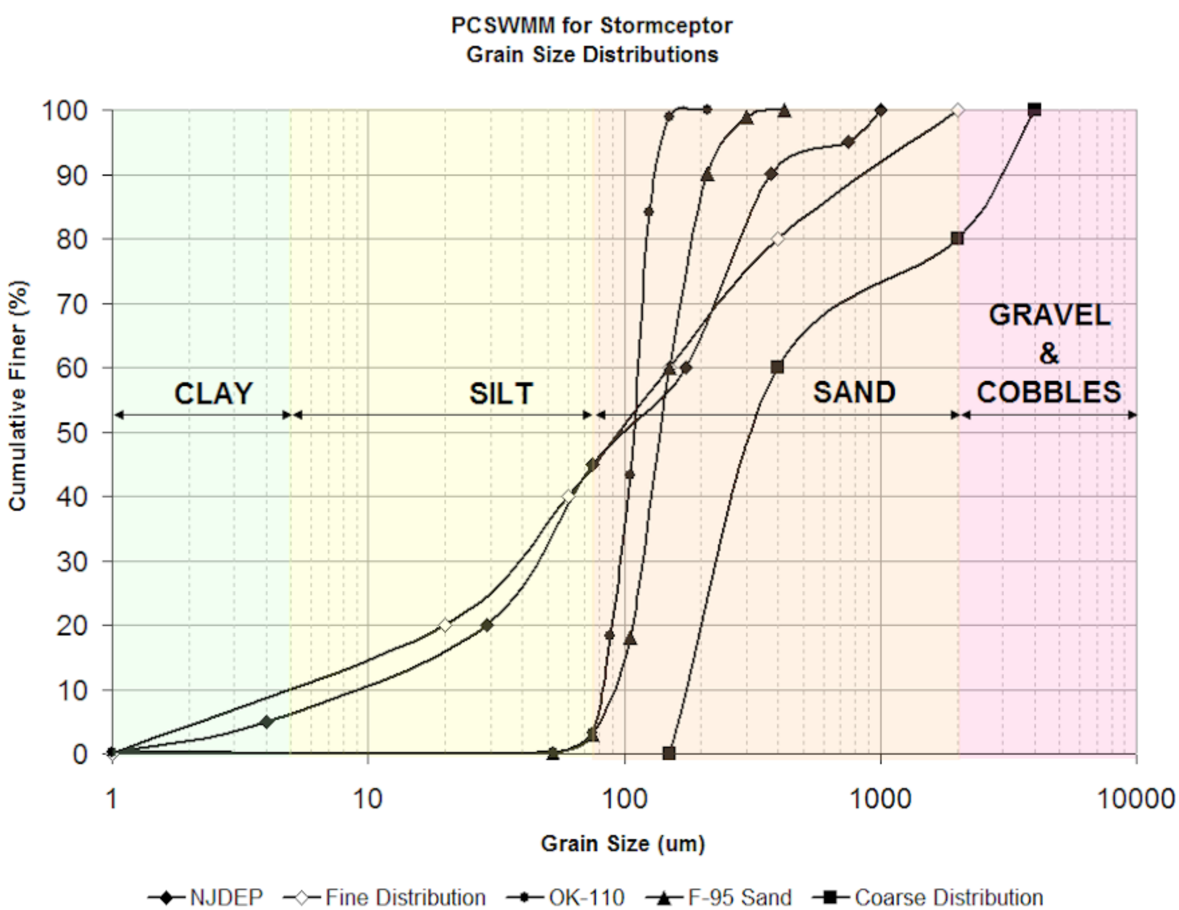

Figure 1. PCSWMM for Stormceptor standard design grain size distributions.

TSS LOADING

TSS Loading Parameters

TSS Loading Function	Buildup / Washoff

Parameters

Target Event Mean Concentration (EMC) (mg/L)	125
Exponential Buildup Power	0.4
Exponential Washoff Exponential	0.2

HYDROLOGY ANALYSIS

PCSWMM for Stormceptor calculates annual hydrology with the US EPA SWMM and local continuous historical rainfall data. Performance calculations of the Stormceptor System are based on the average annual removal of TSS for the selected site parameters. The Stormceptor System is engineered to capture fine particles (silts and sands) by focusing on average annual runoff volume ensuring positive removal efficiency is maintained during all rainfall events, while preventing the opportunity for negative removal efficiency (scour).

Smaller recurring storms account for the majority of rainfall events and average annual runoff volume, as observed in the historical rainfall data analyses presented in this section.

Rainfall Station

Rainfall Station	BLUE HILL		
Rainfall File Name	MA736.NDC	Total Number of Events	9865
Latitude	42°12'44"N	Total Rainfall (in.)	2849.7
Longitude	71°6'53"W	Average Annual Rainfall (in.)	49.1
Elevation (ft)	630	Total Evaporation (in.)	147.7
Rainfall Period of Record (y)	58	Total Infiltration (in.)	1233.2
Total Rainfall Period (y)	58	Percentage of Rainfall that is Runoff (%)	53.0

Rainfall Event Analysis

Rainfall Depth in.	No. of Events	Percentage of Total Events %	Total Volume in.	Percentage of Annual Volume %
0.25	7098	72.0	431	15.1
0.50	1076	10.9	393	13.8
0.75	563	5.7	350	12.3
1.00	360	3.6	311	10.9
1.25	257	2.6	288	10.1
1.50	151	1.5	207	7.3
1.75	102	1.0	165	5.8
2.00	70	0.7	130	4.6
2.25	42	0.4	89	3.1
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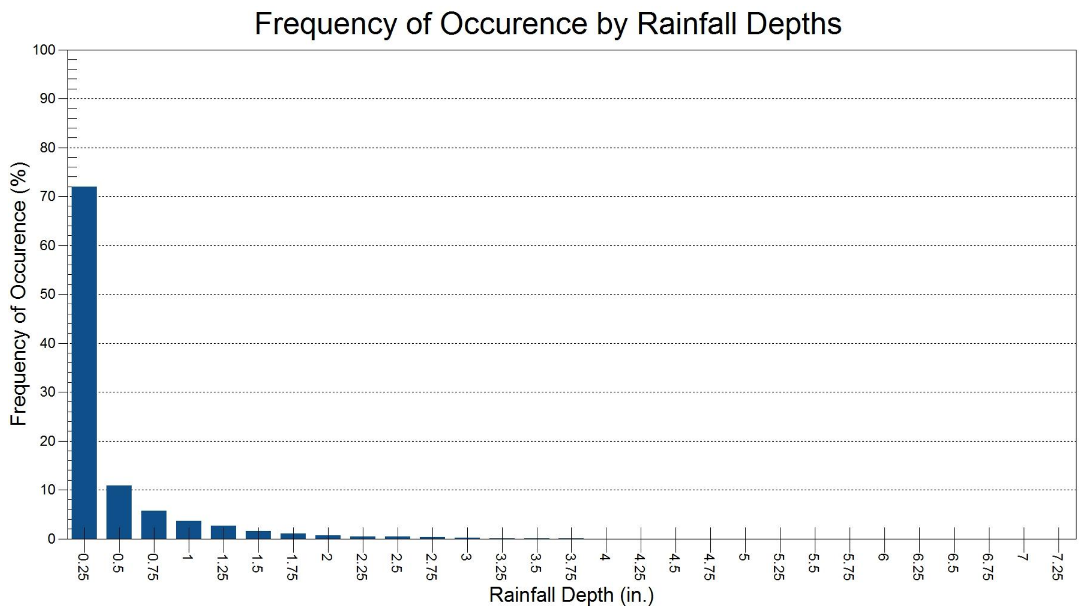

Pollutograph

Flow Rate cfs	Cumulative Mass %
0.035	45.0
0.141	66.5
0.318	77.5
0.565	84.3
0.883	88.9
1.271	92.3
1.73	94.8
2.26	96.6
2.86	97.9
3.531	98.6
4.273	99.1
5.085	99.4
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18.681	100.0
20.341	100.0
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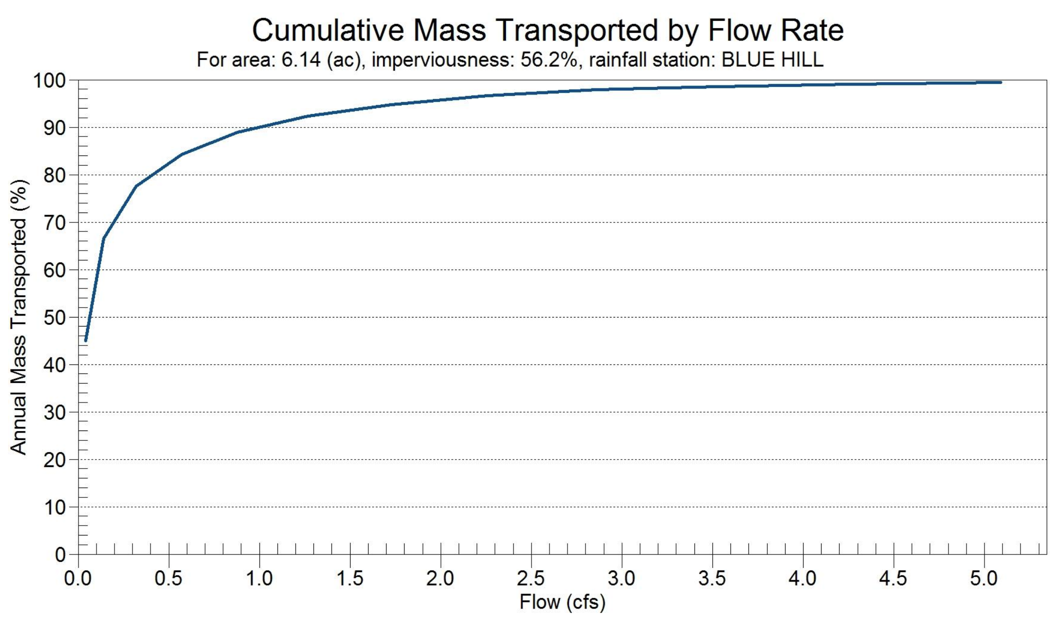
23.873	100.0
25.744	100.0
27.687	100.0
29.7	100.0
31.783	100.0



Stormceptor Sizing Detailed Report

PCSWMM for Stormceptor

Project Information

Date	6/10/2015
Project Name	Salmon ARCPUD
Project Number	8548
Location	Medwawy, MA

Stormwater Quality Objective

This report outlines how Stormceptor System can achieve a defined water quality objective through the removal of total suspended solids (TSS). Attached to this report is the Stormceptor Sizing Summary.

Stormceptor System Recommendation

The Stormceptor System model STC 900 achieves the water quality objective removing 82% TSS for a Fine (organics, silts and sand) particle size distribution.

The Stormceptor System

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- Site parameters
- Continuous historical rainfall, including duration, distribution, peaks (Figure 1)
- Interevent periods
- Particle size distribution
- Particle settling velocities (Stokes Law, corrected for drag)
- TSS load (Figure 2)
- Detention time of the system

The Stormceptor System maintains continuous positive TSS removal for all influent flow rates. Figure 3 illustrates the continuous treatment by Stormceptor throughout the full range of storm events analyzed. It is clear that large events do not significantly impact the average annual TSS removal. There is no decline in cumulative TSS removal, indicating scour does not occur as the flow rate increases.

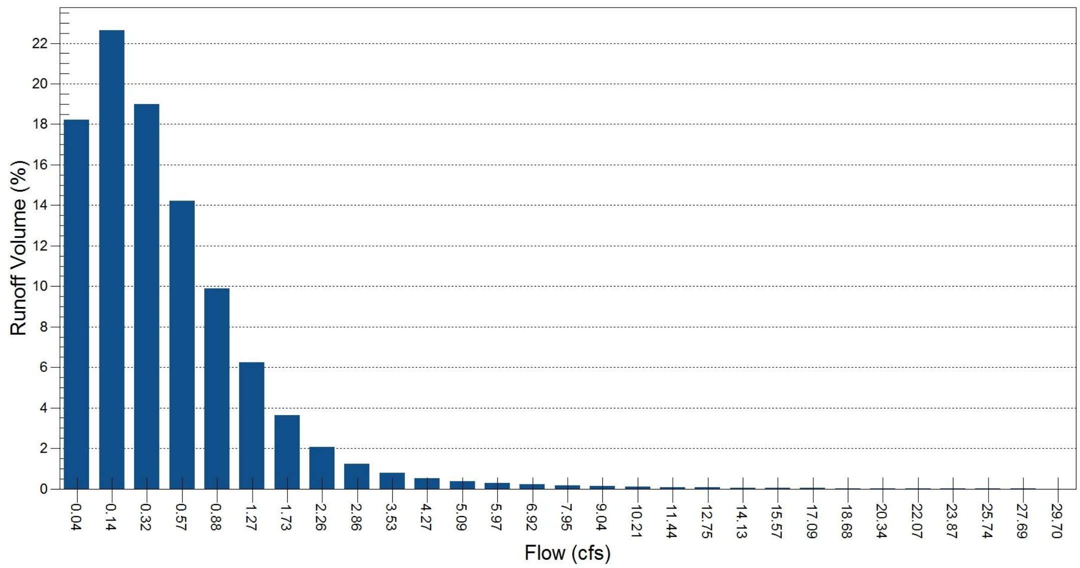


Figure 1. Runoff Volume by Flow Rate for BLUE HILL – MA 736, 1948 to 2005 for 2.81 ac, 50.2% impervious. Small frequent storm events represent the majority of annual rainfall volume. Large infrequent events have little impact on the average annual TSS removal, as they represent a small percentage of the total annual volume of runoff.

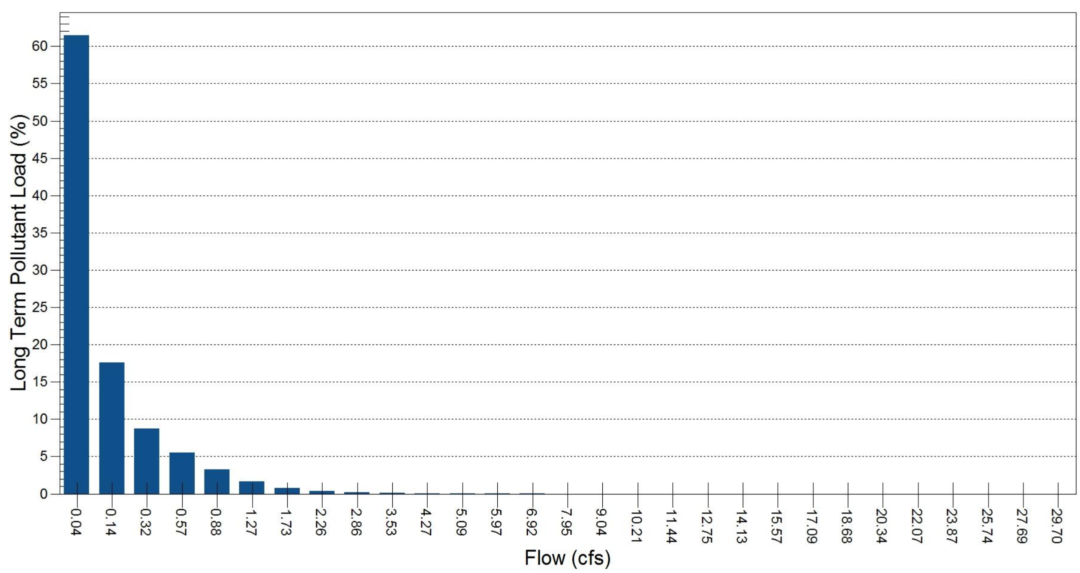
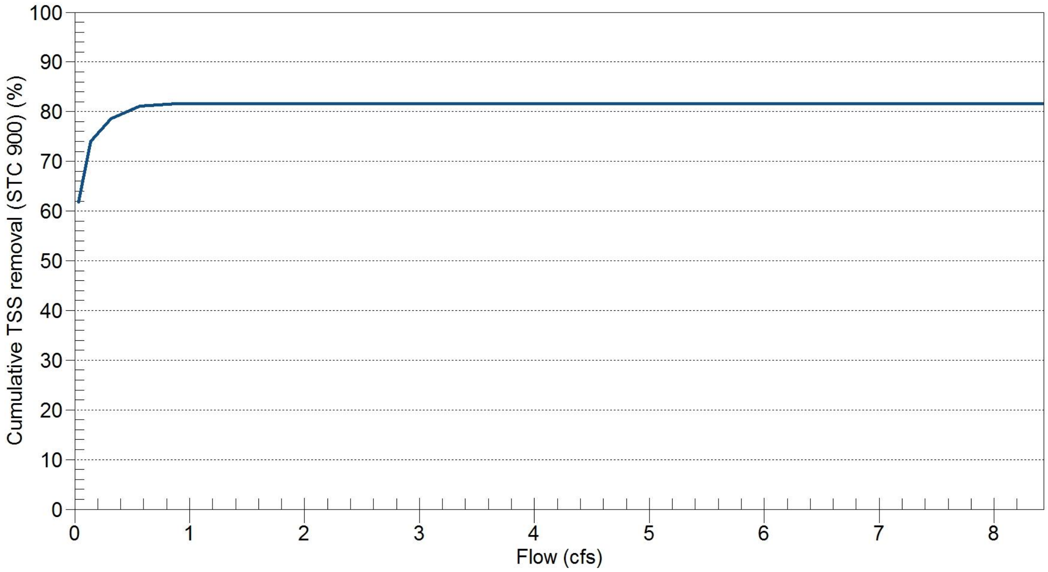


Figure 2. Long Term Pollutant Load by Flow Rate for BLUE HILL – 736, 1948 to 2005 for 2.81 ac, 50.2% impervious. The majority of the annual pollutant load is transported by small frequent storm

events. Conversely, large infrequent events carry an insignificant percentage of the total annual pollutant load.



Stormceptor Model	STC 900	Drainage Area (ac)	2.81
TSS Removal (%)	82	Impervious (%)	50.2

Figure 3. Cumulative TSS Removal by Flow Rate for BLUE HILL – 736, 1948 to 2005. Stormceptor continuously removes TSS throughout the full range of storm events analyzed. Note that large events do not significantly impact the average annual TSS removal. Therefore no decline in cumulative TSS removal indicates scour does not occur as the flow rate increases.

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Appendix 1
Stormceptor Design Summary

Project Information

Date	6/10/2015
Project Name	Salmon ARCPUD
Project Number	8548
Location	Medwawy, MA

Designer Information

Company	Coneco Engineers & Scientist
Contact	N/A

Notes

N/A

Drainage Area

Total Area (ac)	2.81
Imperviousness (%)	50.2

The Stormceptor System model STC 900 achieves the water quality objective removing 82% TSS for a Fine (organics, silts and sand) particle size distribution.

Rainfall

Name	BLUE HILL
State	MA
ID	736
Years of Records	1948 to 2005
Latitude	42°12'44"N
Longitude	71°6'53"W

Water Quality Objective

TSS Removal (%)	80

Upstream Storage

Storage (ac-ft)	Discharge (cfs)
0	0

Stormceptor Sizing Summary

Stormceptor Model	TSS Removal %
STC 450i	73
STC 900	**82**
STC 1200	82
STC 1800	81
STC 2400	85
STC 3600	86
STC 4800	89
STC 6000	89
STC 7200	91
STC 11000	93
STC 13000	93
STC 16000	94

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Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

Fine (organics, silts and sand)

Particle Size µm	Distribution %	Specific Gravity	Settling Velocity ft/s		Particle Size µm	Distribution %	Specific Gravity	Settling Velocity ft/s
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60	20	1.8	0.0051					
150	20	2.2	0.0354					
400	20	2.65	0.2123					
2000	20	2.65	0.9417					

Stormceptor Design Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor.
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- Only the STC 450i is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 450i to STC 7200 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

Inlet and Outlet Pipe Invert Elevations Differences

Inlet Pipe Configuration	STC 450i	STC 900 to STC 7200	STC 11000 to STC 16000
Single inlet pipe	3 in.	1 in.	3 in.
Multiple inlet pipes	3 in.	3 in.	Only one inlet pipe.

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- Design estimates may be modified for specific spills controls. Please contact your local Stormceptor representative for further assistance.
- For pricing inquiries or assistance, please contact Rinker Materials 1 (800) 909-7763 www.rinkerstormceptor.com

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Appendix 2
Summary of Design Assumptions

SITE DETAILS

Site Drainage Area

Total Area (ac)	2.81	Imperviousness (%)	50.2

Surface Characteristics

Width (ft)	700
Slope (%)	2
Impervious Depression Storage (in.)	0.02
Pervious Depression Storage (in.)	0.2
Impervious Manning's n	0.015
Pervious Manning's n	0.25

Maintenance Frequency

Sediment build-up reduces the storage volume for sedimentation. Frequency of maintenance is assumed for TSS removal calculations.

Maintenance Frequency (months)	12

Infiltration Parameters

Horton's equation is used to estimate infiltration

Max. Infiltration Rate (in/hr)	2.44
Min. Infiltration Rate (in/hr)	0.4
Decay Rate (s^{-1})	0.00055
Regeneration Rate (s^{-1})	0.01

Evaporation

Daily Evaporation Rate (inches/day)	0.1

Dry Weather Flow

Dry Weather Flow (cfs)	No

Upstream Attenuation

Stage-storage and stage-discharge relationship used to model attenuation upstream of the Stormceptor System is identified in the table below.

Storage ac-ft	Discharge cfs
0	0

Rinker MATERIALS™

PARTICLE SIZE DISTRIBUTION

Particle Size Distribution

Removing fine particles from runoff ensures the majority of pollutants, such as heavy metals, hydrocarbons, free oils and nutrients are not discharged into natural water resources. The table below identifies the particle size distribution selected to define TSS removal for the design of the Stormceptor System.

Fine (organics, silts and sand)								
Particle Size µm	Distribution %	Specific Gravity	Settling Velocity ft/s		Particle Size µm	Distribution %	Specific Gravity	Settling Velocity ft/s
20	20	1.3	0.0013					
60	20	1.8	0.0051					
150	20	2.2	0.0354					
400	20	2.65	0.2123					
2000	20	2.65	0.9417					

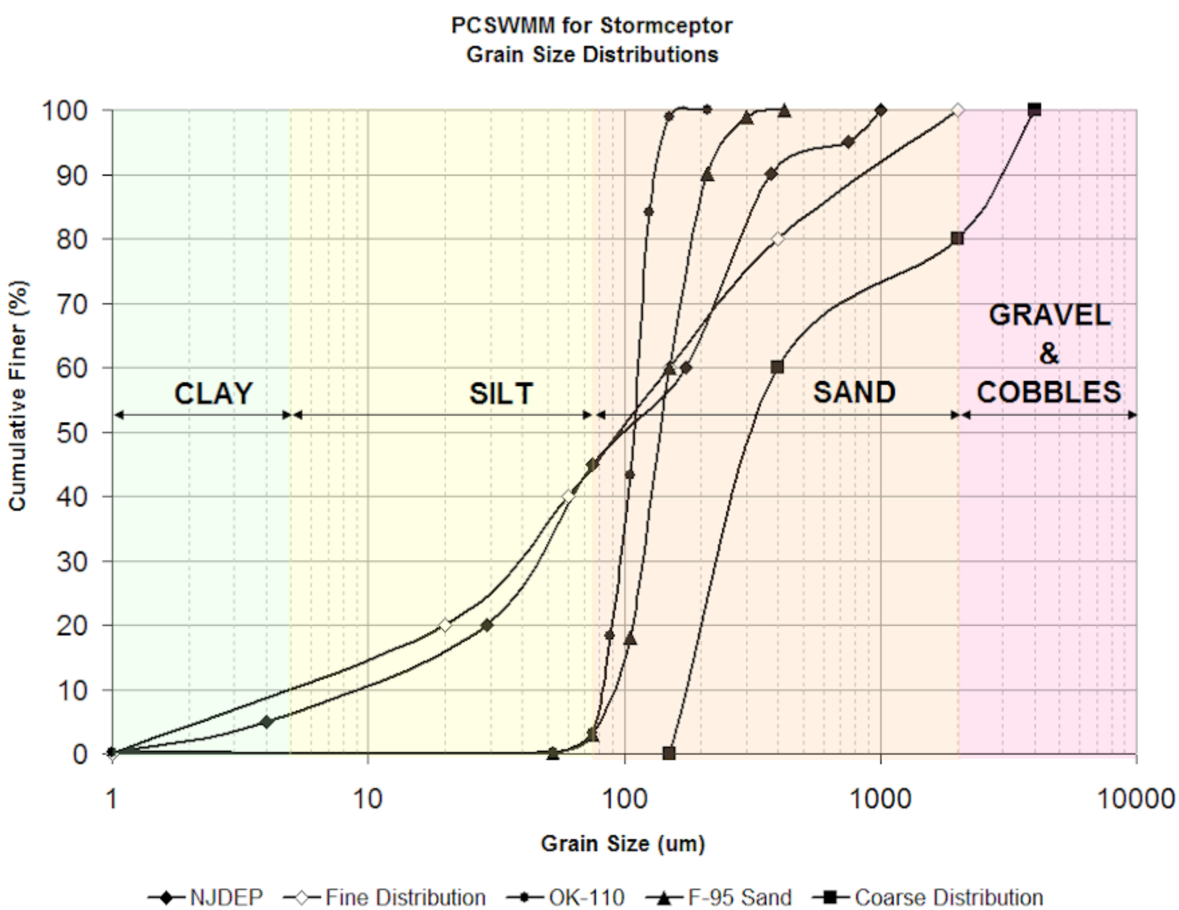


Figure 1. PCSWMM for Stormceptor standard design grain size distributions.

TSS LOADING

TSS Loading Parameters

TSS Loading Function	Buildup / Washoff

Parameters

Target Event Mean Concentration (EMC) (mg/L)	125
Exponential Buildup Power	0.4
Exponential Washoff Exponential	0.2

HYDROLOGY ANALYSIS

PCSWMM for Stormceptor calculates annual hydrology with the US EPA SWMM and local continuous historical rainfall data. Performance calculations of the Stormceptor System are based on the average annual removal of TSS for the selected site parameters. The Stormceptor System is engineered to capture fine particles (silts and sands) by focusing on average annual runoff volume ensuring positive removal efficiency is maintained during all rainfall events, while preventing the opportunity for negative removal efficiency (scour).

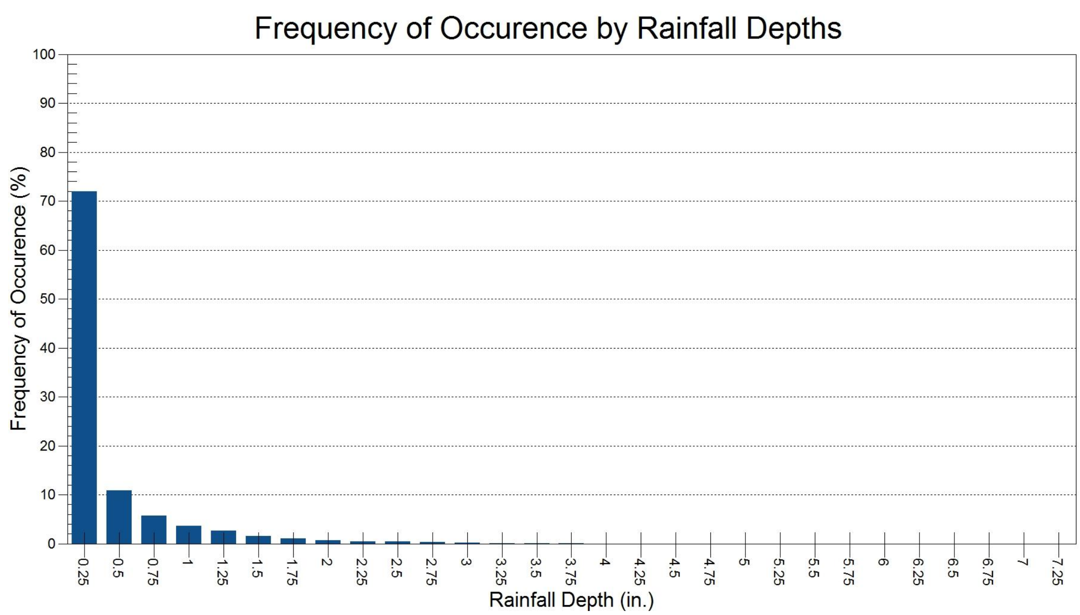
Smaller recurring storms account for the majority of rainfall events and average annual runoff volume, as observed in the historical rainfall data analyses presented in this section.

Rainfall Station

Rainfall Station	BLUE HILL		
Rainfall File Name	MA736.NDC	Total Number of Events	9865
Latitude	42°12'44"N	Total Rainfall (in.)	2849.7
Longitude	71°6'53"W	Average Annual Rainfall (in.)	49.1
Elevation (ft)	630	Total Evaporation (in.)	129.6
Rainfall Period of Record (y)	58	Total Infiltration (in.)	1401.3
Total Rainfall Period (y)	58	Percentage of Rainfall that is Runoff (%)	47.9

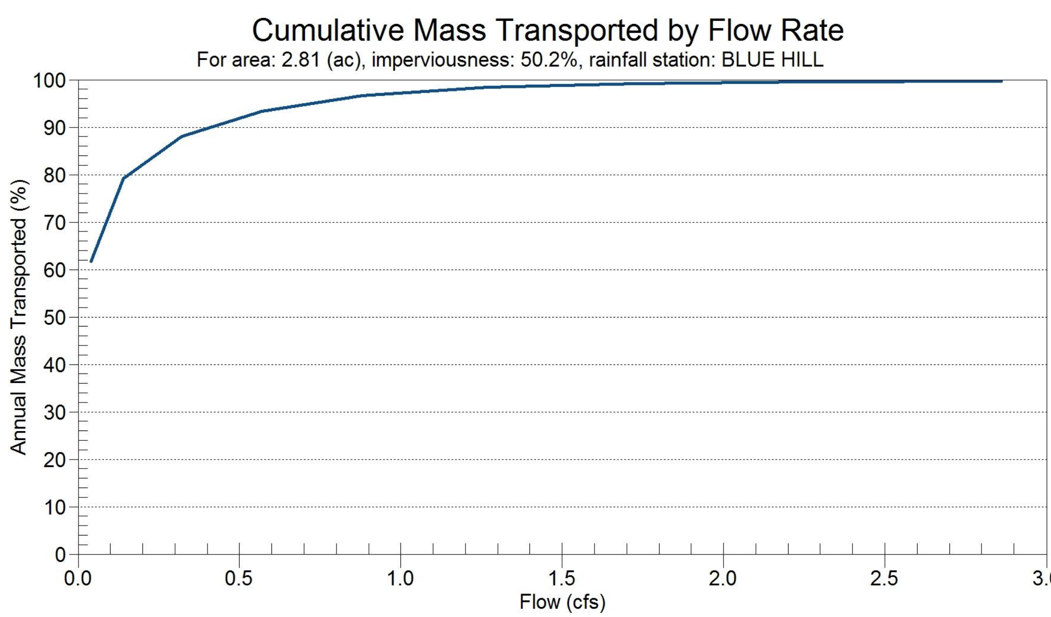
Rainfall Event Analysis

Rainfall Depth in.	No. of Events	Percentage of Total Events %	Total Volume in.	Percentage of Annual Volume %
0.25	7098	72.0	431	15.1
0.50	1076	10.9	393	13.8
0.75	563	5.7	350	12.3
1.00	360	3.6	311	10.9
1.25	257	2.6	288	10.1
1.50	151	1.5	207	7.3
1.75	102	1.0	165	5.8
2.00	70	0.7	130	4.6
2.25	42	0.4	89	3.1
2.50	41	0.4	98	3.4
2.75	27	0.3	71	2.5
3.00	21	0.2	61	2.1
3.25	13	0.1	40	1.4
3.50	10	0.1	34	1.2
3.75	5	0.1	18	0.6
4.00	2	0.0	8	0.3
4.25	1	0.0	4	0.1
4.50	4	0.0	18	0.6
4.75	4	0.0	18	0.6
5.00	0	0.0	0	0.0
5.25	1	0.0	5	0.2
5.50	3	0.0	16	0.6
5.75	2	0.0	11	0.4
6.00	4	0.0	23	0.8
6.25	0	0.0	0	0.0
6.50	0	0.0	0	0.0
6.75	1	0.0	7	0.2
7.00	1	0.0	7	0.2
7.25	2	0.0	14	0.5
7.50	0	0.0	0	0.0
7.75	1	0.0	8	0.3
8.00	1	0.0	8	0.3
8.25	0	0.0	0	0.0
>8.25	2	0.0	17	0.6



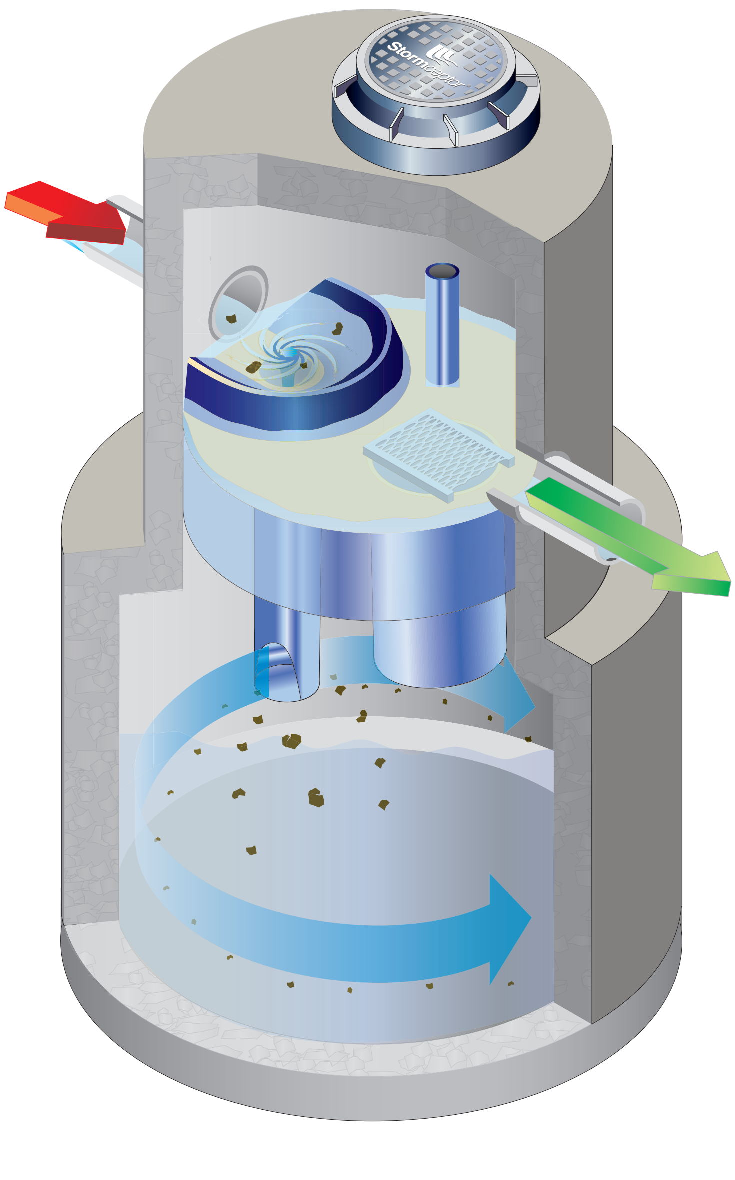
Pollutograph

Flow Rate cfs	Cumulative Mass %
0.035	61.7
0.141	79.2
0.318	88.0
0.565	93.4
0.883	96.7
1.271	98.4
1.73	99.2
2.26	99.6
2.86	99.7
3.531	99.9
4.273	99.9
5.085	100.0
5.968	100.0
6.922	100.0
7.946	100.0
9.041	100.0
10.206	100.0
11.442	100.0
12.749	100.0
14.126	100.0
15.574	100.0
17.092	100.0
18.681	100.0
20.341	100.0
22.072	100.0
23.873	100.0
25.744	100.0
27.687	100.0
29.7	100.0
31.783	100.0



Stormceptor®

Owner's Manual



Stormceptor is protected by one or more of the following patents:

Canadian Patent No. 2,137,942
Canadian Patent No. 2,175,277
Canadian Patent No. 2,180,305
Canadian Patent No. 2,180,383
Canadian Patent No. 2,206,338
Canadian Patent No. 2,327,768
U.S. Patent No. 5,753,115
U.S. Patent No. 5,849,181
U.S. Patent No. 6,068,765
U.S. Patent No. 6,371,690
U.S. Patent No. 7,582,216
U.S. Patent No. 7,666,303
Australia Patent No. 693.164
Australia Patent No. 707,133
Australia Patent No. 729,096
Australia Patent No. 779,401
Australia Patent No. 2008,279,378
Australia Patent No. 2008,288,900
Indonesia Patent No. 0007058
Japan Patent No. 3581233
Japan Patent No. 9-11476
Korean Patent No. 0519212
Malaysia Patent No. 118987
New Zealand Patent No. 314,646
New Zealand Patent No. 583,008
New Zealand Patent No. 583,583
South African Patent No. 2010/00682
South African Patent No. 2010/01796
Other Patents Pending

Table of Contents

Congratulations!

Your selection of a Stormceptor® means that you have chosen the most recognized and efficient stormwater oil/sediment separator available for protecting the environment. Stormceptor is a pollution control device often referred to as a “Hydrodynamic Separator (HDS)” or an “Oil Grit Separator (OGS)”, engineered to remove and retain pollutants from stormwater runoff to protect our lakes, rivers and streams from the harmful effects of non-point source pollution.

1 – Stormceptor Overview

Stormceptor is a patented stormwater quality structure most often utilized as a treatment component of the underground storm drain network for stormwater pollution prevention. Stormceptor is designed to remove sediment, total suspended solids (TSS), other pollutants attached to sediment, hydrocarbons and free oil from stormwater runoff. Collectively the Stormceptor provides spill protection and prevents non-point source pollution from entering downstream waterways.

Key benefits of Stormceptor include:

- Removes sediment, suspended solids, debris, nutrients, heavy metals, and hydrocarbons (oil and grease) from runoff and snowmelt.
- Will not scour or re-suspend trapped pollutants.
- Provides sediment and oil storage.
- Provides spill control for accidents, commercial and industrial developments.
- Easy to inspect and maintain (vacuum truck).
- “STORMCEPTOR” is *clearly* marked on the access cover (excluding inlet designs).
- Relatively small footprint.
- 3rd Party tested and independently verified.
- Dedicated team of experts available to provide support.

Model Types:

- STC (Standard)
- STF (Fiberglass)
- EOS (Extended Oil Storage)
- OSR (Oil and Sand Removal)
- MAX (Custom designed unit, specific to site)

Configuration Types:

- Inlet unit (accommodates inlet flow entry, and multi-pipe entry)
- In-Line (accommodates multi-pipe entry)
- Submerged Unit (accommodates the site’s tailwater conditions)
- Series Unit (combines treatment in two systems)

Please Maintain Your Stormceptor

To ensure long-term environmental protection through continued performance as originally designed for your site, **Stormceptor must be maintained**, as any stormwater treatment practice does. The need for maintenance is determined through inspection of the Stormceptor. Procedures for inspection are provided within this document. Maintenance of the Stormceptor is performed from the surface via vacuum truck.

If you require information about Stormceptor, or assistance in finding resources to facilitate inspections or maintenance of your Stormceptor please call your local Stormceptor Licensee or Imbrium® Systems.

2 – Stormceptor Operation & Components

Stormceptor is a flexibly designed underground stormwater quality treatment device that is unparalleled in its effectiveness for pollutant capture and retention using patented flow separation technology.

Stormceptor creates a non-turbulent treatment environment below the insert platform within the system. The insert diverts water into the lower chamber, allowing free oils and debris to rise, and sediment to settle under relatively low velocity conditions. These pollutants are trapped and stored below the insert and protected from large runoff events for later removal during the maintenance procedure.

With thousands of units operating worldwide, Stormceptor delivers reliable protection every day, in every storm. The patented Stormceptor design prohibits the scour and release of captured pollutants, ensuring superior water quality treatment and protection during even the most extreme storm events. Stormceptor's proven performance is backed by the longest record of lab and field verification in the industry.

Stormceptor Schematic and Component Functions

Below are schematics of two common Stormceptor configurations with key components identified and their functions briefly described.

Figure 1.

Inline Stormceptor

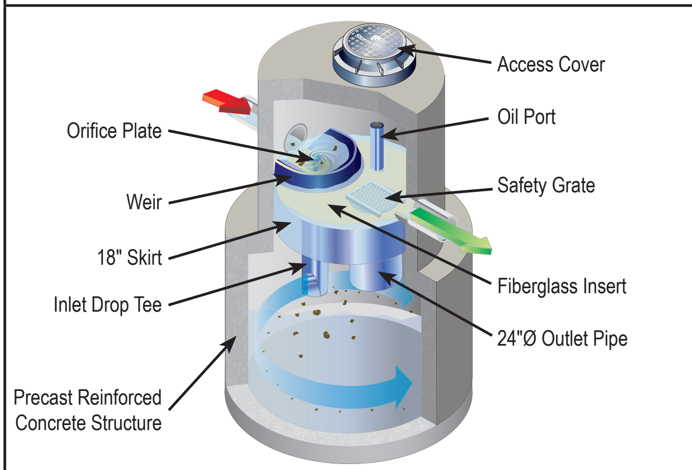
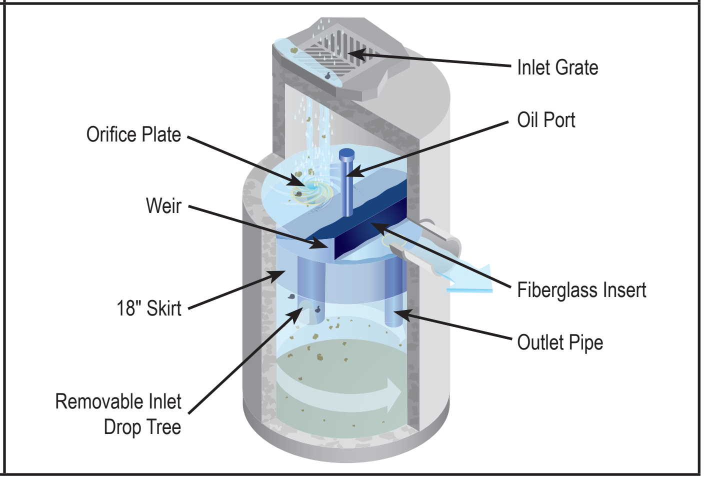


Figure 2.

Inlet Stormceptor



- **Manhole access cover** – provides access to the subsurface components
- **Precast reinforced concrete structure** – provides the vessel's watertight structural support
- **Fiberglass insert** – separates vessel into upper and lower chambers
- **Weir** – directs incoming stormwater and oil spills into the lower chamber
- **Orifice plate** – prevents scour of accumulated pollutants
- **Inlet drop tee** – conveys stormwater into the lower chamber
- **Fiberglass skirt** – provides double-wall containment of hydrocarbons
- **Outlet riser pipe** – conveys treated water to the upper chamber; primary vacuum line access port for sediment removal
- **Oil inspection port** – primary access for measuring oil depth and oil removal
- **Safety grate** – safety measure to cover riser pipe in the event of manned entry into vessel

3 – Stormceptor Identification

Stormceptor is available in both precast concrete and fiberglass vessels, with precast concrete often being the dominant material of construction.

In the Stormceptor, a patented, engineered fiberglass insert separates the structure into an upper chamber and lower chamber. The lower chamber will remain full of water, as this is where the pollutants are sequestered for later removal. Multiple Stormceptor model (STC, OSR, EOS, MAX and STF) configurations exist, each to be inspected and maintained in a similar fashion.

Each unit is easily identifiable as a Stormceptor by the trade name "Stormceptor" embossed on each access cover at the surface. To determine the location of "inlet" Stormceptor units with horizontal catch basin inlet, look down into the grate as the Stormceptor insert will be visible. The name "Stormceptor" is not embossed on inlet models due to the variability of inlet grates used/ approved across North America.

Once the location of the Stormceptor is determined, the model number may be identified by comparing the measured depth from the fiberglass insert level at the outlet pipe's invert (water level) to the bottom of the tank using **Table 1**.

In addition, starting in 1996 a metal serial number tag containing the model number has been affixed to the inside of the unit, on the fiberglass insert. If the unit does not have a serial number, or if there is any uncertainty regarding the size of the unit using depth measurements, please contact your local Stormceptor Representative for assistance.

Sizes/Models

Typical general dimensions and capacities of the standard precast STC, EOS & OSR Stormceptor models in both USA and Canada/International (excluding South East Asia and Australia) are provided in **Tables 1 and 2**. Typical rim to invert measurements are provided later in this document. The total depth for cleaning will be the sum of the depth from outlet pipe invert (generally the water level) to rim (grade) and the depth from outlet pipe invert to the precast bottom of the unit. Note that depths and capacities may vary slightly between regions.

Table 1A. (US) Stormceptor Dimensions – Insert to Base of Structure

STC Model	Insert to Base (in.)	EOS Model	Insert to Base (in.)	OSR Model	Insert to Base (in.)	Typical STF m (in.)
450	60	4-175	60	65	60	1.5 (60)
900	55	9-365	55	140	55	1.5 (61)
1200	71	12-590	71			1.8 (73)
1800	105	18-1000	105			2.9 (115)
2400	94	24-1400	94	250	94	2.3 (89)
3600	134	36-1700	134			3.2 (127)
4800	128	48-2000	128	390	128	2.9 (113)
6000	150	60-2500	150			3.5 (138)
7200	134	72-3400	134	560	134	3.3 (128)
11000*	128	110-5000*	128	780*	128	
13000*	150	130-6000*	150			
16000*	134	160-7800*	134	1125*	134	

Notes:

1. *Depth Below Pipe Inlet Invert to the Bottom of Base Slab can vary slightly by manufacturing facility, and can be modified to accommodate specific site designs, pollutant loads or site conditions. Contact your local representative for assistance.*

   **Consist of two chamber structures in series.*

Table 1B. (CA & Int'l) Stormceptor Dimensions – Insert to Base of Structure

STC Model	Insert to Base (m)	EOS Model	Insert to Base (m)	OSR Model	Insert to Base (m)	Typical STF m (in.)
300	1.5	300	1.5	300	1.7	1.5 (60)
750	1.5	750	1.5	750	1.6	1.5 (61)
1000	1.8	1000	1.8			1.8 (73)
1500	2.8					2.9 (115)
2000	2.8	2000	2.8	2000	2.6	2.3 (89)
3000	3.7	3000	3.7			3.2 (127)
4000	3.4	4000	3.4	4000	3.6	2.9 (113)
5000	4.0	5000	4.0			3.5 (138)
6000	3.7	6000	3.7	6000	3.7	3.3 (128)
9000*	3.4	9000*	3.4	9000*	3.6	
11000*	4.0	10000*	4.0			
14000*	3.7	14000*	3.7	14000*	3.7	

Notes:

1. *Depth Below Pipe Inlet Invert to the Bottom of Base Slab can vary slightly by manufacturing facility, and can be modified to accommodate specific site designs, pollutant loads or site conditions. Contact your local representative for assistance.*

   **Consist of two chamber structures in series.*

Table 2A. (US) Storage Capacities

STC Model	Hydrocarbon Storage Capacity gal	Sediment Capacity ft³	EOS Model	Hydrocarbon Storage Capacity gal	OSR Model	Hydrocarbon Storage Capacity gal	Sediment Capacity ft³
450	86	46	**4-175**	175	**065**	115	46
900	251	89	**9-365**	365	**140**	233	58
1200	251	127	**12-590**	591			
1800	251	207	**18-1000**	1198			
2400	840	205	**24-1400**	1457	**250**	792	156
3600	840	373	**36-1700**	1773			
4800	909	543	**48-2000**	2005	**390**	1233	465
6000	909	687	**60-2500**	2514			
7200	1059	839	**72-3400**	3418	**560**	1384	690
11000*	2797	1089	**110-5000***	5023	**780***	2430	930
13000*	2797	1374	**130-6000***	6041			
16000*	3055	1677	**160-7800***	7850	**1125***	2689	1378

Notes:

1. *Hydrocarbon & Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.*

   **Consist of two chamber structures in series.*

Table 2B. (CA & Int'l) Storage Capacities

STC Model	Hydrocarbon Storage Capacity L	Sediment Capacity L	EOS Model	Hydrocarbon Storage Capacity L	OSR Model	Hydrocarbon Storage Capacity L	Sediment Capacity L
300	300	1450	**300**	662	**300**	300	1500
750	915	3000	**750**	1380	**750**	900	3000
1000	915	3800	**1000**	2235			
1500	915	6205					
2000	2890	7700	**2000**	5515	**2000**	2790	7700
3000	2890	11965	**3000**	6710			
4000	3360	16490	**4000**	7585	**4000**	4700	22200
5000	3360	20940	**5000**	9515			
6000	3930	26945	**6000**	12940	**6000**	5200	26900
9000*	10555	32980	**9000***	19010	**9000***	9300	33000
11000*	10555	37415	**10000***	22865			
14000*	11700	53890	**14000***	29715	**14000***	10500	53900

Notes:

1. *Hydrocarbon & Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.*

   **Consist of two chamber structures in series.*

4 – Stormceptor Inspection & Maintenance

Regular inspection and maintenance is a proven, cost-effective way to maximize water resource protection for all stormwater pollution control practices, and is required to insure proper functioning of the Stormceptor. Both inspection and maintenance of the Stormceptor is easily performed from the surface. Stormceptor's patented technology has no moving parts, simplifying the inspection and maintenance process.

Please refer to the following information and guidelines before conducting inspection and maintenance activities.

When is inspection needed?

- Post-construction inspection is required prior to putting the Stormceptor into service.
- Routine inspections are recommended during the first year of operation to accurately assess the sediment accumulation.
- Inspection frequency in subsequent years is based on the maintenance plan developed in the first year.
- Inspections should also be performed immediately after oil, fuel, or other chemical spills.

When is maintenance cleaning needed?

- For optimum performance, the unit should be cleaned out once the sediment depth reaches the recommended maintenance sediment depth, which is approximately 15% of the unit's total storage capacity (see **Table 2**). The frequency should be adjusted based on historical inspection results due to variable site pollutant loading.

- Sediment removal is easier when removed on a regular basis at or prior to the recommended maintenance sediment depths, as sediment build-up can compact making removal more difficult.
- The unit should be cleaned out immediately after an oil, fuel or chemical spill.

What conditions can compromise Stormceptor performance?

- If construction sediment and debris is not removed prior to activating the Stormceptor unit, maintenance frequency may be reduced.
- If the system is not maintained regularly and fills with sediment and debris beyond the capacity as indicated in **Table 2**, pollutant removal efficiency may be reduced.
- If an oil spill(s) exceeds the oil capacity of the system, subsequent spills may not be captured.
- If debris clogs the inlet of the system, removal efficiency of sediment and hydrocarbons may be reduced.
- If a downstream blockage occurs, a backwater condition may occur for the Stormceptor and removal efficiency of sediment and hydrocarbons may be reduced.

What training is required?

The Stormceptor is to be inspected and maintained by professional vacuum cleaning service providers with experience in the maintenance of underground tanks, sewers and catch basins. For typical inspection and maintenance activities, no specific supplemental training is required for the Stormceptor. Information provided within this Manual (provided to the site owner) contains sufficient guidance to maintain the system properly.

In unusual circumstances, such as if a damaged component needs replacement or some other condition requires manned entry into the vessel, confined space entry procedures must be followed. Only professional maintenance service providers trained in these procedures should enter the vessel. Service provider companies typically have personnel who are trained and certified in confined space entry procedures according to local, state, and federal standards.

What equipment is typically required for inspection?

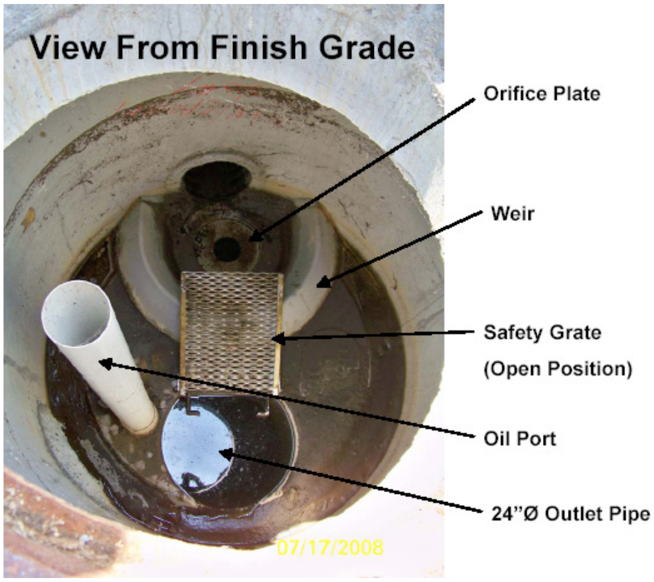
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones and caution tape
- Hard hat, safety shoes, safety glasses, and chemical-resistant gloves

Recommended Stormceptor Inspection Procedure:

- Stormceptor is to be inspected from grade through a standard surface manhole access cover.
- Sediment and oil depth inspections are performed with a sediment probe and oil dipstick.
- Oil depth is measured through the oil inspection port, either a 4-inch (100 mm) or 6-inch (150 mm) diameter port.
- Sediment depth can be measured through the oil inspection port or the 24-inch (610 mm) diameter outlet riser pipe.
- Inspections also involve a visual inspection of the internal components of the system.

Figure 3.

Figure 4.



What equipment is typically required for maintenance?

- Vacuum truck equipped with water hose and jet nozzle
- Small pump and tubing for oil removal
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones
- Hard hats, safety shoes, safety glasses, chemical-resistant gloves, and hearing protection for service providers
- Gas analyzer, respiratory gear, and safety harness for specially trained personnel if confined space entry is required

Recommended Stormceptor Maintenance Procedure

Maintenance of Stormceptor is performed using a vacuum truck.

No entry into the unit is required for maintenance. ***DO NOT ENTER THE STORMCEPTOR CHAMBER*** unless you have the proper personal safety equipment, have been trained and are qualified to enter a confined space, as identified by local Occupational Safety and Health Regulations (e.g. 29 CFR 1910.146 or Canada Occupational Safety and Health Regulations – SOR/86-304). Without the proper equipment, training and permit, entry into confined spaces can result in serious bodily harm and potentially death. Consult local, provincial, and/or state regulations to determine the requirements for confined space entry. Be aware, and take precaution that the Stormceptor fiberglass insert may be slippery. In addition, be aware that some units do not have a safety grate to cover the outlet riser pipe that leads to the submerged, lower chamber.

- Ideally maintenance should be conducted during dry weather conditions when no flow is entering the unit.
- Stormceptor is to be maintained through a standard surface manhole access cover.
- Insert the oil dipstick into the oil inspection port. If oil is present, pump off the oil layer into separate containment using a small pump and tubing.
- Maintenance cleaning of accumulated sediment is performed with a vacuum truck.
    - For 6-ft (1800 mm) diameter models and larger, the vacuum hose is inserted into the lower chamber via the 24-inch (610 mm) outlet riser pipe.
    - For 4-ft (1200 mm) diameter model, the removable drop tee is lifted out, and the vacuum hose is inserted into the lower chamber via the 12-inch (305 mm) drop tee hole.

Figure 5.

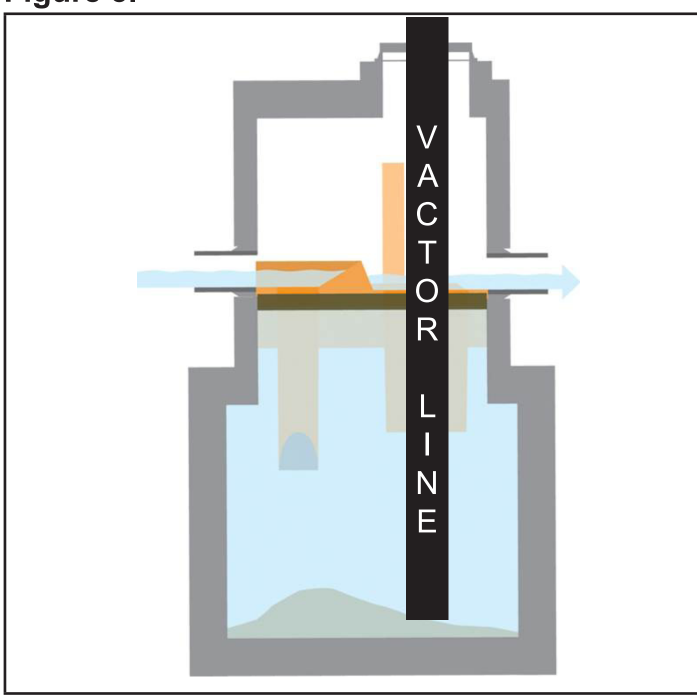
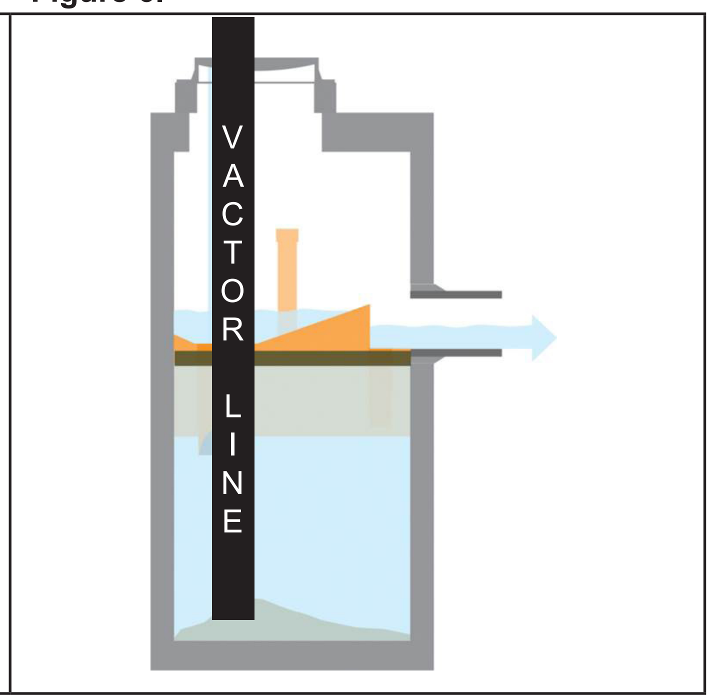


Figure 6.



- Using the vacuum hose, decant the water from the lower chamber into a separate containment tank or to the sanitary sewer, if permitted by the local regulating authority.
- Remove the sediment sludge from the bottom of the unit using the vacuum hose. For large Stormceptor units, a flexible hose is often connected to the primary vacuum line for ease of movement in the lower chamber.
- Units that have not been maintained regularly, have surpassed the maximum recommended sediment capacity, or contain damaged components may require manned entry by trained personnel using safe and proper confined space entry procedures.

Figure 7.

Figure 8.

A maintenance worker stationed at the above ground surface uses a vacuum hose to evacuate water, sediment, and debris from the system.

What is required for proper disposal?

The requirements for the disposal of material removed from Stormceptor units are similar to that of any other stormwater treatment Best Management Practices (BMP). Local guidelines should be consulted prior to disposal of the separator contents. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste. This could be site and pollutant dependent. In some cases, approval from the disposal facility operator/agency may be required.

What about oil spills?

Stormceptor is often implemented in areas where there is high potential for oil, fuel or other hydrocarbon or chemical spills. Stormceptor units should be cleaned immediately after a spill occurs by a licensed liquid waste hauler. You should also notify the appropriate regulatory agencies as required in the event of a spill.

What if I see an oil rainbow or sheen at the Stormceptor outlet?

With a steady influx of water with high concentrations of oil, a sheen may be noticeable at the Stormceptor outlet. This may occur because a hydrocarbon rainbow or sheen can be seen at very small oil concentrations (< 10 ppm). Stormceptor is effective at removing 95% of free oil, and the appearance of a sheen at the outlet with high influent oil concentrations does not mean that the unit is not working to this level of removal. In addition, if the influent oil is emulsified, the Stormceptor will not be able to remove it. The Stormceptor is designed for free oil removal and not emulsified or dissolved oil conditions.

What factors affect the costs involved with inspection/maintenance?
The Vacuum Service Industry for stormwater drainage and sewer systems is a well-established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean Stormceptor units will vary. Inspection and maintenance costs are most often based on unit size, the number of units on a site, sediment/oil/hazardous material loads, transportation distances, tipping fees, disposal requirements and other local regulations.

What factors predict maintenance frequency?
Maintenance frequency will vary with the amount of pollution on your site (number of hydrocarbon spills, amount of sediment, site activity and use, etc.). It is recommended that the frequency of maintenance be increased or reduced based on local conditions. If the sediment load is high from an unstable site or sediment loads transported from upstream catchments, maintenance may be required semi-annually. Conversely once a site has stabilized, maintenance may be required less frequently (for example: two to seven year, site and situation dependent). Maintenance should be performed immediately after an oil spill or once the sediment depth in Stormceptor reaches the value specified in **Table 3** based on the unit size.

Table 3A. (US) Recommended Sediment Depths Indicating Maintenance

STC Model	Maintenance Sediment depth (in)	EOS Model	Maintenance Sediment depth (in)	Oil Storage Depth (in)	OSR Model	Maintenance Sediment depth (in)
450	8	**4-175**	9	24	**065**	8
900	8	**9-365**	9	24	**140**	8
1200	10	**12-590**	11	39		
1800	15					
2400	12	**24-1400**	14	68	**250**	12
3600	17	**36-1700**	19	79		
4800	15	**48-2000**	16	68	**390**	17
6000	18	**60-2500**	20	79		
7200	15	**72-3400**	17	79	**560**	17
11000*	17	**110-5000***	16	68	**780***	17
13000*	20	**130-6000***	20	79		
16000*	17	**160-7800***	17	79	**1125***	17

Note:
1. *The values above are for typical standard units.*

**Per structure.*

Table 3B. (CA & Int'l) Recommended Sediment Depths Indicating Maintenance

STC Model	Maintenance Sediment depth (mm)	EOS Model	Maintenance Sediment depth (mm)	Oil Storage Depth (mm)	OSR Model	Maintenance Sediment depth (mm)
300	225	**300**	225	610	**300**	200
750	230	**750**	230	610	**750**	200
1000	275	**1000**	275	990		
1500	400					
2000	350	**2000**	350	1727	**2000**	300
3000	475	**3000**	475	2006		
4000	400	**4000**	400	1727	**4000**	375
5000	500	**5000**	500	2006		
6000	425	**6000**	425	2006	**6000**	375
9000*	400	**9000***	400	1727	**9000***	425
11000*	500	**10000***	500	2006		
14000*	425	**14000***	425	2006	**14000***	425

Note:

1. *The values above are for typical standard units.*

   **Per structure.*

Replacement parts

Since there are no moving parts during operation in a Stormceptor, broken, damaged, or worn parts are not typically encountered. Therefore, inspection and maintenance activities are generally focused on pollutant removal. However, if replacements parts are necessary, they may be purchased by contacting your local Stormceptor Representative, or Imbrium Systems.

The benefits of regular inspection and maintenance are many – from ensuring maximum operation efficiency, to keeping maintenance costs low, to the continued protection of natural waterways – and provide the key to Stormceptor's long and effective service life.

Stormceptor Inspection and Maintenance Log

Stormceptor Model No: ______________________________

Allowable Sediment Depth: ______________________________

Serial Number: ______________________________

Installation Date: ______________________________

Location Description of Unit: ______________________________

Other Comments: ______________________________

Contact Information

Questions regarding the Stormceptor can be addressed by contacting your area Stormceptor Licensee, Imbrium Systems, or visit our website at www.stormceptor.com.

Stormceptor Licensees:

CANADA

Lafarge Canada Inc.	
www.lafargepipe.com	
403-292-9502 / 1-888-422-4022	Calgary, AB
780-468-5910	Edmonton, AB
204-958-6348	Winnipeg, MB, NW. ON, SK
Langley Concrete Group	
www.langleyconcretegroup.com	
604-502-5236	BC
Hanson Pipe & Precast Inc.	
www.hansonpipeandprecast.com	
519-622-7574 / 1-888-888-3222	ON
Lécuyer et Fils Ltée.	
www.lecuyerbeton.com	
450-454-3928 / 1-800-561-0970	QC
Strescon Limited	
www.strescon.com	
902-494-7400	NS, NF
506-633-8877	NB, PE

UNITED STATES

Rinker Materials
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