STORMWATER REPORT

COMMUNITY BAPTIST CHURCH

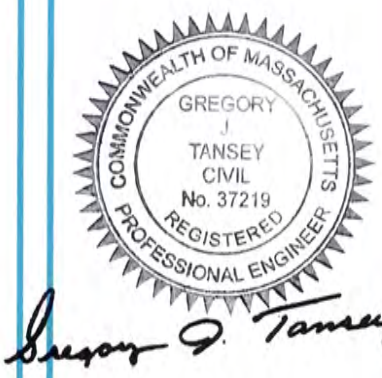
JANUARY 21, 2021

Applicant:

Community Baptist Church

Locus:

17 Mutton Lane
Weymouth, MA



Engineer of Record:

Ross Engineering Co., Inc.

683 Main Street
Norwell, MA
781 659 1325

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PART I
INTRODUCTION

1.0 Project Narrative

The site consists of a House of Worship having an address of 17 Mutton Lane in Weymouth, MA having a paved parking lot consisting of 17 parking spaces and a gravel parking consisting of approximately 18 spaces. The project proposes no expansions or alterations to the existing church building or the existing paved parking lot. The project proposes to make improvements to the existing gravel portion of the parking lot only. The scope of work associated with the parking lot improvements includes drainage improvements, replacing the gravel surface area with a permeable pavement surface, and providing retaining walls to increase the parking lot's capacity and accessibility. The parking lot improvements will result in 14 additional parking spaces.

A stormwater management system is also being proposed to treat and mitigate peak discharge rates for the 2, 10 and 100 year storm events. The stormwater management system will also meet the 10 Performance Standards of the DEP Stormwater Management Policy.

The proposed site and activities are located entirely in a FEMA flood zone "Zone X". Work residing within the "Zone X" simply means the work is not located in the 100' year flood plain. The current FEMA Map 25021C0233E, dated July 17, 2012, located in Appendix A confirms that all work proposed for this project is not within the 100 year flood plain.

The general topographic lay of the site consists of grades as it is a parking area, however steep grades exist along the west side of the parking area resulting from cuts made to construct the existing parking lot. The proposed work proposes to expand the parking area further into these steep grades and then stabilize them with retaining walls.

The proposed project will require the removal of approximately 8-10 trees varying in diameter from 6" to 12". The removal of these trees are necessary to perform grading along the perimeter of the site. The trees proposed for removal will not have canopies that extend over the BVW. The regraded areas will most likely spawn the same type of trees that are presently on site as all work will be performed on land that was at one time disturbed. No work will encroach closer to the BVW than what is currently there.

The proposed project will provide safety to the church parishioners as well as providing the required environmental protection.

1.1 Regulatory Jurisdiction

The proposed activities fall under the jurisdiction of The Massachusetts Wetlands Protection Act, 310 CMR 10.00 and the Weymouth wetland protection bylaw.

More specifically, the project is regulated under 310 CMR 10.05 (6) k-q (Massachusetts Stormwater Policy BMP) for the following reasons:

1. The project proposes institutional development, non residential;
2. The project's scope is not tantamount to work on a single family residential dwelling (trigger threshold is more than 4 dwellings);
3. The project is located in the 100' buffer which will produce a discharge to the wetlands hence from a jurisdictional point with respect to stormwater discharge, the project will require the filling of a Notice of Intent.
4. No Priority Habitats, Zone II's, Zone A's or ORW's are near the project locus as shown in the Maps in Appendix A. By DEP definition, if stormwater flows generated by the project are "unlikely to significantly impact" the ORW, then the project is not near.

The project does require stormwater pretreatment of ½" at 25% TSS removal. This performance standard is met with the permeable pavement (see Standard 4)

The site is located in the Residence C zoning district.

The site is NOT located in the Town of Weymouth Watershed Protection District (WSPD). The project is also not located near an ORW, ACEC, Zone II Aquifer Protection District, or in an endangered species habitat as mapped by the NHESP. The pertinent figures that serve to verify the above claims can be found in Appendix A of this report.

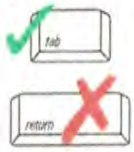
1.2 Stormwater Checklist (DEP)

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

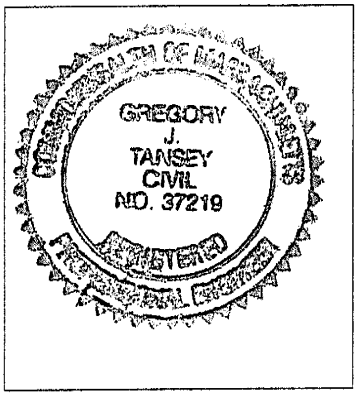
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



Gregory J. Tansey 1-15-21

Signature and Date

Checklist

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

☐ New development

☐ Redevelopment

☒ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

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

Standard 1: No New Untreated Discharges

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☐ Static ☒ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

PART II
BMP STANDARDS 1-10 FOR DEP

1.0 BMP Standard 1

1.1 Definition of Standard

Chapter 1 in Volume 1 of the Massachusetts Stormwater Management Policy defines Standard 1 as the following:

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

1.2 Explanation of Standard

It is important to note that Standard 1 does allow direct discharges into waters and wetlands of the Commonwealth provided the discharge is adequately treated. The term "*adequately treated*" refers to the implementation of stormwater management systems that are specifically designed to achieve sediment and contaminate removal rates that adequately protect groundwater, surface waters and wetlands in accordance with all applicable statutes, regulations, permits, and approvals, and the 10 applicable BMP Standards of the Stormwater Management Policy.

The last portion of the definition of Standard 1 addresses erosion into the waters and wetlands of the Commonwealth. This part of the definition is merely stating that there must be no wearing away or erosion of soil or land surface in excess of natural conditions. Outfalls must be designed to protect the ground surface area between the outfall and the receiving water form scour and erosion. This is typically accomplished by using riprap aprons, level spreaders or other protective devices lending themselves to the site specific characteristics of the outfall. The DEP Stormwater Handbook states the evaluation of scour or erosion should be based upon velocities generated from the 2 year 24 hour storm for sheet flow conditions.

1.3 Identification of Outfalls

The outfalls proposing discharges into wetlands or water ways of the Commonwealth for this project are identified as follows:

Outfall 1: Discharge from the retaining wall underdrains. (To Design Point 1).

Outfall 2: Discharge from the 6" PVC Culvert from lawn drain. (To Design Point 1).

1.4 Treatments at Outfalls

The treatment provided at the outfalls of the level spreaders consists of reducing the discharge velocities of the stormwater below the thresholds of the velocities capable of causing erosion to the soil types present on site. A sandy loam soil type having an 8% slope is capable of resisting erosion up to velocities of 4 FPS. The stormwater runoff analysis concludes the exit velocities from these outfalls are less than 4 FPS as the highest discharge velocity of the outfall from the 6" culvert is only 0.58 FPS and that is from the 2 yr storm. The following is an excerpt from the DEP Stormwater Handbook found in Vol. 1 Chptr. 2 Pgs 2&3:

Stormwater Discharge Velocity: Determine maximum discharge or velocity at each outlet for all conveyances. The maximum discharge or velocity is dependent on the size of the conveyance. Include gravitational forces in the computations when proposing to discharge stormwater above the receiving practice. Tailwater conditions in the receiving wetland must also be factored into the analysis. For sheet flow, the maximum velocity to evaluate is the runoff from the 2-year 24-hour storm. Engineers shall select an accepted method to determine maximum velocity.

Ability of Ground Surface to Resist Erosion: Determine ability of ground or lining materials to resist erosion from the velocity computed in part (a). Banks opposite a stormwater discharge point may need to be evaluated to assess their ability to resist scour when banks are close to the outlets (e.g., a narrow stream channel). This may be done by performing computations to estimate the size/weight of stone or bioengineered materials needed to resist the force of water or comparing the discharge velocity against a "permissible velocity table" that provides information on the ability of different types of materials/vegetation to resist shear.

The references that follow include several different computational methods and permissible velocity tables that are acceptable.

Channel Slope	Lining[1]	Permissible Velocity (feet/second)
0 - 5%	Tall fescue Kentucky bluegrass	5
	Grass-legume mixture	4
	Red fescue Redtop Sericea lespedeza Annual lespedeza Small grains	2.5
5 - 10%	Tall fescue Kentucky bluegrass	4
	Grass-legume mixture	3
Greater Than 10%	Tall fescue Kentucky bluegrass	3

1.5 Conclusion

Standard 1 has been achieved as the project has implemented and designed BMP stormwater control structures capable of treating the stormwater to the levels prescribed in the other applicable BMP Standards of the Stormwater Management Policy. The BMP structures have been designed to recharge the prescribed water volumes associated with the soil types present on the site.
Erosion control measures have been a

chieved through the use of the following approved BMP Structures:

Source Reduction
Permeable pavement

The above outfalls were designed in accordance with the provisions of the Massachusetts Stormwater Management Policy to ensure that erosion problems do not occur as the discharges have been treated , mitigated, and have been released with exist velocities reduced to acceptable levels that will not produce scour and erosion into resource areas.

The performance standards of the Stormwater Management Regulations have been met for this standard as the proposed stormwater management system is designed to prevent an increase in stormwater that is untreated off site or cause erosion to down gradient areas. This was achieved by reducing velocities and tributaries discharging off site. No discharges into the Resource area from metal roofs are proposed by this project.

2.0 BMP Standard 2

2.1 Definition of Standard

Chapter 1 in Volume 1 of the Massachusetts Stormwater Management Policy defines Standard 2 as the following:

Stormwater management systems shall be designed so that the post development peak discharge rates are equal to the pre development rates.

2.2 Explanation of Standard

The DEP's definition is quite clear, the project can't increase the stormwater discharges off site in the proposed condition from those of the existing condition. However the DEP doesn't hold applicants to this standard if the receiving waters are tidal. This issue is not applicable to this project as the receiving waters are all inland.

2.3 Description of Soils Present On-Site

Soils are classified into one of four hydrologic soil groups (HSG's) in order to give a general indication of the infiltration rate for the soil type. The HSG's are A, B, C and D, and range from soils that have very high infiltration rates and low runoff potential, to soils that have very low infiltration rates and high runoff potential. Hydrologic Group A soils have very good infiltration characteristics and produce low levels of stormwater runoff. Group B soils produce moderately higher levels of stormwater runoff. Group C soils have poor infiltration characteristics and produce high levels of stormwater runoff. Group D soils produce the highest levels of stormwater runoff and have the poorest levels of infiltration. For a more complete description of the HSG's, refer to Technical Release 55 (TR-55) issued by The Soil Conservation Service (SCS).

Hydrologic soil group boundaries in Massachusetts were delineated by the Soil Conservation Service and are mapped on soil survey maps for each county. The soil boundaries of these maps were superimposed over the boundaries of the site and are illustrated on the watershed plans in Appendix C. The SCS soil maps revealed that only a very fine loamy sand known as the Merrimack and Urban Land Complex exists on the site and on the tributary watersheds for this hydrologic analysis. This soil has a Hydrologic soil Group designation (HSG) of A, but on site test pits revealed that a good sandy soil existed below the parking area but contained a higher level of silt than what is typical of a Merrimack soil, hence a 2.41 in/hr infiltration rate was used opposed to the 8.27 in/hr infiltration rate.

2.4 Description of Vegetative Covers Present On-Site

The existing topographic cover of the site consists mostly of a bare soil or lawn area with some mature trees growing up around the parking lot's perimeter. The tree cover varies from fair to poor throughout the site due to ground disturbances that occurred 20 years ago. The average tree cover could thus be described as being in a "fair" condition. The existing lawn area was marginally maintained as these lawn area reside at the limits of the lot boundaries. The topographic cover was determined by field survey and site visits, and is identified by descriptions found in Table 2-2 of TR-55.

2.5 Description of On-Site Subcatchment Divides

subcatchment Divides or Drainage Divides as they are sometimes referred to as are limits of watershed boundaries. Small watersheds such as the ones that exist on the site are tributary areas for which stormwater runoff will discharge to a specific point of interest. The drainage divides are illustrated on the watershed plans found in Appendix C and are further described in sections 2.270 &2.271 of this report.

2.6 Design points

A design point is a down gradient point of interest such as an abutting property line, or a resource area for which the pre development and post development stormwater discharge rates are obtained and compared. A typical stormwater analysis will consist of three design storms, the 2, 10 and 100 year storms. The post development stormwater discharge rates at each of the design point in the analysis must be less than or equal to the stormwater discharge rates of the pre development condition for the 2 and 10 year design storm events. The post development discharge may exceed the pre development condition in the 100 year storm event, if it is obvious that a flooding condition will not occur.

This analysis has one design points as identified below:

Design Point 1: This is the discharge along wetland line. (It assess the impact of runoff coming off the site to the wetland line.

2.7 Pre Development Condition

The pre development condition consists of 4 watershed areas referred to as PRE 1, PRE 2, PRE 3, and PRE 4. These watershed areas discharge to the design point identified above. The analysis has obtained the peak rates of runoff at this design point from the predevelopment calculations preformed in this analysis which are compared with the peak rates of discharge of the post development condition.

2.8 Post Development Condition

The post development condition consists of eight watershed areas. These watershed areas are named PST 1, PST 2 PST 3, PST 4, and PST 5. Watershed PST 1 through PST 5 discharge to Design Points 1, just like in the predevelopment condition of the analysis. Subcatchment areas PST 2-4 do not directly discharge to Design Point 1 as they are captured by the proposed drainage system components and are then treated and recharged on site with any overflow being released to Design Point 1. The stormwater discharges generated by the 2, 10, and the 100 year design storms are retained by the proposed subsurface recharge reservoir system beneath the permeable pavement. The remaining watersheds directly tributary to Design Point 1 are either un-contaminated by proposed pavement and are thus considered clean or they are an existing condition. The post development watersheds that are tributary to the abutter's rear yards have been reduced in size as a result of the area intercepted and captured by the proposed stormwater management system. The peak discharge rates have been mitigated as the post development peak discharge rates at Design Point 1 are less than or equal to those of the pre development condition.

The watershed plans located in Appendix "C" of this report clearly identify the subcatchment areas for both the pre and the post development condition and the associated Design Point 1 to illustrate that the performance standards required by BMP Standard 2 have been satisfied.

2.9 Hydrologic Analysis Calculations

Format

The calculations of this report were generated by HydroCAD software. HydroCAD is a Computer Aided Design system for modeling the hydrology and hydraulics of stormwater runoff. It analysis runoff by a method which is based largely on the hydrology techniques developed by the Soil Conservation Service (SCS/NRCS) also known as TR-20, combined with other hydrology and hydraulics calculations. For a given rainfall event, these techniques are used to generate hydrographs throughout a watershed. Typically, this allows the engineer to verify that a given drainage system is adequate for the drainage areas that will ultimately be routed through that drainage system and will also determine the post development runoff impacts of the pre and post development conditions. The regulations require that the analysis be modeled with the TR-20 method, thus the HydroCAD software conforms to the stormwater bylaw.

SCS Unit Hydrograph Method

The SCS unit hydrograph procedure (also known as the TR-20 runoff method) generates a runoff hydrograph by the following basic steps: (For brevity, the following is a simplified description.)

1) A rainfall distribution is selected which indicates how the stormwater depth will be distributed over time. This is usually a standardized distribution, such as the SCS Type III storm, and often has a standardized duration of 24 hours.

2) The design storm rainfall depth is determined from rainfall distribution maps produced by the Cornell Method, based on the return period being modeled. Combined with the rainfall distribution, this specifies the cumulative rainfall depth at all times during the storm.

3) Based on the Time-of-Concentration, the storm is divided into "bursts" of equal duration. For each burst, the SCS runoff equation and the average Curve Number are used to determine the portion of that burst that will appear as runoff.

4) A Unit Hydrograph, in conjunction with the Time-of-Concentration, is used to determine how the runoff from a single burst is distributed over time. The result is a complete runoff hydrograph for a single burst.

5) Individual hydrographs are added together for all bursts in the storm, yielding the complete runoff hydrograph for the storm.
For a Tc of 7.5 minutes, the burst duration is 1 minute, so a 24-hour storm will consist of 1440 bursts. If each burst involves a unit hydrograph of 100 coordinates, then 140,000 coordinates must be summed to produce the composite hydrograph.

2.10 Summary of Hydrologic Analysis Results

Comparative discharge charts

The tables listed below illustrate how the peak discharges for the three design storms have been mitigated for the design points of the analysis.

DESIGN POINT 1
EDGE OF
WETLAND
PEAK DISCHARGE RATES

Storm Frequency T-year Interval	Pre-Development Conditions (cfs)	Post-Development Conditions (cfs)
2	1.30	0.87
10	2.14	1.29
100	3.89	2.23

Comparative Total Discharge Volume Charts
The tables listed below illustrate how the discharge volumes of runoff for the three design storms have been mitigated for the design points of the analysis.

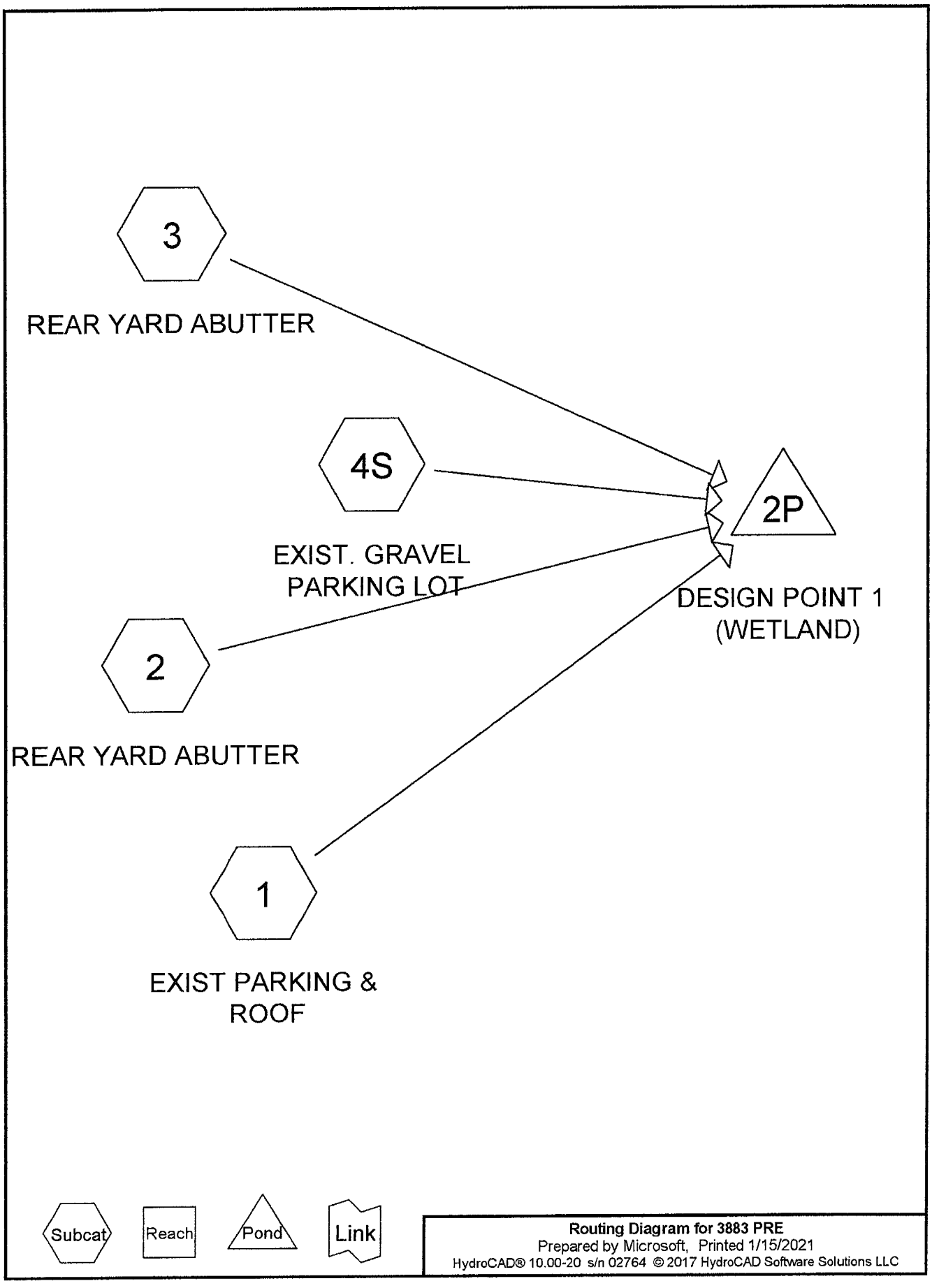
DESIGN POINT 1
EDGE OF WETLAND
TOTAL DISCHARGE VOLUMES

Storm Frequency T-year Interval	Pre-Development Conditions (AF)	Post-Development Conditions (AF)
2	0.104	0.065
10	0.173	0.113
100	0.299	0.203

The results of this analysis indicate that the proposed drainage system will reduce the peak flow and volume of discharge of stormwater off site to below that of the pre development condition. These reductions are shown for the 2-year, 10-year, and 100-year rainfall events. The results shown above satisfy the requirements of BMP Standard 2 of the DEP Stormwater Management Regulations.

2.11 Pre Development Analysis Calculations

PRE DEVELOPMENT ANALYSIS CALCULATIONS



Routing Diagram for 3883 PRE
Prepared by Microsoft, Printed 1/15/2021

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.067	72	DIRT (2, 3)
0.013	98	DRIVEWAY (3)
0.117	49	GRASS FAIR A (3)
0.236	49	GRASS FAIR HSG A (2)
0.178	96	GRAVEL PARKING LOT (4S)
0.258	98	ROOF AND PAVEMENT (1)
0.008	98	SHED ROOF (2)
0.003	36	WOODS (2)
0.141	36	WOODS FAIR A (3)
1.021	**70**	**TOTAL AREA**

2 YEAR STORM

Summary for Subcatchment 1: EXIST PARKING & ROOF

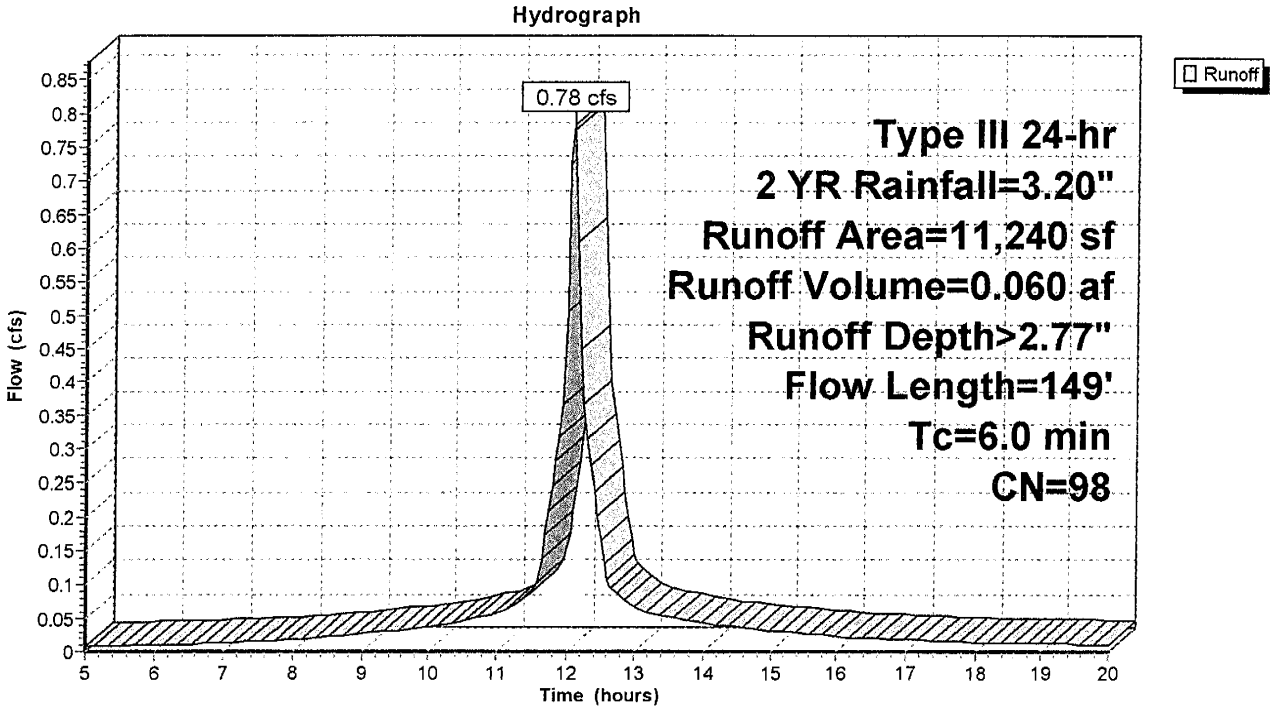
Runoff = 0.78 cfs @ 12.09 hrs, Volume= 0.060 af, Depth> 2.77"

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 YR Rainfall=3.20"

	Area (sf)	CN	Description
*	11,240	98	ROOF AND PAVEMENT
	11,240		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	15	0.4500	3.27		**Sheet Flow, ROOF** Smooth surfaces n= 0.011 P2= 3.20"
0.3	49	0.0050	2.82	0.78	**Trap/Vee/Rect Channel Flow, GUTTER** Bot.W=0.50' D=0.50' Z= 0.1 '/' Top.W=0.60' n= 0.012 Steel, smooth
0.8	29	0.0050	0.62		**Sheet Flow, ROOF** Smooth surfaces n= 0.011 P2= 3.20"
1.0	56	0.0020	0.91		**Shallow Concentrated Flow, P LOT** Paved Kv= 20.3 fps
3.8					**Direct Entry, 6 MINUTE MIN.**
6.0	149	Total			

Subcatchment 1: EXIST PARKING & ROOF



Summary for Subcatchment 2: REAR YARD ABUTTER

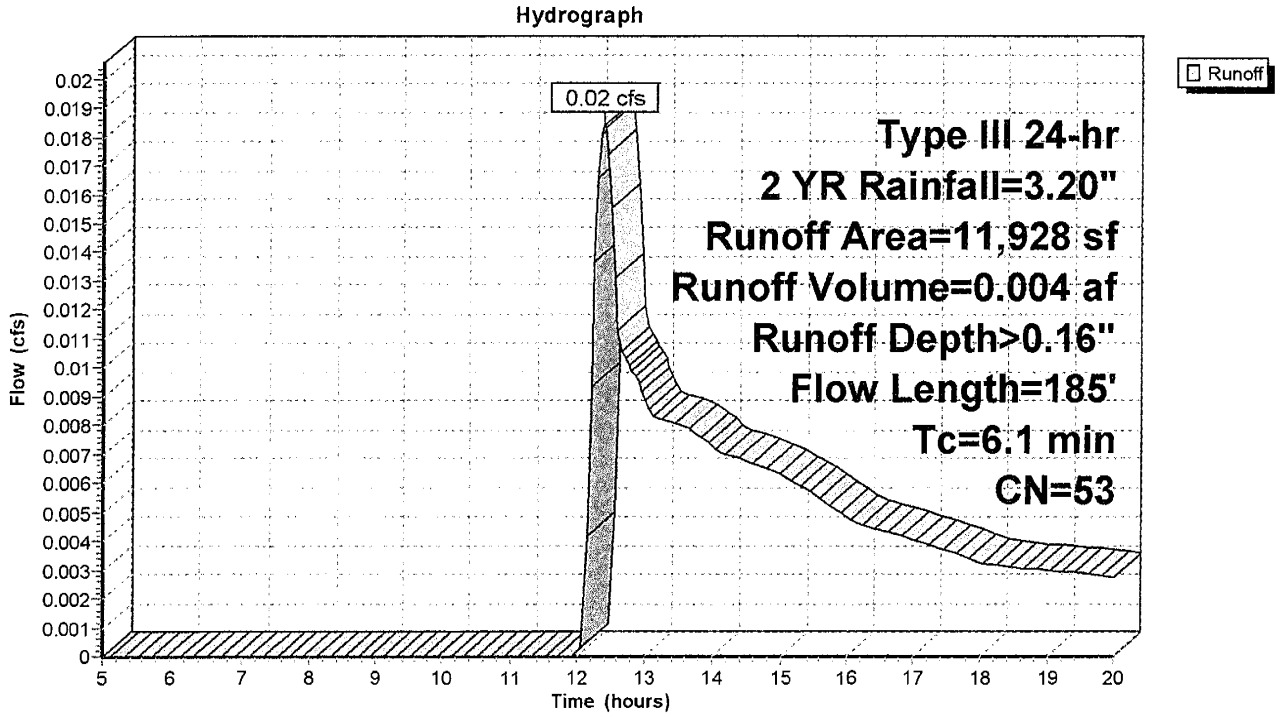
Runoff = 0.02 cfs @ 12.38 hrs, Volume= 0.004 af, Depth> 0.16"

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 YR Rainfall=3.20"

	Area (sf)	CN	Description
*	1,174	72	DIRT
*	10,285	49	GRASS FAIR HSG A
*	115	36	WOODS
*	125	98	SHED ROOF
*	229	98	SHED ROOF
	11,928	53	Weighted Average
	11,574		97.03% Pervious Area
	354		2.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, GRASS** Grass: Short n= 0.150 P2= 3.20"
0.3	83	0.1000	4.74		**Shallow Concentrated Flow, GRASS** Grassed Waterway Kv= 15.0 fps
0.2	52	0.0400	4.42	88.83	**Trap/Vee/Rect Channel Flow, FLOW OVER EXIST GRAVEL DRIVEV** Bot.W=67.00' D=0.30' Z= 0.2 '/' Top.W=67.12' n= 0.030 Earth, cobble bottom, clean sides
6.1	185	Total			

Subcatchment 2: REAR YARD ABUTTER



Summary for Subcatchment 3: REAR YARD ABUTTER

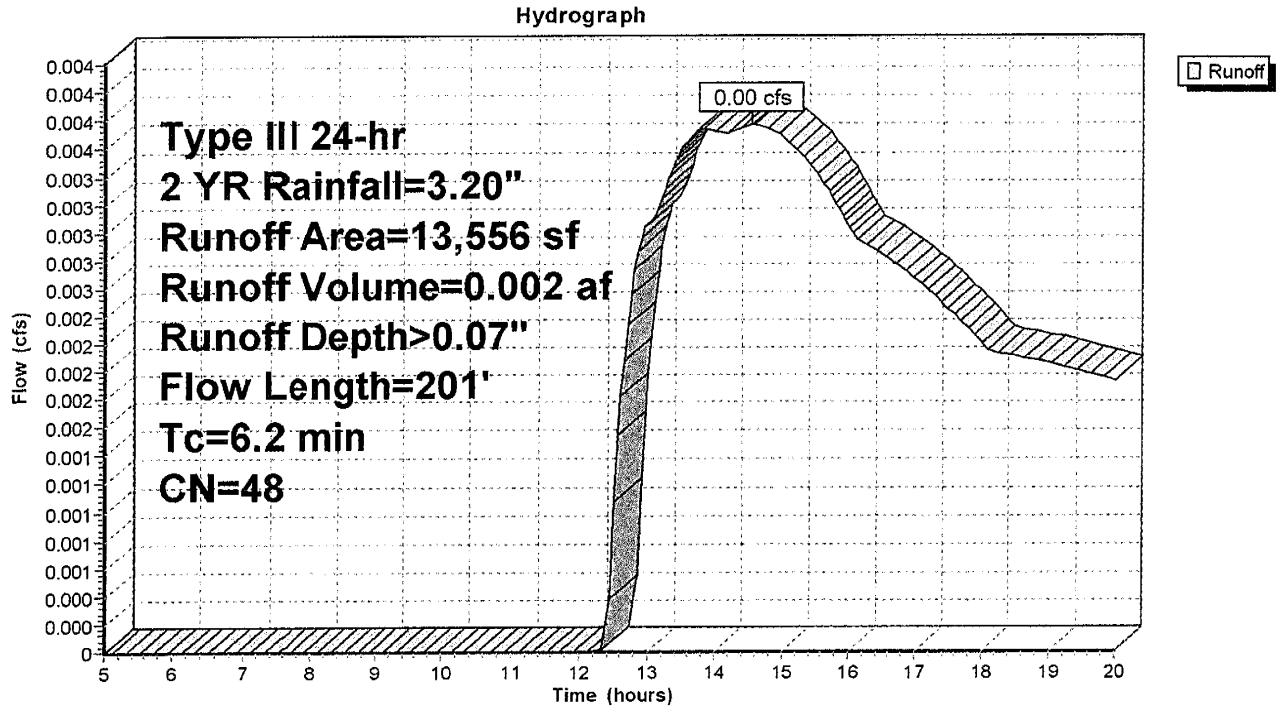
Runoff = 0.00 cfs @ 14.56 hrs, Volume= 0.002 af, Depth> 0.07"

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 YR Rainfall=3.20"

	Area (sf)	CN	Description
*	1,740	72	DIRT
*	552	98	DRIVEWAY
*	5,103	49	GRASS FAIR A
*	6,161	36	WOODS FAIR A
	13,556	48	Weighted Average
	13,004		95.93% Pervious Area
	552		4.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, GRASS** Grass: Short n= 0.150 P2= 3.20"
0.2	76	0.1000	5.09		**Shallow Concentrated Flow, LAWN & TREES** Unpaved Kv= 16.1 fps
0.4	75	0.0440	3.38		**Shallow Concentrated Flow, DISTURBED AREA** Unpaved Kv= 16.1 fps
6.2	201	Total			

Subcatchment 3: REAR YARD ABUTTER



Summary for Subcatchment 4S: EXIST. GRAVEL PARKING LOT

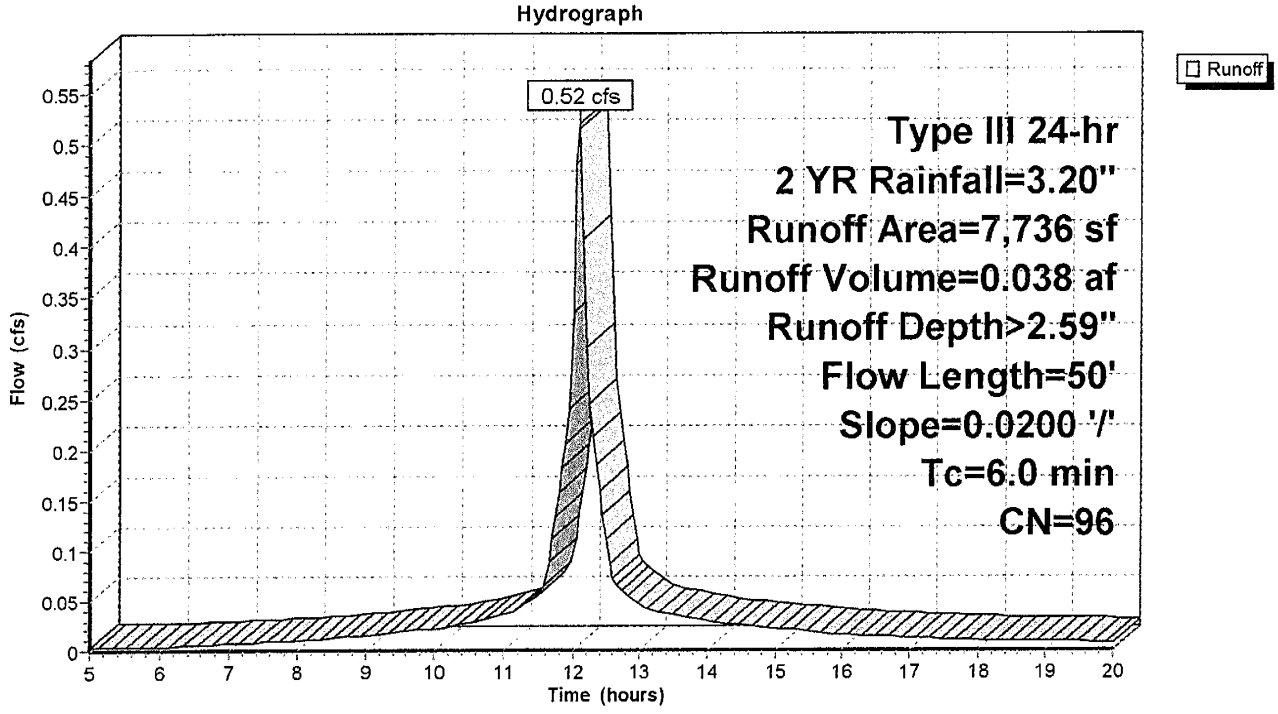
Runoff = 0.52 cfs @ 12.09 hrs, Volume= 0.038 af, Depth> 2.59"

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 YR Rainfall=3.20"

	Area (sf)	CN	Description
*	7,736	96	GRAVEL PARKING LOT
	7,736		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.20		**Sheet Flow, GRAVEL** Smooth surfaces n= 0.011 P2= 3.20"
5.3					**Direct Entry, 6 MINUTE MIN.**
6.0	50	Total			

Subcatchment 4S: EXIST. GRAVEL PARKING LOT

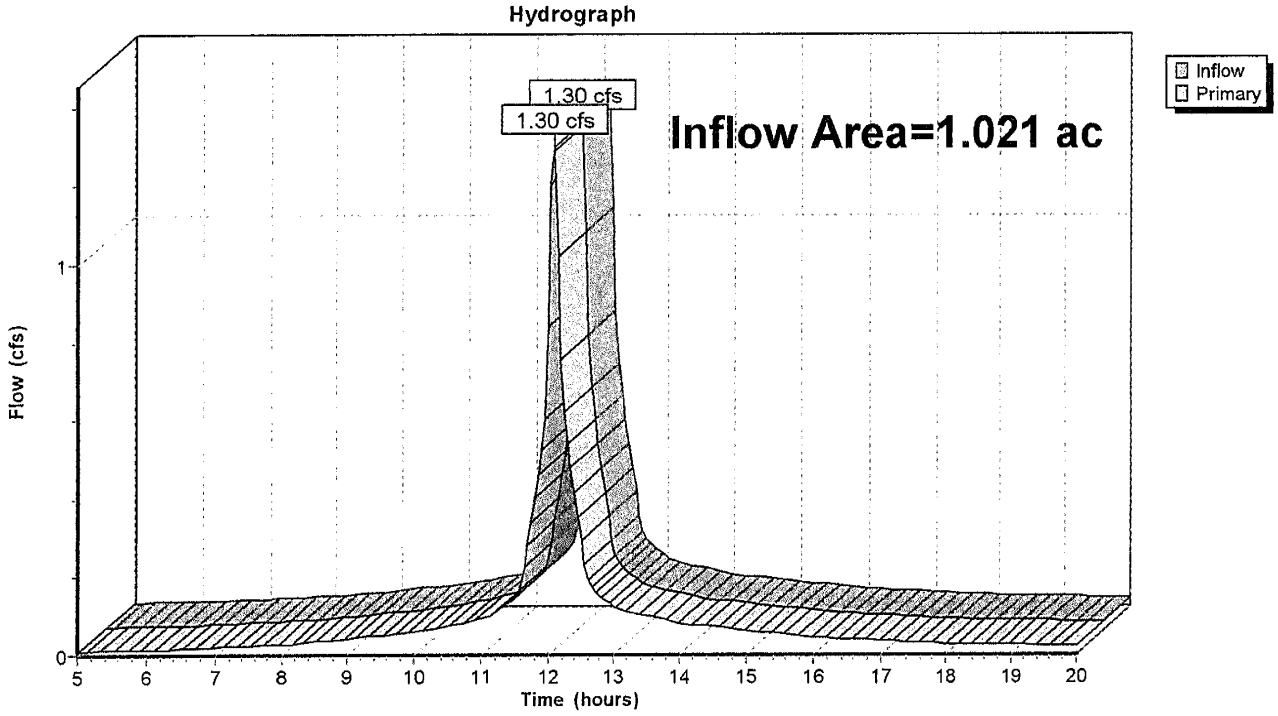


Summary for Pond 2P: DESIGN POINT 1 (WETLAND)

Inflow Area = 1.021 ac, 27.32% Impervious, Inflow Depth > 1.22" for 2 YR event
Inflow = 1.30 cfs @ 12.09 hrs, Volume= 0.104 af
Primary = 1.30 cfs @ 12.09 hrs, Volume= 0.104 af, Atten= 0%, Lag= 0.0 min

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

Pond 2P: DESIGN POINT 1 (WETLAND)



10 YEAR STORM

Summary for Subcatchment 1: EXIST PARKING & ROOF

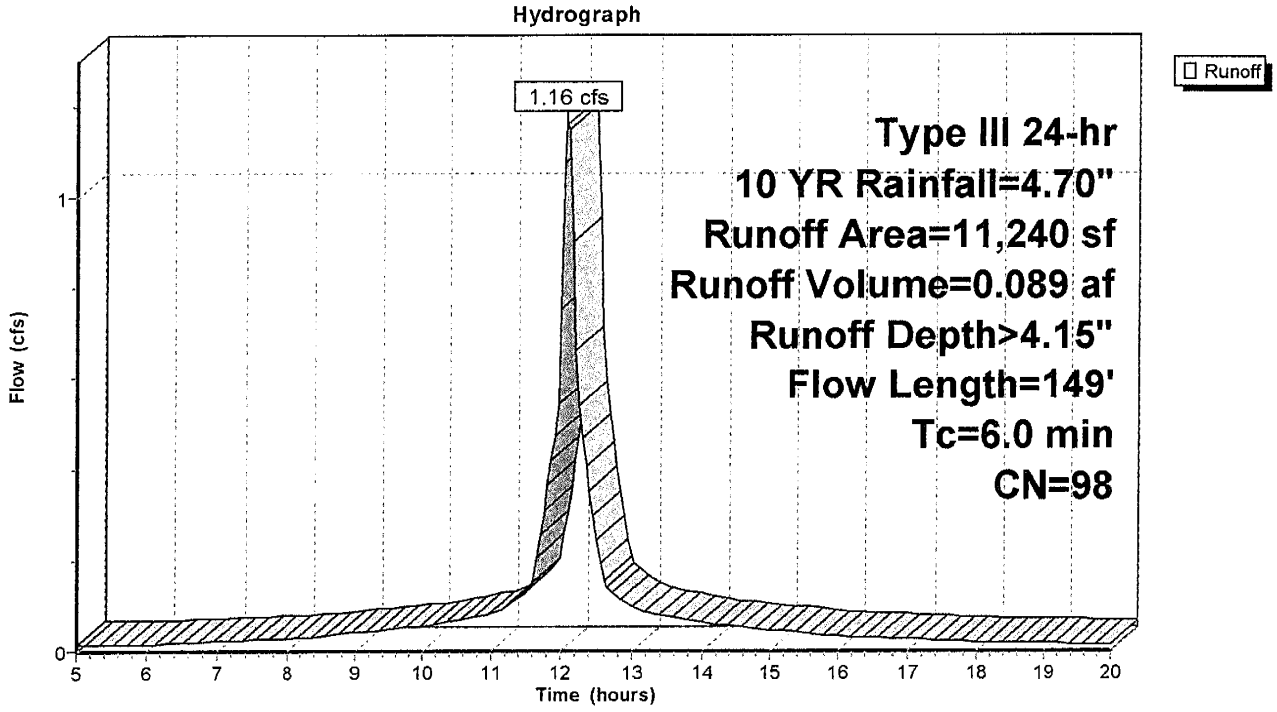
Runoff = 1.16 cfs @ 12.09 hrs, Volume= 0.089 af, Depth> 4.15"

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 YR Rainfall=4.70"

	Area (sf)	CN	Description
*	11,240	98	ROOF AND PAVEMENT
	11,240		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	15	0.4500	3.27		**Sheet Flow, ROOF** Smooth surfaces n= 0.011 P2= 3.20"
0.3	49	0.0050	2.82	0.78	**Trap/Vee/Rect Channel Flow, GUTTER** Bot.W=0.50' D=0.50' Z= 0.1 '/' Top.W=0.60' n= 0.012 Steel, smooth
0.8	29	0.0050	0.62		**Sheet Flow, ROOF** Smooth surfaces n= 0.011 P2= 3.20"
1.0	56	0.0020	0.91		**Shallow Concentrated Flow, P LOT** Paved Kv= 20.3 fps
3.8					**Direct Entry, 6 MINUTE MIN.**
6.0	149	Total			

Subcatchment 1: EXIST PARKING & ROOF



Summary for Subcatchment 2: REAR YARD ABUTTER

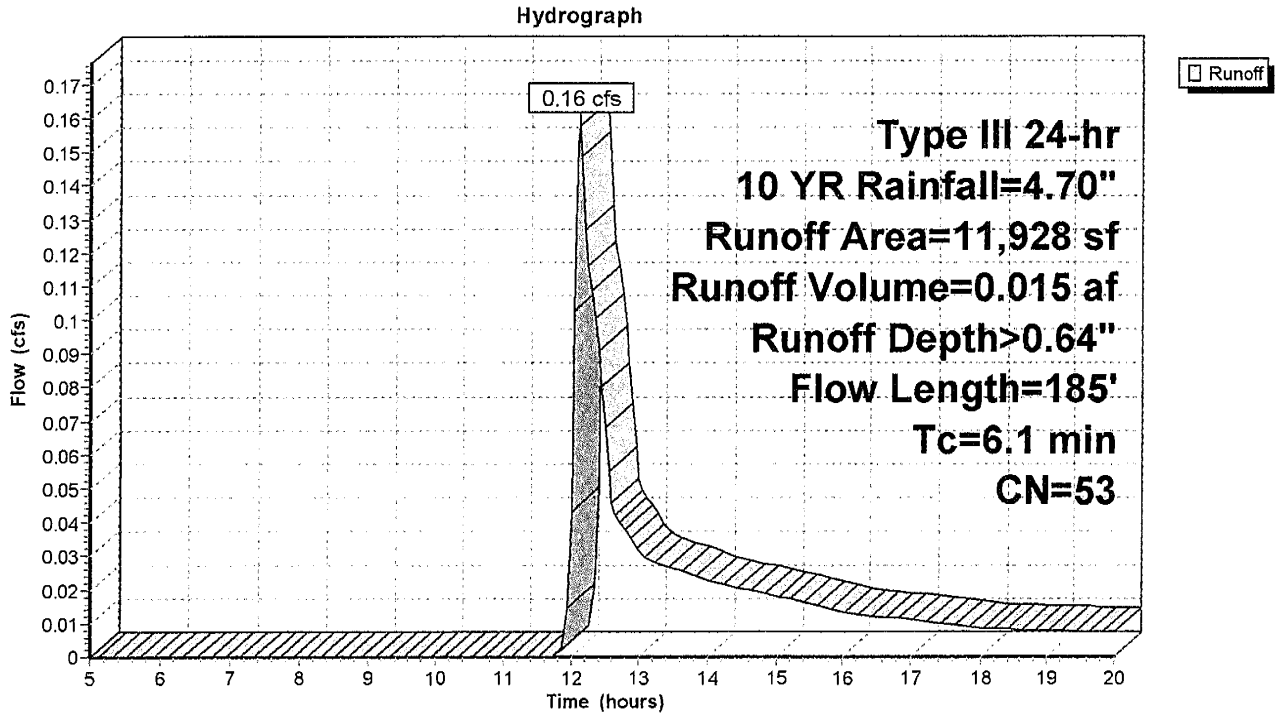
Runoff = 0.16 cfs @ 12.12 hrs, Volume= 0.015 af, Depth> 0.64"

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 YR Rainfall=4.70"

	Area (sf)	CN	Description
*	1,174	72	DIRT
*	10,285	49	GRASS FAIR HSG A
*	115	36	WOODS
*	125	98	SHED ROOF
*	229	98	SHED ROOF
	11,928	53	Weighted Average
	11,574		97.03% Pervious Area
	354		2.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, GRASS** Grass: Short n= 0.150 P2= 3.20"
0.3	83	0.1000	4.74		**Shallow Concentrated Flow, GRASS** Grassed Waterway Kv= 15.0 fps
0.2	52	0.0400	4.42	88.83	**Trap/Vee/Rect Channel Flow, FLOW OVER EXIST GRAVEL DRIVEV** Bot.W=67.00' D=0.30' Z= 0.2 '/' Top.W=67.12' n= 0.030 Earth, cobble bottom, clean sides
6.1	185	Total			

Subcatchment 2: REAR YARD ABUTTER



Summary for Subcatchment 3: REAR YARD ABUTTER

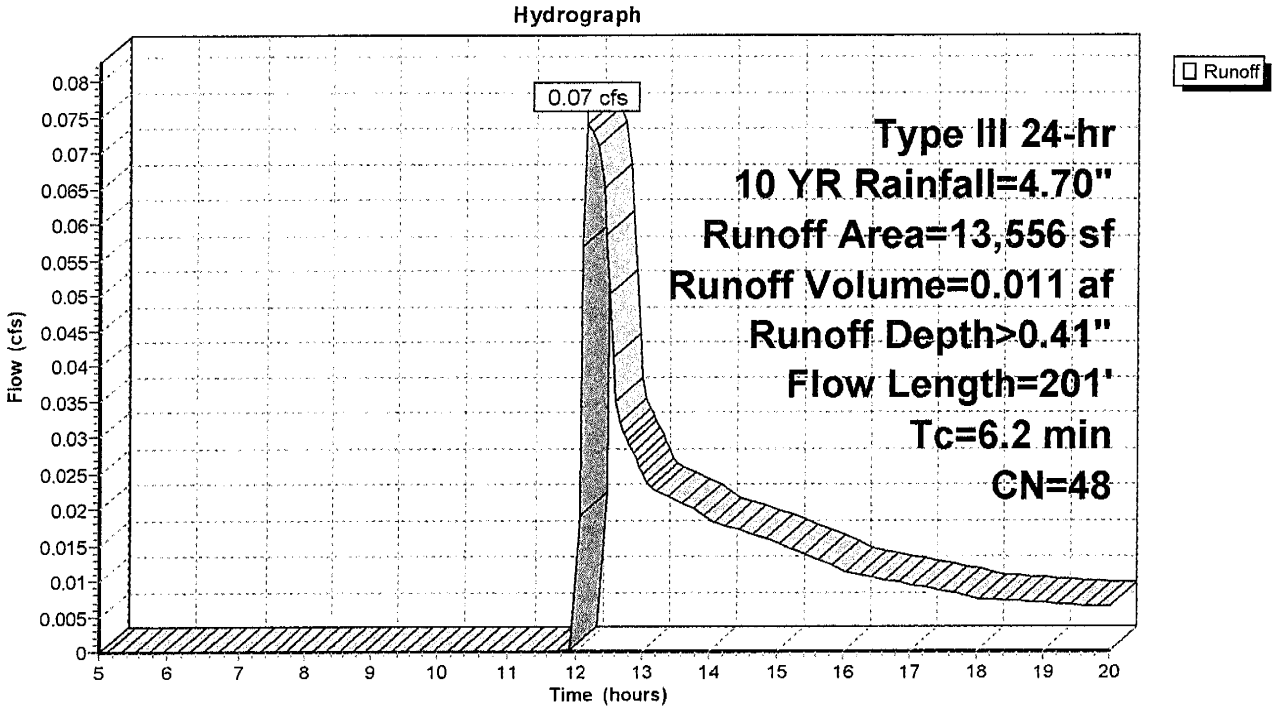
Runoff = 0.07 cfs @ 12.15 hrs, Volume= 0.011 af, Depth> 0.41"

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 YR Rainfall=4.70"

	Area (sf)	CN	Description
*	1,740	72	DIRT
*	552	98	DRIVEWAY
*	5,103	49	GRASS FAIR A
*	6,161	36	WOODS FAIR A
	13,556	48	Weighted Average
	13,004		95.93% Pervious Area
	552		4.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, GRASS** Grass: Short n= 0.150 P2= 3.20"
0.2	76	0.1000	5.09		**Shallow Concentrated Flow, LAWN & TREES** Unpaved Kv= 16.1 fps
0.4	75	0.0440	3.38		**Shallow Concentrated Flow, DISTURBED AREA** Unpaved Kv= 16.1 fps
6.2	201	Total			

Subcatchment 3: REAR YARD ABUTTER



Summary for Subcatchment 4S: EXIST. GRAVEL PARKING LOT

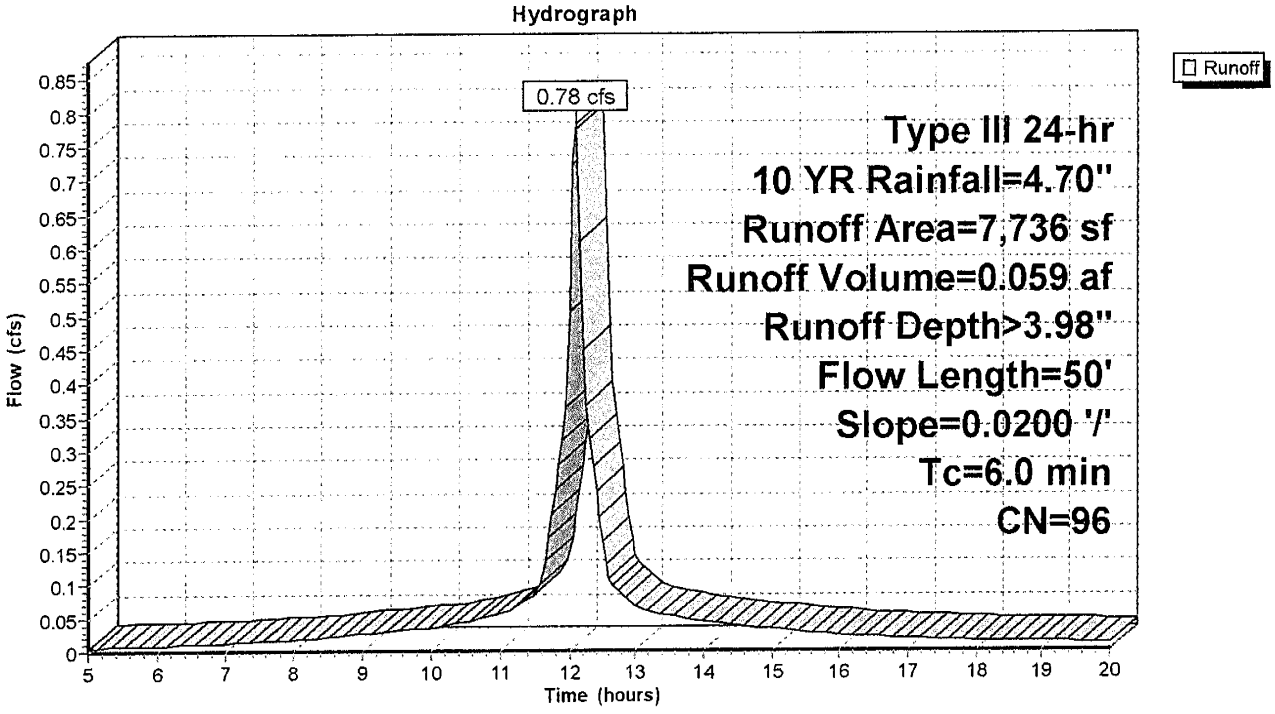
Runoff = 0.78 cfs @ 12.09 hrs, Volume= 0.059 af, Depth> 3.98"

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 YR Rainfall=4.70"

	Area (sf)	CN	Description
*	7,736	96	GRAVEL PARKING LOT
	7,736		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.20		**Sheet Flow, GRAVEL** Smooth surfaces n= 0.011 P2= 3.20"
5.3					**Direct Entry, 6 MINUTE MIN.**
6.0	50	Total			

Subcatchment 4S: EXIST. GRAVEL PARKING LOT

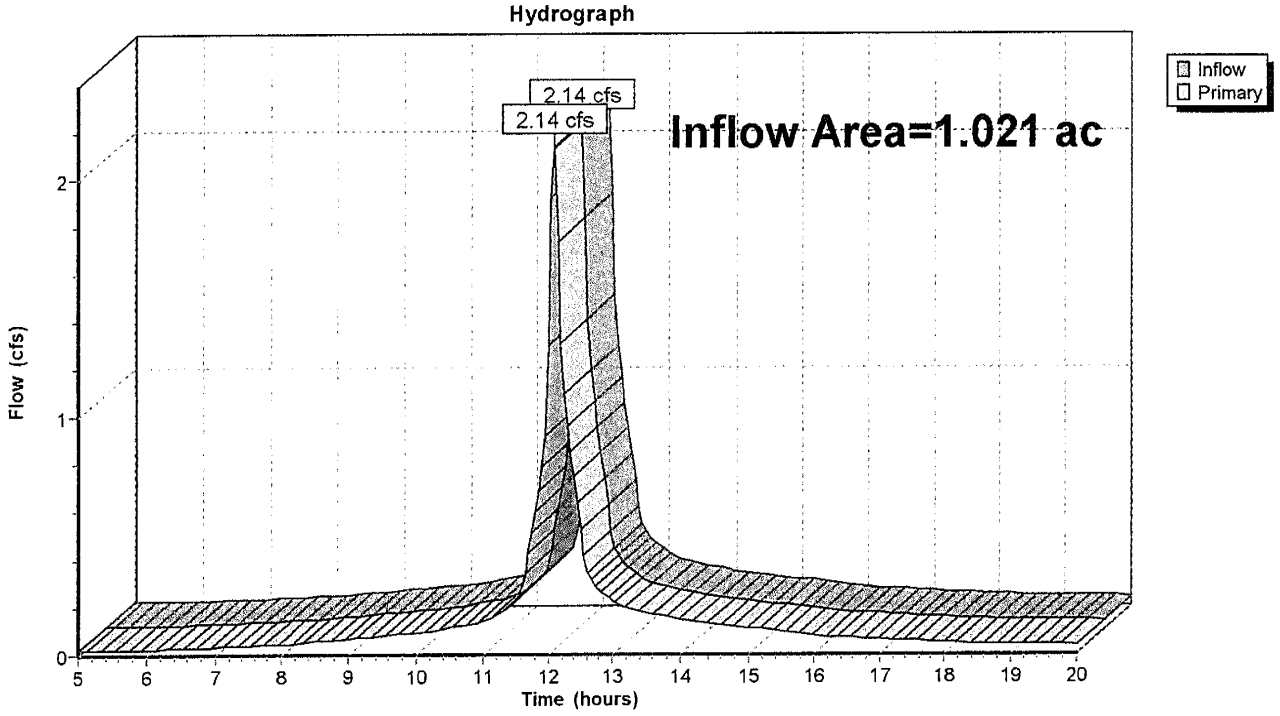


Summary for Pond 2P: DESIGN POINT 1 (WETLAND)

Inflow Area = 1.021 ac, 27.32% Impervious, Inflow Depth > 2.04" for 10 YR event
Inflow = 2.14 cfs @ 12.09 hrs, Volume= 0.173 af
Primary = 2.14 cfs @ 12.09 hrs, Volume= 0.173 af, Atten= 0%, Lag= 0.0 min

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

Pond 2P: DESIGN POINT 1 (WETLAND)



100 YEAR STORM

Summary for Subcatchment 1: EXIST PARKING & ROOF

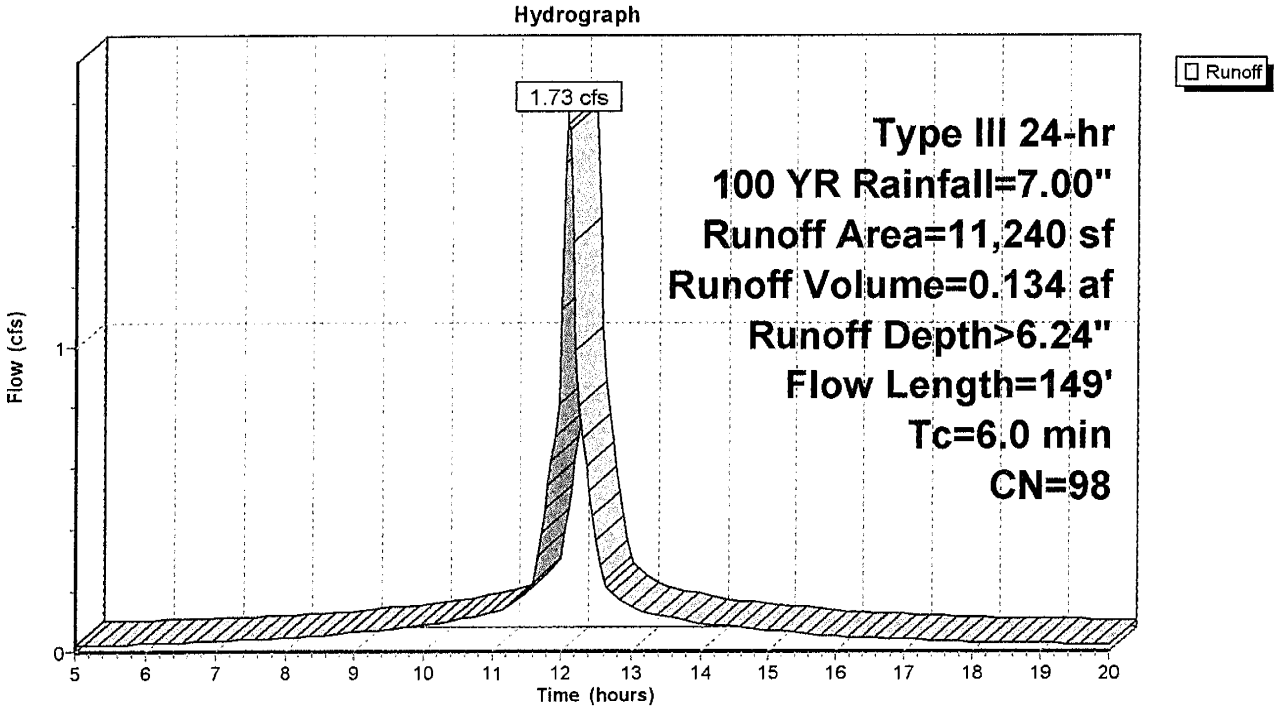
Runoff = 1.73 cfs @ 12.09 hrs, Volume= 0.134 af, Depth> 6.24"

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 YR Rainfall=7.00"

	Area (sf)	CN	Description
*	11,240	98	ROOF AND PAVEMENT
	11,240		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	15	0.4500	3.27		**Sheet Flow, ROOF** Smooth surfaces n= 0.011 P2= 3.20"
0.3	49	0.0050	2.82	0.78	**Trap/Vee/Rect Channel Flow, GUTTER** Bot.W=0.50' D=0.50' Z= 0.1 '/' Top.W=0.60' n= 0.012 Steel, smooth
0.8	29	0.0050	0.62		**Sheet Flow, ROOF** Smooth surfaces n= 0.011 P2= 3.20"
1.0	56	0.0020	0.91		**Shallow Concentrated Flow, P LOT** Paved Kv= 20.3 fps
3.8					**Direct Entry, 6 MINUTE MIN.**
6.0	149	Total			

Subcatchment 1: EXIST PARKING & ROOF



Summary for Subcatchment 2: REAR YARD ABUTTER

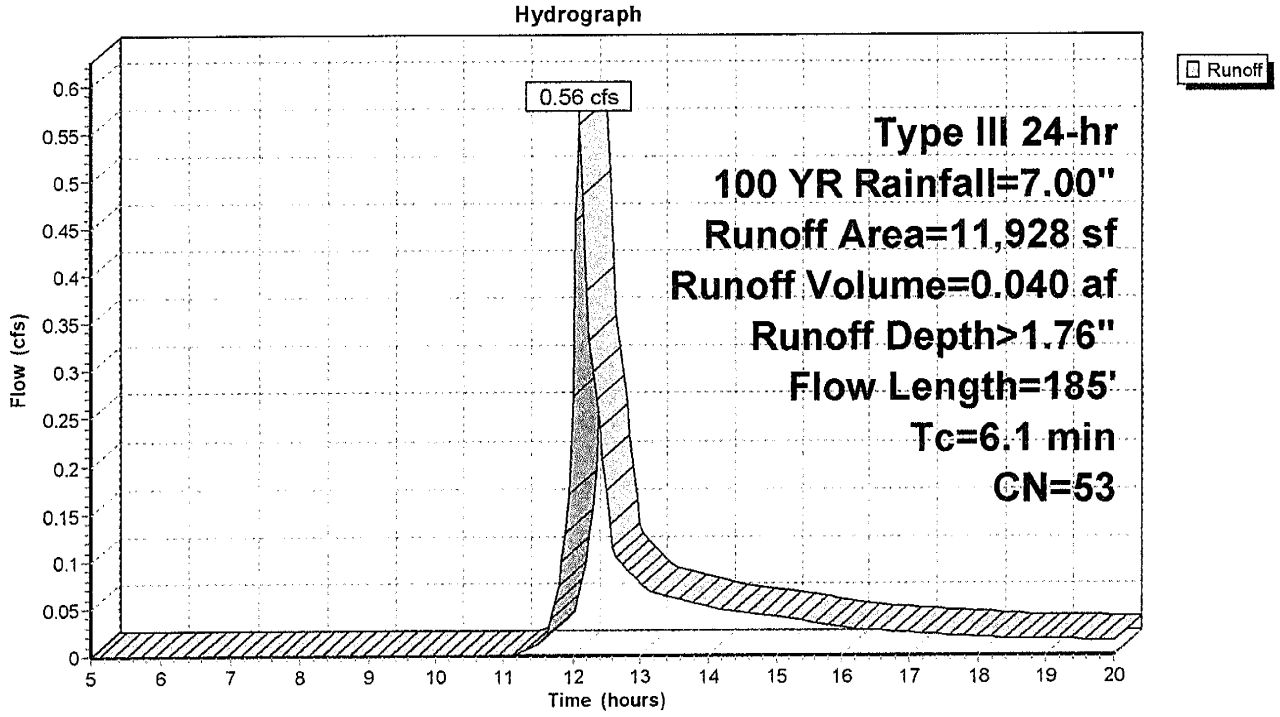
Runoff = 0.56 cfs @ 12.10 hrs, Volume= 0.040 af, Depth> 1.76"

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 YR Rainfall=7.00"

	Area (sf)	CN	Description
*	1,174	72	DIRT
*	10,285	49	GRASS FAIR HSG A
*	115	36	WOODS
*	125	98	SHED ROOF
*	229	98	SHED ROOF
	11,928	53	Weighted Average
	11,574		97.03% Pervious Area
	354		2.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, GRASS** Grass: Short n= 0.150 P2= 3.20"
0.3	83	0.1000	4.74		**Shallow Concentrated Flow, GRASS** Grassed Waterway Kv= 15.0 fps
0.2	52	0.0400	4.42	88.83	**Trap/Vee/Rect Channel Flow, FLOW OVER EXIST GRAVEL DRIVEV** Bot.W=67.00' D=0.30' Z= 0.2 '/' Top.W=67.12' n= 0.030 Earth, cobble bottom, clean sides
6.1	185	Total			

Subcatchment 2: REAR YARD ABUTTER



Summary for Subcatchment 3: REAR YARD ABUTTER

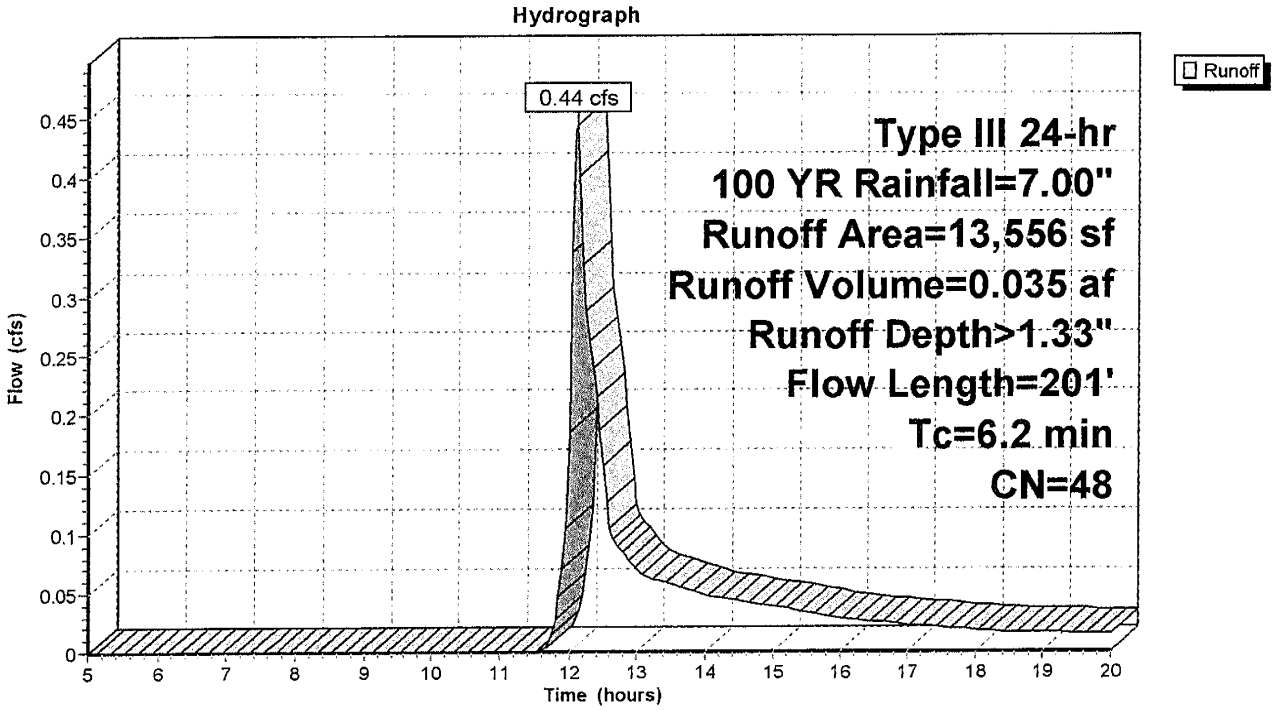
Runoff = 0.44 cfs @ 12.11 hrs, Volume= 0.035 af, Depth> 1.33"

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 YR Rainfall=7.00"

	Area (sf)	CN	Description
*	1,740	72	DIRT
*	552	98	DRIVEWAY
*	5,103	49	GRASS FAIR A
*	6,161	36	WOODS FAIR A
	13,556	48	Weighted Average
	13,004		95.93% Pervious Area
	552		4.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, GRASS** Grass: Short n= 0.150 P2= 3.20"
0.2	76	0.1000	5.09		**Shallow Concentrated Flow, LAWN & TREES** Unpaved Kv= 16.1 fps
0.4	75	0.0440	3.38		**Shallow Concentrated Flow, DISTURBED AREA** Unpaved Kv= 16.1 fps
6.2	201	Total			

Subcatchment 3: REAR YARD ABUTTER



Summary for Subcatchment 4S: EXIST. GRAVEL PARKING LOT

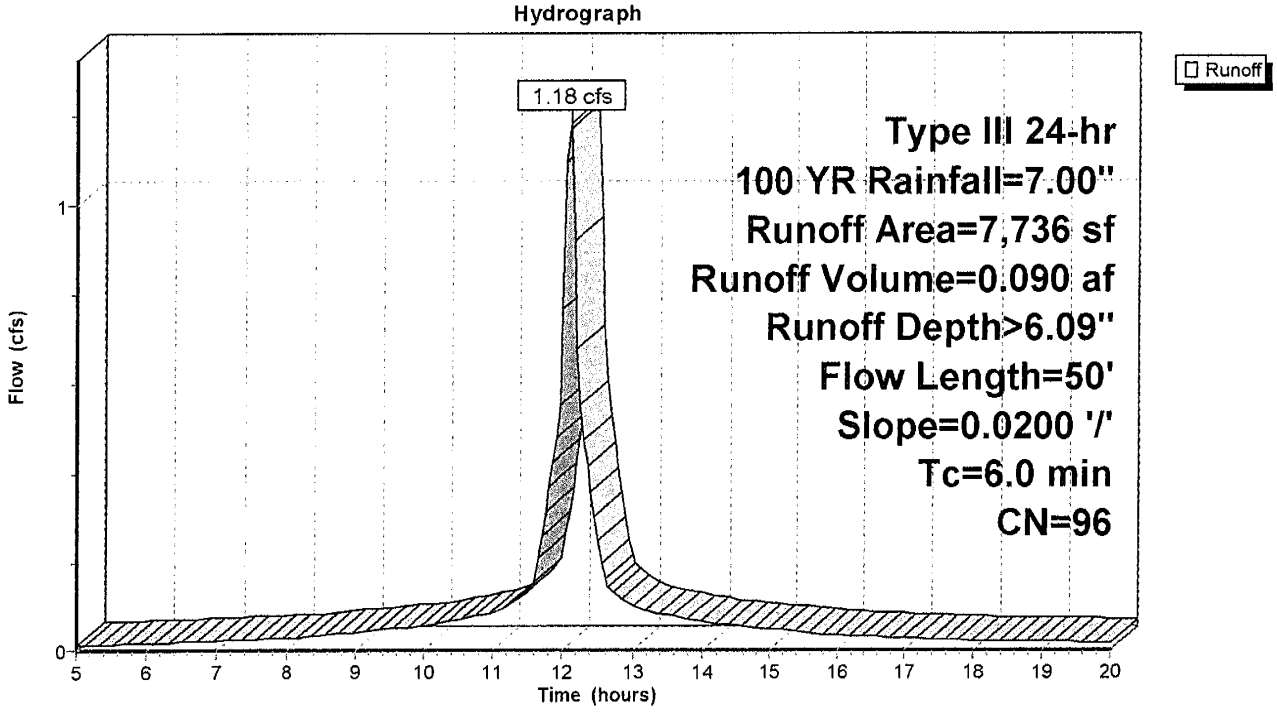
Runoff = 1.18 cfs @ 12.09 hrs, Volume= 0.090 af, Depth> 6.09"

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 YR Rainfall=7.00"

	Area (sf)	CN	Description
*	7,736	96	GRAVEL PARKING LOT
	7,736		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.20		**Sheet Flow, GRAVEL** Smooth surfaces n= 0.011 P2= 3.20"
5.3					**Direct Entry, 6 MINUTE MIN.**
6.0	50	Total			

Subcatchment 4S: EXIST. GRAVEL PARKING LOT

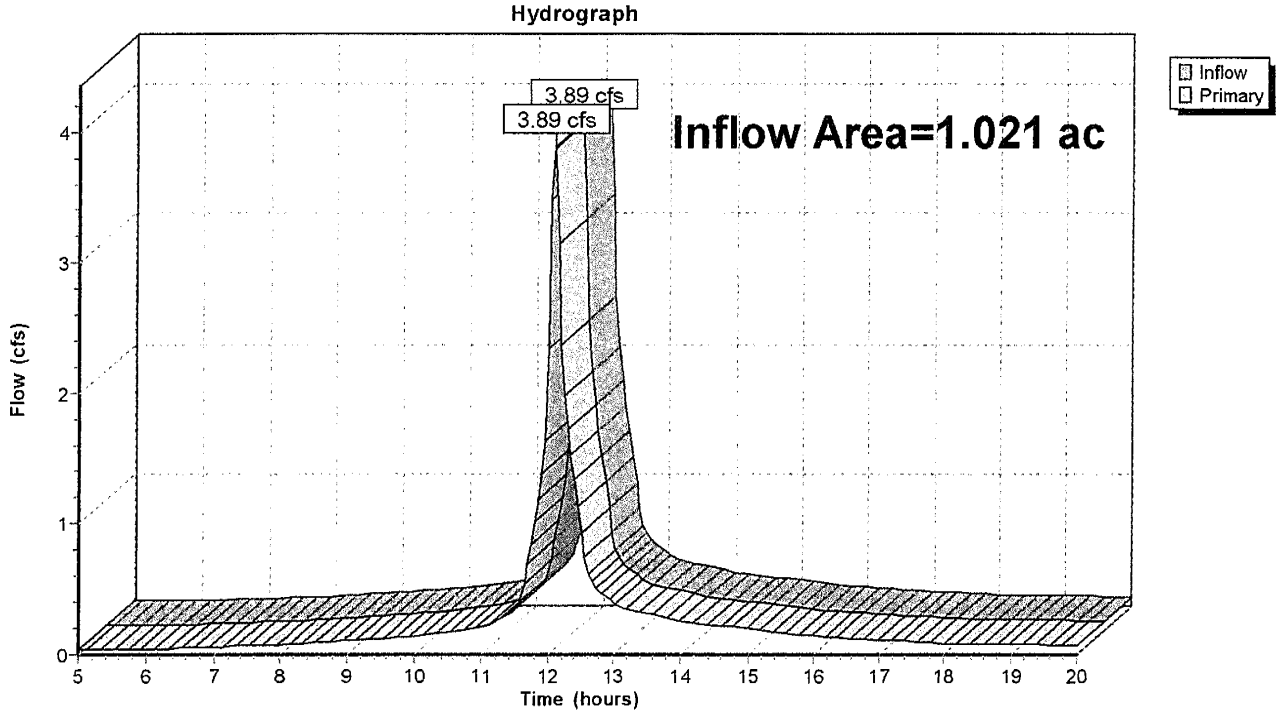


Summary for Pond 2P: DESIGN POINT 1 (WETLAND)

Inflow Area = 1.021 ac, 27.32% Impervious, Inflow Depth > 3.51" for 100 YR event
Inflow = 3.89 cfs @ 12.09 hrs, Volume= 0.299 af
Primary = 3.89 cfs @ 12.09 hrs, Volume= 0.299 af, Atten= 0%, Lag= 0.0 min

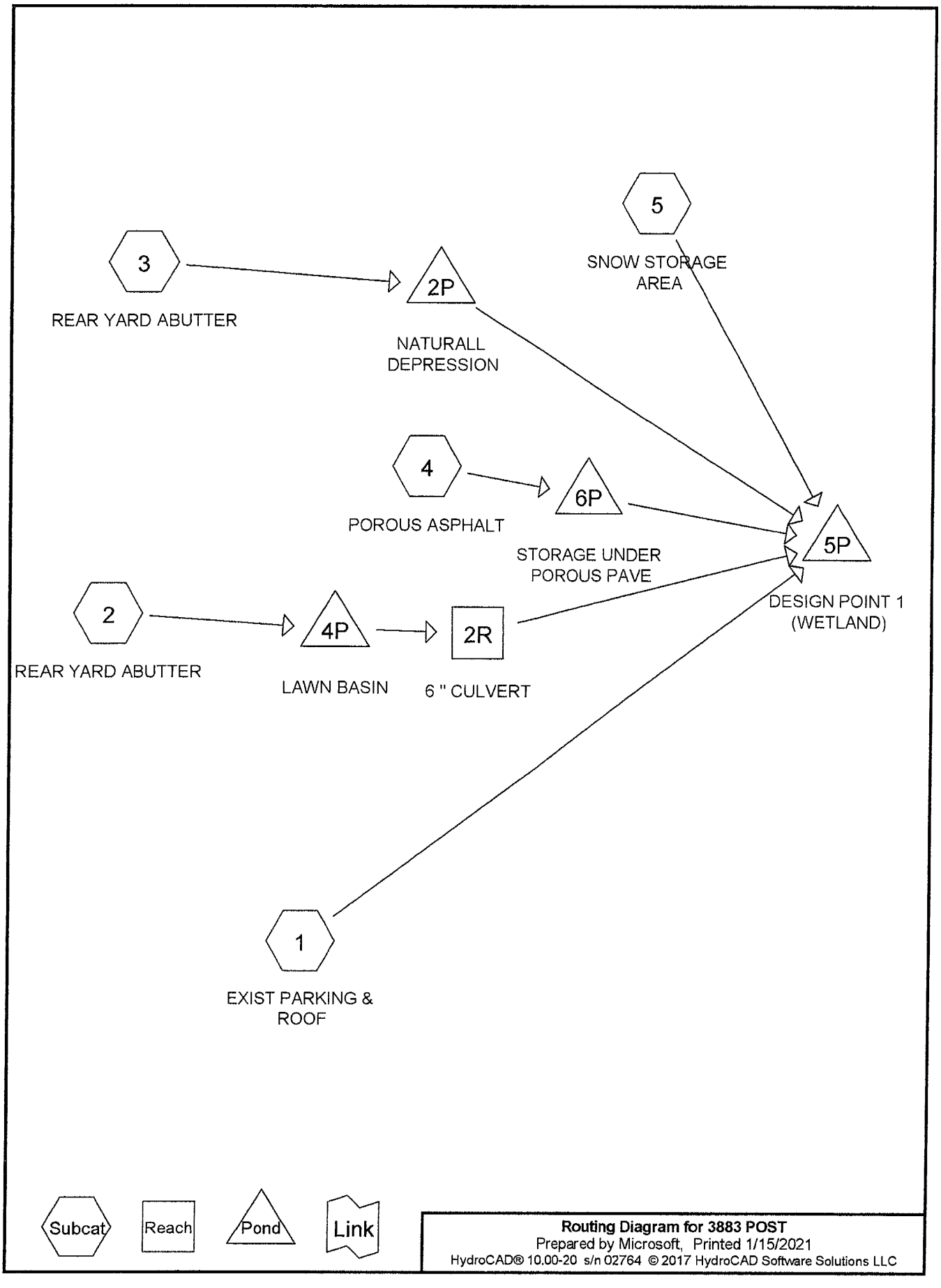
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Pond 2P: DESIGN POINT 1 (WETLAND)



2.12 Post Development Analysis Calculations

POST DEVELOPMENT ANALYSIS CALCULATIONS


3
REAR YARD ABUTTER
2P
NATURALL DEPRESSION
5
SNOW STORAGE AREA
4
POROUS ASPHALT
6P
STORAGE UNDER POROUS PAVE
5P
DESIGN POINT 1 (WETLAND)
2
REAR YARD ABUTTER
4P
LAWN BASIN
2R
6 " CULVERT
1
EXIST PARKING & ROOF
Subcat
Reach
Pond
Link
Routing Diagram for 3883 POST
Prepared by Microsoft, Printed 1/15/2021
HydroCAD® 10.00-20 s/n 02764 © 2017 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.117	49	50-75% Grass cover, Fair, HSG A (3)
0.051	30	Brush, Good, HSG A (5)
0.013	98	DRIVEWAY (3)
0.262	49	GRASS FAIR HSG A (2)
0.002	69	GRAVEL BEHIND RET WALL (2)
0.212	98	Paved parking, HSG A (4)
0.001	98	ROOF (2)
0.258	98	ROOF AND PAVEMENT (1)
0.001	98	WALL (3)
0.103	36	Woods, Fair, HSG A (3)
1.021	**70**	**TOTAL AREA**

2 YEAR STORM

Summary for Subcatchment 1: EXIST PARKING & ROOF

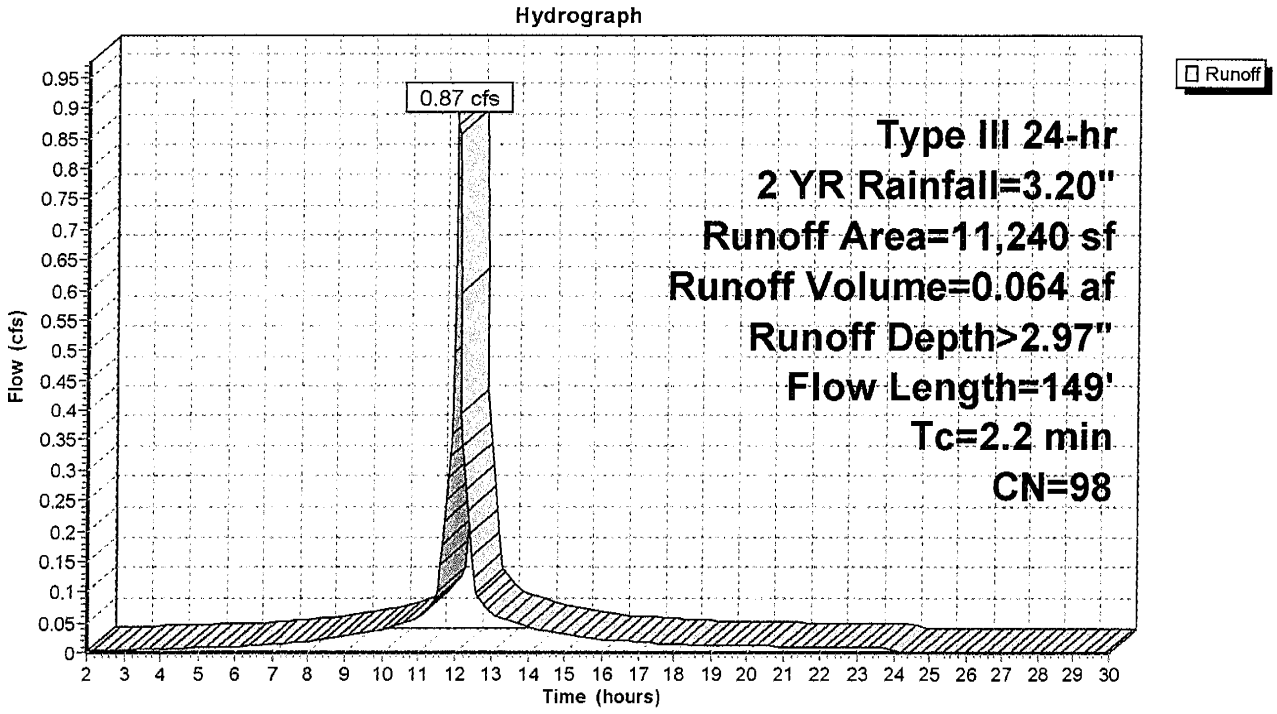
Runoff = 0.87 cfs @ 12.04 hrs, Volume= 0.064 af, Depth> 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YR Rainfall=3.20"

	Area (sf)	CN	Description
*	11,240	98	ROOF AND PAVEMENT
	11,240		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	15	0.4500	3.27		**Sheet Flow, ROOF** Smooth surfaces n= 0.011 P2= 3.20"
0.3	49	0.0050	2.82	0.78	**Trap/Vee/Rect Channel Flow, GUTTER** Bot.W=0.50' D=0.50' Z= 0.1 '/' Top.W=0.60' n= 0.012 Steel, smooth
0.8	29	0.0050	0.62		**Sheet Flow, ROOF** Smooth surfaces n= 0.011 P2= 3.20"
1.0	56	0.0020	0.91		**Shallow Concentrated Flow, P LOT** Paved Kv= 20.3 fps
2.2	149	Total			

Subcatchment 1: EXIST PARKING & ROOF



Summary for Subcatchment 2: REAR YARD ABUTTER

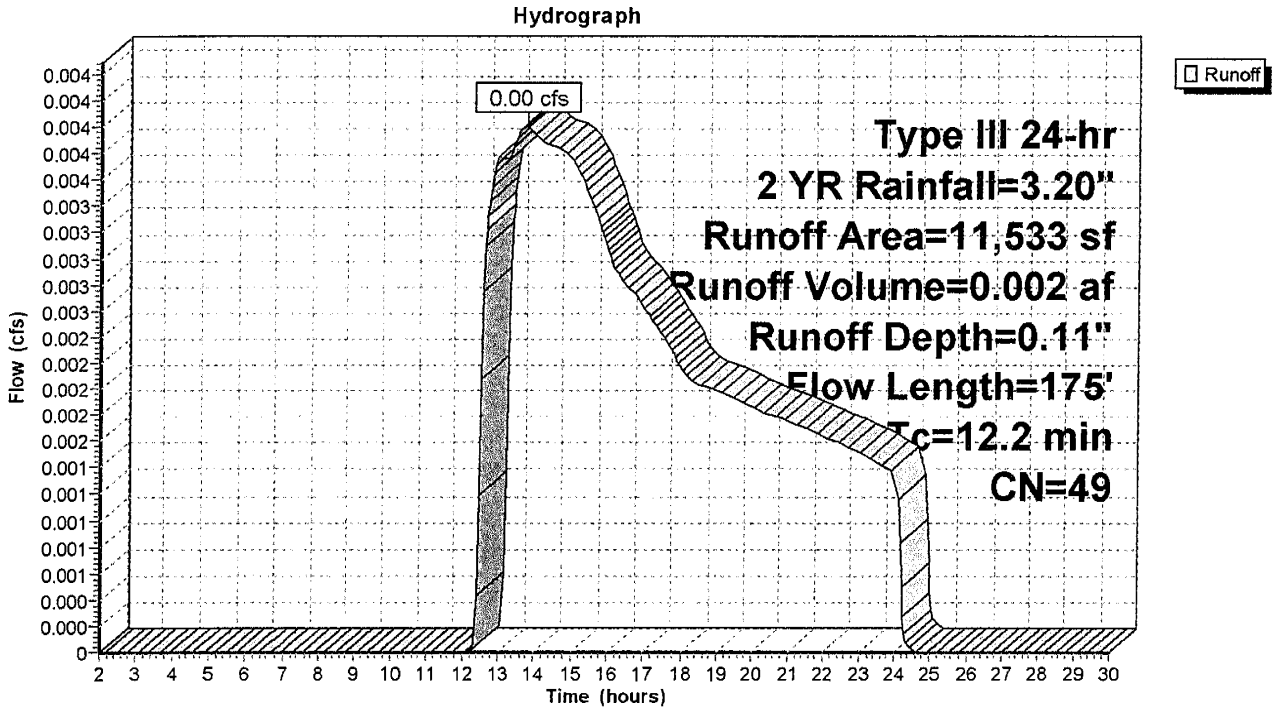
Runoff = 0.00 cfs @ 13.77 hrs, Volume= 0.002 af, Depth= 0.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YR Rainfall=3.20"

	Area (sf)	CN	Description
*	16	98	ROOF
*	48	98	ROOF
*	11,391	49	GRASS FAIR HSG A
*	78	69	GRAVEL BEHIND RET WALL
	11,533	49	Weighted Average
	11,469		99.45% Pervious Area
	64		0.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, LAWN** Grass: Short n= 0.150 P2= 3.20"
0.6	75	0.1000	2.21		**Shallow Concentrated Flow, LAWN** Short Grass Pasture Kv= 7.0 fps
6.0	50		0.14		**Direct Entry, STORAGE UNDER P LOT**
12.2	175	Total			

Subcatchment 2: REAR YARD ABUTTER



Summary for Subcatchment 3: REAR YARD ABUTTER

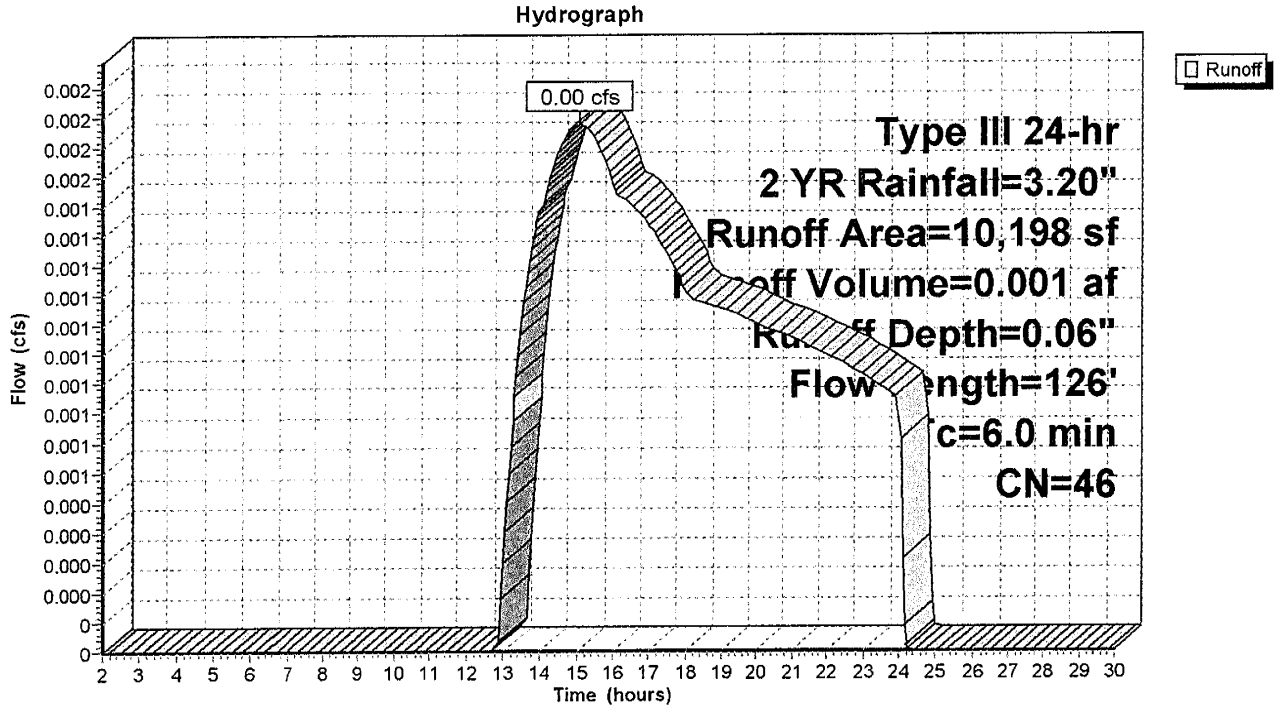
Runoff = 0.00 cfs @ 15.05 hrs, Volume= 0.001 af, Depth= 0.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YR Rainfall=3.20"

	Area (sf)	CN	Description
*	41	98	WALL
	5,103	49	50-75% Grass cover, Fair, HSG A
*	552	98	DRIVEWAY
	4,502	36	Woods, Fair, HSG A
	10,198	46	Weighted Average
	9,605		94.19% Pervious Area
	593		5.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, GRASS** Grass: Short n= 0.150 P2= 3.20"
0.3	76	0.1000	4.74		**Shallow Concentrated Flow, GRASS** Grassed Waterway Kv= 15.0 fps
0.1					**Direct Entry, 6 MINUTE MIN.**
6.0	126	Total			

Subcatchment 3: REAR YARD ABUTTER



Summary for Subcatchment 4: POROUS ASPHALT

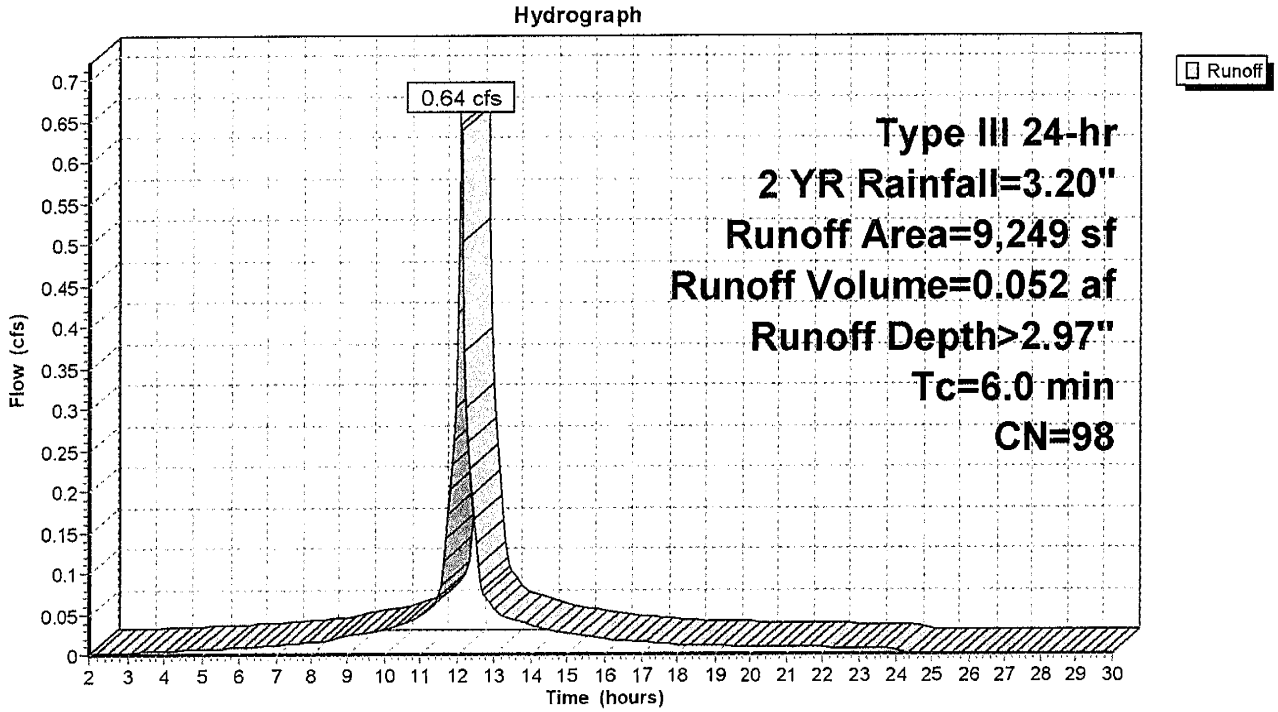
Runoff = 0.64 cfs @ 12.09 hrs, Volume= 0.052 af, Depth> 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YR Rainfall=3.20"

Area (sf)	CN	Description
9,249	98	Paved parking, HSG A
9,249		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, 6 MINUTE MIN.**

Subcatchment 4: POROUS ASPHALT



Summary for Subcatchment 5: SNOW STORAGE AREA

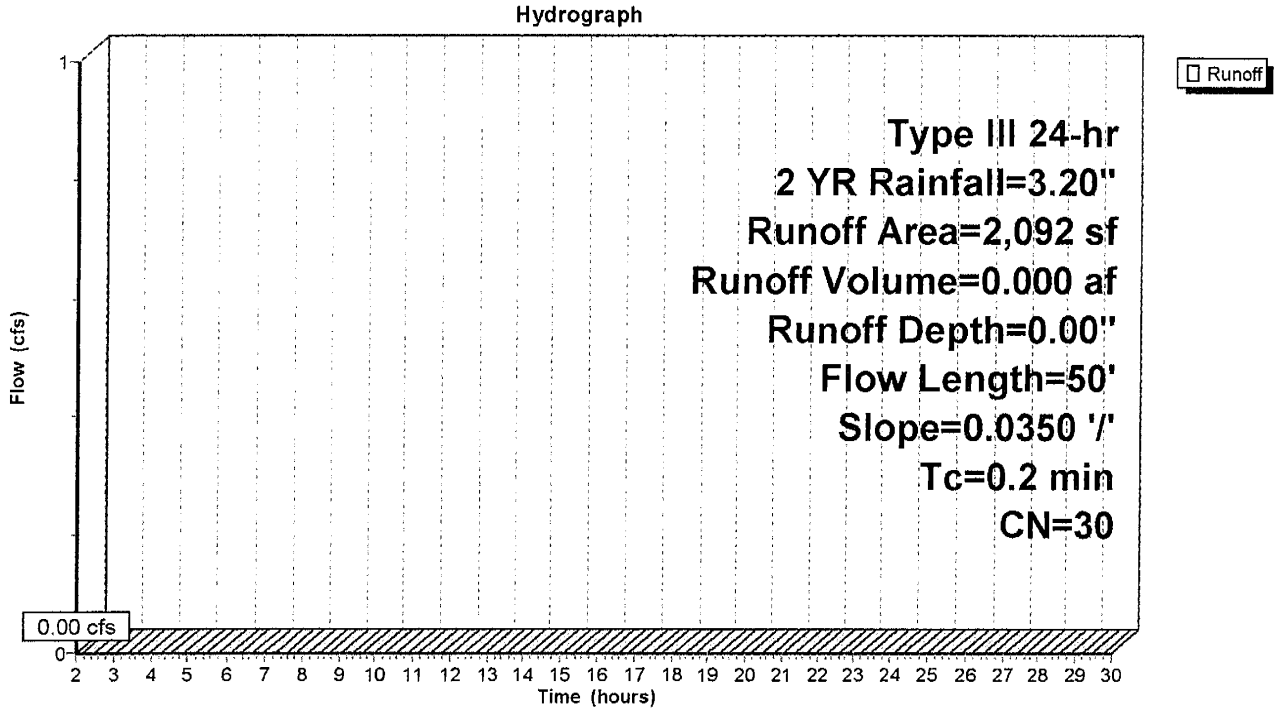
Runoff = 0.00 cfs @ 2.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 YR Rainfall=3.20"

Area (sf)	CN	Description
2,092	30	Brush, Good, HSG A
2,092		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	50	0.0350	3.80		**Shallow Concentrated Flow, P LOT** Paved Kv= 20.3 fps

Subcatchment 5: SNOW STORAGE AREA



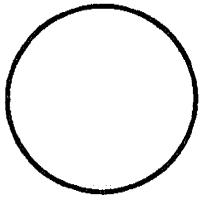
Summary for Reach 2R: 6 " CULVERT

Inflow Area = 0.265 ac, 0.55% Impervious, Inflow Depth = 0.02" for 2 YR event
Inflow = 0.00 cfs @ 13.79 hrs, Volume= 0.001 af
Outflow = 0.00 cfs @ 13.82 hrs, Volume= 0.001 af, Atten= 0%, Lag= 2.2 min

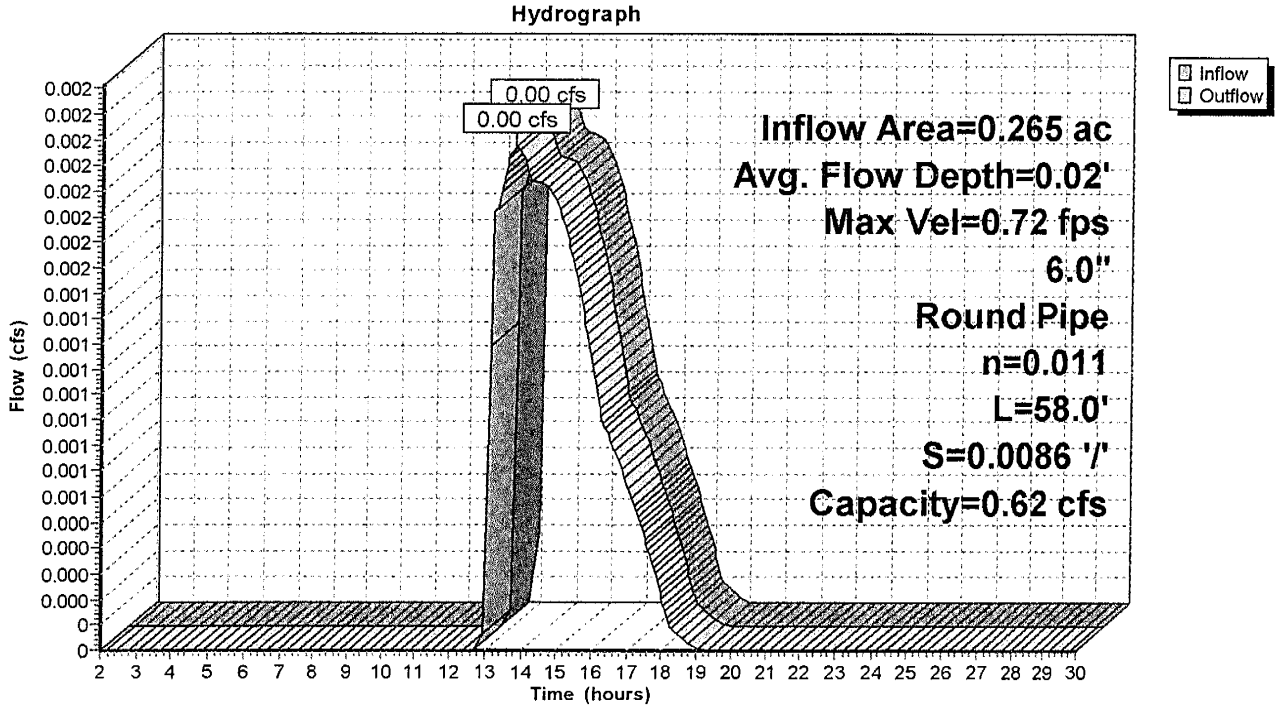
Routing by Stor-Ind+Trans method, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.72 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 0.57 fps, Avg. Travel Time= 1.7 min

Peak Storage= 0 cf @ 13.80 hrs
Average Depth at Peak Storage= 0.02'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 0.62 cfs

6.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 58.0' Slope= 0.0086 '/'
Inlet Invert= 80.20', Outlet Invert= 79.70'



Reach 2R: 6 " CULVERT



Summary for Pond 2P: NATURALL DEPRESSION

Inflow Area = 0.234 ac, 5.81% Impervious, Inflow Depth = 0.06" for 2 YR event
Inflow = 0.00 cfs @ 15.05 hrs, Volume= 0.001 af
Outflow = 0.00 cfs @ 15.05 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 15.05 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 15.05 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 85.00' @ 15.05 hrs Surf.Area= 54 sf Storage= 0 cf

Plug-Flow detention time= 0.0 min calculated for 0.001 af (100% of inflow)
Center-of-Mass det. time= 0.0 min (1,082.3 - 1,082.2)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	206 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

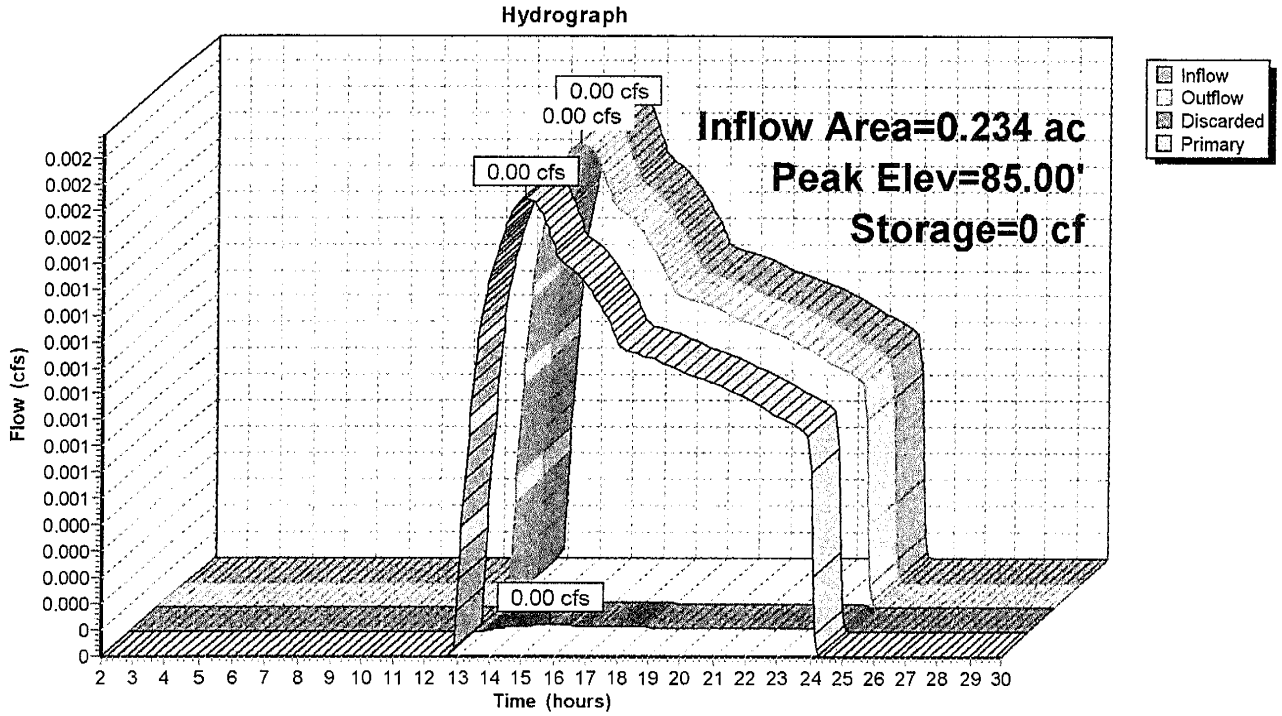
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
85.00	54	0	0
86.00	357	206	206

Device	Routing	Invert	Outlet Devices
#1	Discarded	85.00'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 80.00'
#2	Primary	84.20'	**4.0" Round 4 " UNDERDRAIN** L= 82.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 84.20' / 83.70' S= 0.0061 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.09 sf

Discarded OutFlow Max=0.00 cfs @ 15.05 hrs HW=85.00' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.22 cfs @ 15.05 hrs HW=85.00' (Free Discharge)
↑—**2=4 " UNDERDRAIN** (Barrel Controls 0.22 cfs @ 2.56 fps)

Pond 2P: NATURALL DEPRESSION



Summary for Pond 4P: LAWN BASIN

Inflow Area = 0.265 ac, 0.55% Impervious, Inflow Depth = 0.11" for 2 YR event
Inflow = 0.00 cfs @ 13.77 hrs, Volume= 0.002 af
Outflow = 0.00 cfs @ 13.79 hrs, Volume= 0.002 af, Atten= 0%, Lag= 1.2 min
Discarded = 0.00 cfs @ 13.79 hrs, Volume= 0.002 af
Primary = 0.00 cfs @ 13.79 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 82.90' @ 13.79 hrs Surf.Area= 35 sf Storage= 4 cf

Plug-Flow detention time= 24.1 min calculated for 0.002 af (100% of inflow)
Center-of-Mass det. time= 24.2 min (1,054.8 - 1,030.6)

Volume	Invert	Avail.Storage	Storage Description
#1	82.70'	61 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

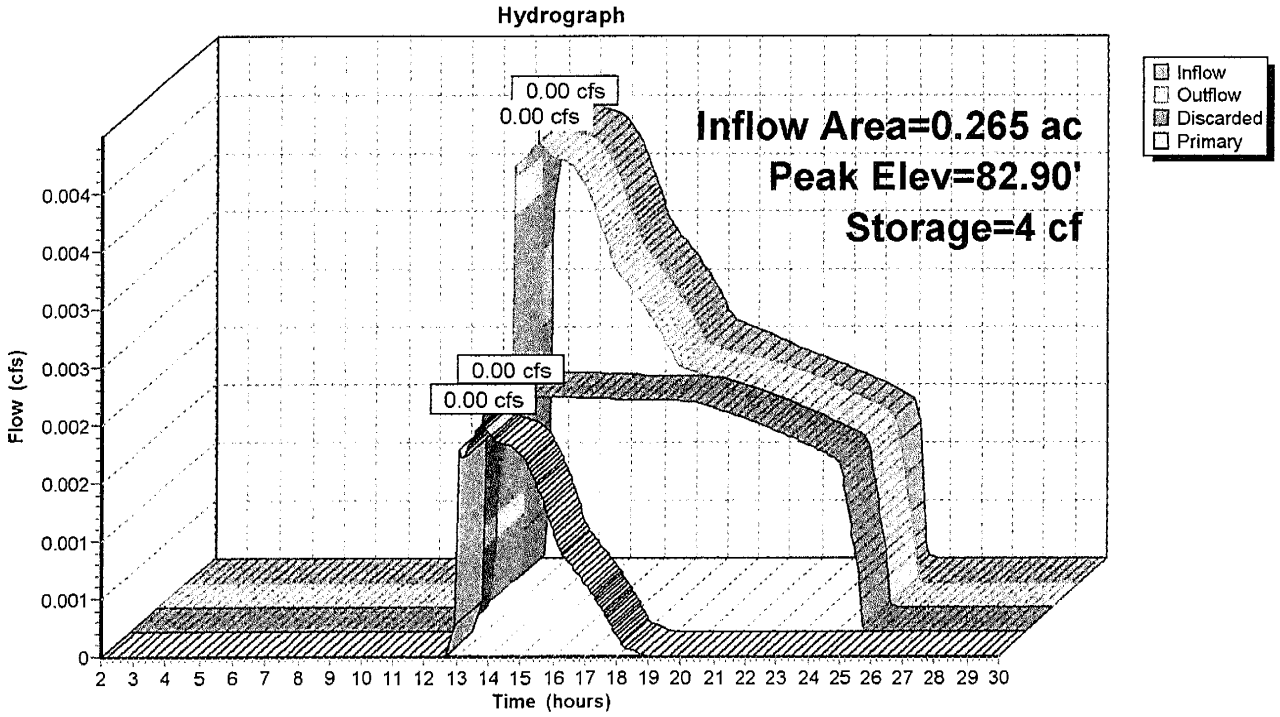
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
82.70	5	0	0
83.00	49	8	8
83.50	163	53	61

Device	Routing	Invert	Outlet Devices
#1	Discarded	82.70'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 80.00'
#2	Primary	83.20'	**10.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#3	Primary	82.90'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.00 cfs @ 13.79 hrs HW=82.90' (Free Discharge)
└**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 13.79 hrs HW=82.90' (Free Discharge)
├**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**3=Orifice/Grate** (Weir Controls 0.00 cfs @ 0.21 fps)

Pond 4P: LAWN BASIN

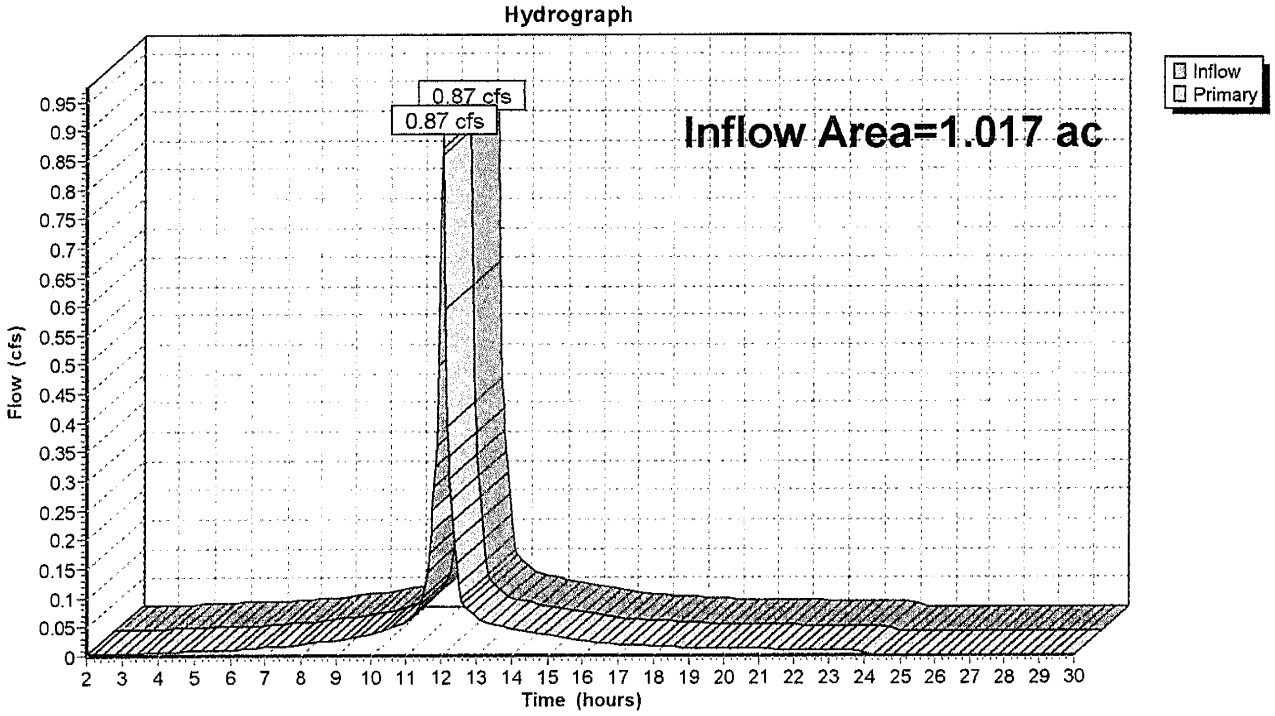


Summary for Pond 5P: DESIGN POINT 1 (WETLAND)

Inflow Area = 1.017 ac, 47.72% Impervious, Inflow Depth > 0.77" for 2 YR event
Inflow = 0.87 cfs @ 12.04 hrs, Volume= 0.065 af
Primary = 0.87 cfs @ 12.04 hrs, Volume= 0.065 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs

Pond 5P: DESIGN POINT 1 (WETLAND)



Summary for Pond 6P: STORAGE UNDER POROUS PAVE

Inflow Area = 0.212 ac,100.00% Impervious, Inflow Depth > 2.97" for 2 YR event
Inflow = 0.64 cfs @ 12.09 hrs, Volume= 0.052 af
Outflow = 0.52 cfs @ 12.15 hrs, Volume= 0.052 af, Atten= 19%, Lag= 3.8 min
Discarded = 0.52 cfs @ 12.15 hrs, Volume= 0.052 af
Primary = 0.00 cfs @ 2.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 82.22' @ 12.14 hrs Surf.Area= 9,249 sf Storage= 56 cf

Plug-Flow detention time= 0.9 min calculated for 0.052 af (100% of inflow)
Center-of-Mass det. time= 0.9 min (757.7 - 756.8)

Volume	Invert	Avail.Storage	Storage Description
#1	82.20'	2,479 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 6,197 cf Overall x 40.0% Voids

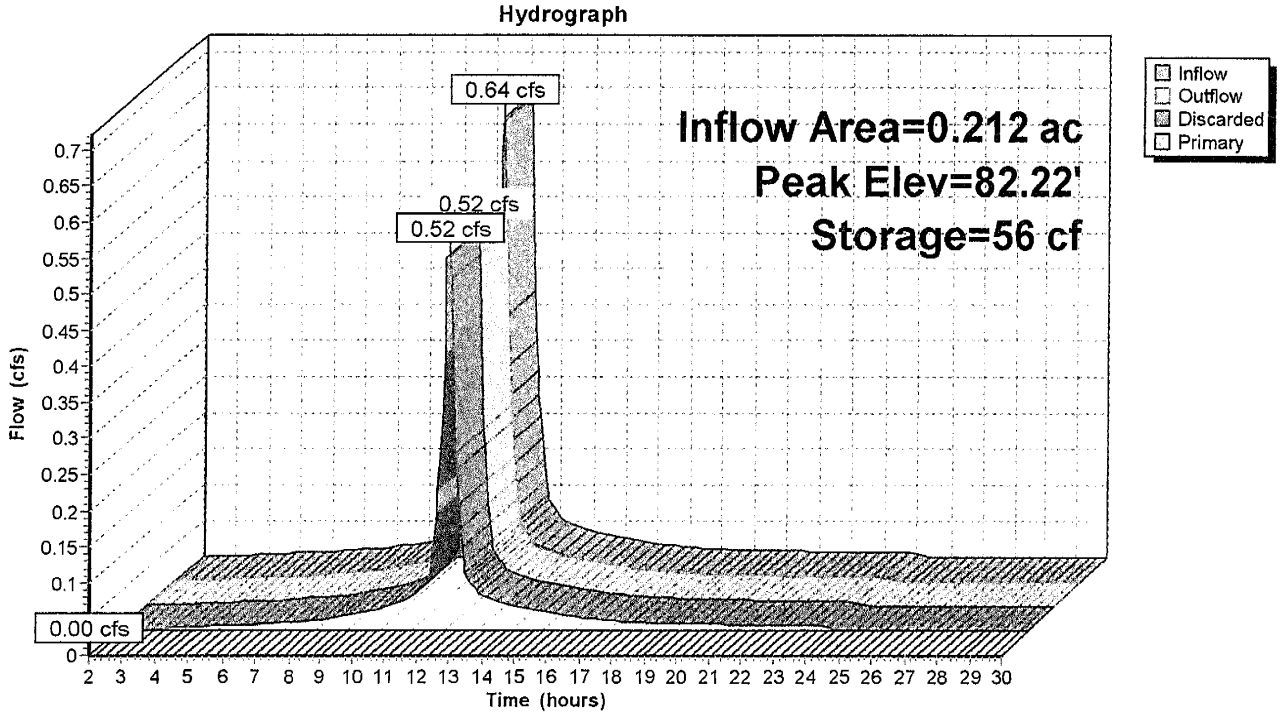
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
82.20	9,249	0	0
82.87	9,249	6,197	6,197

Device	Routing	Invert	Outlet Devices
#1	Discarded	82.20'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 80.00'
#2	Primary	82.50'	**10.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Discarded OutFlow Max=0.52 cfs @ 12.15 hrs HW=82.22' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.52 cfs)

Primary OutFlow Max=0.00 cfs @ 2.00 hrs HW=82.20' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 6P: STORAGE UNDER POROUS PAVE



10 YEAR STORM

Summary for Subcatchment 1: EXIST PARKING & ROOF

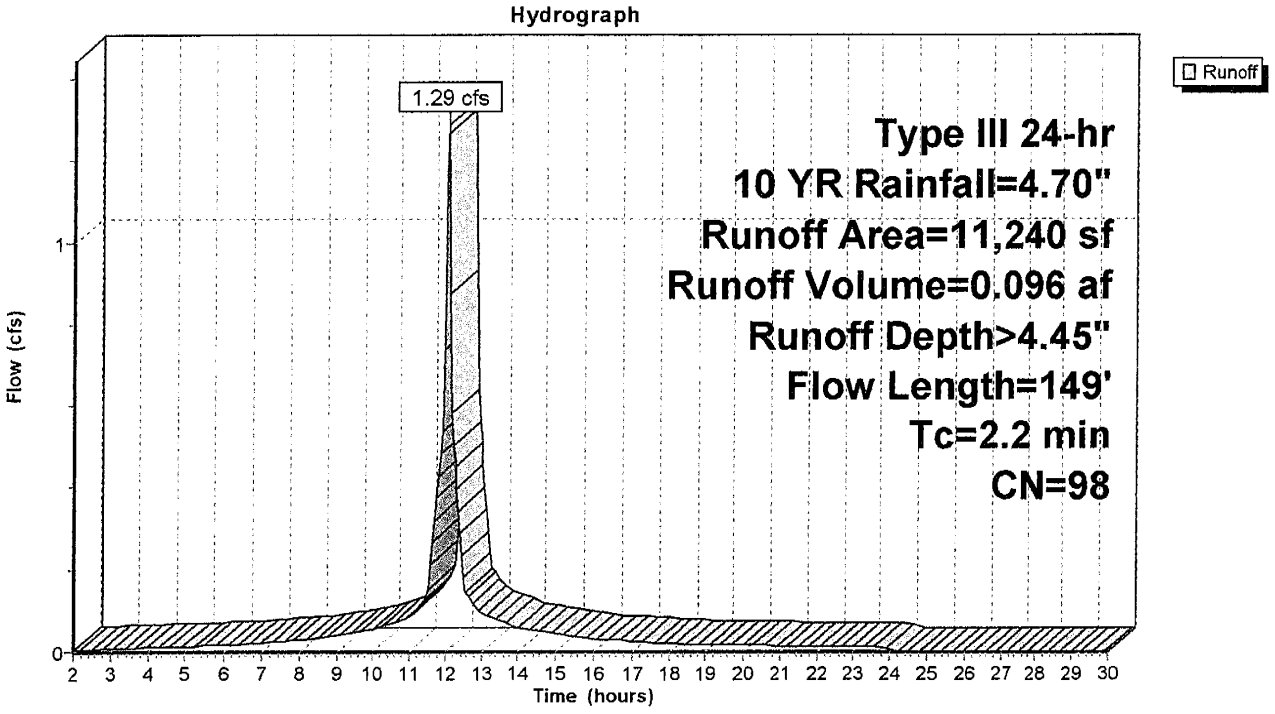
Runoff = 1.29 cfs @ 12.04 hrs, Volume= 0.096 af, Depth> 4.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YR Rainfall=4.70"

	Area (sf)	CN	Description
*	11,240	98	ROOF AND PAVEMENT
	11,240		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	15	0.4500	3.27		**Sheet Flow, ROOF** Smooth surfaces n= 0.011 P2= 3.20"
0.3	49	0.0050	2.82	0.78	**Trap/Vee/Rect Channel Flow, GUTTER** Bot.W=0.50' D=0.50' Z= 0.1 '/' Top.W=0.60' n= 0.012 Steel, smooth
0.8	29	0.0050	0.62		**Sheet Flow, ROOF** Smooth surfaces n= 0.011 P2= 3.20"
1.0	56	0.0020	0.91		**Shallow Concentrated Flow, P LOT** Paved Kv= 20.3 fps
2.2	149	Total			

Subcatchment 1: EXIST PARKING & ROOF



Summary for Subcatchment 2: REAR YARD ABUTTER

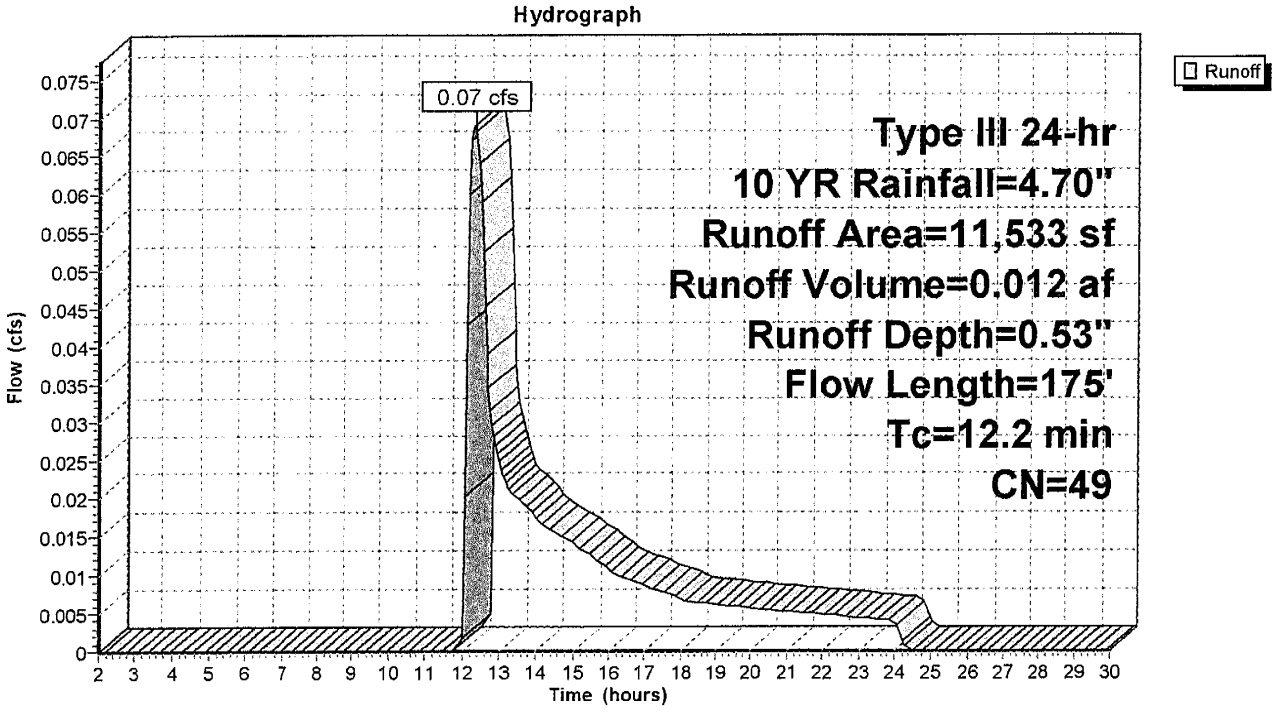
Runoff = 0.07 cfs @ 12.33 hrs, Volume= 0.012 af, Depth= 0.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YR Rainfall=4.70"

	Area (sf)	CN	Description
*	16	98	ROOF
*	48	98	ROOF
*	11,391	49	GRASS FAIR HSG A
*	78	69	GRAVEL BEHIND RET WALL
	11,533	49	Weighted Average
	11,469		99.45% Pervious Area
	64		0.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, LAWN** Grass: Short n= 0.150 P2= 3.20"
0.6	75	0.1000	2.21		**Shallow Concentrated Flow, LAWN** Short Grass Pasture Kv= 7.0 fps
6.0	50		0.14		**Direct Entry, STORAGE UNDER P LOT**
12.2	175	Total			

Subcatchment 2: REAR YARD ABUTTER



Summary for Subcatchment 3: REAR YARD ABUTTER

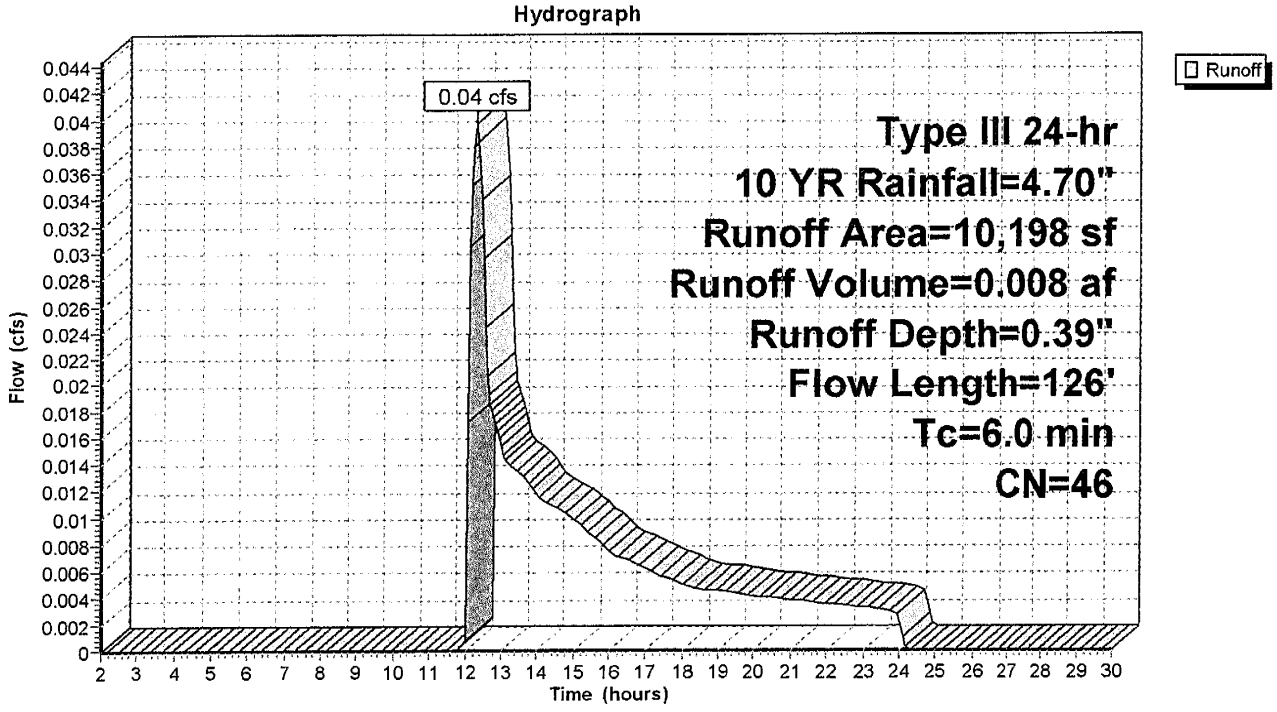
Runoff = 0.04 cfs @ 12.32 hrs, Volume= 0.008 af, Depth= 0.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YR Rainfall=4.70"

	Area (sf)	CN	Description
*	41	98	WALL
	5,103	49	50-75% Grass cover, Fair, HSG A
*	552	98	DRIVEWAY
	4,502	36	Woods, Fair, HSG A
	10,198	46	Weighted Average
	9,605		94.19% Pervious Area
	593		5.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, GRASS** Grass: Short n= 0.150 P2= 3.20"
0.3	76	0.1000	4.74		**Shallow Concentrated Flow, GRASS** Grassed Waterway Kv= 15.0 fps
0.1					**Direct Entry, 6 MINUTE MIN.**
6.0	126	Total			

Subcatchment 3: REAR YARD ABUTTER



Summary for Subcatchment 4: POROUS ASPHALT

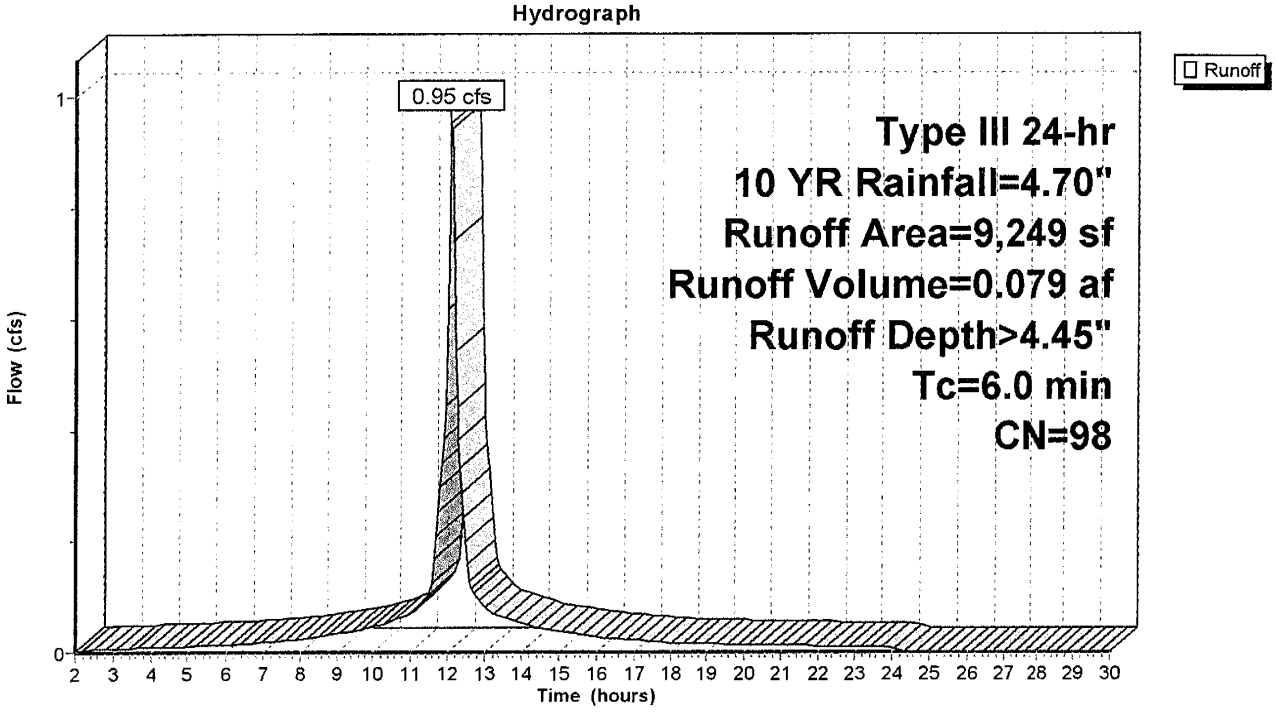
Runoff = 0.95 cfs @ 12.09 hrs, Volume= 0.079 af, Depth> 4.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YR Rainfall=4.70"

Area (sf)	CN	Description
9,249	98	Paved parking, HSG A
9,249		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, 6 MINUTE MIN.**

Subcatchment 4: POROUS ASPHALT



Summary for Subcatchment 5: SNOW STORAGE AREA

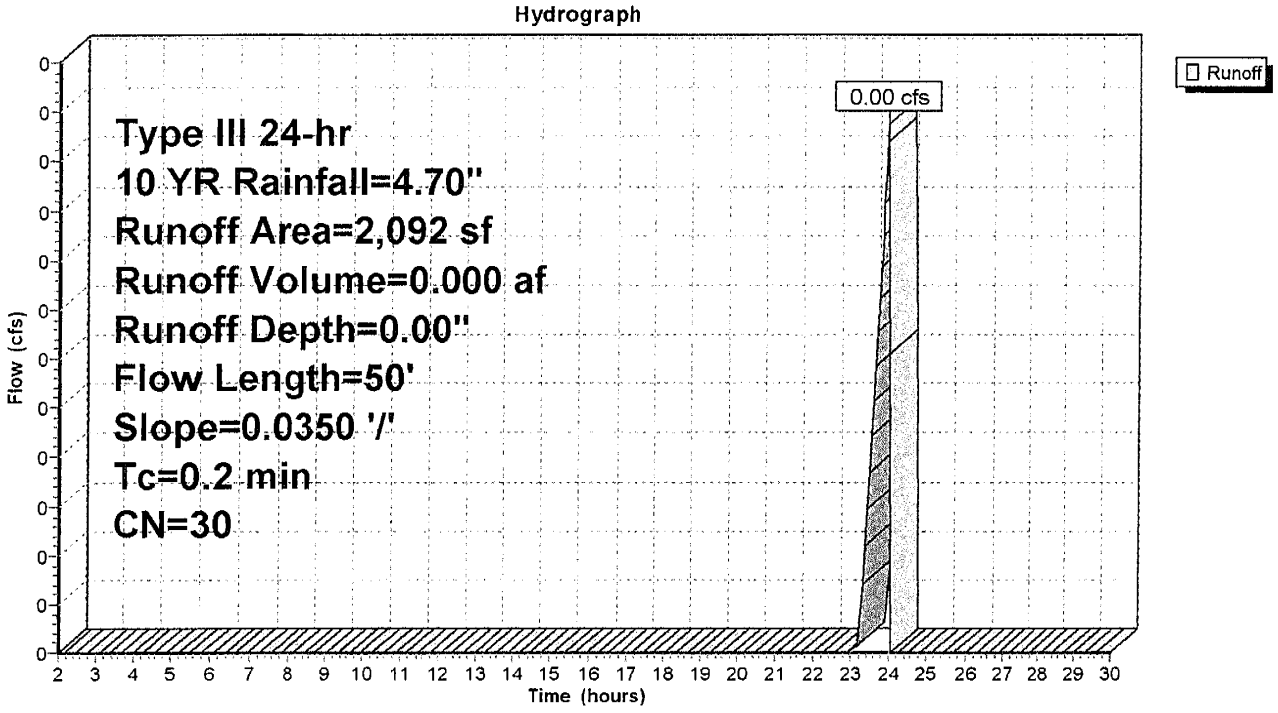
Runoff = 0.00 cfs @ 23.93 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YR Rainfall=4.70"

Area (sf)	CN	Description
2,092	30	Brush, Good, HSG A
2,092		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	50	0.0350	3.80		**Shallow Concentrated Flow, P LOT** Paved Kv= 20.3 fps

Subcatchment 5: SNOW STORAGE AREA



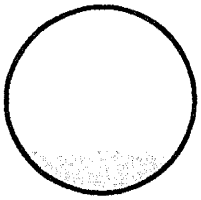
Summary for Reach 2R: 6 " CULVERT

Inflow Area = 0.265 ac, 0.55% Impervious, Inflow Depth = 0.43" for 10 YR event
Inflow = 0.07 cfs @ 12.31 hrs, Volume= 0.009 af
Outflow = 0.07 cfs @ 12.34 hrs, Volume= 0.009 af, Atten= 2%, Lag= 1.9 min

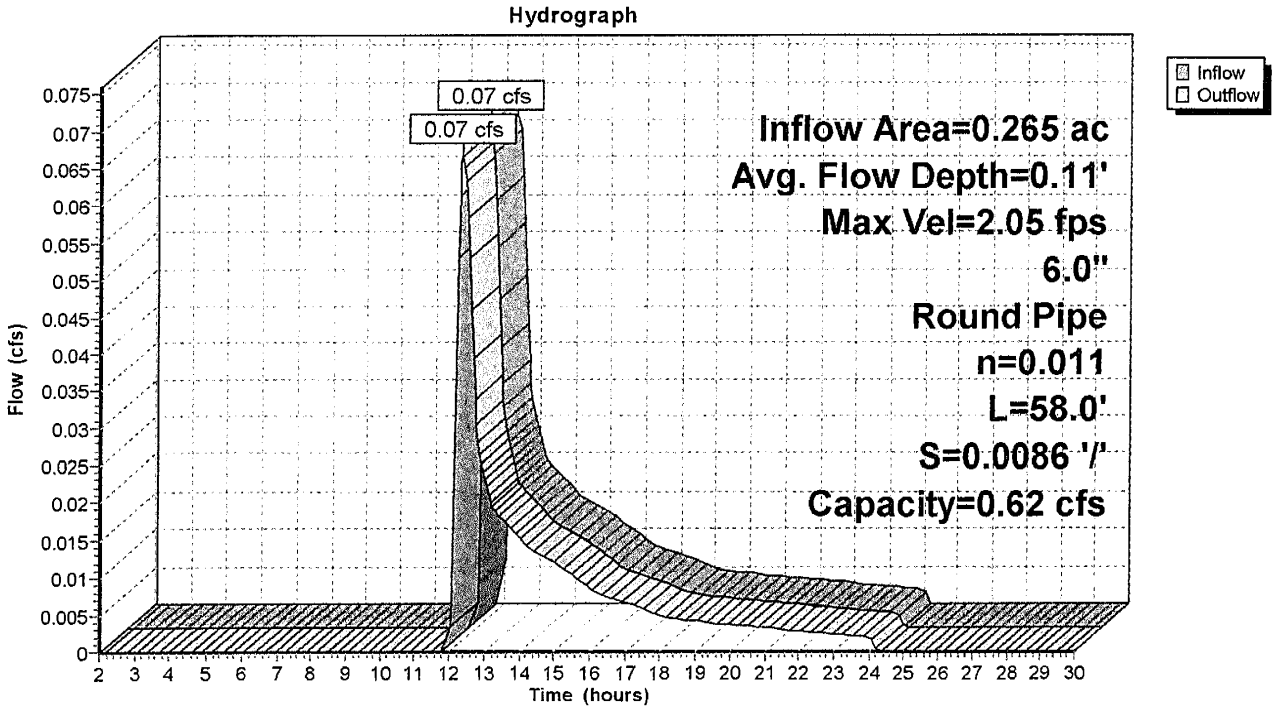
Routing by Stor-Ind+Trans method, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.05 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.04 fps, Avg. Travel Time= 0.9 min

Peak Storage= 2 cf @ 12.33 hrs
Average Depth at Peak Storage= 0.11'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 0.62 cfs

6.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 58.0' Slope= 0.0086 '/'
Inlet Invert= 80.20', Outlet Invert= 79.70'



Reach 2R: 6 " CULVERT



Summary for Pond 2P: NATURALL DEPRESSION

Inflow Area = 0.234 ac, 5.81% Impervious, Inflow Depth = 0.39" for 10 YR event
Inflow = 0.04 cfs @ 12.32 hrs, Volume= 0.008 af
Outflow = 0.04 cfs @ 12.32 hrs, Volume= 0.008 af, Atten= 0%, Lag= 0.1 min
Discarded = 0.00 cfs @ 12.32 hrs, Volume= 0.000 af
Primary = 0.04 cfs @ 12.32 hrs, Volume= 0.008 af

Routing by Stor-Ind method, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 85.00' @ 12.32 hrs Surf.Area= 55 sf Storage= 0 cf

Plug-Flow detention time= 0.0 min calculated for 0.008 af (100% of inflow)
Center-of-Mass det. time= 0.0 min (950.6 - 950.6)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	206 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

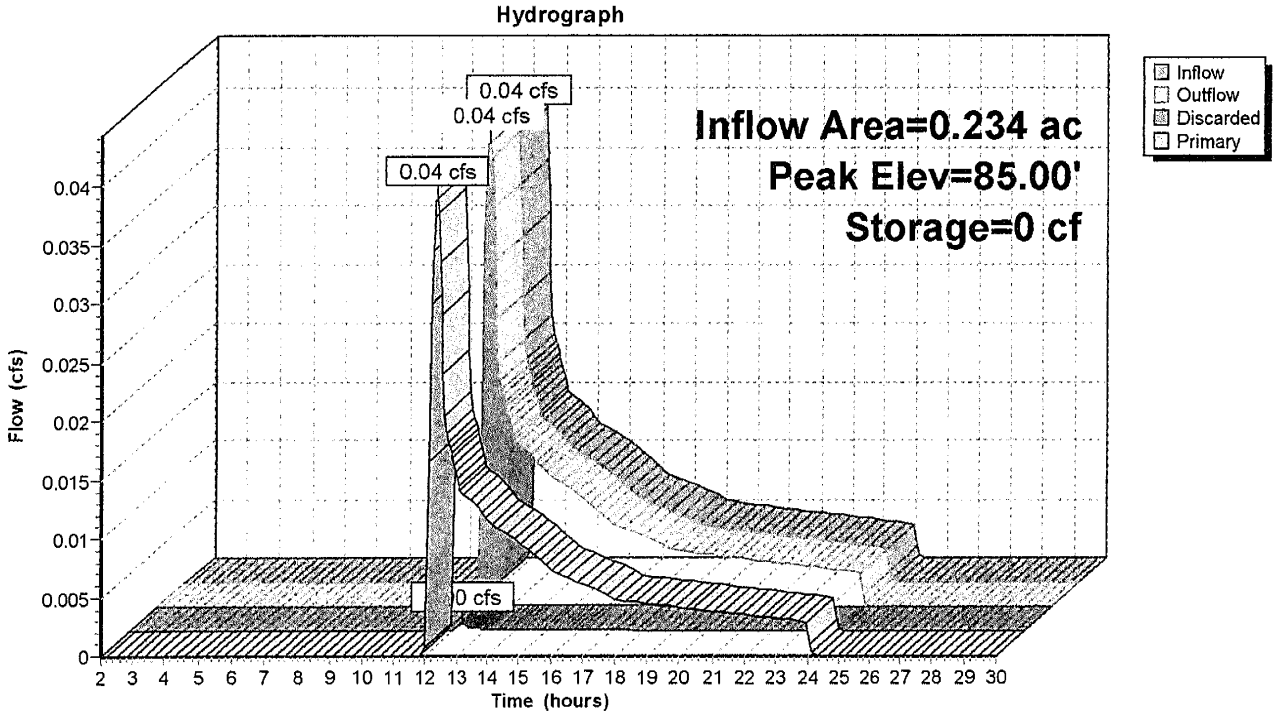
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
85.00	54	0	0
86.00	357	206	206

Device	Routing	Invert	Outlet Devices
#1	Discarded	85.00'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 80.00'
#2	Primary	84.20'	**4.0" Round 4 " UNDERDRAIN** L= 82.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 84.20' / 83.70' S= 0.0061 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.09 sf

Discarded OutFlow Max=0.00 cfs @ 12.32 hrs HW=85.00' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.22 cfs @ 12.32 hrs HW=85.00' (Free Discharge)
↑—**2=4 " UNDERDRAIN** (Barrel Controls 0.22 cfs @ 2.57 fps)

Pond 2P: NATURALL DEPRESSION



Summary for Pond 4P: LAWN BASIN

Inflow Area = 0.265 ac, 0.55% Impervious, Inflow Depth = 0.53" for 10 YR event
Inflow = 0.07 cfs @ 12.33 hrs, Volume= 0.012 af
Outflow = 0.07 cfs @ 12.31 hrs, Volume= 0.012 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 12.31 hrs, Volume= 0.002 af
Primary = 0.07 cfs @ 12.31 hrs, Volume= 0.009 af

Routing by Stor-Ind method, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 82.96' @ 12.31 hrs Surf.Area= 43 sf Storage= 6 cf

Plug-Flow detention time= 6.4 min calculated for 0.012 af (100% of inflow)
Center-of-Mass det. time= 6.5 min (941.6 - 935.1)

Volume	Invert	Avail.Storage	Storage Description
#1	82.70'	61 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

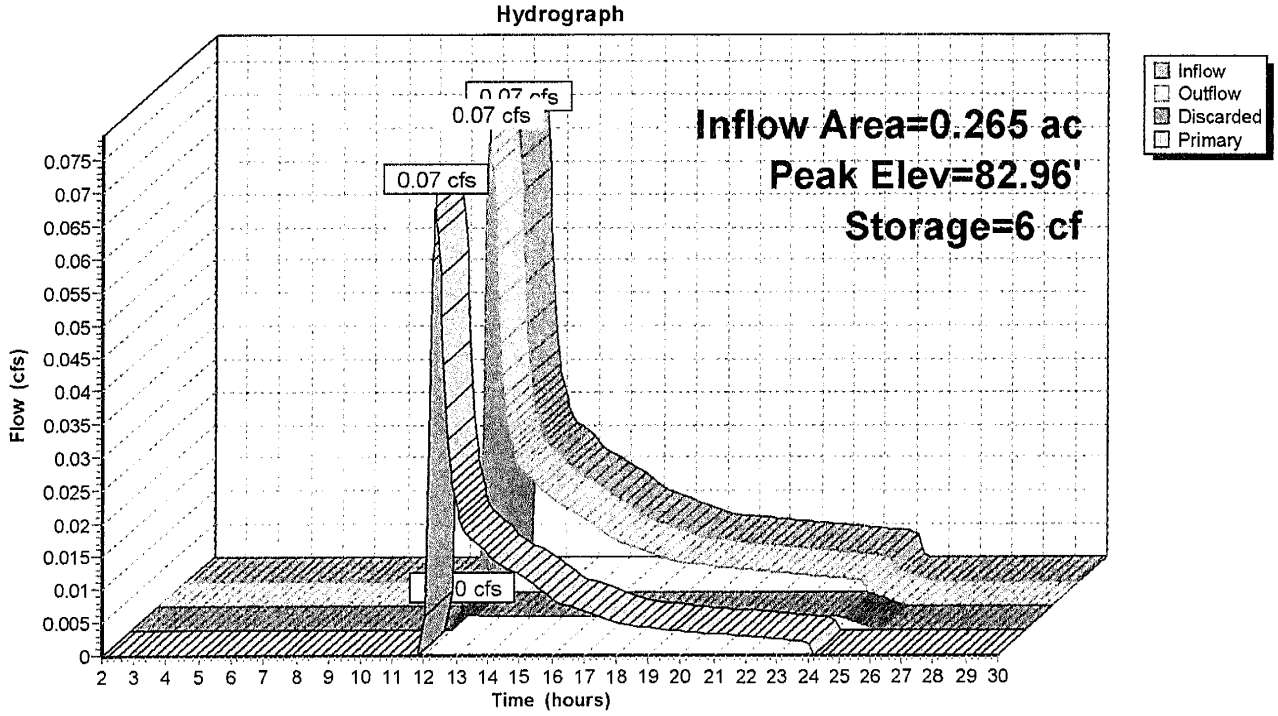
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
82.70	5	0	0
83.00	49	8	8
83.50	163	53	61

Device	Routing	Invert	Outlet Devices
#1	Discarded	82.70'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 80.00'
#2	Primary	83.20'	**10.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#3	Primary	82.90'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.00 cfs @ 12.31 hrs HW=82.96' (Free Discharge)
└**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.07 cfs @ 12.31 hrs HW=82.96' (Free Discharge)
├**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**3=Orifice/Grate** (Weir Controls 0.07 cfs @ 0.77 fps)

Pond 4P: LAWN BASIN

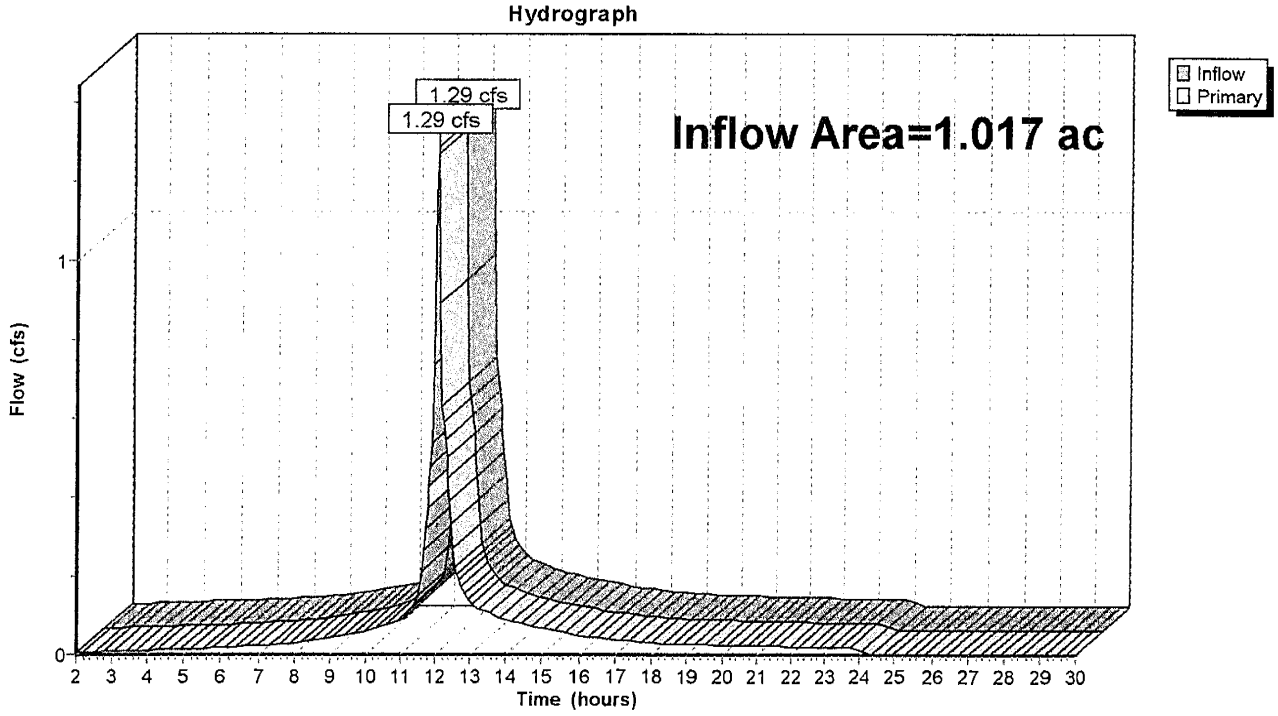


Summary for Pond 5P: DESIGN POINT 1 (WETLAND)

Inflow Area = 1.017 ac, 47.72% Impervious, Inflow Depth > 1.33" for 10 YR event
Inflow = 1.29 cfs @ 12.04 hrs, Volume= 0.113 af
Primary = 1.29 cfs @ 12.04 hrs, Volume= 0.113 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs

Pond 5P: DESIGN POINT 1 (WETLAND)



Summary for Pond 6P: STORAGE UNDER POROUS PAVE

Inflow Area = 0.212 ac,100.00% Impervious, Inflow Depth > 4.45" for 10 YR event
Inflow = 0.95 cfs @ 12.09 hrs, Volume= 0.079 af
Outflow = 0.53 cfs @ 12.21 hrs, Volume= 0.079 af, Atten= 44%, Lag= 7.6 min
Discarded = 0.53 cfs @ 12.21 hrs, Volume= 0.079 af
Primary = 0.00 cfs @ 2.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 82.26' @ 12.21 hrs Surf.Area= 9,249 sf Storage= 222 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 1.8 min (752.2 - 750.4)

Volume	Invert	Avail.Storage	Storage Description
#1	82.20'	2,479 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 6,197 cf Overall x 40.0% Voids

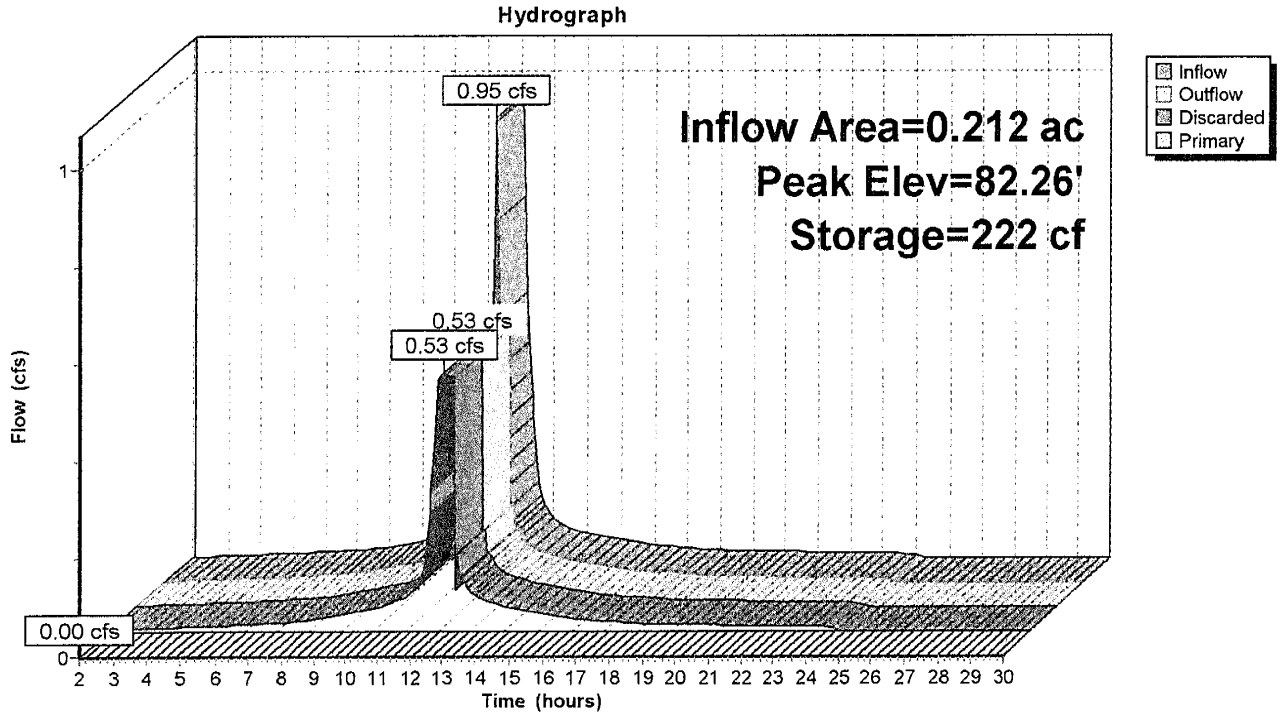
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
82.20	9,249	0	0
82.87	9,249	6,197	6,197

Device	Routing	Invert	Outlet Devices
#1	Discarded	82.20'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 80.00'
#2	Primary	82.50'	**10.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Discarded OutFlow Max=0.53 cfs @ 12.21 hrs HW=82.26' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.53 cfs)

Primary OutFlow Max=0.00 cfs @ 2.00 hrs HW=82.20' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 6P: STORAGE UNDER POROUS PAVE



100 YEAR STORM

Summary for Subcatchment 1: EXIST PARKING & ROOF

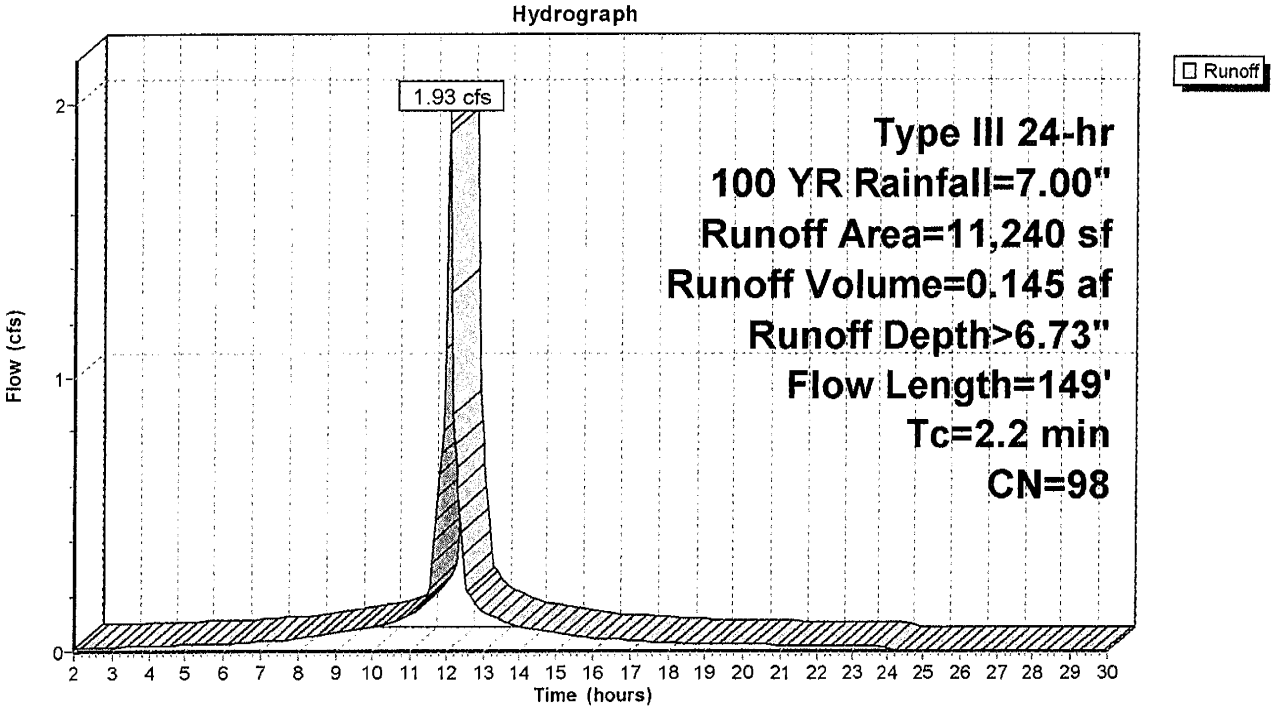
Runoff = 1.93 cfs @ 12.04 hrs, Volume= 0.145 af, Depth> 6.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 YR Rainfall=7.00"

	Area (sf)	CN	Description
*	11,240	98	ROOF AND PAVEMENT
	11,240		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	15	0.4500	3.27		**Sheet Flow, ROOF** Smooth surfaces n= 0.011 P2= 3.20"
0.3	49	0.0050	2.82	0.78	**Trap/Vee/Rect Channel Flow, GUTTER** Bot.W=0.50' D=0.50' Z= 0.1 '/' Top.W=0.60' n= 0.012 Steel, smooth
0.8	29	0.0050	0.62		**Sheet Flow, ROOF** Smooth surfaces n= 0.011 P2= 3.20"
1.0	56	0.0020	0.91		**Shallow Concentrated Flow, P LOT** Paved Kv= 20.3 fps
2.2	149	Total			

Subcatchment 1: EXIST PARKING & ROOF



Summary for Subcatchment 2: REAR YARD ABUTTER

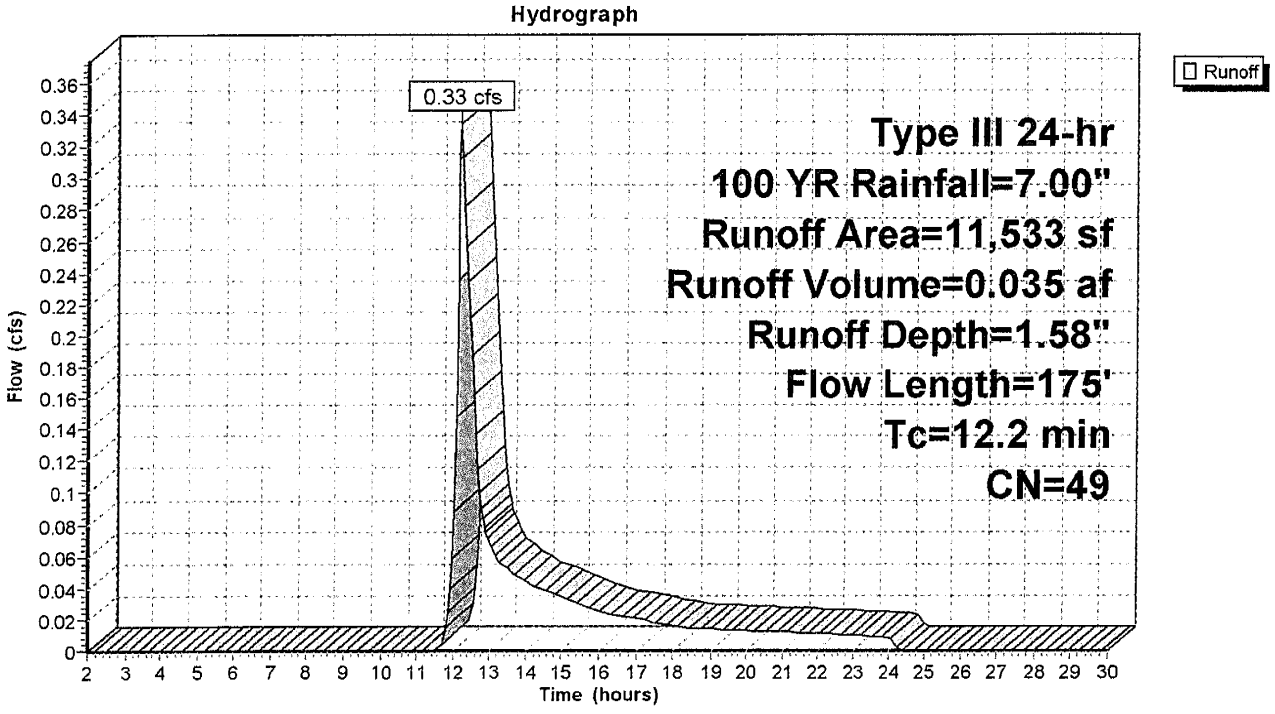
Runoff = 0.33 cfs @ 12.20 hrs, Volume= 0.035 af, Depth= 1.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 YR Rainfall=7.00"

	Area (sf)	CN	Description
*	16	98	ROOF
*	48	98	ROOF
*	11,391	49	GRASS FAIR HSG A
*	78	69	GRAVEL BEHIND RET WALL
	11,533	49	Weighted Average
	11,469		99.45% Pervious Area
	64		0.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, LAWN** Grass: Short n= 0.150 P2= 3.20"
0.6	75	0.1000	2.21		**Shallow Concentrated Flow, LAWN** Short Grass Pasture Kv= 7.0 fps
6.0	50		0.14		**Direct Entry, STORAGE UNDER P LOT**
12.2	175	Total			

Subcatchment 2: REAR YARD ABUTTER



Summary for Subcatchment 3: REAR YARD ABUTTER

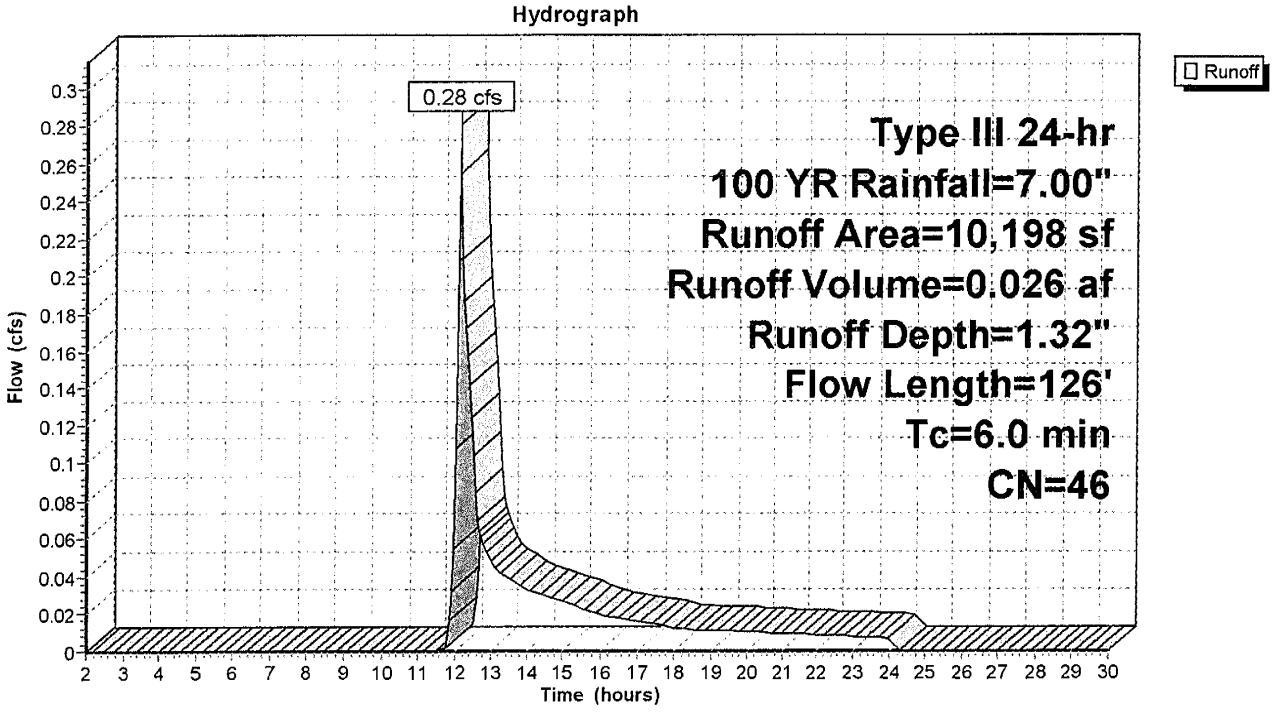
Runoff = 0.28 cfs @ 12.11 hrs, Volume= 0.026 af, Depth= 1.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 YR Rainfall=7.00"

	Area (sf)	CN	Description
*	41	98	WALL
	5,103	49	50-75% Grass cover, Fair, HSG A
*	552	98	DRIVEWAY
	4,502	36	Woods, Fair, HSG A
	10,198	46	Weighted Average
	9,605		94.19% Pervious Area
	593		5.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, GRASS** Grass: Short n= 0.150 P2= 3.20"
0.3	76	0.1000	4.74		**Shallow Concentrated Flow, GRASS** Grassed Waterway Kv= 15.0 fps
0.1					**Direct Entry, 6 MINUTE MIN.**
6.0	126	Total			

Subcatchment 3: REAR YARD ABUTTER



Summary for Subcatchment 4: POROUS ASPHALT

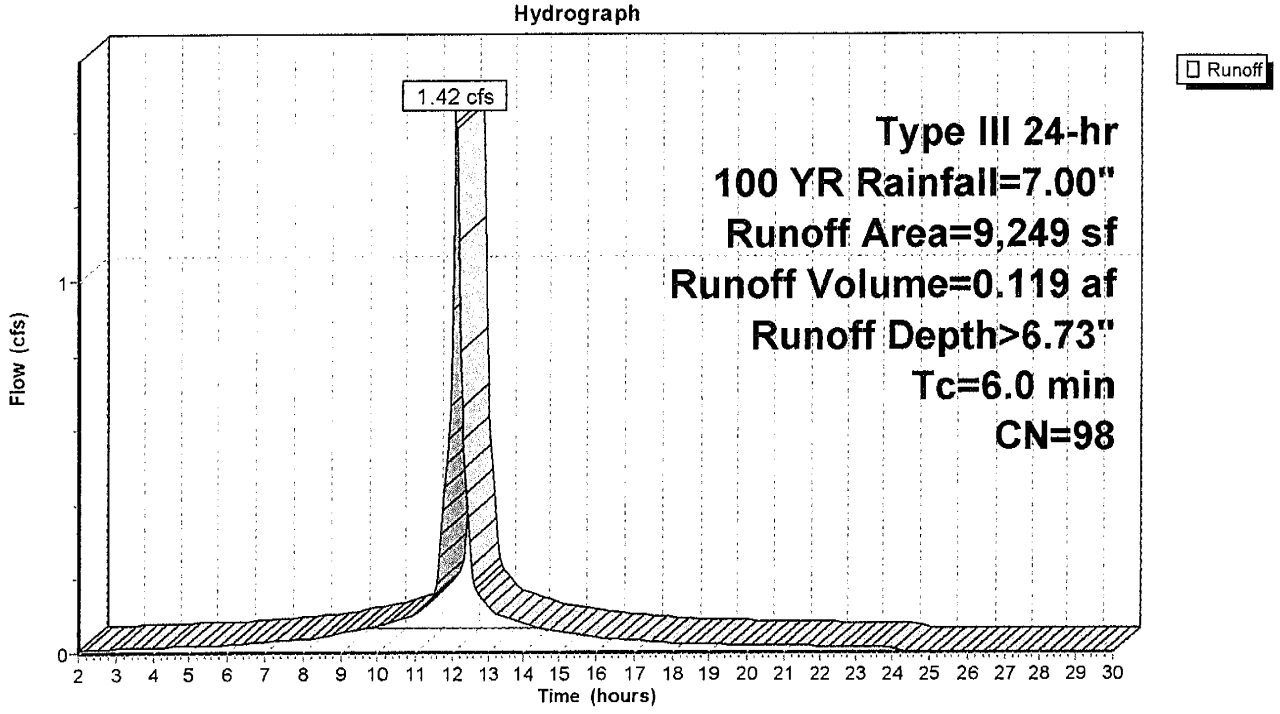
Runoff = 1.42 cfs @ 12.09 hrs, Volume= 0.119 af, Depth> 6.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 YR Rainfall=7.00"

Area (sf)	CN	Description
9,249	98	Paved parking, HSG A
9,249		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, 6 MINUTE MIN.**

Subcatchment 4: POROUS ASPHALT



Summary for Subcatchment 5: SNOW STORAGE AREA

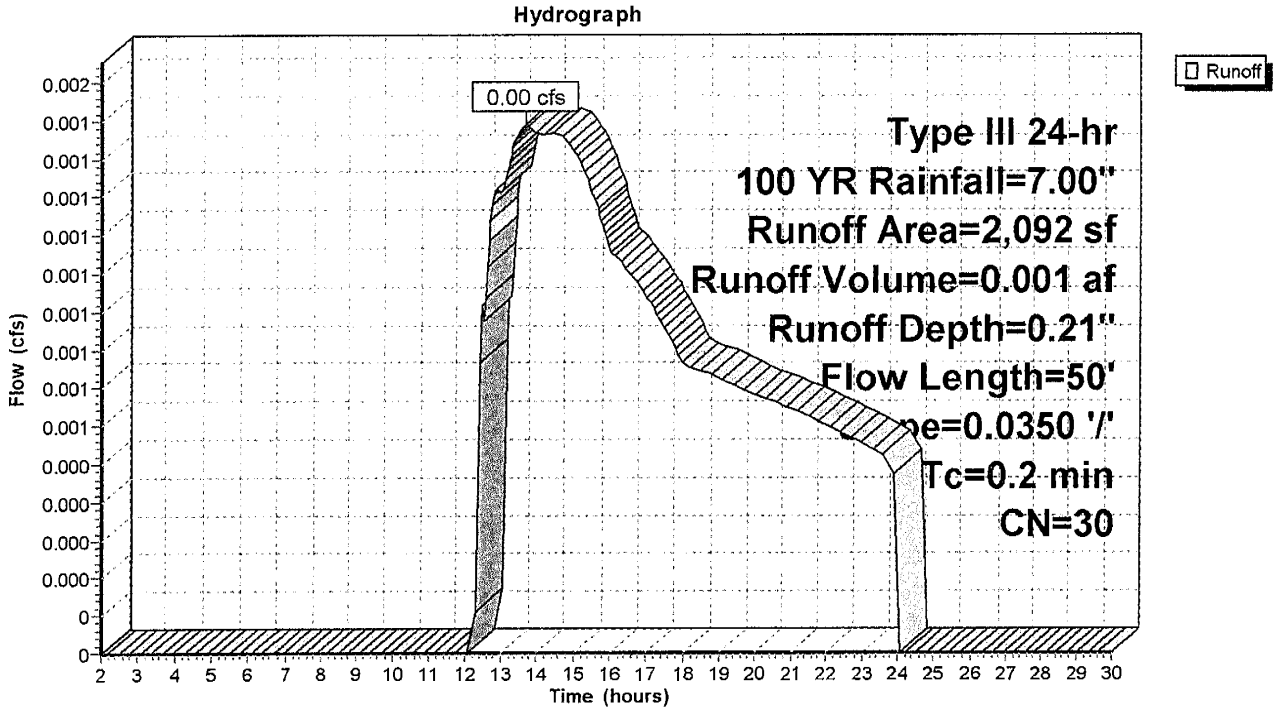
Runoff = 0.00 cfs @ 13.68 hrs, Volume= 0.001 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 YR Rainfall=7.00"

Area (sf)	CN	Description
2,092	30	Brush, Good, HSG A
2,092		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	50	0.0350	3.80		**Shallow Concentrated Flow, P LOT** Paved Kv= 20.3 fps

Subcatchment 5: SNOW STORAGE AREA



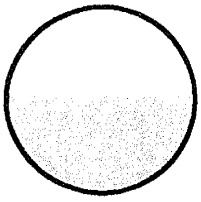
Summary for Reach 2R: 6 " CULVERT

Inflow Area = 0.265 ac, 0.55% Impervious, Inflow Depth = 1.47" for 100 YR event
Inflow = 0.33 cfs @ 12.21 hrs, Volume= 0.032 af
Outflow = 0.33 cfs @ 12.21 hrs, Volume= 0.032 af, Atten= 1%, Lag= 0.5 min

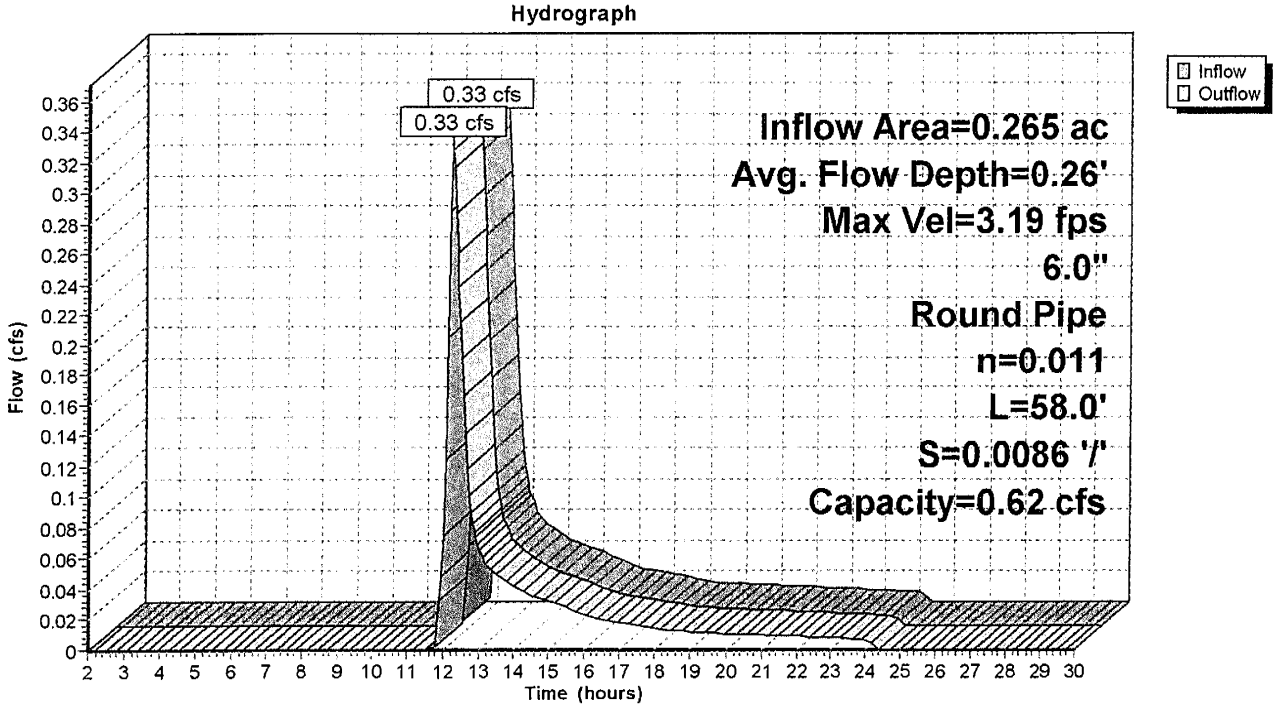
Routing by Stor-Ind+Trans method, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.19 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.44 fps, Avg. Travel Time= 0.7 min

Peak Storage= 6 cf @ 12.21 hrs
Average Depth at Peak Storage= 0.26'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 0.62 cfs

6.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 58.0' Slope= 0.0086 '/'
Inlet Invert= 80.20', Outlet Invert= 79.70'



Reach 2R: 6 " CULVERT



Summary for Pond 2P: NATURALL DEPRESSION

Inflow Area = 0.234 ac, 5.81% Impervious, Inflow Depth = 1.32" for 100 YR event
Inflow = 0.28 cfs @ 12.11 hrs, Volume= 0.026 af
Outflow = 0.24 cfs @ 12.16 hrs, Volume= 0.026 af, Atten= 13%, Lag= 3.0 min
Discarded = 0.01 cfs @ 12.16 hrs, Volume= 0.000 af
Primary = 0.24 cfs @ 12.16 hrs, Volume= 0.025 af

Routing by Stor-Ind method, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 85.13' @ 12.16 hrs Surf.Area= 93 sf Storage= 9 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.1 min (895.1 - 895.0)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	206 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

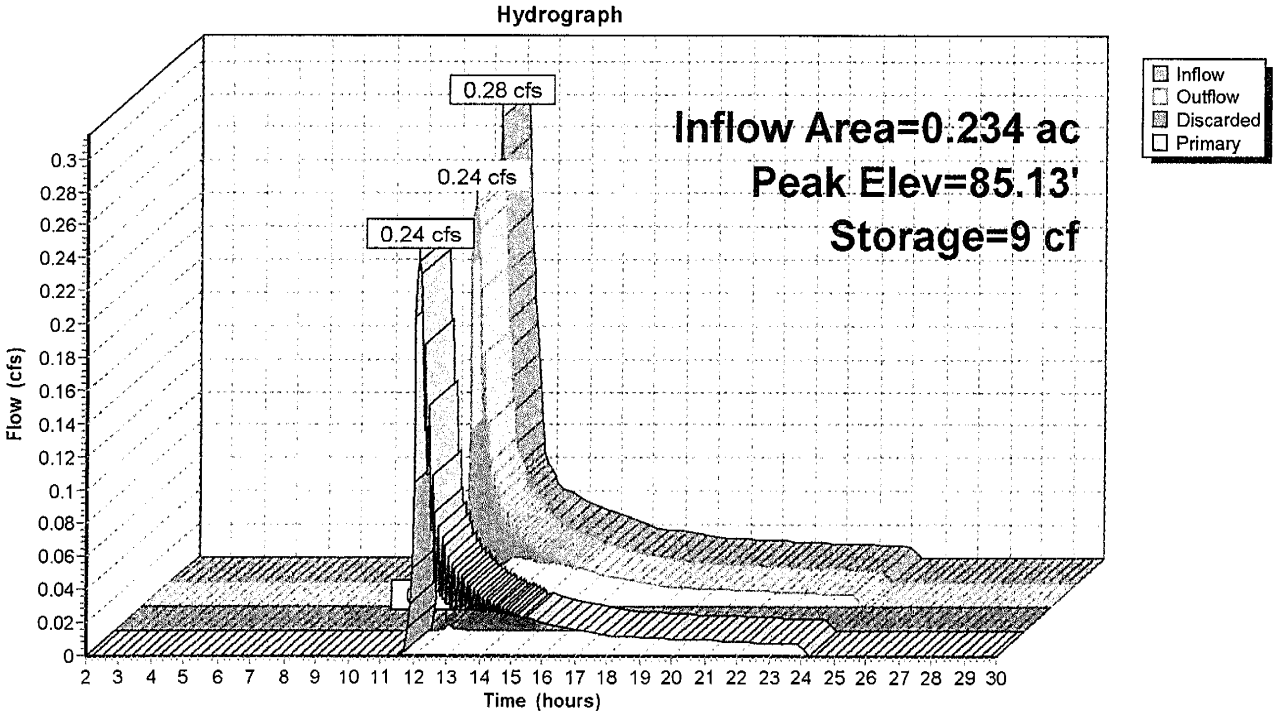
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
85.00	54	0	0
86.00	357	206	206

Device	Routing	Invert	Outlet Devices
#1	Discarded	85.00'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 80.00'
#2	Primary	84.20'	**4.0" Round 4 " UNDERDRAIN** L= 82.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 84.20' / 83.70' S= 0.0061 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.09 sf

Discarded OutFlow Max=0.01 cfs @ 12.16 hrs HW=85.12' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.01 cfs)

Primary OutFlow Max=0.24 cfs @ 12.16 hrs HW=85.12' (Free Discharge)
↑—**2=4 " UNDERDRAIN** (Barrel Controls 0.24 cfs @ 2.72 fps)

Pond 2P: NATURALL DEPRESSION



Summary for Pond 4P: LAWN BASIN

Inflow Area = 0.265 ac, 0.55% Impervious, Inflow Depth = 1.58" for 100 YR event
Inflow = 0.33 cfs @ 12.20 hrs, Volume= 0.035 af
Outflow = 0.34 cfs @ 12.21 hrs, Volume= 0.035 af, Atten= 0%, Lag= 0.3 min
Discarded = 0.00 cfs @ 12.21 hrs, Volume= 0.002 af
Primary = 0.33 cfs @ 12.21 hrs, Volume= 0.032 af

Routing by Stor-Ind method, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 83.06' @ 12.21 hrs Surf.Area= 63 sf Storage= 12 cf

Plug-Flow detention time= 2.5 min calculated for 0.035 af (100% of inflow)
Center-of-Mass det. time= 2.6 min (892.4 - 889.8)

Volume	Invert	Avail.Storage	Storage Description
#1	82.70'	61 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

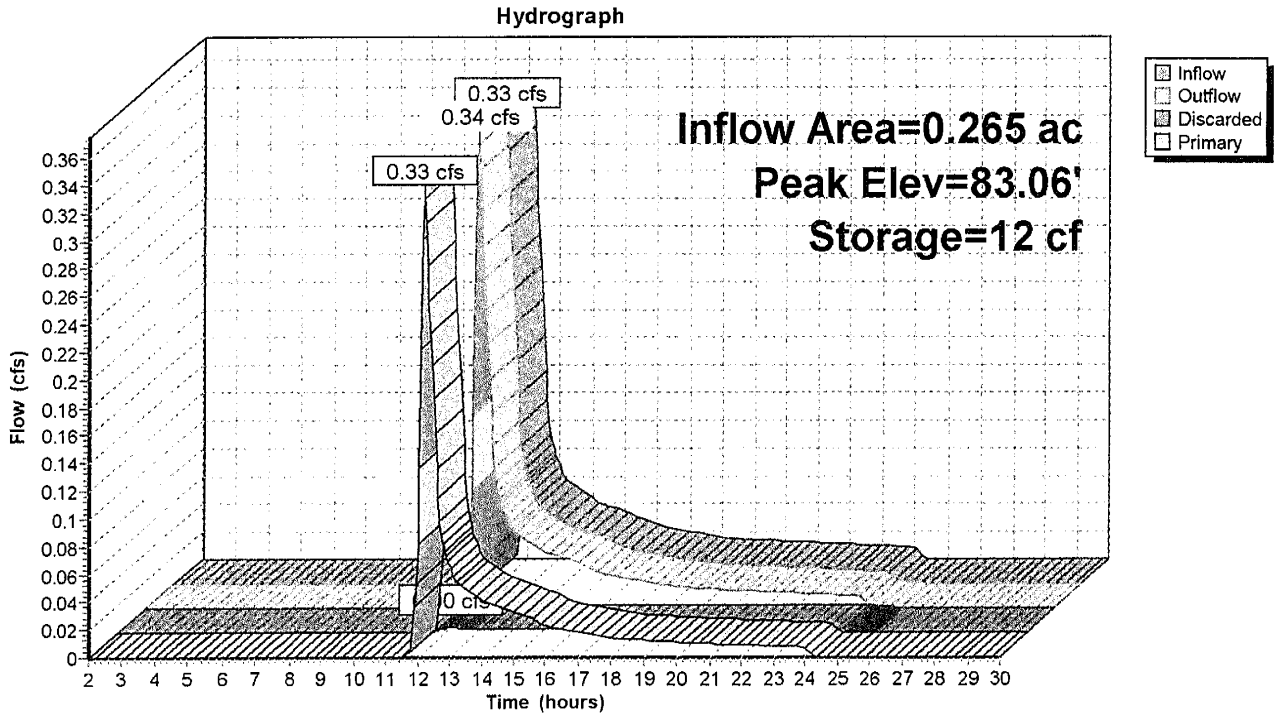
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
82.70	5	0	0
83.00	49	8	8
83.50	163	53	61

Device	Routing	Invert	Outlet Devices
#1	Discarded	82.70'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 80.00'
#2	Primary	83.20'	**10.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#3	Primary	82.90'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.00 cfs @ 12.21 hrs HW=83.06' (Free Discharge)
└**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.33 cfs @ 12.21 hrs HW=83.06' (Free Discharge)
├**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└**3=Orifice/Grate** (Weir Controls 0.33 cfs @ 1.31 fps)

Pond 4P: LAWN BASIN

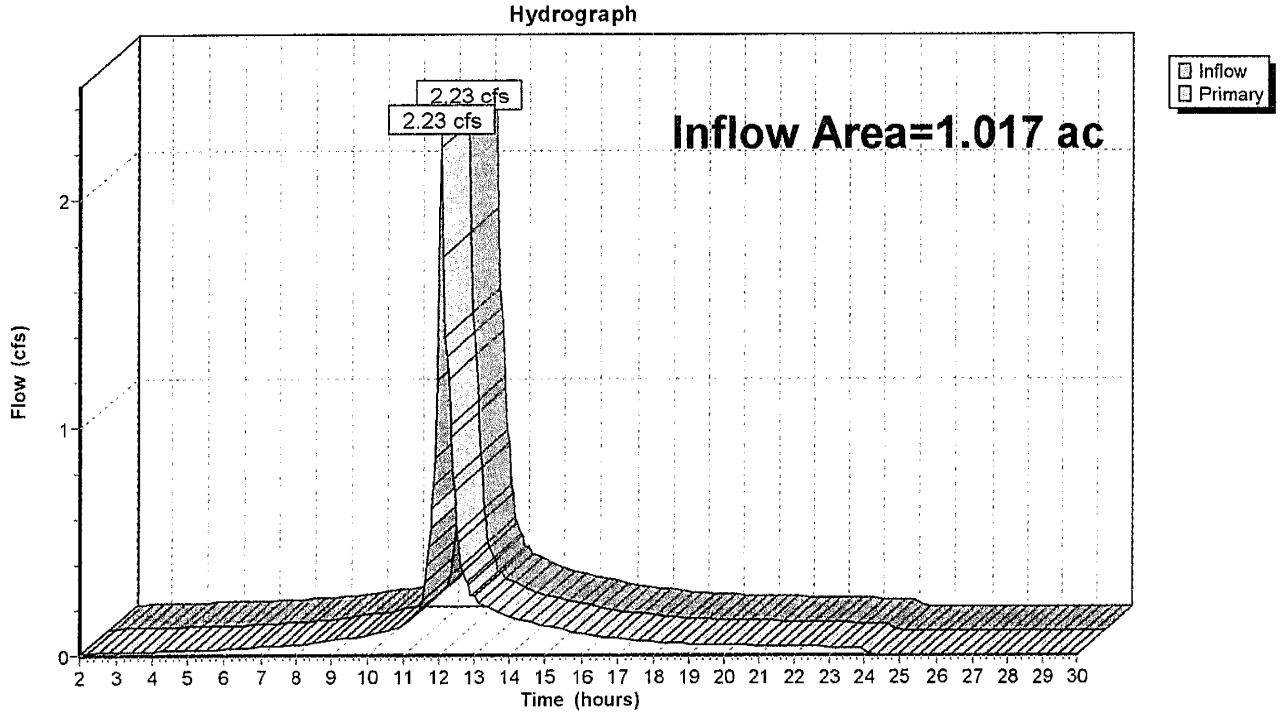


Summary for Pond 5P: DESIGN POINT 1 (WETLAND)

Inflow Area = 1.017 ac, 47.72% Impervious, Inflow Depth > 2.40" for 100 YR event
Inflow = 2.23 cfs @ 12.04 hrs, Volume= 0.203 af
Primary = 2.23 cfs @ 12.04 hrs, Volume= 0.203 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs

Pond 5P: DESIGN POINT 1 (WETLAND)



Summary for Pond 6P: STORAGE UNDER POROUS PAVE

Inflow Area = 0.212 ac,100.00% Impervious, Inflow Depth > 6.73" for 100 YR event
Inflow = 1.42 cfs @ 12.09 hrs, Volume= 0.119 af
Outflow = 0.55 cfs @ 12.31 hrs, Volume= 0.119 af, Atten= 61%, Lag= 13.7 min
Discarded = 0.55 cfs @ 12.31 hrs, Volume= 0.119 af
Primary = 0.00 cfs @ 2.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 2.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 82.36' @ 12.31 hrs Surf.Area= 9,249 sf Storage= 607 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 4.7 min (750.3 - 745.7)

Volume	Invert	Avail.Storage	Storage Description
#1	82.20'	2,479 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 6,197 cf Overall x 40.0% Voids

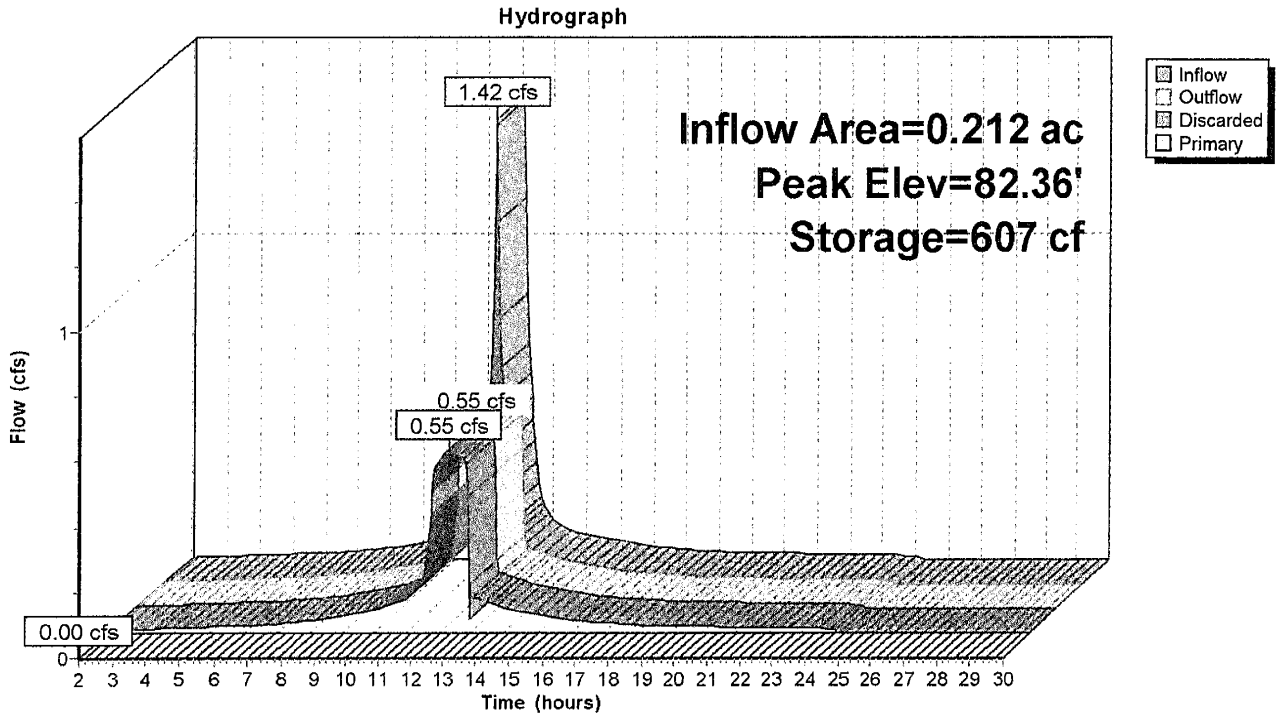
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
82.20	9,249	0	0
82.87	9,249	6,197	6,197

Device	Routing	Invert	Outlet Devices
#1	Discarded	82.20'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 80.00'
#2	Primary	82.50'	**10.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Discarded OutFlow Max=0.55 cfs @ 12.31 hrs HW=82.36' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.55 cfs)

Primary OutFlow Max=0.00 cfs @ 2.00 hrs HW=82.20' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 6P: STORAGE UNDER POROUS PAVE



3.0 BMP Standard 3

3.1 Definition of Standard

Chapter 1 in Volume 1 of the Massachusetts Stormwater Management Policy defines Standard 3 as the following:

The loss of annual recharge to groundwater shall be limited 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 upon 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.

3.2 Explanation of Standard

The intent of this standard is to ensure that the infiltration volume of precipitation into the ground under post development conditions is at least as much as the infiltration volume under pre development conditions. Standard 3 requires the restoration of recharge by implementing the judicious use of LID techniques and other BMP infiltration designs as prescribed in the Massachusetts Stormwater Handbook. Additionally, the CSMR requires the volume of the post development off site runoff to be less than or equal to the pre development condition as shown in the charts of Standard 2, Section 3.
The NRCS classifies soils into four hydrologic groups, A,B,C,&D, indicative of the minimum infiltration obtained from a soil after prolonged wetting. Group A soils have the lowest runoff potential and the highest infiltration rates, while Group D soils have the highest runoff potential and the lowest infiltration rates. The required recharge volume shall be determined using the chart shown below.

Hydrologic Group Volume to Recharge (x Total Impervious Area)

Hydrologic Group	Volume to Recharge x Total Imp. Area
A	0.60 inches of runoff
B	0.35 inches of runoff
C	0.25 inches of runoff
D	0.10 inches of runoff

For example, if a project proposed to have 5000 SF of impervious area cover a soil classified as being in the Hydrologic Soil Group (HSG) B, and 10,000 SF of impervious area cover a soil classified as being in the HSG C, the required volume of recharge would equal:

[5000(.35/12)]+[10000(.25/12)]=354.17 CF.

To size the infiltration BMP's so that they infiltrate the required recharge volume, proponents may use the static method or dynamic methods involving hydrologic calculations and analysis. The static method assumes that no infiltration occurs until the recharge device is filled to the elevation associated with the required recharge volume. The static method is easy to use and generally yields a more conservative result than the dynamic methods.

The DEP recognizes that it may be difficult to infiltrate the required recharge volume on certain sites due to soil conditions. For sites comprised solely of C and D soils and bedrock at the land surface, proponents are required to recharge volume only to the maximum extent practicable.
Infiltration BMP structures may require pre treatment devices depending upon the project's proximity to the environmentally sensitive areas described in Standard 4.

The following chart calculates the site specific recharge volume required by the Stormwater Policy based upon the methodology of the above example.
The total proposed permeable pavement (impervious) area coverage = 9,249 SF.

SITE SPECIFIC REQUIRED RECHARGE VOLUME

HSG	R.O. DEPTH (in)	IMP. CVR (SF)	RECHARGE VOL. (CF)
A	0.6	9249	462.45
B	0.35		0
C	0.25	0	0
D	0.1	0	0
Required Site Recharge Volume			462.45

The required recharge volume for this site is 462.45 cubic feet of runoff, use 463 cubic feet.

Once the required recharge volume has been determined, the infiltration BMP structures need to be sized accordingly. Verification that the infiltration BMP has been sized adequately may be obtained through any one of the following sizing methods:

The Static Method
The Simple Dynamic Method
The Dynamic Field Method

This design will use the Simple Dynamic Method as it is more accurate than the Static Method and more conservative than the Dynamic Field Method making it a very good compromise in predicting the long term performance of the BMP structure.

The Simple Dynamic Method field method requires site specific textural soil analysis be performed in order to determine the *In-Situ Saturated Hydraulic Conductivity* of the soil. The textural soil analysis for this site consistently was determined to be a Sandy Loam soil type. The NRCS Hydraulic Conductivity rates developed by Rawls in 1982, found in TABLE 1 shown below, illustrates the relationship between the soil's texture, HSG and the infiltration rate. All research data and on-site soil evaluations, as provided in Appendix B, indicate that the textural class of the material is a fine sandy loam. The Rawls chart on the next page attributes an infiltration rate of 1.02 inches/hour for Sandy Loams. The Stormwater Handbook mandates that infiltration rates be established by the soil's textural class on Page 19, Chapter 1, Vol. 3. Thus FOR STANDARD 3, the HSG of a loamy sand soil is "A" with an infiltration rate 2.41 in/hr. as determined by the Rawls chart shown below; and as determined by the SITE SPECIFIC REQUIRED RECHARGE VOLUME chat shown above, an HSG A soil has a 0.60 R.O. (in/SF) Depth per square feet of impervious site area.

3.3 Rawls Chart

1982 Rawls Rates

In-Situ Saturated Hydraulic Conductivity Rates

Textual Class	NRCS HSG	Infiltration Rate (In/Hr)
Sand	A	8.27
Loamy Sand	A	2.41
Sandy Loam	B	1.02
Loam	B	0.52
Silt Loam	C	0.27
Sandy Clay Loam	C	0.17
Clay Loam	D	0.09
Silty Clay Loam	D	0.06
Sandy Clay	D	0.05
Silty Clay	D	0.04
Clay	D	0.02

The 2.41 In/Hr. in-situ saturated infiltration rate was therefore used to size the infiltration BMP Structures. This rate was based upon the Textural Class of the soil as mandated in the Massachusetts Stormwater Management Handbook, in Volume 3, Chapter 1, Page 19, as prescribed in the paragraph below the "Simple Dynamic" section of the page.

As mandated in the above stated section of the Massachusetts Stormwater Management Regulations, the field determined Textual Class of the soil controls the NRCS HSG of the soil and not the TR-55 HSG that has traditionally been tied to the soil names of the County Wide Soil Maps.

3.4 Calculation for Minimum Bottom Area of Recharge Structure

The bottom area(s) of all proposed infiltration BMP Structures must equal or exceed the computed area "A" of the equation shown below as prescribed in the Massachusetts Stormwater Management Handbook, in Volume 3, Chapter 2, Page 20:

$$A=Rv/(d+Kt)$$

Where:

A= The minimum required surface area of the BMP Structures;

Rv=The required recharge volume;

d= The depth of the BMP Structure;

K= The In-Situ Saturated Hydraulic Conductivity Rates (Rawls);

T= The allowable draw down time during the peak (accepted as 2 Hrs by regs)

The depth of the recharge system below the permeable pavement is 8" (0.67') and the bottom surface area of it is 9249 SF.

Rv=463 CF (calculated in the site specific recharge volume chart)

D= .67 (depth of infiltration system)

K= (2.41 in/hr)/(12 in/ft)=0.2 ft/hr

T= 2 hr

Hence the required bottom area of the stone recharge reservoir system below the permeable pavement is 9249 SF

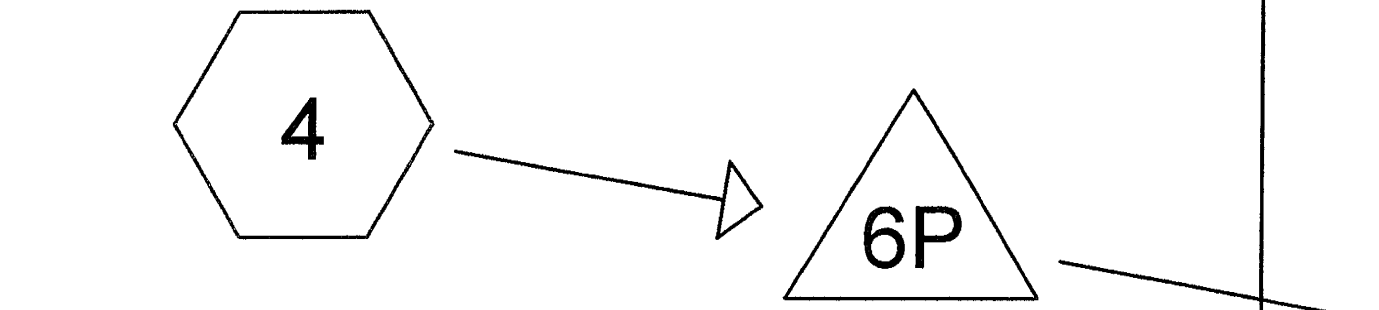
=(463 cf)/(0.67 ft+((0.2 ft/hr)(2 hr)))

=463 cf/1.07 ft= 432.71 SF

The bottom surface area of the BMP stone recharge reservoir system below the permeable pavement is 9249 SF which is greater than the required square footage of 432.71 SF. Hence the design of the proposed recharge system is meets and exceeds the requirements of Standard 3. Hence performance Standard 3 has been met.

3.5 Infiltration BMP 2 Yr. Storm Drain Down in 72 Hours Calculation

BMP Standard 3 required that BMP infiltration structures be able to drain dry the 2 year storm within a 72 hour time frame. The following analysis consists of all watersheds tributary to the subsurface recharge system located under the tennis court for the 2 year storm.



Subcat Reach Pond Link

Routing Diagram for 3883 POST
Prepared by Microsoft, Printed 1/15/2021

Hydrograph for Subcatchment 4: POROUS ASPHALT

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
2.00	0.06	0.00	0.00
2.50	0.08	0.01	0.00
3.00	0.10	0.01	0.00
3.50	0.12	0.02	0.00
4.00	0.14	0.03	0.00
4.50	0.16	0.04	0.01
5.00	0.18	0.06	0.01
5.50	0.21	0.07	0.01
6.00	0.23	0.09	0.01
6.50	0.26	0.11	0.01
7.00	0.29	0.14	0.01
7.50	0.33	0.17	0.01
8.00	0.36	0.20	0.01
8.50	0.41	0.24	0.02
9.00	0.47	0.29	0.02
9.50	0.53	0.35	0.03
10.00	0.60	0.41	0.03
10.50	0.69	0.50	0.04
11.00	0.80	0.60	0.05
11.50	0.95	0.75	0.07
12.00	1.60	1.38	**0.42**
12.50	2.25	2.02	**0.14**
13.00	2.40	2.17	0.06
13.50	2.51	2.28	0.04
14.00	2.60	2.37	0.03
14.50	2.67	2.44	0.03
15.00	2.73	2.50	0.03
15.50	2.79	2.56	0.02
16.00	2.84	2.60	0.02
16.50	2.87	2.64	0.02
17.00	2.91	2.68	0.01
17.50	2.94	2.71	0.01
18.00	2.97	2.74	0.01
18.50	2.99	2.76	0.01
19.00	3.02	2.79	0.01
19.50	3.04	2.81	0.01
20.00	3.06	2.83	0.01
20.50	3.08	2.85	0.01
21.00	3.10	2.87	0.01
21.50	3.12	2.89	0.01
22.00	3.14	2.91	0.01
22.50	3.16	2.92	0.01
23.00	3.17	2.94	0.01
23.50	3.19	2.95	0.01
24.00	**3.20**	**2.97**	0.01
24.50	3.20	2.97	0.00
25.00	3.20	2.97	0.00
25.50	3.20	2.97	0.00
26.00	3.20	2.97	0.00
26.50	3.20	2.97	0.00
27.00	3.20	2.97	0.00
27.50	3.20	2.97	0.00
28.00	3.20	2.97	0.00
28.50	3.20	2.97	0.00
29.00	3.20	2.97	0.00
29.50	3.20	2.97	0.00
30.00	3.20	2.97	0.00

Hydrograph for Pond 6P: STORAGE UNDER POROUS PAVE

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
2.00	0.00	0	82.20	0.00	0.00	**0.00**
3.00	0.00	0	82.20	0.00	0.00	0.00
4.00	0.00	0	82.20	0.00	0.00	0.00
5.00	0.01	0	82.20	0.01	0.01	0.00
6.00	0.01	0	82.20	0.01	0.01	0.00
7.00	0.01	1	82.20	0.01	0.01	0.00
8.00	0.01	1	82.20	0.01	0.01	0.00
9.00	0.02	1	82.20	0.02	0.02	0.00
10.00	0.03	1	82.20	0.03	0.03	0.00
11.00	0.05	2	82.20	0.05	0.05	0.00
12.00	**0.42**	18	**82.20**	**0.38**	**0.38**	0.00
13.00	**0.06**	**3**	**82.20**	**0.06**	**0.06**	0.00
14.00	0.03	2	82.20	0.04	0.04	0.00
15.00	0.03	1	82.20	0.03	0.03	0.00
16.00	0.02	1	82.20	0.02	0.02	0.00
17.00	0.01	1	82.20	0.01	0.01	0.00
18.00	0.01	1	82.20	0.01	0.01	0.00
19.00	0.01	0	82.20	0.01	0.01	0.00
20.00	0.01	0	82.20	0.01	0.01	0.00
21.00	0.01	0	82.20	0.01	0.01	0.00
22.00	0.01	0	82.20	0.01	0.01	0.00
23.00	0.01	0	82.20	0.01	0.01	0.00
24.00	0.01	0	82.20	0.01	0.01	0.00
25.00	0.00	0	82.20	0.00	0.00	0.00
26.00	0.00	0	82.20	0.00	0.00	0.00
27.00	0.00	0	82.20	0.00	0.00	0.00
28.00	0.00	0	82.20	0.00	0.00	0.00
29.00	0.00	0	82.20	0.00	0.00	0.00
30.00	0.00	0	82.20	0.00	0.00	0.00

3.6 Mounding Analysis

BMP Standard 3 requires that all infiltration structures that mitigate the 10 and 100 year storms by recharging stormwater into the ground, perform a groundwater analysis to ensure that there will be a 2' groundwater separation between the bottom of the system and watertable after the effects of mounding. Mounding is a condition where the groundwater table is artificially raised beneath any system designed to dispose volumes of water via infiltration into the ground. The system could be a large common septic system or it can be a stormwater infiltration system as is the case with this analysis.

The following charts constitutes the mounding analysis that has utilized the Hantush Method of analyzing mounding effects of recharge systems. As can be seen by the analysis, a maximum height of mounding of 0.16 feet is produced from the design storm. This is a negligible amount of mounding due to the fact that the system was designed to drain dry in 24 hours. This is a short period of time as mounding analysis are concerned, resulting in a miniscule rise in the watertable. If this were a septic system, the infiltration period would be taken as weeks and not hours resulting in a noticeable increase in mounding. The 2' groundwater separation is maintained accounting for the mounding.

JN 3883
Perm Pavement
DURATION OF INFILTRATION PERIOD, t (HOURS)

t=(Vol of RO to be Infiltrated (CF) x 12)/(infiltration area x recharge rate in/hr)
where:
infiltration area= bottom area of BMP infiltration structure

Recharge Rate=(0.5)(Perc Rate MPI)

L=	160	ft
W=	57.7	ft
AREA=	9232	sf

INFIL RATE	2.41	in/hr
RECHARGE RATE (R)=	1.205	in/ hr

VRO = VOL OF R.O. TO RECHARGE 100 YR STORM RECHARGE VOL (CF) from Hydrocad Model

VRO=	5096	CF						
t=	5096	cf	x	12in/hr	/	9232 SF	X	2.41 in/hr
t=	2.748513	hrs	=	0.114521	days			

MassDEP

Well Completion Report

WELL LOCATION

GPS North: **GPS West:** **Assessors Map:**

Address: 55 Fogg Road **Assessors Lot:**

Sub Division: **Permit Number:**

City/Town: WEYMOUTH **Date Issued:**

Board Of Health Permit Obtained:

Work Performed	Well Type	Drilling Method Overburden	Drilling Method Bedrock
New Well	Irrigation	Air Rotary	Air Rotary

ADDITIONAL WELL INFORMATION

Developed:

Disinfected:

Total Well Depth: 700.00

Fracture Enhancement:

Well Seal Type:

Depth to Bedrock: 110.00

PERMANENT PUMP (IF AVAILABLE)

Pump Description:

Type:

Nominal Pump Capacity:

Intake Depth:

Horsepower:

Comments: Geographic Description----------Well is located 300ft N of Fogg Road, .1893939393 mi E of intersection with Route 18Water-bearing rock/unconsolidated material Description: Granite

CASING

From(ft)	To(ft)	Type	Thickness	Diameter
0.00	130.00	Steel		

SCREEN

From(ft)	To(ft)	Type	slotsize	Diameter

WELL SEAL / FILTER PACK / ABANDONMENT MATERIAL

From(ft)	To(ft)	Material Description	Purpose

STATIC WATER LEVEL(ALL WELLS)

Date Measured	Depth Below Ground Surface
09/12/1993	40.00

WELL TEST DATA (ALL SECTIONS MANDATORY FOR PRODUCTION WELLS)

Date	Method	Yield(GPM)	Time Pumped (hrs & min)	Pumping Level (Ft. BGS)	Time To Recoover (Hrs & min)	Recovery
09/12/1993	Air Blow with Drill Stem	6.00	00:45	700	5:30	40

OVER BURDEN

From(ft)	To(ft)	Lithology	Color	Comment	Water Zone	Loss / Add of Fluid	Drill Stem Drop	Drill Rate
0.00	20.00	Till						
20.00	40.00	Till						
40.00	60.00	Till						
60.00	80.00	Till						
80.00	100.00	Till						
100.00	110.00	Till						

BEDROCK

From(ft)	To(ft)	Lithology	Comment	Water Zone	Drill Stem Drop	Extra Large	Drill Rate	Rust Stain	Loss / Add Of Fluid	# of Fract Per Ft
110	210	Granite								
210	310	Granite								
310	410	Granite								
410	510	Granite								
510	610	Granite								
610	700	Granite								

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. G Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the hα rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the l change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution wi values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Input Values		
1.2050	*R*	**Recharge (infiltration) rate (feet/day)**
0.850	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**
12.04	K	**Horizontal hydraulic conductivity, Kh (feet/day)***
85.000	x	**1/2 length of basin (x direction, in feet)**
31.000	y	**1/2 width of basin (y direction, in feet)**
0.114	t	**duration of infiltration period (days)**
110.000	hi(0)	**initial thickness of saturated zone (feet)**

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

hours	days
36	1.50

In the report (USGS SIR 2C (ft/d) is assu hydraulic co

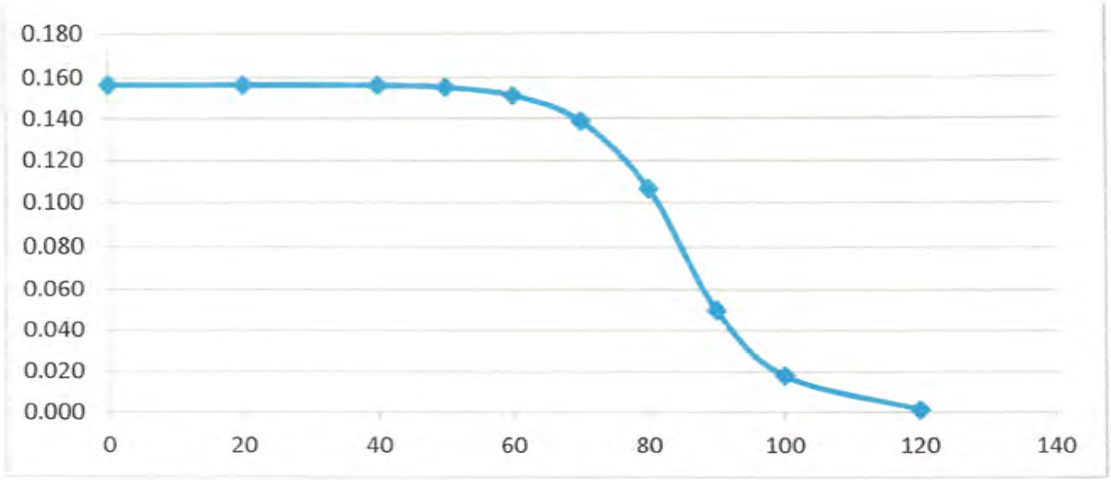
110.157	h(max)	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.157	Δh(max)	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
0.157	0
0.157	20
0.156	40
0.155	50
0.151	60

Re-Calculate Now

Groundwater Mounding, in feet

0.139	70
0.107	80
0.050	90
0.018	100
0.001	120



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

4.0 BMP Standard 4

4.1 Definition of Standard

Chapter 1 in Volume 1 of the Massachusetts Stormwater Management Policy defines Standard 4 as the following:

Stormwater management systems shall be designed to remove 80% Total Suspended Solids (TSS). This Standard is met when:

a. Suitable practices for source control and pollution prevention are identified as a long term pollution prevention plan, and therefore 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. Pre treatment is provided in accordance with the Massachusetts Stormwater Handbook.

4.2 Explanation of Standard

This standard applies to the post construction era, after the site is stabilized as opposed to Standard 8 which pertains to pollution and erosion control during the construction phases of the project. The 80% TSS removal rate is not required for every storm as the efficiency removal may vary from storm to storm. Therefore the runoff volume requiring TSS treatment is equal to the average annual volume. The average annual runoff volume requiring 80% treatment for TSS, which is also referred to as the required water quality volume, is calculated as follows:

Outfalls to wetlands and waterways of the Commonwealth must be equipped with BMP trains capable of treating the required water quality volume of 1.0 inch X the post development impervious area to a TSS removal rate of 80%:

From a land use with a higher potential pollutant load;
Within an area of a rapid infiltration rate (greater than 2.4 inches per hour);
Within a Zone II or Interim Wellhead Protection Area;
Near the following critical areas:
- Outstanding Resource Waters (ORW),
- Special Resource Waters (SRW),
- Bathing Beaches,
- Shellfish Growing Areas,
- Cold-water fisheries.

The required water quality volume is equal 0.5 inch of runoff times the impervious area of the post development project tributary to the BMP train for all other discharges.

4.3 Site Specific WQV Determinations

The following site specific review is a check list specific to the site to determine the water quality volume (WQV) and whether or not 44% TSS pretreatment is required by the Stormwater Policy.

SITE SPECIFIC REVIEW

From a land use with a higher potential pollutant load	NO
Rapid Infiltration Rates (>2.4 in/hr=<25 MPI)	NO
Located within a Zone II or IWPA	NO
Near the following critical areas:	
Special Resource Waters (SRW)	NO
Outstanding Resource Waters (ORW)	NO
Bathing Beaches	NO
Shellfish Growing Areas	NO
Cold-water fisheries.	NO

Because there was *NOT* a YES answer in the above review, the Water Quality Volume (WQV) required to be treated is 0.5".

If recharge BMP structures are being proposed, stormwater must be pre-treated to 25% TSS removal prior to any recharge BMP structure if a YES answer appears anywhere in the above site specific review.

To conclude:

Required Water Quality Volume (WQV): 0.5" x Impervious Area of Site
Required Pretreatment of the WQV Prior to Infiltration BMP Structures: 25%

The Stormwater Handbook states on Page 7 Chapter 1, Vol. 1 that "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." Since the overland stormwater flows from the site will not result in a discharge to any mapped critical area, it is thus conclusive that the discharge is not "near" the ORW as there is *not* a *strong* likelihood to have a *significant* impact on it.

4.4 Identification and Description of Treatment Trains

BMP TREATMENT TRAIN DESCRIPTION

The project proposes one BMP Treatment Train referred to as TT 1. The BMP Treatment Train, TT 1 consists only of the permeable pavement parking area. Runoff is captured by the permeable and transmitted directly to the 6" crushed stone choker course below it where by a 25% TSS pre-treatment credit is assigned to the filtration of the runoff. Runoff is then stored in the 6" stone choker course where it is infiltrated into the parent material below resulting in an additional 80% TSS removal rating. All other clean runoff originating from tributary areas up-gradient from the parking lot is diverted around the parking lot and is then slowly released into the BVW maintaining its pre development flow pattern.

4.5 Treatment Train Sizing Calculations for WQV

The water quality volume for this project is 0.5" of runoff times the surface area of the permeable pavement (9249 SF); thus the WQV is (.5/12)(9249)=365.37 SF.

Normally a hydrograph would be produced with a rainfall intensity yielding a volume of 365.SF and would be routed through the BMP structure, in this case the permeable pavement, and if no bypass occurs, full treatment has been achieved. This process is unnecessary for this project as the 100 year storm has been completely infiltrated with no bypass occurring. The HydroCad calculations for the 100 year produces a volume of 0.119 AF (5183 CF) that was totally infiltrated, thus intuitively the much lesser WQV (365.SF) would also be infiltrated with no bypass.

4.6 TSS removal Rate Spreadsheets

The following pages contain the spreadsheets developed by the DEP specifically for the calculation of TSS Removal rates from a given Stormwater Treatment Train. The spreadsheet represents permeable pavement BMP Treatment Train for which the TSS removal rate calculation was performed.

The TSS removal rates of the spreadsheets are not derived by adding the TSS removal rate credits for each BMP Structure of the treatment train directly to achieve the cumulative 80% TSS removal rate. Rather, each subsequent BMP Structure treats only the untreated percentage of the WQV it receives from the upstream BMP structure. For example:

If the first BMP structures of a treatment train is credited with a TSS removal rate of 60% and the second BMP Structure is credited with a TSS removal rate of 20%, the cumulative TSS removal rate of the treatment train will not be 80% (60%+20%). Rather, the cumulative TSS removal rate of the train will only be 68%. This cumulative removal rate is derived by the following:

The first BMP structure treats the WQV to 60% TSS removal, but 40% of the WQV is not treated, thus the second BMP structure can only treat the untreated portion of the WQV to a 20% TSS removal rate. Thus the second BMP Structure treats the 40% untreated WQV portion at a rate of 20% (20% of the untreated 40% WQV=8%). Thus the cumulative TSS removal rate for the treatment train is 60%+8%=68% total.

The following spreadsheet represents the treatment train TT! For the permeable pavement parking area:

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: TT 1 PERMEABLE PAVEMENT

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Porous Pavement	0.80	1.00	0.80	0.20
Street Sweeping - 0%	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20

Total TSS Removal = 80%

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

Project: Community Baptist Church
Prepared By: GJT
Date: 1/21/2021

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

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

4.7 Conclusions

The above calculations conclude that the BMP structures selected have the capacity to control the WQV and related peak discharges. The above spreadsheet calculations conclude that the BMP structures selected for each treatment train have the ability to treat the stormwater WQV to a minimum of an 80% TSS removal rate.

In conclusion, the performance standards for Standard 4 have been met.

Long Term Pollution Prevention Plan

The following plan is an outline of suitable practices for source control of contaminates and pollution control that can desecrate the performance of BMP Structures. This plan or elements of it may be incorporated as ongoing conditions of the Orders of Conditions if the Commission deems it appropriate.

The following practices when implemented with due diligence will yield substantial benefits pertaining to the functionality and performance of the stormwater system.

Good House Keeping

Adapting good housekeeping policies within the premises can reduce a variety of contaminants. Windblown litter and debris typically is a source of pollution and is unsightly. Non-biodegradable materials such as plastics can clog inlets and other components of the stormwater system. They can also prevent the growth of vegetation and become a source of erosion. The following practices will have a significant and positive impact on the stormwater system:

- Properly store all refuse in covered containers
- Use containers with covers that cannot be opened by animals
- Owners should police remote yard areas for windblown litter

Storage of materials and waste Products

Owners should not store any refuse receptacles near BMP Structures vulnerable to windblown sources of pollution.

- Refuse should be bagged and covered within receptacles.
- All receptacles should be stored within a closed area so as to prevent being blown over or knocked over by animals.
- There shall be no exterior storage of open refuse, waste products, or debris.
- Organic materials from landscaped areas shall be bagged and removed for legal disposal, or composted in an approved bin located outside of any stormwater BMP.

Proper grounds keeping is essential to the life and performance of a stormwater management system.

- Leaf litter should be kept out of roof gutters through proper maintenance. Gutters shall be cleaned in late November and April to prevent compost contaminant from entering and clogging any of the components of the stormwater management system. It is strongly recommended that the association install gutter guards on the roof gutters as a source control mechanism to avoid potentially damaging and costly blockages resulting from the accumulation of windblown leaf litter.
- The disposal of grounds keeping wastes within stormwater impounds, other conveyance and impound structures is strictly prohibited.
- The Owner(s) should never use areas designated for stormwater attenuation, storage and collection as waste receptacles.
-

Vehicle washings

Discharges from vehicle washings should be discharged sparingly into Stormwater BMP Structures. Association Members should adhere to the following practices when washing their vehicles:

- The use of harsh chemicals and degreasing agents should not be used if BMP Structures incorporate vegetation as treatment processes (rain gardens, grass swales, etc.) If the washing necessitates the use of degreasing agents or harsh chemicals, the homeowner should consider washing the vehicle at a commercial carwash.
- No car washing should be conducted that directly flushes hydro carbon, lubricants, or coolants to any BMP Train.
- No car washing should be conducted where a direct discharge into a BMP Infiltration Structure will occur.
- Wash buckets should not be directly discharged into BMP structures. Allowing a discharge to flow by overland flow is more preferable and can be flushed and diluted by flushing with clean water.

Routine Inspections

Routine inspections can be done quickly and visually in most cases. Frequent inspection can save on costly repairs in the future and provides aesthetic benefits as well and are therefore greatly encouraged. A little bit of common sense goes a long way. Homeowners are encouraged to adhere to the following practices:

- Educate themselves on the basic functions of the system components.
- Make observations as they pass components for potential or obvious problems.

Spill Prevention and Response

Spill preventions are easily avoided. The use of proper equipment will almost always prevent spills. Activities requiring the transfer of harmful fluids from one container to another should be performed in a designated area. The following policy to conduct such transfers should be implemented and be strictly adhered to:

- The designated area should be set on a level impervious surface having a shallow perimeter wall so as to contain spills and to facilitate and expedite cleanups should a spill occur.
- The designated area should be located far enough away from sensitive BMP Structures so as not to be a threat to them and if possible be located down gradient. If possible, the designated area should be in a covered area or be able to be covered so that it will not become a source of pollution from stormwater runoff.
- Access to equipment necessary to clean up spills should be stored in the vicinity of the designated area so as to prevent pollution and make cleanup readily available.
- The spill of any petroleum product greater than 2 gallons shall be immediately reported to the Cohasset fire department at 781-383-1515 or 911 if it is an emergency.
- Other than the limited use of fuel for lawn maintenance and snow removal equipment, the outdoor transfer of liquids such as paint and other potential pollutants between containers shall be avoided.
- There shall be no on site storage of materials not typically associated with normal household use.

Maintenance of lawns and gardens, and other landscaped areas

All yard and wastes from landscaped area shall be properly disposed of. Much of the BMP maintenance can be performed intrinsically through the employment of a quality landscaping contractor. Removal of litter and debris on a regular basis is a predominant component of BMP inspection and maintenance and is therefore greatly encouraged.

Storage of fertilizers and pesticides

All harmful and potentially harmful chemicals shall be stored in areas where migration of such chemicals into a stormwater system will be highly unlikely.

- Home owners shall responsibly store chemicals within water tight receptacles with latching covers that serve to prevent spillage.
- Fertilizers and some form of pesticides typically are purchased in bags that once opened and partially used can spill easily from the bag. Transferring the unused volume of chemicals into a plastic container with a latching cover is a good storage practice.

Pet waste management

Pet owners should be considerate of their abutting fellow citizens of their communities. What is not widely understood about pet wastes is the habits of pets going continually in the same place during the daily walks can have adverse impacts on vegetation. More particularly if the vegetation being destroyed is a component of a BMP Structure such as a rain water garden, the effective treatment of stormwater will be compromised. The following practices should be adhered to as a practical measure to prudent and considerate pet waste management:

- Train your pet to relieve itself in a designated area of *your* yard prior to walking and not in common areas or private properties owned by others.
- Clean up after your pet and dispose of waste matter responsibly.
- Always keep your pet leashed, never let your pet roam free.
- Discourage your pet from going in the same place over and over. Animals tend to do this so as to mark their territories.

Proper management of deicing and snow

The storage of all deicing agents shall be stored and dispensed as prescribed in the protocols contained in the above sections of this plan for the Storage of Materials and Spill Prevention and Response. Deicing agents should be applied in concentrations necessary only to ensure save vehicular and pedestrian access to the facility. Dispersion of deicing agents should be performed with moderation.

Proper and adequate clearing and removal of snow will reduce the use of deicing agents. Snow should be removed with shovels and plows to the greatest extent practicable. At a minimum, the entire paved area should be cleared of snow prior to the application of deicing agents.

Since this project proposes vegetative BMP structures, deicing agents and sanding should be used sparingly. Alternative de-icing should be considered. One such alternative that could be could employed is to remove snow with a shovel or by plowing and then allow sunlight to melt ice and snow glazed on pavement surfaces. Be sure to store snow off the driveway so as to prevent a snow-melt discharge over the driveway. This will reduce or eliminate the need for conventional deicing agents.

Any accumulations of silt, sand or other debris shall be removed in the early spring, prior to the heavy rains. Removal of the heavy or deeper deposits shall be done carefully with a flat shovel so as to avoid grinding the finer particulate into the voids of the pavement. The finer particulate can be blown off the surface using compressed air. The air hose should be aimed at a 45 degree angle from the pavement surface to effectively remove the finer particulate. Another good option is to have the finer particulate vacuumed in the early spring prior to the heavy rains.

Whenever possible snow removal should be stored or piled in suitable areas having the following parameters:

- Snow storage areas should not result in a snow melt discharge on to areas of pavement generating a residual need for more applications of deicing agents.
- Snow storage areas should not be located at intersections so as to produce hazardous blind drives or reduce sight distances.
- Snow storage areas should not be located in detention basins or in areas that could cause damage other BMP Structures particularly those that rely upon various forms of vegetation to provide stormwater treatment.
- Deicing agents should be mixed with sand to reduce the amount of chemicals such as salt. Environmentally sensitive areas may warrant the exclusive use sand as a deicing agent to prevent other deicing chemicals from contaminating wells or destroying vegetation.

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The following plan is an outline of suitable practices for source control of contaminates and pollution control that can desecrate the performance of BMP Structures. This plan or elements of it may be incorporated as ongoing conditions of the Orders of Conditions if the Commission deems it appropriate.

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- The disposal of grounds keeping wastes within stormwater impounds, other conveyance and impound structures is strictly prohibited.
- The Owner(s) should never use areas designated for stormwater attenuation, storage and collection as waste receptacles.
-

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- No car washing should be conducted where a direct discharge into a BMP Infiltration Structure will occur.
- Wash buckets should not be directly discharged into BMP structures. Allowing a discharge to flow by overland flow is more preferable and can be flushed and diluted by flushing with clean water.

Routine Inspections

Routine inspections can be done quickly and visually in most cases. Frequent inspection can save on costly repairs in the future and provides aesthetic benefits as well and are therefore greatly encouraged. A little bit of common sense goes a long way. Homeowners are encouraged to adhere to the following practices:

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- Make observations as they pass components for potential or obvious problems.

Spill Prevention and Response

Spill preventions are easily avoided. The use of proper equipment will almost always prevent spills. Activities requiring the transfer of harmful fluids from one container to another should be performed in a designated area. The following policy to conduct such transfers should be implemented and be strictly adhered to:

- The designated area should be set on a level impervious surface having a shallow perimeter wall so as to contain spills and to facilitate and expedite cleanups should a spill occur.
- The designated area should be located far enough away from sensitive BMP Structures so as not to be a threat to them and if possible be located down gradient. If possible, the designated area should be in a covered area or be able to be covered so that it will not become a source of pollution from stormwater runoff.
- Access to equipment necessary to clean up spills should be stored in the vicinity of the designated area so as to prevent pollution and make cleanup readily available.
- The spill of any petroleum product greater than 2 gallons shall be immediately reported to the Cohasset fire department at 781-383-1515 or 911 if it is an emergency.
- Other than the limited use of fuel for lawn maintenance and snow removal equipment, the outdoor transfer of liquids such as paint and other potential pollutants between containers shall be avoided.
- There shall be no on site storage of materials not typically associated with normal household use.

Maintenance of lawns and gardens, and other landscaped areas

All yard and wastes from landscaped area shall be properly disposed of. Much of the BMP maintenance can be performed intrinsically through the employment of a quality landscaping contractor. Removal of litter and debris on a regular basis is a predominant component of BMP inspection and maintenance and is therefore greatly encouraged.

Storage of fertilizers and pesticides

All harmful and potentially harmful chemicals shall be stored in areas where migration of such chemicals into a stormwater system will be highly unlikely.

- Home owners shall responsibly store chemicals within water tight receptacles with latching covers that serve to prevent spillage.
- Fertilizers and some form of pesticides typically are purchased in bags that once opened and partially used can spill easily from the bag. Transferring the unused volume of chemicals into a plastic container with a latching cover is a good storage practice.

Pet waste management

Pet owners should be considerate of their abutting fellow citizens of their communities. What is not widely understood about pet wastes is the habits of pets going continually in the same place during the daily walks can have adverse impacts on vegetation. More particularly if the vegetation being destroyed is a component of a BMP Structure such as a rain water garden, the effective treatment of stormwater will be compromised. The following practices should be adhered to as a practical measure to prudent and considerate pet waste management:

- Train your pet to relieve itself in a designated area of *your* yard prior to walking and not in common areas or private properties owned by others.
- Clean up after your pet and dispose of waste matter responsibly.
- Always keep your pet leashed, never let your pet roam free.
- Discourage your pet from going in the same place over and over. Animals tend to do this so as to mark their territories.

Proper management of deicing and snow

The storage of all deicing agents shall be stored and dispensed as prescribed in the protocols contained in the above sections of this plan for the Storage of Materials and Spill Prevention and Response. Deicing agents should be applied in concentrations necessary only to ensure save vehicular and pedestrian access to the facility. Dispersion of deicing agents should be performed with moderation.

Proper and adequate clearing and removal of snow will reduce the use of deicing agents. Snow should be removed with shovels and plows to the greatest extent practicable. At a minimum, the entire paved area should be cleared of snow prior to the application of deicing agents.

Since this project proposes vegetative BMP structures, deicing agents and sanding should be used sparingly. Alternative de-icing should be considered. One such alternative that could be could employed is to remove snow with a shovel or by plowing and then allow sunlight to melt ice and snow glazed on pavement surfaces. Be sure to store snow off the driveway so as to prevent a snow-melt discharge over the driveway. This will reduce or eliminate the need for conventional deicing agents.

Any accumulations of silt, sand or other debris shall be removed in the early spring, prior to the heavy rains. Removal of the heavy or deeper deposits shall be done carefully with a flat shovel so as to avoid grinding the finer particulate into the voids of the pavement. The finer particulate can be blown off the surface using compressed air. The air hose should be aimed at a 45 degree angle from the pavement surface to effectively remove the finer particulate. Another good option is to have the finer particulate vacuumed in the early spring prior to the heavy rains.

Whenever possible snow removal should be stored or piled in suitable areas having the following parameters:

- Snow storage areas should not result in a snow melt discharge on to areas of pavement generating a residual need for more applications of deicing agents.
- Snow storage areas should not be located at intersections so as to produce hazardous blind drives or reduce sight distances.
- Snow storage areas should not be located in detention basins or in areas that could cause damage other BMP Structures particularly those that rely upon various forms of vegetation to provide stormwater treatment.
- Deicing agents should be mixed with sand to reduce the amount of chemicals such as salt. Environmentally sensitive areas may warrant the exclusive use sand as a deicing agent to prevent other deicing chemicals from contaminating wells or destroying vegetation.

5.0 BMP Standard 5

5.1 Definition of Standard

Standard 5 pertains to "Land Uses with Higher Potential Pollutant Loads" (LUHPPL). Chapter 1 in Volume 1 of the Massachusetts Stormwater Management Policy defines Standard 5 as the following:

Land uses with higher potential pollutant loads (LUHPPL) include the industrial sectors regulated by the NPDES Multi Sector General Permit Program. These sectors include the manufacturing: mineral, metal, oil and gas, hazardous waste treatment or disposal facilities; solid waste facilities; wastewater residual landfills; recycling facilities; stream electric plants; transportation facilities; treatment works, and light industrial activity. LUHPPL also include any land uses that are regulated by an individual NPDES permit or that or that are subject to individual effluent limits established by the EPA. LUHPPL also include any land uses that the Department has determined are not suitable fro Zone IIs or Zone As of public water supplies including without limitation the following: automobile junkyards; the removal of sand and gravel within four feet of the historical high water mark; the storage of hazardous materials, liquid petroleum,; liquid propane, chemical fertilizers, pesticides, manures, septage, sludge, road de-icing materials or sanding materials; snow or ice that has been removed and is contaminated with de-icing chemicals, cemeteries, mausoleums, bulk oil terminals; commercial washing of vehicles and car washes. In addition, land uses with higher potential pollutant loads include: exterior fleet storage areas; exterior vehicle service maintenance and cleaning areas; marinas and boatyards; and parking lots with high intensity uses (1000 vehicle trips per day or more). Shopping centers, malls, and large office parks typically have high intensity use parking lots. Finally, LUHPPL include confined disposal facilities as defined in 314 CMR 9.02 and disposal sites as defined in M.G. L. c.21 E and 310 CMR 40.000.

5.2 Explanation of Standard

If a project contains any of the above mentioned uses, then the project is said to incorporate Land Uses with Higher Potential Pollutant Loads or LUHPPL's (pronounced lupples). Only stormwater discharges contaminated from the above uses are LUHPPL's. For example, a boat yard has an area dedicated for painting maintaining boats and an area used solely for customer parking. The entire boat yard is not a LUHPPL only the areas used for boat maintenance. The boat yard's parking lot is not a LUHPPL as long as it is not contaminated with stormwater discharges from the LUHPPL area.

The treatment trains used to manage stormwater discharges generated from LUHPPL areas are limited to incorporating only the BMP structures listed in the chart found on Page 14, Chapter 1, Vol. 1 of the DEP's Stormwater Handbook. The WQV to be treated shall also be 1.0" times the impervious area of the LUHPPL. Stormwater generated from a LUHPPL must be pretreated to 44% TSS removal prior to discharging into a infiltration BMP structure.

5.3 Determination of Applicability of Standard 5 to the project

Standard 5 is not applicable to the proposed project as it does not include any of the above uses for LUHPPL described above. The project proposed by the applicant is only a low impact minimal use parking lot project.

6.0 BMP Standard 6

6.1 Definition of Standard

Standard 6 pertains to the protection of "Critical Areas. Chapter 1 in Volume 1 of the Massachusetts Stormwater Management Policy defines critical areas and Standard 6 in the following:

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 specific source control and pollution prevention measures and the specific structural stormwater 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 setback from the receiving water or wetland and receive the highest and best practical method of treatment. A "stormwater 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 a Zone A are prohibited unless essential to the operation of the public water supply.
Critical Areas are Outstanding Resource Waters as designated in 314 CMR 4.00, Special resource waters, as designated in 314 CMR 4.00, recharge areas for public water supplies as defined in 310 CMR 22.02 (Zone Is, Zone IIs, and Interim Wellhead protection areas for groundwater sources and Zone As for surface water sources), bathing beaches as defined in 105 CMR 445.000, cold-water fisheries as defined in 314 CMR 9.02 and 310 CMR 10.04, and shellfish growing area as defined 314 CMR 9.02 and 310 CMR 10.04.

6.2 Explanation of Standard

If a project proposes a discharge "near" (as defined above) to a shellfish growing area or bathing beach (as defined above), then the BMP Treatment trains are limited to incorporating only those BMP structures that appear in Table CA 1 Standard 6 in the DEP's Stormwater Handbook. The WQV is equal to 1.0" times the impervious area and the WQV must be pretreated to 44% TSS removal prior to discharging into a BMP recharge structure.

If a project proposes a discharge "near" (as defined above) to an ORW including vernal pools and surface water sources for Public Water Systems (as defined above), then the BMP Treatment trains are limited to incorporating only those BMP structures that appear in Table CA 2 Standard 6 in the DEP's Stormwater Handbook. The WQV is equal to 1.0" times the impervious area and the WQV must be pretreated to 44% TSS removal prior to discharging into a BMP recharge structure. If the construction site area tributary to the ORW disturbs more than 1 acre, the SWPPP must be approved by the Massachusetts DEP under a WM 09 NOI filing.

If a project proposes a discharge "near" (as defined above) to a Zone 1, Zone II, or IWPA (as defined above), then the BMP Treatment trains are limited to incorporating only those BMP structures that appear in Table CA 3 Standard 6 in the DEP's Stormwater Handbook. The WQV is equal to 1.0" times the impervious area and the WQV must be pretreated to 44% TSS removal prior to discharging into a BMP recharge structure.

If a project proposes a discharge "near" (as defined above) to a Cold water Fishery (as defined above), then the BMP Treatment trains are limited to incorporating only those BMP structures that appear in Table CA 4 Standard 6 in the DEP's Stormwater Handbook. The WQV is equal to 1.0" times the impervious area and the WQV must be pretreated to 44% TSS removal prior to discharging into a BMP recharge structure.

6.3 Determination of Applicability of Standard 6 to the project

Since the project does not propose any discharges in or near any of the Critical Areas defined above, Standard 6 does not apply to this project. If the project did propose discharges to or near any of the critical areas prescribed above, the project would be subject to strict source control measures and would limit the use of BMP Structures to those listed in Tables CA 1, 2, 3, & 4 found on page 17, 18, 19, & 20 in the Massachusetts Stormwater Handbook, Chapter 1 of Volume 1.

7.0 BMP Standard 7

7.1 Definition of Standard

Standard 7 pertains to projects that qualify as Redevelopment Projects. Chapter 1 in Volume 1 of the Massachusetts Stormwater Management Policy defines what a redevelopment project is and the minimum required limits of compliance to the applicable 10 Standards of Massachusetts Stormwater Handbook as follows:

A redevelopment project is required to meet the following stormwater management standards only to the maximum extent practicable: Standard 2, Standard 3, and the pre treatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply to 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.

For purposes of the Stormwater Management standards, redevelopment projects are defined to include the following:

1. *Maintenance and improvements of existing roadways, including widening less than a single lane, adding shoulders, correcting substandard intersections, improving existing drainage systems, and repaving;*
2. *Development and rehabilitation, expansion and phased projects on previously developed sites, provided the redevelopment results in no net increase in impervious area; and*
3. *Remedial projects specifically designed to provide improved stormwater management, such as projects to separate storm drains and sanitary sewers and stormwater retrofit projects.*

7.2 Explanation of Standard

All redevelopment projects must fully comply with the provisions of the Stormwater Management Standards requiring the development and implementation of a construction period erosion and sedimentation control plan, a pollution prevention plan, an operation and maintenance plan, and the prohibition of illicit discharges. All redevelopment projects are also required to meet the following standards only to the maximum extent practicable: Standard 2, Standard 3, and the pre treatment and structural best management practice requirements of Standards 4, 5, and 6 and improve existing conditions. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable.

For purposes of Standard 7, "to the maximum extent practicable" means that:

1. Proponents of redevelopment projects have made all reasonable efforts to meet the applicable standard;
2. They have made a complete evaluation of possible stormwater management measures including environmentally sensitive site design that minimizes land disturbance and impervious surfaces, low impact development techniques, and stormwater BMP's and;
3. If not in full compliance with the applicable standard, they are implementing the highest practicable level of stormwater management.

7.3 Determination of Applicability of Standard 7 to the project:

Standard 7 does apply to this project as a net increase in impervious parking area is not being proposed.. Therefore Standard 7 does apply to this project, however project meet all the required performance standards..

8.0 BMP Standard 8

8.1 Definition of Standard

Standard 8 requires proponents to prepare a plan designed to prevent erosion and pollution during the construction phases of the project. Chapter 1 in Volume 1 of the Massachusetts Stormwater Handbook (page 22) Standard 8 is defined as follows:

A plan designed 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.

8.2 Definition of Standard

Projects that disturb an acre or more of land must obtain coverage under the NPDES Construction General Permit issued by the EPA. A requirement of obtaining such a permit is the preparation of Stormwater Pollution Prevention Plan (SWPPP). Since this project does not disturb more than 1 acre of land, the project does not require coverage under the NPDES Construction General Permit issued by the EPA.

The project does require an erosion control and sediment plan to be prepared for the protection of downstream sensitive receptors.

8.3 Sediment and Erosion Control Plan

The Sediment and Erosion Control Plan prepared for this site to meet the performance standards of BMP Standard 8 is found on sheets 6&7 of the plan of record filed with this report for the NOI. The Erosion Control Plan performs the applicable erosion control practices as required by Standard 8, and will maintain a high level of erosion control through the construction period.

9.0 BMP Standard 9

9.1 Definition of Standard

Standard 9 requires proponents to prepare a plan designed to maintain the BMP control structures after construction of the project has been completed. Chapter 1 in Volume 1 of the Massachusetts Stormwater Handbook (page 23) Standard 9 is defined as follows:

> *A Long-Term Operation and Maintenance (O&M) Plan shall be developed and implemented to ensure that the stormwater management system function as designed.*
>
> *The Long-term Operation and Maintenance Plan shall at a minimum include:*
>
> 1. *Stormwater management system(s) owners;*
> 2. *The party or parties responsible for operation and maintenance, including how future property owners will be notified of the presence of the stormwater management system and the requirement for proper operation and maintenance;*
> 3. *The routine and non-routine maintenance tasks to be undertaken after construction is complete and a schedule for implementing those tasks;*
> 4. *A plan that is drawn to scale and shows the location of all stormwater BMP's in each treatment train along with the discharge point;*
> 5. *A description and delineation of public safety features; and*
> 6. *An estimated operations and maintenance budget.*

9.2 Explanation of Standard

The Goal of Standard 9 is to ensure all responsible parties and owners are aware of their maintenance obligations and all of the financial obligations associated with the maintenance. Another goal of Standard 9 is to alert the potential owner or responsible party of their maintenance obligations prior to becoming an owner or responsible party by a real estate purchase.

9.3 Long Term Operation and Maintenance Plan

9.4 Owners Identified

The owners of the Stormwater Management System are the record names of those individual(s) who currently appear on the deed for the real property identified at the Weymouth Assessor's Map 34 Parcel 447 Parcel 15. The property is more commonly known as the Community Baptist Church 17 Mutton Lane.

9.5 Responsible Parties Identified

The responsible parties of the Stormwater Management System for 73 Atlantic Avenue in Cohasset, MA are the record names of those individual(s) who currently appear on the deed for the Community Baptist Church in Weymouth, MA. The owner or responsible party may delegate the maintenance responsibilities to a qualified company knowledgeable of landscape and maintenance maters involved with the BMP Structures present at the church.

9.6 Maintenance Tasks

The following areas and BMP structures identified below shall be maintained in perpetuity by the owner(s):

Lawns

The Owner(s) of premises shall keep all lawn areas in a good healthy condition. Particular care shall be made to lawn areas associated with BMP Practices. It is recommended that green scape areas be maintained by a competent landscaper who will perform the following maintenance tasks as applicable to the season and lawn conditions:

- Aerate the lawn areas
- Dethatch lawn areas
- Fertilize lawn areas
- Reseeding of lawn areas
- Cut heights of Lawns accordingly to drought conditions
- Proper and adequate irrigation of lawn areas
- Leaf removal of lawn areas
- Pesticide treatments of lawn areas

Shallow lawn basin

The Owner(s) shall keep the vegetation in the shallow lawn basin located near the light pole in a good healthy condition. Particular care shall be made to the side slopes located within the banks of the shallow lawn basin. It is recommended that the shallow lawn basin be maintained by a competent landscaper who will perform the following maintenance tasks as applicable to the season and lawn conditions:

- Clear leaves or debris out of channel bottom of the basin
- Clear leaves or debris out of lawn drain within the basin
- Inspect lawnbasin inlet grate and clean of debris out of sumps.
- Snake or vacuum 6" culvert free of grass clippings, sediments, etc. when clogging becomes evident.

The lawn basin and associated 6" culvert should be inspected at least twice a year in the spring and fall and maintain accordingly.

Rainwater Garden

The rainwater garden located along the edge of pavement in back of the church building shall be maintained by performing the following tasks:

- Inspect all plants for health and condition and replace or treat any plants as needed

Clear leaves or debris out of channel bottom of the swales
Inspect mulch and re-mulch as necessary.
Clean sediments and debris out of rainwater garden.

Rainwater gardens shall be inspected at least twice per year, in the spring and fall.

Permeable Pavement Parking Lot

Permeable pavement shall be kept free of debris. The surface area shall be swept or blown clear with mechanical equipment. Applications of salt and sand should be applied sparingly.
The standard pavement should also be swept clean on an as needed basin to prevent sediment tracking onto the permeable pavement.

Parking lot sweeping should be conducted at least twice per year and on an as needed basis.

9.7 BMP Treatment Structure Location Plan

The BMP structures described above may be seen on the NOI Plan of record or the watershed plans located in Appendix C of this report.

9.8 Description and delineation of safety measures

All confined space entry work shall conform to the applicable OSHA standards. Safety goggles, safety vests, hard hats, etc. shall be worn at all times.

9.9 Cost to Maintain Budget Estimate

Estimated Annual Maintenance Budget

BMP STRUCTURE	EST. AVG. ANNUAL MAINTENANCE COST
Inspectional services	$1000.00
Plowing Services	$ 1400.00
Pavement Sweeping	$100.00
BMP Shallow Lawn basin	$300.00
Lawns	$600.00
Rainwater Garden	$100.00
Total	$3500.00

9.10 Inspection Logs

Field Log for Inspections

Community Baptist Church, Weymouth, Ma

Date:_____

Inspector:_____

Component	Functioning Properly	Debris removal required	Maintenance Needed	Comments
Shallow Lawn Basin				
6" Culvert				
Rainwater garden				
Permeable Pavement				

Lawn areas				

10.0 BMP Standard 10

10.1 Definition of Standard

Standard 10 requires proponents to prepare the SWPPP of Standard 8 to incorporate measures that ensure illicit discharges of contaminates into BMP stormwater management structures will not occur during the construction phases of the project. Standard 10 also requires the proponent to submit to issuing authority an "Illicit Discharge Compliance Statement" stating that no illicit discharges have occurred during construction and that no sources of illicit discharges have been tied into the stormwater management system for current and future use. Chapter 1 in Volume 1 of the Massachusetts Stormwater Handbook (page 25) Standard 10 is defined as follows:

All illicit discharges to the stormwater management system are prohibited. An illicit discharge to a stormwater management system is a discharge that is not comprised entirely of stormwater. Not withstanding the foregoing, an illicit discharge does not include discharges from the following activities or facilities: firefighting, waterline flushing, landscape irrigation, uncontaminated groundwater, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, de-chlorinated water from swimming pools, water used for street washing, and water used to clean residential buildings without detergents.

10.2 Explanation of Standard

Prior to the issuing authority issuing the Certificate of Compliance at the completion of construction, the site will have to be inspected for compliance with the Orders of Conditions. This inspection will also serve to verify that their no illicit discharges tied into any of the components of the stormwater management system. Upon the verification that no illicit discharges are present, the project proponent will be required to sign the "Illicit Discharge Compliance Statement" shown on the following page and submit it to the issuing authority with the Request for Certificate of Compliance.

10.3 Certification

ILLICIT DISCHARGE COMPLIANCE STATEMENT

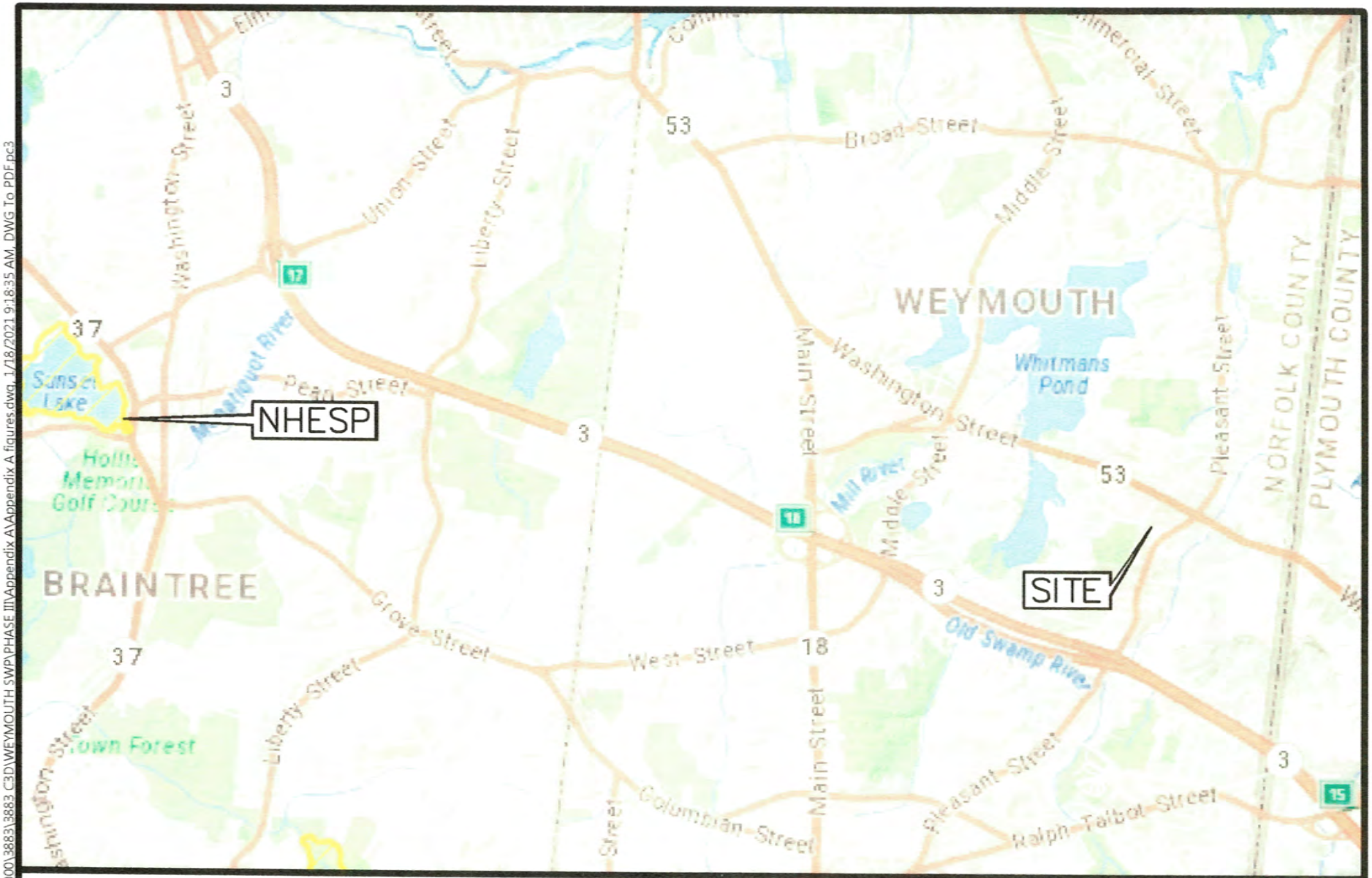
I certify under the pains and penalties of perjury, that to the best of my knowledge, no illicit discharges as defined in Standard 10 were discharged into the stormwater management system at the Community Baptist Church located at 17 Mutton Lane in Weymouth, MA during the construction phases of the project and that there are no illicit discharges currently tied into the said stormwater management system.

_____ _____

Project Proponent **Date**

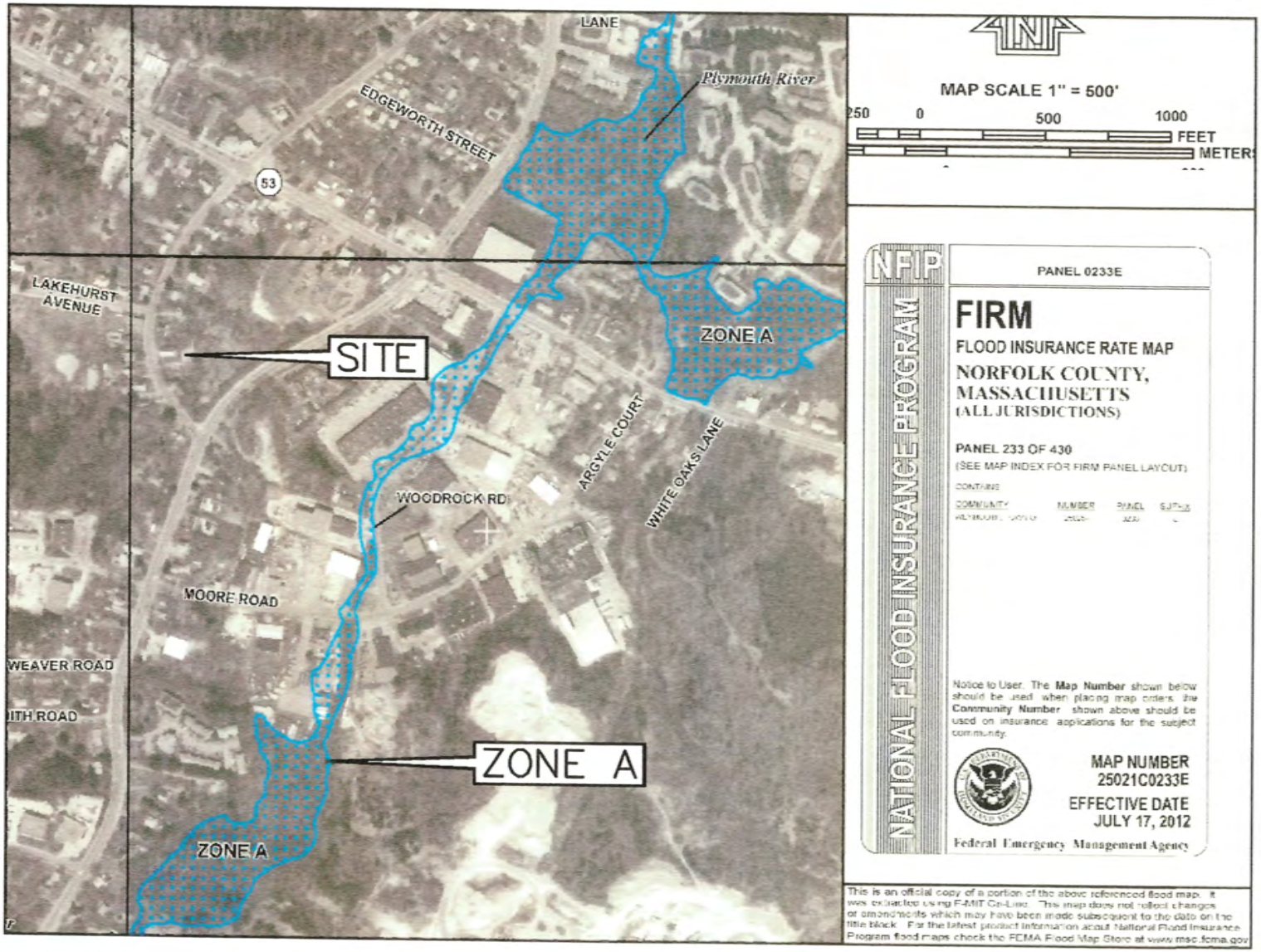
PART III
APPENDICIES

APPENDIX A



NHESP MAP

COMMUNITY BAPTIST CHURCH
17 MUTTON LANE
WEYMOUTH, MA

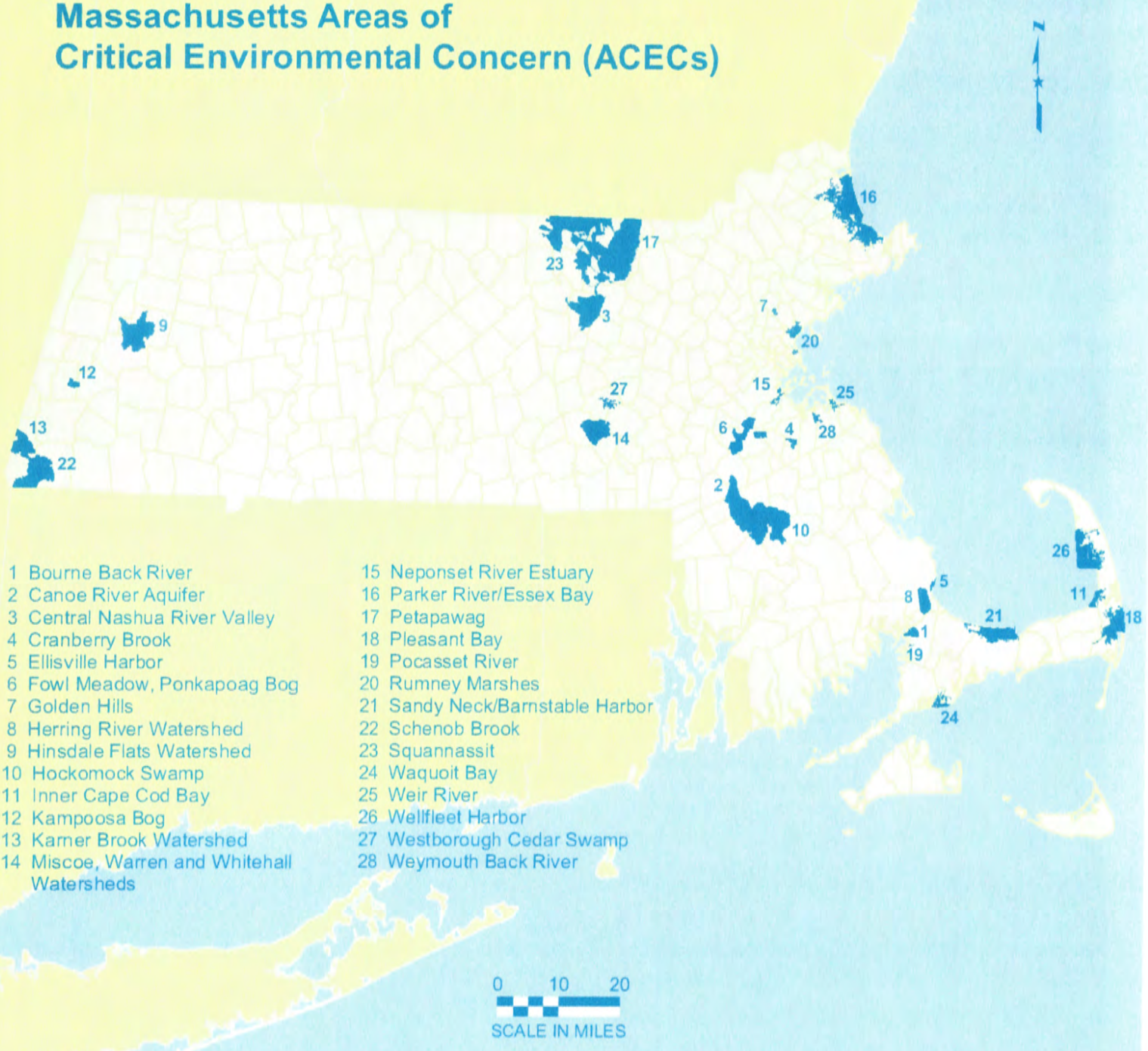


ZONE A MAP

COMMUNITY BAPTIST CHURCH
17 MUTTON LANE
WEYMOUTH, MA

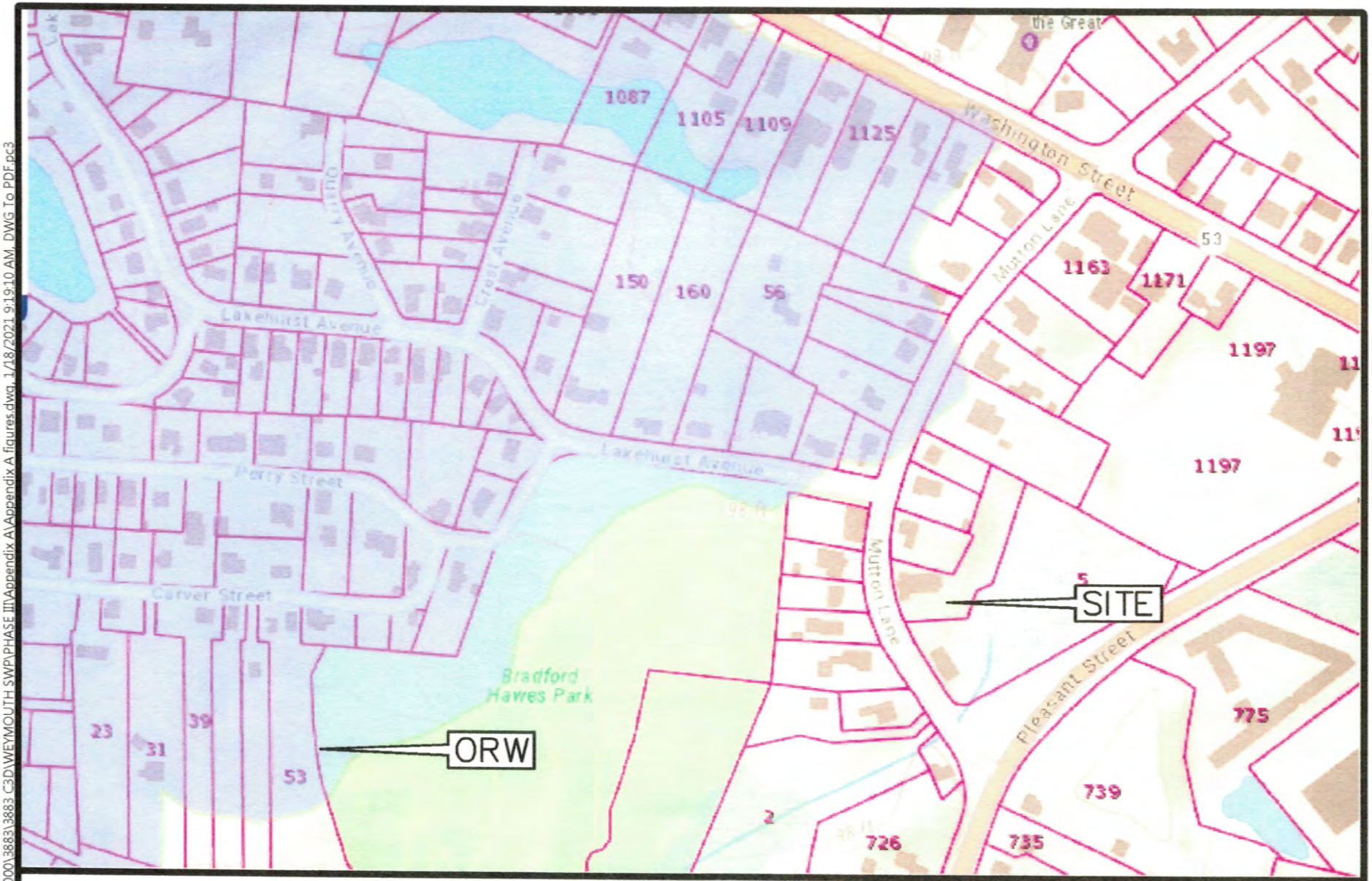
ACEC STATEWIDE MAP

Massachusetts Areas of Critical Environmental Concern (ACECs)



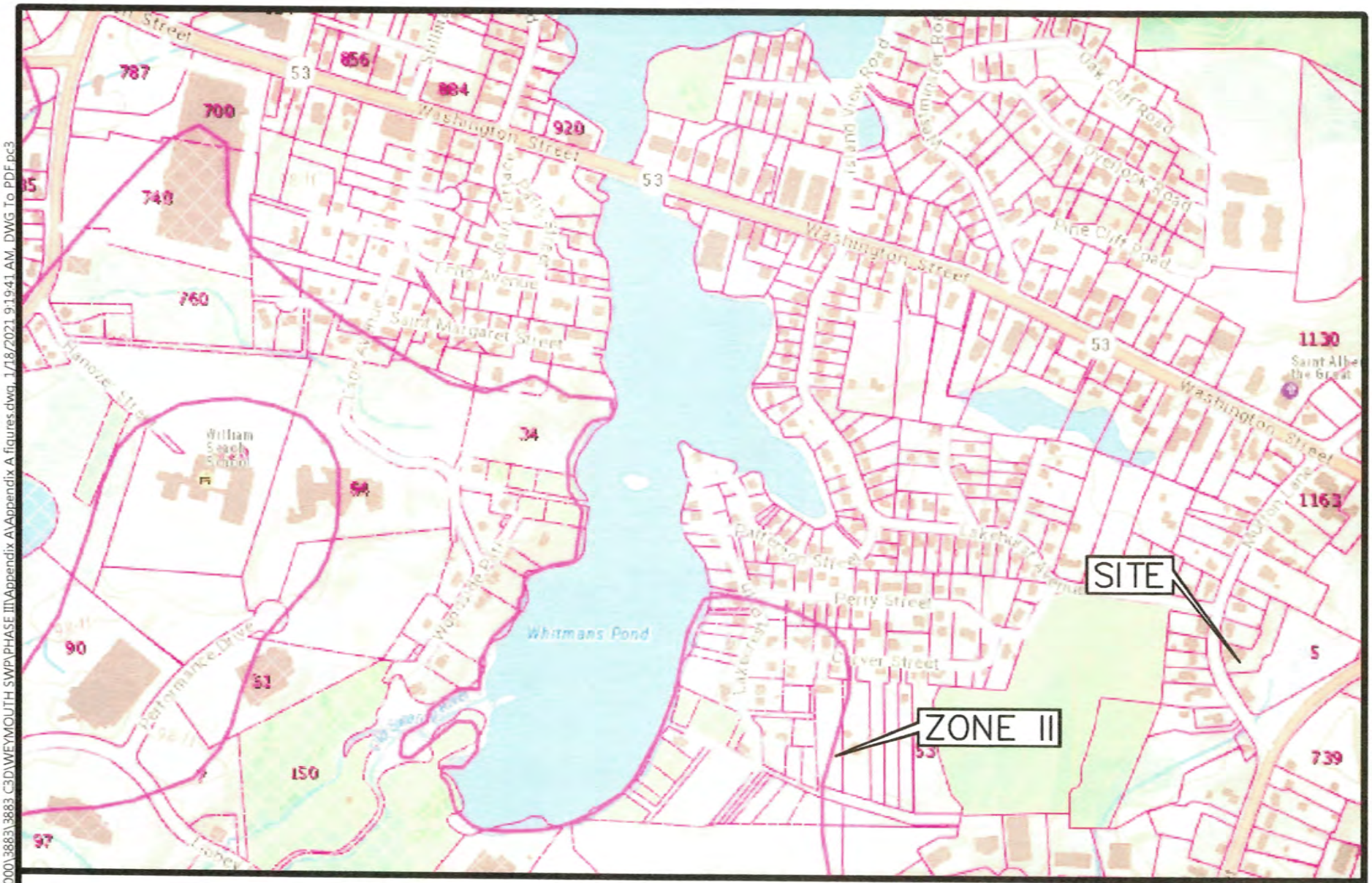
DEM GIS
March 2003

ACEC PROGRAM
Executive Office of Environmental Affairs
Department of Environmental Management
251 Causeway Street, Suite 600-700
Boston, Massachusetts 02114
617-626-1250 www.state.ma.us/dem/programs/acec



ORW MAP

COMMUNITY BAPTIST CHURCH
17 MUTTON LANE
WEYMOUTH, MA



ZONE II MAP

COMMUNITY BAPTIST CHURCH
17 MUTTON LANE
WEYMOUTH, MA

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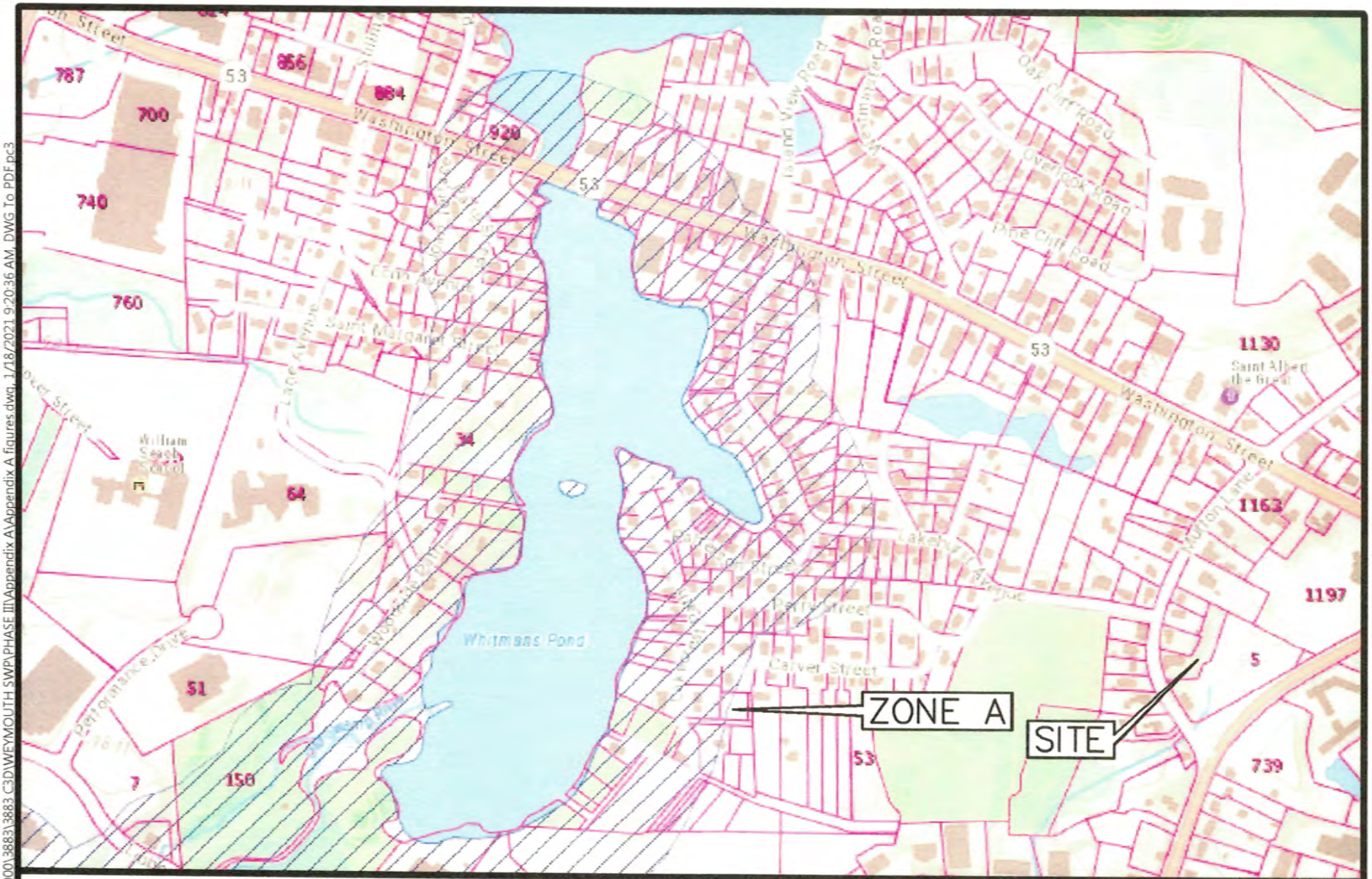


ZONE A MAP

COMMUNITY BAPTIST CHURCH
17 MUTTON LANE
WEYMOUTH, MA

Q:\JOBS\3751 4000\3883\3883 C3D\WEYMOUTH SWPPP\PHASE III\Appendix A\Appendix A figures.dwg, 1/18/2021 9:20:36 AM, DWG To PDF.pc3

APPENDIX B

Soil Map—Norfolk and Suffolk Counties, Massachusetts
(17 Mutton Lane Weymouth, MA)

Map Scale: 1:1,420 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 16, Jun 11, 2020

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

Date(s) aerial images were photographed: Aug 26, 2014—Sep 4, 2014

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
51	Swansea muck, 0 to 1 percent slopes	3.6	33.6%
103B	Charlton-Hollis-Rock outcrop complex, 3 to 8 percent slopes	0.3	2.9%
104C	Hollis-Rock outcrop-Charlton complex, 0 to 15 percent slopes	0.2	1.9%
602	Urban land, 0 to 15 percent slopes	0.1	0.8%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	6.5	60.8%
Totals for Area of Interest		10.6	100.0%

Norfolk and Suffolk Counties, Massachusetts

626B—Merrimac-Urban land complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyr9
Elevation: 0 to 820 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Merrimac and similar soils: 45 percent
Urban land: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Eskers, moraines, outwash terraces, outwash plains, kames
Landform position (two-dimensional): Backslope, footslope, summit, shoulder
Landform position (three-dimensional): Side slope, crest, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand
2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Maximum salinity: Nonsaline (0.0 to 1.4 mmhos/cm)

Sodium adsorption ratio, maximum: 1.0
Available water capacity: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Description of Urban Land

Typical profile

M - 0 to 10 inches: cemented material

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 0 inches to manufactured layer
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water capacity: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Windsor

Percent of map unit: 5 percent
Landform: Dunes, outwash terraces, deltas, outwash plains
Landform position (three-dimensional): Tread, riser
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Outwash plains, terraces, deltas
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Hinckley

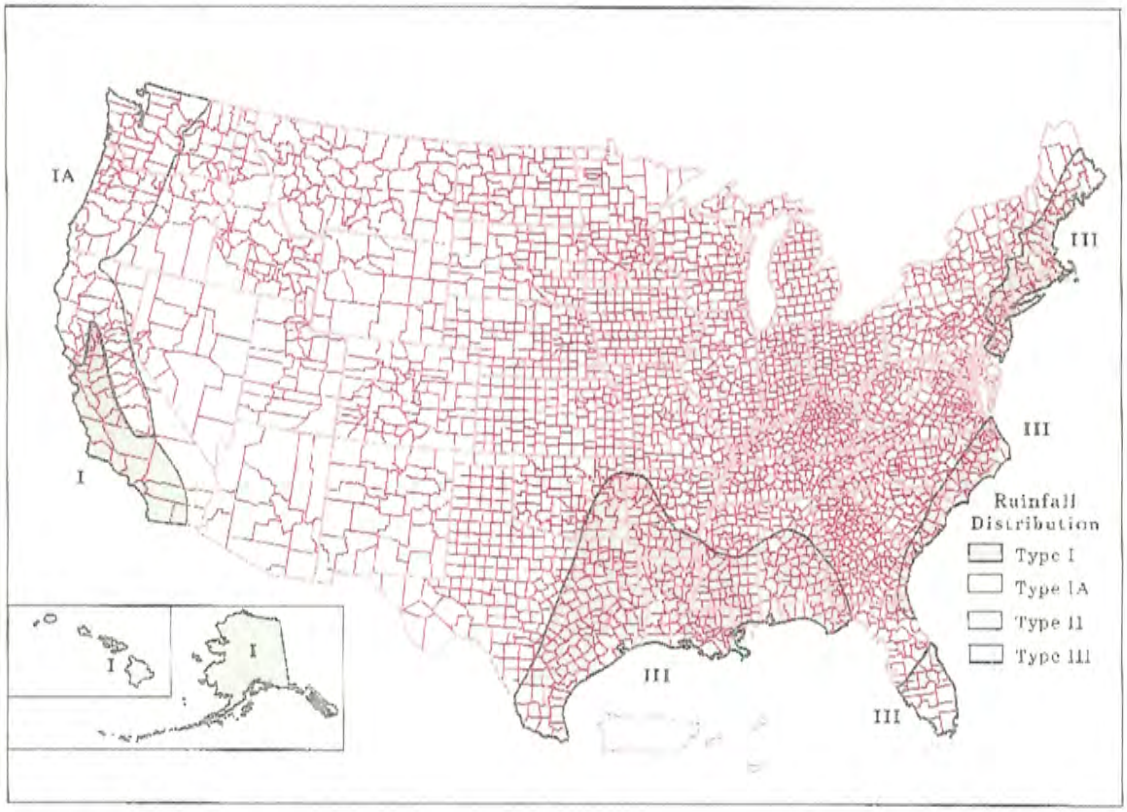
Percent of map unit: 5 percent
Landform: Eskers, kames, deltas, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise
Down-slope shape: Convex

Across-slope shape: Convex, linear
Hydric soil rating: No

Data Source Information

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 16, Jun 11, 2020

Figure B-2 Approximate geographic boundaries for NRCS (SCS) rainfall distributions



Rainfall data sources

This section lists the most current 24-hour rainfall data published by the National Weather Service (NWS) for various parts of the country. Because NWS Technical Paper 40 (TP-40) is out of print, the 24-hour rainfall maps for areas east of the 105th meridian are included here as figures B-3 through B-8. For the area generally west of the 105th meridian, TP-40 has been superseded by NOAA Atlas 2, the Precipitation-Frequency Atlas of the Western United States, published by the National Ocean and Atmospheric Administration.

East of 105th meridian

Hershfield, D.M. 1961. Rainfall frequency atlas of the United States for durations from 30 minutes to 24 hours and return periods from 1 to 100 years. U.S. Dept. Commerce, Weather Bur. Tech. Pap. No. 40. Washington, DC. 155 p.

West of 105th meridian

Miller, J.F., R.H. Frederick, and R.J. Tracey. 1973. Precipitation-frequency atlas of the Western United States. Vol. I Montana; Vol. II, Wyoming; Vol III, Colorado; Vol. IV, New Mexico; Vol V, Idaho; Vol. VI, Utah; Vol. VII, Nevada; Vol. VIII, Arizona; Vol. IX, Washington; Vol. X, Oregon; Vol. XI, California. U.S. Dept. of Commerce, National Weather Service, NOAA Atlas 2. Silver Spring, MD.

Alaska

Miller, John F. 1963. Probable maximum precipitation and rainfall-frequency data for Alaska for areas to 400 square miles, durations to 24 hours and return periods from 1 to 100 years. U.S. Dept. of Commerce, Weather Bur. Tech. Pap. No. 47. Washington, DC. 69 p.

Hawaii

Weather Bureau. 1962. Rainfall-frequency atlas of the Hawaiian Islands for areas to 200 square miles, durations to 24 hours and return periods from 1 to 100 years. U.S. Dept. Commerce, Weather Bur. Tech. Pap. No. 43. Washington, DC. 60 p.

Puerto Rico and Virgin Islands

Weather Bureau. 1961. Generalized estimates of probable maximum precipitation and rainfall-frequency data for Puerto Rico and Virgin Islands for areas to 400 square miles, durations to 24 hours, and return periods from 1 to 100 years. U.S. Dept. Commerce, Weather Bur. Tech. Pap. No. 42. Washington, DC. 94 P.

Figure B-3 2-year, 24-hr rainfall

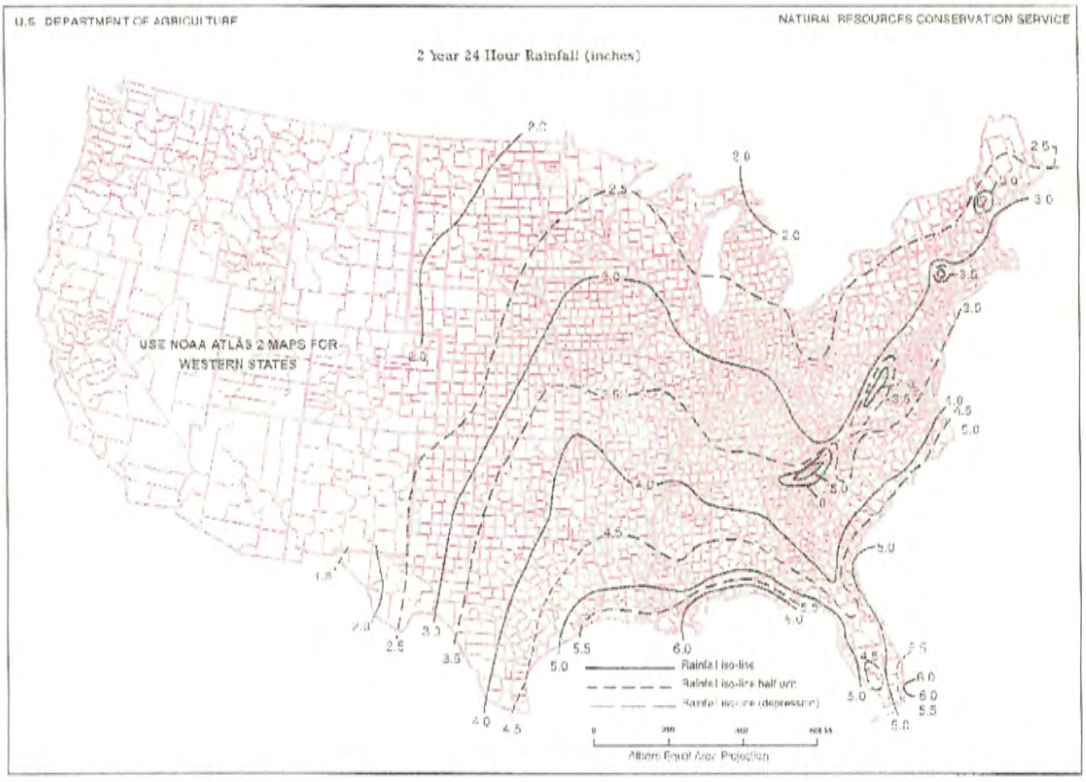


Figure B-4 5-year, 24-hour rainfall

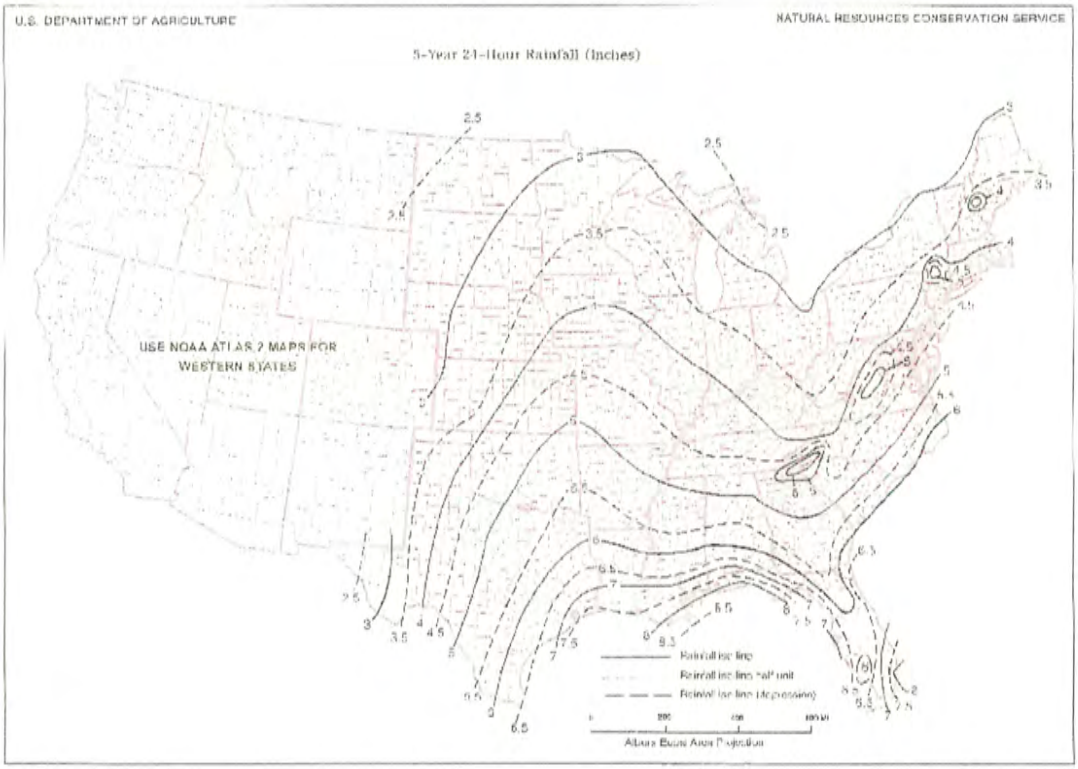


Figure B-5 10-year, 24-hour rainfall

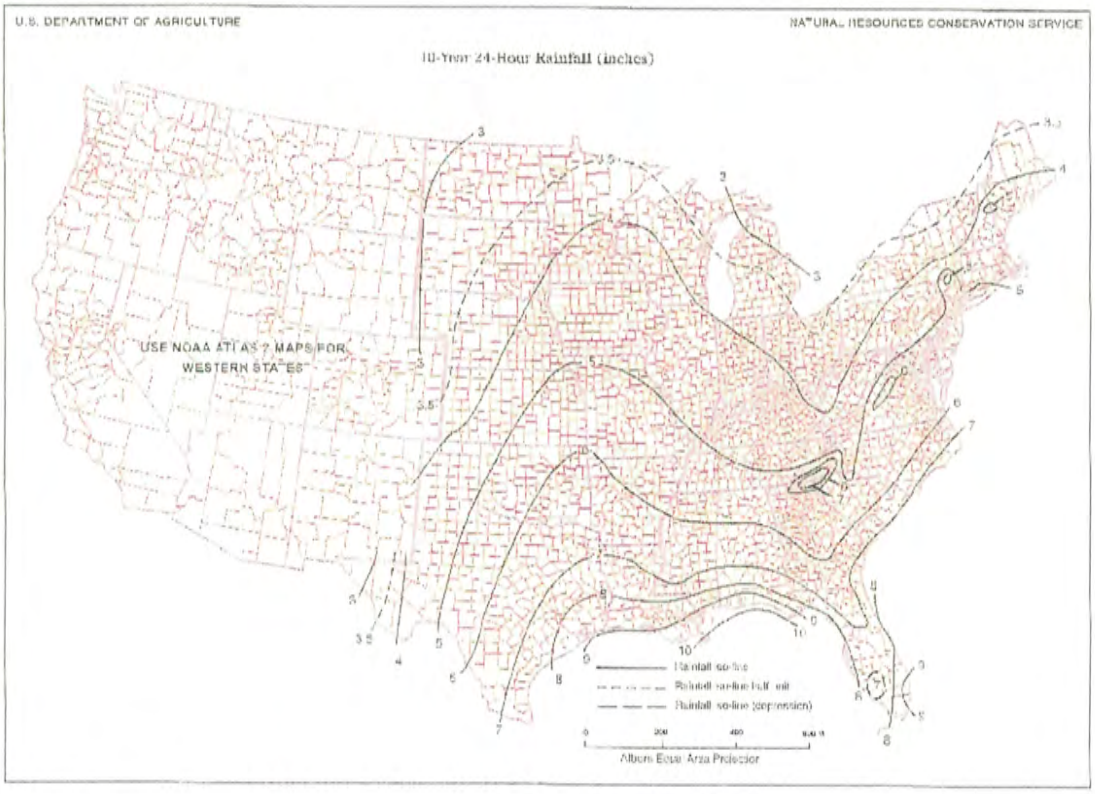


Figure B-6 25-year, 24-hour rainfall

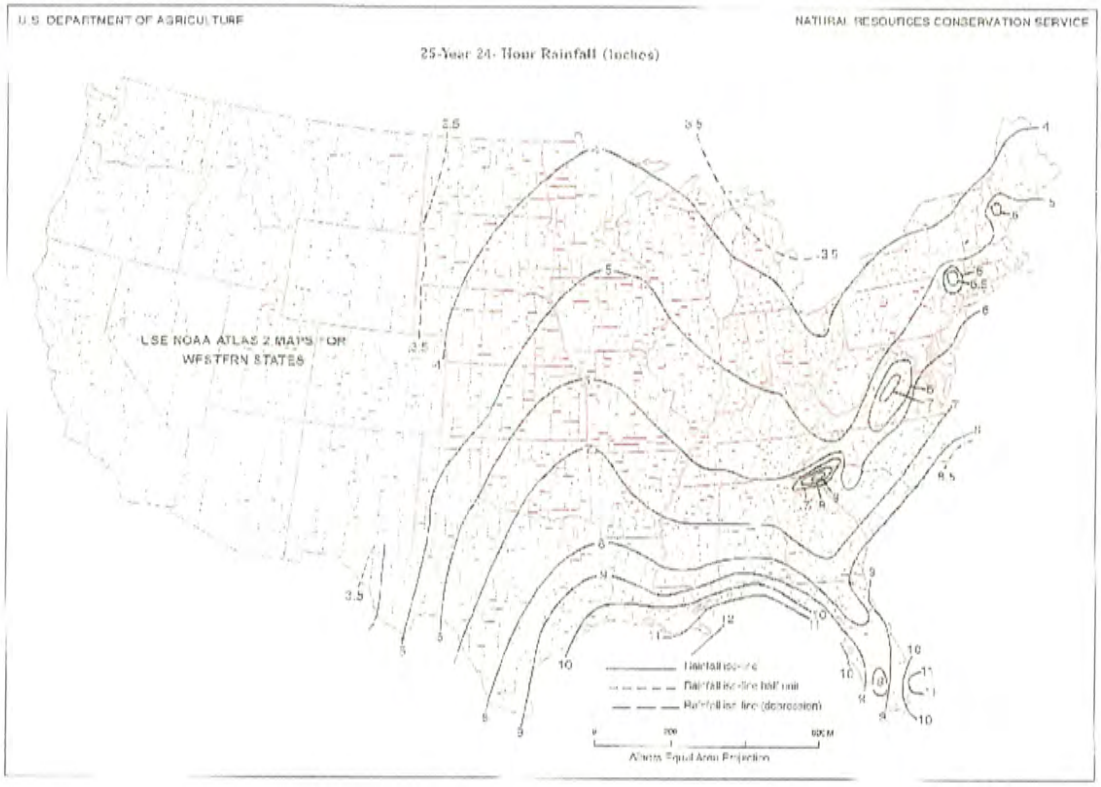


Figure B-7 50-year, 24-hour rainfall

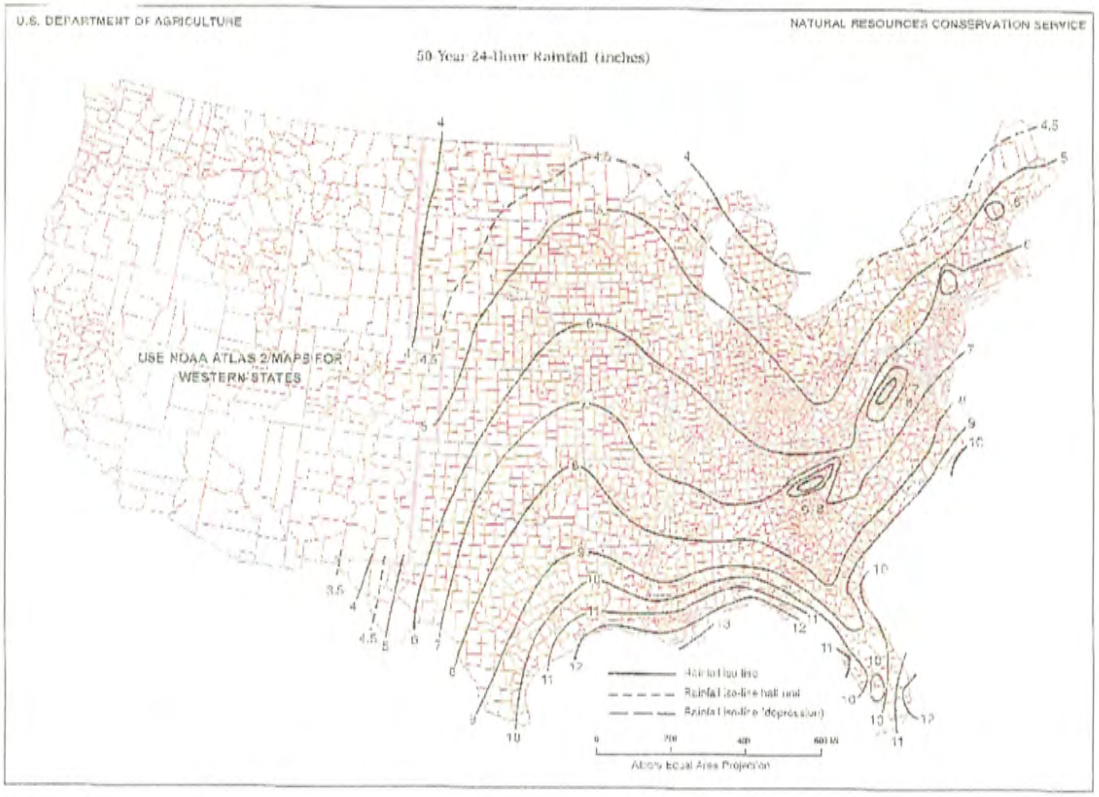
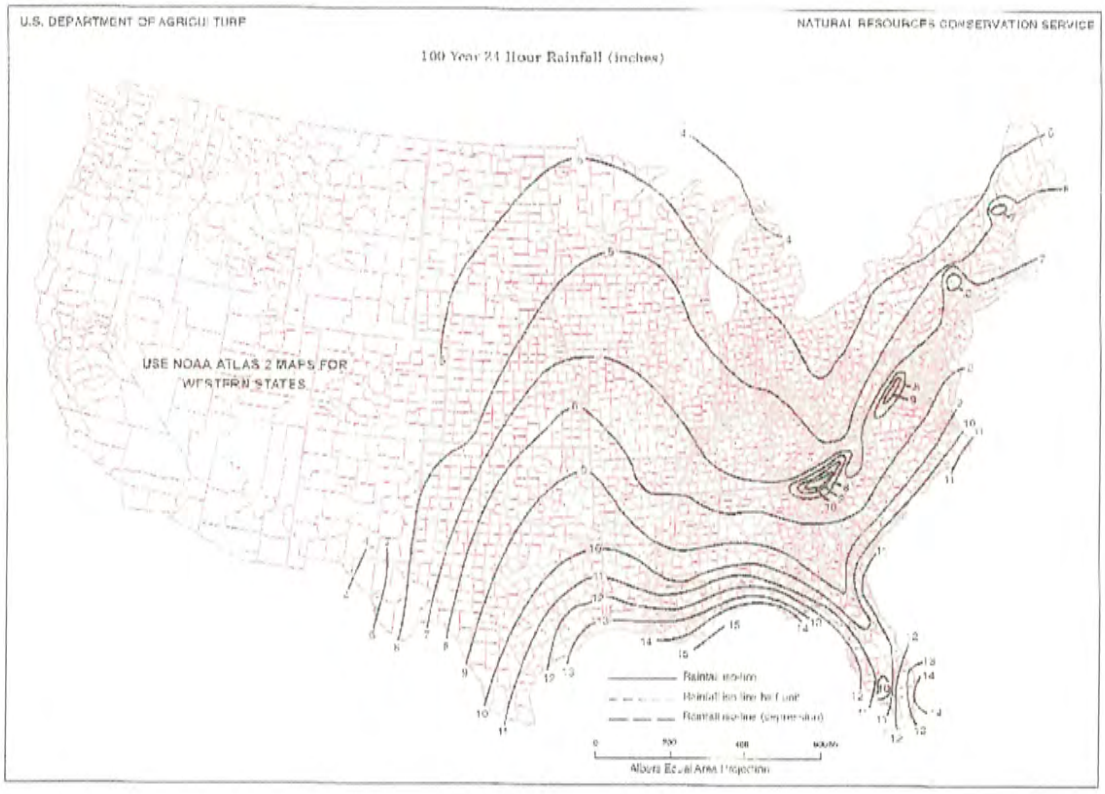


Figure B-8 100-year, 24-hour rainfall



Commonwealth of Massachusetts

Town **Weymouth**

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

Test Hole# TH-1 Date: 11/6/19 **Time:** 9AM **Owner:** Community Baptist Church

Site Locus: 17 Mutton Ln **Lot#** **Weather:** Overcast 50 °F

Land Use: Disturbed **Ground Slope:** 3 **Surface Stones:** FEW **Landform:** Outwash plain

Layer Depth (in)	Soil Horizon Layer	Soil Matrix Color-Moist (Munsell)	Redoximorhhic Features (Mottles)			Soil Texture USDA	Coarse Fragment % By Volume		Soil Structure	Consistance	Other
			Depth	Color	Percent		Gravel	Cobs&Stones			
0 - 12	FILL										
12 - 39	C1	2.5 YR 4/2	28	7.5 YR 5/8	15	MC-Loamy Sand	5	1	Single Grain	Friable	
39 - 42	M	10 YR 3/2							Massive	Firm	
-											
-											
-											
-											
-											
-											

Ground Surface Elev.: 81.5 **Depth of SHGW:** 28 **Weeping:** 37 **Standing:** 47 **48" of Pervious Material?** NO 0

Parent Material: Till **Soil Name:** Merrimac-Urban Soil **Bedrock:** > 42 **Upper Boundary:**

SHGW Det. By: Redoximorphic Features **Lower Boundary:**

	Test 1	Test 2
Depth of Perc.		-
Start Pre Soak		
End Pre Soak		
Time at 12"		
Time at 9"		
Time at 6"		
Elapsed Time	0:00	0:00
Perc Rate	0:00	0:00

SHGW EL 79.2
PERC EL 81.5
WEEP EL 78.42

TP LOCATION SKETCH

Soil Evaluator: Gregory J. Tansey, P.E.; SE 2399 **Witnessed By:** Mary Ellen Schloss **Excavator:** ABS CO.

Notes: Top surface layer is 12" gravel parking lot ; C Layer goes into fill closer to wetland above an organic peat layer below

Commonwealth of Massachusetts

Town **Weymouth**

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

Test Hole# TH-2 Date: 11/6/19 **Time:** 9:15AM **Owner:** Community Baptist Church

Site Locus: 17 Mutton Ln **Lot#** **Weather:** Overcast 50 °F

Land Use: Disturbed **Ground Slope:** 2 **Surface Stones:** FEW **Landform:** Outwash plain

Layer Depth (in)	Soil Horizon Layer	Soil Matrix Color-Moist (Munsel)	Redoximorhhic Features (Mottles)			Soil Texture USDA	Coarse Fragment % By Volume		Soil Structure	Consistance	Other
			Depth	Color	Percent		Gravel	Cobs&Stones			
0 - 12	FILL								Single Grain	Friable	
12 - 42	Fill	10 YR 5/3	32	7.5 YR 5/8	3	MC-Loamy Sand	40	0	Single Grain	Firm	
-											
-											
-											
-											
-											
-											
-											

Ground Surface Elev.: 82.3 **Depth of SHGW:** 28 **Weeping:** 38 **Standing:** 40 **48" of Pervious Material?** NO 0

Parent Material: Till **Soil Name:** Merrimac-Urban Soil **Bedrock:** > 42 **Upper Boundary:**

SHGW Det. By: Redoximorphic Features **Lower Boundary:**

	Test 1	Test 2
Depth of Perc.		-
Start Pre Soak		
End Pre Soak		
Time at 12"		
Time at 9"		
Time at 6"		
Elapsed Time	0:00	0:00
Perc Rate	0:00	0:00

SHGW EL 80.0

PERC EL

WEEP EL 79.13

TP LOCATION SKETCH

Soil Evaluator: Gregory J. Tansey, P.E.; SE 2399 **Witnessed By:** Mary Ellen Schloss **Excavator:** ABS CO.

Notes: Top surface layer is 12" gravel parking lot supported by a granular fill layer, parent material under water was less granular than fill.

Commonwealth of Massachusetts

Town **Weymouth**

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

Test Hole# TH-3 Date: 11/6/19 **Time:** 9:30am **Owner:** Community Baptist Church

Site Locus: 17 Mutton Ln **Lot#** **Weather:** Overcast 50 °F

Land Use: Disturbed **Ground Slope:** 2 **Surface Stones:** FEW **Landform:** Outwash plain

Layer Depth (in)	Soil Horizon Layer	Soil Matrix Color-Moist (Munsel)	Redoximorhhic Features (Mottles)			Soil Texture USDA	Coarse Fragment % By Volume		Soil Structure	Consistance	Other
			Depth	Color	Percent		Gravel	Cobs&Stones			
0 - 12	FILL									Friable	
12 - 40	Fill	10 YR 4/2	27	7.5 YR 5/8	20	MC-Loamy Sand	40	0	Single Grain	Firm	
-											
-											
-											
-											
-											
-											
-											

Ground Surface Elev.: 82.2 **Depth of SHGW:** 27 **Weeping:** 27 **Standing:** 30 **48" of Pervious Material?** NO 0

Parent Material: Till **Soil Name:** Merrimac-Urban Soil **Bedrock:** > 40 **Upper Boundary:**

SHGW Det. By: **Lower Boundary:**

	Test 1	Test 2	
Depth of Perc.		-	SHGW EL
Start Pre Soak			PERC EL
End Pre Soak			WEEP EL 79.95
Time at 12"			
Time at 9"			
Time at 6"			
Elapsed Time	0:00	0:00	
Perc Rate	0:00	0:00	

TP LOCATION SKETCH

Soil Evaluator: Gregory J. Tansey, P.E.; SE 2399 **Witnessed By:** Mary Ellen Schloss **Excavator:** ABS CO.

Notes: Top surface layer is 12" gravel parking lot w/ granular fill below, parent material was a tighter finer material below the wate table.

APPENDIX C