

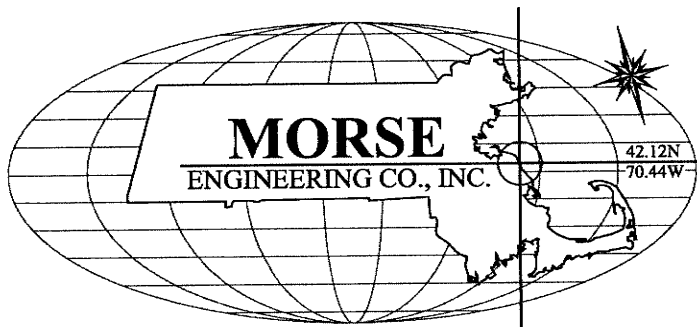
Stormwater Permit Application
Town of Scituate Stormwater Bylaw (Sec. 32050) &
Stormwater Regulations

Project
Proposed Mixed-Use Development
61 New Driftway
Scituate, Massachusetts
Assessor's Parcels: 53-3-2A

Owner/Applicant
John Tedeschi
PO Box 361
Scituate, MA 02066

Date: July 14, 2022

Prepared by:



*Registered Professional Engineers,
Land Surveyors & Environmental Consultants*

www.Morsecoinc.com

10 New Driftway, P.O. Box 92
Scituate, MA 02066
Tel: (781) 545-0895
gmorse@morsecoinc.com



Gregory J. Morse

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Project Narrative

61 New Driftway

Scituate, Massachusetts

Project Summary

The project/applicant owner, John Tedeschi, proposes to demolish and existing canine training and boarding facility and construct a mixed-use structure at 61 New Driftway in Scituate, MA. The site is currently developed, consisting of a commercial building, paved driveway, parking areas, lawn, and woodland areas. A significant portion of the site was once a portion of the MBTA Greenbush parking lot. Shown as Assessor's Parcels 53-3-2A, and is 34,727 square feet in size, all of which is upland area. The site is bordered by former MBTA property on all sides, area which is now encompassed by the Drew Company's mixed-use developments which are currently under construction. The site has frontage on Old Driftway to the west, and New Driftway to the south.

This report contains a narrative review of the stormwater management systems associated with the proposed project in accordance with the Town of Scituate Stormwater Bylaw. The work proposed includes the demolition of an existing commercial building and the construction of a mixed-use structure, with associated parking areas, stormwater management BMPs, and utilities. The work will result in a total impervious area of 30,884 square feet and will disturb approximately 34,000 square feet of land, which will be restored and stabilized post-construction with the proposed buildings, parking areas, and loam and seed.

Pre-Development Condition

The site in its pre-construction state currently consists of an existing canine training and boarding facility with paved driveway, parking lot, lawn, and woodland areas. In general, the site slopes to the southwest. There are several existing catch basins on-site that discharge to drainage systems off-site, all of which are proposed to be decommissioned.

Soils information was obtained through a review of the web-based USDA Soil Survey as well as on-site soils testing. The USDA Soil Survey describes the soils as Udorthents, Urban Land Complex, Hydraulic Soil Group B, Map Unit 656B. Multiple areas on-site had soil testing conducted for the stormwater systems, conducted by Paul Graeme Gunn, S.E.#14392 on June 20, 2022. The test pits across the property were consistent in demonstrating the existing material to be loamy sand or fill over fine and coarse sands to a depth of at least ten feet.

Post-Development Condition

The proposed site will include a multi-family dwelling, mixed-use development, impervious parking areas, and lawn and community garden areas. The project proposes to disturb approximately 34,000 square feet of the project site and will result in 30,884 square feet of impervious area. The runoff from the roof and parking areas is to be directed to multiple systems of subsurface Cultec drywells embedded in crushed stone.

These drywell systems will serve to reduce the post-construction rates and runoff volumes when compared to the pre-construction conditions, and will ensure there is no loss of annual recharge to the groundwater table.

Standard #1: No new stormwater conveyances (i.e. outfalls)...

The project complies as it does not propose any new stormwater outfalls. It is the intent of the proposed design to follow the natural/existing conditions stormwater flow paths to the extent practicable.

Standard #2: Post-Development peak discharge rates do not exceed pre-development rates...

The project has been designed to mitigate peak rates and volumes of runoff. See below for calculations of the runoff discharges and volumes for the 1, 2, 10 and 100-yr. storm events.

DESIGN POINT 1

RATES OF RUNOFF (C.F.S.)

<i>Event</i>	<i>1-yr.</i>	<i>2-yr.</i>	<i>10-yr.</i>	<i>100-yr.</i>
Pre-Dev.	0.62	1.03	1.64	2.73
Post-Dev.	0.00	0.01	0.02	0.06

VOLUME OF RUNOFF (Ac-ft.)

<i>Event</i>	<i>1-yr.</i>	<i>2-yr.</i>	<i>10-yr.</i>	<i>100-yr.</i>
Pre-Dev.	0.048	0.078	0.126	0.213
Post-Dev.	0.000	0.001	0.002	0.004

DESIGN POINT 2

RATES OF RUNOFF (C.F.S.)

<i>Event</i>	<i>1-yr.</i>	<i>2-yr.</i>	<i>10-yr.</i>	<i>100-yr.</i>
Pre-Dev.	0.20	0.44	0.87	1.72
Post-Dev.	0.15	0.25	0.41	0.69

VOLUME OF RUNOFF (Ac-ft.)

<i>Event</i>	<i>1-yr.</i>	<i>2-yr.</i>	<i>10-yr.</i>	<i>100-yr.</i>
Pre-Dev.	0.017	0.034	0.063	0.122
Post-Dev.	0.011	0.018	0.029	0.050

Standard #3: Loss of annual recharge to groundwater shall be eliminated...

There is no loss of annual recharge to groundwater because the project proposes roof drywells to capture and promote recharge.

Recharge Volume = (0.35 inch of runoff) (Total Proposed Impervious Area)

The proposed roof and retaining walls result in 30,884 s.f. of impervious area.

Minimum Recharge Volume = (0.35 in.) (30,884 s.f.(1 ft./12 in.)) = 900 c.f.

PROVIDED RECHARGE = 5,581 c.f.

(Provided within the roof drywells and crushed stone – see HydroCAD results in Appendix B)

Standard #4: Stormwater management systems...shall remove 80% of the average... TSS....

Requirement: Provide 80% TSS Removal of the Water Quality Volume.

Water Quality Volume = (1.0 inch of runoff) (Total Driveway Area*)

The proposed driveway results in an impervious area of 19,733 s.f.

Therefore - Minimum Water Quality Volume = (1.0 in.) (19,733 s.f.(1 ft./12 in.)) = 1,644 c.f. (min.)

PROVIDED RECHARGE = 5,581 c.f.

**Total impervious area for Std. 4 Calculation is not required to include roof or patio runoff, as roof and patio runoff is considered clean and free of suspended solids (non-metal roof is proposed).*

Standard #5: Stormwater discharges from Land Uses with Higher Potential Pollutant Loads

Not applicable. The proposed uses are not considered a land use with higher potential pollutant loads.

Standard #6: Stormwater discharges to critical areas...

The site is not located within an area designated as an Outstanding Resource Water or other designated critical area.

Standard #7: A redevelopment project is required to meet standards....only to the extent practicable

The project cannot be considered a redevelopment project. It complies with all applicable standards.

Standard #8: Erosion & Sedimental Control Plan

An Erosion & Sedimentation Control plan is submitted in Appendix A of this report.

Standard #9: A Long-Term Operation & Maintenance Plan shall be developed...

A Post-Construction Operation & Maintenance Plan is submitted in Appendix A of this report.

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

An illicit discharge compliance statement is submitted in Appendix A of this report.

Erosion and Siltation Control

The potential for temporary off-site impacts due to erosion and migration of sediments will be mitigated by adherence to basic erosion control practices. Erosion control consisting of a staked mulch sock will be placed along the entire limit of work prior to project commencement, which will serve to clearly define the limit of work. The integrity of the erosion control barrier will be maintained by periodic inspection and replacement as necessary. The barrier will remain in place until all disturbed surfaces have been loamed and seeded and vegetation has been established.

Silt socks will be placed on all existing catch basins and newly installed catch basins until the site is fully stabilized in order to prevent any undue sedimentation build up. A stabilized crushed stone construction entrance is to be provided as shown on the site plan and will be maintained until the site is fully stabilized or until the new driveway is installed.

Application Date:

7.14.22



Town of Scituate Stormwater Permit Application

April, 2009

Revised December 2011, August 2015, October 2016

Do not fill out this form if areas proposed to be altered are subject to the Wetland Protection Act, Local Wetlands Bylaw, Rivers Act or other Conservation Commission Jurisdiction. You must file an application with the Conservation Commission who will also review stormwater.

1. General Information and Site Features

John Tedeschi	(781) 424-8551	johntedeschi17@comcast.net
Owner's Name	Phone No	E-mail
Contractor's Name	Phone No	E-mail
61 New Driftway		
Site Address		
53-3-2A	34,727	
Map-Block-Lot	Lot Area (Sq ft):	
Book 37580 Page 266		
Recording Information: (Book & Page or Certificate number if registered land)		

CHECK ONE AND GO TO THE APPLICABLE SECTION:

- () Site is undeveloped land. Go to **A.** below.
- Existing buildings may be razed or an addition may be proposed. Site currently contains building(s), a driveway, grading, landscaping, or other developed area. Go to **B.** below.

A. Total Number of Sq. ft. to be Altered or Disturbed:	Proposed Impervious Area (sq. ft.):	Area disturbed on >25% slopes, if any:
B. Existing Impervious Area (include building footprint, paved driveway, patio, walkway, pool or any other pavement or hard surface) (sq. ft.):	Proposed Impervious Area (sq. ft.):	% Increase:
19,384 s.f.	30,884 s.f.	59%

2. Proposed Activity

- ↑ New Re-grading or Clearing Area (sq. ft.) 34,000 s.f.
- Addition of Impervious Area Existing (sq. ft.) 19,384 Proposed (sq. ft.) 30,884
- Construct New Home or Reconstruct Existing Home
- Subdivision and/or Common Driveway # of Lots: _____
- New Business / Commercial / Industrial Development or Redevelopment
- Other

2. Applicant

John Tedeschi
Applicant (print)



Applicant (signature) (If using a representative, attach letter of authorization)

PO Box 361

Mailing Address

Scituate

MA

02066

Town

State

Zip Code

johntedeschi17@comcast.net

(781) 424-8551

Email

Telephone (including area code)

3. Property Owner (if different from applicant)

Property Owner(s) All owners must be listed w/printed name and signatures

Mailing Address

Town

State

Zip Code

Email

Telephone (including area code)

4. Authorized Representative

Gregory J. Morse, P.E.

Authorized Representative
10 New Driftway

Address

Scituate

MA

02066

Town

State

Zip Code

gmorse@morsecoinc.com

(781) 545-0895

Email

Telephone (cell phone where available)

5. Builder / Contractor Information

Builder / Contractor Name

Address

Town

State

Zip Code

Email

Telephone (cell phone where available)

6. Description of Stormwater Management System

Describe overall system of stormwater management: All pavement and roof areas are directed to a system of subsurface infiltration Cultec chambers.

Describe use of BMP's and LID techniques: Cultec subsurface infiltration chambers.

Describe long term maintenance and the party responsible, including inspection schedules:
See attached O&M plans.

- Please feel free to attach a narrative
- Plan and Information on Erosion / Sedimentation Control provided

7. Stormwater Management Plan and Report

The Stormwater Permit Application must include submission of a **Land Alteration and Stormwater Management Plan and Report**. The purpose of the Stormwater Management Plan is to ensure that the runoff from a site has been treated for water quality and quantity impacts during the construction of the project and for the long term. See the Scituate Stormwater Regulations for additional information and references to Low Impact Development and Best Management Practices, and requirements for plan contents.

The applicant shall provide a narrative and supporting drainage calculations containing sufficient information for the Town to evaluate the environmental impact, effectiveness, and acceptability of the measures proposed by the applicant for reducing adverse impacts from stormwater. The calculations **must** include a diagram depicting the flow of runoff through the proposed system for treatment.

The Stormwater Report shall indicate the extent of compliance with the Stormwater Management Standards identified in the Scituate Stormwater Regulations.

All components of the Stormwater Management Plan shall be prepared and stamped by a licensed Professional Engineer for all site plans, subdivisions and residential projects greater than 2 building lots.

8. Engineer's Agreement

In signing the plan, the authorized representative certifies that the information is true and assumes liability for the plan. In addition, the undersigned agrees:

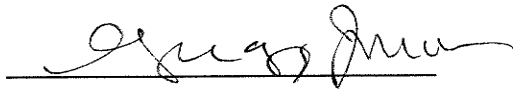
1. To furnish additional information relating to the quality or quantity of the stormwater from this site or evaluation of the adequacy of the stormwater management system for which this permit is sought as may be requested by the Planning Board or Conservation Commission.
2. To accept and abide by all the provisions of the Stormwater Bylaw of the Town of Scituate and of all other pertinent local, state or federal laws and regulations regarding stormwater discharge.
3. An Operation & Maintenance Plan will be submitted with the application which provides for the homeowner(s) to own, operate and maintain any stormwater management facilities in an efficient manner that supports their continued successful operation, with no municipal responsibility or liability, and at no expense to the Town, and includes a description of the timing and type of maintenance required.
4. That this plan require the notification of the Planning Board or Conservation Commission, as applicable, and Department of Public Works immediately in the event of any accident, negligence, or other occurrence that occasions discharge to the storm drain or any downstream wetlands or waterways, of any wastes or process waters not covered by this permit or allowed by the Stormwater Bylaw.
5. That this plan indemnify the Town of Scituate from loss or damage that may directly or indirectly be occasioned by the installation and use of the Stormwater Management System, and related facilities or connections.
6. To cooperate at all items with the Planning Board or Conservation Commission, as applicable, and the Department of Public Works, and their representatives in the inspection of the stormwater management system authorized by this Permit, and any maintenance thereof.

9. Engineer Certification Statement

The Stormwater Permit Application must include a statement signed by the applicant or his representative that the drainage system can be expected to result in post-development runoff characteristics (including peak flow, total volume of runoff, and water quality of the runoff) for development and redevelopment projects equal to or less than the pre-development runoff characteristics. It is recommended that this be by a Professional Engineer.

I hereby certify that I prepared the Plan, that I have reviewed the Town of Scituate Stormwater Regulations, and that the drainage system will result in post-development runoff characteristics equal to or less than the pre-development runoff characteristics.

SIGNED UNDER OATH AND SUBJECT TO PENALTIES OF PERJURY THIS 13th DAY OF July, 2022



Signature of Registered Engineer

(Print Name: Gregory J. Morse)



APPENDIX

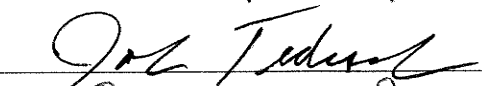
**Town of Scituate
Application for a Stormwater Permit**

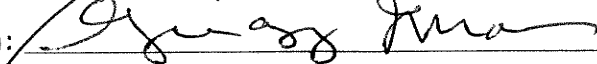
All applications shall also include a Stormwater Report including:

- A narrative describing the proposed system of stormwater management, the stormwater practices employed, including best management practices, better site design and Low Impact Development techniques
- Drainage calculations, with a diagram depicting the flow of runoff through the proposed system for treatment
- A Stormwater Management Plan
- An Operation and Maintenance Plan

Name of Applicant: John Tedeschi	Address: PO Box 361	Phone: 781-424-8551
Address of Property: 61 New Driftway	Is application for new development, redevelopment, or a mix of new and redevelopment? New Development	Plan meets standard for 80% removal of total suspended solids: Yes
Plan shows existing and proposed topography: Yes	Soil information provided: Yes	Plan shows location and capacity of BMP's: Yes
Area of lot to be altered or disturbed: 34,000 s.f.	Pre-development area of impervious surface: 19,384 s.f.	Post-development area of impervious surface: 30,884 s.f.
Name of Engineer, if any, who prepared Stormwater Report: Gregory J. Morse, P.E.	Address of engineer: 10 New Driftway	Phone and E-mail of engineer: (781) 545-0895 gmorse@morsecoinc.com
Map-Block-Lot #s of all parcel(s) included in site: 53-3-2A	Disturbance is within 100' of wetlands: No	LID Measures Used: Subsurface Infiltration Chambers
	Erosion and Sedimentation Plan Included: Yes	Plan for maintenance of stormwater management system provided: Yes

The drainage system can be expected to result in post-development runoff characteristics (including peak flow, total volume of runoff, and water quality of the runoff) for development and redevelopment projects equal to or less than pre-development.

Applicant's Signature: 

Engineer's Certification:  (Recommended)

APPENDIX A

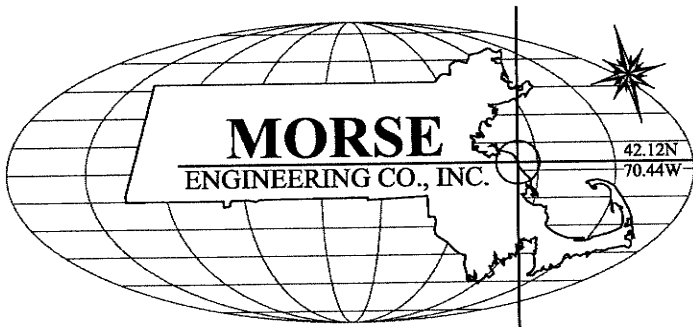
- Best Management Practices - Inspection Schedule & Evaluation Checklist
- Long-term Operation & Maintenance Plan
- Cultec O&M Maintenance Plan
- Illicit Discharge Compliance Statement
- TSS Removal Worksheet
- Drawdown Calculations
- Mounding Analysis

Construction Phase
Operation & Maintenance Plan
Best Management Practices
MA DEP Stormwater Management Policy

Project
61 New Driftway
Scituate, MA 02066
Assessor's Parcels: 53-3-2A
Proposed Mixed-Use Building

Applicant/Owner
John Tedeschi
PO Box 361
Scituate, MA 02066

Date: July 14, 2022



*Registered Professional Engineers,
Project Managers & Environmental Consultants*

10 New Driftway Street, P.O. Box 92
Scituate, MA 02066
Tel. 781.545.0895
GMorse@Morsecoinc.com

www.MorseCoInc.com

Construction Phase Operation & Maintenance Plan
Best Management Practices
61 New Driftway
Scituate, MA

Responsible Parties & Contact Information:

Applicant/Owner:

John Tedeschi
PO Box 361
Scituate, MA 02066
(781) 424-8551

Contractor / Stormwater Manager:

Name:
Address:
Address:
Contact:

Inspection & Record Keeping:

The responsible party shall maintain an operation and maintenance log during construction to control construction-related impacts, including erosion, sedimentation and other pollutant sources and land disturbance activities.

The responsible party shall inspect the construction site at least once every 14 calendar days and within 24 hours of a storm event of ½ inch or greater. Inspections shall be performed until the site is fully stabilized and the temporary sedimentation controls have been removed. The inspector shall inspect each measure to determine if it was installed/performed correctly. The inspector shall also determine if the measures have been damaged and if so the corrective action.

The log shall be kept on-site at all times and shall be made available to MassDEP and Town officials upon request. Member and agents of MassDEP and the Town officials shall be allowed to enter and inspect the premises to evaluate and ensure that the responsible party complies with the Operation and Maintenance Plan requirements for each BMP.

Operation & Maintenance:

During land disturbance and construction activities, project proponents must implement controls that prevent erosion, control sediment movement, and stabilize exposed soils to prevent pollutants from moving offsite or entering wetlands or waters. Land disturbance activities include demolition, construction, clearing, excavation, grading, filling and reconstruction.

Construction activities increase the potential for erosion and sedimentation at a site which may adversely impact wetland resource areas. To prevent this impact, the following conditions shall be imposed to control erosion and sedimentation:

Erosion Control Barrier: An erosion control barrier shall be placed along the down-gradient limit of work/clearing prior to commencement of any construction activity. The integrity of the erosion control barrier shall be maintained by periodic inspection and replacement as necessary. The erosion control barrier shall remain in place until all disturbed surfaces have been loamed and seeded and vegetation has been established.

Stabilized Construction Entrance: A crushed stone construction entrance shall be installed at the entrance to the proposed construction area to prevent the migration of mud and sediments off-site. The entrance shall be inspected weekly and maintained in good condition. Additional stone shall be applied as necessary. Mud and sediment tracked onto the way shall be removed immediately.

Stabilization Practices: Disturbed areas shall be stabilized and protected as soon as practicable. Disturbed areas shall be stabilized when construction activity in the area has ceased for more than 14 days unless not feasible due to snow cover or if construction activities will resume within 21 days after construction temporarily ceased. Stabilization measures include the following:

- Temporary Seeding
- Geotextiles
- Mulching and Netting
- Permanent Seeding

Air Quality/Dust: Dust can be generated by dumping, excavating and moving the raw materials and exposed soil storage during periods of mechanical disturbance, transfer operations or high winds. Measures to mitigate dust emissions shall be utilized to reduce emissions and to minimize related impacts. These measures include: watering areas of exposed soils on a regular basis, vegetative cover, calcium chloride, stone and the use of tarpaulin covered trucks when transporting material.

Storage and Disposal of Hazardous Materials: Hazardous materials shall be stored and disposed of in accordance with the U.S. Environmental Protection Agency hazardous waste regulations and all other applicable regulations to ensure they do not adversely impact the environment.

In the event of a spill, the supervisor is to first contact the Fire Department and then notify the Police Department, Department of Public Works, Board of Health, and Conservation Commission. The Fire Department will assess the spill and determine if additional notifications are necessary and the level of cleanup.

The following equipment and materials shall be stored on-site at all times; sorbent pads, sand bags, speedi-dri absorbent and square end shovels.

Stockpiling: Temporary construction phase soil storage piles shall be stabilized or protected with sediment trapping measures to keep soil in place and prevent sediment runoff. Temporary perimeter protection such as berms, dikes and silt fences shall be applied to all soil piles. Stockpiles to be stored for an extended period of time shall be stabilized with vegetative cover.

Construction Phase: Erosion Control Maintenance Schedule & Checklist

Construction Practices

Best Management Practice	Inspection Frequency (1)	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check (1)	Cleaning/Repair Needed: <input type="checkbox"/> yes <input type="checkbox"/> no (List Items)	Date of Cleaning/Repair	Performed by
Construction Site Stabilization	Weekly			Construction Site Stabilization Inspection/ Maintenance, temporary seeding, mulching etc.			
Land Grading	Weekly			Check for washouts and/or gullies. Check for accumulated silt.			
Permanent Seeding	Bi-Weekly			Permanent Seeding Inspection/ Maintenance			
Soil Stockpiling	Daily			Check mulch sock around piles.			

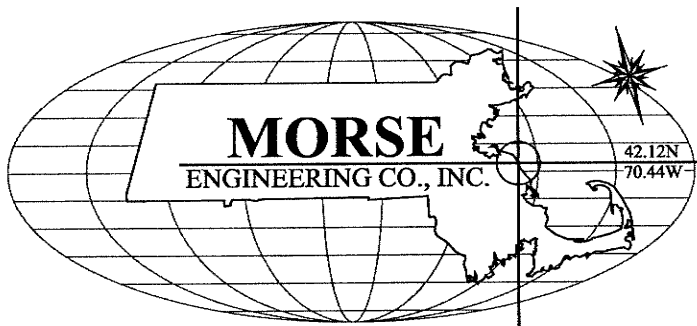
Stormwater Control Manager _____

Post-Construction Phase
Operation & Maintenance Plan
Best Management Practices
MA DEP Stormwater Management Policy

Project
61 New Driftway
Scituate, MA 02066
Assessor's Parcels: 53-3-2A
Proposed Multi-Family Building

Applicant/Owner
John Tedeschi
PO Box 361
Scituate, MA 02066

Date: July 14, 2022



*Registered Professional Engineers,
Project Managers & Environmental Consultants*

10 New Driftway, P.O. Box 92
Scituate, MA 02066
Tel. 781.545.0895
GMorse@Morsecoinc.com

www.MorseCoInc.com

Post Construction Phase Operation & Maintenance Plan
Best Management Practices
61 New Driftway
Scituate, MA

Responsible Parties & Contact Information:

Applicant/Owner:

John Tedeschi
PO Box 361
Scituate, MA 02066
(781) 424-8551

Record Keeping:

The responsible party shall maintain an operation and maintenance log for a minimum of three years prior including inspections, repairs, replacement and disposal. The log shall be kept on-site at all times.

The log shall be made available to MassDEP and the Town upon request. Members and agents of MassDEP and the Town shall be allowed to enter and inspect the premises to evaluate and ensure that the responsible party complies with the Operation and Maintenance Plan requirements for each BMP.

Operation & Maintenance:

In order to maintain the integrity of the stormwater management system, frequent inspections and maintenance shall be performed by the owner. The BMPs require continuous inspections and maintenance in order to function properly. The BMPs should be inspected and maintained as specified and after all major storm events.

Ground Cover shall be inspected at a minimum of every month and maintained as necessary. Maintenance includes removing any accumulated sediment, trash and debris and repairing erosion. Disposal of accumulated sediment must be in accordance with applicable local, state and federal guidelines and regulations. Important items to check during inspection include: signs of differential settlement or cracking of the pavement, erosion, tree growth on any embankments, condition of riprap and the health of the turf.

Subsurface Infiltration System & Gutter Downspout Systems shall be inspected at a minimum of twice a year and maintained as necessary. Maintenance includes inspecting water levels, removing debris, cleaning out gutter and downspouts systems, and replacing drywell systems if standing water is observed for greater than 72 hours after a storm event. Refer to Cultec O&M guidelines in Appendix A for further maintenance instructions.

HydroInternational First Defense Stormwater Separator shall be inspected routinely during the first year of installation and thereafter every six months. Maintenance includes inspecting water levels and sediment accumulation. At least once per year, a vacuor hose should be used to remove sediment from the separator.

Illicit Discharges:

No illicit discharges shall be created. An illicit discharge is any discharge that is not composed entirely of stormwater.

Storage and Disposal of Hazardous Materials:

Hazardous materials shall be stored and disposed of in accordance with the U.S. Environmental Protection Agency hazardous waste regulations and all other applicable regulations to ensure they do not adversely impact the environment.

The exterior storage of hazardous materials shall be prohibited.

In the event of a spill, the supervisor is to first contact the Fire Department and then notify the Police Department, Department of Public Works, Board of Health, and Conservation Commission. The Fire Department will assess the spill and determine if additional notifications are necessary and the level of cleanup.

Pesticides, Herbicides and Fertilizers

Fertilizers shall be restricted to organic fertilizers only. Pesticides and herbicides shall be used sparingly and applied by a professional applicator licensed under the Massachusetts Department of Agriculture.

The exterior storage of fertilizers, herbicides and fertilizers shall be prohibited.

Project Location : 61 New Driftway, Scituate, MA
Stormwater Management – Post Construction Phase
Best Management Practices – Inspection Schedule and Evaluation Checklist

Long Term Practices

Best Management Practice	Inspection Frequency	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning/Repair Needed: <input type="checkbox"/> yes <input type="checkbox"/> no (List Items)	Date of Cleaning/Repair	Performed by
Subsurface Infiltration System	Semi-Annually			Refer to CULTEC O&M Guidelines in Appendix A.			
Gutter and Downspout System	Quarterly			Remove material in gutters and downspouts. Install gutter guards. Inspect for signs of overflow to surcharge.			
Turf Management	Semi-Annually			Repair eroded site areas. Plant grass or mulch exposed soil surfaces.			
Driveway Surface	Semi-Annually			Sweep clean of accumulated sediments.			
Hydro-International First Defense	Semi-Annually			Regularly inspect separator during first year of use and every 6 months thereafter. Once per year, or as needed, sediment should be removed with a vacator hose.			

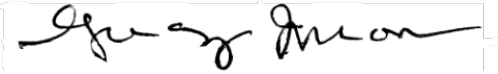
Illicit Discharge Compliance Statement

To: Town of Scituate
600 Chief Justice Cushing Highway
Town Hall
Scituate, MA 02066

RE: 61 New Driftway, Scituate, MA

To Whom it May Concern:

This letter is a statement that to the best of my knowledge, no illicit discharges currently exist or are being considered by me to the stormwater management system at the above referenced property.

A handwritten signature in black ink, appearing to read "Gregory J. Morse", enclosed in a thin black rectangular border.

Gregory J. Morse, P.E.
Applicant's Representative



Contactor® & Recharger® Stormwater Chambers



Operation and Maintenance Guidelines for CULTEC Stormwater Management Systems

The Founder of Plastic Chamber Technology

www.cultec.com | 1(800) 4-CULTEC |  





Operations and Maintenance Guidelines

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www.cultec.com

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U.S. Patents 6,129,482; 6,322,288; 6,854,925; 7,226,241; 7,806,627; 8,366,346; 8,425,148; and others; U.S. Designs D613819; D638,095; D668,318 and others; Canadian Patent 2,591,255 and others; Community Designs 1092191; 1745209; and others.

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Contact Information:

For general information on our other products and services, please contact our offices within the United States at (800)428-5832, (203)775-4416 ext. 202, or e-mail us at custservice@cultec.com.

For technical support, please call (203)775-4416 ext. 203 or e-mail tech@cultec.com.

Visit www.cultec.com/downloads.html for Product Downloads and CAD details.

Doc ID: CULG008 05-17
May 2017

These instructions are for single-layer traffic applications only. For multi-layer applications, contact CULTEC. All illustrations and photos shown herein are examples of typical situations. Be sure to follow the engineer's drawings. Actual designs may vary.

This manual contains guidelines recommended by CULTEC, Inc. and may be used in conjunction with, but not to supersede, local regulations or regulatory authorities. OSHA Guidelines must be followed when inspecting or cleaning any structure.

Introduction

The CULTEC Subsurface Stormwater Management System is a high-density polyethylene (HDPE) chamber system arranged in parallel rows surrounded by washed stone. The CULTEC chambers create arch-shaped voids within the washed stone to provide stormwater detention, retention, infiltration, and reclamation. Filter fabric is placed between the native soil and stone interface to prevent the intrusion of fines into the system. In order to minimize the amount of sediment which may enter the CULTEC system, a sediment collection device (stormwater pretreatment device) is recommended upstream from the CULTEC chamber system. Examples of pretreatment devices include, but are not limited to, an appropriately sized catch basin with sump, pretreatment catchment device, oil grit separator, or baffled distribution box. Manufactured pretreatment devices may also be used in accordance with CULTEC chambers. Installation, operation, and maintenance of these devices shall be in accordance with manufacturer's recommendations. Almost all of the sediment entering the stormwater management system will be collected within the pretreatment device.

Best Management Practices allow for the maintenance of the preliminary collection systems prior to feeding the CULTEC chambers. The pretreatment structures shall be inspected for any debris that will restrict inlet flow rates. Outfall structures, if any, such as outlet control must also be inspected for any obstructions that would restrict outlet flow rates. OSHA Guidelines must be followed when inspecting or cleaning any structure.

Operation and Maintenance Requirements

I. Operation

CULTEC stormwater management systems shall be operated to receive only stormwater run-off in accordance with applicable local regulations. CULTEC subsurface stormwater management chambers operate at peak performance when installed in series with pretreatment. Pretreatment of suspended solids is superior to treatment of solids once they have been introduced into the system. The use of pretreatment is adequate as long as the structure is maintained and the site remains stable with finished impervious surfaces such as parking lots, walkways, and pervious areas are properly maintained. If there is to be an unstable condition, such as improvements to buildings or parking areas, all proper silt control measures shall be implemented according to local regulations.

II. Inspection and Maintenance Options

- A. The CULTEC system may be equipped with an inspection port located on the inlet row. The inspection port is a circular cast box placed in a rectangular concrete collar. When the lid is removed, a 6-inch (150 mm) pipe with a screw-in plug will be exposed. Remove the plug. This will provide access to the CULTEC Chamber row below. From the surface, through this access, the sediment may be measured at this location. A stadia rod may be used to measure the depth of sediment if any in this row. If the depth of sediment is in excess of 3 inches (76 mm), then this row should be cleaned with high pressure water through a culvert cleaning nozzle. This would be carried out through an upstream manhole or through the CULTEC StormFilter Unit (or other pretreatment device). CCTV inspection of this row can be deployed through this access port to determine if any sediment has accumulated in the inlet row.
- B. If the CULTEC bed is not equipped with an inspection port, then access to the inlet row will be through an upstream manhole or the CULTEC StormFilter.
 1. **Manhole Access**

This inspection should only be carried out by persons trained in confined space entry and sewer inspection services. After the manhole cover has been removed a gas detector must be lowered into the manhole to ensure that there are not high concentrations of toxic gases present. The inspector should be lowered into the manhole with the proper safety equipment as per OSHA requirements. The inspector may be able to observe sediment from this location. If this is not possible, the inspector will need to deploy a CCTV robot to permit viewing of the sediment.

2. StormFilter Access

Remove the manhole cover to allow access to the unit. Typically a 30-inch (750 mm) pipe is used as a riser from the StormFilter to the surface. As in the case with manhole access, this access point requires a technician trained in confined space entry with proper gas detection equipment. This individual must be equipped with the proper safety equipment for entry into the StormFilter. The technician will be lowered onto the StormFilter unit. The hatch on the unit must be removed. Inside the unit are two filters which may be removed according to StormFilter maintenance guidelines. Once these filters are removed the inspector can enter the StormFilter unit to launch the CCTV camera robot.

- C. The inlet row of the CULTEC system is placed on a polyethylene liner to prevent scouring of the washed stone beneath this row. This also facilitates the flushing of this row with high pressure water through a culvert cleaning nozzle. The nozzle is deployed through a manhole or the StormFilter and extended to the end of the row. The water is turned on and the inlet row is back-flushed into the manhole or StormFilter. This water is to be removed from the manhole or StormFilter using a vacuum truck.

III. Maintenance Guidelines

The following guidelines shall be adhered to for the operation and maintenance of the CULTEC stormwater management system:

- A. The owner shall keep a maintenance log which shall include details of any events which would have an effect on the system's operational capacity.
- B. The operation and maintenance procedure shall be reviewed periodically and changed to meet site conditions.
- C. Maintenance of the stormwater management system shall be performed by qualified workers and shall follow applicable occupational health and safety requirements.
- D. Debris removed from the stormwater management system shall be disposed of in accordance with applicable laws and regulations.

IV. Suggested Maintenance Schedules

A. Minor Maintenance

The following suggested schedule shall be followed for routine maintenance during the regular operation of the stormwater system:

Frequency	Action
Monthly in first year	Check inlets and outlets for clogging and remove any debris, as required.
Spring and Fall	Check inlets and outlets for clogging and remove any debris, as required.
One year after commissioning and every third year following	Check inlets and outlets for clogging and remove any debris, as required.

B. Major Maintenance

The following suggested maintenance schedule shall be followed to maintain the performance of the CULTEC stormwater management chambers. Additional work may be necessary due to insufficient performance and other issues that might be found during the inspection of the stormwater management chambers. (See table on next page)



Frequency		Action
Inlets and Outlets	Every 3 years	<ul style="list-style-type: none"> Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.
	Spring and Fall	<ul style="list-style-type: none"> Check inlet and outlets for clogging and remove any debris as required.
CULTEC Stormwater Chambers	2 years after commissioning	<ul style="list-style-type: none"> Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique. Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated.
	9 years after commissioning every 9 years following	<ul style="list-style-type: none"> Clean stormwater management chambers and feed connectors of any debris. Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique. Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended.
	45 years after commissioning	<ul style="list-style-type: none"> Clean stormwater management chambers and feed connectors of any debris. Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required. Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique. Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection. Attain the appropriate approvals as required. Establish a new operation and maintenance schedule.
Surrounding Site	Monthly in 1 st year	<ul style="list-style-type: none"> Check for depressions in areas over and surrounding the stormwater management system.
	Spring and Fall	<ul style="list-style-type: none"> Check for depressions in areas over and surrounding the stormwater management system.
	Yearly	<ul style="list-style-type: none"> Confirm that no unauthorized modifications have been performed to the site.

For additional information concerning the maintenance of CULTEC Subsurface Stormwater Management Chambers, please contact CULTEC, Inc. at 1-800-428-5832.



10 New Driftway, Suite 303, P.O. Box 92
Scituate, MA 02066
(781) 545-0895

JOB _____

SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

SCALE _____

Drawdown Calculations

Coltec System (Large)

$$V_{\text{total}} = 4,861 \text{ cf} \quad (\text{Assume system fills to capacity})$$

$$\text{Time} = 4,861 \text{ cf} / (8.27 \text{ in/hr} \cdot 2,106 \text{ sf} \cdot 1/12")$$

$$\text{Time} = 3.3 \text{ hours} = 0.14 \text{ days}$$

Coltec System (Small)

$$V_{\text{total}} = 1,034.3 \text{ cf} \quad (\text{Assume system fills to capacity})$$

$$\text{Time} = 1,034.3 \text{ cf} / (8.27 \text{ in/hr} \cdot 465 \text{ sf} \cdot 1/12")$$

$$\text{Time} = 3.3 \text{ hours} = 0.14 \text{ days}$$

- 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.

Location:

BMP ¹	C TSS Removal Rate ¹	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
Subsurface Infiltration Structure	0.80	0.75	0.60	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15

Total TSS Removal =

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

Project:
 Prepared By:
 Date:

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

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey 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 (t), and the initial thickness of the saturated zone (h(0)), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a 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. Conversely, if the 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 basin. Users can 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 MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed** otherwise necessary iterations to converge on the correct solution will not be done and 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
R
Sy
K
x
y
t
h(0)

Recharge (infiltration) rate (feet/day)
 Specific yield, Sy (dimensionless, between 0 and 1)
 Horizontal hydraulic conductivity, Kh (feet/day)*
 1/2 length of basin (x direction, in feet)
 1/2 width of basin (y direction, in feet)
 duration of infiltration period (days)
 Initial thickness of saturated zone (feet)

Conversion Table	
Inch/hour	feet/day
0.67	1.33
2.00	4.00

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

h(max)
Δh(max)

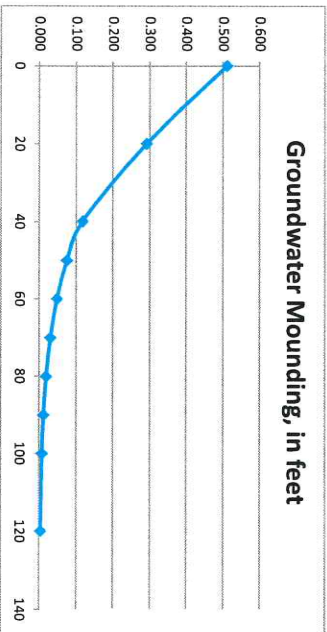
Ground- water Mounding, in feet
 Distance from center of basin in x direction, in feet

0.511	0
0.291	20
0.116	40
0.074	50
0.047	60
0.029	70
0.018	80
0.011	90
0.007	100
0.003	120



Re-Calculate Now

maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
 maximum groundwater mounding (beneath center of basin at end of infiltration period)



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.

61 New Driftway

7/13/2022

PGG

MOUNDING ANALYSIS

R (100 – Year) = Recharge (Infiltration Rate) (Ft/Day)

Infiltration rate was determined to be the quantity of water discarded in a 100-year storm over the drain time of the system.

$R \text{ (SUB-2C)} = (0.067 \text{ ac.ft.} \times 43,560 \text{ s.f./ac.}) / 465 \text{ s.f. system footprint} / (24 \text{ h} \times 1\text{day}/24 \text{ h}) = \underline{6.3 \text{ ft/day}}$

Sy = Specific Yield

Value per Table for Specific Yield of Various Geologic Materials (From Morris and Johnson 1967).

$Sy = 21\% \text{ (Average Value for Fine Sand)} = \underline{0.21}$

K = Horizontal Hydraulic Conductivity

Vertical soil permeability is assumed to be one-tenth of the horizontal hydraulic conductivity.

Vertical soil permeability was determined to be 8.27 in/hour = 16.54 ft/day.

Therefore $K = \underline{165.4 \text{ ft/day}}$

X and Y = ½ Length and Width of Basin

T = Duration of Infiltration Period, Days

The designed system has a drain down time of 3.3 hours = 0.14 days

hi = Initial Saturated Thickness

Initial saturated thickness is conservatively assumed to be 10-ft based on testpit data.

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey 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 (t), and the initial thickness of the saturated zone (h(0)), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a 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. Conversely, if the 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 basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.

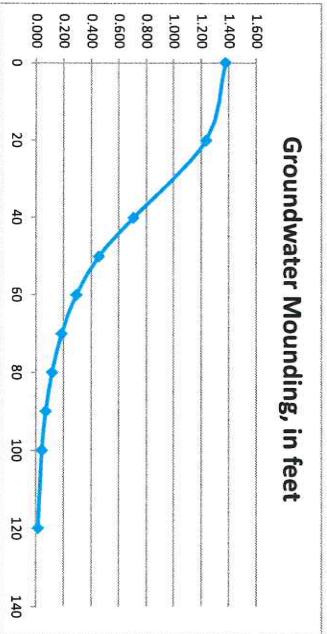
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. **The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed** otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days).

Input Values	
R	6.5000
Sy	0.210
K	165.40
x	36.000
y	14.600
t	0.140
h(0)	10.000

	Conversion Table
	Inch/hour feet/day
Recharge (infiltration) rate (feet/day)	0.67 1.33
Specific yield, Sy (dimensionless, between 0 and 1)	
Horizontal hydraulic conductivity, Kh (feet/day)*	2.00 4.00
1/2 length of basin (x direction, in feet)	
1/2 width of basin (y direction, in feet)	hours days
duration of infiltration period (days)	36 1.50
Initial thickness of saturated zone (feet)	hydraulic conductivity (ft/d).

maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
 maximum groundwater mounding (beneath center of basin at end of infiltration period)

h(max)	11.374
Δh(max)	1.374
Ground-water mounding, in feet	Distance from center of basin in x direction, in feet
0	1.374
20	1.235
40	0.706
50	0.454
60	0.291
70	0.184
80	0.114
90	0.069
100	0.041
120	0.014



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.

61 New Driftway

7/13/2022

PGG

MOUNDING ANALYSIS

R (100 – Year) = Recharge (Infiltration Rate) (Ft/Day)

Infiltration rate was determined to be the quantity of water discarded in a 100-year storm over the drain time of the system.

$R \text{ (SUB-2A \& 2B)} = (0.315 \text{ ac.ft.} \times 43,560 \text{ s.f./ac.}) / 2,106 \text{ s.f. system footprint} / (24 \text{ h} \times 1\text{day}/24 \text{ h}) = \underline{6.5 \text{ ft/day}}$

Sy = Specific Yield

Value per Table for Specific Yield of Various Geologic Materials (From Morris and Johnson 1967).

$Sy = 21\% \text{ (Average Value for Fine Sand)} = \underline{0.21}$

K = Horizontal Hydraulic Conductivity

Vertical soil permeability is assumed to be one-tenth of the horizontal hydraulic conductivity.

Vertical soil permeability was determined to be 8.27 in/hour = 16.54 ft/day.

Therefore $K = \underline{165.4 \text{ ft/day}}$

X and Y = ½ Length and Width of Basin

T = Duration of Infiltration Period, Days

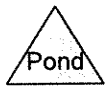
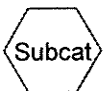
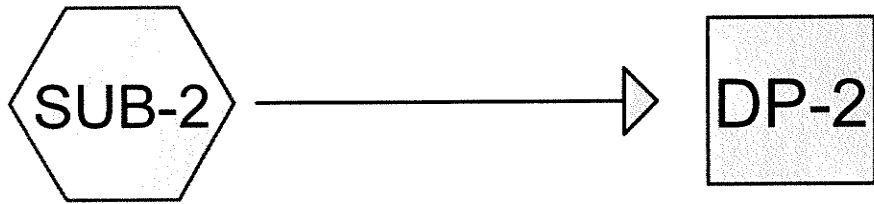
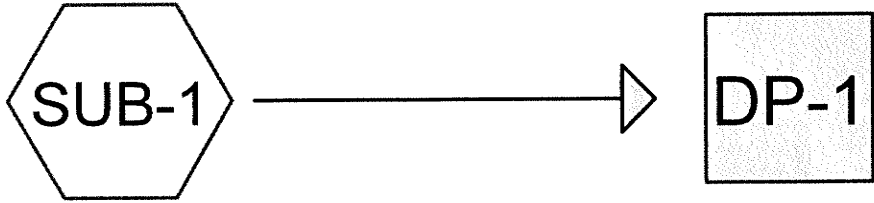
The designed system has a drain down time of 3.3 hours = 0.14 days

hi = Initial Saturated Thickness

Initial saturated thickness is conservatively assumed to be 10-ft based on testpit data.

APPENDIX B

- Pre-Development HydroCAD Analysis
- Post-Development HydroCAD Analysis



Existing Conditions

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Page 2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.130	55	Woods, Good, HSG B (SUB-1, SUB-2)
0.296	61	>75% Grass cover, Good, HSG B (SUB-1, SUB-2)
0.398	98	Pavement (SUB-1, SUB-2)
0.047	98	Roof (SUB-1, SUB-2)
0.871	79	TOTAL AREA

Existing Conditions

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.427	HSG B	SUB-1, SUB-2
0.000	HSG C	
0.000	HSG D	
0.444	Other	SUB-1, SUB-2
0.871		TOTAL AREA

Existing Conditions

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Type III 24-hr 1-Year Rainfall=2.50"

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Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment SUB-1:

Runoff Area=21,264 sf 65.70% Impervious Runoff Depth>1.18"
Flow Length=145' Tc=8.0 min CN=85 Runoff=0.62 cfs 0.048 af

Subcatchment SUB-2:

Runoff Area=16,680 sf 32.28% Impervious Runoff Depth>0.53"
Tc=6.0 min CN=72 Runoff=0.20 cfs 0.017 af

Reach DP-1:

Inflow=0.62 cfs 0.048 af
Outflow=0.62 cfs 0.048 af

Reach DP-2:

Inflow=0.20 cfs 0.017 af
Outflow=0.20 cfs 0.017 af

Total Runoff Area = 0.871 ac Runoff Volume = 0.065 af Average Runoff Depth = 0.89"
48.99% Pervious = 0.427 ac 51.01% Impervious = 0.444 ac

Existing Conditions

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Type III 24-hr 1-Year Rainfall=2.50"

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Summary for Subcatchment SUB-1:

Runoff = 0.62 cfs @ 12.12 hrs, Volume= 0.048 af, Depth> 1.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
 Type III 24-hr 1-Year Rainfall=2.50"

Area (sf)	CN	Description
* 387	98	Roof
2,448	55	Woods, Good, HSG B
* 13,584	98	Pavement
4,845	61	>75% Grass cover, Good, HSG B
21,264	85	Weighted Average
7,293		34.30% Pervious Area
13,971		65.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	25	0.0400	0.08		Sheet Flow, 0-25' Woods: Light underbrush n= 0.400 P2= 3.40"
2.4	25	0.0400	0.18		Sheet Flow, 25-50' Grass: Short n= 0.150 P2= 3.40"
0.2	50	0.0500	3.35		Shallow Concentrated Flow, 50-100' Grassed Waterway Kv= 15.0 fps
0.2	45	0.0300	3.52		Shallow Concentrated Flow, 100-145' Paved Kv= 20.3 fps
8.0	145	Total			

Existing Conditions

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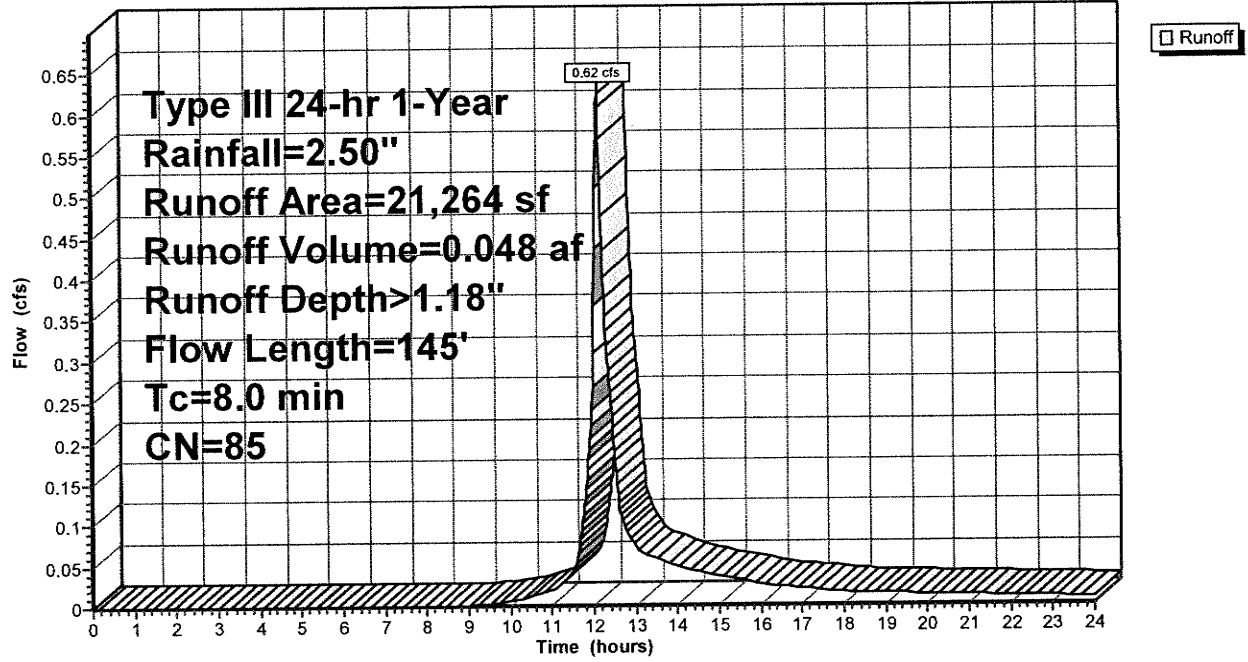
Type III 24-hr 1-Year Rainfall=2.50"

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Page 6

Subcatchment SUB-1:

Hydrograph



Existing Conditions

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Type III 24-hr 1-Year Rainfall=2.50"

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Page 7

Summary for Subcatchment SUB-2:

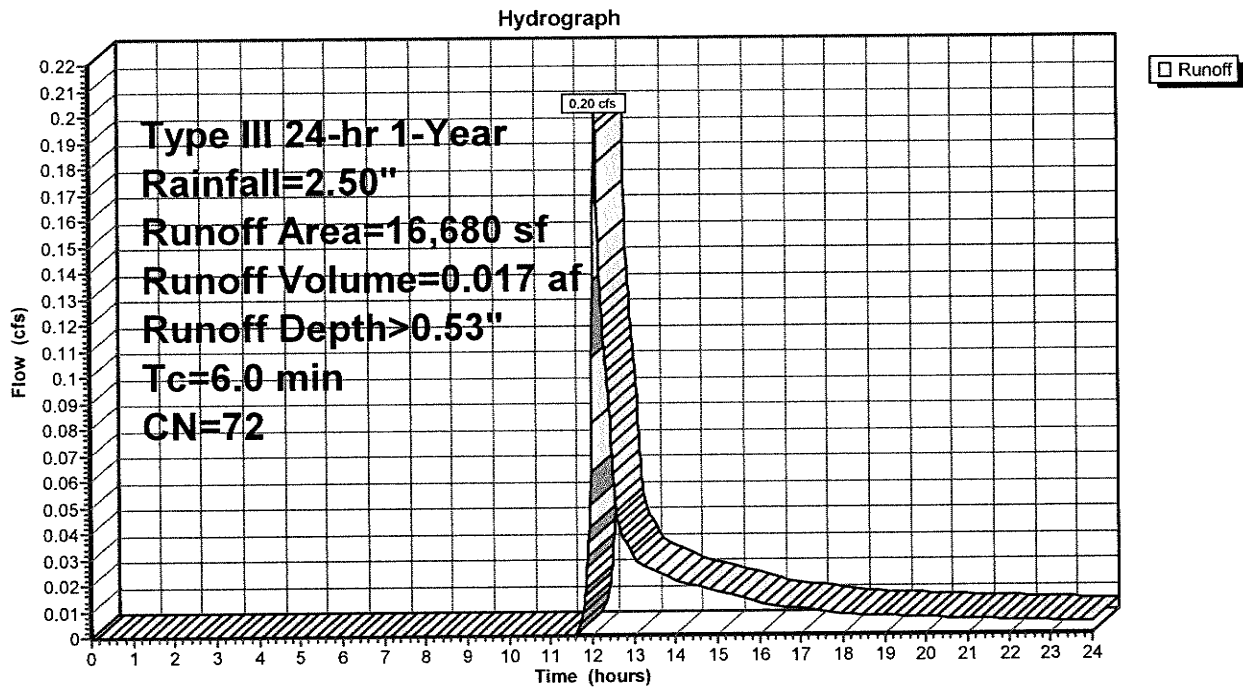
Runoff = 0.20 cfs @ 12.11 hrs, Volume= 0.017 af, Depth> 0.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
 Type III 24-hr 1-Year Rainfall=2.50"

	Area (sf)	CN	Description
*	1,640	98	Roof
*	3,744	98	Pavement
	3,229	55	Woods, Good, HSG B
	8,067	61	>75% Grass cover, Good, HSG B
	16,680	72	Weighted Average
	11,296		67.72% Pervious Area
	5,384		32.28% Impervious Area

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

Subcatchment SUB-2:



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Type III 24-hr 1-Year Rainfall=2.50"

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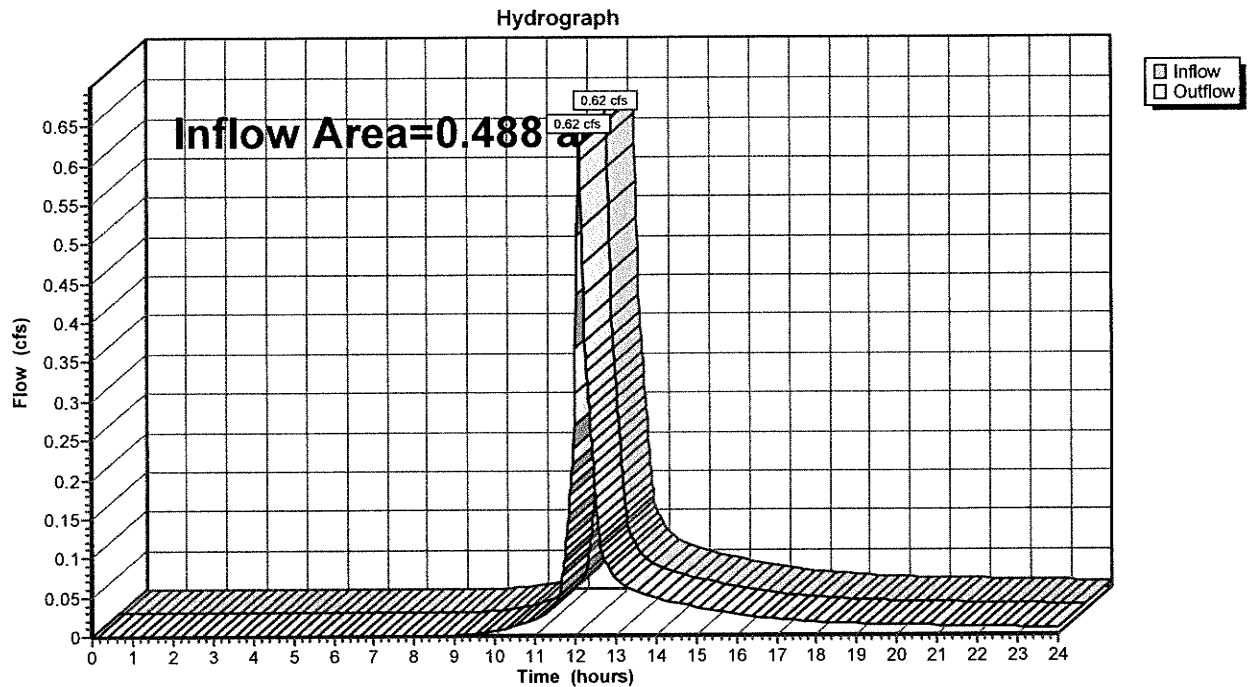
Page 8

Summary for Reach DP-1:

Inflow Area = 0.488 ac, 65.70% Impervious, Inflow Depth > 1.18" for 1-Year event
Inflow = 0.62 cfs @ 12.12 hrs, Volume= 0.048 af
Outflow = 0.62 cfs @ 12.12 hrs, Volume= 0.048 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-1:



Existing Conditions

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Type III 24-hr 1-Year Rainfall=2.50"

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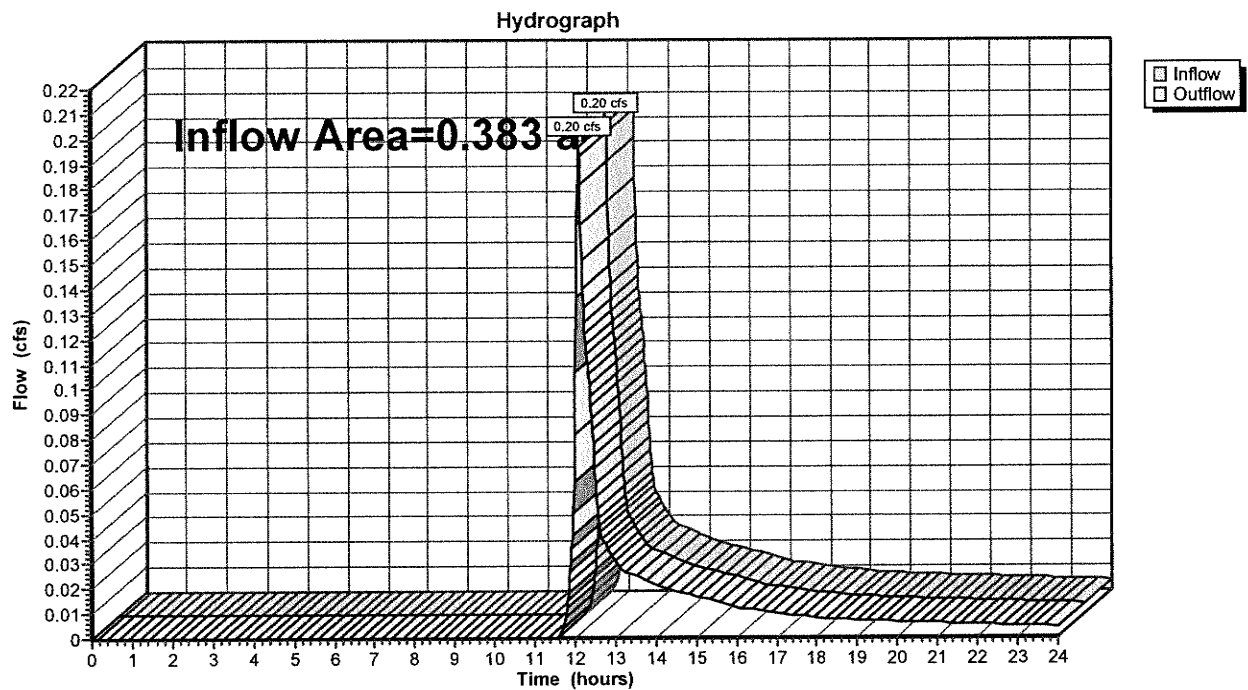
Page 9

Summary for Reach DP-2:

Inflow Area = 0.383 ac, 32.28% Impervious, Inflow Depth > 0.53" for 1-Year event
Inflow = 0.20 cfs @ 12.11 hrs, Volume= 0.017 af
Outflow = 0.20 cfs @ 12.11 hrs, Volume= 0.017 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-2:



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Type III 24-hr 2-Year Rainfall=3.40"

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Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment SUB-1:

Runoff Area=21,264 sf 65.70% Impervious Runoff Depth>1.93"
Flow Length=145' Tc=8.0 min CN=85 Runoff=1.03 cfs 0.078 af

Subcatchment SUB-2:

Runoff Area=16,680 sf 32.28% Impervious Runoff Depth>1.05"
Tc=6.0 min CN=72 Runoff=0.44 cfs 0.034 af

Reach DP-1:

Inflow=1.03 cfs 0.078 af
Outflow=1.03 cfs 0.078 af

Reach DP-2:

Inflow=0.44 cfs 0.034 af
Outflow=0.44 cfs 0.034 af

Total Runoff Area = 0.871 ac Runoff Volume = 0.112 af Average Runoff Depth = 1.54"
48.99% Pervious = 0.427 ac 51.01% Impervious = 0.444 ac

Existing Conditions

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Type III 24-hr 2-Year Rainfall=3.40"

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Summary for Subcatchment SUB-1:

Runoff = 1.03 cfs @ 12.11 hrs, Volume= 0.078 af, Depth> 1.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
 Type III 24-hr 2-Year Rainfall=3.40"

Area (sf)	CN	Description
* 387	98	Roof
2,448	55	Woods, Good, HSG B
* 13,584	98	Pavement
4,845	61	>75% Grass cover, Good, HSG B
21,264	85	Weighted Average
7,293		34.30% Pervious Area
13,971		65.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	25	0.0400	0.08		Sheet Flow, 0-25' Woods: Light underbrush n= 0.400 P2= 3.40"
2.4	25	0.0400	0.18		Sheet Flow, 25-50' Grass: Short n= 0.150 P2= 3.40"
0.2	50	0.0500	3.35		Shallow Concentrated Flow, 50-100' Grassed Waterway Kv= 15.0 fps
0.2	45	0.0300	3.52		Shallow Concentrated Flow, 100-145' Paved Kv= 20.3 fps
8.0	145	Total			

Existing Conditions

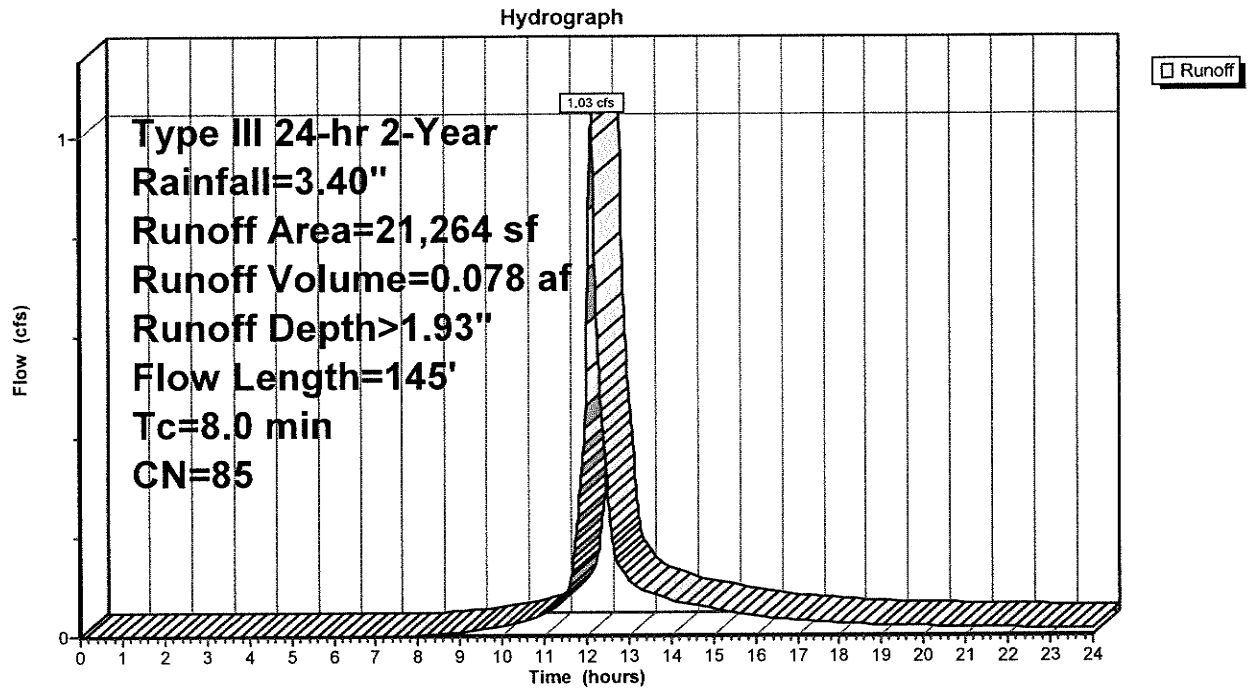
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Type III 24-hr 2-Year Rainfall=3.40"

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Subcatchment SUB-1:



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Type III 24-hr 2-Year Rainfall=3.40"

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Summary for Subcatchment SUB-2:

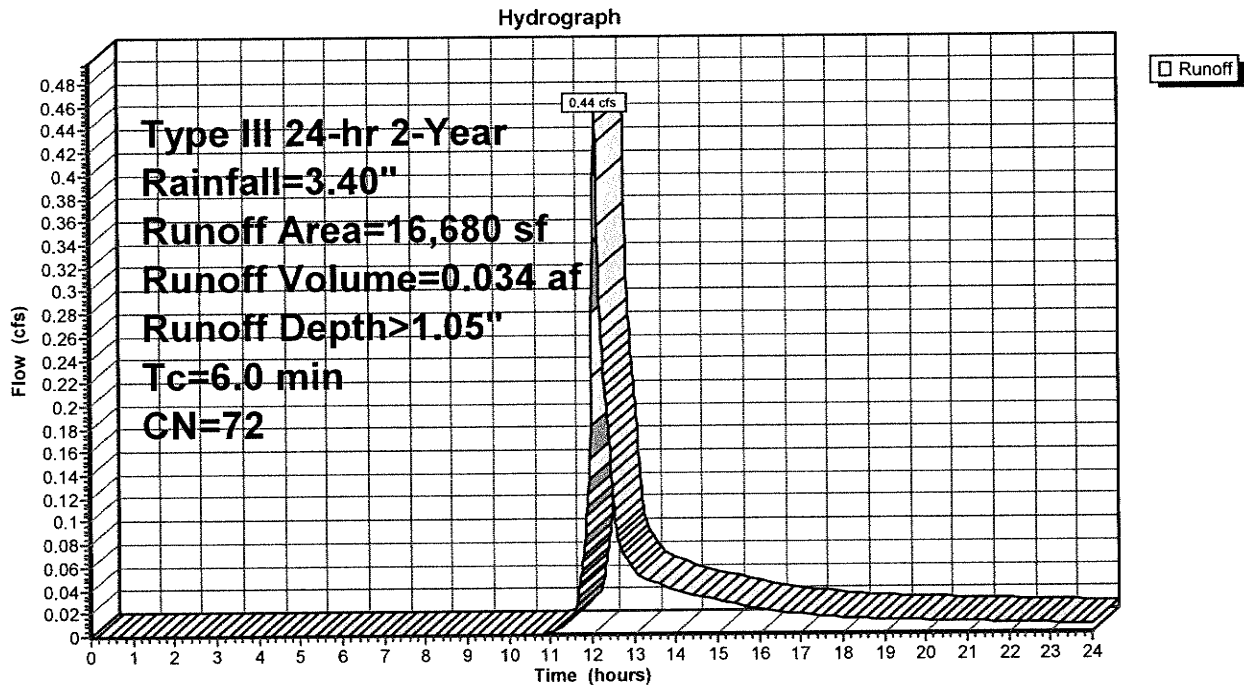
Runoff = 0.44 cfs @ 12.10 hrs, Volume= 0.034 af, Depth> 1.05"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
 Type III 24-hr 2-Year Rainfall=3.40"

	Area (sf)	CN	Description
*	1,640	98	Roof
*	3,744	98	Pavement
	3,229	55	Woods, Good, HSG B
	8,067	61	>75% Grass cover, Good, HSG B
	16,680	72	Weighted Average
	11,296		67.72% Pervious Area
	5,384		32.28% Impervious Area

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

Subcatchment SUB-2:



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Type III 24-hr 2-Year Rainfall=3.40"

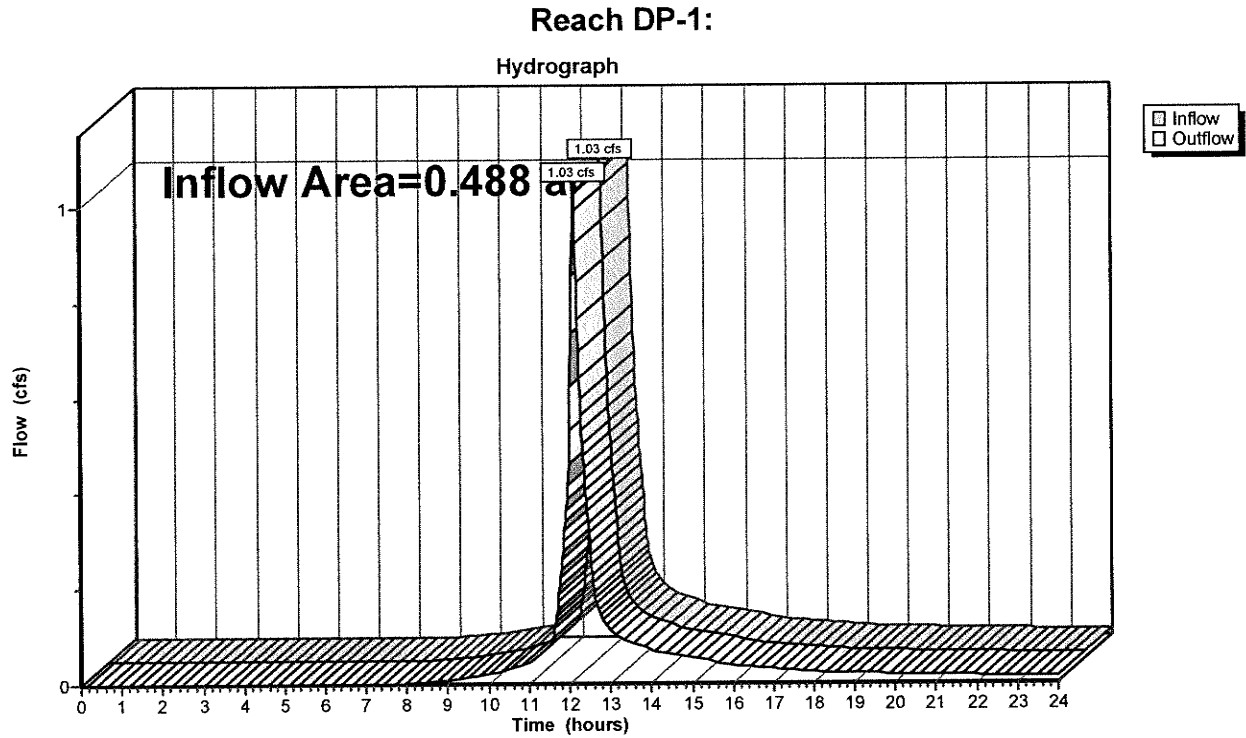
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Summary for Reach DP-1:

Inflow Area = 0.488 ac, 65.70% Impervious, Inflow Depth > 1.93" for 2-Year event
Inflow = 1.03 cfs @ 12.11 hrs, Volume= 0.078 af
Outflow = 1.03 cfs @ 12.11 hrs, Volume= 0.078 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs



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Type III 24-hr 2-Year Rainfall=3.40"

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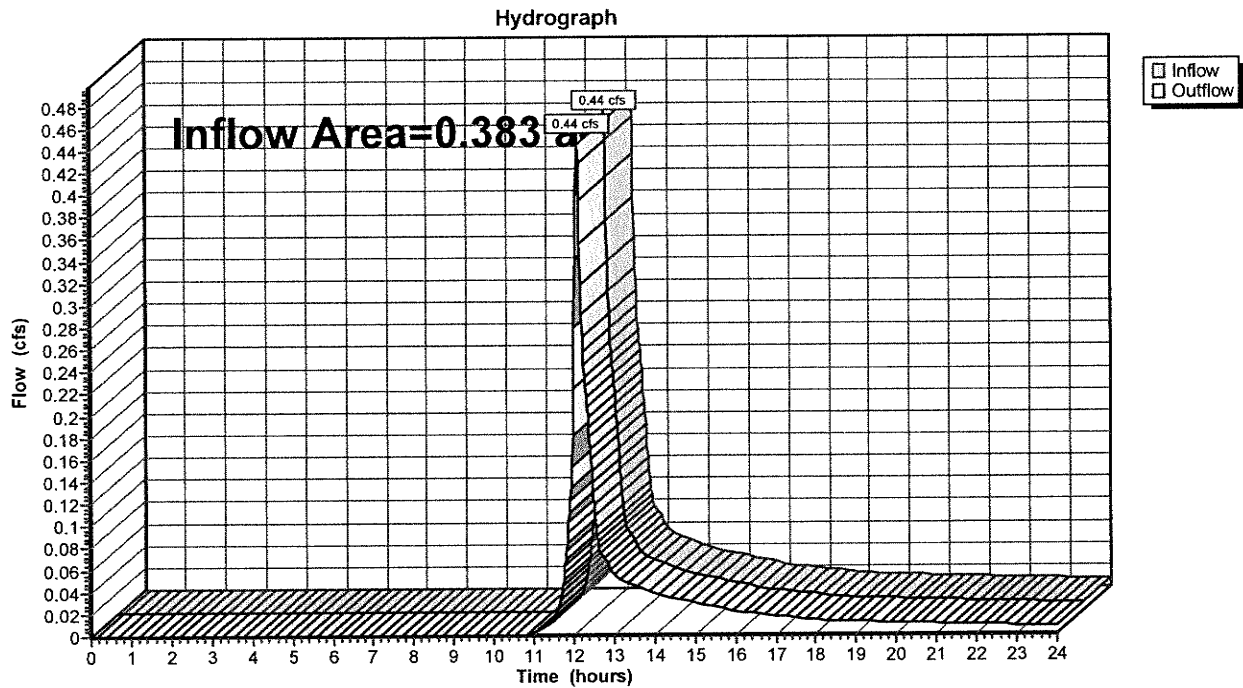
Page 15

Summary for Reach DP-2:

Inflow Area = 0.383 ac, 32.28% Impervious, Inflow Depth > 1.05" for 2-Year event
Inflow = 0.44 cfs @ 12.10 hrs, Volume= 0.034 af
Outflow = 0.44 cfs @ 12.10 hrs, Volume= 0.034 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-2:



Existing Conditions

Type III 24-hr 10-Year Rainfall=4.70"

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Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment SUB-1:

Runoff Area=21,264 sf 65.70% Impervious Runoff Depth>3.09"
Flow Length=145' Tc=8.0 min CN=85 Runoff=1.64 cfs 0.126 af

Subcatchment SUB-2:

Runoff Area=16,680 sf 32.28% Impervious Runoff Depth>1.97"
Tc=6.0 min CN=72 Runoff=0.87 cfs 0.063 af

Reach DP-1:

Inflow=1.64 cfs 0.126 af
Outflow=1.64 cfs 0.126 af

Reach DP-2:

Inflow=0.87 cfs 0.063 af
Outflow=0.87 cfs 0.063 af

Total Runoff Area = 0.871 ac Runoff Volume = 0.188 af Average Runoff Depth = 2.60"
48.99% Pervious = 0.427 ac 51.01% Impervious = 0.444 ac

Existing Conditions

Type III 24-hr 10-Year Rainfall=4.70"

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Summary for Subcatchment SUB-1:

Runoff = 1.64 cfs @ 12.11 hrs, Volume= 0.126 af, Depth> 3.09"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
* 387	98	Roof
2,448	55	Woods, Good, HSG B
* 13,584	98	Pavement
4,845	61	>75% Grass cover, Good, HSG B
21,264	85	Weighted Average
7,293		34.30% Pervious Area
13,971		65.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	25	0.0400	0.08		Sheet Flow, 0-25' Woods: Light underbrush n= 0.400 P2= 3.40"
2.4	25	0.0400	0.18		Sheet Flow, 25-50' Grass: Short n= 0.150 P2= 3.40"
0.2	50	0.0500	3.35		Shallow Concentrated Flow, 50-100' Grassed Waterway Kv= 15.0 fps
0.2	45	0.0300	3.52		Shallow Concentrated Flow, 100-145' Paved Kv= 20.3 fps
8.0	145	Total			

Existing Conditions

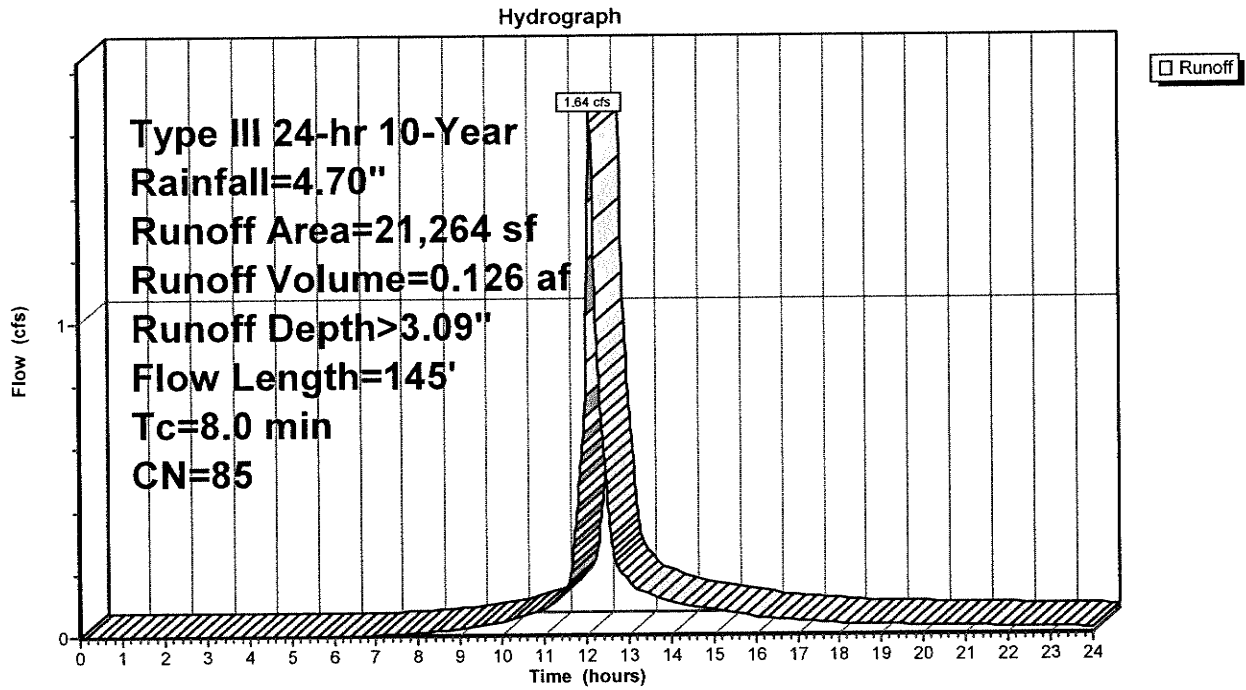
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Type III 24-hr 10-Year Rainfall=4.70"

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Subcatchment SUB-1:



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Type III 24-hr 10-Year Rainfall=4.70"

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Summary for Subcatchment SUB-2:

Runoff = 0.87 cfs @ 12.09 hrs, Volume= 0.063 af, Depth> 1.97"

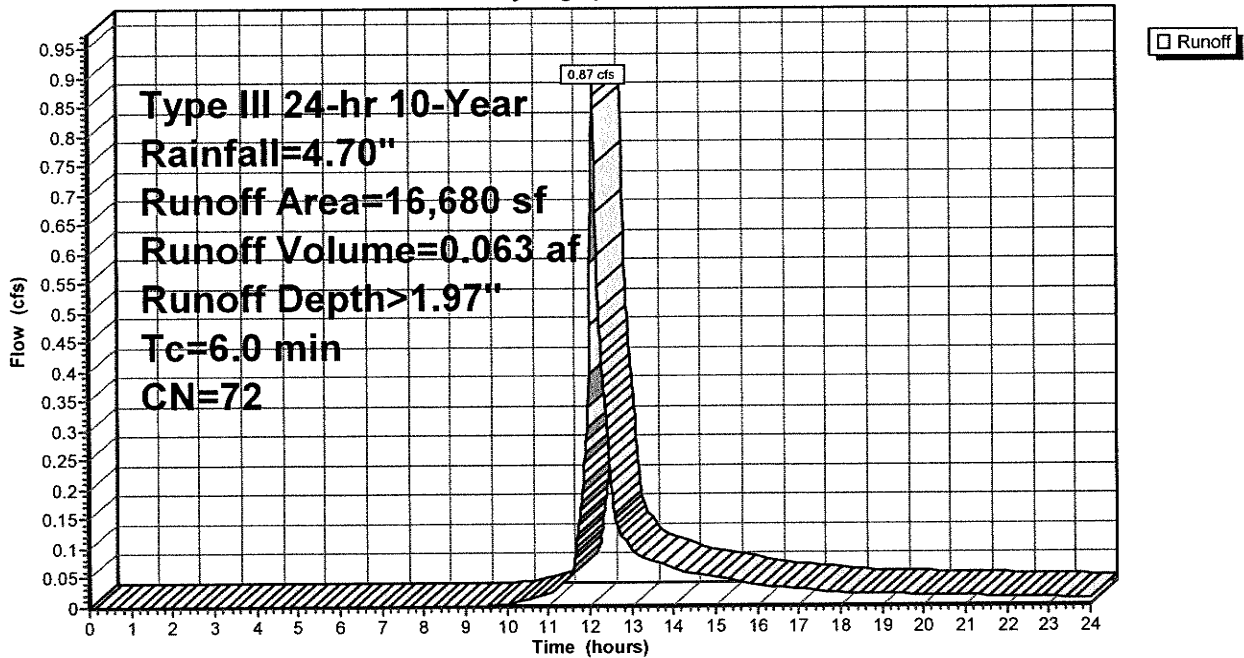
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-Year Rainfall=4.70"

	Area (sf)	CN	Description
*	1,640	98	Roof
*	3,744	98	Pavement
	3,229	55	Woods, Good, HSG B
	8,067	61	>75% Grass cover, Good, HSG B
	16,680	72	Weighted Average
	11,296		67.72% Pervious Area
	5,384		32.28% Impervious Area

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

Subcatchment SUB-2:

Hydrograph



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Type III 24-hr 10-Year Rainfall=4.70"

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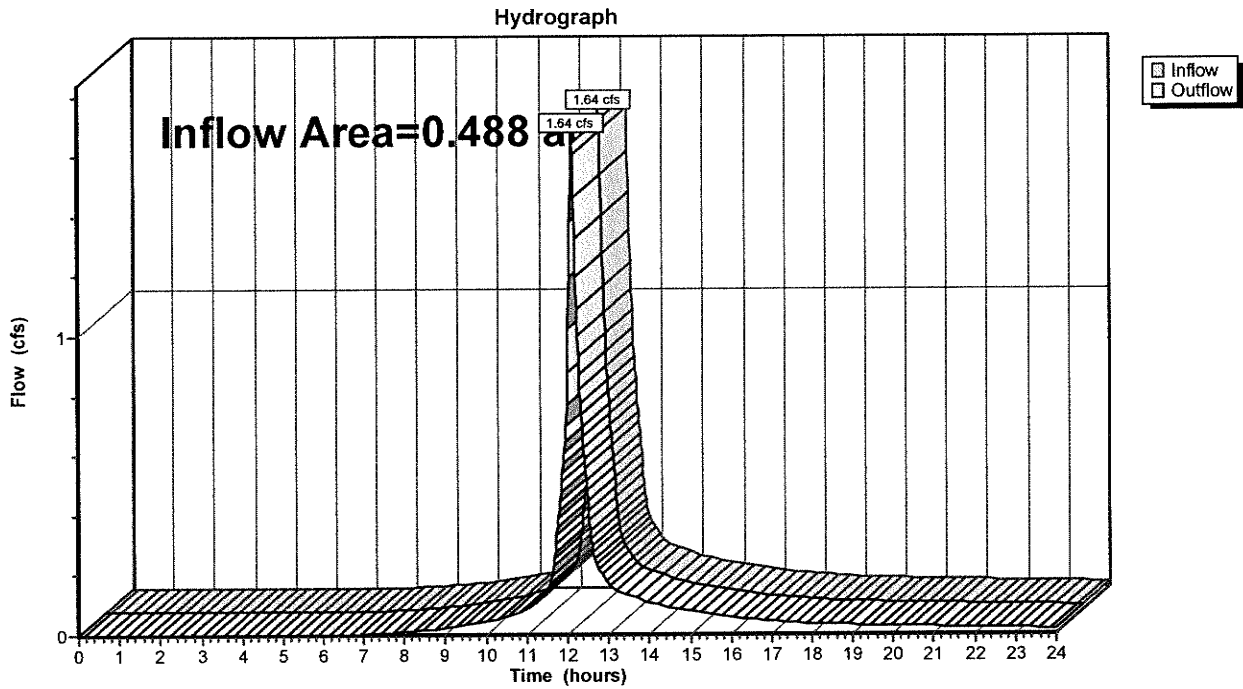
Page 20

Summary for Reach DP-1:

Inflow Area = 0.488 ac, 65.70% Impervious, Inflow Depth > 3.09" for 10-Year event
Inflow = 1.64 cfs @ 12.11 hrs, Volume= 0.126 af
Outflow = 1.64 cfs @ 12.11 hrs, Volume= 0.126 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-1:



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Type III 24-hr 10-Year Rainfall=4.70"

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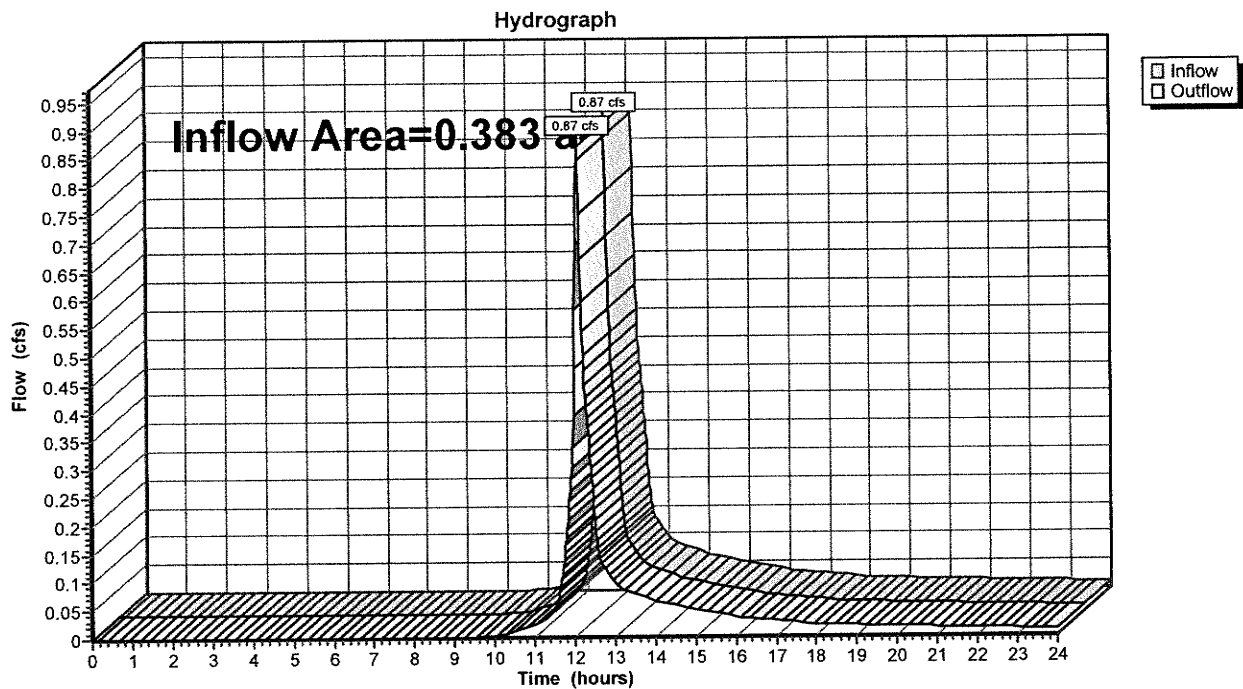
Page 21

Summary for Reach DP-2:

Inflow Area = 0.383 ac, 32.28% Impervious, Inflow Depth > 1.97" for 10-Year event
Inflow = 0.87 cfs @ 12.09 hrs, Volume= 0.063 af
Outflow = 0.87 cfs @ 12.09 hrs, Volume= 0.063 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-2:



Existing Conditions

Type III 24-hr 100-Year Rainfall=7.00"

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Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment SUB-1:

Runoff Area=21,264 sf 65.70% Impervious Runoff Depth>5.25"
Flow Length=145' Tc=8.0 min CN=85 Runoff=2.73 cfs 0.213 af

Subcatchment SUB-2:

Runoff Area=16,680 sf 32.28% Impervious Runoff Depth>3.82"
Tc=6.0 min CN=72 Runoff=1.72 cfs 0.122 af

Reach DP-1:

Inflow=2.73 cfs 0.213 af
Outflow=2.73 cfs 0.213 af

Reach DP-2:

Inflow=1.72 cfs 0.122 af
Outflow=1.72 cfs 0.122 af

Total Runoff Area = 0.871 ac Runoff Volume = 0.335 af Average Runoff Depth = 4.62"
48.99% Pervious = 0.427 ac 51.01% Impervious = 0.444 ac

Existing Conditions

Type III 24-hr 100-Year Rainfall=7.00"

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Summary for Subcatchment SUB-1:

Runoff = 2.73 cfs @ 12.11 hrs, Volume= 0.213 af, Depth> 5.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (sf)	CN	Description
* 387	98	Roof
2,448	55	Woods, Good, HSG B
* 13,584	98	Pavement
4,845	61	>75% Grass cover, Good, HSG B
21,264	85	Weighted Average
7,293		34.30% Pervious Area
13,971		65.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	25	0.0400	0.08		Sheet Flow, 0-25' Woods: Light underbrush n= 0.400 P2= 3.40"
2.4	25	0.0400	0.18		Sheet Flow, 25-50' Grass: Short n= 0.150 P2= 3.40"
0.2	50	0.0500	3.35		Shallow Concentrated Flow, 50-100' Grassed Waterway Kv= 15.0 fps
0.2	45	0.0300	3.52		Shallow Concentrated Flow, 100-145' Paved Kv= 20.3 fps
8.0	145	Total			

Existing Conditions

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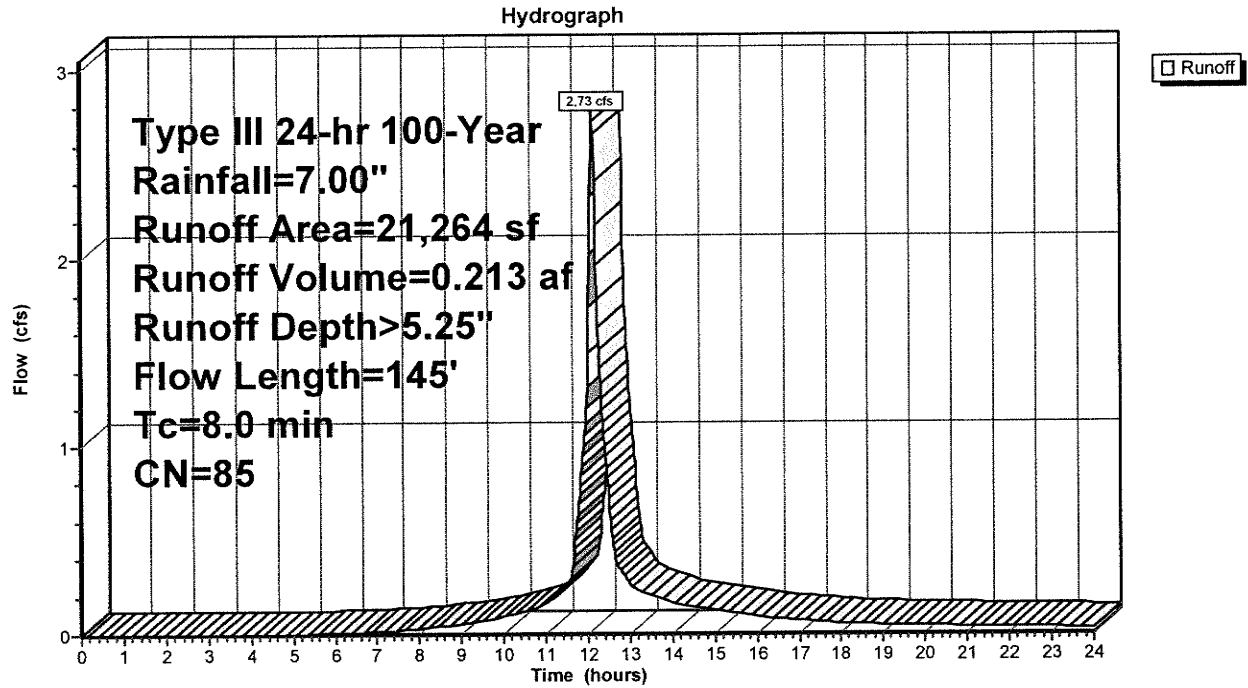
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Type III 24-hr 100-Year Rainfall=7.00"

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Subcatchment SUB-1:



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Type III 24-hr 100-Year Rainfall=7.00"

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Summary for Subcatchment SUB-2:

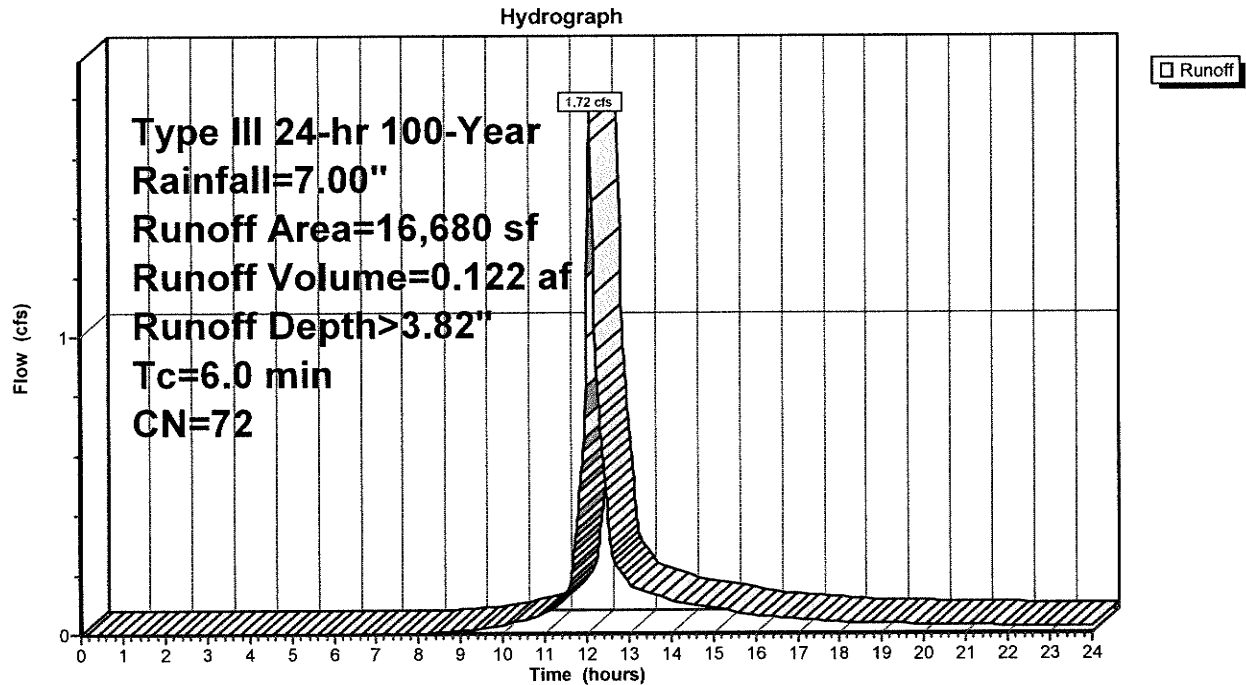
Runoff = 1.72 cfs @ 12.09 hrs, Volume= 0.122 af, Depth> 3.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
 Type III 24-hr 100-Year Rainfall=7.00"

	Area (sf)	CN	Description
*	1,640	98	Roof
*	3,744	98	Pavement
	3,229	55	Woods, Good, HSG B
	8,067	61	>75% Grass cover, Good, HSG B
	16,680	72	Weighted Average
	11,296		67.72% Pervious Area
	5,384		32.28% Impervious Area

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

Subcatchment SUB-2:



Existing Conditions

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Type III 24-hr 100-Year Rainfall=7.00"

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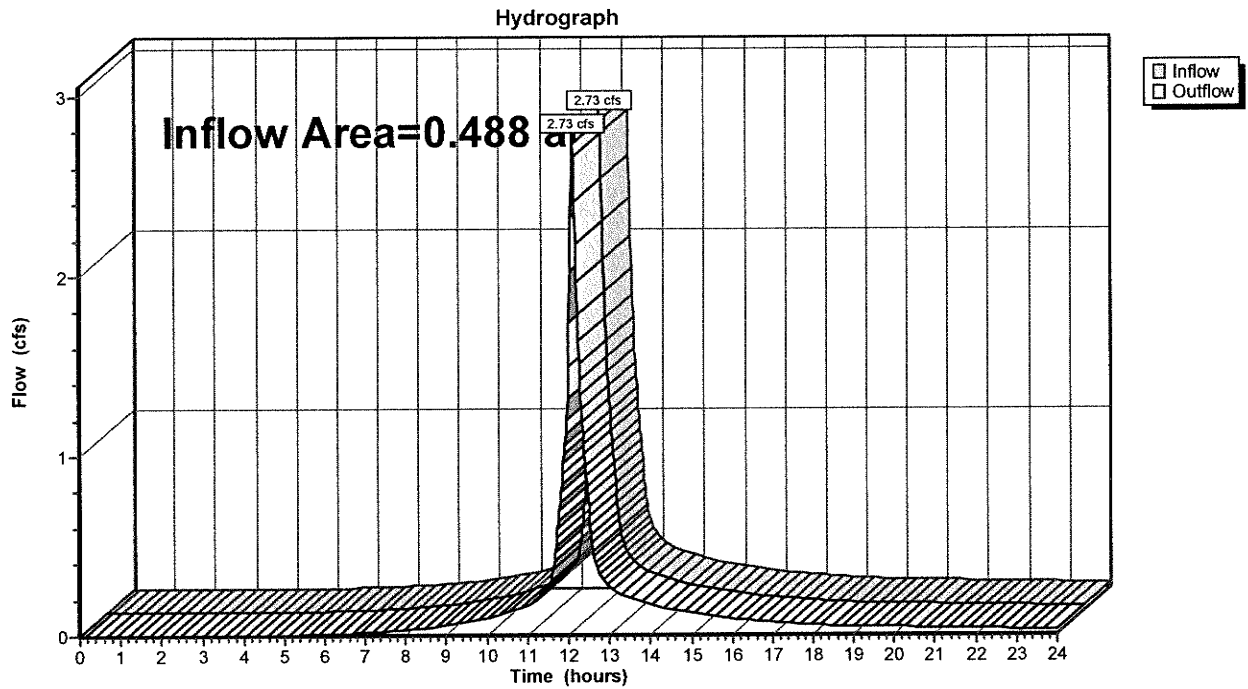
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Summary for Reach DP-1:

Inflow Area = 0.488 ac, 65.70% Impervious, Inflow Depth > 5.25" for 100-Year event
Inflow = 2.73 cfs @ 12.11 hrs, Volume= 0.213 af
Outflow = 2.73 cfs @ 12.11 hrs, Volume= 0.213 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-1:



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Type III 24-hr 100-Year Rainfall=7.00"

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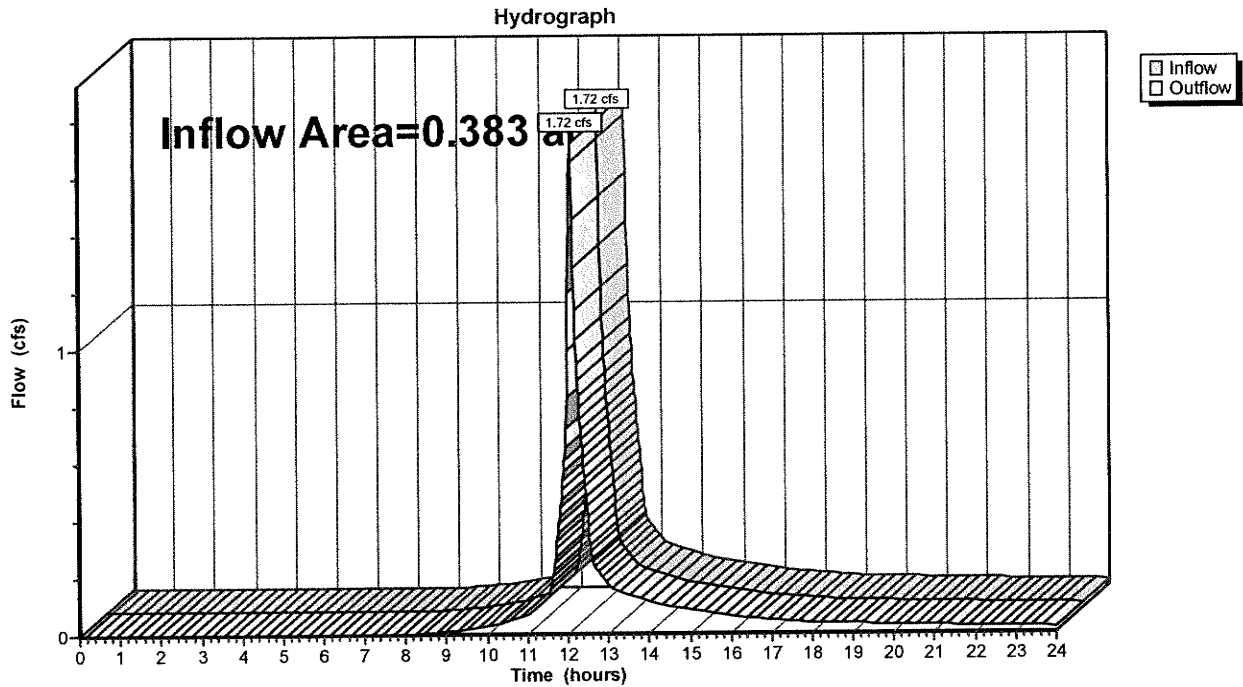
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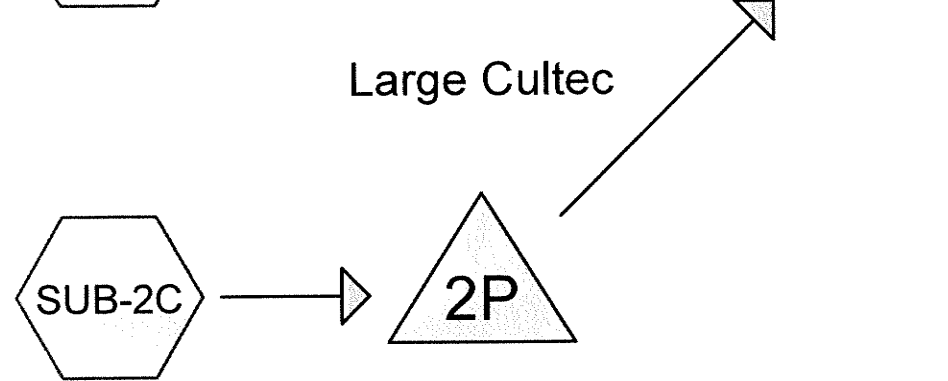
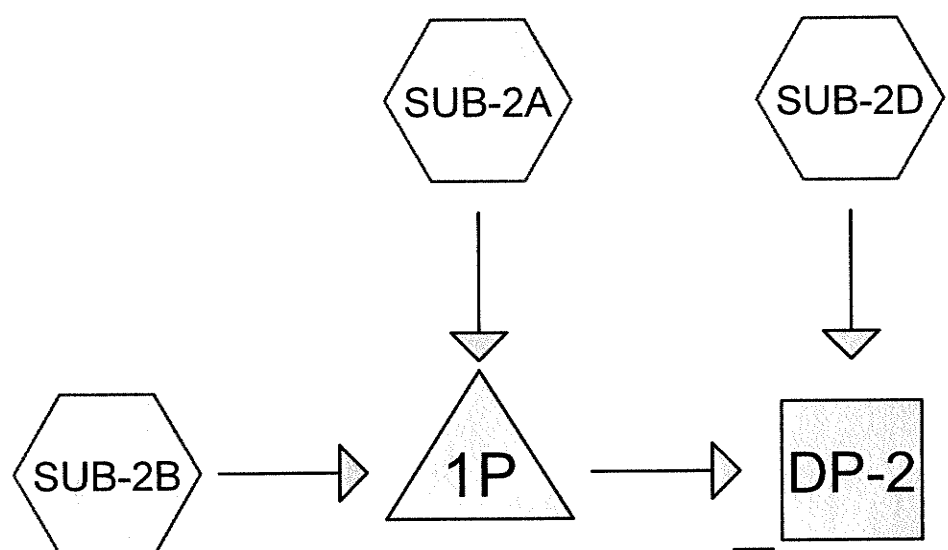
Summary for Reach DP-2:

Inflow Area = 0.383 ac, 32.28% Impervious, Inflow Depth > 3.82" for 100-Year event
Inflow = 1.72 cfs @ 12.09 hrs, Volume= 0.122 af
Outflow = 1.72 cfs @ 12.09 hrs, Volume= 0.122 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

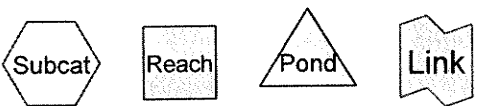
Reach DP-2:





Large Cultec

Small Cultec



Drainage Diagram for Proposed Conditions
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.162	61	>75% Grass cover, Good, HSG B (SUB-1, SUB-2A, SUB-2C, SUB-2D)
0.453	98	Pavement (SUB-2A, SUB-2C, SUB-2D)
0.256	98	Roof (SUB-2B)
0.871	91	TOTAL AREA

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.162	HSG B	SUB-1, SUB-2A, SUB-2C, SUB-2D
0.000	HSG C	
0.000	HSG D	
0.709	Other	SUB-2A, SUB-2B, SUB-2C, SUB-2D
0.871		TOTAL AREA

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Type III 24-hr 1-Year Rainfall=2.50"

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Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment SUB-1:	Runoff Area=790 sf 0.00% Impervious Runoff Depth>0.20" Tc=6.0 min CN=61 Runoff=0.00 cfs 0.000 af
Subcatchment SUB-2A:	Runoff Area=14,904 sf 80.21% Impervious Runoff Depth>1.61" Tc=6.0 min CN=91 Runoff=0.64 cfs 0.046 af
Subcatchment SUB-2B:	Runoff Area=11,149 sf 100.00% Impervious Runoff Depth>2.27" Tc=6.0 min CN=98 Runoff=0.62 cfs 0.048 af
Subcatchment SUB-2C:	Runoff Area=5,894 sf 80.32% Impervious Runoff Depth>1.61" Tc=6.0 min CN=91 Runoff=0.25 cfs 0.018 af
Subcatchment SUB-2D:	Runoff Area=5,210 sf 58.23% Impervious Runoff Depth>1.05" Tc=6.0 min CN=83 Runoff=0.15 cfs 0.011 af
Reach DP-1:	Inflow=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af
Reach DP-2:	Inflow=0.15 cfs 0.011 af Outflow=0.15 cfs 0.011 af
Pond 1P: Large Cultec	Peak Elev=25.12' Storage=638 cf Inflow=1.26 cfs 0.094 af Outflow=0.40 cfs 0.094 af
Pond 2P: Small Cultec	Peak Elev=21.56' Storage=115 cf Inflow=0.25 cfs 0.018 af Outflow=0.09 cfs 0.018 af

Total Runoff Area = 0.871 ac Runoff Volume = 0.123 af Average Runoff Depth = 1.70"
18.65% Pervious = 0.162 ac 81.35% Impervious = 0.709 ac

Proposed Conditions

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Type III 24-hr 1-Year Rainfall=2.50"

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Summary for Subcatchment SUB-2A:

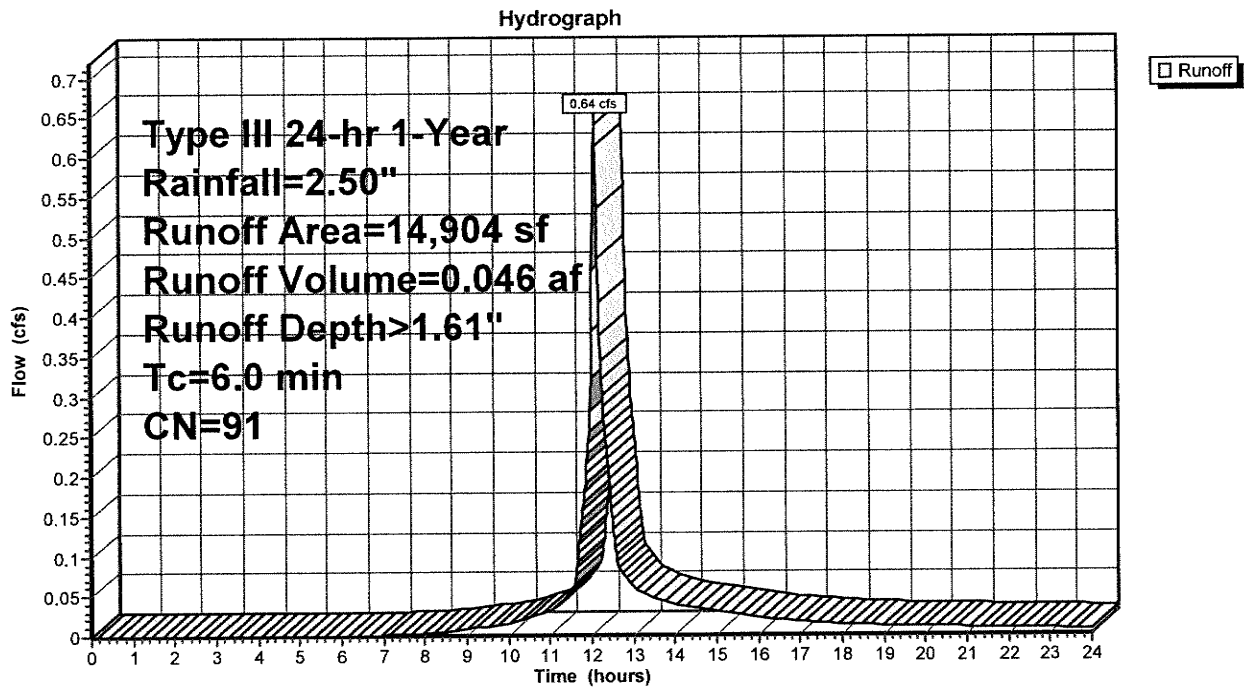
Runoff = 0.64 cfs @ 12.09 hrs, Volume= 0.046 af, Depth> 1.61"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 1-Year Rainfall=2.50"

	Area (sf)	CN	Description
*	11,954	98	Pavement
	2,950	61	>75% Grass cover, Good, HSG B
	14,904	91	Weighted Average
	2,950		19.79% Pervious Area
	11,954		80.21% Impervious Area

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

Subcatchment SUB-2A:



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Type III 24-hr 1-Year Rainfall=2.50"

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Summary for Subcatchment SUB-2B:

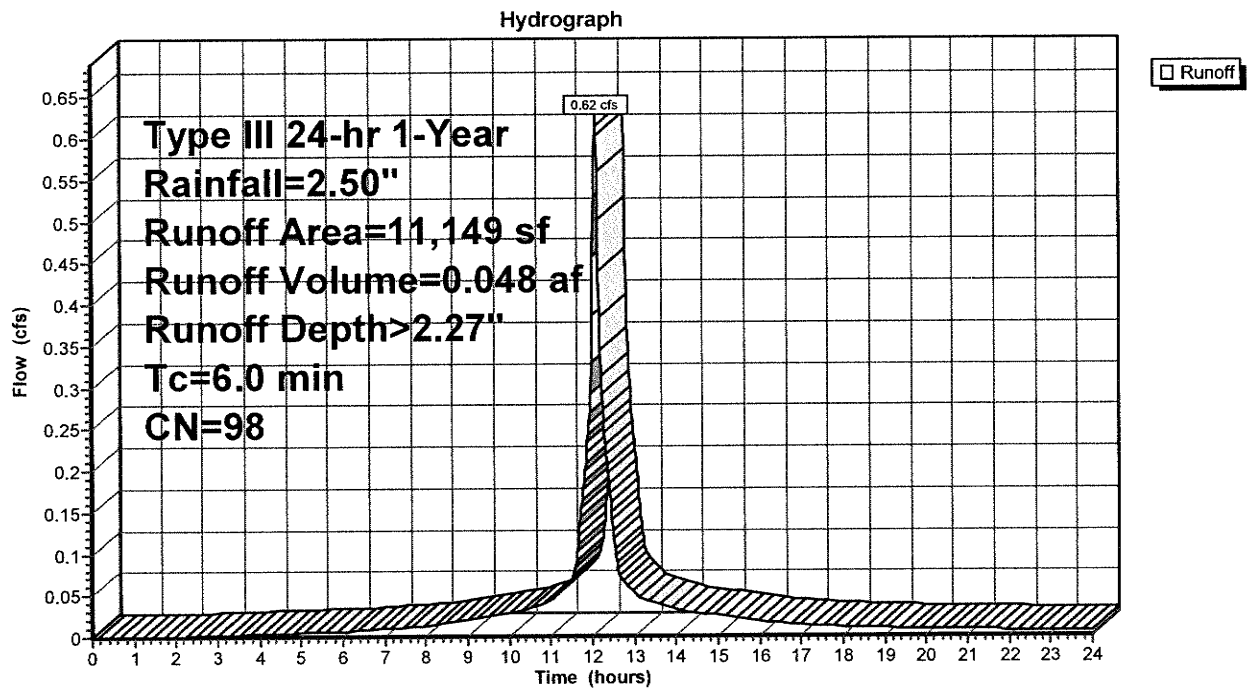
Runoff = 0.62 cfs @ 12.08 hrs, Volume= 0.048 af, Depth> 2.27"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 1-Year Rainfall=2.50"

Area (sf)	CN	Description
* 11,149	98	Roof
11,149		100.00% Impervious Area

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

Subcatchment SUB-2B:



Proposed Conditions

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Type III 24-hr 1-Year Rainfall=2.50"

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Summary for Subcatchment SUB-2C:

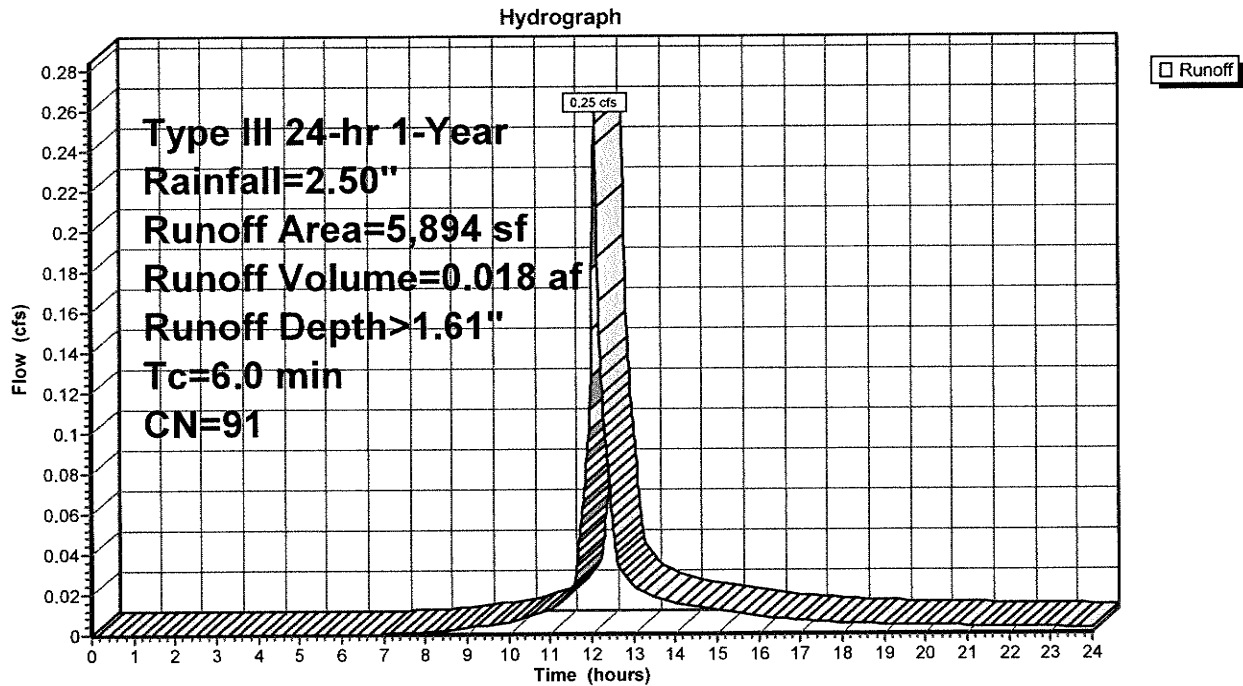
Runoff = 0.25 cfs @ 12.09 hrs, Volume= 0.018 af, Depth> 1.61"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 1-Year Rainfall=2.50"

Area (sf)	CN	Description
* 4,734	98	Pavement
1,160	61	>75% Grass cover, Good, HSG B
5,894	91	Weighted Average
1,160		19.68% Pervious Area
4,734		80.32% Impervious Area

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

Subcatchment SUB-2C:



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Type III 24-hr 1-Year Rainfall=2.50"

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Summary for Subcatchment SUB-2D:

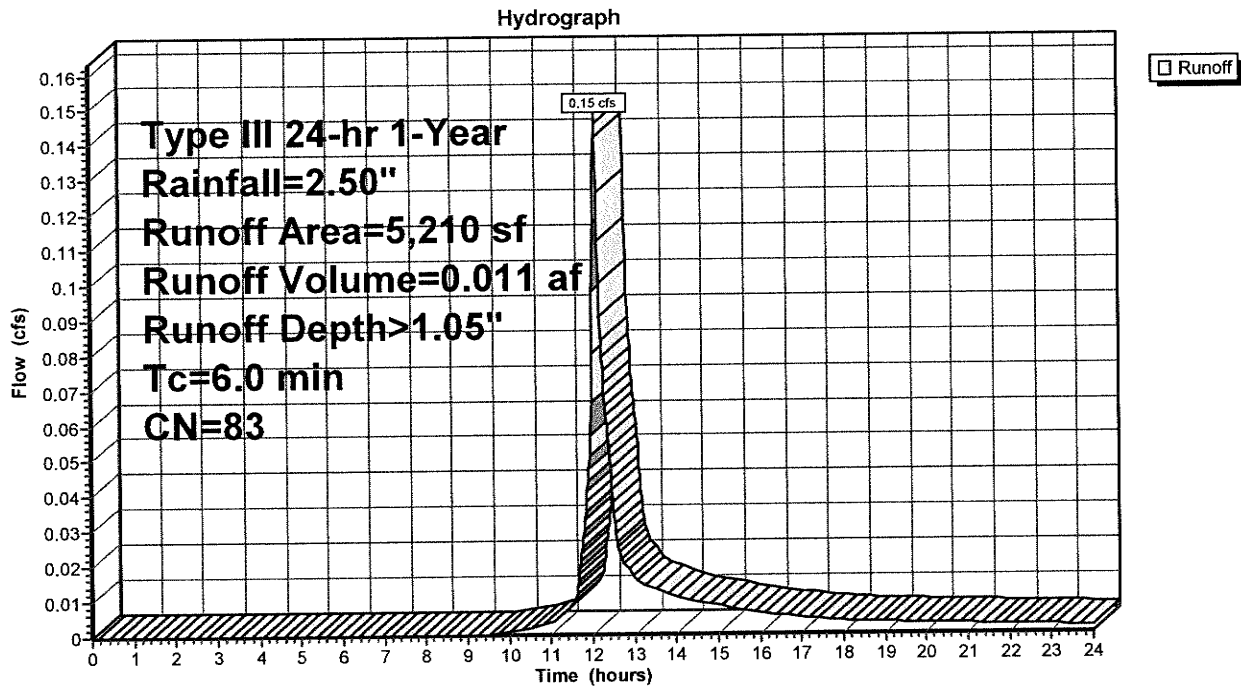
Runoff = 0.15 cfs @ 12.09 hrs, Volume= 0.011 af, Depth> 1.05"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
 Type III 24-hr 1-Year Rainfall=2.50"

Area (sf)	CN	Description
* 3,034	98	Pavement
2,176	61	>75% Grass cover, Good, HSG B
5,210	83	Weighted Average
2,176		41.77% Pervious Area
3,034		58.23% Impervious Area

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

Subcatchment SUB-2D:



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Type III 24-hr 1-Year Rainfall=2.50"

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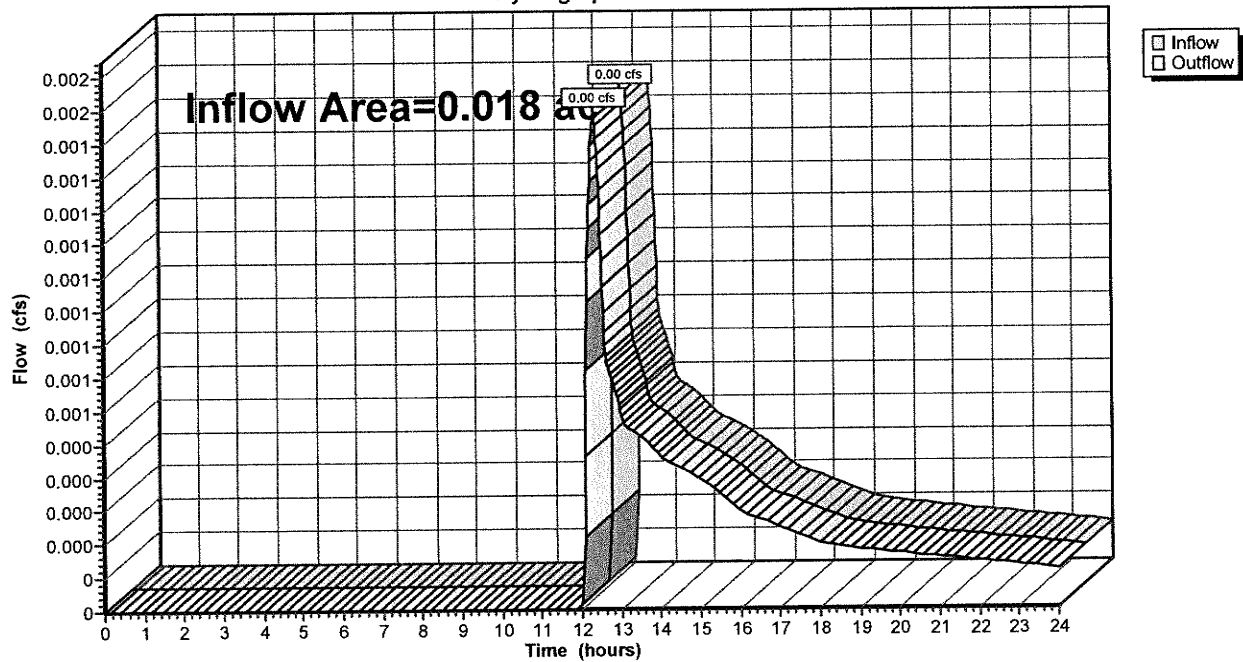
Summary for Reach DP-1:

Inflow Area = 0.018 ac, 0.00% Impervious, Inflow Depth > 0.20" for 1-Year event
Inflow = 0.00 cfs @ 12.33 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 12.33 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-1:

Hydrograph



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Type III 24-hr 1-Year Rainfall=2.50"

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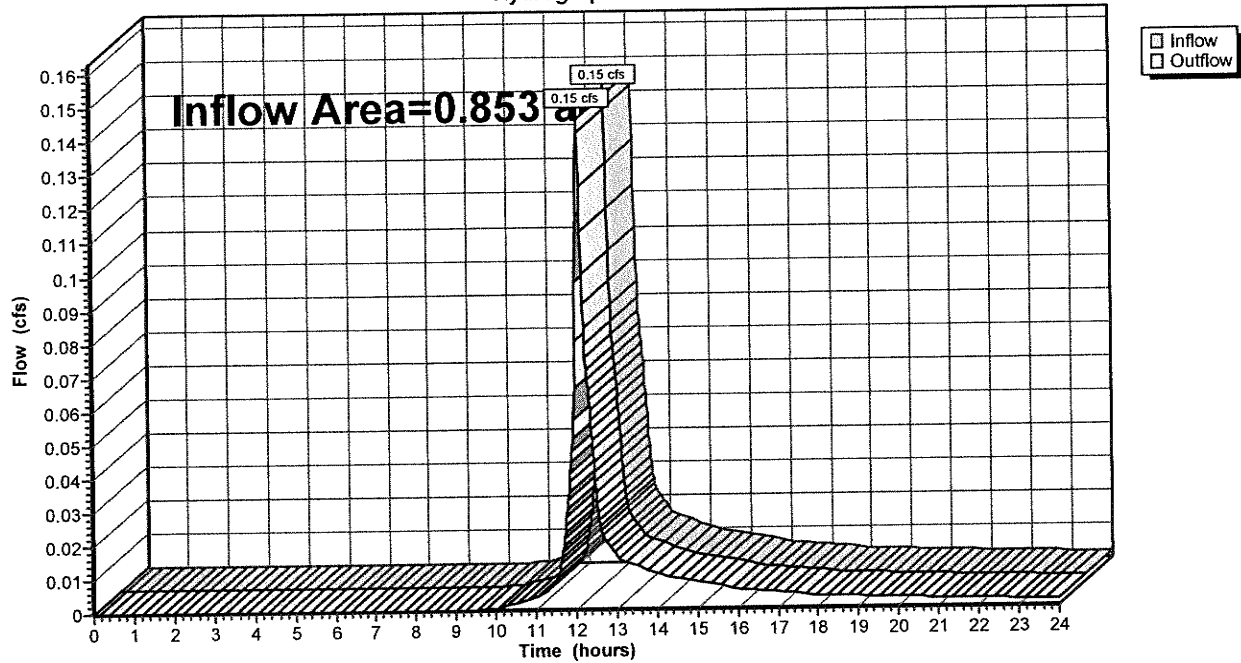
Summary for Reach DP-2:

Inflow Area = 0.853 ac, 83.08% Impervious, Inflow Depth > 0.15" for 1-Year event
Inflow = 0.15 cfs @ 12.09 hrs, Volume= 0.011 af
Outflow = 0.15 cfs @ 12.09 hrs, Volume= 0.011 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-2:

Hydrograph



Proposed Conditions

Type III 24-hr 1-Year Rainfall=2.50"

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Summary for Pond 1P: Large Cultec

Inflow Area = 0.598 ac, 88.68% Impervious, Inflow Depth > 1.89" for 1-Year event
 Inflow = 1.26 cfs @ 12.09 hrs, Volume= 0.094 af
 Outflow = 0.40 cfs @ 11.88 hrs, Volume= 0.094 af, Atten= 68%, Lag= 0.0 min
 Discarded = 0.40 cfs @ 11.88 hrs, Volume= 0.094 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
 Peak Elev= 25.12' @ 12.39 hrs Surf.Area= 2,106 sf Storage= 638 cf

Plug-Flow detention time= 7.6 min calculated for 0.094 af (100% of inflow)
 Center-of-Mass det. time= 7.5 min (793.2 - 785.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	24.50'	1,732 cf	29.25'W x 72.00'L x 3.54'H Field A 7,459 cf Overall - 3,129 cf Embedded = 4,329 cf x 40.0% Voids
#2A	25.00'	3,129 cf	Cultec R-330XLHD x 60 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
		4,861 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	24.50'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.40 cfs @ 11.88 hrs HW=24.54' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.40 cfs)

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Type III 24-hr 1-Year Rainfall=2.50"

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Pond 1P: Large Cultec - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

52.0" Wide + 3.0" Spacing = 55.0" C-C

10 Chambers/Row x 7.00' Long = 70.00' + 12.0" End Stone x 2 = 72.00' Base Length

6 Rows x 52.0" Wide + 3.0" Spacing x 5 + 12.0" Side Stone x 2 = 29.25' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

60 Chambers x 52.2 cf = 3,129.4 cf Chamber Storage

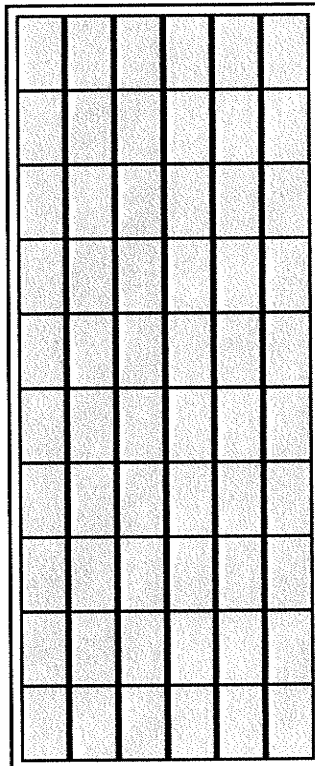
7,458.8 cf Field - 3,129.4 cf Chambers = 4,329.3 cf Stone x 40.0% Voids = 1,731.7 cf Stone Storage

Stone + Chamber Storage = 4,861.2 cf = 0.112 af

60 Chambers

276.3 cy Field

160.3 cy Stone



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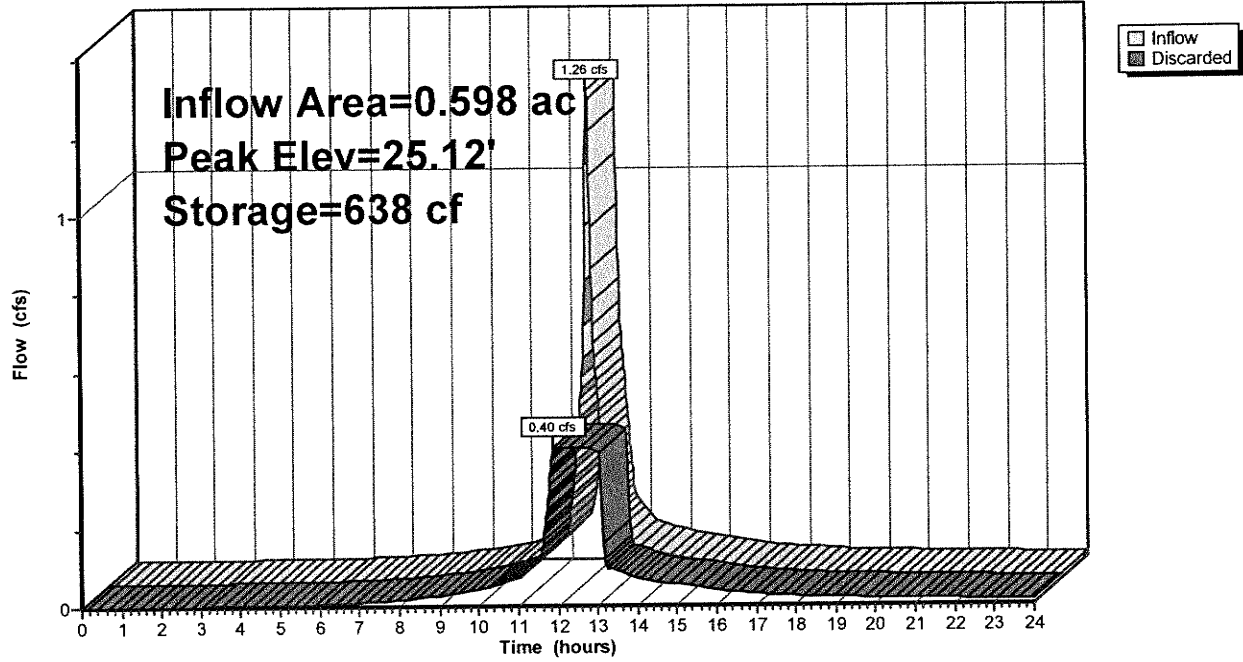
Type III 24-hr 1-Year Rainfall=2.50"

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Pond 1P: Large Cultec

Hydrograph



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Type III 24-hr 1-Year Rainfall=2.50"

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Summary for Pond 2P: Small Cultec

Inflow Area = 0.135 ac, 80.32% Impervious, Inflow Depth > 1.61" for 1-Year event
Inflow = 0.25 cfs @ 12.09 hrs, Volume= 0.018 af
Outflow = 0.09 cfs @ 11.92 hrs, Volume= 0.018 af, Atten= 65%, Lag= 0.0 min
Discarded = 0.09 cfs @ 11.92 hrs, Volume= 0.018 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Peak Elev= 21.56' @ 12.37 hrs Surf.Area= 465 sf Storage= 115 cf

Plug-Flow detention time= 6.5 min calculated for 0.018 af (100% of inflow)
Center-of-Mass det. time= 6.4 min (817.8 - 811.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	21.00'	408 cf	15.50'W x 30.00'L x 3.54'H Field A 1,647 cf Overall - 626 cf Embedded = 1,021 cf x 40.0% Voids
#2A	21.50'	626 cf	Cultec R-330XLHD x 12 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
		1,034 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	21.00'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.09 cfs @ 11.92 hrs HW=21.04' (Free Discharge)
↑1=Exfiltration (Exfiltration Controls 0.09 cfs)

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Type III 24-hr 1-Year Rainfall=2.50"

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Pond 2P: Small Cultec - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

52.0" Wide + 3.0" Spacing = 55.0" C-C

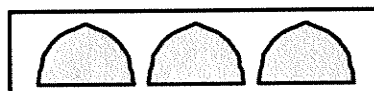
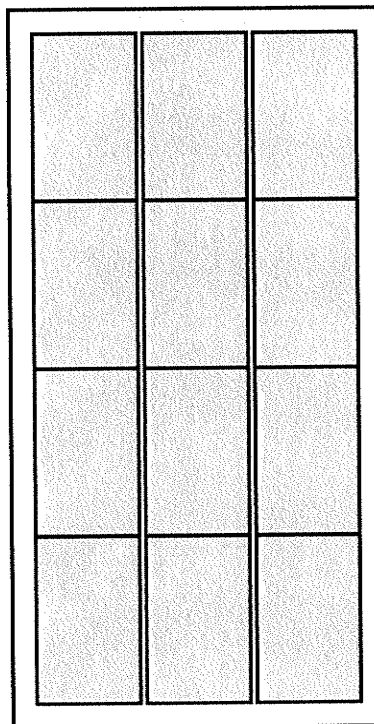
4 Chambers/Row x 7.00' Long = 28.00' + 12.0" End Stone x 2 = 30.00' Base Length
3 Rows x 52.0" Wide + 3.0" Spacing x 2 + 12.0" Side Stone x 2 = 15.50' Base Width
6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

12 Chambers x 52.2 cf = 625.9 cf Chamber Storage

1,646.9 cf Field - 625.9 cf Chambers = 1,021.0 cf Stone x 40.0% Voids = 408.4 cf Stone Storage

Stone + Chamber Storage = 1,034.3 cf = 0.024 af

12 Chambers
61.0 cy Field
37.8 cy Stone



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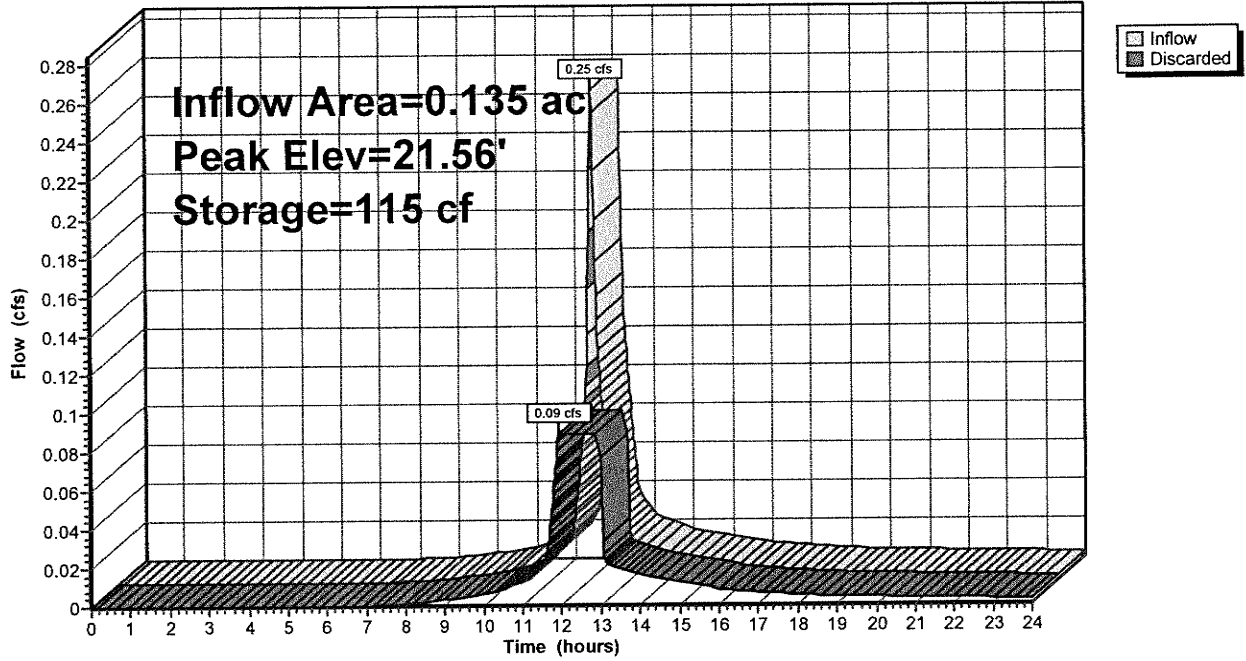
Type III 24-hr 1-Year Rainfall=2.50"

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Pond 2P: Small Cultec

Hydrograph



Proposed Conditions

Type III 24-hr 2-Year Rainfall=3.40"

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Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment SUB-1:	Runoff Area=790 sf 0.00% Impervious Runoff Depth>0.53" Tc=6.0 min CN=61 Runoff=0.01 cfs 0.001 af
Subcatchment SUB-2A:	Runoff Area=14,904 sf 80.21% Impervious Runoff Depth>2.44" Tc=6.0 min CN=91 Runoff=0.96 cfs 0.070 af
Subcatchment SUB-2B:	Runoff Area=11,149 sf 100.00% Impervious Runoff Depth>3.16" Tc=6.0 min CN=98 Runoff=0.84 cfs 0.067 af
Subcatchment SUB-2C:	Runoff Area=5,894 sf 80.32% Impervious Runoff Depth>2.44" Tc=6.0 min CN=91 Runoff=0.38 cfs 0.028 af
Subcatchment SUB-2D:	Runoff Area=5,210 sf 58.23% Impervious Runoff Depth>1.77" Tc=6.0 min CN=83 Runoff=0.25 cfs 0.018 af
Reach DP-1:	Inflow=0.01 cfs 0.001 af Outflow=0.01 cfs 0.001 af
Reach DP-2:	Inflow=0.25 cfs 0.018 af Outflow=0.25 cfs 0.018 af
Pond 1P: Large Cultec	Peak Elev=25.49' Storage=1,320 cf Inflow=1.81 cfs 0.137 af Outflow=0.40 cfs 0.137 af
Pond 2P: Small Cultec	Peak Elev=21.95' Storage=266 cf Inflow=0.38 cfs 0.028 af Outflow=0.09 cfs 0.028 af

Total Runoff Area = 0.871 ac Runoff Volume = 0.183 af Average Runoff Depth = 2.52"
18.65% Pervious = 0.162 ac 81.35% Impervious = 0.709 ac

Proposed Conditions

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Type III 24-hr 2-Year Rainfall=3.40"

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Summary for Subcatchment SUB-1:

Runoff = 0.01 cfs @ 12.12 hrs, Volume= 0.001 af, Depth> 0.53"

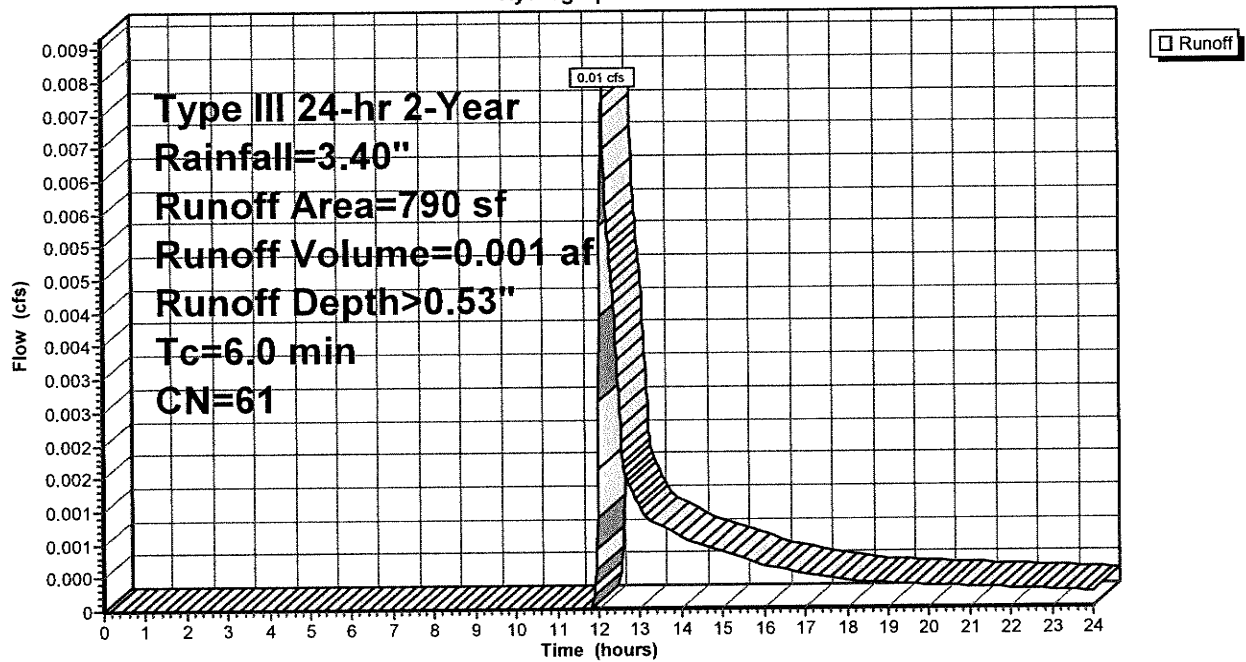
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (sf)	CN	Description
790	61	>75% Grass cover, Good, HSG B
790		100.00% Pervious Area

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

Subcatchment SUB-1:

Hydrograph



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Type III 24-hr 2-Year Rainfall=3.40"

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Summary for Subcatchment SUB-2A:

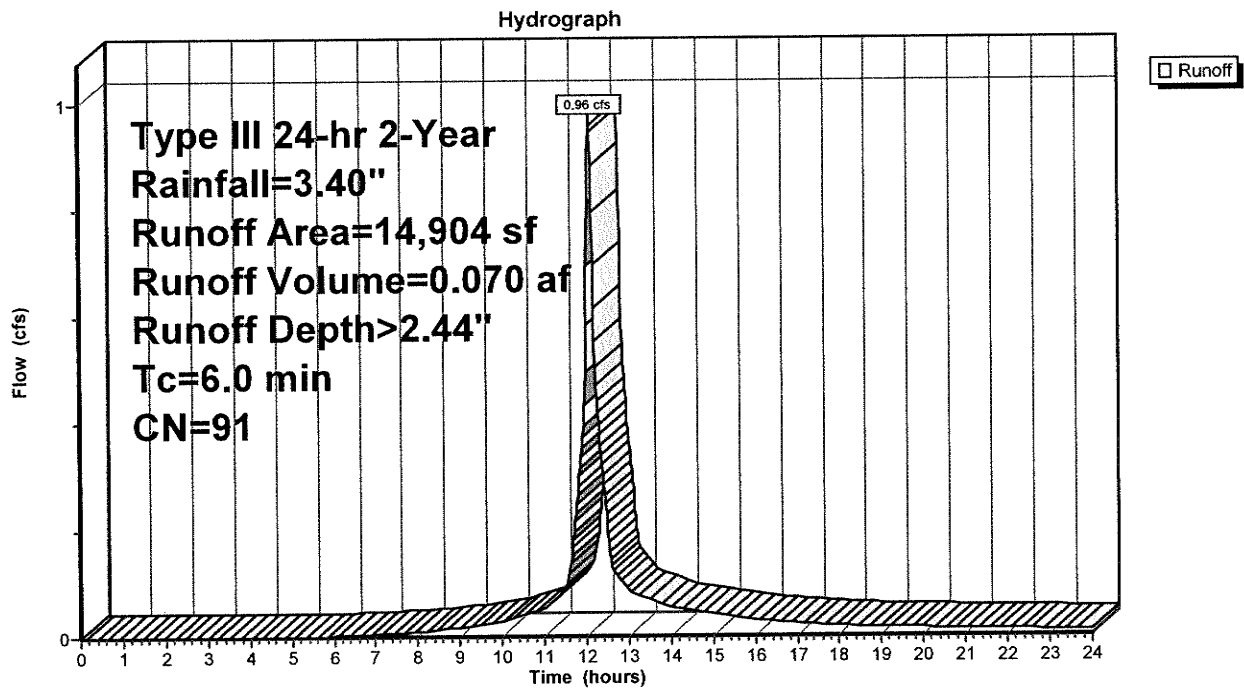
Runoff = 0.96 cfs @ 12.09 hrs, Volume= 0.070 af, Depth> 2.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
 Type III 24-hr 2-Year Rainfall=3.40"

Area (sf)	CN	Description
* 11,954	98	Pavement
2,950	61	>75% Grass cover, Good, HSG B
14,904	91	Weighted Average
2,950		19.79% Pervious Area
11,954		80.21% Impervious Area

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

Subcatchment SUB-2A:



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Type III 24-hr 2-Year Rainfall=3.40"

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Summary for Subcatchment SUB-2B:

Runoff = 0.84 cfs @ 12.08 hrs, Volume= 0.067 af, Depth> 3.16"

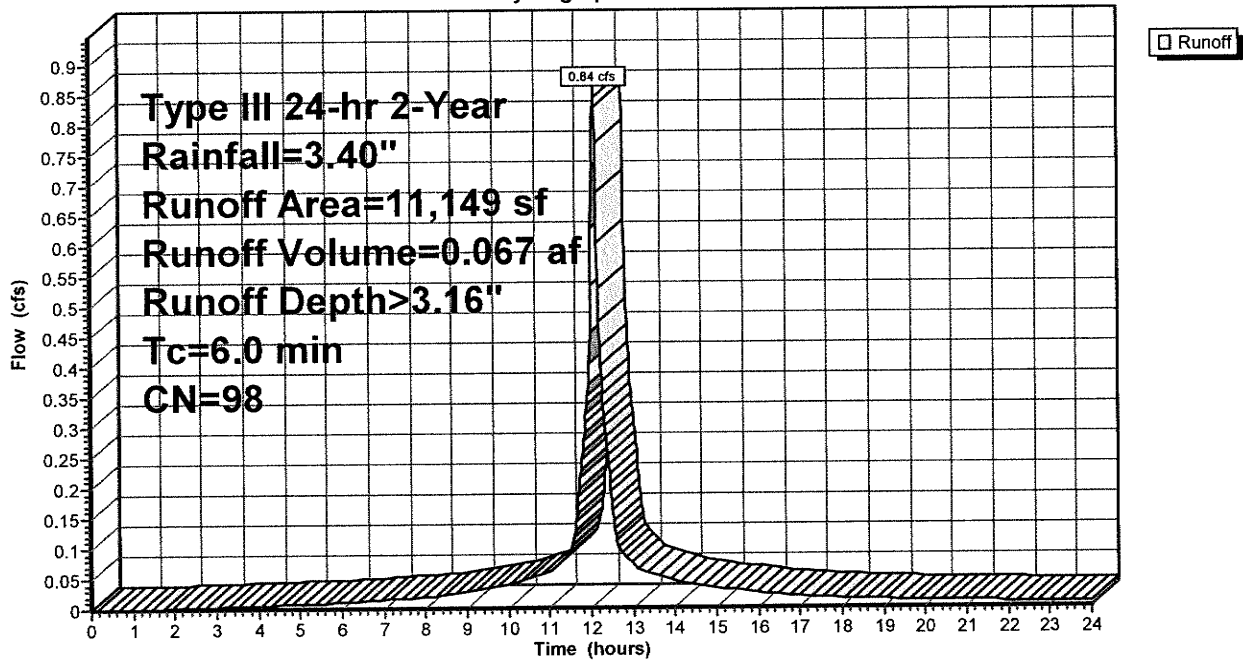
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (sf)	CN	Description
* 11,149	98	Roof
11,149		100.00% Impervious Area

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

Subcatchment SUB-2B:

Hydrograph



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Summary for Subcatchment SUB-2C:

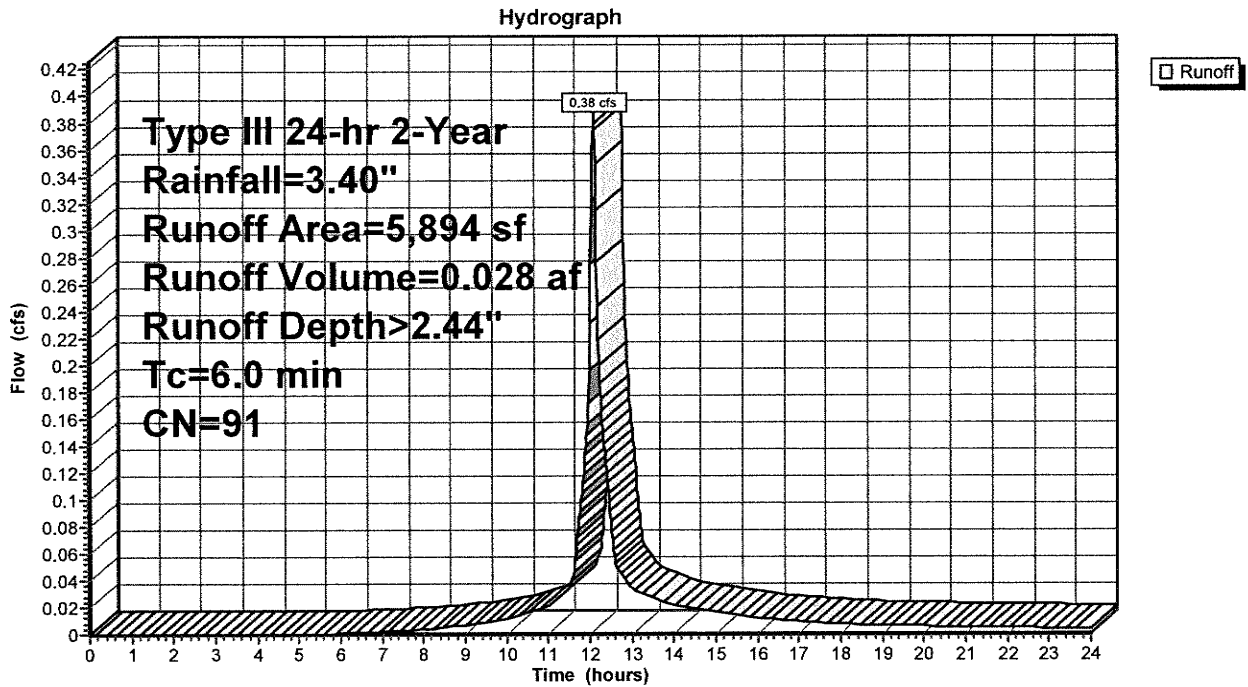
Runoff = 0.38 cfs @ 12.09 hrs, Volume= 0.028 af, Depth> 2.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-Year Rainfall=3.40"

	Area (sf)	CN	Description
*	4,734	98	Pavement
	1,160	61	>75% Grass cover, Good, HSG B
	5,894	91	Weighted Average
	1,160		19.68% Pervious Area
	4,734		80.32% Impervious Area

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

Subcatchment SUB-2C:



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Summary for Subcatchment SUB-2D:

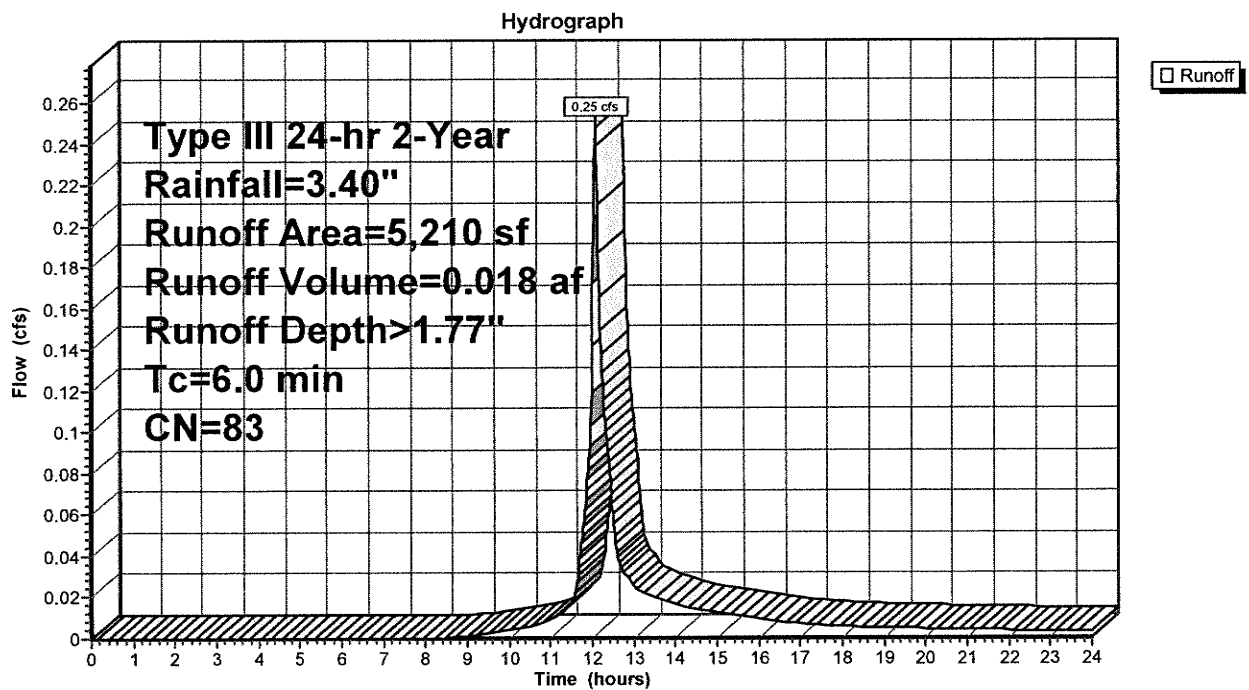
Runoff = 0.25 cfs @ 12.09 hrs, Volume= 0.018 af, Depth> 1.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
 Type III 24-hr 2-Year Rainfall=3.40"

	Area (sf)	CN	Description
*	3,034	98	Pavement
	2,176	61	>75% Grass cover, Good, HSG B
	5,210	83	Weighted Average
	2,176		41.77% Pervious Area
	3,034		58.23% Impervious Area

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

Subcatchment SUB-2D:



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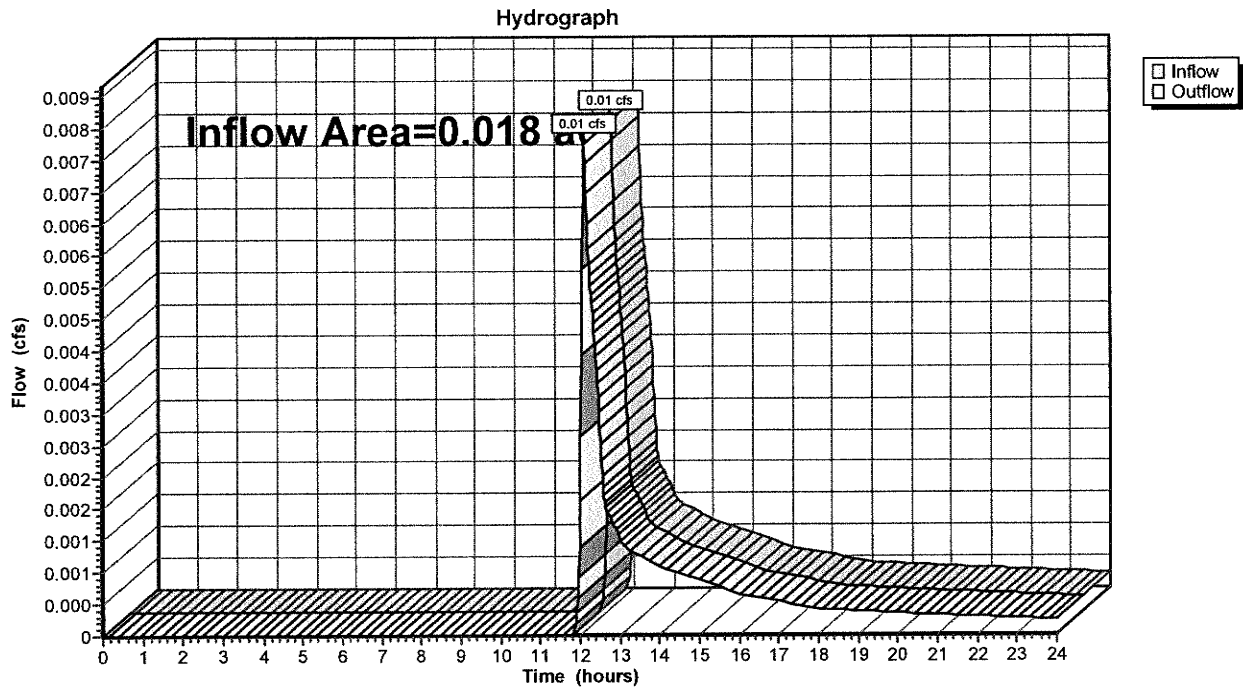
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Summary for Reach DP-1:

Inflow Area = 0.018 ac, 0.00% Impervious, Inflow Depth > 0.53" for 2-Year event
Inflow = 0.01 cfs @ 12.12 hrs, Volume= 0.001 af
Outflow = 0.01 cfs @ 12.12 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-1:



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Type III 24-hr 2-Year Rainfall=3.40"

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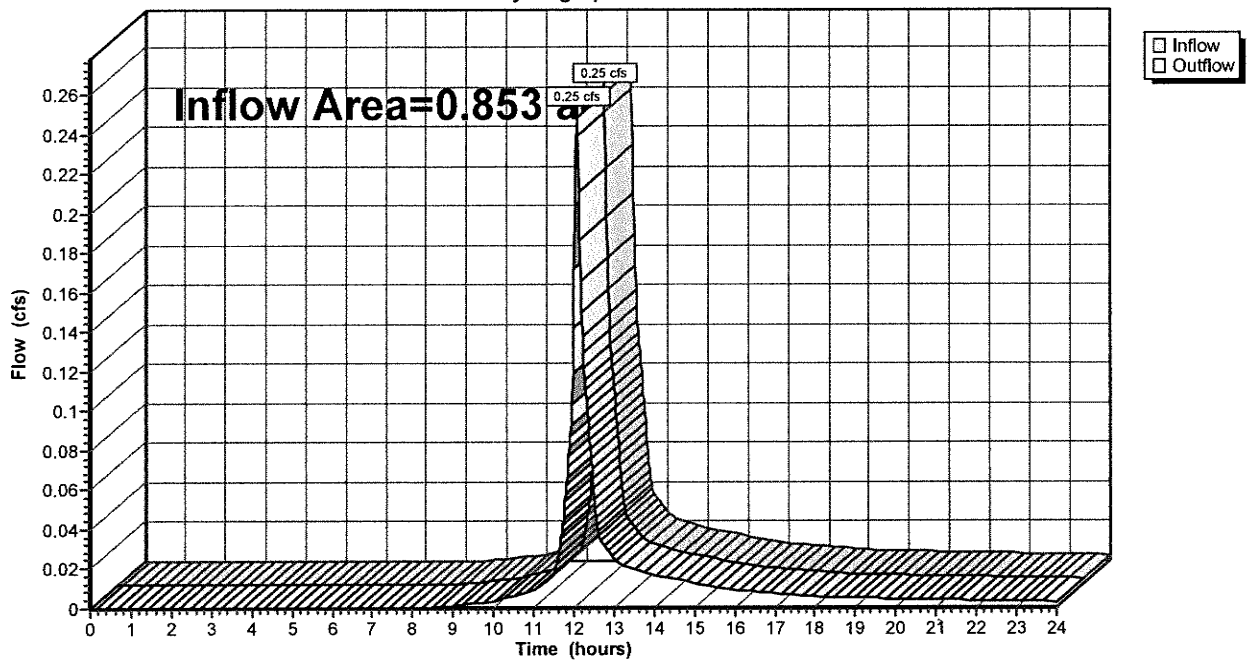
Summary for Reach DP-2:

Inflow Area = 0.853 ac, 83.08% Impervious, Inflow Depth > 0.25" for 2-Year event
Inflow = 0.25 cfs @ 12.09 hrs, Volume= 0.018 af
Outflow = 0.25 cfs @ 12.09 hrs, Volume= 0.018 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-2:

Hydrograph



Proposed Conditions

Type III 24-hr 2-Year Rainfall=3.40"

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Summary for Pond 1P: Large Cultec

Inflow Area = 0.598 ac, 88.68% Impervious, Inflow Depth > 2.75" for 2-Year event
 Inflow = 1.81 cfs @ 12.08 hrs, Volume= 0.137 af
 Outflow = 0.40 cfs @ 11.76 hrs, Volume= 0.137 af, Atten= 78%, Lag= 0.0 min
 Discarded = 0.40 cfs @ 11.76 hrs, Volume= 0.137 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
 Peak Elev= 25.49' @ 12.49 hrs Surf.Area= 2,106 sf Storage= 1,320 cf

Plug-Flow detention time= 16.9 min calculated for 0.137 af (100% of inflow)
 Center-of-Mass det. time= 16.7 min (794.2 - 777.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	24.50'	1,732 cf	29.25'W x 72.00'L x 3.54'H Field A 7,459 cf Overall - 3,129 cf Embedded = 4,329 cf x 40.0% Voids
#2A	25.00'	3,129 cf	Cultec R-330XLHD x 60 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
		4,861 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	24.50'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.40 cfs @ 11.76 hrs HW=24.54' (Free Discharge)
 ↑**1=Exfiltration** (Exfiltration Controls 0.40 cfs)

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Type III 24-hr 2-Year Rainfall=3.40"

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Pond 1P: Large Cultec - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

52.0" Wide + 3.0" Spacing = 55.0" C-C

10 Chambers/Row x 7.00' Long = 70.00' + 12.0" End Stone x 2 = 72.00' Base Length

6 Rows x 52.0" Wide + 3.0" Spacing x 5 + 12.0" Side Stone x 2 = 29.25' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

60 Chambers x 52.2 cf = 3,129.4 cf Chamber Storage

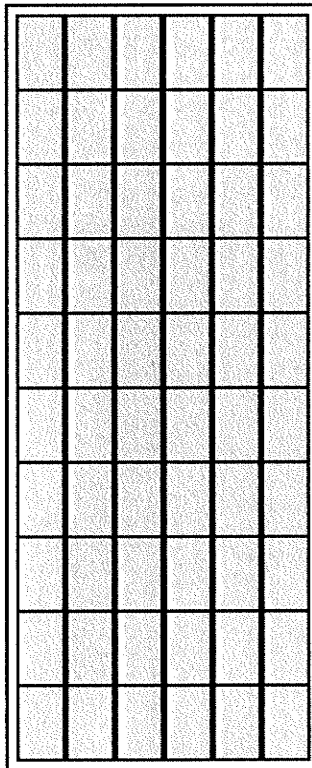
7,458.8 cf Field - 3,129.4 cf Chambers = 4,329.3 cf Stone x 40.0% Voids = 1,731.7 cf Stone Storage

Stone + Chamber Storage = 4,861.2 cf = 0.112 af

60 Chambers

276.3 cy Field

160.3 cy Stone



Proposed Conditions

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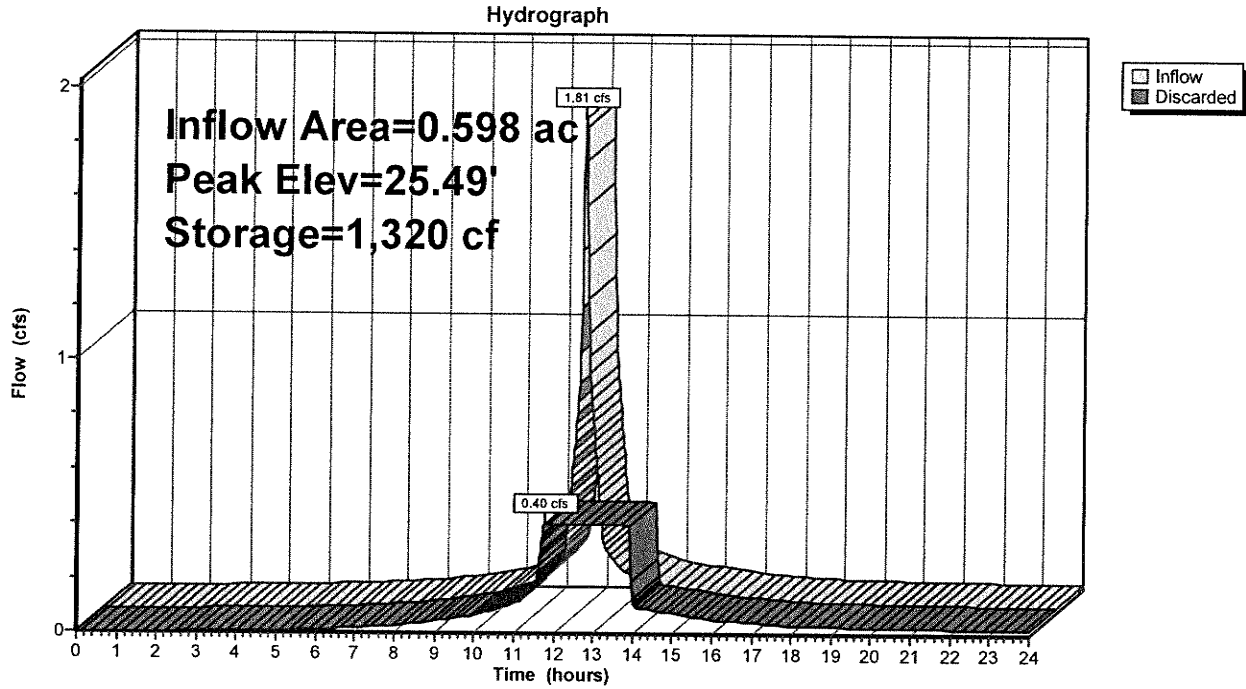
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Type III 24-hr 2-Year Rainfall=3.40"

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Pond 1P: Large Cultec



Proposed Conditions

Type III 24-hr 2-Year Rainfall=3.40"

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Summary for Pond 2P: Small Cultec

Inflow Area = 0.135 ac, 80.32% Impervious, Inflow Depth > 2.44" for 2-Year event
 Inflow = 0.38 cfs @ 12.09 hrs, Volume= 0.028 af
 Outflow = 0.09 cfs @ 11.78 hrs, Volume= 0.028 af, Atten= 77%, Lag= 0.0 min
 Discarded = 0.09 cfs @ 11.78 hrs, Volume= 0.028 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
 Peak Elev= 21.95' @ 12.49 hrs Surf.Area= 465 sf Storage= 266 cf

Plug-Flow detention time= 15.9 min calculated for 0.028 af (100% of inflow)
 Center-of-Mass det. time= 15.7 min (815.4 - 799.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	21.00'	408 cf	15.50'W x 30.00'L x 3.54'H Field A 1,647 cf Overall - 626 cf Embedded = 1,021 cf x 40.0% Voids
#2A	21.50'	626 cf	Cultec R-330XLHD x 12 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
		1,034 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	21.00'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.09 cfs @ 11.78 hrs HW=21.04' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.09 cfs)

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Type III 24-hr 2-Year Rainfall=3.40"

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Pond 2P: Small Cultec - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

52.0" Wide + 3.0" Spacing = 55.0" C-C

4 Chambers/Row x 7.00' Long = 28.00' + 12.0" End Stone x 2 = 30.00' Base Length

3 Rows x 52.0" Wide + 3.0" Spacing x 2 + 12.0" Side Stone x 2 = 15.50' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

12 Chambers x 52.2 cf = 625.9 cf Chamber Storage

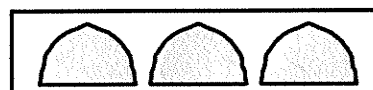
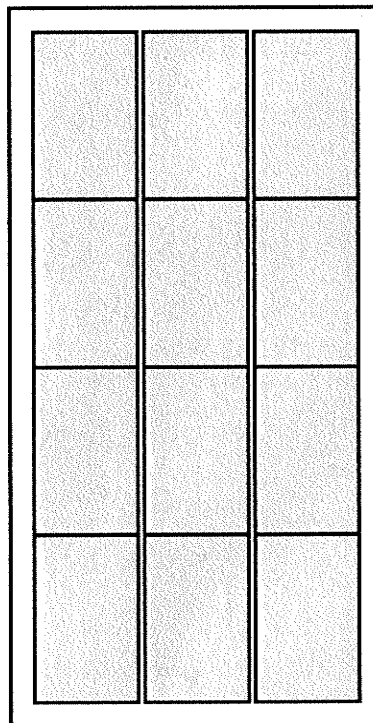
1,646.9 cf Field - 625.9 cf Chambers = 1,021.0 cf Stone x 40.0% Voids = 408.4 cf Stone Storage

Stone + Chamber Storage = 1,034.3 cf = 0.024 af

12 Chambers

61.0 cy Field

37.8 cy Stone



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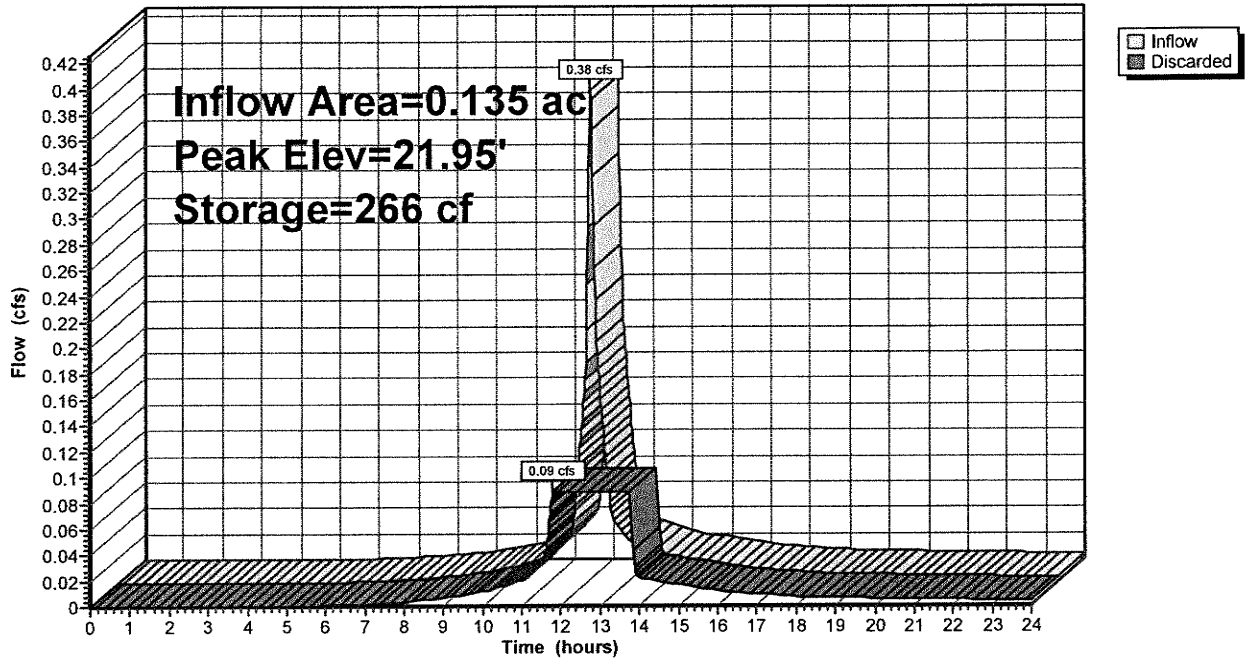
Type III 24-hr 2-Year Rainfall=3.40"

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Pond 2P: Small Cultec

Hydrograph



Proposed Conditions

Type III 24-hr 10-Year Rainfall=4.70"

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Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment SUB-1: Runoff Area=790 sf 0.00% Impervious Runoff Depth>1.19"
Tc=6.0 min CN=61 Runoff=0.02 cfs 0.002 af

Subcatchment SUB-2A: Runoff Area=14,904 sf 80.21% Impervious Runoff Depth>3.69"
Tc=6.0 min CN=91 Runoff=1.42 cfs 0.105 af

Subcatchment SUB-2B: Runoff Area=11,149 sf 100.00% Impervious Runoff Depth>4.46"
Tc=6.0 min CN=98 Runoff=1.17 cfs 0.095 af

Subcatchment SUB-2C: Runoff Area=5,894 sf 80.32% Impervious Runoff Depth>3.69"
Tc=6.0 min CN=91 Runoff=0.56 cfs 0.042 af

Subcatchment SUB-2D: Runoff Area=5,210 sf 58.23% Impervious Runoff Depth>2.90"
Tc=6.0 min CN=83 Runoff=0.41 cfs 0.029 af

Reach DP-1: Inflow=0.02 cfs 0.002 af
Outflow=0.02 cfs 0.002 af

Reach DP-2: Inflow=0.41 cfs 0.029 af
Outflow=0.41 cfs 0.029 af

Pond 1P: Large Cultec Peak Elev=26.12' Storage=2,427 cf Inflow=2.60 cfs 0.200 af
Outflow=0.40 cfs 0.200 af

Pond 2P: Small Cultec Peak Elev=22.63' Storage=517 cf Inflow=0.56 cfs 0.042 af
Outflow=0.09 cfs 0.042 af

Total Runoff Area = 0.871 ac Runoff Volume = 0.273 af Average Runoff Depth = 3.75"
18.65% Pervious = 0.162 ac 81.35% Impervious = 0.709 ac

Proposed Conditions

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Type III 24-hr 10-Year Rainfall=4.70"

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Summary for Subcatchment SUB-1:

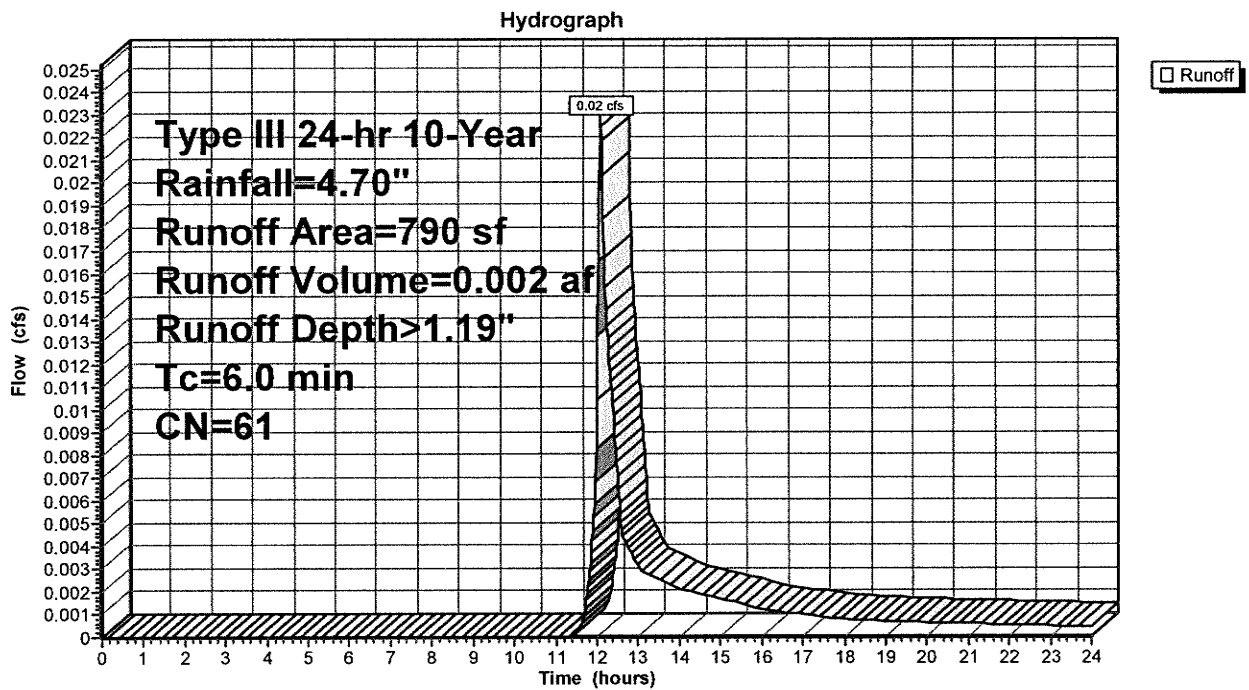
Runoff = 0.02 cfs @ 12.10 hrs, Volume= 0.002 af, Depth> 1.19"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
790	61	>75% Grass cover, Good, HSG B
790		100.00% Pervious Area

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

Subcatchment SUB-1:



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Type III 24-hr 10-Year Rainfall=4.70"

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Summary for Subcatchment SUB-2A:

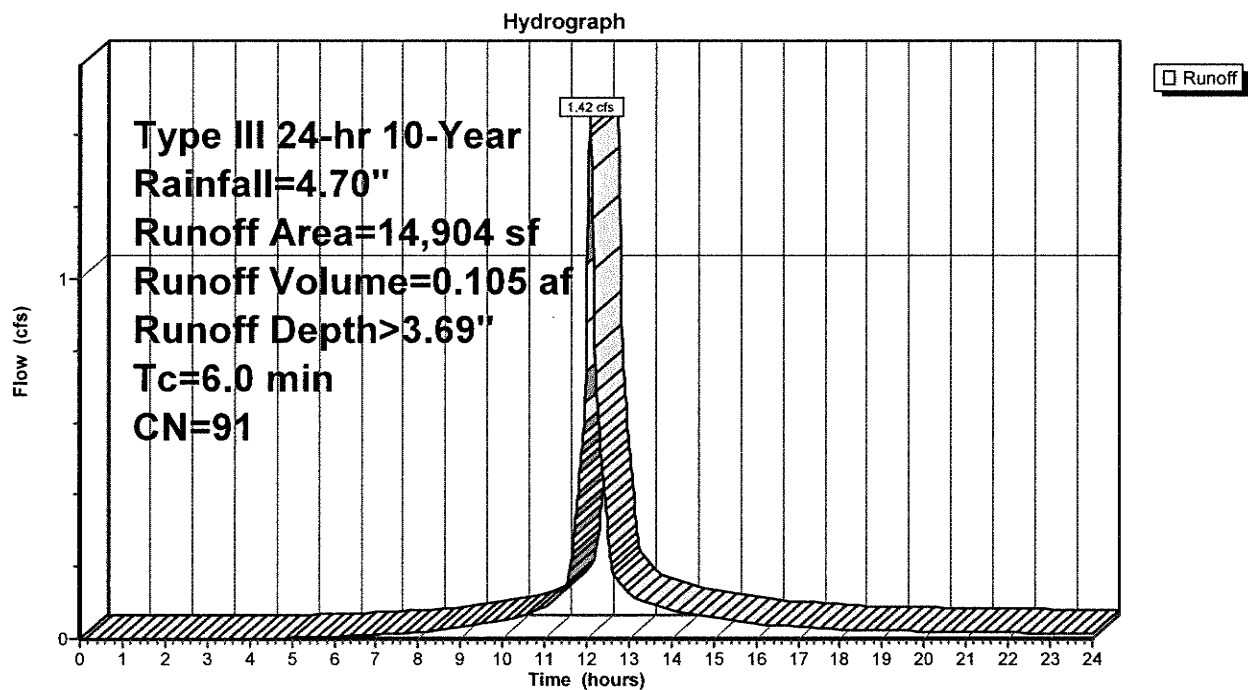
Runoff = 1.42 cfs @ 12.08 hrs, Volume= 0.105 af, Depth> 3.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
 Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
* 11,954	98	Pavement
2,950	61	>75% Grass cover, Good, HSG B
14,904	91	Weighted Average
2,950		19.79% Pervious Area
11,954		80.21% Impervious Area

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

Subcatchment SUB-2A:



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Type III 24-hr 10-Year Rainfall=4.70"

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Summary for Subcatchment SUB-2B:

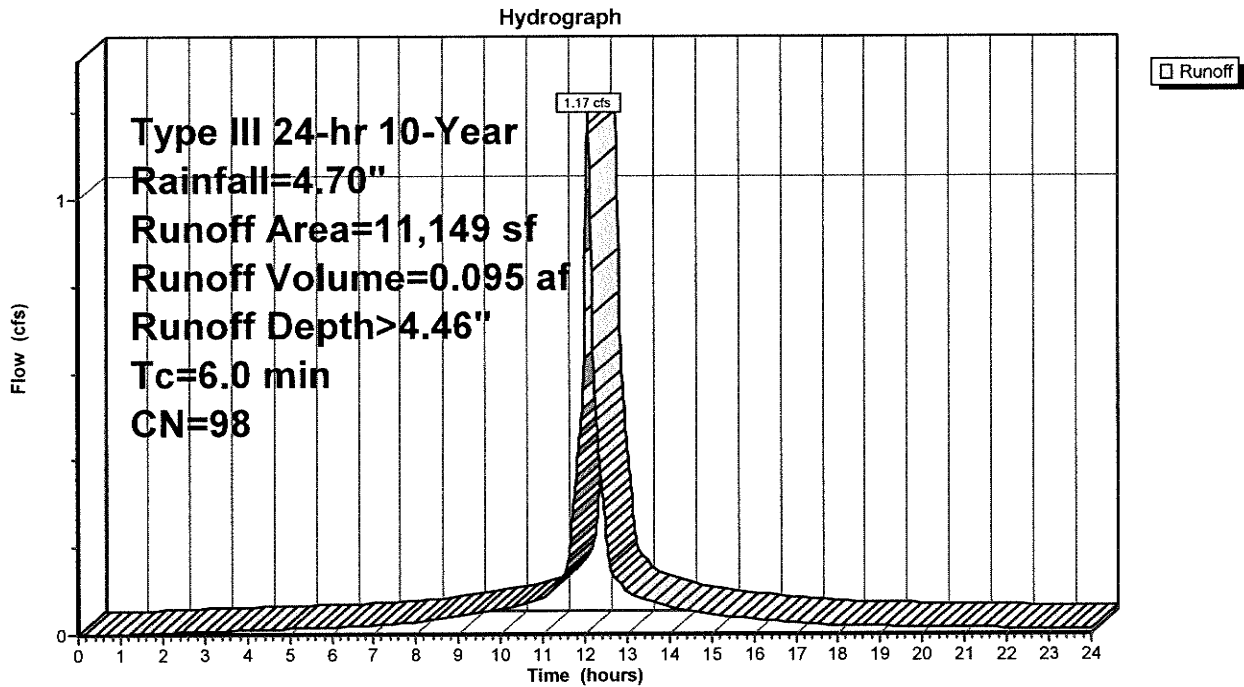
Runoff = 1.17 cfs @ 12.08 hrs, Volume= 0.095 af, Depth> 4.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
* 11,149	98	Roof
11,149		100.00% Impervious Area

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

Subcatchment SUB-2B:



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Type III 24-hr 10-Year Rainfall=4.70"

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Summary for Subcatchment SUB-2C:

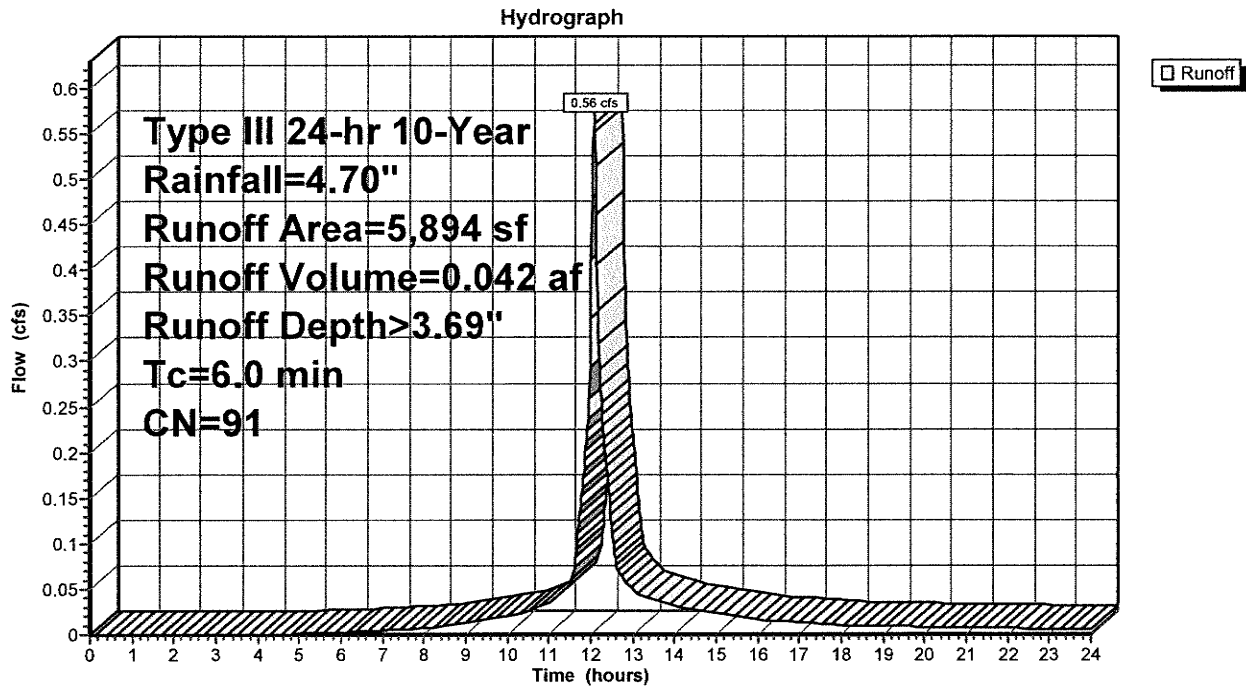
Runoff = 0.56 cfs @ 12.08 hrs, Volume= 0.042 af, Depth> 3.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
 Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
* 4,734	98	Pavement
1,160	61	>75% Grass cover, Good, HSG B
5,894	91	Weighted Average
1,160		19.68% Pervious Area
4,734		80.32% Impervious Area

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

Subcatchment SUB-2C:



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Type III 24-hr 10-Year Rainfall=4.70"

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Summary for Subcatchment SUB-2D:

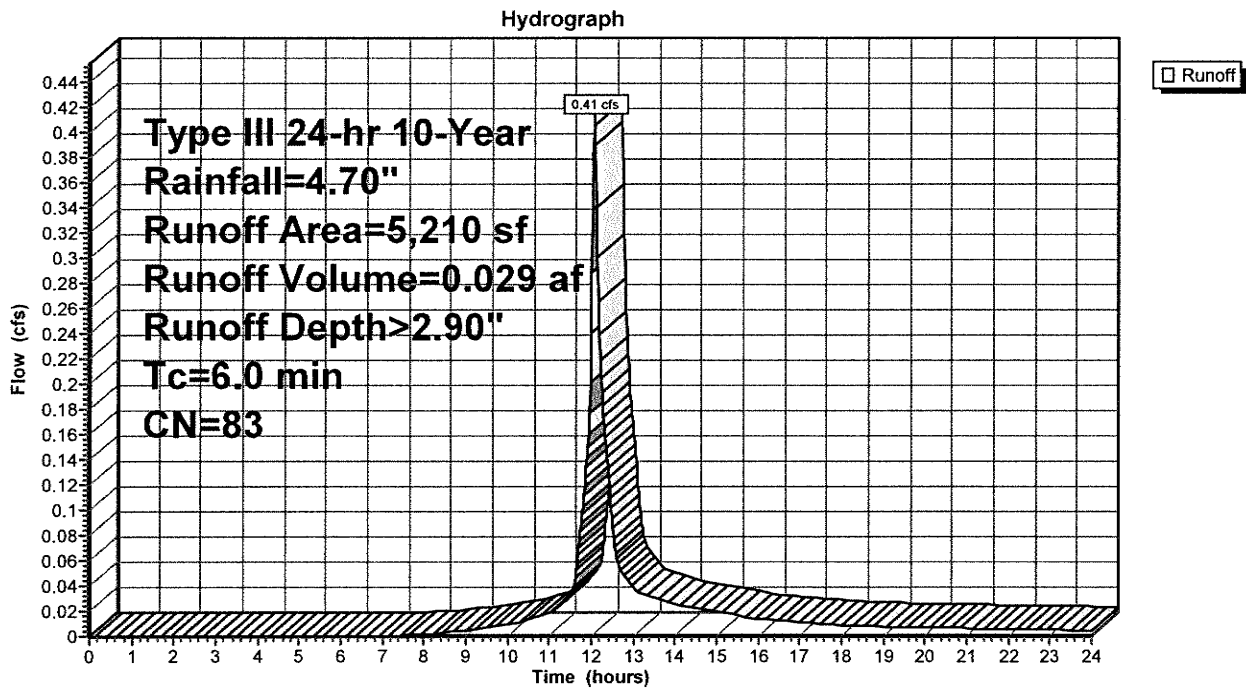
Runoff = 0.41 cfs @ 12.09 hrs, Volume= 0.029 af, Depth> 2.90"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
 Type III 24-hr 10-Year Rainfall=4.70"

	Area (sf)	CN	Description
*	3,034	98	Pavement
	2,176	61	>75% Grass cover, Good, HSG B
	5,210	83	Weighted Average
	2,176		41.77% Pervious Area
	3,034		58.23% Impervious Area

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

Subcatchment SUB-2D:



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Type III 24-hr 10-Year Rainfall=4.70"

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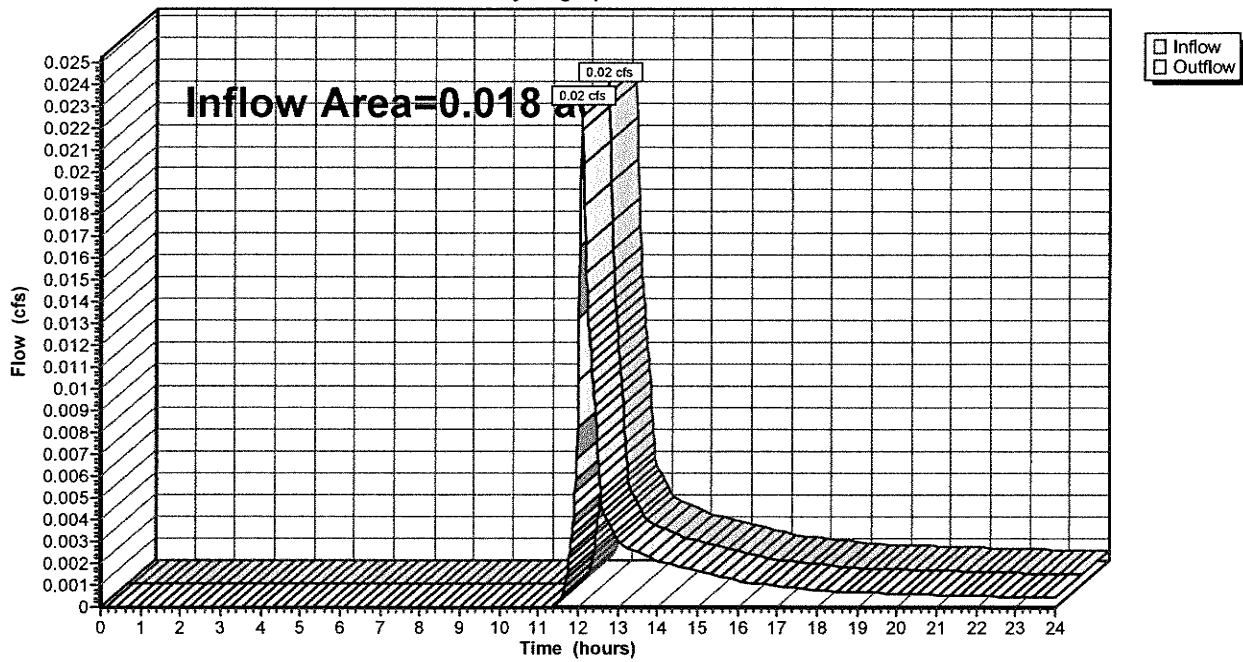
Summary for Reach DP-1:

Inflow Area = 0.018 ac, 0.00% Impervious, Inflow Depth > 1.19" for 10-Year event
Inflow = 0.02 cfs @ 12.10 hrs, Volume= 0.002 af
Outflow = 0.02 cfs @ 12.10 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-1:

Hydrograph



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Type III 24-hr 10-Year Rainfall=4.70"

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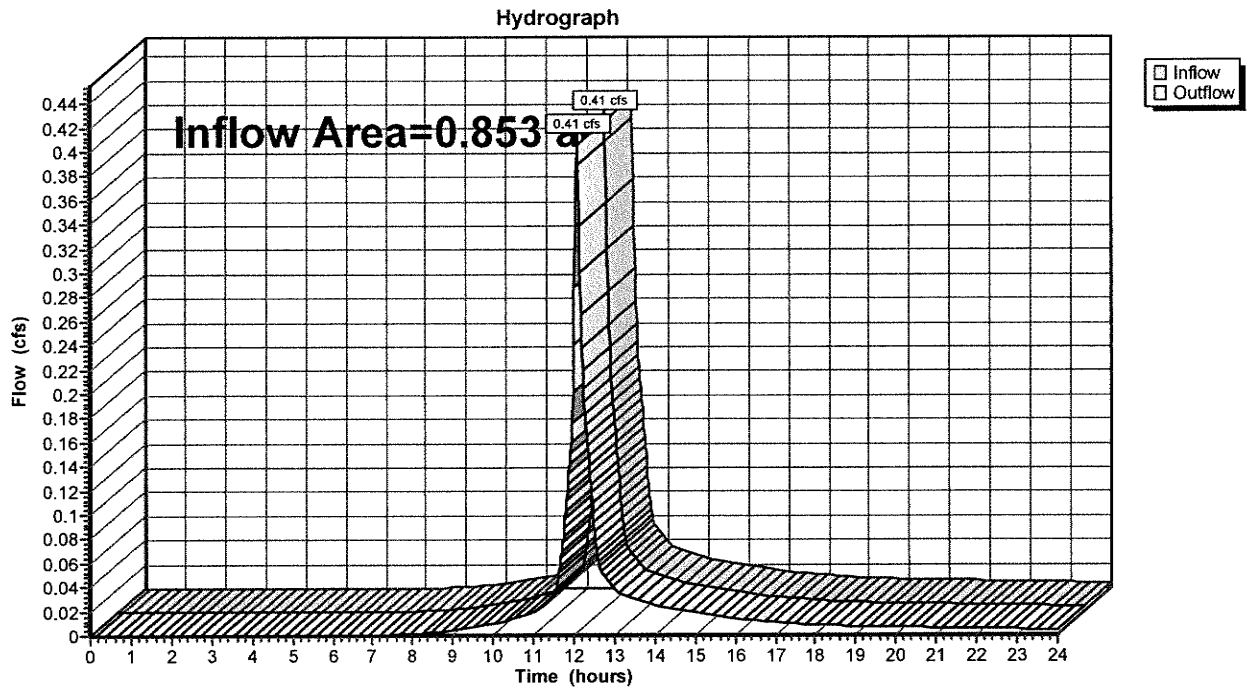
Page 39

Summary for Reach DP-2:

Inflow Area = 0.853 ac, 83.08% Impervious, Inflow Depth > 0.41" for 10-Year event
Inflow = 0.41 cfs @ 12.09 hrs, Volume= 0.029 af
Outflow = 0.41 cfs @ 12.09 hrs, Volume= 0.029 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-2:



Proposed Conditions

Type III 24-hr 10-Year Rainfall=4.70"

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Summary for Pond 1P: Large Cultec

Inflow Area = 0.598 ac, 88.68% Impervious, Inflow Depth > 4.02" for 10-Year event
 Inflow = 2.60 cfs @ 12.08 hrs, Volume= 0.200 af
 Outflow = 0.40 cfs @ 11.66 hrs, Volume= 0.200 af, Atten= 84%, Lag= 0.0 min
 Discarded = 0.40 cfs @ 11.66 hrs, Volume= 0.200 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
 Peak Elev= 26.12' @ 12.57 hrs Surf.Area= 2,106 sf Storage= 2,427 cf

Plug-Flow detention time= 35.0 min calculated for 0.200 af (100% of inflow)
 Center-of-Mass det. time= 34.9 min (804.3 - 769.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	24.50'	1,732 cf	29.25'W x 72.00'L x 3.54'H Field A 7,459 cf Overall - 3,129 cf Embedded = 4,329 cf x 40.0% Voids
#2A	25.00'	3,129 cf	Cultec R-330XLHD x 60 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
		4,861 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	24.50'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.40 cfs @ 11.66 hrs HW=24.54' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.40 cfs)

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Type III 24-hr 10-Year Rainfall=4.70"

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Pond 1P: Large Cultec - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

52.0" Wide + 3.0" Spacing = 55.0" C-C

10 Chambers/Row x 7.00' Long = 70.00' + 12.0" End Stone x 2 = 72.00' Base Length

6 Rows x 52.0" Wide + 3.0" Spacing x 5 + 12.0" Side Stone x 2 = 29.25' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

60 Chambers x 52.2 cf = 3,129.4 cf Chamber Storage

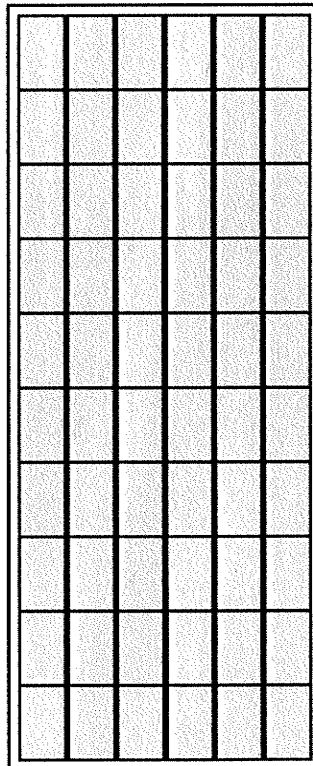
7,458.8 cf Field - 3,129.4 cf Chambers = 4,329.3 cf Stone x 40.0% Voids = 1,731.7 cf Stone Storage

Stone + Chamber Storage = 4,861.2 cf = 0.112 af

60 Chambers

276.3 cy Field

160.3 cy Stone



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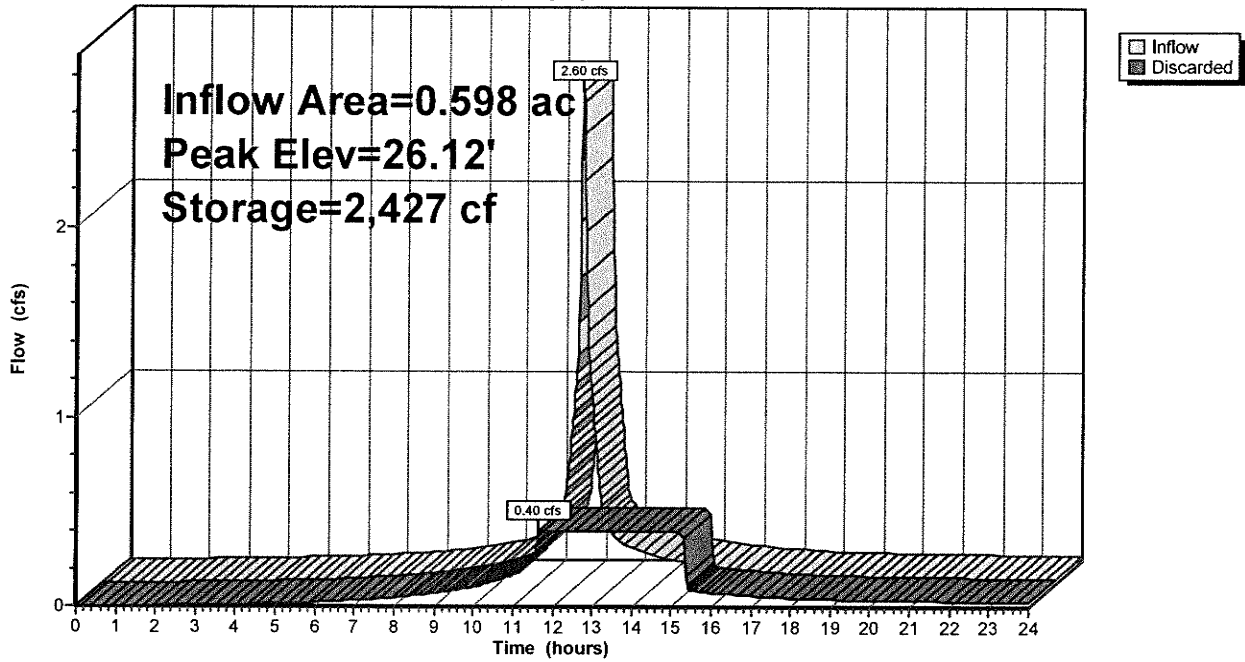
Type III 24-hr 10-Year Rainfall=4.70"

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Pond 1P: Large Cultec

Hydrograph



Proposed Conditions

Type III 24-hr 10-Year Rainfall=4.70"

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Summary for Pond 2P: Small Cultec

Inflow Area = 0.135 ac, 80.32% Impervious, Inflow Depth > 3.69" for 10-Year event
 Inflow = 0.56 cfs @ 12.08 hrs, Volume= 0.042 af
 Outflow = 0.09 cfs @ 11.68 hrs, Volume= 0.042 af, Atten= 84%, Lag= 0.0 min
 Discarded = 0.09 cfs @ 11.68 hrs, Volume= 0.042 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
 Peak Elev= 22.63' @ 12.57 hrs Surf.Area= 465 sf Storage= 517 cf

Plug-Flow detention time= 35.2 min calculated for 0.042 af (100% of inflow)
 Center-of-Mass det. time= 35.0 min (823.3 - 788.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	21.00'	408 cf	15.50'W x 30.00'L x 3.54'H Field A 1,647 cf Overall - 626 cf Embedded = 1,021 cf x 40.0% Voids
#2A	21.50'	626 cf	Cultec R-330XLHD x 12 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
		1,034 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	21.00'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.09 cfs @ 11.68 hrs HW=21.04' (Free Discharge)

↑-1=Exfiltration (Exfiltration Controls 0.09 cfs)

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Type III 24-hr 10-Year Rainfall=4.70"

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Pond 2P: Small Cultec - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

52.0" Wide + 3.0" Spacing = 55.0" C-C

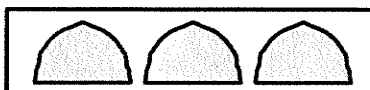
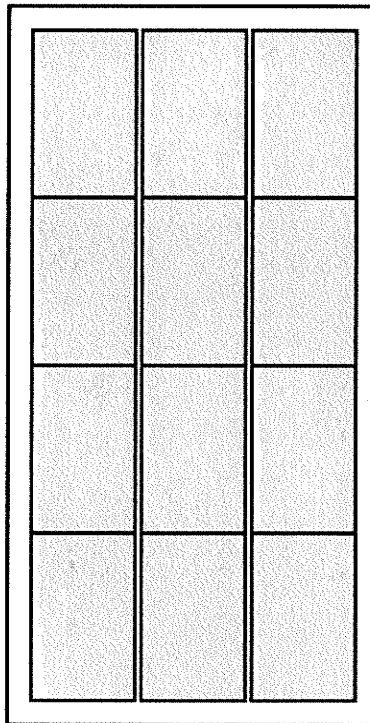
4 Chambers/Row x 7.00' Long = 28.00' + 12.0" End Stone x 2 = 30.00' Base Length
3 Rows x 52.0" Wide + 3.0" Spacing x 2 + 12.0" Side Stone x 2 = 15.50' Base Width
6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

12 Chambers x 52.2 cf = 625.9 cf Chamber Storage

1,646.9 cf Field - 625.9 cf Chambers = 1,021.0 cf Stone x 40.0% Voids = 408.4 cf Stone Storage

Stone + Chamber Storage = 1,034.3 cf = 0.024 af

12 Chambers
61.0 cy Field
37.8 cy Stone



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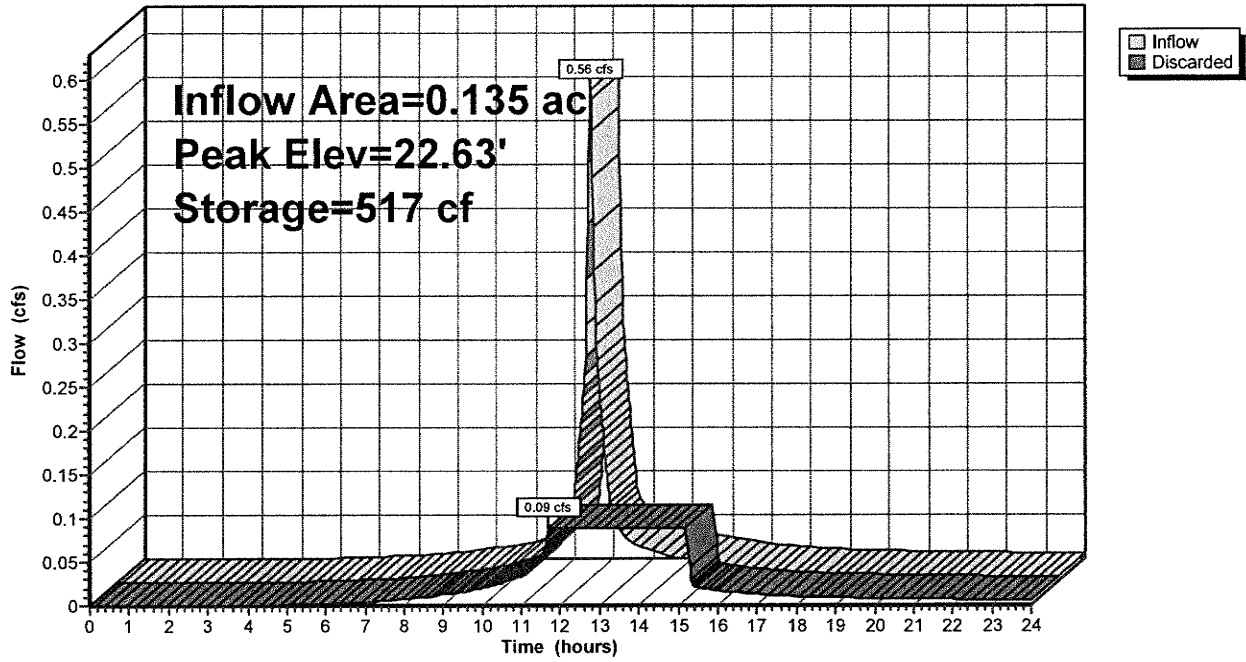
Type III 24-hr 10-Year Rainfall=4.70"

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Pond 2P: Small Cultec

Hydrograph



Proposed Conditions

Type III 24-hr 100-Year Rainfall=7.00"

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Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment SUB-1: Runoff Area=790 sf 0.00% Impervious Runoff Depth>2.70"
Tc=6.0 min CN=61 Runoff=0.06 cfs 0.004 af

Subcatchment SUB-2A: Runoff Area=14,904 sf 80.21% Impervious Runoff Depth>5.93"
Tc=6.0 min CN=91 Runoff=2.23 cfs 0.169 af

Subcatchment SUB-2B: Runoff Area=11,149 sf 100.00% Impervious Runoff Depth>6.76"
Tc=6.0 min CN=98 Runoff=1.76 cfs 0.144 af

Subcatchment SUB-2C: Runoff Area=5,894 sf 80.32% Impervious Runoff Depth>5.93"
Tc=6.0 min CN=91 Runoff=0.88 cfs 0.067 af

Subcatchment SUB-2D: Runoff Area=5,210 sf 58.23% Impervious Runoff Depth>5.02"
Tc=6.0 min CN=83 Runoff=0.69 cfs 0.050 af

Reach DP-1: Inflow=0.06 cfs 0.004 af
Outflow=0.06 cfs 0.004 af

Reach DP-2: Inflow=0.69 cfs 0.050 af
Outflow=0.69 cfs 0.050 af

Pond 1P: Large Cultec Peak Elev=27.68' Storage=4,554 cf Inflow=3.98 cfs 0.313 af
Outflow=0.40 cfs 0.313 af

Pond 2P: Small Cultec Peak Elev=24.38' Storage=1,004 cf Inflow=0.88 cfs 0.067 af
Outflow=0.09 cfs 0.067 af

Total Runoff Area = 0.871 ac Runoff Volume = 0.434 af Average Runoff Depth = 5.98"
18.65% Pervious = 0.162 ac 81.35% Impervious = 0.709 ac

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Type III 24-hr 100-Year Rainfall=7.00"

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Summary for Subcatchment SUB-1:

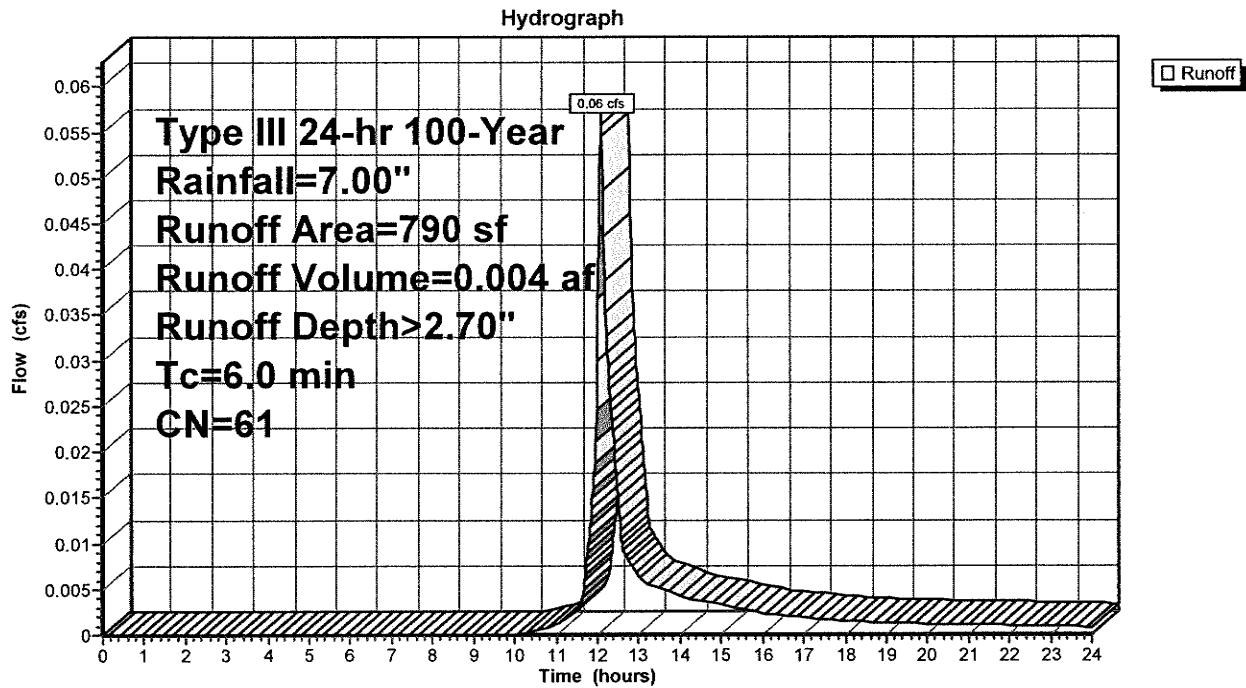
Runoff = 0.06 cfs @ 12.09 hrs, Volume= 0.004 af, Depth> 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (sf)	CN	Description
790	61	>75% Grass cover, Good, HSG B
790		100.00% Pervious Area

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

Subcatchment SUB-1:



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Type III 24-hr 100-Year Rainfall=7.00"

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Summary for Subcatchment SUB-2A:

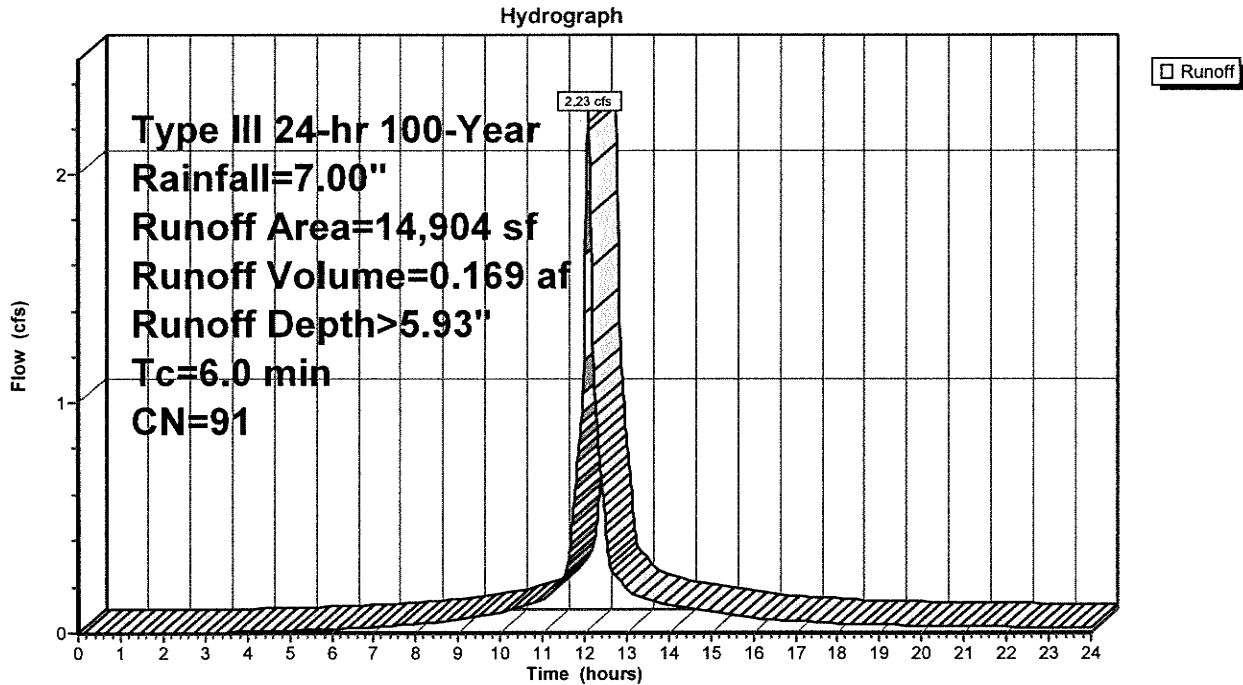
Runoff = 2.23 cfs @ 12.08 hrs, Volume= 0.169 af, Depth> 5.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-Year Rainfall=7.00"

	Area (sf)	CN	Description
*	11,954	98	Pavement
	2,950	61	>75% Grass cover, Good, HSG B
	14,904	91	Weighted Average
	2,950		19.79% Pervious Area
	11,954		80.21% Impervious Area

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

Subcatchment SUB-2A:



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Type III 24-hr 100-Year Rainfall=7.00"

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Summary for Subcatchment SUB-2B:

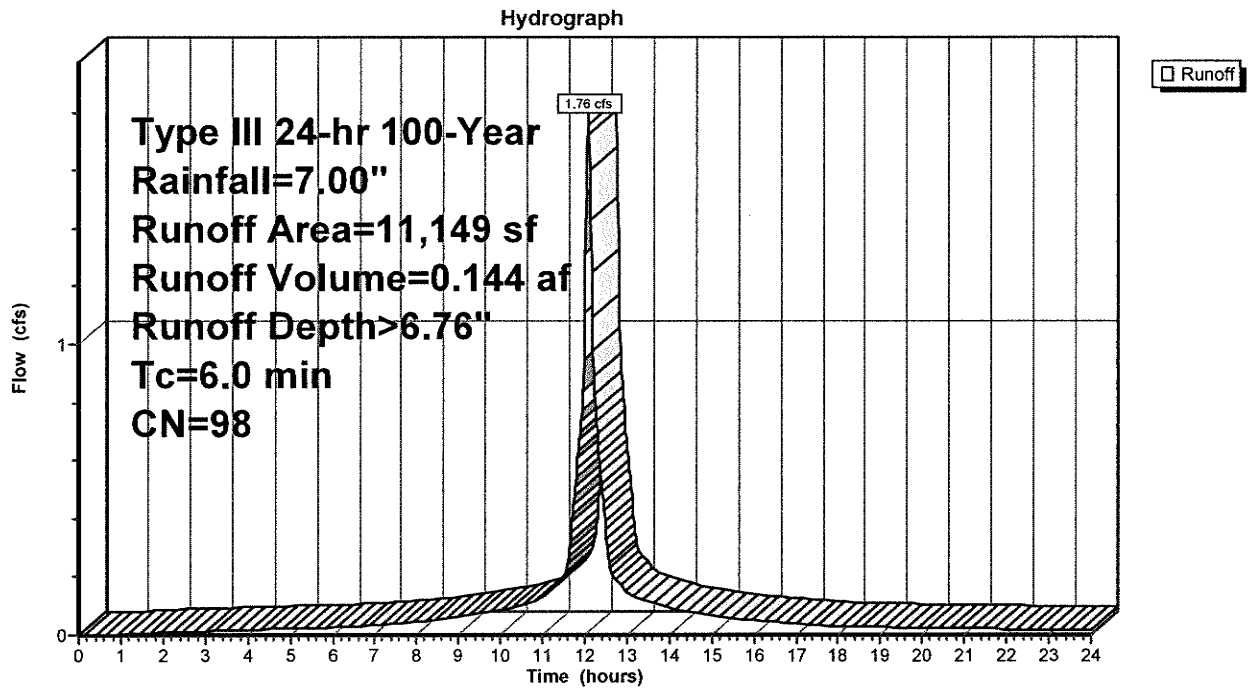
Runoff = 1.76 cfs @ 12.08 hrs, Volume= 0.144 af, Depth> 6.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (sf)	CN	Description
* 11,149	98	Roof
11,149		100.00% Impervious Area

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

Subcatchment SUB-2B:



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Summary for Subcatchment SUB-2C:

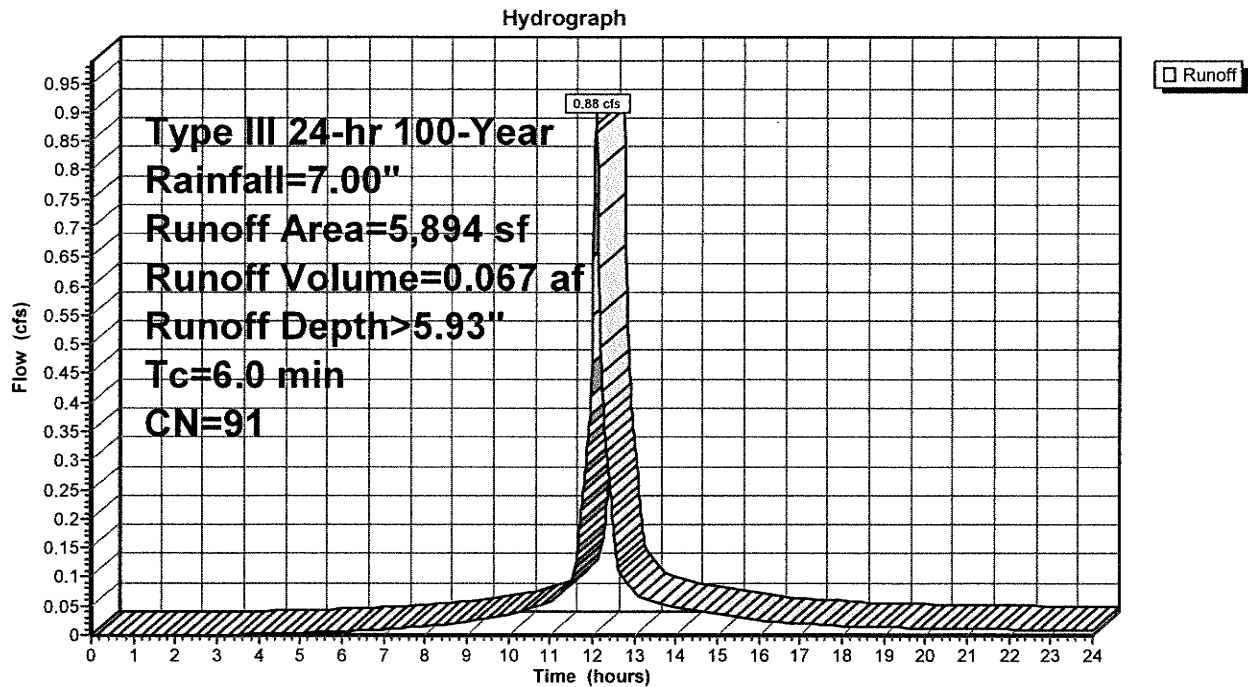
Runoff = 0.88 cfs @ 12.08 hrs, Volume= 0.067 af, Depth> 5.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-Year Rainfall=7.00"

	Area (sf)	CN	Description
*	4,734	98	Pavement
	1,160	61	>75% Grass cover, Good, HSG B
	5,894	91	Weighted Average
	1,160		19.68% Pervious Area
	4,734		80.32% Impervious Area

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

Subcatchment SUB-2C:



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Summary for Subcatchment SUB-2D:

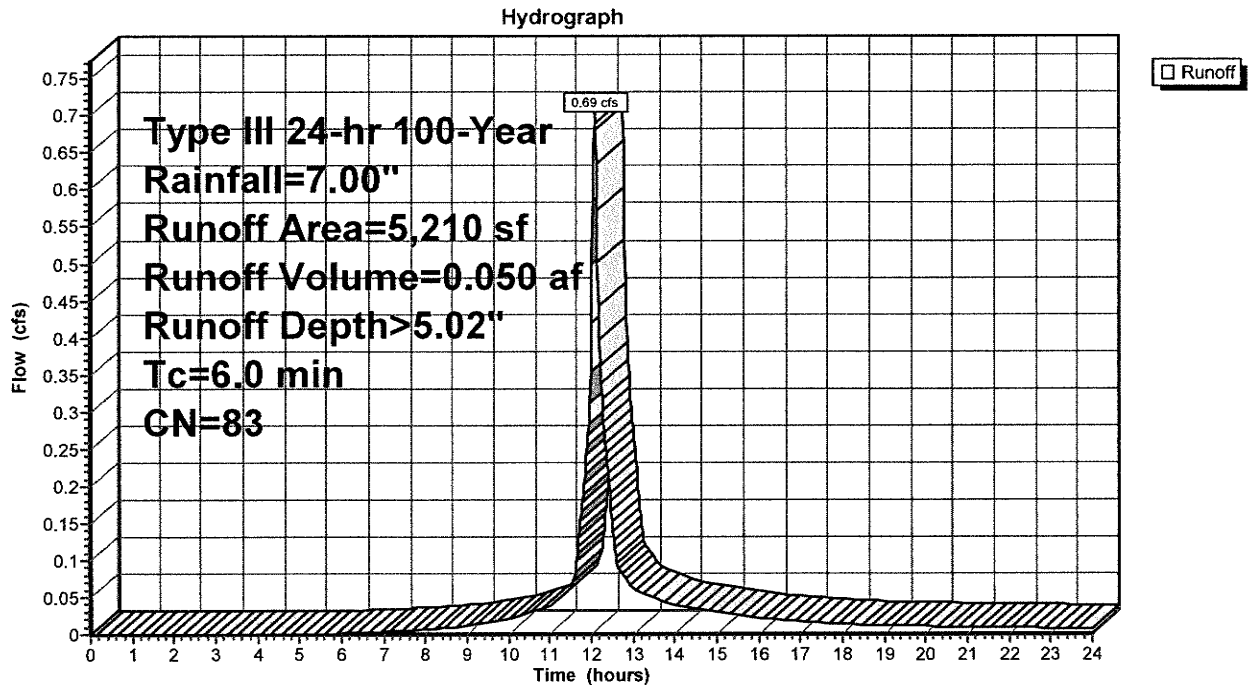
Runoff = 0.69 cfs @ 12.09 hrs, Volume= 0.050 af, Depth> 5.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (sf)	CN	Description
* 3,034	98	Pavement
2,176	61	>75% Grass cover, Good, HSG B
5,210	83	Weighted Average
2,176		41.77% Pervious Area
3,034		58.23% Impervious Area

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

Subcatchment SUB-2D:



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Type III 24-hr 100-Year Rainfall=7.00"

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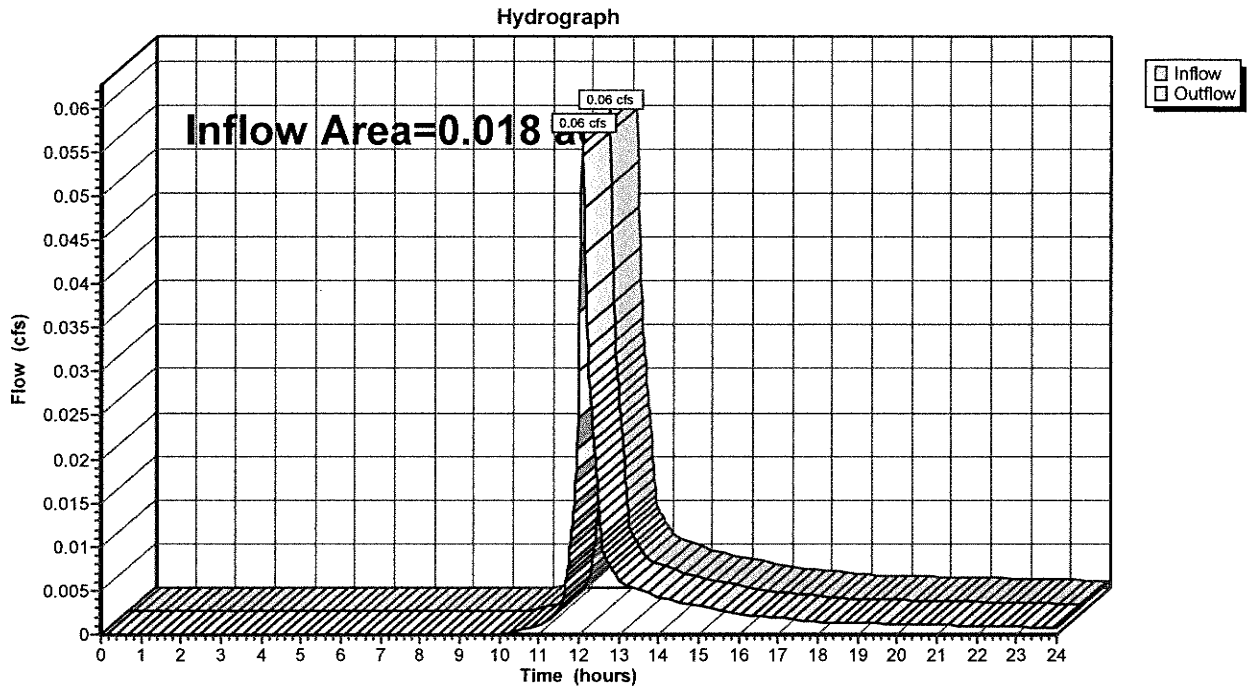
Page 52

Summary for Reach DP-1:

Inflow Area = 0.018 ac, 0.00% Impervious, Inflow Depth > 2.70" for 100-Year event
Inflow = 0.06 cfs @ 12.09 hrs, Volume= 0.004 af
Outflow = 0.06 cfs @ 12.09 hrs, Volume= 0.004 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach DP-1:



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Type III 24-hr 100-Year Rainfall=7.00"

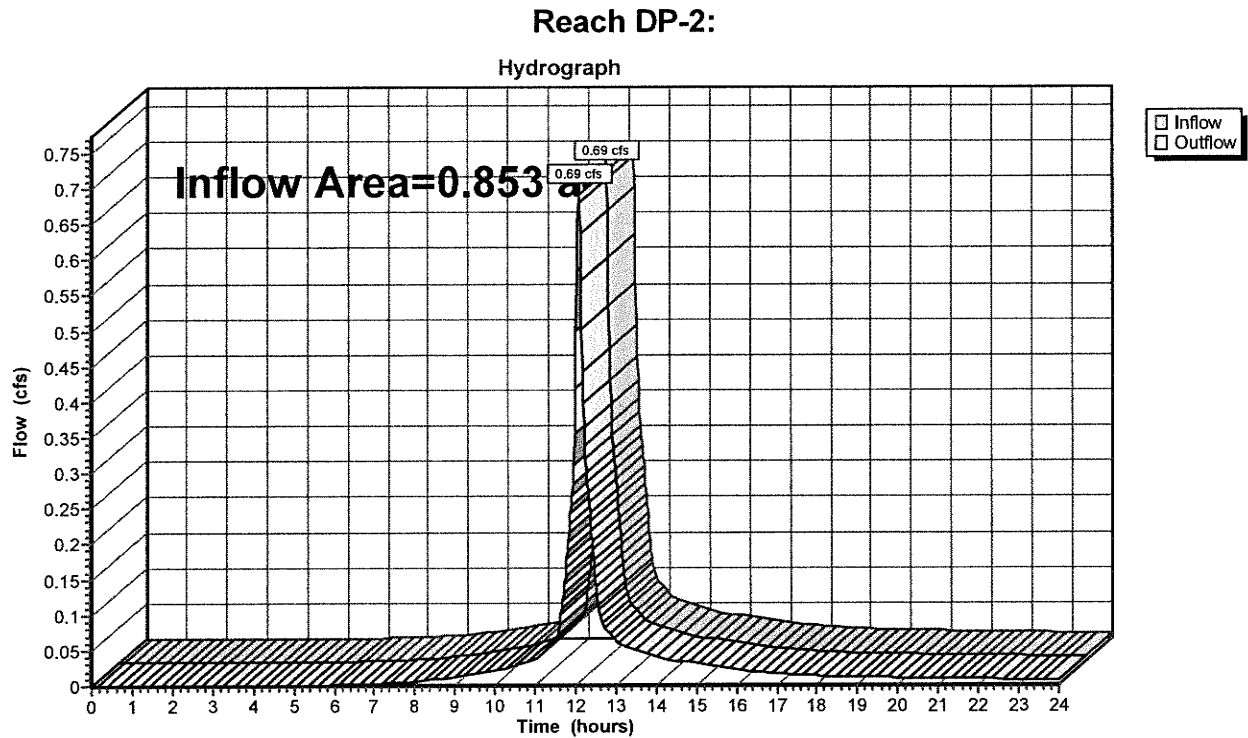
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Summary for Reach DP-2:

Inflow Area = 0.853 ac, 83.08% Impervious, Inflow Depth > 0.70" for 100-Year event
Inflow = 0.69 cfs @ 12.09 hrs, Volume= 0.050 af
Outflow = 0.69 cfs @ 12.09 hrs, Volume= 0.050 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs



Proposed Conditions

Type III 24-hr 100-Year Rainfall=7.00"

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Summary for Pond 1P: Large Cultec

Inflow Area = 0.598 ac, 88.68% Impervious, Inflow Depth > 6.29" for 100-Year event
 Inflow = 3.98 cfs @ 12.08 hrs, Volume= 0.313 af
 Outflow = 0.40 cfs @ 11.46 hrs, Volume= 0.313 af, Atten= 90%, Lag= 0.0 min
 Discarded = 0.40 cfs @ 11.46 hrs, Volume= 0.313 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
 Peak Elev= 27.68' @ 12.83 hrs Surf.Area= 2,106 sf Storage= 4,554 cf

Plug-Flow detention time= 76.3 min calculated for 0.313 af (100% of inflow)
 Center-of-Mass det. time= 76.1 min (836.6 - 760.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	24.50'	1,732 cf	29.25'W x 72.00'L x 3.54'H Field A 7,459 cf Overall - 3,129 cf Embedded = 4,329 cf x 40.0% Voids
#2A	25.00'	3,129 cf	Cultec R-330XLHD x 60 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
		4,861 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	24.50'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.40 cfs @ 11.46 hrs HW=24.54' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.40 cfs)

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Type III 24-hr 100-Year Rainfall=7.00"

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Pond 1P: Large Cultec - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

52.0" Wide + 3.0" Spacing = 55.0" C-C

10 Chambers/Row x 7.00' Long = 70.00' + 12.0" End Stone x 2 = 72.00' Base Length

6 Rows x 52.0" Wide + 3.0" Spacing x 5 + 12.0" Side Stone x 2 = 29.25' Base Width

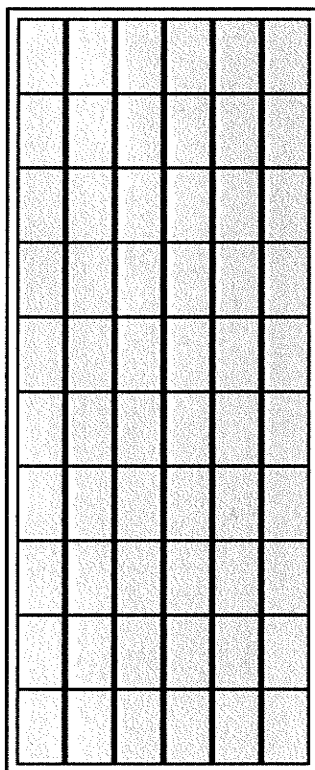
6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

60 Chambers x 52.2 cf = 3,129.4 cf Chamber Storage

7,458.8 cf Field - 3,129.4 cf Chambers = 4,329.3 cf Stone x 40.0% Voids = 1,731.7 cf Stone Storage

Stone + Chamber Storage = 4,861.2 cf = 0.112 af

60 Chambers
276.3 cy Field
160.3 cy Stone



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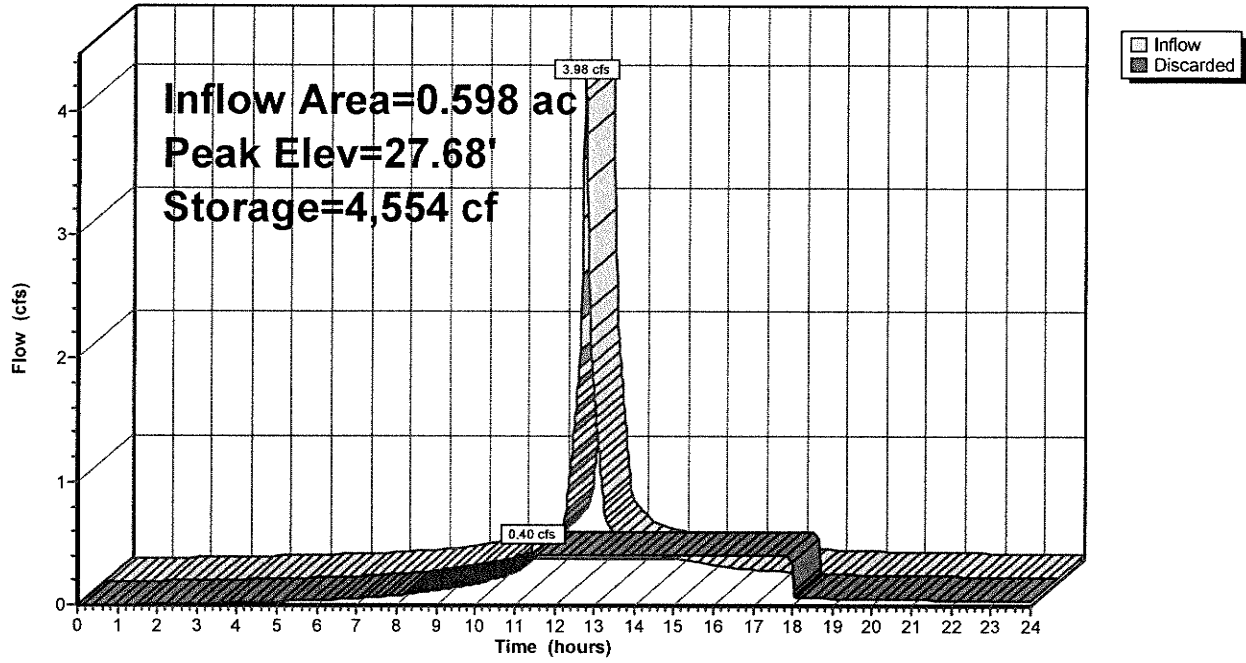
Type III 24-hr 100-Year Rainfall=7.00"

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Pond 1P: Large Cultec

Hydrograph



Proposed Conditions

Type III 24-hr 100-Year Rainfall=7.00"

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Summary for Pond 2P: Small Cultec

Inflow Area = 0.135 ac, 80.32% Impervious, Inflow Depth > 5.93" for 100-Year event
 Inflow = 0.88 cfs @ 12.08 hrs, Volume= 0.067 af
 Outflow = 0.09 cfs @ 11.50 hrs, Volume= 0.067 af, Atten= 90%, Lag= 0.0 min
 Discarded = 0.09 cfs @ 11.50 hrs, Volume= 0.067 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
 Peak Elev= 24.38' @ 12.84 hrs Surf.Area= 465 sf Storage= 1,004 cf

Plug-Flow detention time= 79.2 min calculated for 0.067 af (100% of inflow)
 Center-of-Mass det. time= 79.0 min (854.8 - 775.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	21.00'	408 cf	15.50'W x 30.00'L x 3.54'H Field A 1,647 cf Overall - 626 cf Embedded = 1,021 cf x 40.0% Voids
#2A	21.50'	626 cf	Cultec R-330XLHD x 12 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
		1,034 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	21.00'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.09 cfs @ 11.50 hrs HW=21.04' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.09 cfs)

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Type III 24-hr 100-Year Rainfall=7.00"

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Pond 2P: Small Cultec - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

52.0" Wide + 3.0" Spacing = 55.0" C-C

4 Chambers/Row x 7.00' Long = 28.00' + 12.0" End Stone x 2 = 30.00' Base Length

3 Rows x 52.0" Wide + 3.0" Spacing x 2 + 12.0" Side Stone x 2 = 15.50' Base Width

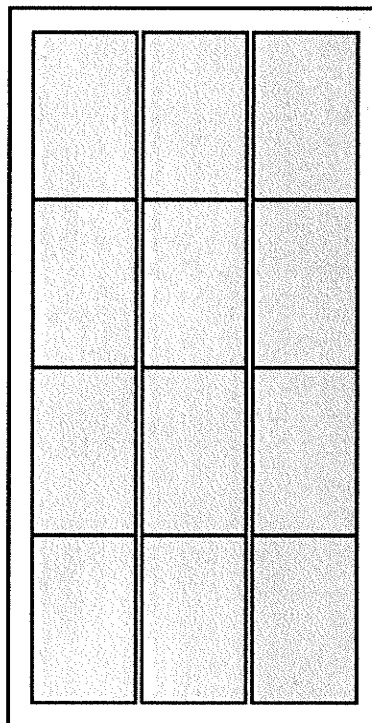
6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

12 Chambers x 52.2 cf = 625.9 cf Chamber Storage

1,646.9 cf Field - 625.9 cf Chambers = 1,021.0 cf Stone x 40.0% Voids = 408.4 cf Stone Storage

Stone + Chamber Storage = 1,034.3 cf = 0.024 af

12 Chambers
61.0 cy Field
37.8 cy Stone



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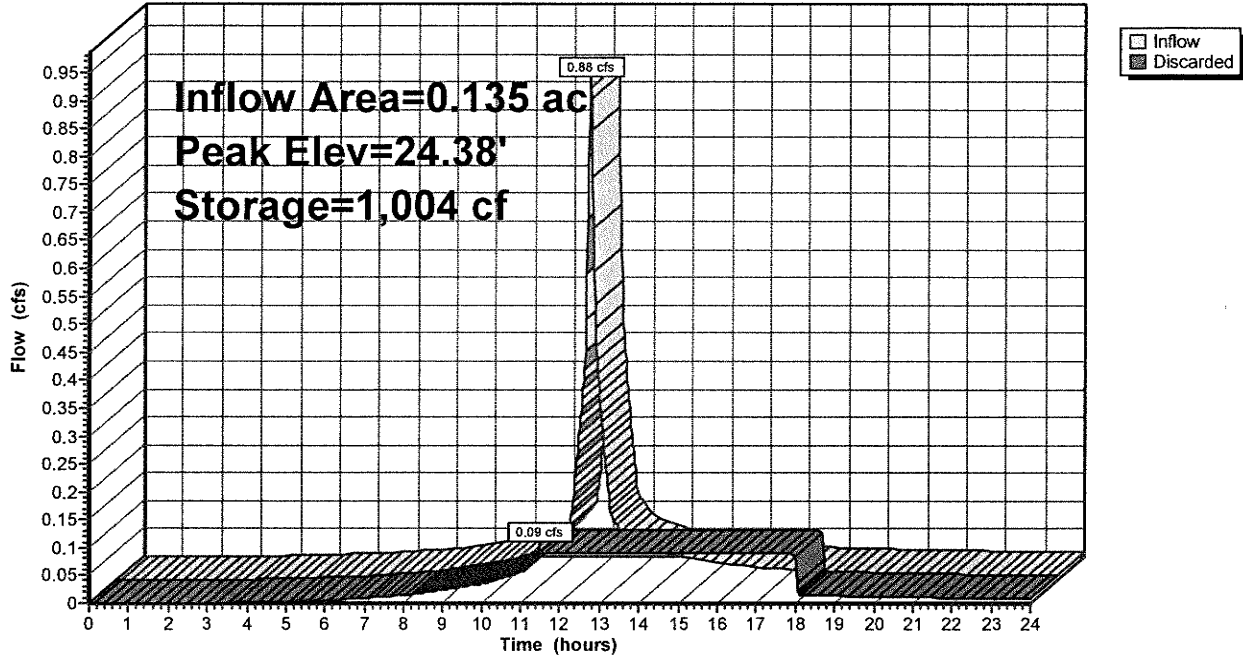
Type III 24-hr 100-Year Rainfall=7.00"

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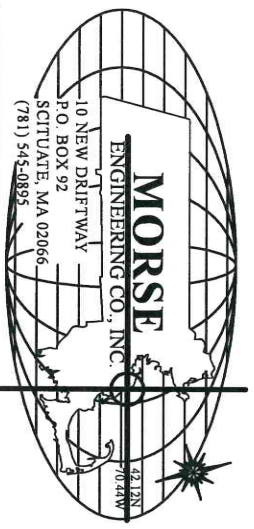
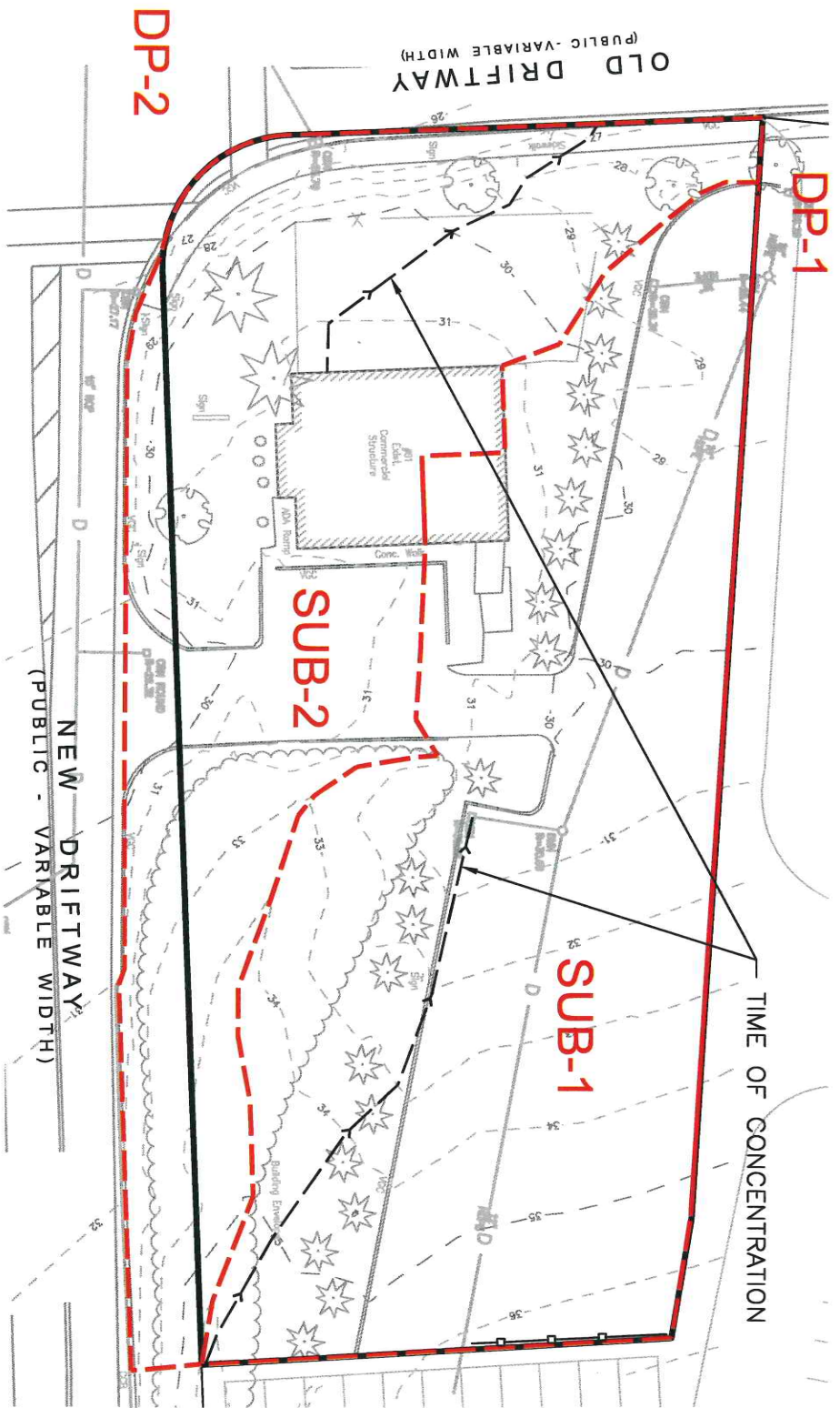
Pond 2P: Small Cultec

Hydrograph



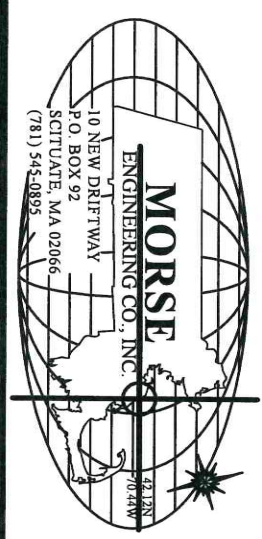
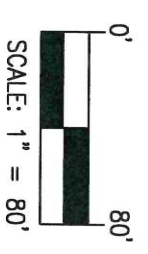
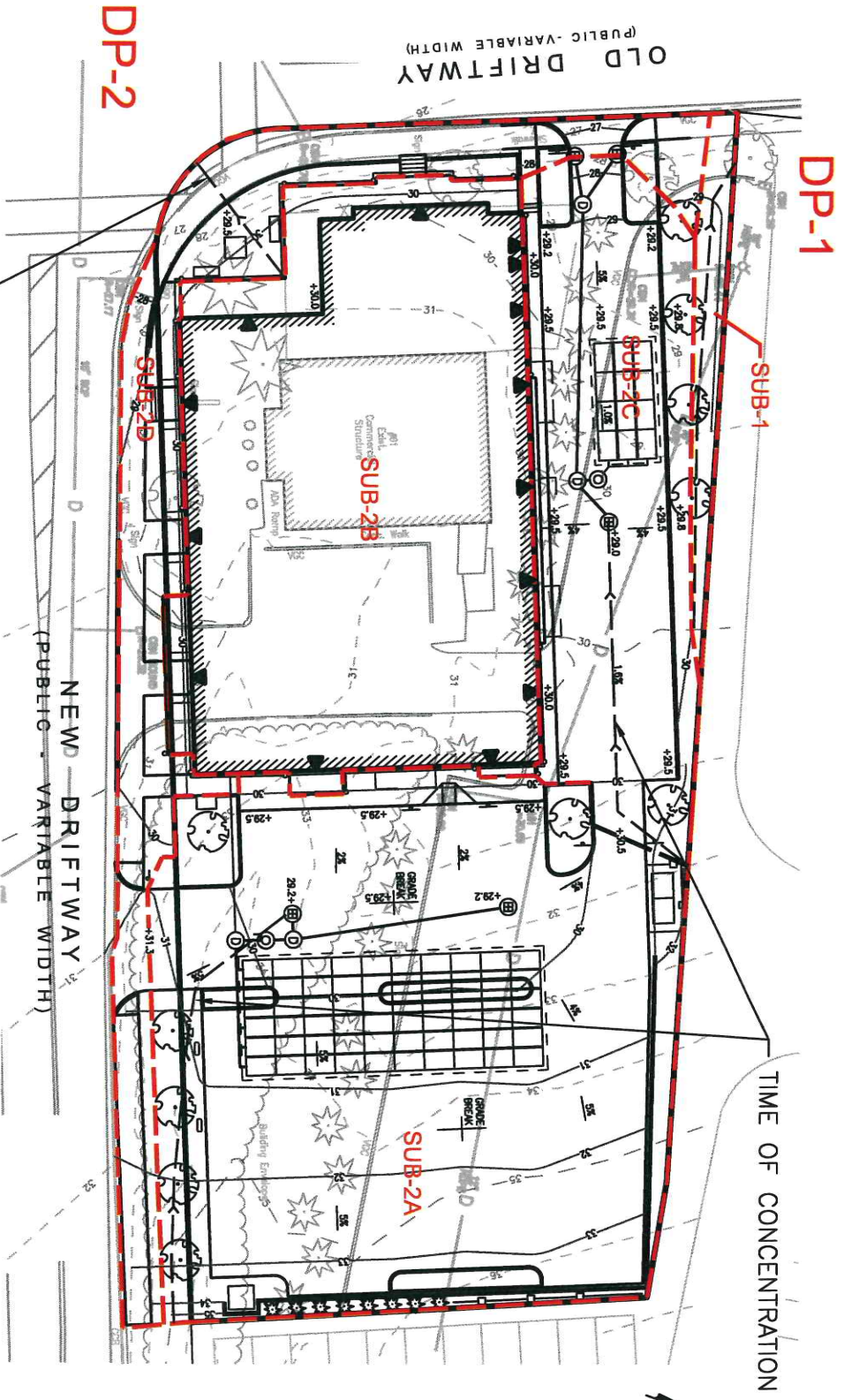
APPENDIX C

- Pre-Development Watershed Plan
- Post-Development Watershed Plan



WS - 1

**PRE-DEVELOPMENT
 WATERSHED PLAN
 61 NEW DRIFTWAY
 SCITUATE, MASSACHUSETTS**



WS - 1
**POST-DEVELOPMENT
 WATERSHED PLAN**
 61 NEW DRIFTWAY
 SCITUATE, MASSACHUSETTS