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N.J. STATE BOARD OF PROFESSIONAL ENGINEERS & LAND SURVEYORS CERTIFICATE OF AUTHORIZATION NO. 24GA27985400

258 MAIN STREET, MILLBURN, NEW JERSEY, 07041

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STORM WATER MANAGEMENT REPORT

THE VILLAS AT ORANGE LAWN

305 RIDGEWOOD ROAD NORTH

TOWNSHIP OF SOUTH ORANGE VILLAGE ESSEX COUNTY, NJ

PROJECT # 1140108

DATE: September 18, 2016

MICHAEL LANZAFAMA, P.E. & P.L.S.

NJ REG. # GB 30084

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INTRODUCTION

The property in question is located on the north side of Ridgewood Road North, approximately 125 feet west of the intersection with Forest Road in the Township of South Orange Village. Locally it is known as the Orange Lawn Tennis Club. The club encompasses total an area of 687,358 square feet or 15.780 acres. The Tax Lot is designated as Lot 6, Block 1304. The parcel is bounded by residential homes to the north, east and west.

The Lot will be divided into two parts. The first will remain the Orange Lawn Tennis Club and will encompass a total of 479,160 square feet or 11.000 acres. The zoning for this property has been designated as the *PR Private Recreational District.* The second section will be on the south of the site and will be a total of 208,198 square feet or 4.780 acres. The zoning for the section of the site will be *RT Residential Townhouse District.* The proposal for this application is the construction of 20 townhomes. This project, as proposed, is in conformance with the current zoning.

The State Plane Coordinates for the project are **E 557925—N 699600**. A portion of the U.S.G.S Roselle Quadrangle Map is attached showing the project's location within the community.

SOILS

The site contains one soil type. The *Soil Survey of Essex County* has identified the soil as the Boonton-Urban Land, Boonton substratum complex (BowrB). The Soil Conservation Service has classified this soil as Hydrologic Soil Group "C". Based on the Soil Survey information, this soil is described as being "well-drained" with subsoil composed of a silt loam near the top to a gravelly loam two feet deep, to a gravelly fine sandy loam material about six feet. Melick-Tully have performed site specific soils investigation in the property to determine depth to rock and depth to the seasonal high water table. Test pits were excavated and their soils log sheets are appended to this report.

TOPOGRAPHY

The Townhome site is sloping with about a 10% slope with a high point of about110 feet in the north of the site near the road into the Tennis Club. The property slopes down north to south to an elevation of about 54 feet at the northeasterly tip of the property (over a distance of about 560 feet).

NONSTRUCTURAL BEST MANAGEMENT PRACTICES (BMPs)

Stormwater management is an important aspect of the project, not only for the safety and convenience of potential residents, but for the environment as well. Thus, it has been endeavored to include various stormwater management techniques that include both natural and structural means to accomplish that task.

The following low impact, nonstructural, development (NJAC 7:8-5.3) approaches to site design has been incorporated into this project;

- (NJAC 7:8-5.3 (b) 3)The proposed total lot coverage (including buildings, parking areas, driveways, and sidewalks) is approximately 1.903 acres or 82,894 sf, currently 8,274 sf or 0.190 acres of the site is covered with impervious surfaces. (Up to 83,279 sf is permitted by ordinance).
- (NJAC 7:8-5.3 (b) 3,4)New shade and evergreen trees as well as shrubs and groundcover would be planted throughout the project area to help reduce runoff rates and volumes.
- (NJAC 7:8-5.3 (b) 7)As much of the existing natural vegetation would be preserved to the maximum extent as practical.
- (NJAC 7:8-5.3 (b) 9)All stormwater inlets would be installed with an "N" type curb piece to prevent larger pieces of debris from entering the drainage system.
- (NJAC 7:8-5.4 (a) 1)Soil erosion and sediment control during construction and post-construction soil stabilization and vegetation establishment would be subject to approval and monitoring of the local soil conservation district.

Other aspects of the stormwater management plan include structural elements:

- A piped stormwater collection system that would receive water from certain grass swales, pavement, and roof areas.
- An underground stormwater detention system.
- An above ground filter system to capture runoff coming from the road and driveways.

HYDROLOGY AND STORMWATER MANAGEMENT

The proposed site work would disturb approximately 3.771 acres and increase impervious cover by approximately 1.710 acres, thus the drainage design is subject to the stormwater management rules and regulations promulgated by the N.J.D.E.P. and adopted by most municipalities. These rules (as adopted by the Township of South Orange) require that an analysis be performed for the 2-, 10-, and 100-year storm frequencies. The stormwater collection system was designed based on the "Rational Method" for determining peak flow rates for the 100-year frequency storm. However the "Natural Resources Conservation Service Method," outlined in *Technical Release 55* was used for the sizing and routing of stormwater through the detention basins. Stormwater hydrographs for both existing and proposed conditions are included in this report.

The proposed site work would involve approximately two acres of mostly non-disturbed areas of the subject property. Significantly, however, the proposed project design would actually increase impervious cover from what exists today by about 1.8 acres. Specifically:

Total Lot Area = 208,198 square feet (4.780 acres)

Existing Building Area =	0 sf	Proposed Building Area =	39,120 sf
Existing Impervious Areas =	8,274 sf	Proposed Paved Areas =	44,014 sf
Total Existing Impervious Area=	8,274 sf	Proposed Impervious Area=	83,134 sf

This additional impervious would only apply to the post-construction disturbed area. The "Natural Resources Conservation Service Method," outlined in *Technical Release 55* was used for the sizing and routing of stormwater through the detention basins. The methodology being used is the SCS Runoff Curve Number (CN) method. This methodology is best referenced in the

USDA-SCS. 1985. National Engineering Handbook, Section 4 - Hydrology. Washington, D.C.: USDA-SCS.

The SCS runoff equation is

$$Q = \frac{(P - Ia)^2}{(P - Ia) + S}$$

where

Q = runoff (in)
P = rainfall (in)
S = Potential maximum retention after runoff begins (in)
Ia= initial abstraction (in)

In order to achieve this methodology, we used Hydrocad 9.0, a software that will carry out and tabulate the answers for the different storm frequencies.

To account for the increase in impervious cover and other changes to the project area, it is proposed to construct one surface bio-retention basin that will empty into an underground pipe system to control the rate of post-development runoff. The bio-retention system would have the capacity to store about 14,700 cubic feet while the underground system would be able to store up to 11,561 cubic feet of runoff. The bio-retention system utilizes "constructed sandbed" in which runoff would flow into the sandbed for water quality control.

The stormwater collection system is designed based on the "Rational Method" for determining peak flow rates for the 100-year frequency storm. Bentley StormCad v5.6 was the software instrument used to calculate the collection system. The "Rational Method" Q = CIA
where

Q = maximum rate of runoff, flow (cfs)
C = runoff coefficient as outlined in the Residential Site Improvement Standards (RSIS) (NJAC 5:21-7.2)
I = average rainfall intensity (in/hr) from Livingston's Precipitation Frequency Data
A = drainage area (acres)

The Rational formula estimates the peak rate of runoff in a watershed.

Since there are no direct discharges into the regulated waters proposed for this project, all stormwater management review would be conducted by local and county agencies.

GROUNDWATER RECHARGE

The project site is located with the New Jersey State PA-1 Planning Area, which usually means areas of previous and intense development (that is, impervious cover, disturbed soils, contaminated areas, et al.) (NJAC 7:8-5.4 (a) 2 ii). Because of the extensive alterations of the native soils (as in this case) there is generally no requirement for groundwater recharge. Determining groundwater recharge is based on the New Jersey Geological Survey Report GSR-32. This is a spreadsheet that is use to evaluate the Ground-Water-Recharge Areas in New Jersey (NJAC 7:8-5.6 (b) 1). The spreadsheet works by figuring the annual recharge for the pre-developed areas and comparing them to the annual recharge for the post-developed areas soils. The difference is the deficit of water per year that is needed to be recharged.

As it turn out the recharge volume calculation (based on the state spreadsheet) is 90,878 cubic feet. Groundwater Recharge is provided in 5-8 foot diameter Drywells imbedded within 12' x 12' stone. The total footprint of the Drywell systems are 438 square feet and it only needs to be 38.6 inches deep (please refer to the Groundwater Calculation Spreadsheet). Soils analysis information is attached to the site commentary report.

WATER QUALITY

As per 7:8-5.5 "Stormwater management measures shall only be required for water quality control if an additional one-quarter acre of impervious surface is being proposed on a development site." This project is considered to need water quality, not only because there is 1.7 acres of additional impervious added but also there is approximately 3.7 acres of disturbance.

Part of the collection system will terminate into a Bio-retention system on the southwest part of the site. The basin is a dry basin with a sand bed for water quality. This basin will be dry most of the time, but will fill up during heavy rains. The runoff entering the basins will percolate thru the sand bed filter and act to remove sediments, metals, hydrocarbons, and any other floatables. The volume of the west basin is 14,700 cubic feet. The water quality storm for the total site would produce 15,309 cubic feet of runoff in the Bio-retention system. The Department of Environmental Protection has adopted a TSS removal rate for a bio-retention system of 80% if the bio-retention vegetation is Terrestrial Forested Community and the thickness of the sand-soil mixture is 24" deep.
The northeastern section of the site will be piped directly to the underground system while passing a Contech Jelly Fish with a TSS removal rate of 80% adopted by the Department of Environmental Protection.

DISCHARGE SUMMARY

The existing and proposed peak runoff rates (Q) at various discharge points around the site are summarized as follows:

Detention Systems

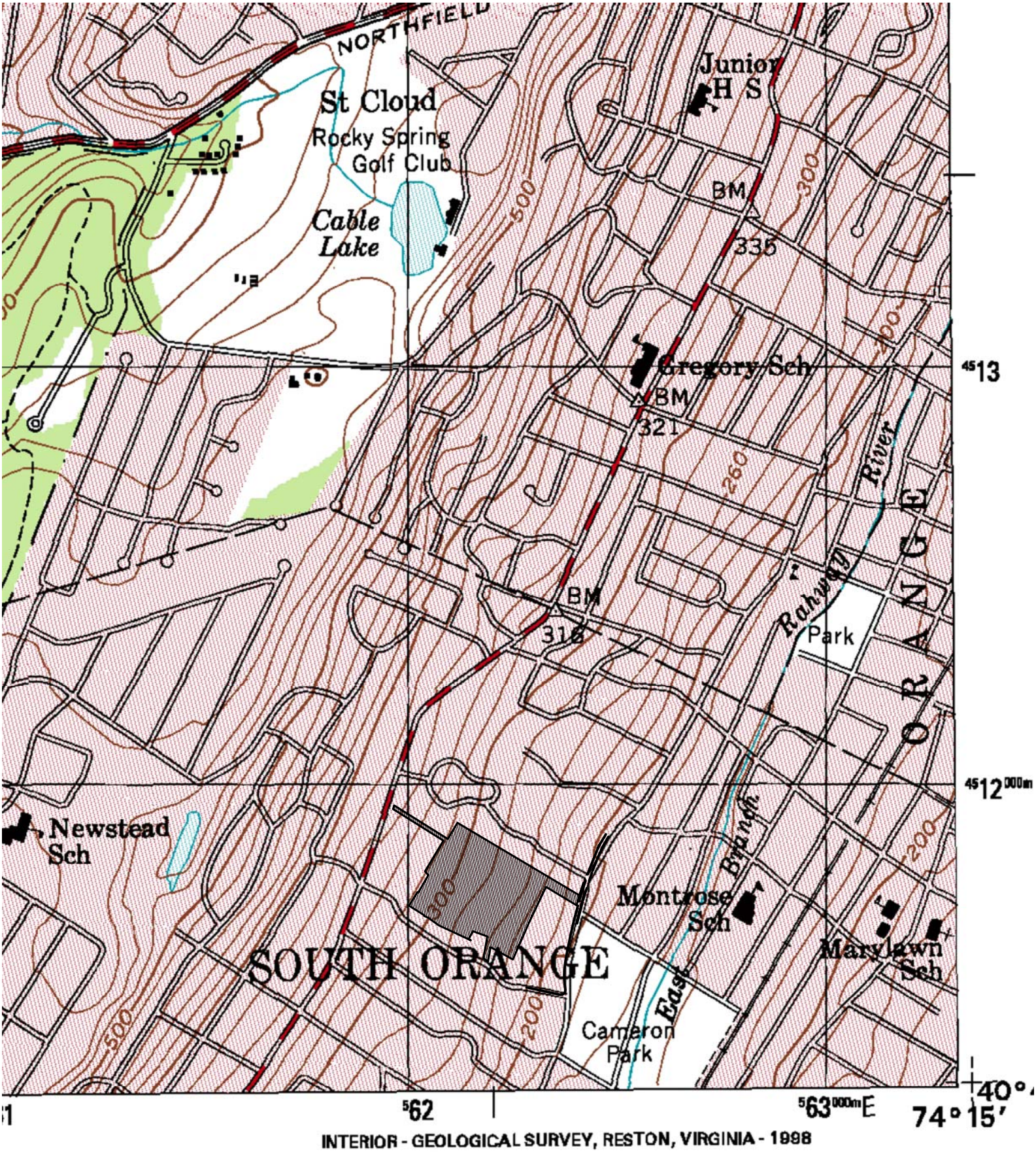
Storm	Q Existing Subject to Reduction	Required Reduction	Q Existing Non-Disturbed	Q Allowable	Q Proposed
2 year	4.28 cfs	50%	3.09 cfs	5.23 cfs	3.53 cfs
10 year	9.60 cfs	25%	5.67 cfs	12.87 cfs	7.95 cfs
100 year	21.11 cfs	20%	11.06 cfs	27.95 cfs	24.76 cfs

The above tables clearly show that the detention basins would produce post-developed runoff rates that are considerably lower than the site's existing rates of runoff.

Based upon our analysis, the proposed storm water management system will enhance the existing downstream conveyance systems by reducing peak flow rates to them.

Calculations supporting our findings constitute the remainder of this report.

USGS MAP



INTERIOR - GEOLOGICAL SURVEY, RESTON, VIRGINIA - 1998

ROAD CLASSIFICATION

Primary highway hard surface	Light-duty road, hard or improved surface .....
Secondary highway hard surface	Unimproved road .....

SOIL DATA
AND
FIELD PERCOLATION TESTS


Glenside Rd
Forest Rd
N Wyoming Ave
Brookside Rd
Ridgewood
N Ridgewood Rd

Tables — Saturated Hydraulic Conductivity (Ksat), Standard Classes — Summary By Map Unit

Summary by Map Unit — Essex County, New Jersey (NJ013)

Map unit symbol	Map unit name	Rating (micrometers per second)	Acres in AOI	Percent of AOI
BowrB	Boonton - Urban land, Boonton substratum complex, red sandstone lowland, 0 to 8 percent slopes	3.8297	15.7	100.0%
Totals for Area of Interest			15.7	100.0%

Tables — Hydrologic Soil Group — Summary By Map Unit

Summary by Map Unit — Essex County, New Jersey (NJ013)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BowrB	Boonton - Urban land, Boonton substratum complex, red sandstone lowland, 0 to 8 percent slopes	C	15.7	100.0%
Totals for Area of Interest			15.7	100.0%

REPORT
SOILS AND FOUNDATION INVESTIGATION

PROPOSED RESIDENTIAL DEVELOPMENT
SOUTH ORANGE, ESSEX COUNTY, NEW JERSEY
BNE REAL ESTATE GROUP

March 14, 2014

Prepared By:
Melick-Tully and Associates, P.C.
117 Canal Road
South Bound Brook, NJ 08880
Tel: 732-356-3400 Fax: 732-356-9054

MTA Project No.: 5225-024*1D

LOG OF TEST PIT

TEST PIT NO: 1

COMPLETION DATE: 2/27/14
JOB NUMBER: 5225-024*1D

SURFACE ELEVATION: +100 ft (±)

WATER LEVEL: *
READING DATE: 2/27/14

DEPTH	SAMPLES (1)	MOISTURE CONTENT (%)	SYMBOL	DESCRIPTION	DEPTH
				12" Topsoil	
				FILL - Red-brown topsoil/clayey silt mix (very moist)	
	S1	17.2	SM	Red-brown fine to coarse sand, and clayey silt, trace fine gravel (very moist)(medium dense)	
				- gray mottling @ 4'	
5				- grading with little silt and cobbles (moist)(dense)	5
	S2	6.3			
				Red-brown weathered sandstone	
	S3			- grading to highly fractured sandstone	
				- refusal to further excavation with a rubber-tire backhoe encountered @ 9.5'	
10					10
				Test pit completed @ 9.5'	
				*Groundwater not encountered	
15					15

NOTES FOR COLUMNS:
1. SAMPLE AT AVERAGE SAMPLING DEPTH

SOIL DESCRIPTION MODIFIERS:
TRACE 0 - 10%
LITTLE 10 - 20%
SOME 20 - 35%
AND OVER 35%

Typist/Date: cpt/mh 3/14

Sheet: 1 of 1 PLATE: 3A

MELICK-TULLY AND ASSOCIATES, P.C.
Geotechnical Engineers and Environmental Consultants

LOG OF TEST PIT

TEST PIT NO: 2

COMPLETION DATE: 2/27/14 SURFACE ELEVATION: +88 ft (±) WATER LEVEL: *

JOB NUMBER: 5225-024*1D READING DATE: 2/27/14

DEPTH	SAMPLES (1)	MOISTURE CONTENT (%)	SYMBOL	DESCRIPTION	DEPTH
				5" Topsoil	
	S1	21.4	ML	Brown clayey silt, and fine to coarse sand (wet)(stiff)	
	S2	11.1	SM	Red-brown fine to coarse sand, little silt, and fine to coarse gravel, with cobbles (moist)(very dense)	
5				Red-brown highly fractured sandstone	5
				- refusal to further excavation with a rubber-tire backhoe encountered @ 8'	
10				Test pit completed @ 8' *Groundwater not encountered	10
15					15

NOTES FOR COLUMNS:
1. SAMPLE AT AVERAGE SAMPLING DEPTH

SOIL DESCRIPTION MODIFIERS:
TRACE 0 - 10%
LITTLE 10 - 20%
SOME 20 - 35%
AND OVER 35%

Typist/Date: cpt/mh 3/14 Sheet: 1 of 1 PLATE: 3B

MELICK-TULLY AND ASSOCIATES, P.C.
Geotechnical Engineers and Environmental Consultants

LOG OF TEST PIT

TEST PIT NO: 3

COMPLETION DATE: 2/27/14 | SURFACE ELEVATION: +78 ft (±) | WATER LEVEL: *

JOB NUMBER: 5225-024*1D | READING DATE: 2/27/14

DEPTH	SAMPLES (1)	MOISTURE CONTENT (%)	SYMBOL	DESCRIPTION	DEPTH
				5" Topsoil	
	S1	16.3		FILL - Red-brown silty sand, with gravel (very moist)	
				Buried topsoil	
	S2	22.0	ML	Brown clayey silt, and fine to coarse sand, trace fine gravel (wet)(medium)	
5			SM	Red-brown fine to coarse sand, little silt, some fine to coarse gravel, with cobbles (moist)(dense)	5
				Red-brown weathered sandstone - refusal to further excavation with a rubber-tire backhoe encountered @ 8.5'	
10				Test pit completed @ 8.5' *Groundwater not encountered	10
15					15

NOTES FOR COLUMNS:
1. SAMPLE AT AVERAGE SAMPLING DEPTH

SOIL DESCRIPTION MODIFIERS:
TRACE 0 - 10%
LITTLE 10 - 20%
SOME 20 - 35%
AND OVER 35%

Typist/Date: cpt/mh 3/14 | Sheet: 1 of 1 | PLATE: 3C

MELICK-TULLY AND ASSOCIATES, P.C.
Geotechnical Engineers and Environmental Consultants

LOG OF TEST PIT

TEST PIT NO: 4

COMPLETION DATE: 2/27/14 SURFACE ELEVATION: +101 ft (±) WATER LEVEL: *

JOB NUMBER: 5225-024*1D READING DATE: 2/27/14

DEPTH	SAMPLES (1)	MOISTURE CONTENT (%)	SYMBOL	DESCRIPTION	DEPTH
				22" Topsoil	
	S1	22.8	ML	Brown clayey silt, some fine to coarse sand, trace fine to coarse gravel (wet)(medium)	
	S2	15.0	SM	Red-brown fine to coarse sand, some silt, some fine to coarse gravel, with cobbles (very moist)(very dense)	
5	S3	11.7		- grading (moist)	5
10					10
				Test pit completed @ 11' *Groundwater not encountered	
15					15

NOTES FOR COLUMNS:
1. SAMPLE AT AVERAGE SAMPLING DEPTH

SOIL DESCRIPTION MODIFIERS:
TRACE 0 - 10%
LITTLE 10 - 20%
SOME 20 - 35%
AND OVER 35%

Typist/Date: cpt/mh 3/14 Sheet: 1 of 1 PLATE: 3D

MELICK-TULLY AND ASSOCIATES, P.C.
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LOG OF TEST PIT

TEST PIT NO: 5

COMPLETION DATE: 2/27/14
JOB NUMBER: 5225-024*1D

SURFACE ELEVATION: +96 ft (±)

WATER LEVEL: *
READING DATE: 2/27/14

DEPTH	SAMPLES (1)	MOISTURE CONTENT (%)	SYMBOL	DESCRIPTION	DEPTH
				3" Roots	
	S1	12.2		FILL - Dark brown sandy clayey silt (moist)	
				Buried topsoil	
			ML	Brown clayey silt, some fine to coarse sand (very moist)(stiff)	
	S2	17.1	SM	Red-brown fine to coarse sand, and silt (very moist)(medium dense)	
5	S3		SP	Red-brown fine to coarse sand, trace silt, some fine to coarse gravel, with cobbles (moist)(dense)	5
				Red-brown fractured sandstone	
10				- refusal to further excavation with a rubber-tire backhoe encountered @ 11'	10
				Test pit completed @ 11'	
				*Groundwater not encountered	
15					15

NOTES FOR COLUMNS:
1. SAMPLE AT AVERAGE SAMPLING DEPTH

SOIL DESCRIPTION MODIFIERS:
TRACE 0 - 10%
LITTLE 10 - 20%
SOME 20 - 35%
AND OVER 35%

Typist/Date: cpt/mh 3/14

Sheet: 1 of 1 PLATE: 3E

MELICK-TULLY AND ASSOCIATES, P.C.
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LOG OF TEST PIT

TEST PIT NO: 6

COMPLETION DATE: 2/27/14 SURFACE ELEVATION: +81 ft (±) WATER LEVEL: *

JOB NUMBER: 5225-024*1D READING DATE: 2/27/14

DEPTH	SAMPLES (1)	MOISTURE CONTENT (%)	SYMBOL	DESCRIPTION	DEPTH
				6" Topsoil	
	S1	19.4		FILL - Red-brown sandy clayey silt (wet)	
				Buried topsoil	
			ML	Red-brown clayey silt, and fine to coarse sand, trace fine to coarse gravel (very moist)(stiff)	
5					5
	S2		SM	Red-brown fine sand, some silt (moist)(medium dense)	
10				Red-brown fractured sandstone - refusal to further excavation with a rubber-tire backhoe encountered @ 10'	10
				Test pit completed @ 10' *Groundwater not encountered	
15					15

NOTES FOR COLUMNS:
1. SAMPLE AT AVERAGE SAMPLING DEPTH

SOIL DESCRIPTION MODIFIERS:
TRACE 0 - 10%
LITTLE 10 - 20%
SOME 20 - 35%
AND OVER 35%

Typist/Date: cpt/mh 3/14 Sheet: 1 of 1 PLATE: 3F

MELICK-TULLY AND ASSOCIATES, P.C.
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LOG OF TEST PIT

TEST PIT NO: 7

COMPLETION DATE: 2/27/14 | SURFACE ELEVATION: +82 ft (±) | WATER LEVEL: *

JOB NUMBER: 5225-024*1D | READING DATE: 2/27/14

DEPTH	SAMPLES (1)	MOISTURE CONTENT (%)	SYMBOL	DESCRIPTION	DEPTH
				14" Topsoil	
			ML	Brown clayey silt, some fine to medium sand, trace fine gravel (very moist)(medium)	
			SM	Red-brown fine to coarse sand, some clayey silt, some fine to coarse gravel (very moist)(medium dense)	
5			SM	Red-brown-gray fine to coarse sand, some silt (very moist)(medium dense)	5
				Dark red-brown fractured sandstone - refusal to further excavation with a rubber-tire backhoe encountered @ 8'	
10				Test pit completed @ 8' *Groundwater not encountered	10
15					15

NOTES FOR COLUMNS:

1. SAMPLE AT AVERAGE SAMPLING DEPTH

SOIL DESCRIPTION MODIFIERS:

TRACE 0 - 10%
LITTLE 10 - 20%
SOME 20 - 35%
AND OVER 35%

Typist/Date: cpt/mh 3/14 Sheet: 1 of 1 PLATE: 3G

MELICK-TULLY AND ASSOCIATES, P.C.
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LOG OF TEST PIT

TEST PIT NO: 8

COMPLETION DATE: 2/28/14 SURFACE ELEVATION: +102 ft (±) WATER LEVEL: *

JOB NUMBER: 5225-024*1D READING DATE: 2/28/14

DEPTH	SAMPLES (1)	MOISTURE CONTENT (%)	SYMBOL	DESCRIPTION	DEPTH
				10" Topsoil	
	S1	18.1	SM	Dark red-brown fine to coarse sand, and clayey silt, little fine gravel, with cobbles (wet)(medium dense)	
5	S2	14.9		- grading (very moist)	5
	S3			Dark red-brown weathered sandstone	
10				- grading to fractured sandstone - refusal to further excavation with a rubber-tire backhoe encountered @ 11.5'	10
				Test pit completed @ 11.5' *Groundwater not encountered	
15					15

NOTES FOR COLUMNS:
1. SAMPLE AT AVERAGE SAMPLING DEPTH

SOIL DESCRIPTION MODIFIERS:
TRACE 0 - 10%
LITTLE 10 - 20%
SOME 20 - 35%
AND OVER 35%

Typist/Date: cpt/mh 3/14 Sheet: 1 of 1 PLATE: 3H

MELICK-TULLY AND ASSOCIATES, P.C.
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LOG OF TEST PIT

TEST PIT NO: 9

COMPLETION DATE: 2/28/14 | SURFACE ELEVATION: +87 ft (±) | WATER LEVEL: *

JOB NUMBER: 5225-024*1D | READING DATE: 2/28/14

DEPTH	SAMPLES (1)	MOISTURE CONTENT (%)	SYMBOL	DESCRIPTION	DEPTH
				15" Topsoil	
	S1	20.1	ML	Brown clayey silt, little fine to coarse sand (wet)(stiff)	
	S2	13.4	SM	Dark red-brown fine to coarse sand, some silt, some fine to coarse gravel, with cobbles (moist)(dense)	
5					5
				Red-brown weathered sandstone	
				- grading to fractured sandstone - refusal to further excavation with a rubber-tire backhoe encountered @ 9.5'	
10					10
				Test pit completed @ 9.5' *Groundwater not encountered	
15					15

NOTES FOR COLUMNS:
1. SAMPLE AT AVERAGE SAMPLING DEPTH

SOIL DESCRIPTION MODIFIERS:
TRACE 0 - 10%
LITTLE 10 - 20%
SOME 20 - 35%
AND OVER 35%

Typist/Date: cpt/mh 3/14 Sheet: 1 of 1 PLATE: 3I

MELICK-TULLY AND ASSOCIATES, P.C.
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LOG OF TEST PIT

TEST PIT NO: 10

COMPLETION DATE: 2/28/14 SURFACE ELEVATION: +85 ft (±) WATER LEVEL: *

JOB NUMBER: 5225-024*1D READING DATE: 2/28/14

DEPTH	SAMPLES (1)	MOISTURE CONTENT (%)	SYMBOL	DESCRIPTION	DEPTH
				FILL - Red-brown sandstone cobbles and boulders	
				Buried topsoil	
5	S1	15.5	SM	Red-brown fine to coarse sand, and clayey silt, some fine to coarse gravel, with cobbles (very moist to wet)(dense)	5
10				Test pit completed @ 7' *Groundwater not encountered	10
15					15

NOTES FOR COLUMNS:
1. SAMPLE AT AVERAGE SAMPLING DEPTH

SOIL DESCRIPTION MODIFIERS:
TRACE 0 - 10%
LITTLE 10 - 20%
SOME 20 - 35%
AND OVER 35%

Typist/Date: cpt/mh 3/14 Sheet: 1 of 1 PLATE: 3J

MELICK-TULLY AND ASSOCIATES, P.C.
Geotechnical Engineers and Environmental Consultants

LOG OF TEST PIT

TEST PIT NO: 11

COMPLETION DATE: 2/28/14 | SURFACE ELEVATION: +91 ft (±) | WATER LEVEL: *

JOB NUMBER: 5225-024*1D | READING DATE: 2/28/14

DEPTH	SAMPLES (1)	MOISTURE CONTENT (%)	SYMBOL	DESCRIPTION	DEPTH
				7" Topsoil	
			ML	Brown clayey silt, some fine to coarse sand, little fine to coarse gravel (moist)(stiff)	
	S1	13.7	SM	Dark red-brown fine to coarse sand, some silt, some fine to coarse gravel (very moist)(dense)	
5				Red-gray weathered and highly fractured sandstone	5
10				- refusal to further excavation with a rubber-tire backhoe encountered @ 9.5'	10
				Test pit completed @ 9.5' *Groundwater not encountered Note: Pinnacled rock observed from 4' to refusal @ 9.5'	
15					15

NOTES FOR COLUMNS:
1. SAMPLE AT AVERAGE SAMPLING DEPTH

SOIL DESCRIPTION MODIFIERS:
TRACE 0 - 10%
LITTLE 10 - 20%
SOME 20 - 35%
AND OVER 35%

Typist/Date: cpt/mh 3/14 Sheet: 1 of 1 PLATE: 3K

MELICK-TULLY AND ASSOCIATES, P.C.
Geotechnical Engineers and Environmental Consultants

LOG OF TEST PIT

TEST PIT NO: 12

COMPLETION DATE: 2/28/14 SURFACE ELEVATION: +98 ft (±) WATER LEVEL: *

JOB NUMBER: 5225-024*1D READING DATE: 2/28/14

DEPTH	SAMPLES (1)	MOISTURE CONTENT (%)	SYMBOL	DESCRIPTION	DEPTH
				10" Topsoil	
			ML	Brown clayey silt, and fine to coarse sand, little fine gravel (moist)(stiff)	
			SM	Dark red-brown fine to coarse sand, and silt, some fine to coarse gravel (moist)(dense)	
5				Dark red-gray-brown fractured sandstone	5
				- refusal to further excavation with a rubber-tire backhoe encountered @ 7'	
10				Test pit completed @ 7' *Groundwater not encountered	10
15					15

NOTES FOR COLUMNS:
1. SAMPLE AT AVERAGE SAMPLING DEPTH

SOIL DESCRIPTION MODIFIERS:
TRACE 0 - 10%
LITTLE 10 - 20%
SOME 20 - 35%
AND OVER 35%

Typist/Date: cpt/mh 3/14 Sheet: 1 of 1 PLATE: 3L

MELICK-TULLY AND ASSOCIATES, P.C.
Geotechnical Engineers and Environmental Consultants

MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS More than 50% of material is LARGER than No. 200 Sieve	GRAVEL & GRAVELLY SOILS More than 50% of coarse fraction RETAINED on No. 4 Sieve	CLEAN GRAVELS (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
		GRAVELS WITH FINES (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS More than 50% of coarse fraction PASSING a No. 4 Sieve	CLEAN SAND (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines.
			SP	Poorly-graded sands, gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS More than 50% of material is SMALLER than No. 200 Sieve.	SILTS AND CLAYS Liquid limit LESS than 50		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS Liquid limit GREATER than 50		MH	Inorganic silts, micaceous or diatomaceous fine sand or silty soils.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			PT	Peat, humus, swamp soils with high organic contents

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS.

GRADATION*	COMPACTNESS* sand and/or gravel	CONSISTENCY* clay and/or silt
% Finer by Weight	Relative Density	Range of Shearing Strength in Pounds per Square Foot

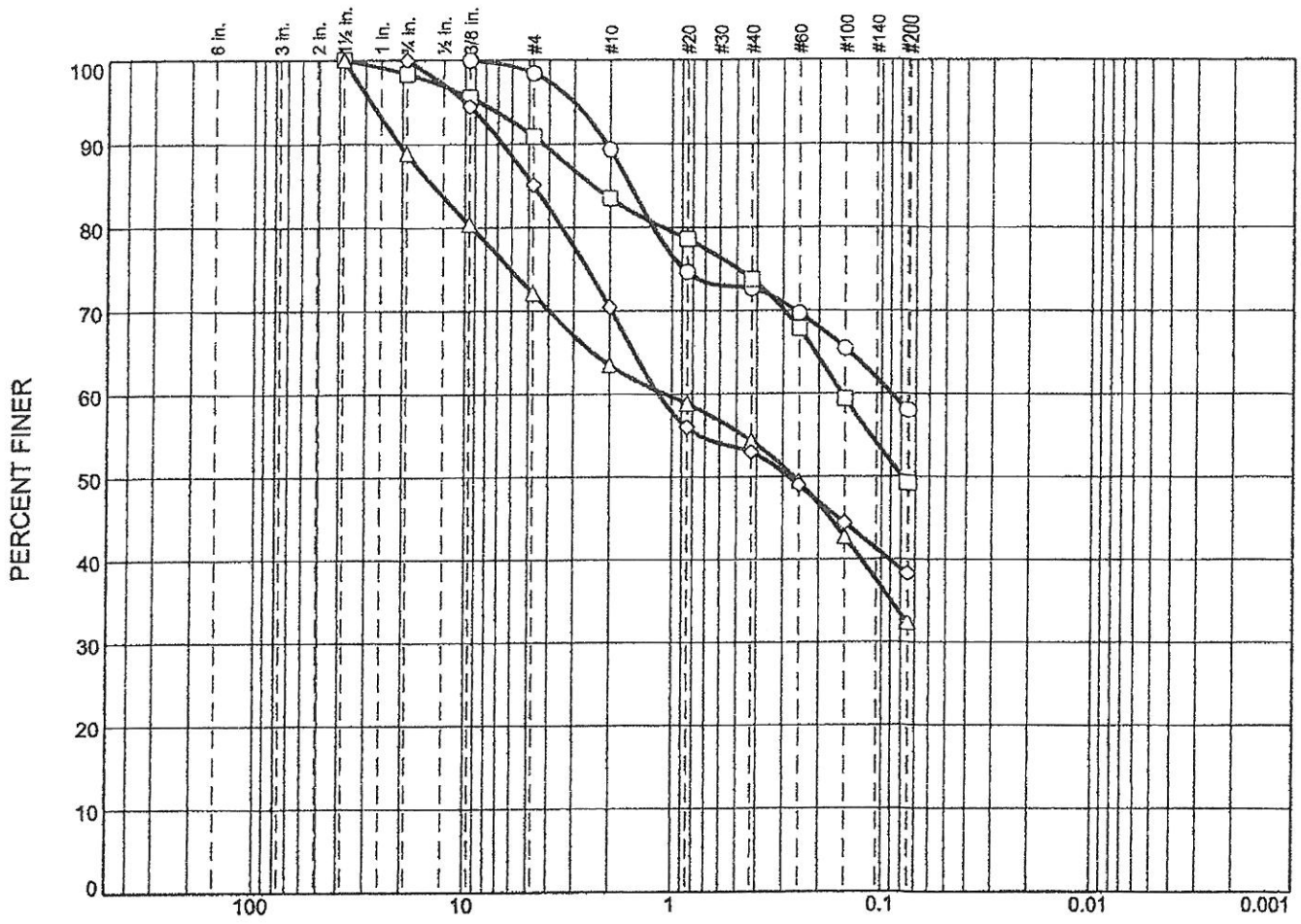
Trace	0% to 10%	Loose	0% to 40%	Very Soft	less than 250
Little	10% to 20%	Medium Dense	40% to 70%	Soft	250 to 500
Some	20% to 35%	Dense	70% to 90%	Medium	500 to 1000
And	35% to 50%	Very Dense	90% to 100%	Stiff	1000 to 2000
				Very Stiff	2000 to 4000
				Hard	Greater than 4000

**Values are from laboratory or field test data, where applicable. When no testing was performed, values are estimated.*

UNIFIED SOIL CLASSIFICATION SYSTEM

SOIL CLASSIFICATION CHART

Gradation Curve(s)



	% Cobbles	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	1.6	9.1	16.6	14.7	58.0
□	0.0	1.7	7.4	7.4	9.7	24.5	49.3
△	0.0	11.1	16.7	8.7	9.1	22.0	32.4
◇	0.0	0.0	14.9	14.6	17.5	14.7	38.3

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	TP-3	S-2	3.5	Clayey Silt, and f-c Sand, trace fine Gravel. (MC=22.0%)	ML
□	TP-1	S-1	2.5	F-c Sand, and Clayey Silt, trace fine Gravel. (MC=17.2%)	SM
△	TP-4	S-3	6.5	Fine to coarse Sand, some Silt, some f-c Gravel. (MC=11.7%)	SM
◇	TP-8	S-1	2	F-c Sand, and Clayey Silt, little fine Gravel. (MC=18.1%)	SM

Melick-Tully & Associates, P.C.

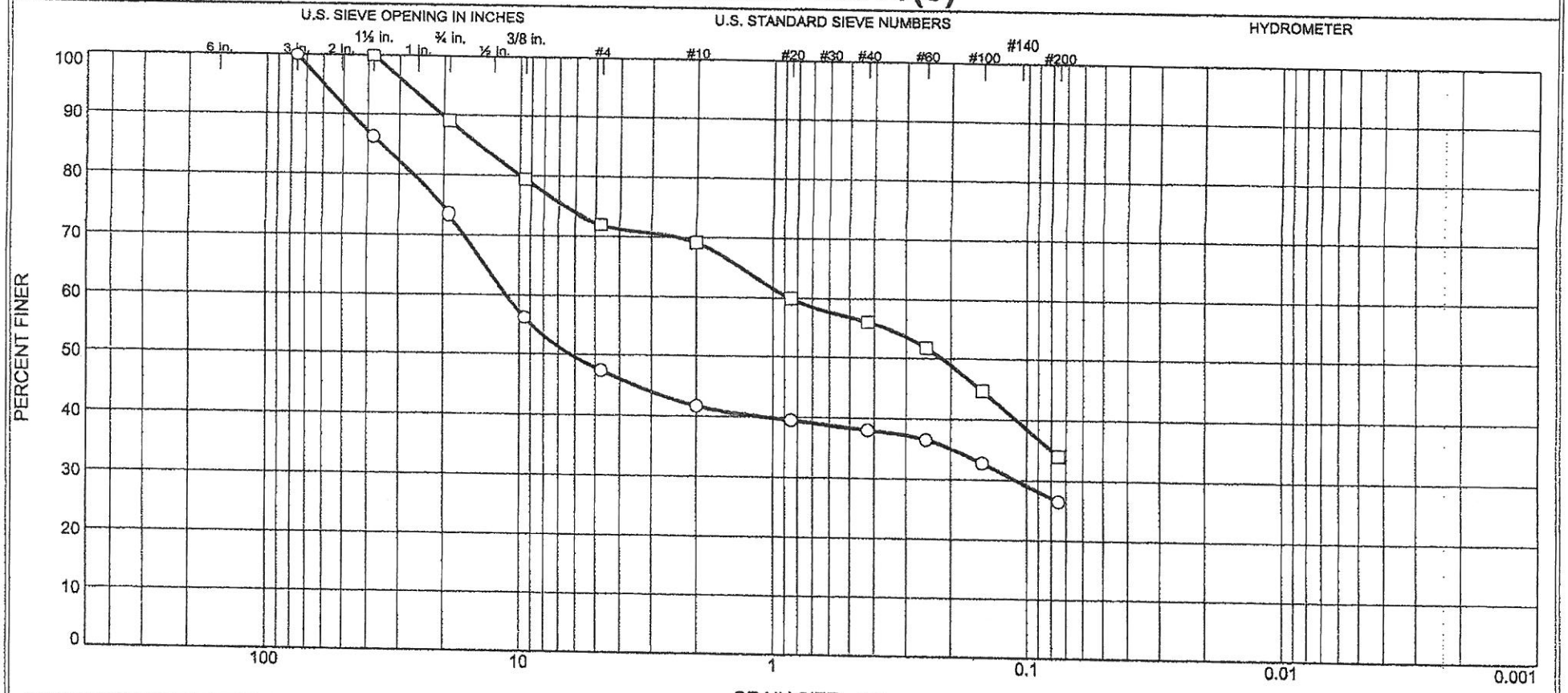
South Bound Brook, NJ

Client: BNE Associates

Project: Proposed Townhomes, South Orange, NJ

Project No.: 5225-024 **Plate** 5A

Gradation Curve(s)



	% Cobbles	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	26.5	26.0	5.7	3.8	11.5	26.5
□	0.0	11.0	16.9	3.0	13.0	22.1	34.0

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	TP-1		6	2/27/2014	GM	Fine to coarse Gravel, some f-c Sand, some Silt.	3.6		
□	TP-12		2-3	2/27/2014	SM	Fine to coarse Sand, some Silt, some f-c Gravel.	9.0		

Client BNE Associates

Project Proposed Townhomes, South Orange, NJ

Project 5225-024 Plate 5B

Melick-Tully & Associates, P.C.

South E nd Brook, NJ

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NONSTRUCTURAL STRATEGIES POINTS SYSTEM (NSPS) AND LOW INPACT DEVELOPMENT CHECKLIST

NJDEP Nonstructural Strategies Points System (NSPS)

Version: September 2, 2010
(See 'Revisions' Worksheet for Summary of Program Revisions)

Note: Input Values in Yellow Cells Only

Project:	ORANGE LAWN TENNIS CLUB
Date:	August 18, 2016
User:	Casey and Keller, Inc.
Notes:	

Step 1 - Provide Basic Major Development Site Information

A. Specify Total Area in Acres of Development Site Described in Steps 2 and 3 = 5.003 **Acres**

B. Specify by Percent the Various Planning Areas Located within the Development Site:

State Plan Planning Area:	PA-1	PA-2	PA-3	PA-4	PA-4B	PA-5	Total % Area
% of Each Planning Area within Site:	100.0%						100.0%

Note: See User's Guide for Equivalent Zones within Designated Centers and the NJ Meadowlands, Pinelands, and Highlands Districts

Step 2 - Describe Existing or Pre-Developed Site Conditions

A. Specify Existing Land Use/Land Cover Descriptions and Areas:

Site Segment	Land Use/Land Cover Description	Specify Land Use/Land Cover in Acres for Each HSG				Use/Cover Subtotals		Points
		HSG A	HSG B	HSG C	HSG D			
1	Wetlands and Undisturbed Stream Buffers					0.0		0
2	Lawn and Open Space			4.005		4.0		184
3	Brush and Shrub					0.0		0
4	Meadow, Pasture, Grassland, or Range					0.0		0
5	Row Crop					0.0		0
6	Small Grain and Legumes					0.0		0
7	Woods - Indigenous			0.706		0.7		46
8	Woods - Planted					0.0		0
9	Woods and Grass Combination					0.0		0
10	Ponds, Lakes, and Other Open Water					0.0		0
11	Gravel and Dirt					0.0		0
12	Porous and Permeable Paving					0.0		0
13	Directly Connected Impervious			0.292		0.3		0
14	Unconnected Impervious with Small D/S Pervious					0.0		0
15	Unconnected Impervious with Large D/S Pervious					0.0		0
	HSG Subtotals (Acres):	0.0	0.0	5.003	0.0		**Total Area:**	5.0
	HSG Subtotals (%):	0.0%	0.0%	100.0%	0.0%		**Total % Area:**	100.0%

Points Subtotal: **230**

Total Existing Site Points: **230**

Step 3 - Describe Proposed or Post-Developed Site Conditions

A. Specify Proposed Land Use/Land Cover Descriptions and Areas:

Site Segment	Land Use/Land Cover Description	Specify Land Use/Land Cover in Acres for Each HSG				Use/Cover Subtotals		Points
		HSG A	HSG B	HSG C	HSG D			
1	Wetlands and Undisturbed Stream Buffers					0.0		0
2	Lawn and Open Space			2.631		2.6		121
3	Brush and Shrub					0.0		0
4	Meadow, Pasture, Grassland, or Range					0.0		0
5	Row Crop					0.0		0
6	Small Grain and Legumes					0.0		0
7	Woods - Indigenous			0.359		0.4		23
8	Woods - Planted					0.0		0
9	Woods and Grass Combination					0.0		0
10	Ponds, Lakes, and Other Open Water					0.0		0
11	Gravel and Dirt					0.0		0
12	Porous and Permeable Paving					0.0		0
13	Directly Connected Impervious			1.115		1.1		0
14	Unconnected Impervious with Small D/S Pervious			0.898		0.9		12
15	Unconnected Impervious with Large D/S Pervious					0.0		0
	HSG Subtotals (Acres):	0.0	0.0	5.003	0.0		**Total Area:**	5.0
	HSG Subtotals (%):	0.0%	0.0%	100.0%	0.0%		**Total % Area:**	100.0%

Points Subtotal: **156**

B. Compare Proposed Impervious Coverage with Maximum Allowable Impervious Coverage:

Total Proposed Directly Connected Impervious Coverage =	22.0%	% of Site
Total Proposed Unconnected Impervious Coverage with Small D/S Pervious =	18.0%	% of Site
Total Proposed Unconnected Impervious Coverage with Large D/S Pervious =	0.0%	% of Site
Total Proposed Site Impervious Coverage =	40.0%	% of Site
Effective Proposed Site Impervious Coverage =	37.3%	% of Site
Specify Source of Maximum Allowable Impervious Coverage:	Table	(None or Table)
Allowable Site Impervious Cover from Maximum Impervious Cover Table:	65.0%	

Note: See Maximum Impervious Cover Table Worksheet for Details

Points Subtotal: 20

C. Compare Proposed Site Disturbance with Maximum Allowable Site Disturbance Permitted by Municipal Ordinance:

Total Proposed Site Disturbance =		% of Site
Does Municipality have a Maximum Site Disturbance Ordinance?		(Yes or No)
Number of Such Municipal Ordinance =		
Maximum Allowable Site Disturbance by Such Municipal Ordinance =		% of Site

Points Subtotal: 0

D. Describe Proposed Runoff Conveyance System:

Total Length of Runoff Conveyance System =		Feet
Length of Vegetated Runoff Conveyance System =		Feet
% of Total Runoff Conveyance System That is Vegetated =	0%	

Points Subtotal: 0

E. Single Family Residential Lot Clustering:

Percent of Total Site Area that will be Clustered =	100%	% of Site
Minimum Single Family Standard Lot Size per Zoning (Note: 1/2 Acre or Greater) =		Acres
Maximum Proposed Single Family Cluster Lot Size (Note:1/4 Acre or Less) =		Acres
Percent of Clustered Portion of Site to be Preserved as Vegetated Open Space =		% of Clustered Site Portion

Points Subtotal: 0

F. Will the Following be Utilized to Minimize Soil Compaction?

Total Proposed Vegetated Site Area		Acres
Proposed Vegetated Areas to Incorporate Soil Amendment as Necessary	Yes	(Yes or No)
% of Proposed Vegetated Areas to Incorporate Soil Amendment if Necessary: (Note: Do Not Include Area of Proposed Infiltration or Bioretention Basins)	50%	% of Proposed Lawn Areas

Points Subtotal: **6**

Total Existing Site Points: **230**

Total Proposed Site Points: **182**

Ratio of Proposed to Existing Site Points: **79%**

Required Site Points Ratio: **73%**

Nonstructural Point System Results: **Proposed Nonstructural Measures are Adequate**

Low Impact Development Checklist

A checklist for identifying nonstructural stormwater management strategies incorporated into proposed land development

Municipality: South Orange Village

County: Essex Date: 04-15-16

Review board or agency: South Orange Village Enginnering

Proposed land development name: South Orange Lawn Tennis Club

Lot(s): 6 Block(s): 1304

Project or application number: _____

Applicant's name: _____

Applicant's address: _____

_____

Telephone: _____ Fax: _____

Email address: _____

Designer's name: Michael Lanzafama, Casey and Keller, Inc.

Designer's address: 258 Main Street, Millburn, NJ

_____

Telephone: 973-379-3280 Fax: 973-379-7993

Email address: mike@caseyandkeller.com

Part 1: Description of Nonstructural Approach to Site Design

In narrative form, provide an overall description of the nonstructural stormwater management approach and strategies incorporated into the proposed site's design. Attach additional pages as necessary. Details of each nonstructural strategy are provided in Part 3 below.

THE EXISTING LOT IS LOCATED ON THE NORTH SIDE OF RIDGEWOOD ROAD NORTH, ABOUT 125 FEET WEST FROM THE CORNER WITH FOREST ROAD IN THE TOWNSHIP OF SOUTH ORANGE. THE PROPOSED PROJECT IS TO DEVELOPED THE EASTERN SIDE OF THE SITE. TOWNHOMES AND A ROAD ARE PROPOSED FOR THE DEVELOPING SITE. THE ORDINANCE PERMITS UP TO 40% OR 87,180 SF OF LOT COVERAGE, THERE WOULD BE ONLY 77,327 SF OF LOT COVERAGE USED. NEW SHADE TREES AND EVERGREEN TREES AS WELL AS SHRUBS AND GROUNDCOVER WOULD BE PLANTED THROUGHOUT THE PROJECT. ALL INLETS WOULD BE INSTALLED WITH TYPE 'N' CURB PIECES. NATURAL VEGETATION WOULD BE PRESERVED AND SWALES ON THE SIDE OF THE SITE WOULD BE CONSTRUCTED TO HAVE RUNOFF LEAD TO THE DETENTION BASINS.

Part 2: Review of Local Stormwater Management Regulations

Title and date of stormwater management regulations used in development design:

NJAC 7:8-5.3, NJAC 7:8-5.3 (b) 3,4,7,8,9, NJAC 7:8-5.4 (a) 1, 2009, TOWN ORD. 92-200.6

Do regulations include nonstructural requirements? Yes: X No: _____

If yes, briefly describe: _____

List LID-BMPs prohibited by local regulations: N/A

Pre-design meeting held? Yes: X Date: _____ No: _____

Meeting held with: CLIENTS, OWNERS, CONSULTANTS

Pre-design site walk held? Yes: X Date: _____ No: _____

Site walk held with: _____

Other agencies with stormwater review jurisdiction:

Name: ESSEX COUNTY

Required approval: _____

Name: H.E.P. , SCD

Required approval: _____

Name: _____

Required approval: _____

Part 3: Nonstructural Strategies and LID-BMPs in Design

3.1 Vegetation and Landscaping

Effective management of both existing and proposed site vegetation can reduce a development's adverse impacts on groundwater recharges and runoff quality and quantity. This section of the checklist helps identify the vegetation and landscaping strategies and nonstructural LID-BMPs that have been incorporated into the proposed development's design to help maintain existing recharge rates and/or minimize or prevent increases in runoff quantity and pollutant loading.

A. Has an inventory of existing site vegetation been performed? Yes: X No: _____

If yes, was this inventory a factor in the site's layout and design? Yes: X No: _____

B. Does the site design utilize any of the following nonstructural LID-BMPs?

Preservation of natural areas? Yes: X No: _____ If yes, specify % of site: 10%

Native ground cover? Yes: X No: _____ If yes, specify % of site: 13%

Vegetated buffers? Yes: X No: _____ If yes, specify % of site: 15%

C. Do the land development regulations require these nonstructural LID-BMPs?

Preservation of natural areas? Yes: _____ No: X If yes, specify % of site: _____

Native ground cover? Yes: _____ No: X If yes, specify % of site: _____

Vegetated buffers? Yes: _____ No: X If yes, specify % of site: _____

D. If vegetated filter strips or buffers are utilized, specify their functions:

Reduce runoff volume increases through lower runoff coefficient: Yes: X No: _____

Reduce runoff pollutant loads through runoff treatment: Yes: X No: _____

Maintain groundwater recharge by preserving natural areas: Yes: X No: _____

3.2 Minimize Land Disturbance

Minimizing land disturbance is a nonstructural LID-BMP that can be applied during both the development's construction and post-construction phases. This section of the checklist helps identify those land disturbance strategies and nonstructural LID-BMPs that have been incorporated into the proposed development's design to minimize land disturbance and the resultant change in the site's hydrologic character.

A. Have inventories of existing site soils and slopes been performed? Yes: X No: _____

If yes, were these inventories factors in the site's layout and design? Yes: X No: _____

B. Does the development's design utilize any of the following nonstructural LID-BMPs?

Restrict permanent site disturbance by land owners? Yes: X No: _____

If yes, how: THE PROJECT WILL BE MAINTAINED INITIALLY BY THE DEVELOPER AND THEN BY THE HOMEOWNERS ASSOCIATION.

Restrict temporary site disturbance during construction? Yes: _____ No: X

If yes, how: _____

Consider soils and slopes in selecting disturbance limits? Yes: _____ No: X

If yes, how: _____

C. Specify percentage of site to be cleared: 40% Regraded: 30%

D. Specify percentage of cleared areas done so for buildings: 11%

For driveways and parking: 7% For roadways: 13%

E. What design criteria and/or site changes would be required to reduce the percentages in C and D above?

CHANGES WOULD BE REQUIRED TO LOCAL ORDINANCES AND RSIS CRITERIA.

F. Specify site's hydrologic soil group (HSG) percentages:

HSG A: _____ HSG B: _____ HSG C: 100% HSG D: _____

G. Specify percentage of each HSG that will be permanently disturbed:

HSG A: _____ HSG B: _____ HSG C: 40% HSG D: _____

H. Locating site disturbance within areas with less permeable soils (HSG C and D) and minimizing disturbance within areas with greater permeable soils (HSG A and B) can help maintain groundwater recharge rates and reduce runoff volume increases. In light of the HSG percentages in F and G above, what other practical measures if any can be taken to achieve this?

MINIMIZE SOIL COMPACTION IN ORDER TO INCREASE TIME OF CONCENTRAION

I. Does the site include Karst topography? Yes: _____ No: X

If yes, discuss measures taken to limit Karst impacts:

3.3 Impervious Area Management

New impervious surfaces at a development site can have the greatest adverse effect on groundwater recharge and stormwater quality and quantity. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into a proposed development's design to comprehensively manage the extent and impacts of new impervious surfaces.

A. Specify impervious cover at site: Existing: 5.8% Proposed: 35.5%

B. Specify maximum site impervious coverage allowed by regulations: 40%

C. Compare proposed street cartway widths with those required by regulations:

Type of Street	Proposed Cartway Width (feet)	Required Cartway Width (feet)
Residential access – low intensity		
Residential access – medium intensity		
Residential access – high intensity with parking	24	24
Residential access – high intensity without parking		
Neighborhood		
Minor collector – low intensity without parking		
Minor collector – with one parking lane		
Minor collector – with two parking lanes		
Minor collector – without parking		
Major collector		

D. Compare proposed parking space dimensions with those required by regulations:

Proposed: 9 X 18 Regulations: 9 X 18

E. Compare proposed number of parking spaces with those required by regulations:

Proposed: 84 SPACES Regulations: 53 SPACES

F. Specify percentage of total site impervious cover created by buildings: 11%

By driveways and parking: 7% By roadways: 13%

G. What design criteria and/or site changes would be required to reduce the percentages in F above?

CHANGES WOULD HAVE TO BE MADE TO THE ORDINANCES AND RSIS CRITERIA.

H. Specify percentage of total impervious area that will be unconnected:

Total site: 9% Buildings: 9% Driveways and parking: _____ Roads: _____

I. Specify percentage of total impervious area that will be porous:

Total site: _____ Buildings: _____ Driveways and parking: _____ Roads: _____

J. Specify percentage of total building roof area that will be vegetated: _____

K. Specify percentage of total parking area located beneath buildings: 3%

L. Specify percentage of total parking located within multi-level parking deck: _____

3.4 Time of Concentration Modifications

Decreasing a site's time of concentration (Tc) can lead directly to increased site runoff rates which, in turn, can create new and/or aggravate existing erosion and flooding problems downstream. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into the proposed development's design to effectively minimize such Tc decreases.

When reviewing Tc modification strategies, it is important to remember that a drainage area's Tc should reflect the general conditions throughout the area. As a result, Tc modifications must generally be applied throughout a drainage area, not just along a specific Tc route.

A. Specify percentage of site's total stormwater conveyance system length that will be:

Storm sewer: 53% Vegetated swale: 47% Natural channel: _____

Stormwater management facility: _____ Other: _____

Note: the total length of the stormwater conveyance system should be measured from the site's downstream property line to the downstream limit of sheet flow at the system's headwaters.

B. What design criteria and/or site changes would be required to reduce the storm sewer percentages and increase the vegetated swale and natural channel percentages in A above?

SITE IS LIMITED BY SIZE AND CONFIGURATION, CHANGES ON ORDINANCES AND RSIS WOULD BE REQUIRED.

C. In conveyance system subareas that have overland or sheet flow over impervious surfaces or turf grass, what practical and effective site changes can be made to:

Decrease overland flow slope: ADD BUSHES AND TREES.

Increase overland flow roughness: MINIMIZE SOIL COMPACTION AND MORE BUSHES.

3.5 Preventative Source Controls

The most effective way to address water quality concerns is by pollution prevention. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into the proposed development's design to reduce the exposure of pollutants to prevent their release into the stormwater runoff.

A. Trash Receptacles

Specify the number of trash receptacles provided: NON-INDIVIDUAL TRASH CANS

Specify the spacing between the trash receptacles: N/A

Compare trash receptacles proposed with those required by regulations:

Proposed: _____ Regulations: _____

B. Pet Waste Stations

Specify the number of pet waste stations provided: NONE

Specify the spacing between the pet waste stations: _____

Compare pet waste stations proposed with those required by regulations:

Proposed: _____ Regulations: _____

C. Inlets, Trash Racks, and Other Devices that Prevent Discharge of Large Trash and Debris

Specify percentage of total inlets that comply with the NJPDES storm drain inlet criteria: 100%

D. Maintenance

Specify the frequency of the following maintenance activities:

Street sweeping: Proposed: ONCE/WEKK Regulations: _____

Litter collection: Proposed: ONCE/WEEK Regulations: _____

Identify other stormwater management measures on the site that prevent discharge of large trash and debris:

LOCAL ORDINANCES AGAINST DUMPING, USE OF MODERN ECO-INLETS, MAINTENANCE BY DEVELOPER AND/OR HOMEOWNER ASSOCIATION

E. Prevention and Containment of Spills

Identify locations where pollutants are located on the site, and the features that prevent these pollutants from being exposed to stormwater runoff:

Pollutant: _____ Location: _____

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: _____ Location: _____

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: _____ Location: _____

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: _____ Location: _____

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: _____ Location: _____

Part 4: Compliance with Nonstructural Requirements of NJDEP Stormwater Management Rules

1. Based upon the checklist responses above, indicate which nonstructural strategies have been incorporated into the proposed development's design in accordance with N.J.A.C. 7:8-5.3(b):

No.	Nonstructural Strategy	Yes	No
1.	Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss.	X	
2.	Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces.	X	
3.	Maximize the protection of natural drainage features and vegetation.	X	
4.	Minimize the decrease in the pre-construction time of concentration.		X
5.	Minimize land disturbance including clearing and grading.	X	
6.	Minimize soil compaction.	X	
7.	Provide low maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers, and pesticides.	X	
8.	Provide vegetated open-channel conveyance systems discharge into and through stable vegetated areas.	X	
9.	Provide preventative source controls.	X	

2. For those strategies that have not been incorporated into the proposed development's design, provide engineering, environmental, and/or safety reasons. Attached additional pages as necessary.

NO 4- THERE WILL BE AN INCREASE IN IMPERVIOUS COVER, Tc WILL CHANGE

GROUNDWATER RECHARGE

New Jersey Groundwater Recharge Spreadsheet
Version 2.0
November 2003

Annual Groundwater Recharge Analysis (based on GSR-32)

Select Township ↓	Average Annual P (in)	Climatic Factor
ESSEX CO., SOUTH ORANGE VILLAGE	48.1	1.63

Project Name:	ORANGE LAWN TENNIS CLUB
Description:	DRYWELLS
Analysis Date:	08/18/16

Pre-Developed Conditions

Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	0.292	Impervious areas	Boonton	0.0	-
2	4.005	Open space	Boonton	14.4	209,508
3	0.706	Woods	Boonton	15.1	38,660
4					
5					
6					
7	0				
8	0				
9	0				
10	0				
11	0				
12	0				
13	0				
14	0				
15	0				
Total =	5.0			Total Annual Recharge (in)	Total Annual Recharge (cu-ft)
				13.7	248,168

Post-Developed Conditions

Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	2.013	Impervious areas	Boonton	0.0	-
2	2.631	Open space	Boonton	14.4	137,632
3	0.359	Woods	Boonton	15.1	19,659
4	0				
5	0				
6	0				
7	0				
8	0				
9	0				
10	0				
11	0				
12	0				
13	0				
14	0				
15	0				
Total =	5.0			Total Annual Recharge (in)	Total Annual Recharge (cu.ft)
				8.7	157,290

Annual Recharge Requirements Calculation ↓

% of Pre-Developed Annual Recharge to Preserve =	100%	Total Impervious Area (sq.ft) 87,686
Post-Development Annual Recharge Deficit=	*90,878*	(cubic feet)

Recharge Efficiency Parameters Calculations (area averages)

RWC=	3.54	(in)	DRWC=	0.00	(in)
ERWC =	0.66	(in)	EDRWC=	0.00	(in)

Procedure to fill the Pre-Development and Post-Development Conditions Tables

For each land segment, first enter the area, then select TR-55 Land Cover, then select Soil. Start from the top of the table and proceed downward. Don't leave blank rows (with A=0) in between your segment entries. Rows with A=0 will not be displayed or used in calculations. For impervious areas outside of standard lots select "Impervious Areas" as the Land Cover. Soil type for impervious areas are only required if an infiltration facility will be built within these areas.

Project Name	Description	Analysis Date	BMP or LID Type
ORANGE LAWN TENNIS C	DRYWELLS	08/18/16	

Recharge BMP Input Parameters

Parameter	Symbol	Value	Unit
BMP Area	ABMP	438.0	sq.ft
BMP Effective Depth, this is the design variable	dBMP	38.6	in
Upper level of the BMP surface (negative if above ground)	dBMPu	12.0	in
Depth of lower surface of BMP, must be>=dBMPu	dEXC	60.0	in
Post-development Land Segment Location of BMP , Input Zero if Location is distributed or undetermined	SegBMP	2	unitless

Root Zone Water capacity Calculated Parameters

Parameter	Symbol	Value	Unit
Empty Portion of RWC under Post-D Natural Recharge	ERWC	0.68	in
ERWC Modified to consider dEXC	EDRWC	0.00	in
Empty Portion of RWC under Infilt. BMP	RERWC	0.00	in

Recharge Design Parameters

Parameter	Symbol	Value	Unit
Inches of Runoff to capture	Qdesign	0.22	in
Inches of Rainfall to capture	Pdesign	0.30	in
Recharge Provided Avg. over Imp. Area		14.3	in
Runoff Captured Avg. over imp. Area		14.3	in

ABMP will be from (5) 8' Dia. Drywells inbedded in 12' x 12' stone.

BMP Calculated Size Parameters

ABMP/Aimp	Aratio	0.01	unitless
BMP Volume	VBMP	1,409	cu.ft

CALCULATION CHECK MESSAGES

Volume Balance-> OK
dBMP Check---> OK
dEXC Check---> OK
BMP Location---> OK

Parameters from Annual Recharge Worksheet

Post-D Deficit Recharge (or desired recharge volume)	Vdef	90,878	cu.ft
Post-D Impervious Area (or target Impervious Area)	Aimp	76,037	sq.ft
Root Zone Water Capacity	RWC	3.69	in
RWC Modified to consider dEXC	DRWC	0.00	in
Climatic Factor	C-factor	1.63	no units
Average Annual P	Pavg	48.1	in
Recharge Requirement over Imp. Area	dr	12.4	in

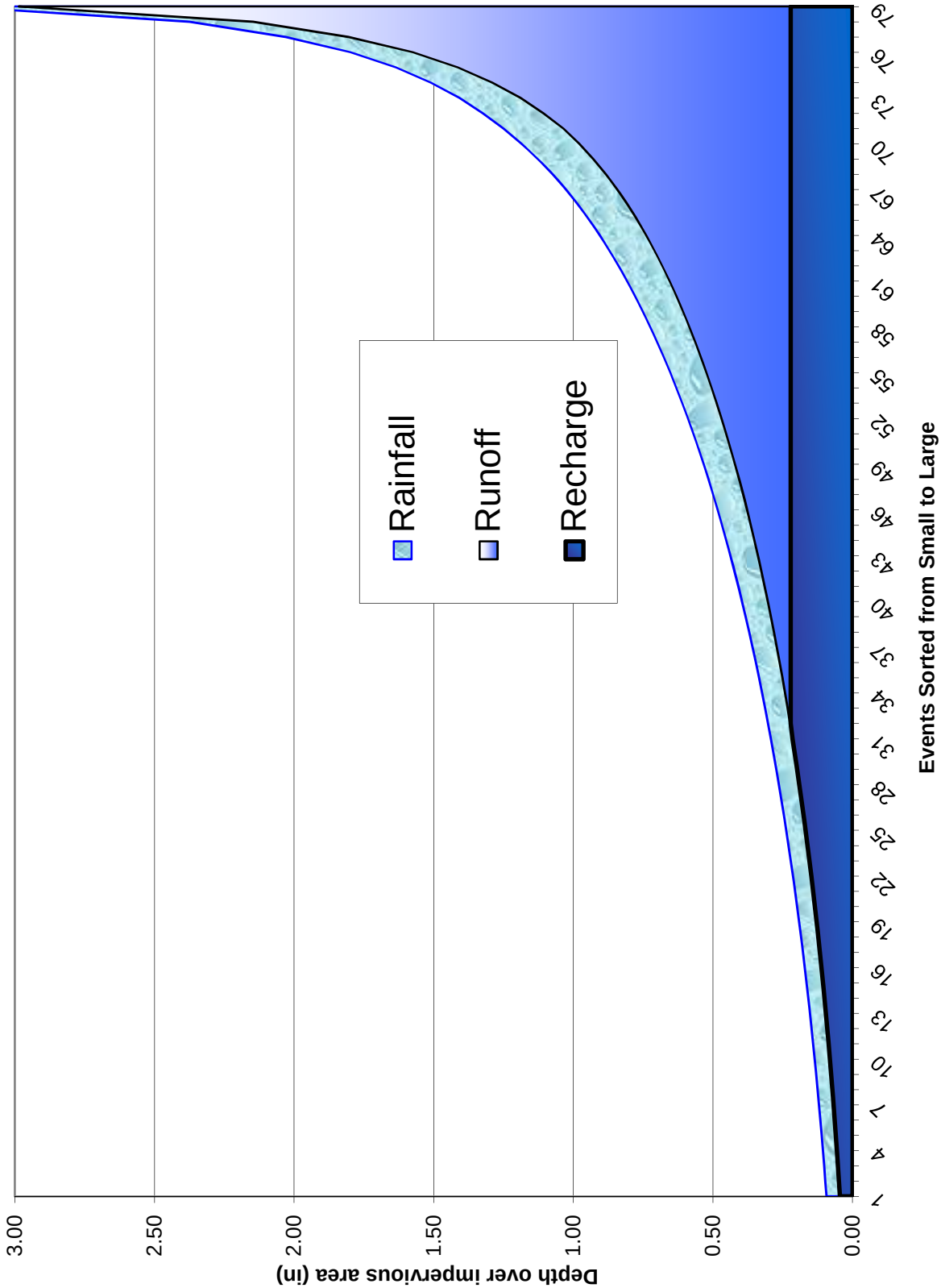
System Performance Calculated Parameters

Annual BMP Recharge Volume		90,878	cu.ft
Avg BMP Recharge Efficiency		100.0%	Represents % Infiltration Recharged
%Rainfall became Runoff		78.3%	%
%Runoff Infiltrated		38.1%	%
%Runoff Recharged		33.0%	%
%Rainfall Recharged		25.9%	%

OTHER NOTES

Pdesign is accurate only after BMP dimensions are updated to make rech volume= deficit volume. The portion of BMP infiltration prior to filling and the area occupied by BMP are ignored in these calculations. Results are sensetive to dBMP, make sure dBMP selected is small enough for BMP to empty in less than 3 days. For land Segment Location of BMP if you select "impervious areas" RWC will be minimal but not zero as determined by the soil type and a shallow root zone for this Land Cover allowing consideration of lateral flow and other losses.

How to solve for different recharge volumes: By default the spreadsheet assigns the values of total deficit recharge volume "Vdef" and total proposed impervious area "Aimp" from the "Annual Recharge" sheet to "Vdef" and "Aimp" on this page. This allows solution for a single BMP to handle the entire recharge requirement assuming the runoff from entire impervious area is available to the BMP.
To solve for a smaller BMP or a LID-IMP to recharge only part of the recharge requirement, set Vdef to your target value and Aimp to impervious area directly connected to your infiltration facility and then solve for ABMP or dBMP. To go back to the default configuration clik the "Default Vdef & Aimp" button.


Depth over impervious area (in)
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Rainfall
Runoff
Recharge
Events Sorted from Small to Large
1
4
7
10
13
16
19
22
25
28
31
34
37
40
43
46
49
52
55
58
61
64
67
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79

WATER QUALITY CALCULATIONS

Casey & Keller, Inc.
258 Main St
Millburn,N.J. 07041
Phone: (973) 379-3280
Fax: (973) 379-7993

ORANGE LAWN TENNIS CLUB
SOUTH ORANGE
1140108
8/18/2016

QUALITY STORM DESIGN
Sand Filter and Forebay Calculations

Developed C = 0.68
I = 0.625
A = 5.003

Quality Storm = Qp = C I A = 2.126

Duration = 2 hrs

Vqs = Qp x D x 3600 sec/hr = 15309 cf

PARAMETER DESCRIPTION		PARAMETER	VALUE	
Total Temporary Volume in Sand Bed Zones	Vqs		15309	cf
Approximate Sand Bed Volume	Vst	(0.5)Vqs	7655	cf
Min. Sand Thicknes	THs	12 in	24	in
Sand Bed Design Porosity	n	0.3	0.3	
Sand Bed Design Permeabiltiy (K2)	k	4 ft/day	4	feet/day
Sand Bed Design Drain Time	Td	1.5 days	1.5	days
Min. Sand Bed Surface Area	As		1458.02	sf
Sand Bed Depth (Water Volume)	Dst		3.00	ft
Approximate Forebay Volume	Vft	(0.5)Vqs	7655	cf
Min. Forebay Surface Area	Af	(0.05)Vqs	765	sf

Design Min. Sand Area = As = (Vqs)(THs) / ((k)(Dst/2 + THs)(Td)) = 1458.02 sf
Sand Vol.= Vst = (As)(Dst) +(As)(THs)(n) = 5248.86 cf

Proposed
Sand Area = 1612.00 sq ft
Water Volume in Sand = 967.20 cf

Sand Bed Area = 2000.00 sq ft
Bottom of Basin 77.00 feet
Orifice or Weir Elevation 80.00 feet

Sand Bed Water Volume = 6000.00 cf

Total Sand Bed Volume Proposed = 6967.20 cf

Active Scenario: 100 Yr Storm

Label	Start Node	Stop Node	Inlet Area (acres)	Inlet C	Inlet CA (acres)	Intensity (in/h)	Total System Flow (cfs)	Length (ft)	Slope (ft/ft)	Size (in)	"n" value	Velocity (ft/s)	Total Capacity of Pipe (cfs)	Design Capacity (%)	Tc (min)	Up stream Invert (ft)	Down stream Invert (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Down stream Rim (ft)
PIPE 1	INLET 1a	MH 1a	0.082	0.520	0.043	7.610	0.33	45.0	0.010	12.0	0.011	3.19	4.21	7.8	10.000	88.00	87.55	88.24	87.88	90.35
PIPE 2	INLET 1b	MH 1a	0.078	0.540	0.042	7.610	0.32	43.0	0.010	12.0	0.011	3.22	4.31	7.5	10.000	88.00	87.55	88.23	87.88	90.35
PIPE 3	MH 1a	INLET 1	(N/A)	(N/A)	0.085	7.558	0.65	98.0	0.030	12.0	0.011	5.73	7.29	8.9	10.235	87.55	84.61	87.88	85.26	86.80
PIPE 4	INLET 1	INLET 2	0.571	0.670	0.467	7.494	3.53	26.0	0.010	15.0	0.011	6.10	7.63	46.2	10.520	84.50	84.24	85.26	85.18	86.80
PIPE 5	INLET 2	MH 1	0.267	0.920	0.713	7.479	5.37	117.0	0.010	15.0	0.011	6.74	7.63	70.4	10.592	84.24	83.07	85.18	83.84	88.80
PIPE 6	MH 1	HW 1	(N/A)	(N/A)	0.713	7.414	5.33	37.0	0.005	15.0	0.011	5.08	5.47	97.4	10.881	82.19	82.00	83.18	82.94	85.00
PIPE 7	INLET 3a	MH 3a	0.120	0.520	0.062	7.610	0.48	52.0	0.010	12.0	0.011	3.56	4.21	11.4	10.000	87.33	86.81	87.62	87.04	89.00
pipe 8	INLET 3b	MH 3a	0.175	0.520	0.091	7.610	0.70	50.0	0.010	12.0	0.011	3.97	4.21	16.6	10.000	86.33	85.83	86.68	86.29	89.00
PIPE 9	MH 3a	INLET 3	(N/A)	(N/A)	0.153	7.556	1.17	108.0	0.022	12.0	0.013	5.45	5.34	21.9	10.243	85.83	83.40	86.29	84.13	85.70
PIPE 10	INLET 3	INLET 4	0.404	0.690	0.432	7.483	3.26	26.0	0.010	15.0	0.011	5.97	7.63	42.7	10.574	83.40	83.14	84.13	83.97	85.70
PIPE 11	INLET 4	INLET 6	0.136	0.930	0.559	7.466	4.20	43.0	0.010	15.0	0.011	6.37	7.63	55.1	10.646	83.14	82.71	83.97	83.38	85.70
PIPE 12	INLET 6	MH-19	0.009	0.990	0.568	7.442	4.26	76.0	0.020	15.0	0.011	8.27	10.80	39.4	10.759	71.56	70.04	72.40	70.59	76.00
PIPE 13	MH-19	DIS STRUCT	(N/A)	(N/A)	0.568	7.408	4.24	4.0	0.010	15.0	0.011	6.38	7.63	55.5	10.912	70.04	70.00	70.87	70.76	75.00
PIPE 14	DIS STRUCT	INLET 7	(N/A)	(N/A)	0.000	9.240	11.96	58.0	0.010	24.0	0.011	8.27	26.73	44.7	0.000	68.00	67.42	69.24	68.40	71.50
PIPE 15	INLET 7	MH 2	0.817	0.850	0.694	7.610	17.29	100.0	0.007	24.0	0.011	7.86	22.37	77.3	10.000	61.80	61.10	63.30	62.68	64.00
PIPE 16	MH 2	HW 2	(N/A)	(N/A)	0.694	7.563	17.25	51.0	0.002	30.0	0.011	4.86	21.46	80.4	10.212	61.10	61.00	62.68	62.41	65.00
PIPE 20	INLET 30	INLET 31	(N/A)	(N/A)	0.000	9.240	11.96	28.0	0.010	24.0	0.011	8.27	26.73	44.7	0.000	46.94	46.66	48.18	47.68	49.86
PIPE 21	INLET 31	INLET 32	(N/A)	(N/A)	0.000	9.240	11.96	107.0	0.015	24.0	0.011	9.62	32.79	36.5	0.056	45.22	43.61	46.46	44.46	46.81
PIPE 22	INLET 32	INLET 33	(N/A)	(N/A)	0.000	9.240	11.96	65.0	0.015	24.0	0.011	9.62	32.83	36.4	0.242	42.63	41.65	43.87	42.53	44.85
PIPE 23	INLET 33	INLET 34	(N/A)	(N/A)	0.000	9.240	11.96	222.0	0.015	24.0	0.011	9.61	32.74	36.5	0.354	35.63	32.30	36.87	33.14	35.50
PIPE 24	INLET 34	CULVERT	(N/A)	(N/A)	0.000	9.240	11.96	148.0	0.015	24.0	0.011	9.61	32.74	36.5	0.739	28.96	26.74	30.20	27.58	31.21

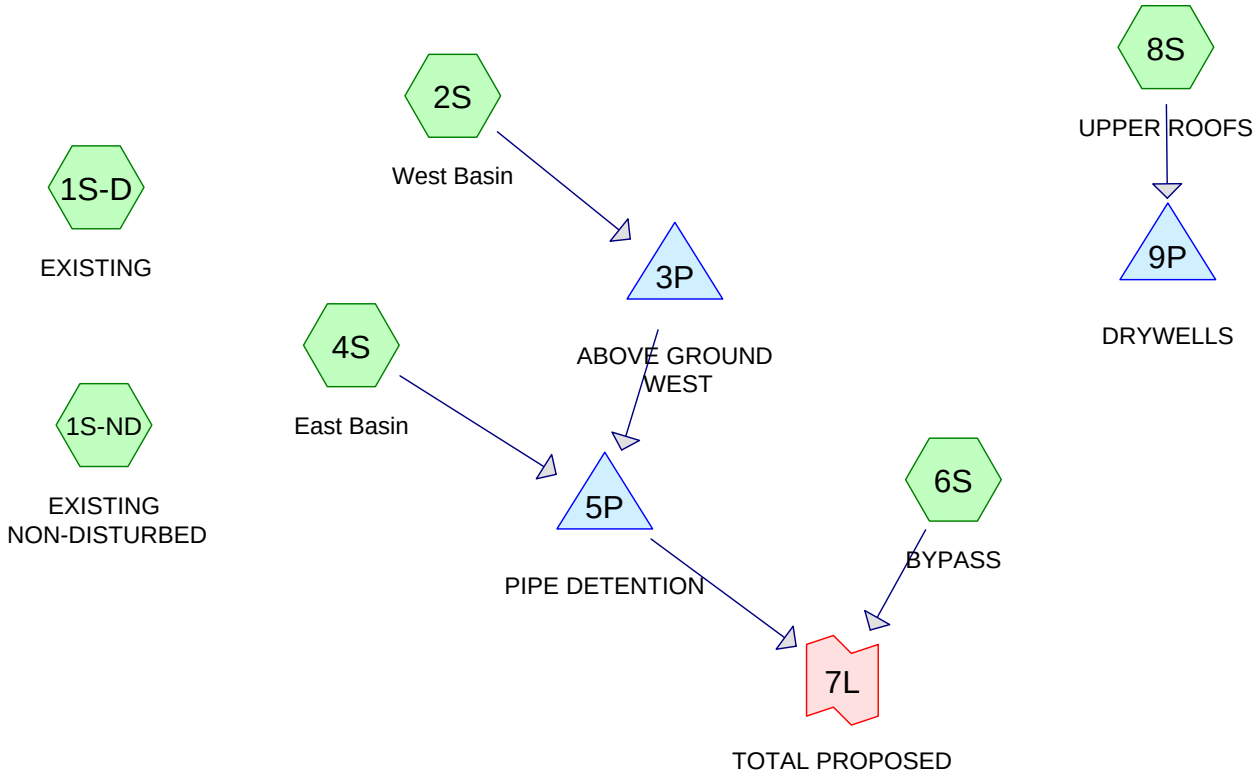
Total flow going into Contech Jellyfish Treatment device = 4.26 cfs

Maximum Treatment Flow Rates and Inflow Drainage Area for 54” Cartridge Jellyfish Models

Manhole Diameter (ft)	Model No.	Hi-Flo Cartridges (54" Length)	Draindown Cartridges (54" Length)	Max Treatment Flow Rate (cfs)	Max Inflow Drainage Area (Impervious Acres)
4	JF4-2-1	2	1	0.45	1.62
6	JF6-3-1	3	1	0.62	2.27
	JF6-4-1	4	1	0.80	2.92
	JF6-5-1	5	1	0.98	3.57
	JF6-6-1	6	1	1.16	4.22
8	JF8-6-2	6	2	1.25	4.54
	JF8-7-2	7	2	1.43	5.19
	JF8-8-2	8	2	1.60	5.84
	JF8-9-2	9	2	1.78	6.49
	JF8-10-2	10	2	1.96	7.14
10	JF10-11-3	11	3	2.23	8.11
	JF10-12-3	12	3	2.41	8.76
	JF10-13-3	13	3	2.58	9.41
	JF10-14-3	14	3	2.76	10.06
	JF10-15-3	15	3	2.94	10.71
	JF10-16-3	16	3	3.12	11.36
12	JF12-17-4	17	4	3.39	12.33
	JF12-18-4	18	4	3.57	12.98
	JF12-19-4	19	4	3.74	13.63
	JF12-20-4	20	4	3.92	14.28
	JF12-21-4	21	4	4.10	14.93
	JF12-22-4	22	4	4.28	15.58
	JF12-23-4	23	4	4.46	16.23
	JF12-24-4	24	4	4.63	16.88

- For each 54” hi-flo cartridge: max inflow = 0.178 cfs; max drainage area: 0.65 acres
- For each 54” draindown cartridge: max inflow = 0.089 cfs; max drainage area: 0.32 acres

DETENTION SYSTEM CALCULATIONS



Subcat Reach Pond Link

Routing Diagram for 1140108-G
Prepared by CASEY AND KELLER, INC., Printed 9/8/2016
HydroCAD® 10.00-13 s/n 03272 © 2014 HydroCAD Software Solutions LLC

Time span=0.00-120.00 hrs, dt=0.05 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S-D: EXISTING Runoff Area=164,268 sf 0.00% Impervious Runoff Depth=1.17"
Tc=10.0 min CN=74/0 Runoff=4.28 cfs 0.368 af

Subcatchment 1S-ND: EXISTING Runoff Area=77,768 sf 37.26% Impervious Runoff Depth=1.88"
Tc=10.0 min CN=73/98 Runoff=3.09 cfs 0.279 af

Subcatchment 2S: West Basin Runoff Area=55,751 sf 33.97% Impervious Runoff Depth=1.85"
Tc=10.0 min CN=74/98 Runoff=2.20 cfs 0.197 af

Pond 3P: ABOVE GROUND WEST Peak Elev=80.43' Storage=3,869 cf Inflow=2.20 cfs 0.197 af
Outflow=0.17 cfs 0.197 af

Subcatchment 4S: East Basin Runoff Area=84,236 sf 42.30% Impervious Runoff Depth=2.02"
Tc=10.0 min CN=74/98 Runoff=3.60 cfs 0.325 af

Pond 5P: PIPE DETENTION Peak Elev=72.93' Storage=7,301 cf Inflow=3.73 cfs 0.522 af
Outflow=0.40 cfs 0.522 af

Subcatchment 6S: BYPASS Runoff Area=82,489 sf 36.01% Impervious Runoff Depth=1.85"
Tc=10.0 min CN=73/98 Runoff=3.23 cfs 0.292 af

Link 7L: TOTAL PROPOSED Inflow=3.53 cfs 0.814 af
Primary=3.53 cfs 0.814 af

Subcatchment 8S: UPPER ROOFS Runoff Area=19,560 sf 100.00% Impervious Runoff Depth=3.17"
Tc=10.0 min CN=0/98 Runoff=1.28 cfs 0.119 af

Pond 9P: DRYWELLS Peak Elev=110.36' Storage=3,255 cf Inflow=1.28 cfs 0.119 af
Outflow=0.03 cfs 0.119 af

Summary for Subcatchment 1S-D: EXISTING

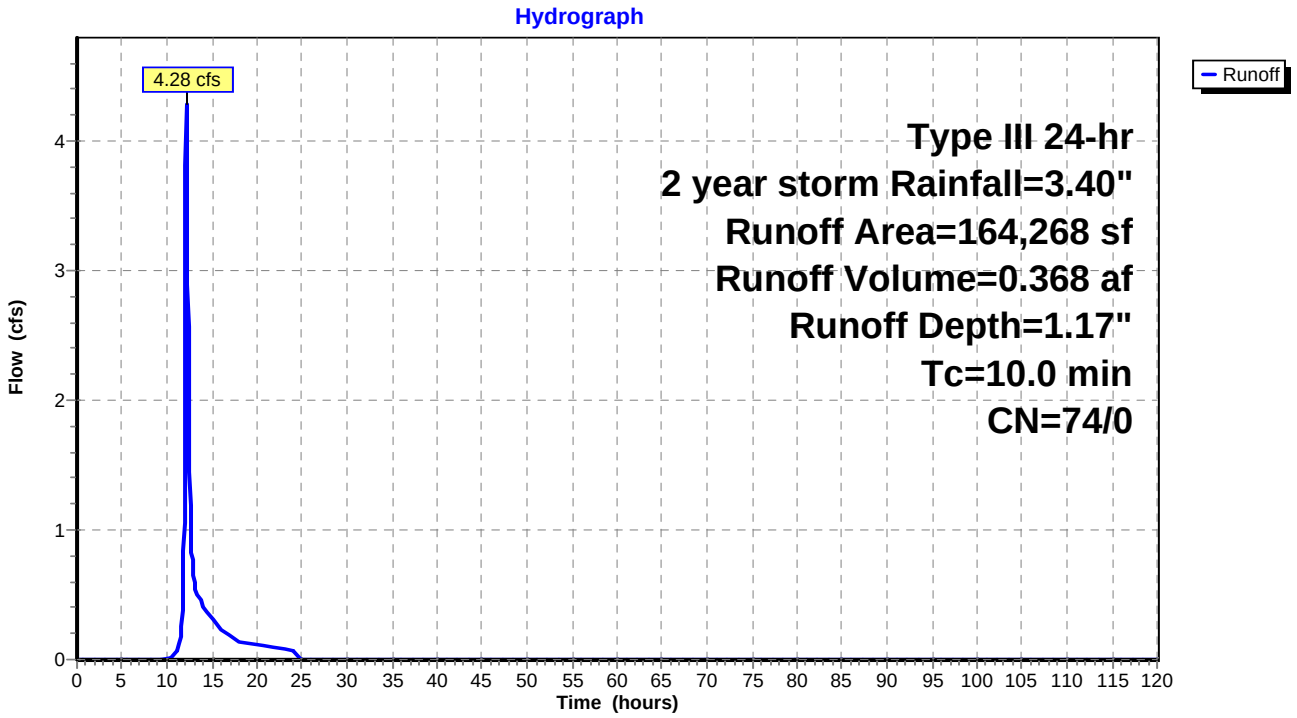
Runoff = 4.28 cfs @ 12.15 hrs, Volume= 0.368 af, Depth= 1.17"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year storm Rainfall=3.40"

Area (sf)	CN	Description
145,868	74	>75% Grass cover, Good, HSG C
18,400	70	Woods, Good, HSG C
164,268	74	Weighted Average
164,268	74	100.00% Pervious Area

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

Subcatchment 1S-D: EXISTING



Summary for Subcatchment 1S-ND: EXISTING NON-DISTURBED

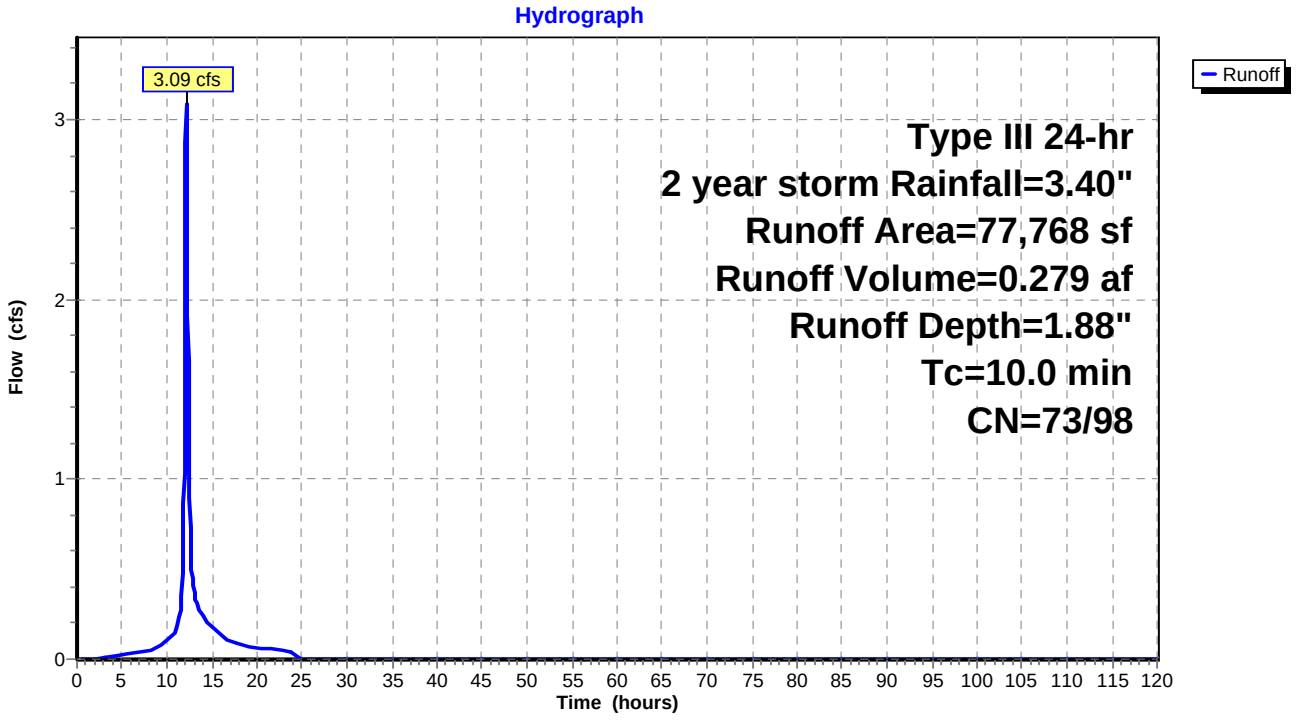
Runoff = 3.09 cfs @ 12.14 hrs, Volume= 0.279 af, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year storm Rainfall=3.40"

	Area (sf)	CN	Description
	8,274	98	Paved parking, HSG C
	27,267	74	>75% Grass cover, Good, HSG C
	8,389	70	Woods, Good, HSG C
*	7,739	98	Roofs, HSG C-OFFSITE
*	12,960	98	Paved parking, HSG C-OFFSITE
*	13,139	74	>75% Grass cover, Good, HSG C-OOFSITE
	77,768	83	Weighted Average
	48,795	73	62.74% Pervious Area
	28,973	98	37.26% Impervious Area

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

Subcatchment 1S-ND: EXISTING NON-DISTURBED



Summary for Subcatchment 2S: West Basin

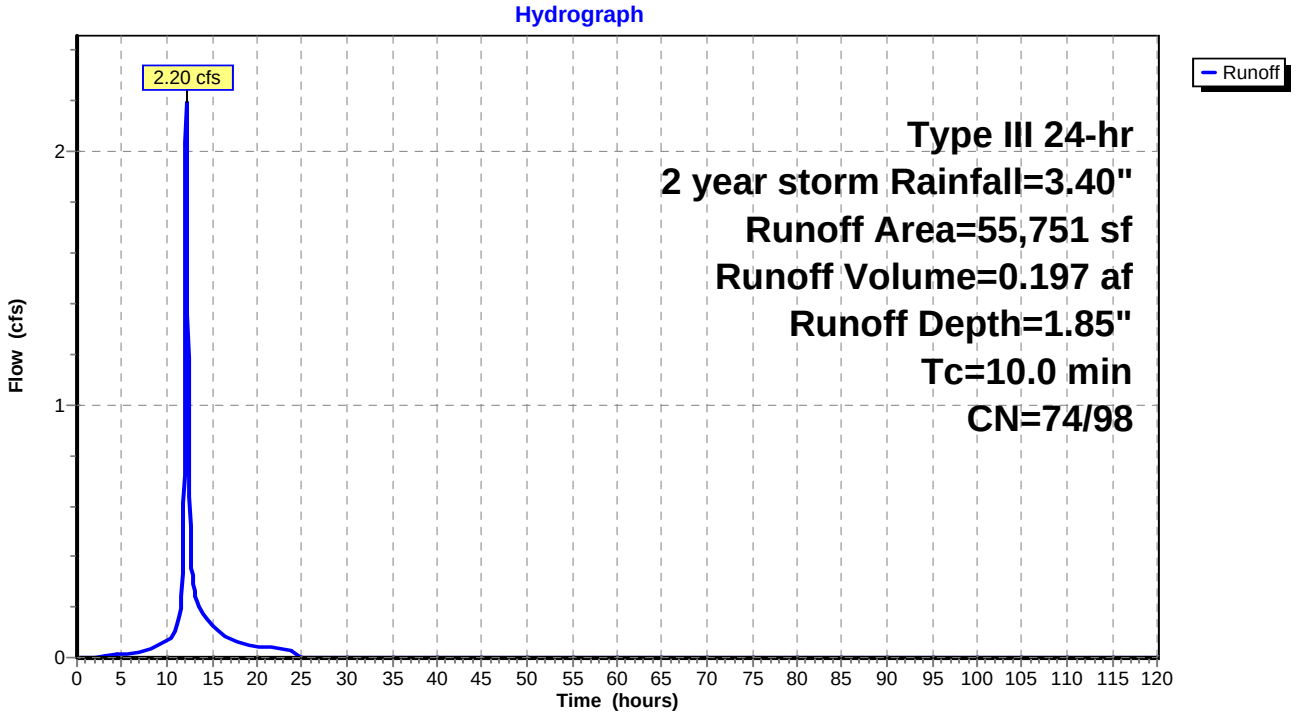
Runoff = 2.20 cfs @ 12.14 hrs, Volume= 0.197 af, Depth= 1.85"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year storm Rainfall=3.40"

	Area (sf)	CN	Description
	18,937	98	Paved parking, HSG C
	35,442	74	>75% Grass cover, Good, HSG C
*	1,372	74	>75% Grass cover, Good, HSG C-OFFSITE
	55,751	82	Weighted Average
	36,814	74	66.03% Pervious Area
	18,937	98	33.97% Impervious Area

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

Subcatchment 2S: West Basin



Summary for Pond 3P: ABOVE GROUND WEST

Inflow Area = 1.280 ac, 33.97% Impervious, Inflow Depth = 1.85" for 2 year storm event
Inflow = 2.20 cfs @ 12.14 hrs, Volume= 0.197 af
Outflow = 0.17 cfs @ 14.00 hrs, Volume= 0.197 af, Atten= 92%, Lag= 111.1 min
Primary = 0.17 cfs @ 14.00 hrs, Volume= 0.197 af

Routing by Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 80.43' @ 14.00 hrs Surf.Area= 3,666 sf Storage= 3,869 cf

Plug-Flow detention time= 235.8 min calculated for 0.197 af (100% of inflow)
Center-of-Mass det. time= 235.8 min (1,037.8 - 802.0)

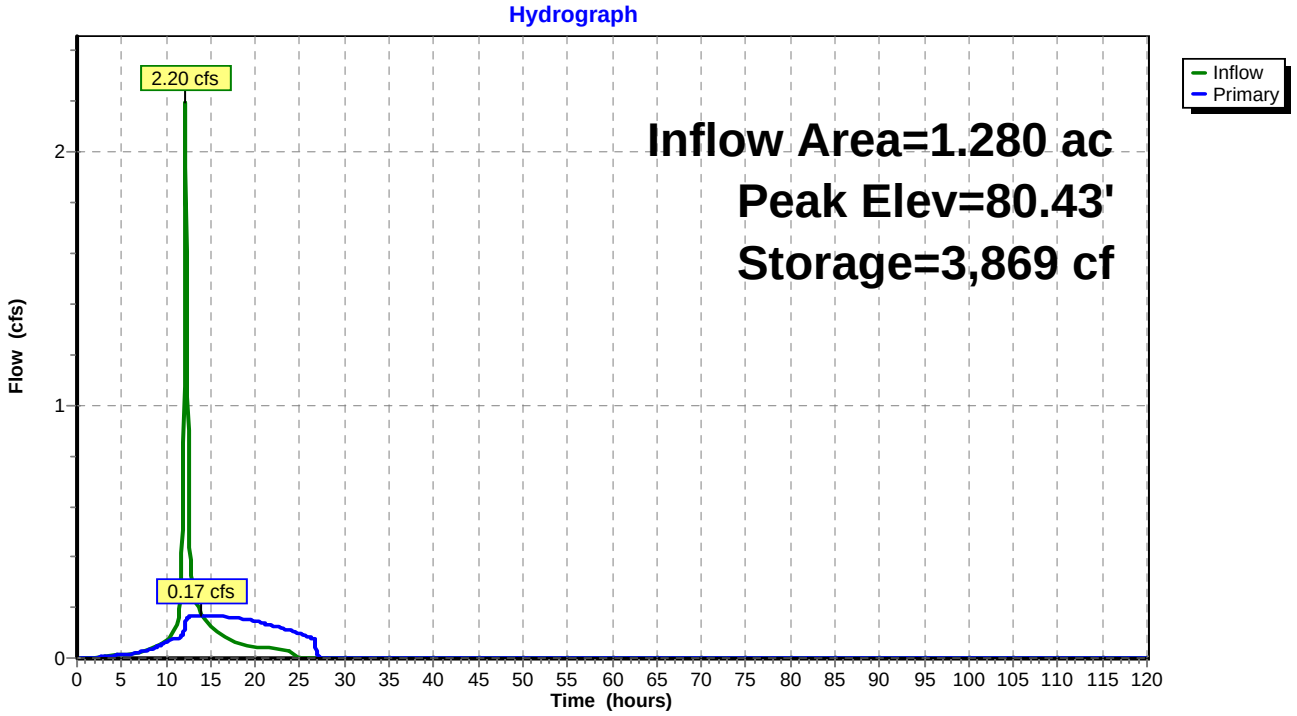
Volume	Invert	Avail.Storage	Storage Description
#1	79.00'	10,494 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
79.00	1,511	0	0
80.00	3,253	2,382	2,382
81.00	4,215	3,734	6,116
82.00	4,540	4,378	10,494

Device	Routing	Invert	Outlet Devices
#1	Primary	79.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	81.75'	**36.0" Horiz. Grate X 2.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.17 cfs @ 14.00 hrs HW=80.43' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.17 cfs)
└─**2=Grate** (Controls 0.00 cfs)

Pond 3P: ABOVE GROUND WEST



Summary for Subcatchment 4S: East Basin

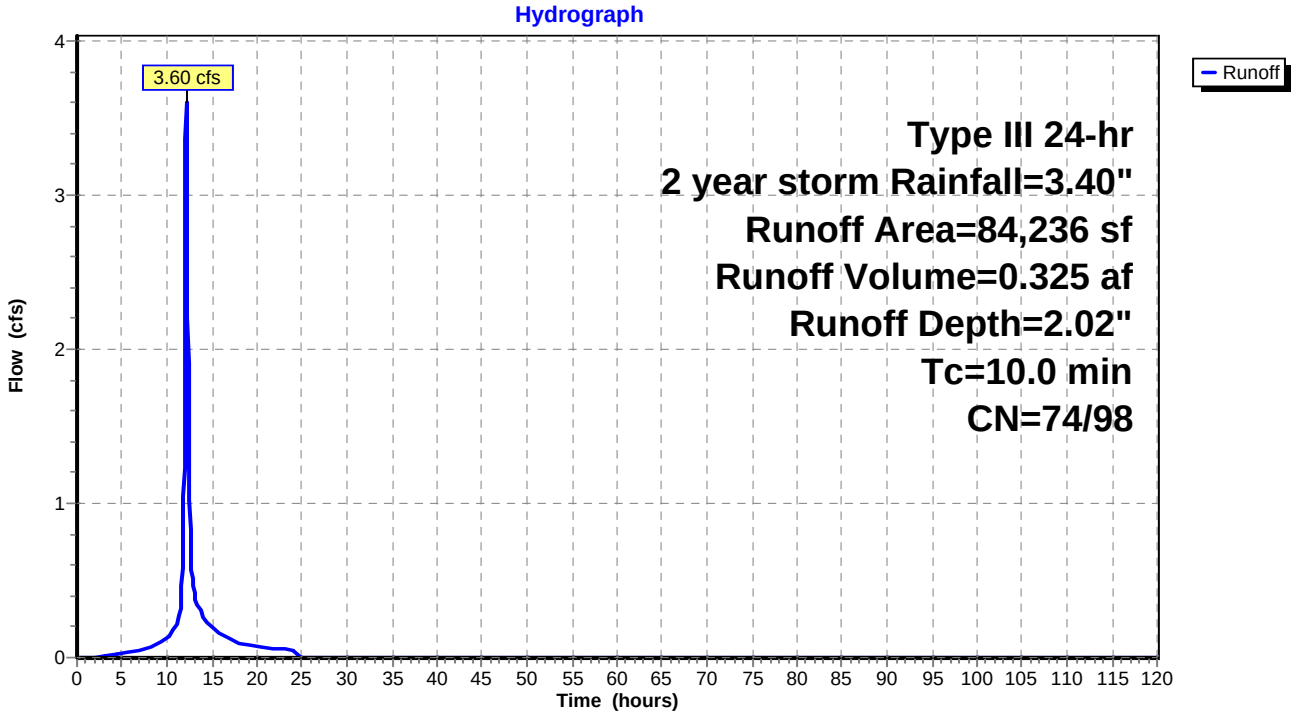
Runoff = 3.60 cfs @ 12.14 hrs, Volume= 0.325 af, Depth= 2.02"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year storm Rainfall=3.40"

Area (sf)	CN	Description
19,560	98	Roofs, HSG C
16,071	98	Paved parking, HSG C
48,605	74	>75% Grass cover, Good, HSG C
84,236	84	Weighted Average
48,605	74	57.70% Pervious Area
35,631	98	42.30% Impervious Area

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

Subcatchment 4S: East Basin



Summary for Pond 5P: PIPE DETENTION

Inflow Area = 3.214 ac, 38.98% Impervious, Inflow Depth = 1.95" for 2 year storm event
Inflow = 3.73 cfs @ 12.14 hrs, Volume= 0.522 af
Outflow = 0.40 cfs @ 14.58 hrs, Volume= 0.522 af, Atten= 89%, Lag= 146.0 min
Primary = 0.40 cfs @ 14.58 hrs, Volume= 0.522 af

Routing by Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 72.93' @ 14.58 hrs Surf.Area= 2,974 sf Storage= 7,301 cf

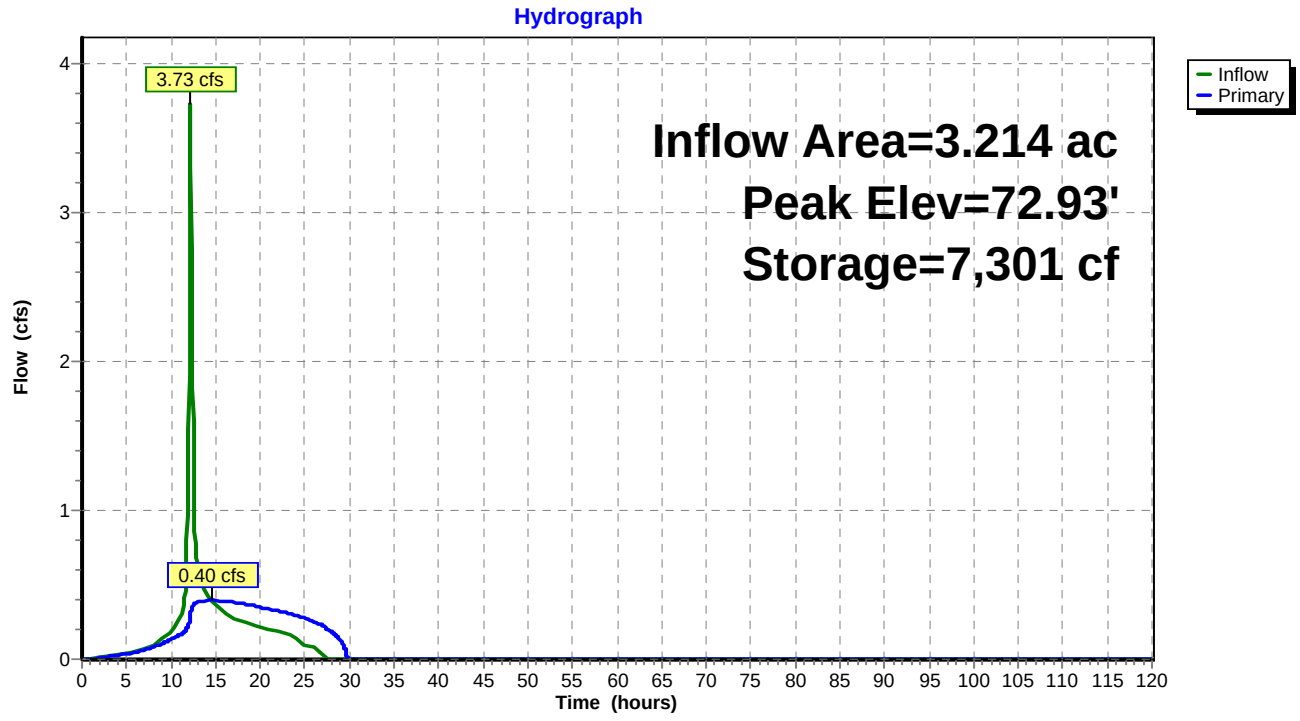
Plug-Flow detention time= 213.3 min calculated for 0.522 af (100% of inflow)
Center-of-Mass det. time= 213.3 min (1,099.1 - 885.8)

Volume	Invert	Avail.Storage	Storage Description
#1	70.00'	10,053 cf	**48.0" Round Pipe Storage** x 4 L= 200.0' S= 0.0020 '/'

Device	Routing	Invert	Outlet Devices
#1	Primary	70.00'	**3.0" Vert. Orifice** C= 0.600
#2	Primary	73.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.40 cfs @ 14.58 hrs HW=72.93' (Free Discharge)
└**1=Orifice** (Orifice Controls 0.40 cfs @ 8.06 fps)
└**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 5P: PIPE DETENTION



Summary for Subcatchment 6S: BYPASS

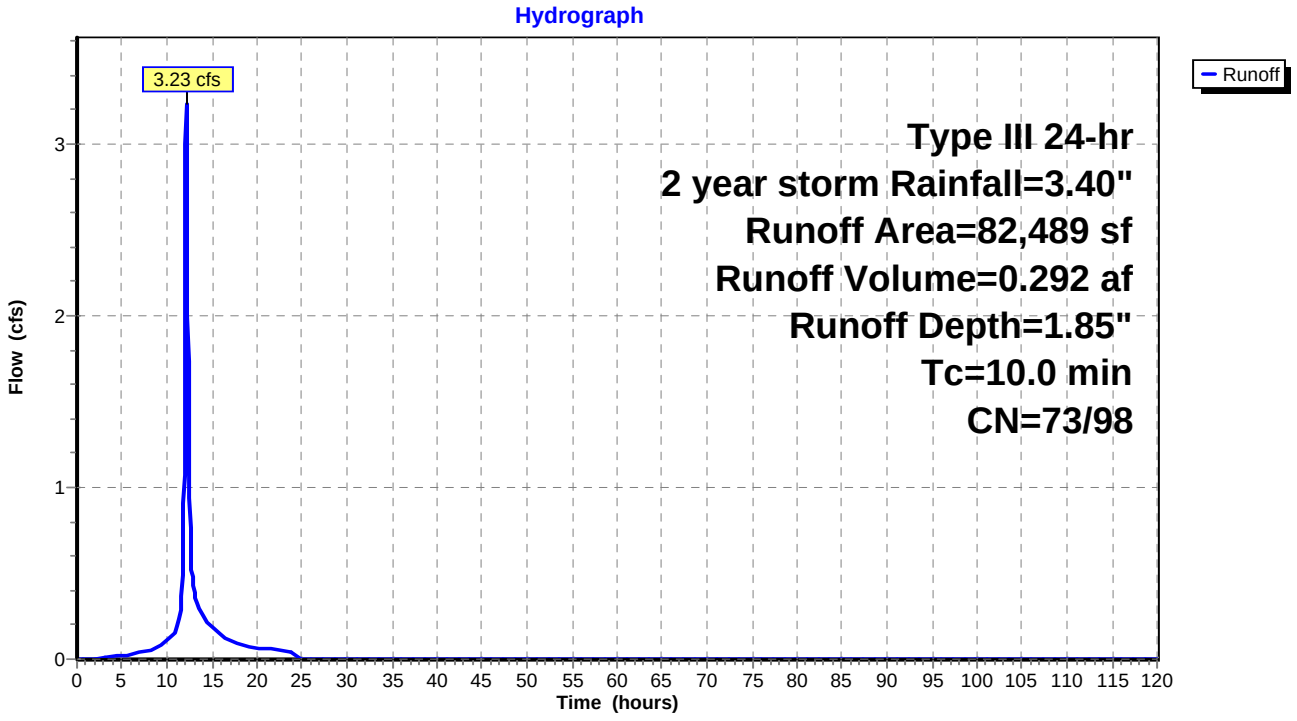
Runoff = 3.23 cfs @ 12.14 hrs, Volume= 0.292 af, Depth= 1.85"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year storm Rainfall=3.40"

	Area (sf)	CN	Description
	9,006	98	Paved parking, HSG C
	33,165	74	>75% Grass cover, Good, HSG C
	12,032	70	Woods, Good, HSG C
*	7,739	98	Roofs, HSG C-OFFSITE
*	12,960	98	Paved parking, HSG C-OFFSITE
*	7,587	74	>75% Grass cover, Good, HSG C-OFFSITE
	82,489	82	Weighted Average
	52,784	73	63.99% Pervious Area
	29,705	98	36.01% Impervious Area

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

Subcatchment 6S: BYPASS

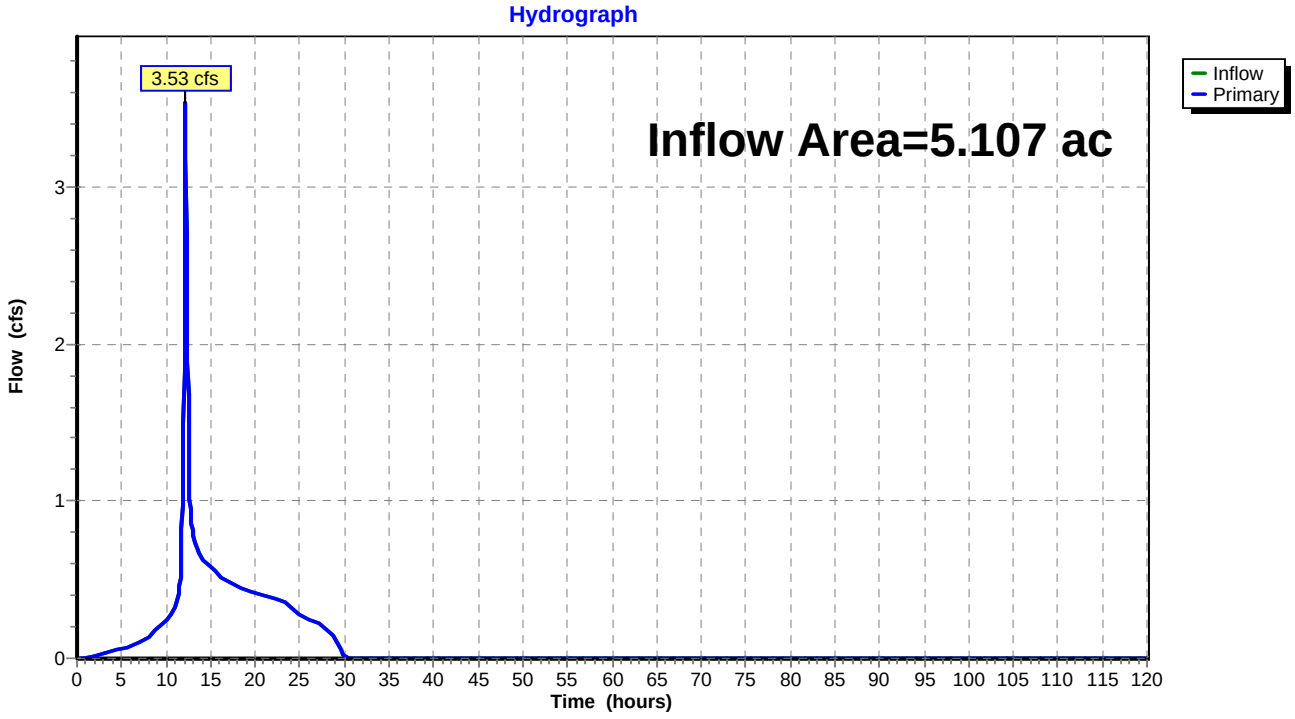


Summary for Link 7L: TOTAL PROPOSED

Inflow Area = 5.107 ac, 37.88% Impervious, Inflow Depth = 1.91" for 2 year storm event
Inflow = 3.53 cfs @ 12.15 hrs, Volume= 0.814 af
Primary = 3.53 cfs @ 12.15 hrs, Volume= 0.814 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs

Link 7L: TOTAL PROPOSED



Summary for Subcatchment 8S: UPPER ROOFS

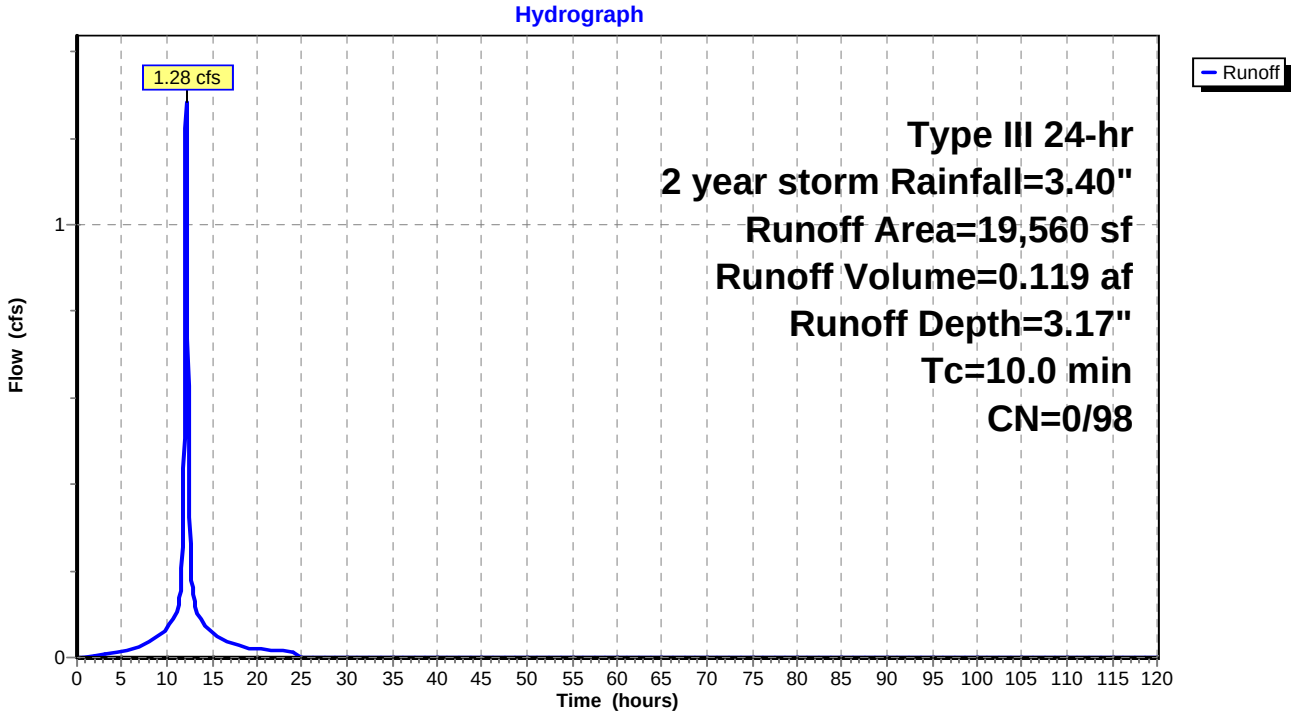
Runoff = 1.28 cfs @ 12.14 hrs, Volume= 0.119 af, Depth= 3.17"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year storm Rainfall=3.40"

Area (sf)	CN	Description
19,560	98	Paved parking, HSG C
19,560	98	100.00% Impervious Area

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

Subcatchment 8S: UPPER ROOFS



Summary for Pond 9P: DRYWELLS

Inflow Area = 0.449 ac,100.00% Impervious, Inflow Depth = 3.17" for 2 year storm event
Inflow = 1.28 cfs @ 12.14 hrs, Volume= 0.119 af
Outflow = 0.03 cfs @ 8.25 hrs, Volume= 0.119 af, Atten= 97%, Lag= 0.0 min
Primary = 0.03 cfs @ 8.25 hrs, Volume= 0.119 af

Routing by Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 110.36' @ 17.01 hrs Surf.Area= 720 sf Storage= 3,255 cf

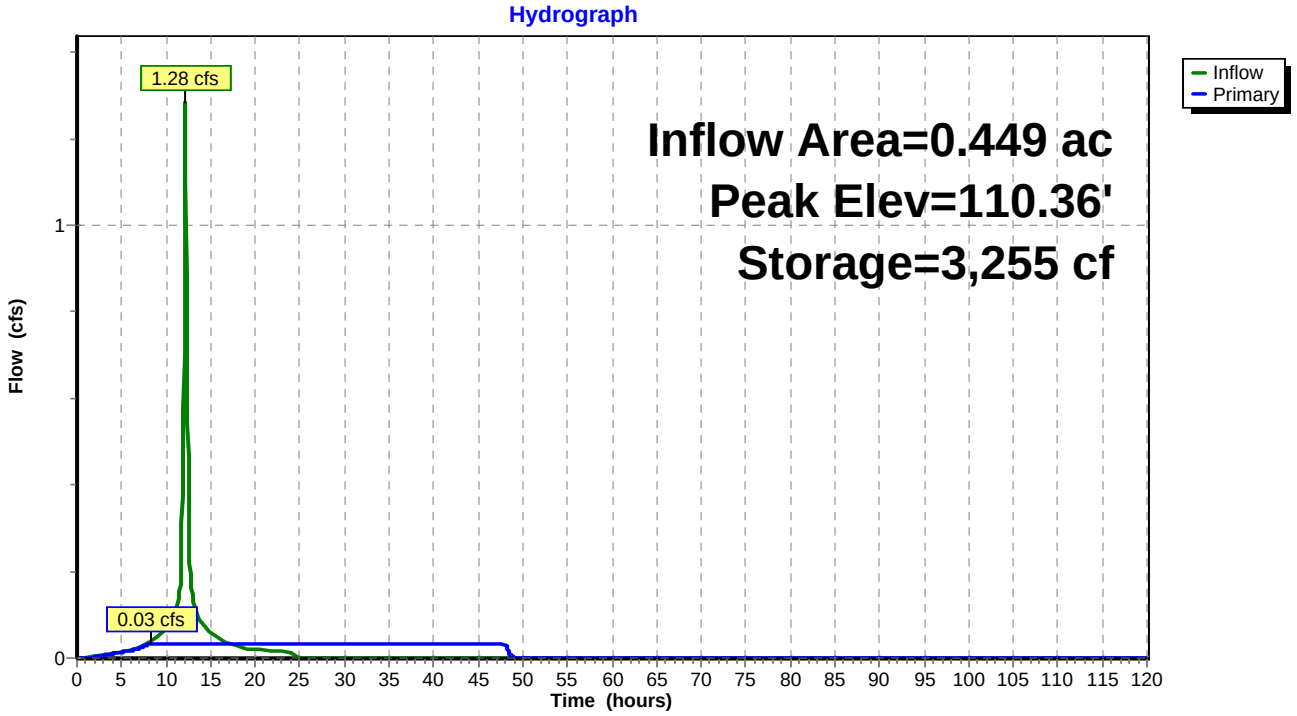
Plug-Flow detention time= 853.9 min calculated for 0.118 af (100% of inflow)
Center-of-Mass det. time= 854.2 min (1,613.0 - 758.9)

Volume	Invert	Avail.Storage	Storage Description
#1	102.00'	1,936 cf	**12.00'W x 12.00'L x 10.00'H Prismatoid** x 5 7,200 cf Overall - 2,360 cf Embedded = 4,840 cf x 40.0% Voids
#2	104.00'	2,011 cf	**8.00'D x 8.00'H DRYWELLS** x 5 Inside #1 2,360 cf Overall - 4.0" Wall Thickness = 2,011 cf
		3,947 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	102.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	112.00'	**36.0" Horiz. Grate X 8.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.03 cfs @ 8.25 hrs HW=102.10' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.03 cfs)
2=Grate (Controls 0.00 cfs)

Pond 9P: DRYWELLS



Time span=0.00-120.00 hrs, dt=0.05 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S-D: EXISTING Runoff Area=164,268 sf 0.00% Impervious Runoff Depth=2.52"
Tc=10.0 min CN=74/0 Runoff=9.60 cfs 0.793 af

Subcatchment 1S-ND: EXISTING Runoff Area=77,768 sf 37.26% Impervious Runoff Depth=3.38"
Tc=10.0 min CN=73/98 Runoff=5.67 cfs 0.503 af

Subcatchment 2S: West Basin Runoff Area=55,751 sf 33.97% Impervious Runoff Depth=3.35"
Tc=10.0 min CN=74/98 Runoff=4.06 cfs 0.358 af

Pond 3P: ABOVE GROUND WEST Peak Elev=81.56' Storage=8,541 cf Inflow=4.06 cfs 0.358 af
Outflow=0.20 cfs 0.358 af

Subcatchment 4S: East Basin Runoff Area=84,236 sf 42.30% Impervious Runoff Depth=3.56"
Tc=10.0 min CN=74/98 Runoff=6.44 cfs 0.573 af

Pond 5P: PIPE DETENTION Peak Elev=73.43' Storage=8,697 cf Inflow=6.61 cfs 0.931 af
Outflow=4.08 cfs 0.931 af

Subcatchment 6S: BYPASS Runoff Area=82,489 sf 36.01% Impervious Runoff Depth=3.35"
Tc=10.0 min CN=73/98 Runoff=5.97 cfs 0.528 af

Link 7L: TOTAL PROPOSED Inflow=7.95 cfs 1.459 af
Primary=7.95 cfs 1.459 af

Subcatchment 8S: UPPER ROOFS Runoff Area=19,560 sf 100.00% Impervious Runoff Depth=4.96"
Tc=10.0 min CN=0/98 Runoff=1.98 cfs 0.186 af

Pond 9P: DRYWELLS Peak Elev=112.01' Storage=3,947 cf Inflow=1.98 cfs 0.186 af
Outflow=0.92 cfs 0.194 af

Summary for Subcatchment 1S-D: EXISTING

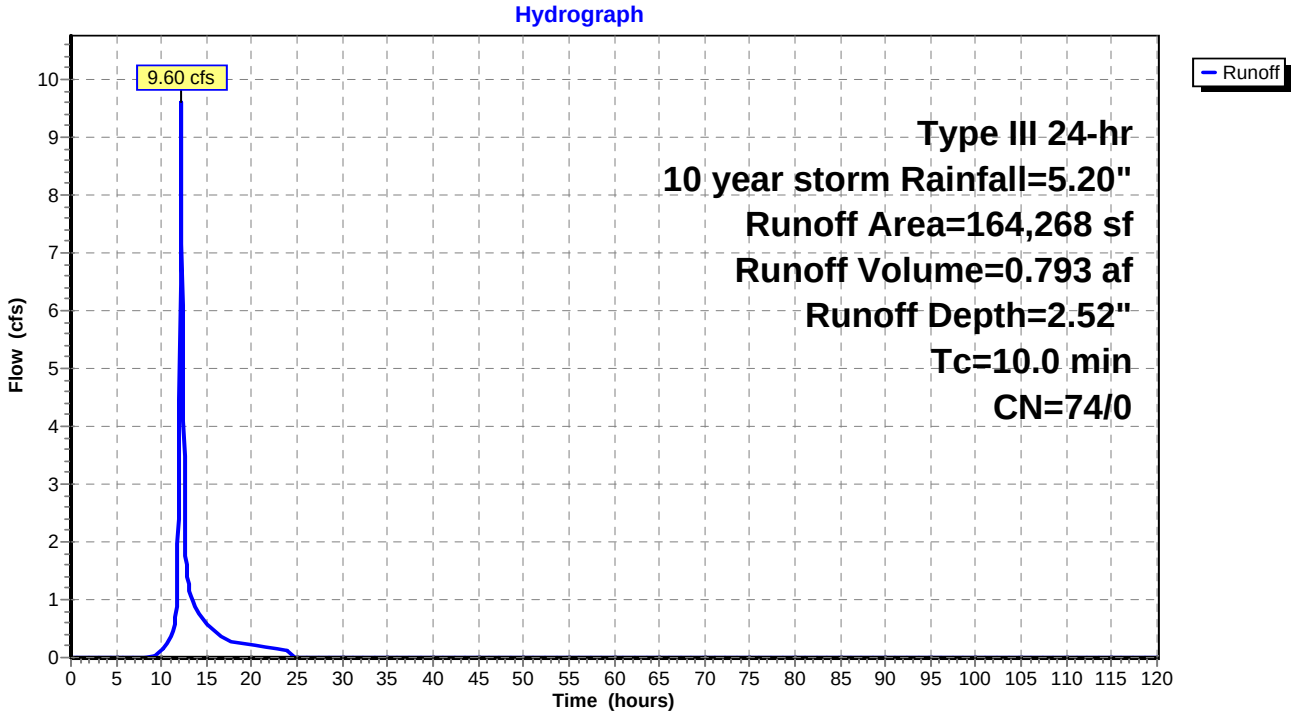
Runoff = 9.60 cfs @ 12.15 hrs, Volume= 0.793 af, Depth= 2.52"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year storm Rainfall=5.20"

Area (sf)	CN	Description
145,868	74	>75% Grass cover, Good, HSG C
18,400	70	Woods, Good, HSG C
164,268	74	Weighted Average
164,268	74	100.00% Pervious Area

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

Subcatchment 1S-D: EXISTING



Summary for Subcatchment 1S-ND: EXISTING NON-DISTURBED

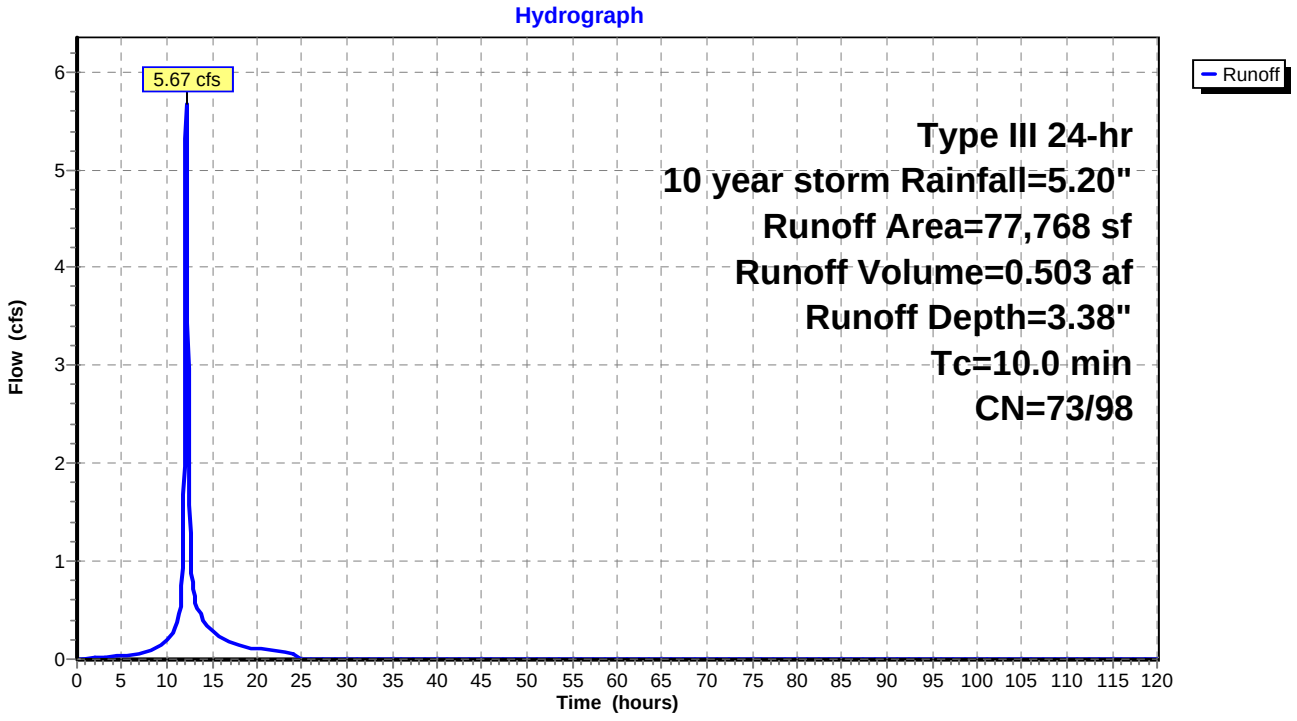
Runoff = 5.67 cfs @ 12.14 hrs, Volume= 0.503 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year storm Rainfall=5.20"

	Area (sf)	CN	Description
	8,274	98	Paved parking, HSG C
	27,267	74	>75% Grass cover, Good, HSG C
	8,389	70	Woods, Good, HSG C
*	7,739	98	Roofs, HSG C-OFFSITE
*	12,960	98	Paved parking, HSG C-OFFSITE
*	13,139	74	>75% Grass cover, Good, HSG C-OOFSITE
	77,768	83	Weighted Average
	48,795	73	62.74% Pervious Area
	28,973	98	37.26% Impervious Area

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

Subcatchment 1S-ND: EXISTING NON-DISTURBED



Summary for Subcatchment 2S: West Basin

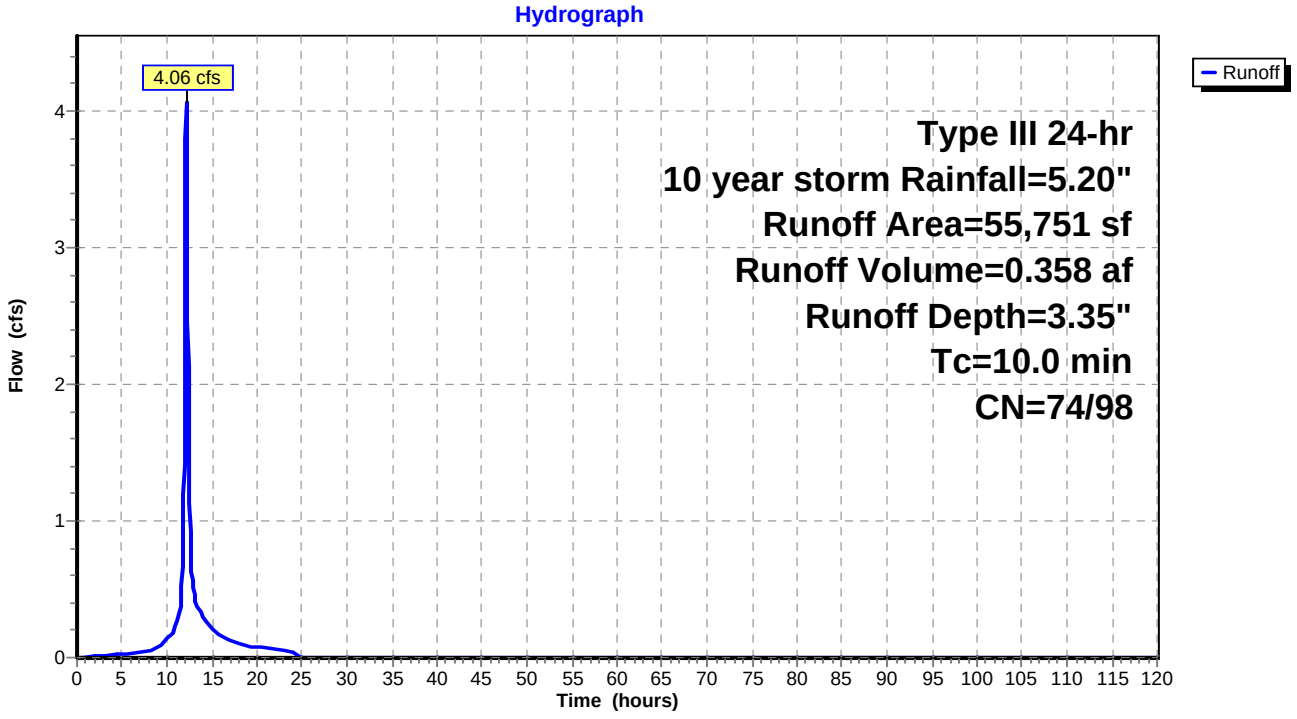
Runoff = 4.06 cfs @ 12.14 hrs, Volume= 0.358 af, Depth= 3.35"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year storm Rainfall=5.20"

	Area (sf)	CN	Description
	18,937	98	Paved parking, HSG C
	35,442	74	>75% Grass cover, Good, HSG C
*	1,372	74	>75% Grass cover, Good, HSG C-OFFSITE
	55,751	82	Weighted Average
	36,814	74	66.03% Pervious Area
	18,937	98	33.97% Impervious Area

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

Subcatchment 2S: West Basin



Summary for Pond 3P: ABOVE GROUND WEST

Inflow Area = 1.280 ac, 33.97% Impervious, Inflow Depth = 3.35" for 10 year storm event
Inflow = 4.06 cfs @ 12.14 hrs, Volume= 0.358 af
Outflow = 0.20 cfs @ 15.30 hrs, Volume= 0.358 af, Atten= 95%, Lag= 189.2 min
Primary = 0.20 cfs @ 15.30 hrs, Volume= 0.358 af

Routing by Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 81.56' @ 15.30 hrs Surf.Area= 4,398 sf Storage= 8,541 cf

Plug-Flow detention time= 435.7 min calculated for 0.357 af (100% of inflow)
Center-of-Mass det. time= 435.7 min (1,230.7 - 794.9)

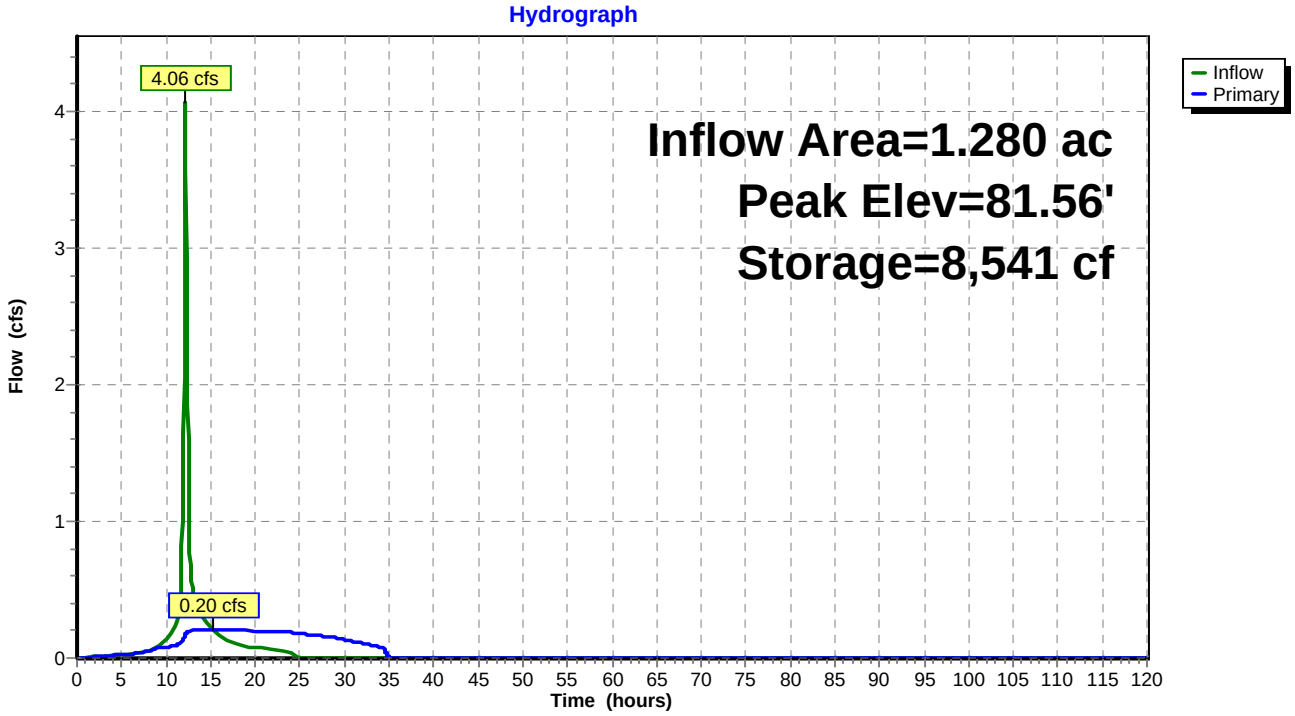
Volume	Invert	Avail.Storage	Storage Description
#1	79.00'	10,494 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
79.00	1,511	0	0
80.00	3,253	2,382	2,382
81.00	4,215	3,734	6,116
82.00	4,540	4,378	10,494

Device	Routing	Invert	Outlet Devices
#1	Primary	79.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	81.75'	**36.0" Horiz. Grate X 2.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.20 cfs @ 15.30 hrs HW=81.56' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.20 cfs)
└─**2=Grate** (Controls 0.00 cfs)

Pond 3P: ABOVE GROUND WEST



Summary for Subcatchment 4S: East Basin

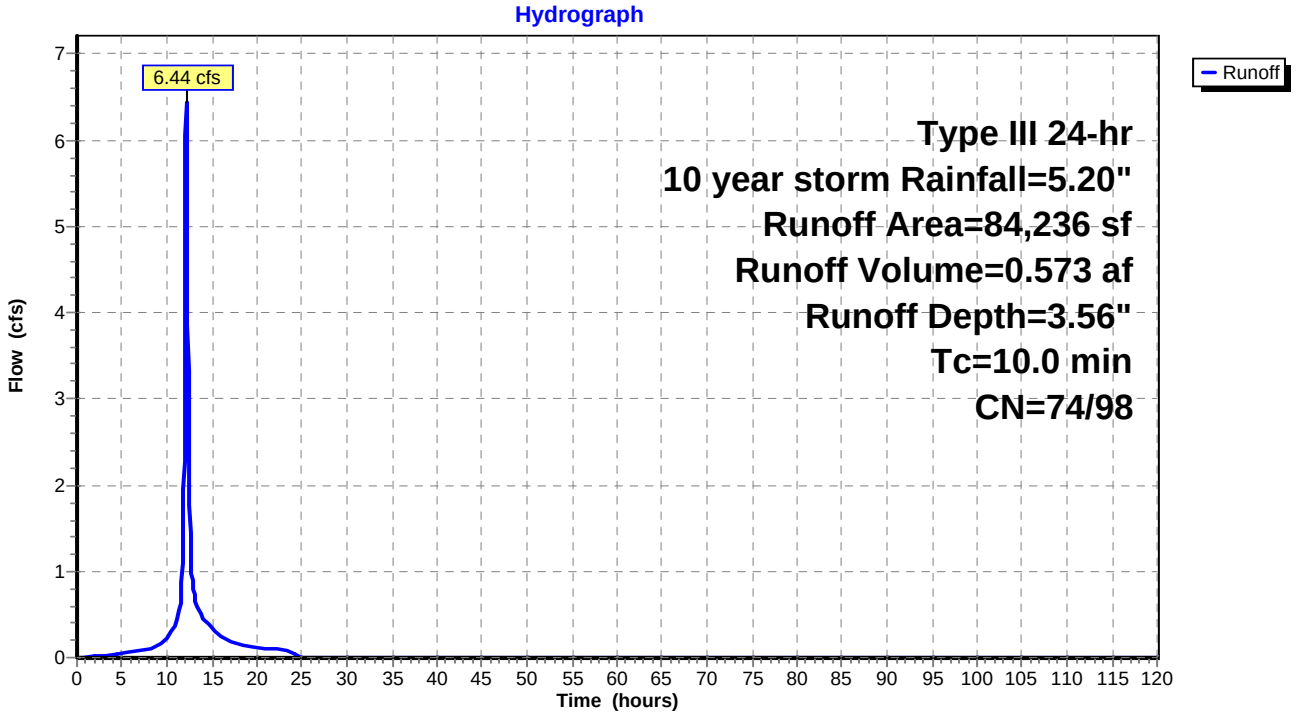
Runoff = 6.44 cfs @ 12.14 hrs, Volume= 0.573 af, Depth= 3.56"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year storm Rainfall=5.20"

Area (sf)	CN	Description
19,560	98	Roofs, HSG C
16,071	98	Paved parking, HSG C
48,605	74	>75% Grass cover, Good, HSG C
84,236	84	Weighted Average
48,605	74	57.70% Pervious Area
35,631	98	42.30% Impervious Area

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

Subcatchment 4S: East Basin



Summary for Pond 5P: PIPE DETENTION

Inflow Area = 3.214 ac, 38.98% Impervious, Inflow Depth = 3.48" for 10 year storm event
Inflow = 6.61 cfs @ 12.14 hrs, Volume= 0.931 af
Outflow = 4.08 cfs @ 12.31 hrs, Volume= 0.931 af, Atten= 38%, Lag= 10.2 min
Primary = 4.08 cfs @ 12.31 hrs, Volume= 0.931 af

Routing by Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 73.43' @ 12.31 hrs Surf.Area= 2,508 sf Storage= 8,697 cf

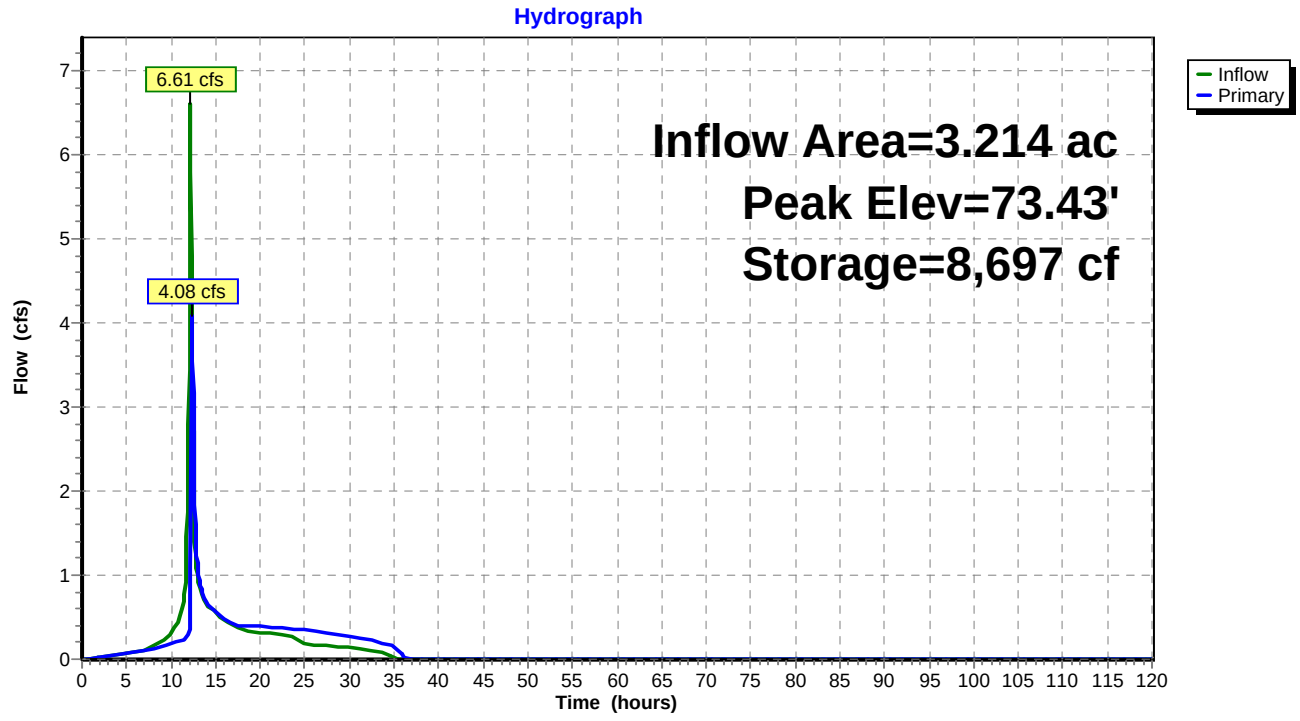
Plug-Flow detention time= 181.0 min calculated for 0.931 af (100% of inflow)
Center-of-Mass det. time= 181.3 min (1,138.9 - 957.6)

Volume	Invert	Avail.Storage	Storage Description
#1	70.00'	10,053 cf	**48.0" Round Pipe Storage** x 4 L= 200.0' S= 0.0020 '/'

Device	Routing	Invert	Outlet Devices
#1	Primary	70.00'	**3.0" Vert. Orifice** C= 0.600
#2	Primary	73.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=4.02 cfs @ 12.31 hrs HW=73.43' (Free Discharge)
└**1=Orifice** (Orifice Controls 0.43 cfs @ 8.75 fps)
└**2=Sharp-Crested Rectangular Weir** (Weir Controls 3.59 cfs @ 2.14 fps)

Pond 5P: PIPE DETENTION



Summary for Subcatchment 6S: BYPASS

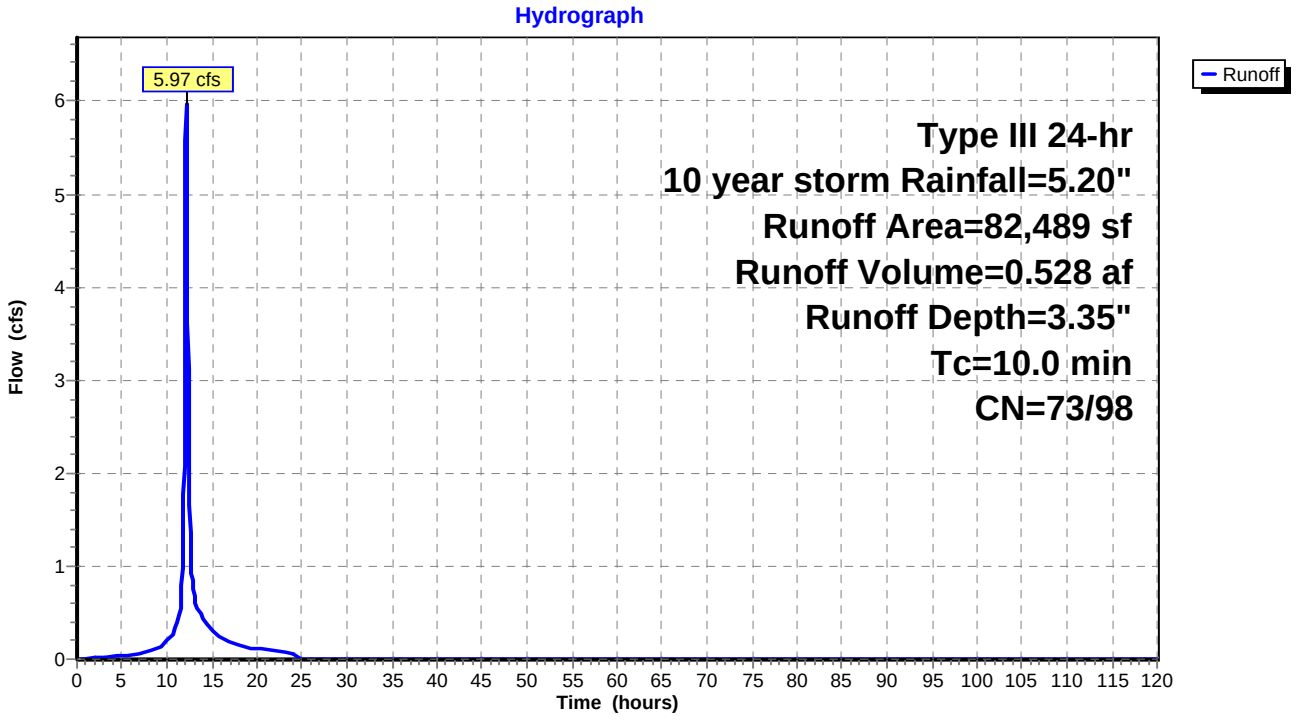
Runoff = 5.97 cfs @ 12.14 hrs, Volume= 0.528 af, Depth= 3.35"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year storm Rainfall=5.20"

	Area (sf)	CN	Description
	9,006	98	Paved parking, HSG C
	33,165	74	>75% Grass cover, Good, HSG C
	12,032	70	Woods, Good, HSG C
*	7,739	98	Roofs, HSG C-OFFSITE
*	12,960	98	Paved parking, HSG C-OFFSITE
*	7,587	74	>75% Grass cover, Good, HSG C-OFFSITE
	82,489	82	Weighted Average
	52,784	73	63.99% Pervious Area
	29,705	98	36.01% Impervious Area

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

Subcatchment 6S: BYPASS

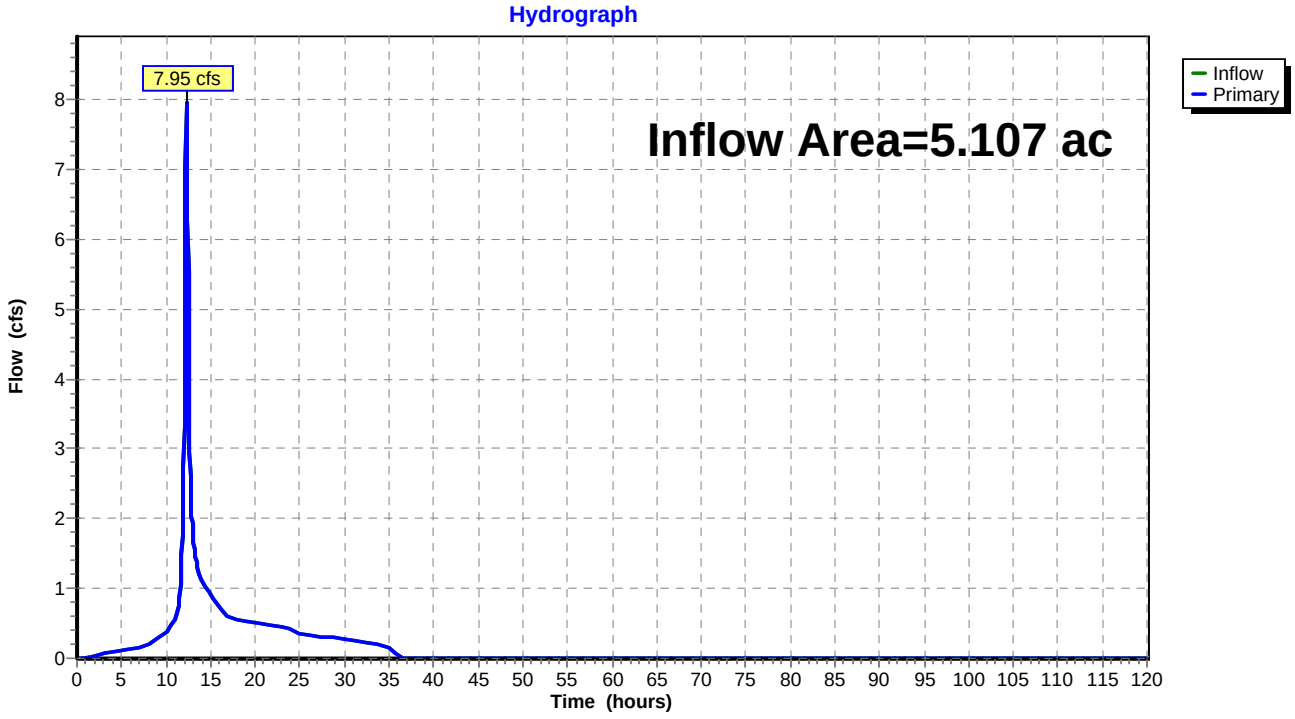


Summary for Link 7L: TOTAL PROPOSED

Inflow Area = 5.107 ac, 37.88% Impervious, Inflow Depth = 3.43" for 10 year storm event
Inflow = 7.95 cfs @ 12.26 hrs, Volume= 1.459 af
Primary = 7.95 cfs @ 12.26 hrs, Volume= 1.459 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs

Link 7L: TOTAL PROPOSED



Summary for Subcatchment 8S: UPPER ROOFS

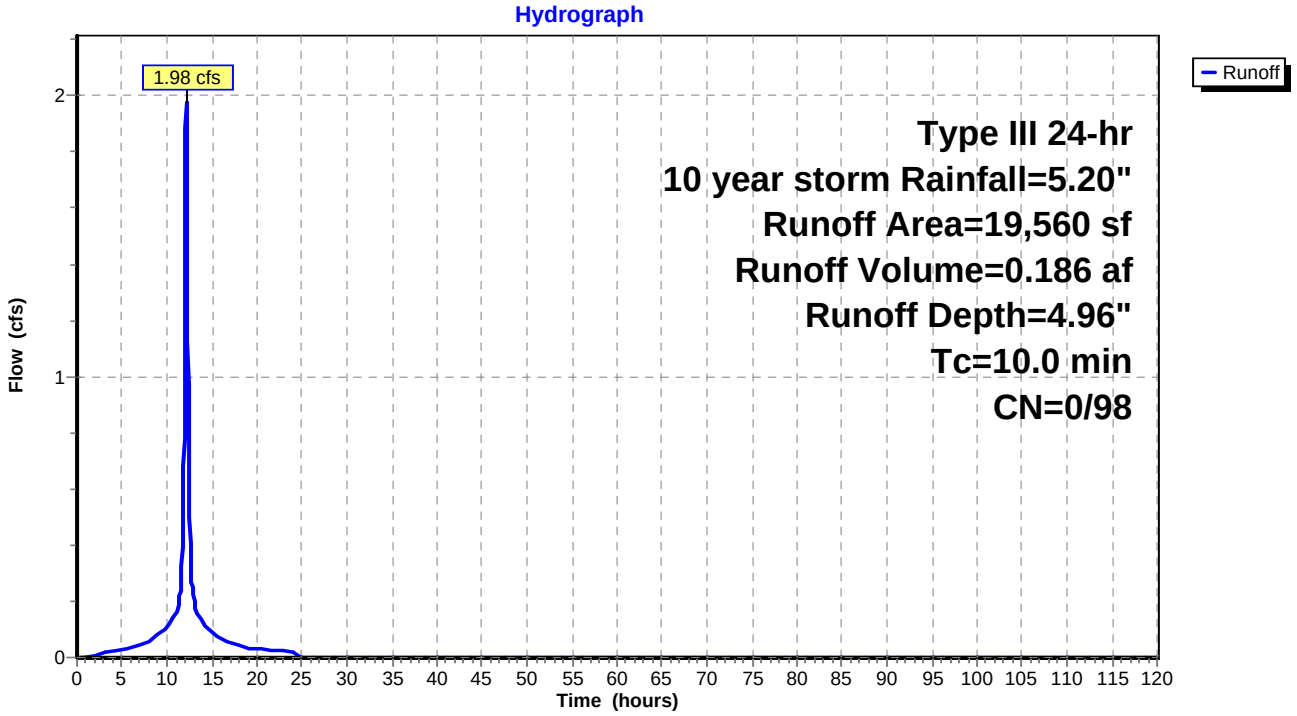
Runoff = 1.98 cfs @ 12.14 hrs, Volume= 0.186 af, Depth= 4.96"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year storm Rainfall=5.20"

Area (sf)	CN	Description
19,560	98	Paved parking, HSG C
19,560	98	100.00% Impervious Area

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

Subcatchment 8S: UPPER ROOFS



Summary for Pond 9P: DRYWELLS

Inflow Area = 0.449 ac,100.00% Impervious, Inflow Depth = 4.96" for 10 year storm event
Inflow = 1.98 cfs @ 12.14 hrs, Volume= 0.186 af
Outflow = 0.92 cfs @ 12.42 hrs, Volume= 0.194 af, Atten= 54%, Lag= 17.0 min
Primary = 0.92 cfs @ 12.42 hrs, Volume= 0.194 af

Routing by Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 112.01' @ 12.40 hrs Surf.Area= 720 sf Storage= 3,947 cf

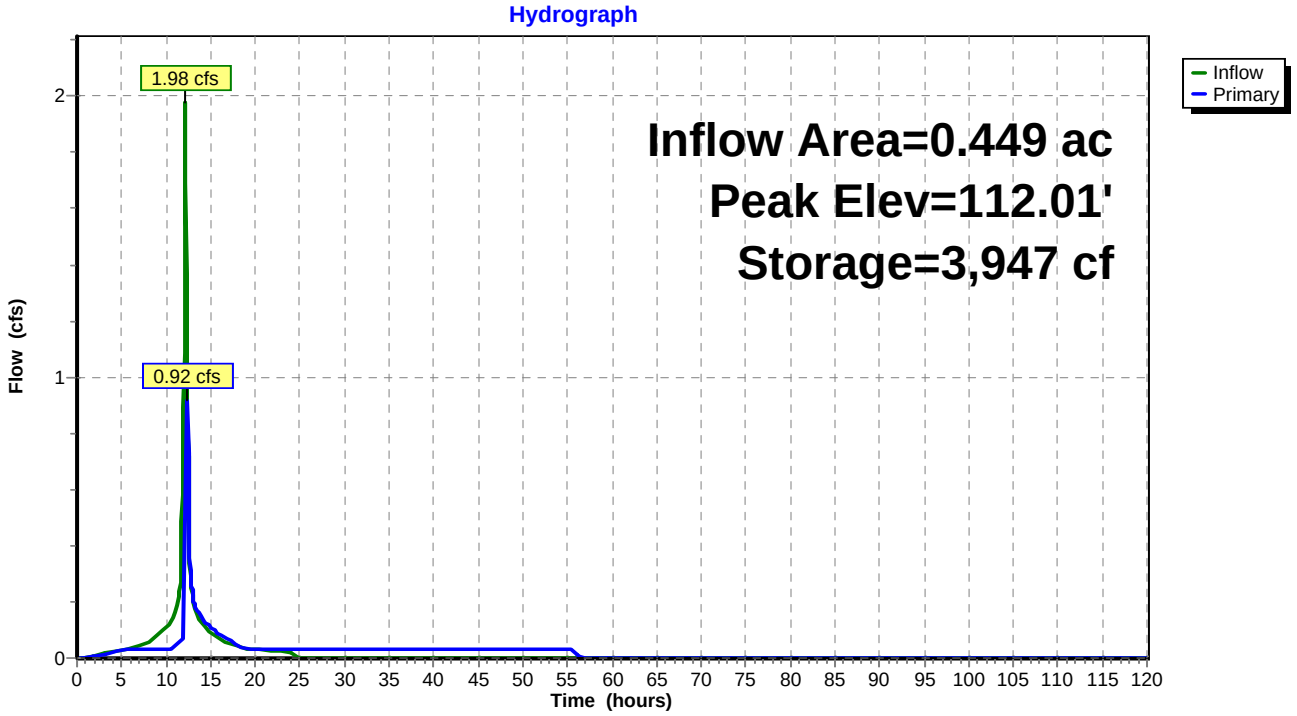
Plug-Flow detention time= 710.5 min calculated for 0.186 af (100% of inflow)
Center-of-Mass det. time= 791.6 min (1,542.7 - 751.1)

Volume	Invert	Avail.Storage	Storage Description
#1	102.00'	1,936 cf	**12.00'W x 12.00'L x 10.00'H Prismatoid** x 5 7,200 cf Overall - 2,360 cf Embedded = 4,840 cf x 40.0% Voids
#2	104.00'	2,011 cf	**8.00'D x 8.00'H DRYWELLS** x 5 Inside #1 2,360 cf Overall - 4.0" Wall Thickness = 2,011 cf
		3,947 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	102.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	112.00'	**36.0" Horiz. Grate X 8.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.28 cfs @ 12.42 hrs HW=112.01' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.03 cfs)
└─**2=Grate** (Weir Controls 0.24 cfs @ 0.33 fps)

Pond 9P: DRYWELLS



Time span=0.00-120.00 hrs, dt=0.05 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S-D: EXISTING Runoff Area=164,268 sf 0.00% Impervious Runoff Depth=5.56"
Tc=10.0 min CN=74/0 Runoff=21.11 cfs 1.746 af

Subcatchment 1S-ND: EXISTING Runoff Area=77,768 sf 37.26% Impervious Runoff Depth=6.56"
Tc=10.0 min CN=73/98 Runoff=11.06 cfs 0.976 af

Subcatchment 2S: West Basin Runoff Area=55,751 sf 33.97% Impervious Runoff Depth=6.54"
Tc=10.0 min CN=74/98 Runoff=7.94 cfs 0.698 af

Pond 3P: ABOVE GROUND WEST Peak Elev=81.95' Storage=10,289 cf Inflow=7.94 cfs 0.698 af
Outflow=5.94 cfs 0.697 af

Subcatchment 4S: East Basin Runoff Area=84,236 sf 42.30% Impervious Runoff Depth=6.78"
Tc=10.0 min CN=74/98 Runoff=12.29 cfs 1.093 af

Pond 5P: PIPE DETENTION Peak Elev=74.11' Storage=9,961 cf Inflow=15.84 cfs 1.790 af
Outflow=14.99 cfs 1.790 af

Subcatchment 6S: BYPASS Runoff Area=82,489 sf 36.01% Impervious Runoff Depth=6.52"
Tc=10.0 min CN=73/98 Runoff=11.68 cfs 1.030 af

Link 7L: TOTAL PROPOSED Inflow=24.76 cfs 2.820 af
Primary=24.76 cfs 2.820 af

Subcatchment 8S: UPPER ROOFS Runoff Area=19,560 sf 100.00% Impervious Runoff Depth=8.46"
Tc=10.0 min CN=0/98 Runoff=3.32 cfs 0.317 af

Pond 9P: DRYWELLS Peak Elev=112.03' Storage=3,947 cf Inflow=3.32 cfs 0.317 af
Outflow=2.73 cfs 0.220 af

Summary for Subcatchment 1S-D: EXISTING

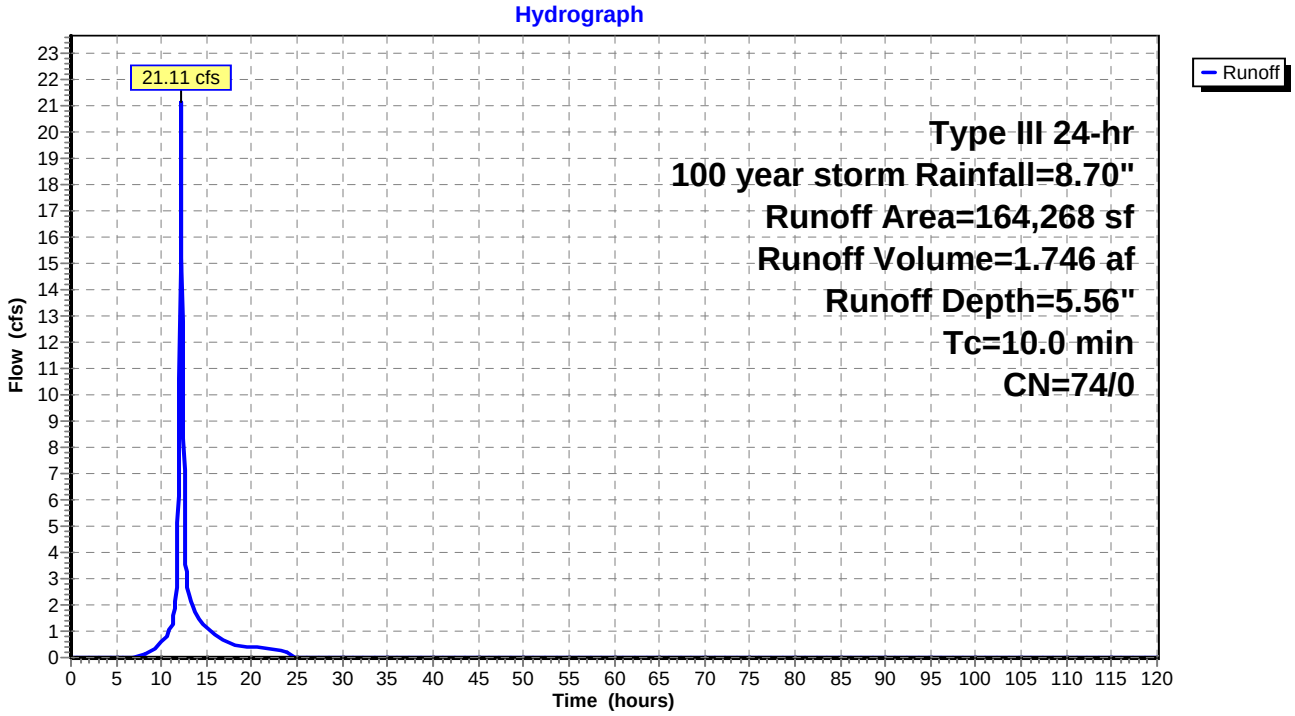
Runoff = 21.11 cfs @ 12.14 hrs, Volume= 1.746 af, Depth= 5.56"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 year storm Rainfall=8.70"

Area (sf)	CN	Description
145,868	74	>75% Grass cover, Good, HSG C
18,400	70	Woods, Good, HSG C
164,268	74	Weighted Average
164,268	74	100.00% Pervious Area

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

Subcatchment 1S-D: EXISTING



Summary for Subcatchment 1S-ND: EXISTING NON-DISTURBED

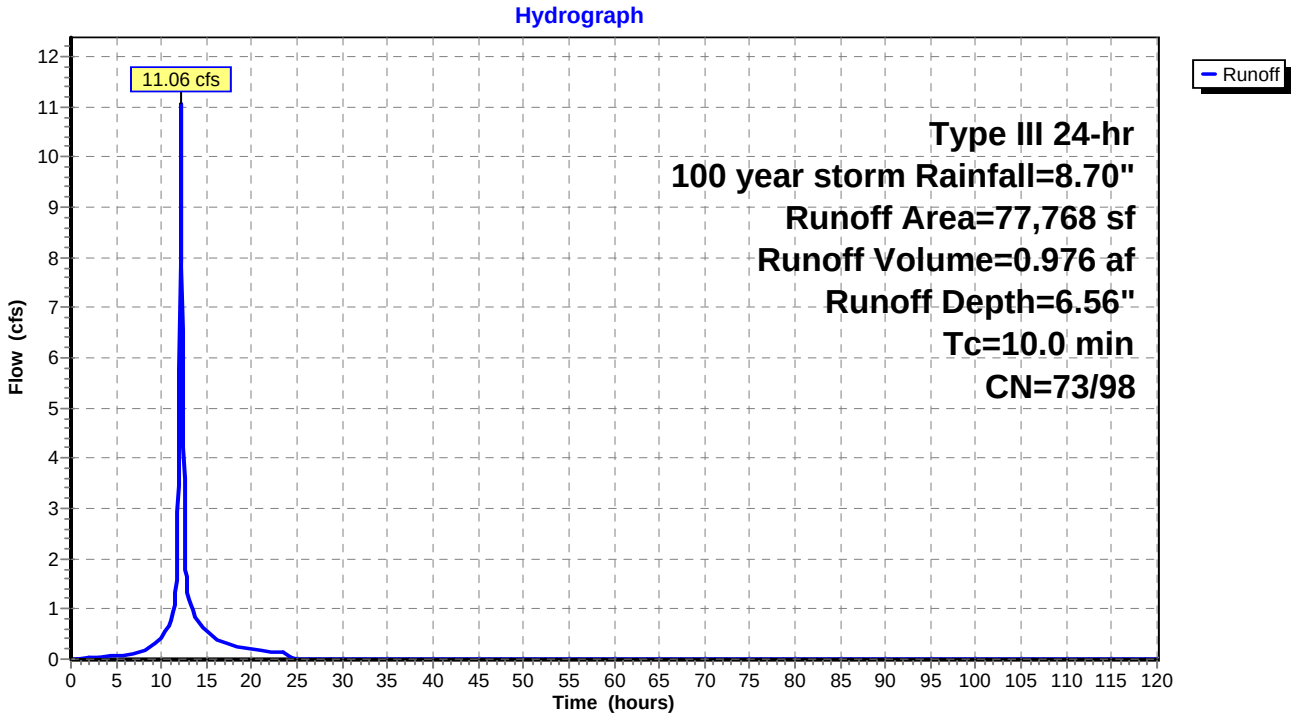
Runoff = 11.06 cfs @ 12.14 hrs, Volume= 0.976 af, Depth= 6.56"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 year storm Rainfall=8.70"

	Area (sf)	CN	Description
	8,274	98	Paved parking, HSG C
	27,267	74	>75% Grass cover, Good, HSG C
	8,389	70	Woods, Good, HSG C
*	7,739	98	Roofs, HSG C-OFFSITE
*	12,960	98	Paved parking, HSG C-OFFSITE
*	13,139	74	>75% Grass cover, Good, HSG C-OOFSITE
	77,768	83	Weighted Average
	48,795	73	62.74% Pervious Area
	28,973	98	37.26% Impervious Area

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

Subcatchment 1S-ND: EXISTING NON-DISTURBED



Summary for Subcatchment 2S: West Basin

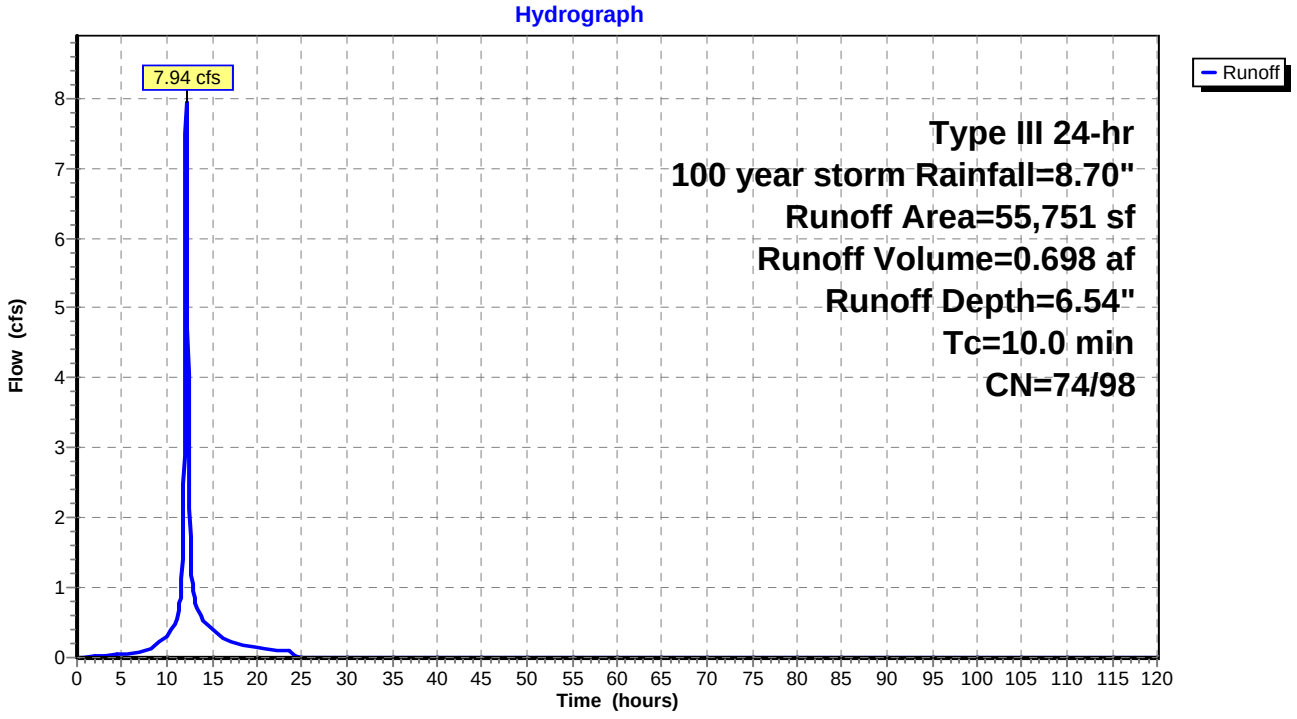
Runoff = 7.94 cfs @ 12.14 hrs, Volume= 0.698 af, Depth= 6.54"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 year storm Rainfall=8.70"

	Area (sf)	CN	Description
	18,937	98	Paved parking, HSG C
	35,442	74	>75% Grass cover, Good, HSG C
*	1,372	74	>75% Grass cover, Good, HSG C-OFFSITE
	55,751	82	Weighted Average
	36,814	74	66.03% Pervious Area
	18,937	98	33.97% Impervious Area

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

Subcatchment 2S: West Basin



Summary for Pond 3P: ABOVE GROUND WEST

Inflow Area = 1.280 ac, 33.97% Impervious, Inflow Depth = 6.54" for 100 year storm event
Inflow = 7.94 cfs @ 12.14 hrs, Volume= 0.698 af
Outflow = 5.94 cfs @ 12.25 hrs, Volume= 0.697 af, Atten= 25%, Lag= 6.8 min
Primary = 5.94 cfs @ 12.25 hrs, Volume= 0.697 af

Routing by Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 81.95' @ 12.25 hrs Surf.Area= 4,525 sf Storage= 10,289 cf

Plug-Flow detention time= 319.8 min calculated for 0.697 af (100% of inflow)
Center-of-Mass det. time= 319.1 min (1,103.7 - 784.7)

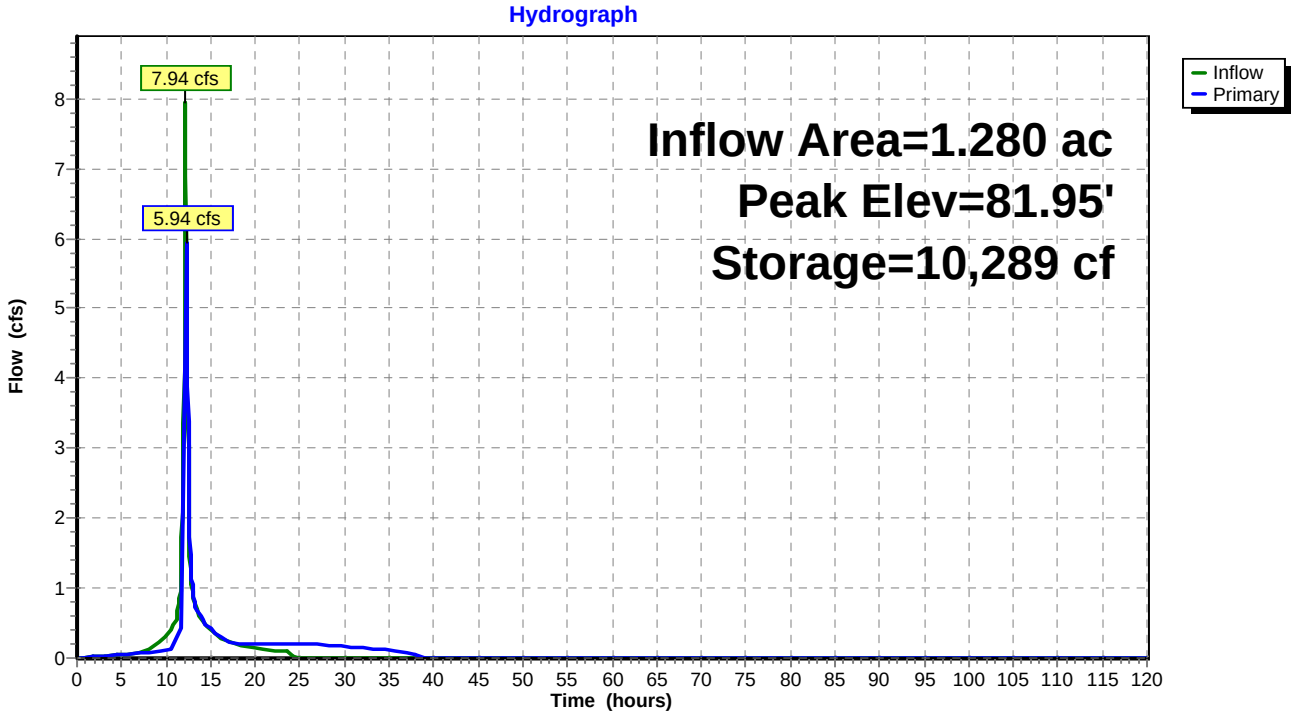
Volume	Invert	Avail.Storage	Storage Description
#1	79.00'	10,494 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
79.00	1,511	0	0
80.00	3,253	2,382	2,382
81.00	4,215	3,734	6,116
82.00	4,540	4,378	10,494

Device	Routing	Invert	Outlet Devices
#1	Primary	79.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	81.75'	**36.0" Horiz. Grate X 2.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=5.89 cfs @ 12.25 hrs HW=81.95' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.21 cfs)
└**2=Grate** (Weir Controls 5.68 cfs @ 1.48 fps)

Pond 3P: ABOVE GROUND WEST



Summary for Subcatchment 4S: East Basin

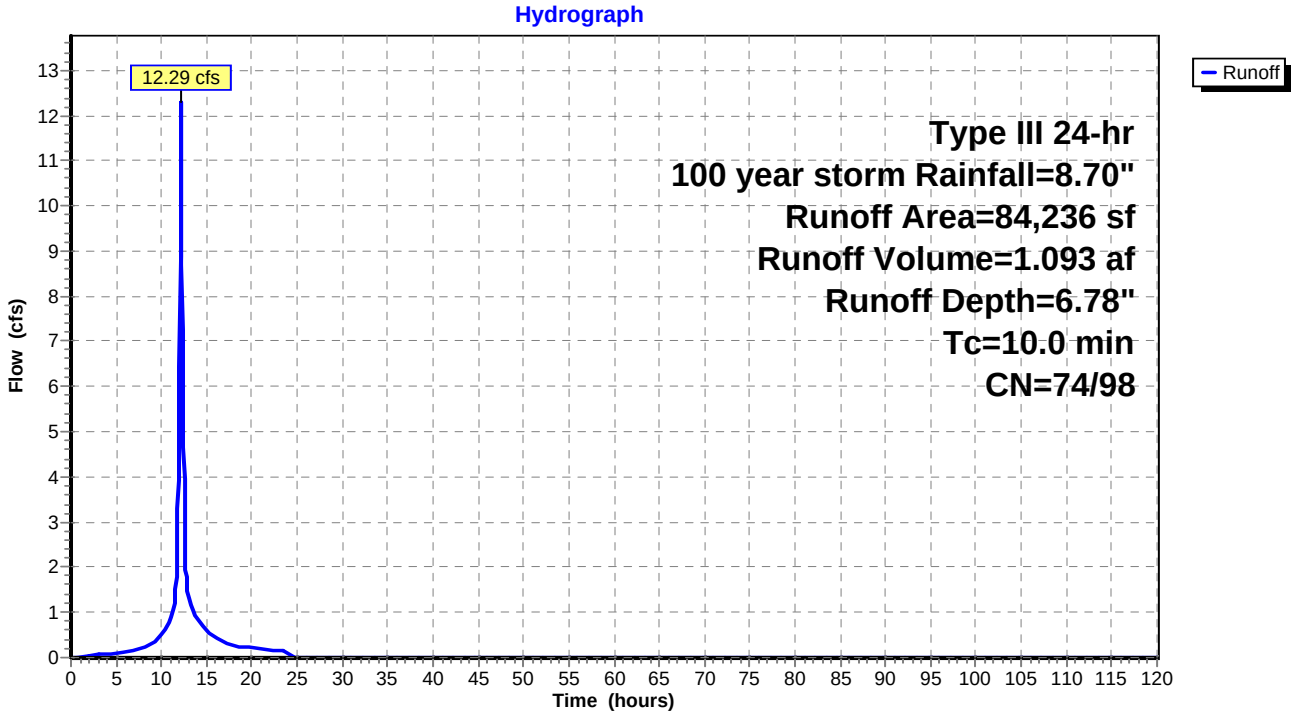
Runoff = 12.29 cfs @ 12.14 hrs, Volume= 1.093 af, Depth= 6.78"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 year storm Rainfall=8.70"

Area (sf)	CN	Description
19,560	98	Roofs, HSG C
16,071	98	Paved parking, HSG C
48,605	74	>75% Grass cover, Good, HSG C
84,236	84	Weighted Average
48,605	74	57.70% Pervious Area
35,631	98	42.30% Impervious Area

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

Subcatchment 4S: East Basin



Summary for Pond 5P: PIPE DETENTION

Inflow Area = 3.214 ac, 38.98% Impervious, Inflow Depth = 6.68" for 100 year storm event
Inflow = 15.84 cfs @ 12.21 hrs, Volume= 1.790 af
Outflow = 14.99 cfs @ 12.23 hrs, Volume= 1.790 af, Atten= 5%, Lag= 1.1 min
Primary = 14.99 cfs @ 12.23 hrs, Volume= 1.790 af

Routing by Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 74.11' @ 12.23 hrs Surf.Area= 798 sf Storage= 9,961 cf

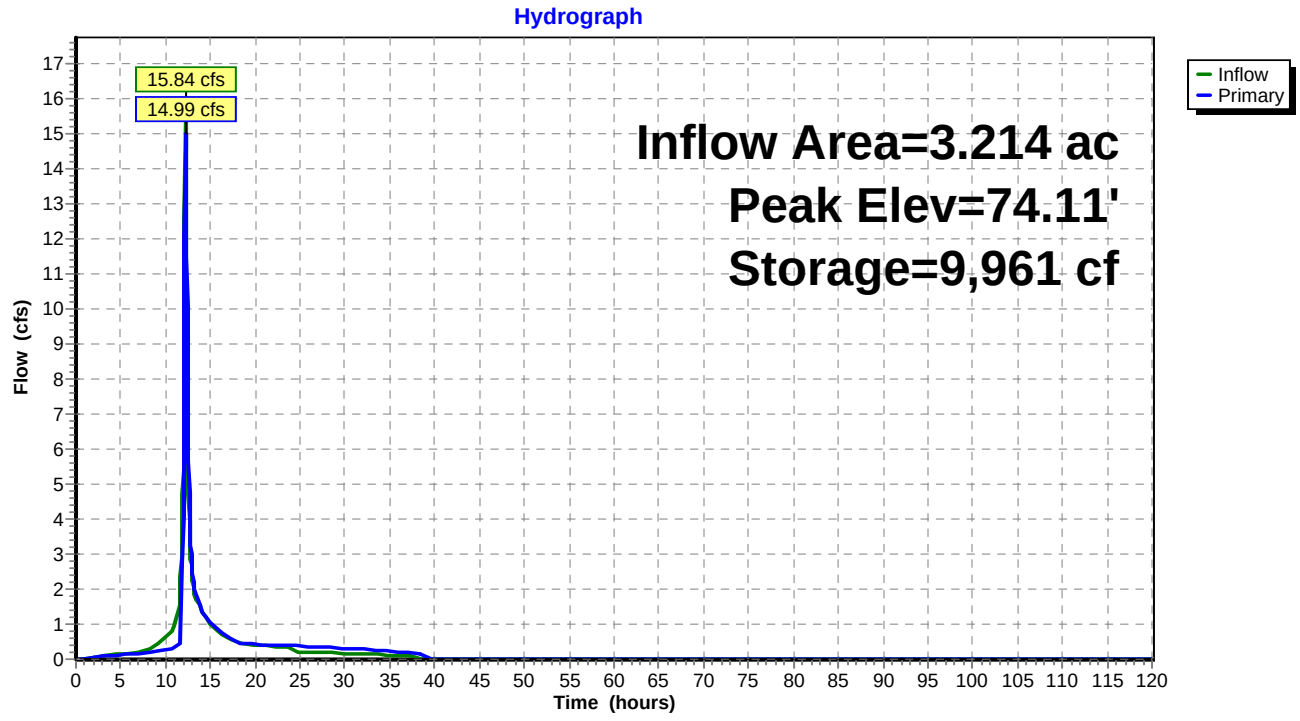
Plug-Flow detention time= 119.7 min calculated for 1.790 af (100% of inflow)
Center-of-Mass det. time= 119.5 min (1,024.5 - 904.9)

Volume	Invert	Avail.Storage	Storage Description
#1	70.00'	10,053 cf	**48.0" Round Pipe Storage** x 4 L= 200.0' S= 0.0020 '/'

Device	Routing	Invert	Outlet Devices
#1	Primary	70.00'	**3.0" Vert. Orifice** C= 0.600
#2	Primary	73.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=14.77 cfs @ 12.23 hrs HW=74.10' (Free Discharge)
└**1=Orifice** (Orifice Controls 0.47 cfs @ 9.60 fps)
└**2=Sharp-Crested Rectangular Weir** (Weir Controls 14.29 cfs @ 3.43 fps)

Pond 5P: PIPE DETENTION



Summary for Subcatchment 6S: BYPASS

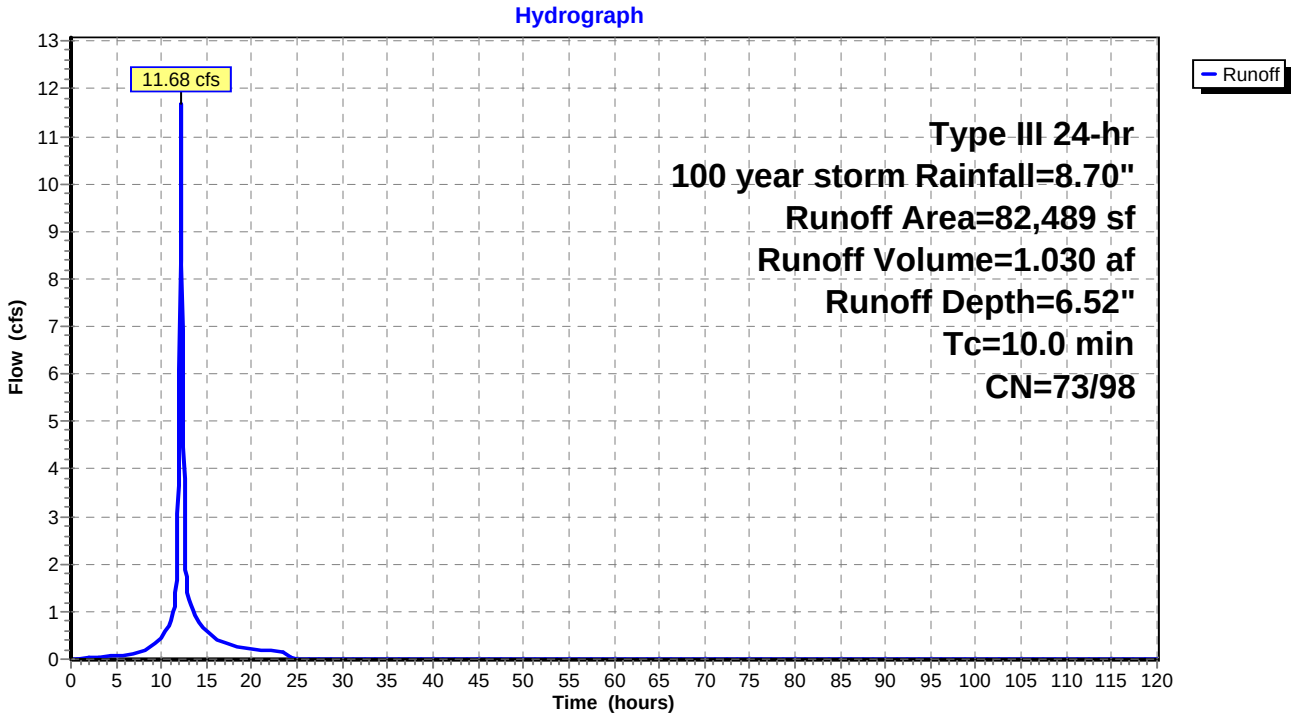
Runoff = 11.68 cfs @ 12.14 hrs, Volume= 1.030 af, Depth= 6.52"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 year storm Rainfall=8.70"

	Area (sf)	CN	Description
	9,006	98	Paved parking, HSG C
	33,165	74	>75% Grass cover, Good, HSG C
	12,032	70	Woods, Good, HSG C
*	7,739	98	Roofs, HSG C-OFFSITE
*	12,960	98	Paved parking, HSG C-OFFSITE
*	7,587	74	>75% Grass cover, Good, HSG C-OFFSITE
	82,489	82	Weighted Average
	52,784	73	63.99% Pervious Area
	29,705	98	36.01% Impervious Area

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

Subcatchment 6S: BYPASS

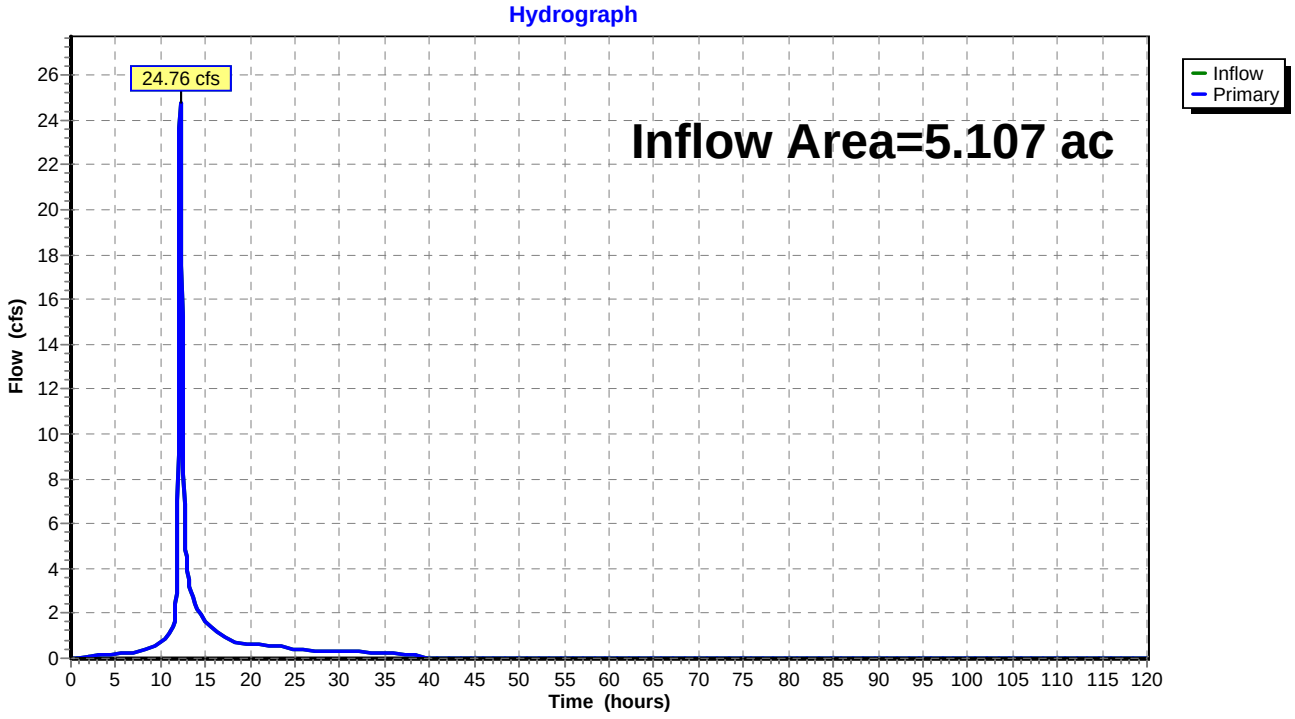


Summary for Link 7L: TOTAL PROPOSED

Inflow Area = 5.107 ac, 37.88% Impervious, Inflow Depth = 6.62" for 100 year storm event
Inflow = 24.76 cfs @ 12.20 hrs, Volume= 2.820 af
Primary = 24.76 cfs @ 12.20 hrs, Volume= 2.820 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs

Link 7L: TOTAL PROPOSED



Summary for Subcatchment 8S: UPPER ROOFS

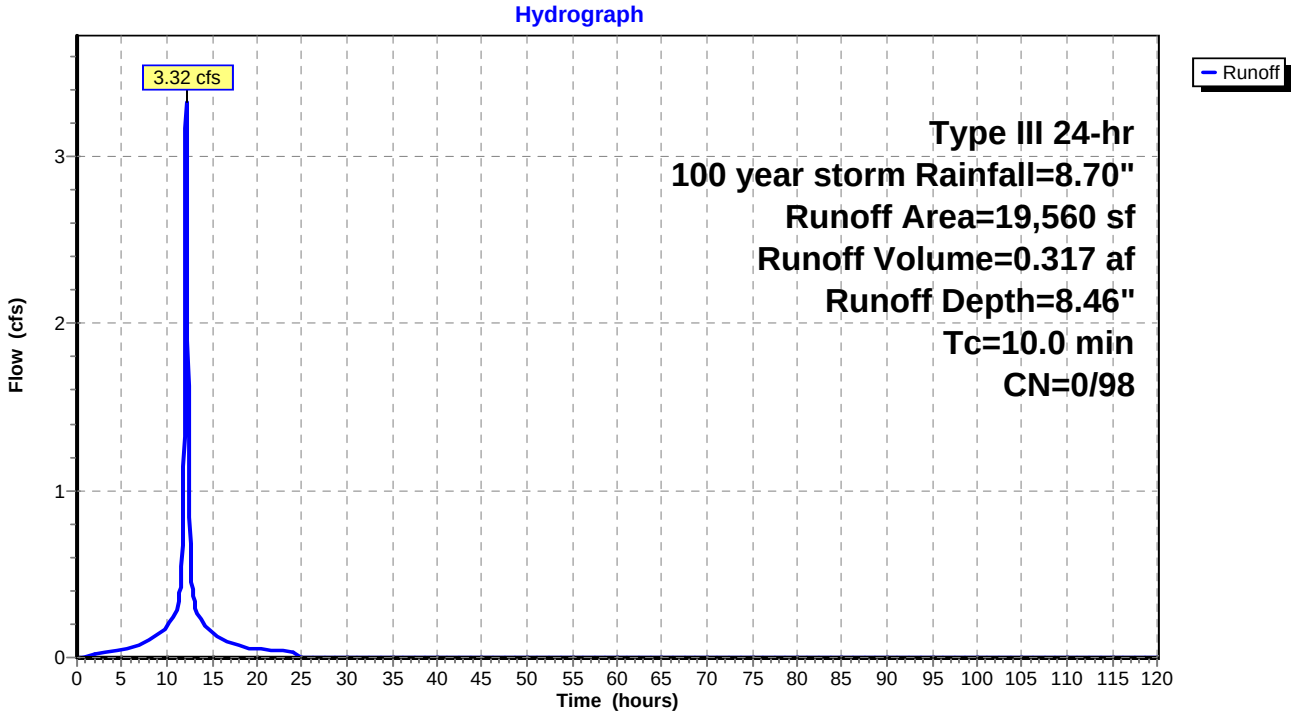
Runoff = 3.32 cfs @ 12.14 hrs, Volume= 0.317 af, Depth= 8.46"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 year storm Rainfall=8.70"

Area (sf)	CN	Description
19,560	98	Paved parking, HSG C
19,560	98	100.00% Impervious Area

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

Subcatchment 8S: UPPER ROOFS



Summary for Pond 9P: DRYWELLS

Inflow Area = 0.449 ac,100.00% Impervious, Inflow Depth = 8.46" for 100 year storm event
Inflow = 3.32 cfs @ 12.14 hrs, Volume= 0.317 af
Outflow = 2.73 cfs @ 12.14 hrs, Volume= 0.220 af, Atten= 18%, Lag= 0.0 min
Primary = 2.73 cfs @ 12.14 hrs, Volume= 0.220 af

Routing by Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 112.03' @ 12.14 hrs Surf.Area= 720 sf Storage= 3,947 cf

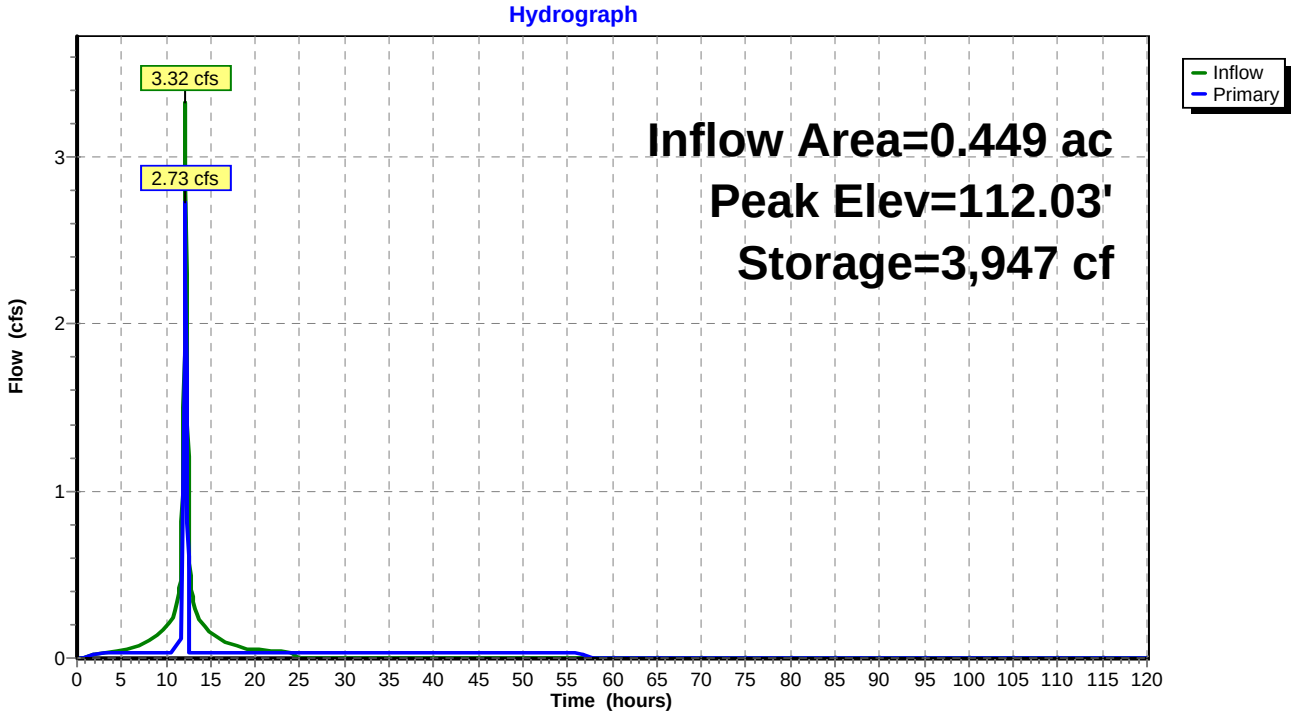
Plug-Flow detention time= 799.9 min calculated for 0.220 af (70% of inflow)
Center-of-Mass det. time= 702.1 min (1,446.0 - 743.9)

Volume	Invert	Avail.Storage	Storage Description
#1	102.00'	1,936 cf	**12.00'W x 12.00'L x 10.00'H Prismatoid** x 5 7,200 cf Overall - 2,360 cf Embedded = 4,840 cf x 40.0% Voids
#2	104.00'	2,011 cf	**8.00'D x 8.00'H DRYWELLS** x 5 Inside #1 2,360 cf Overall - 4.0" Wall Thickness = 2,011 cf
		3,947 cf	Total Available Storage

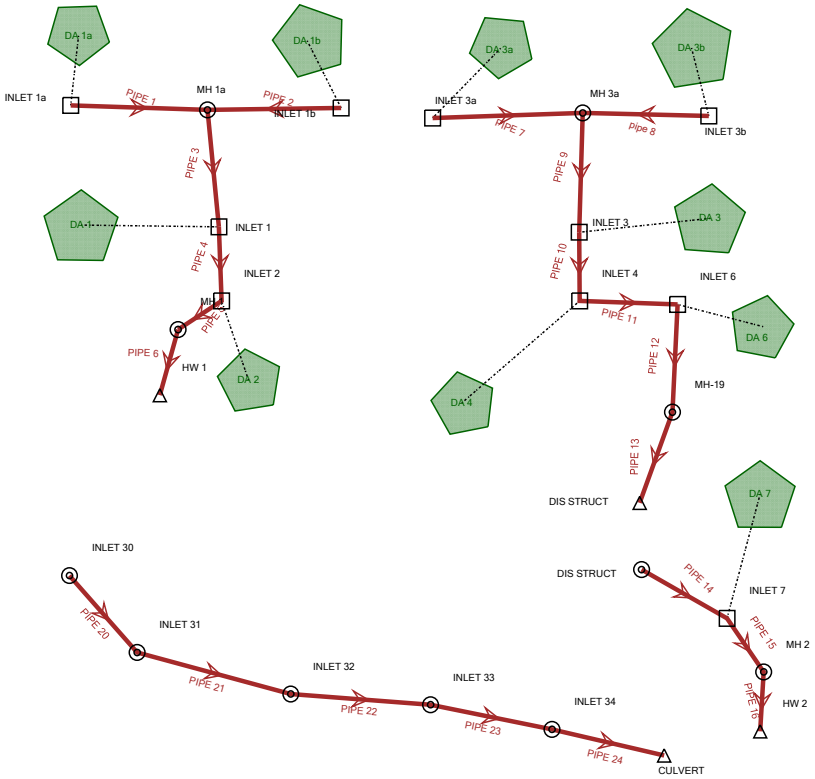
Device	Routing	Invert	Outlet Devices
#1	Primary	102.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	112.00'	**36.0" Horiz. Grate X 8.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.57 cfs @ 12.14 hrs HW=112.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.03 cfs)
└─**2=Grate** (Weir Controls 1.53 cfs @ 0.60 fps)

Pond 9P: DRYWELLS



DRAINAGE COLLECTION SYSTEM CALCULATIONS


DA 1a
DA 1b
INLET 1a
PIPE 1
MH 1a
PIPE 2
INLET 1b
PIPE 3
DA 1
INLET 1
PIPE 4
INLET 2
MH 1
PIPE 5
PIPE 6
HW 1
DA 2
DA 3a
DA 3b
INLET 3a
PIPE 7
MH 3a
Pipe 8
INLET 3b
PIPE 9
INLET 3
DA 3
PIPE 10
INLET 4
INLET 6
PIPE 11
DA 6
PIPE 12
DA 4
MH-19
PIPE 13
DIS STRUCT
DA 7
INLET 30
DIS STRUCT
PIPE 14
INLET 7
PIPE 20
INLET 31
PIPE 15
MH 2
PIPE 21
INLET 32
INLET 33
PIPE 16
HW 2
INLET 34
PIPE 22
PIPE 23
PIPE 24
CULVERT

1140108-C.stsw

Active Scenario: 100 Yr Storm

Label	Start Node	Stop Node	Inlet Area (acres)	Inlet C	Inlet CA (acres)	Intensity (in/h)	Total System Flow (cfs)	Length (ft)	Slope (ft/ft)	Size (in)	"n" value	Velocity (ft/s)	Total Capacity of Pipe (cfs)	Design Capacity (%)	Tc (min)	Up stream Invert (ft)	Down stream Invert (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Down stream Rim (ft)
PIPE 1	INLET 1a	MH 1a	0.082	0.520	0.043	7.610	0.33	45.0	0.010	12.0	0.011	3.19	4.21	7.8	10.000	88.00	87.55	88.24	87.88	90.35
PIPE 2	INLET 1b	MH 1a	0.078	0.540	0.042	7.610	0.32	43.0	0.010	12.0	0.011	3.22	4.31	7.5	10.000	88.00	87.55	88.23	87.88	90.35
PIPE 3	MH 1a	INLET 1	(N/A)	(N/A)	0.085	7.558	0.65	98.0	0.030	12.0	0.011	5.73	7.29	8.9	10.235	87.55	84.61	87.88	85.26	86.80
PIPE 4	INLET 1	INLET 2	0.571	0.670	0.467	7.494	3.53	26.0	0.010	15.0	0.011	6.10	7.63	46.2	10.520	84.50	84.24	85.26	85.18	86.80
PIPE 5	INLET 2	MH 1	0.267	0.920	0.713	7.479	5.37	117.0	0.010	15.0	0.011	6.74	7.63	70.4	10.592	84.24	83.07	85.18	83.84	88.80
PIPE 6	MH 1	HW 1	(N/A)	(N/A)	0.713	7.414	5.33	37.0	0.005	15.0	0.011	5.08	5.47	97.4	10.881	82.19	82.00	83.18	82.94	85.00
PIPE 7	INLET 3a	MH 3a	0.120	0.520	0.062	7.610	0.48	52.0	0.010	12.0	0.011	3.56	4.21	11.4	10.000	87.33	86.81	87.62	87.04	89.00
pipe 8	INLET 3b	MH 3a	0.175	0.520	0.091	7.610	0.70	50.0	0.010	12.0	0.011	3.97	4.21	16.6	10.000	86.33	85.83	86.68	86.29	89.00
PIPE 9	MH 3a	INLET 3	(N/A)	(N/A)	0.153	7.556	1.17	108.0	0.022	12.0	0.013	5.45	5.34	21.9	10.243	85.83	83.40	86.29	84.13	85.70
PIPE 10	INLET 3	INLET 4	0.404	0.690	0.432	7.483	3.26	26.0	0.010	15.0	0.011	5.97	7.63	42.7	10.574	83.40	83.14	84.13	83.97	85.70
PIPE 11	INLET 4	INLET 6	0.136	0.930	0.559	7.466	4.20	43.0	0.010	15.0	0.011	6.37	7.63	55.1	10.646	83.14	82.71	83.97	83.38	85.70
PIPE 12	INLET 6	MH-19	0.009	0.990	0.568	7.442	4.26	76.0	0.020	15.0	0.011	8.27	10.80	39.4	10.759	71.56	70.04	72.40	70.59	76.00
PIPE 13	MH-19	DIS STRUCT	(N/A)	(N/A)	0.568	7.408	4.24	4.0	0.010	15.0	0.011	6.38	7.63	55.5	10.912	70.04	70.00	70.87	70.76	75.00
PIPE 14	DIS STRUCT	INLET 7	(N/A)	(N/A)	0.000	9.240	11.96	58.0	0.010	24.0	0.011	8.27	26.73	44.7	0.000	68.00	67.42	69.24	68.40	71.50
PIPE 15	INLET 7	MH 2	0.817	0.850	0.694	7.610	17.29	100.0	0.007	24.0	0.011	7.86	22.37	77.3	10.000	61.80	61.10	63.30	62.68	64.00
PIPE 16	MH 2	HW 2	(N/A)	(N/A)	0.694	7.563	17.25	51.0	0.002	30.0	0.011	4.86	21.46	80.4	10.212	61.10	61.00	62.68	62.41	65.00
PIPE 20	INLET 30	INLET 31	(N/A)	(N/A)	0.000	9.240	11.96	28.0	0.010	24.0	0.011	8.27	26.73	44.7	0.000	46.94	46.66	48.18	47.68	49.86
PIPE 21	INLET 31	INLET 32	(N/A)	(N/A)	0.000	9.240	11.96	107.0	0.015	24.0	0.011	9.62	32.79	36.5	0.056	45.22	43.61	46.46	44.46	46.81
PIPE 22	INLET 32	INLET 33	(N/A)	(N/A)	0.000	9.240	11.96	65.0	0.015	24.0	0.011	9.62	32.83	36.4	0.242	42.63	41.65	43.87	42.53	44.85
PIPE 23	INLET 33	INLET 34	(N/A)	(N/A)	0.000	9.240	11.96	222.0	0.015	24.0	0.011	9.61	32.74	36.5	0.354	35.63	32.30	36.87	33.14	35.50
PIPE 24	INLET 34	CULVERT	(N/A)	(N/A)	0.000	9.240	11.96	148.0	0.015	24.0	0.011	9.61	32.74	36.5	0.739	28.96	26.74	30.20	27.58	31.21

RIP-RAP CALCULATIONS

Casey & Keller, Inc.
258 Main St
Millburn,N.J. 07041
Phone: (973) 379-3280
Fax: (973) 379-7993

ORANGE LAWN TENNIS CLUB
SOUTH ORANGE
1140108
9/7/2016

Apron Dimensions for HW 1:

For a Horizontal Riprap Apron (fig. 12-1)

Do	=	Maximum inside Culvert Height in feet	=	1.25	feet
Wo	=	Maximum inside Culvert Width in feet	=	1.25	feet
Q_{100}	=	Discharge Rate for the Design Storm	=	5.33	cfs
q	=	Unit Discharge = Q_{100} / Wo in cfs/ft	=	4.26	cfs/ft
TW	=	Tail Water Elevation	=	0.25	feet
La	=	Length of the Apron			
W	=	Width of the Apron			

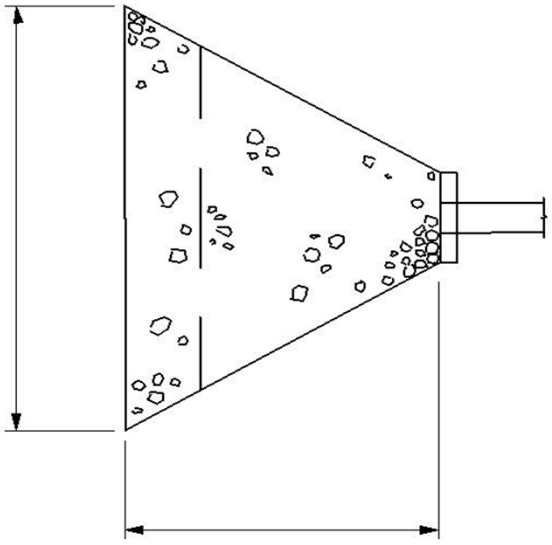
If TW < $^1/_2$ Do La =$1.8(q / Do^{1/2}) + 7Do$ = 15.61 use 16.00 feet
W = 3Wo+La = 19.36 use 20.00 feet

If TW >= $^1/_2$ Do La = $3(q / Do^{1/2})$ =
W = 3Wo+ 0.4La =

Wo = 1.25 feet

Stone Size:

d50 = $(0.02 / TW) \times (Q_{100} / Do)^{4/3}$ = 0.55 feet
6.64 inches
use 6 inch stone



W = 20.00

Wo = 1.25 feet

Wd = 3.75 feet

La = 16.00

Note: end of flare end section = 3 Wo = 3.75 feet

Casey & Keller, Inc.
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ORANGE LAWN TENNIS CLUB
SOUTH ORANGE
1140108
9/7/2016

Apron Dimensions for HW 2:

For a Horizontal Riprap Apron (fig. 12-1)

Do	=	Maximum inside Culvert Height in feet	=	2.50	feet
Wo	=	Maximum inside Culvert Width in feet	=	2.50	feet
Q_{100}	=	Discharge Rate for the Design Storm	=	17.26	cfs
q	=	Unit Discharge = Q_{100} / Wo in cfs/ft	=	6.90	cfs/ft
TW	=	Tail Water Elevation	=	0.50	feet
La	=	Length of the Apron			
W	=	Width of the Apron			

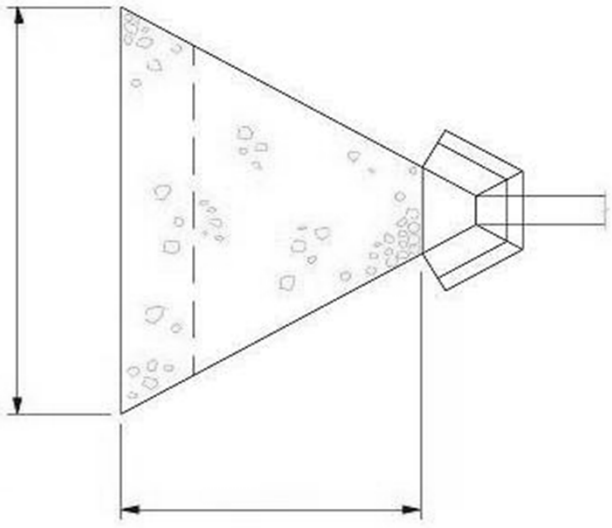
If TW < $^1/_2$ Do La =1.8(q / $Do^{1/2}$) + 7Do = 25.36 use 26.00 feet
W = 3Wo+La = 32.86 use 33.00 feet

If TW >= $^1/_2$ Do La = 3(q / $Do^{1/2}$) =
W = 3Wo+ 0.4La =

Wo = 2.50 feet

Stone Size:

d50 = (0.02 / TW) x (Q_{100} / Do)$^{4/3}$ = 0.53 feet
6.31 inches
use 6 inch stone



W = 33.00

Wo = 2.50 feet

Wd = 7.50 feet

La = 26.00

Note: end of flare end section = 3 Wo = 7.5 feet

DRAINAGE AREA MAPS