Stormwater Management Report

The Residences at Norfolk Station

194 Main Street

Norfolk, Massachusetts

August 23, 2018

Prepared for:

Norfolk Station, LLC – c/o Alan Quaglieri, Manager

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8-23-18

COMMONWEALTH OF MASSACHUSETTS

ROBERT M. FORBES

CIVIL

No. 53722

REGISTERED

PROFESSIONAL ENGINEER

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OPERATIONS AND MAINTENANCE PLAN

NARRATIVE

STORMWATER NARRATIVE
194 Main Street, Norfolk, Massachusetts

The storm drainage system at the proposed apartment building known as The Residences at Norfolk Station, located at 194 Main Street in Norfolk, Massachusetts has been designed to create a reduction in the rate of storm water runoff when compared to the existing site. In addition, the project's design will not reduce the quality of the runoff discharging from the site. The collection and treatment systems will be in the form of water quality catch basin units, a subsurface infiltration system, vegetated swales and infiltration basins. Hydrologic computations were performed in order to model the rate of flow of stormwater from the site under both existing and proposed conditions for a broad range of design storms.

1.0 STORM WATER COLLECTION SYSTEM

Throughout the proposed project, storm water will be collected from the impervious areas by a series of stormwater quality catch basin units. These proprietary systems promote settlement of solids and prevent the discharge of floating debris and other substances.

The collected runoff will be conveyed to the water quality components through smooth interior walled HDPE piping with corrugated exterior walls. The corrugated exterior of the piping provides for exceptional strength and bearing capacity. The smooth interior walls of the piping provide a smoothness that exceeds that of concrete pipe, thus providing increased hydraulic capacity. The piping is designed to provide self cleansing velocities in large storm events to remain essentially maintenance free throughout its life.

All runoff from the project will be directed through infiltration systems – either subsurface infiltration chambers or infiltration basins. This reduces runoff rate and volume while increasing recharge to groundwater. The infiltration systems have been designed to meet the requirement for recharge and to handle more than the 10-year design storm event. An overflow spillway has been provided as an outlet from the infiltration basin to direct excess flow from extraordinarily large storm events into the existing catch basin which receives all of the runoff from the site under existing conditions.

2.0 STORM WATER MANAGEMENT FACILITIES

Current Department of Environmental Protection Policies require that the peak runoff rate after development is not more than peak runoff rate prior to development for the 2 and 10 year 24-hour storm events. Additionally, it is required that the storm water management system be evaluated for the 100 year storm projections.

Hydrologic modeling has been conducted for the design of the infiltration areas to determine appropriate sizing and infiltration characteristics. HydroCAD Version 10.00 was utilized to

perform this hydrologic and hydraulic modeling. The 2, 10, and 100 year - design storms were evaluated. The hydrologic and hydraulic modeling established that the stormwater management systems will effectively attenuate the full range of design storms. That is, the peak rate of flow after development will be less than under existing conditions. The drainage summary provided with this document tabulates the projected decrease in runoff rate when the site is subjected to the design storm events. The complete hydrologic and hydraulic computational output is presented in this document.

2.1 LOW IMPACT DEVELOPMENT (LID) CONSIDERATIONS

The Massachusetts Stormwater Handbook encourages the use of Low Impact Development (LID) techniques by offering design credits for their implementation. No credits are sought or required for this project and, therefore, no LID techniques are required. Nevertheless, the project design incorporates LID techniques by proposing the minimum amount of pavement necessary to provide the parking spaces required for the project and the accessibility of the site for emergency response vehicles. In addition, the project proposes to utilize multiple infiltration systems to handle stormwater runoff near its origin rather than collecting and managing the runoff in one location for the entire project.

3.0 WATER QUALITY CONSIDERATIONS

On November 18, 1996, The Massachusetts Department of Environmental Protection (MADEP) issued the Storm Water Management Policy. The goal of this policy is to improve water quality and address flooding problems, which are sometimes caused by development projects, by the implementation of performance standards for storm water management. These standards were issued as guidelines with the possibility that in several years, after review by design engineers, they might be implemented as regulations. The project was designed to meet and exceed all relevant standards established in the policy. The following sections describe how each of these standards will be achieved on this project by incorporating Best Management Practices into the design. In January, 2008, the revised policy was issued.

3.1 UNTREATED STORM WATER - Standard 1

Standard 1 recommends that no new storm water conveyance, such as storm drain outfalls, discharge untreated storm water directly to wetlands or waterways of the Commonwealth. Flows from woods, fields, and other undeveloped areas are to be considered uncontaminated, however, runoff from paved road surfaces should receive treatment prior to discharge.

In designing this project, provisions have been made so that the runoff from all paved surfaces will receive proper treatment prior to discharge. All the proposed improvements will be located and graded such that runoff from the paved areas will be directed to a series of BMP structures. Runoff from these areas will be collected and conveyed to the water quality measures through a series of catch basins, manholes and subsurface piping. This collected runoff will receive a

treatment utilizing Best Management Practice (BMP) measures designed into the water quality catch basin units as further described under the discussions for Standards 2 through 9. Through the collection and treatment of all runoff from paved areas, DEP Standard 1 is satisfied.

3.2 POST DEVELOPMENT PEAK DISCHARGE RATES - Standard 2

Standard 2 prescribes that storm water management systems be implemented in order to ensure that post-development peak rates of discharge do not exceed existing rates of runoff for standard 2-year and 10-year design storms. In addition, the pre and post peak rates for the 100 year storm must be evaluated to assure that there will not be increased off-site flooding. Hydrologic calculations have been conducted in designing the storm water control measures to ensure that this standard is satisfied.

HydroCAD version 10.00, a computer aided design program, was selected for modeling the hydrology and hydraulics of storm water runoff for the site and its contributing drainage area. This program utilizes the latest techniques to predict the consequences of any given storm event and to verify that the drainage system is adequate to meet the performance standards for the area under consideration. The HydroCAD computer model uses TR-20 and TR-55 methodologies to generate runoff hydrographs and perform hydraulic routings through the modeled project.

Runoff hydrographs were generated for each subcatchment area. For post-development, all roadways, driveways, sidewalks, roof areas and lawn areas were considered in determining composite runoff curve numbers for each subcatchment. For pre-development, all subcatchments were evaluated in their existing condition. The soils within the development area of this project are described as hydrologic soils group A, according to the U.S.D.A., Soil Conservation Service mapping.

In evaluating the same areas under pre and post development conditions, a direct comparison can be made as to the net increase or decrease in runoff rates attributable to altered land uses. The Drainage Summary table included in this report presents a summary of the hydrologic modeling conducted for this project. As presented in this table, the drainage system successfully moderates the flow for the full range of design storms and this standard is met.

3.3 RECHARGE TO GROUNDWATER - STANDARD 3

The loss of annual recharge to groundwater will be minimized through the infiltration of runoff from the proposed roofs, and the treated stormwater from the paved and unpaved surface areas of the project site. The annual recharge from the post development site will approximate the annual recharge from the pre-development conditions based on an assessment of soil types. Standard 3 of the DEP Stormwater Policy prescribes that the storm water runoff volume to be recharged to groundwater should be determined using existing soil. According to the U.S.D.A. Soil Conservation Service mapping, the surficial soils are Hydrologic Soil Group A. The DEP Stormwater Policy requires that a certain volume of runoff be infiltrated to groundwater based on

the type of soil present and the amount of impervious area being generated by the proposed development. For Type A soils, the recharge rate has been established to be 0.6 inches of runoff.

The proposed amount of impervious area on the site is 55,222 sf over Type A soils. So, the required volume of recharge is:

$$(55{,}222 \text{ sf} \times 0.6 \text{ in})\ (1 \text{ ft}/12 \text{ in}) = 2{,}761 \text{ cf}$$

All of the runoff from the proposed roofs, pavement and sidewalks is designed to be infiltrated on site up to that volume generated by the 2-year design storm event. Based on the HydroCAD model, in the 2-year storm, 8,232 cf of runoff is recharged. Thus, this criterion is easily satisfied.

3.4 REMOVAL OF 80% OF TOTAL SUSPENDED SOLIDS - Standard 4

A series of stormwater BMP's have been designed in order to meet the objectives of removing 80% of the average annual load of total suspended solids. These proposed measures include:

- All catch basins will be Stormceptor 450i proprietary water quality units.
- Infiltration chambers and infiltration basins are proposed for this project. It is clear that these systems will provide some degree of TSS removal. It should be noted, however, that no credit has been taken here for the detention basin.

The combination of the above features will result in the removal of over 80% of the total suspended solids as demonstrating through the following table:

A BMP	B TSS Removal Rate*	C Starting TSS Load**	D Amount Removed (BxC)	E Remaining load (C-D)
Water Quality Units	80%	1.00**	.20	.80
TOTAL TSS REMOVAL			**.80 x 100 = 80% Removal**	

** Equals remaining load from previous BMP (E)

* TSS Removal Rates As Published in the DEP Storm Water Policy Handbook (3/97)

3.5 USES WITH HIGHER POTENTIAL POLLUTANT LOADS - Standard 5

The DEP Storm Water Management Policy - Standard 5 requires that storm water discharges with higher potential pollutant loads, such as gas stations, be provided with specific BMP's. The use of infiltration practices for these discharges prior to pretreatment is prohibited. However, DEP has determined that roofs and roadways are not to be considered to be high yield potential pollutant loads, therefore, this standard does not apply to this project.

3.6 STORM WATER DISCHARGES TO CRITICAL AREAS - Standard 6

Standard 6 of the DEP Storm water Policy seeks to protect critical areas. Critical areas are specifically designated Outstanding Resource Waters (ORW's) such as shell fish beds, swimming beaches, cold water fisheries and recharge areas for public water supplies. Such areas require the use of specific BMP's, however, the proposed project will not discharge to any of these areas, therefore, this standard does not apply.

3.7 REDEVELOPMENT OF PREVIOUSLY DEVELOPED SITES - Standard 7

Standard 7 applies to sites which have been previously developed and are being redeveloped. Diminished performance of BMP's is allowed in these areas. Although this project is a re-development of a fully constructed residential and commercial facility, the design of the storm water management system not only meets, but exceeds all of the design standards as if the project was not a re-development.

3.8 EROSION AND SEDIMENT CONTROL -Standard 8

Erosion and sediment control measures have been developed for this project and are included in the construction set of drawings. These plans show the proposed locations for erosion control devices. The following supplemental provisions are also a part of this plan.

Erosion and Sedimentation Control measures which are proposed to be implemented during construction include the installation of and silt fencing which has the bottom 6 inches buried in the ground. Any extra excavated soil which is not used to bury the base of the fence will be cast up-gradient of the silt fence.

- Silt fence and haybales, or silt sock, if installed, shall be inspected after every major rainfall runoff event (over 1½" depth of precipitation). All damaged or misaligned fences shall be immediately repaired. Silt shall be immediately removed from all areas of the silt fence when depth of accumulation exceeds 6 inches.

- Sumps and out falls shall be inspected after every major rainfall runoff event (over 1½" depth of precipitation). Silt shall be immediately removed from all sumps where the

depth of accumulation exceeds 9 inches.)

- All exposed construction areas will be stabilized upon completion in order to minimize the time that these areas are unstabilized.

With the full impact of the measures presented on the Erosion and Sedimentation Control Plans, along with the provisions stipulated above, Standard 8 will be satisfied.

3.9 OPERATIONS AND MAINTENANCE PLANS - Standard 9

Standard 9 of the DEP Storm Water Policy prescribes the adoption of a formal operation and maintenance plan to ensure that the storm water management systems function properly as designed. The proposed Operations and Maintenance Plan is attached in an appendix to this report.

DRAINAGE SUMMARY

Proposed
Residences at Norfolk Station
Norfolk, Massachusetts

Drainage Summary

2 YR STORM (3.2 in.)

Receptor	Pre Development		Post Development	
	Q Max (cfs)	V (AF)	Q Max (cfs)	V (AF)
Existing CB	1.39	0.139	0.05	0.012

10 YR STORM (4.6 in.)

Receptor	Pre Development		Post Development	
	Q Max (cfs)	V (AF)	Q Max (cfs)	V (AF)
Existing CB	4.32	0.338	1.26	0.115

25 YR STORM (5.5 in.)

Receptor	Pre Development		Post Development	
	Q Max (cfs)	V (AF)	Q Max (cfs)	V (AF)
Existing CB	6.58	0.491	3.21	0.231

50 YR STORM (6.1 in.)

Receptor	Pre Development		Post Development	
	Q Max (cfs)	V (AF)	Q Max (cfs)	V (AF)
Existing CB	8.20	0.601	5.16	0.316

100 YR STORM (6.8 in.)

Receptor	Pre Development		Post Development	
	Q Max (cfs)	V (AF)	Q Max (cfs)	V (AF)
Existing CB	10.17	0.736	7.67	0.433

PIPE CALCULATIONS AND GRATE ANALYSIS

NORFOLK STATION

Input Values

K Values for grate R-3405-A with a transverse gutter slope of 2%	
LONGITUDINAL SLOPE (%)	K FOR R-3405-A
1	19
1.5	20.75
2	22.5
2.5	24.25
3	26
3.5	27.25
4	28.5
4.5	29.5
5	30.5
5.5	31.5
6	32.5

K Values for grate R-3455-A with a transverse gutter slope of 2%	
LONGITUDINAL SLOPE (%)	K FOR R-3405-A
1	19
1.5	22
2	25
2.5	26.5
3	28
3.5	29.5
4	31
4.5	31.75
5	32.5
5.5	33.25
6	34

ROADWAY PROPERTIES	
Roughness Coefficient of Bituminous Asphalt	0.016
Transverse Slope	0.03

Geometric Values for grate R-3405-A	
Square Dimention (in.)	23.6
Free Area (sq. ft.)	1.3

GUTTER DEPTH OF FLOW

$$D = \left(\frac{QN}{0.56Z\sqrt{S}}\right)^{\frac{3}{8}}$$

Q = Channel flow (cfs)
Z = Reciprocal of transverse slope (ft/ft)
S = Longitudinal Slope
N = Roughness Coefficient
D = Depth (ft)

GUTTER CAPACITY OF GRATE

$$Q = KD^{\frac{5}{3}}$$

Q = Grate capacity (cfs)
K = Grate coef. from "Inlet Grate Capacities Manual"
D = Depth of flow in feet (from previous equation)

ORIFICE FLOW EQUATION

$$Q = .6A\sqrt{2gh}$$

Q = Capacity (cfs)
A = Free open area (sq. ft.)
g = Acceleration of Gravity (32.2 ft/s^2)
h = Head (ft.)

WEIR EQUATION

$$Q = 3.3P(h)^{\frac{3}{2}}$$

Q = Capacity (cfs)
P = Perimeter (ft.)
h = Head (ft.)

NORFOLK STATION

CATCH BASINS IN DEPRESSIONS

STRUCTURE	CONTRIBUTING FLOW (cfs)	CARRYOVER FLOW (cfs)	TOTAL FLOW (cfs)	SIDES ON CURB	(S)INGLE OR (D)OUBLE	P (ft)	HEAD OVER GRATE (ft)	ORIFICE		WEIR		MAX CAPACITY (cfs)	ACTUAL DEPTH (ft)	OVERFLOW (cfs)	OVERFLOW TO
								Q_{MAX} (cfs)	H (ft)	Q_{MAX} (cfs)	H (ft)				
STC-1	0.87	0.00	0.87	1	S	5.9	0.5	4.43	0.02	6.89	0.13	4.43 cfs	0.02 ft.	0.00	BASIN
STC-2	4.50	0.00	4.50	1	D	7.9	0.50	8.85	0.13	9.19	0.31	8.85 cfs	0.13 ft.	0.00	BASIN

RATIONAL METHOD OF FLOWS TOWARD INLET GRATES									
FROM	UNPAVED AREA	UNPAVED COEFFICIENT	PAVE/ROOF AREA	PAVE/ROOF COEFFICIENT	AREA ACRES	WEIGHTED C	TOC MIN.	i	Q cfs
STC-1	4654.0	0.20	4961.0	0.90	0.22	0.56	6	7.0^	0.87
STC-2	20524.0	0.20	26521.0	0.90	1.08	0.59	6	7.0^	4.50

^ 100-YEAR STORM INTENSITY

OPEN CHANNEL FLOW CAPACITIES								
FROM	TO	PIPE DIA.	FROM INVERT	TO INVERT	PIPE LENGTH	SLOPE FT./FT.	N VALUE	Q FULL cfs
STC-1	INF	12	217.80	217.65	15	0.010	0.01	4.64
STC-2	BASIN	12	211.20	210.65	48	0.011	0.01	4.97

ZENITH CONSULTING ENGINEERS, LLC
CIVIL ENGINEERING

3 MAIN STREET
LAKEVILLE, MA 02347
TEL: (508) 947-4208

Pipe Design Calculations

PROJECT NORFOLK STATION

INLET GRATE AND PIPE ANALYSIS

CALCULATED BY: RMF DATE

CHECKED BY: DATE

LOCATION		GRATE ANALYSIS						PIPE ANALYSIS							
FROM	TO	(S)ag or (G)utter	FLOW TO GRATE	GRATE CAPACITY	OVER-FLOW	DEPTH OF FLOW	FLOW TO PIPE	PIPE SIZE DIA.	LNGTH FT.	SLOPE FT./FT.	Q CAPACITY cfs	Q ACTUAL cfs	V FULL fps	V ACTUAL fps	CHECK?
STC-1	INF	S	0.87	4.43	0.00	0.2"	0.87	12	15	0.0100	4.64	0.87	5.91	4.48	OK
STC-2	BASIN	S	4.50	8.85	0.00	1.5"	4.50	12	48	0.0115	4.97	4.50	6.33	7.03	OK

STORMCEPTOR SIZING CALCULATIONS

Stormceptor®

Rinker MATERIALS™

Brief Stormceptor Sizing Report - STC-1

Project Information & Location			
Project Name	Residences at Norfolk Station	Project Number	8556
City	Norfolk	State/ Province	Massachusetts
Country	United States of America	Date	8/23/2018
Designer Information		EOR Information (optional)	
Name	Robert Forbes	Name	
Company	Zenith Consulting Engineers, LLC	Company	
Phone #	508-947-4208	Phone #	
Email	rforbes@zcellc.com	Email	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	STC-1
Target TSS Removal (%)	80
TSS Removal (%) Provided	93
Recommended Stormceptor Model	STC 450i

The recommended Stormceptor Model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	% TSS Removal Provided
STC 450i	93
STC 900	96
STC 1200	96
STC 1800	96
STC 2400	97
STC 3600	98
STC 4800	98
STC 6000	98
STC 7200	99
STC 11000	99
STC 13000	99
STC 16000	99
StormceptorMAX	Custom

Stormceptor®

Rinker MATERIALS™

Sizing Details	
Drainage Area	
Total Area (acres)	0.22
Imperviousness %	52.0
Rainfall	
Station Name	BOSTON WSFO AP
State/Province	Massachusetts
Station ID #	0770
Years of Records	58
Latitude	42°21'38"N
Longitude	71°0'38"W

Water Quality Objective	
TSS Removal (%)	80.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (Gal)	
Peak Conveyed Flow Rate (CFS)	
Water Quality Flow Rate (CFS)	

Up Stream Storage	
Storage (ac-ft)	**Discharge (cfs)**
0.000	0.000

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cfs)	

Particle Size Distribution (PSD) The selected PSD defines TSS removal		
Fine Distribution		
Particle Diameter (microns)	**Distribution %**	**Specific Gravity**
20.0	20.0	1.30
60.0	20.0	1.80
150.0	20.0	2.20
400.0	20.0	2.65
2000.0	20.0	2.65

Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
- For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

For Stormceptor Specifications and Drawings Please Visit:
http://www.imbriumsystems.com/technical-specifications

Stormceptor®

Rinker MATERIALS™

Brief Stormceptor Sizing Report - STC-2

Project Information & Location			
Project Name	Residences at Norfolk Station	Project Number	8556
City	Norfolk	State/ Province	Massachusetts
Country	United States of America	Date	8/23/2018
Designer Information		**EOR Information (optional)**	
Name	Robert Forbes	Name	
Company	Zenith Consulting Engineers, LLC	Company	
Phone #	508-947-4208	Phone #	
Email	rforbes@zcellc.com	Email	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	STC-2
Target TSS Removal (%)	80
TSS Removal (%) Provided	
Recommended Stormceptor Model	STC 450i

The recommended Stormceptor Model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	**% TSS Removal Provided**
STC 450i	82
STC 900	88
STC 1200	88
STC 1800	89
STC 2400	91
STC 3600	92
STC 4800	94
STC 6000	94
STC 7200	95
STC 11000	96
STC 13000	97
STC 16000	97
StormceptorMAX	Custom

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Sizing Details

Drainage Area	
Total Area (acres)	1.08
Imperviousness %	56.0

Rainfall	
Station Name	BOSTON WSFO AP
State/Province	Massachusetts
Station ID #	0770
Years of Records	58
Latitude	42°21'38"N
Longitude	71°0'38"W

Water Quality Objective	
TSS Removal (%)	80.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (Gal)	
Peak Conveyed Flow Rate (CFS)	
Water Quality Flow Rate (CFS)	

Up Stream Storage	
Storage (ac-ft)	Discharge (cfs)
0.000	0.000

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cfs)	

Particle Size Distribution (PSD)
The selected PSD defines TSS removal

Fine Distribution		
Particle Diameter (microns)	Distribution %	Specific Gravity
20.0	20.0	1.30
60.0	20.0	1.80
150.0	20.0	2.20
400.0	20.0	2.65
2000.0	20.0	2.65

Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
- For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

For Stormceptor Specifications and Drawings Please Visit:
http://www.imbriumsystems.com/technical-specifications

ILLICIT DISCHARGE STATEMENT

Zenith Consulting Engineers, LLC

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(508) 947-4208 - www.zcellc.com

- Civil Engineering
- Septic Design (Title 5)
- Septic Inspections (Title 5)
- Commercial and Industrial Site Plans
- Chapter 91 Permitting

ILLICIT DISCHARGE STATEMENT
(STANDARD #10)

RE: THE RESIDENCES AT NORFOLK STATION
194 MAIN STREET, NORFOLK, MASSACHUSETTS

Standard 10 of the Massachusetts Stormwater Handbook prohibits illicit discharges to stormwater management systems. The following is an illicit discharge compliance statement based on existing conditions and design conditions for the proposed project.

EXISTING CONDITIONS

The existing site is a mostly developed parcel including three buildings, paved parking areas , lawns , woods and gravel surfaces with no known illicit connections to the stormwater management systems in the area. Based on all the information available to the undersigned, and therefore, to the best of my knowledge, there are no current illicit discharges to the storm drainage system. If during construction, an illicit discharge is discovered, it shall be removed immediately.

PROPOSED DESIGN

The proposed project design does not include any illicit discharges. There are no points in the proposed storm drainage system where illicit discharges are likely to occur.

I hereby certify that the preceding is accurate.

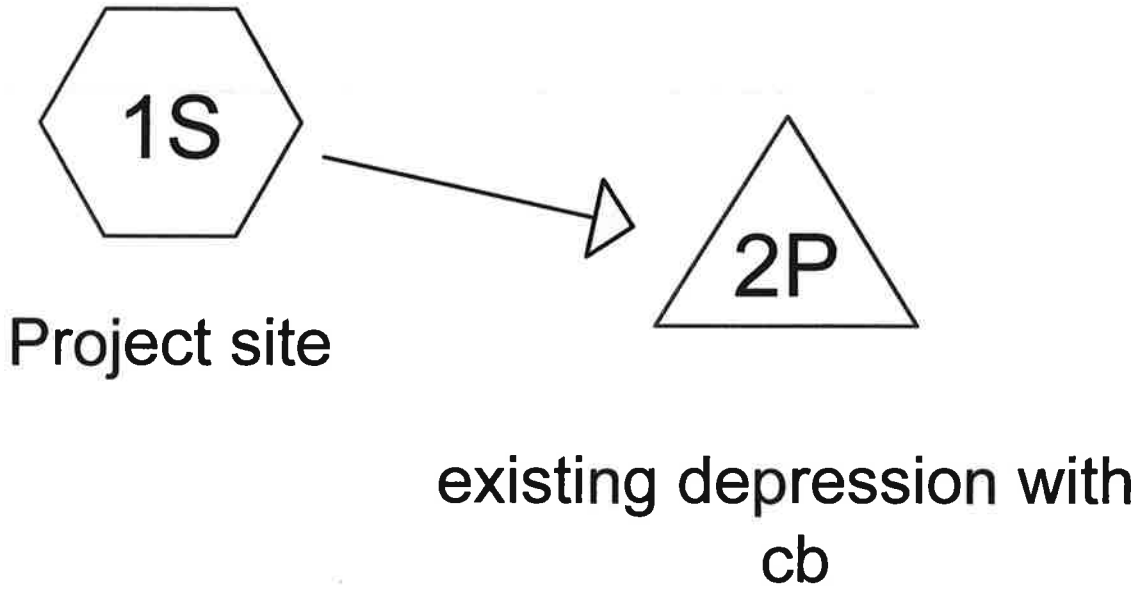
_____

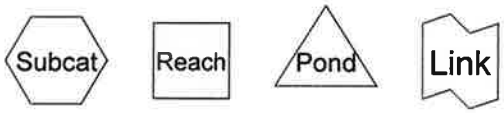
Robert M. Forbes, P.E.
Zenith Consulting Engineers, LLC.

HYDROCAD OUTPUT

ATTACHMENT A
Pre-Development Calculations

2 Year 3.20"
10 Year 4.60"
25 Year 5.50"
50 Year 6.10"
100 Year 6.80"





Routing Diagram for Pre-Development Site
Prepared by {enter your company name here}, Printed 8/23/2018
HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.510	39	>75% Grass cover, Good, HSG A (1S)
0.592	72	Dirt roads, HSG A (1S)
0.194	98	Existing Roofs (1S)
0.873	30	Woods, Good, HSG A (1S)
0.301	72	bare gravel (MBTA), HSG A (1S)
0.626	98	paved and concrete (1S)
0.114	98	paved parking (abutter) (1S)
3.210	**63**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
2.276	HSG A	1S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.934	Other	1S
3.210		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.510	0.000	0.000	0.000	0.000	0.510	>75% Grass cover, Good	1S
0.592	0.000	0.000	0.000	0.000	0.592	Dirt roads	1S
0.000	0.000	0.000	0.000	0.194	0.194	Existing Roofs	1S
0.873	0.000	0.000	0.000	0.000	0.873	Woods, Good	1S
0.301	0.000	0.000	0.000	0.000	0.301	bare gravel (MBTA)	1S
0.000	0.000	0.000	0.000	0.626	0.626	paved and concrete	1S
0.000	0.000	0.000	0.000	0.114	0.114	paved parking (abutter)	1S
2.276	**0.000**	**0.000**	**0.000**	**0.934**	**3.210**	**TOTAL AREA**	

PRE-DEVELOPMENT CALCULATIONS
2-YEAR STORM - 3.20" RAINFALL

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Project site Runoff Area=139,840 sf 29.10% Impervious Runoff Depth=0.52"
Flow Length=420' Tc=6.0 min CN=63 Runoff=1.39 cfs 0.139 af

Pond 2P: existing depression with cb Peak Elev=208.06' Storage=1,425 cf Inflow=1.39 cfs 0.139 af
Discarded=0.17 cfs 0.116 af Primary=0.39 cfs 0.023 af Outflow=0.55 cfs 0.139 af

Total Runoff Area = 3.210 ac Runoff Volume = 0.139 af Average Runoff Depth = 0.52"
70.90% Pervious = 2.276 ac 29.10% Impervious = 0.934 ac

Summary for Subcatchment 1S: Project site

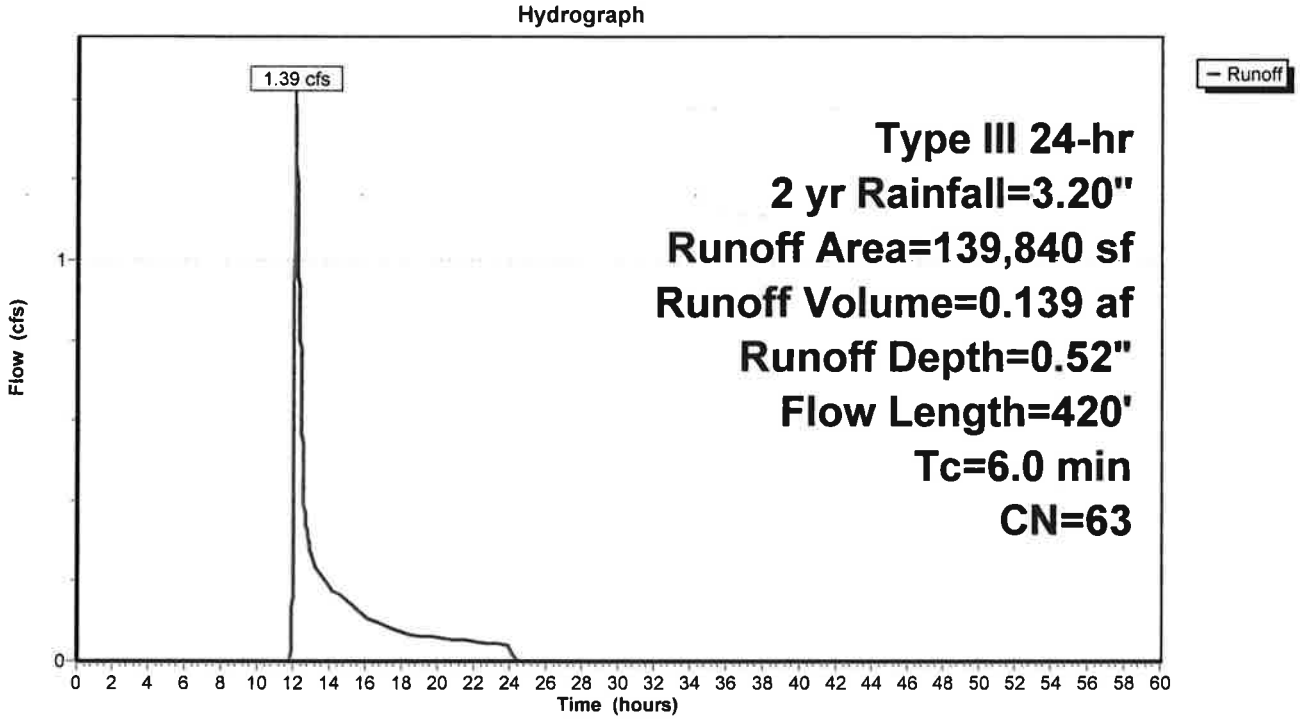
Runoff = 1.39 cfs @ 12.11 hrs, Volume= 0.139 af, Depth= 0.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 yr Rainfall=3.20"

	Area (sf)	CN	Description
*	8,442	98	Existing Roofs
*	27,290	98	paved and concrete
	25,783	72	Dirt roads, HSG A
	38,013	30	Woods, Good, HSG A
	22,222	39	>75% Grass cover, Good, HSG A
*	4,961	98	paved parking (abutter)
*	13,129	72	bare gravel (MBTA), HSG A
	139,840	63	Weighted Average
	99,147		70.90% Pervious Area
	40,693		29.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0400	1.63		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.40"
1.9	265	0.0210	2.33		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.5	105	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.1					**Direct Entry, factor to bring to 6 min**
6.0	420	Total			

Subcatchment 1S: Project site



Summary for Pond 2P: existing depression with cb

Inflow Area =	3.210 ac, 29.10% Impervious, Inflow Depth = 0.52" for 2 yr event				
Inflow =	1.39 cfs @	12.11 hrs,	Volume=	0.139 af	
Outflow =	0.55 cfs @	12.51 hrs,	Volume=	0.139 af,	Atten= 60%, Lag= 23.6 min
Discarded =	0.17 cfs @	12.51 hrs,	Volume=	0.116 af	
Primary =	0.39 cfs @	12.51 hrs,	Volume=	0.023 af	

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 208.06' @ 12.51 hrs Surf.Area= 3,006 sf Storage= 1,425 cf

Plug-Flow detention time= 106.9 min calculated for 0.139 af (100% of inflow)
Center-of-Mass det. time= 106.9 min (1,011.4 - 904.5)

Volume	Invert	Avail.Storage	Storage Description
#1	207.00'	8,687 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

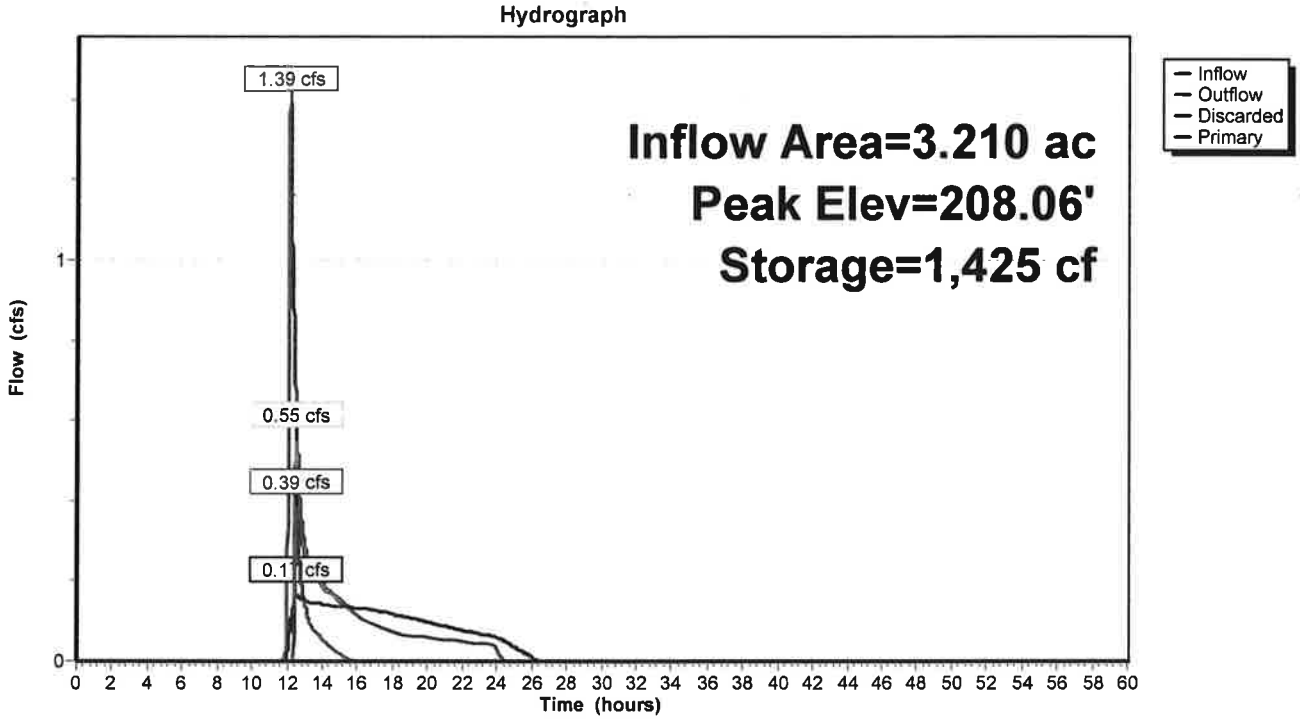
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
207.00	122	0	0
208.00	2,402	1,262	1,262
209.00	12,447	7,425	8,687

Device	Routing	Invert	Outlet Devices
#1	Discarded	207.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	208.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.17 cfs @ 12.51 hrs HW=208.06' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=0.39 cfs @ 12.51 hrs HW=208.06' (Free Discharge)
└**2=Orifice/Grate** (Weir Controls 0.39 cfs @ 0.80 fps)

Pond 2P: existing depression with cb



PRE-DEVELOPMENT CALCULATIONS
10-YEAR STORM - 4.60" RAINFALL

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Project site Runoff Area=139,840 sf 29.10% Impervious Runoff Depth=1.26"
Flow Length=420' Tc=6.0 min CN=63 Runoff=4.32 cfs 0.338 af

Pond 2P: existing depression with cb Peak Elev=208.24' Storage=2,116 cf Inflow=4.32 cfs 0.338 af
Discarded=0.27 cfs 0.164 af Primary=3.03 cfs 0.174 af Outflow=3.30 cfs 0.338 af

Total Runoff Area = 3.210 ac Runoff Volume = 0.338 af Average Runoff Depth = 1.26"
70.90% Pervious = 2.276 ac 29.10% Impervious = 0.934 ac

Summary for Subcatchment 1S: Project site

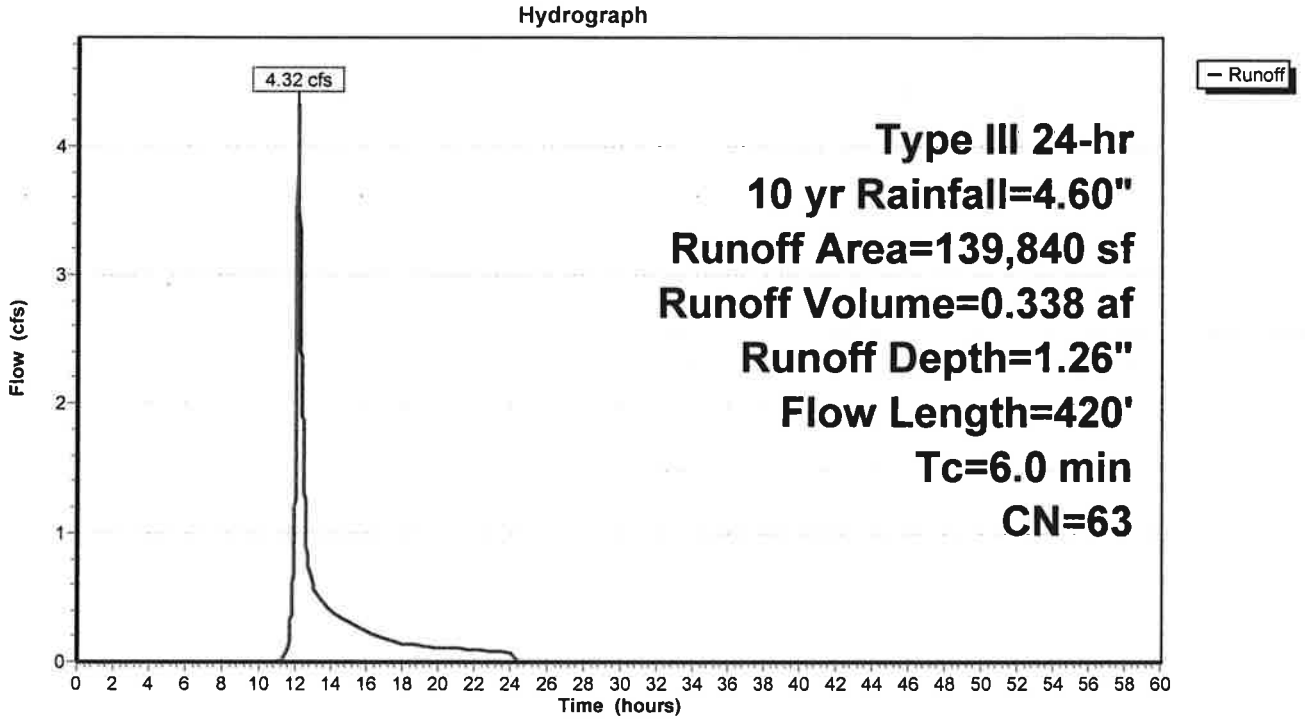
Runoff = 4.32 cfs @ 12.10 hrs, Volume= 0.338 af, Depth= 1.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=4.60"

	Area (sf)	CN	Description
*	8,442	98	Existing Roofs
*	27,290	98	paved and concrete
	25,783	72	Dirt roads, HSG A
	38,013	30	Woods, Good, HSG A
	22,222	39	>75% Grass cover, Good, HSG A
*	4,961	98	paved parking (abutter)
*	13,129	72	bare gravel (MBTA), HSG A
	139,840	63	Weighted Average
	99,147		70.90% Pervious Area
	40,693		29.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0400	1.63		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.40"
1.9	265	0.0210	2.33		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.5	105	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.1					**Direct Entry, factor to bring to 6 min**
6.0	420	Total			

Subcatchment 1S: Project site



Summary for Pond 2P: existing depression with cb

Inflow Area =	3.210 ac, 29.10% Impervious, Inflow Depth = 1.26" for 10 yr event				
Inflow =	4.32 cfs @	12.10 hrs,	Volume=	0.338 af	
Outflow =	3.30 cfs @	12.17 hrs,	Volume=	0.338 af,	Atten= 24%, Lag= 4.4 min
Discarded =	0.27 cfs @	12.17 hrs,	Volume=	0.164 af	
Primary =	3.03 cfs @	12.17 hrs,	Volume=	0.174 af	

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 208.24' @ 12.17 hrs Surf.Area= 4,788 sf Storage= 2,116 cf

Plug-Flow detention time= 66.9 min calculated for 0.338 af (100% of inflow)
Center-of-Mass det. time= 66.9 min (939.1 - 872.2)

Volume	Invert	Avail.Storage	Storage Description
#1	207.00'	8,687 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

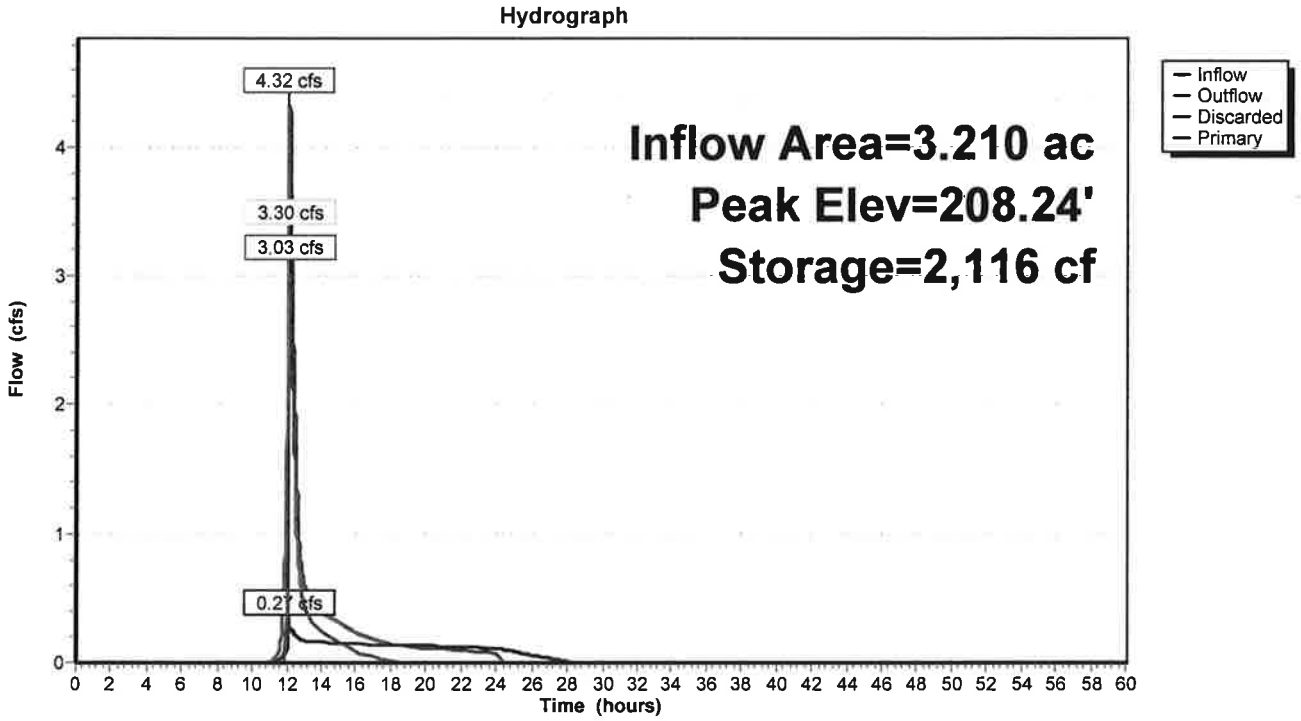
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
207.00	122	0	0
208.00	2,402	1,262	1,262
209.00	12,447	7,425	8,687

Device	Routing	Invert	Outlet Devices
#1	Discarded	207.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	208.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.27 cfs @ 12.17 hrs HW=208.24' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.27 cfs)

Primary OutFlow Max=3.03 cfs @ 12.17 hrs HW=208.24' (Free Discharge)
└**2=Orifice/Grate** (Weir Controls 3.03 cfs @ 1.59 fps)

Pond 2P: existing depression with cb



PRE-DEVELOPMENT CALCULATIONS
25-YEAR STORM - 5.50" RAINFALL

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Project site Runoff Area=139,840 sf 29.10% Impervious Runoff Depth=1.83"
Flow Length=420' Tc=6.0 min CN=63 Runoff=6.58 cfs 0.491 af

Pond 2P: existing depression with cb Peak Elev=208.34' Storage=2,649 cf Inflow=6.58 cfs 0.491 af
Discarded=0.32 cfs 0.185 af Primary=5.15 cfs 0.306 af Outflow=5.47 cfs 0.491 af

Total Runoff Area = 3.210 ac Runoff Volume = 0.491 af Average Runoff Depth = 1.83"
70.90% Pervious = 2.276 ac 29.10% Impervious = 0.934 ac

Summary for Subcatchment 1S: Project site

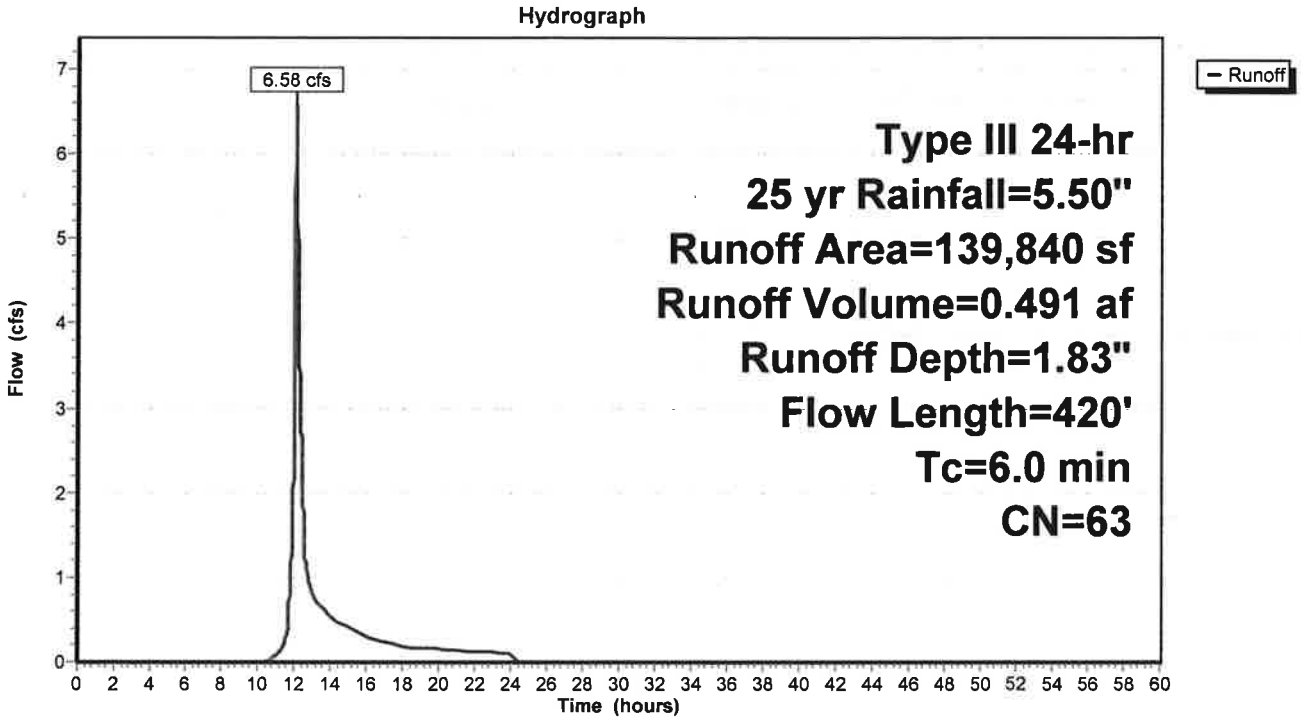
Runoff = 6.58 cfs @ 12.10 hrs, Volume= 0.491 af, Depth= 1.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr Rainfall=5.50"

	Area (sf)	CN	Description
*	8,442	98	Existing Roofs
*	27,290	98	paved and concrete
	25,783	72	Dirt roads, HSG A
	38,013	30	Woods, Good, HSG A
	22,222	39	>75% Grass cover, Good, HSG A
*	4,961	98	paved parking (abutter)
*	13,129	72	bare gravel (MBTA), HSG A
	139,840	63	Weighted Average
	99,147		70.90% Pervious Area
	40,693		29.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0400	1.63		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.40"
1.9	265	0.0210	2.33		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.5	105	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.1					**Direct Entry, factor to bring to 6 min**
6.0	420	Total			

Subcatchment 1S: Project site



Summary for Pond 2P: existing depression with cb

Inflow Area =	3.210 ac, 29.10% Impervious, Inflow Depth = 1.83" for 25 yr event				
Inflow =	6.58 cfs @	12.10 hrs,	Volume=	0.491 af	
Outflow =	5.47 cfs @	12.15 hrs,	Volume=	0.491 af,	Atten= 17%, Lag= 3.3 min
Discarded =	0.32 cfs @	12.15 hrs,	Volume=	0.185 af	
Primary =	5.15 cfs @	12.15 hrs,	Volume=	0.306 af	

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 208.34' @ 12.15 hrs Surf.Area= 5,800 sf Storage= 2,649 cf

Plug-Flow detention time= 52.5 min calculated for 0.491 af (100% of inflow)
Center-of-Mass det. time= 52.5 min (912.9 - 860.3)

Volume	Invert	Avail.Storage	Storage Description
#1	207.00'	8,687 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

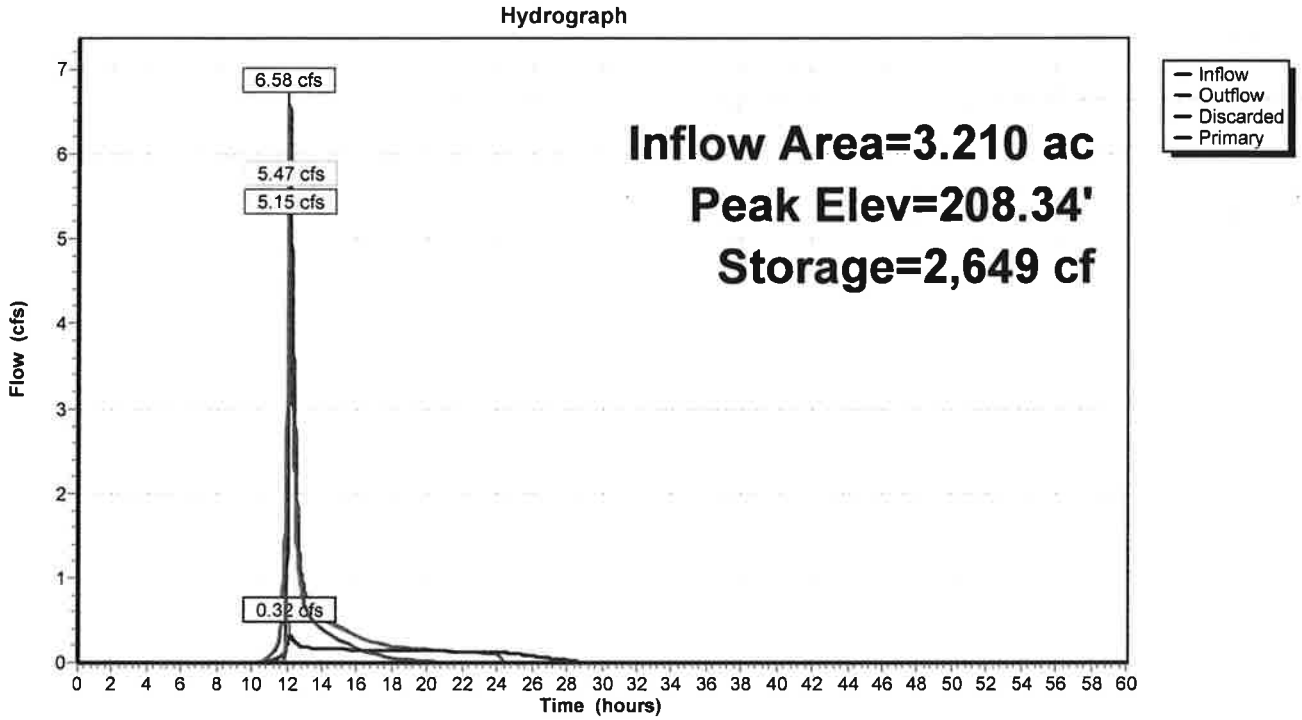
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
207.00	122	0	0
208.00	2,402	1,262	1,262
209.00	12,447	7,425	8,687

Device	Routing	Invert	Outlet Devices
#1	Discarded	207.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	208.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.32 cfs @ 12.15 hrs HW=208.34' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.32 cfs)

Primary OutFlow Max=5.15 cfs @ 12.15 hrs HW=208.34' (Free Discharge)
└**2=Orifice/Grate** (Weir Controls 5.15 cfs @ 1.90 fps)

Pond 2P: existing depression with cb



PRE-DEVELOPMENT CALCULATIONS
50-YEAR STORM – 6.10" RAINFALL

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Project site Runoff Area=139,840 sf 29.10% Impervious Runoff Depth=2.25"
Flow Length=420' Tc=6.0 min CN=63 Runoff=8.20 cfs 0.601 af

Pond 2P: existing depression with cb Peak Elev=208.40' Storage=2,998 cf Inflow=8.20 cfs 0.601 af
Discarded=0.36 cfs 0.196 af Primary=6.51 cfs 0.405 af Outflow=6.86 cfs 0.601 af

Total Runoff Area = 3.210 ac Runoff Volume = 0.601 af Average Runoff Depth = 2.25"
70.90% Pervious = 2.276 ac 29.10% Impervious = 0.934 ac

Summary for Subcatchment 1S: Project site

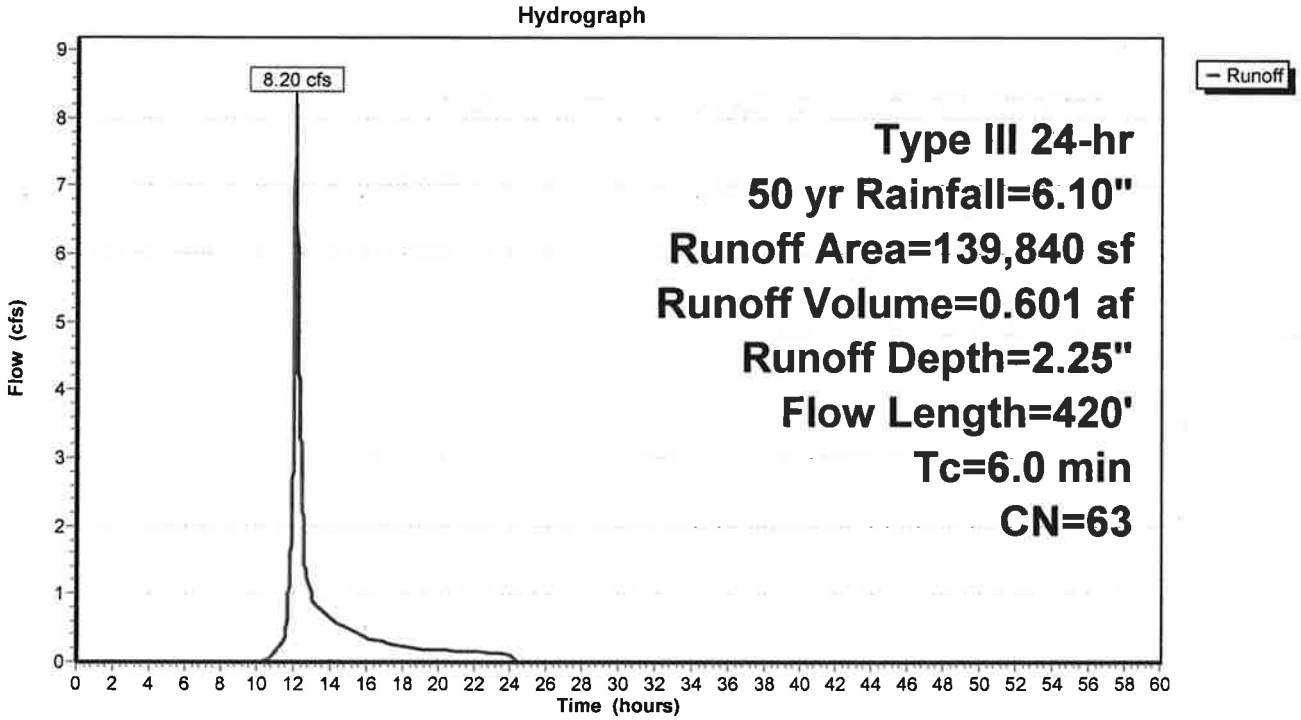
Runoff = 8.20 cfs @ 12.09 hrs, Volume= 0.601 af, Depth= 2.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 50 yr Rainfall=6.10"

	Area (sf)	CN	Description
*	8,442	98	Existing Roofs
*	27,290	98	paved and concrete
	25,783	72	Dirt roads, HSG A
	38,013	30	Woods, Good, HSG A
	22,222	39	>75% Grass cover, Good, HSG A
*	4,961	98	paved parking (abutter)
*	13,129	72	bare gravel (MBTA), HSG A
	139,840	63	Weighted Average
	99,147		70.90% Pervious Area
	40,693		29.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0400	1.63		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.40"
1.9	265	0.0210	2.33		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.5	105	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.1					**Direct Entry, factor to bring to 6 min**
6.0	420	Total			

Subcatchment 1S: Project site



Summary for Pond 2P: existing depression with cb

Inflow Area =	3.210 ac, 29.10% Impervious, Inflow Depth = 2.25" for 50 yr event				
Inflow =	8.20 cfs @	12.09 hrs,	Volume=	0.601 af	
Outflow =	6.86 cfs @	12.15 hrs,	Volume=	0.601 af,	Atten= 16%, Lag= 3.2 min
Discarded =	0.36 cfs @	12.15 hrs,	Volume=	0.196 af	
Primary =	6.51 cfs @	12.15 hrs,	Volume=	0.405 af	

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 208.40' @ 12.15 hrs Surf.Area= 6,375 sf Storage= 2,998 cf

Plug-Flow detention time= 45.1 min calculated for 0.601 af (100% of inflow)
Center-of-Mass det. time= 45.1 min (899.3 - 854.1)

Volume	Invert	Avail.Storage	Storage Description
#1	207.00'	8,687 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

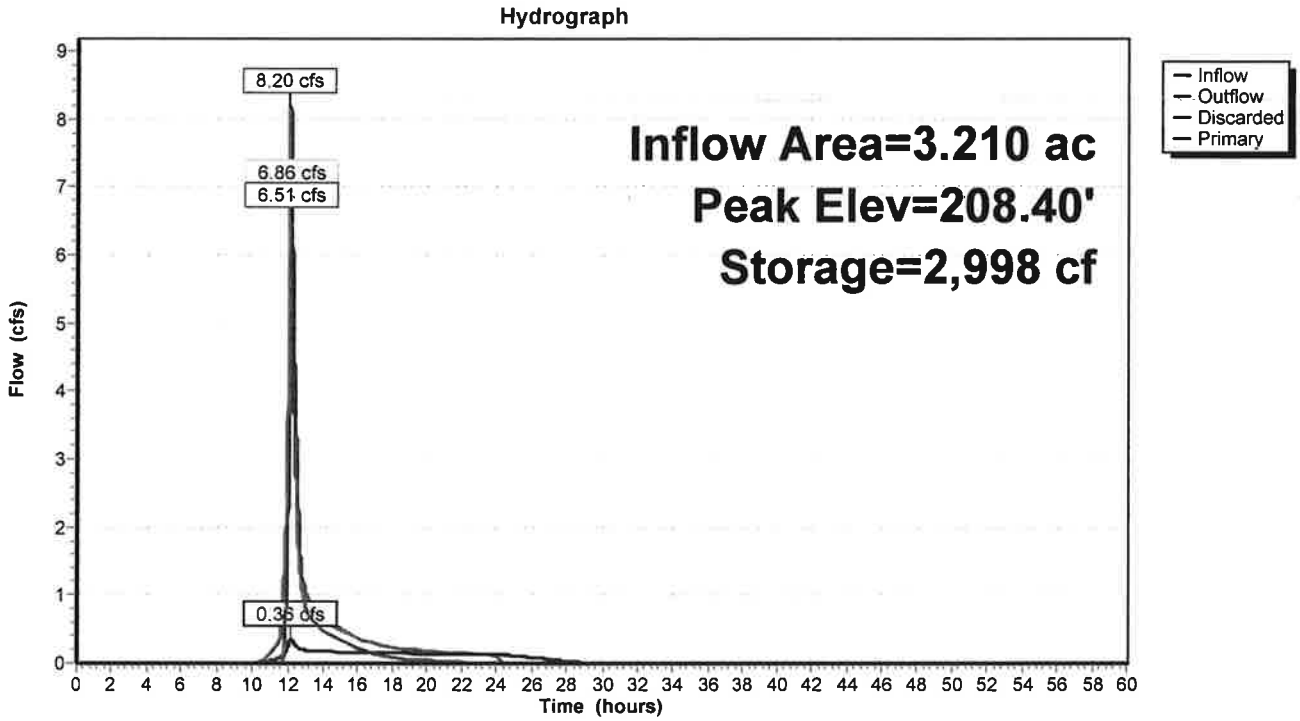
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
207.00	122	0	0
208.00	2,402	1,262	1,262
209.00	12,447	7,425	8,687

Device	Routing	Invert	Outlet Devices
#1	Discarded	207.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	208.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.36 cfs @ 12.15 hrs HW=208.40' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.36 cfs)

Primary OutFlow Max=6.50 cfs @ 12.15 hrs HW=208.40' (Free Discharge)
└**2=Orifice/Grate** (Weir Controls 6.50 cfs @ 2.06 fps)

Pond 2P: existing depression with cb



PRE-DEVELOPMENT CALCULATIONS
100-YEAR STORM – 6.80" RAINFALL

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Project site Runoff Area=139,840 sf 29.10% Impervious Runoff Depth=2.75"
Flow Length=420' Tc=6.0 min CN=63 Runoff=10.17 cfs 0.736 af

Pond 2P: existing depression with cb Peak Elev=208.46' Storage=3,420 cf Inflow=10.17 cfs 0.736 af
Discarded=0.39 cfs 0.206 af Primary=8.12 cfs 0.530 af Outflow=8.52 cfs 0.736 af

Total Runoff Area = 3.210 ac Runoff Volume = 0.736 af Average Runoff Depth = 2.75"
70.90% Pervious = 2.276 ac 29.10% Impervious = 0.934 ac

Summary for Subcatchment 1S: Project site

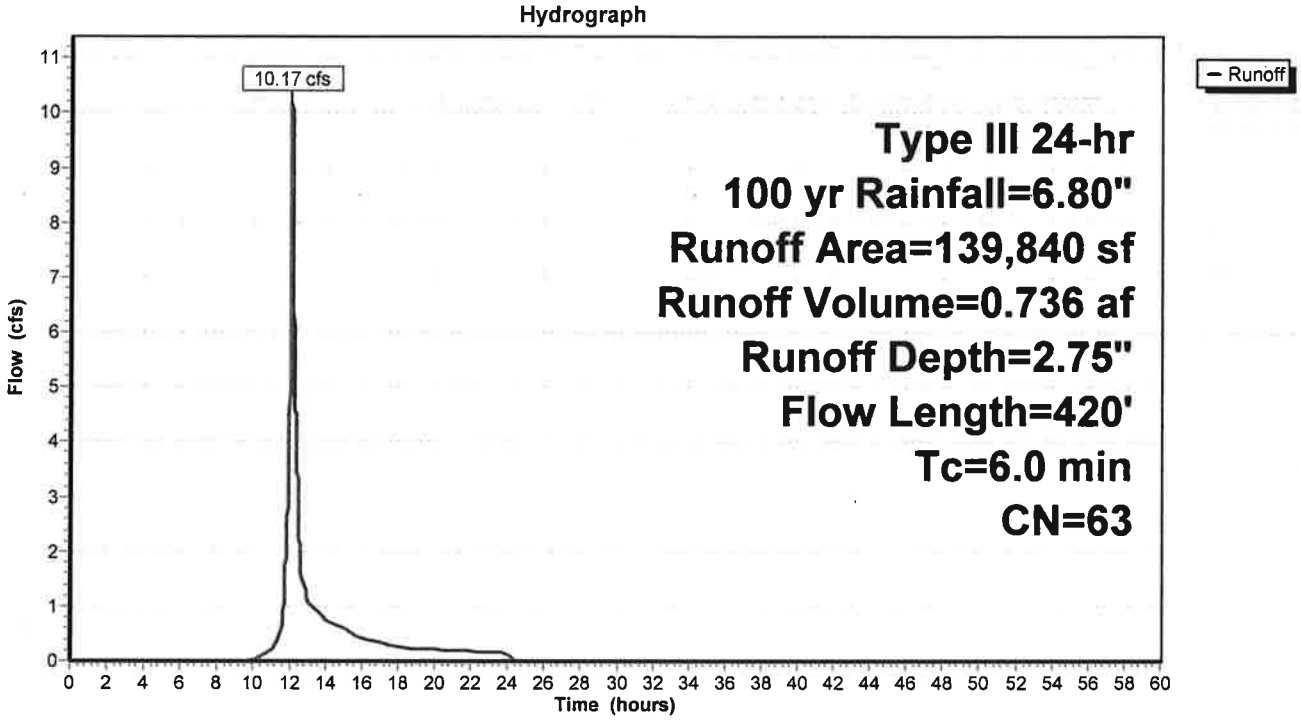
Runoff = 10.17 cfs @ 12.09 hrs, Volume= 0.736 af, Depth= 2.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr Rainfall=6.80"

	Area (sf)	CN	Description
*	8,442	98	Existing Roofs
*	27,290	98	paved and concrete
	25,783	72	Dirt roads, HSG A
	38,013	30	Woods, Good, HSG A
	22,222	39	>75% Grass cover, Good, HSG A
*	4,961	98	paved parking (abutter)
*	13,129	72	bare gravel (MBTA), HSG A
	139,840	63	Weighted Average
	99,147		70.90% Pervious Area
	40,693		29.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0400	1.63		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.40"
1.9	265	0.0210	2.33		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.5	105	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.1					**Direct Entry, factor to bring to 6 min**
6.0	420	Total			

Subcatchment 1S: Project site



Summary for Pond 2P: existing depression with cb

Inflow Area =	3.210 ac, 29.10% Impervious, Inflow Depth = 2.75" for 100 yr event				
Inflow =	10.17 cfs @	12.09 hrs,	Volume=	0.736 af	
Outflow =	8.52 cfs @	12.15 hrs,	Volume=	0.736 af,	Atten= 16%, Lag= 3.2 min
Discarded =	0.39 cfs @	12.15 hrs,	Volume=	0.206 af	
Primary =	8.12 cfs @	12.15 hrs,	Volume=	0.530 af	

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 208.46' @ 12.15 hrs Surf.Area= 7,009 sf Storage= 3,420 cf

Plug-Flow detention time= 38.4 min calculated for 0.736 af (100% of inflow)
Center-of-Mass det. time= 38.5 min (886.5 - 848.1)

Volume	Invert	Avail.Storage	Storage Description
#1	207.00'	8,687 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

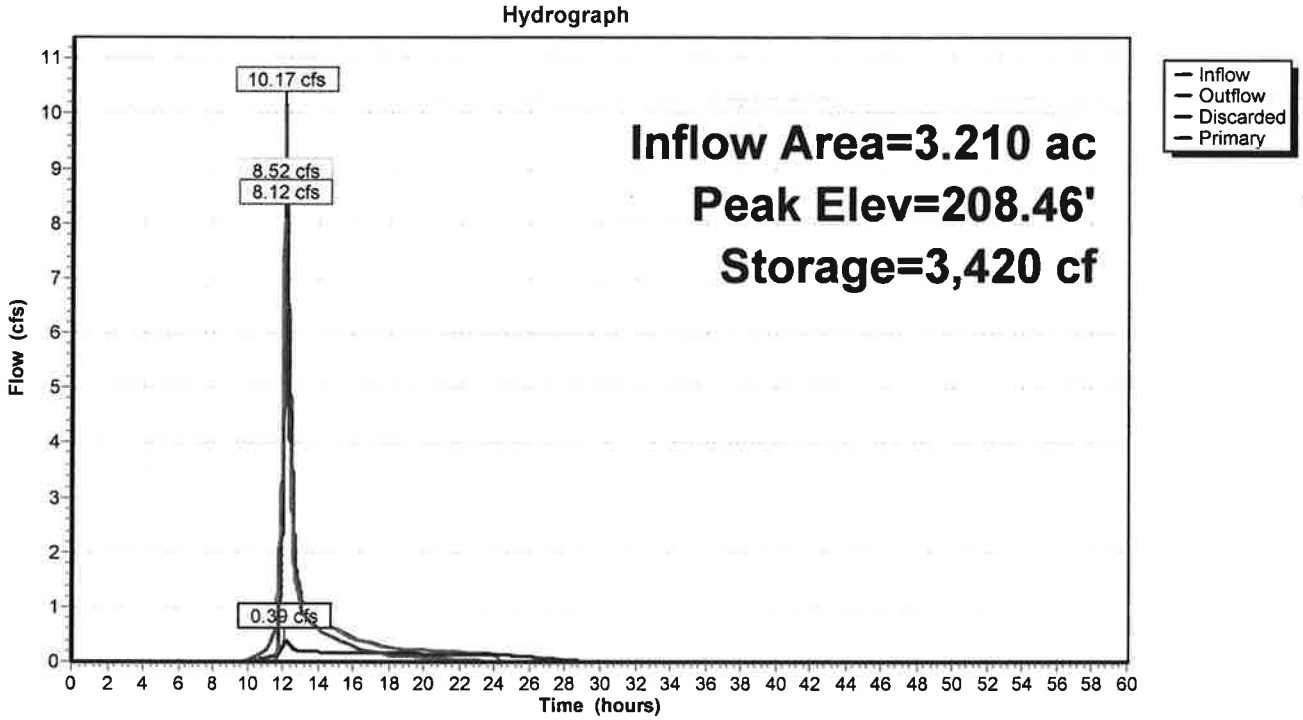
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
207.00	122	0	0
208.00	2,402	1,262	1,262
209.00	12,447	7,425	8,687

Device	Routing	Invert	Outlet Devices
#1	Discarded	207.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	208.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.39 cfs @ 12.15 hrs HW=208.46' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.39 cfs)

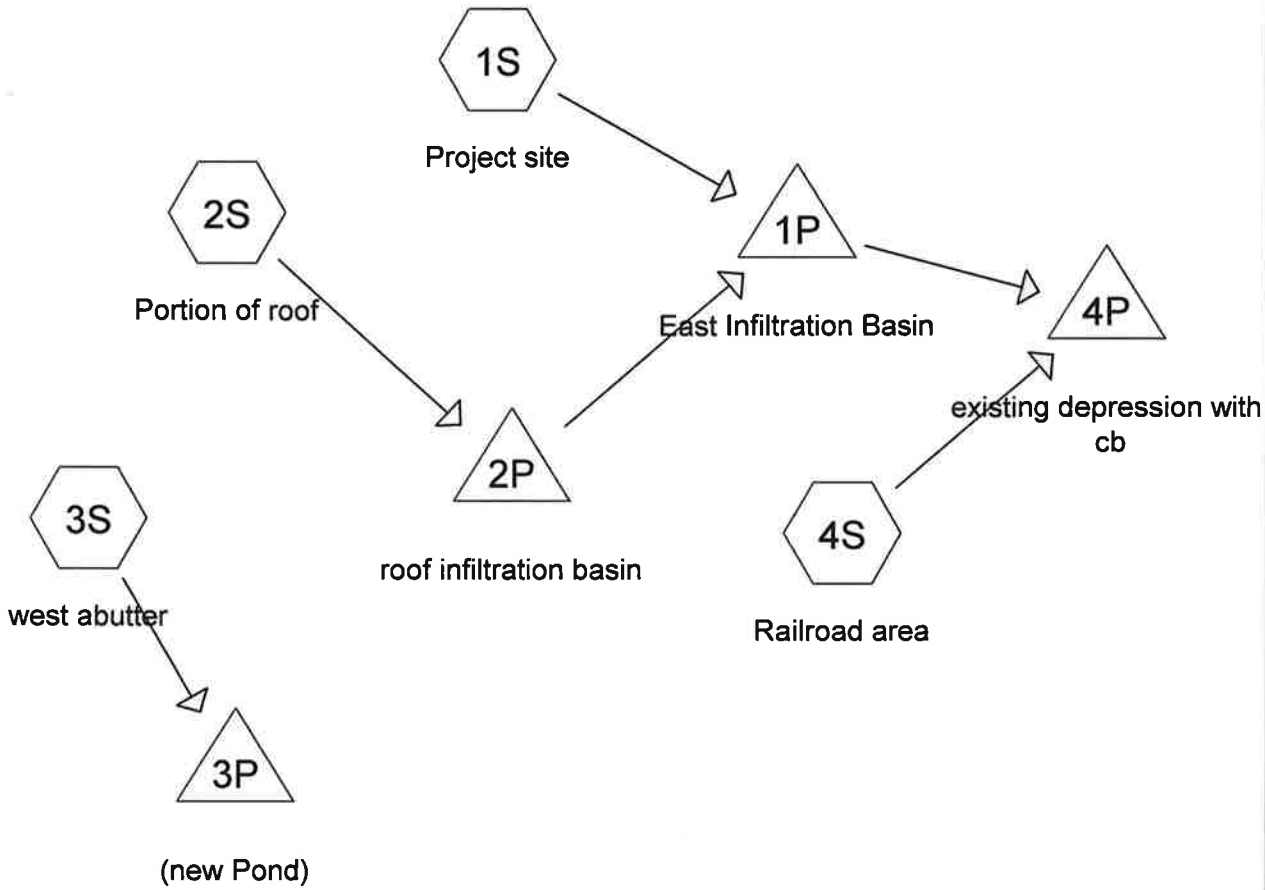
Primary OutFlow Max=8.12 cfs @ 12.15 hrs HW=208.46' (Free Discharge)
└**2=Orifice/Grate** (Weir Controls 8.12 cfs @ 2.21 fps)

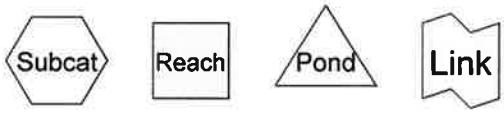
Pond 2P: existing depression with cb



ATTACHMENT B
Post-Development Calculations

2 Year 3.20"
10 Year 4.60"
25 Year 5.50"
50 Year 6.10"
100 Year 6.80"





Routing Diagram for Post-Development Site
Prepared by {enter your company name here}, Printed 8/23/2018
HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.218	39	>75% Grass cover, Good, HSG A (1S, 2S, 3S, 4S)
0.444	98	Roofs (1S)
0.271	30	Woods, Good, HSG A (3S, 4S)
0.011	98	bottom of basin (2S)
0.329	72	crushed stone railroad bed (4S)
0.114	98	paved (3S)
0.609	98	paved and sidewalk (1S)
0.215	98	roof (2S)
3.210	**67**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
1.489	HSG A	1S, 2S, 3S, 4S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
1.722	Other	1S, 2S, 3S, 4S
3.210		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
1.218	0.000	0.000	0.000	0.000	1.218	>75% Grass cover, Good	1S, 2S, 3S, 4S
0.000	0.000	0.000	0.000	0.444	0.444	Roofs	1S
0.271	0.000	0.000	0.000	0.000	0.271	Woods, Good	3S, 4S
0.000	0.000	0.000	0.000	0.011	0.011	bottom of basin	2S
0.000	0.000	0.000	0.000	0.329	0.329	crushed stone railroad bed	4S
0.000	0.000	0.000	0.000	0.114	0.114	paved	3S
0.000	0.000	0.000	0.000	0.609	0.609	paved and sidewalk	1S
0.000	0.000	0.000	0.000	0.215	0.215	roof	2S
1.489	**0.000**	**0.000**	**0.000**	**1.722**	**3.210**	**TOTAL AREA**	

POST-DEVELOPMENT CALCULATIONS
2-YEAR STORM - 3.20" RAINFALL

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Project site Runoff Area=88,222 sf 51.97% Impervious Runoff Depth=0.83"
Tc=6.0 min CN=70 Runoff=1.76 cfs 0.140 af

Subcatchment 2S: Portion of roof Runoff Area=14,660 sf 67.35% Impervious Runoff Depth=1.34"
Tc=6.0 min CN=79 Runoff=0.52 cfs 0.037 af

Subcatchment 3S: west abutter Runoff Area=9,615 sf 51.60% Impervious Runoff Depth=0.64"
Tc=6.0 min CN=66 Runoff=0.13 cfs 0.012 af

Subcatchment 4S: Railroad area Runoff Area=27,343 sf 0.00% Impervious Runoff Depth=0.22"
Tc=6.0 min CN=54 Runoff=0.05 cfs 0.012 af

Pond 1P: East Infiltration Basin Peak Elev=211.03' Storage=2,757 cf Inflow=1.76 cfs 0.140 af
Discarded=0.13 cfs 0.140 af Primary=0.00 cfs 0.000 af Outflow=0.13 cfs 0.140 af

Pond 2P: roof infiltration basin Peak Elev=223.61' Storage=729 cf Inflow=0.52 cfs 0.037 af
Discarded=0.04 cfs 0.037 af Primary=0.00 cfs 0.000 af Outflow=0.04 cfs 0.037 af

Pond 3P: (new Pond) Peak Elev=217.29' Storage=0.012 af Inflow=0.13 cfs 0.012 af
Outflow=0.00 cfs 0.000 af

Pond 4P: existing depression with cb Peak Elev=208.01' Storage=3 cf Inflow=0.05 cfs 0.012 af
Discarded=0.02 cfs 0.005 af Primary=0.04 cfs 0.007 af Outflow=0.05 cfs 0.012 af

Total Runoff Area = 3.210 ac Runoff Volume = 0.201 af Average Runoff Depth = 0.75"
56.61% Pervious = 1.817 ac 43.39% Impervious = 1.393 ac

Summary for Subcatchment 1S: Project site

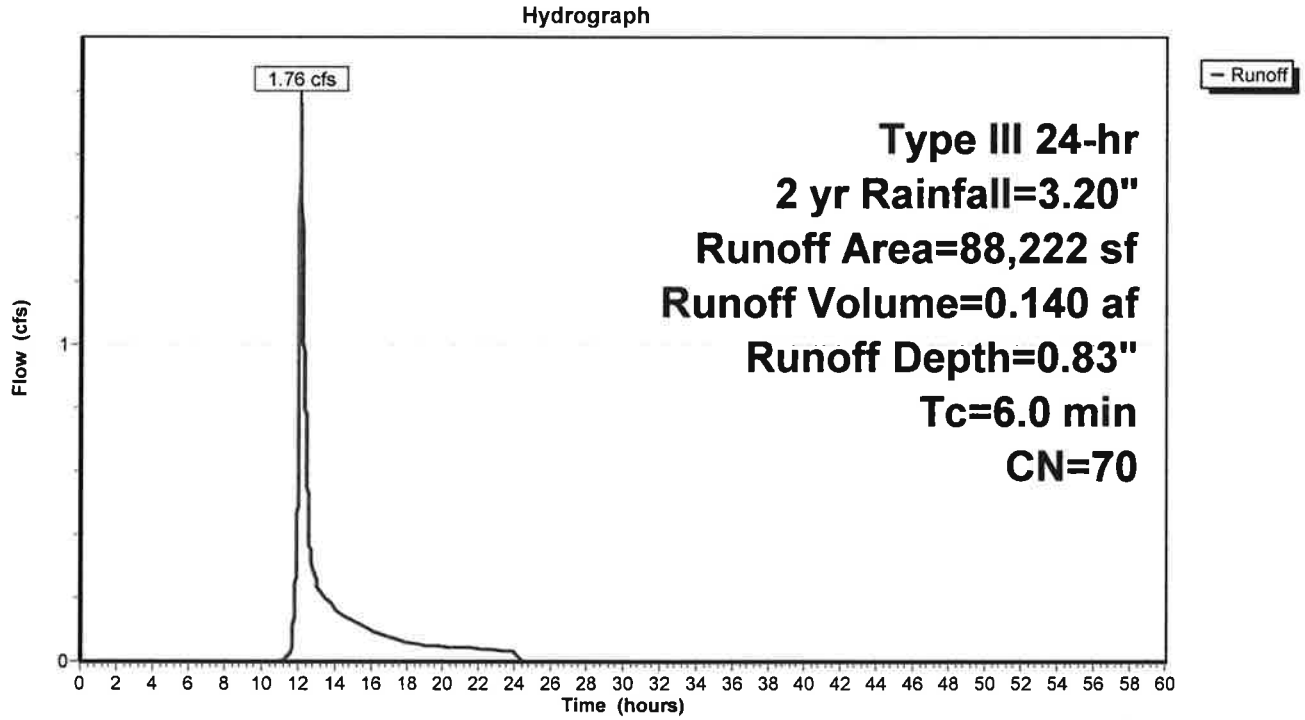
Runoff = 1.76 cfs @ 12.10 hrs, Volume= 0.140 af, Depth= 0.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 yr Rainfall=3.20"

	Area (sf)	CN	Description
*	19,326	98	Roofs
*	26,521	98	paved and sidewalk
	42,375	39	>75% Grass cover, Good, HSG A
	88,222	70	Weighted Average
	42,375		48.03% Pervious Area
	45,847		51.97% Impervious Area

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

Subcatchment 1S: Project site



Summary for Subcatchment 2S: Portion of roof

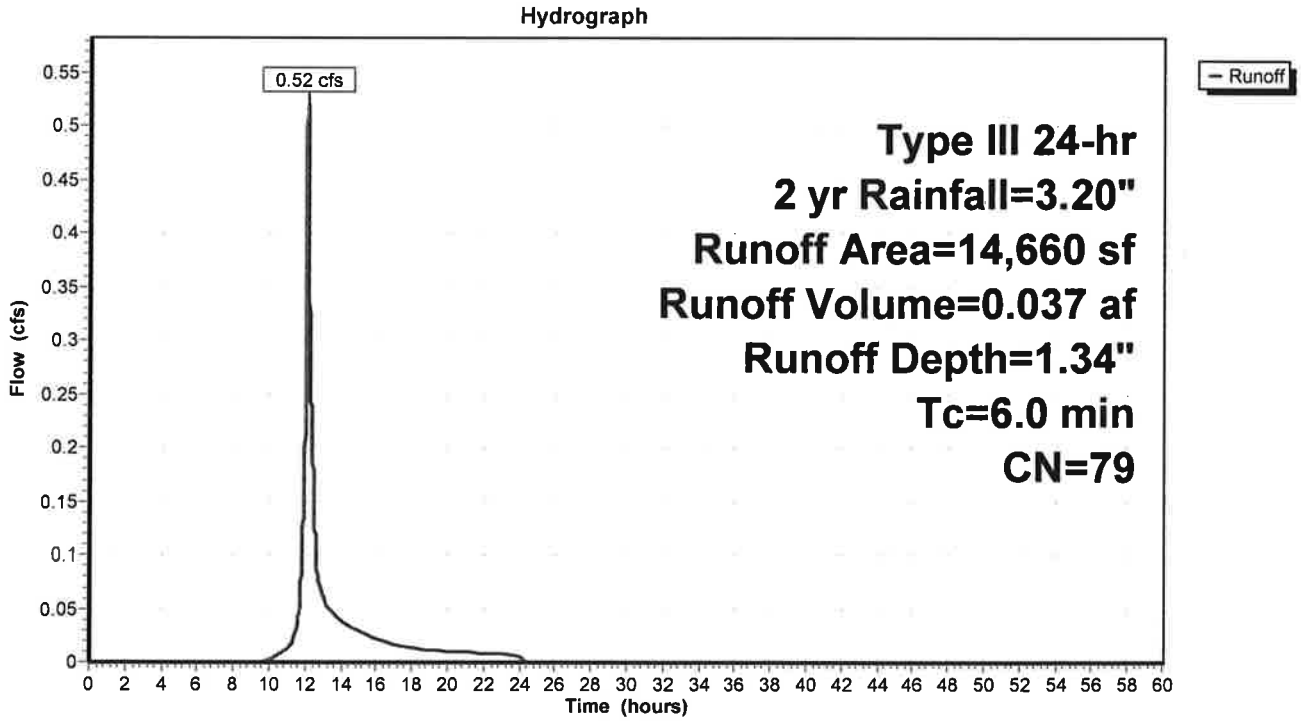
Runoff = 0.52 cfs @ 12.09 hrs, Volume= 0.037 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 yr Rainfall=3.20"

	Area (sf)	CN	Description
*	9,375	98	roof
*	498	98	bottom of basin
	4,787	39	>75% Grass cover, Good, HSG A
	14,660	79	Weighted Average
	4,787		32.65% Pervious Area
	9,873		67.35% Impervious Area

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

Subcatchment 2S: Portion of roof



Summary for Subcatchment 3S: west abutter

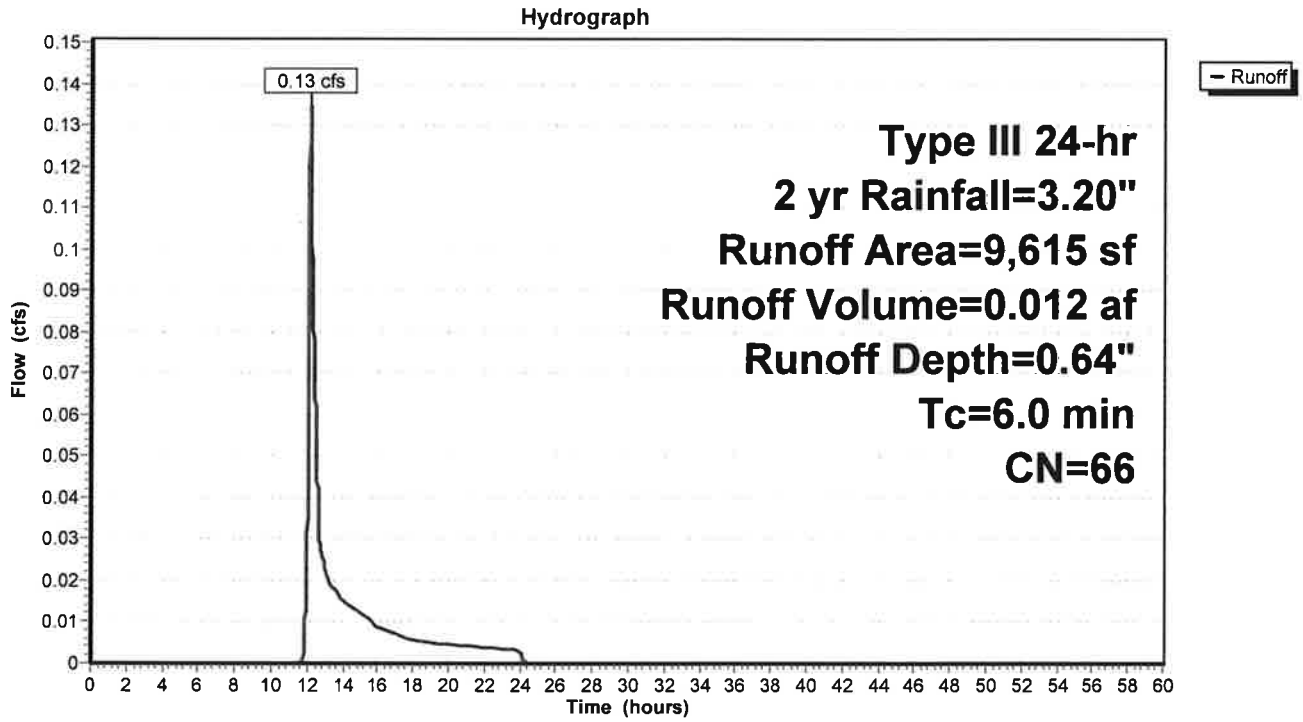
Runoff = 0.13 cfs @ 12.11 hrs, Volume= 0.012 af, Depth= 0.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 yr Rainfall=3.20"

	Area (sf)	CN	Description
*	4,961	98	paved
	750	39	>75% Grass cover, Good, HSG A
	3,904	30	Woods, Good, HSG A
	9,615	66	Weighted Average
	4,654		48.40% Pervious Area
	4,961		51.60% Impervious Area

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

Subcatchment 3S: west abutter



Summary for Subcatchment 4S: Railroad area

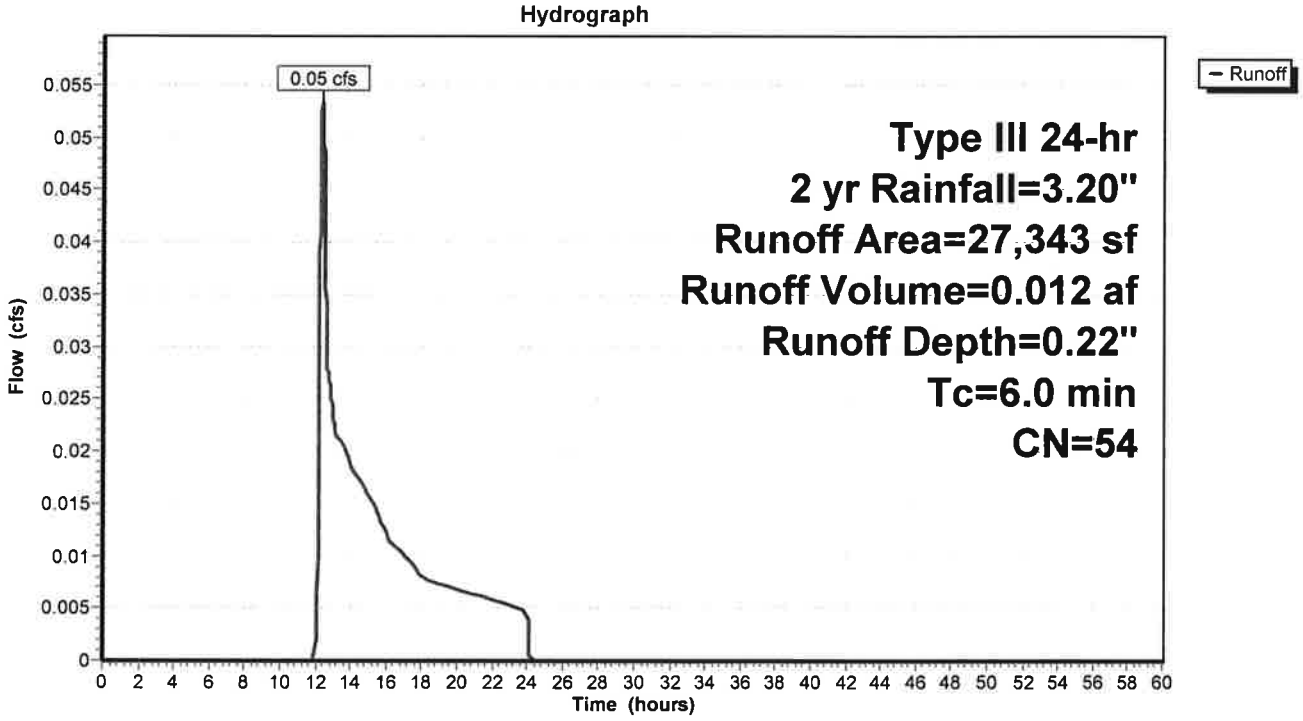
Runoff = 0.05 cfs @ 12.36 hrs, Volume= 0.012 af, Depth= 0.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 yr Rainfall=3.20"

	Area (sf)	CN	Description
	7,880	30	Woods, Good, HSG A
	5,145	39	>75% Grass cover, Good, HSG A
*	14,318	72	crushed stone railroad bed
	27,343	54	Weighted Average
	27,343		100.00% Pervious Area

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

Subcatchment 4S: Railroad area



Summary for Pond 1P: East Infiltration Basin

Inflow Area =	2.362 ac, 54.16% Impervious, Inflow Depth = 0.71" for 2 yr event				
Inflow =	1.76 cfs @	12.10 hrs,	Volume=	0.140 af	
Outflow =	0.13 cfs @	15.06 hrs,	Volume=	0.140 af,	Atten= 93%, Lag= 177.8 min
Discarded =	0.13 cfs @	15.06 hrs,	Volume=	0.140 af	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 211.03' @ 15.06 hrs Surf.Area= 2,286 sf Storage= 2,757 cf

Plug-Flow detention time= 261.0 min calculated for 0.140 af (100% of inflow)
Center-of-Mass det. time= 261.0 min (1,136.7 - 875.7)

Volume	Invert	Avail.Storage	Storage Description
#1	209.50'	8,874 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

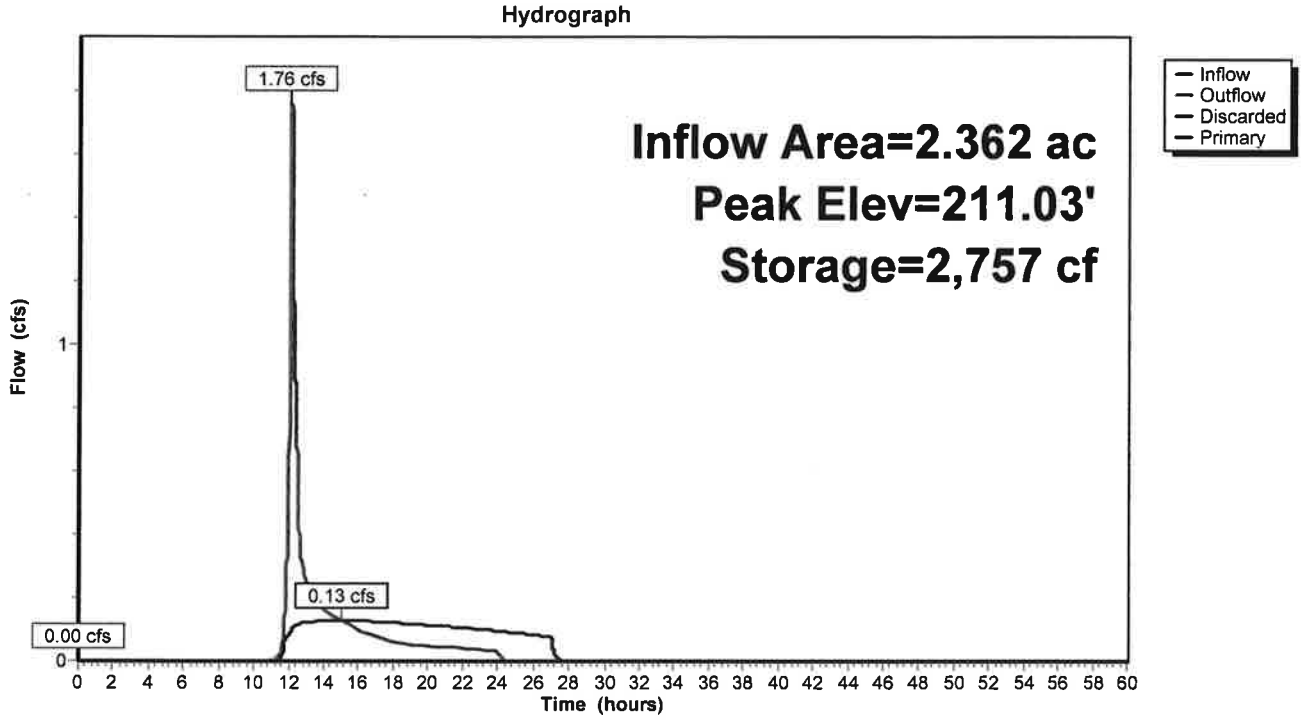
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
209.50	1,346	0	0
210.00	1,638	746	746
211.00	2,265	1,952	2,698
212.00	3,059	2,662	5,360
213.00	3,969	3,514	8,874

Device	Routing	Invert	Outlet Devices
#1	Discarded	209.50'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	211.60'	**6.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.13 cfs @ 15.06 hrs HW=211.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=209.50' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: East Infiltration Basin



Summary for Pond 2P: roof infiltration basin

Inflow Area =	0.337 ac, 67.35% Impervious, Inflow Depth = 1.34" for 2 yr event				
Inflow =	0.52 cfs @	12.09 hrs,	Volume=	0.037 af	
Outflow =	0.04 cfs @	13.59 hrs,	Volume=	0.037 af,	Atten= 91%, Lag= 89.8 min
Discarded =	0.04 cfs @	13.59 hrs,	Volume=	0.037 af	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 223.61' @ 13.59 hrs Surf.Area= 798 sf Storage= 729 cf

Plug-Flow detention time= 208.2 min calculated for 0.037 af (100% of inflow)
Center-of-Mass det. time= 208.2 min (1,054.1 - 846.0)

Volume	Invert	Avail.Storage	Storage Description
#1	222.00'	4,684 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

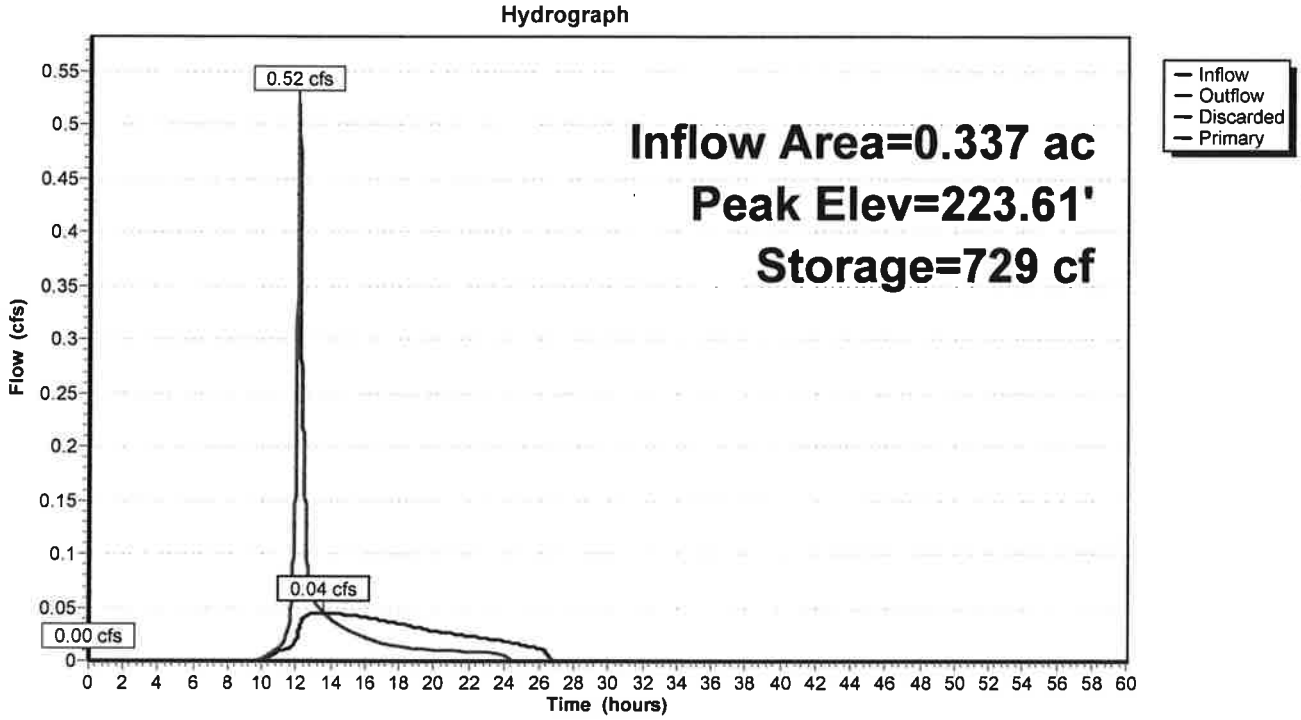
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
222.00	170	0	0
223.00	498	334	334
224.00	989	744	1,078
225.00	1,612	1,301	2,378
226.00	2,999	2,306	4,684

Device	Routing	Invert	Outlet Devices
#1	Discarded	222.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	225.00'	**12.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 225.00' / 224.00' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Discarded OutFlow Max=0.04 cfs @ 13.59 hrs HW=223.61' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=222.00' (Free Discharge)
└─**2=Culvert** (Controls 0.00 cfs)

Pond 2P: roof infiltration basin



Summary for Pond 3P: (new Pond)

Inflow Area = 0.221 ac, 51.60% Impervious, Inflow Depth = 0.64" for 2 yr event
Inflow = 0.13 cfs @ 12.11 hrs, Volume= 0.012 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

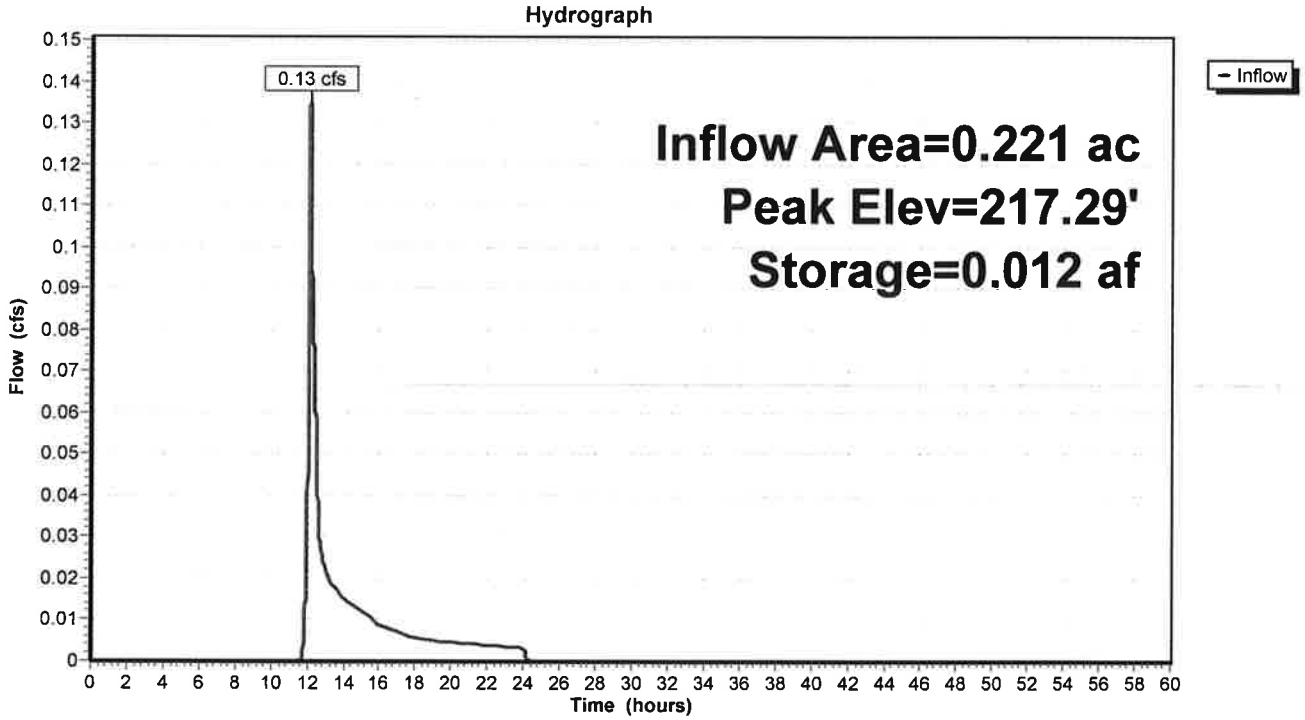
Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 217.29' @ 24.34 hrs Surf.Area= 0.027 ac Storage= 0.012 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1A	216.50'	0.023 af	**25.67'W x 45.50'L x 3.54'H Field A** 0.095 af Overall - 0.037 af Embedded = 0.058 af x 40.0% Voids
#2A	217.00'	0.037 af	**Cultec R-330XLHD** x 30 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 5 rows
		0.060 af	Total Available Storage

Storage Group A created with Chamber Wizard

Pond 3P: (new Pond)



Summary for Pond 4P: existing depression with cb

Inflow Area =	2.990 ac, 42.79% Impervious, Inflow Depth = 0.05" for 2 yr event				
Inflow =	0.05 cfs @	12.36 hrs,	Volume=	0.012 af	
Outflow =	0.05 cfs @	12.38 hrs,	Volume=	0.012 af,	Atten= 0%, Lag= 1.2 min
Discarded =	0.02 cfs @	12.38 hrs,	Volume=	0.005 af	
Primary =	0.04 cfs @	12.38 hrs,	Volume=	0.007 af	

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 208.01' @ 12.38 hrs Surf.Area= 314 sf Storage= 3 cf

Plug-Flow detention time= 1.1 min calculated for 0.012 af (100% of inflow)
Center-of-Mass det. time= 1.1 min (965.3 - 964.3)

Volume	Invert	Avail.Storage	Storage Description
#1	208.00'	2,973 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

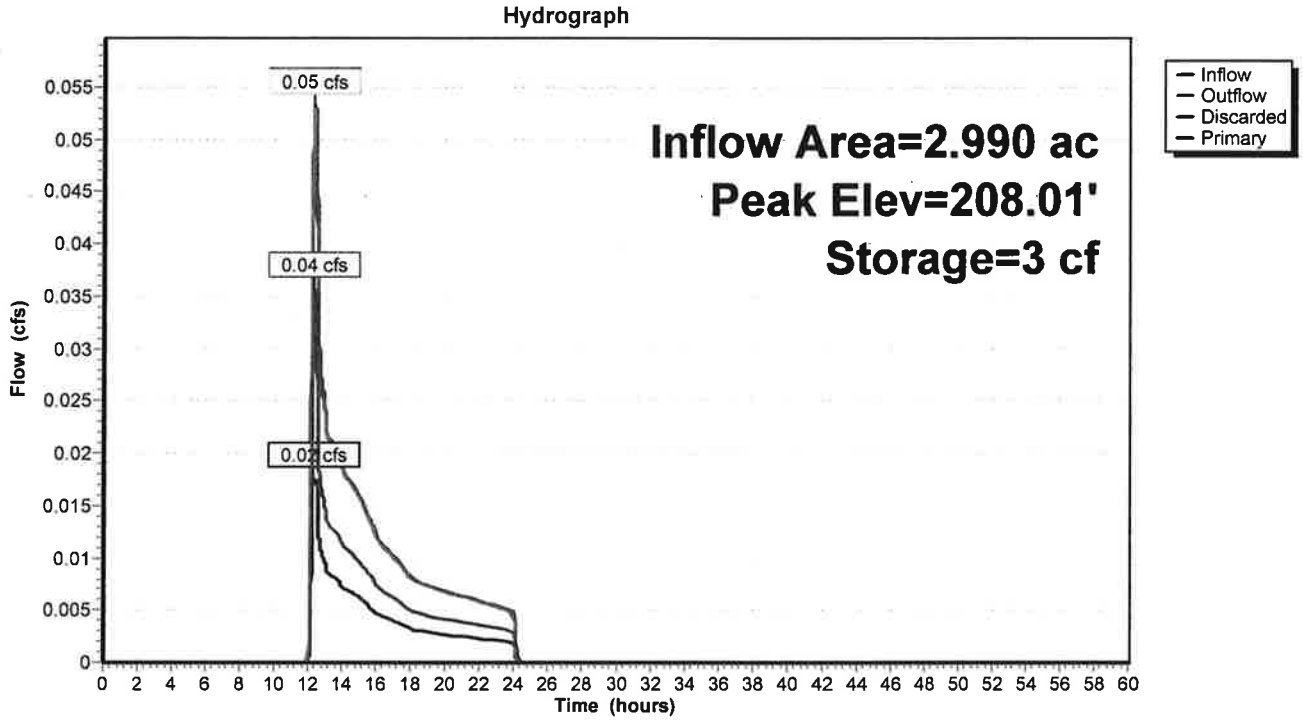
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
208.00	249	0	0
209.00	5,696	2,973	2,973

Device	Routing	Invert	Outlet Devices
#1	Primary	208.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Discarded	208.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.02 cfs @ 12.38 hrs HW=208.01' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.03 cfs @ 12.38 hrs HW=208.01' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 0.03 cfs @ 0.36 fps)

Pond 4P: existing depression with cb



POST-DEVELOPMENT CALCULATIONS
10-YEAR STORM - 4.60" RAINFALL

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Project site Runoff Area=88,222 sf 51.97% Impervious Runoff Depth=1.74"
Tc=6.0 min CN=70 Runoff=4.03 cfs 0.294 af

Subcatchment 2S: Portion of roof Runoff Area=14,660 sf 67.35% Impervious Runoff Depth=2.46"
Tc=6.0 min CN=79 Runoff=0.97 cfs 0.069 af

Subcatchment 3S: west abutter Runoff Area=9,615 sf 51.60% Impervious Runoff Depth=1.46"
Tc=6.0 min CN=66 Runoff=0.36 cfs 0.027 af

Subcatchment 4S: Railroad area Runoff Area=27,343 sf 0.00% Impervious Runoff Depth=0.73"
Tc=6.0 min CN=54 Runoff=0.38 cfs 0.038 af

Pond 1P: East Infiltration Basin Peak Elev=211.78' Storage=4,704 cf Inflow=4.03 cfs 0.294 af
Discarded=0.16 cfs 0.218 af Primary=1.08 cfs 0.076 af Outflow=1.24 cfs 0.294 af

Pond 2P: roof infiltration basin Peak Elev=224.39' Storage=1,508 cf Inflow=0.97 cfs 0.069 af
Discarded=0.07 cfs 0.069 af Primary=0.00 cfs 0.000 af Outflow=0.07 cfs 0.069 af

Pond 3P: (new Pond) Peak Elev=217.97' Storage=0.027 af Inflow=0.36 cfs 0.027 af
Outflow=0.00 cfs 0.000 af

Pond 4P: existing depression with cb Peak Elev=208.13' Storage=77 cf Inflow=1.26 cfs 0.115 af
Discarded=0.05 cfs 0.014 af Primary=1.20 cfs 0.101 af Outflow=1.25 cfs 0.115 af

Total Runoff Area = 3.210 ac Runoff Volume = 0.429 af Average Runoff Depth = 1.60"
56.61% Pervious = 1.817 ac 43.39% Impervious = 1.393 ac

Summary for Subcatchment 1S: Project site

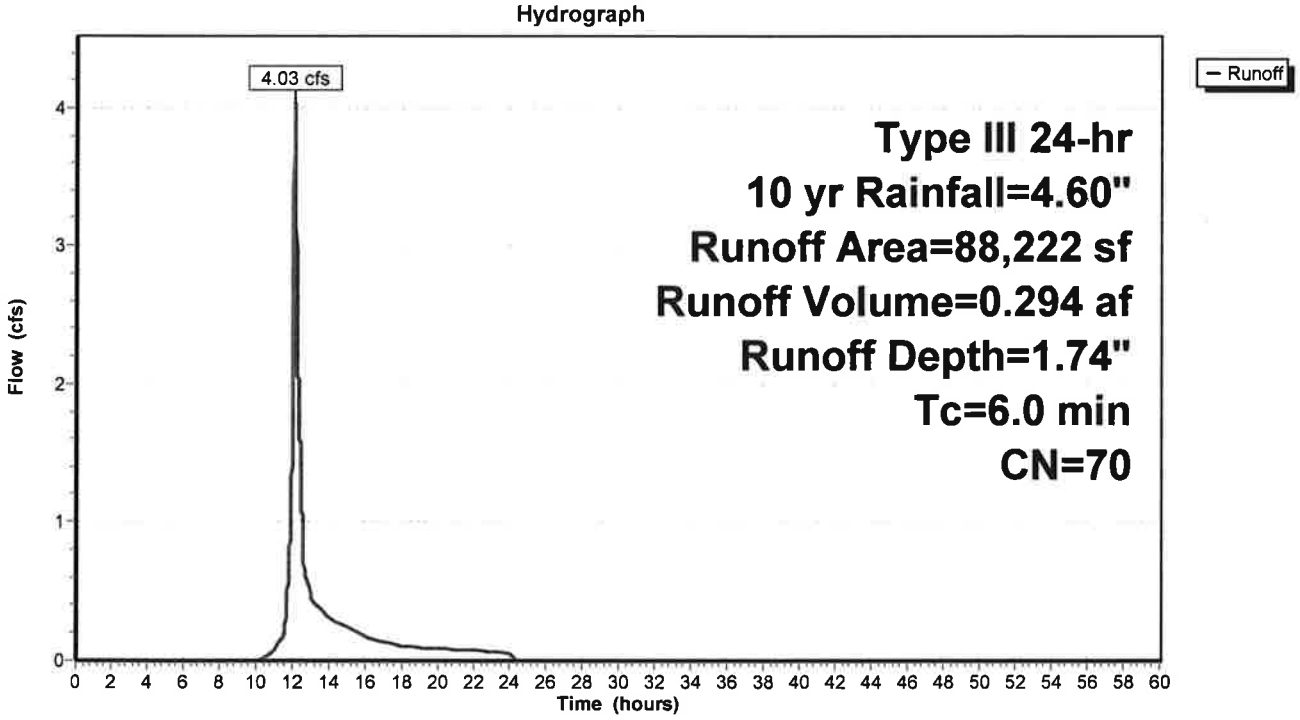
Runoff = 4.03 cfs @ 12.09 hrs, Volume= 0.294 af, Depth= 1.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=4.60"

	Area (sf)	CN	Description
*	19,326	98	Roofs
*	26,521	98	paved and sidewalk
	42,375	39	>75% Grass cover, Good, HSG A
	88,222	70	Weighted Average
	42,375		48.03% Pervious Area
	45,847		51.97% Impervious Area

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

Subcatchment 1S: Project site



Summary for Subcatchment 2S: Portion of roof

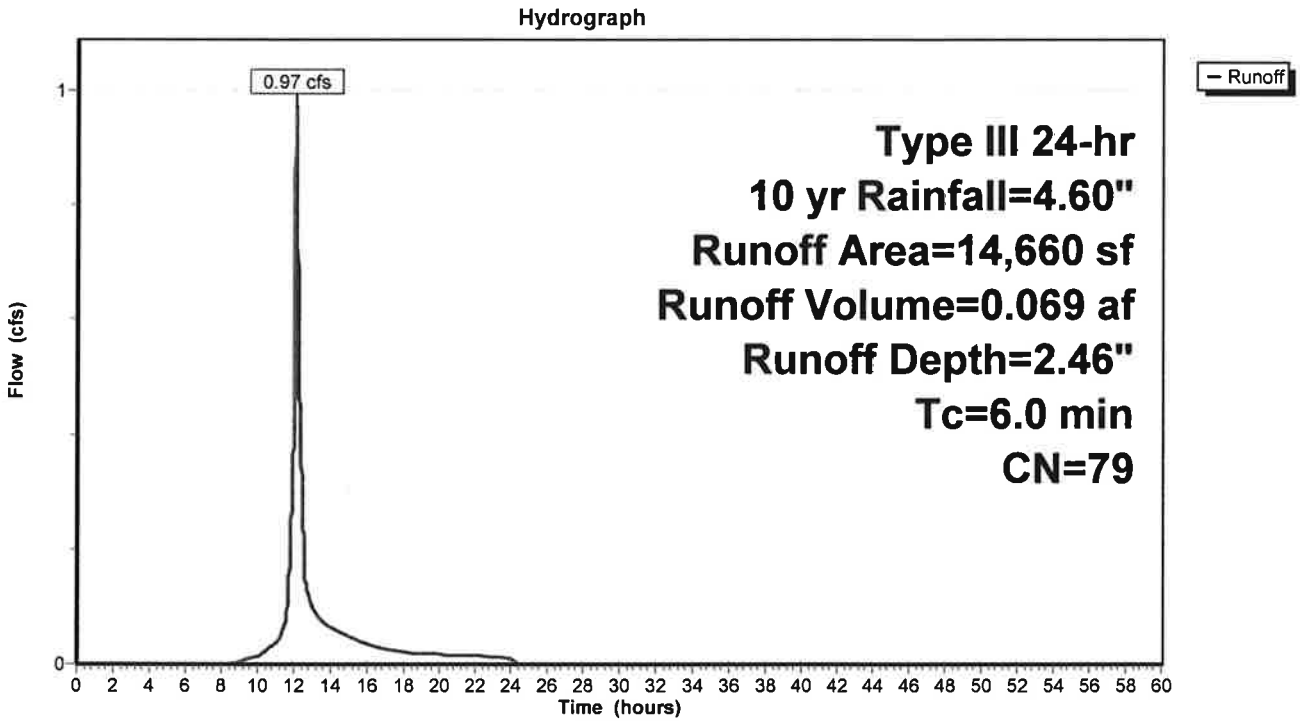
Runoff = 0.97 cfs @ 12.09 hrs, Volume= 0.069 af, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=4.60"

	Area (sf)	CN	Description
*	9,375	98	roof
*	498	98	bottom of basin
	4,787	39	>75% Grass cover, Good, HSG A
	14,660	79	Weighted Average
	4,787		32.65% Pervious Area
	9,873		67.35% Impervious Area

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

Subcatchment 2S: Portion of roof



Summary for Subcatchment 3S: west abutter

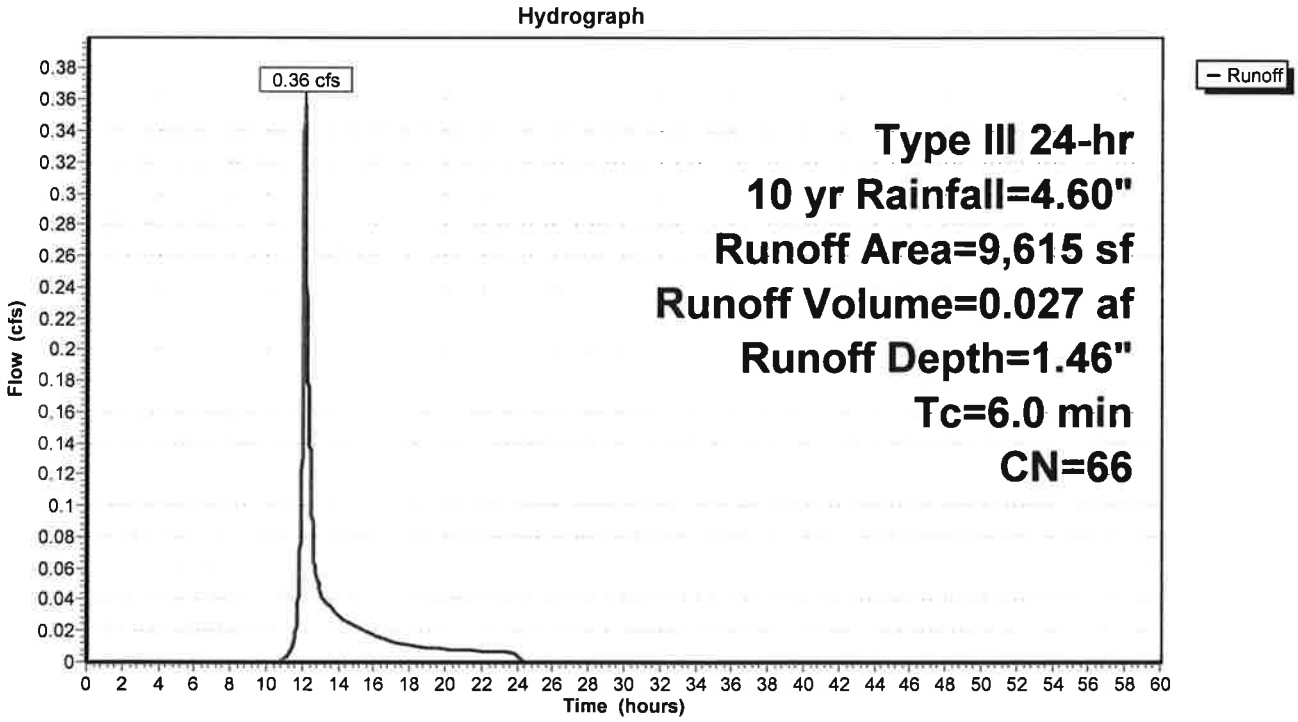
Runoff = 0.36 cfs @ 12.10 hrs, Volume= 0.027 af, Depth= 1.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=4.60"

	Area (sf)	CN	Description
*	4,961	98	paved
	750	39	>75% Grass cover, Good, HSG A
	3,904	30	Woods, Good, HSG A
	9,615	66	Weighted Average
	4,654		48.40% Pervious Area
	4,961		51.60% Impervious Area

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

Subcatchment 3S: west abutter



Summary for Subcatchment 4S: Railroad area

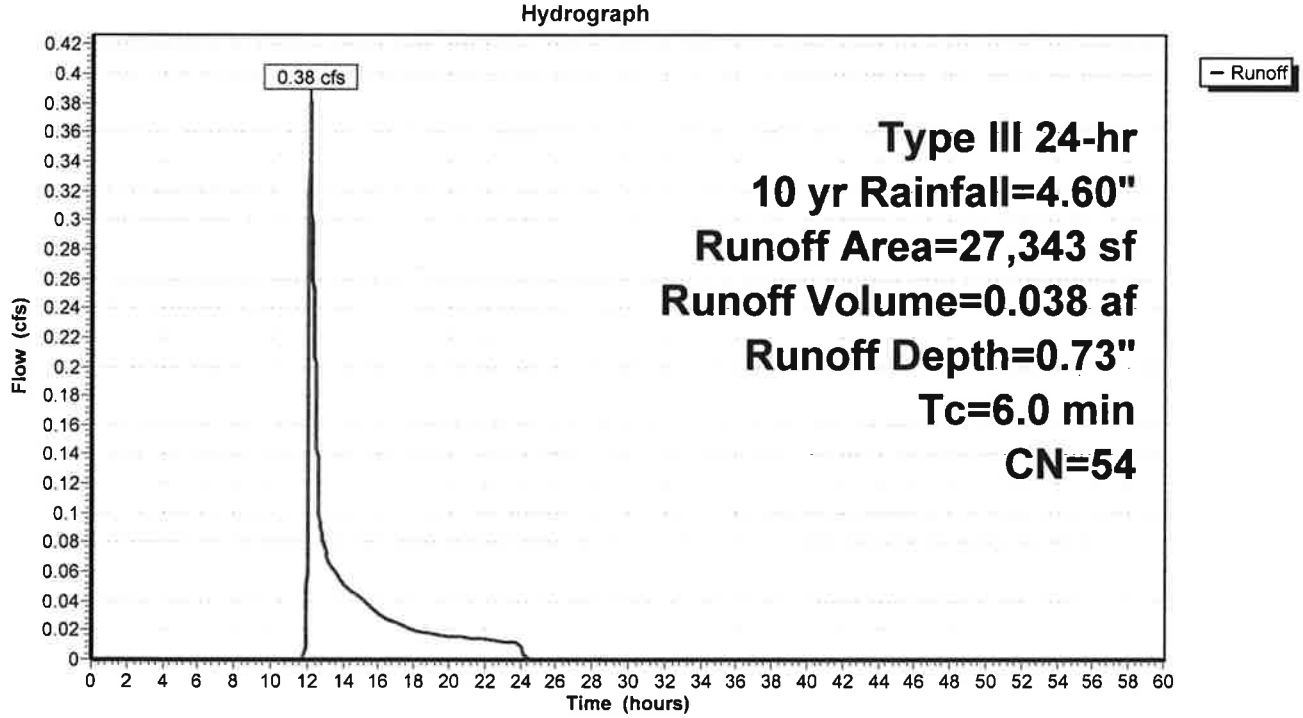
Runoff = 0.38 cfs @ 12.11 hrs, Volume= 0.038 af, Depth= 0.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=4.60"

	Area (sf)	CN	Description
	7,880	30	Woods, Good, HSG A
	5,145	39	>75% Grass cover, Good, HSG A
*	14,318	72	crushed stone railroad bed
	27,343	54	Weighted Average
	27,343		100.00% Pervious Area

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

Subcatchment 4S: Railroad area



Summary for Pond 1P: East Infiltration Basin

Inflow Area =	2.362 ac, 54.16% Impervious, Inflow Depth = 1.50" for 10 yr event				
Inflow =	4.03 cfs @	12.09 hrs,	Volume=	0.294 af	
Outflow =	1.24 cfs @	12.46 hrs,	Volume=	0.294 af,	Atten= 69%, Lag= 22.3 min
Discarded =	0.16 cfs @	12.46 hrs,	Volume=	0.218 af	
Primary =	1.08 cfs @	12.46 hrs,	Volume=	0.076 af	

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 211.78' @ 12.46 hrs Surf.Area= 2,884 sf Storage= 4,704 cf

Plug-Flow detention time= 263.3 min calculated for 0.294 af (100% of inflow)
Center-of-Mass det. time= 263.3 min (1,115.6 - 852.3)

Volume	Invert	Avail.Storage	Storage Description
#1	209.50'	8,874 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

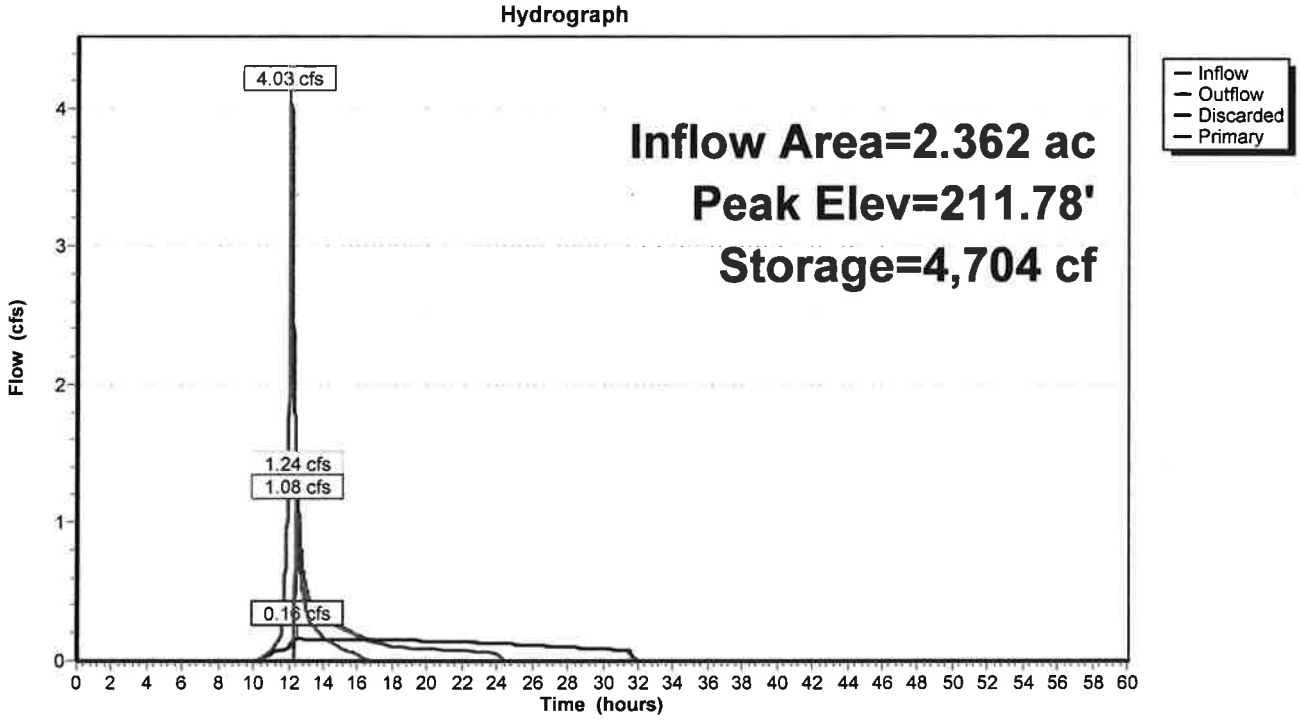
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
209.50	1,346	0	0
210.00	1,638	746	746
211.00	2,265	1,952	2,698
212.00	3,059	2,662	5,360
213.00	3,969	3,514	8,874

Device	Routing	Invert	Outlet Devices
#1	Discarded	209.50'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	211.60'	**6.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.16 cfs @ 12.46 hrs HW=211.78' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.16 cfs)

Primary OutFlow Max=1.08 cfs @ 12.46 hrs HW=211.78' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 1.08 cfs @ 1.00 fps)

Pond 1P: East Infiltration Basin



Summary for Pond 2P: roof infiltration basin

Inflow Area =	0.337 ac, 67.35% Impervious, Inflow Depth = 2.46" for 10 yr event				
Inflow =	0.97 cfs @	12.09 hrs,	Volume=	0.069 af	
Outflow =	0.07 cfs @	13.81 hrs,	Volume=	0.069 af,	Atten= 93%, Lag= 103.4 min
Discarded =	0.07 cfs @	13.81 hrs,	Volume=	0.069 af	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 224.39' @ 13.81 hrs Surf.Area= 1,231 sf Storage= 1,508 cf

Plug-Flow detention time= 284.7 min calculated for 0.069 af (100% of inflow)
Center-of-Mass det. time= 284.7 min (1,112.9 - 828.2)

Volume	Invert	Avail.Storage	Storage Description
#1	222.00'	4,684 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

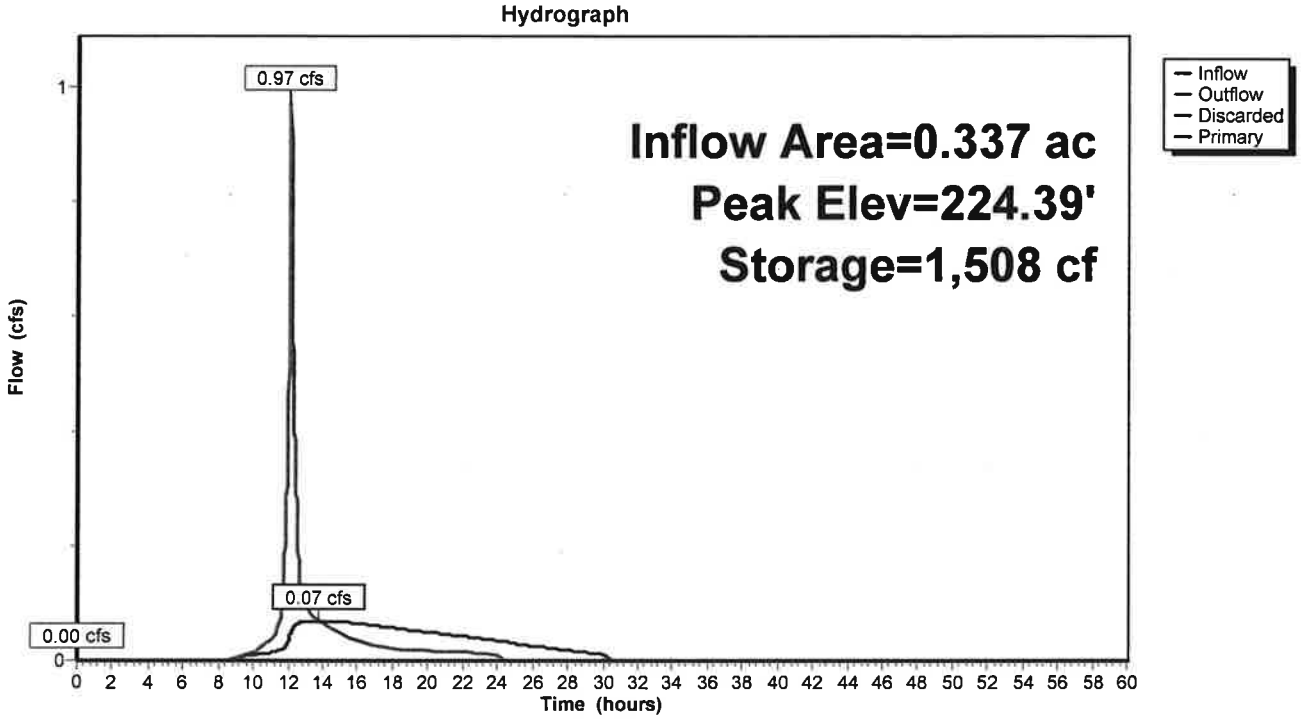
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
222.00	170	0	0
223.00	498	334	334
224.00	989	744	1,078
225.00	1,612	1,301	2,378
226.00	2,999	2,306	4,684

Device	Routing	Invert	Outlet Devices
#1	Discarded	222.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	225.00'	**12.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 225.00' / 224.00' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Discarded OutFlow Max=0.07 cfs @ 13.81 hrs HW=224.39' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=222.00' (Free Discharge)
└─**2=Culvert** (Controls 0.00 cfs)

Pond 2P: roof infiltration basin



Summary for Pond 3P: (new Pond)

Inflow Area = 0.221 ac, 51.60% Impervious, Inflow Depth = 1.46" for 10 yr event
Inflow = 0.36 cfs @ 12.10 hrs, Volume= 0.027 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

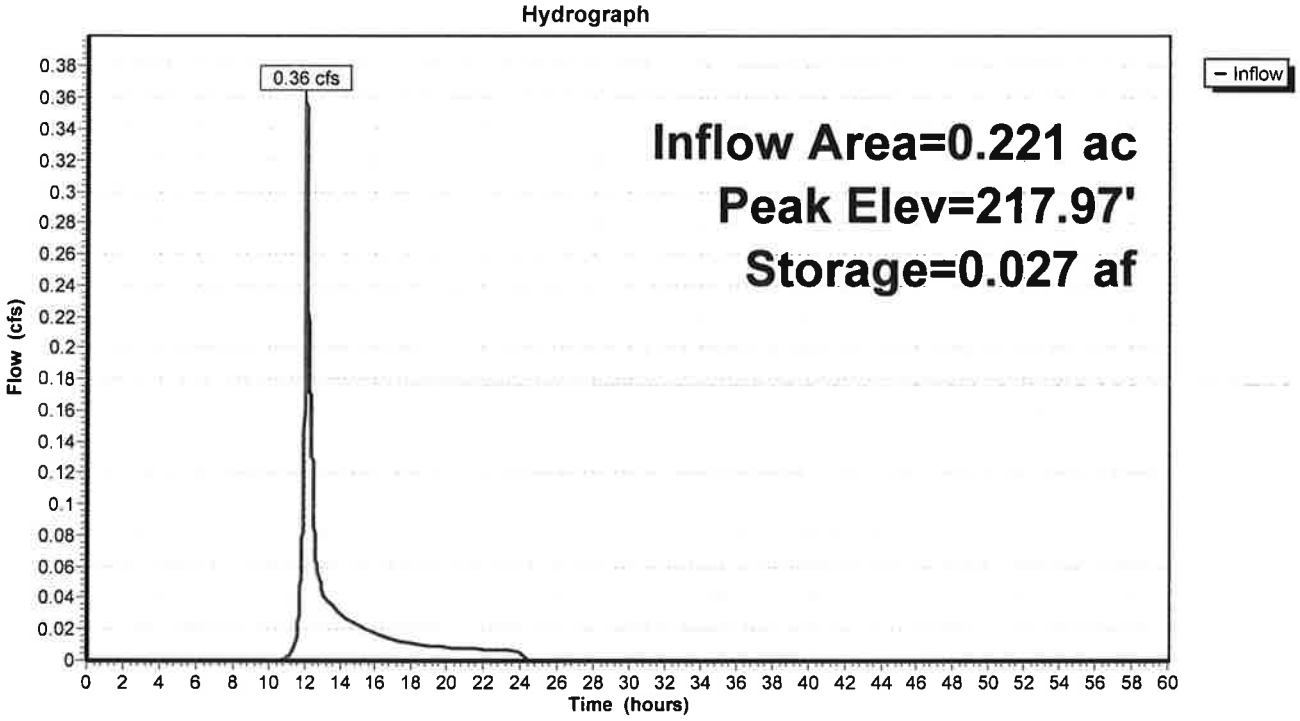
Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 217.97' @ 24.34 hrs Surf.Area= 0.027 ac Storage= 0.027 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1A	216.50'	0.023 af	**25.67'W x 45.50'L x 3.54'H Field A** 0.095 af Overall - 0.037 af Embedded = 0.058 af x 40.0% Voids
#2A	217.00'	0.037 af	**Cultec R-330XLHD** x 30 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 5 rows
		0.060 af	Total Available Storage

Storage Group A created with Chamber Wizard

Pond 3P: (new Pond)



Summary for Pond 4P: existing depression with cb

Inflow Area =	2.990 ac, 42.79% Impervious, Inflow Depth = 0.46" for 10 yr event				
Inflow =	1.26 cfs @	12.45 hrs,	Volume=	0.115 af	
Outflow =	1.25 cfs @	12.47 hrs,	Volume=	0.115 af,	Atten= 1%, Lag= 1.2 min
Discarded =	0.05 cfs @	12.47 hrs,	Volume=	0.014 af	
Primary =	1.20 cfs @	12.47 hrs,	Volume=	0.101 af	

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 208.13' @ 12.47 hrs Surf.Area= 947 sf Storage= 77 cf

Plug-Flow detention time= 1.0 min calculated for 0.115 af (100% of inflow)
Center-of-Mass det. time= 1.0 min (836.7 - 835.7)

Volume	Invert	Avail.Storage	Storage Description
#1	208.00'	2,973 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

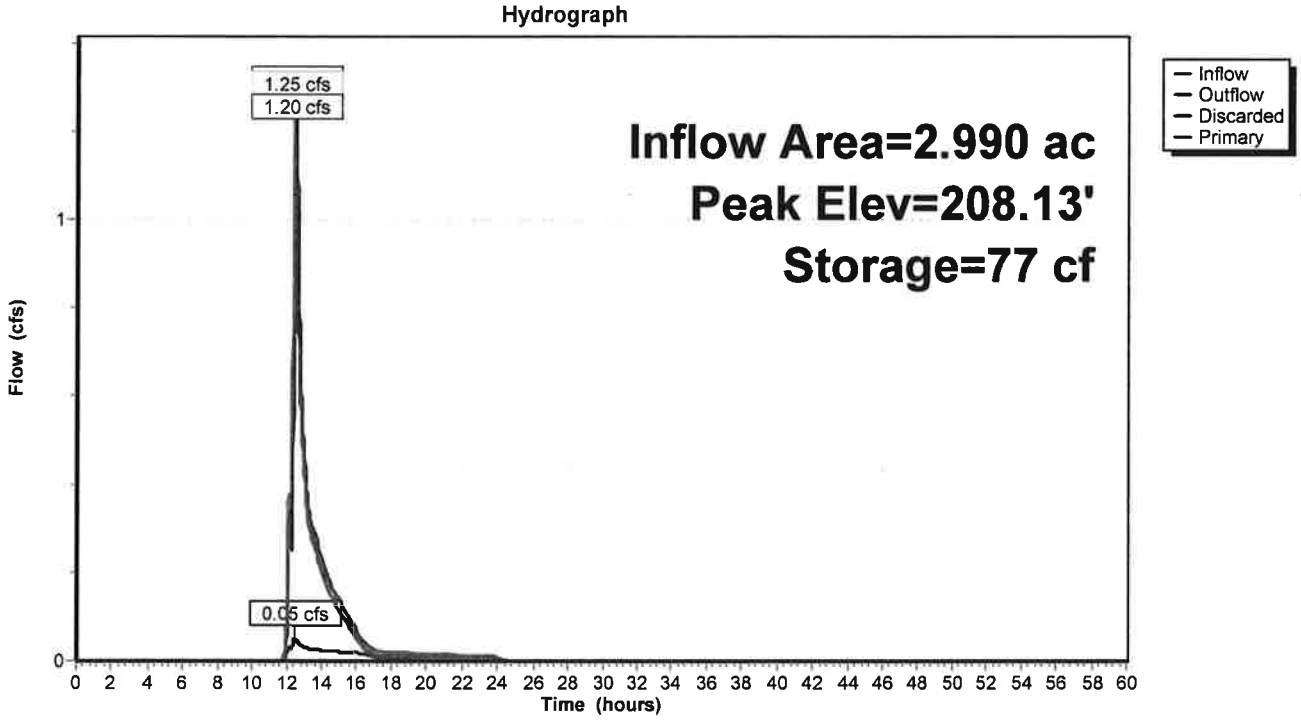
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
208.00	249	0	0
209.00	5,696	2,973	2,973

Device	Routing	Invert	Outlet Devices
#1	Primary	208.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Discarded	208.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.05 cfs @ 12.47 hrs HW=208.13' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=1.20 cfs @ 12.47 hrs HW=208.13' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 1.20 cfs @ 1.17 fps)

Pond 4P: existing depression with cb



POST-DEVELOPMENT CALCULATIONS
25-YEAR STORM – 5.50" RAINFALL

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Project site Runoff Area=88,222 sf 51.97% Impervious Runoff Depth=2.41"
Tc=6.0 min CN=70 Runoff=5.68 cfs 0.407 af

Subcatchment 2S: Portion of roof Runoff Area=14,660 sf 67.35% Impervious Runoff Depth=3.24"
Tc=6.0 min CN=79 Runoff=1.28 cfs 0.091 af

Subcatchment 3S: west abutter Runoff Area=9,615 sf 51.60% Impervious Runoff Depth=2.08"
Tc=6.0 min CN=66 Runoff=0.52 cfs 0.038 af

Subcatchment 4S: Railroad area Runoff Area=27,343 sf 0.00% Impervious Runoff Depth=1.17"
Tc=6.0 min CN=54 Runoff=0.72 cfs 0.061 af

Pond 1P: East Infiltration Basin Peak Elev=211.93' Storage=5,137 cf Inflow=5.68 cfs 0.407 af
Discarded=0.17 cfs 0.238 af Primary=2.76 cfs 0.169 af Outflow=2.93 cfs 0.407 af

Pond 2P: roof infiltration basin Peak Elev=224.80' Storage=2,073 cf Inflow=1.28 cfs 0.091 af
Discarded=0.08 cfs 0.091 af Primary=0.00 cfs 0.000 af Outflow=0.08 cfs 0.091 af

Pond 3P: (new Pond) Peak Elev=218.51' Storage=0.038 af Inflow=0.52 cfs 0.038 af
Outflow=0.00 cfs 0.000 af

Pond 4P: existing depression with cb Peak Elev=208.24' Storage=217 cf Inflow=3.21 cfs 0.231 af
Discarded=0.09 cfs 0.019 af Primary=3.08 cfs 0.211 af Outflow=3.16 cfs 0.231 af

Total Runoff Area = 3.210 ac Runoff Volume = 0.598 af Average Runoff Depth = 2.23"
56.61% Pervious = 1.817 ac 43.39% Impervious = 1.393 ac

Summary for Subcatchment 1S: Project site

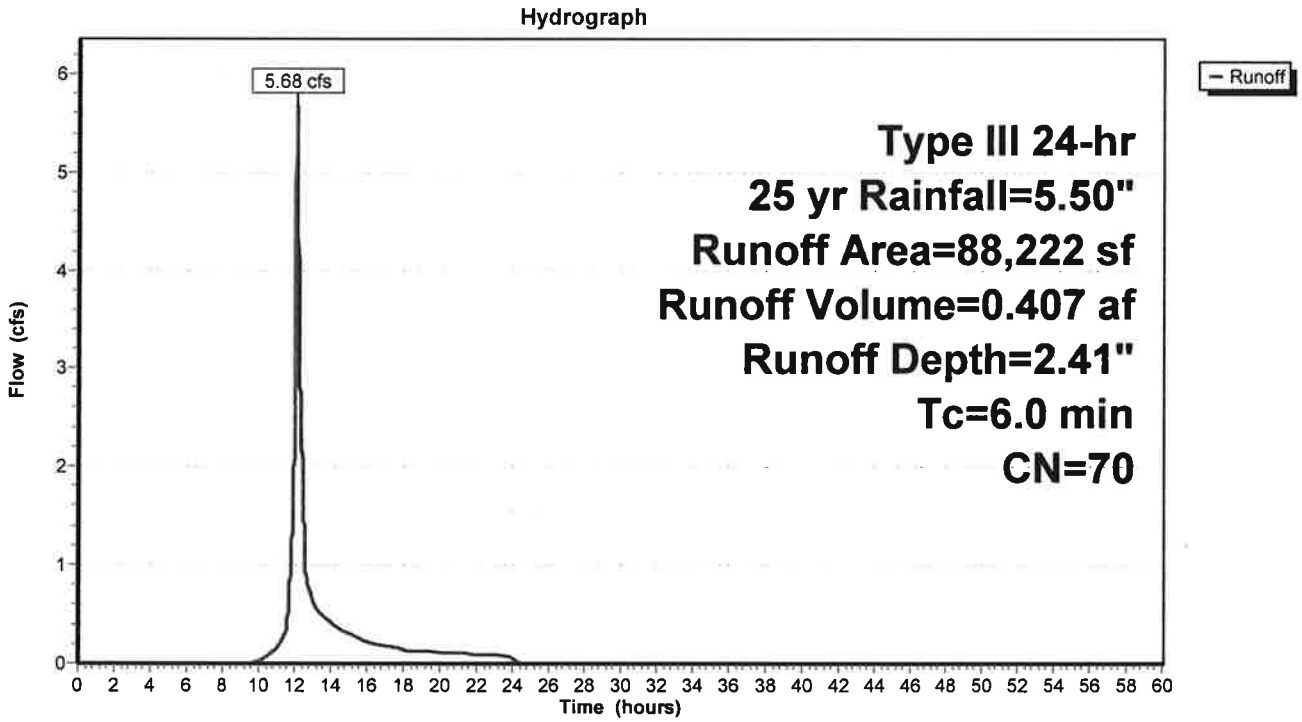
Runoff = 5.68 cfs @ 12.09 hrs, Volume= 0.407 af, Depth= 2.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr Rainfall=5.50"

	Area (sf)	CN	Description
*	19,326	98	Roofs
*	26,521	98	paved and sidewalk
	42,375	39	>75% Grass cover, Good, HSG A
	88,222	70	Weighted Average
	42,375		48.03% Pervious Area
	45,847		51.97% Impervious Area

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

Subcatchment 1S: Project site



Summary for Subcatchment 2S: Portion of roof

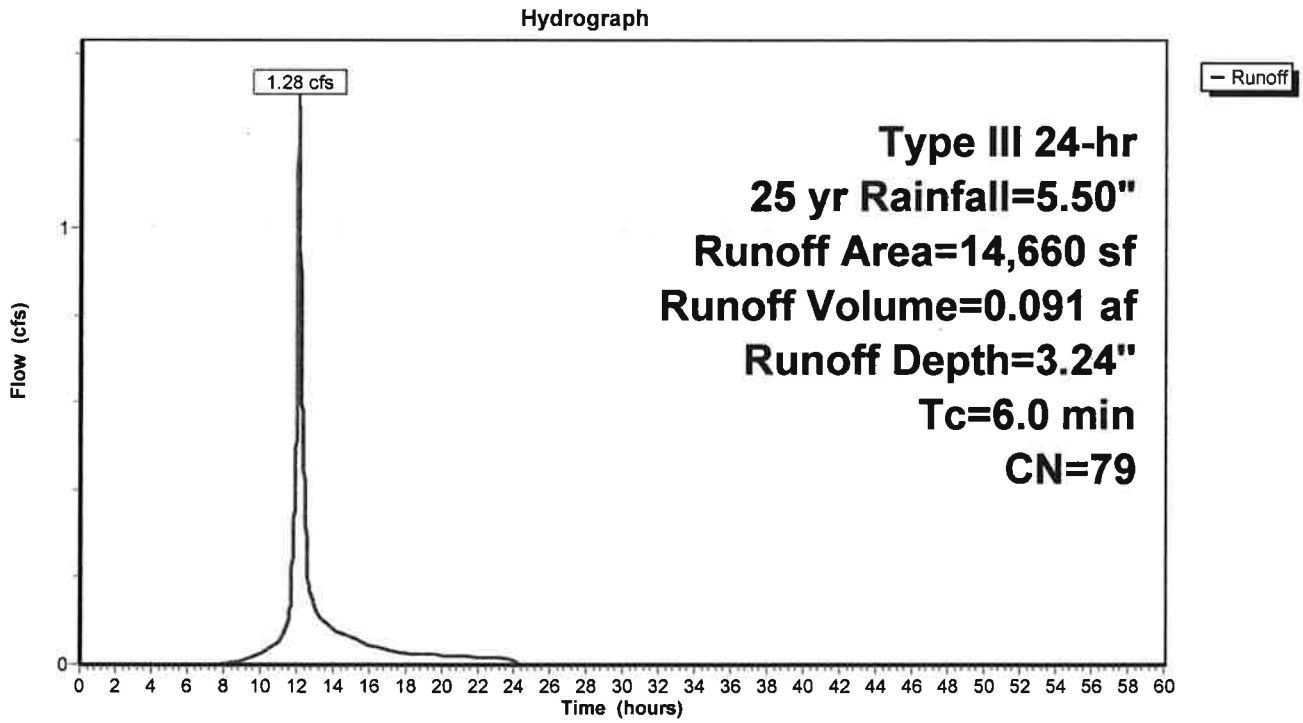
Runoff = 1.28 cfs @ 12.09 hrs, Volume= 0.091 af, Depth= 3.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr Rainfall=5.50"

	Area (sf)	CN	Description
*	9,375	98	roof
*	498	98	bottom of basin
	4,787	39	>75% Grass cover, Good, HSG A
	14,660	79	Weighted Average
	4,787		32.65% Pervious Area
	9,873		67.35% Impervious Area

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

Subcatchment 2S: Portion of roof



Summary for Subcatchment 3S: west abutter

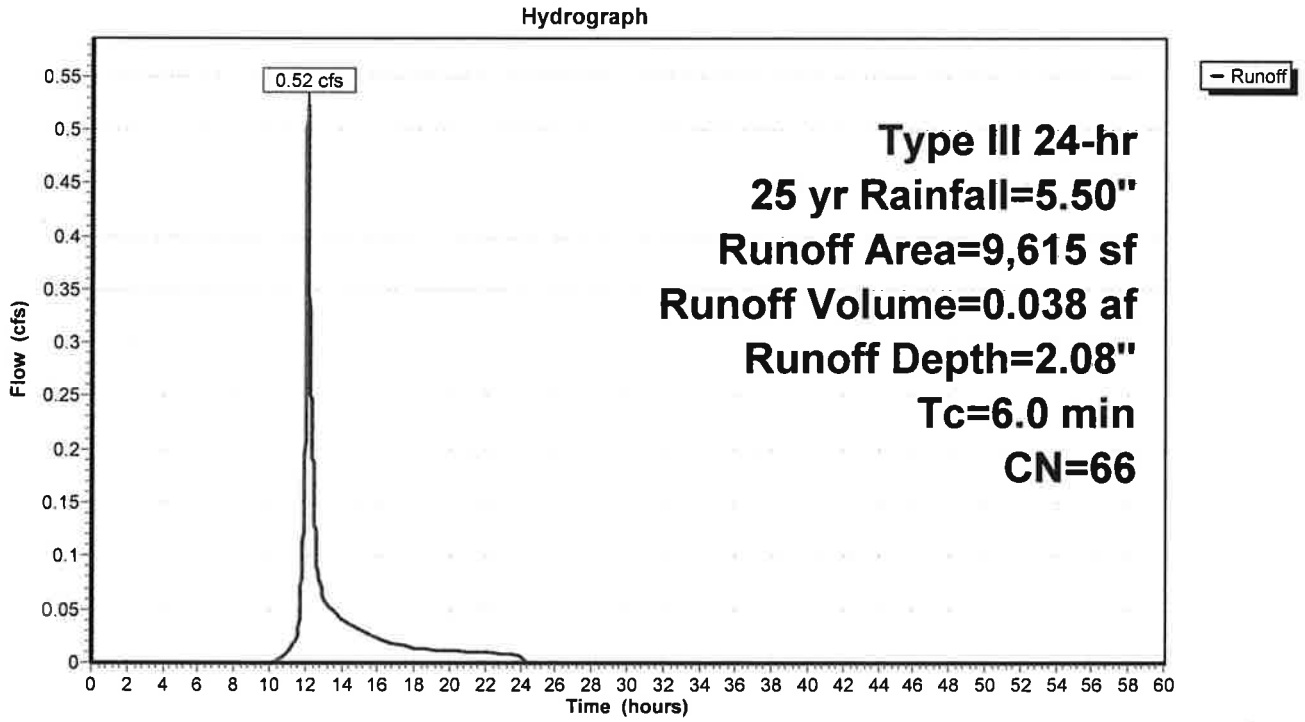
Runoff = 0.52 cfs @ 12.09 hrs, Volume= 0.038 af, Depth= 2.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr Rainfall=5.50"

	Area (sf)	CN	Description
*	4,961	98	paved
	750	39	>75% Grass cover, Good, HSG A
	3,904	30	Woods, Good, HSG A
	9,615	66	Weighted Average
	4,654		48.40% Pervious Area
	4,961		51.60% Impervious Area

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

Subcatchment 3S: west abutter



Summary for Subcatchment 4S: Railroad area

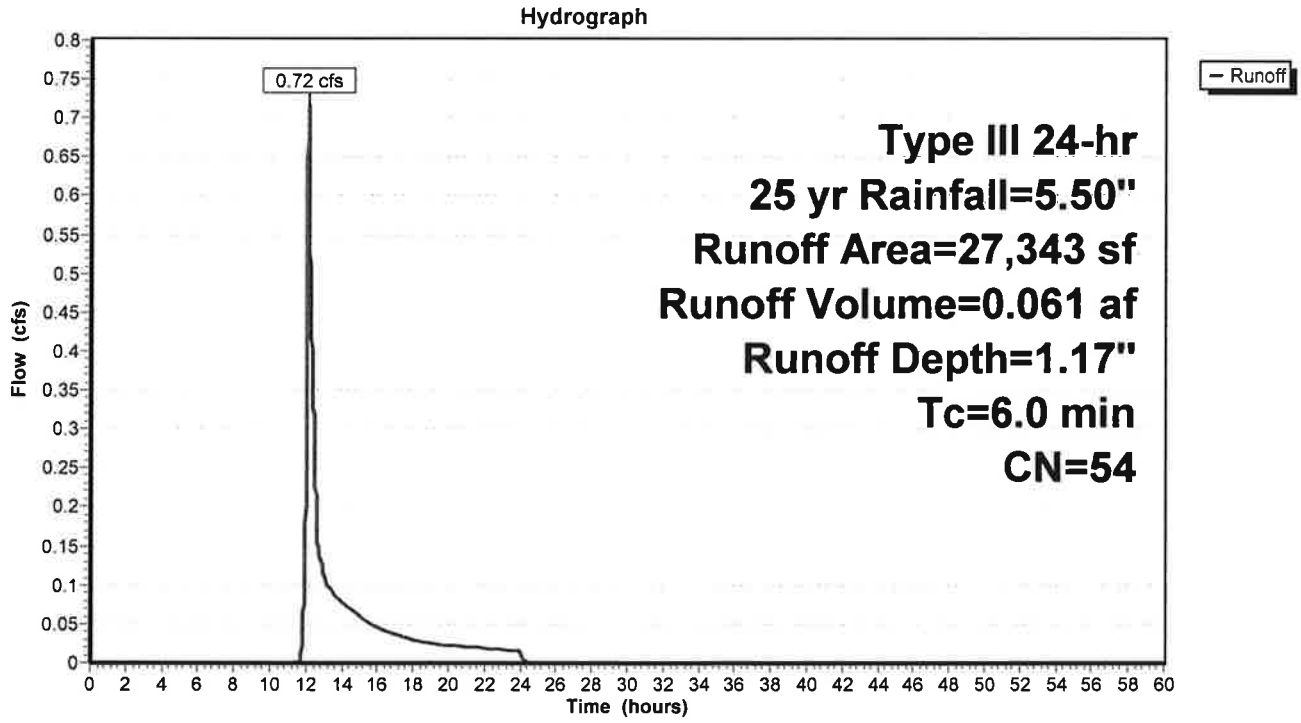
Runoff = 0.72 cfs @ 12.10 hrs, Volume= 0.061 af, Depth= 1.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr Rainfall=5.50"

	Area (sf)	CN	Description
	7,880	30	Woods, Good, HSG A
	5,145	39	>75% Grass cover, Good, HSG A
*	14,318	72	crushed stone railroad bed
	27,343	54	Weighted Average
	27,343		100.00% Pervious Area

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

Subcatchment 4S: Railroad area



Summary for Pond 1P: East Infiltration Basin

Inflow Area =	2.362 ac, 54.16% Impervious, Inflow Depth = 2.07" for 25 yr event				
Inflow =	5.68 cfs @	12.09 hrs, Volume=	0.407 af		
Outflow =	2.93 cfs @	12.25 hrs, Volume=	0.407 af, Atten= 48%, Lag= 9.8 min		
Discarded =	0.17 cfs @	12.25 hrs, Volume=	0.238 af		
Primary =	2.76 cfs @	12.25 hrs, Volume=	0.169 af		

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 211.93' @ 12.25 hrs Surf.Area= 3,001 sf Storage= 5,137 cf

Plug-Flow detention time= 211.6 min calculated for 0.407 af (100% of inflow)
Center-of-Mass det. time= 211.7 min (1,054.3 - 842.6)

Volume	Invert	Avail.Storage	Storage Description
#1	209.50'	8,874 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

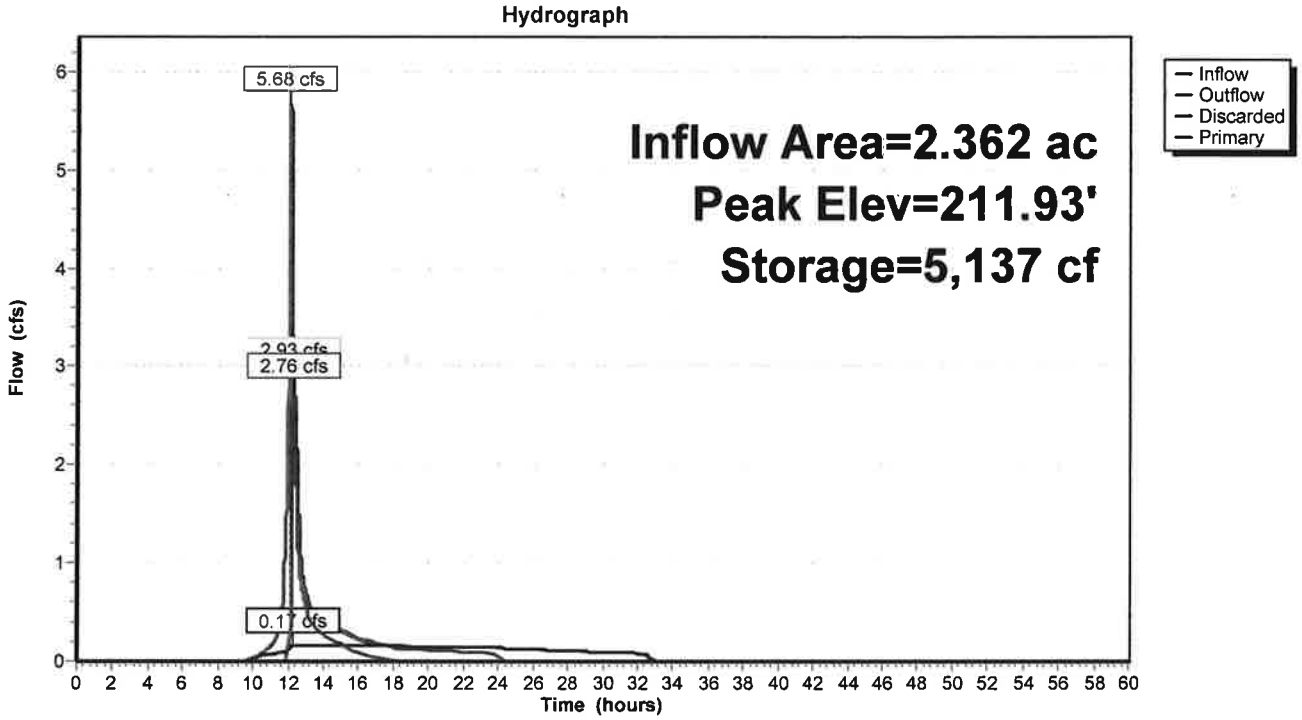
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
209.50	1,346	0	0
210.00	1,638	746	746
211.00	2,265	1,952	2,698
212.00	3,059	2,662	5,360
213.00	3,969	3,514	8,874

Device	Routing	Invert	Outlet Devices
#1	Discarded	209.50'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	211.60'	**6.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.17 cfs @ 12.25 hrs HW=211.93' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=2.75 cfs @ 12.25 hrs HW=211.93' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 2.75 cfs @ 1.41 fps)

Pond 1P: East Infiltration Basin



Summary for Pond 2P: roof infiltration basin

Inflow Area =	0.337 ac, 67.35% Impervious, Inflow Depth = 3.24" for 25 yr event				
Inflow =	1.28 cfs @	12.09 hrs, Volume=	0.091 af		
Outflow =	0.08 cfs @	13.91 hrs, Volume=	0.091 af, Atten= 93%, Lag= 109.4 min		
Discarded =	0.08 cfs @	13.91 hrs, Volume=	0.091 af		
Primary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af		

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 224.80' @ 13.91 hrs Surf.Area= 1,490 sf Storage= 2,073 cf

Plug-Flow detention time= 323.3 min calculated for 0.091 af (100% of inflow)
Center-of-Mass det. time= 323.4 min (1,143.7 - 820.3)

Volume	Invert	Avail.Storage	Storage Description
#1	222.00'	4,684 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

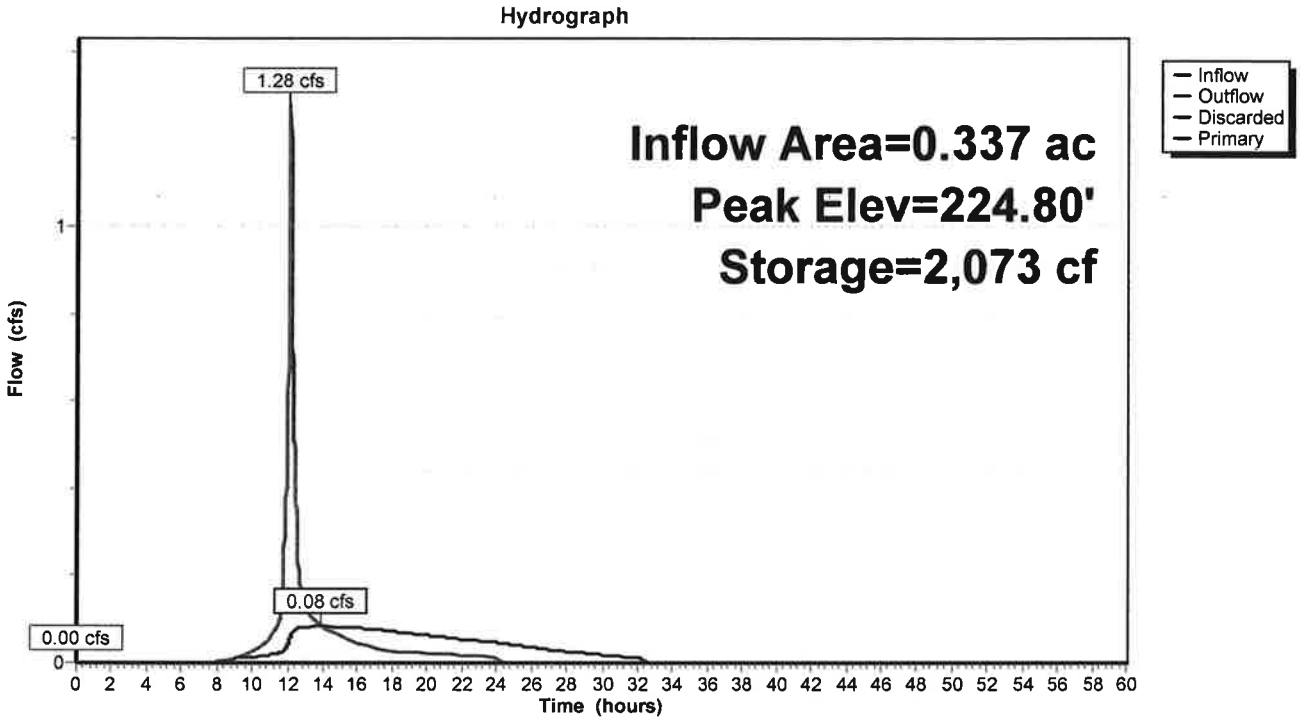
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
222.00	170	0	0
223.00	498	334	334
224.00	989	744	1,078
225.00	1,612	1,301	2,378
226.00	2,999	2,306	4,684

Device	Routing	Invert	Outlet Devices
#1	Discarded	222.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	225.00'	**12.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 225.00' / 224.00' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Discarded OutFlow Max=0.08 cfs @ 13.91 hrs HW=224.80' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=222.00' (Free Discharge)
└─**2=Culvert** (Controls 0.00 cfs)

Pond 2P: roof infiltration basin



Summary for Pond 3P: (new Pond)

Inflow Area = 0.221 ac, 51.60% Impervious, Inflow Depth = 2.08" for 25 yr event
Inflow = 0.52 cfs @ 12.09 hrs, Volume= 0.038 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

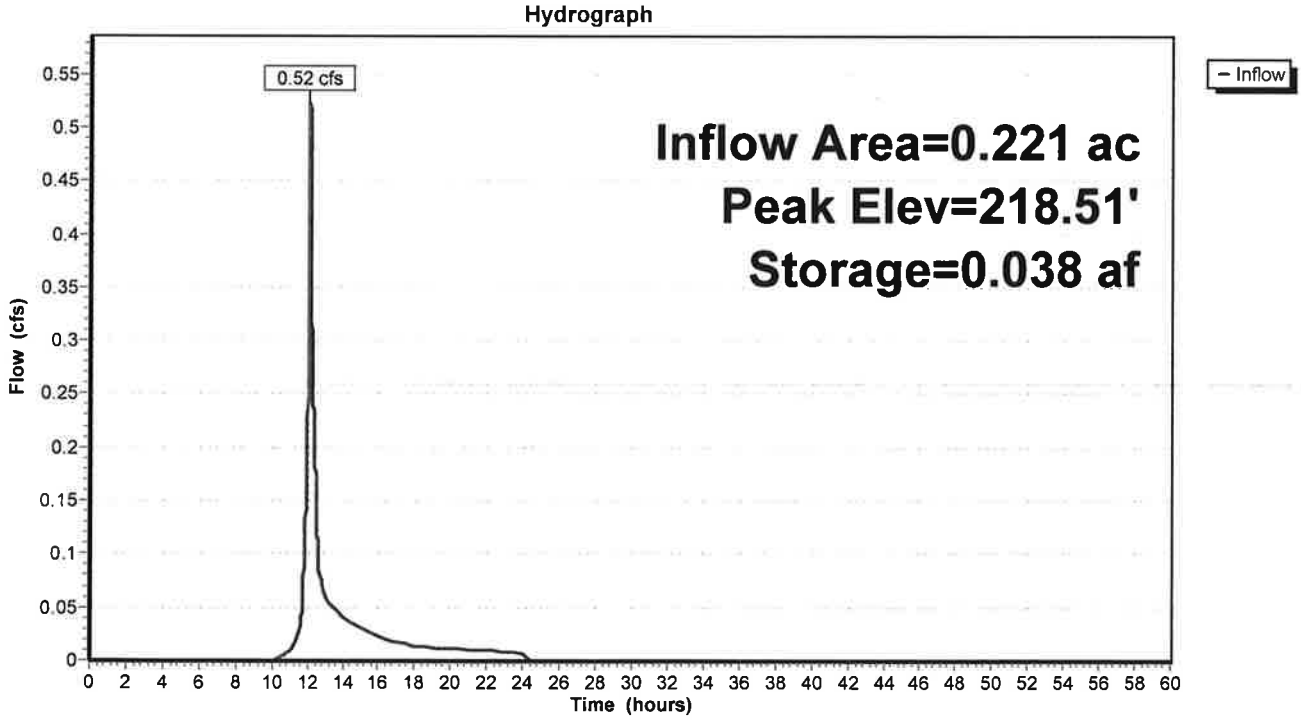
Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 218.51' @ 24.34 hrs Surf.Area= 0.027 ac Storage= 0.038 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1A	216.50'	0.023 af	**25.67'W x 45.50'L x 3.54'H Field A** 0.095 af Overall - 0.037 af Embedded = 0.058 af x 40.0% Voids
#2A	217.00'	0.037 af	**Cultec R-330XLHD** x 30 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 5 rows
		0.060 af	Total Available Storage

Storage Group A created with Chamber Wizard

Pond 3P: (new Pond)



Summary for Pond 4P: existing depression with cb

Inflow Area =	2.990 ac, 42.79% Impervious, Inflow Depth = 0.93" for 25 yr event				
Inflow =	3.21 cfs @	12.25 hrs,	Volume=	0.231 af	
Outflow =	3.16 cfs @	12.28 hrs,	Volume=	0.231 af,	Atten= 1%, Lag= 1.6 min
Discarded =	0.09 cfs @	12.28 hrs,	Volume=	0.019 af	
Primary =	3.08 cfs @	12.28 hrs,	Volume=	0.211 af	

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 208.24' @ 12.28 hrs Surf.Area= 1,557 sf Storage= 217 cf

Plug-Flow detention time= 1.0 min calculated for 0.231 af (100% of inflow)
Center-of-Mass det. time= 1.0 min (817.6 - 816.5)

Volume	Invert	Avail.Storage	Storage Description
#1	208.00'	2,973 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

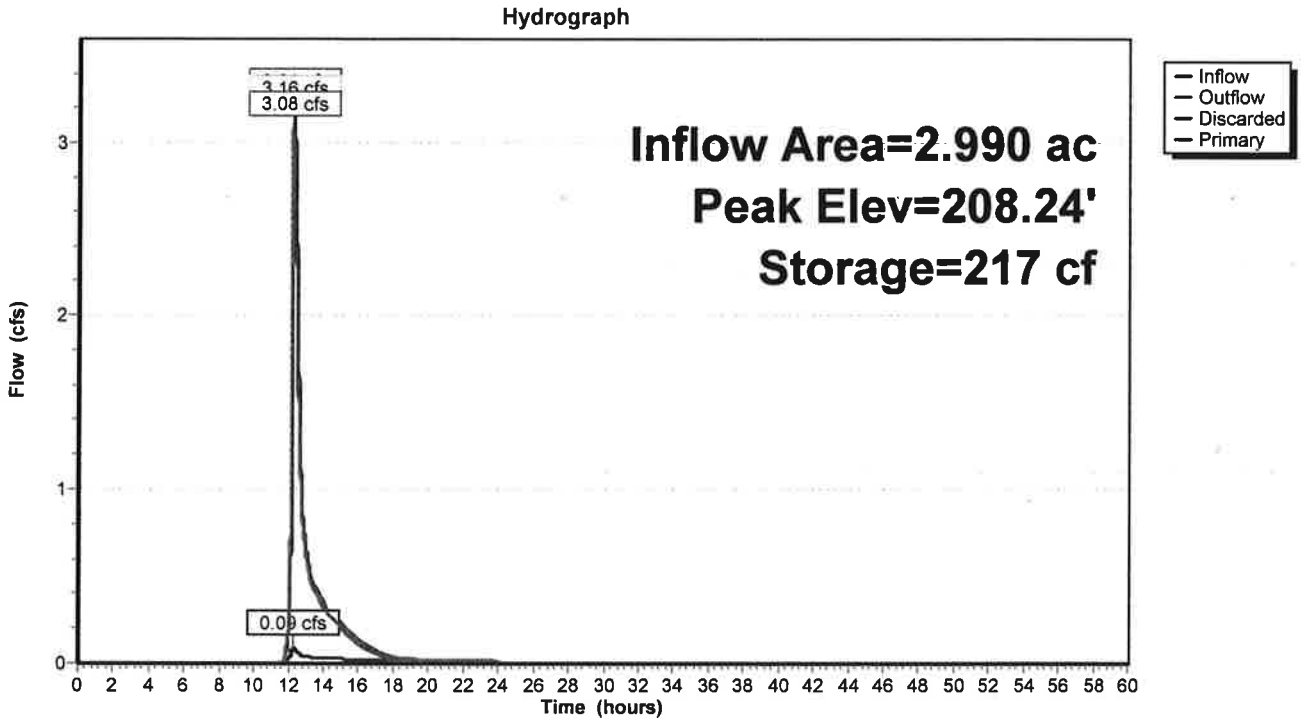
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
208.00	249	0	0
209.00	5,696	2,973	2,973

Device	Routing	Invert	Outlet Devices
#1	Primary	208.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Discarded	208.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.09 cfs @ 12.28 hrs HW=208.24' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=3.08 cfs @ 12.28 hrs HW=208.24' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 3.08 cfs @ 1.60 fps)

Pond 4P: existing depression with cb



POST-DEVELOPMENT CALCULATIONS
50-YEAR STORM – 6.10" RAINFALL

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Project site Runoff Area=88,222 sf 51.97% Impervious Runoff Depth=2.88"
Tc=6.0 min CN=70 Runoff=6.82 cfs 0.487 af

Subcatchment 2S: Portion of roof Runoff Area=14,660 sf 67.35% Impervious Runoff Depth=3.77"
Tc=6.0 min CN=79 Runoff=1.48 cfs 0.106 af

Subcatchment 3S: west abutter Runoff Area=9,615 sf 51.60% Impervious Runoff Depth=2.51"
Tc=6.0 min CN=66 Runoff=0.64 cfs 0.046 af

Subcatchment 4S: Railroad area Runoff Area=27,343 sf 0.00% Impervious Runoff Depth=1.50"
Tc=6.0 min CN=54 Runoff=0.97 cfs 0.078 af

Pond 1P: East Infiltration Basin Peak Elev=212.04' Storage=5,475 cf Inflow=6.82 cfs 0.488 af
Discarded=0.17 cfs 0.250 af Primary=4.43 cfs 0.238 af Outflow=4.60 cfs 0.488 af

Pond 2P: roof infiltration basin Peak Elev=225.04' Storage=2,451 cf Inflow=1.48 cfs 0.106 af
Discarded=0.09 cfs 0.105 af Primary=0.01 cfs 0.001 af Outflow=0.10 cfs 0.106 af

Pond 3P: (new Pond) Peak Elev=218.94' Storage=0.046 af Inflow=0.64 cfs 0.046 af
Outflow=0.00 cfs 0.000 af

Pond 4P: existing depression with cb Peak Elev=208.33' Storage=370 cf Inflow=5.16 cfs 0.316 af
Discarded=0.11 cfs 0.023 af Primary=4.86 cfs 0.294 af Outflow=4.98 cfs 0.316 af

Total Runoff Area = 3.210 ac Runoff Volume = 0.717 af Average Runoff Depth = 2.68"
56.61% Pervious = 1.817 ac 43.39% Impervious = 1.393 ac

Summary for Subcatchment 1S: Project site

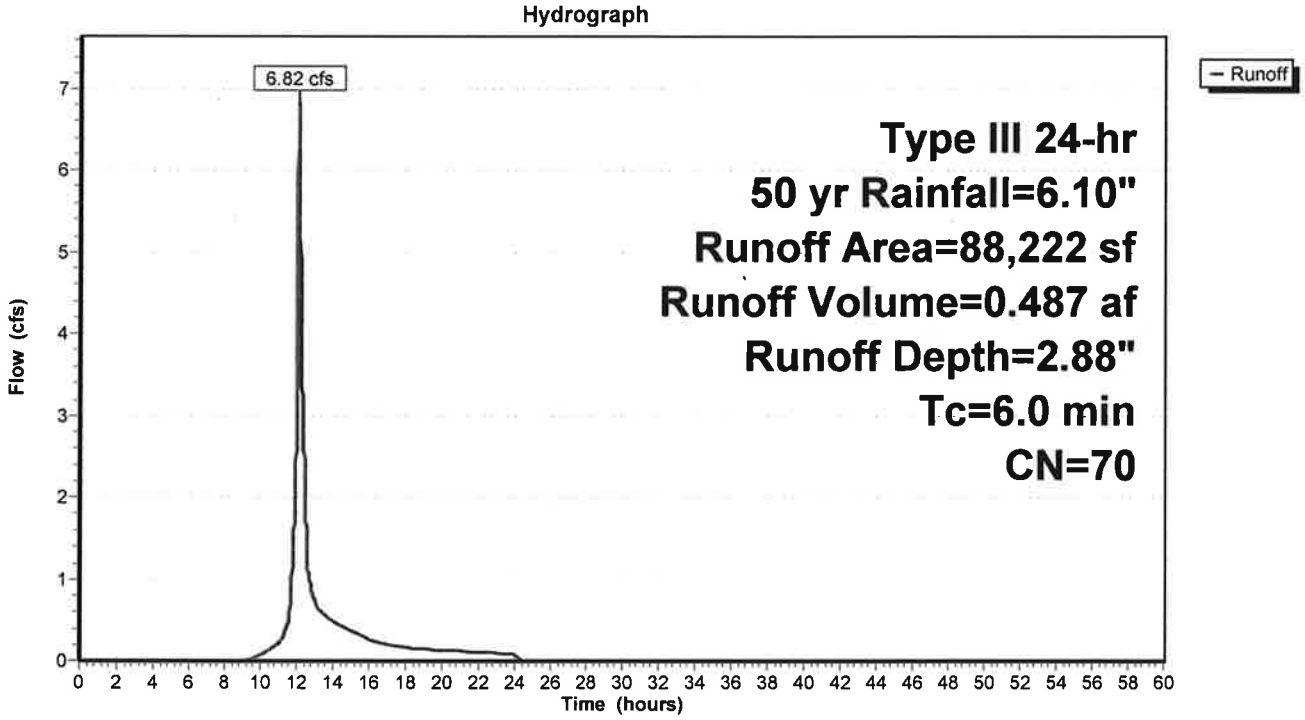
Runoff = 6.82 cfs @ 12.09 hrs, Volume= 0.487 af, Depth= 2.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 50 yr Rainfall=6.10"

	Area (sf)	CN	Description
*	19,326	98	Roofs
*	26,521	98	paved and sidewalk
	42,375	39	>75% Grass cover, Good, HSG A
	88,222	70	Weighted Average
	42,375		48.03% Pervious Area
	45,847		51.97% Impervious Area

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

Subcatchment 1S: Project site



Summary for Subcatchment 2S: Portion of roof

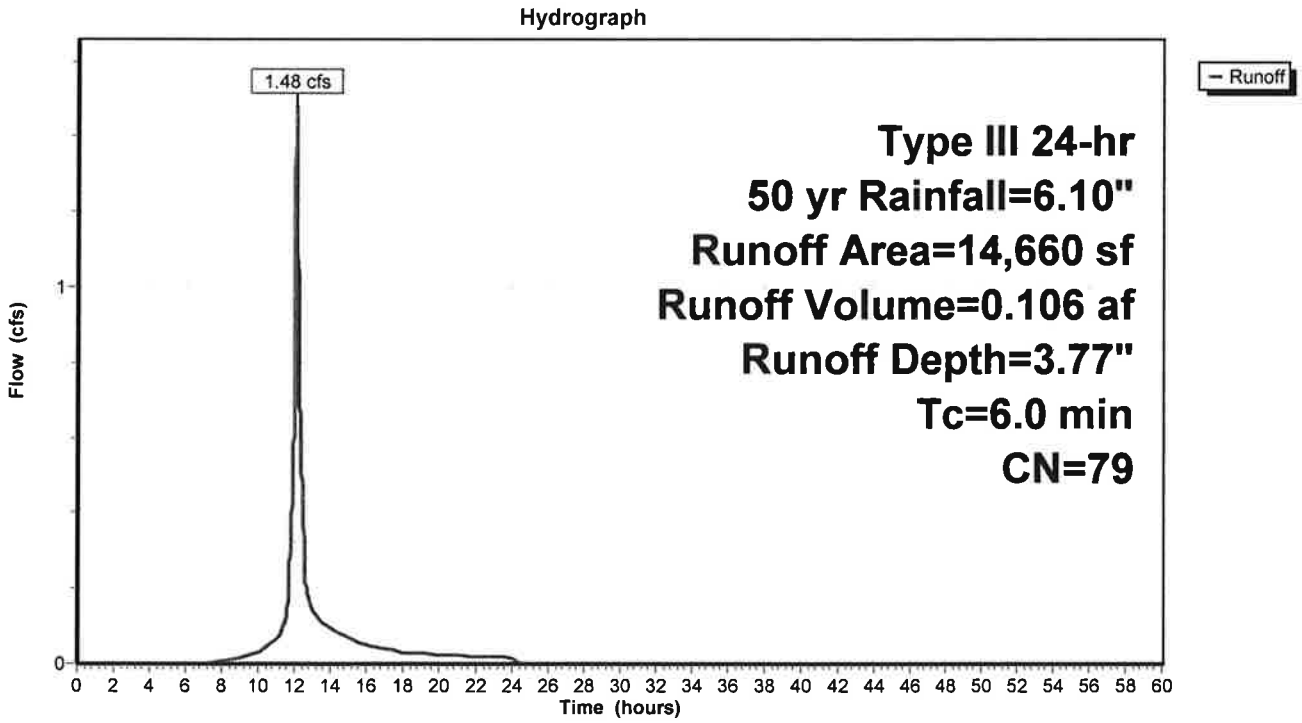
Runoff = 1.48 cfs @ 12.09 hrs, Volume= 0.106 af, Depth= 3.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 50 yr Rainfall=6.10"

	Area (sf)	CN	Description
*	9,375	98	roof
*	498	98	bottom of basin
	4,787	39	>75% Grass cover, Good, HSG A
	14,660	79	Weighted Average
	4,787		32.65% Pervious Area
	9,873		67.35% Impervious Area

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

Subcatchment 2S: Portion of roof



Summary for Subcatchment 3S: west abutter

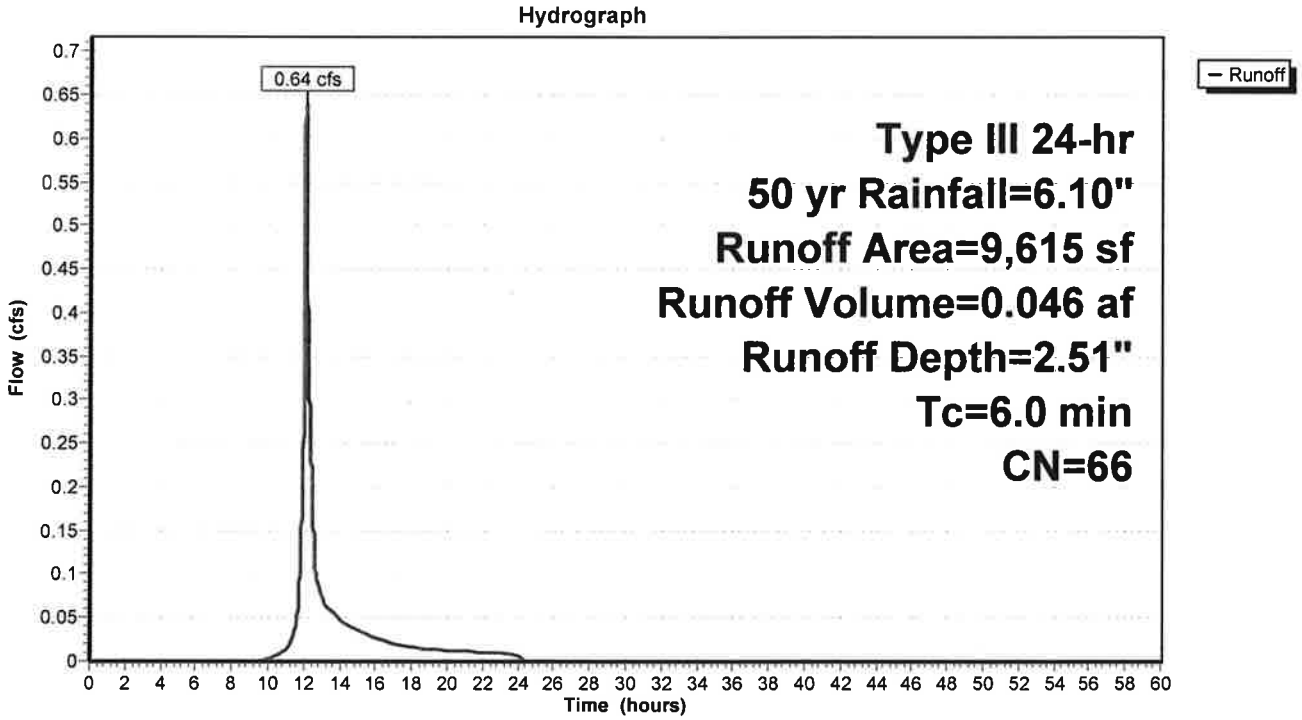
Runoff = 0.64 cfs @ 12.09 hrs, Volume= 0.046 af, Depth= 2.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 50 yr Rainfall=6.10"

	Area (sf)	CN	Description
*	4,961	98	paved
	750	39	>75% Grass cover, Good, HSG A
	3,904	30	Woods, Good, HSG A
	9,615	66	Weighted Average
	4,654		48.40% Pervious Area
	4,961		51.60% Impervious Area

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

Subcatchment 3S: west abutter



Summary for Subcatchment 4S: Railroad area

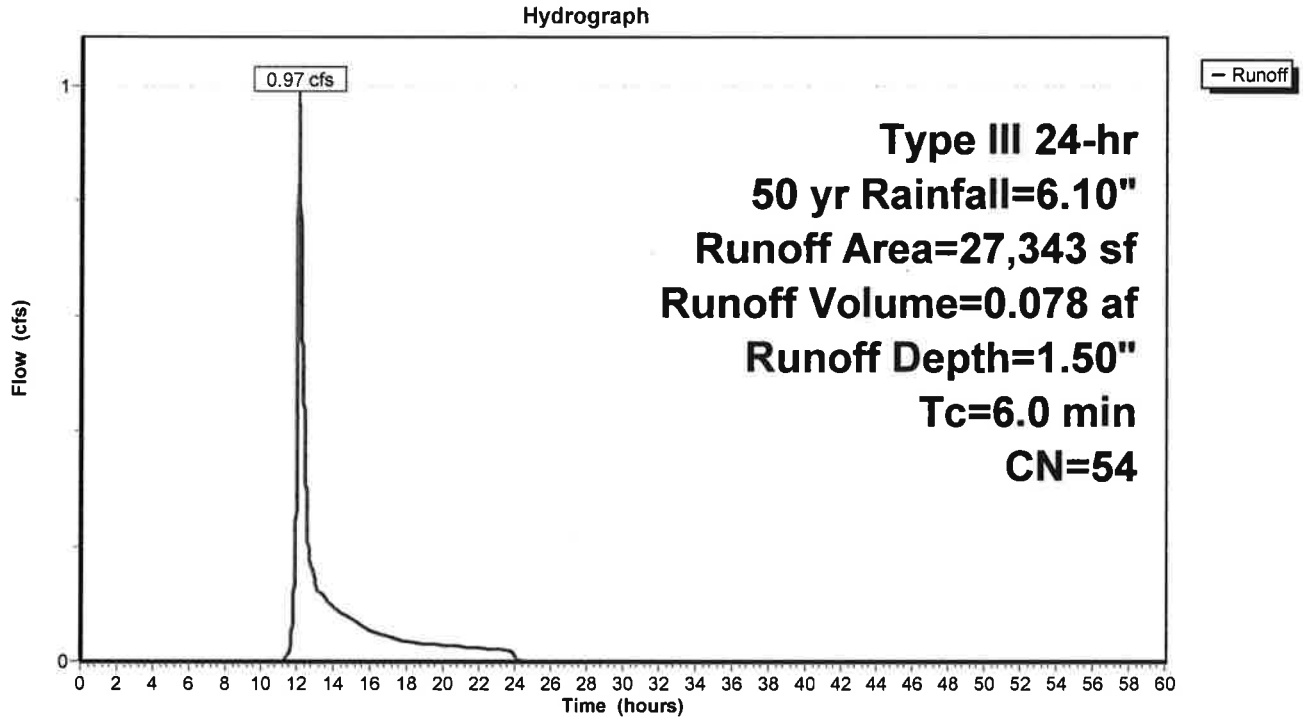
Runoff = 0.97 cfs @ 12.10 hrs, Volume= 0.078 af, Depth= 1.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 50 yr Rainfall=6.10"

	Area (sf)	CN	Description
	7,880	30	Woods, Good, HSG A
	5,145	39	>75% Grass cover, Good, HSG A
*	14,318	72	crushed stone railroad bed
	27,343	54	Weighted Average
	27,343		100.00% Pervious Area

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

Subcatchment 4S: Railroad area



Summary for Pond 1P: East Infiltration Basin

Inflow Area =	2.362 ac, 54.16% Impervious, Inflow Depth = 2.48" for 50 yr event				
Inflow =	6.82 cfs @	12.09 hrs,	Volume=	0.488 af	
Outflow =	4.60 cfs @	12.18 hrs,	Volume=	0.488 af,	Atten= 33%, Lag= 5.4 min
Discarded =	0.17 cfs @	12.18 hrs,	Volume=	0.250 af	
Primary =	4.43 cfs @	12.18 hrs,	Volume=	0.238 af	

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 212.04' @ 12.18 hrs Surf.Area= 3,093 sf Storage= 5,475 cf

Plug-Flow detention time= 187.3 min calculated for 0.488 af (100% of inflow)
Center-of-Mass det. time= 187.3 min (1,024.8 - 837.4)

Volume	Invert	Avail.Storage	Storage Description
#1	209.50'	8,874 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

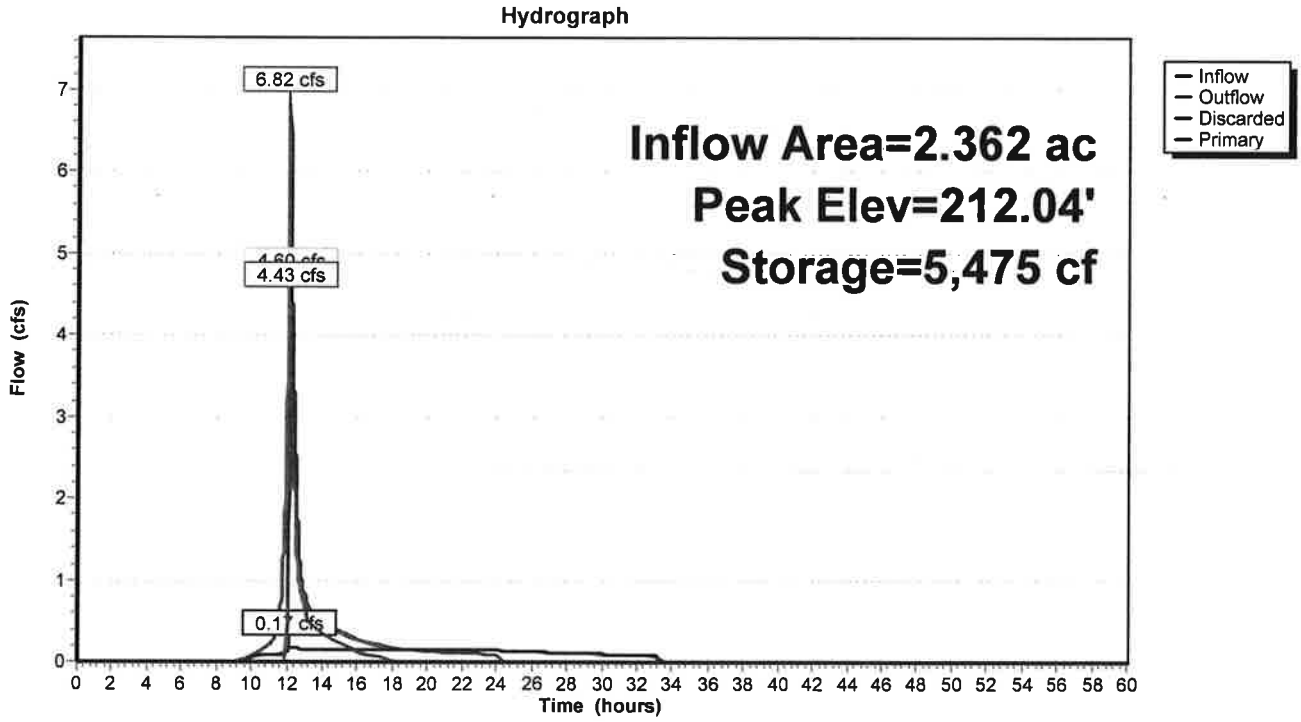
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
209.50	1,346	0	0
210.00	1,638	746	746
211.00	2,265	1,952	2,698
212.00	3,059	2,662	5,360
213.00	3,969	3,514	8,874

Device	Routing	Invert	Outlet Devices
#1	Discarded	209.50'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	211.60'	**6.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.17 cfs @ 12.18 hrs HW=212.04' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=4.42 cfs @ 12.18 hrs HW=212.04' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 4.42 cfs @ 1.68 fps)

Pond 1P: East Infiltration Basin



Summary for Pond 2P: roof infiltration basin

Inflow Area =	0.337 ac, 67.35% Impervious, Inflow Depth = 3.77" for 50 yr event				
Inflow =	1.48 cfs @	12.09 hrs, Volume=	0.106 af		
Outflow =	0.10 cfs @	13.75 hrs, Volume=	0.106 af, Atten= 93%, Lag= 99.9 min		
Discarded =	0.09 cfs @	13.75 hrs, Volume=	0.105 af		
Primary =	0.01 cfs @	13.75 hrs, Volume=	0.001 af		

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 225.04' @ 13.75 hrs Surf.Area= 1,673 sf Storage= 2,451 cf

Plug-Flow detention time= 342.2 min calculated for 0.106 af (100% of inflow)
Center-of-Mass det. time= 342.3 min (1,158.3 - 816.0)

Volume	Invert	Avail.Storage	Storage Description
#1	222.00'	4,684 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

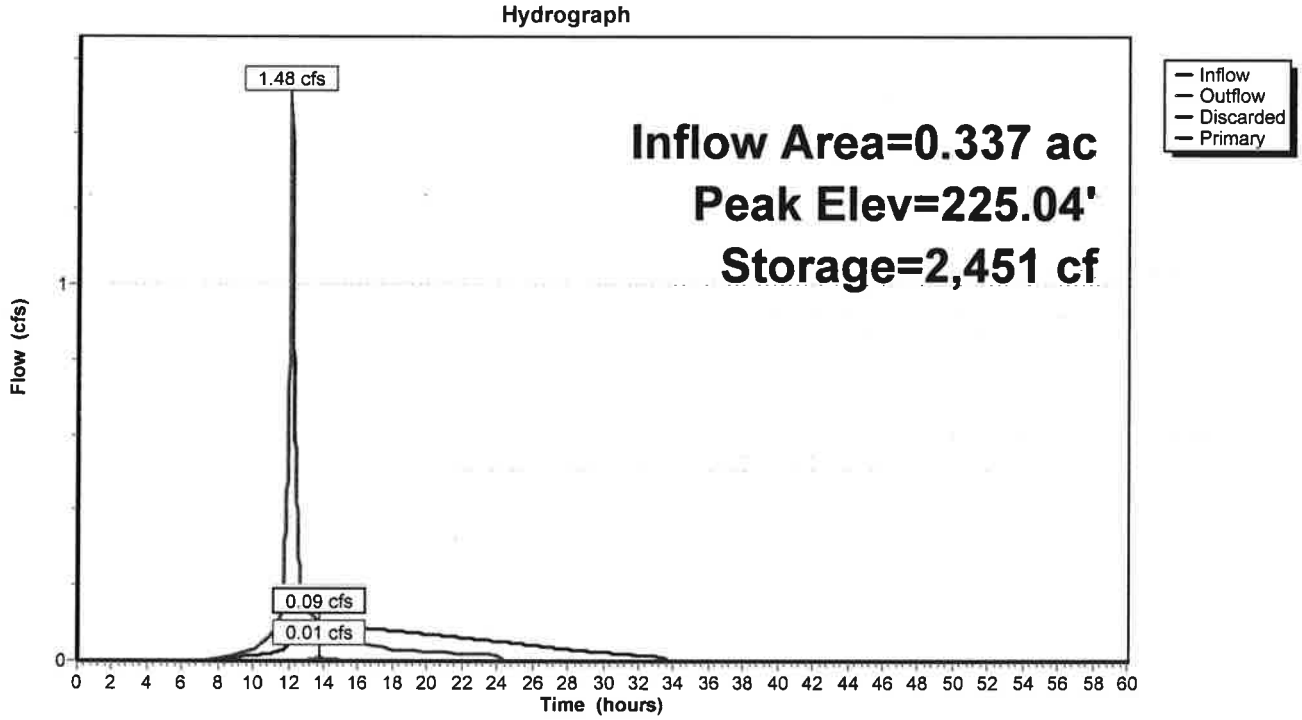
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
222.00	170	0	0
223.00	498	334	334
224.00	989	744	1,078
225.00	1,612	1,301	2,378
226.00	2,999	2,306	4,684

Device	Routing	Invert	Outlet Devices
#1	Discarded	222.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	225.00'	**12.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 225.00' / 224.00' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Discarded OutFlow Max=0.09 cfs @ 13.75 hrs HW=225.04' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=0.01 cfs @ 13.75 hrs HW=225.04' (Free Discharge)
└**2=Culvert** (Barrel Controls 0.01 cfs @ 0.89 fps)

Pond 2P: roof infiltration basin



Summary for Pond 3P: (new Pond)

Inflow Area = 0.221 ac, 51.60% Impervious, Inflow Depth = 2.51" for 50 yr event
Inflow = 0.64 cfs @ 12.09 hrs, Volume= 0.046 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

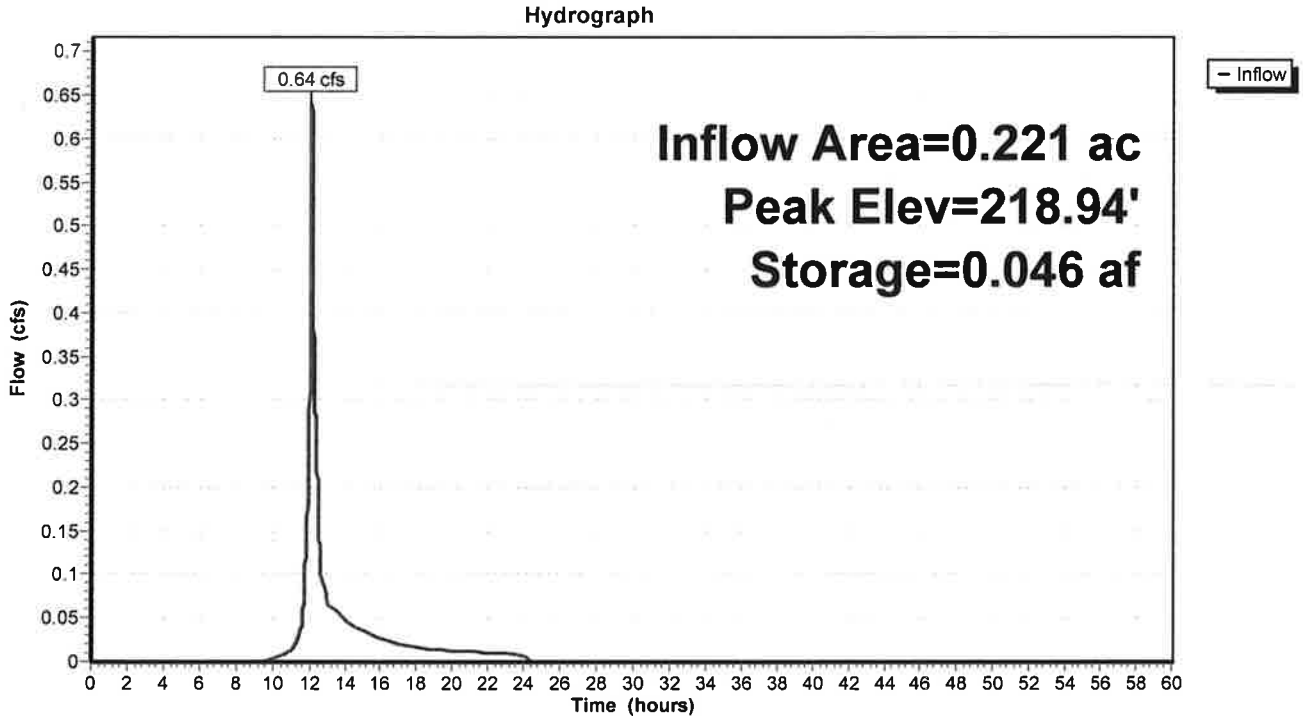
Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 218.94' @ 24.34 hrs Surf.Area= 0.027 ac Storage= 0.046 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1A	216.50'	0.023 af	**25.67'W x 45.50'L x 3.54'H Field A** 0.095 af Overall - 0.037 af Embedded = 0.058 af x 40.0% Voids
#2A	217.00'	0.037 af	**Cultec R-330XLHD** x 30 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 5 rows
		0.060 af	Total Available Storage

Storage Group A created with Chamber Wizard

Pond 3P: (new Pond)



Summary for Pond 4P: existing depression with cb

Inflow Area =	2.990 ac, 42.79% Impervious, Inflow Depth = 1.27" for 50 yr event				
Inflow =	5.16 cfs @	12.17 hrs,	Volume=	0.316 af	
Outflow =	4.98 cfs @	12.20 hrs,	Volume=	0.316 af,	Atten= 4%, Lag= 1.8 min
Discarded =	0.11 cfs @	12.20 hrs,	Volume=	0.023 af	
Primary =	4.86 cfs @	12.20 hrs,	Volume=	0.294 af	

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 208.33' @ 12.20 hrs Surf.Area= 2,023 sf Storage= 370 cf

Plug-Flow detention time= 1.1 min calculated for 0.316 af (100% of inflow)
Center-of-Mass det. time= 1.1 min (812.4 - 811.3)

Volume	Invert	Avail.Storage	Storage Description
#1	208.00'	2,973 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

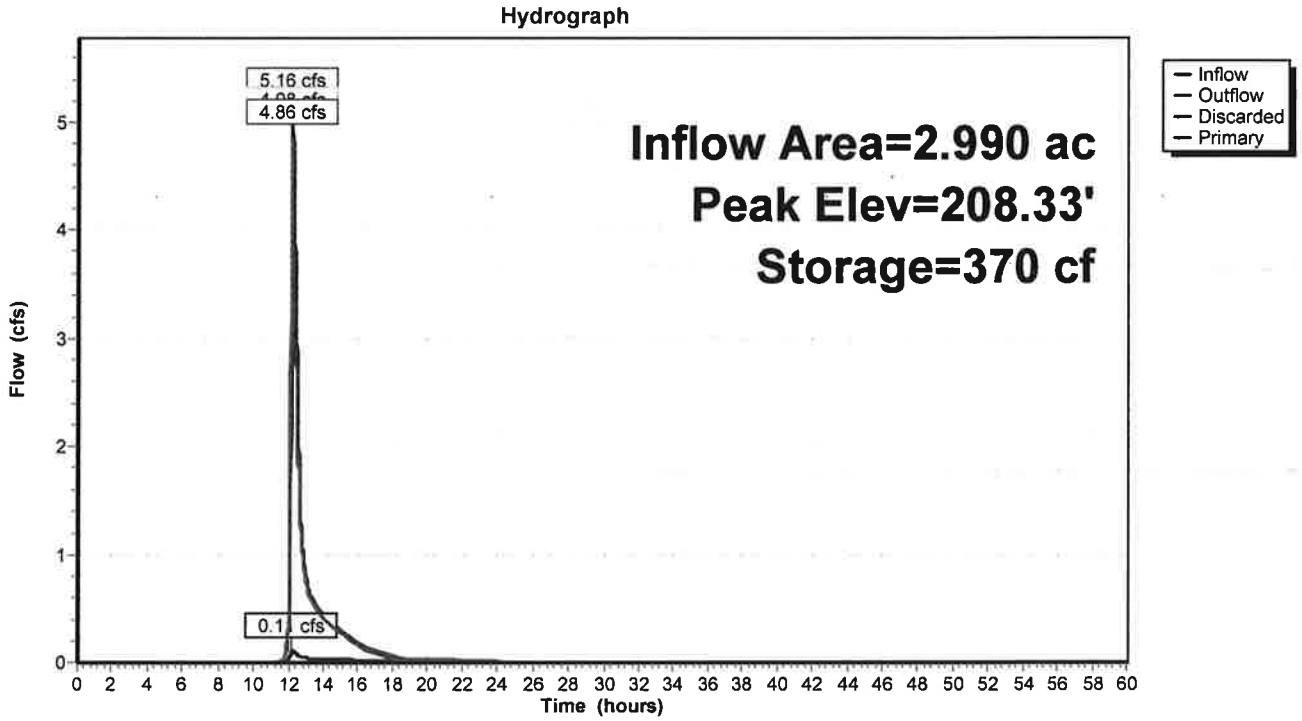
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
208.00	249	0	0
209.00	5,696	2,973	2,973

Device	Routing	Invert	Outlet Devices
#1	Primary	208.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Discarded	208.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.11 cfs @ 12.20 hrs HW=208.33' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.11 cfs)

Primary OutFlow Max=4.86 cfs @ 12.20 hrs HW=208.33' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 4.86 cfs @ 1.87 fps)

Pond 4P: existing depression with cb



POST-DEVELOPMENT CALCULATIONS
100-YEAR STORM – 6.80" RAINFALL

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Project site Runoff Area=88,222 sf 51.97% Impervious Runoff Depth=3.45"
Tc=6.0 min CN=70 Runoff=8.19 cfs 0.583 af

Subcatchment 2S: Portion of roof Runoff Area=14,660 sf 67.35% Impervious Runoff Depth=4.40"
Tc=6.0 min CN=79 Runoff=1.73 cfs 0.123 af

Subcatchment 3S: west abutter Runoff Area=9,615 sf 51.60% Impervious Runoff Depth=3.05"
Tc=6.0 min CN=66 Runoff=0.78 cfs 0.056 af

Subcatchment 4S: Railroad area Runoff Area=27,343 sf 0.00% Impervious Runoff Depth=1.91"
Tc=6.0 min CN=54 Runoff=1.29 cfs 0.100 af

Pond 1P: East Infiltration Basin Peak Elev=212.15' Storage=5,835 cf Inflow=8.19 cfs 0.594 af
Discarded=0.18 cfs 0.261 af Primary=6.53 cfs 0.333 af Outflow=6.71 cfs 0.594 af

Pond 2P: roof infiltration basin Peak Elev=225.16' Storage=2,662 cf Inflow=1.73 cfs 0.123 af
Discarded=0.10 cfs 0.112 af Primary=0.11 cfs 0.011 af Outflow=0.22 cfs 0.123 af

Pond 3P: (new Pond) Peak Elev=219.65' Storage=0.056 af Inflow=0.78 cfs 0.056 af
Outflow=0.00 cfs 0.000 af

Pond 4P: existing depression with cb Peak Elev=208.42' Storage=590 cf Inflow=7.67 cfs 0.433 af
Discarded=0.14 cfs 0.027 af Primary=7.17 cfs 0.406 af Outflow=7.31 cfs 0.433 af

Total Runoff Area = 3.210 ac Runoff Volume = 0.862 af Average Runoff Depth = 3.22"
56.61% Pervious = 1.817 ac 43.39% Impervious = 1.393 ac

Summary for Subcatchment 1S: Project site

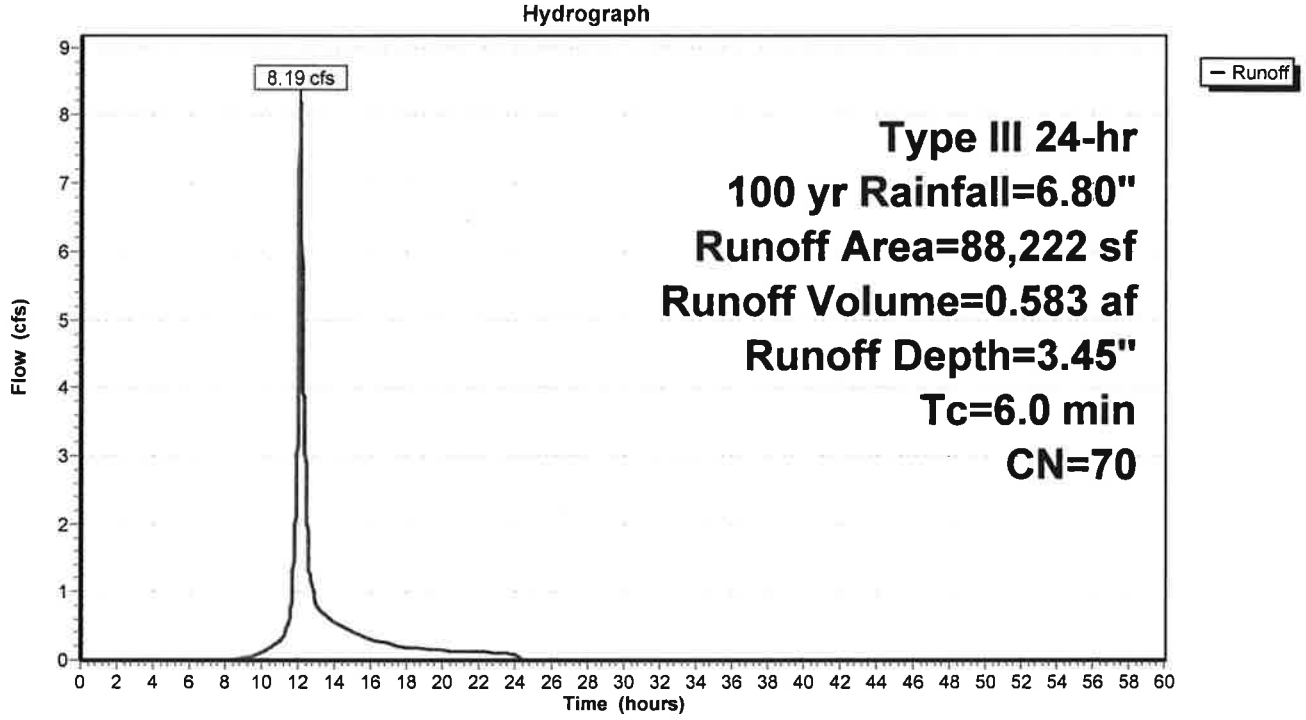
Runoff = 8.19 cfs @ 12.09 hrs, Volume= 0.583 af, Depth= 3.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr Rainfall=6.80"

	Area (sf)	CN	Description
*	19,326	98	Roofs
*	26,521	98	paved and sidewalk
	42,375	39	>75% Grass cover, Good, HSG A
	88,222	70	Weighted Average
	42,375		48.03% Pervious Area
	45,847		51.97% Impervious Area

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

Subcatchment 1S: Project site



Summary for Subcatchment 2S: Portion of roof

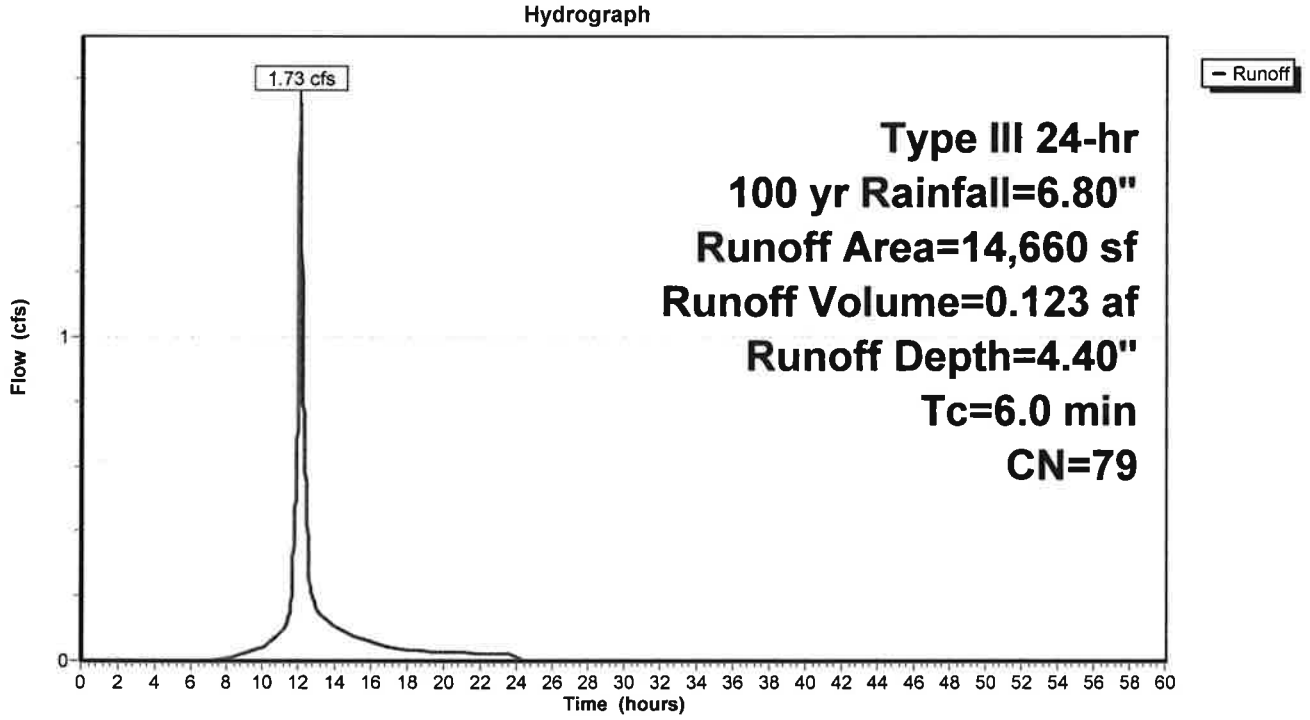
Runoff = 1.73 cfs @ 12.09 hrs, Volume= 0.123 af, Depth= 4.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr Rainfall=6.80"

	Area (sf)	CN	Description
*	9,375	98	roof
*	498	98	bottom of basin
	4,787	39	>75% Grass cover, Good, HSG A
	14,660	79	Weighted Average
	4,787		32.65% Pervious Area
	9,873		67.35% Impervious Area

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

Subcatchment 2S: Portion of roof



Summary for Subcatchment 3S: west abutter

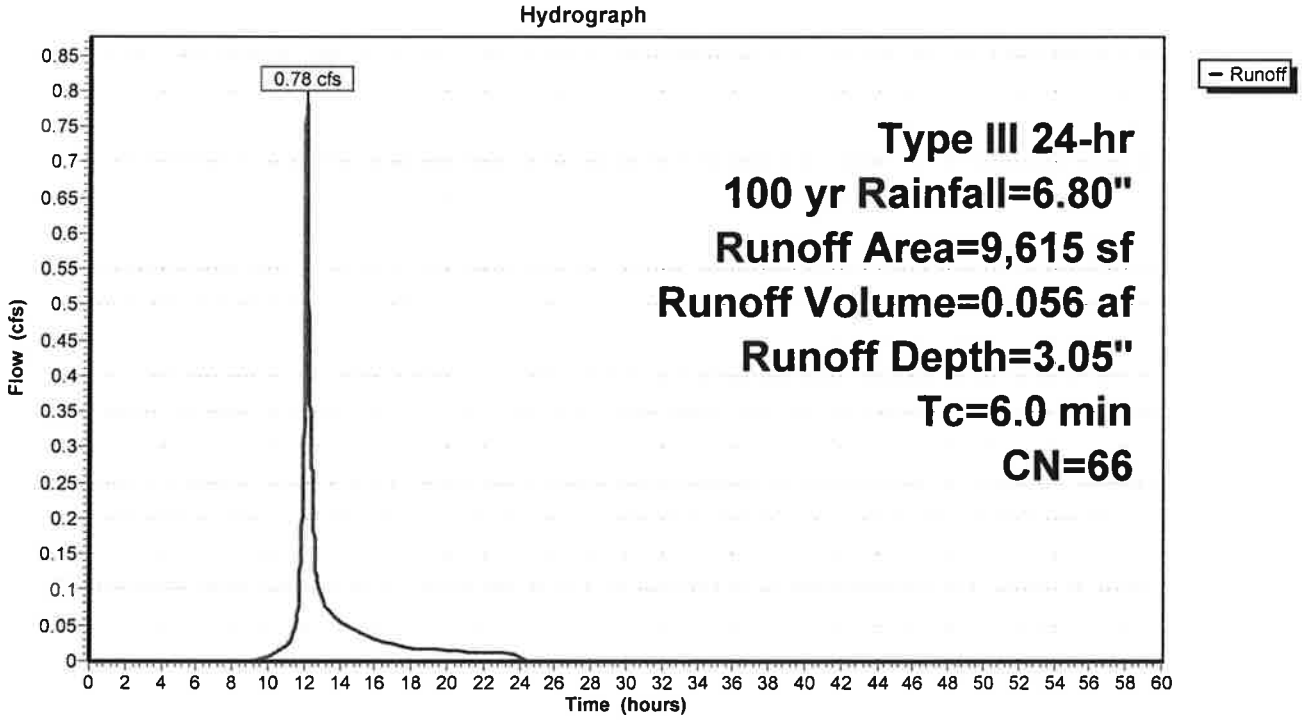
Runoff = 0.78 cfs @ 12.09 hrs, Volume= 0.056 af, Depth= 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr Rainfall=6.80"

	Area (sf)	CN	Description
*	4,961	98	paved
	750	39	>75% Grass cover, Good, HSG A
	3,904	30	Woods, Good, HSG A
	9,615	66	Weighted Average
	4,654		48.40% Pervious Area
	4,961		51.60% Impervious Area

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

Subcatchment 3S: west abutter



Summary for Subcatchment 4S: Railroad area

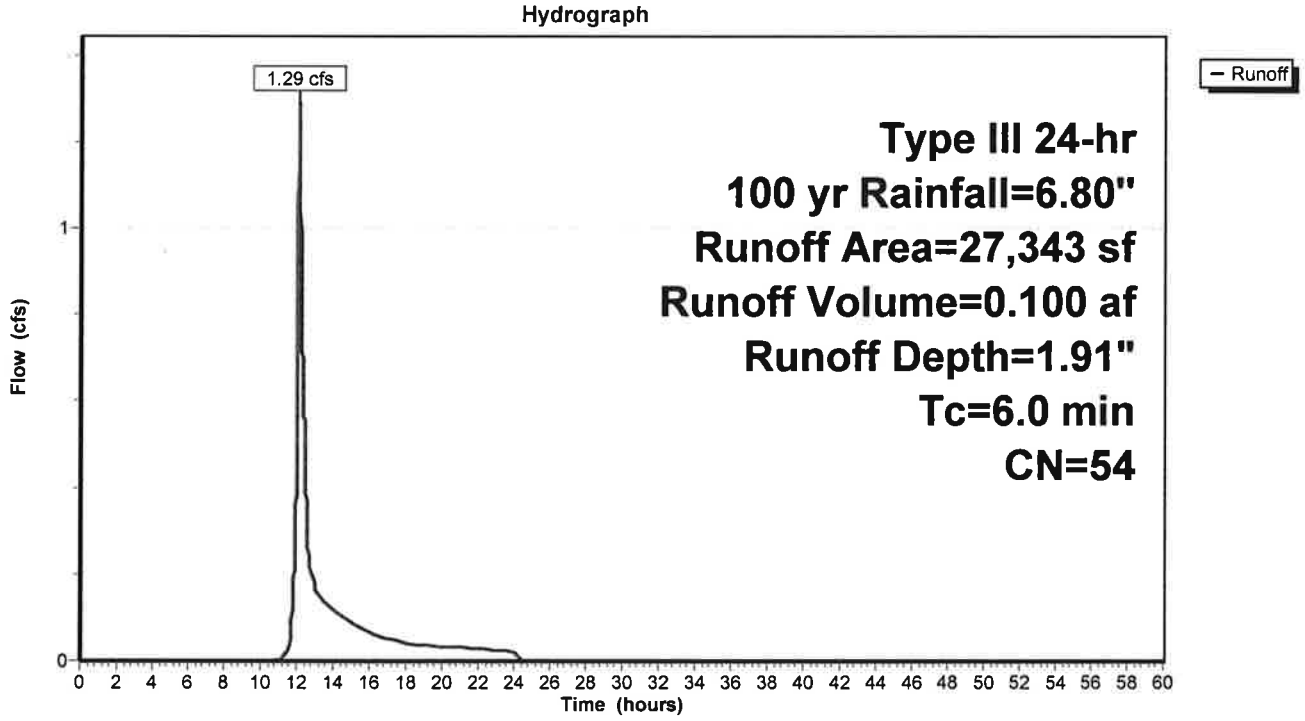
Runoff = 1.29 cfs @ 12.10 hrs, Volume= 0.100 af, Depth= 1.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr Rainfall=6.80"

	Area (sf)	CN	Description
	7,880	30	Woods, Good, HSG A
	5,145	39	>75% Grass cover, Good, HSG A
*	14,318	72	crushed stone railroad bed
	27,343	54	Weighted Average
	27,343		100.00% Pervious Area

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

Subcatchment 4S: Railroad area



Summary for Pond 1P: East Infiltration Basin

Inflow Area =	2.362 ac, 54.16% Impervious, Inflow Depth = 3.02" for 100 yr event				
Inflow =	8.19 cfs @	12.09 hrs,	Volume=	0.594 af	
Outflow =	6.71 cfs @	12.15 hrs,	Volume=	0.594 af,	Atten= 18%, Lag= 3.4 min
Discarded =	0.18 cfs @	12.15 hrs,	Volume=	0.261 af	
Primary =	6.53 cfs @	12.15 hrs,	Volume=	0.333 af	

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 212.15' @ 12.15 hrs Surf.Area= 3,197 sf Storage= 5,835 cf

Plug-Flow detention time= 162.3 min calculated for 0.594 af (100% of inflow)
Center-of-Mass det. time= 162.2 min (993.8 - 831.5)

Volume	Invert	Avail.Storage	Storage Description
#1	209.50'	8,874 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

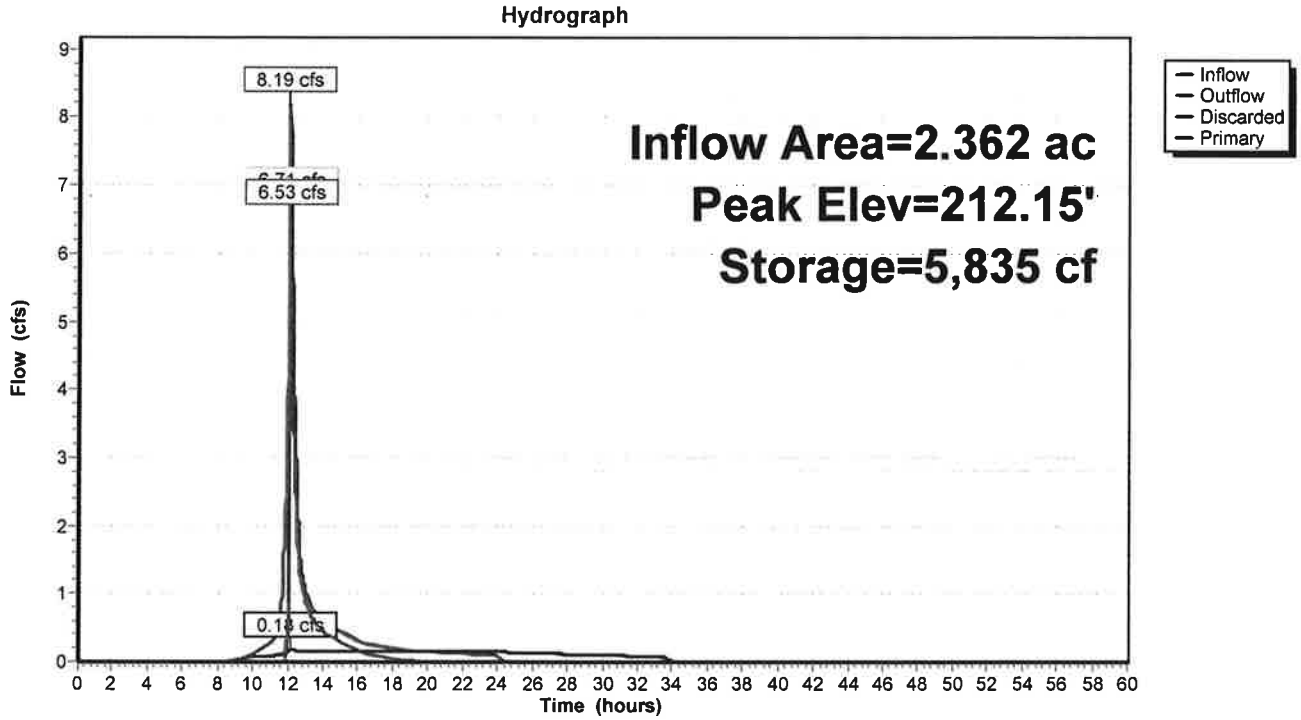
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
209.50	1,346	0	0
210.00	1,638	746	746
211.00	2,265	1,952	2,698
212.00	3,059	2,662	5,360
213.00	3,969	3,514	8,874

Device	Routing	Invert	Outlet Devices
#1	Discarded	209.50'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	211.60'	**6.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.18 cfs @ 12.15 hrs HW=212.15' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.18 cfs)

Primary OutFlow Max=6.52 cfs @ 12.15 hrs HW=212.15' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 6.52 cfs @ 1.97 fps)

Pond 1P: East Infiltration Basin



Summary for Pond 2P: roof infiltration basin

Inflow Area =	0.337 ac, 67.35% Impervious, Inflow Depth = 4.40" for 100 yr event				
Inflow =	1.73 cfs @	12.09 hrs, Volume=	0.123 af		
Outflow =	0.22 cfs @	12.71 hrs, Volume=	0.123 af, Atten= 88%, Lag= 37.3 min		
Discarded =	0.10 cfs @	12.71 hrs, Volume=	0.112 af		
Primary =	0.11 cfs @	12.71 hrs, Volume=	0.011 af		

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 225.16' @ 12.71 hrs Surf.Area= 1,840 sf Storage= 2,662 cf

Plug-Flow detention time= 316.6 min calculated for 0.123 af (100% of inflow)
Center-of-Mass det. time= 316.7 min (1,128.2 - 811.6)

Volume	Invert	Avail.Storage	Storage Description
#1	222.00'	4,684 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

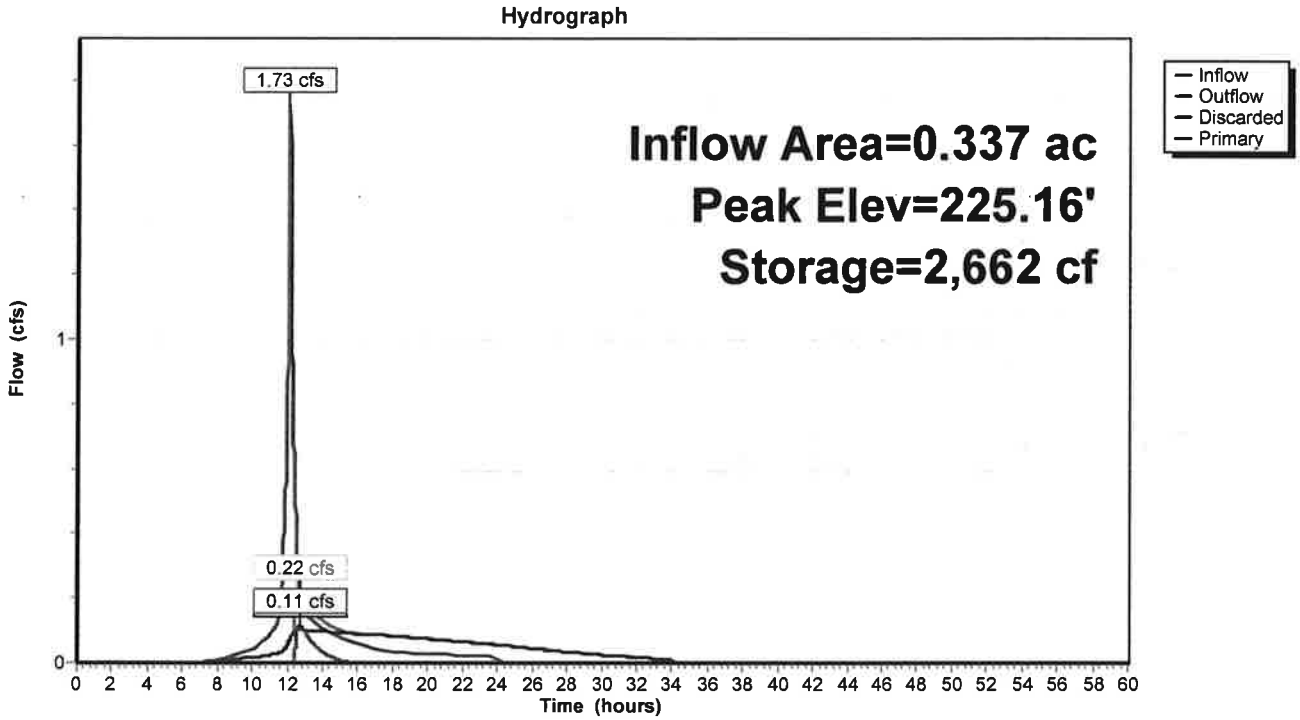
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
222.00	170	0	0
223.00	498	334	334
224.00	989	744	1,078
225.00	1,612	1,301	2,378
226.00	2,999	2,306	4,684

Device	Routing	Invert	Outlet Devices
#1	Discarded	222.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	225.00'	**12.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 225.00' / 224.00' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Discarded OutFlow Max=0.10 cfs @ 12.71 hrs HW=225.16' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.10 cfs)

Primary OutFlow Max=0.11 cfs @ 12.71 hrs HW=225.16' (Free Discharge)
└**2=Culvert** (Barrel Controls 0.11 cfs @ 2.02 fps)

Pond 2P: roof infiltration basin



Summary for Pond 3P: (new Pond)

Inflow Area = 0.221 ac, 51.60% Impervious, Inflow Depth = 3.05" for 100 yr event
Inflow = 0.78 cfs @ 12.09 hrs, Volume= 0.056 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

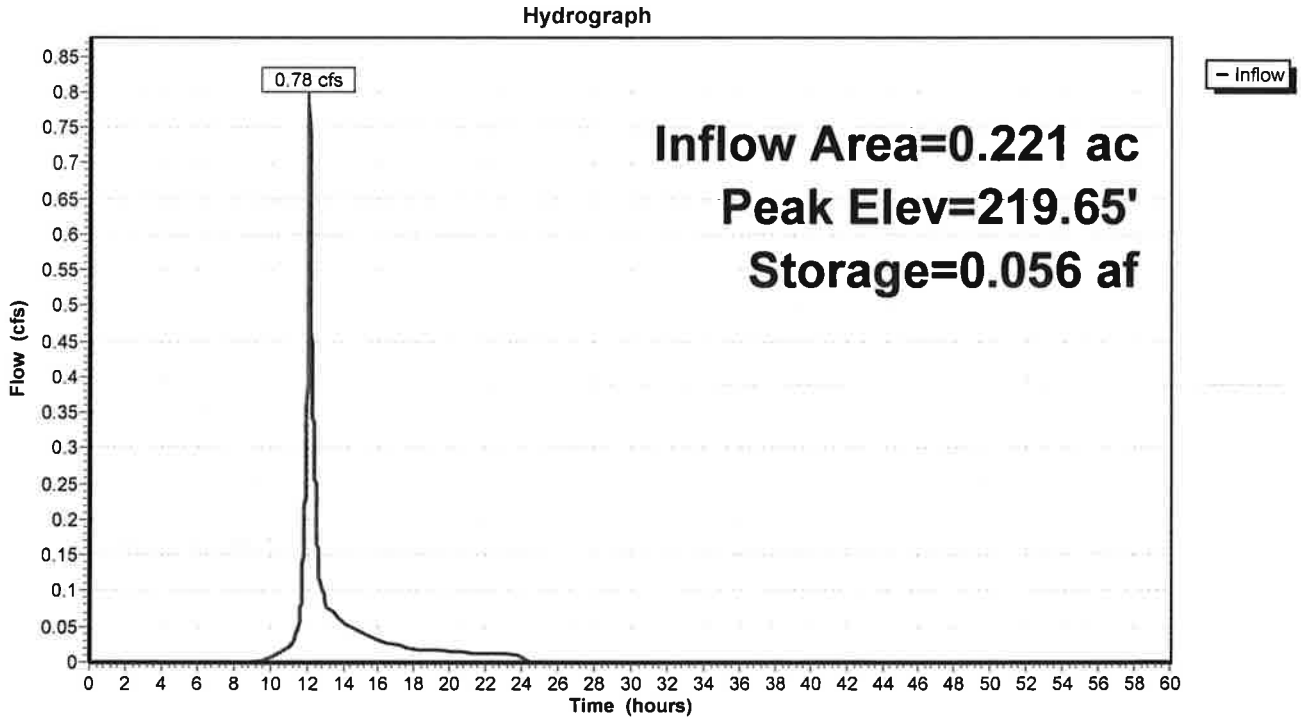
Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 219.65' @ 24.34 hrs Surf.Area= 0.027 ac Storage= 0.056 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1A	216.50'	0.023 af	**25.67'W x 45.50'L x 3.54'H Field A** 0.095 af Overall - 0.037 af Embedded = 0.058 af x 40.0% Voids
#2A	217.00'	0.037 af	**Cultec R-330XLHD** x 30 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 5 rows
		0.060 af	Total Available Storage

Storage Group A created with Chamber Wizard

Pond 3P: (new Pond)



Summary for Pond 4P: existing depression with cb

Inflow Area =	2.990 ac, 42.79% Impervious, Inflow Depth = 1.74" for 100 yr event				
Inflow =	7.67 cfs @	12.14 hrs,	Volume=	0.433 af	
Outflow =	7.31 cfs @	12.17 hrs,	Volume=	0.433 af,	Atten= 5%, Lag= 1.8 min
Discarded =	0.14 cfs @	12.17 hrs,	Volume=	0.027 af	
Primary =	7.17 cfs @	12.17 hrs,	Volume=	0.406 af	

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 208.42' @ 12.17 hrs Surf.Area= 2,546 sf Storage= 590 cf

Plug-Flow detention time= 1.1 min calculated for 0.433 af (100% of inflow)
Center-of-Mass det. time= 1.1 min (809.3 - 808.2)

Volume	Invert	Avail.Storage	Storage Description
#1	208.00'	2,973 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

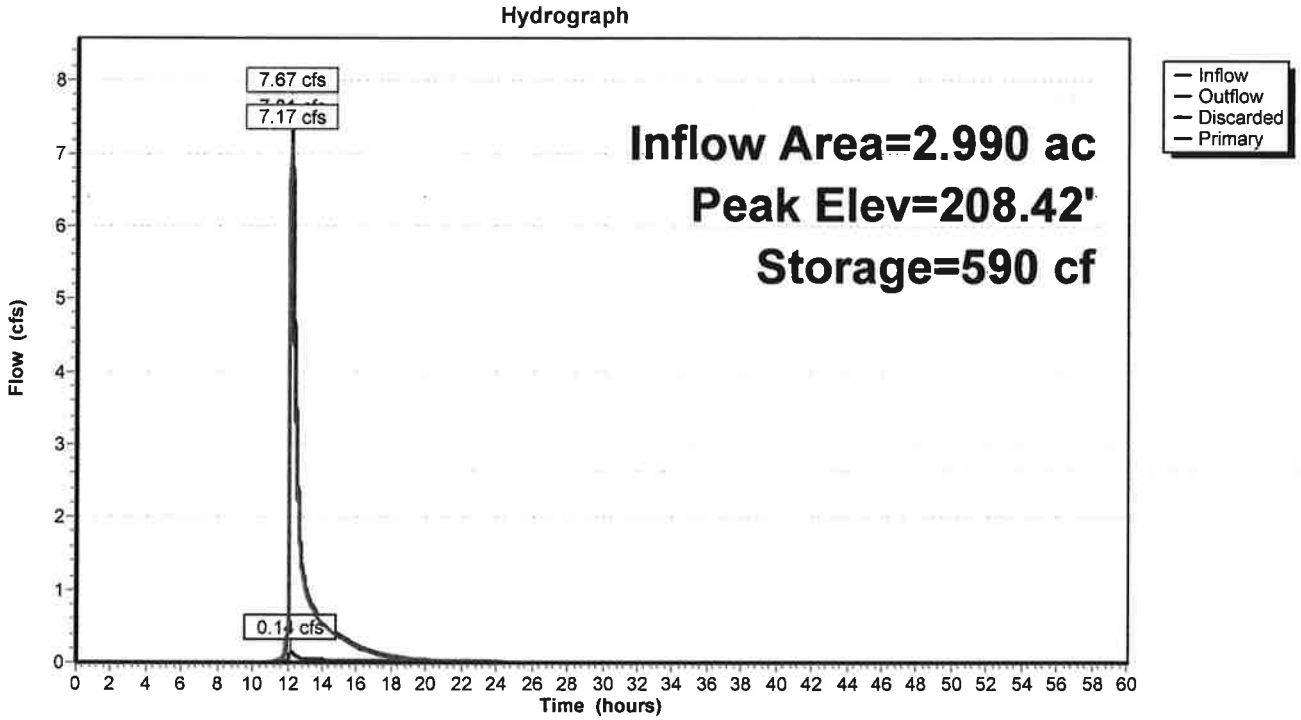
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
208.00	249	0	0
209.00	5,696	2,973	2,973

Device	Routing	Invert	Outlet Devices
#1	Primary	208.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Discarded	208.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.14 cfs @ 12.17 hrs HW=208.42' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.14 cfs)

Primary OutFlow Max=7.16 cfs @ 12.17 hrs HW=208.42' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 7.16 cfs @ 2.12 fps)

Pond 4P: existing depression with cb



OPERATIONS AND MAINTENANCE PLAN

OPERATIONS AND MAINTENANCE PLAN

The following is the proposed operation and maintenance plan for the storm water management systems at the Residences at Norfolk Station located at 194 Main Street in Norfolk, Massachusetts:

- Owner: Norfolk Station, LLC – c/o Alan Quaglieri, Manager
  2075 Main Street
  Walpole, MA 02081

- Parties responsible for Operation and Maintenance:
  Same as above

The storm water management facilities were designed to require little or no intervention in the operation and to require little or no maintenance once the project is built and stable vegetative cover is established. However, the drainage improvements shall be subject to the following maintenance schedule:

A. Routine Maintenance

1. Debris: All debris and litter are to be removed from all catch basins, accessible drain pipes, swales, flared end sections, infiltration basins and surrounding areas at least twice per year.

2. Re-seeding: Embankments that have excessive erosion or slumping are to be re-graded and seeded (with canary grass or tall fescue grass) during the spring or fall growing seasons as needed.

3. Inspect: Stormceptor units, infiltration chamber systems, infiltration basins and overflow devices shall be inspected for signs of proper functioning on a monthly basis. Any potential blockages in the down spouts or roof drainage piping will be removed if discovered.

4. Mowing: The infiltration basin sideslopes shall be mowed at least four times per year. The infitration basin bottoms shall be inspected at each mowing event. If vegetation has accumulated that could cause a negative impact on the function of the detention basin, then it will be removed.

B. Periodic Maintenance

1. All swales and Stormceptor units will be cleaned a minimum of once per year and inspected monthly during the active construction stage. In this cleaning, the entire

contents of the sumps and any accumulated sediment in the swales will be removed.

2. Accumulated sediment in the water quality units will be inspected and removed in accordance with the manufacturer's recommendations or, at a minimum, once per year. If the accumulated sediment is equal to 15% of the capacity of the device, the sediment shall be cleaned out using a vacuum truck.

C. Non-routine Maintenance

1. Structural: All flared end sections, Stormceptor units, pipes, infiltration basin sideslopes and outlet devices should be inspected once every four (4) years for proper function, clogging, signs of deterioration and structural inadequacy. Any adverse situations are to be repaired as needed.

D. Non-periodic Inspection

1. The storm water management system shall be inspected after two years of full operation by a Registered Professional Civil Engineer to confirm its adequacy. The inspection shall include an examination of all components of the system including catch basins, water quality units and infiltration systems.

SURVEY COMPANY OF RECORD

DATE

· CIVIL ENGINEERING
· LAND SURVEYING
· ENVIRONMENTAL ASSESSMENT

PRIME ENGINEERING INC

P.O. BOX 1088
350 BEDFORD ST.
LAKEVILLE, MA 02347
TEL: 508.947.0050
FAX: 508.947.2004

FOR REGISTRY USE ONLY

PROGRESS PRINT NOT ISSUED FOR CONSTRUCTION

P.E. STAMP

ZCE
ZENITH CONSULTING ENGINEERS, LLC
3 MAIN STREET LAKEVILLE, MA 02347
PHONE: (508) 947-4208

NORFOLK ZONING BOARD OF APPEALS

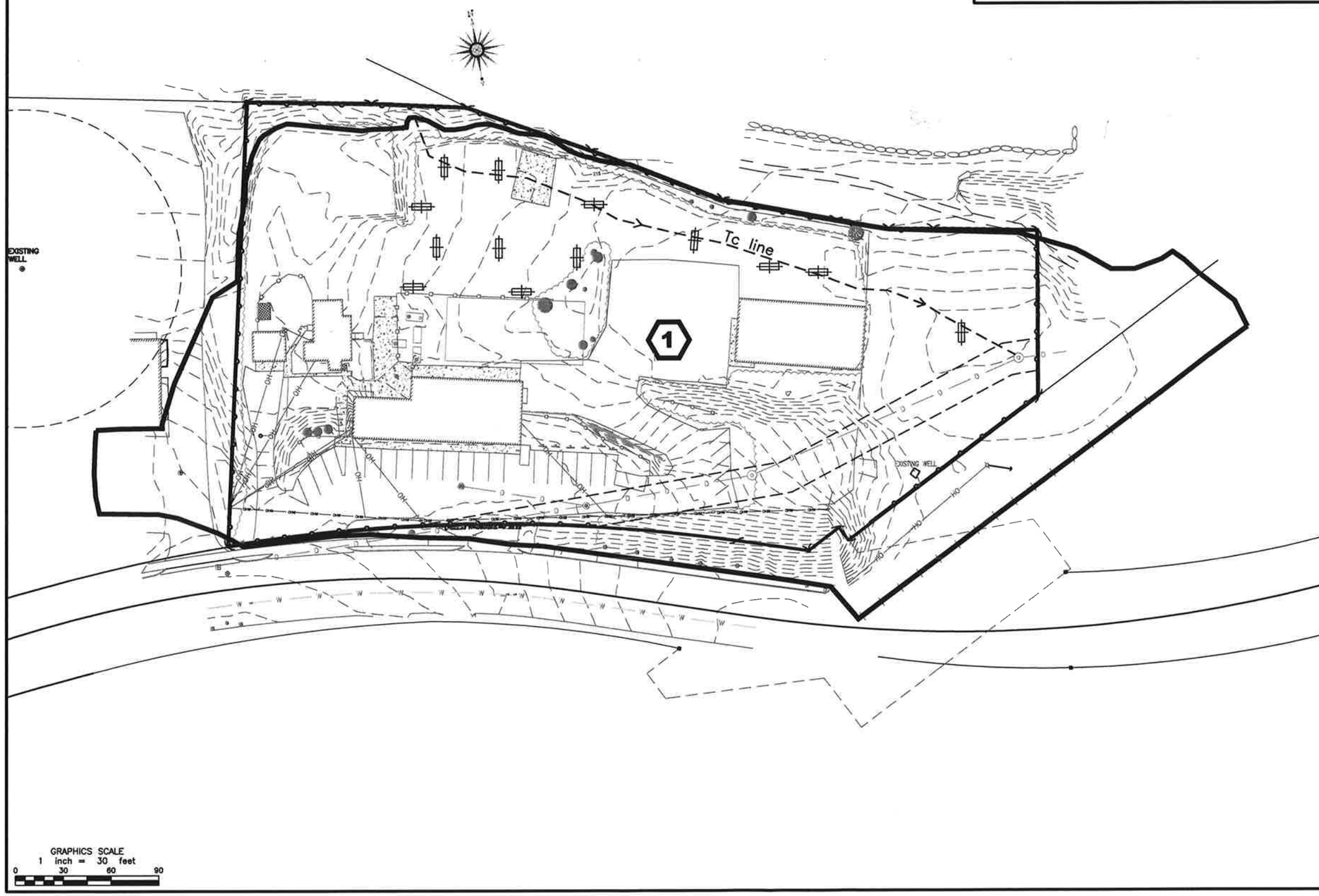
APPROVED AND ENDORSED UNDER M.G.L. C. 40B BY THE NORFOLK ZONING BOARD OF APPEALS

APPROVED;

ENDORSED:

I HEREBY CERTIFY THAT THE NOTICE OF APPROVAL OF THIS PLAN BY THE NORFOLK ZONING BOARD OF APPEALS WAS RECEIVED AND RECORDED ON _____ AT THIS OFFICE, AND NO APPEAL WAS RECEIVED DURING THE TWENTY (20) DAYS NEXT AFTER SUCH RECEIPT OF RECORDING OF SAID NOTICE.

TOWN CLERK, NORFOLK, MA DATE



LOCUS PLAN
SCALE: 1" = 500'

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMANCE WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS.

DATE

LEGEND

EXISTING	DESCRIPTION	PROPOSED
98	CONTOURS	94
	BOUND	
DH(FND)	DRILL HOLE	
IR	IRON ROD	
	TEST PIT	
19X24	SPOT GRADE	+68.5
	WELL	
D D	DRAIN LINE	D
	DRAIN MANHOLE	
	CATCH BASIN	
	EROSION CONTROL MEASURES	
	UTILITY POLE	
	LIGHT POLE	
	STONEWALL	
	GUARD RAIL	
	SINGLE POLE SIGN	
	CHAIN LINKED FENCE	

REV.	DATE	DESCRIPTION	BY	APP.

DATE: 8/6/2018
PROJECT NUMBER: 0101-01-02
SCALE: 1"=30'
SHEET ID: PRE

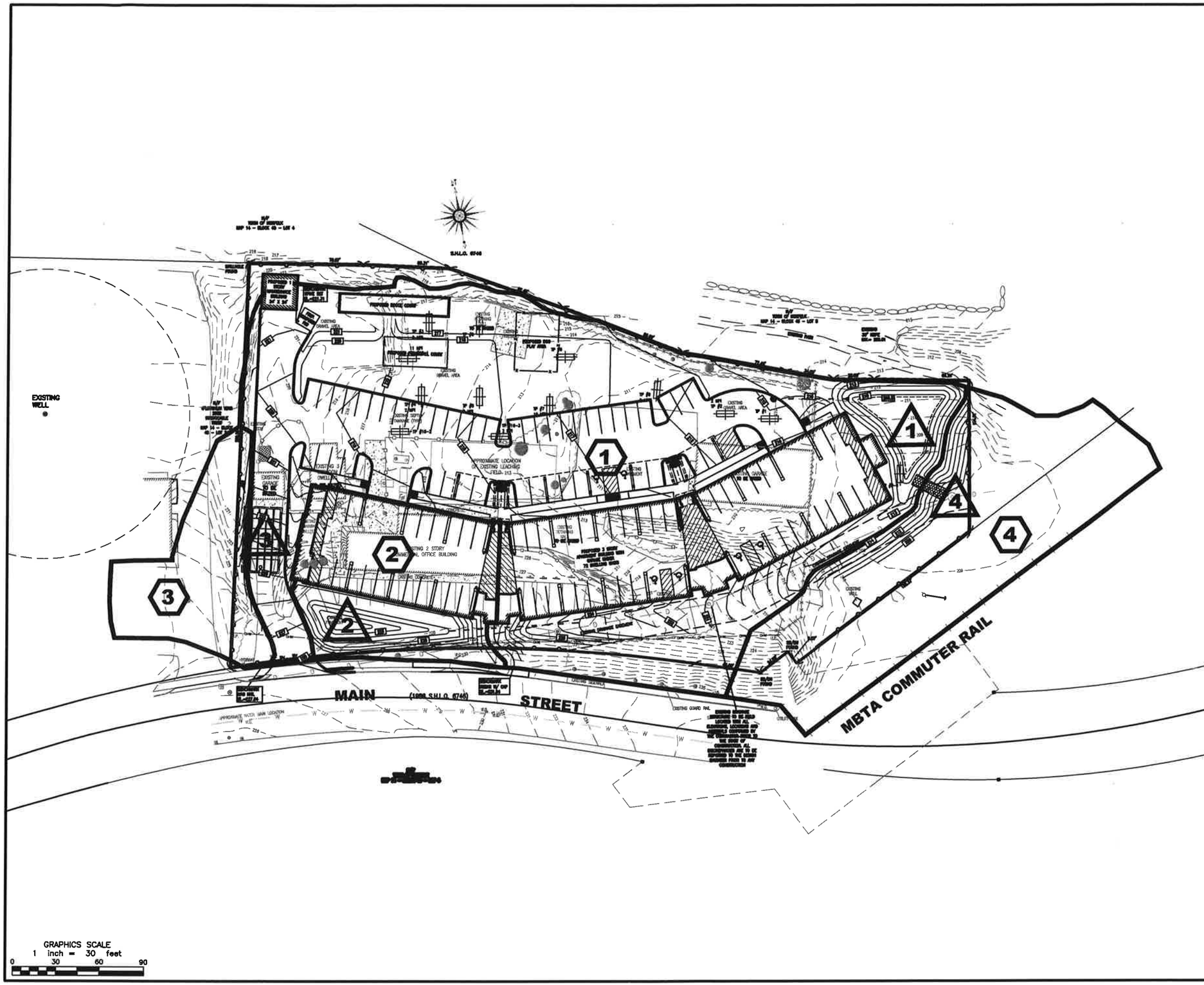
DRAWN BY: JLB
DESIGNED BY: JLB/RMF
CHECKED BY: WCZ
APPROVED BY: JLB

SHEET NAME: PRE-DEVELOPMENT DRAINAGE AREAS PLAN

PROJECT SITE: THE RESIDENCES AT NORFOLK STATION
194 MAIN STREET
NORFOLK, MASSACHUSETTS

CLIENT INFO: NORFOLK STATION, LLC
2075 MAIN STREET
WALPOLE, MASSACHUSETTS

S:\Civil Engineering Projects\Norfolk\Main Street\194 Main Street\2007\108 Site Plan.dwg



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NORFOLK ZONING BOARD OF APPEALS

APPROVED AND ENDORSED UNDER M.G.L. C. 40B BY THE NORFOLK ZONING BOARD OF APPEALS

APPROVED: _____

ENDORSED: _____

I HEREBY CERTIFY THAT THE NOTICE OF APPROVAL OF THIS PLAN BY THE NORFOLK ZONING BOARD OF APPEALS WAS RECEIVED AND RECORDED ON _____ AT THIS OFFICE, AND NO APPEAL WAS RECEIVED DURING THE TWENTY (20) DAYS NEXT AFTER SUCH RECEIPT OF RECORDING OF SAID NOTICE.

TOWN CLERK, NORFOLK, MA DATE

ZCE
ZENITH CONSULTING ENGINEERS, LLC
3 MAIN STREET LAKEVILLE, MA 02347
PHONE: (508) 947-4208

LOCUS PLAN
SCALE: 1" = 500'

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMANCE WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS.

DATE

LEGEND

EXISTING	DESCRIPTION	PROPOSED
98	CONTOURS	94
	BOUND	
DH(FND)	DRILL HOLE	
IR	IRON ROD	
	TEST PIT	
19X24	SPOT GRADE	+98.5
	WELL	
D D	DRAIN LINE	D
	DRAIN MANHOLE	
	CATCH BASIN	
	EROSION CONTROL MEASURES	
	UTILITY POLE	
	LIGHT POLE	
	STONEWALL	
	GUARD RAIL	
	SINGLE POLE SIGN	
	CHAIN LINKED FENCE	

REV.	DATE	DESCRIPTION	BY	APP.

DATE:	8/6/2018
PROJECT NUMBER	0101-01-02
SCALE:	1"=30'
SHEET ID	POST
DRAWN BY:	AB
DESIGNED BY:	AB/MJF
CHECKED BY:	MCZ
APPROVED BY	AB

SHEET NAME: POST-DEVELOPMENT DRAINAGE AREAS PLAN

PROJECT SITE: THE RESIDENCES AT NORFOLK STATION
194 MAIN STREET
NORFOLK, MASSACHUSETTS

CLIENT NAME: NORFOLK STATION, LLC
2075 MAIN STREET
WALPOLE, MASSACHUSETTS