KREBS & LANSING
CONSULTING ENGINEERS

164 Main Street, Suite 201
Colchester, VT 05446

P: (802) 878-0375 | greg.dixson@krebsandlansing.com

May 6, 2024

Chelsea Mandigo
Water Quality Superintendent
City of Essex Junction
2 Lincoln Street
Essex Junction, VT 05452
chelsea@essexjunction.org
(802) 878-6943, ext. 1705

RE: Sewer Calculations
227 Pearl Street, Essex Junction, VT 05452

Dear Chelsea,

This Project is proposing to revise the previous submission to add additional units to the project. The previous submission had 34 residential units, and all were studio apartments. The proposed revision would increase the number of units to 39 units and a mixture of studio, single bedroom, and multibedroom units. You requested additional information about septic from this property in the last submission, we are providing an update to that calculation here.

Sunderland Apartments sewer flow path:

- Project into sewer manhole B6
- 8" gravity lines southeasterly along Pearl Street {B6 to B5 to B4 to B3 to B2 to B1}
- 8" gravity line across Rout 15 to the West Street Pump Station {B1 to Pump Station}
- 4" force main from West Street Pump Station along West Street Extension, southeast along West Street, and south cross lots/South Street to gravity manhole F2
- 15" gravity line south along South Hill Drive {F2 to F1 to G5 to G4 to G3 to G2 to G1 to H1}
- 18" gravity line south across Cascade Street to Wastewater Treatment Facility {H1 to H1B to Facility}

You have asked me to analyze the gravity line from B1 to pump Station (C1)

- Length of 8" line from B1 to C1 = 165 feet
- Slope of pipe from O'Leary Burke Analysis provide by City = 0.0088
- Maximum capacity of an 8" line at 0.0088 slope from O'Leary Burke Analysis = 716 GPM
- Based on average flow data from the West Street Pumpstation, the average of two months sewage flows is 255,417 GPD or 178 GPM.
- Exclude flows coming from the portion of West Street which drains to that station and assume all flows come from manhole B1. Flow through that pipe would be 178 GPM which is less than 716 GPM.
- Proposed flow from project = 6,860 GPD = 9.5 GPM (assuming all flow happens within 12 hours)
- Conservatively 178 GPM + 10 GPM for the project = 188 GPM which is less than 716 GPM

The proposed flows from this project are slightly more than 1% the total capacity of the maximum capacity of the pipe from B1 to pumpstation. This also assumes all the flow happens in 12 hours. This increase is unlikely to have an adverse effect on the flow in this section of pipe.

Also, in the O'Leary Burke analysis from Aug 2022, the City confirmed that there was adequacy for additional flows to the West Street Pump Station. From January 1, 2023 to February 28, 2023 the average daily flow from that pump station was 255,417 GPD. This project adding 6,860 GPD would result in a 2.7 % increase in that flow. This increase is unlikely to have an adverse effect on the flows from this pumpstation.

I do not know the capacity the West Street Pump Station was designed to handle. There are daily flows within the pumpstation's log which exceed 300,000 GPD. This project's modest increase to the recent average flows for the pumpstation, are not close to 300K GPD.

Please let me know if there is anything more you need.

Sincerely,

Greg Dixson, P.E.

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May 6, 2024

Chelsea Mandigo
Water Quality Superintendent
City of Essex Junction
2 Lincoln Street
Essex Junction, VT 05452
chelsea@essexjunction.org
(802) 878-6943, ext. 1705

RE: Water/Wastewater Allocation Request
227 Pearl Street, Essex Junction, VT 05452

Dear Chelsea,

This Project is proposing to revise the previous submission to add additional units to the project. The previous submission had 34 residential units, and all were studio apartments. The proposed revision would increase the number of units to 39 units and a mixture of studio, single bedroom, and multibedroom units.

On behalf of this Project, we are requesting a letter approving our additional water and wastewater allocation. This parcel requested allocation for the previous project, this allocation was confirmed by the City of Essex Junction on May 2, 2023, but that design did not move forward. The flows for water and wastewater use, based on gallons per day (GPD), are as follows:

From Last Submission (34 Units):
Sewer: 4,760 GPD
Water: 4,760 GPD

Updated Flows for Proposed Revision (39 Units): *{see attached calculation breakdown}*
Sewer: 6,860 GPD
Water: 8,260 GPD

Additional Allocation Requested:
Sewer: 2,100 GPD Increase
Water: 3,500 GPD Increase

Please contact us if there is anything more you need or if there are any comments/questions. Thank you for your time in reviewing this project.

Sincerely,

Greg Dixson, P.E.

City of Essex Junction Sewer Allocation Request

Instructions:

1) Submit completed form to planning and zoning department electronically at thass@essexjunction.org during conceptual plan review and amended at final plan review, if necessary.
*2) Payment of **sewer allocation fee** is due upon zoning permit request (final municipal permit before start of construction). Refer to the current fee schedule for more information. Please note **sewer connection fees** may also be applicable.*

****

Applicant Name and Mailing Address:

Handy Hotels and Rentals LLC
197 Pearl Street, Suite 100, Essex Junction, VT 05452

Phone Number: (802) 878-8920 Email Address: handysrentals@yahoo.com

Property Owner(s) Name and Mailing Address (if different):

Same as Applicant

Project Address: 227 Pearl Street, Essex Junction, VT 05452

Project Information (check or circle any that are applicable)

☐**Single-family home** # of bedrooms _____ ☐ Multiplex ***(see attachment calculations)***

Business: # of employees_____ **Public restroom available:** Yes or No?

Type of business: ☐Animal groomer/kennel ☐Conference space
☐Hair salon ☐ Tasting Room ☐ Brewery ☐ Car Wash

☐Care Facility ☐ Catering ☐ Child Care Facility ☐Dentist office

☐Doctors Office ☐ Grocery Store ☐ Hotel ☐ Laundromat

☐Nail Salon ☐ Office ☐Restaurant ☐ Store ☐ Therapist office

☐Other **See attached letter and Calculations**

Detailed information about business (i.e. # of chairs with sinks, type of office or store)

See Letter

Existing land use of parcel or building (be detailed): See Letter

If residential, include # of bedrooms. If commercial, include type of business, # of employees.

See letter and calculation breakdown.

Sewer allocation request calculations (reference Attachment A for housing). If unsure leave blank. Staff will make the assessment and circulate it back to you for review:

See letter and calculation breakdown.

*Applicants should request the difference between Proposed and Existing Sewer Allocation. If the proposed change results in a net decrease in flow rates, no sewer allocation fee will apply.

Signature of Property Owner: _____

Date: 5-2-24

****

STAFF USE ONLY

Existing Sewer Allocation: 1470 **gpd** **Proposed Sewer Allocation:** 6860 **gpd**

Provisional Sewer Allocation Requested*: 5390 **gpd X $12.80 allocation fee = $** 68,992

Final Allocation Approved _____ **gpd**

Amount of fee collected $ _____

DEPARTMENTAL APPROVAL

Wastewater signature: Chelsea H. Mandigo 5/10/2024

Planning signature: C. Yuen 5/30/2024

City of Essex Junction

Attachment A

Number of bedrooms	Gallons/day (gpd)
1	140
2 or more	210

Examples:

1) Addition of bedroom to single family dwelling 2 BR or more= 0 gal/day allocation

2) Single family dwelling with accessory apartment= 140 gal/day

3) Duplex= Number of bedrooms/duplex

i.e. 2 two bedroom units in duplex= 2 X 210 gpd=420 gal/day allocation

4) Triplex, Fourplex = Number of bedrooms/triplex or fourplex

i.e. 3 three bedroom units in triplex= 3X 210gpd= 630 gal/day allocation

Proposed Use Table for WW Flows based on Wastewater System and Potable Water Supply Rules
Grenerated by Krebs and Lansing - Date 05/06/24

SEWER:

Type	Use per WW Standards	Number of Employees	Number of Dwelling Units (DU)	Rate (Gal. Per Day Per employee)	Rate (Gal. Per Day Per DU)	Gallons Per Day	
Studio Apartments	Studio Dwelling Units		11		140	1540	
Single Bedroom Apartments	Single-bedroom Dwelling Units		8		140	1120	
Double Bedroom Apartments	Multi-bedroom Dwelling Units		20		210	4200	
			39		**TOTALS:**	**6860**	**GPD**

WATER:

Type	Use per WW Standards	Number of Employees	Number of Dwelling Units (DU)	Rate (Gal. Per Day Per employee)	Rate (Gal. Per Day Per DU)	Gallons Per Day	
Studio Apartments	Studio Dwelling Units		11		140	1540	
Single Bedroom Apartments	Single-bedroom Dwelling Units		8		140	1120	
Double Bedroom Apartments	Multi-bedroom Dwelling Units		20		280	5600	
			39		**TOTALS:**	**8260**	**GPD**

Chelsea H. Mandigo
Water Quality Superintendent
Ph. (802) 878-6943, ext. 1705
chelsea@essexjunction.org

City Offices
2 Lincoln Street
Essex Junction, VT 05452
Office (802) 878-6944
Fax: (802) 878-6946
www.essexjunction.org

May 10, 2024

Ernestine Chevrier
Environmental Commission
111 West St, Essex Junction, VT 05452

RE: 227-229 Pearl St-Sunderland Apartments

To whom it may concern,

The City of Essex Junction has sufficient water capacity and sewer capacity to serve the redevelopment of 227-229 Pearl St. Below is a table indicating the proposed development of 39 studio apartment dwellings and the allocation that already existed for the existing three buildings with 7-dweling under 3 bedrooms.

Units	Type	Wastewater (gpd/unit)	WW Design Demand (gpd)	Water (gpd/unit)	Water Design Demand (gpd)
Proposed	39 dwellings (studio, 1 Br, 2 Br)	140 and 210	6860	140 & 280	8260
Existing	7 dwellings (2-bedroom)	210	1470	280	1960
Net Increase in Design Demand:			**5,390**		**6,300**

*7 existing 2-bedroom dwellings to be torn down.

The proposed redevelopment will use 6,860 GPD wastewater capacity and 8,260 GPD of water capacity. This is an increase of 5,390 GPD in wastewater capacity and 6,300 GPD in water capacity than what was previously permitted for the site.

If you have any questions, please do not hesitant to contact me.

Sincerely,

Chelsea H. Mandigo

Chelsea H. Mandigo
Water Quality Superintendent

Proposed Use Table for WW Flows based on Wastewater System and Potable Water Supply Rules
Grenerated by Krebs and Lansing - Date 05/06/24

SEWER:

Type	Use per WW Standards	Number of Employees	Number of Dwelling Units (DU)	Rate (Gal. Per Day Per employee)	Rate (Gal. Per Day Per DU)	Gallons Per Day	
Studio Apartments	Studio Dwelling Units		11		140	1540	
Single Bedroom Apartments	Single-bedroom Dwelling Units		8		140	1120	
Double Bedroom Apartments	Multi-bedroom Dwelling Units		20		210	4200	
			39		**TOTALS:**	**6860**	**GPD**

WATER:

Type	Use per WW Standards	Number of Employees	Number of Dwelling Units (DU)	Rate (Gal. Per Day Per employee)	Rate (Gal. Per Day Per DU)	Gallons Per Day	
Studio Apartments	Studio Dwelling Units		11		140	1540	
Single Bedroom Apartments	Single-bedroom Dwelling Units		8		140	1120	
Double Bedroom Apartments	Multi-bedroom Dwelling Units		20		280	5600	
			39		**TOTALS:**	**8260**	**GPD**

Stormwater Treatment Practice Calculator

Identification

Date	3/14/2024
WPD ID	SN-001
STP Name	Infiltration Basin 1

Loading Information

Drainage Area	5 - Winooski River	
Impervious Area	0.24	acres
Pervious Area	0.08	acres

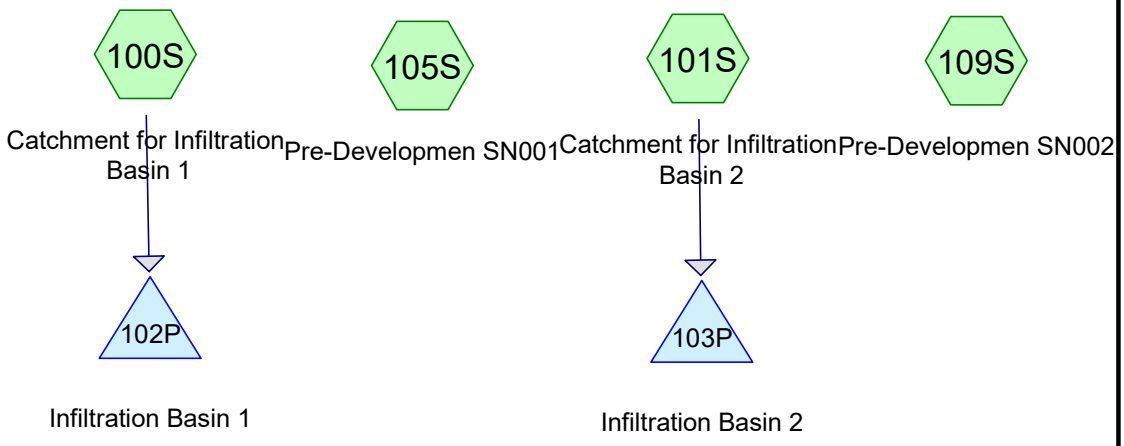
STP Information

STP Type	Infiltration Trench	
Storage Volume	1120	ft^3
Infiltration Rate	8.27 (Sand, HSG - A)	in/hr
Filter Course Depth		in

Estimated Phosphorus Reduction

Load	0.29	kg/year
STP Capacity	1.16	in
Efficiency	100	%
Reduction	0.29	kg/year

QP10



Subcat Reach Pond Link

Routing Diagram for Sunderland-Apartments
Prepared by Krebs & Lansing Consulting Engineers, Inc., Printed 3/14/2024
HydroCAD® 10.00 s/n 06429 © 2013 HydroCAD Software Solutions LLC

Summary for Subcatchment 100S: Catchment for Infiltration Basin 1

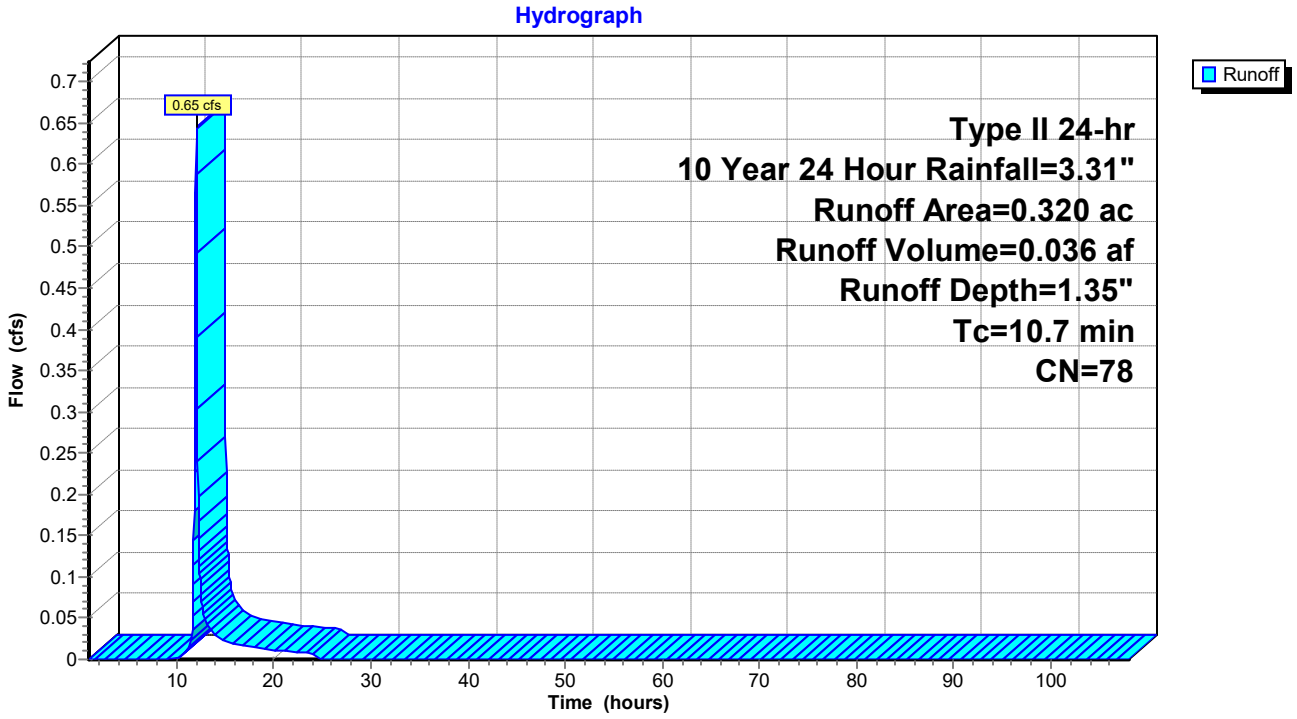
Runoff = 0.65 cfs @ 12.03 hrs, Volume= 0.036 af, Depth= 1.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-108.01 hrs, dt= 0.03 hrs
Type II 24-hr 10 Year 24 Hour Rainfall=3.31"

	Area (ac)	CN	Description
*	0.320	78	From Workbook
	0.320		100.00% Pervious Area

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

Subcatchment 100S: Catchment for Infiltration Basin 1



Summary for Subcatchment 101S: Catchment for Infiltration Basin 2

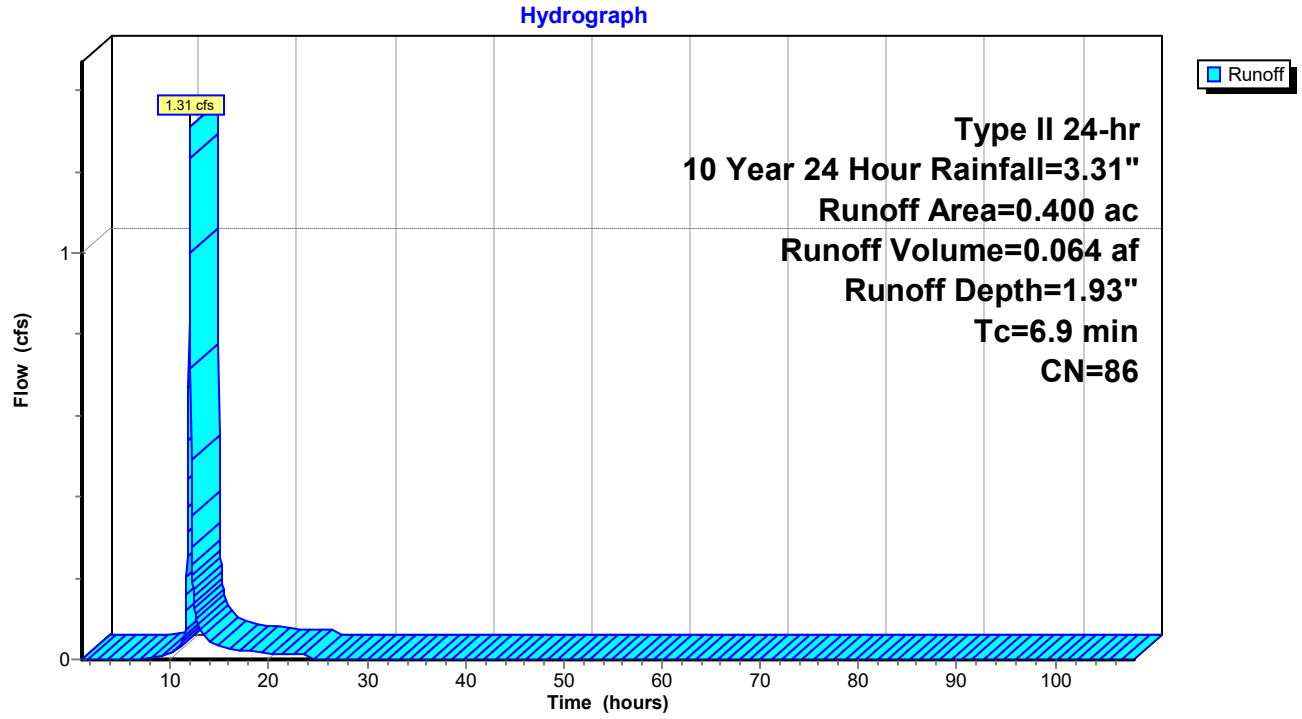
Runoff = 1.31 cfs @ 11.98 hrs, Volume= 0.064 af, Depth= 1.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-108.01 hrs, dt= 0.03 hrs
Type II 24-hr 10 Year 24 Hour Rainfall=3.31"

	Area (ac)	CN	Description
*	0.400	86	From Workbook
	0.400		100.00% Pervious Area

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

Subcatchment 101S: Catchment for Infiltration Basin 2



Summary for Subcatchment 105S: Pre-Developmen SN001

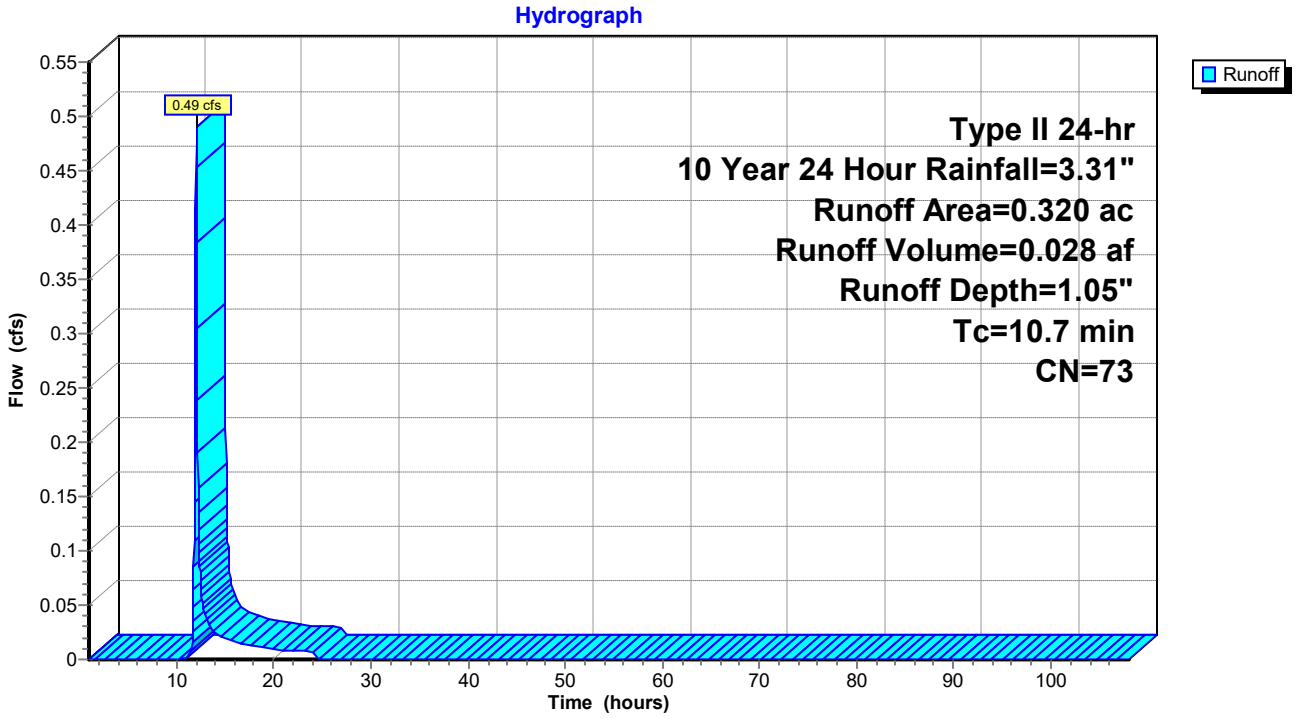
Runoff = 0.49 cfs @ 12.03 hrs, Volume= 0.028 af, Depth= 1.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-108.01 hrs, dt= 0.03 hrs
Type II 24-hr 10 Year 24 Hour Rainfall=3.31"

	Area (ac)	CN	Description
*	0.320	73	From Workbook
	0.320		100.00% Pervious Area

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

Subcatchment 105S: Pre-Developmen SN001



Summary for Subcatchment 109S: Pre-Developmen SN002

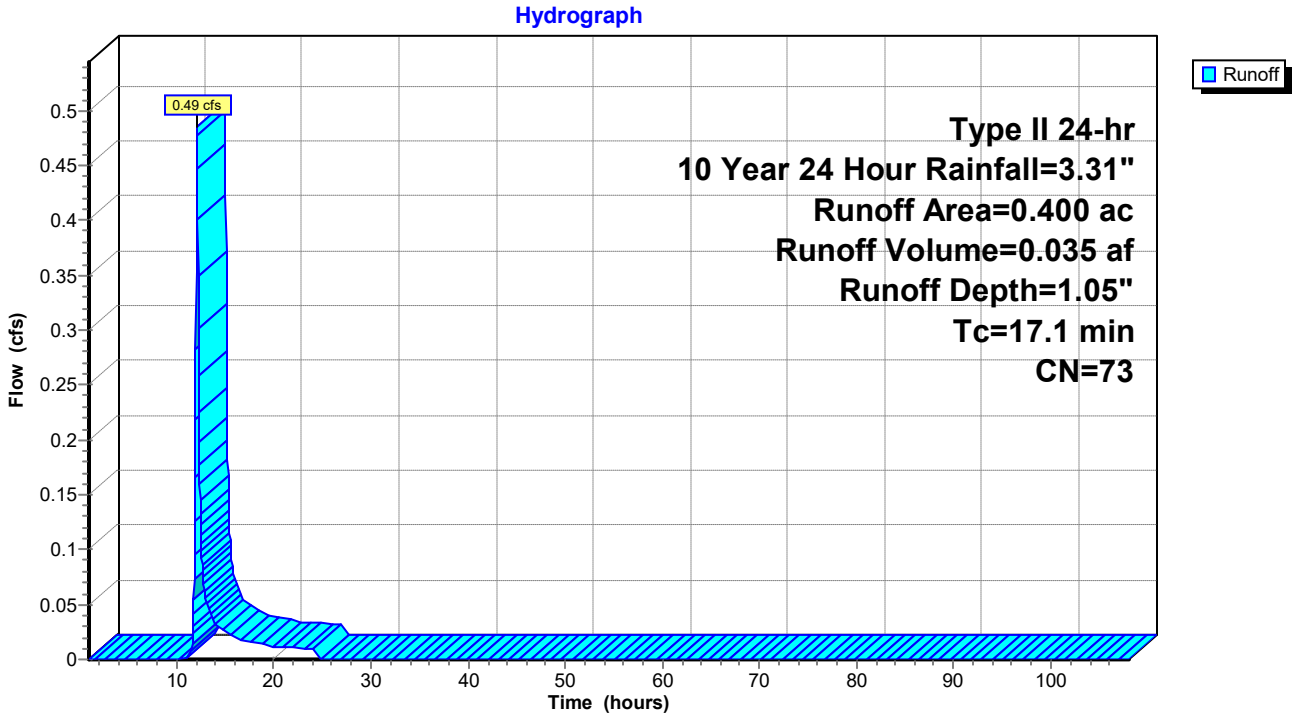
Runoff = 0.49 cfs @ 12.11 hrs, Volume= 0.035 af, Depth= 1.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-108.01 hrs, dt= 0.03 hrs
Type II 24-hr 10 Year 24 Hour Rainfall=3.31"

	Area (ac)	CN	Description
*	0.400	73	From Workbook
	0.400		100.00% Pervious Area

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

Subcatchment 109S: Pre-Developmen SN002



Summary for Pond 102P: Infiltration Basin 1

Inflow Area = 0.320 ac, 0.00% Impervious, Inflow Depth = 1.35" for 10 Year 24 Hour event
Inflow = 0.65 cfs @ 12.03 hrs, Volume= 0.036 af
Outflow = 0.02 cfs @ 11.59 hrs, Volume= 0.036 af, Atten= 96%, Lag= 0.0 min
Discarded = 0.02 cfs @ 11.59 hrs, Volume= 0.036 af
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 1.00-108.01 hrs, dt= 0.03 hrs
Peak Elev= 331.54' @ 14.93 hrs Surf.Area= 1,309 sf Storage= 828 cf

Plug-Flow detention time= 380.9 min calculated for 0.036 af (100% of inflow)
Center-of-Mass det. time= 380.9 min (1,229.3 - 848.4)

Volume	Invert	Avail.Storage	Storage Description
#1	331.00'	1,257 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	320.50'	126 cf	**4.00'D x 10.00'H Vertical Cone/Cylinder**
#3	320.50'	126 cf	**4.00'D x 10.00'H Vertical Cone/Cylinder**
		1,508 cf	Total Available Storage

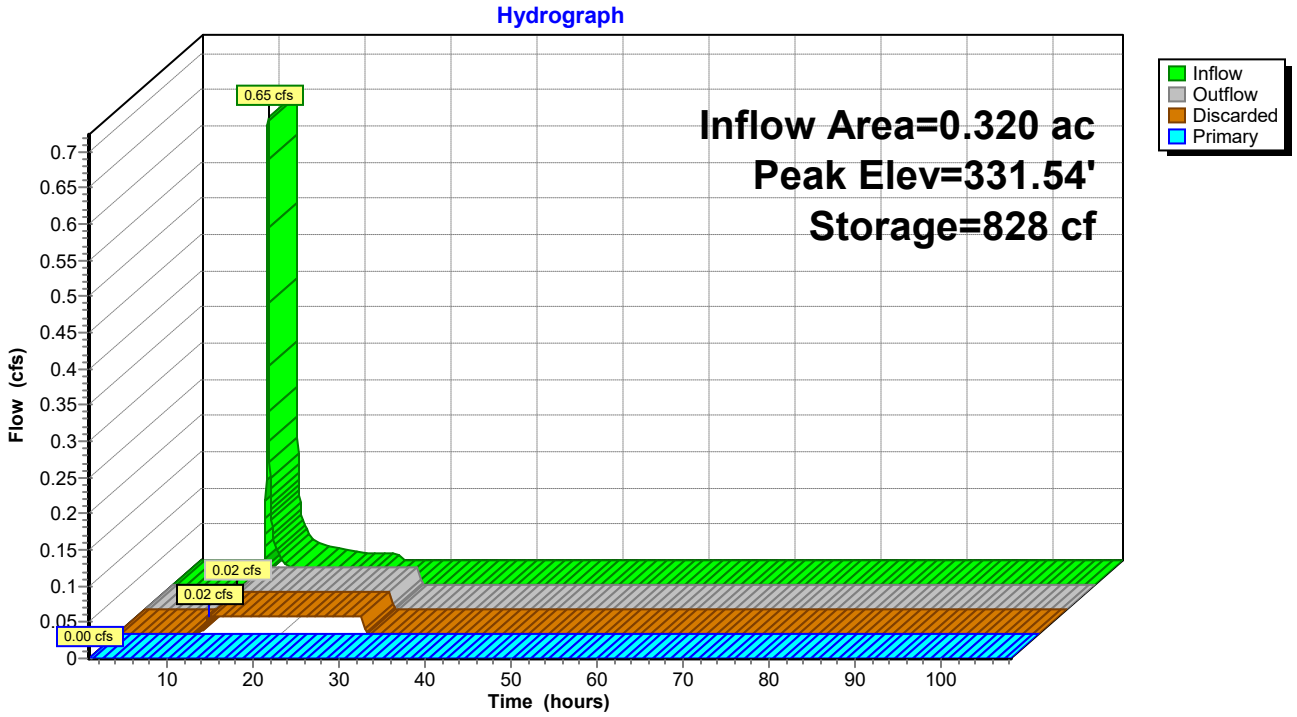
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
331.00	866	0	0
331.50	1,255	530	530
331.75	1,452	338	869
332.00	1,651	388	1,257

Device	Routing	Invert	Outlet Devices
#1	Discarded	320.50'	**40.000 in/hr Exfiltration over Surface area below 320.51'**
#2	Primary	331.75'	**5.0' long x 3.0' 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
			Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Discarded OutFlow Max=0.02 cfs @ 11.59 hrs HW=320.62' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=320.50' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 102P: Infiltration Basin 1



Summary for Pond 103P: Infiltration Basin 2

Inflow Area = 0.400 ac, 0.00% Impervious, Inflow Depth = 1.93" for 10 Year 24 Hour event
Inflow = 1.31 cfs @ 11.98 hrs, Volume= 0.064 af
Outflow = 0.08 cfs @ 12.93 hrs, Volume= 0.064 af, Atten= 94%, Lag= 56.7 min
Discarded = 0.02 cfs @ 10.69 hrs, Volume= 0.057 af
Primary = 0.05 cfs @ 12.93 hrs, Volume= 0.007 af

Routing by Stor-Ind method, Time Span= 1.00-108.01 hrs, dt= 0.03 hrs
Peak Elev= 331.77' @ 12.93 hrs Surf.Area= 2,001 sf Storage= 1,493 cf

Plug-Flow detention time= 573.8 min calculated for 0.064 af (100% of inflow)
Center-of-Mass det. time= 573.9 min (1,392.7 - 818.8)

Volume	Invert	Avail.Storage	Storage Description
#1	331.00'	1,714 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	320.50'	126 cf	**4.00'D x 10.00'H Vertical Cone/Cylinder**
#3	320.50'	126 cf	**4.00'D x 10.00'H Vertical Cone/Cylinder**
		1,965 cf	Total Available Storage

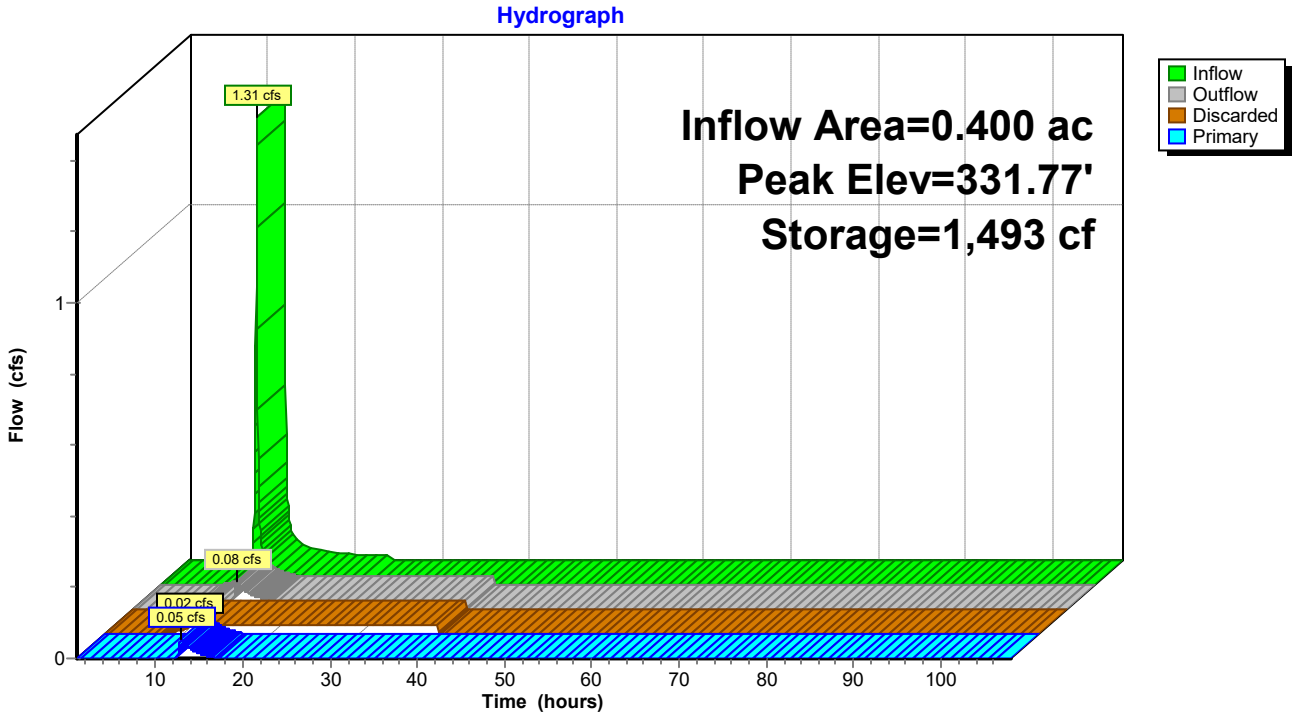
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
331.00	1,236	0	0
331.50	1,712	737	737
331.75	1,953	458	1,195
332.00	2,195	519	1,714

Device	Routing	Invert	Outlet Devices
#1	Discarded	320.50'	**40.000 in/hr Exfiltration over Surface area below 320.51'**
#2	Primary	331.75'	**5.0' long x 3.0' 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 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

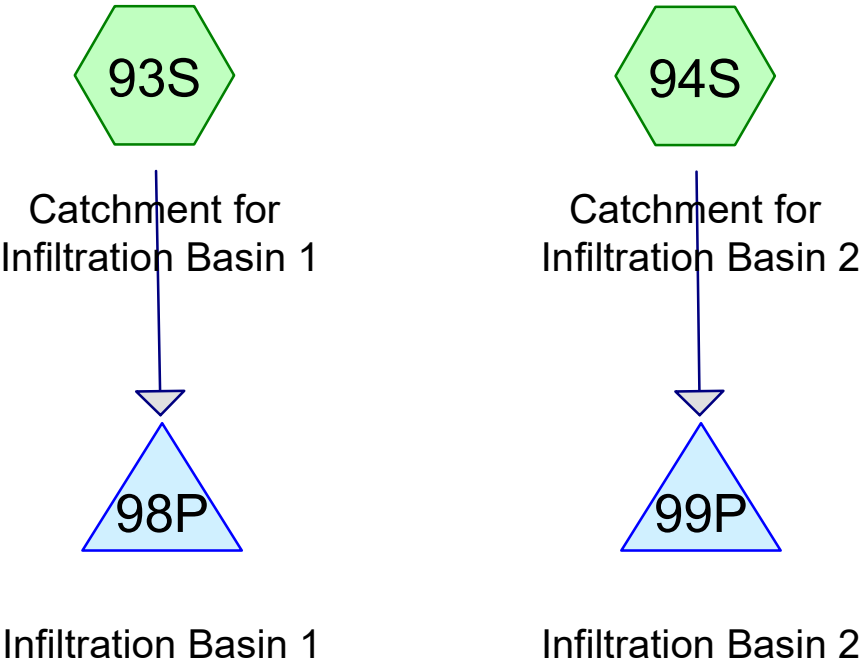
Discarded OutFlow Max=0.02 cfs @ 10.69 hrs HW=320.62' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.04 cfs @ 12.93 hrs HW=331.77' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.04 cfs @ 0.38 fps)

Pond 103P: Infiltration Basin 2



CPv



Subcat Reach Pond Link

Routing Diagram for Sunderland-Apartments
Prepared by Krebs & Lansing Consulting Engineers, Inc., Printed 3/14/2024
HydroCAD® 10.00 s/n 06429 © 2013 HydroCAD Software Solutions LLC

Summary for Subcatchment 93S: Catchment for Infiltration Basin 1

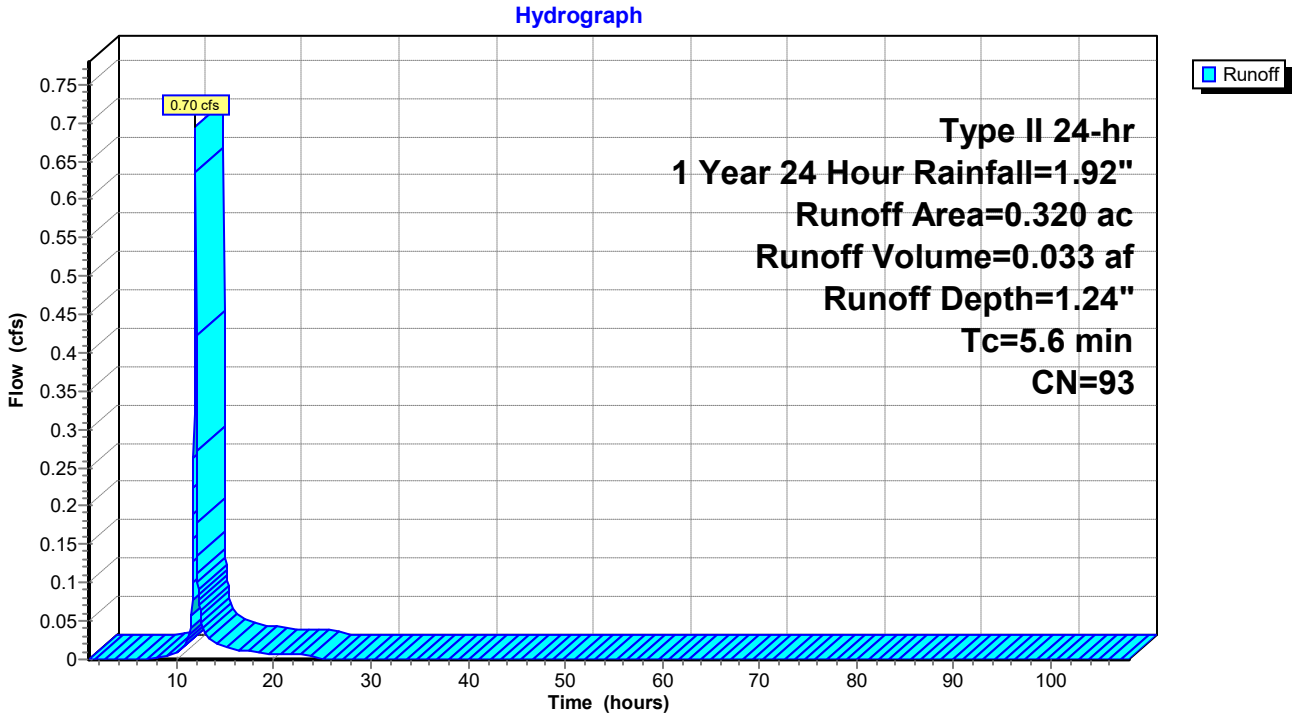
Runoff = 0.70 cfs @ 11.97 hrs, Volume= 0.033 af, Depth= 1.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-108.01 hrs, dt= 0.03 hrs
Type II 24-hr 1 Year 24 Hour Rainfall=1.92"

	Area (ac)	CN	Description
*	0.320	93	From Workbook
	0.320		100.00% Pervious Area

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

Subcatchment 93S: Catchment for Infiltration Basin 1



Summary for Subcatchment 94S: Catchment for Infiltration Basin 2

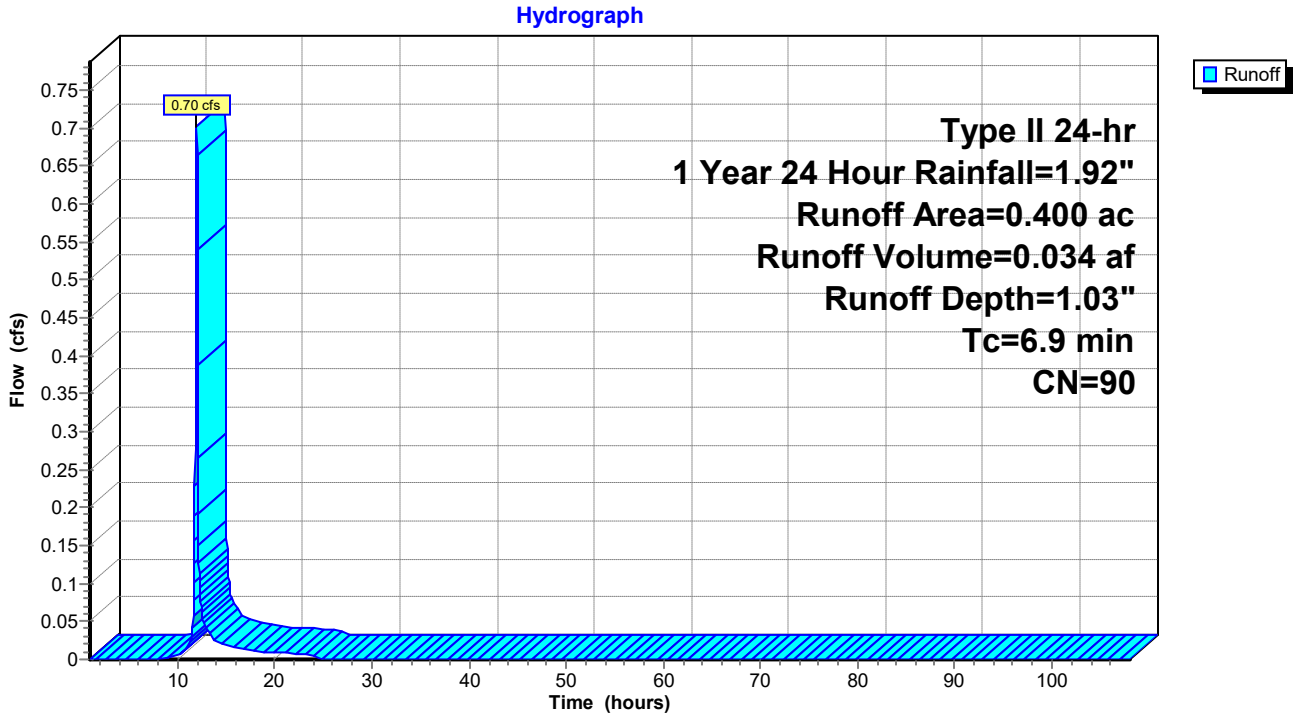
Runoff = 0.70 cfs @ 11.98 hrs, Volume= 0.034 af, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-108.01 hrs, dt= 0.03 hrs
Type II 24-hr 1 Year 24 Hour Rainfall=1.92"

	Area (ac)	CN	Description
*	0.400	90	From Workbook
	0.400		100.00% Pervious Area

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

Subcatchment 94S: Catchment for Infiltration Basin 2



Summary for Pond 98P: Infiltration Basin 1

Inflow Area = 0.320 ac, 0.00% Impervious, Inflow Depth = 1.24" for 1 Year 24 Hour event
Inflow = 0.70 cfs @ 11.97 hrs, Volume= 0.033 af
Outflow = 0.02 cfs @ 11.17 hrs, Volume= 0.033 af, Atten= 97%, Lag= 0.0 min
Discarded = 0.02 cfs @ 11.17 hrs, Volume= 0.033 af
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 1.00-108.01 hrs, dt= 0.03 hrs
Peak Elev= 331.46' @ 13.80 hrs Surf.Area= 1,251 sf Storage= 735 cf

Plug-Flow detention time= 301.3 min calculated for 0.033 af (100% of inflow)
Center-of-Mass det. time= 301.3 min (1,109.5 - 808.2)

Volume	Invert	Avail.Storage	Storage Description
#1	331.00'	1,257 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	320.50'	126 cf	**4.00'D x 10.00'H Vertical Cone/Cylinder**
#3	320.50'	126 cf	**4.00'D x 10.00'H Vertical Cone/Cylinder**
		1,508 cf	Total Available Storage

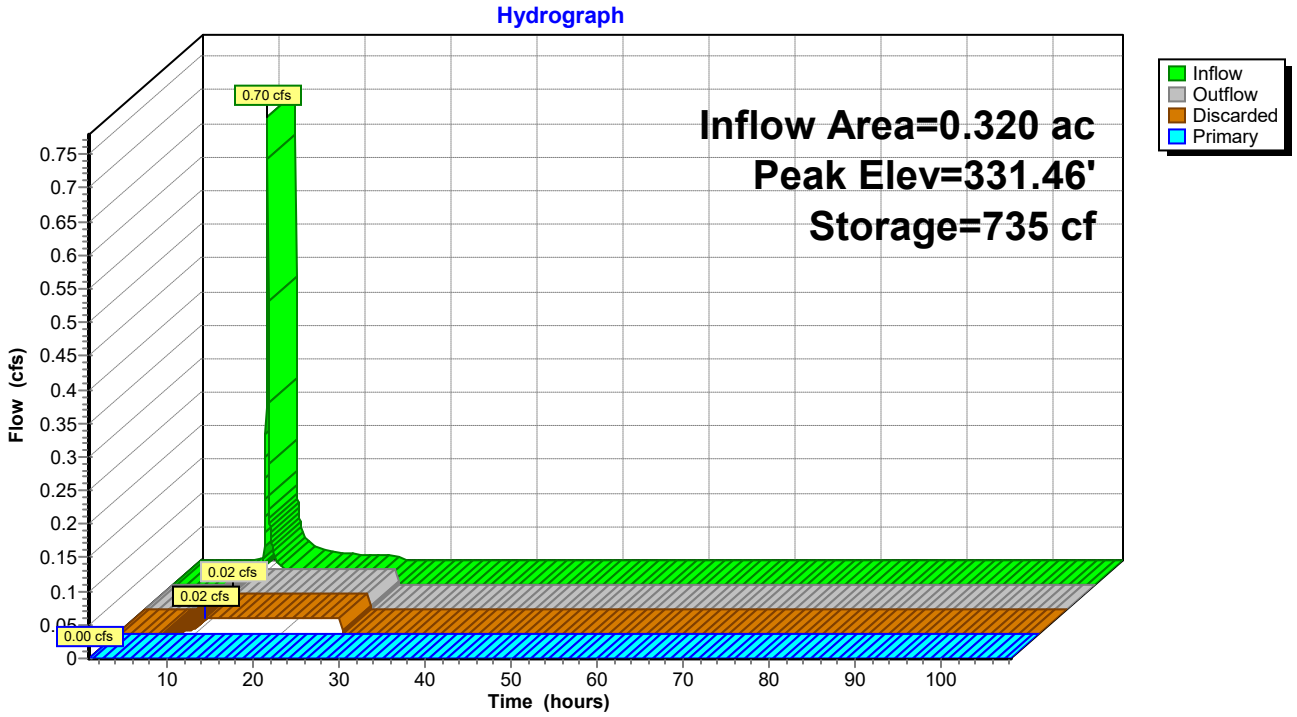
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
331.00	866	0	0
331.50	1,255	530	530
331.75	1,452	338	869
332.00	1,651	388	1,257

Device	Routing	Invert	Outlet Devices
#1	Discarded	320.50'	**40.000 in/hr Exfiltration over Surface area below 320.51'**
#2	Primary	331.75'	**5.0' long x 3.0' 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 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Discarded OutFlow Max=0.02 cfs @ 11.17 hrs HW=320.62' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=320.50' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 98P: Infiltration Basin 1



Summary for Pond 99P: Infiltration Basin 2

Inflow Area = 0.400 ac, 0.00% Impervious, Inflow Depth = 1.03" for 1 Year 24 Hour event
Inflow = 0.70 cfs @ 11.98 hrs, Volume= 0.034 af
Outflow = 0.02 cfs @ 11.32 hrs, Volume= 0.034 af, Atten= 97%, Lag= 0.0 min
Discarded = 0.02 cfs @ 11.32 hrs, Volume= 0.034 af
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 1.00-108.01 hrs, dt= 0.03 hrs
Peak Elev= 331.37' @ 14.07 hrs Surf.Area= 1,613 sf Storage= 773 cf

Plug-Flow detention time= 335.4 min calculated for 0.034 af (100% of inflow)
Center-of-Mass det. time= 335.4 min (1,161.4 - 826.0)

Volume	Invert	Avail.Storage	Storage Description
#1	331.00'	1,714 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	320.50'	126 cf	**4.00'D x 10.00'H Vertical Cone/Cylinder**
#3	320.50'	126 cf	**4.00'D x 10.00'H Vertical Cone/Cylinder**
		1,965 cf	Total Available Storage

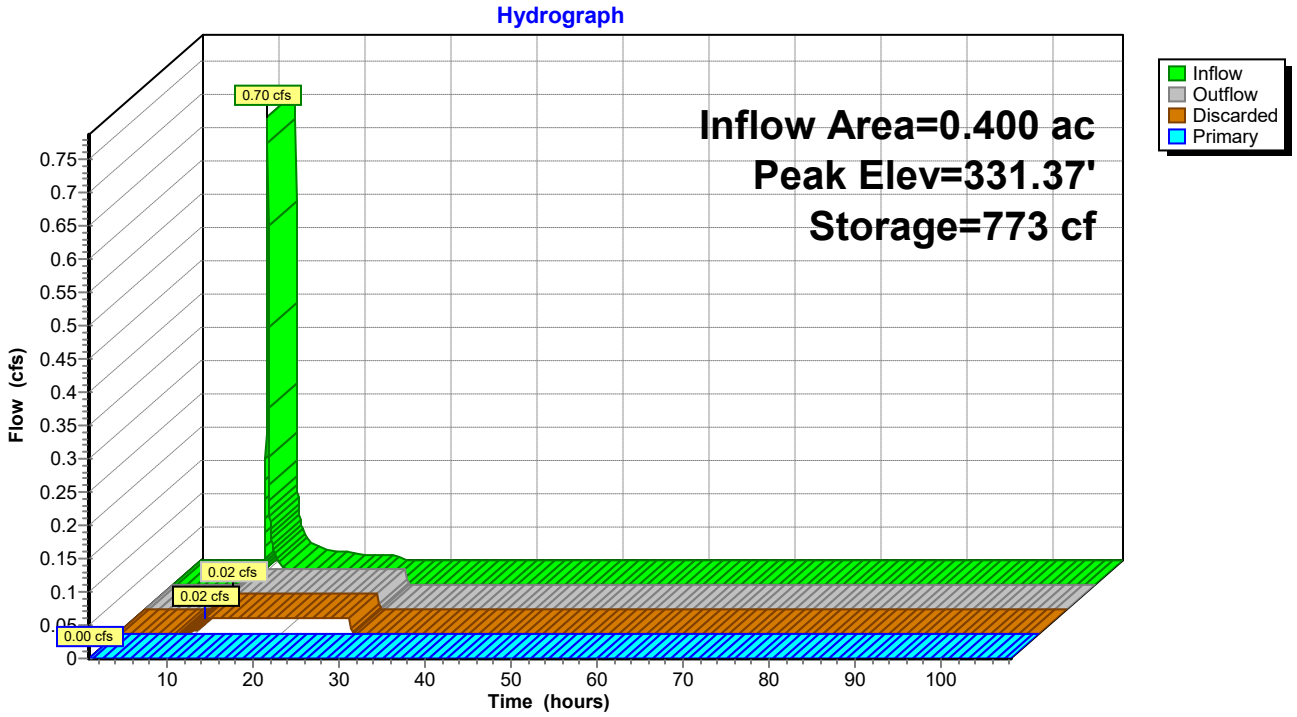
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
331.00	1,236	0	0
331.50	1,712	737	737
331.75	1,953	458	1,195
332.00	2,195	519	1,714

Device	Routing	Invert	Outlet Devices
#1	Discarded	320.50'	**40.000 in/hr Exfiltration over Surface area below 320.51'**
#2	Primary	331.75'	**5.0' long x 3.0' 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
			Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Discarded OutFlow Max=0.02 cfs @ 11.32 hrs HW=320.62' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=320.50' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 99P: Infiltration Basin 2



Stormwater Treatment Practice Calculator

Identification

Date	3/14/2024	
WPD ID	SN-002	
STP Name	Infiltration Basin 2	

Loading Information

Drainage Area	5 - Winooski River	
Impervious Area	0.25	acres
Pervious Area	0.15	acres

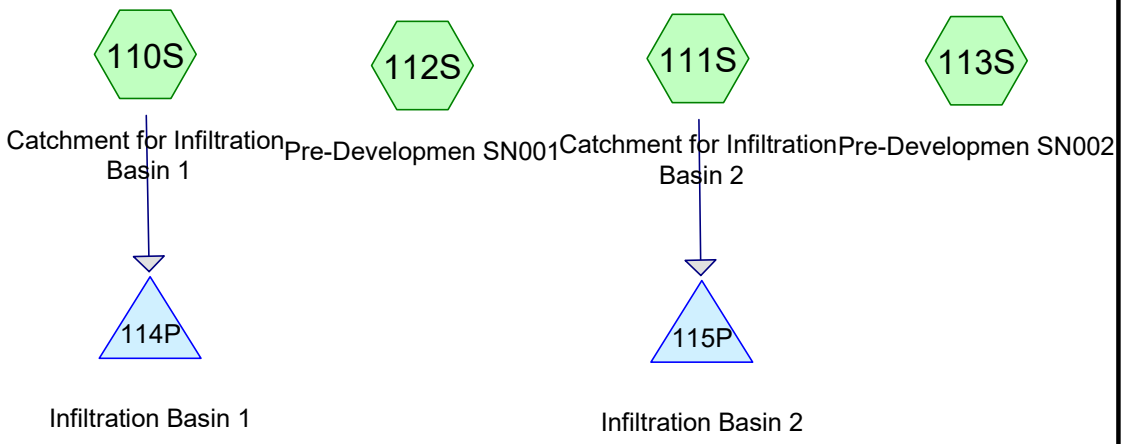
STP Information

STP Type	Infiltration Trench	
Storage Volume	1447	ft³
Infiltration Rate	8.27 (Sand, HSG - A)	in/hr
Filter Course Depth		in

Estimated Phosphorus Reduction

Load	0.31	kg/year
STP Capacity	1.31	in
Efficiency	100	%
Reduction	0.31	kg/year

QP100



Subcat Reach Pond Link

Routing Diagram for Sunderland-Apartments
Prepared by Krebs & Lansing Consulting Engineers, Inc., Printed 3/14/2024
HydroCAD® 10.00 s/n 06429 © 2013 HydroCAD Software Solutions LLC

Summary for Subcatchment 110S: Catchment for Infiltration Basin 1

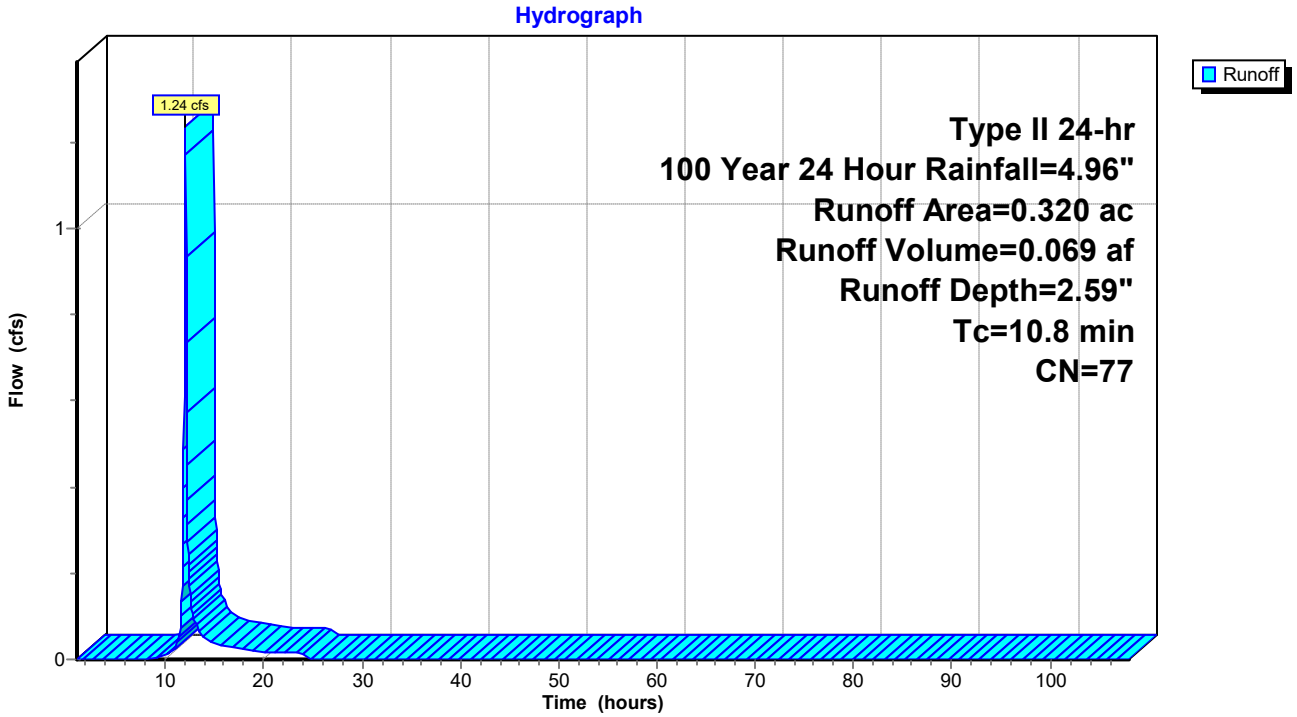
Runoff = 1.24 cfs @ 12.03 hrs, Volume= 0.069 af, Depth= 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-108.01 hrs, dt= 0.03 hrs
Type II 24-hr 100 Year 24 Hour Rainfall=4.96"

	Area (ac)	CN	Description
*	0.320	77	From Workbook
	0.320		100.00% Pervious Area

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

Subcatchment 110S: Catchment for Infiltration Basin 1



Summary for Subcatchment 111S: Catchment for Infiltration Basin 2

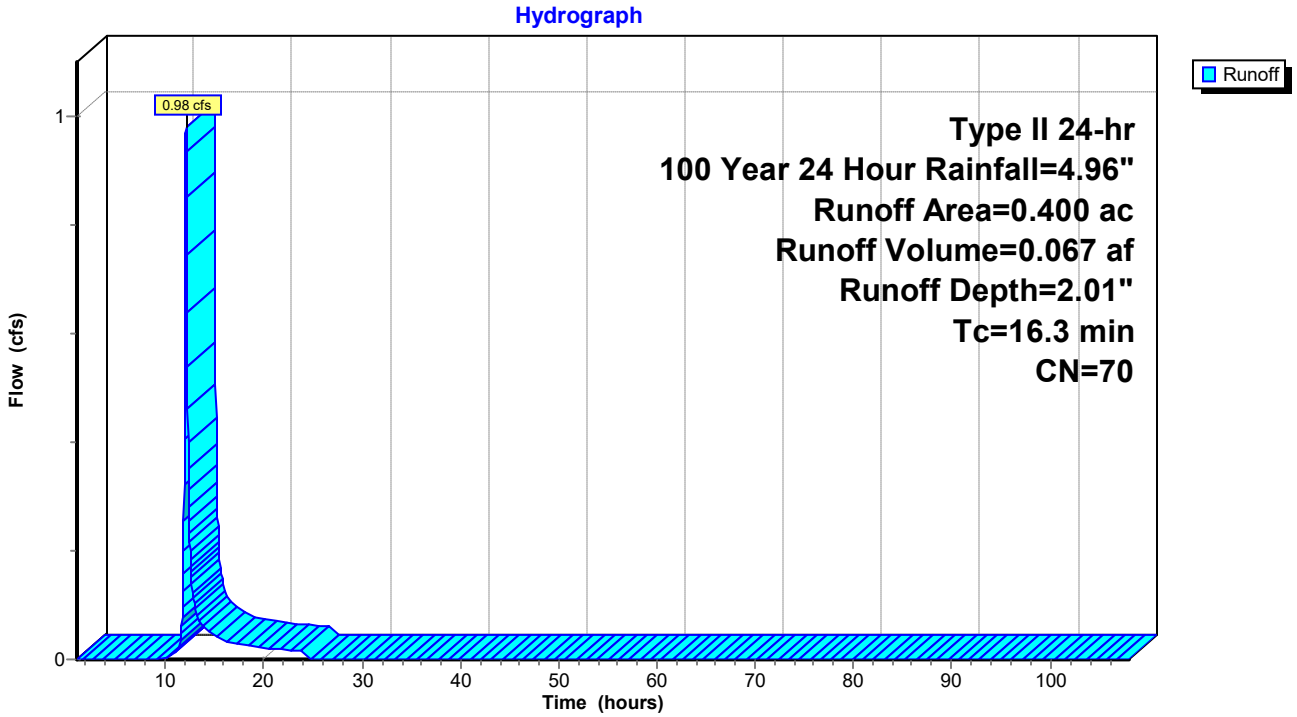
Runoff = 0.98 cfs @ 12.09 hrs, Volume= 0.067 af, Depth= 2.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-108.01 hrs, dt= 0.03 hrs
Type II 24-hr 100 Year 24 Hour Rainfall=4.96"

	Area (ac)	CN	Description
*	0.400	70	From Workbook
	0.400		100.00% Pervious Area

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

Subcatchment 111S: Catchment for Infiltration Basin 2



Summary for Subcatchment 112S: Pre-Developmen SN001

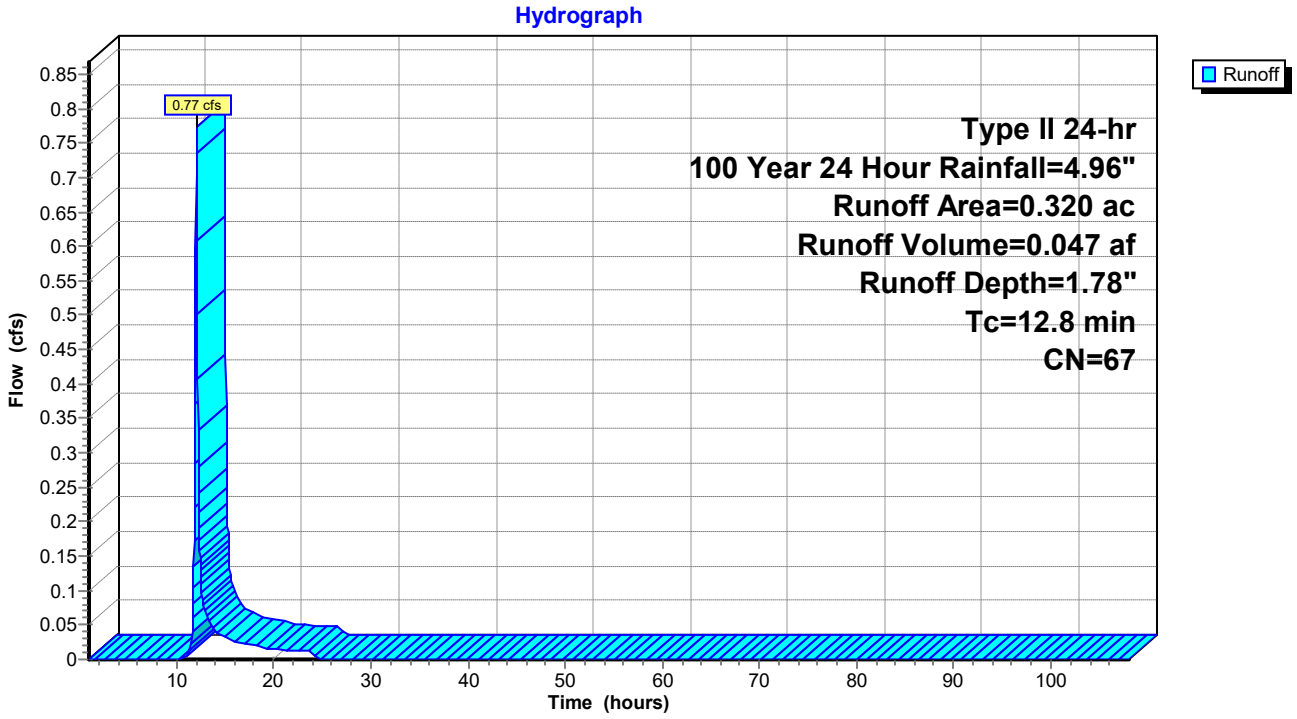
Runoff = 0.77 cfs @ 12.05 hrs, Volume= 0.047 af, Depth= 1.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-108.01 hrs, dt= 0.03 hrs
Type II 24-hr 100 Year 24 Hour Rainfall=4.96"

	Area (ac)	CN	Description
*	0.320	67	From Workbook
	0.320		100.00% Pervious Area

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

Subcatchment 112S: Pre-Developmen SN001



Summary for Subcatchment 113S: Pre-Developmen SN002

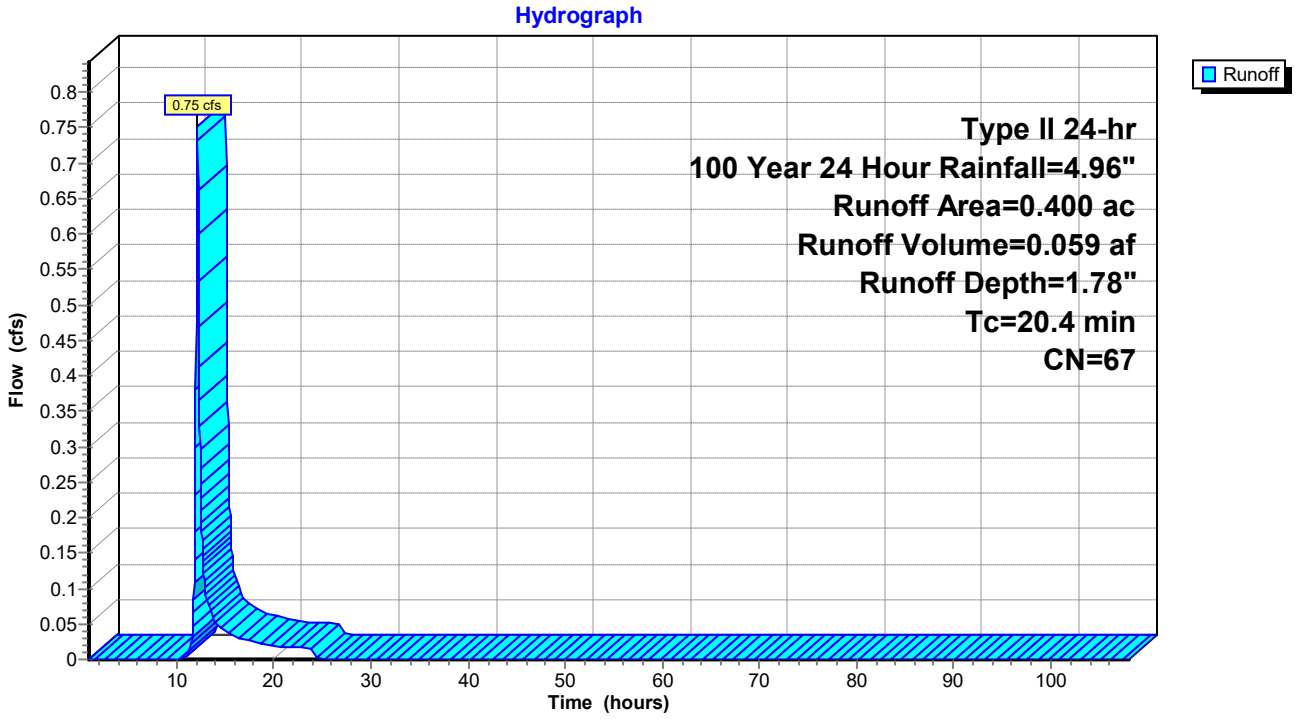
Runoff = 0.75 cfs @ 12.14 hrs, Volume= 0.059 af, Depth= 1.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-108.01 hrs, dt= 0.03 hrs
Type II 24-hr 100 Year 24 Hour Rainfall=4.96"

	Area (ac)	CN	Description
*	0.400	67	From Workbook
	0.400		100.00% Pervious Area

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

Subcatchment 113S: Pre-Developmen SN002



Summary for Pond 114P: Infiltration Basin 1

Inflow Area = 0.320 ac, 0.00% Impervious, Inflow Depth = 2.59" for 100 Year 24 Hour event
Inflow = 1.24 cfs @ 12.03 hrs, Volume= 0.069 af
Outflow = 0.33 cfs @ 12.24 hrs, Volume= 0.069 af, Atten= 73%, Lag= 12.9 min
Discarded = 0.02 cfs @ 10.87 hrs, Volume= 0.050 af
Primary = 0.31 cfs @ 12.24 hrs, Volume= 0.019 af

Routing by Stor-Ind method, Time Span= 1.00-108.01 hrs, dt= 0.03 hrs
Peak Elev= 331.83' @ 12.24 hrs Surf.Area= 1,537 sf Storage= 1,232 cf

Plug-Flow detention time= 387.4 min calculated for 0.069 af (100% of inflow)
Center-of-Mass det. time= 387.5 min (1,218.9 - 831.4)

Volume	Invert	Avail.Storage	Storage Description
#1	331.00'	1,257 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	320.50'	126 cf	**4.00'D x 10.00'H Vertical Cone/Cylinder**
#3	320.50'	126 cf	**4.00'D x 10.00'H Vertical Cone/Cylinder**
		1,508 cf	Total Available Storage

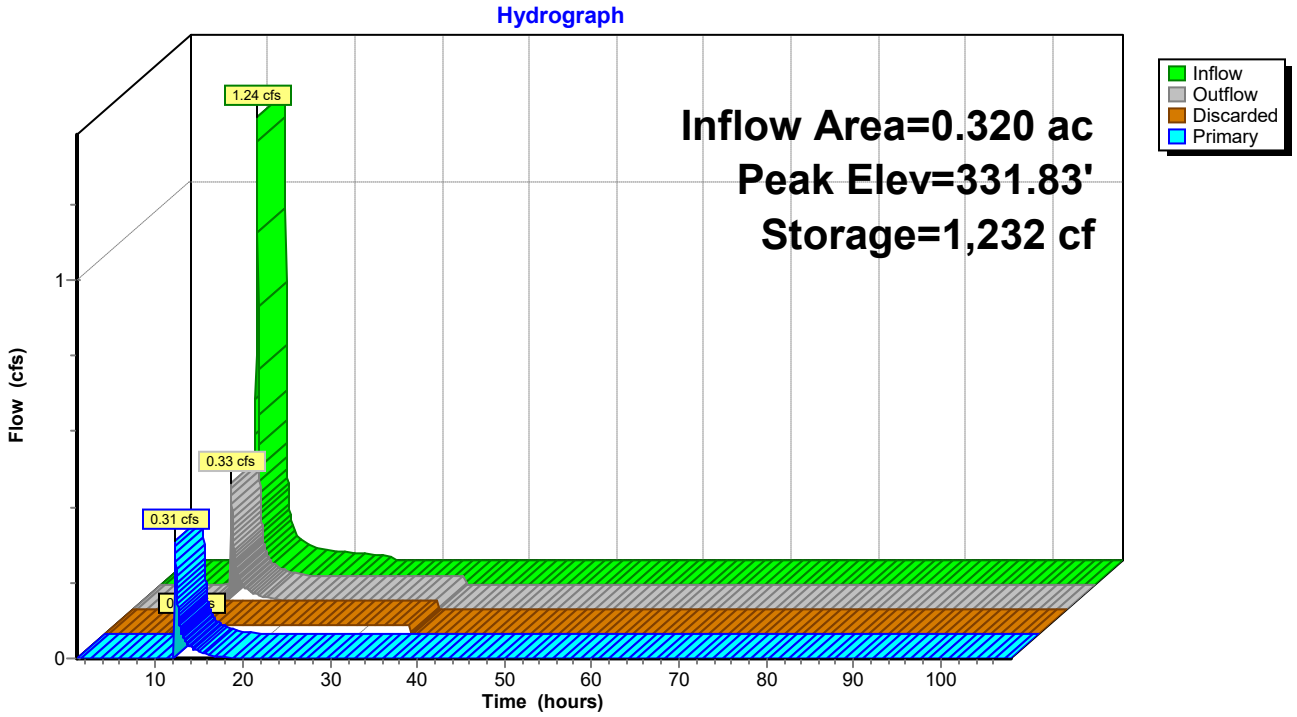
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
331.00	866	0	0
331.50	1,255	530	530
331.75	1,452	338	869
332.00	1,651	388	1,257

Device	Routing	Invert	Outlet Devices
#1	Discarded	320.50'	**40.000 in/hr Exfiltration over Surface area below 320.51'**
#2	Primary	331.75'	**5.0' long x 3.0' 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 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Discarded OutFlow Max=0.02 cfs @ 10.87 hrs HW=320.62' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.25 cfs @ 12.24 hrs HW=331.82' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.25 cfs @ 0.67 fps)

Pond 114P: Infiltration Basin 1



Summary for Pond 115P: Infiltration Basin 2

Inflow Area = 0.400 ac, 0.00% Impervious, Inflow Depth = 2.01" for 100 Year 24 Hour event
Inflow = 0.98 cfs @ 12.09 hrs, Volume= 0.067 af
Outflow = 0.09 cfs @ 13.16 hrs, Volume= 0.067 af, Atten= 91%, Lag= 64.3 min
Discarded = 0.02 cfs @ 11.38 hrs, Volume= 0.057 af
Primary = 0.06 cfs @ 13.16 hrs, Volume= 0.010 af

Routing by Stor-Ind method, Time Span= 1.00-108.01 hrs, dt= 0.03 hrs
Peak Elev= 331.78' @ 13.16 hrs Surf.Area= 2,003 sf Storage= 1,497 cf

Plug-Flow detention time= 584.4 min calculated for 0.067 af (100% of inflow)
Center-of-Mass det. time= 584.3 min (1,438.7 - 854.3)

Volume	Invert	Avail.Storage	Storage Description
#1	331.00'	1,714 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	320.50'	126 cf	**4.00'D x 10.00'H Vertical Cone/Cylinder**
#3	320.50'	126 cf	**4.00'D x 10.00'H Vertical Cone/Cylinder**
		1,965 cf	Total Available Storage

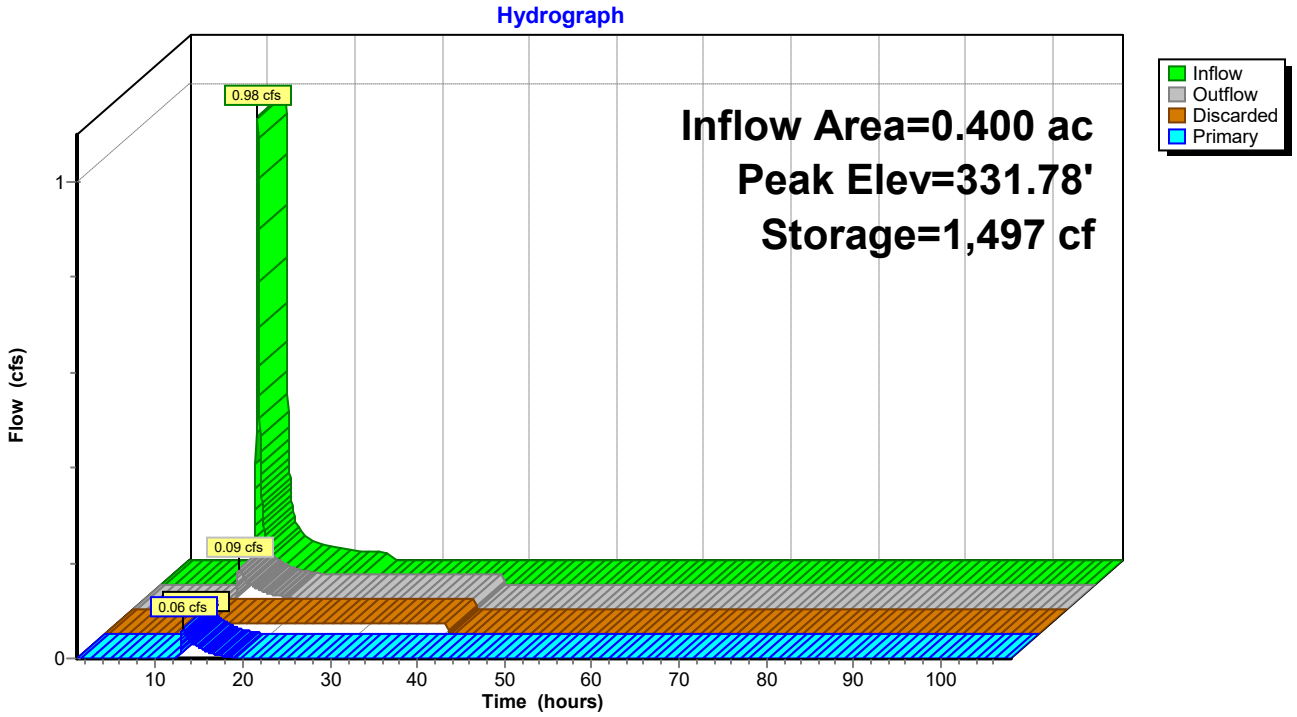
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
331.00	1,236	0	0
331.50	1,712	737	737
331.75	1,953	458	1,195
332.00	2,195	519	1,714

Device	Routing	Invert	Outlet Devices
#1	Discarded	320.50'	**40.000 in/hr Exfiltration over Surface area below 320.51'**
#2	Primary	331.75'	**5.0' long x 3.0' 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
			Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Discarded OutFlow Max=0.02 cfs @ 11.38 hrs HW=320.62' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.05 cfs @ 13.16 hrs HW=331.78' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 0.05 cfs @ 0.39 fps)

Pond 115P: Infiltration Basin 2



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March 14, 2024

Chelsea Mandigo
Water Quality Superintendent
City of Essex Junction
2 Lincoln Street
Essex Junction, VT 05452
chelsea@essexjunction.org
(802) 878-6943, ext. 1705

RE: Project Stormwater Analysis
Sunderland Apartments - 227-229 Pearl, Essex Junction, VT 05452

Dear Chelsea,

The property owner of 227-229 Pearl Street is proposing to amend the approved residential building project on the existing lot, that permit is number SP-1.203.1. The new Applicant is proposing a different building layout, different site layout and additional units to the original submission. The new design will have 39 dwelling units on 4 stories, this is an increase of 5 additional units. The 39 new residential dwelling units will also now be a combination of studio units, single bedroom units, and double bedroom units.

This project intends to treat stormwater runoff in the same manor that the last project did. This would be two infiltration basins on either side of the proposed development. Both the Basins would also have infiltration catch basins which will provide additional capacity. The project is still in a unique situation where the project is neither creating more than 0.50 acres of new or redeveloping more than 0.5 acres of existing impervious. There is approximately 0.26 acres of existing impervious on site, the project will redevelop approximately 0.20 acres of that impervious and add approximately 0.29 additional acres of new impervious. Therefore, this project does not meet the State of Vermont Stormwater Discharge Permit thresholds.

The site is mapped as Adams Windsor Sands. We performed a soil test pit onsite and found very consistent structureless sands which is what we expected. We dug that test pit to a depth of 4.5 feet without finding evidence of water or a high water table. The project planned and has now performed soil boring for structural analysis. Those bores were performed the week of April 3, 2023, a water table was discovered at approximately 30’ down which is approximately elevation 300’ which is consistent with the elevation in Sunderland Brook. The project also performed 2 infiltration tests onsite. Both found extremely high infiltration rates near 120 in/hr. To be conservative we planned to use a third of that value, 40 in/hr. With deep sands, a low water table, and high infiltration rates; we planned to infiltrate as much stormwater as we could. Much of this information is shown on the plans, the bores were just performed but we will forward that information when we can.

Using State of Vermont workbooks and HydroCAD we have modeled the system during the water quality storm (WQv), channel protection storm (CPv), 10-year storm (QP_{10}), and 100-year storm (QP_{100}). Had this been a State submission the larger storm events would not need to be reviewed because the pre-routed post-development flows were lower than 2 cubic feet per second (cfs). However, we reviewed all the

storm events to review how the system would react. Below are the project results.

SN001: Proposed Sunderland Apartments – 227-229 Pearl Street, Essex Junction

a) Description of Impervious Area:

- Existing Impervious Area = 0.11 acres
- New Impervious (treated) = 0.13 acres
- Redeveloped Impervious Area (treated) = 0.11 acres

b) Receiving Body: Groundwater to the Sunderland Brook and the Sunderland Brook

c) Fish Habitat Designation for Receiving Water: Sunderland Brook is designated a cold-water fish habitat.

d) Description of compliance with each of the treatment standards in the 2017 VSMM including the treatment practices or waivers used to meet each of the following standards:

i) **Post-Construction Soil Depth and Quality Standard:**
The Post Construction Soil Restoration will be outlined on the Erosion Prevention and Sediment Control plan which will be on sheet C-1.01 and further detailed on C-2.03 of the project details. The plan outlines the areas of the site that must meet the standard, which is the entire limit of disturbance. There will be very little area within the proposed limit of disturbance which will not be covered by hardscape post development. Post construction the vegetated area's soil will be tested per the details outlined on C-2.03, locations will be identified on site plan C-1.01.

Furthermore, to the extent practical areas outside of construction will be left undisturbed and protected from compaction during construction. However, most of these areas are also covered by existing hardscape. In areas disturbed, topsoil will be removed and stockpiled during construction. Topsoil will be used to restore proposed vegetated areas post construction.

ii) **Groundwater Recharge Standard:**
SN-001: The Groundwater Recharge Standard is met by infiltrating more than the QP10 Storm Event within the proposed infiltration practice.

iii) **Water Quality Treatment Standard (WQ_v)**:
SN-001: The Water Quality Treatment Standard is met by infiltrating the entire WQv within the proposed infiltration practice.

iv) **Channel Protection Standard (CP_v):**
SN-001: The Channel Protection Standard is met by infiltrating the entire CPv within the proposed infiltration practice.

v) **Overbank Flood Protection Standard (Q_{P10})**:
SN-001: The Overbank Flood Protection standard is not required because the pre-routed post-development flow from the QP10 storm event is less than 2 c.f.s. However, the project's design would meet the standard by infiltrating the entire QP10 Storm event

within the proposed infiltration practice. We further evaluated the pre and post development hydrologic models in HydroCAD using the values created from the State's Worksheets and Workbook. Below are the values:

- Predevelopment 10-year, 24-hour Storm = 0.49 cfs
- Pre-routed Post Development 10-year, 24-hour Storm = 0.65 cfs
- Routed Post Development 10-year, 24-hour Storm = 0.00 cfs

vi) **Extreme Flood Protection Standard (Q_{P100}):**
SN-002: The overbank flood protection standard is not required because the permit is still less than 10 acres of impervious. However, the project's design would meet the standard by infiltrating a portion of the Q_{P100} storm within the proposed infiltration practices. Then by evaluating the pre and post development hydrologic models in HydroCAD using the values created from the State's Worksheets and Workbook. Below are the values:

- Predevelopment 100-year, 24-hour Storm = 0.77 cfs
- Pre-routed Post Development 100-year, 24-hour Storm = 1.24 cfs
- Routed Post Development 100-year, 24-hour Storm = 0.31 cfs

SN002: Proposed Sunderland Apartments – 227-229 Pearl Street, Essex Junction

a) Description of Impervious Area:

- Existing Impervious Area = 0.14 acres
- New Impervious (treated) = 0.16 acres
- Redeveloped Impervious Area (treated) = 0.09 acres
- Existing Impervious Area that will be Revegetated = 0.05 acres

b) Receiving Body: Groundwater to the Sunderland Brook and the Sunderland Brook
c) Fish Habitat Designation for Receiving Water: Sunderland Brook is designated a cold-water fish habitat.
d) Description of compliance with each of the treatment standards in the 2017 VSMM including the treatment practices or waivers used to meet each of the following standards:

i) **Post-Construction Soil Depth and Quality Standard:**
The Post Construction Soil Restoration will be outlined on the Erosion Prevention and Sediment Control plan which will be on sheet C-1.01 and further detailed on C-2.03 of the project details. The plan outlines the areas of the site that must meet the standard, which is the entire limit of disturbance. There will be very little area within the proposed limit of disturbance which will not be covered by hardscape post development. Post construction the vegetated area's soil will be tested per the details outlined on C-2.03, locations will be identified on site plan C-1.01.

Furthermore, to the extent practical areas outside of construction will be left undisturbed and protected from compaction during construction. However, most of these areas are also covered by existing hardscape. In areas disturbed, topsoil will be removed and stockpiled

during construction. Topsoil will be used to restore proposed vegetated areas post construction.

ii) **Groundwater Recharge Standard:**
SN-002: The Groundwater Recharge Standard is met by infiltrating more than the CPv Storm Event within the proposed infiltration practice.

iii) **Water Quality Treatment Standard (WQ_V)**:
SN-002: The Water Quality Treatment Standard is met by infiltrating the entire WQv within the proposed infiltration practice.

iv) **Channel Protection Standard (CP_V):**
SN-002: The Channel Protection Standard is met by infiltrating the entire CPv within the proposed infiltration practice.

v) **Overbank Flood Protection Standard (Q_{P10})**:
SN-002: The Overbank Flood Protection standard is not required because the pre-routed post-development flow from the QP10 storm event is less than 2 c.f.s. However, the project's design would meet the standard by infiltrating a portion of the QP10 Storm event within the proposed infiltration practice. We further evaluated the pre and post development hydrologic models in HydroCAD using the values created from the State's Worksheets and Workbook. Below are the values:

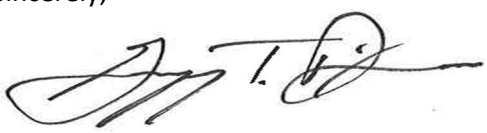
- Predevelopment 10-year, 24-hour Storm = 0.49 cfs
- Pre-routed Post Development 10-year, 24-hour Storm = 1.31 cfs
- Routed Post Development 10-year, 24-hour Storm = 0.05 cfs

vi) **Extreme Flood Protection Standard (Q_{P100}):**
SN-002: The overbank flood protection standard is not required because the permit is still less than 10 acres of impervious. However, the project's design would meet the standard by infiltrating a portion of the Q_{P100} storm within the proposed infiltration practices. Then by evaluating the pre and post development hydrologic models in HydroCAD using the values created from the State's Worksheets and Workbook. Below are the values:

- Predevelopment 100-year, 24-hour Storm = 0.75 cfs
- Pre-routed Post Development 100-year, 24-hour Storm = 0.98 cfs
- Routed Post Development 100-year, 24-hour Storm = 0.06 cfs

Please feel free to contact us if you have any questions, comments or need additional information.

Sincerely,



Greg Dixson, P.E.

Vermont Operational Stormwater Permit - Standards Compliance Workbook

Project Name Sunderland Apartments

The name above will appear on all the discharge point tabs

Site Summary

Do not fill this tab out, apart from the project name and notes. It will auto-populated based on the values on the discharge point tabs. Discharge points (SN) will only show on the summary if an area has been entered on that tab. Areas listed below are those seeking permit coverage.

		Total	SN1	SN2
Impervious	New	0.29	0.13	0.16
	Redeveloped	0.20	0.11	0.09
	Existing	0.00	0.00	0.00
	Previously Authorized	0.00	0.00	0.00
	Total	0.49	0.24	0.25
	Site Area	0.72	0.32	0.40
	Latitude		44.50292	44.50273
	Longitude		-73.13441	-73.13399
	Receiving Water		Sunderland Brook	Sunderland Brook

Recharge

	Total	SN1	SN2
Required	0.0145	0.0065	0.0080
Provided	0.0589	0.0257	0.0332
Standard met?	Yes	Yes	Yes

Notes:

Water Quality

	Total	SN1	SN2
Required	0.0338	0.0159	0.0179
Provided	0.0589	0.0257	0.0332
Standard met?	Yes	Yes	Yes

A minimum WQ_V of 0.2" ($P*R_V$) is required for sites with low impervious (<16.67%). This calculation has not been incorporated into this workbook. Designers should check that the minimum WQ_V has been met for their site.

Notes:

Channel Protection

	Total	SN1	SN2
Standard Applies?		Yes	Yes
Waiver		n/a	n/a
Method		Hydrologic Condition Method	Hydrologic Condition Method
HC_V	0.0339	0.0184	0.0155
T_V Provided	0.0589	0.0257	0.0332

Notes:

Overbank Flood Protection

	SN1	SN2
Standard Applies?	No	No
Pre-Dev Q (cfs)	0.49	0.49
Routed, Post-Dev Q (cfs)	0	0.05
Waiver	<2 cfs	<2 cfs

Notes:

Extreme Flood Protection

	SN1	SN2
Standard Applies?	No	No
Pre-Dev Q (cfs)	0.77	0.75
Routed, Post-Dev Q (cfs)	0.31	0.06
Waiver	< 10 ac impervious	< 10 ac impervious

Notes:

General Notes

Vermont Operational Stormwater Permit - Standards Compliance Workbook

General Discharge Point Information

Project name	**Sunderland Apartments**
Discharge point serial number (e.g. S/N 001)	S/N001
Name of receiving water	Sunderland Brook
Latitude (decimal degrees to five decimal places)	44.50292
Longitude (decimal degrees to five decimal places)	-73.13441

Precipitation Data

* Preciptation values shall be obtained from NOAA Atlas 14

Storm	WQ Storm	1 yr, 24 hr	10 yr, 24 hr	100 yr, 24 hr
Precipitation (inches)	1.00	1.92	3.31	4.96

Drainage Area Information

Pre Development Land Use (acres)

Landuse	A	B	C	D	Total
Grass	0.200	0.000	0.000	0.000	**0.200**
Meadow	0.000	0.000	0.000	0.000	**0.000**
Woods	0.010	0.000	0.000	0.000	**0.010**
Existing Impervious	0.110	0.000	0.000	0.000	**0.110**
Impervious previously authorized under 2002 VSMM (not included in calculations)					**0.000**
Total Pre Site Area					**0.320**

Post Development Land Use (acres)

Landuse	A	B	C	D	Total	%
Grass	0.080	0.000	0.000	0.000	**0.080**	
Meadow	0.000	0.000	0.000	0.000	**0.000**	
Woods	0.000	0.000	0.000	0.000	**0.000**	
New Impervious	0.130	0.000	0.000	0.000	**0.130**	*40.6%*
Existing for Permit Coverage (Treated to New Standards)	0.000	0.000	0.000	0.000	**0.000**	*0.0%*
Existing Impervious Not for Permit Coverage					**0.000**	*0.0%*
Redeveloped Impervious					**0.110**	*34.4%*
Impervious previously authorized under 2002 VSMM					**0.000**	
Total Site Area					**0.320**	
Total Impervious for Permit Coverage					**0.240**	
Net Reduced Impervious					**0.000**	*0.0%*
Reduced Existing Impervious (for redevelopment)					**0.000**	*0.0%*

Information for Calculating T_C by the Watershed Lag Method

	Average Catchment Slope, Y (%)	Hydraulic Length, l (ft)
Pre Development	1	200.00
Post Development	1.2	265.00

Vermont Operational Stormwater Permit - Standards Compliance Workbook

Runoff Calculations

	1 yr, 24-hr	10 yr, 24-hr	100 yr, 24-hr
Predevelopment runoff volume (ac-ft)	0.0155	0.0282	0.0465
Pre-routed, post development runoff volume (ac-ft)	0.0339	0.0616	0.0957

Tier 1/Runoff Reduction Practices

List all Tier 1 practices below with the associated treatment volume (T_V). The T_V will be applied to all treatment standards, except for Green Roofs, which do not receive recharge or water quality credit. Please include the appropriate STP worksheet(s) with the application.

Practice	T_V (ac-ft)	Practice	T_V (ac-ft)
Infiltration Basin	0.026		

Runoff Reduction Calculations

Standard	Re	WQ	CP	Q_{P10}	Q_{P100}
T_V Required (ac-ft)	0.0065	0.0159	0.0184	0.0333	0.0492
T_V Provided (ac-ft)	0.0257	0.0257	0.0257	0.0257	0.0257
T_V Remaining (ac-ft)	0.0000	0.0000	0.0000	0.0076	0.0235
Standard met with HCM?	Yes	Yes	Yes	No	No
Post-Development CN	n/a	95	93	90	88
CN_{adj}	n/a	n/a	n/a	78	77
Pre-Development CN	n/a	n/a	82	73	67

Groundwater Recharge Standard (Re)

Standard Applicable? (●) Yes ( ) No

Re_V: 0.0065

Standard met with Tier 1 Practices?: Yes

Recharge Notes:

Fully Infiltrates more than the QP10 Storm Event

Vermont Operational Stormwater Permit - Standards Compliance Workbook

Water Quality Treatment Standard (WQ)

	(ac-ft)
WQ_V - New & Existing	0.0111
WQ_V - Redevelopment	0.0048
Total WQ_V	0.0159
WQ_V met with Tier 1 practices	0.0159
WQ_V to be met with Tier 2 and/or Tier 3 practices	0.0000

		Apply Reduction?
% Net Reduction	0.0%	(●) No ( ) Yes
% Removed Existing Impervious (Redevelopment)	0.0%	(●) No ( ) Yes

Is all impervious treated by disconnection? (●) No ( ) Yes (WQv met)

Tier 2 & 3 Water Quality Practice	WQ_V Provided (ac-ft)	Tier
Total WQ_V Provided (ac-ft)	0.0000	ac-ft
Is the WQ_V Standard met?	Yes	

Water Quality Notes: Fully Infiltrates WQv Storm Event

Channel Protection Standard (CP)

Standard Applicable? (●) Yes ( ) No

Standard Met with HCM? Yes

The channel protection standard has been fully met with hydrologic condition method. Additional treatment of the 1 year storm is not required.

Provide Extended Detention for: n/a ac-ft

Warm or Cold Water Fishery? (●) Cold ( ) Warm →

Provide: 12 hours of extended detention

OR

☐ The Alternative Extended Detention Method (§2.2.5.4) is being used.

See the Vermont Water Quality Standards for warm and cold water designations

Extended Detention STP:

Modeling Info: When demonstrating CP compliance with extended detention in a hydrologic model, use the CN and T_C below if the practice being modelled is not a Tier 1 practice. The CN_{Adj} takes into account the reduction in runoff volume achieved through Tier 1 practices. The T_C is calculated by the watershed lag method using CN_{Adj} as CN'.

CN_{Adj}: n/a Post Development T_C (min): 5.6 (Watershed Lag Method)

Channel Protection Notes: Fully Infiltrates CPv Storm Event

Last Updated 8/28/2018

Overbank Flood Protection (Q_{P10})

Standard Applicable?	○ Yes ◉ No	Waiver (if No is selected):	<2 cfs pre-routed, post development 10 yr discharge
Standard Met with HCM?	No	*The QP10 standard has not been fully met. Provide additional STPs to ensure post development peak runoff does not exceed pre development peak runoff for the 10 yr, 24 hour storm event.*	
STP used:			
Pre-development peak discharge rate (cfs)	0.49		
Pre-routed, post-development peak discharge rate (cfs)	0.65		
Routed, post-development peak discharge rate (cfs)	0.00		

Modeling Info: *When demonstrating Q_{P10} compliance in a hydrologic model, use the following CN and T_C below, if the practice used to meet Q_{P10} is not itself a Tier 1 practice. The CN_{Adj} takes into account the reduction in runoff volume achieved through Tier 1 practices. The T_C is calculated by the watershed lag method using CN_{Adj} as CN'.*

Pre-Development CN (Flow-weighted composite)	73	Pre Development T_C (min)	10.7	(Watershed Lag Method)
CN_{Adj}	78	Post Development T_C (min)	10.7	
Overbank Flood Notes:	Fully Infiltrates the QP10 Storm Event			

Extreme Flood Protection (Q_{P100})

Standard Applicable?	○ Yes ◉ No	Waiver (if No is selected):	<10 acres impervious
Standard Met with HCM?	No	*The extreme standard has not been fully met. Provide additional STPs to ensure post development peak runoff does not exceed pre development peak runoff for the 100 yr, 24 hour storm event.*	
STP used:			
Pre-development peak discharge rate (cfs)	0.77		
Pre-routed, post-development peak discharge rate (cfs)	1.24		
Routed, post-development peak discharge rate (cfs)	0.31		

Modeling Info: *When demonstrating Q_{P100} compliance in a hydrologic model, use the following CN and T_C below, if the practice used to meet Q_{P100} is not a Tier 1 practice. The CN_{Adj} takes into account the reduction in runoff volume achieved through runoff reduction practices. The T_C is calculated by the watershed lag method using CN_{Adj} as CN'.*

Pre-Development CN (Flow-weighted composite)	67	Pre Development T_C (min)	12.8	(Watershed Lag Method)
CN_{Adj}	77	Post Development T_C (min)	10.8	
Extreme Flood Notes:	Not an applicable standard but standard is met. By the routed post-development flows being less than the pre-development flows.			

Vermont Operational Stormwater Permit - Standards Compliance Workbook

General Discharge Point Information

Project name	**Sunderland Apartments**
Discharge point serial number (e.g. S/N 001)	S/N002
Name of receiving water	Sunderland Brook
Latitude (decimal degrees to five decimal places)	44.50273
Longitude (decimal degrees to five decimal places)	-73.13399

Precipitation Data

* Preciptation values shall be obtained from NOAA Atlas 14

Storm	WQ Storm	1 yr, 24 hr	10 yr, 24 hr	100 yr, 24 hr
Precipitation (inches)	1.00	1.92	3.31	4.96

Drainage Area Information

Pre Development Land Use (acres)

Landuse	A	B	C	D	Total
Grass	0.260	0.000	0.000	0.000	**0.260**
Meadow	0.000	0.000	0.000	0.000	**0.000**
Woods	0.000	0.000	0.000	0.000	**0.000**
Existing Impervious	0.140	0.000	0.000	0.000	**0.140**
Impervious previously authorized under 2002 VSMM (not included in calculations)					**0.000**
Total Pre Site Area					**0.400**

Post Development Land Use (acres)

Landuse	A	B	C	D	Total	%
Grass	0.150	0.000	0.000	0.000	**0.150**	
Meadow	0.000	0.000	0.000	0.000	**0.000**	
Woods	0.000	0.000	0.000	0.000	**0.000**	
New Impervious	0.160	0.000	0.000	0.000	**0.160**	*40.0%*
Existing for Permit Coverage (Treated to New Standards)	0.000	0.000	0.000	0.000	**0.000**	*0.0%*
Existing Impervious Not for Permit Coverage					**0.000**	*0.0%*
Redeveloped Impervious					**0.090**	*22.5%*
Impervious previously authorized under 2002 VSMM					**0.000**	
Total Site Area					**0.400**	
Total Impervious for Permit Coverage					**0.250**	
Net Reduced Impervious					**0.000**	*0.0%*
Reduced Existing Impervious (for redevelopment)					**0.050**	*35.7%*

Information for Calculating T_C by the Watershed Lag Method

	Average Catchment Slope, Y (%)	Hydraulic Length, l (ft)
Pre Development	0.5	235.00
Post Development	0.8	265.00

Vermont Operational Stormwater Permit - Standards Compliance Workbook

Runoff Calculations

	1 yr, 24-hr	10 yr, 24-hr	100 yr, 24-hr
Predevelopment runoff volume (ac-ft)	0.0198	0.0359	0.0593
Pre-routed, post development runoff volume (ac-ft)	0.0353	0.0641	0.1008

Tier 1/Runoff Reduction Practices

List all Tier 1 practices below with the associated treatment volume (T_V). The T_V will be applied to all treatment standards, except for Green Roofs, which do not receive recharge or water quality credit. Please include the appropriate STP worksheet(s) with the application.

Practice	T_V (ac-ft)	Practice	T_V (ac-ft)
Infiltration Basin	0.033		

Runoff Reduction Calculations

Standard	Re	WQ	CP	Q_{P10}	Q_{P100}
T_V Required (ac-ft)	0.0080	0.0179	0.0155	0.0282	0.0415
T_V Provided (ac-ft)	0.0332	0.0332	0.0332	0.0332	0.0332
T_V Remaining (ac-ft)	0.0000	0.0000	0.0000	0.0000	0.0083
Standard met with HCM?	Yes	Yes	Yes	Yes	No
Post-Development CN	n/a	95	90	86	82
CN_{adj}	n/a	n/a	n/a	n/a	70
Pre-Development CN	n/a	n/a	82	73	67

Groundwater Recharge Standard (Re)

Standard Applicable?	(●) Yes ( ) No
Re_V	0.0080
Standard met with Tier 1 Practices?	Yes
Recharge Notes:	Fully Infiltrates more than the CPv Storm Event

Vermont Operational Stormwater Permit - Standards Compliance Workbook

Water Quality Treatment Standard (WQ)

	(ac-ft)
WQ_V - New & Existing	0.0137
WQ_V - Redevelopment	0.0042
Total WQ_V	0.0179
WQ_V met with Tier 1 practices	0.0179
WQ_V to be met with Tier 2 and/or Tier 3 practices	0.0000

		Apply Reduction?	
% Net Reduction	0.0%	(•) No ( ) Yes	
% Removed Existing Impervious (Redevelopment)	35.7%	(•) No ( ) Yes	Max 25% applied

Is all impervious treated by disconnection? (•) No ( ) Yes (WQv met)

Tier 2 & 3 Water Quality Practice	WQ_V Provided (ac-ft)	Tier
Total WQ_V Provided (ac-ft)	0.0000	ac-ft
Is the WQ_V Standard met?	Yes	

Water Quality Notes: Fully Infiltrates the WQv Storm Event

Channel Protection Standard (CP)

Standard Applicable? (•) Yes ( ) No

Standard Met with HCM? Yes

The channel protection standard has been fully met with hydrologic condition method. Additional treatment of the 1 year storm is not required.

Provide Extended Detention for: n/a ac-ft

Warm or Cold Water Fishery? (•) Cold ( ) Warm →

Provide: 12 hours of extended detention

OR

☐ The Alternative Extended Detention Method (§2.2.5.4) is being used.

See the Vermont Water Quality Standards for warm and cold water designations

Extended Detention STP:

Modeling Info: When demonstrating CP compliance with extended detention in a hydrologic model, use the CN and T_C below if the practice being modelled is not a Tier 1 practice. The CN_{Adj} takes into account the reduction in runoff volume achieved through Tier 1 practices. The T_C is calculated by the watershed lag method using CN_{Adj} as CN'.

CN_{Adj}: n/a Post Development T_C (min): 6.9 (Watershed Lag Method)

Channel Protection Notes: Fully Infiltrates the CPv Storm Event

Overbank Flood Protection (Q_{P10})

Standard Applicable? ○ Yes ◉ No

Waiver (if No is selected): <2 cfs pre-routed, post development 10 yr discharge

Standard Met with HCM? **Yes**

The QP10 standard has been fully met. No additional STPs are required.

STP used:

Pre-development peak discharge rate (cfs)	0.49
Pre-routed, post-development peak discharge rate (cfs)	1.31
Routed, post-development peak discharge rate (cfs)	0.05

Modeling Info: When demonstrating Q_{P10} compliance in a hydrologic model, use the following CN and T_C below, if the practice used to meet Q_{P10} is not itself a Tier 1 practice. The CN_{Adj} takes into account the reduction in runoff volume achieved through Tier 1 practices. The T_C is calculated by the watershed lag method using CN_{Adj} as CN'.

Pre-Development CN (Flow-weighted composite)	73	Pre Development T_C (min)	17.1	(Watershed Lag Method)
CN_{Adj}	n/a	Post Development T_C (min)	6.9	

Overbank Flood Notes: Not an applicable standard but standard is met. By the routed post-development flows being less than the pre-development flows.

Extreme Flood Protection (Q_{P100})

Standard Applicable? ○ Yes ◉ No

Waiver (if No is selected): <10 acres impervious

Standard Met with HCM? **No**

The extreme standard has not been fully met. Provide additional STPs to ensure post development peak runoff does not exceed pre development peak runoff for the 100 yr, 24 hour storm event.

STP used:

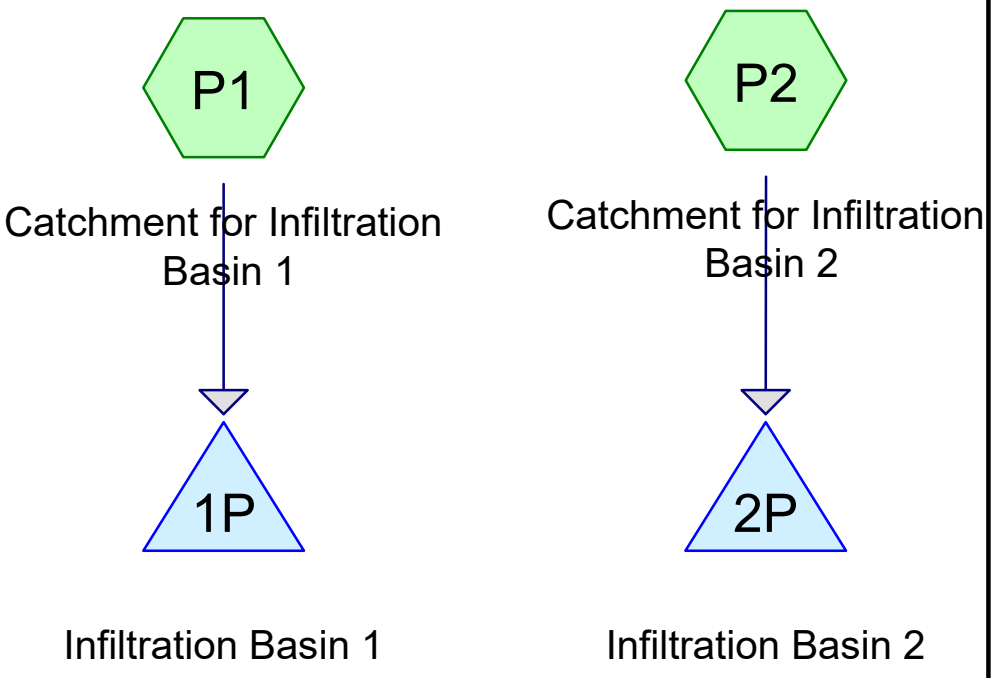
Pre-development peak discharge rate (cfs)	0.75
Pre-routed, post-development peak discharge rate (cfs)	0.98
Routed, post-development peak discharge rate (cfs)	0.06

Modeling Info: When demonstrating Q_{P100} compliance in a hydrologic model, use the following CN and T_C below, if the practice used to meet Q_{P100} is not a Tier 1 practice. The CN_{Adj} takes into account the reduction in runoff volume achieved through runoff reduction practices. The T_C is calculated by the watershed lag method using CN_{Adj} as CN'.

Pre-Development CN (Flow-weighted composite)	67	Pre Development T_C (min)	20.4	(Watershed Lag Method)
CN_{Adj}	70	Post Development T_C (min)	16.3	

Extreme Flood Notes: Not an applicable standard but standard is met. By the routed post-development flows being less than the pre-development flows.

WQv



Subcat Reach Pond Link

Summary for Subcatchment P1: Catchment for Infiltration Basin 1

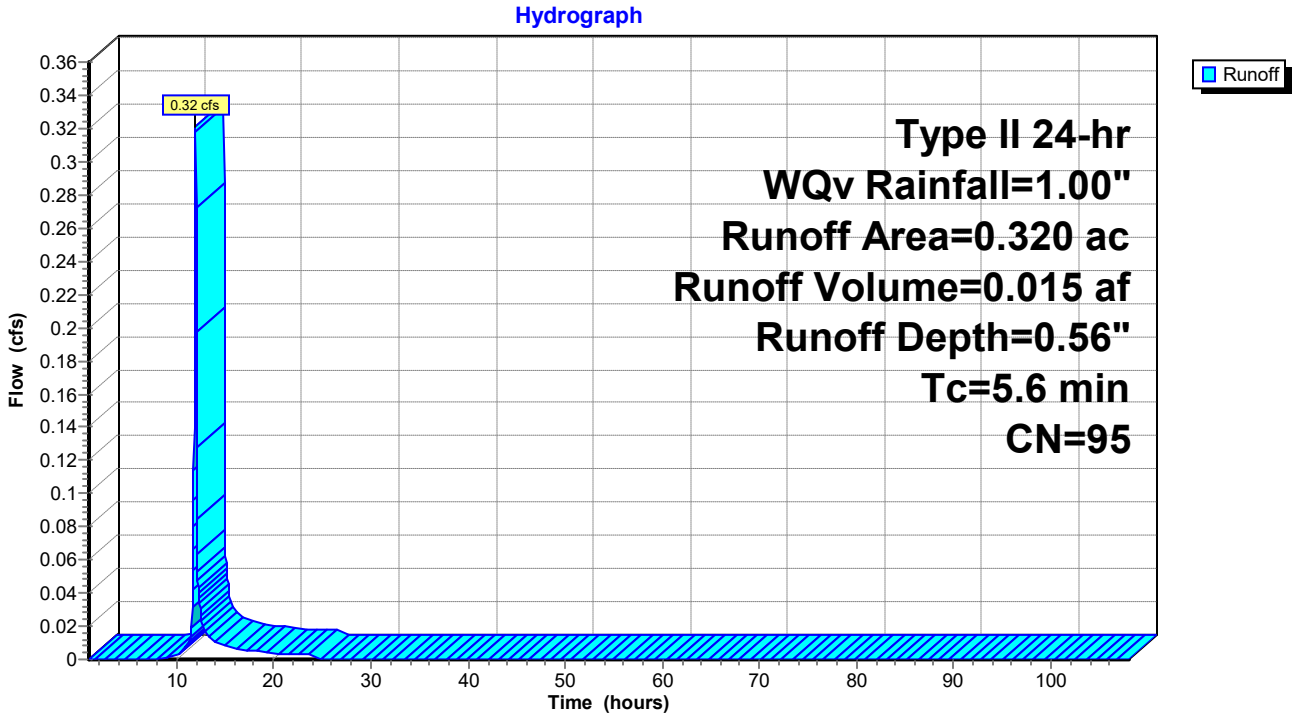
Runoff = 0.32 cfs @ 11.97 hrs, Volume= 0.015 af, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-108.01 hrs, dt= 0.03 hrs
Type II 24-hr WQv Rainfall=1.00"

	Area (ac)	CN	Description
*	0.320	95	From IB Worksheet
	0.320		100.00% Pervious Area

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

Subcatchment P1: Catchment for Infiltration Basin 1



Summary for Subcatchment P2: Catchment for Infiltration Basin 2

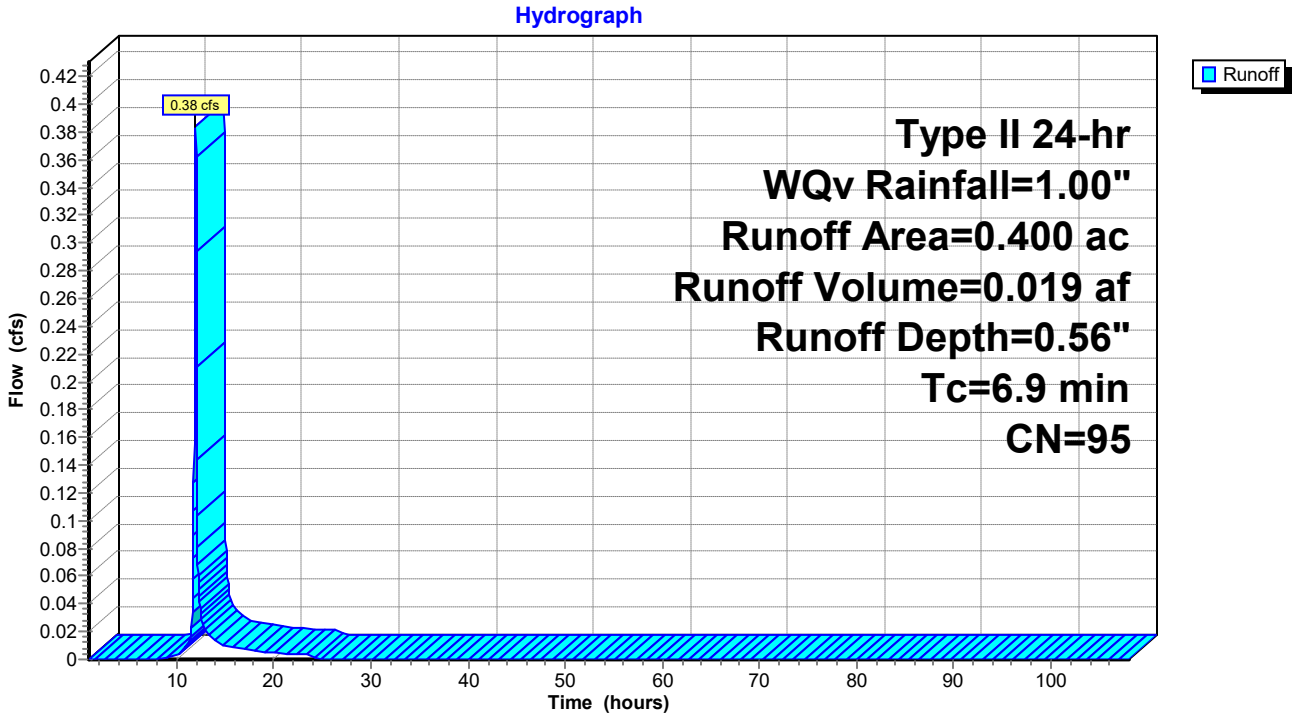
Runoff = 0.38 cfs @ 11.98 hrs, Volume= 0.019 af, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-108.01 hrs, dt= 0.03 hrs
Type II 24-hr WQv Rainfall=1.00"

	Area (ac)	CN	Description
*	0.400	95	From Workbook
	0.400		100.00% Pervious Area

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

Subcatchment P2: Catchment for Infiltration Basin 2



Summary for Pond 1P: Infiltration Basin 1

Inflow Area = 0.320 ac, 0.00% Impervious, Inflow Depth = 0.56" for WQv event
Inflow = 0.32 cfs @ 11.97 hrs, Volume= 0.015 af
Outflow = 0.02 cfs @ 11.62 hrs, Volume= 0.015 af, Atten= 93%, Lag= 0.0 min
Discarded = 0.02 cfs @ 11.62 hrs, Volume= 0.015 af
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 1.00-108.01 hrs, dt= 0.03 hrs
Peak Elev= 331.01' @ 12.58 hrs Surf.Area= 903 sf Storage= 264 cf

Plug-Flow detention time= 88.9 min calculated for 0.015 af (100% of inflow)
Center-of-Mass det. time= 88.9 min (909.4 - 820.5)

Volume	Invert	Avail.Storage	Storage Description
#1	331.00'	1,257 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	320.50'	126 cf	**4.00'D x 10.00'H Vertical Cone/Cylinder**
#3	320.50'	126 cf	**4.00'D x 10.00'H Vertical Cone/Cylinder**
		1,508 cf	Total Available Storage

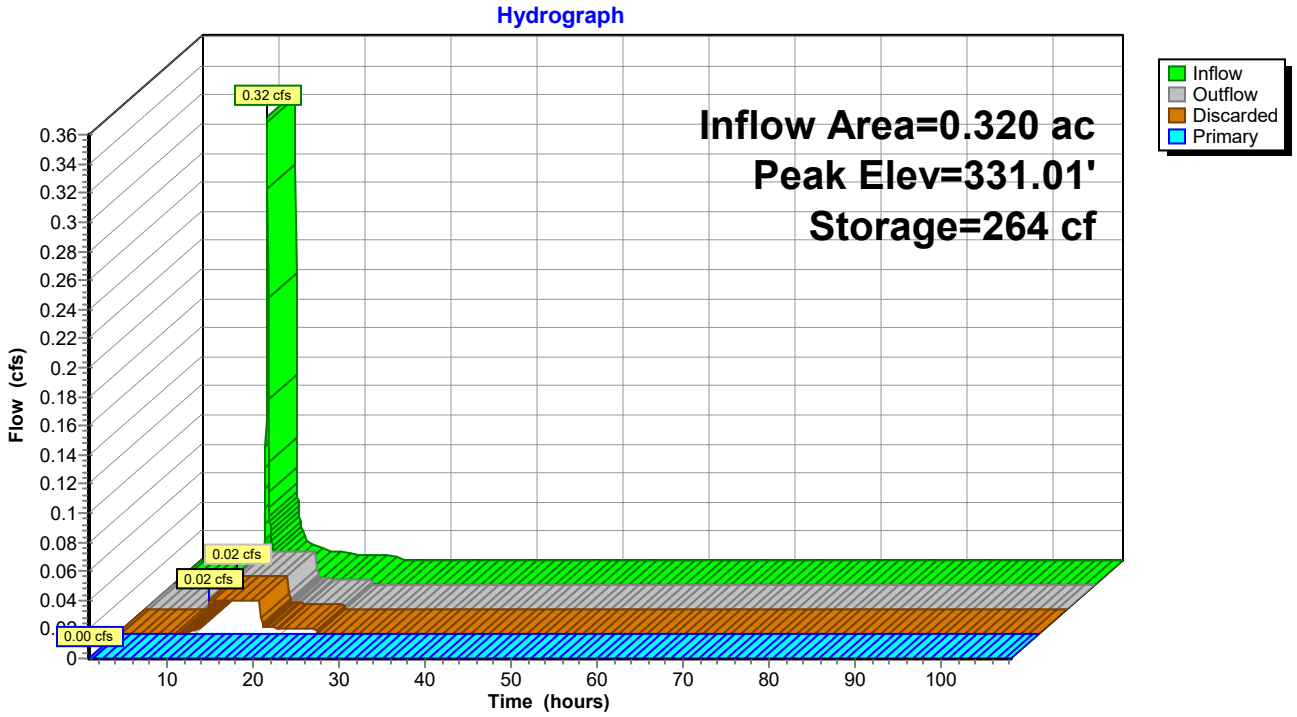
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
331.00	866	0	0
331.50	1,255	530	530
331.75	1,452	338	869
332.00	1,651	388	1,257

Device	Routing	Invert	Outlet Devices
#1	Discarded	320.50'	**40.000 in/hr Exfiltration over Surface area below 320.51'**
#2	Primary	331.75'	**5.0' long x 3.0' 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 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Discarded OutFlow Max=0.02 cfs @ 11.62 hrs HW=320.62' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=320.50' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: Infiltration Basin 1



Summary for Pond 2P: Infiltration Basin 2

Inflow Area = 0.400 ac, 0.00% Impervious, Inflow Depth = 0.56" for WQv event
Inflow = 0.38 cfs @ 11.98 hrs, Volume= 0.019 af
Outflow = 0.02 cfs @ 11.62 hrs, Volume= 0.019 af, Atten= 94%, Lag= 0.0 min
Discarded = 0.02 cfs @ 11.62 hrs, Volume= 0.019 af
Primary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 1.00-108.01 hrs, dt= 0.03 hrs
Peak Elev= 331.08' @ 12.89 hrs Surf.Area= 1,338 sf Storage= 354 cf

Plug-Flow detention time= 128.1 min calculated for 0.019 af (100% of inflow)
Center-of-Mass det. time= 128.1 min (949.8 - 821.8)

Volume	Invert	Avail.Storage	Storage Description
#1	331.00'	1,714 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	320.50'	126 cf	**4.00'D x 10.00'H Vertical Cone/Cylinder**
#3	320.50'	126 cf	**4.00'D x 10.00'H Vertical Cone/Cylinder**
		1,965 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
331.00	1,236	0	0
331.50	1,712	737	737
331.75	1,953	458	1,195
332.00	2,195	519	1,714

Device	Routing	Invert	Outlet Devices
#1	Discarded	320.50'	**40.000 in/hr Exfiltration over Surface area below 320.51'**
#2	Primary	331.75'	**5.0' long x 3.0' 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
			Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Discarded OutFlow Max=0.02 cfs @ 11.62 hrs HW=320.64' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=320.50' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: Infiltration Basin 2