Stormwater Management Report – Addendum I

Date: March 2025

Project: Ashland Rec Facility
240 & 260 Pleasant Street
Ashland, MA

Prepared For: Roger Martin
5 Michigan Drive
Natick, MA

Locus Map:

LAND DESIGN COLLABORATIVE

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Stormwater quality and quantity calculations have been performed for 240-260 Pleasant Street in Ashland, MA to demonstrate compliance with the MassDEP Stormwater Standards, as enumerated in the Wetland Protection Regulations (310 CMR 10) and Town of Ashland Stormwater Management Bylaw (Chapter 343).

Discussions with various members of Town Staff have occurred since the original submittal took place back in January 2025. As a result of these conversations, some revisions and modifications to the Proposed Plans were required. For ease of review, the intent of Addendum I of the Stormwater Management Report is to provide updated documentation for only the components affected by the aforementioned revisions and modifications. In brief, some of the revisions and modifications include a two-way access and egress, Emergency Vehicle access to the field (i.e. ambulance), A.D.A parking spaces, and a bitconc walkway adjoining to the Parcel West of the site (Connect Church). These revisions and modifications all result in a slight increase in the impervious area, hence the reason for an Addendum to the original Stormwater Management Report. It should be noted that all discharge points remain unchanged, and these revisions and modifications do not result in more disturbance than already proposed.

Lastly, the Applicant is still seeking to develop the Property with a recreational facility including a soccer field, playground area with a rubberized surface, crushed stone parking area, and other associated improvements. Due to some maintenance concerns the Applicant is considering switching the Proposed grass field to a turf field. Regardless of which cover type the Applicant chooses to install, the Hydrologic Analysis will remain the same for a couple reasons. First, an accepted practice analyzes the turf field as its “>75% Grass” for its given Hydrologic Soil Group (in this instance HSG A). Secondly, the Turf field will be designed with panel drains underneath the field to promote recharge, which may even increase the overall performance of the proposed stormwater management system.

This Report contains:

A) Revised Proposed Hydrologic Calculations (MassDEP Standards 1 & 2)

B) Revised Water Quality Calculations (MassDEP Standards 3 & 4)

C) Revised Proposed Watershed Map

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Westborough, Massachusetts 01581
508.952.6300 | LDCollaborative.com

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A) Revised Proposed Hydrologic Calculations (Standards 1 & 2)

Standard 1)

The stormwater system has been designed to mimic existing conditions and infiltrate runoff during the 2-, 10- & 100-year storm events, collecting, treating, and discharging stormwater runoff to groundwater via "country drainage" (a LID measure) conveyances to the designed drainage swales upgradient of the 100-foot Buffer Zone. The proposed drainage system will mitigate water quality and quantity to match the existing conditions in that stormwater will be collected, treated, and discharged to a surface infiltration/retention basin. To further help the system draw down during winter conditions, drainage catch basins/area drains are proposed at designed low points to promote infiltration. All runoff from the proposed Project will still be managed directly on the site.

Standard 2)

The Project results in newly graded areas, cover types, and some new impervious surfaces. The proposed stormwater management system has been designed to mitigate stormwater runoff rates for the required storm events (refer to HydroCAD calculations), as summarized below.

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E XY	Existing Conditions Features where "E" designates "Existing"; X designates the area or feature "name"; and Y designates the feature - a sub-catchment "S", a basin/depression/pond/ "P", a conveyance/reach "R", or a point of interest/summation point/link "L"
P XY	Proposed Conditions Features where "P" designates "Proposed"; X designates area or feature "name"; and Y designates the feature - a sub-catchment "S", a basin/depression/pond/ "P", a conveyance/reach "R", or a point of interest/summation point/link "L"

Rates

Point of Interest	Storm Event / Runoff (cubic feet/second)		
	2-Year	10-Year	100-Year
E 1L	0.0	0.4	1.7
E 2S	0.0	0.0	0.0
E 4S	0.0	0.0	0.1
P 1L	0.0	0.0	0.0
P 2S	0.0	0.0	0.0
P 4S	0.0	0.0	0.1

Volumes

Point of Interest	Storm Event / Runoff (cubic feet)		
	2-Year	10-Year	100-Year
E 1L	416	2,419	8,817
E 2S	0	10	344
E 4S	18	84	246
P 1L	0	0	0
P 2S	0	27*	387*
P 4S	16	65	181

* Note: Flow remains on-site as there is a depression located in this Subcatchment.

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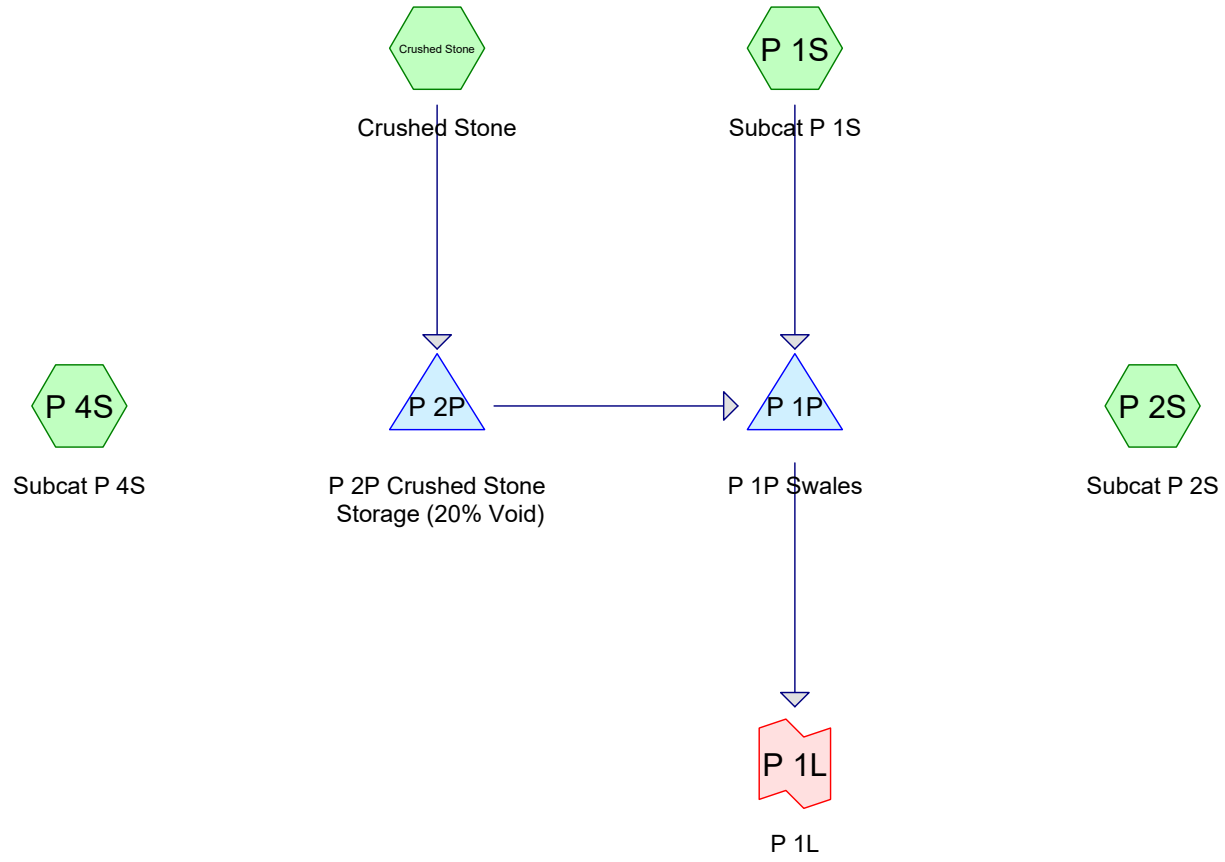


Subcat Reach Pond Link

Routing Diagram for 24-0281 - Proposed Hydrology
Prepared by Land Design Collaborative

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	3.36	2
2	10-Year	Type III 24-hr		Default	24.00	1	5.24	2
3	100-Year	Type III 24-hr		Default	24.00	1	8.23	2

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
47,180	39	>75% Grass cover, Good, HSG A (P 1S, P 2S, P 4S)
529	30	Brush, Good, HSG A (P 4S)
16,210	76	Gravel roads, HSG A (Crushed Stone)
2,271	98	Paved parking, HSG A (P 1S, P 4S)
3,590	98	Unconnected pavement, HSG A (P 1S, P 2S)
12,185	30	Woods, Good, HSG A (P 1S, P 2S)
81,965	**49**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
81,965	HSG A	Crushed Stone, P 1S, P 2S, P 4S
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
81,965		**TOTAL AREA**

Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 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 Crushed Stone: Crushed Stone Runoff Area=16,210 sf 0.00% Impervious Runoff Depth=1.26"
Tc=6.0 min CN=76 Runoff=0.5 cfs 1,708 cf

Subcatchment P 1S: Subcat P 1S Runoff Area=57,554 sf 9.72% Impervious Runoff Depth=0.02"
Tc=6.0 min UI Adjusted CN=42 Runoff=0.0 cfs 119 cf

Subcatchment P 2S: Subcat P 2S Runoff Area=7,403 sf 0.04% Impervious Runoff Depth=0.00"
Flow Length=97' Tc=19.7 min CN=32 Runoff=0.0 cfs 0 cf

Subcatchment P 4S: Subcat P 4S Runoff Area=798 sf 33.21% Impervious Runoff Depth=0.24"
Tc=6.0 min CN=53 Runoff=0.0 cfs 16 cf

Pond P 1P: P 1P Swales Peak Elev=197.36' Storage=392 cf Inflow=0.5 cfs 746 cf
Discarded=0.1 cfs 751 cf Primary=0.0 cfs 0 cf Outflow=0.1 cfs 751 cf

Pond P 2P: P 2P Crushed Stone Storage (20% Void) Peak Elev=198.72' Storage=94 cf Inflow=0.5 cfs 1,708 cf
Discarded=0.0 cfs 1,071 cf Primary=0.5 cfs 627 cf Outflow=0.5 cfs 1,699 cf

Link P 1L: P 1L Inflow=0.0 cfs 0 cf
Primary=0.0 cfs 0 cf

Total Runoff Area = 81,965 sf Runoff Volume = 1,843 cf Average Runoff Depth = 0.27"
92.85% Pervious = 76,104 sf 7.15% Impervious = 5,861 sf

Summary for Subcatchment Crushed Stone: Crushed Stone

Note:

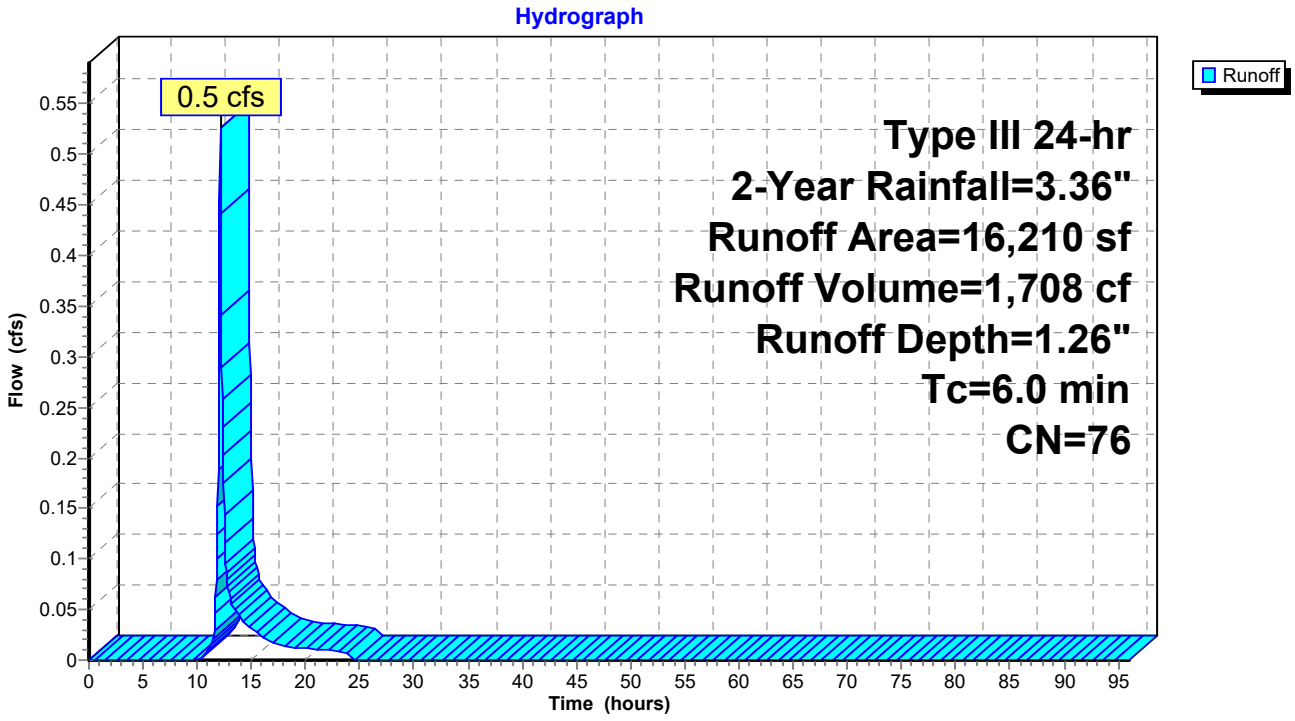
Runoff = 0.5 cfs @ 12.10 hrs, Volume= 1,708 cf, Depth= 1.26"
Routed to Pond P 2P : P 2P Crushed Stone Storage (20% Void)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.36"

Area (sf)	CN	Description
16,210	76	Gravel roads, HSG A
16,210		100.00% Pervious Area

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

Subcatchment Crushed Stone: Crushed Stone



Summary for Subcatchment P 1S: Subcat P 1S

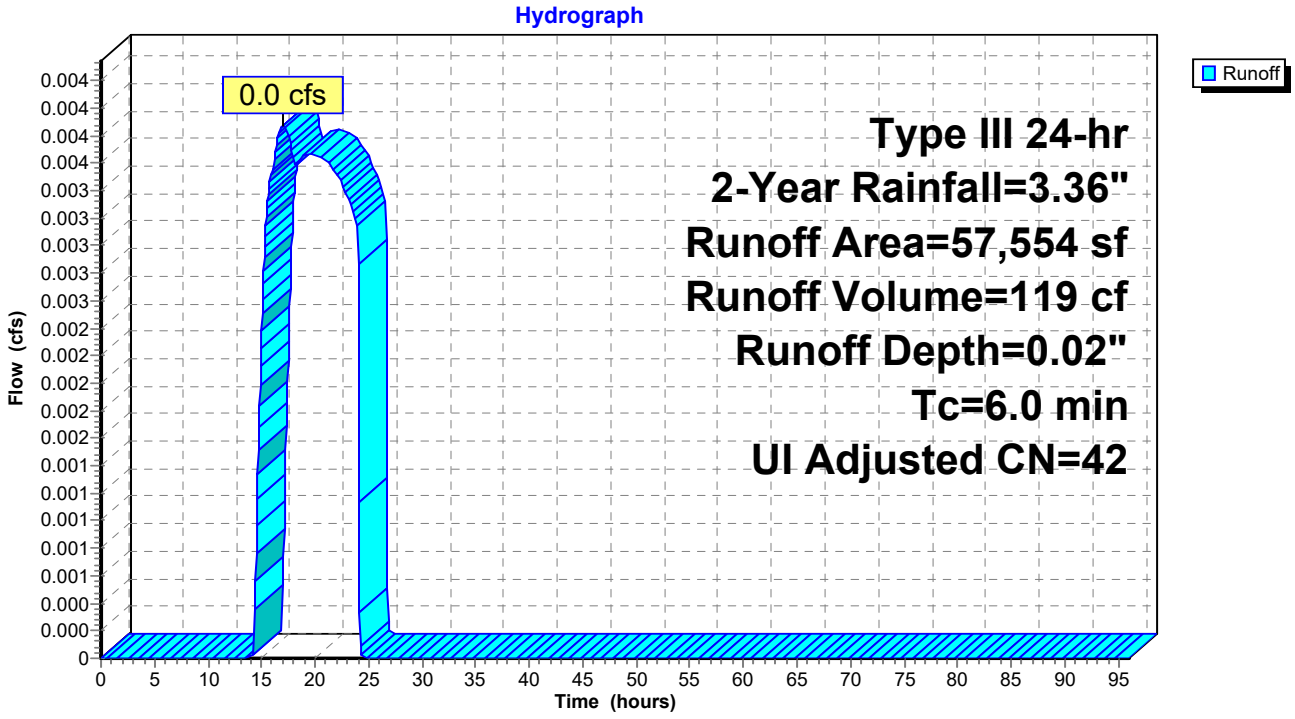
Runoff = 0.0 cfs @ 17.06 hrs, Volume= 119 cf, Depth= 0.02"
Routed to Pond P 1P : P 1P Swales

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.36"

Area (sf)	CN	Adj	Description
45,776	39		>75% Grass cover, Good, HSG A
2,006	98		Paved parking, HSG A
3,587	98		Unconnected pavement, HSG A
6,185	30		Woods, Good, HSG A
57,554	44	42	Weighted Average, UI Adjusted
51,961			90.28% Pervious Area
5,593			9.72% Impervious Area
3,587			64.13% Unconnected

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

Subcatchment P 1S: Subcat P 1S



Summary for Subcatchment P 2S: Subcat P 2S

[45] Hint: Runoff=Zero

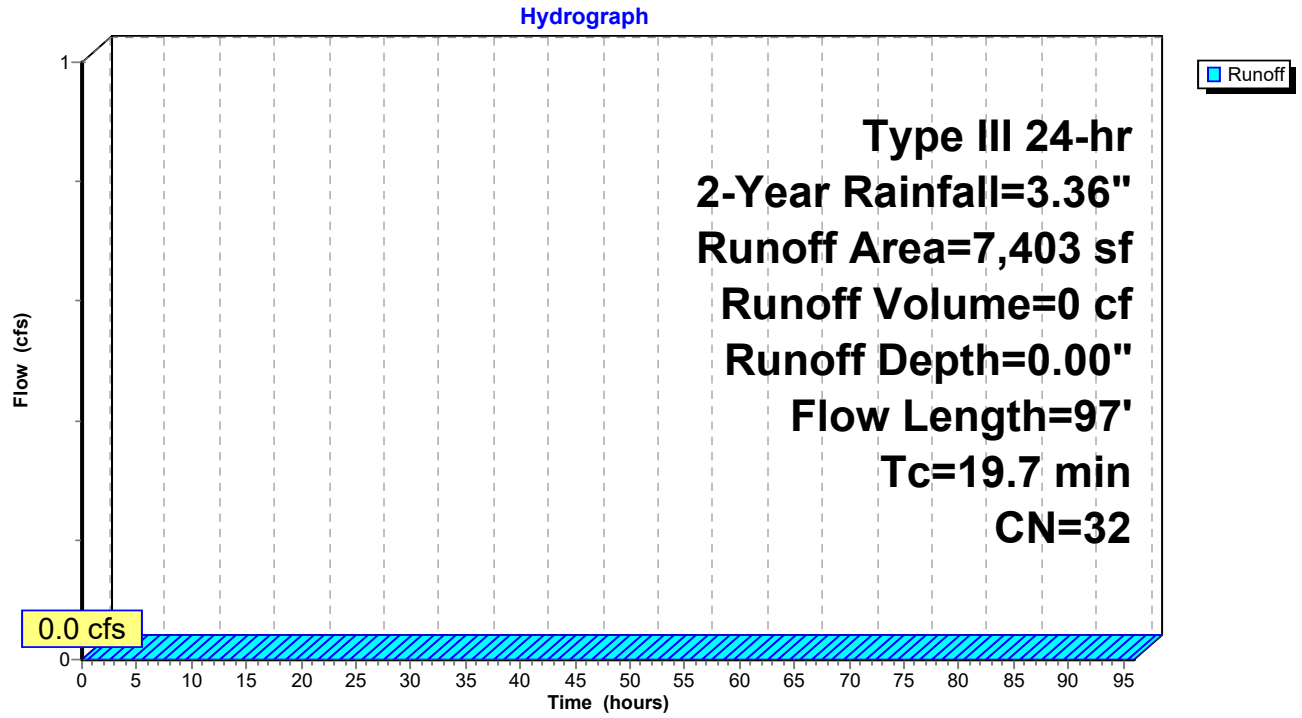
Runoff = 0.0 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.36"

Area (sf)	CN	Description
0	39	>75% Grass cover, Good, HSG A
1,369	39	>75% Grass cover, Good, HSG A
1	39	>75% Grass cover, Good, HSG A
30	39	>75% Grass cover, Good, HSG A
3	98	Unconnected pavement, HSG A
110	30	Woods, Good, HSG A
5,890	30	Woods, Good, HSG A
7,403	32	Weighted Average
7,400		99.96% Pervious Area
3		0.04% Impervious Area
3		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.3	50	0.0300	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.20"
1.4	47	0.0128	0.57		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
19.7	97	Total			

Subcatchment P 2S: Subcat P 2S



Summary for Subcatchment P 4S: Subcat P 4S

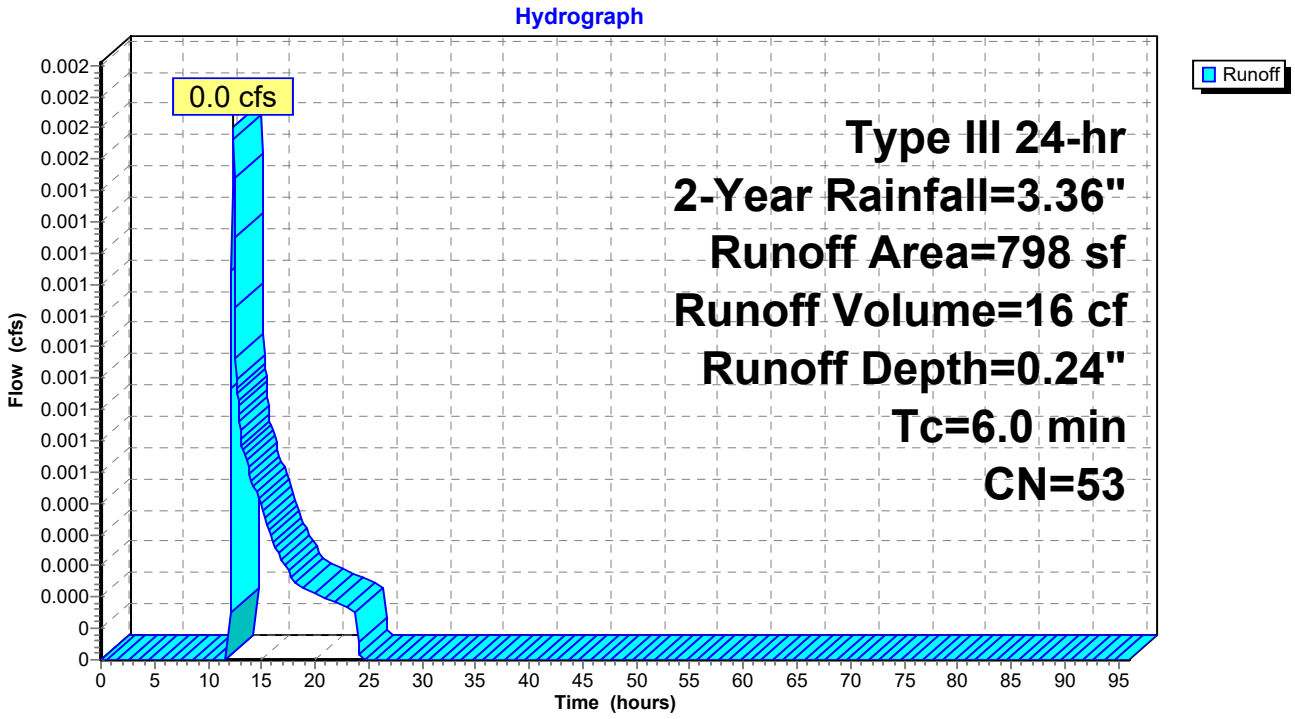
Runoff = 0.0 cfs @ 12.35 hrs, Volume= 16 cf, Depth= 0.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.36"

Area (sf)	CN	Description
4	39	>75% Grass cover, Good, HSG A
265	98	Paved parking, HSG A
529	30	Brush, Good, HSG A
798	53	Weighted Average
533		66.79% Pervious Area
265		33.21% Impervious Area

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

Subcatchment P 4S: Subcat P 4S



Summary for Pond P 1P: P 1P Swales

Inflow Area = 73,764 sf, 7.58% Impervious, Inflow Depth = 0.12" for 2-Year event
Inflow = 0.5 cfs @ 12.10 hrs, Volume= 746 cf
Outflow = 0.1 cfs @ 12.54 hrs, Volume= 751 cf, Atten= 83%, Lag= 26.5 min
Discarded = 0.1 cfs @ 12.54 hrs, Volume= 751 cf
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link P 1L : P 1L

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 197.36' @ 12.54 hrs Surf.Area= 1,444 sf Storage= 392 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 46.6 min (851.1 - 804.5)

Volume	Invert	Avail.Storage	Storage Description
#1	197.00'	23,643 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	195.89'	0 cf	**0.50'D x 1.11'H Vertical Cone/Cylinder** x 2
		23,643 cf	Total Available Storage

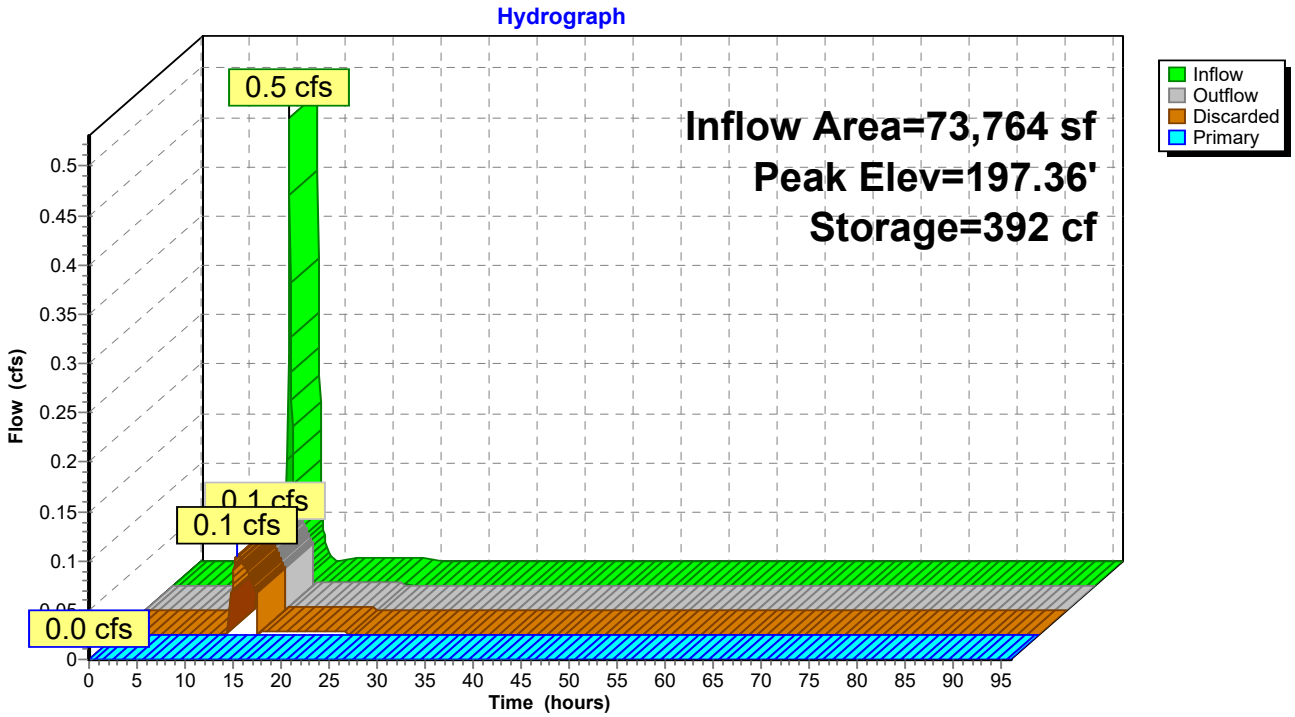
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
197.00	742	0	0
198.00	2,701	1,722	1,722
199.00	13,166	7,934	9,655
199.60	33,460	13,988	23,643

Device	Routing	Invert	Outlet Devices
#1	Primary	199.59'	**240.0' long x 1.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00
			Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Discarded	195.89'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.1 cfs @ 12.54 hrs HW=197.36' (Free Discharge)
↑**2=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=195.89' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Pond P 1P: P 1P Swales



Summary for Pond P 2P: P 2P Crushed Stone Storage (20% Void)

Storage Calculation HydroCAD is conservative:

Surafce Area of Gravel Parking Lot = 16,210 sf

Provided 4 inch thick layer of stone = 4/12

Storage Provide by Parking Area (Assume 20% Voids) =

(16,210) x (4/12) * (.2) = 1,081 cf

Inflow Area = 16,210 sf, 0.00% Impervious, Inflow Depth = 1.26" for 2-Year event
Inflow = 0.5 cfs @ 12.10 hrs, Volume= 1,708 cf
Outflow = 0.5 cfs @ 12.10 hrs, Volume= 1,699 cf, Atten= 2%, Lag= 0.1 min
Discarded = 0.0 cfs @ 12.10 hrs, Volume= 1,071 cf
Primary = 0.5 cfs @ 12.10 hrs, Volume= 627 cf
Routed to Pond P 1P : P 1P Swales

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 198.72' @ 12.10 hrs Surf.Area= 1,879 sf Storage= 94 cf

Plug-Flow detention time= 22.7 min calculated for 1,699 cf (99% of inflow)
Center-of-Mass det. time= 19.2 min (872.0 - 852.8)

Volume	Invert	Avail.Storage	Storage Description
#1	198.00'	842 cf	**Custom Stage Data (Prismatic)** Listed below x 0.33 4,210 cf Overall x 20.0% Voids

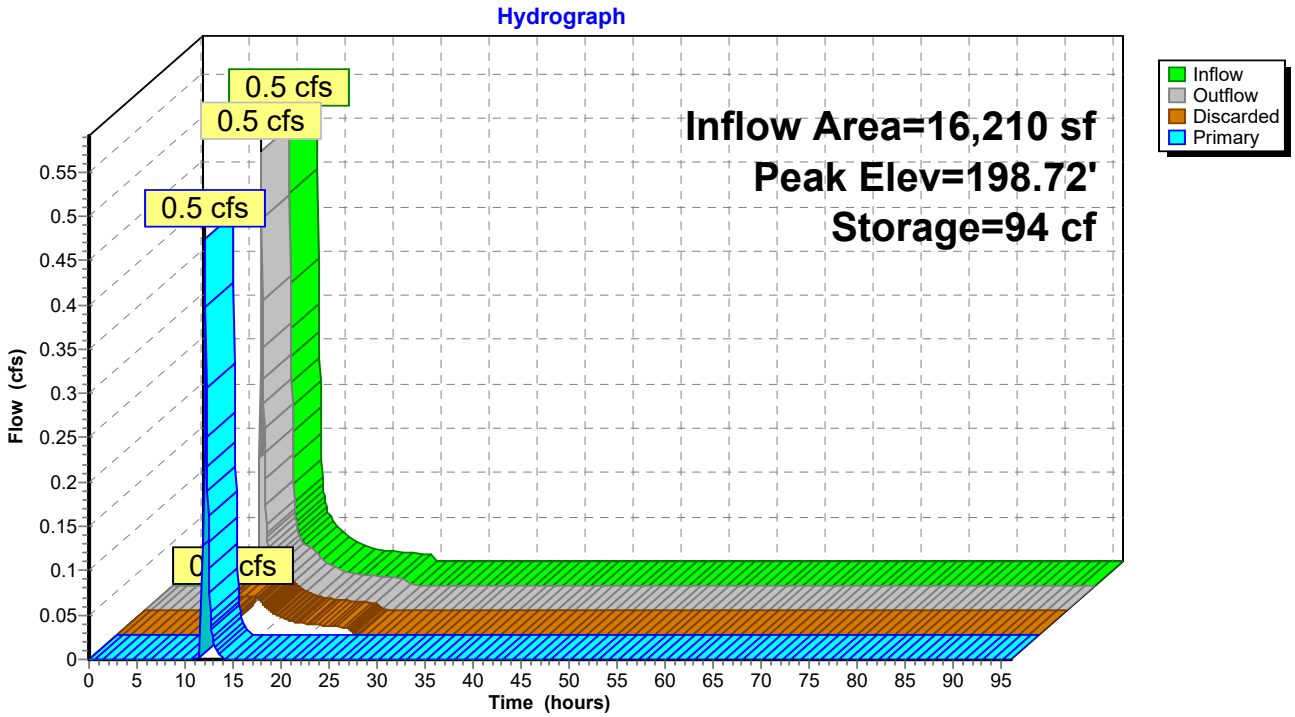
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
198.00	0	0	0
198.37	773	143	143
198.67	5,606	957	1,100
199.67	7,393	6,500	7,599
200.67	2,437	4,915	12,514
200.87	0	244	12,758

Device	Routing	Invert	Outlet Devices
#1	Primary	198.70'	**60.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Discarded	198.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.0 cfs @ 12.10 hrs HW=198.72' (Free Discharge)
↑**2=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.5 cfs @ 12.10 hrs HW=198.72' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 0.5 cfs @ 0.39 fps)

Pond P 2P: P 2P Crushed Stone Storage (20% Void)

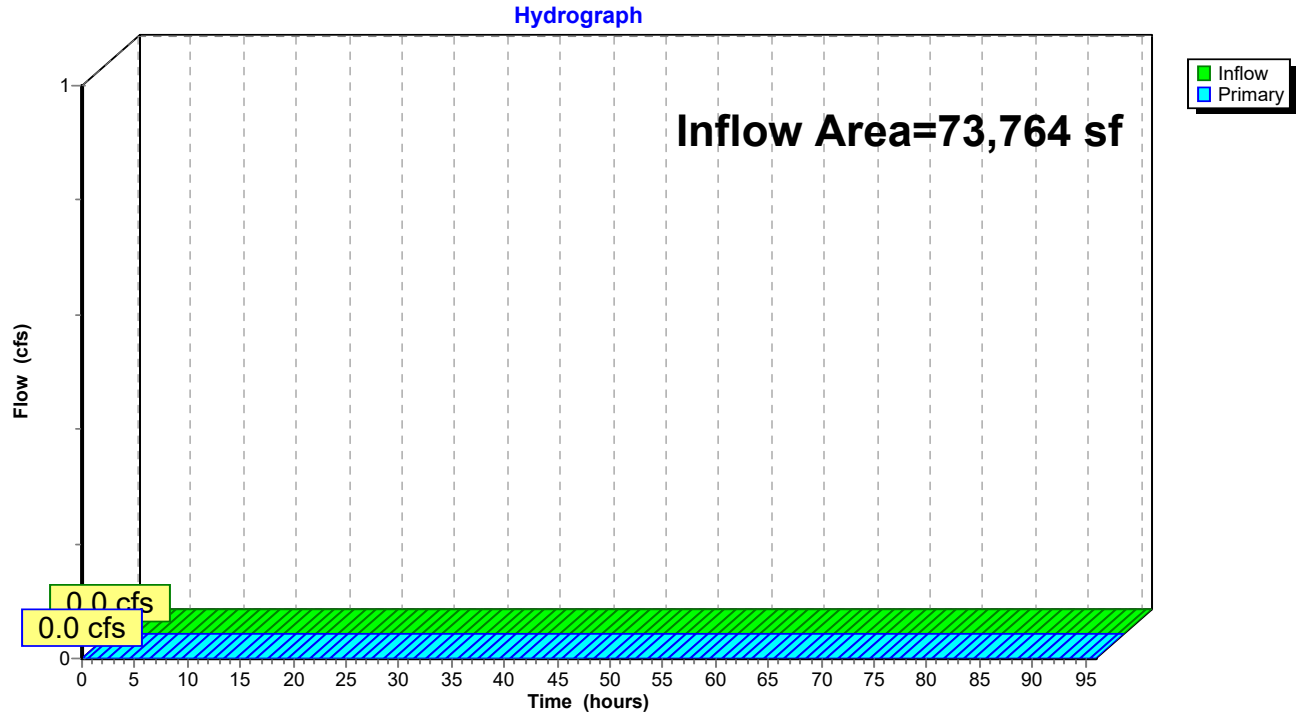


Summary for Link P 1L: P 1L

Inflow Area = 73,764 sf, 7.58% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.0 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link P 1L: P 1L



Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 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 Crushed Stone: Crushed Stone Runoff Area=16,210 sf 0.00% Impervious Runoff Depth=2.73"
Tc=6.0 min CN=76 Runoff=1.2 cfs 3,694 cf

Subcatchment P 1S: Subcat P 1S Runoff Area=57,554 sf 9.72% Impervious Runoff Depth=0.38"
Tc=6.0 min UI Adjusted CN=42 Runoff=0.2 cfs 1,808 cf

Subcatchment P 2S: Subcat P 2S Runoff Area=7,403 sf 0.04% Impervious Runoff Depth=0.04"
Flow Length=97' Tc=19.7 min CN=32 Runoff=0.0 cfs 27 cf

Subcatchment P 4S: Subcat P 4S Runoff Area=798 sf 33.21% Impervious Runoff Depth=0.97"
Tc=6.0 min CN=53 Runoff=0.0 cfs 65 cf

Pond P 1P: P 1P Swales Peak Elev=197.95' Storage=1,598 cf Inflow=1.1 cfs 3,860 cf
Discarded=0.1 cfs 3,834 cf Primary=0.0 cfs 0 cf Outflow=0.1 cfs 3,834 cf

Pond P 2P: P 2P Crushed Stone Storage (20% Void) Peak Elev=198.73' Storage=100 cf Inflow=1.2 cfs 3,694 cf
Discarded=0.0 cfs 1,643 cf Primary=1.1 cfs 2,052 cf Outflow=1.2 cfs 3,695 cf

Link P 1L: P 1L Inflow=0.0 cfs 0 cf
Primary=0.0 cfs 0 cf

Total Runoff Area = 81,965 sf Runoff Volume = 5,594 cf Average Runoff Depth = 0.82"
92.85% Pervious = 76,104 sf 7.15% Impervious = 5,861 sf

Summary for Subcatchment Crushed Stone: Crushed Stone

Note:

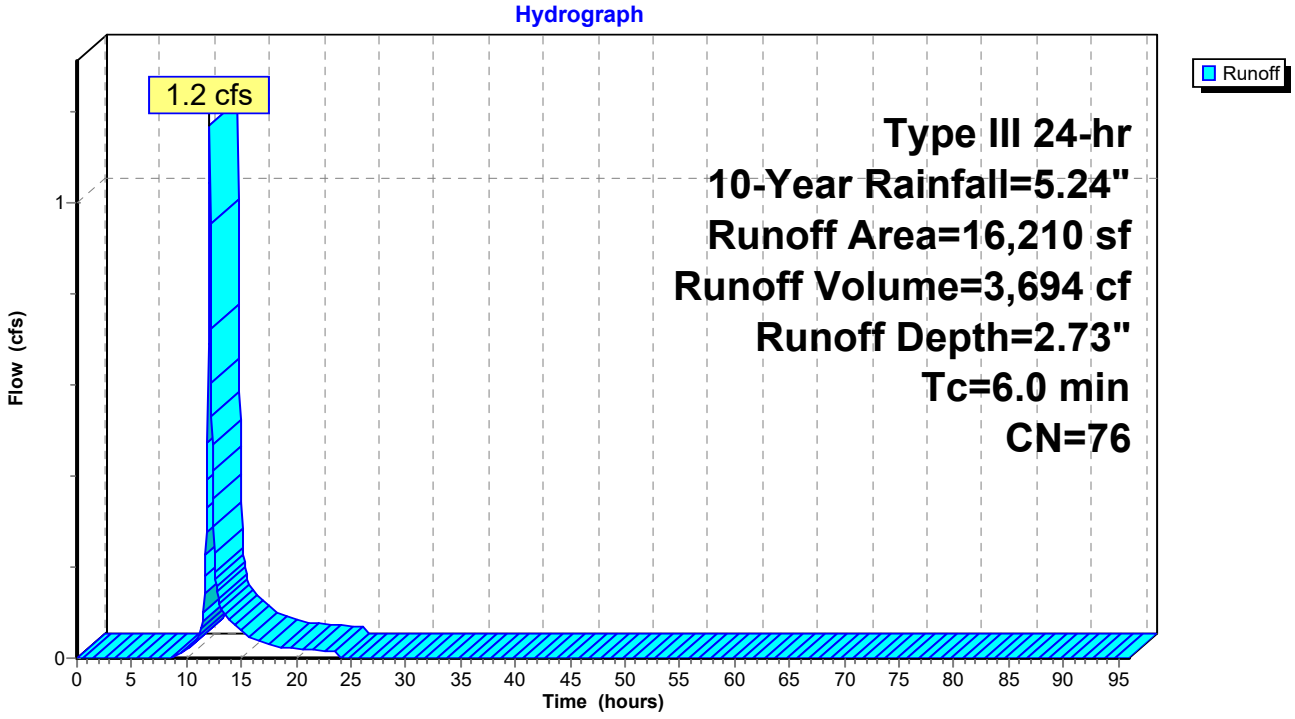
Runoff = 1.2 cfs @ 12.09 hrs, Volume= 3,694 cf, Depth= 2.73"
Routed to Pond P 2P : P 2P Crushed Stone Storage (20% Void)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.24"

Area (sf)	CN	Description
16,210	76	Gravel roads, HSG A
16,210		100.00% Pervious Area

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

Subcatchment Crushed Stone: Crushed Stone



Summary for Subcatchment P 1S: Subcat P 1S

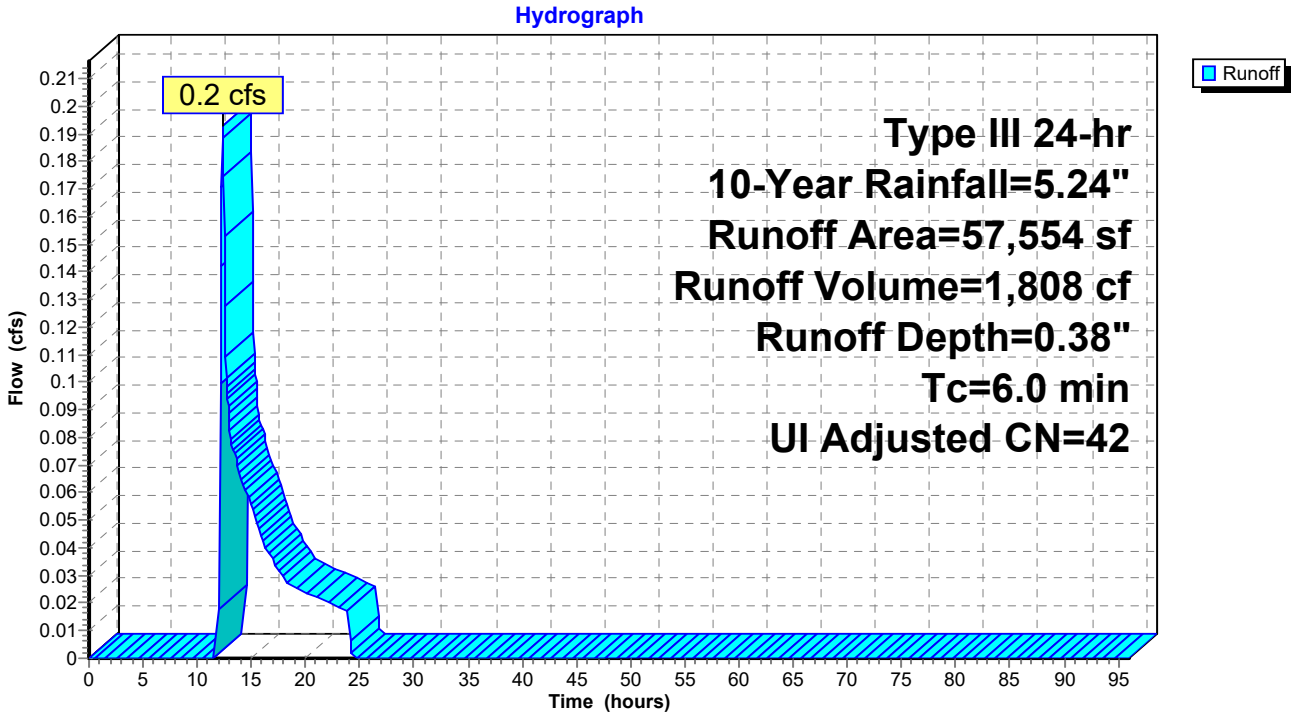
Runoff = 0.2 cfs @ 12.35 hrs, Volume= 1,808 cf, Depth= 0.38"
Routed to Pond P 1P : P 1P Swales

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.24"

Area (sf)	CN	Adj	Description
45,776	39		>75% Grass cover, Good, HSG A
2,006	98		Paved parking, HSG A
3,587	98		Unconnected pavement, HSG A
6,185	30		Woods, Good, HSG A
57,554	44	42	Weighted Average, UI Adjusted
51,961			90.28% Pervious Area
5,593			9.72% Impervious Area
3,587			64.13% Unconnected

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

Subcatchment P 1S: Subcat P 1S



Summary for Subcatchment P 2S: Subcat P 2S

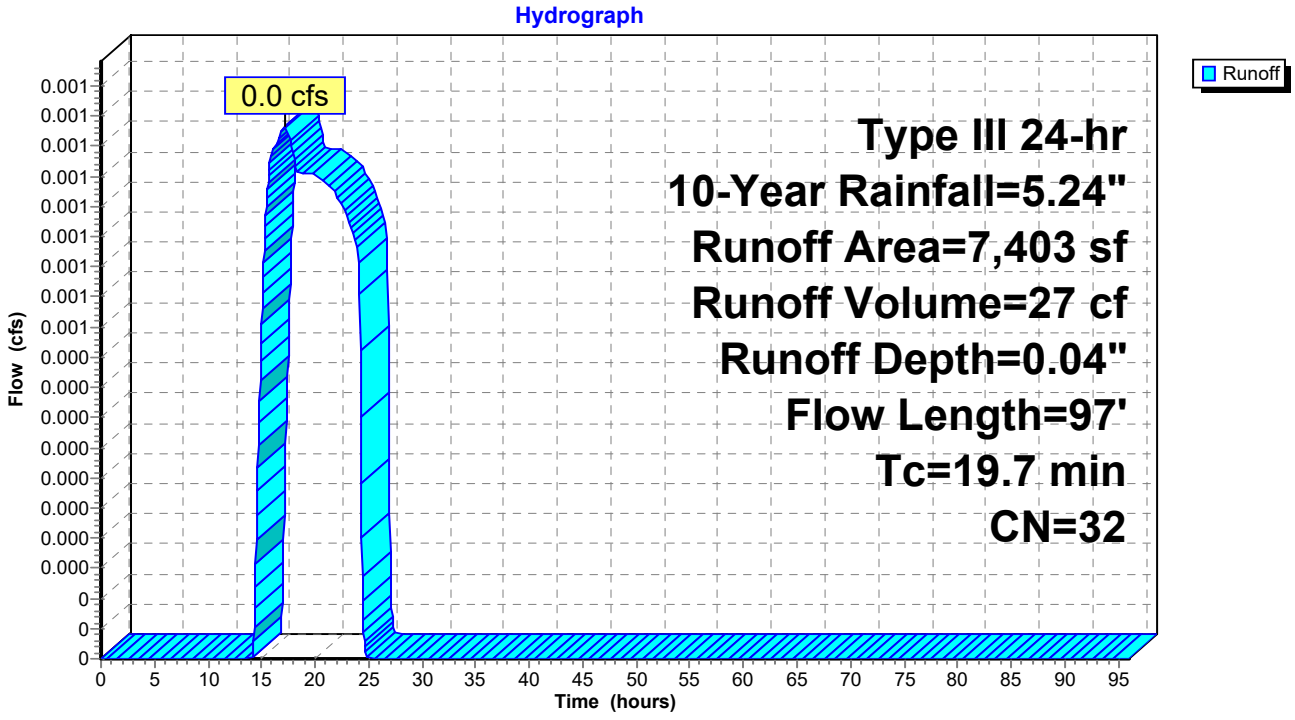
Runoff = 0.0 cfs @ 17.10 hrs, Volume= 27 cf, Depth= 0.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.24"

Area (sf)	CN	Description
0	39	>75% Grass cover, Good, HSG A
1,369	39	>75% Grass cover, Good, HSG A
1	39	>75% Grass cover, Good, HSG A
30	39	>75% Grass cover, Good, HSG A
3	98	Unconnected pavement, HSG A
110	30	Woods, Good, HSG A
5,890	30	Woods, Good, HSG A
7,403	32	Weighted Average
7,400		99.96% Pervious Area
3		0.04% Impervious Area
3		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.3	50	0.0300	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.20"
1.4	47	0.0128	0.57		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
19.7	97	Total			

Subcatchment P 2S: Subcat P 2S



Summary for Subcatchment P 4S: Subcat P 4S

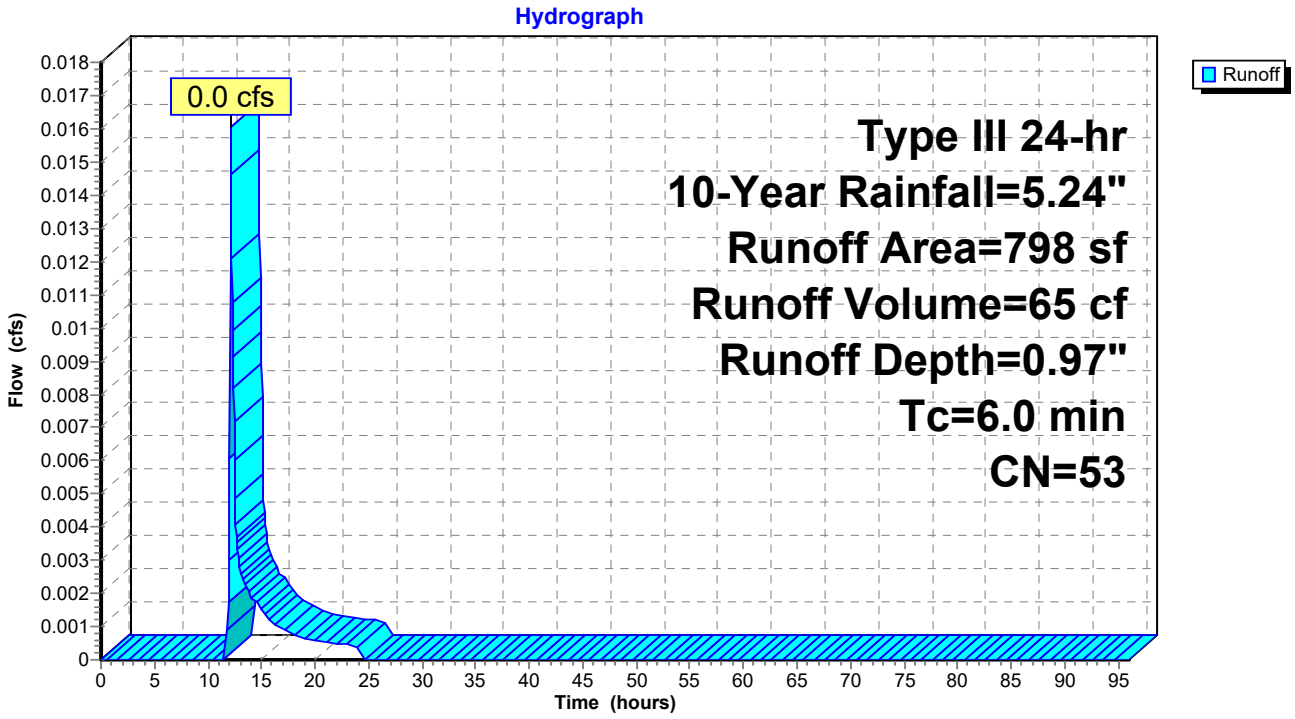
Runoff = 0.0 cfs @ 12.11 hrs, Volume= 65 cf, Depth= 0.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.24"

Area (sf)	CN	Description
4	39	>75% Grass cover, Good, HSG A
265	98	Paved parking, HSG A
529	30	Brush, Good, HSG A
798	53	Weighted Average
533		66.79% Pervious Area
265		33.21% Impervious Area

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

Subcatchment P 4S: Subcat P 4S



Summary for Pond P 1P: P 1P Swales

Inflow Area = 73,764 sf, 7.58% Impervious, Inflow Depth = 0.63" for 10-Year event
Inflow = 1.1 cfs @ 12.10 hrs, Volume= 3,860 cf
Outflow = 0.1 cfs @ 13.09 hrs, Volume= 3,834 cf, Atten= 87%, Lag= 59.5 min
Discarded = 0.1 cfs @ 13.09 hrs, Volume= 3,834 cf
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link P 1L : P 1L

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 197.95' @ 13.09 hrs Surf.Area= 2,610 sf Storage= 1,598 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 121.7 min (969.1 - 847.4)

Volume	Invert	Avail.Storage	Storage Description
#1	197.00'	23,643 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	195.89'	0 cf	**0.50'D x 1.11'H Vertical Cone/Cylinder** x 2
		23,643 cf	Total Available Storage

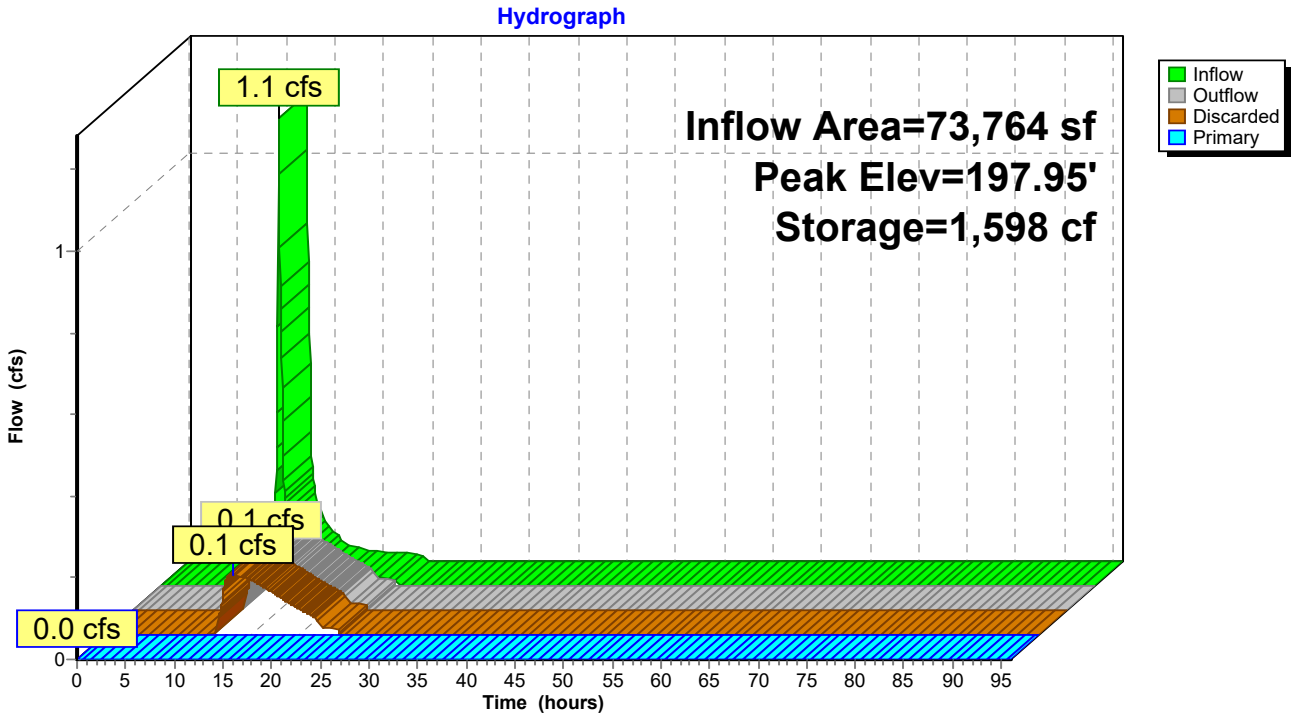
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
197.00	742	0	0
198.00	2,701	1,722	1,722
199.00	13,166	7,934	9,655
199.60	33,460	13,988	23,643

Device	Routing	Invert	Outlet Devices
#1	Primary	199.59'	**240.0' long x 1.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00
			Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Discarded	195.89'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.1 cfs @ 13.09 hrs HW=197.95' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=195.89' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Pond P 1P: P 1P Swales



Summary for Pond P 2P: P 2P Crushed Stone Storage (20% Void)

Storage Calculation HydroCAD is conservative:

Surafce Area of Gravel Parking Lot = 16,210 sf

Provided 4 inch thick layer of stone = 4/12

Storage Provide by Parking Area (Assume 20% Voids) =

(16,210) x (4/12) * (.2) = 1,081 cf

Inflow Area = 16,210 sf, 0.00% Impervious, Inflow Depth = 2.73" for 10-Year event
Inflow = 1.2 cfs @ 12.09 hrs, Volume= 3,694 cf
Outflow = 1.2 cfs @ 12.09 hrs, Volume= 3,695 cf, Atten= 1%, Lag= 0.1 min
Discarded = 0.0 cfs @ 12.09 hrs, Volume= 1,643 cf
Primary = 1.1 cfs @ 12.09 hrs, Volume= 2,052 cf
Routed to Pond P 1P : P 1P Swales

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 198.73' @ 12.09 hrs Surf.Area= 1,888 sf Storage= 100 cf

Plug-Flow detention time= 13.2 min calculated for 3,693 cf (100% of inflow)
Center-of-Mass det. time= 13.4 min (843.5 - 830.1)

Volume	Invert	Avail.Storage	Storage Description
#1	198.00'	842 cf	**Custom Stage Data (Prismatic)** Listed below x 0.33 4,210 cf Overall x 20.0% Voids

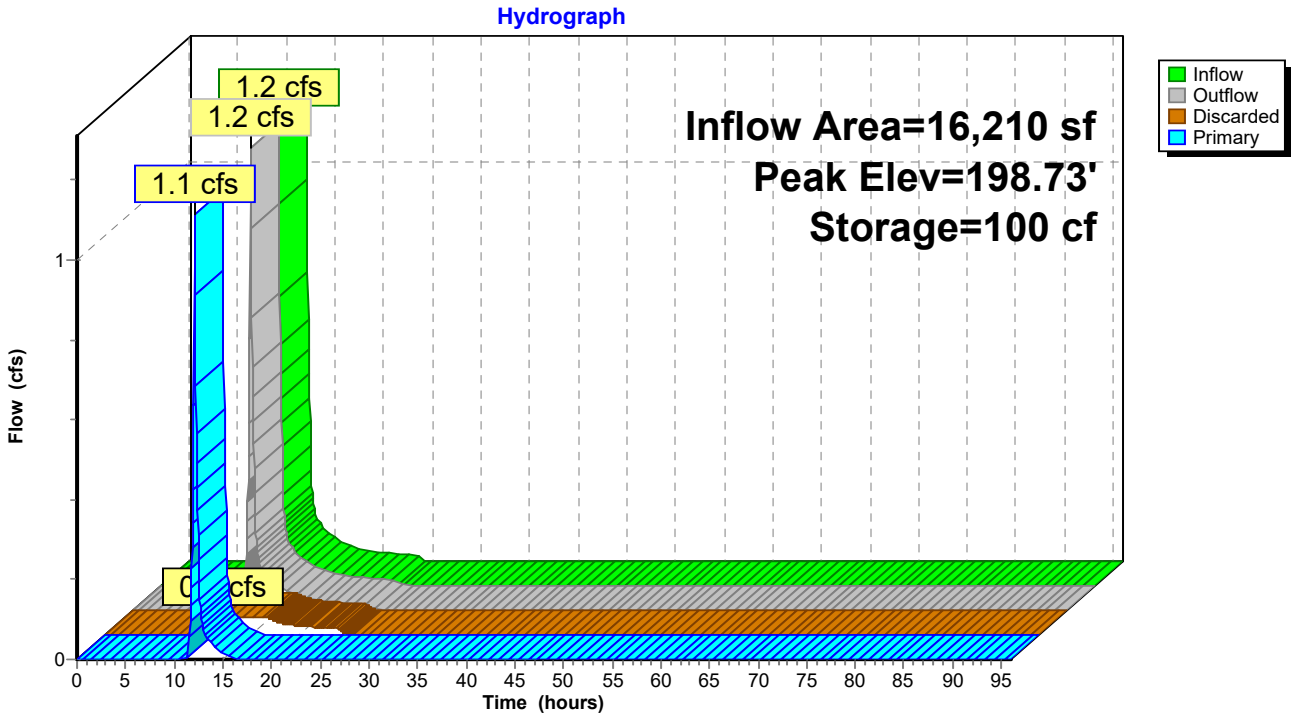
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
198.00	0	0	0
198.37	773	143	143
198.67	5,606	957	1,100
199.67	7,393	6,500	7,599
200.67	2,437	4,915	12,514
200.87	0	244	12,758

Device	Routing	Invert	Outlet Devices
#1	Primary	198.70'	**60.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Discarded	198.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.0 cfs @ 12.09 hrs HW=198.73' (Free Discharge)
↑└**2=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=1.0 cfs @ 12.09 hrs HW=198.73' (Free Discharge)
↑└**1=Broad-Crested Rectangular Weir** (Weir Controls 1.0 cfs @ 0.51 fps)

Pond P 2P: P 2P Crushed Stone Storage (20% Void)

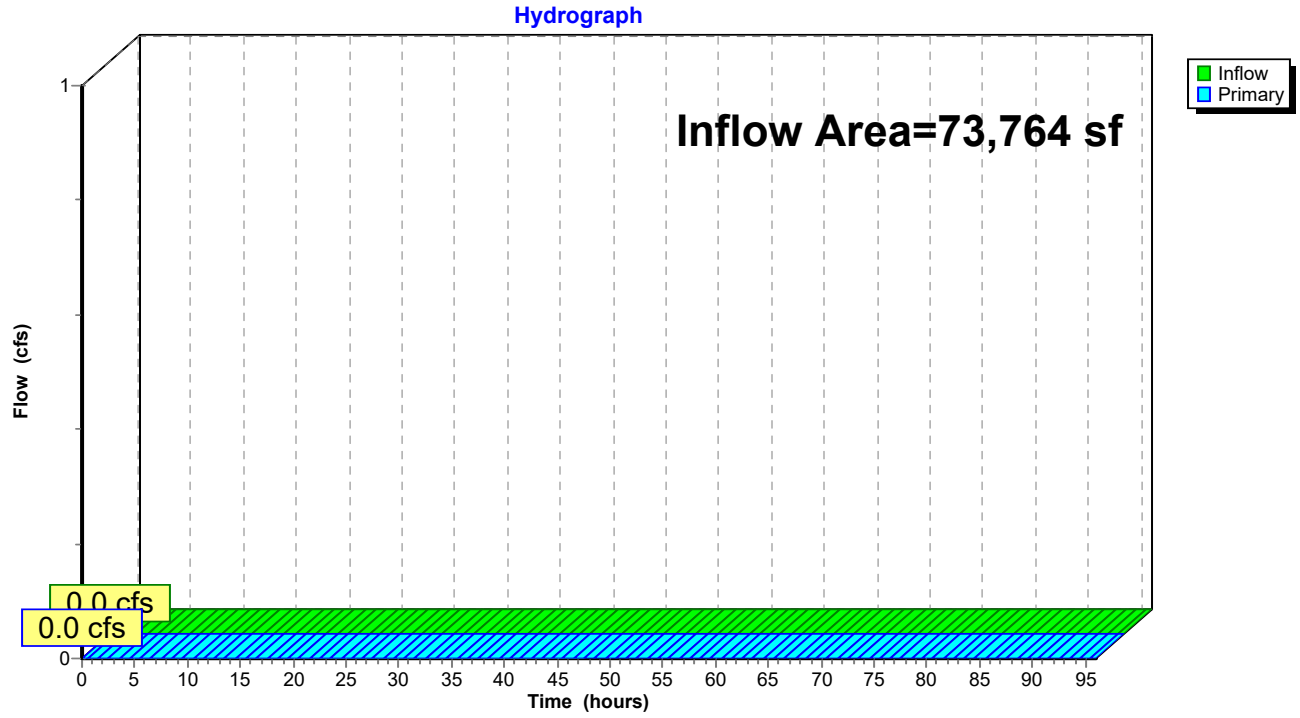


Summary for Link P 1L: P 1L

Inflow Area = 73,764 sf, 7.58% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.0 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link P 1L: P 1L



Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 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 Crushed Stone: Crushed Stone Runoff Area=16,210 sf 0.00% Impervious Runoff Depth=5.37"
Tc=6.0 min CN=76 Runoff=2.3 cfs 7,251 cf

Subcatchment P 1S: Subcat P 1S Runoff Area=57,554 sf 9.72% Impervious Runoff Depth=1.55"
Tc=6.0 min UI Adjusted CN=42 Runoff=1.9 cfs 7,439 cf

Subcatchment P 2S: Subcat P 2S Runoff Area=7,403 sf 0.04% Impervious Runoff Depth=0.63"
Flow Length=97' Tc=19.7 min CN=32 Runoff=0.0 cfs 387 cf

Subcatchment P 4S: Subcat P 4S Runoff Area=798 sf 33.21% Impervious Runoff Depth=2.72"
Tc=6.0 min CN=53 Runoff=0.1 cfs 181 cf

Pond P 1P: P 1P Swales Peak Elev=198.60' Storage=5,223 cf Inflow=4.1 cfs 12,408 cf
Discarded=0.5 cfs 12,421 cf Primary=0.0 cfs 0 cf Outflow=0.5 cfs 12,421 cf

Pond P 2P: P 2P Crushed Stone Storage (20% Void) Peak Elev=198.76' Storage=109 cf Inflow=2.3 cfs 7,251 cf
Discarded=0.0 cfs 2,288 cf Primary=2.2 cfs 4,969 cf Outflow=2.3 cfs 7,257 cf

Link P 1L: P 1L Inflow=0.0 cfs 0 cf
Primary=0.0 cfs 0 cf

Total Runoff Area = 81,965 sf Runoff Volume = 15,258 cf Average Runoff Depth = 2.23"
92.85% Pervious = 76,104 sf 7.15% Impervious = 5,861 sf

Summary for Subcatchment Crushed Stone: Crushed Stone

Note:

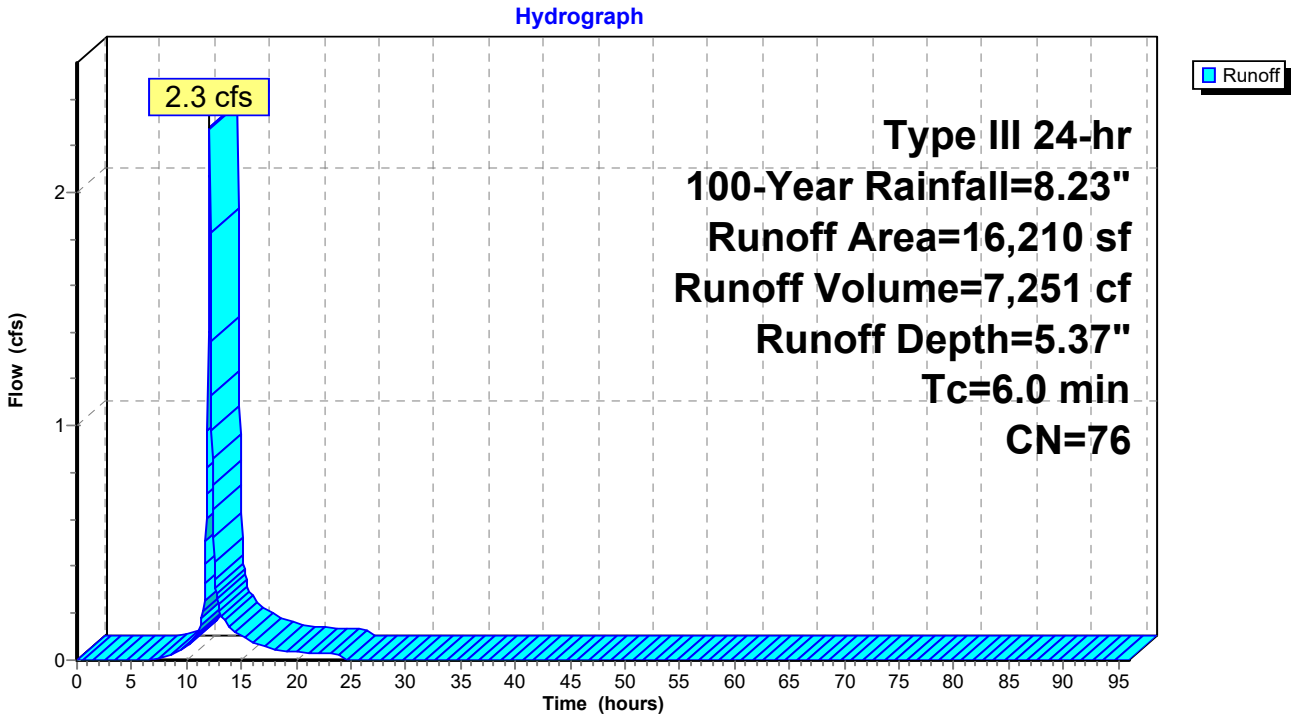
Runoff = 2.3 cfs @ 12.09 hrs, Volume= 7,251 cf, Depth= 5.37"
Routed to Pond P 2P : P 2P Crushed Stone Storage (20% Void)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.23"

Area (sf)	CN	Description
16,210	76	Gravel roads, HSG A
16,210		100.00% Pervious Area

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

Subcatchment Crushed Stone: Crushed Stone



Summary for Subcatchment P 1S: Subcat P 1S

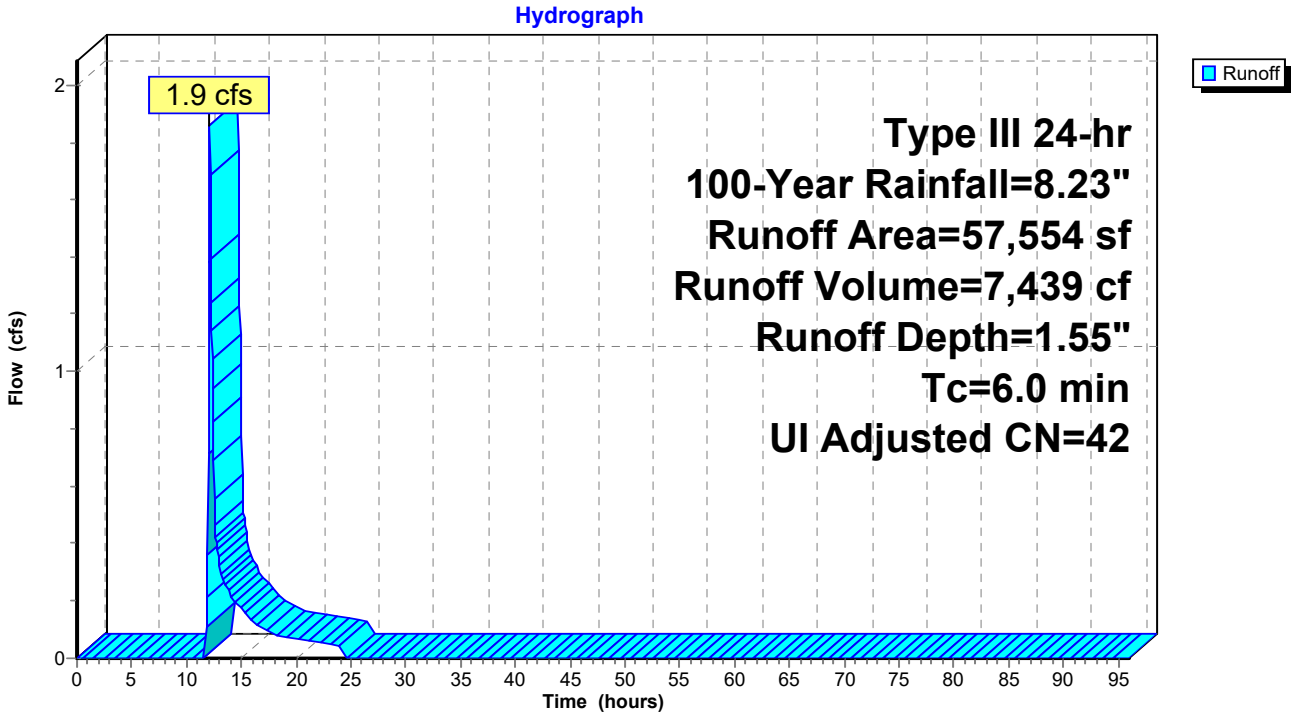
Runoff = 1.9 cfs @ 12.11 hrs, Volume= 7,439 cf, Depth= 1.55"
Routed to Pond P 1P : P 1P Swales

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.23"

Area (sf)	CN	Adj	Description
45,776	39		>75% Grass cover, Good, HSG A
2,006	98		Paved parking, HSG A
3,587	98		Unconnected pavement, HSG A
6,185	30		Woods, Good, HSG A
57,554	44	42	Weighted Average, UI Adjusted
51,961			90.28% Pervious Area
5,593			9.72% Impervious Area
3,587			64.13% Unconnected

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

Subcatchment P 1S: Subcat P 1S



Summary for Subcatchment P 2S: Subcat P 2S

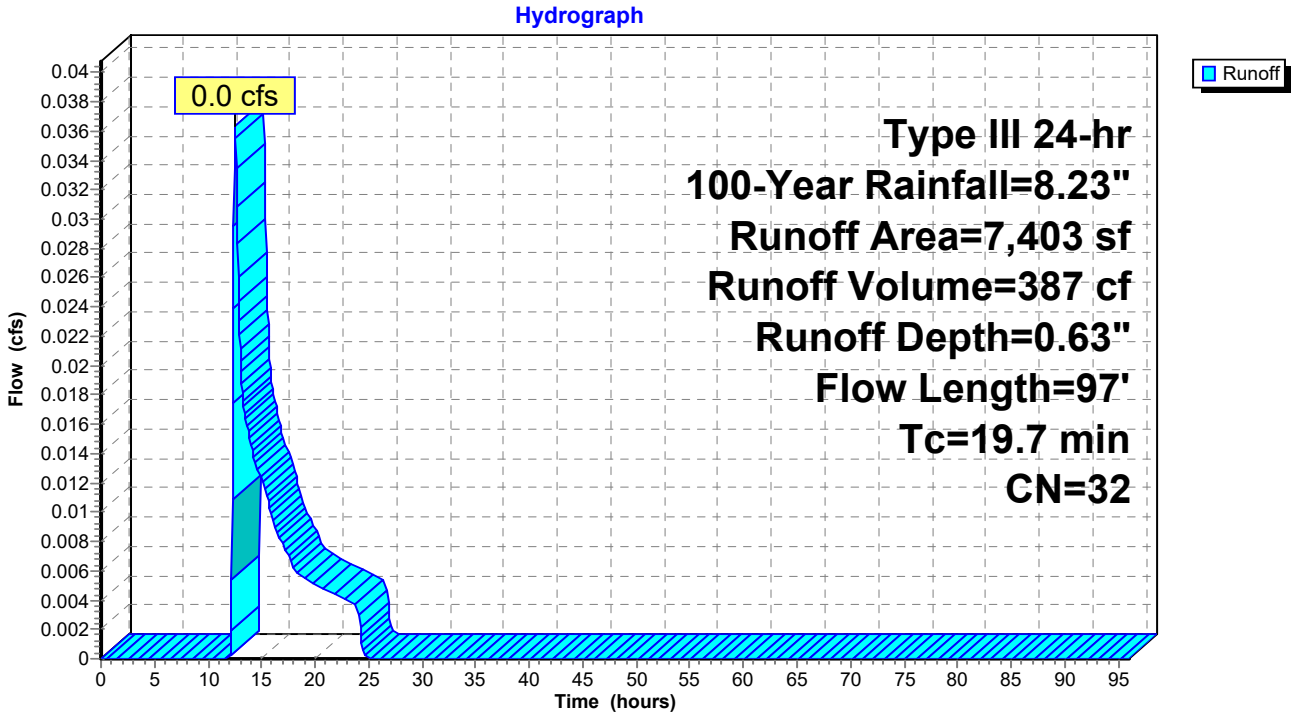
Runoff = 0.0 cfs @ 12.55 hrs, Volume= 387 cf, Depth= 0.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.23"

Area (sf)	CN	Description
0	39	>75% Grass cover, Good, HSG A
1,369	39	>75% Grass cover, Good, HSG A
1	39	>75% Grass cover, Good, HSG A
30	39	>75% Grass cover, Good, HSG A
3	98	Unconnected pavement, HSG A
110	30	Woods, Good, HSG A
5,890	30	Woods, Good, HSG A
7,403	32	Weighted Average
7,400		99.96% Pervious Area
3		0.04% Impervious Area
3		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.3	50	0.0300	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.20"
1.4	47	0.0128	0.57		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
19.7	97	Total			

Subcatchment P 2S: Subcat P 2S



Summary for Subcatchment P 4S: Subcat P 4S

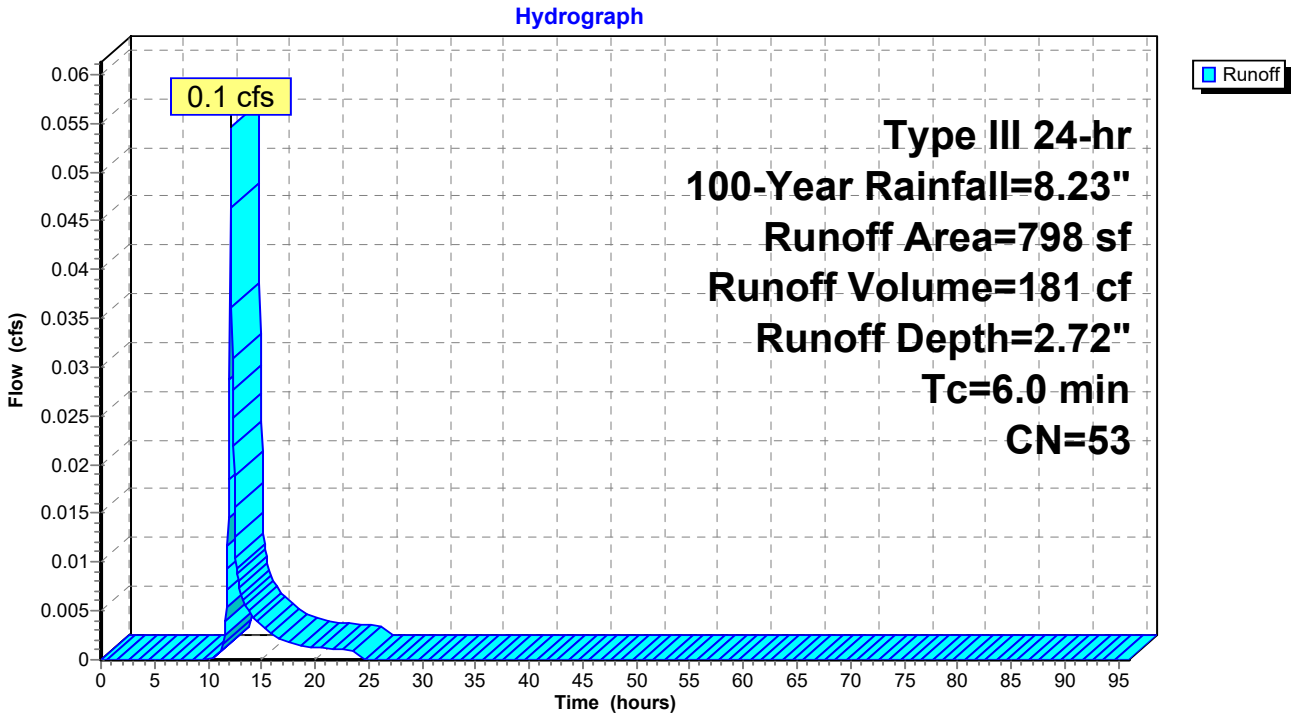
Runoff = 0.1 cfs @ 12.10 hrs, Volume= 181 cf, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.23"

Area (sf)	CN	Description
4	39	>75% Grass cover, Good, HSG A
265	98	Paved parking, HSG A
529	30	Brush, Good, HSG A
798	53	Weighted Average
533		66.79% Pervious Area
265		33.21% Impervious Area

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

Subcatchment P 4S: Subcat P 4S



Summary for Pond P 1P: P 1P Swales

Inflow Area = 73,764 sf, 7.58% Impervious, Inflow Depth = 2.02" for 100-Year event
Inflow = 4.1 cfs @ 12.10 hrs, Volume= 12,408 cf
Outflow = 0.5 cfs @ 12.98 hrs, Volume= 12,421 cf, Atten= 88%, Lag= 52.7 min
Discarded = 0.5 cfs @ 12.98 hrs, Volume= 12,421 cf
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link P 1L : P 1L

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 198.60' @ 12.98 hrs Surf.Area= 8,977 sf Storage= 5,223 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 153.8 min (992.2 - 838.4)

Volume	Invert	Avail.Storage	Storage Description
#1	197.00'	23,643 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	195.89'	0 cf	**0.50'D x 1.11'H Vertical Cone/Cylinder** x 2
		23,643 cf	Total Available Storage

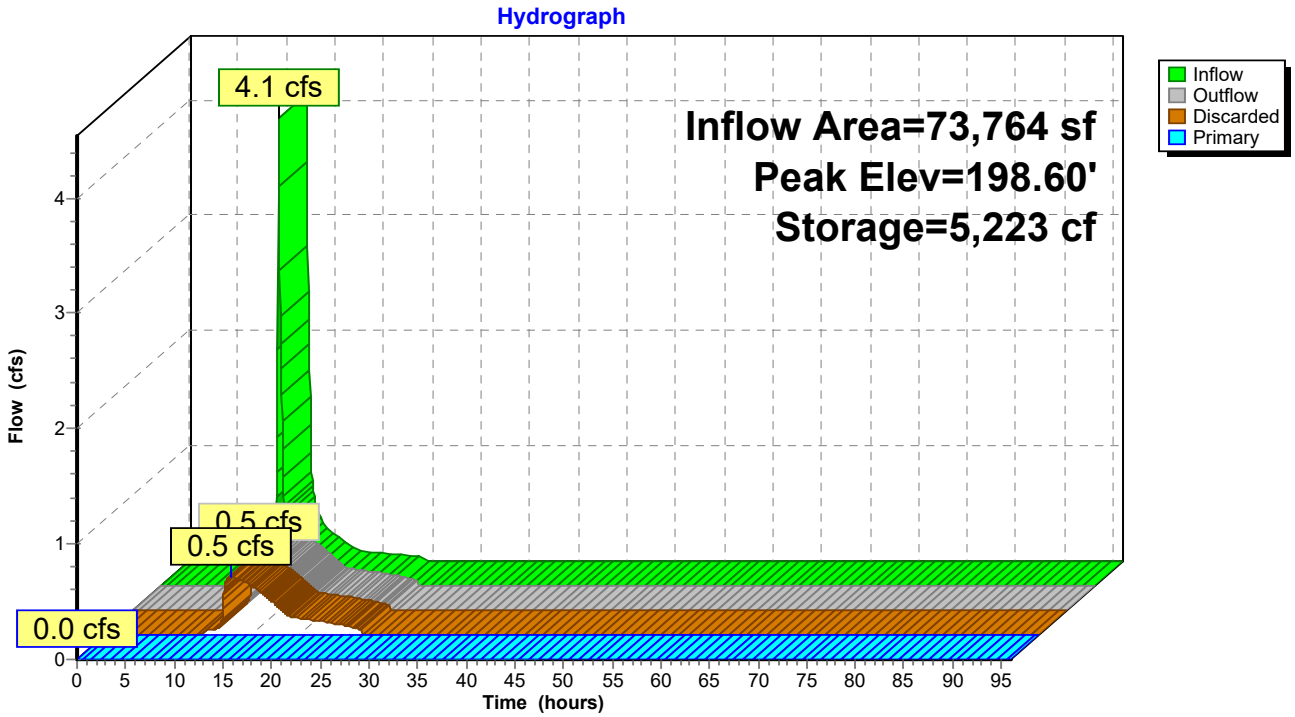
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
197.00	742	0	0
198.00	2,701	1,722	1,722
199.00	13,166	7,934	9,655
199.60	33,460	13,988	23,643

Device	Routing	Invert	Outlet Devices
#1	Primary	199.59'	**240.0' long x 1.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00
			Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Discarded	195.89'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.5 cfs @ 12.98 hrs HW=198.60' (Free Discharge)
2=Exfiltration (Exfiltration Controls 0.5 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=195.89' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.0 cfs)

Pond P 1P: P 1P Swales



Summary for Pond P 2P: P 2P Crushed Stone Storage (20% Void)

Storage Calculation HydroCAD is conservative:

Surafce Area of Gravel Parking Lot = 16,210 sf

Provided 4 inch thick layer of stone = 4/12

Storage Provide by Parking Area (Assume 20% Voids) =

(16,210) x (4/12) * (.2) = 1,081 cf

Inflow Area = 16,210 sf, 0.00% Impervious, Inflow Depth = 5.37" for 100-Year event
Inflow = 2.3 cfs @ 12.09 hrs, Volume= 7,251 cf
Outflow = 2.3 cfs @ 12.09 hrs, Volume= 7,257 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.0 cfs @ 12.09 hrs, Volume= 2,288 cf
Primary = 2.2 cfs @ 12.09 hrs, Volume= 4,969 cf
Routed to Pond P 1P : P 1P Swales

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 198.76' @ 12.09 hrs Surf.Area= 1,900 sf Storage= 109 cf

Plug-Flow detention time= 9.1 min calculated for 7,250 cf (100% of inflow)
Center-of-Mass det. time= 9.7 min (820.5 - 810.8)

Volume	Invert	Avail.Storage	Storage Description
#1	198.00'	842 cf	**Custom Stage Data (Prismatic)** Listed below x 0.33 4,210 cf Overall x 20.0% Voids

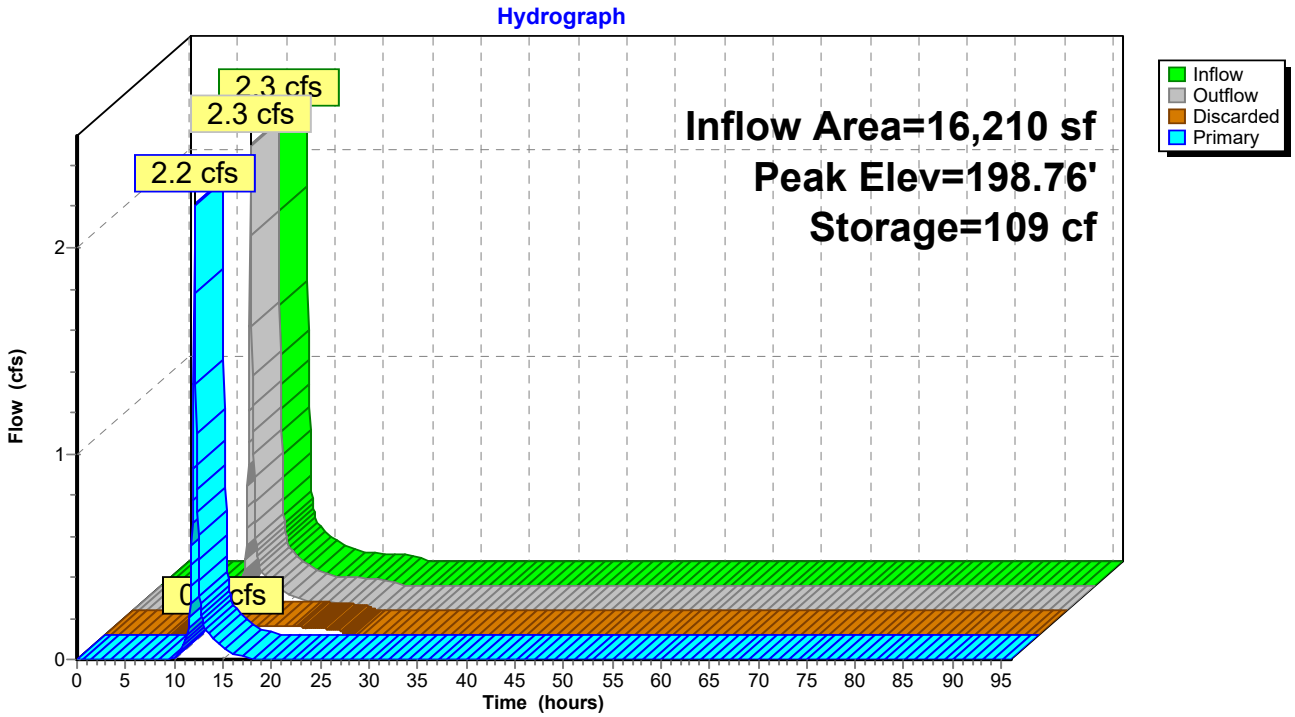
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
198.00	0	0	0
198.37	773	143	143
198.67	5,606	957	1,100
199.67	7,393	6,500	7,599
200.67	2,437	4,915	12,514
200.87	0	244	12,758

Device	Routing	Invert	Outlet Devices
#1	Primary	198.70'	**60.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#2	Discarded	198.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.0 cfs @ 12.09 hrs HW=198.75' (Free Discharge)
↑└**2=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=2.1 cfs @ 12.09 hrs HW=198.75' (Free Discharge)
↑└**1=Broad-Crested Rectangular Weir** (Weir Controls 2.1 cfs @ 0.65 fps)

Pond P 2P: P 2P Crushed Stone Storage (20% Void)

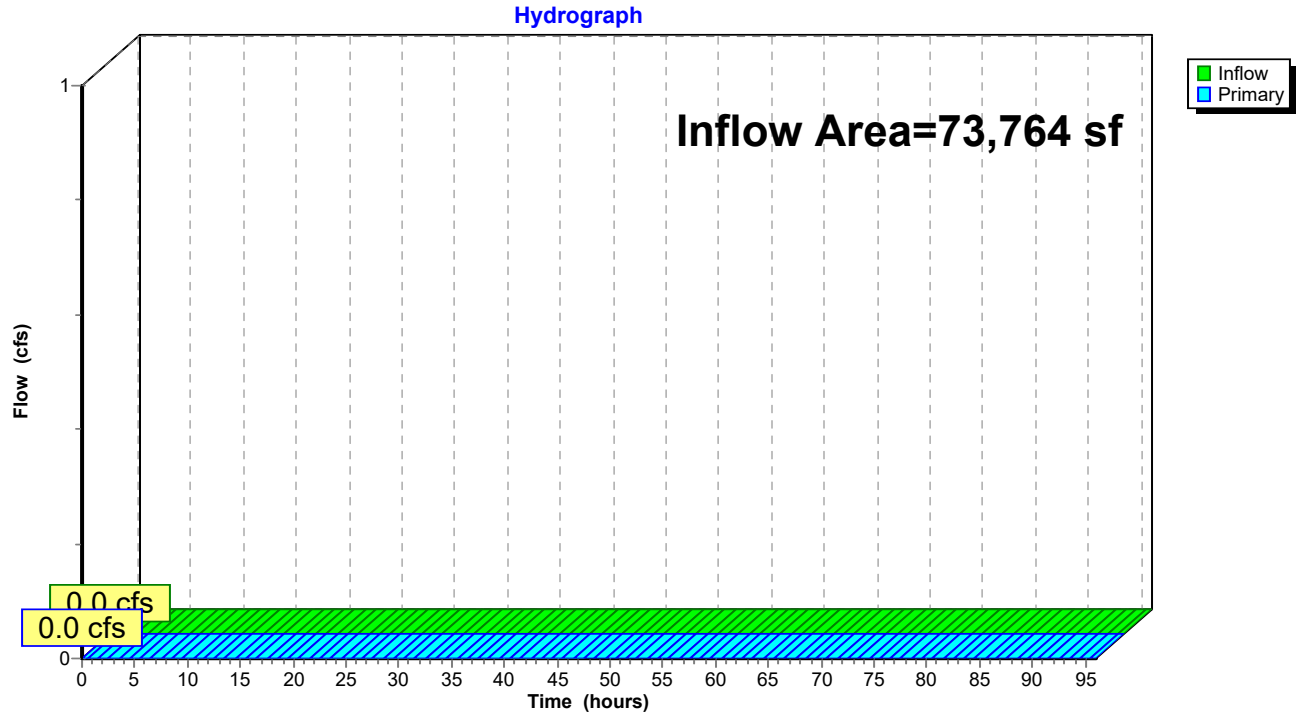


Summary for Link P 1L: P 1L

Inflow Area = 73,764 sf, 7.58% Impervious, Inflow Depth = 0.00" for 100-Year event
Inflow = 0.0 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link P 1L: P 1L



B) Revised Water Quality Calculations (Standards 3 & 4)

The proposed stormwater management system is comprised of drainage catch basins/ area drains, open "country drainage", and a surface infiltration retention basin. The proposed stormwater management system utilizes Low Impact Development (LID) measures including no disturbance to any Wetland Resource Areas, use of "country drainage", and grass channels. The recharge and water quality volume calculations for the revised proposed conditions have been updated and provided below.

Standard 3)

The Project results in a slight increase in impervious area of roughly 4,105 s.f., however, accounts for recharge volume for the 5,861 s.f. paved access drive, paved spaces, paved walkway, and rubber impervious play area, thereby meeting the recharge requirements. Specifically, the required recharge volume is 307 c.f. (when factoring the capture area adjustment) while the proposed design provides 23,395 c.f.; more than satisfying the minimum requirement. Although the gravel surface is pervious, the proposed stormwater management design will provide adequate recharge volume to account for this area as well.

Standard 4)

The Project results in a slight increase in impervious area of roughly 4,105 s.f., however, proposed TSS removal accounts for a water quality volume for the 5,861 s.f. paved access drive, paved spaces, paved walkway, and rubber impervious play area, thereby meeting the water quality volume requirements. Specifically, the required water quality volume for the first inch of runoff is 488 c.f. while the proposed design provides 23,395 c.f. more than satisfying the minimum requirement. The site stormwater system provides water quality volume in the crushed stone parking area as well as the surface infiltration retention basin below their respective outlets for each

No Information on This Page

MassDEP Stormwater Standard 3 | Project: 240 - 260 Pleasant Street | Date: Mar-25
Recharge Volume | Project No: 24-0281 | Page: B-2

Critical Area - Yes or No: No

Impervious Area	Area (S.F.)	Soil	Depth (inches)	Volume (C.F.)
P 1S	5,593	A	0.60	279.7
P 2S	3	A	0.60	0.2
P 4S	265	A	0.60	13.3

Total Area 5,861 S.F. Volume Required **293.1** C.F.

Capture Area Adjustment

To Recharge Facility	Area (S.F.)	
P 1S	5,593	Volume Required **307.1** C.F.

Volume Provided below lowest invert (Static Method)

BMP		
P 1P	23,310	(See Stormwater Report)
P 2P	85	(See Stormwater Report)

Volume Provided: **23,395.0** C.F. **OK**

No Information on This Page

Critical Area and/or Rapid Infiltration - Yes or No No

Watershed (Subcatchment)	Impervious Area (S.F.)	Required Depth (inches)	Required Volume (C.F.)
P 1S	5,593	1.00	466.1
P 2S	3	1.00	0.3
P 4S	265	1.00	22.1
Total Area:	5,861	Volume Required:	**488.4**

Volume Provided (per HydroCAD)

BMP		
P 1S	23,310	(See Stormwater Report)
P 4S	85	(See Stormwater Report)

Volumes reported are below lowest invert (Static Method)

Volume Provided **23,395.0** C.F. **OK**

No Information on This Page

C) Revised Proposed Watershed Map

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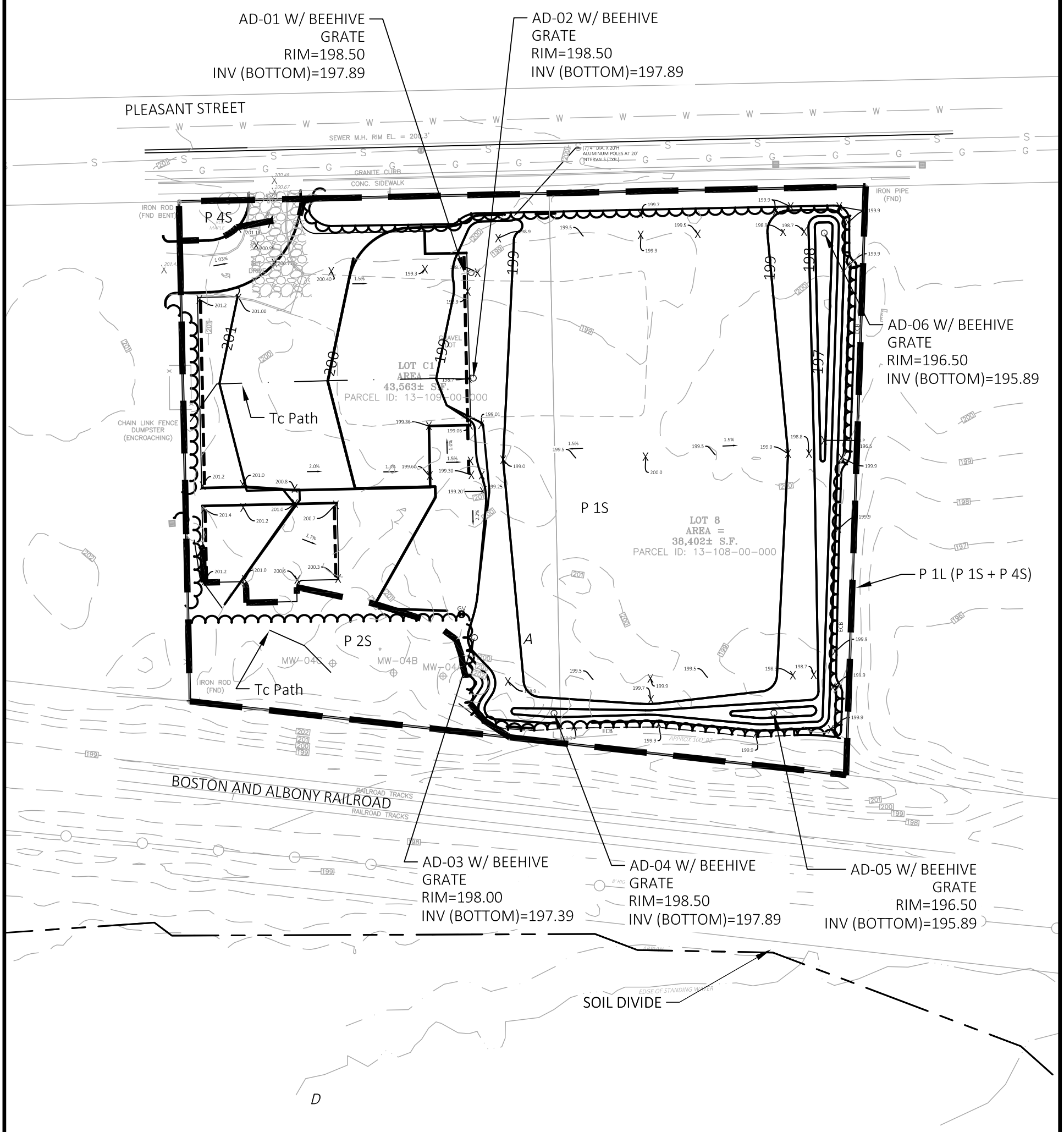

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Project Title:
Ashland Rec Facility
240 & 260 Pleasant Street
Ashland, MA

Sheet Title:
Proposed Hydrology
240 & 260 Pleasant Street
Ashland, MA

Date: March 2025 | Project No.: 24-0281 | Reference Plan No.: C-260 | Drawn By: ESM | Checked By: MJS

0 12.5 25 50 100 150
Scale: 1" = 50'

H-2

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