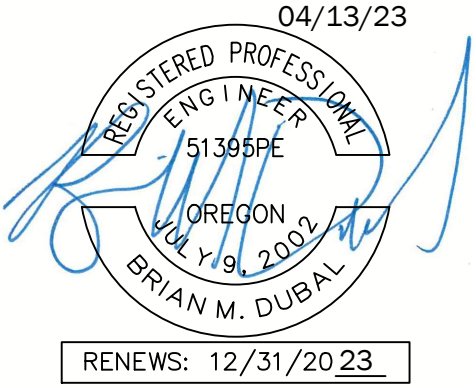
124TH AVENUE BUSINESS PARK

SW 124th Ave
Tualatin, Oregon 97062

STORMWATER REPORT

VLMK Project Number: 20200748



Prepared By: Malee Garcia, EI
Match 31, 2022

VLMK
ENGINEERING + DESIGN

Project:	124th Avenue Business Park	*Project Number:*	20200748
Project Address:	SW 124th Ave Tualatin, Oregon 97062		

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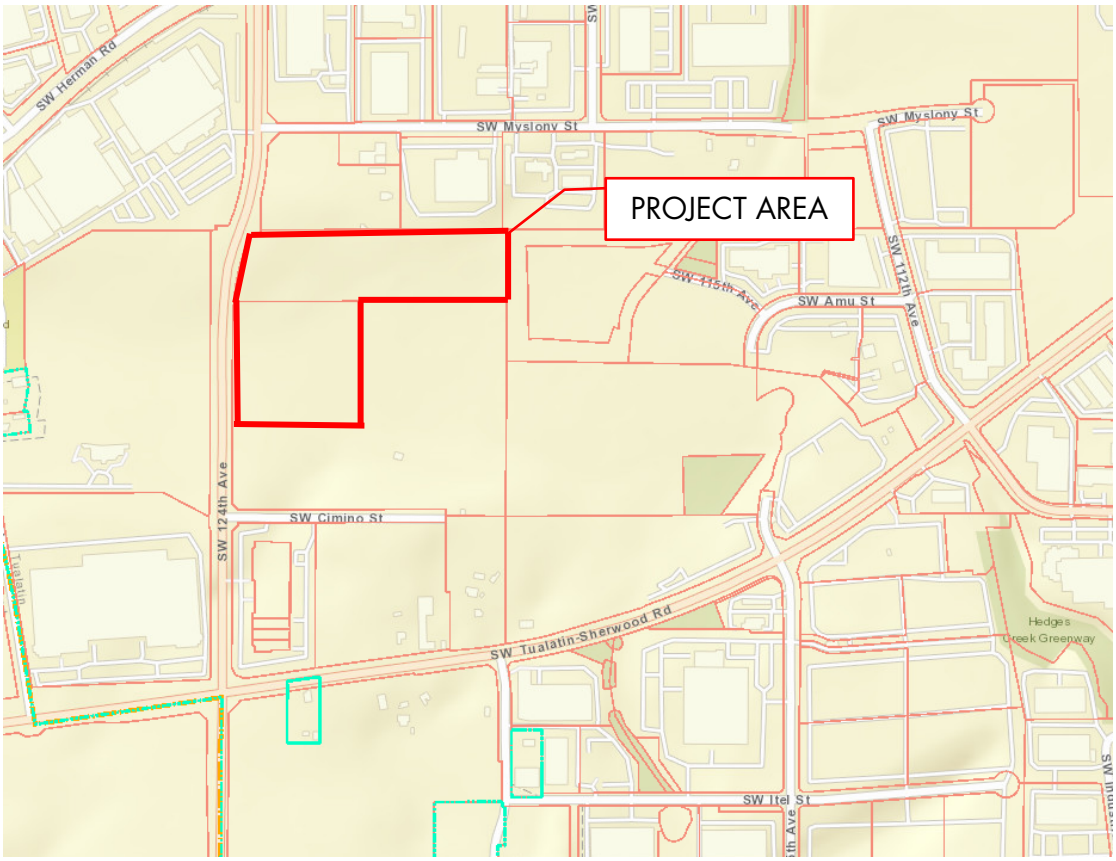
A. Site Vicinity Map



B. **Project Information**

124th Avenue Business Park is a 14.42 acre proposed development in Tualatin, Oregon. The site is zoned as General Manufacturing (GM). This development includes three buildings, Building B being owned by a tenant and Buildings A and C are shell buildings capable of multiple tenants. Building A is 70,670 sf, Building B is 76,000 sf, and Building C is 52,500 sf. The proposed development includes 2 driveway entrances; both are on the western boundary of the site accessing SW 124th Ave. Other new impervious areas on-site include trailer parking, auto parking and drive aisles and will be paved with asphalt concrete. This report describes the proposed stormwater management approach for this building.

The existing site is undeveloped comprised of trees, brush, and wetlands. The majority of the site flows to the southeast into the wetlands onsite. There is an existing ridge in the middle of the site which splits the southern portion from the northern portion. The existing wetlands were identified by Environmental Science & Assessment, LLC along the eastern boundary.

Survey information for the site is from a topographic survey provided by: Weddle Surverying Inc. (6950 SW Hampton St., Ste.170, Tigard, OR 97223 (503)941-9585.

All stormwater facilities and conveyance systems for this development have been designed per the 2019 Clean Water Services Design & Construction Standards.

Additional design information was obtained from:

- USDA NRCS Web Soil Survey of Washington County, Oregon

Software used in design:

- HydroCAD Stormwater Modeling Software
- Microsoft Excel
- AutoCAD Civil 3D 2020

C. **Stormwater Narrative**

Onsite stormwater runoff will be collected at various catch basins and roof drains located throughout the property. All stormwater runoff from pollution-generating surfaces (i.e. asphalt, roofs) will be treated on-site using Peak Diversion Stormfilter vaults manufactured by Contech.
The post development drainage areas are split into two sections between the north and south. Following treatment, stormwater from Building A will be routed to an underground detention facility consisting of (132) MC-3500 chambers manufactured by ADS and Buildings B and C will share another one consisting of (315) MC-4500 chambers. The 2-year storm will be attenuated to 50% of the pre-development flow rate. Post-development discharge rates from the 5 and 10-year storms will be reduced below pre-developed conditions as shown in the Hydro CAD report in the appendix.

Per Clean Water Services section 4.03.3, this development is classified as a Low Risk, Developed, and Large. Hydromodification will be addressed via CWS C&DS 4.03.5 (b). See the Appendix for a breakdown of this analysis.

D. **Stormwater Treatment Methodology**

Water Quality Treatment

The CWS water quality event used to size on-site water quality facilities is 0.36" developed over 4 hours. Please see the appendix for a WQ Basin Map delineating the treatment areas of the various treatment approaches, including sizing calculations for all treatment systems on-site.

The Stormwater Management StormFilter is an underground stormwater treatment system that utilizes rechargeable, media-filled cartridges that trap particulates and adsorb pollutants from stormwater runoff such as total suspended solids, hydrocarbons, nutrients, metals, and other common pollutants. The proposed site will utilize these filters in vaults shown on the Utility Plan.

Storm Quantity Control

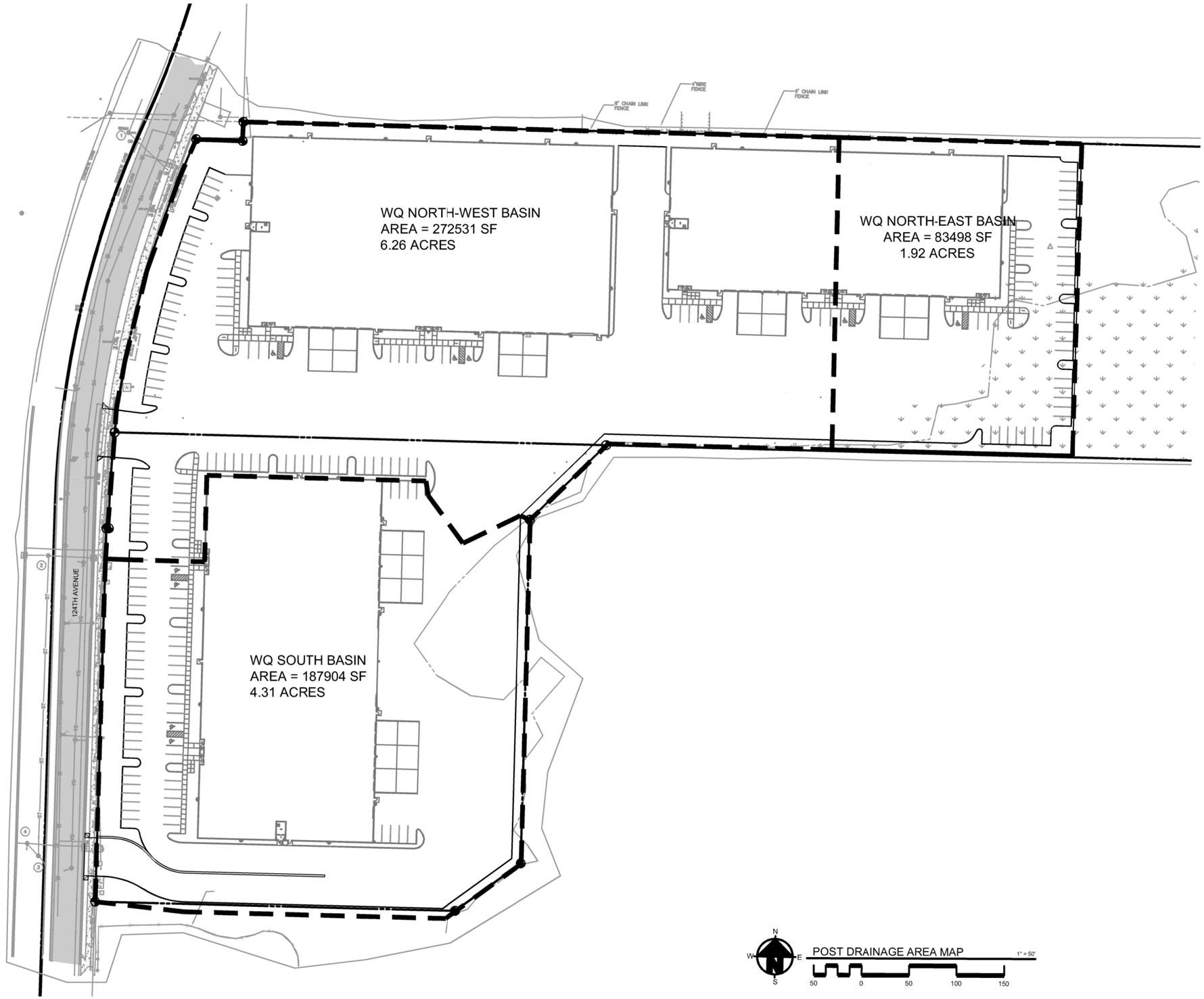
Stormtech underground chambers have been proposed as a method for stormwater detention. An overflow manhole is located near the wetlands where the controlled flow will be released through a pip with a headwall. The design storms are controlled by an orifice and weir plate in the flow control manhole. The discharge from the proposed system will meet the hydromodification requirements set forth in Table 4-7 of the CWS Design and Construction Standards.

Conveyance

The proposed storm conveyance pipes will be sized to convey the peak flow from the 25-year design event (4.0" over 24 hours) as calculated using the Santa Barbara Unit Hydrograph (SBUH). The minimum time of concentration in the SBUH calculations is 5.0 minutes. A conservative Manning's coefficient (η) of 0.013 is used to size conveyance pipes. It is conservatively assumed that the entire site area is impervious for the conveyance calculations.

II. APPENDIX

A. Basin Maps



N
W E
S

POST DRAINAGE AREA MAP 1" = 50'

50 0 50 100 150

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VLMK.COM

PROJECT NAME
124th AVENUE
BUSINESS PARK

124th AVENUE
TUALATIN, OREGON

REVISIONS

	DATE	DESCRIPTION

DATE
DECEMBER 2021

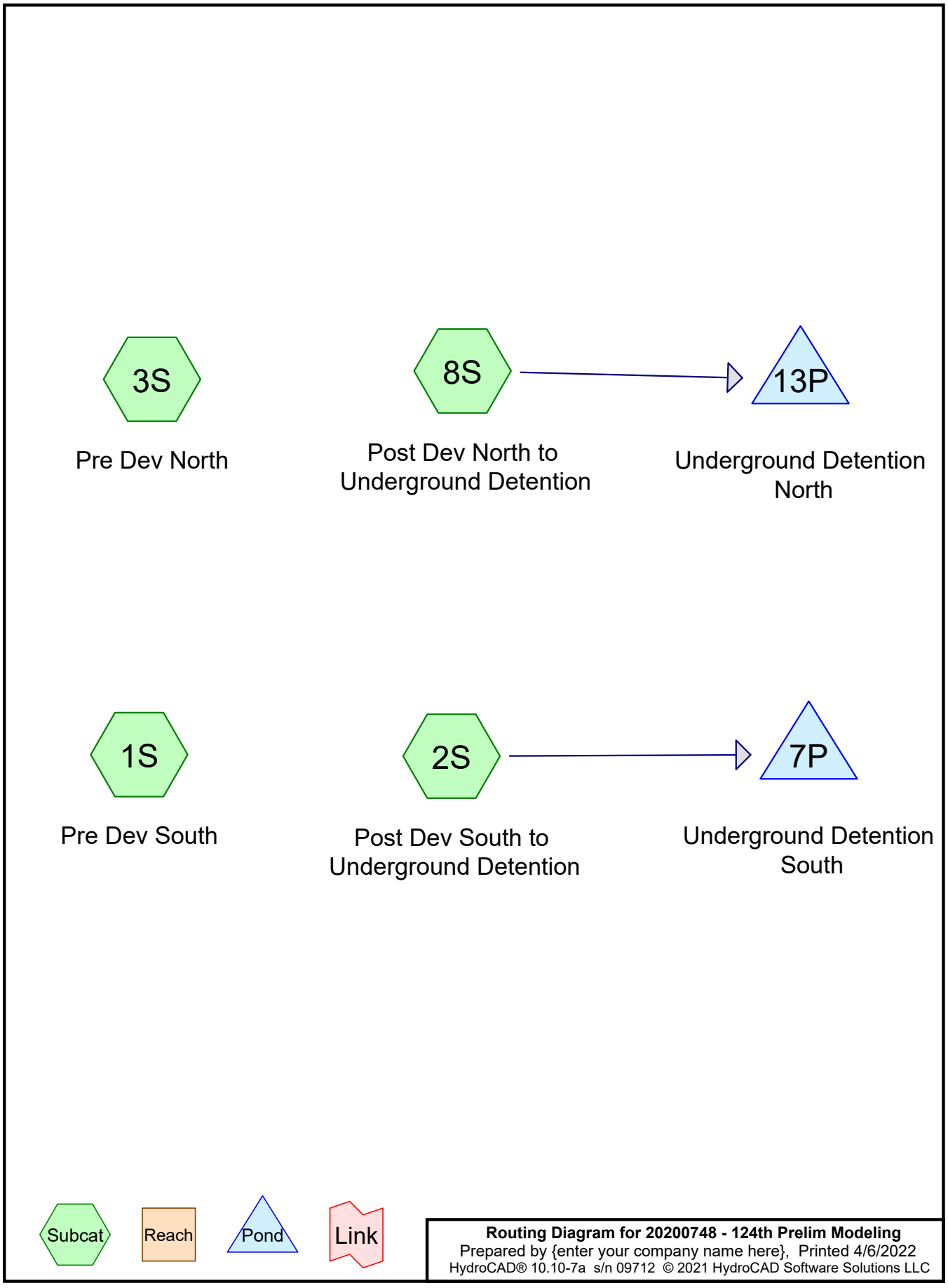
SCALE	PROJ. NO.
AS NOTED	20200748
DRAWN	CHECKED
KAN	HGK

POST DRAINAGE
AREA MAP

NOT FOR CONSTRUCTION

G:\Acad2020\20200748\Calculations\Civil\06 STORM REPORTS\Basin Map.dwg4/6/2022 12:30 PM

B. **Flow Attenuation: HydroCAD Calculations**


3S
Pre Dev North
8S
Post Dev North to Underground Detention
13P
Underground Detention North
1S
Pre Dev South
2S
Post Dev South to Underground Detention
7P
Underground Detention South
Subcat
Reach
Pond
Link
Routing Diagram for 20200748 - 124th Prelim Modeling
Prepared by {enter your company name here}, Printed 4/6/2022
HydroCAD® 10.10-7a s/n 09712 © 2021 HydroCAD Software Solutions LLC

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-year	Type IA 24-hr		Default	24.00	1	2.50	2
2	5-year	Type IA 24-hr		Default	24.00	1	3.10	2
3	10-year	Type IA 24-hr		Default	24.00	1	3.45	2
4	25-year	Type IA 24-hr		Default	24.00	1	3.90	2
5	100-year	Type IA 24-hr		Default	24.00	1	4.80	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
12.304	75	(1S, 3S)
1.453	61	>75% Grass cover, Good, HSG B (2S, 8S)
11.034	98	Paved parking, HSG D (2S, 8S)
24.791	**84**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
1.453	HSG B	2S, 8S
0.000	HSG C	
11.034	HSG D	2S, 8S
12.304	Other	1S, 3S
24.791		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	12.304	12.304		1S, 3S
0.000	1.453	0.000	0.000	0.000	1.453	>75% Grass cover, Good	2S, 8S
0.000	0.000	0.000	11.034	0.000	11.034	Paved parking	2S, 8S
0.000	**1.453**	**0.000**	**11.034**	**12.304**	**24.791**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Pre Dev South Runoff Area=224,197 sf 0.00% Impervious Runoff Depth>0.64"
Flow Length=568' Tc=15.0 min CN=75/0 Runoff=0.41 cfs 0.276 af

Subcatchment2S: Post Dev South to Runoff Area=187,903 sf 88.45% Impervious Runoff Depth>2.03"
Tc=5.0 min CN=61/98 Runoff=2.20 cfs 0.729 af

Subcatchment3S: Pre Dev North Runoff Area=311,751 sf 0.00% Impervious Runoff Depth>0.64"
Flow Length=1,313' Tc=25.9 min CN=75/0 Runoff=0.46 cfs 0.381 af

Subcatchment8S: Post Dev North to Runoff Area=356,028 sf 88.31% Impervious Runoff Depth>2.02"
Tc=5.0 min CN=61/98 Runoff=4.16 cfs 1.379 af

Pond 7P: Underground Detention South Peak Elev=3.71' Storage=0.441 af Inflow=2.20 cfs 0.729 af
Outflow=0.20 cfs 0.288 af

Pond 13P: Underground Detention North Peak Elev=4.66' Storage=1.071 af Inflow=4.16 cfs 1.379 af
Outflow=0.22 cfs 0.308 af

Total Runoff Area = 24.791 ac Runoff Volume = 2.765 af Average Runoff Depth = 1.34"
55.49% Pervious = 13.757 ac 44.51% Impervious = 11.034 ac

Summary for Subcatchment 1S: Pre Dev South

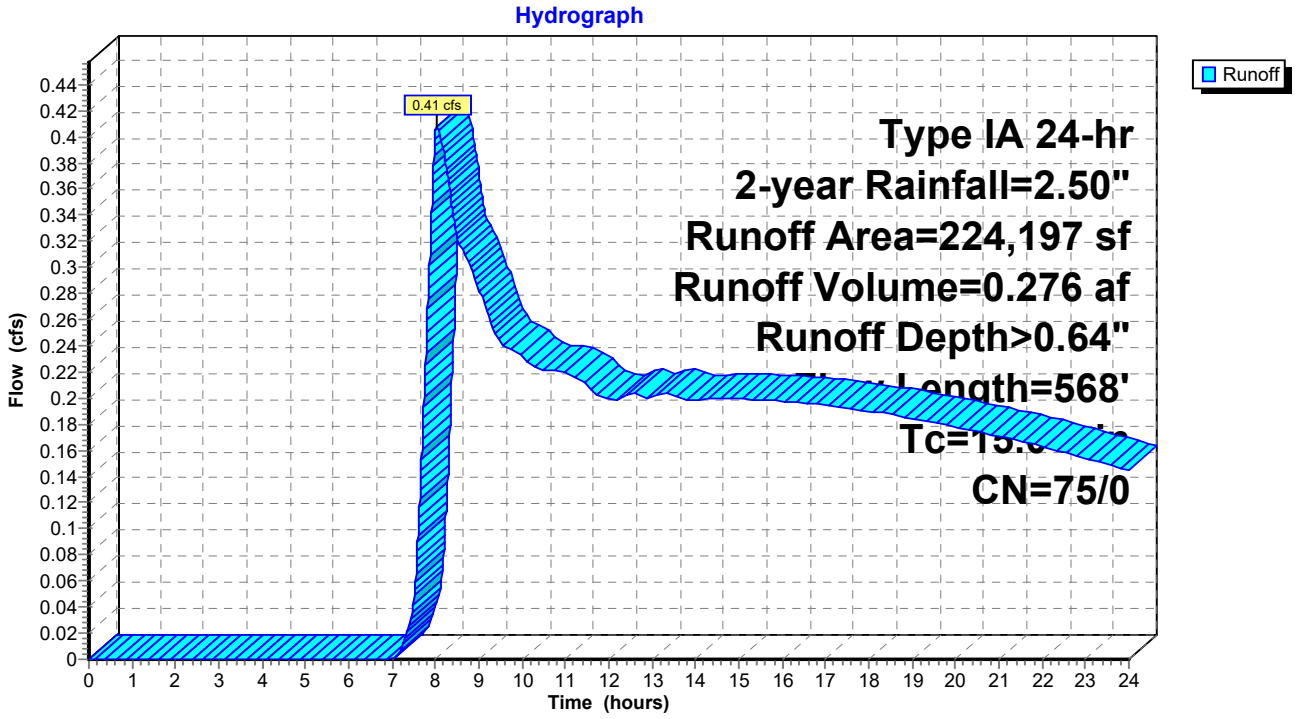
Runoff = 0.41 cfs @ 8.01 hrs, Volume= 0.276 af, Depth> 0.64"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-year Rainfall=2.50"

	Area (sf)	CN	Description
*	224,197	75	
	224,197	75	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	100	0.1400	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.50"
3.8	468	0.0160	2.04		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
15.0	568	Total			

Subcatchment 1S: Pre Dev South



Summary for Subcatchment 2S: Post Dev South to Underground Detention

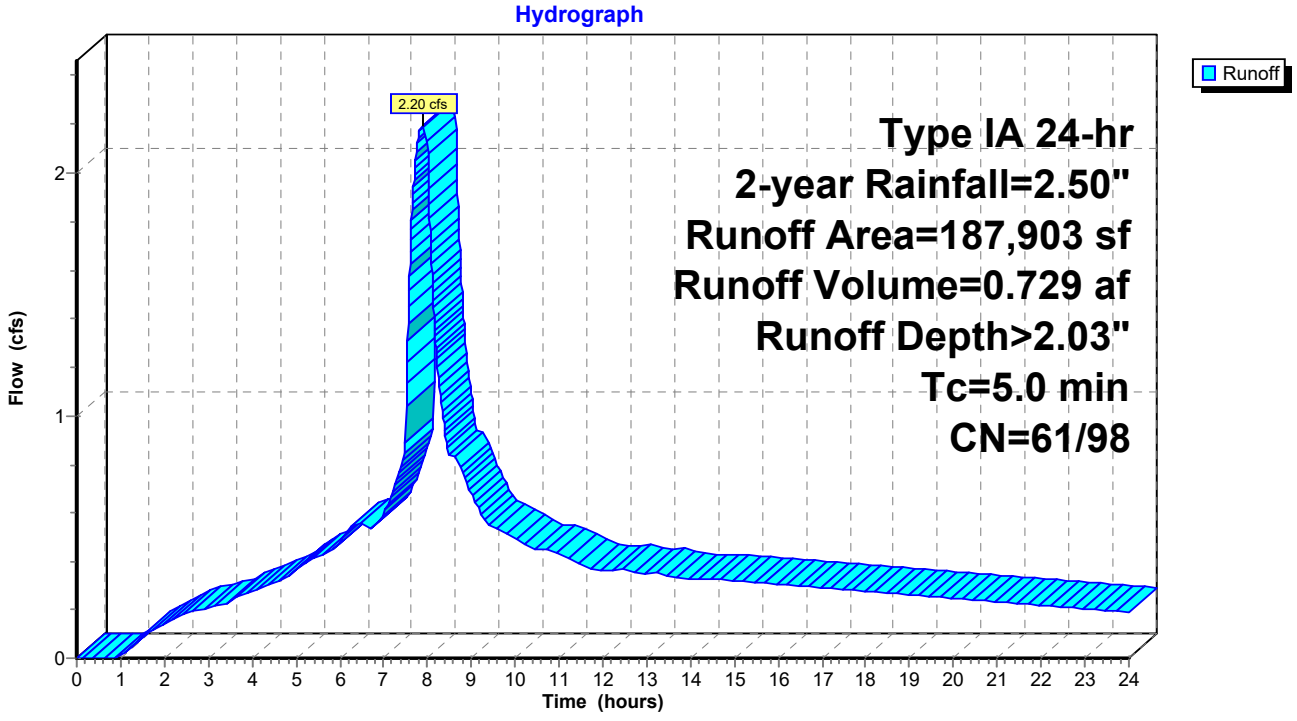
Runoff = 2.20 cfs @ 7.88 hrs, Volume= 0.729 af, Depth> 2.03"
Routed to Pond 7P : Underground Detention South

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-year Rainfall=2.50"

Area (sf)	CN	Description
166,209	98	Paved parking, HSG D
21,694	61	>75% Grass cover, Good, HSG B
187,903	94	Weighted Average
21,694	61	11.55% Pervious Area
166,209	98	88.45% Impervious Area

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

Subcatchment 2S: Post Dev South to Underground Detention



Summary for Subcatchment 3S: Pre Dev North

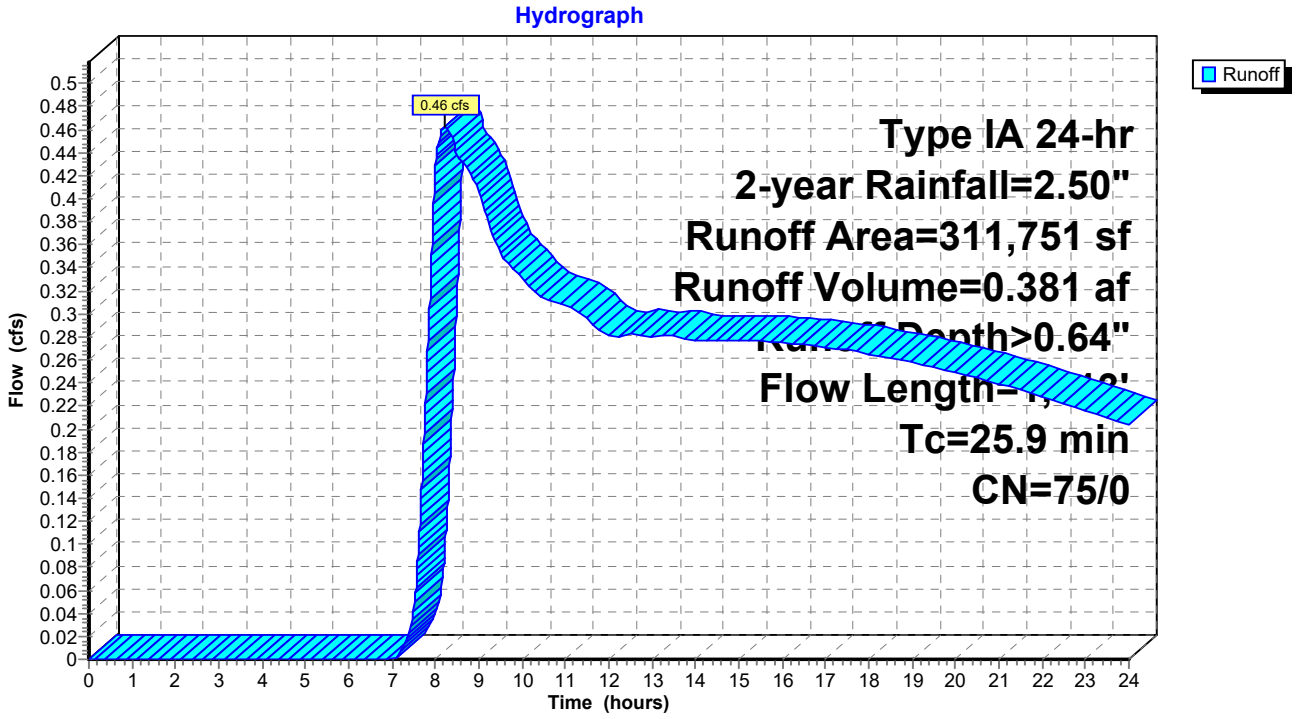
Runoff = 0.46 cfs @ 8.22 hrs, Volume= 0.381 af, Depth> 0.64"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-year Rainfall=2.50"

	Area (sf)	CN	Description
*	311,751	75	
	311,751	75	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.8	100	0.0250	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.50"
11.1	1,213	0.0127	1.81		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
25.9	1,313	Total			

Subcatchment 3S: Pre Dev North



Summary for Subcatchment 8S: Post Dev North to Underground Detention

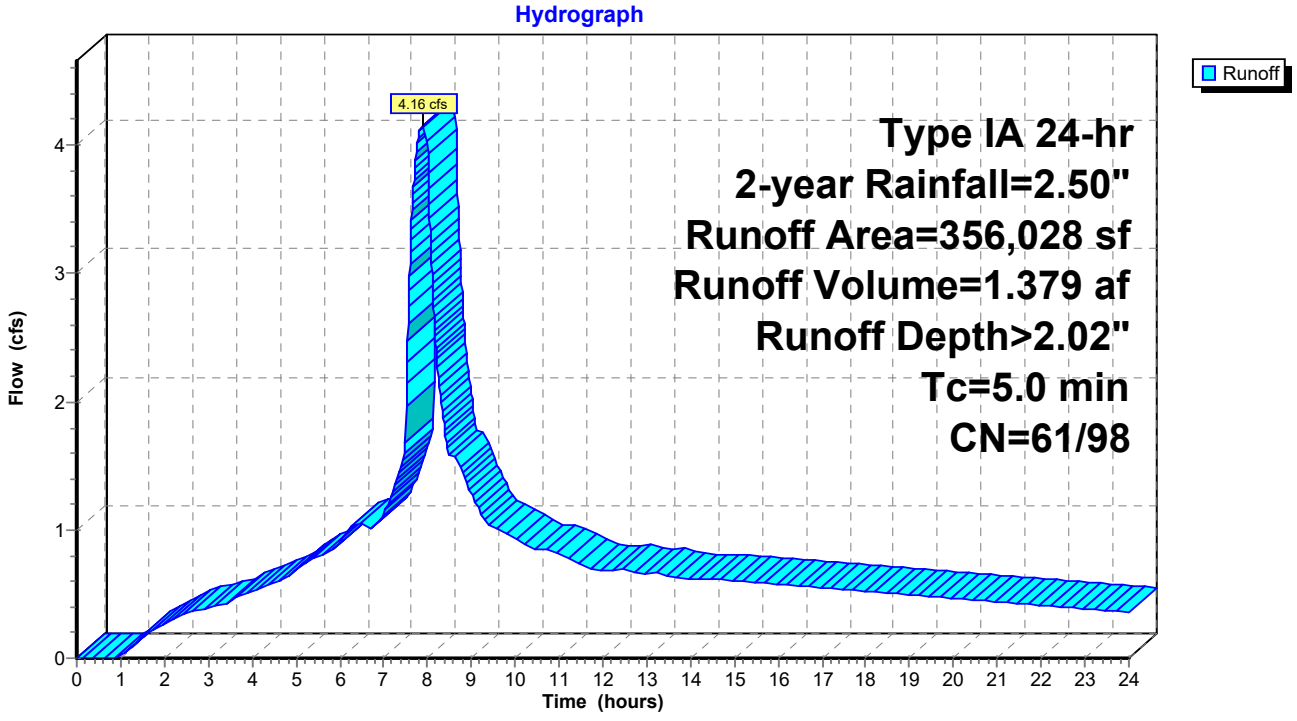
Runoff = 4.16 cfs @ 7.88 hrs, Volume= 1.379 af, Depth> 2.02"
Routed to Pond 13P : Underground Detention North

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-year Rainfall=2.50"

Area (sf)	CN	Description
314,416	98	Paved parking, HSG D
41,612	61	>75% Grass cover, Good, HSG B
356,028	94	Weighted Average
41,612	61	11.69% Pervious Area
314,416	98	88.31% Impervious Area

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

Subcatchment 8S: Post Dev North to Underground Detention



Summary for Pond 7P: Underground Detention South

Inflow Area = 4.314 ac, 88.45% Impervious, Inflow Depth > 2.03" for 2-year event
Inflow = 2.20 cfs @ 7.88 hrs, Volume= 0.729 af
Outflow = 0.20 cfs @ 23.20 hrs, Volume= 0.288 af, Atten= 91%, Lag= 919.0 min
Primary = 0.20 cfs @ 23.20 hrs, Volume= 0.288 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 3.71' @ 23.20 hrs Surf.Area= 0.169 ac Storage= 0.441 af

Plug-Flow detention time= 511.0 min calculated for 0.288 af (39% of inflow)
Center-of-Mass det. time= 213.0 min (888.5 - 675.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	0.236 af	**87.25'W x 84.57'L x 5.50'H Field A** 0.932 af Overall - 0.341 af Embedded = 0.590 af x 40.0% Voids
#2A	0.75'	0.341 af	**ADS_StormTech MC-3500 d +Cap**x 132 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 132 Chambers in 12 Rows Cap Storage= 14.9 cf x 2 x 12 rows = 357.6 cf
		0.578 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	5.25'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.20 cfs @ 23.20 hrs HW=3.71' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.20 cfs @ 9.17 fps)
└**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 7P: Underground Detention South - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-3500 d +Cap (ADS StormTech®MC-3500 d rev 03/14 with Cap volume)
Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf
Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap
Cap Storage= 14.9 cf x 2 x 12 rows = 357.6 cf

77.0" Wide + 9.0" Spacing = 86.0" C-C Row Spacing

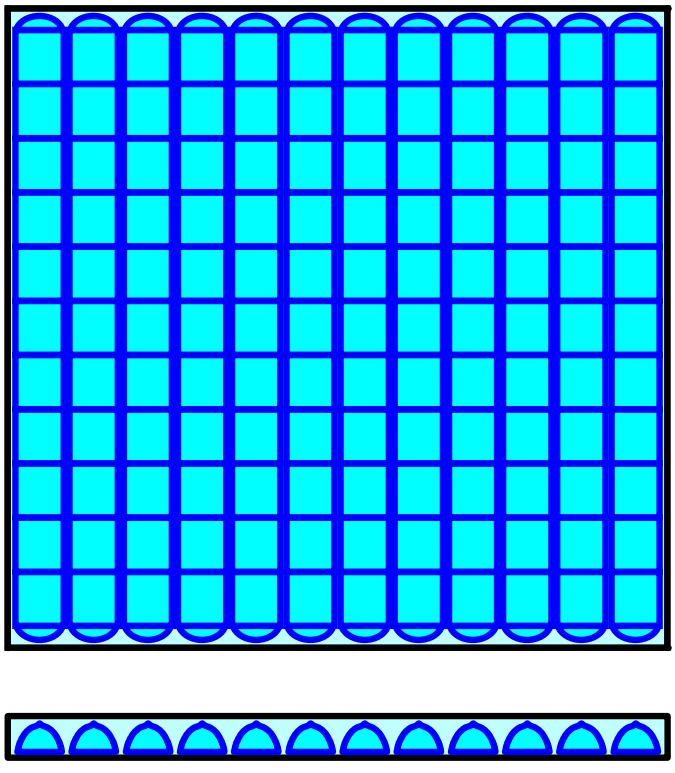
11 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 82.57' Row Length +12.0" End Stone x 2 = 84.57' Base Length
12 Rows x 77.0" Wide + 9.0" Spacing x 11 + 12.0" Side Stone x 2 = 87.25' Base Width
9.0" Stone Base + 45.0" Chamber Height + 12.0" Stone Cover = 5.50' Field Height

132 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 12 Rows = 14,871.3 cf Chamber Storage

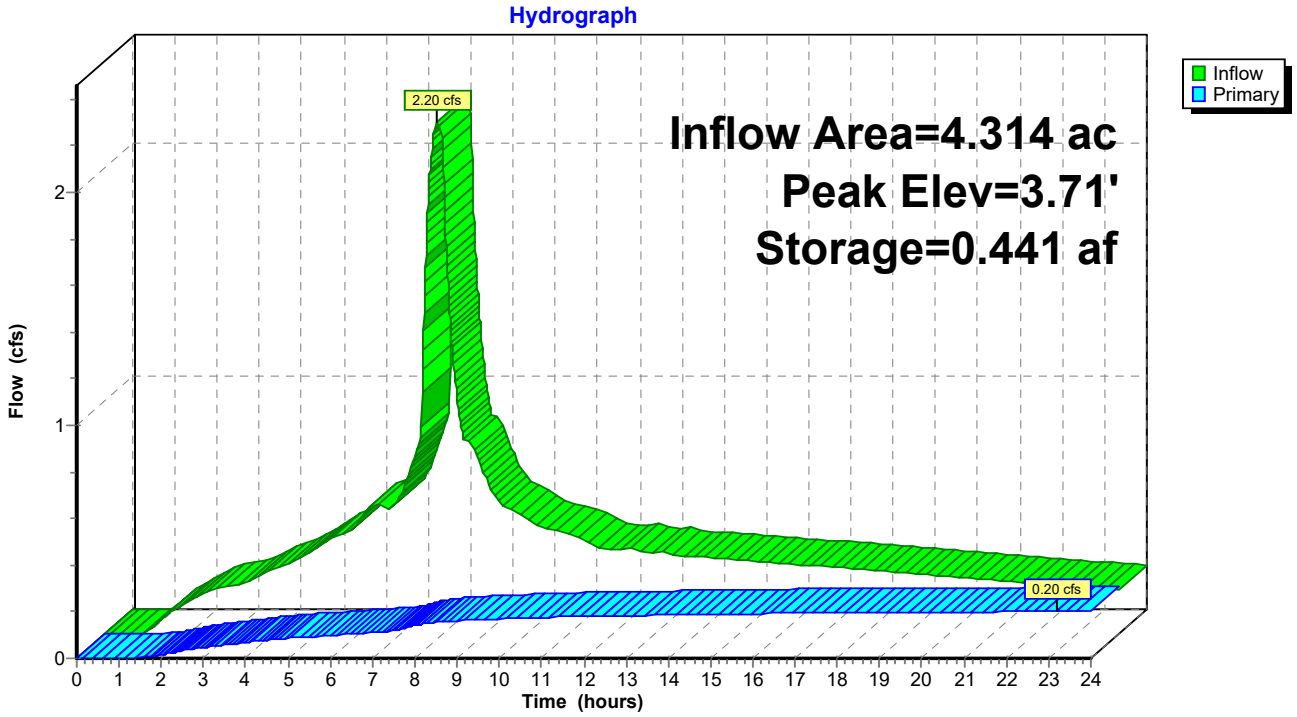
40,583.0 cf Field - 14,871.3 cf Chambers = 25,711.8 cf Stone x 40.0% Voids = 10,284.7 cf Stone Storage

Chamber Storage + Stone Storage = 25,156.0 cf = 0.578 af
Overall Storage Efficiency = 62.0%
Overall System Size = 84.57' x 87.25' x 5.50'

132 Chambers
1,503.1 cy Field
952.3 cy Stone



Pond 7P: Underground Detention South



Summary for Pond 13P: Underground Detention North

Inflow Area = 8.173 ac, 88.31% Impervious, Inflow Depth > 2.02" for 2-year event
Inflow = 4.16 cfs @ 7.88 hrs, Volume= 1.379 af
Outflow = 0.22 cfs @ 24.00 hrs, Volume= 0.308 af, Atten= 95%, Lag= 967.2 min
Primary = 0.22 cfs @ 24.00 hrs, Volume= 0.308 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 4.66' @ 24.00 hrs Surf.Area= 0.316 ac Storage= 1.071 af

Plug-Flow detention time= 589.0 min calculated for 0.308 af (22% of inflow)
Center-of-Mass det. time= 220.7 min (896.2 - 675.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	0.504 af	**137.50'W x 100.04'L x 6.75'H Field A** 2.132 af Overall - 0.871 af Embedded = 1.261 af x 40.0% Voids
#2A	0.75'	0.871 af	**ADS_StormTech MC-4500 b +Cap**x 345 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 345 Chambers in 15 Rows Cap Storage= 39.5 cf x 2 x 15 rows = 1,185.0 cf
		1.375 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	6.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.22 cfs @ 24.00 hrs HW=4.66' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.22 cfs @ 10.30 fps)
└**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 13P: Underground Detention North - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 b +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= 39.5 cf x 2 x 15 rows = 1,185.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

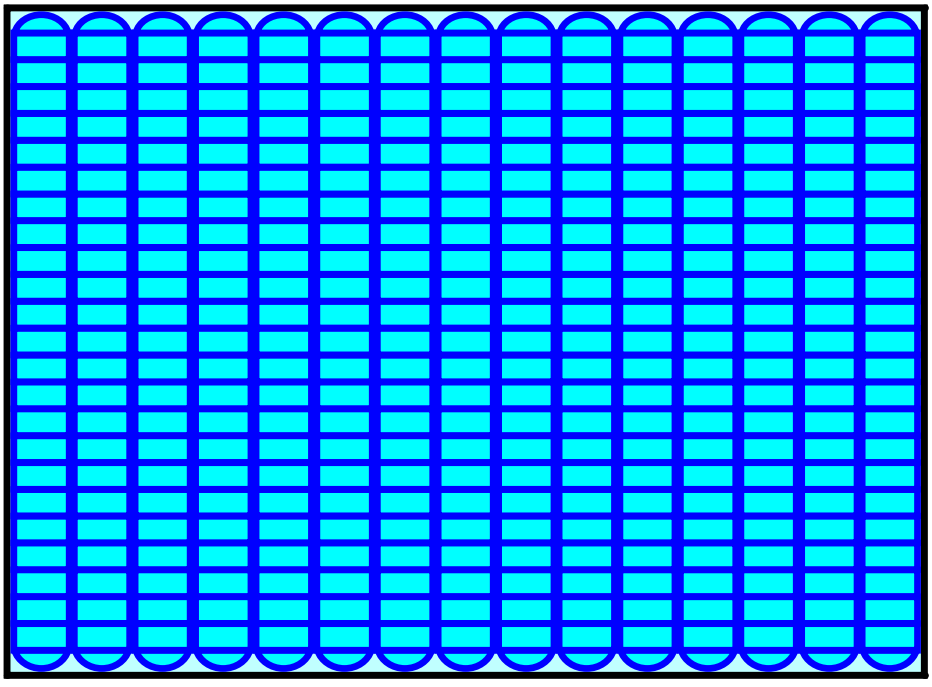
23 Chambers/Row x 4.02' Long +2.73' Cap Length x 2 = 98.04' Row Length +12.0" End Stone x 2 = 100.04' Base Length
15 Rows x 100.0" Wide + 9.0" Spacing x 14 + 12.0" Side Stone x 2 = 137.50' Base Width
9.0" Stone Base + 60.0" Chamber Height + 12.0" Stone Cover = 6.75' Field Height

345 Chambers x 106.5 cf + 39.5 cf Cap Volume x 2 x 15 Rows = 37,924.2 cf Chamber Storage

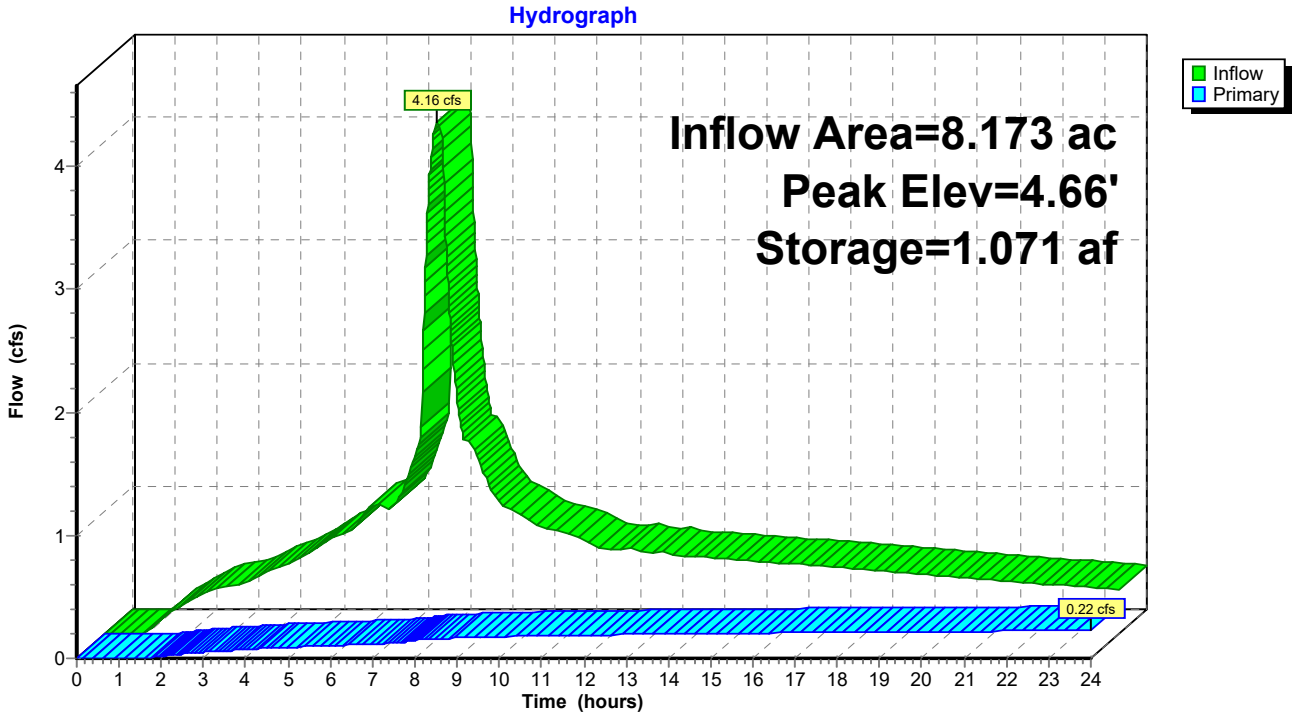
92,851.2 cf Field - 37,924.2 cf Chambers = 54,927.0 cf Stone x 40.0% Voids = 21,970.8 cf Stone Storage

Chamber Storage + Stone Storage = 59,895.0 cf = 1.375 af
Overall Storage Efficiency = 64.5%
Overall System Size = 100.04' x 137.50' x 6.75'

345 Chambers
3,438.9 cy Field
2,034.3 cy Stone



Pond 13P: Underground Detention North



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Pre Dev South Runoff Area=224,197 sf 0.00% Impervious Runoff Depth>1.02"
Flow Length=568' Tc=15.0 min CN=75/0 Runoff=0.83 cfs 0.436 af

Subcatchment2S: Post Dev South to Runoff Area=187,903 sf 88.45% Impervious Runoff Depth>2.58"
Tc=5.0 min CN=61/98 Runoff=2.76 cfs 0.927 af

Subcatchment3S: Pre Dev North Runoff Area=311,751 sf 0.00% Impervious Runoff Depth>1.01"
Flow Length=1,313' Tc=25.9 min CN=75/0 Runoff=0.94 cfs 0.602 af

Subcatchment8S: Post Dev North to Runoff Area=356,028 sf 88.31% Impervious Runoff Depth>2.58"
Tc=5.0 min CN=61/98 Runoff=5.22 cfs 1.754 af

Pond 7P: Underground Detention South Peak Elev=5.28' Storage=0.563 af Inflow=2.76 cfs 0.927 af
Outflow=0.33 cfs 0.366 af

Pond 13P: Underground Detention North Peak Elev=6.57' Storage=1.352 af Inflow=5.22 cfs 1.754 af
Outflow=0.50 cfs 0.403 af

Total Runoff Area = 24.791 ac Runoff Volume = 3.719 af Average Runoff Depth = 1.80"
55.49% Pervious = 13.757 ac 44.51% Impervious = 11.034 ac

Summary for Subcatchment 1S: Pre Dev South

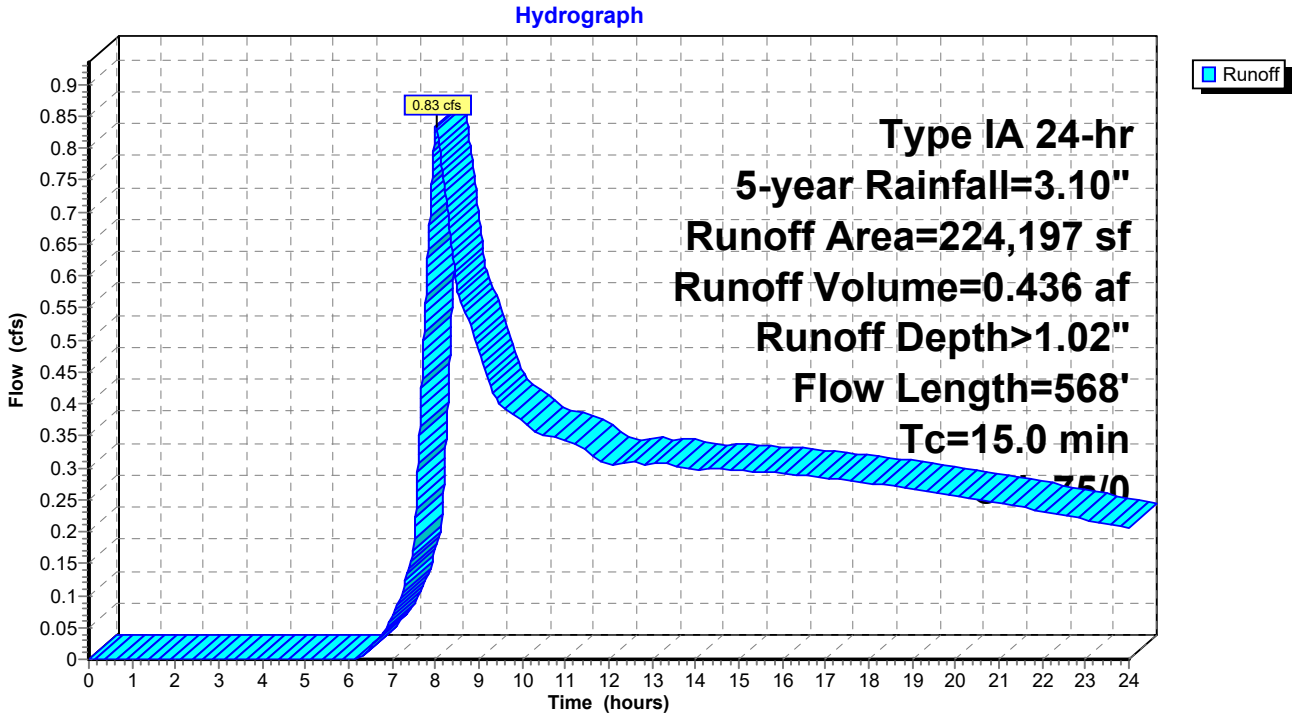
Runoff = 0.83 cfs @ 8.01 hrs, Volume= 0.436 af, Depth> 1.02"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 5-year Rainfall=3.10"

	Area (sf)	CN	Description
*	224,197	75	
	224,197	75	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	100	0.1400	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.50"
3.8	468	0.0160	2.04		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
15.0	568	Total			

Subcatchment 1S: Pre Dev South



Summary for Subcatchment 2S: Post Dev South to Underground Detention

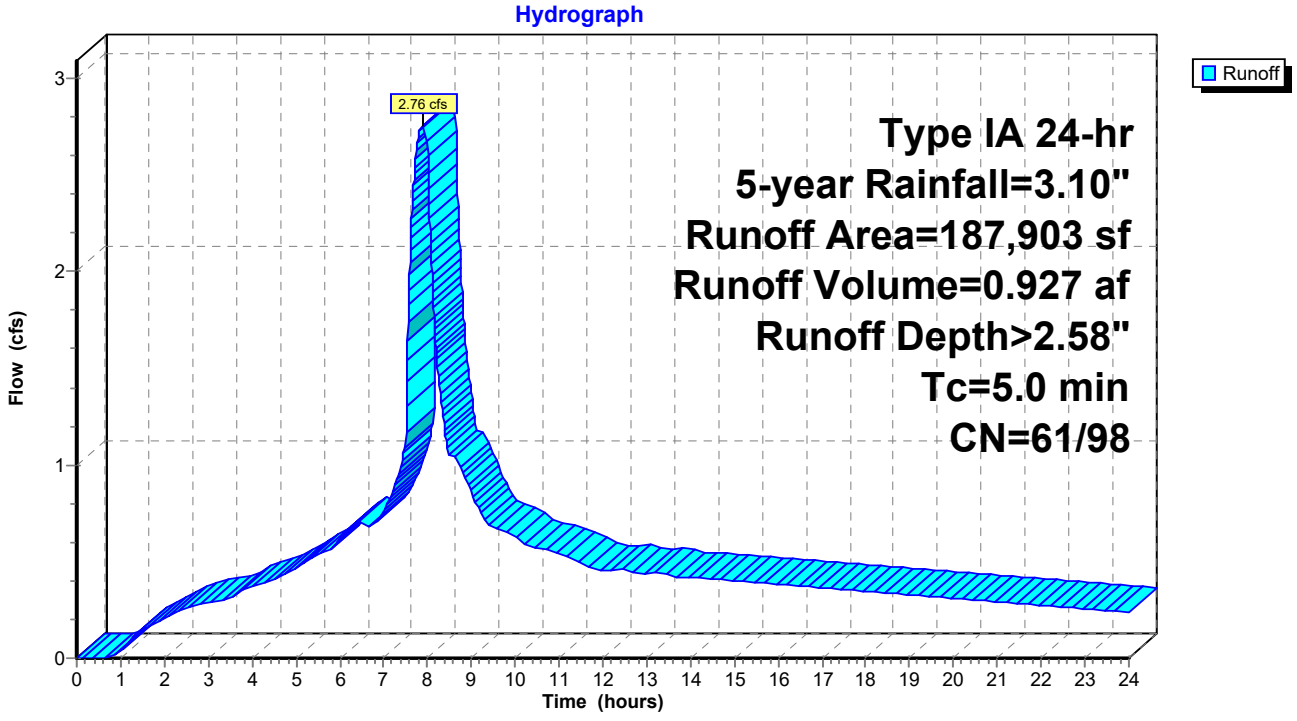
Runoff = 2.76 cfs @ 7.88 hrs, Volume= 0.927 af, Depth> 2.58"
Routed to Pond 7P : Underground Detention South

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 5-year Rainfall=3.10"

Area (sf)	CN	Description
166,209	98	Paved parking, HSG D
21,694	61	>75% Grass cover, Good, HSG B
187,903	94	Weighted Average
21,694	61	11.55% Pervious Area
166,209	98	88.45% Impervious Area

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

Subcatchment 2S: Post Dev South to Underground Detention



Summary for Subcatchment 3S: Pre Dev North

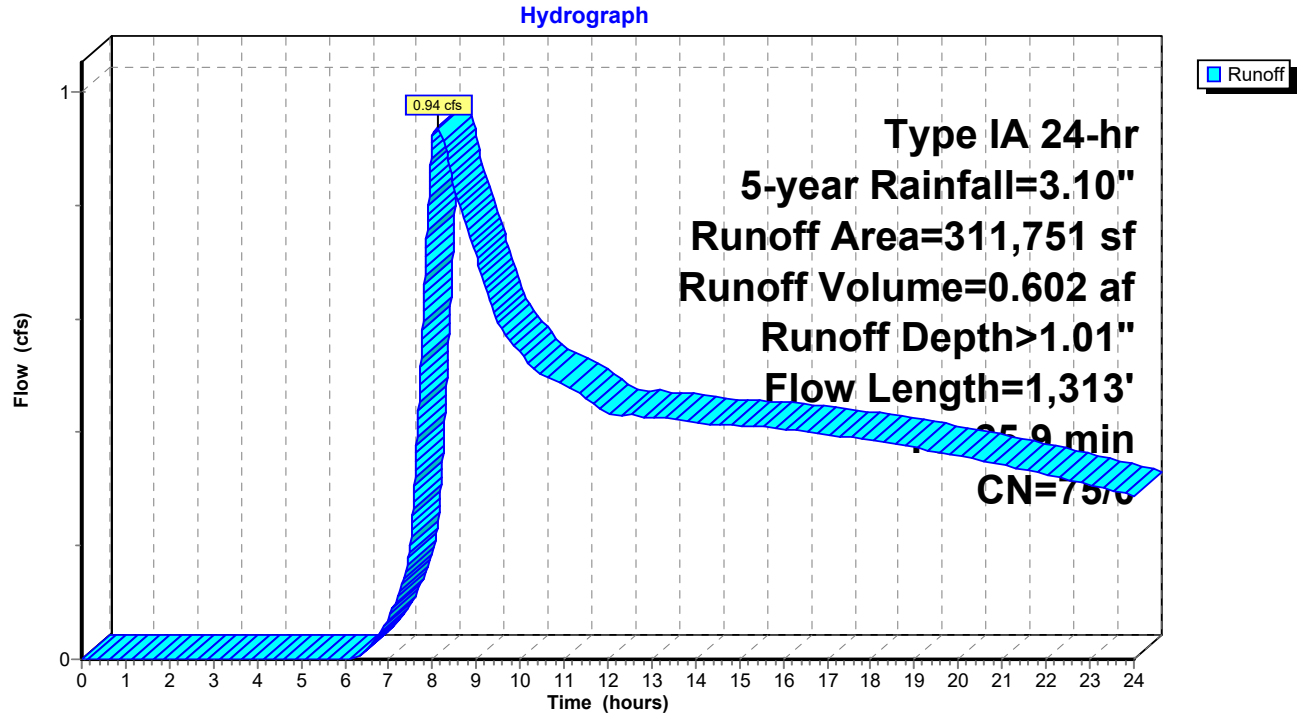
Runoff = 0.94 cfs @ 8.10 hrs, Volume= 0.602 af, Depth> 1.01"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 5-year Rainfall=3.10"

	Area (sf)	CN	Description
*	311,751	75	
	311,751	75	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.8	100	0.0250	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.50"
11.1	1,213	0.0127	1.81		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
25.9	1,313	Total			

Subcatchment 3S: Pre Dev North



Summary for Subcatchment 8S: Post Dev North to Underground Detention

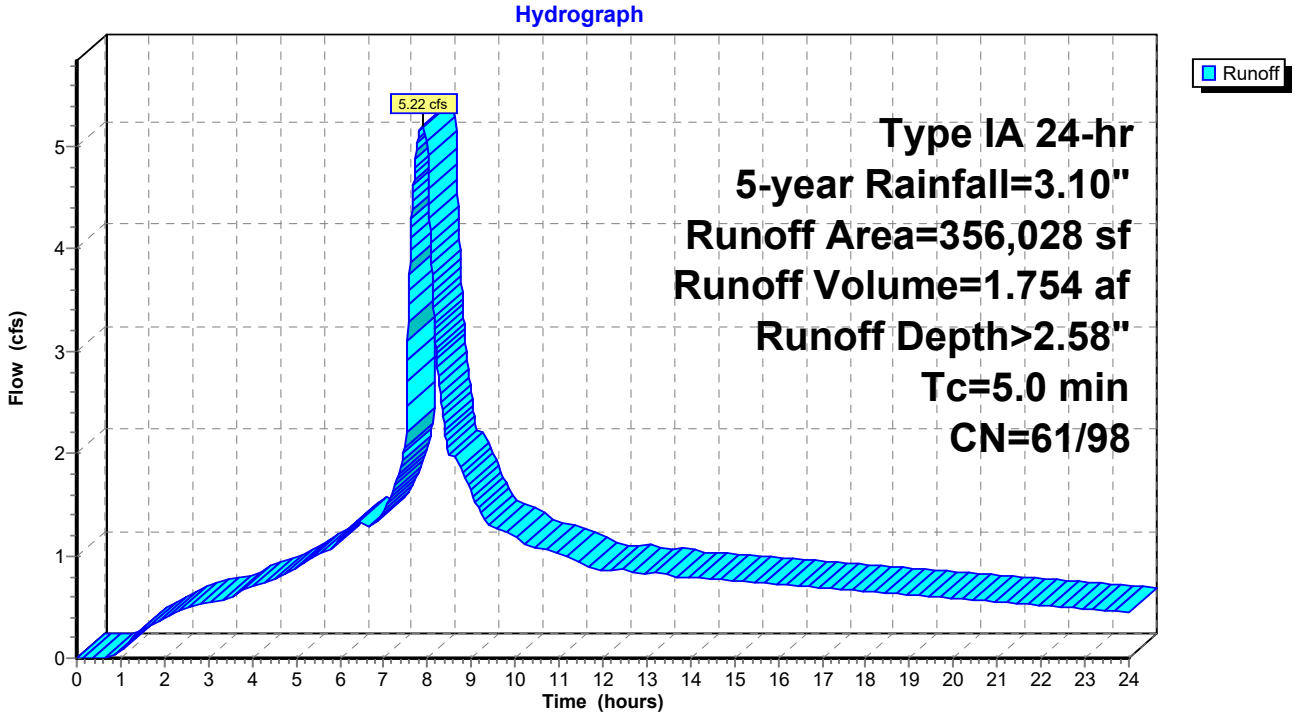
Runoff = 5.22 cfs @ 7.88 hrs, Volume= 1.754 af, Depth> 2.58"
Routed to Pond 13P : Underground Detention North

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 5-year Rainfall=3.10"

Area (sf)	CN	Description
314,416	98	Paved parking, HSG D
41,612	61	>75% Grass cover, Good, HSG B
356,028	94	Weighted Average
41,612	61	11.69% Pervious Area
314,416	98	88.31% Impervious Area

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

Subcatchment 8S: Post Dev North to Underground Detention



Summary for Pond 7P: Underground Detention South

Inflow Area = 4.314 ac, 88.45% Impervious, Inflow Depth > 2.58" for 5-year event
Inflow = 2.76 cfs @ 7.88 hrs, Volume= 0.927 af
Outflow = 0.33 cfs @ 18.92 hrs, Volume= 0.366 af, Atten= 88%, Lag= 662.4 min
Primary = 0.33 cfs @ 18.92 hrs, Volume= 0.366 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 5.28' @ 18.92 hrs Surf.Area= 0.169 ac Storage= 0.563 af

Plug-Flow detention time= 544.2 min calculated for 0.366 af (40% of inflow)
Center-of-Mass det. time= 244.5 min (915.0 - 670.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	0.236 af	**87.25'W x 84.57'L x 5.50'H Field A** 0.932 af Overall - 0.341 af Embedded = 0.590 af x 40.0% Voids
#2A	0.75'	0.341 af	**ADS_StormTech MC-3500 d +Cap**x 132 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 132 Chambers in 12 Rows Cap Storage= 14.9 cf x 2 x 12 rows = 357.6 cf
		0.578 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	5.25'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.32 cfs @ 18.92 hrs HW=5.28' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.24 cfs @ 10.98 fps)
└**2=Sharp-Crested Rectangular Weir** (Weir Controls 0.09 cfs @ 0.61 fps)

Pond 7P: Underground Detention South - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-3500 d +Cap (ADS StormTech®MC-3500 d rev 03/14 with Cap volume)
Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf
Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap
Cap Storage= 14.9 cf x 2 x 12 rows = 357.6 cf

77.0" Wide + 9.0" Spacing = 86.0" C-C Row Spacing

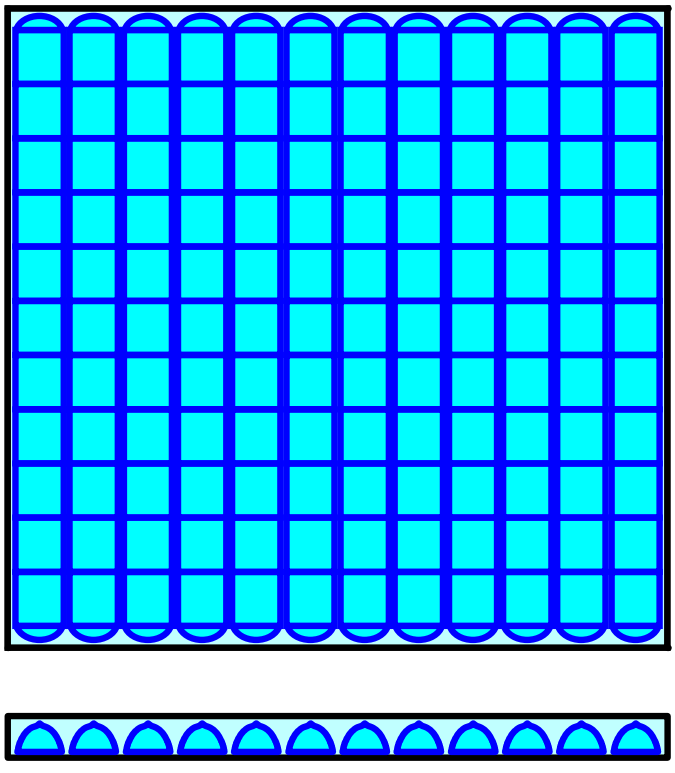
11 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 82.57' Row Length +12.0" End Stone x 2 = 84.57' Base Length
12 Rows x 77.0" Wide + 9.0" Spacing x 11 + 12.0" Side Stone x 2 = 87.25' Base Width
9.0" Stone Base + 45.0" Chamber Height + 12.0" Stone Cover = 5.50' Field Height

132 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 12 Rows = 14,871.3 cf Chamber Storage

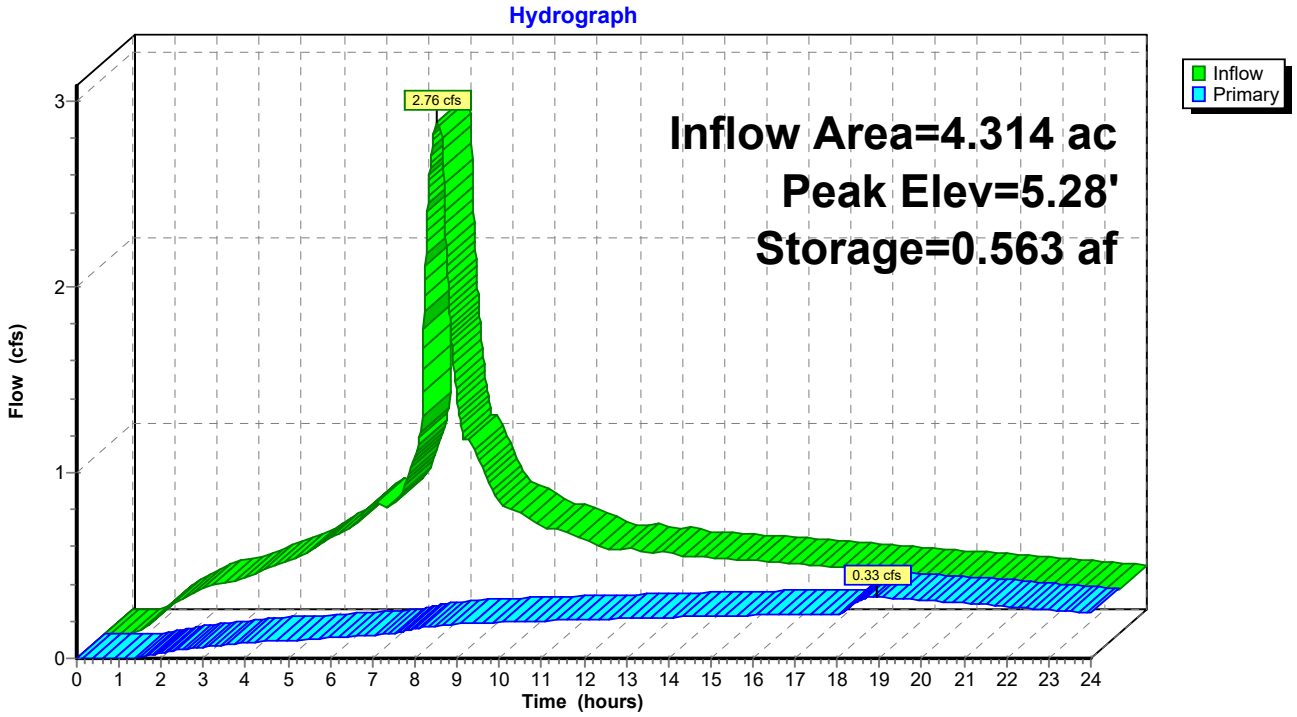
40,583.0 cf Field - 14,871.3 cf Chambers = 25,711.8 cf Stone x 40.0% Voids = 10,284.7 cf Stone Storage

Chamber Storage + Stone Storage = 25,156.0 cf = 0.578 af
Overall Storage Efficiency = 62.0%
Overall System Size = 84.57' x 87.25' x 5.50'

132 Chambers
1,503.1 cy Field
952.3 cy Stone



Pond 7P: Underground Detention South



Summary for Pond 13P: Underground Detention North

Inflow Area = 8.173 ac, 88.31% Impervious, Inflow Depth > 2.58" for 5-year event
Inflow = 5.22 cfs @ 7.88 hrs, Volume= 1.754 af
Outflow = 0.50 cfs @ 22.43 hrs, Volume= 0.403 af, Atten= 90%, Lag= 873.3 min
Primary = 0.50 cfs @ 22.43 hrs, Volume= 0.403 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 6.57' @ 22.43 hrs Surf.Area= 0.316 ac Storage= 1.352 af

Plug-Flow detention time= 649.5 min calculated for 0.403 af (23% of inflow)
Center-of-Mass det. time= 279.9 min (950.4 - 670.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	0.504 af	**137.50'W x 100.04'L x 6.75'H Field A** 2.132 af Overall - 0.871 af Embedded = 1.261 af x 40.0% Voids
#2A	0.75'	0.871 af	**ADS_StormTech MC-4500 b +Cap**x 345 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 345 Chambers in 15 Rows Cap Storage= 39.5 cf x 2 x 15 rows = 1,185.0 cf
		1.375 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	6.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.49 cfs @ 22.43 hrs HW=6.57' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.27 cfs @ 12.26 fps)
└**2=Sharp-Crested Rectangular Weir** (Weir Controls 0.22 cfs @ 0.84 fps)

Pond 13P: Underground Detention North - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 b +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= 39.5 cf x 2 x 15 rows = 1,185.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

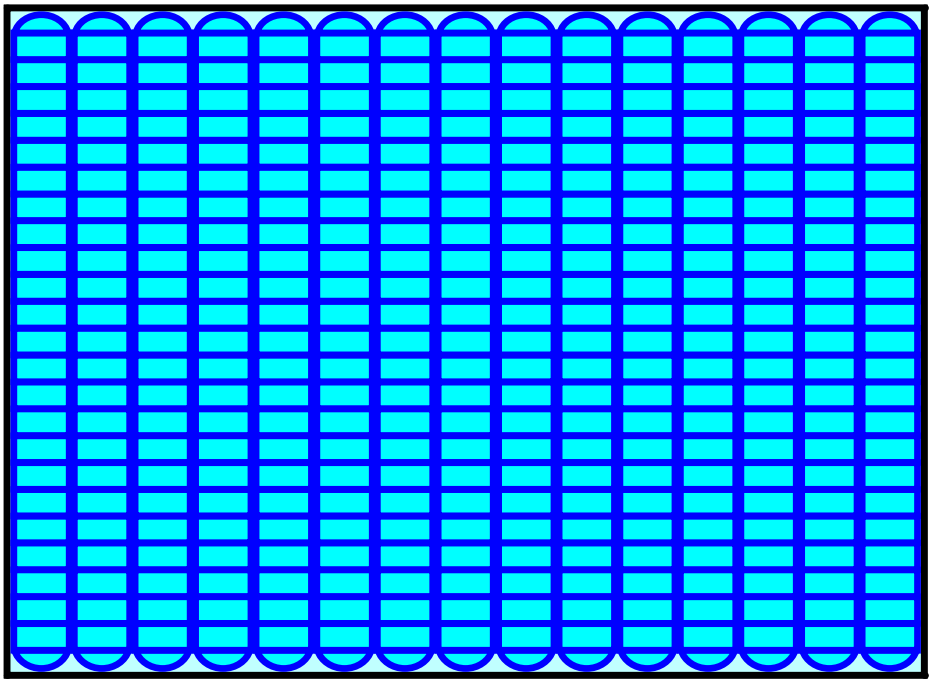
23 Chambers/Row x 4.02' Long +2.73' Cap Length x 2 = 98.04' Row Length +12.0" End Stone x 2 = 100.04' Base Length
15 Rows x 100.0" Wide + 9.0" Spacing x 14 + 12.0" Side Stone x 2 = 137.50' Base Width
9.0" Stone Base + 60.0" Chamber Height + 12.0" Stone Cover = 6.75' Field Height

345 Chambers x 106.5 cf + 39.5 cf Cap Volume x 2 x 15 Rows = 37,924.2 cf Chamber Storage

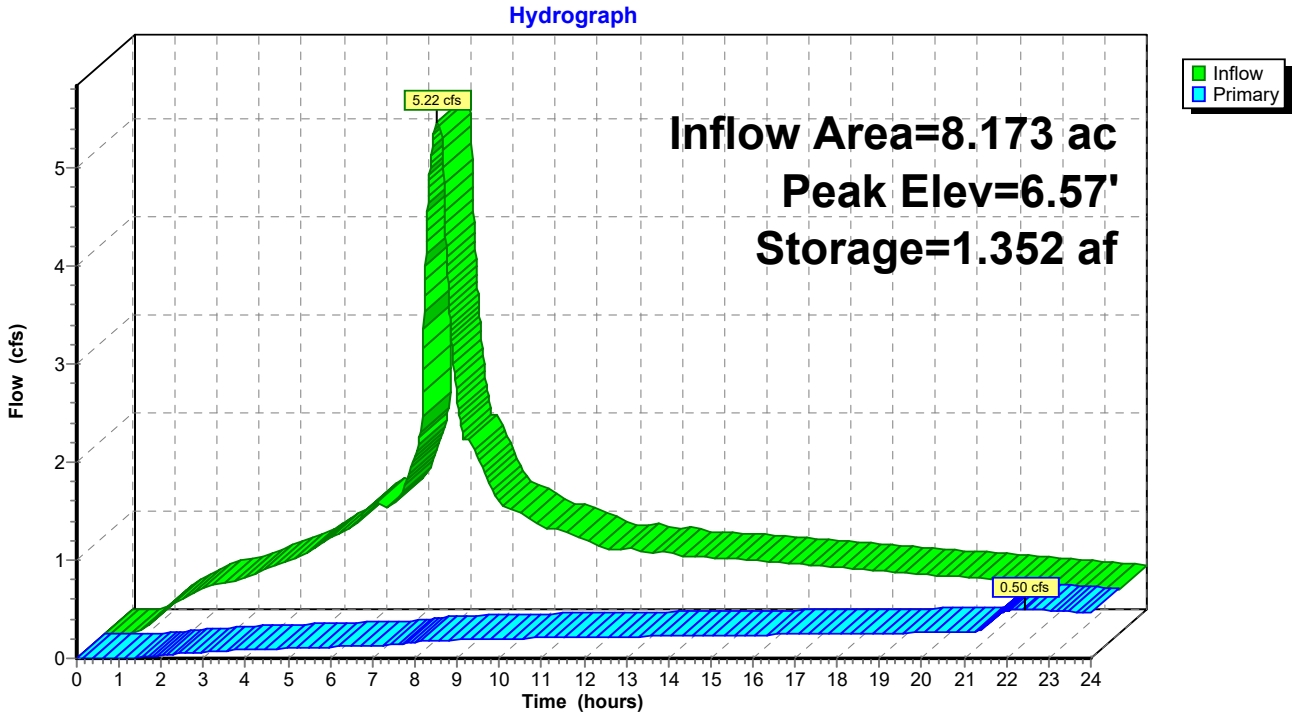
92,851.2 cf Field - 37,924.2 cf Chambers = 54,927.0 cf Stone x 40.0% Voids = 21,970.8 cf Stone Storage

Chamber Storage + Stone Storage = 59,895.0 cf = 1.375 af
Overall Storage Efficiency = 64.5%
Overall System Size = 100.04' x 137.50' x 6.75'

345 Chambers
3,438.9 cy Field
2,034.3 cy Stone



Pond 13P: Underground Detention North



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Pre Dev South Runoff Area=224,197 sf 0.00% Impervious Runoff Depth>1.25"
Flow Length=568' Tc=15.0 min CN=75/0 Runoff=1.11 cfs 0.538 af

Subcatchment2S: Post Dev South to Runoff Area=187,903 sf 88.45% Impervious Runoff Depth>2.90"
Tc=5.0 min CN=61/98 Runoff=3.09 cfs 1.044 af

Subcatchment3S: Pre Dev North Runoff Area=311,751 sf 0.00% Impervious Runoff Depth>1.25"
Flow Length=1,313' Tc=25.9 min CN=75/0 Runoff=1.26 cfs 0.743 af

Subcatchment8S: Post Dev North to Runoff Area=356,028 sf 88.31% Impervious Runoff Depth>2.90"
Tc=5.0 min CN=61/98 Runoff=5.84 cfs 1.975 af

Pond 7P: Underground Detention South Peak Elev=5.32' Storage=0.565 af Inflow=3.09 cfs 1.044 af
Outflow=0.47 cfs 0.482 af

Pond 13P: Underground Detention North Peak Elev=6.61' Storage=1.358 af Inflow=5.84 cfs 1.975 af
Outflow=0.76 cfs 0.623 af

Total Runoff Area = 24.791 ac Runoff Volume = 4.300 af Average Runoff Depth = 2.08"
55.49% Pervious = 13.757 ac 44.51% Impervious = 11.034 ac

Summary for Subcatchment 1S: Pre Dev South

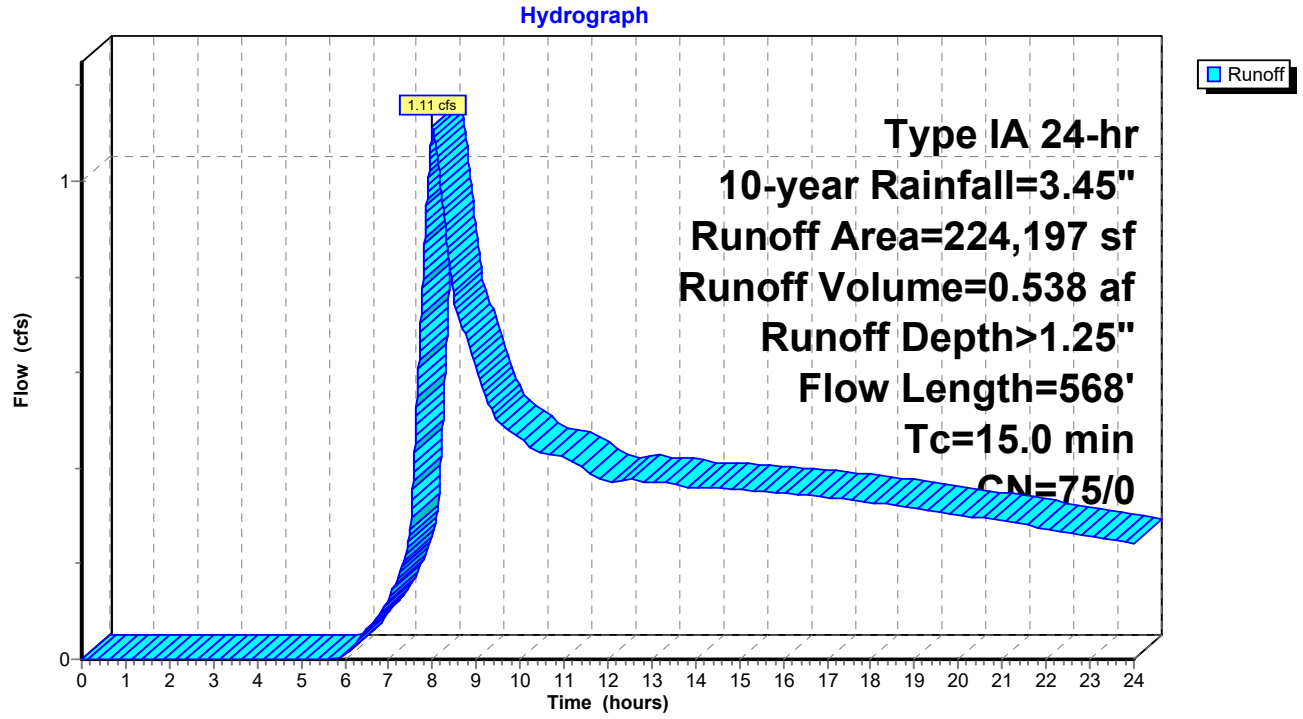
Runoff = 1.11 cfs @ 8.01 hrs, Volume= 0.538 af, Depth> 1.25"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-year Rainfall=3.45"

	Area (sf)	CN	Description
*	224,197	75	
	224,197	75	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	100	0.1400	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.50"
3.8	468	0.0160	2.04		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
15.0	568	Total			

Subcatchment 1S: Pre Dev South



Summary for Subcatchment 2S: Post Dev South to Underground Detention

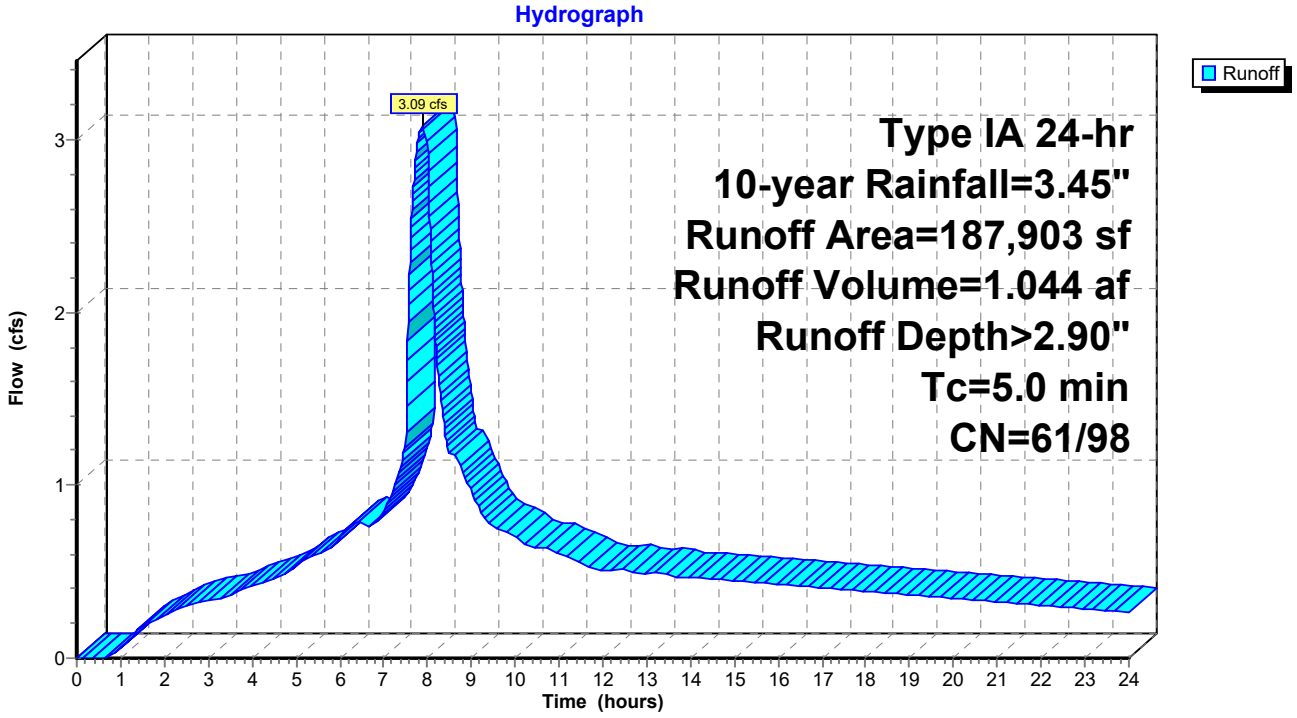
Runoff = 3.09 cfs @ 7.88 hrs, Volume= 1.044 af, Depth> 2.90"
Routed to Pond 7P : Underground Detention South

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-year Rainfall=3.45"

Area (sf)	CN	Description
166,209	98	Paved parking, HSG D
21,694	61	>75% Grass cover, Good, HSG B
187,903	94	Weighted Average
21,694	61	11.55% Pervious Area
166,209	98	88.45% Impervious Area

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

Subcatchment 2S: Post Dev South to Underground Detention



Summary for Subcatchment 3S: Pre Dev North

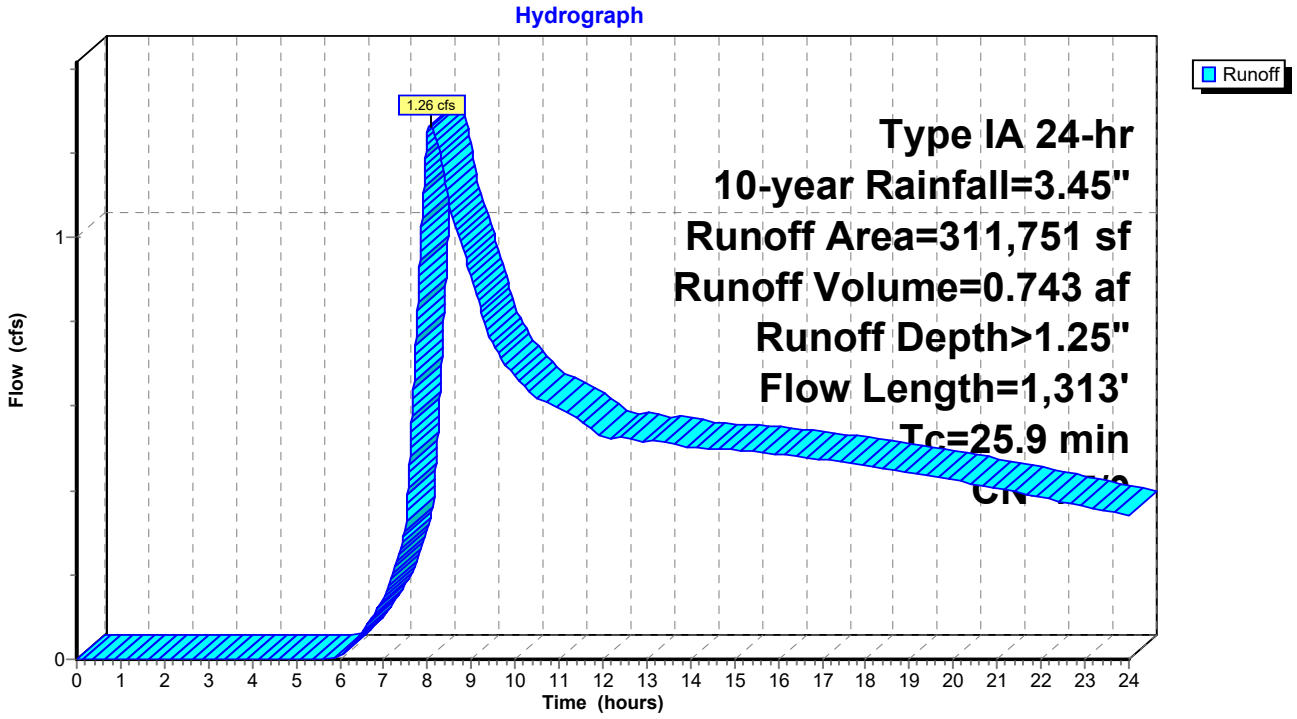
Runoff = 1.26 cfs @ 8.07 hrs, Volume= 0.743 af, Depth> 1.25"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-year Rainfall=3.45"

	Area (sf)	CN	Description
*	311,751	75	
	311,751	75	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.8	100	0.0250	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.50"
11.1	1,213	0.0127	1.81		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
25.9	1,313	Total			

Subcatchment 3S: Pre Dev North



Summary for Subcatchment 8S: Post Dev North to Underground Detention

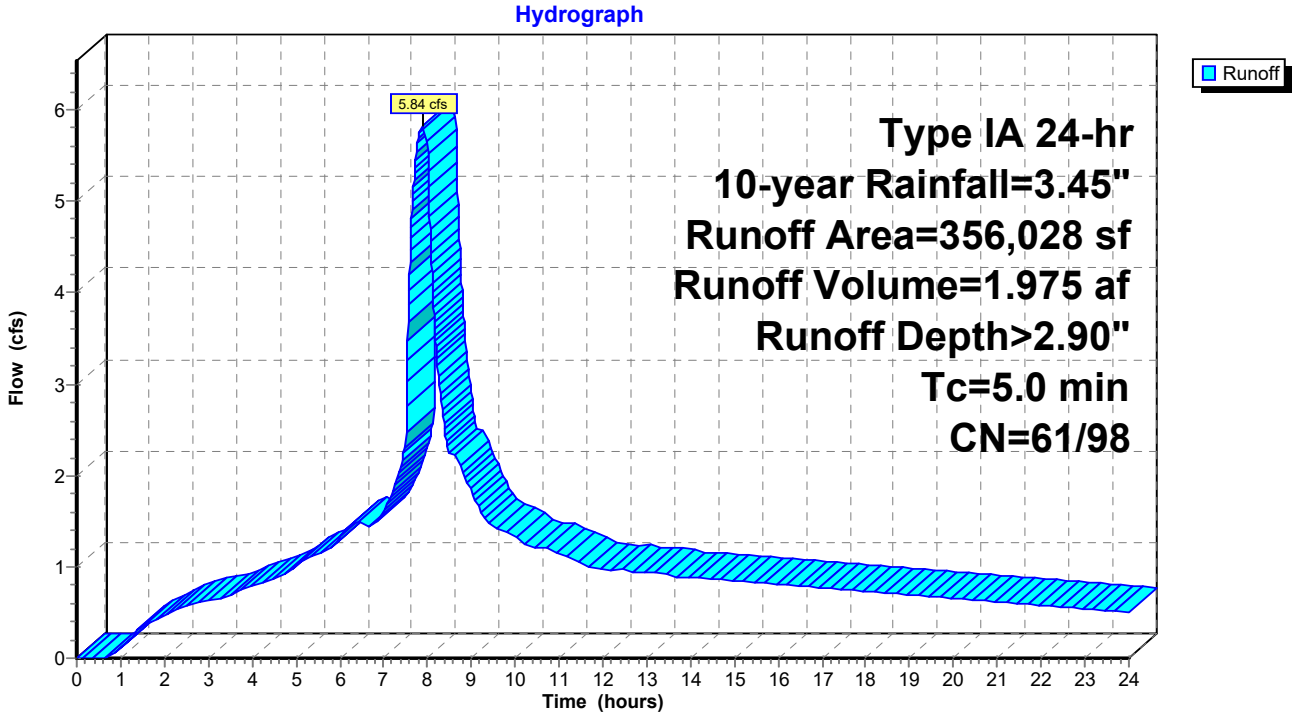
Runoff = 5.84 cfs @ 7.88 hrs, Volume= 1.975 af, Depth> 2.90"
Routed to Pond 13P : Underground Detention North

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-year Rainfall=3.45"

Area (sf)	CN	Description
314,416	98	Paved parking, HSG D
41,612	61	>75% Grass cover, Good, HSG B
356,028	94	Weighted Average
41,612	61	11.69% Pervious Area
314,416	98	88.31% Impervious Area

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

Subcatchment 8S: Post Dev North to Underground Detention



Summary for Pond 7P: Underground Detention South

Inflow Area = 4.314 ac, 88.45% Impervious, Inflow Depth > 2.90" for 10-year event
Inflow = 3.09 cfs @ 7.88 hrs, Volume= 1.044 af
Outflow = 0.47 cfs @ 13.64 hrs, Volume= 0.482 af, Atten= 85%, Lag= 345.4 min
Primary = 0.47 cfs @ 13.64 hrs, Volume= 0.482 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 5.32' @ 13.64 hrs Surf.Area= 0.169 ac Storage= 0.565 af

Plug-Flow detention time= 532.1 min calculated for 0.482 af (46% of inflow)
Center-of-Mass det. time= 252.4 min (920.6 - 668.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	0.236 af	**87.25'W x 84.57'L x 5.50'H Field A** 0.932 af Overall - 0.341 af Embedded = 0.590 af x 40.0% Voids
#2A	0.75'	0.341 af	**ADS_StormTech MC-3500 d +Cap**x 132 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 132 Chambers in 12 Rows Cap Storage= 14.9 cf x 2 x 12 rows = 357.6 cf
		0.578 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	5.25'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.46 cfs @ 13.64 hrs HW=5.32' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.24 cfs @ 11.01 fps)
└**2=Sharp-Crested Rectangular Weir** (Weir Controls 0.22 cfs @ 0.84 fps)

Pond 7P: Underground Detention South - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-3500 d +Cap (ADS StormTech®MC-3500 d rev 03/14 with Cap volume)
Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf
Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap
Cap Storage= 14.9 cf x 2 x 12 rows = 357.6 cf

77.0" Wide + 9.0" Spacing = 86.0" C-C Row Spacing

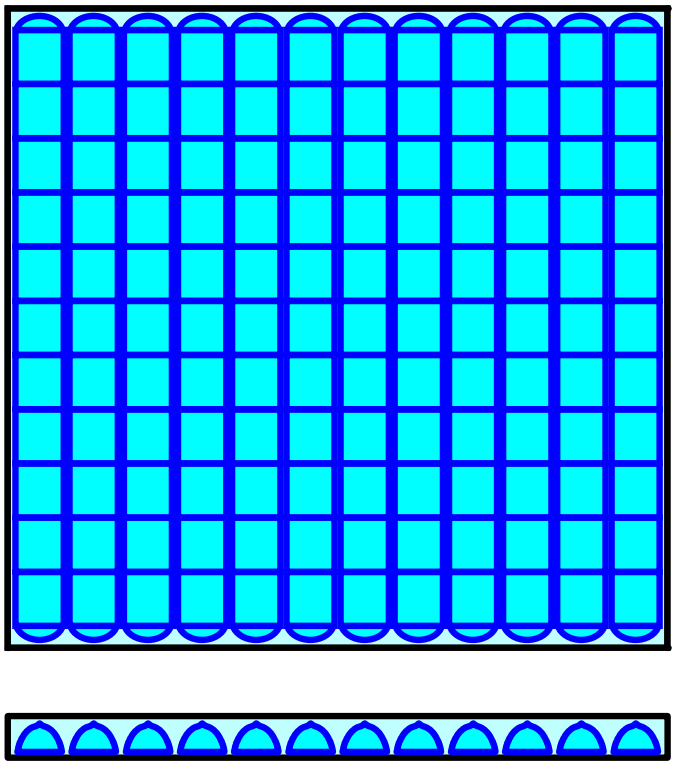
11 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 82.57' Row Length +12.0" End Stone x 2 = 84.57' Base Length
12 Rows x 77.0" Wide + 9.0" Spacing x 11 + 12.0" Side Stone x 2 = 87.25' Base Width
9.0" Stone Base + 45.0" Chamber Height + 12.0" Stone Cover = 5.50' Field Height

132 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 12 Rows = 14,871.3 cf Chamber Storage

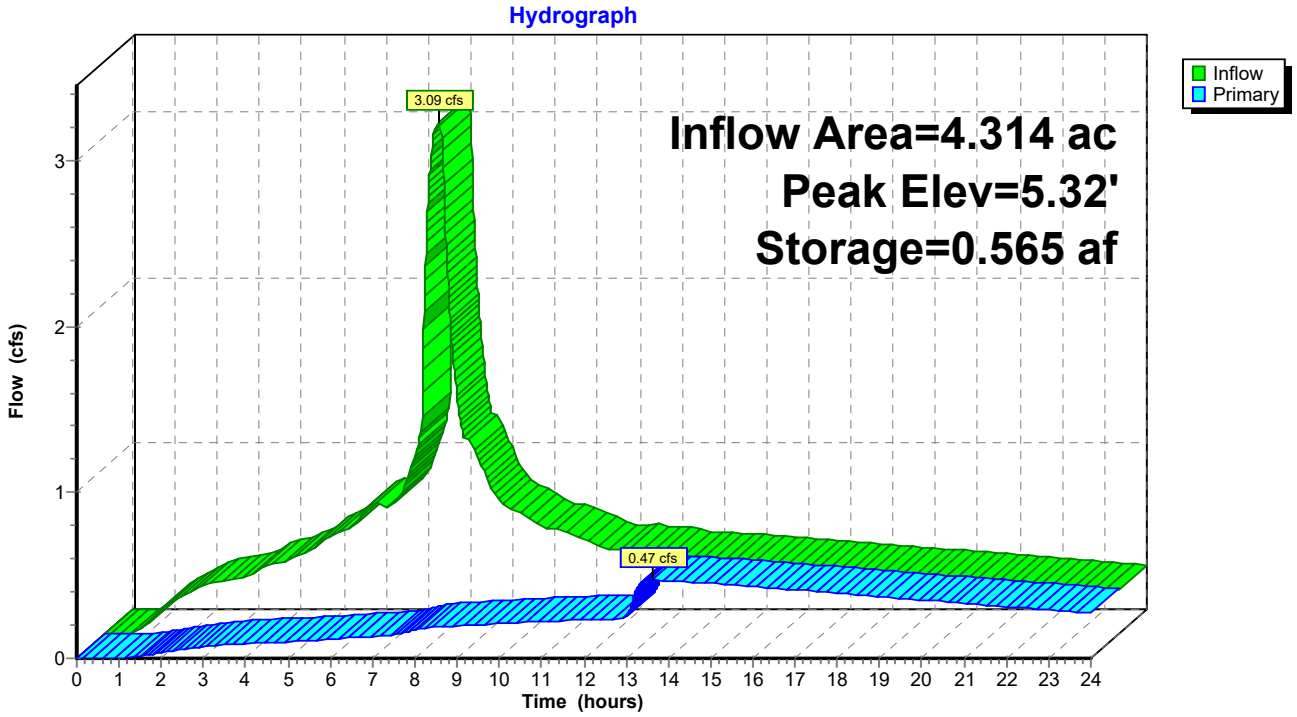
40,583.0 cf Field - 14,871.3 cf Chambers = 25,711.8 cf Stone x 40.0% Voids = 10,284.7 cf Stone Storage

Chamber Storage + Stone Storage = 25,156.0 cf = 0.578 af
Overall Storage Efficiency = 62.0%
Overall System Size = 84.57' x 87.25' x 5.50'

132 Chambers
1,503.1 cy Field
952.3 cy Stone



Pond 7P: Underground Detention South



Summary for Pond 13P: Underground Detention North

Inflow Area = 8.173 ac, 88.31% Impervious, Inflow Depth > 2.90" for 10-year event
Inflow = 5.84 cfs @ 7.88 hrs, Volume= 1.975 af
Outflow = 0.76 cfs @ 17.36 hrs, Volume= 0.623 af, Atten= 87%, Lag= 568.4 min
Primary = 0.76 cfs @ 17.36 hrs, Volume= 0.623 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 6.61' @ 17.36 hrs Surf.Area= 0.316 ac Storage= 1.358 af

Plug-Flow detention time= 667.7 min calculated for 0.623 af (32% of inflow)
Center-of-Mass det. time= 339.0 min (1,007.3 - 668.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	0.504 af	**137.50'W x 100.04'L x 6.75'H Field A** 2.132 af Overall - 0.871 af Embedded = 1.261 af x 40.0% Voids
#2A	0.75'	0.871 af	**ADS_StormTech MC-4500 b +Cap**x 345 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 345 Chambers in 15 Rows Cap Storage= 39.5 cf x 2 x 15 rows = 1,185.0 cf
		1.375 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	6.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.76 cfs @ 17.36 hrs HW=6.61' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.27 cfs @ 12.30 fps)
└**2=Sharp-Crested Rectangular Weir** (Weir Controls 0.49 cfs @ 1.10 fps)

Pond 13P: Underground Detention North - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 b +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= 39.5 cf x 2 x 15 rows = 1,185.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

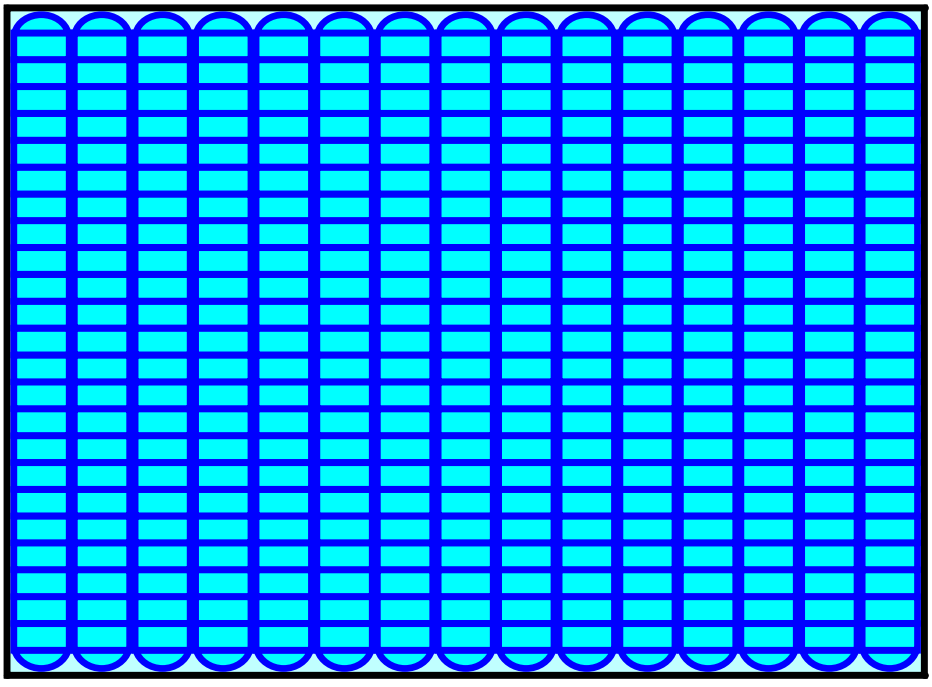
23 Chambers/Row x 4.02' Long +2.73' Cap Length x 2 = 98.04' Row Length +12.0" End Stone x 2 = 100.04' Base Length
15 Rows x 100.0" Wide + 9.0" Spacing x 14 + 12.0" Side Stone x 2 = 137.50' Base Width
9.0" Stone Base + 60.0" Chamber Height + 12.0" Stone Cover = 6.75' Field Height

345 Chambers x 106.5 cf + 39.5 cf Cap Volume x 2 x 15 Rows = 37,924.2 cf Chamber Storage

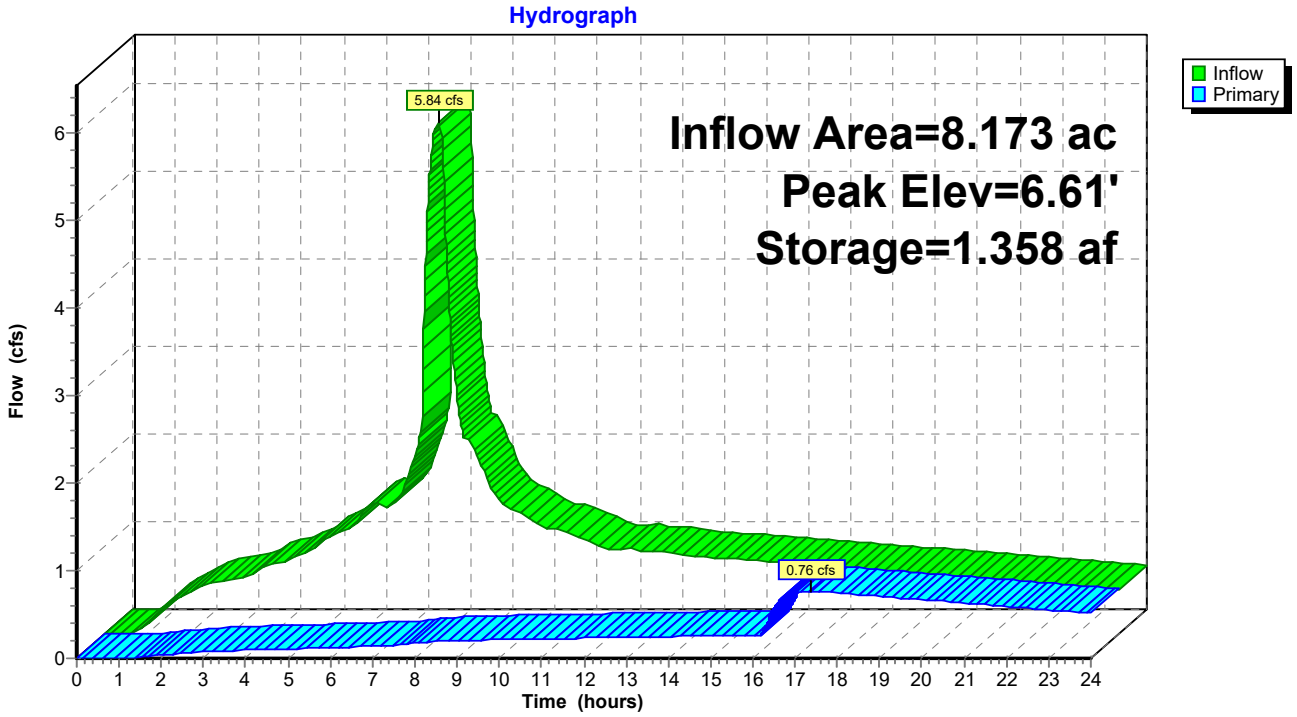
92,851.2 cf Field - 37,924.2 cf Chambers = 54,927.0 cf Stone x 40.0% Voids = 21,970.8 cf Stone Storage

Chamber Storage + Stone Storage = 59,895.0 cf = 1.375 af
Overall Storage Efficiency = 64.5%
Overall System Size = 100.04' x 137.50' x 6.75'

345 Chambers
3,438.9 cy Field
2,034.3 cy Stone



Pond 13P: Underground Detention North



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Pre Dev South Runoff Area=224,197 sf 0.00% Impervious Runoff Depth>1.58"
Flow Length=568' Tc=15.0 min CN=75/0 Runoff=1.50 cfs 0.677 af

Subcatchment2S: Post Dev South to Runoff Area=187,903 sf 88.45% Impervious Runoff Depth>3.32"
Tc=5.0 min CN=61/98 Runoff=3.52 cfs 1.195 af

Subcatchment3S: Pre Dev North Runoff Area=311,751 sf 0.00% Impervious Runoff Depth>1.57"
Flow Length=1,313' Tc=25.9 min CN=75/0 Runoff=1.71 cfs 0.935 af

Subcatchment8S: Post Dev North to Runoff Area=356,028 sf 88.31% Impervious Runoff Depth>3.32"
Tc=5.0 min CN=61/98 Runoff=6.67 cfs 2.261 af

Pond 7P: Underground Detention South Peak Elev=5.36' Storage=0.568 af Inflow=3.52 cfs 1.195 af
Outflow=0.72 cfs 0.632 af

Pond 13P: Underground Detention North Peak Elev=6.65' Storage=1.362 af Inflow=6.67 cfs 2.261 af
Outflow=1.03 cfs 0.908 af

Total Runoff Area = 24.791 ac Runoff Volume = 5.068 af Average Runoff Depth = 2.45"
55.49% Pervious = 13.757 ac 44.51% Impervious = 11.034 ac

Summary for Subcatchment 1S: Pre Dev South

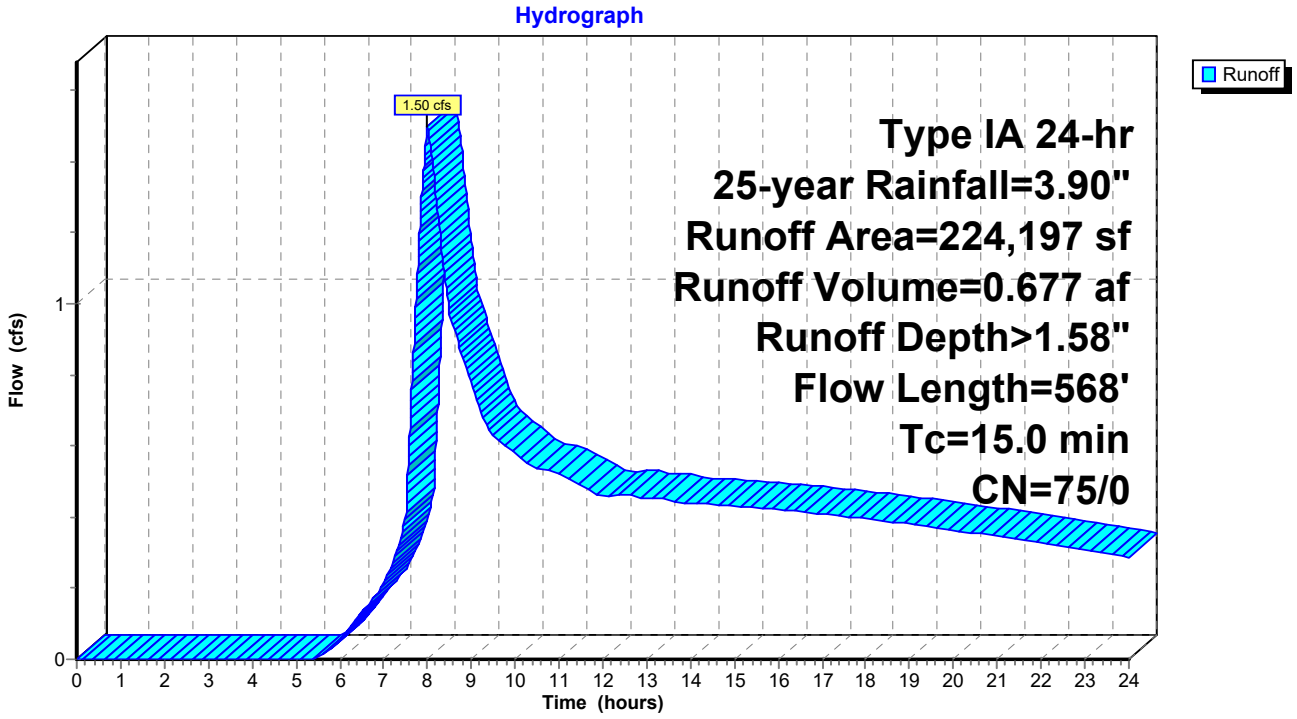
Runoff = 1.50 cfs @ 8.01 hrs, Volume= 0.677 af, Depth> 1.58"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-year Rainfall=3.90"

	Area (sf)	CN	Description
*	224,197	75	
	224,197	75	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	100	0.1400	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.50"
3.8	468	0.0160	2.04		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
15.0	568	Total			

Subcatchment 1S: Pre Dev South



Summary for Subcatchment 2S: Post Dev South to Underground Detention

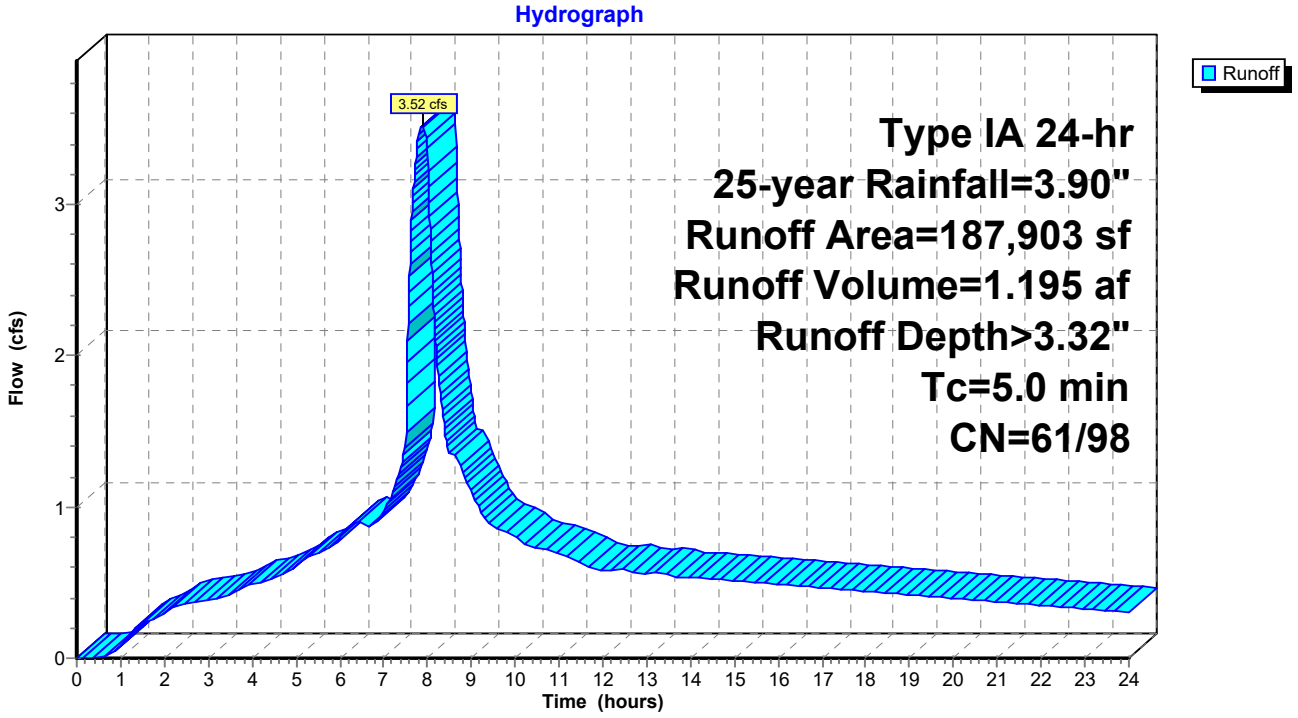
Runoff = 3.52 cfs @ 7.88 hrs, Volume= 1.195 af, Depth> 3.32"
Routed to Pond 7P : Underground Detention South

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-year Rainfall=3.90"

Area (sf)	CN	Description
166,209	98	Paved parking, HSG D
21,694	61	>75% Grass cover, Good, HSG B
187,903	94	Weighted Average
21,694	61	11.55% Pervious Area
166,209	98	88.45% Impervious Area

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

Subcatchment 2S: Post Dev South to Underground Detention



Summary for Subcatchment 3S: Pre Dev North

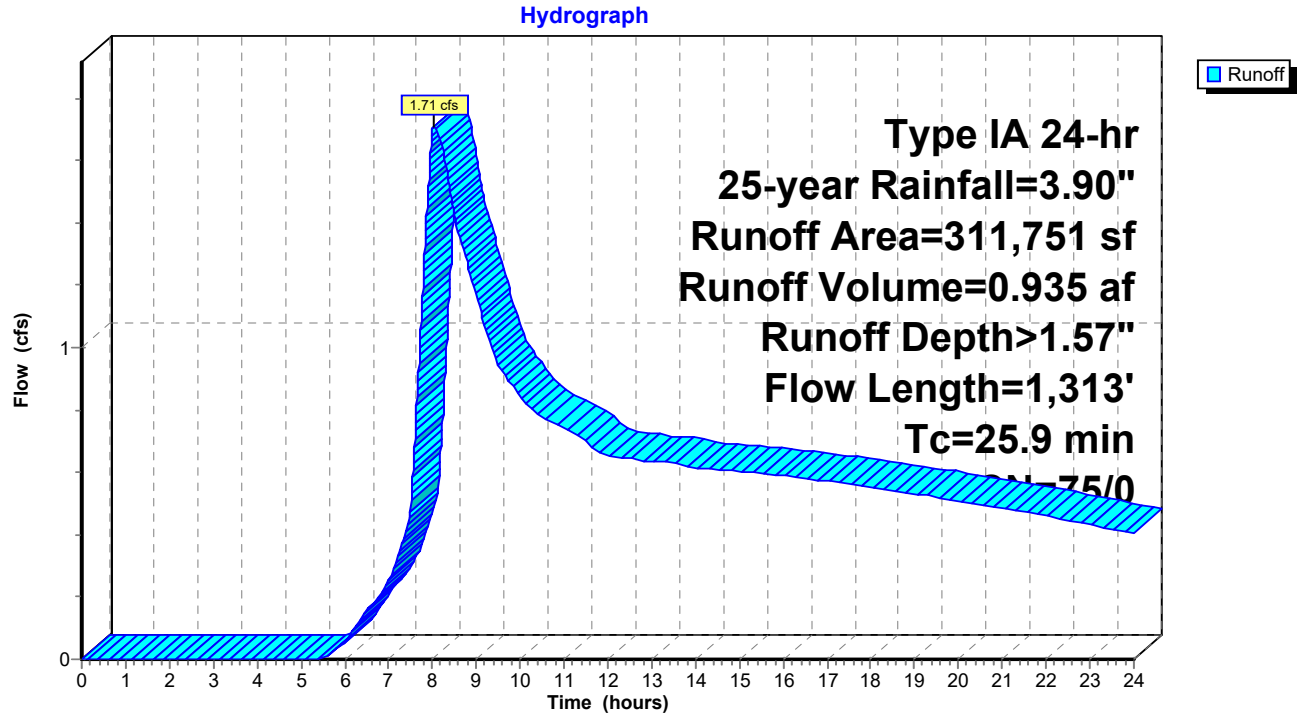
Runoff = 1.71 cfs @ 8.03 hrs, Volume= 0.935 af, Depth> 1.57"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-year Rainfall=3.90"

	Area (sf)	CN	Description
*	311,751	75	
	311,751	75	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.8	100	0.0250	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.50"
11.1	1,213	0.0127	1.81		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
25.9	1,313	Total			

Subcatchment 3S: Pre Dev North



Summary for Subcatchment 8S: Post Dev North to Underground Detention

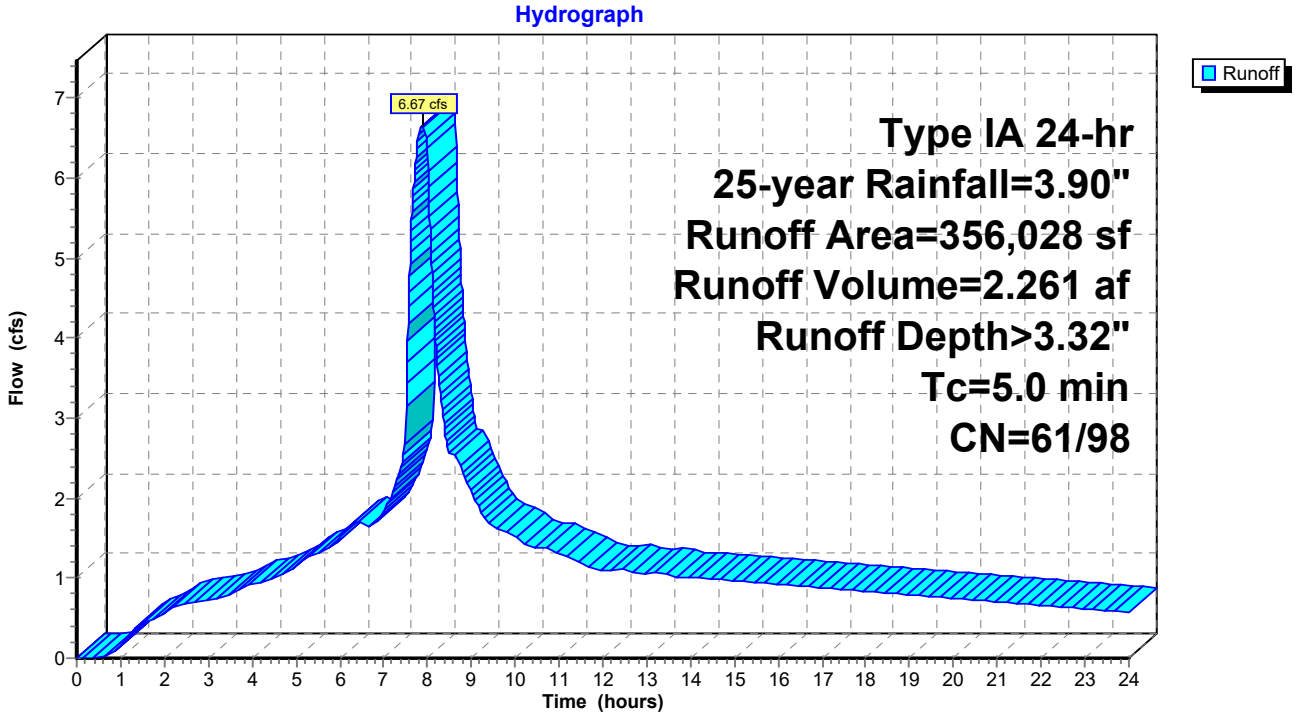
Runoff = 6.67 cfs @ 7.88 hrs, Volume= 2.261 af, Depth> 3.32"
Routed to Pond 13P : Underground Detention North

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-year Rainfall=3.90"

Area (sf)	CN	Description
314,416	98	Paved parking, HSG D
41,612	61	>75% Grass cover, Good, HSG B
356,028	94	Weighted Average
41,612	61	11.69% Pervious Area
314,416	98	88.31% Impervious Area

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

Subcatchment 8S: Post Dev North to Underground Detention



Summary for Pond 7P: Underground Detention South

Inflow Area = 4.314 ac, 88.45% Impervious, Inflow Depth > 3.32" for 25-year event
Inflow = 3.52 cfs @ 7.88 hrs, Volume= 1.195 af
Outflow = 0.72 cfs @ 10.79 hrs, Volume= 0.632 af, Atten= 80%, Lag= 174.6 min
Primary = 0.72 cfs @ 10.79 hrs, Volume= 0.632 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 5.36' @ 10.79 hrs Surf.Area= 0.169 ac Storage= 0.568 af

Plug-Flow detention time= 485.1 min calculated for 0.632 af (53% of inflow)
Center-of-Mass det. time= 226.7 min (892.6 - 665.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	0.236 af	**87.25'W x 84.57'L x 5.50'H Field A** 0.932 af Overall - 0.341 af Embedded = 0.590 af x 40.0% Voids
#2A	0.75'	0.341 af	**ADS_StormTech MC-3500 d +Cap**x 132 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 132 Chambers in 12 Rows Cap Storage= 14.9 cf x 2 x 12 rows = 357.6 cf
		0.578 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	5.25'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.70 cfs @ 10.79 hrs HW=5.36' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.24 cfs @ 11.06 fps)
└**2=Sharp-Crested Rectangular Weir** (Weir Controls 0.46 cfs @ 1.08 fps)

Pond 7P: Underground Detention South - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-3500 d +Cap (ADS StormTech®MC-3500 d rev 03/14 with Cap volume)
Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf
Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap
Cap Storage= 14.9 cf x 2 x 12 rows = 357.6 cf

77.0" Wide + 9.0" Spacing = 86.0" C-C Row Spacing

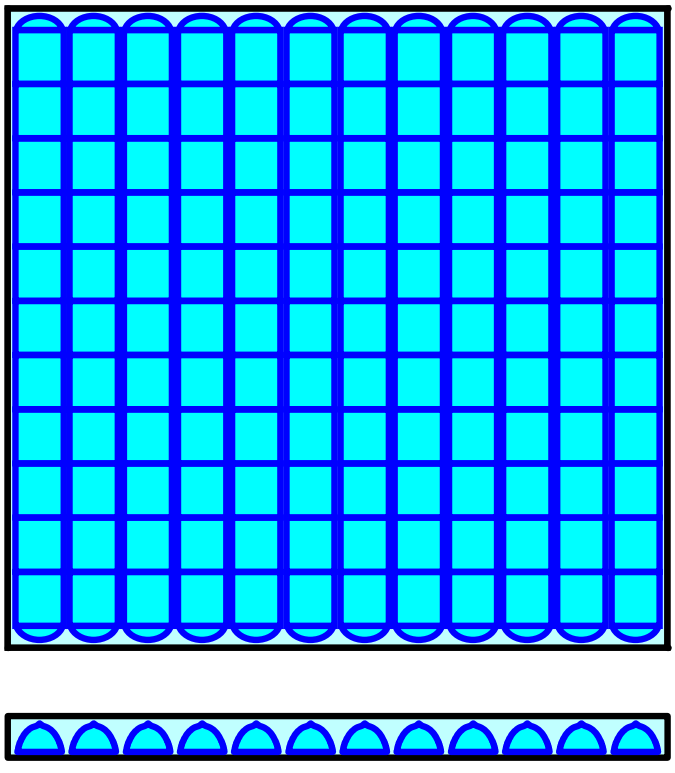
11 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 82.57' Row Length +12.0" End Stone x 2 = 84.57' Base Length
12 Rows x 77.0" Wide + 9.0" Spacing x 11 + 12.0" Side Stone x 2 = 87.25' Base Width
9.0" Stone Base + 45.0" Chamber Height + 12.0" Stone Cover = 5.50' Field Height

132 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 12 Rows = 14,871.3 cf Chamber Storage

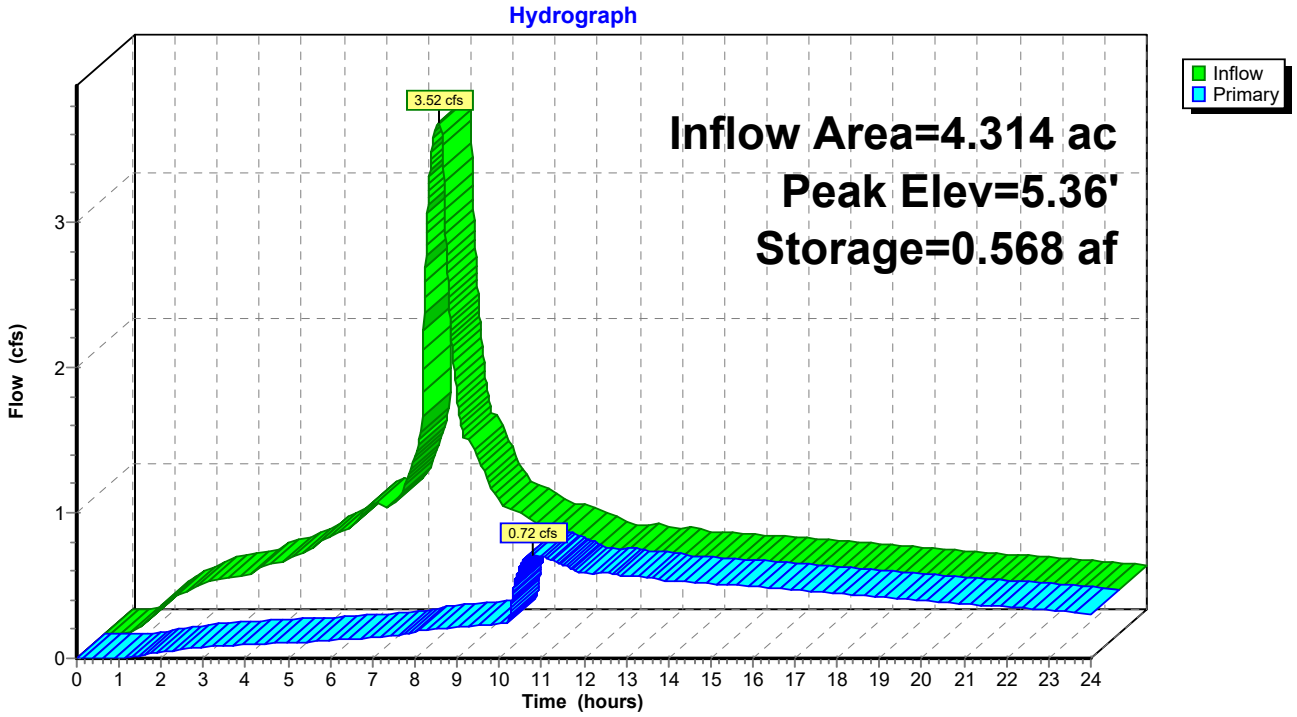
40,583.0 cf Field - 14,871.3 cf Chambers = 25,711.8 cf Stone x 40.0% Voids = 10,284.7 cf Stone Storage

Chamber Storage + Stone Storage = 25,156.0 cf = 0.578 af
Overall Storage Efficiency = 62.0%
Overall System Size = 84.57' x 87.25' x 5.50'

132 Chambers
1,503.1 cy Field
952.3 cy Stone



Pond 7P: Underground Detention South



Summary for Pond 13P: Underground Detention North

Inflow Area = 8.173 ac, 88.31% Impervious, Inflow Depth > 3.32" for 25-year event
Inflow = 6.67 cfs @ 7.88 hrs, Volume= 2.261 af
Outflow = 1.03 cfs @ 13.54 hrs, Volume= 0.908 af, Atten= 85%, Lag= 339.3 min
Primary = 1.03 cfs @ 13.54 hrs, Volume= 0.908 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 6.65' @ 13.54 hrs Surf.Area= 0.316 ac Storage= 1.362 af

Plug-Flow detention time= 615.6 min calculated for 0.908 af (40% of inflow)
Center-of-Mass det. time= 316.2 min (982.2 - 666.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	0.504 af	**137.50'W x 100.04'L x 6.75'H Field A** 2.132 af Overall - 0.871 af Embedded = 1.261 af x 40.0% Voids
#2A	0.75'	0.871 af	**ADS_StormTech MC-4500 b +Cap**x 345 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 345 Chambers in 15 Rows Cap Storage= 39.5 cf x 2 x 15 rows = 1,185.0 cf
		1.375 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	6.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=1.02 cfs @ 13.54 hrs HW=6.65' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.27 cfs @ 12.34 fps)
└**2=Sharp-Crested Rectangular Weir** (Weir Controls 0.75 cfs @ 1.26 fps)

Pond 13P: Underground Detention North - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 b +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= 39.5 cf x 2 x 15 rows = 1,185.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

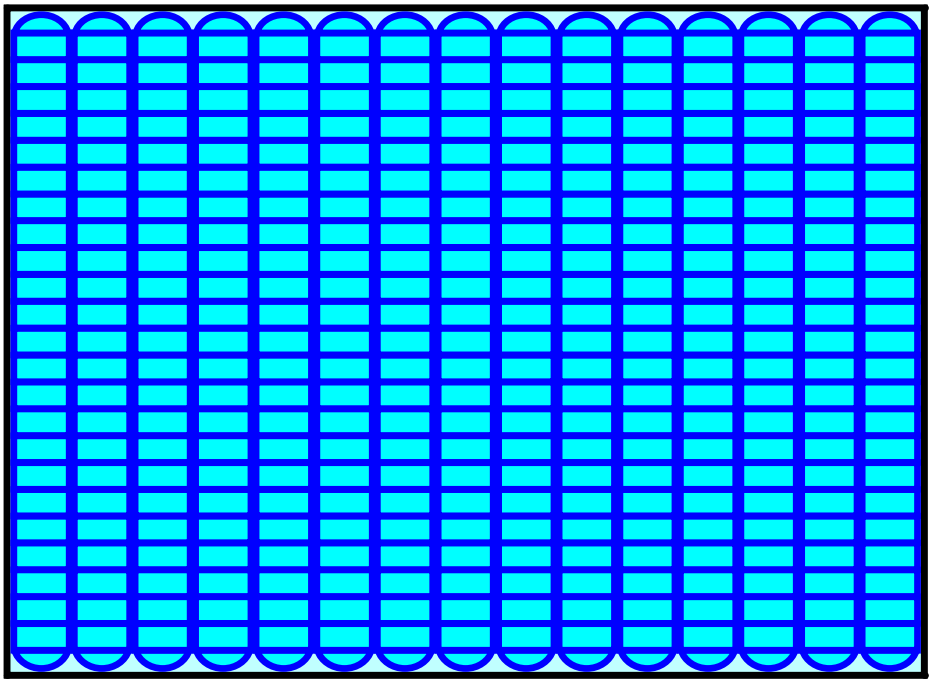
23 Chambers/Row x 4.02' Long +2.73' Cap Length x 2 = 98.04' Row Length +12.0" End Stone x 2 = 100.04' Base Length
15 Rows x 100.0" Wide + 9.0" Spacing x 14 + 12.0" Side Stone x 2 = 137.50' Base Width
9.0" Stone Base + 60.0" Chamber Height + 12.0" Stone Cover = 6.75' Field Height

345 Chambers x 106.5 cf + 39.5 cf Cap Volume x 2 x 15 Rows = 37,924.2 cf Chamber Storage

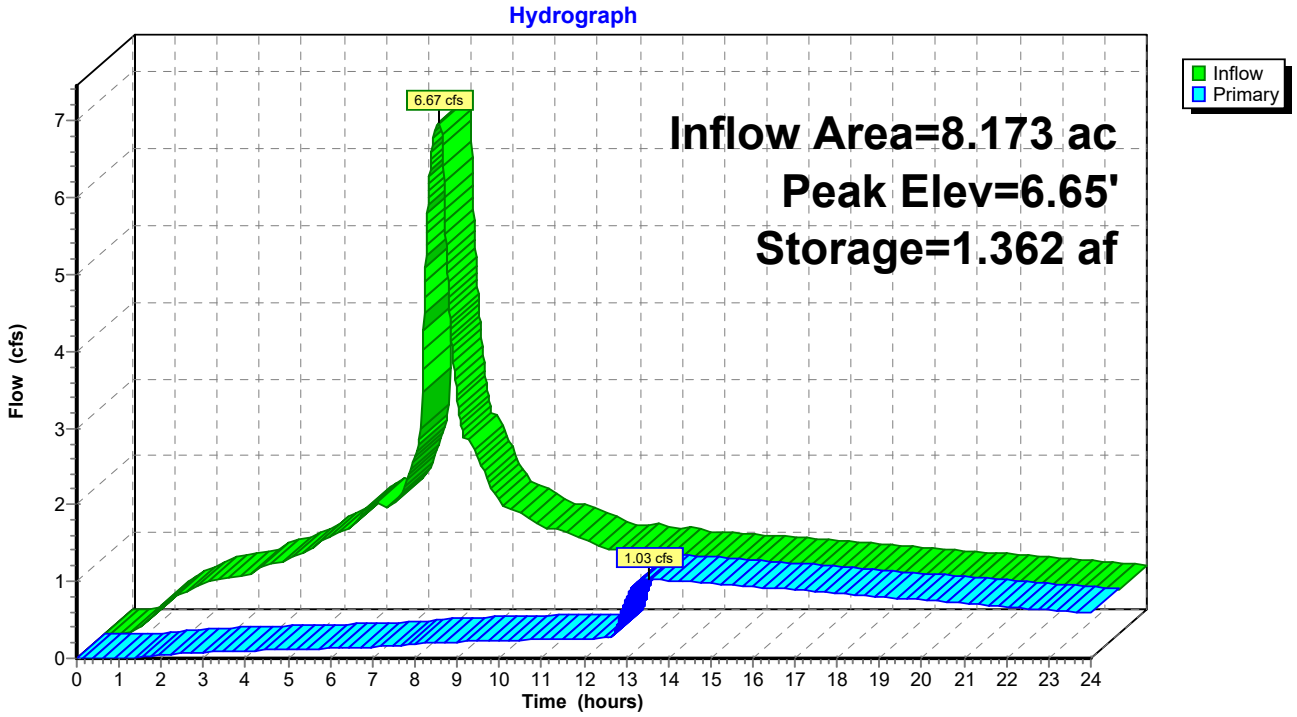
92,851.2 cf Field - 37,924.2 cf Chambers = 54,927.0 cf Stone x 40.0% Voids = 21,970.8 cf Stone Storage

Chamber Storage + Stone Storage = 59,895.0 cf = 1.375 af
Overall Storage Efficiency = 64.5%
Overall System Size = 100.04' x 137.50' x 6.75'

345 Chambers
3,438.9 cy Field
2,034.3 cy Stone



Pond 13P: Underground Detention North



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Pre Dev South Runoff Area=224,197 sf 0.00% Impervious Runoff Depth>2.27"
Flow Length=568' Tc=15.0 min CN=75/0 Runoff=2.34 cfs 0.973 af

Subcatchment2S: Post Dev South to Runoff Area=187,903 sf 88.45% Impervious Runoff Depth>4.17"
Tc=5.0 min CN=61/98 Runoff=4.41 cfs 1.500 af

Subcatchment3S: Pre Dev North Runoff Area=311,751 sf 0.00% Impervious Runoff Depth>2.26"
Flow Length=1,313' Tc=25.9 min CN=75/0 Runoff=2.70 cfs 1.345 af

Subcatchment8S: Post Dev North to Runoff Area=356,028 sf 88.31% Impervious Runoff Depth>4.17"
Tc=5.0 min CN=61/98 Runoff=8.34 cfs 2.840 af

Pond 7P: Underground Detention South Peak Elev=5.47' Storage=0.576 af Inflow=4.41 cfs 1.500 af
Outflow=1.63 cfs 0.937 af

Pond 13P: Underground Detention North Peak Elev=6.75' Storage=1.375 af Inflow=8.34 cfs 2.840 af
Outflow=1.87 cfs 1.483 af

Total Runoff Area = 24.791 ac Runoff Volume = 6.659 af Average Runoff Depth = 3.22"
55.49% Pervious = 13.757 ac 44.51% Impervious = 11.034 ac

Summary for Subcatchment 1S: Pre Dev South

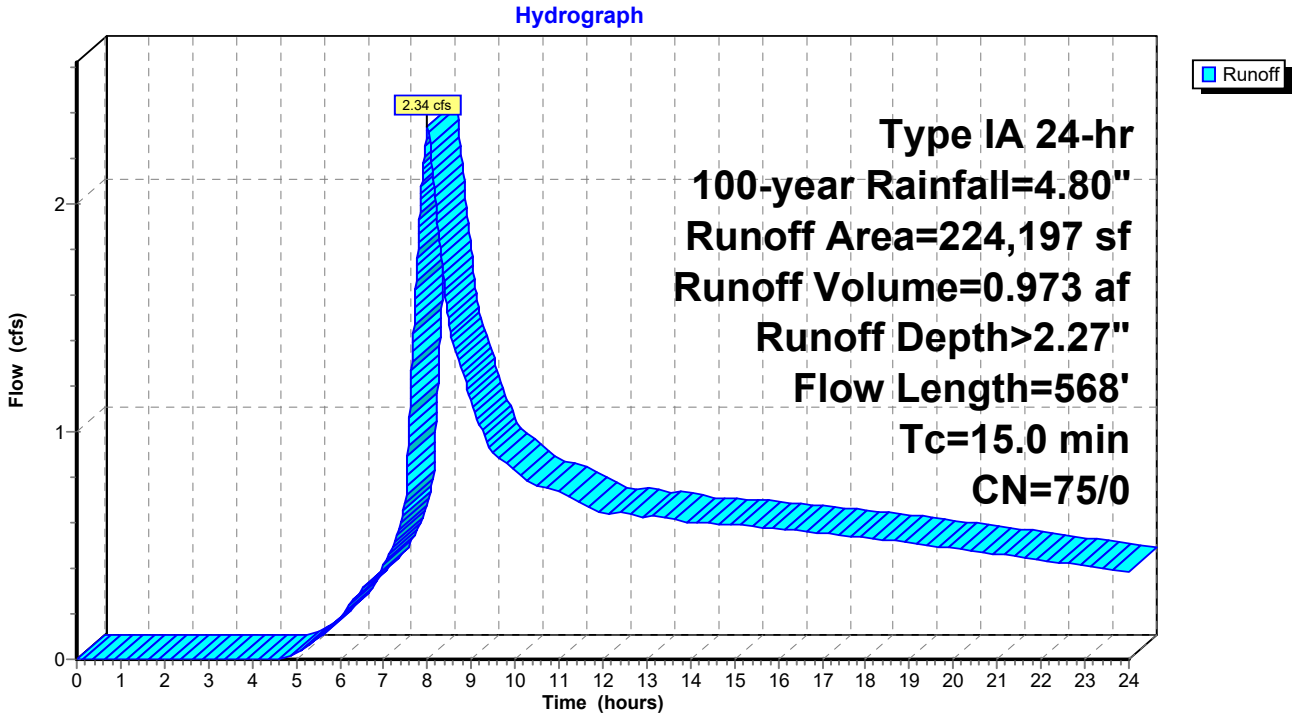
Runoff = 2.34 cfs @ 8.00 hrs, Volume= 0.973 af, Depth> 2.27"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-year Rainfall=4.80"

	Area (sf)	CN	Description
*	224,197	75	
	224,197	75	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	100	0.1400	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.50"
3.8	468	0.0160	2.04		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
15.0	568	Total			

Subcatchment 1S: Pre Dev South



Summary for Subcatchment 2S: Post Dev South to Underground Detention

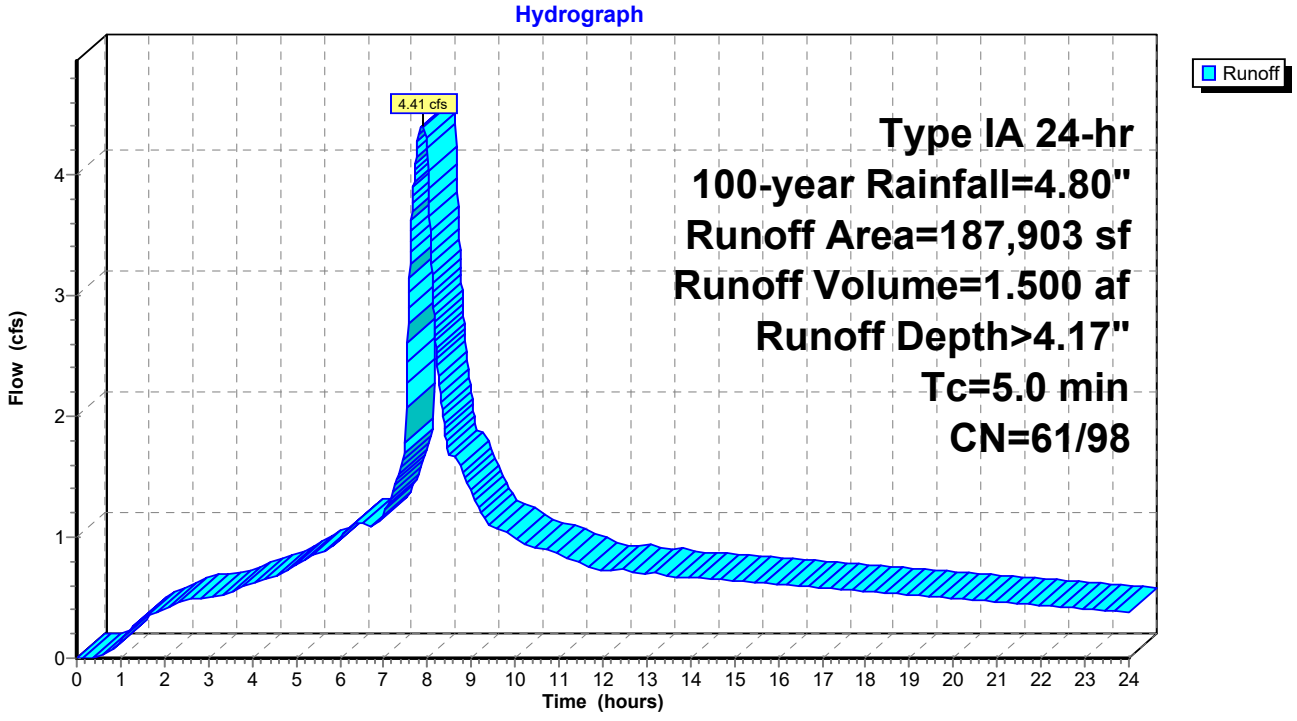
Runoff = 4.41 cfs @ 7.88 hrs, Volume= 1.500 af, Depth> 4.17"
Routed to Pond 7P : Underground Detention South

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-year Rainfall=4.80"

Area (sf)	CN	Description
166,209	98	Paved parking, HSG D
21,694	61	>75% Grass cover, Good, HSG B
187,903	94	Weighted Average
21,694	61	11.55% Pervious Area
166,209	98	88.45% Impervious Area

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

Subcatchment 2S: Post Dev South to Underground Detention



Summary for Subcatchment 3S: Pre Dev North

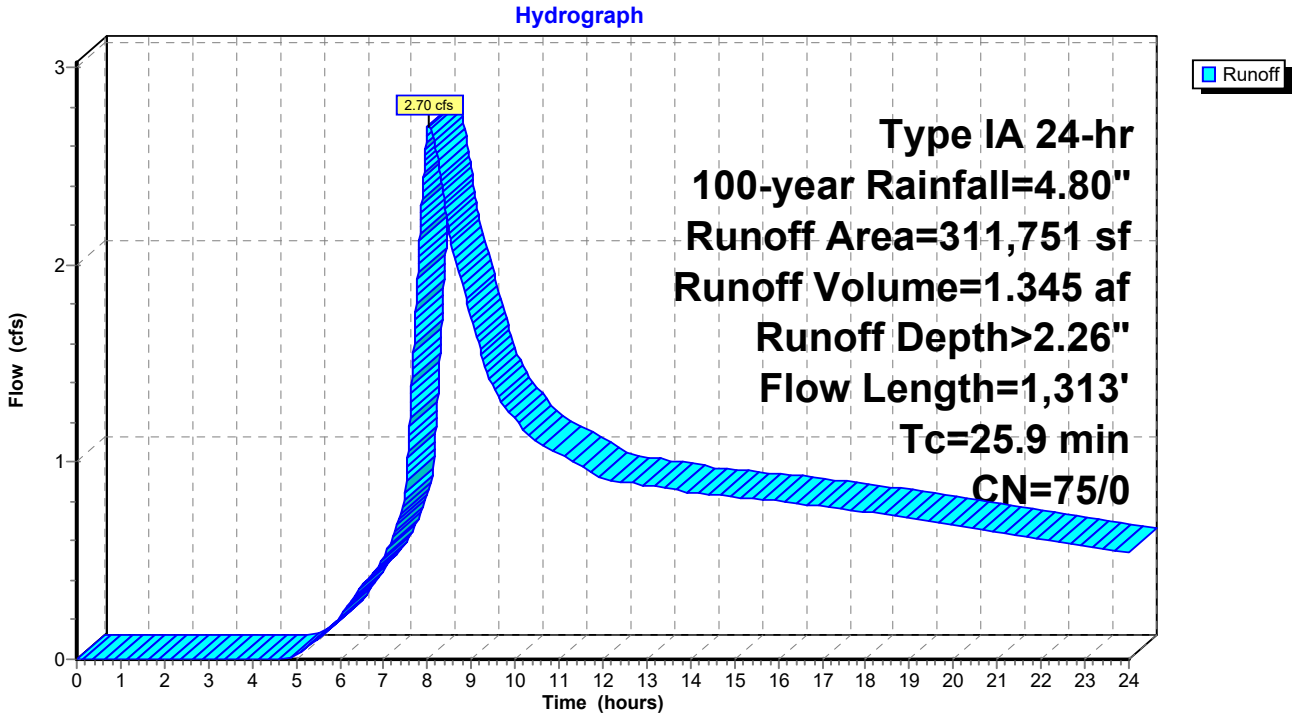
Runoff = 2.70 cfs @ 8.01 hrs, Volume= 1.345 af, Depth> 2.26"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-year Rainfall=4.80"

	Area (sf)	CN	Description
*	311,751	75	
	311,751	75	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.8	100	0.0250	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.50"
11.1	1,213	0.0127	1.81		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
25.9	1,313	Total			

Subcatchment 3S: Pre Dev North



Summary for Subcatchment 8S: Post Dev North to Underground Detention

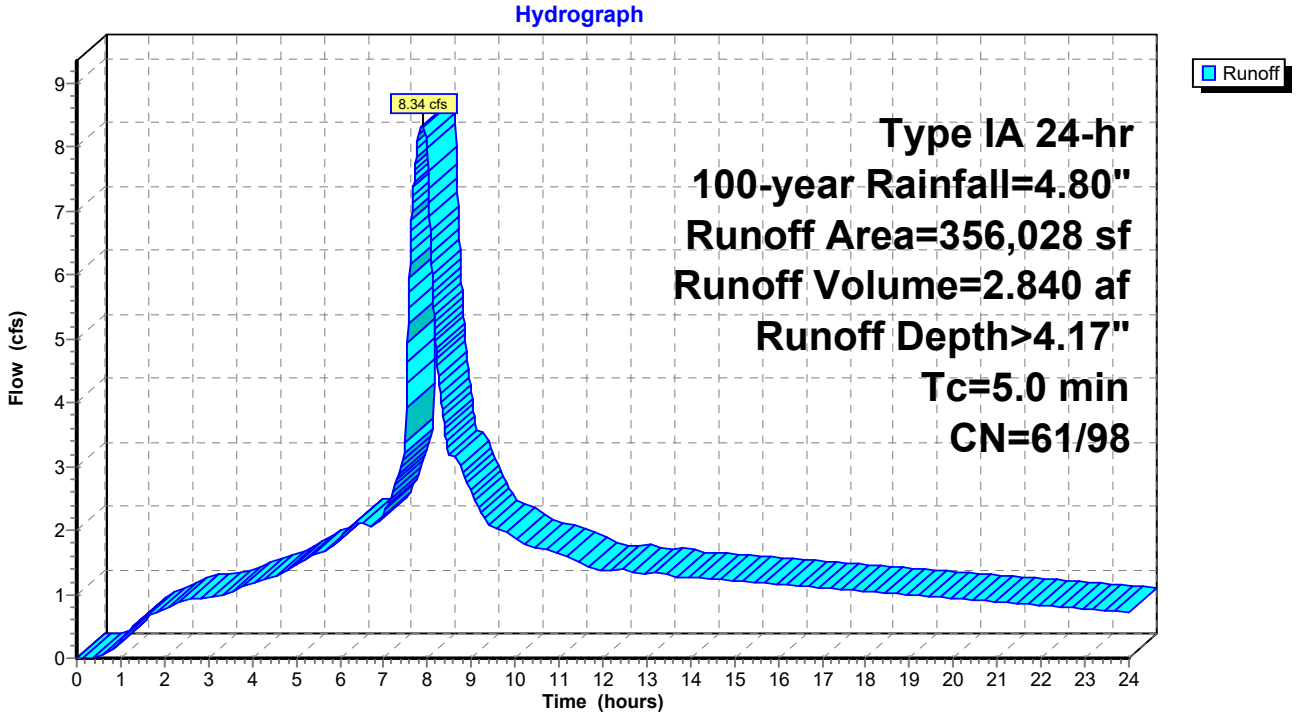
Runoff = 8.34 cfs @ 7.88 hrs, Volume= 2.840 af, Depth> 4.17"
Routed to Pond 13P : Underground Detention North

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-year Rainfall=4.80"

Area (sf)	CN	Description
314,416	98	Paved parking, HSG D
41,612	61	>75% Grass cover, Good, HSG B
356,028	94	Weighted Average
41,612	61	11.69% Pervious Area
314,416	98	88.31% Impervious Area

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

Subcatchment 8S: Post Dev North to Underground Detention



Summary for Pond 7P: Underground Detention South

Inflow Area = 4.314 ac, 88.45% Impervious, Inflow Depth > 4.17" for 100-year event
Inflow = 4.41 cfs @ 7.88 hrs, Volume= 1.500 af
Outflow = 1.63 cfs @ 8.71 hrs, Volume= 0.937 af, Atten= 63%, Lag= 49.4 min
Primary = 1.63 cfs @ 8.71 hrs, Volume= 0.937 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 5.47' @ 8.71 hrs Surf.Area= 0.169 ac Storage= 0.576 af

Plug-Flow detention time= 400.6 min calculated for 0.937 af (62% of inflow)
Center-of-Mass det. time= 177.9 min (840.2 - 662.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	0.236 af	**87.25'W x 84.57'L x 5.50'H Field A** 0.932 af Overall - 0.341 af Embedded = 0.590 af x 40.0% Voids
#2A	0.75'	0.341 af	**ADS_StormTech MC-3500 d +Cap**x 132 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 132 Chambers in 12 Rows Cap Storage= 14.9 cf x 2 x 12 rows = 357.6 cf
		0.578 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	5.25'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=1.62 cfs @ 8.71 hrs HW=5.47' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.24 cfs @ 11.18 fps)
└**2=Sharp-Crested Rectangular Weir** (Weir Controls 1.38 cfs @ 1.55 fps)

Pond 7P: Underground Detention South - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-3500 d +Cap (ADS StormTech®MC-3500 d rev 03/14 with Cap volume)
Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf
Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap
Cap Storage= 14.9 cf x 2 x 12 rows = 357.6 cf

77.0" Wide + 9.0" Spacing = 86.0" C-C Row Spacing

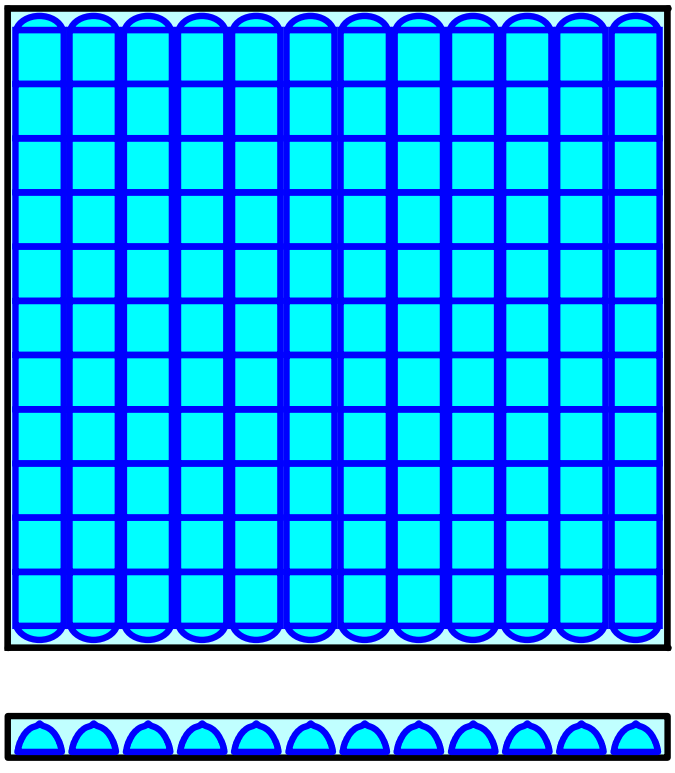
11 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 82.57' Row Length +12.0" End Stone x 2 = 84.57' Base Length
12 Rows x 77.0" Wide + 9.0" Spacing x 11 + 12.0" Side Stone x 2 = 87.25' Base Width
9.0" Stone Base + 45.0" Chamber Height + 12.0" Stone Cover = 5.50' Field Height

132 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 12 Rows = 14,871.3 cf Chamber Storage

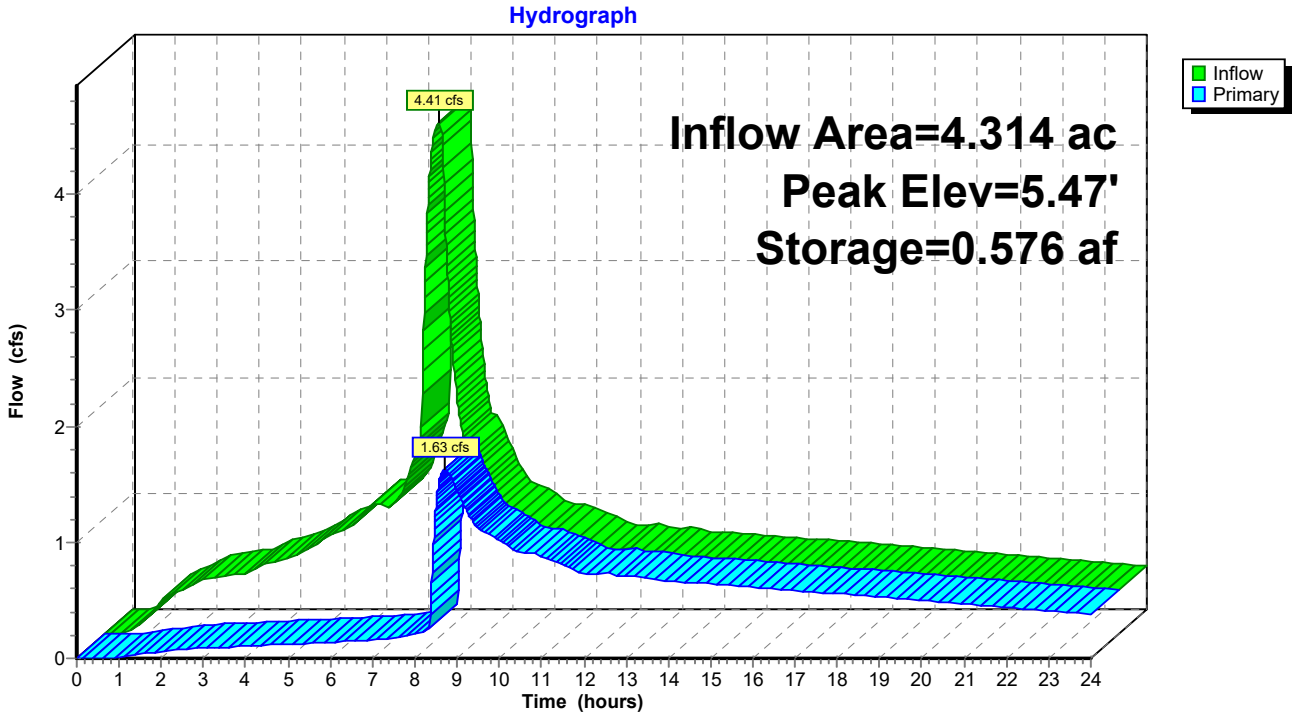
40,583.0 cf Field - 14,871.3 cf Chambers = 25,711.8 cf Stone x 40.0% Voids = 10,284.7 cf Stone Storage

Chamber Storage + Stone Storage = 25,156.0 cf = 0.578 af
Overall Storage Efficiency = 62.0%
Overall System Size = 84.57' x 87.25' x 5.50'

132 Chambers
1,503.1 cy Field
952.3 cy Stone



Pond 7P: Underground Detention South



Summary for Pond 13P: Underground Detention North

Inflow Area = 8.173 ac, 88.31% Impervious, Inflow Depth > 4.17" for 100-year event
Inflow = 8.34 cfs @ 7.88 hrs, Volume= 2.840 af
Outflow = 1.87 cfs @ 10.03 hrs, Volume= 1.483 af, Atten= 78%, Lag= 128.9 min
Primary = 1.87 cfs @ 10.03 hrs, Volume= 1.483 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 6.75' @ 10.03 hrs Surf.Area= 0.316 ac Storage= 1.375 af

Plug-Flow detention time= 508.0 min calculated for 1.483 af (52% of inflow)
Center-of-Mass det. time= 246.3 min (908.7 - 662.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	0.504 af	**137.50'W x 100.04'L x 6.75'H Field A** 2.132 af Overall - 0.871 af Embedded = 1.261 af x 40.0% Voids
#2A	0.75'	0.871 af	**ADS_StormTech MC-4500 b +Cap**x 345 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 345 Chambers in 15 Rows Cap Storage= 39.5 cf x 2 x 15 rows = 1,185.0 cf
		1.375 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	6.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=1.87 cfs @ 10.03 hrs HW=6.75' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.27 cfs @ 12.43 fps)
└**2=Sharp-Crested Rectangular Weir** (Weir Controls 1.60 cfs @ 1.63 fps)

Pond 13P: Underground Detention North - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 b +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= 39.5 cf x 2 x 15 rows = 1,185.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

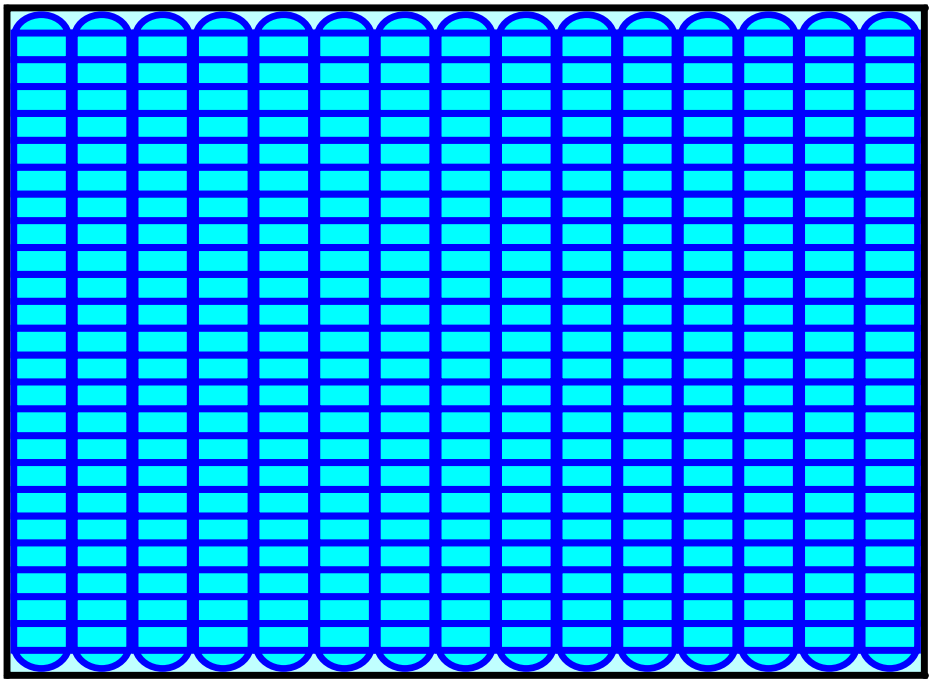
23 Chambers/Row x 4.02' Long +2.73' Cap Length x 2 = 98.04' Row Length +12.0" End Stone x 2 = 100.04' Base Length
15 Rows x 100.0" Wide + 9.0" Spacing x 14 + 12.0" Side Stone x 2 = 137.50' Base Width
9.0" Stone Base + 60.0" Chamber Height + 12.0" Stone Cover = 6.75' Field Height

345 Chambers x 106.5 cf + 39.5 cf Cap Volume x 2 x 15 Rows = 37,924.2 cf Chamber Storage

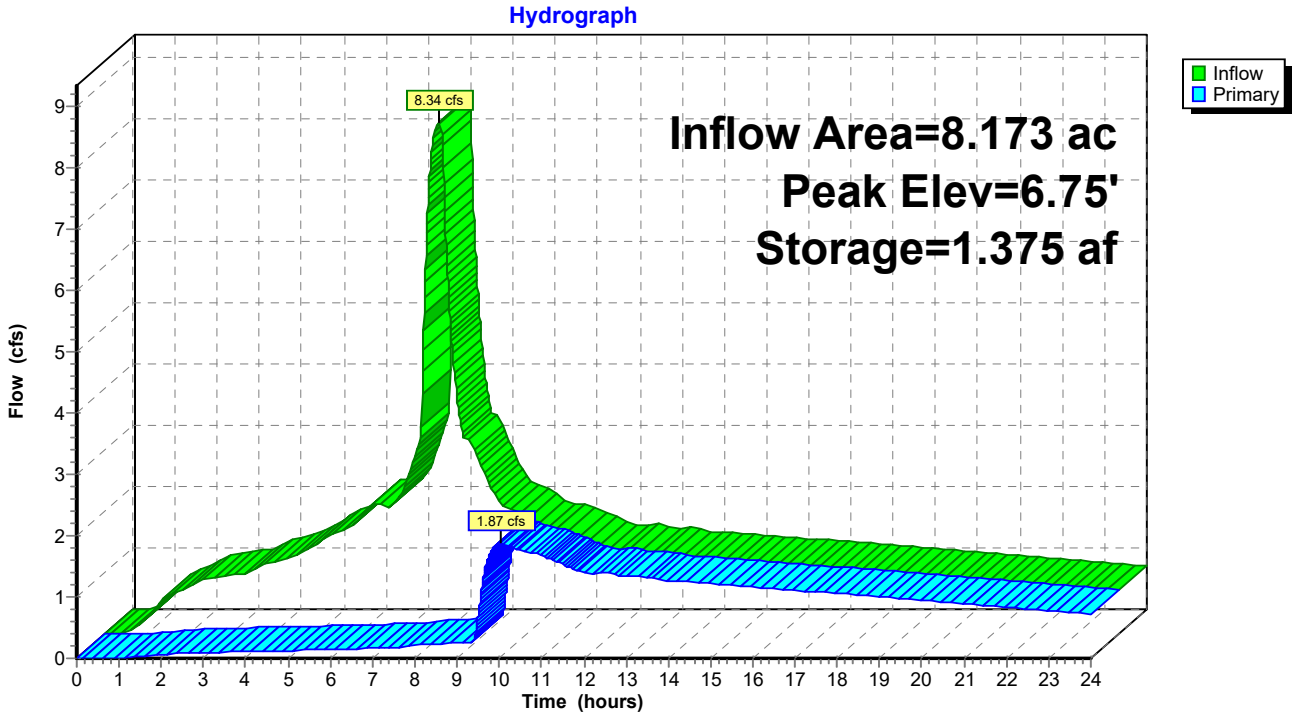
92,851.2 cf Field - 37,924.2 cf Chambers = 54,927.0 cf Stone x 40.0% Voids = 21,970.8 cf Stone Storage

Chamber Storage + Stone Storage = 59,895.0 cf = 1.375 af
Overall Storage Efficiency = 64.5%
Overall System Size = 100.04' x 137.50' x 6.75'

345 Chambers
3,438.9 cy Field
2,034.3 cy Stone



Pond 13P: Underground Detention North



VLMK ENGINEERING + DESIGN

Project: 124th Ave | Job #: 20200748 | By: | Date: | Sheet #:

Water Quality Calculations

Based on the CWS December 2019 Design and Construction Standards

Treat Using Contech StormFilter Vaults:
Each (Low Drop) Cartridge Treats 10 gpm (0.022 cfs)

SOUTH VAULT 166,209 sf of Impervious Surface Area

Water Quality Volume (V_{wq}):

V_{wq} = Impervious Area • 0.36"

V_{wq} = 166,209 sf • 0.36 in • 1/12 ft/in

V_{wq} = 4,986 cf

Water Quality Flowrate (Q_{wq}):

$Q_{wq} = V_{wq}$ / Time Time = 4 hours

Q_{wq} = 0.346 cfs

16 low flow cartridges

Each (27") Cartridge Treats 22 gpm (0.05 cfs)

NORTH EAST VAULT 73,388 sf of Impervious Surface Area

Water Quality Volume (V_{wq}):

V_{wq} = Impervious Area • 0.36"

V_{wq} = 73,388 sf • 0.36 in • 1/12 ft/in

V_{wq} = 2,202 cf

Water Quality Flowrate (Q_{wq}):

$Q_{wq} = V_{wq}$ / Time Time = 4 hours

Q_{wq} = 0.153 cfs

Use 4 (27") flow cartridges

Water Quality Requirements Met

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Each (27") Cartridge Treats 22 gpm (0.05 cfs)

NORTH WEST VAULT 241,053 sf of Impervious Surface Area

Water Quality Volume (V_{wq}):

V_{wq} = Impervious Area • 0.36"

V_{wq} = 241,053 sf • 0.36 in • 1/12 ft/in

V_{wq} = 7,232 cf

Water Quality Flowrate (Q_{wq}):

$Q_{wq} = V_{wq} / time$ time = 4 hours

Q_{wq} = 0.502

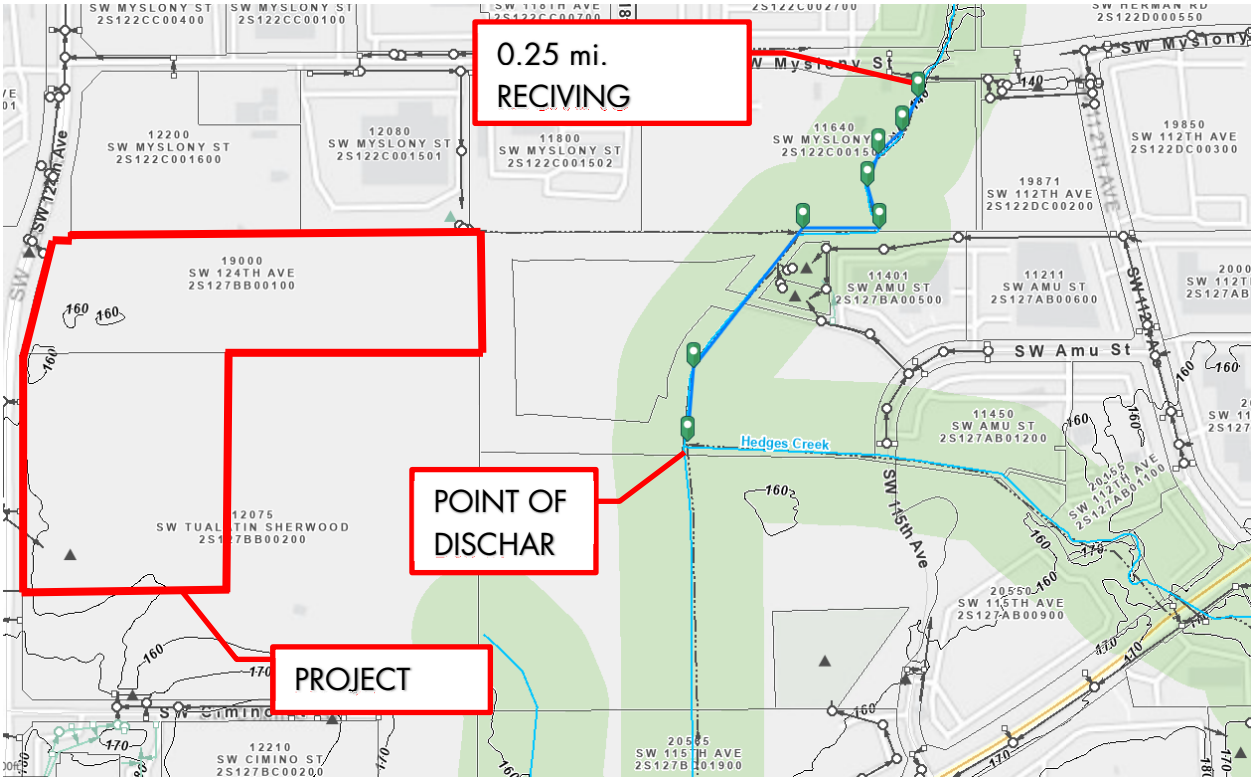
Use 11 (27") cartridges

Water Quality Requirements Met

C. **Water Quality Treatment Sizing Calculations**

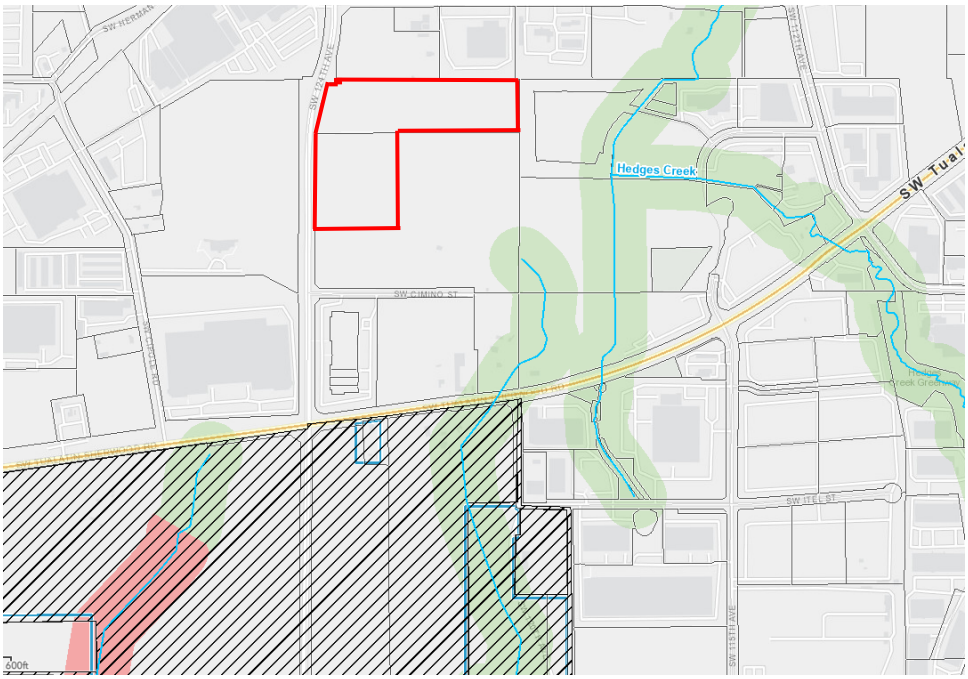
D. **Hydromodification Analysis**

Starting with CWS Design and construction Stds, section 4.03.3:
Using the CWS public Sanitary and Storm sewer map:



Per 4.03.3.a.3, the receiving reach is ¼ mile past the point of discharge, which as shown on the above map is green, and therefore we are **Low Risk.**

Using 4.03.3(b), the project site is not within the expansion areas, and is therefore designated as a **Developed Area:**



Per 4.03.3 (c) , building's combined over 80,000 SF will be **Project Size Category: Large**

A) Small: 1,000 to 12,000 square feet
B) Medium: over 12,000 to 80,000 square feet
C) Large: over 80,000 square feet and larger

Therefore, we are Low Risk, Developed, and Large → **Category 2:**
Hydromodification will be based on the below table.

TABLE 4-2
HYDROMODIFICATION APPROACH PROJECT CATEGORY TABLE

Development Class/ Risk Level	Small Project 1,000 – 12,000 SF	Medium Project >12,000 – 80,000 SF	Large Project > 80,000 SF
Expansion/High	Category 1	Category 3	Category 3
Expansion/ Moderate			
Expansion/ Low		Category 2	
Developed/ High		Category 3	
Developed/ Moderate		Category 2	Category 2
Developed/ Low			

b. Category 2
Projects in Category 2 represent those with a moderate anticipated risk. Any of the following options may be used to address hydromodification:

1. Infiltration facility, using the Standard Sizing, described in Section 4.08.5; or

2. Peak-Flow Matching Detention, using design criteria described in Section 4.08.6; or

3. Combination of Infiltration facility and Peak-Flow Matching Detention, using criteria described in Section 4.08.5 and 4.08.6; or

4. Any option listed in Category 3.