

**MEMORANDUM**

To: Town of Munster

From: Taylor Eschbach, P.E.  
Kimley-Horn and Associates, Inc.

Date: April 14<sup>th</sup>, 2025

Re: ***Drainage Report  
Proposed MOR Munster Development  
9260 Calumet Ave.  
Munster, IN***

***Introduction***

Kimley-Horn and Associates, Inc., serves as the engineering consultant for Midwest Orthopedics at Rush, who is proposing to construct a medical office building. The sitework includes grading, storm sewer, water, sanitary sewer, and paving installation along with associated dry utilities and landscaping.

The site was previously covered entirely by the building footprint of the Simmons office and manufacturing facility but is currently an open undeveloped grass lot with no existing structures or utilities.

***Existing Conditions***

The existing site has relatively mild slopes and generally drains from west to east. Runoff from the existing site is collected in the existing storm sewer system that runs north in the existing private access road east of the site. The storm sewer system is ultimately tributary to an existing storm water lift station northwest of the Lake Business Center Campus and south of Fisher Street.

There is no existing impervious area on site as the property is in the process of being re-developed but as mentioned above, the site was previously 100% impervious.

***Proposed Conditions***

The site will consist of the proposed medical office building with associated parking and utilities. The site will have on site storm sewer pipes that are routed to an underground detention system designed to include manufactured BMP pre-treatment for storm water quality. Per coordination with Town staff, the underground stormwater management system has been sized to detain the difference between the volume required under the current Town of Munster Stormwater Ordinance and the volume required under the previous Ordinance when the site was developed as 100% impervious area. As shown in the attachments, this volume was determined to be approximately 0.48 acre-feet of volume. The underground detention system then discharges to the existing storm sewer network in the private access road east of the site property. The discharge from the underground system will be controlled

by a restrictor which will help ensure that the existing storm sewer network immediately downstream of the site has adequate capacity for the site runoff during the 10-year storm.

The on-site impervious area is approximately 1.91 acres as seen on the attached impervious area exhibit. See attached Stormwater calculations for underground detention sizing. See attached existing storm sewer calculations and tributary area map exhibit for existing storm sewer capacity.

### **Stormwater Storage Volume Requirements**

The required stormwater storage volume for the proposed development was calculated using the following steps.

1. **The allowable release rate under the 2003 ordinance was calculated to be 1.26 cfs** assuming a predevelopment C-value of 0.15, a 10-minute time of concentration, and the 2-yr rainfall data in the 2003 ordinance.
2. **The required stormwater storage volume under the 2003 ordinance was calculated to be 0.52 ac-ft** at the peak during the 100-yr, 2-hour storm event. This calculation method was consistent with the stormwater approval for the hotel site to the north on the Lake Business Center campus.
3. **The allowable release rate under the 2023 ordinance was calculated to be 0.47 cfs** assuming 0.2 cfs per acre.
4. **The required stormwater storage volume under the 2023 ordinance was calculated to be 1.00 ac-ft** using HydroCAD software to generate a hydrologic model. This model assumed a 48-inch diameter underground detention system with a control structure.
5. As discussed with the Town, the proposed on-site stormwater storage volume required will be the difference between the 2023 requirement and the 2003 requirement:

$$1.0 \text{ ac-ft} - 0.52 \text{ ac-ft} = 0.48 \text{ ac-ft stormwater storage volume required}$$

### **Proposed Detention System**

In order to meet the requirements above, an underground detention system will be proposed under the on-site parking lot. This system is intended to provide approximately 0.50 ac-ft of storage between the pipes and stone backfill. Manufactured BMP pre-treatment structures will be installed upstream of the underground detention system to provide a storm water quality benefit for the site. Downstream of the underground detention system, a control structure will be provided to maximize the detention volume provided.

A calculation summary for the proposed system has been included in the attachments. Preliminary calculations indicate an 11-inch orifice would maximize the underground system during the 100-year storm without overtopping. This would result in a release rate of approximately 5.66 cfs in the 100-yr, 24-hr storm and 4.06 cfs in the 10-yr, 24-hr storm.

### Downstream Storm Sewer Capacity

After discussion with Town staff, Kimley-Horn reviewed the storm sewer capacity of the existing pipe network immediately downstream of the proposed connection point. As shown on the Utility Plan sheet, the proposed development intends to connect to the existing storm sewer network at the existing storm manhole to the southwest of the 9140 Calumet Avenue retail building (currently Noodles and Company). As shown in the attachments, a tributary area was determined for all area upstream of this structure including the proposed development. A rational method calculation was used for this area to determine an estimated 10-year peak runoff without any on-site detention. A similar exercise was performed for the next storm structure downstream with a slightly larger tributary area. The tributary area map and runoff calculations can be found in the attachments.

Alternatively, the estimated 10-year peak flows were also determined if on-site underground stormwater detention were to be provided. These reduced flows were determined using a HydroCAD model for the proposed development. The calculations summary has been included in the attachments and the estimated flows are summarized in the table below.

Manning's equation was used to determine existing pipe capacities for these two 30-inch diameter pipe segments immediately downstream. Both were determined to have sufficient capacity for the runoff from the proposed development as shown in the summary table below:

	Existing Pipe Capacity (cfs)	Proposed 10-Year Peak Flow Without On-Site Detention (cfs)	Proposed 10-Year Peak Flow With On-Site Detention (cfs)
Downstream Pipe Segment #1	22.22	19.72	14.39
Downstream Pipe Segment #2	25.52	23.24	17.91

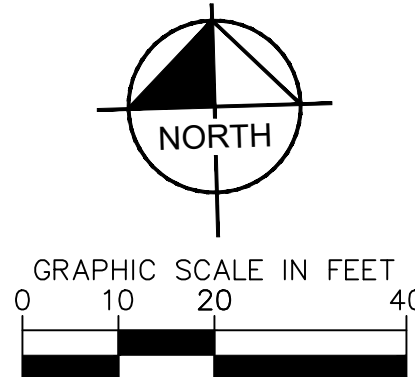
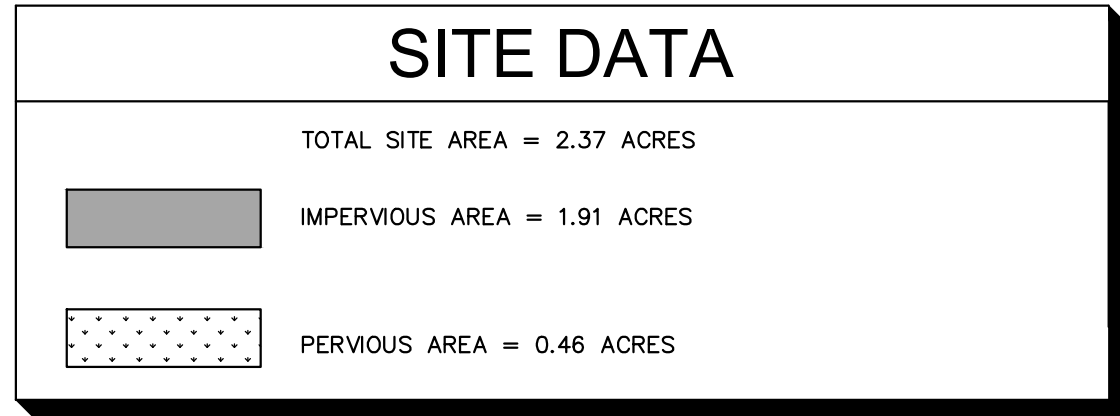
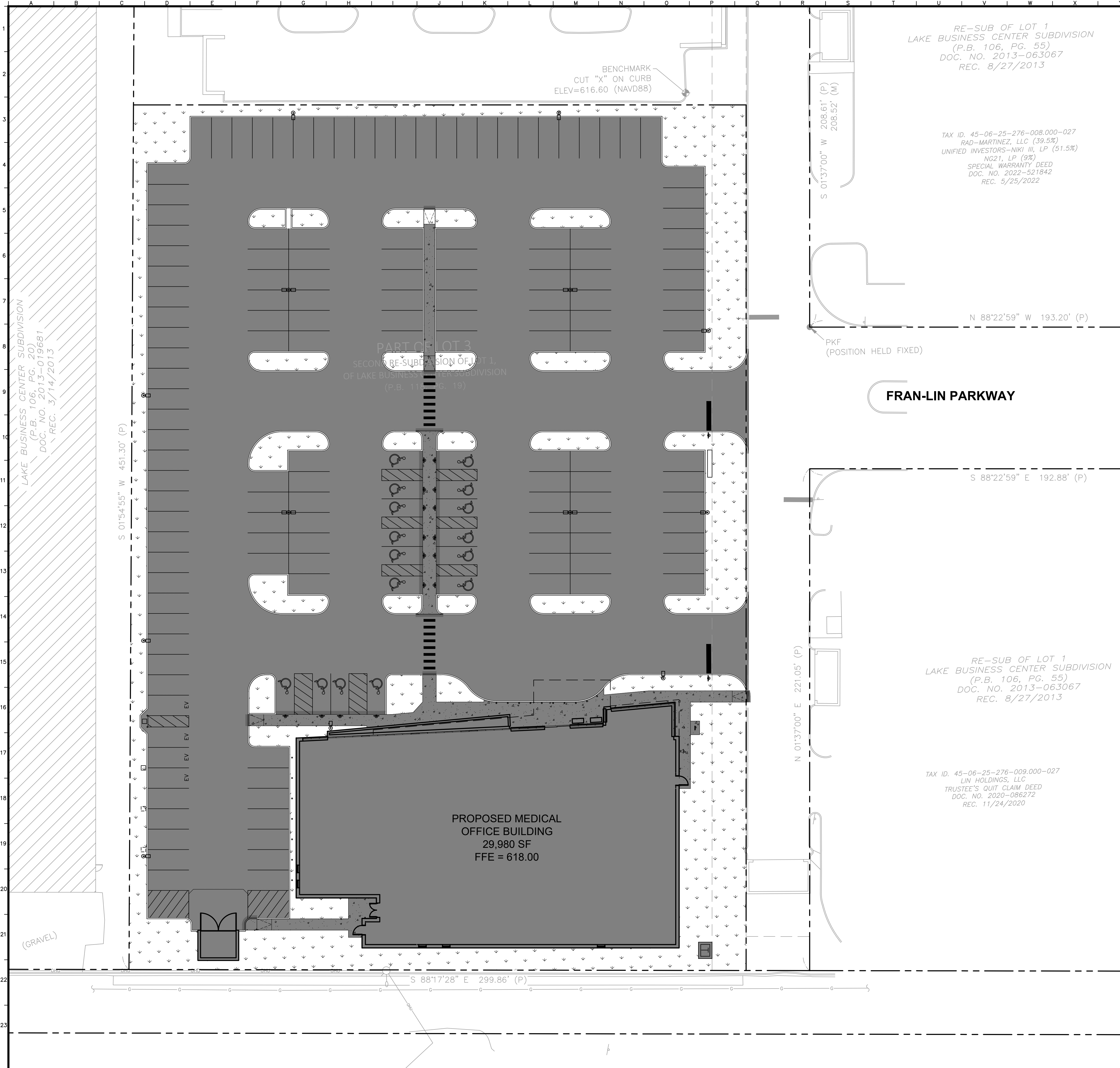
### Conclusions

As summarized above and as supported in the attached calculations, it is our opinion that the existing storm sewer extension constructed with the adjacent retail parcels provides adequate capacity for the proposed development. Considering that the subject property was previously 100% impervious, the proposed development will provide a reduction in impervious coverage from its previously developed condition. Providing approximately 0.5 ac-ft of detention on-site will provide a significant benefit for the property and the surrounding parcels.

### Attachments

- Appendix A - Impervious Area Exhibit
- Appendix B – Required Stormwater Management Under 2003 Ordinance
- Appendix C – Required Stormwater Management Under 2023 Ordinance
- Appendix D – Proposed On-Site Underground Detention Model
- Appendix E – Tributary Area Map
- Appendix F – Downstream Storm Sewer Capacity Calculations

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Apr 14, 2025 3:19pm by OdehLewis  
This document without written authorization and attestation by Vinayachandran and Associates, Inc. shall be without liability to Vinayachandran and Associates, Inc.

[illegible]

## APPENDIX B - REQUIRED STORMWATER MANAGEMENT UNDER 2003 ORDINANCE

Q=Cia

Allowable Release Rate Calculation for Pre Building Condition (Duration, Intensity and C value pulled from 2003 Ordinance)

duration (min)	I (in/hr)	c (Runoff Coefficient)	A (Acres)	Q (CFS)
10	3.55	0.15	2.37	1.262
20	2.6	0.15	2.37	0.924
30	2.1	0.15	2.37	0.747
40	1.8	0.15	2.37	0.640
50	1.6	0.15	2.37	0.569
60	1.4	0.15	2.37	0.498
90	1.05	0.15	2.37	0.373
120	0.8	0.15	2.37	0.284
180	0.6	0.15	2.37	0.213

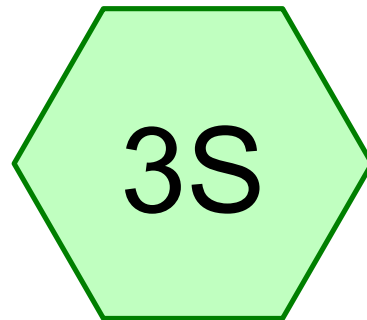
3. To calculate the allowable two (2) year release rate, the following data shall be used:

Storm (hrs)	Duration (min)	Intensity (in/hr)
0.17	10	3.55
0.33	20	2.60
0.50	30	2.10
0.67	40	1.80
0.83	50	1.60
1.00	60	1.40
1.50	90	1.05
2.00	120	0.80
3.00	180	0.60

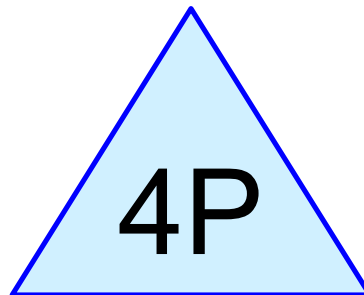
Storage Required during Building Phase

Developed "C"	Storm Duration (HR)	Rainfall Frequency (IN)	Rainfall Intensity (IN/HR)	Drainage Area (Acres)	Inflow Rate (CFS)	Release Rate (CFS)	Storage Rate (CFS)	Storage Required (AC*FT)
0.9	0.08	0.85	10.63	2.37	22.674	1.26	21.414	0.142
0.9	0.17	1.5	8.82	2.37	18.813	1.26	17.553	0.247
0.9	0.25	1.92	7.68	2.37	16.381	1.26	15.121	0.312
0.9	0.5	2.63	5.26	2.37	11.220	1.26	9.960	0.412
0.9	1	3.35	3.35	2.37	7.146	1.26	5.886	0.486
0.9	2	4.13	2.07	2.37	4.415	1.26	3.155	0.522
0.9	3	4.56	1.52	2.37	3.242	1.26	1.982	0.491
0.9	6	5.34	0.89	2.37	1.898	1.26	0.638	0.317
0.9	12	6.19	0.52	2.37	1.109	1.26	-0.151	-0.150
0.9	18	6.69	0.37	2.37	0.789	1.26	-0.471	-0.700
0.9	24	7.12	0.3	2.37	0.640	1.26	-0.620	-1.230

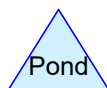
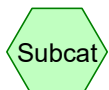




(new Subcat)



Underground SWM - 1.0  
acft



## 2025-0414 - Preliminary SWM Model - 1.0 acft Onsite Detention

Prepared by Kimley-Horn & Associates

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### Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	100-YR, 24-HR	Type II 24-hr		Default	24.00	1	8.02	2

## 2025-0414 - Preliminary SWM Model - 1.0 acft Onsite Detention

Prepared by Kimley-Horn & Associates

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### Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.490	80	>75% Grass cover, Good, HSG D (3S)
1.880	98	Paved parking, HSG D (3S)
<b>2.370</b>	<b>94</b>	<b>TOTAL AREA</b>



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment3S: (new Subcat)** Runoff Area=2.370 ac 79.32% Impervious Runoff Depth=6.78"  
Tc=10.0 min CN=94 Runoff=23.20 cfs 1.339 af

**Pond 4P: Underground SWM - 1.0 acft** Peak Elev=3.98' Storage=1.000 af Inflow=23.20 cfs 1.339 af  
Outflow=0.46 cfs 0.374 af

**Total Runoff Area = 2.370 ac Runoff Volume = 1.339 af Average Runoff Depth = 6.78"**  
**20.68% Pervious = 0.490 ac 79.32% Impervious = 1.880 ac**

### Summary for Subcatchment 3S: (new Subcat)

Runoff = 23.20 cfs @ 12.01 hrs, Volume= 1.339 af, Depth> 6.78"  
 Routed to Pond 4P : Underground SWM - 1.0 acft

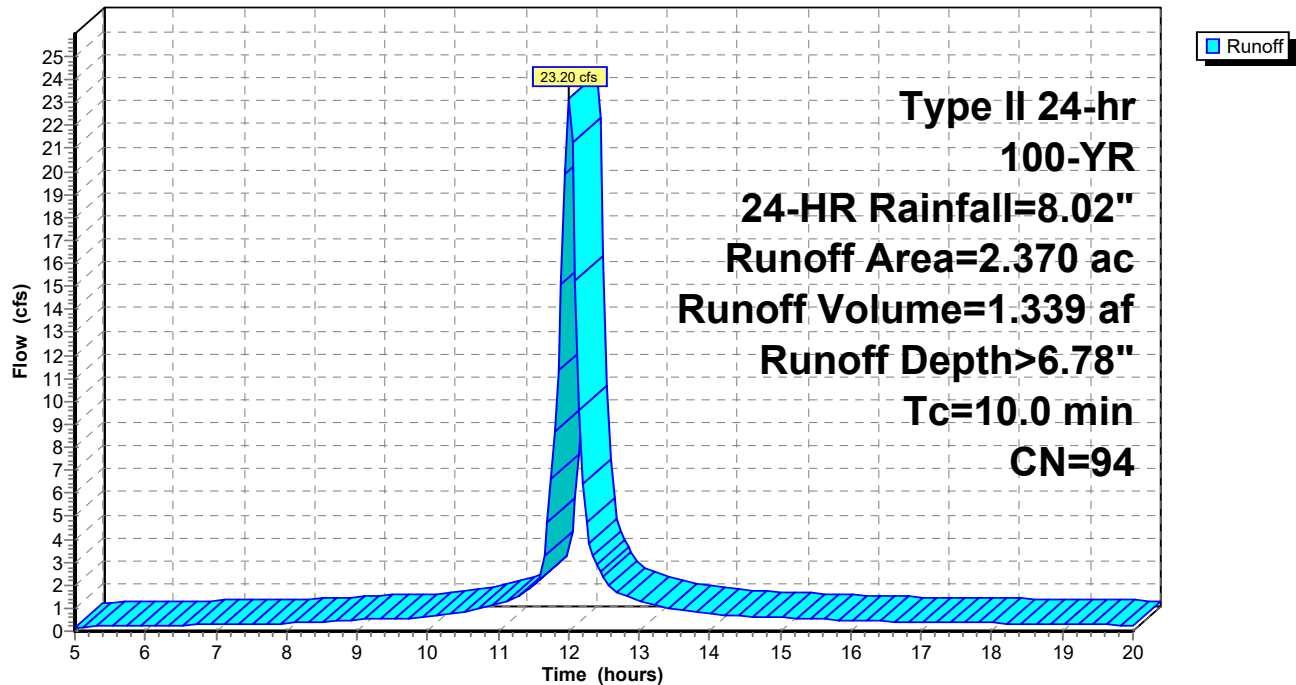
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Type II 24-hr 100-YR, 24-HR Rainfall=8.02"

Area (ac)	CN	Description
1.880	98	Paved parking, HSG D
0.490	80	>75% Grass cover, Good, HSG D
2.370	94	Weighted Average
0.490		20.68% Pervious Area
1.880		79.32% Impervious Area

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

### Subcatchment 3S: (new Subcat)

Hydrograph



## Summary for Pond 4P: Underground SWM - 1.0 acft

[82] Warning: Early inflow requires earlier time span

Inflow Area = 2.370 ac, 79.32% Impervious, Inflow Depth > 6.78" for 100-YR, 24-HR event  
 Inflow = 23.20 cfs @ 12.01 hrs, Volume= 1.339 af  
 Outflow = 0.46 cfs @ 15.96 hrs, Volume= 0.374 af, Atten= 98%, Lag= 237.0 min  
 Primary = 0.46 cfs @ 15.96 hrs, Volume= 0.374 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 3.98' @ 15.96 hrs Surf.Area= 0.045 ac Storage= 1.000 af

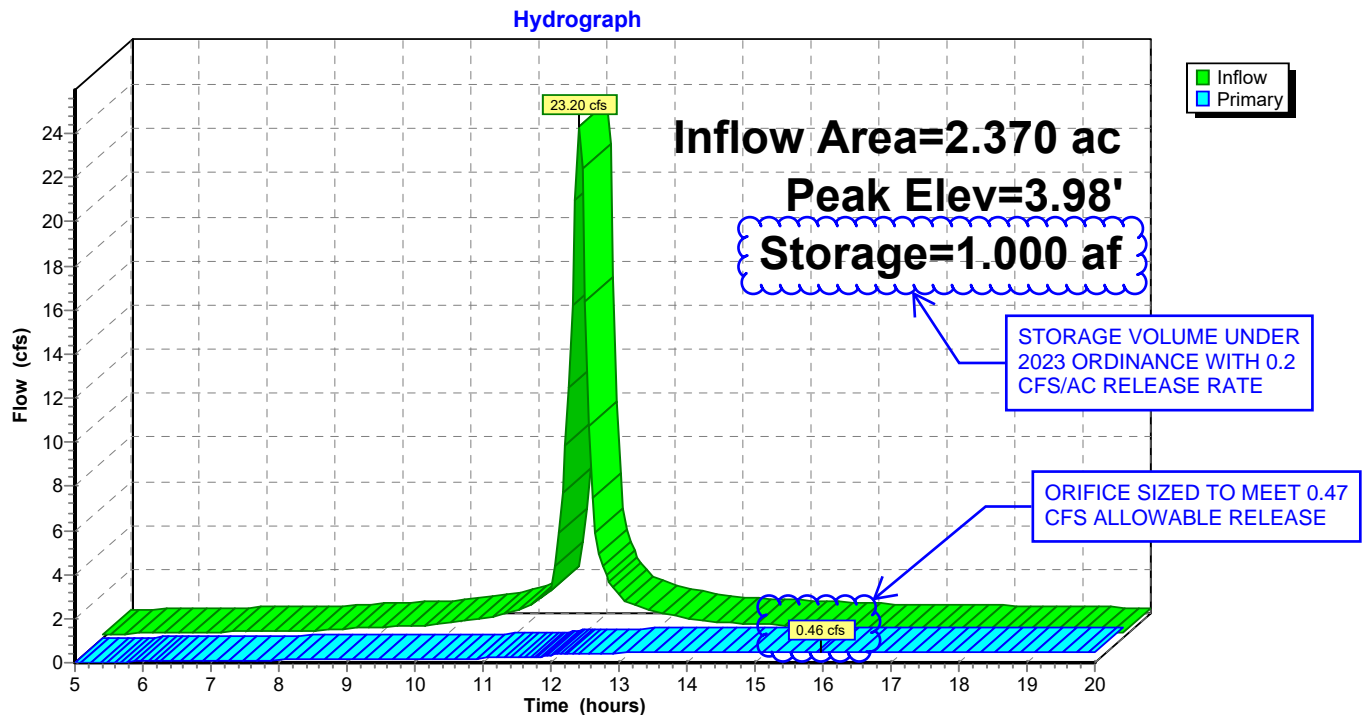
Plug-Flow detention time= 284.7 min calculated for 0.372 af (28% of inflow)  
 Center-of-Mass det. time= 146.0 min ( 884.4 - 738.4 )

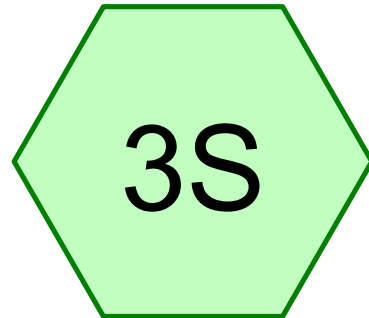
Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	1.001 af	<b>48.0" Round Pipe Storage</b> L= 3,470.0'

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	<b>3.0" Vert. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

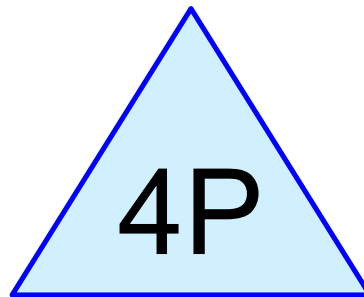
**Primary OutFlow** Max=0.46 cfs @ 15.96 hrs HW=3.98' (Free Discharge)  
 ←1=Orifice/Grate (Orifice Controls 0.46 cfs @ 9.45 fps)

## Pond 4P: Underground SWM - 1.0 acft

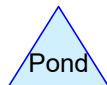
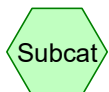




(new Subcat)



Underground SWM - 0.5  
acft



## 2025-0414 - Preliminary SWM Model

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### Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	10-YR, 24-HR	Type II 24-hr		Default	24.00	1	4.94	2
2	100-YR, 24-HR	Type II 24-hr		Default	24.00	1	8.02	2

## 2025-0414 - Preliminary SWM Model

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### Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.490	80	>75% Grass cover, Good, HSG D (3S)
1.880	98	Paved parking, HSG D (3S)
<b>2.370</b>	<b>94</b>	<b>TOTAL AREA</b>

## 2025-0414 - Preliminary SWM Model

Type II 24-hr 10-YR, 24-HR Rainfall=4.94"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment3S: (new Subcat)

Runoff Area=2.370 ac 79.32% Impervious Runoff Depth>3.97"

Tc=10.0 min CN=94 Runoff=13.92 cfs 0.784 af

### Pond 4P: UndergroundSWM - 0.5 acft

Peak Elev=2.09' Storage=0.265 af Inflow=13.92 cfs 0.784 af

Outflow=4.06 cfs 0.775 af

**Total Runoff Area = 2.370 ac Runoff Volume = 0.784 af Average Runoff Depth = 3.97"**  
**20.68% Pervious = 0.490 ac 79.32% Impervious = 1.880 ac**



## 2025-0414 - Preliminary SWM Model

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Type II 24-hr 10-YR, 24-HR Rainfall=4.94"

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### Summary for Subcatchment 3S: (new Subcat)

Runoff = 13.92 cfs @ 12.01 hrs, Volume= 0.784 af, Depth> 3.97"  
Routed to Pond 4P : Underground SWM - 0.5 acft

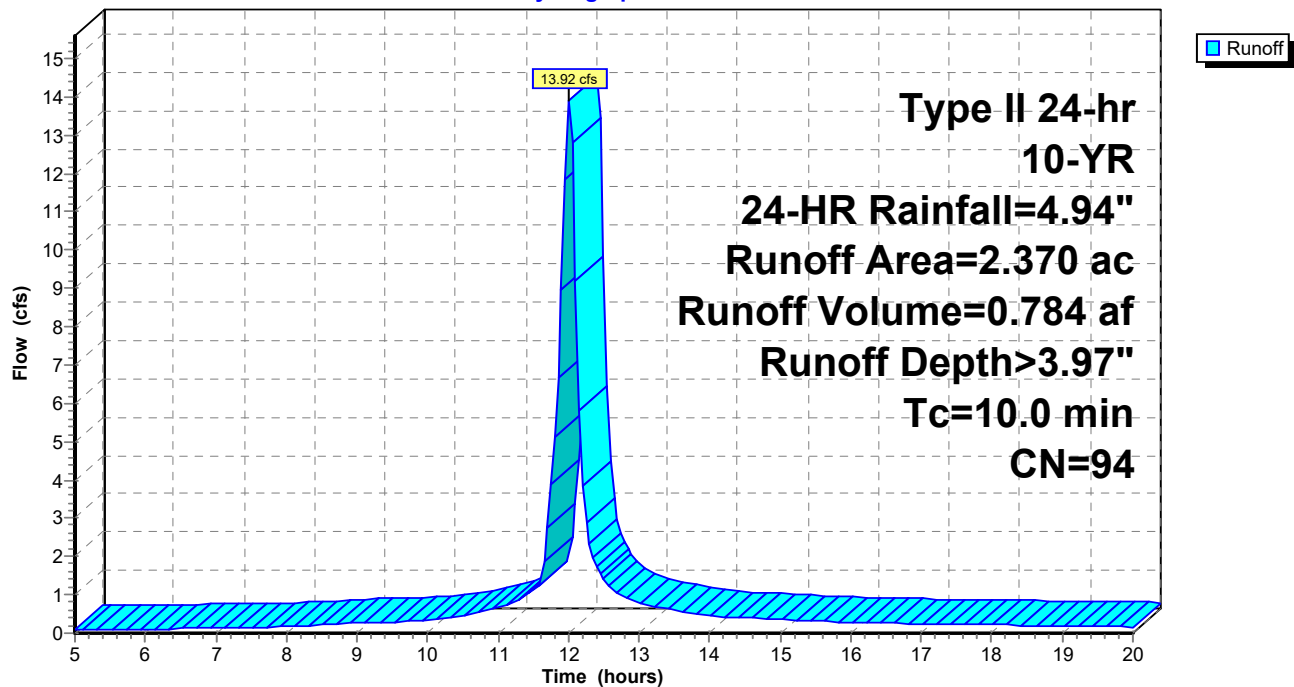
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type II 24-hr 10-YR, 24-HR Rainfall=4.94"

Area (ac)	CN	Description
1.880	98	Paved parking, HSG D
0.490	80	>75% Grass cover, Good, HSG D
2.370	94	Weighted Average
0.490		20.68% Pervious Area
1.880		79.32% Impervious Area

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

### Subcatchment 3S: (new Subcat)

Hydrograph



## Summary for Pond 4P: Underground SWM - 0.5 acft

[82] Warning: Early inflow requires earlier time span

Inflow Area = 2.370 ac, 79.32% Impervious, Inflow Depth > 3.97" for 10-YR, 24-HR event  
 Inflow = 13.92 cfs @ 12.01 hrs, Volume= 0.784 af  
 Outflow = 4.06 cfs @ 12.20 hrs, Volume= 0.775 af, Atten= 71%, Lag= 11.6 min  
 Primary = 4.06 cfs @ 12.20 hrs, Volume= 0.775 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 2.09' @ 12.20 hrs Surf.Area= 0.159 ac Storage= 0.265 af

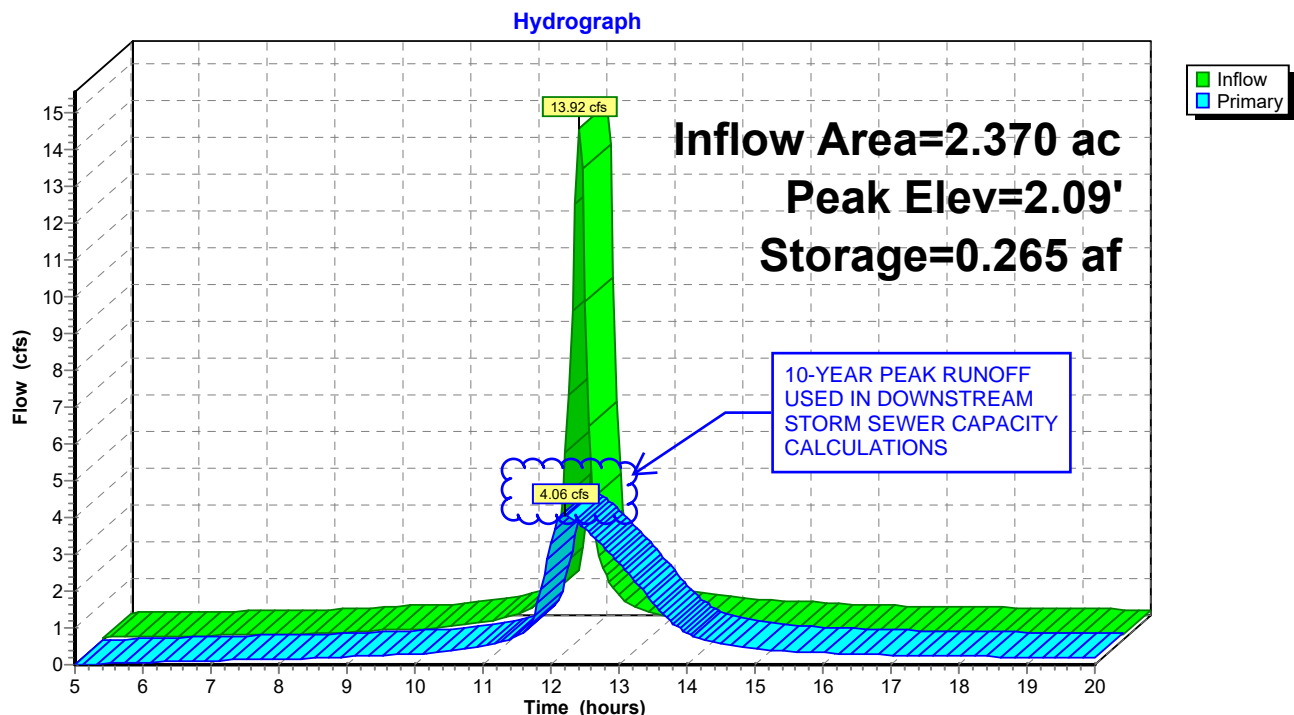
Plug-Flow detention time= 36.9 min calculated for 0.772 af (98% of inflow)  
 Center-of-Mass det. time= 31.3 min ( 776.7 - 745.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	0.501 af	<b>48.0" Round Pipe Storage</b> L= 1,735.0'

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	<b>11.0" Vert. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Primary OutFlow** Max=4.06 cfs @ 12.20 hrs HW=2.09' (Free Discharge)  
 ←1=Orifice/Grate (Orifice Controls 4.06 cfs @ 6.15 fps)

## Pond 4P: Underground SWM - 0.5 acft



## 2025-0414 - Preliminary SWM Model

Type II 24-hr 100-YR, 24-HR Rainfall=8.02"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment3S: (new Subcat)

Runoff Area=2.370 ac 79.32% Impervious Runoff Depth=6.78"  
Tc=10.0 min CN=94 Runoff=23.20 cfs 1.339 af

### Pond 4P: Underground SWM - 0.5 acft

Peak Elev=3.63' Storage=0.477 af Inflow=23.20 cfs 1.339 af  
Outflow=5.66 cfs 1.325 af

**Total Runoff Area = 2.370 ac Runoff Volume = 1.339 af Average Runoff Depth = 6.78"**  
**20.68% Pervious = 0.490 ac 79.32% Impervious = 1.880 ac**

## 2025-0414 - Preliminary SWM Model

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Type II 24-hr 100-YR, 24-HR Rainfall=8.02"

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### Summary for Subcatchment 3S: (new Subcat)

Runoff = 23.20 cfs @ 12.01 hrs, Volume= 1.339 af, Depth> 6.78"  
Routed to Pond 4P : Underground SWM - 0.5 acft

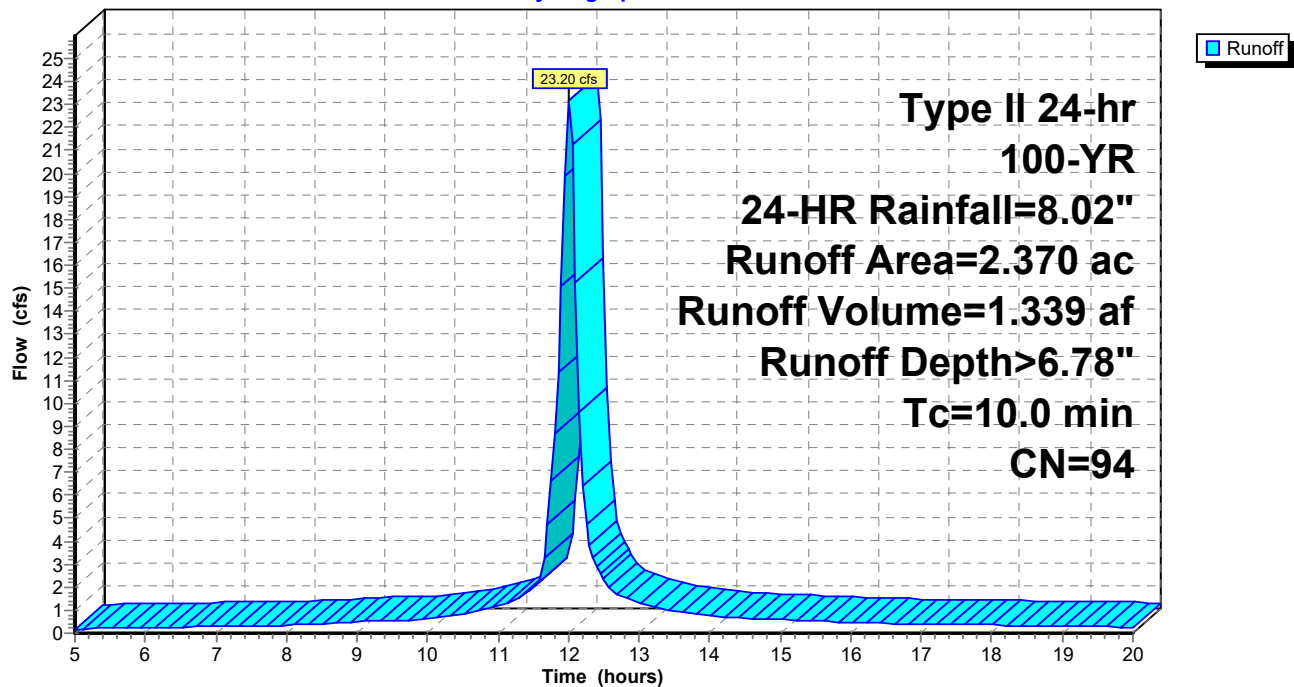
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type II 24-hr 100-YR, 24-HR Rainfall=8.02"

Area (ac)	CN	Description
1.880	98	Paved parking, HSG D
0.490	80	>75% Grass cover, Good, HSG D
2.370	94	Weighted Average
0.490		20.68% Pervious Area
1.880		79.32% Impervious Area

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

### Subcatchment 3S: (new Subcat)

Hydrograph



## Summary for Pond 4P: Underground SWM - 0.5 acft

[82] Warning: Early inflow requires earlier time span

Inflow Area = 2.370 ac, 79.32% Impervious, Inflow Depth > 6.78" for 100-YR, 24-HR event  
 Inflow = 23.20 cfs @ 12.01 hrs, Volume= 1.339 af  
 Outflow = 5.66 cfs @ 12.22 hrs, Volume= 1.325 af, Atten= 76%, Lag= 13.0 min  
 Primary = 5.66 cfs @ 12.22 hrs, Volume= 1.325 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 3.63' @ 12.22 hrs Surf.Area= 0.092 ac Storage= 0.477 af

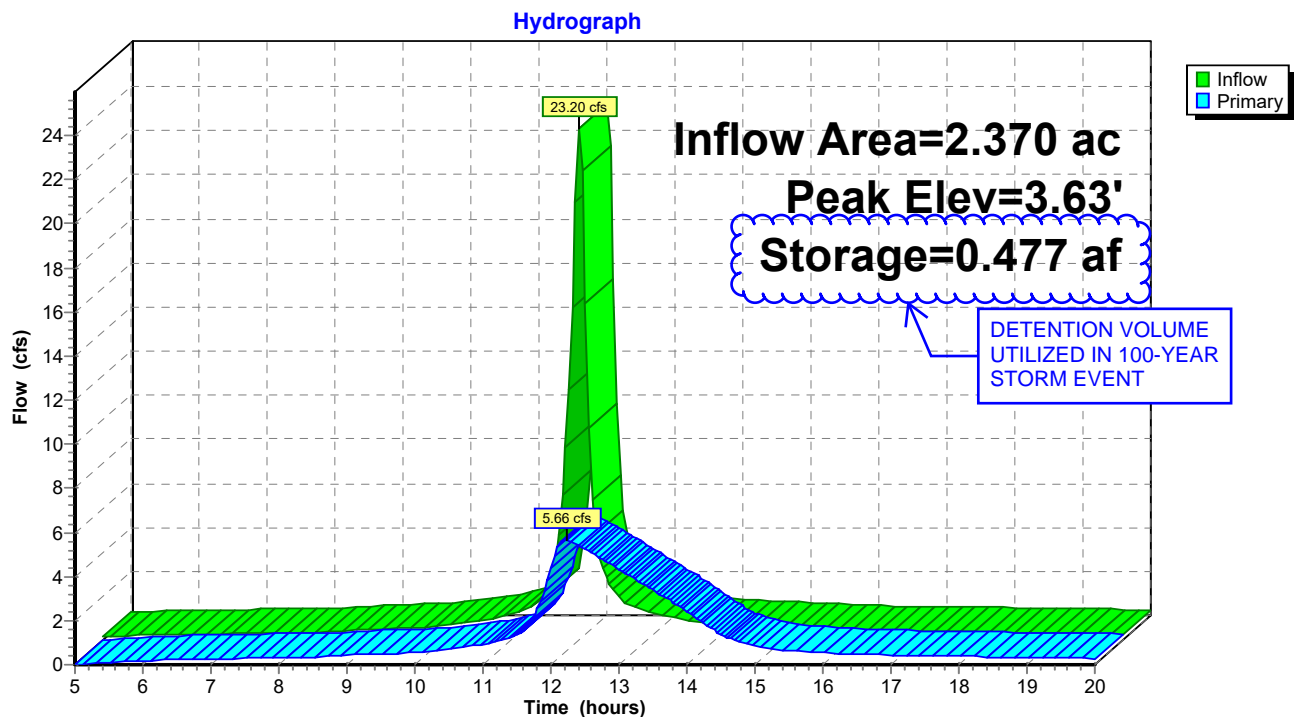
Plug-Flow detention time= 42.5 min calculated for 1.324 af (99% of inflow)  
 Center-of-Mass det. time= 37.5 min ( 775.9 - 738.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	0.501 af	<b>48.0" Round Pipe Storage</b> L= 1,735.0'

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	<b>11.0" Vert. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Primary OutFlow** Max=5.65 cfs @ 12.22 hrs HW=3.62' (Free Discharge)  
 ←1=Orifice/Grate (Orifice Controls 5.65 cfs @ 8.56 fps)

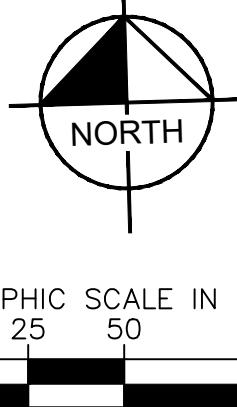
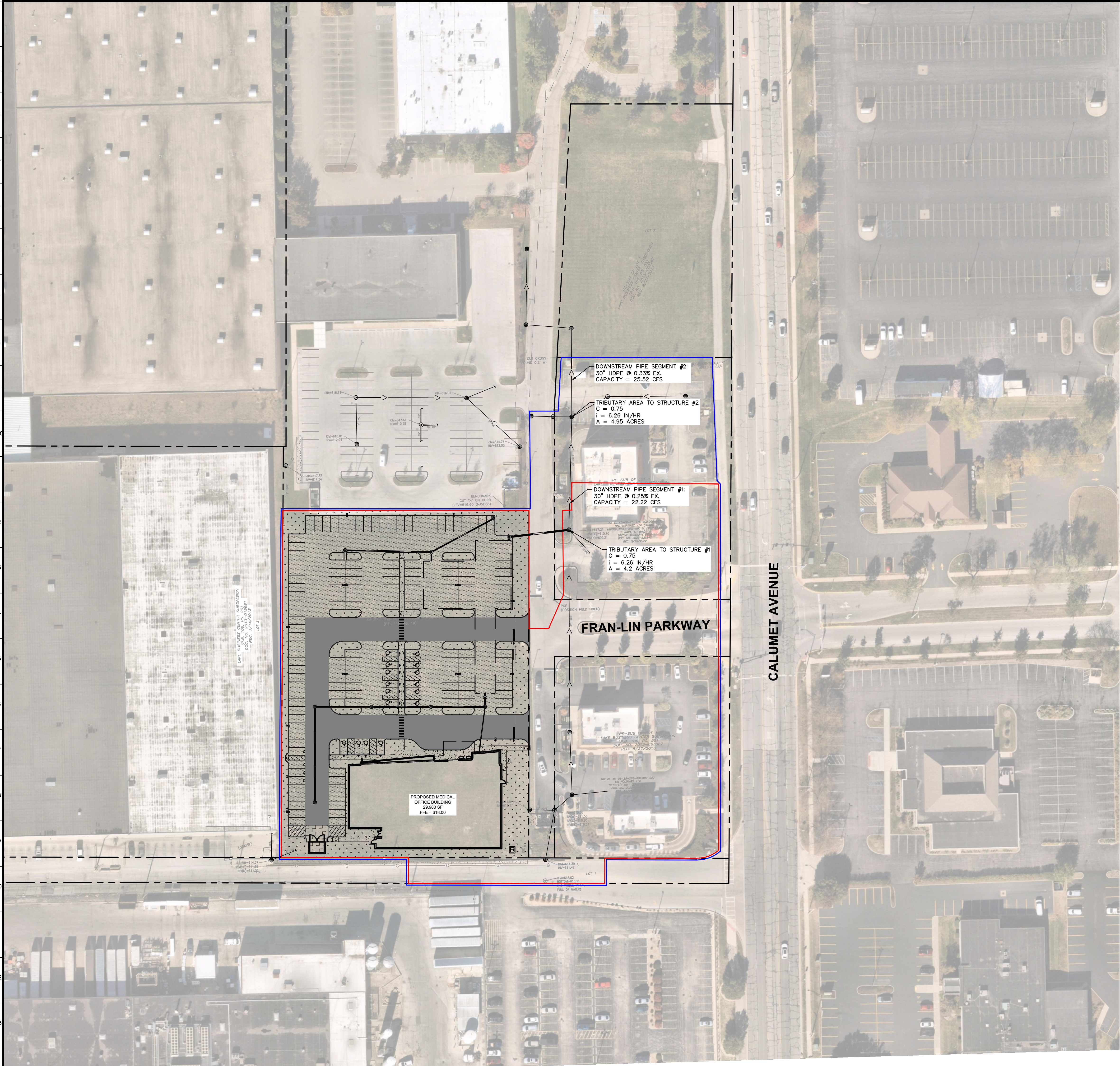
## Pond 4P: Underground SWM - 0.5 acft





Drawing name: K:\GIS\DEV\168411004\_Canon\_RUSH-MOB\_Munster\_JN\2\_Design\CAD\Exhibits\Existing Storm Tria Area Map.dwg C2.0 Apr 14, 2025 3:19pm by: GdoriLewis

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MUNSTER MOB		TRIBUTARY AREA		CANNON DESIGN		Kimley»Horn			
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								REVISIONS	
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## APPENDIX F - DOWNSTREAM STORM SEWER CAPACITY CALCULATIONS

### Downstream Storm Sewer Capacity (Without On-Site Detention)

#### 10-yr Storm

##### Point of connection SW of Noodles:

C = 0.75 Commercial (CBD) < 25-yr storm, Flat

i = 6.26 10-min, 10-yr storm

A = 4.2 ac (MOR, Starbucks, Potbelly, Noodles, part of Pepsi driveway)

Q10 = CiA = 19.72 cfs

30" HDPE @ 0.25% at connection point

Full Flow Capacity = 22.22 cfs (per Flowmaster)

##### Next Downstream Storm MH:

C = 0.75 Commercial (CBD) < 25-yr storm, Flat

i = 6.26 10-min, 10-yr storm

A = 4.95 ac (MOR, Starbucks, Potbelly, Noodles, Bibibop, part of Pepsi driveway)

Q10 = CiA = 23.24 cfs

30" HDPE @ 0.25% at connection point

Full Flow Capacity = 25.52 cfs (per Flowmaster)

### Downstream Storm Sewer Capacity (With On-Site Detention)

#### 10-yr Storm

##### Point of connection SW of Noodles:

C = 0.75 Commercial (CBD) < 25-yr storm, Flat

i = 6.26 10-min, 10-yr storm

A = 2.2 ac (Starbucks, Potbelly, Noodles, part of Pepsi driveway)

Q10 = CiA = 10.33 cfs (off-site)

Q10 = 4.06 cfs (on-site, per HydroCAD model)

Total Q10 = 14.39 cfs

30" HDPE @ 0.25% at connection point

Full Flow Capacity = 22.22 cfs (per Flowmaster)

##### Next Downstream Storm MH:

C = 0.75 Commercial (CBD) < 25-yr storm, Flat

i = 6.26 10-min, 10-yr storm

A = 2.95 ac (Starbucks, Potbelly, Noodles, Bibibop, part of Pepsi driveway)

Q10 = CiA = 13.85 cfs

Q10 = 4.06 cfs (on-site, per HydroCAD model)

Total Q10 = 17.91 cfs

30" HDPE @ 0.25% at connection point

Full Flow Capacity = 25.52 cfs (per Flowmaster)