

Appendix C:
*Stormwater
Management
Plan*

Stormwater Management Plan

Hermantown Industrial
Hermantown, MN

City of Hermantown

Prepared for:
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Prepared On: August 11, 2025
Revised On:

Stormwater Management Report

for

Hermantown Industrial

Prepared for:

Harmony Group LLC
60 S. 6th Street, Suite 3400
Minneapolis, MN 55402

August 11, 2025

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I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.

Jason Scrimshaw, PE

Date: 8-11-2025 Registration No. 53203

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1.0 Introduction

The Hermantown Industrial development encompasses approximately 234 acres located in the City of Hermantown Minnesota. The project site is bordered by Morris Thomas Road to the north, Midway Road to the east, an existing Minnesota Power substation to the west and a wetland area to the south. The site has topographic relief with elevations ranging from approximately 1340 feet on the north end of the site to 1270 feet on the south and east side of the site. The site generally drains to the south with a small portion of the northeast corner draining to the east.

Hermantown Industrial will be constructed in phases; this report analyses the stormwater requirements of the full build out (Day-N) conditions and verifies the interim (Day-1) conditions meet the applicable stormwater standards.

Kimley-Horn and Associates, Inc. (Kimley-Horn) has analyzed the existing and proposed drainage conditions of the site, and this report provides computations for all applicable City of Hermantown and MPCA stormwater requirements. The analysis of the existing and proposed drainage systems was completed with the assistance of HydroCAD, Version 10, a computer aided design system for modeling the hydrology and hydraulics of stormwater runoff. These calculations are largely based on the hydrology techniques developed by the Soil Conservation Service (SCS/NRCS), combined with other hydrology and hydraulics calculations. For a given rainfall event, these techniques are used to generate hydrographs throughout a watershed.

Atlas 14 precipitation frequency data (PFD) was used as a basis for the design frequency events, with PFD retrieved from the nearest weather station for the project.

2.0 Pre-development Conditions

The existing project site includes single-family residential areas along with significant wooded regions and approximately 50 acres of wetlands. About 174 acres of this site drains southeast into an existing wetland that discharges through a culvert that crosses Midway Road. The remaining 60 acres drains northeast to another wetland and culvert that also crosses Midway Road. Both discharge points eventually converge and flow into the Midway River at the same location, through an existing culvert approximately 1,450 feet northeast of the railroad crossing at St. Louis River Road. No on-site detention or water treatment facilities are present in the existing conditions. Refer to the appendix for the Existing Drainage Map.

A preliminary geotechnical investigation was conducted by Braun Intertec and completed on December 20, 2024. This investigation included 11 soil borings. The soil type found throughout the site is classified as CL (Sandy Lean Clay) according to ASTM standards. These clayey soils are categorized as Type C/D soils and have an estimated infiltration rate of 0.06 inches per hour, based on the Minnesota Stormwater Manual. Practically, the current site soils are not suitable for infiltration as a stormwater management option. Refer to the appendix for the full Geotechnical Report.

A summary of the pervious and impervious coverage for existing conditions is included below:

- *Total modeled area = 234 acres*
 - *Existing Pervious Area = 228.3 acres (98%)*
 - *Existing Impervious Area = 5.7 acres (2%)*
 - *Weighted Curve Number (CN) = 71*

To accurately represent existing vs proposed conditions, the modeled area in existing conditions was sized to the extent of the disturbed area in proposed conditions. See the appendix for the Existing Conditions HydroCAD report.

3.0 Post-development Conditions

A series of eight (8) filtration and detention ponds located throughout the property will serve as the primary stormwater management system for the development. Filtration with underdrains is used due to the inability to infiltrate with the presence of poor soils. The proposed system has three separate “treatment trunklines” that each outlet to the southeastern wetland (W7) and eventually discharge through the existing culvert under Midway Road.

Treatment trunkline A: Pond 1 → Pond 2 → Pond 8* → Outlet

Treatment trunkline B: Pond 3 → Pond 4 → Outlet

Treatment trunkline C: Pond 5 → Pond 6 → Pond 7 → Outlet

*Connected in Day-N conditions.

Each pond will be designed to fully treat the required Water Quality Volume (WQv) for its respective drainage area. Additionally, each pond will include extra storage capacity to manage discharge rates from storm events up to a 100-year, 24-hour storm.

The discharge from upstream ponds will bypass the downstream ponds and connect directly to a main trunkline through a junction structure. This routing effectively links the discharges from multiple ponds in sequence.

The bypass system has several advantages:

1. **Increased Lifespan of Filter Media:** By directing the flows from upstream ponds away from downstream ponds, the filter media in the downstream ponds will experience less frequent inundation. This reduction in water exposure increases the lifespan of the filter media.
2. **Reduced Inundation Times:** With less total volume, the downstream ponds will spend less time in a flooded state. This not only maintains the quality and functionality of the filter media but also enhances the overall efficiency of the pond system.

The design aims to efficiently manage water quality treatment and flood control across the drainage areas, while also optimizing the performance and longevity of the pond treatment components.

The Day-1 scenario includes the development of approximately 70.6 acres of the western portion of the site. Four (4) ponds will be constructed for Day-1 treatment and detention. Each pond will be routed to the existing wetland in the southeast (W7).

- Pond 1: ± 1.0-acre pond that serves 20.7 acres of drainage area. Pond 1 discharges to the east and connects with the outlet pipe from Pond 2 before flowing into W6 to the east.
- Pond 2: ± 1.4-acre pond that serves 8.3 acres of drainage area. Pond 2 discharges to W6 to the east. The Pond 1/Pond 2 combined outlet pipe will have a gate valve to stop flow in case of a spill.
- Pond 3: ± 2.5-acre pond that serves 39.0 acres of drainage area. Pond 3 and Pond 4 will work together to treat and detain the runoff from this drainage area.
- Pond 4: ± 1.8-acre pond with a minimal direct drainage area but will work with pond 3 to manage the runoff from the upstream drainage area. The Pond 3/Pond 4 combined outlet pipe will have a gate valve to stop flow in case of a spill.

The Day-N scenario includes the development of the remaining 163.4 acres of the northern and eastern portions of the site. Four (4) additional ponds will be constructed in the Day-N scenario to manage the treatment and detention of the fully developed site. Each pond will be routed to the existing wetland in the southeast (W7).

- Pond 5: ± 3.5-acre pond that serves 56.5 acres of drainage area from the north. Pond 5 discharges to the south and connects with the outlet pipe from Pond 6 and Pond 7 before flowing into W7 in the southeast.
- Pond 6: ± 1.2-acre pond that serves 16.3 acres of drainage area. Pond 6 discharges to the east and connects with the outlet pipe serving Pond 5, 6 and 7 before flowing into W7 in the southeast.
- Pond 7: ± 3.7-acre pond that serves 37.1 acres of drainage area. Pond 7 discharges to W7 in the southeast. The Pond 5/Pond 6/Pond 7 combined outlet pipe will have a gate valve to stop flow in case of a spill.
- Pond 8: ± 1.8-acre pond that serves 7.9 acres of drainage area. Pond 8 discharges to the existing wetland in the southeast. Pond 2 outlet will be rerouted to the south and connect with the outlet of pond 8 in the Day-N scenario. The Pond 1/Pond 2/Pond 8 combined outlet pipe will have a gate valve to stop flow in case of a spill.

A summary of the pervious and impervious coverage for proposed conditions is included below.

- *Total Day-N modeled area = 234 acres*
 - *Proposed Day-N Pervious Area = 122.7 acres (52%)*
 - *Propose Day-N Impervious Area = 111.3 acres (48%)*
 - *Weighted Curve Number (CN) = 87*

4.0 Rate Attenuation Summary

The City requires that the runoff rate does not exceed the existing runoff rates for the 2-, 10- and 100-year, 24-hour storm events. The proposed development achieves this requirement using multi-stage outlet control structures in each pond. Discharge Point #1 is the culvert crossing Midway Road in the northeast corner of the property. Discharge Point #2 is the culvert crossing Midway Road in the southeast corner of the property. The results are listed in Table 1. See Appendix for detailed HydroCAD analysis.

Table 1: Rate Attenuation

	2 Year (2.88 in.)	10 Year (4.29in.)	100 Year (7.42 in.)
Discharge Point #1 - NE			
Pre-Development Rate (CFS)	11.47	19.38	34.03
Post-Development Rate (CFS)	7.24	9.54	12.84
Discharge Point #2 - SE			
Pre-Development Rate (CFS)	27.91	62.46	193.22
Post-Development Rate (CFS)	17.55	45.95	75.73

5.0 Water Quality Summary

The City of Hermantown minimum stormwater management requirements state that new developments must treat stormwater for 9,100 SF per lot plus the stormwater from additional impervious surfaces. Since the development is >> 9,100 SF, the treatment volume uses the MPCA guidance of 1" over the proposed impervious surfaces. The treatment will occur in each pond for the corresponding direct drainage area. Biofiltration with underdrain ponding a maximum depth of 1.6' is the treatment method for stormwater throughout the site. Ponding depth is limited by drawdown times assuming a filtration rate of 0.8 in/hr based on the Minnesota stormwater manual. See Appendix 3 for a summary of required water quality volume and proposed filtration volume.

Additionally, the City of Hermantown requires no net increase in Total Suspended Solids (TSS) and no net increase in Total Phosphorous (TP) on an annual basis when compared to existing conditions. The existing and proposed effluent was modeled using MIDS version 4.

When modeling in MIDS it is common to use different dissolved phosphorous (DP) ratios and Event Mean Concentration (EMC) values when transitioning from existing wooded and vegetated areas to proposed impervious areas. According to the Minnesota Stormwater Manual, woods and vegetated lands often have higher initial DP due to organic matter decomposition and nutrient cycling. This results in elevated phosphorus concentrations entering runoff. Conversely, the impervious areas, like building roofs, generally have lower phosphorus loadings because these surfaces do not contribute organic material. Therefore, applying differentiated phosphorus loading and EMC values is important for accurately reflecting the distinct characteristics of land types and ensuring effective stormwater management. This approach aligns with the Minnesota Stormwater Manual's guidance to appropriately model and mitigate phosphorus runoff. See Table 2 for a summary of existing and proposed TSS and TP loading on an annual basis.

Table 2: Water Quality Modeling Results

	EMC	DP:TP Ratio	Annual TSS Discharge (lbs)	Annual TP Discharge (lbs)
Pre-Development Conditions	0.3	0.45	6913.0	38.02
Post Development Conditions	0.2	0.25	3687.1	37.82

6.0 Receiving Waters Impacts Summary

Due to the site's discharge into a tributary of the Midway River, a designated trout stream, the Minnesota Pollution Control Agency (MPCA) has specific temperature control requirements. The site shall be designed to minimize or eliminate discharge of treated stormwater that has increased temperature to mitigate impacts to downstream trout streams. One MPCA-recommended method is to use stormwater filtration systems that discharge within 24 hours. The Midway River, located about 1,000 feet downstream of the site, has been considered in the design measures to mitigate runoff temperature impacts. Each filtration pond is engineered to drain the WQv within 24 hours, utilizing native plantings to enhance evapotranspiration and provide shading during warmer seasons. Rather than discharging directly into the river, the runoff flows into an established wetland with dense vegetation, further reducing temperature changes before reaching the river. Comprehensive design measures have been implemented to minimize impacts to the trout stream from temperature increases caused by stormwater runoff.

7.0 Spill Protection

It is standard practice for the end user to provide spill protection within or directly downstream of the stormwater ponds if a spill occurs and upstream pollution containment fails. The threshold for spill protection governed by the end user is the runoff volume of the 25-yr, 6-hour storm. This volume must be stored within the ponds when the downstream gate valves are closed. To limit the number of valves needed for the site, the spill protection gate valves will be located downstream of the filtration ponds along the outlet trunkline. Each of the treatment trunk lines will provide the spill protection for the contributing area of the upstream ponds.

In Day-1 conditions, Pond 2 has the capacity to hold the 25-year, 6-hour storm for each of the upstream drainage areas (1S and 2S). Pond 4 has the capacity to hold the 25-year, 6-hour storm for the upstream drainage area (3/4S).

In Day-N conditions, Pond 7 has the capacity to hold the 25-year, 6-hour storm for each of the upstream drainage areas (5S, 6S, 7S). Pond 8 has the capacity to hold the 25-year, 6-hour storm for each of the upstream drainage areas (1S, 2S, 8S).

See Table 3 for a summary of the required spill protection volumes.

Table 3: Spill Protection Summary

Drainage Areas	Pond Providing Spill Protection	<i>25-yr, 6-hr Volume (ac-ft)</i>	<i>Spill Protection Elevation</i>
1S, 2S	Pond 2 (Day-1 only)	5.5	1293.2
3/4S	Pond 4 (Day-1 & -N)	8.1	1292.8
5S, 6S, 7S	Pond 7 (Day-N)	23.7	1284.4*
1S, 2S, 8S	Pond 8 (Day-N)	6.9	1286.4

*0.6 feet of freeboard

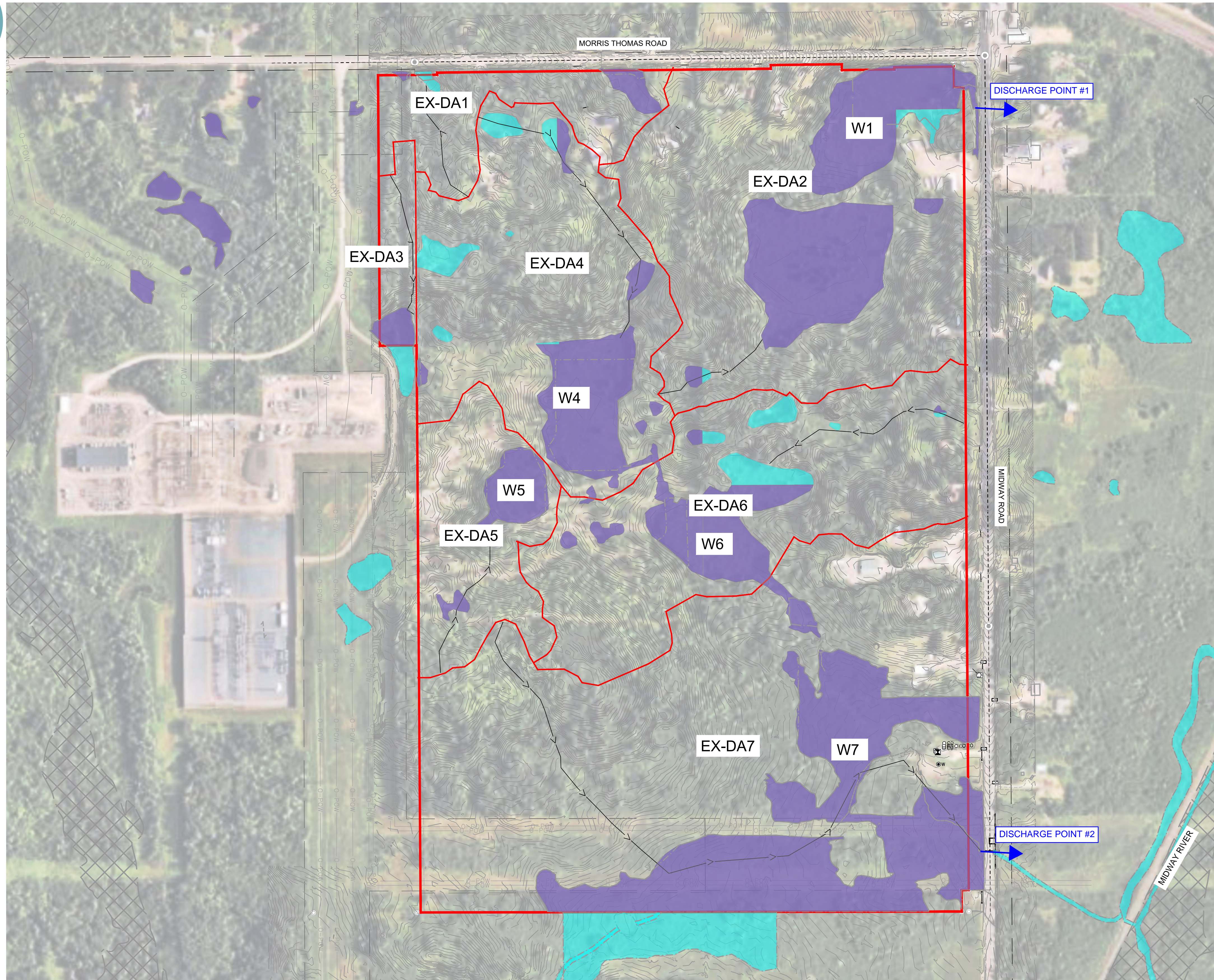
Appendices

Appendix 1.	Existing Conditions Drainage Map
Appendix 2.	Proposed Conditions Drainage Map
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Appendix 1. Existing Conditions Drainage Map

HERMANTOWN INDUSTRIAL - EXISTING CONDITIONS DRAINAGE MAP

HERMANTOWN, MN
ST. LOUIS COUNTY

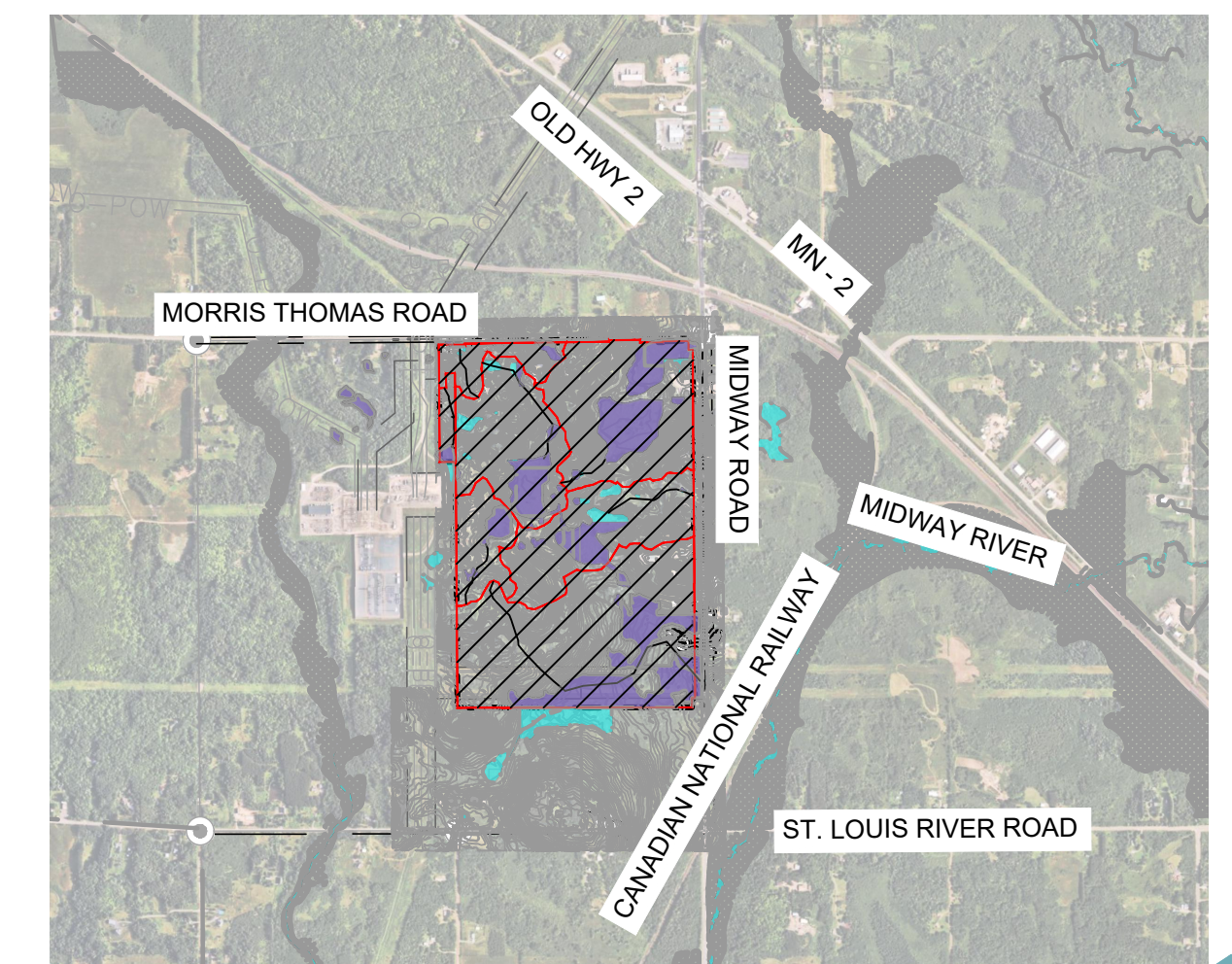


EXISTING DRAINAGE AREAS	
TIME OF CONCENTRATION FLOWPATH	
EXISTING WETLAND PER PUBLICLY AVAILABLE DATA	
PRELIMINARY EXISTING WETLAND DELINEATION	
EXISTING LIDAR CONTOURS	
EXISTING PARCEL LINES	

***NOTE:**

- STORMWATER CONVEYANCE AND TREATMENT IS SCHEMATIC AND WILL BE FURTHER REFINED
- FEMA FLOODZONE INFORMATION SHOWN PER FEMA FLOOD MAP #2707080010B
- WETLAND AND WATERWAY INFORMATION SHOWN PER U.S. FISH & WILDLIFE SERVICE NATIONAL WETLANDS INVENTORY

VICINITY MAP: NOT TO SCALE

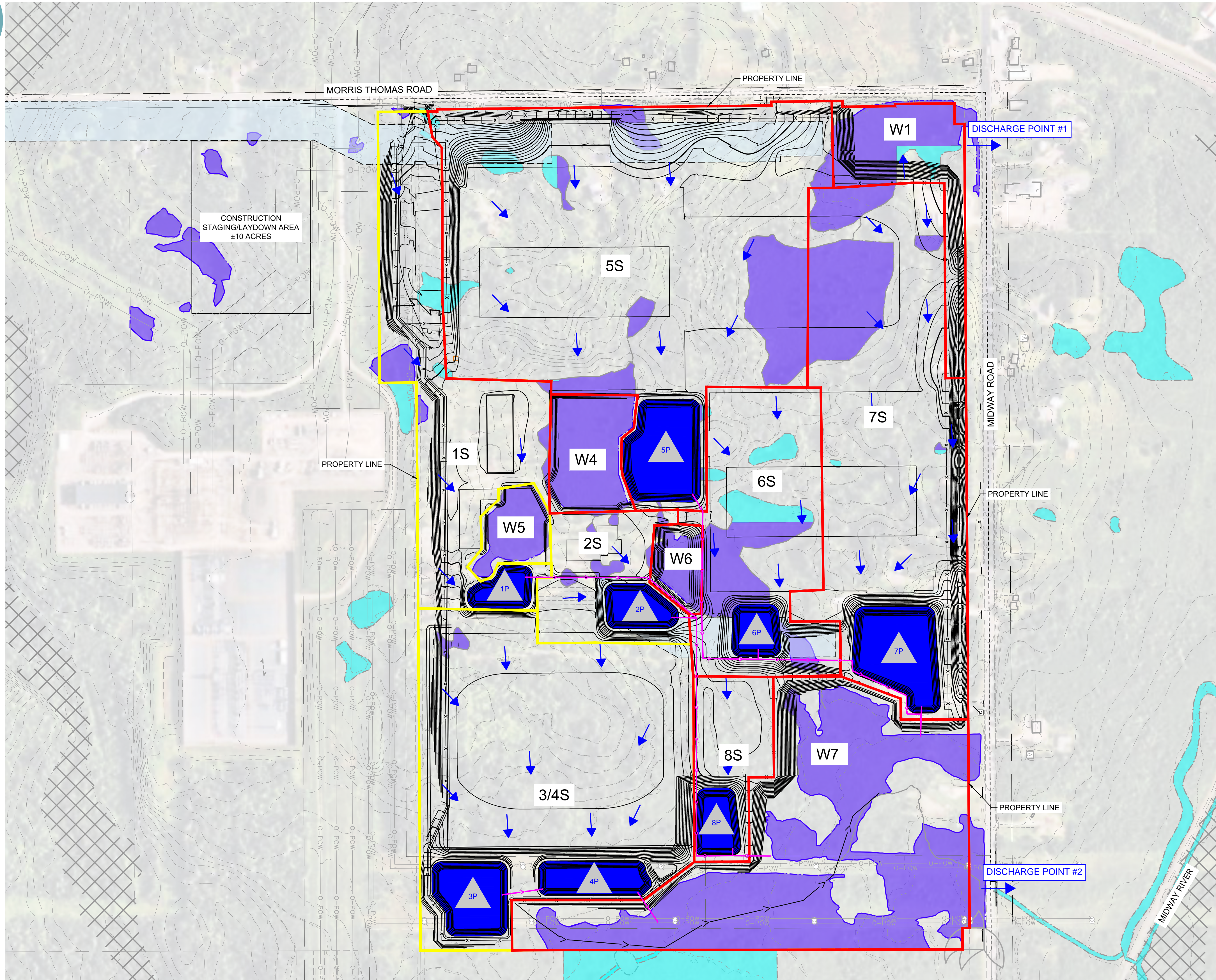


Appendix 2. Proposed Conditions Drainage Map

HERMANTOWN INDUSTRIAL - PROPOSED CONDITIONS

HERMANTOWN, MN
ST. LOUIS COUNTY

DRAINAGE MAP



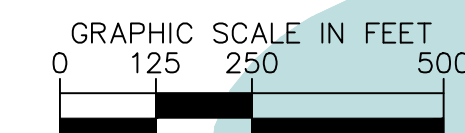
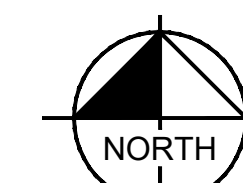
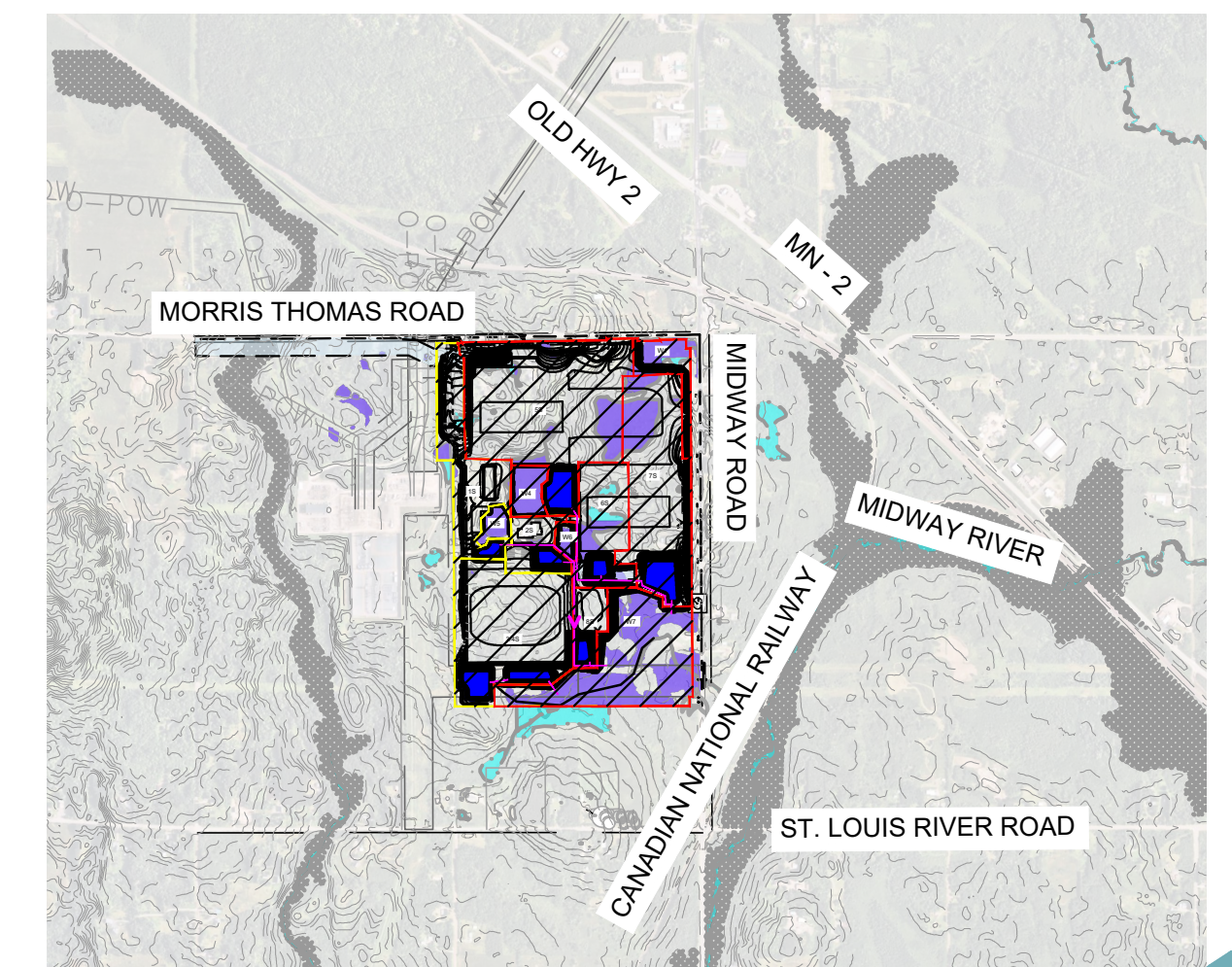
LEGEND

DRAINAGE AREAS - DAY 1	
DRAINAGE AREAS - DAY N	
PROPOSED STORMWATER POND	
PROPOSED STORMWATER CONVEYANCE	
EXISTING WETLAND PER PUBLICLY AVAILABLE DATA	
PRELIMINARY EXISTING WETLAND DELINEATION	
EXISTING LIDAR CONTOURS	
PROPOSED CONTOURS	
EXISTING PARCEL LINES	

***NOTE:**

- STORMWATER CONVEYANCE AND TREATMENT IS SCHEMATIC AND WILL BE FURTHER REFINED
- FEMA FLOODZONE INFORMATION SHOWN PER FEMA FLOOD MAP #2707080010B
- WETLAND AND WATERWAY INFORMATION SHOWN PER U.S. FISH & WILDLIFE SERVICE NATIONAL WETLANDS INVENTORY

VICINITY MAP: NOT TO SCALE



Kimley»Horn

08.06.2025

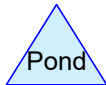
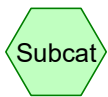
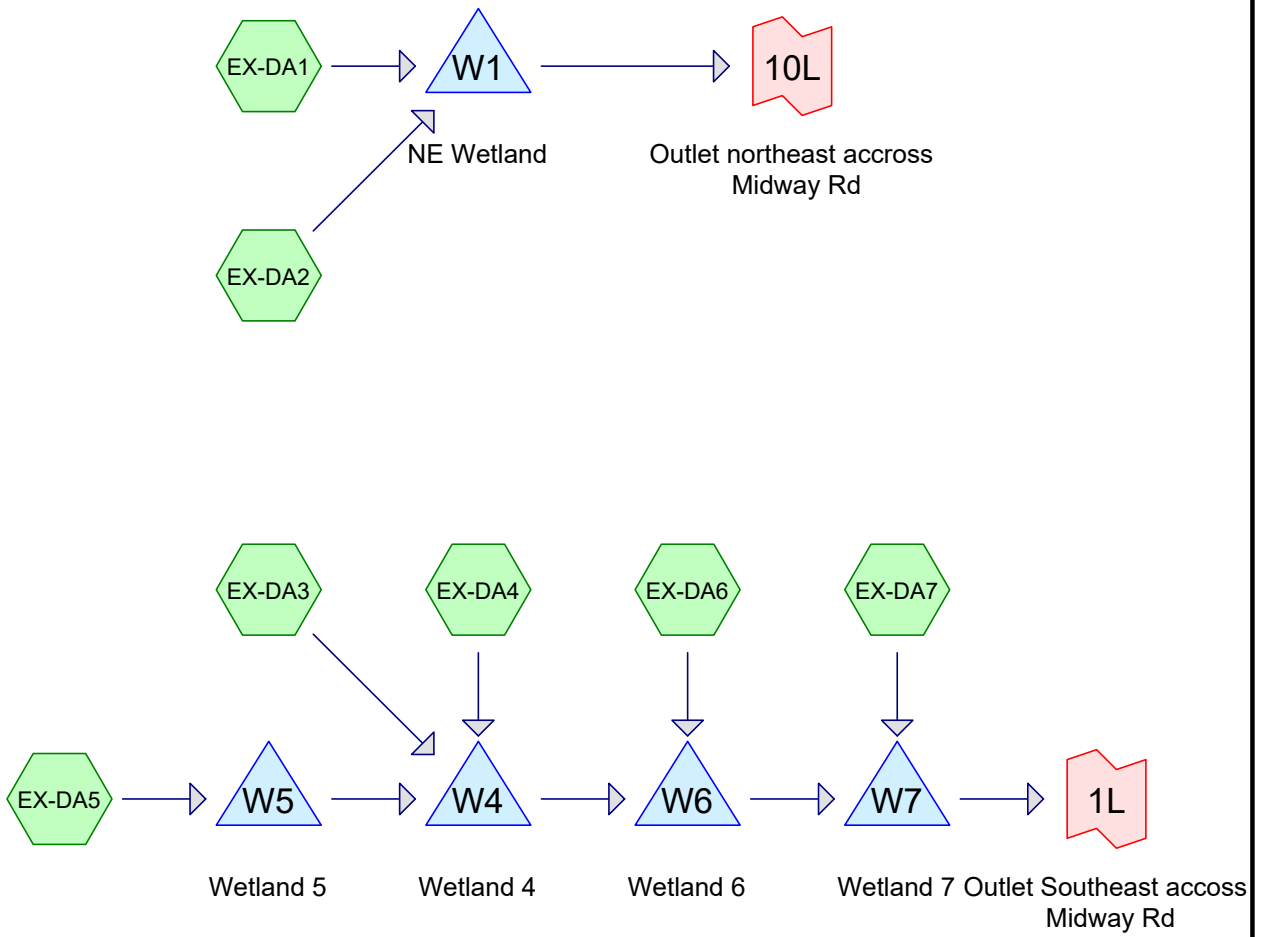
Appendix 3. Stormwater Summary Table

Hermantown Industrial Stormwater Treatment Summary Table

Day-1							
	Impervious Area (ac)	Total Drainage Area (ac)	Water Quality Volume (ac-ft) ¹	Filtration Volume Provided (ac-ft) ²	25-yr, 6-hr runoff Volume (ac-ft) ³	100-yr, 24-hr runoff Volume (ac-ft)	Provided Volume (ac-ft) ⁴
Pond 1	8.8	20.7	0.7	0.8	3.7	8.1	6.3
Pond 2	5.3	8.3	0.4	1.2	1.8	3.6	8.8
Pond 3+4	22.3	39	1.9	4.2	8.1	16.7	21.0
Total	36.4	68.0	3.0	6.2	13.6	28.4	36.1
Day-N							
	Impervious Area (ac)	Total Drainage Area (ac)	Water Quality Volume (ac-ft) ¹	Filtration Volume Provided (ac-ft) ²	25-yr, 6-hr runoff Volume (ac-ft) ³	100-yr, 24-hr runoff Volume (ac-ft)	Provided Volume (ac-ft) ⁴
Pond 5	38.5	56.5	3.2	3.79	12.5	25.2	24.9
Pond 6	11.6	16.3	1.0	1.02	4.1	8	7.5
Pond 7	21.5	37.1	1.8	2.80	7.1	15	18.2
Pond 8	3.3	7.9	0.3	1.22	1.4	3.1	8.9
Total	74.9	117.8	6.2	8.8	25.1	51.3	59.5
Total Site Draining to Ponds							
	Impervious Area (ac)	Total Drainage Area (ac)	Water Quality Volume (ac-ft) ¹	Filtration Volume Provided (ac-ft) ²	25-yr, 6-hr runoff Volume (ac-ft) ³	100-yr, 24-hr runoff Volume (ac-ft)	Provided Volume (ac-ft) ⁴
Total	111.3	185.80	9.3	15.0	38.7	79.7	95.6
Notes:							
General Note: Drainage areas and impervious areas will be refined as the onsite site storm sewer is designed and final grading is complete. Using multiple basins in series is an acceptable method for complete treatment and is described in the Minnesota Stormwater Manual.							
1: Water Quality Volume (WQv) Calculated as 1" times the impervious drainage area							
2: Calculated as the bottom area times a ponding depth of 1.6' (Used to comply with a drawdown time of 24 hours based on a filtration rate of 0.8 in/hr for sand)							
3: Used as Minimum Spill Protection volume if gate valves are closed							
4: Top contour of area shown on map with 10' safety bench and ponding depth of 8' with side 3:1 slopes							

Appendix 4. Pre Development HydroCAD Model Analysis

Existing Conditions



2025-0717- Hermantown Industrial - Existing

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Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
5.730	98	Unconnected pavement, HSG C (EX-DA1, EX-DA2, EX-DA4, EX-DA6, EX-DA7)
228.270	70	Woods, Good, HSG C (EX-DA1, EX-DA2, EX-DA3, EX-DA4, EX-DA5, EX-DA6, EX-DA7)
234.000	71	TOTAL AREA

2025-0717- Hermantown Industrial - Existing

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Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
234.000	HSG C	EX-DA1, EX-DA2, EX-DA3, EX-DA4, EX-DA5, EX-DA6, EX-DA7
0.000	HSG D	
0.000	Other	
234.000		TOTAL AREA

2025-0717- Hermantown Industrial - Existing

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Ground Covers (selected 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	5.730	0.000	0.000	5.730	Unconnected pavement	EX-DA1, EX-DA2, EX-DA4, EX-DA6, EX-DA7
0.000	0.000	228.270	0.000	0.000	228.270	Woods, Good	EX-DA1, EX-DA2, EX-DA3, EX-DA4, EX-DA5, EX-DA6, EX-DA7
0.000	0.000	234.000	0.000	0.000	234.000	TOTAL AREA	

2025-0717- Hermantown Industrial - Existing

MSE 24-hr 3 2-yr Rainfall=2.70"

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Time span=0.00-60.00 hrs, dt=0.02 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Sim-Route method - Pond routing by Sim-Route method

SubcatchmentEX-DA1: Runoff Area=10.000 ac 7.30% Impervious Runoff Depth=0.59"
Flow Length=590' Tc=26.5 min UI Adjusted CN=71 Runoff=4.90 cfs 0.495 af

SubcatchmentEX-DA2: Runoff Area=50.100 ac 3.19% Impervious Runoff Depth=0.55"
Flow Length=568' Tc=42.4 min UI Adjusted CN=70 Runoff=16.86 cfs 2.314 af

SubcatchmentEX-DA3: Runoff Area=3.500 ac 0.00% Impervious Runoff Depth=0.55"
Flow Length=330' Tc=32.4 min CN=70 Runoff=1.38 cfs 0.162 af

SubcatchmentEX-DA4: Runoff Area=36.000 ac 0.78% Impervious Runoff Depth=0.55"
Flow Length=1,450' Tc=76.4 min CN=70 Runoff=8.20 cfs 1.662 af

SubcatchmentEX-DA5: Runoff Area=14.900 ac 0.00% Impervious Runoff Depth=0.55"
Flow Length=720' Tc=40.4 min CN=70 Runoff=5.17 cfs 0.688 af

SubcatchmentEX-DA6: Runoff Area=36.200 ac 0.97% Impervious Runoff Depth=0.55"
Flow Length=1,000' Tc=92.4 min CN=70 Runoff=7.19 cfs 1.672 af

SubcatchmentEX-DA7: Runoff Area=83.300 ac 3.33% Impervious Runoff Depth=0.55"
Flow Length=3,350' Tc=108.0 min UI Adjusted CN=70 Runoff=15.04 cfs 3.847 af

Pond W1: NE Wetland Peak Elev=1,273.40' Storage=22,377 cf Inflow=20.29 cfs 2.809 af
Outflow=11.47 cfs 2.809 af

Pond W4: Wetland 4 Peak Elev=1,296.16' Storage=32,461 cf Inflow=12.34 cfs 2.512 af
Outflow=7.15 cfs 2.509 af

Pond W5: Wetland 5 Peak Elev=1,299.07' Storage=5,163 cf Inflow=5.17 cfs 0.688 af
Outflow=3.98 cfs 0.688 af

Pond W6: Wetland 6 Peak Elev=1,285.07' Storage=10,782 cf Inflow=13.68 cfs 4.181 af
Outflow=13.38 cfs 4.180 af

Pond W7: Wetland 7 Peak Elev=1,258.19' Storage=8,538 cf Inflow=28.32 cfs 8.027 af
Outflow=27.91 cfs 8.027 af

Link 1L: Outlet Southeast accross Midway Rd Inflow=27.91 cfs 8.027 af
Primary=27.91 cfs 8.027 af

Link 10L: Outlet northeast accross Midway Rd Inflow=11.47 cfs 2.809 af
Primary=11.47 cfs 2.809 af

Total Runoff Area = 234.000 ac Runoff Volume = 10.839 af Average Runoff Depth = 0.56"
97.55% Pervious = 228.270 ac 2.45% Impervious = 5.730 ac

Summary for Subcatchment EX-DA1:

Runoff = 4.90 cfs @ 12.44 hrs, Volume= 0.495 af, Depth= 0.59"
 Routed to Pond W1 : NE Wetland

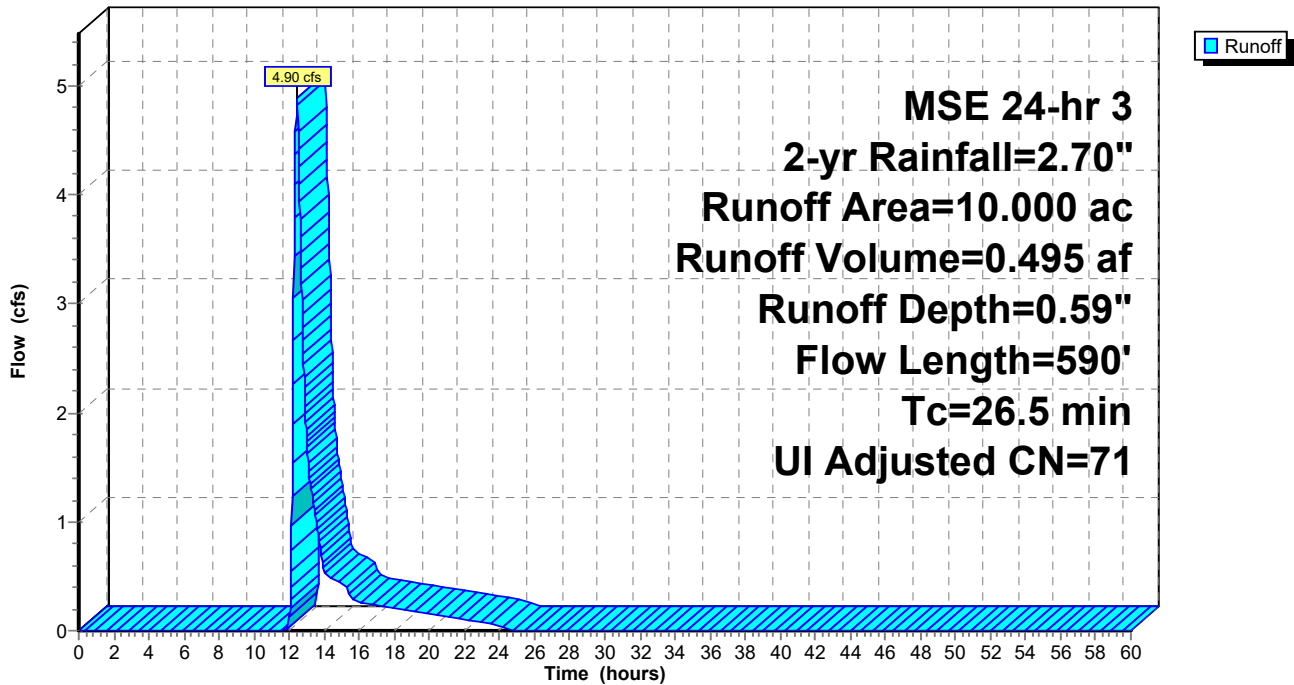
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 2-yr Rainfall=2.70"

Area (ac)	CN	Adj	Description
0.730	98		Unconnected pavement, HSG C
9.270	70		Woods, Good, HSG C
10.000	72	71	Weighted Average, UI Adjusted
9.270			92.70% Pervious Area
0.730			7.30% Impervious Area
0.730			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	100	0.0730	0.18		Sheet Flow, Grass: Dense n= 0.240 P2= 2.70"
17.2	490	0.0360	0.47		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
26.5	590	Total			

Subcatchment EX-DA1:

Hydrograph



Summary for Subcatchment EX-DA2:

Runoff = 16.86 cfs @ 12.68 hrs, Volume= 2.314 af, Depth= 0.55"
 Routed to Pond W1 : NE Wetland

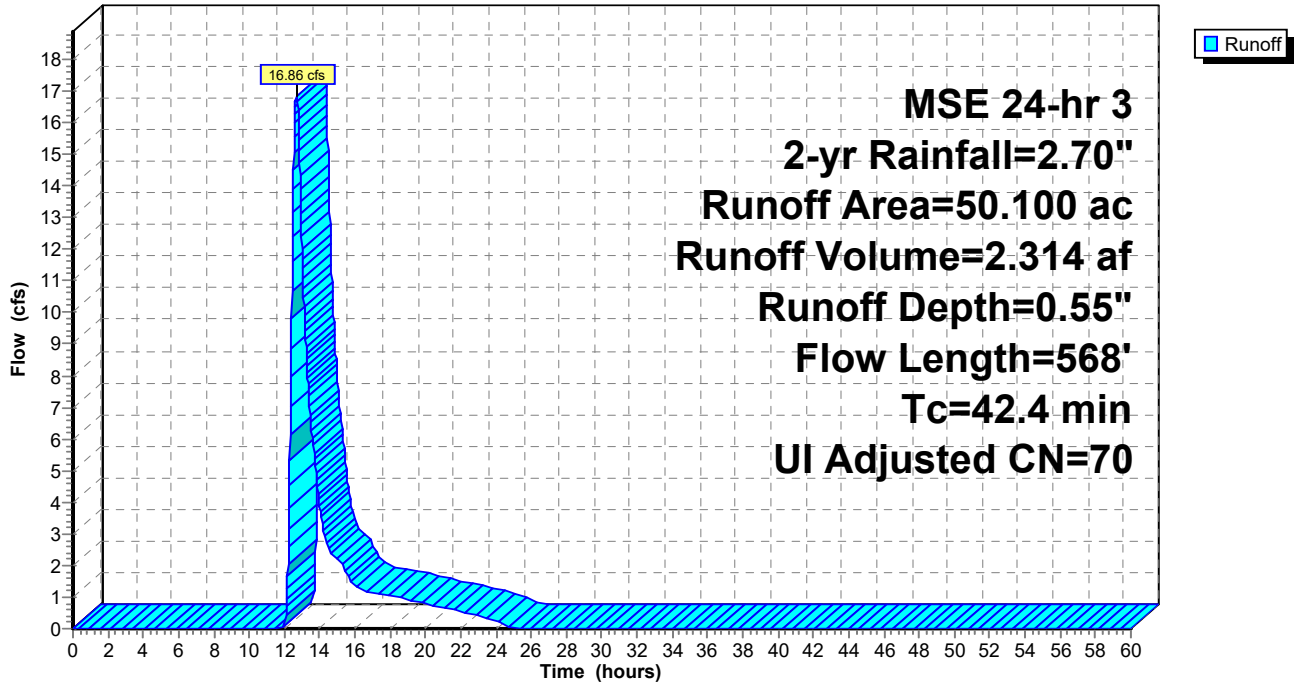
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 2-yr Rainfall=2.70"

Area (ac)	CN	Adj	Description
1.600	98		Unconnected pavement, HSG C
48.500	70		Woods, Good, HSG C
50.100	71	70	Weighted Average, UI Adjusted
48.500			96.81% Pervious Area
1.600			3.19% Impervious Area
1.600			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.2	100	0.0500	0.06		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.70"
14.2	468	0.0480	0.55		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
42.4	568	Total			

Subcatchment EX-DA2:

Hydrograph



Summary for Subcatchment EX-DA3:

Runoff = 1.38 cfs @ 12.52 hrs, Volume= 0.162 af, Depth= 0.55"
 Routed to Pond W4 : Wetland 4

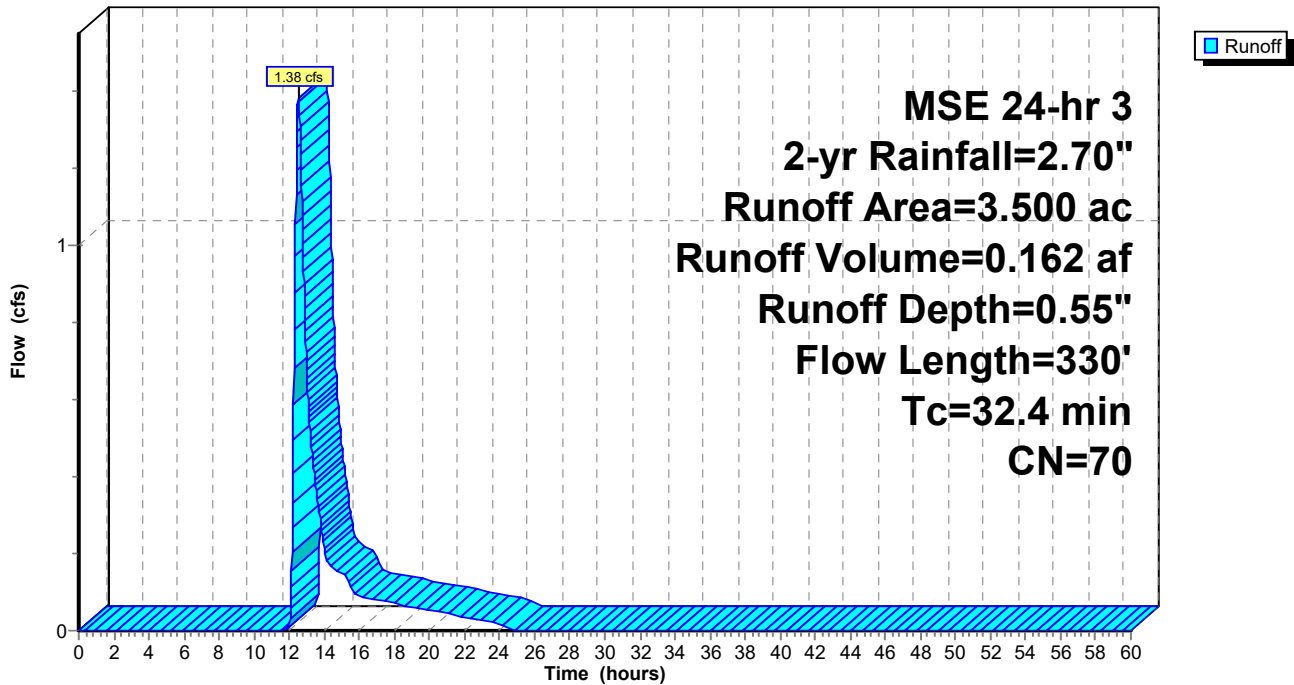
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 2-yr Rainfall=2.70"

Area (ac)	CN	Description
0.000	98	Unconnected pavement, HSG C
3.500	70	Woods, Good, HSG C
3.500	70	Weighted Average
3.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.8	100	0.0520	0.06		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.70"
4.6	230	0.1100	0.83		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
32.4	330	Total			

Subcatchment EX-DA3:

Hydrograph



Summary for Subcatchment EX-DA4:

Runoff = 8.20 cfs @ 13.17 hrs, Volume= 1.662 af, Depth= 0.55"
 Routed to Pond W4 : Wetland 4

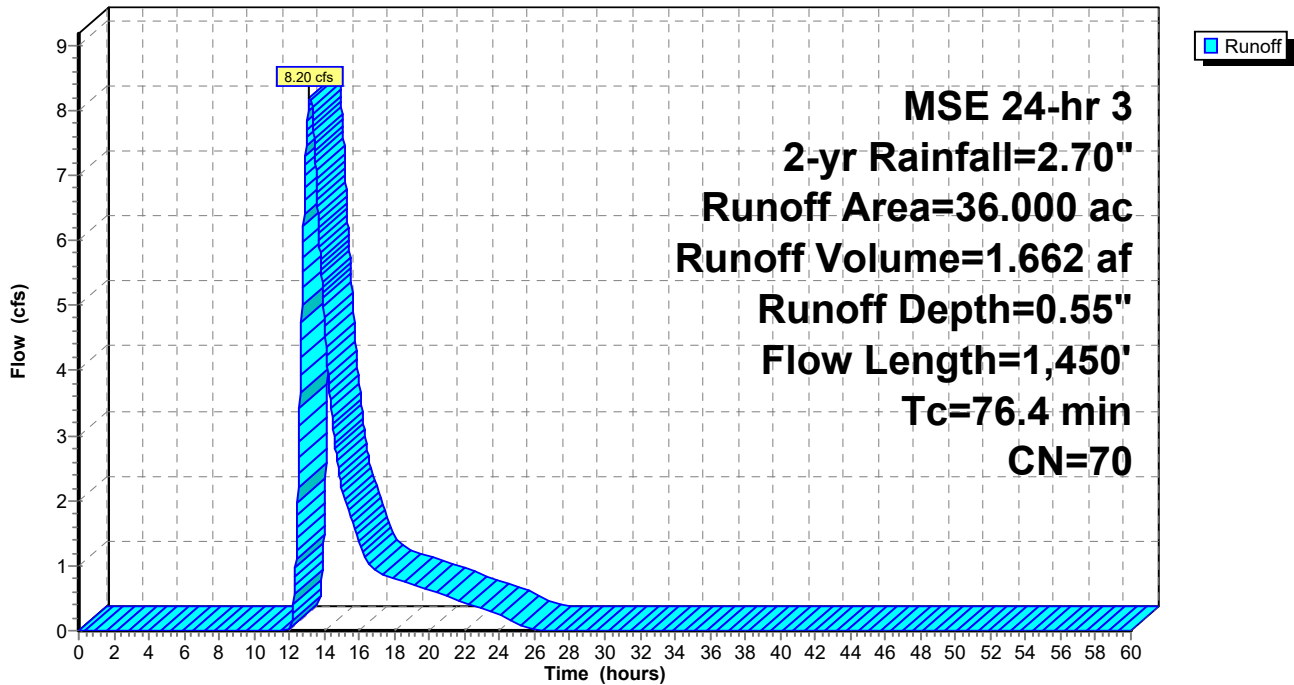
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 2-yr Rainfall=2.70"

Area (ac)	CN	Description
0.280	98	Unconnected pavement, HSG C
35.720	70	Woods, Good, HSG C
36.000	70	Weighted Average
35.720		99.22% Pervious Area
0.280		0.78% Impervious Area
0.280		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.8	100	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 2.70"
45.6	1,350	0.0390	0.49		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
76.4	1,450	Total			

Subcatchment EX-DA4:

Hydrograph



Summary for Subcatchment EX-DA5:

Runoff = 5.17 cfs @ 12.64 hrs, Volume= 0.688 af, Depth= 0.55"
 Routed to Pond W5 : Wetland 5

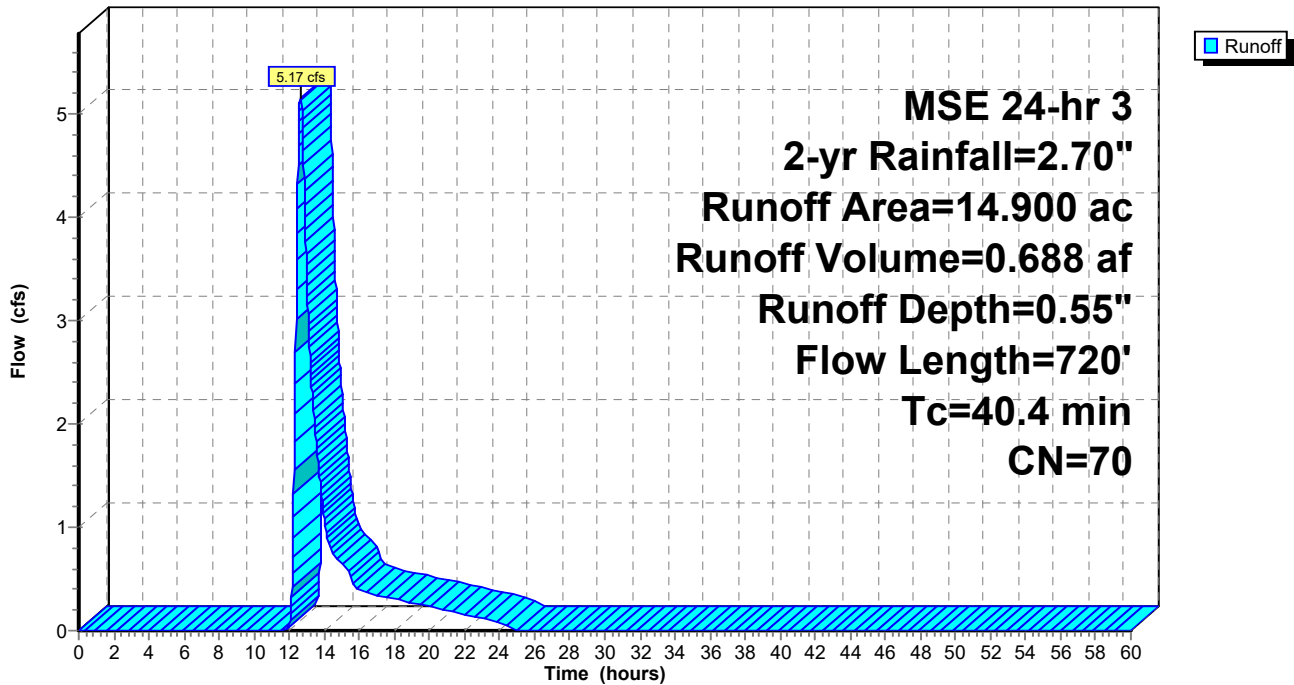
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 2-yr Rainfall=2.70"

Area (ac)	CN	Description
0.000	98	Unconnected pavement, HSG C
14.900	70	Woods, Good, HSG C
14.900	70	Weighted Average
14.900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	100	0.0380	0.05		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.70"
8.9	620	0.0540	1.16		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
40.4	720	Total			

Subcatchment EX-DA5:

Hydrograph



Summary for Subcatchment EX-DA6:

Runoff = 7.19 cfs @ 13.44 hrs, Volume= 1.672 af, Depth= 0.55"
 Routed to Pond W6 : Wetland 6

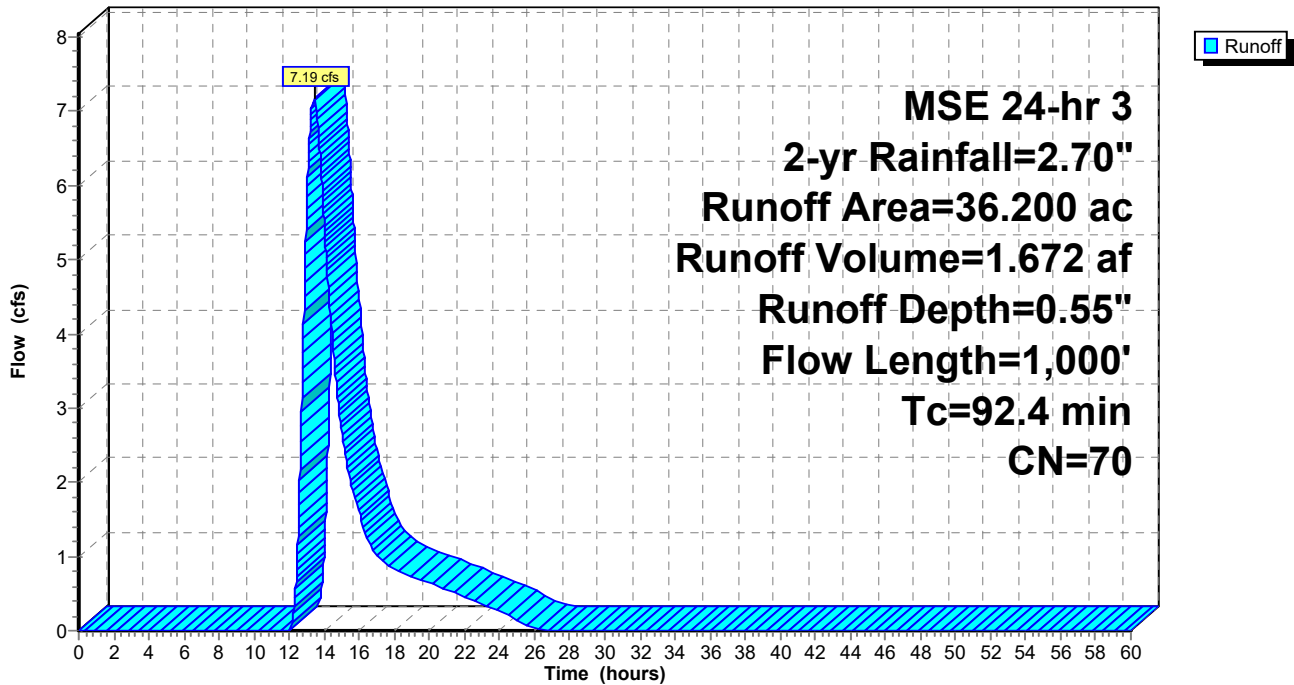
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 2-yr Rainfall=2.70"

Area (ac)	CN	Description
0.350	98	Unconnected pavement, HSG C
35.850	70	Woods, Good, HSG C
36.200	70	Weighted Average
35.850		99.03% Pervious Area
0.350		0.97% Impervious Area
0.350		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
53.7	100	0.0100	0.03		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.70"
38.7	900	0.0240	0.39		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
92.4	1,000	Total			

Subcatchment EX-DA6:

Hydrograph



Summary for Subcatchment EX-DA7:

Runoff = 15.04 cfs @ 13.68 hrs, Volume= 3.847 af, Depth= 0.55"
 Routed to Pond W7 : Wetland 7

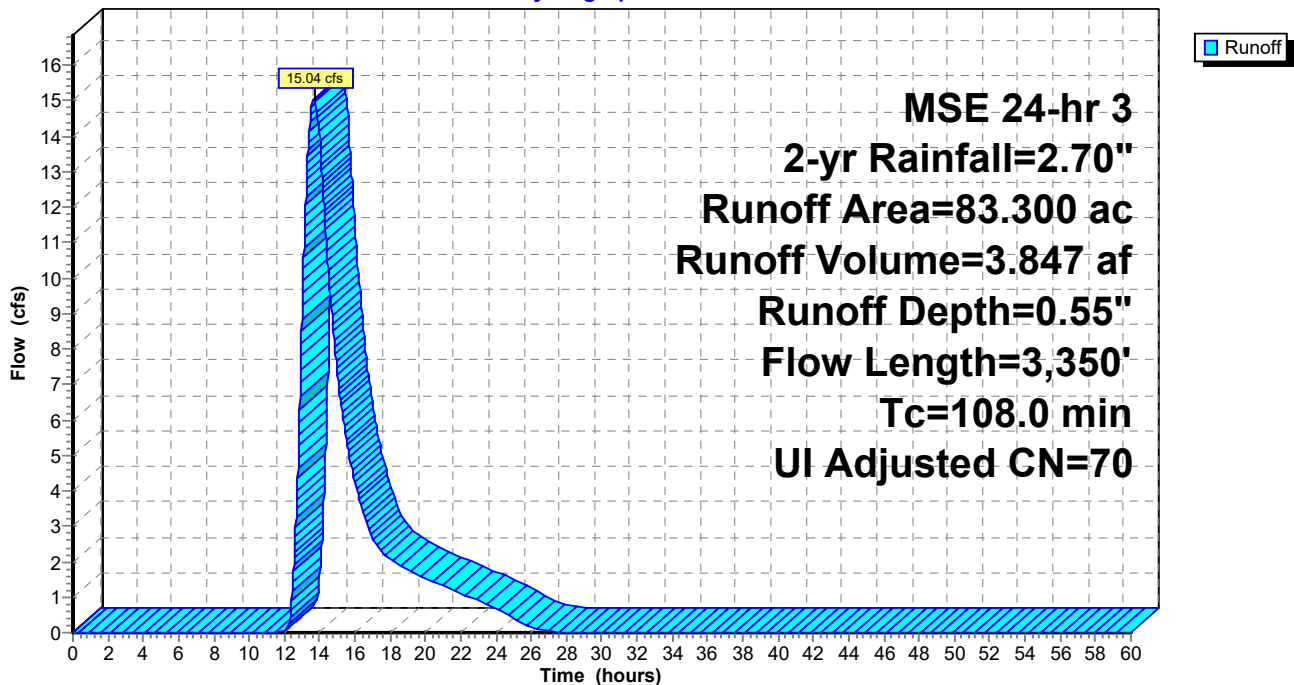
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 2-yr Rainfall=2.70"

Area (ac)	CN	Adj	Description
2.770	98		Unconnected pavement, HSG C
80.530	70		Woods, Good, HSG C
83.300	71	70	Weighted Average, UI Adjusted
80.530			96.67% Pervious Area
2.770			3.33% Impervious Area
2.770			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
39.2	100	0.0220	0.04		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.70"
51.4	1,400	0.0330	0.45		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
17.4	1,850	0.0140	1.77		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
108.0	3,350	Total			

Subcatchment EX-DA7:

Hydrograph



Summary for Pond W1: NE Wetland

Inflow Area = 60.100 ac, 3.88% Impervious, Inflow Depth = 0.56" for 2-yr event
 Inflow = 20.29 cfs @ 12.64 hrs, Volume= 2.809 af
 Outflow = 11.47 cfs @ 13.14 hrs, Volume= 2.809 af, Atten= 43%, Lag= 30.3 min
 Primary = 11.47 cfs @ 13.14 hrs, Volume= 2.809 af
 Routed to Link 10L : Outlet northeast accross Midway Rd

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,273.40' @ 13.14 hrs Surf.Area= 90,648 sf Storage= 22,377 cf

Plug-Flow detention time= 18.3 min calculated for 2.808 af (100% of inflow)
 Center-of-Mass det. time= 18.3 min (898.3 - 880.0)

Volume	Invert	Avail.Storage	Storage Description
#1	1,272.00'	1,287,831 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,272.00	200	0	0
1,273.00	6,116	3,158	3,158
1,274.00	218,914	112,515	115,673
1,276.00	368,040	586,954	702,627
1,277.00	802,367	585,204	1,287,831

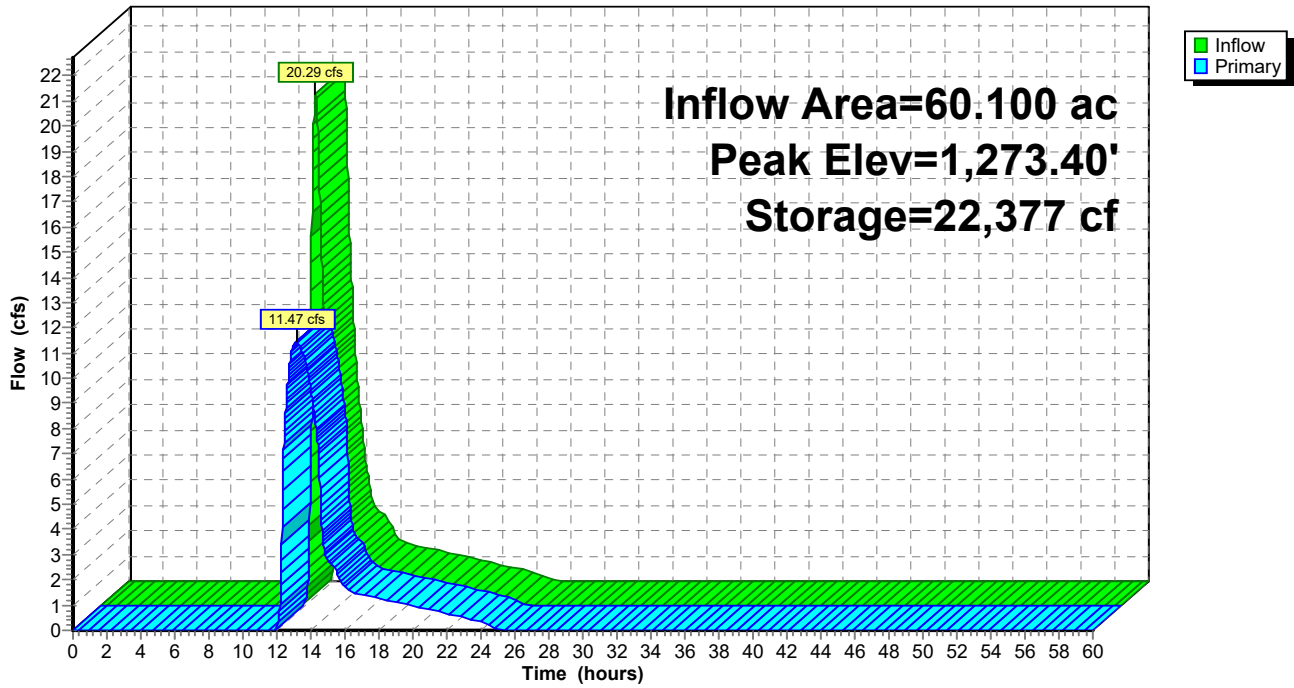
Device	Routing	Invert	Outlet Devices
#1	Primary	1,272.00'	36.0" Round Culvert L= 50.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,272.00' / 1,271.50' S= 0.0100 '/ Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf
#2	Primary	1,276.80'	42.0' long + 10.0 ' SideZ x 50.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=11.47 cfs @ 13.14 hrs HW=1,273.40' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Barrel Controls 11.47 cfs @ 5.21 fps)
- 2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond W1: NE Wetland

Hydrograph



Summary for Pond W4: Wetland 4

Inflow Area = 54.400 ac, 0.51% Impervious, Inflow Depth = 0.55" for 2-yr event
 Inflow = 12.34 cfs @ 13.07 hrs, Volume= 2.512 af
 Outflow = 7.15 cfs @ 13.92 hrs, Volume= 2.509 af, Atten= 42%, Lag= 50.8 min
 Primary = 7.15 cfs @ 13.92 hrs, Volume= 2.509 af
 Routed to Pond W6 : Wetland 6

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,296.16' @ 13.92 hrs Surf.Area= 206,209 sf Storage= 32,461 cf

Plug-Flow detention time= 111.1 min calculated for 2.508 af (100% of inflow)
 Center-of-Mass det. time= 110.6 min (1,023.3 - 912.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,296.00'	226,046 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

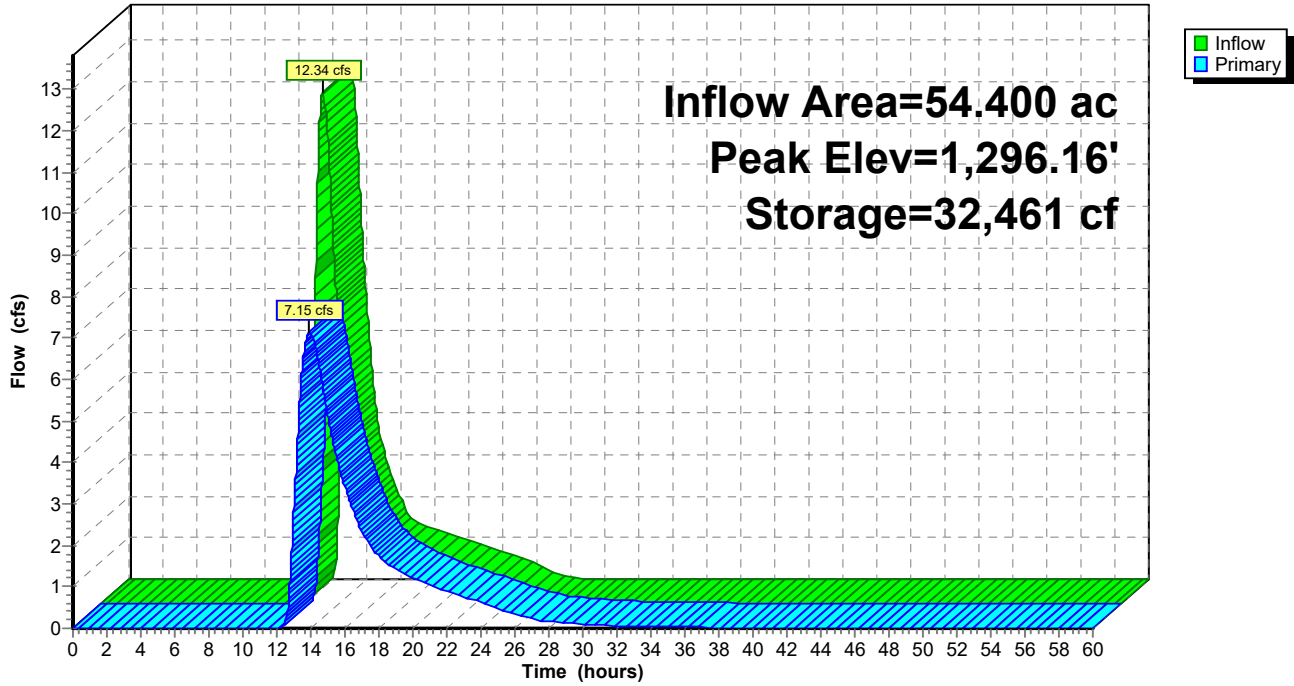
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,296.00	196,780	0	0
1,297.00	255,311	226,046	226,046

Device	Routing	Invert	Outlet Devices
#1	Primary	1,296.00'	40.0' long + 10.0 ' SideZ x 100.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=7.15 cfs @ 13.92 hrs HW=1,296.16' TW=1,285.07' (Dynamic Tailwater)
 ↑1=**Broad-Crested Rectangular Weir**(Weir Controls 7.15 cfs @ 1.07 fps)

Pond W4: Wetland 4

Hydrograph



Summary for Pond W5: Wetland 5

Inflow Area = 14.900 ac, 0.00% Impervious, Inflow Depth = 0.55" for 2-yr event
 Inflow = 5.17 cfs @ 12.64 hrs, Volume= 0.688 af
 Outflow = 3.98 cfs @ 12.91 hrs, Volume= 0.688 af, Atten= 23%, Lag= 16.3 min
 Primary = 3.98 cfs @ 12.91 hrs, Volume= 0.688 af
 Routed to Pond W4 : Wetland 4

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,299.07' @ 12.91 hrs Surf.Area= 75,910 sf Storage= 5,163 cf

Plug-Flow detention time= 35.4 min calculated for 0.688 af (100% of inflow)
 Center-of-Mass det. time= 35.7 min (917.0 - 881.3)

Volume	Invert	Avail.Storage	Storage Description
#1	1,299.00'	189,268 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

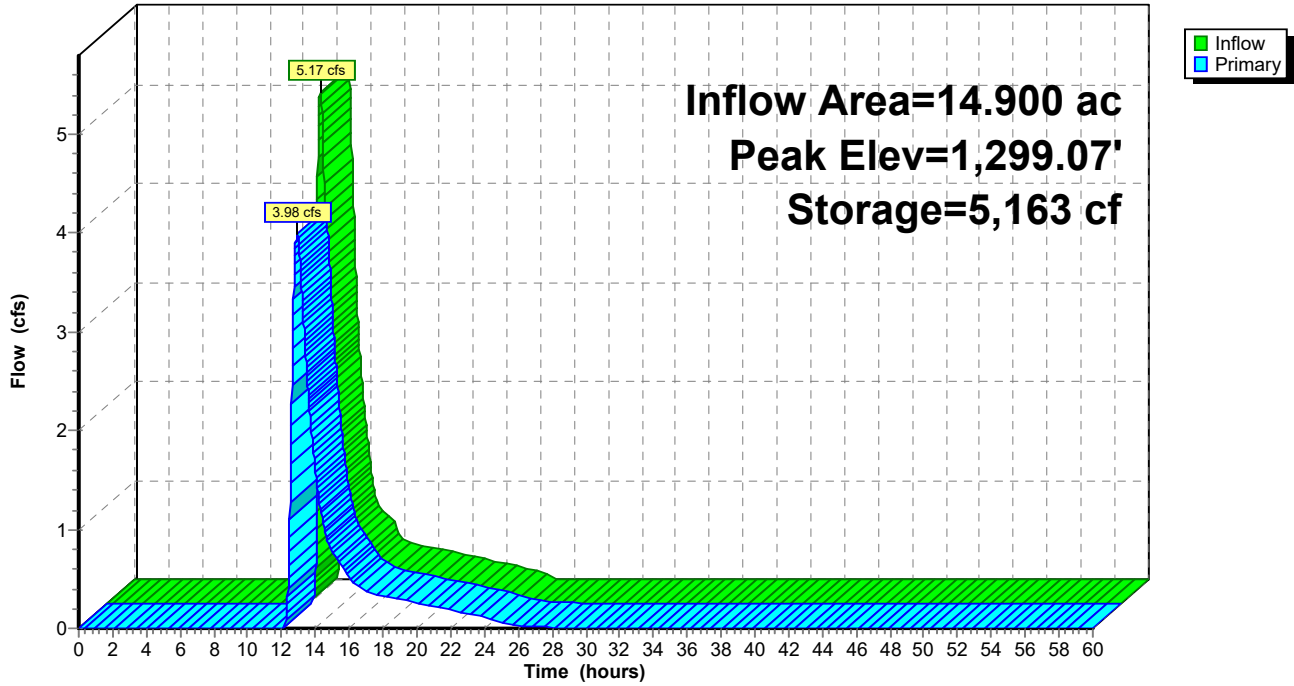
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,299.00	74,530	0	0
1,301.00	114,738	189,268	189,268

Device	Routing	Invert	Outlet Devices
#1	Primary	1,299.00'	82.0' long + 10.0 ' SideZ x 25.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=3.98 cfs @ 12.91 hrs HW=1,299.07' TW=1,296.07' (Dynamic Tailwater)
 ↑1=**Broad-Crested Rectangular Weir**(Weir Controls 3.98 cfs @ 0.70 fps)

Pond W5: Wetland 5

Hydrograph



Summary for Pond W6: Wetland 6

Inflow Area = 90.600 ac, 0.70% Impervious, Inflow Depth > 0.55" for 2-yr event
 Inflow = 13.68 cfs @ 13.64 hrs, Volume= 4.181 af
 Outflow = 13.38 cfs @ 13.80 hrs, Volume= 4.180 af, Atten= 2%, Lag= 9.5 min
 Primary = 13.38 cfs @ 13.80 hrs, Volume= 4.180 af
 Routed to Pond W7 : Wetland 7

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,285.07' @ 13.80 hrs Surf.Area= 155,712 sf Storage= 10,782 cf

Plug-Flow detention time= 20.2 min calculated for 4.180 af (100% of inflow)
 Center-of-Mass det. time= 19.8 min (1,005.5 - 985.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,285.00'	208,642 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

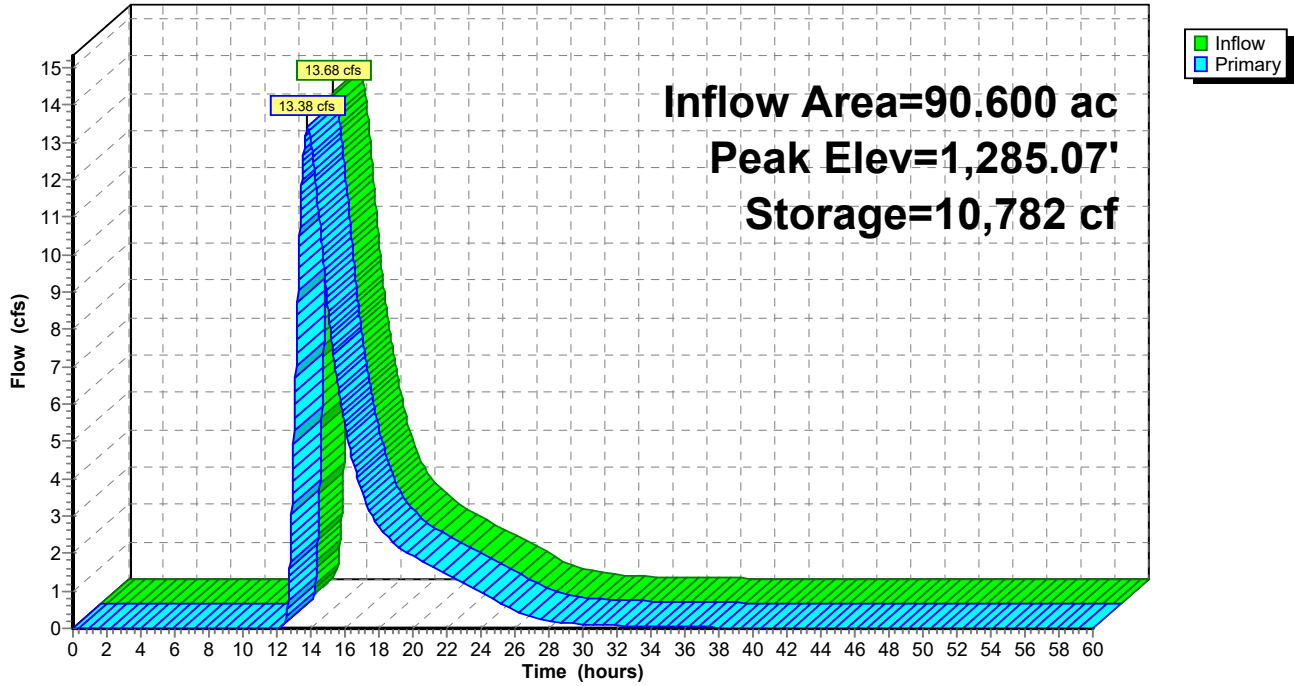
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,285.00	146,915	0	0
1,286.00	270,368	208,642	208,642

Device	Routing	Invert	Outlet Devices
#1	Primary	1,285.00'	262.0' long + 10.0 ' SideZ x 100.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=13.38 cfs @ 13.80 hrs HW=1,285.07' TW=1,258.18' (Dynamic Tailwater)
 ↑1=**Broad-Crested Rectangular Weir**(Weir Controls 13.38 cfs @ 0.72 fps)

Pond W6: Wetland 6

Hydrograph



Summary for Pond W7: Wetland 7

Inflow Area = 173.900 ac, 1.96% Impervious, Inflow Depth = 0.55" for 2-yr event
 Inflow = 28.32 cfs @ 13.74 hrs, Volume= 8.027 af
 Outflow = 27.91 cfs @ 13.89 hrs, Volume= 8.027 af, Atten= 1%, Lag= 8.7 min
 Primary = 27.91 cfs @ 13.89 hrs, Volume= 8.027 af
 Routed to Link 1L : Outlet Southeast access Midway Rd

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,258.19' @ 13.89 hrs Surf.Area= 11,199 sf Storage= 8,538 cf

Plug-Flow detention time= 3.8 min calculated for 8.027 af (100% of inflow)
 Center-of-Mass det. time= 3.8 min (980.0 - 976.2)

Volume	Invert	Avail.Storage	Storage Description
#1	1,256.00'	818,699 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,256.00	201	0	0
1,257.00	2,165	1,183	1,183
1,258.00	8,713	5,439	6,622
1,259.00	21,630	15,172	21,794
1,260.00	37,628	29,629	51,423
1,261.00	59,330	48,479	99,902
1,262.00	105,590	82,460	182,362
1,263.00	164,210	134,900	317,262
1,264.00	253,441	208,826	526,087
1,265.00	331,783	292,612	818,699

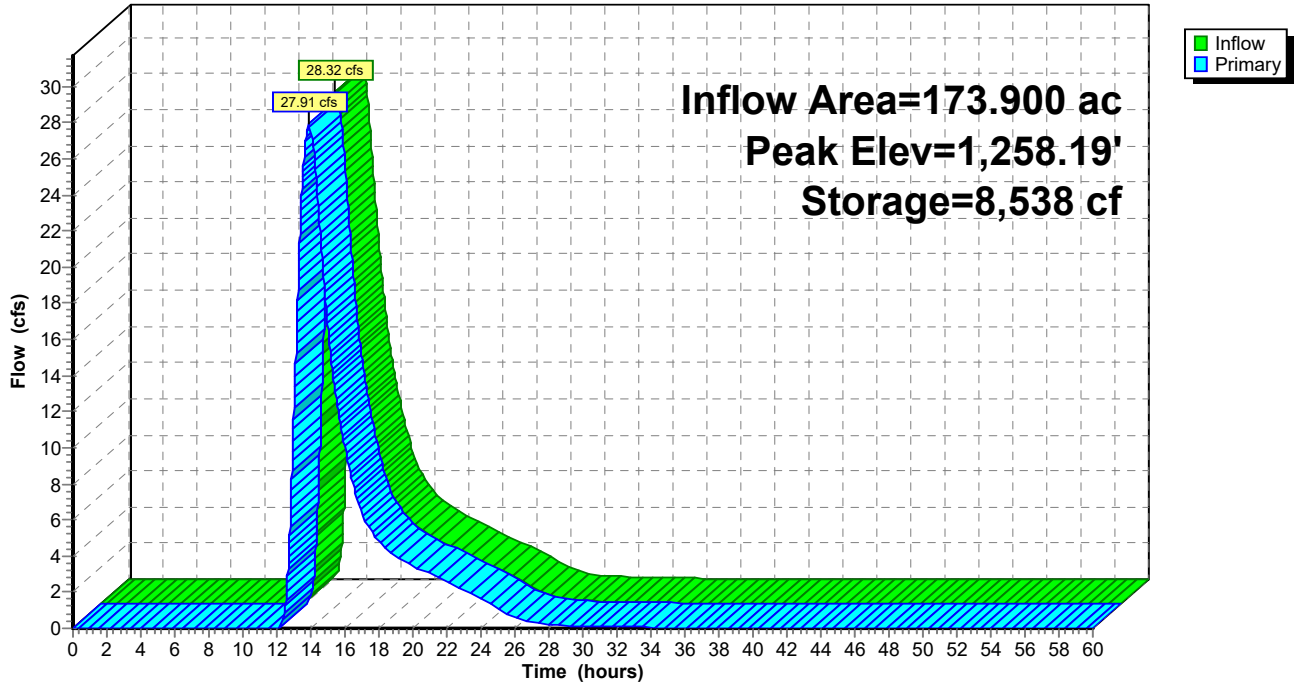
Device	Routing	Invert	Outlet Devices
#1	Primary	1,256.00'	36.0" Round Culvert L= 50.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,256.00' / 1,254.00' S= 0.0400 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf
#2	Primary	1,263.00'	300.0' long + 10.0 ' SideZ x 40.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=27.90 cfs @ 13.89 hrs HW=1,258.19' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Inlet Controls 27.90 cfs @ 5.04 fps)
- 2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond W7: Wetland 7

Hydrograph



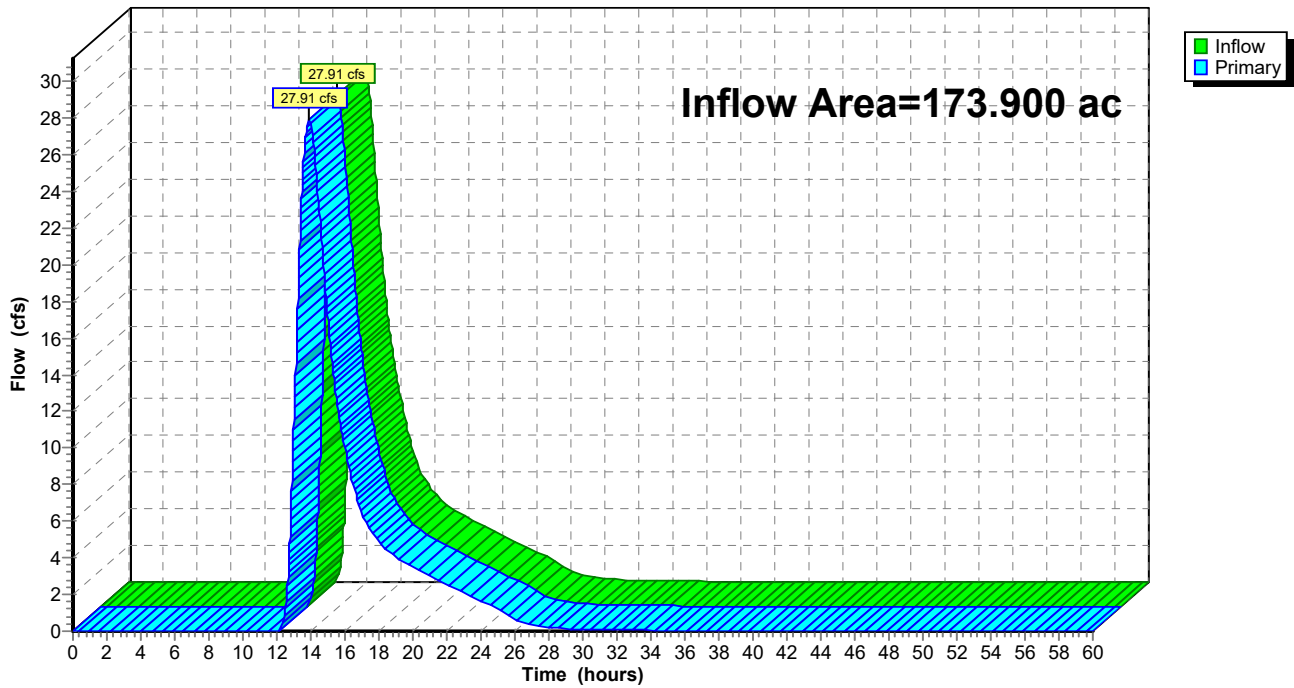
Summary for Link 1L: Outlet Southeast access Midway Rd

Inflow Area = 173.900 ac, 1.96% Impervious, Inflow Depth = 0.55" for 2-yr event
Inflow = 27.91 cfs @ 13.89 hrs, Volume= 8.027 af
Primary = 27.91 cfs @ 13.91 hrs, Volume= 8.027 af, Atten= 0%, Lag= 1.2 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

Link 1L: Outlet Southeast access Midway Rd

Hydrograph



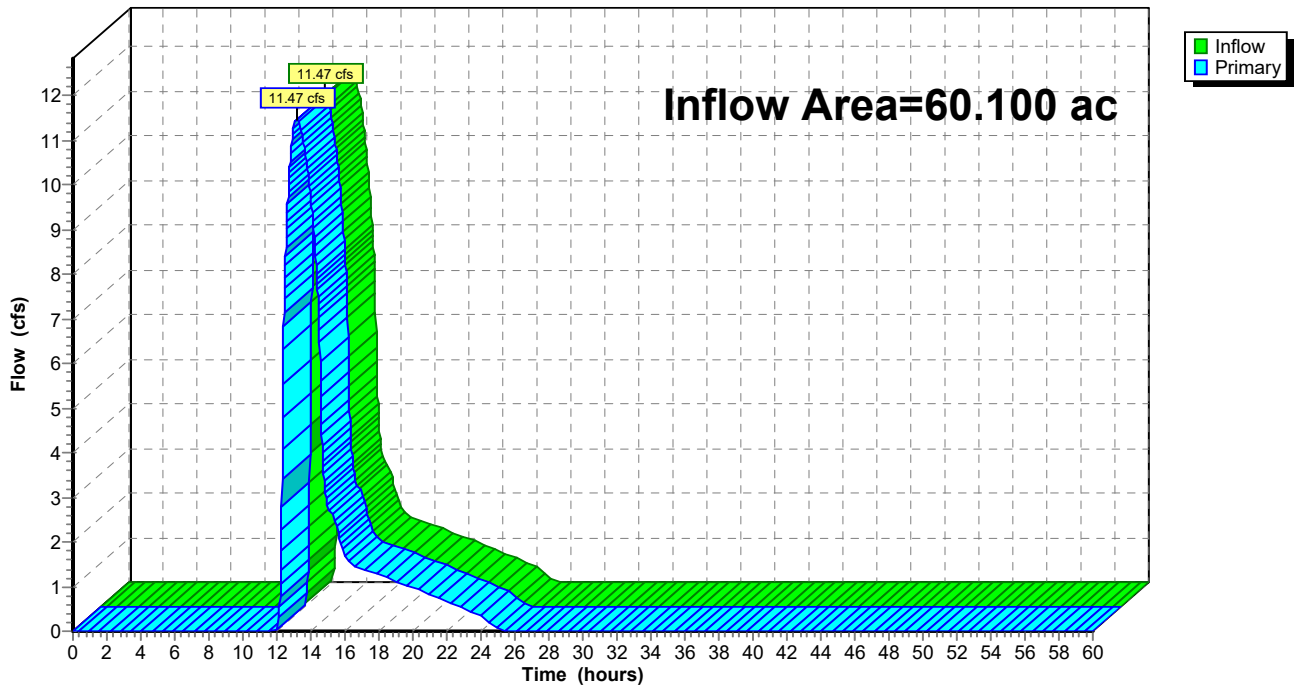
Summary for Link 10L: Outlet northeast accross Midway Rd

Inflow Area = 60.100 ac, 3.88% Impervious, Inflow Depth = 0.56" for 2-yr event
Inflow = 11.47 cfs @ 13.14 hrs, Volume= 2.809 af
Primary = 11.47 cfs @ 13.16 hrs, Volume= 2.809 af, Atten= 0%, Lag= 1.2 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

Link 10L: Outlet northeast accross Midway Rd

Hydrograph



2025-0717- Hermantown Industrial - Existing

MSE 24-hr 3 10-yr Rainfall=4.00"

Prepared by Kimley-Horn & Associates

Printed 7/30/2025

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Time span=0.00-60.00 hrs, dt=0.02 hrs, 3001 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Sim-Route method - Pond routing by Sim-Route method

SubcatchmentEX-DA1: Runoff Area=10.000 ac 7.30% Impervious Runoff Depth=1.39"
 Flow Length=590' Tc=26.5 min UI Adjusted CN=71 Runoff=12.90 cfs 1.162 af

SubcatchmentEX-DA2: Runoff Area=50.100 ac 3.19% Impervious Runoff Depth=1.33"
 Flow Length=568' Tc=42.4 min UI Adjusted CN=70 Runoff=45.74 cfs 5.551 af

SubcatchmentEX-DA3: Runoff Area=3.500 ac 0.00% Impervious Runoff Depth=1.33"
 Flow Length=330' Tc=32.4 min CN=70 Runoff=3.79 cfs 0.388 af

SubcatchmentEX-DA4: Runoff Area=36.000 ac 0.78% Impervious Runoff Depth=1.33"
 Flow Length=1,450' Tc=76.4 min CN=70 Runoff=22.02 cfs 3.989 af

SubcatchmentEX-DA5: Runoff Area=14.900 ac 0.00% Impervious Runoff Depth=1.33"
 Flow Length=720' Tc=40.4 min CN=70 Runoff=14.10 cfs 1.651 af

SubcatchmentEX-DA6: Runoff Area=36.200 ac 0.97% Impervious Runoff Depth=1.33"
 Flow Length=1,000' Tc=92.4 min CN=70 Runoff=19.28 cfs 4.011 af

SubcatchmentEX-DA7: Runoff Area=83.300 ac 3.33% Impervious Runoff Depth=1.33"
 Flow Length=3,350' Tc=108.0 min UI Adjusted CN=70 Runoff=40.11 cfs 9.230 af

Pond W1: NE Wetland Peak Elev=1,273.92' Storage=97,963 cf Inflow=55.21 cfs 6.713 af
 Outflow=19.38 cfs 6.713 af

Pond W4: Wetland 4 Peak Elev=1,296.34' Storage=70,331 cf Inflow=33.80 cfs 6.028 af
 Outflow=22.84 cfs 6.025 af

Pond W5: Wetland 5 Peak Elev=1,299.14' Storage=10,947 cf Inflow=14.10 cfs 1.651 af
 Outflow=12.19 cfs 1.651 af

Pond W6: Wetland 6 Peak Elev=1,285.15' Storage=23,439 cf Inflow=41.53 cfs 10.036 af
 Outflow=41.01 cfs 10.035 af

Pond W7: Wetland 7 Peak Elev=1,260.87' Storage=92,229 cf Inflow=81.11 cfs 19.265 af
 Outflow=62.46 cfs 19.265 af

Link 1L: Outlet Southeast accross Midway Rd Inflow=62.46 cfs 19.265 af
 Primary=62.46 cfs 19.265 af

Link 10L: Outlet northeast accross Midway Rd Inflow=19.38 cfs 6.713 af
 Primary=19.38 cfs 6.713 af

Total Runoff Area = 234.000 ac Runoff Volume = 25.982 af Average Runoff Depth = 1.33"
97.55% Pervious = 228.270 ac 2.45% Impervious = 5.730 ac

Summary for Subcatchment EX-DA1:

Runoff = 12.90 cfs @ 12.40 hrs, Volume= 1.162 af, Depth= 1.39"
 Routed to Pond W1 : NE Wetland

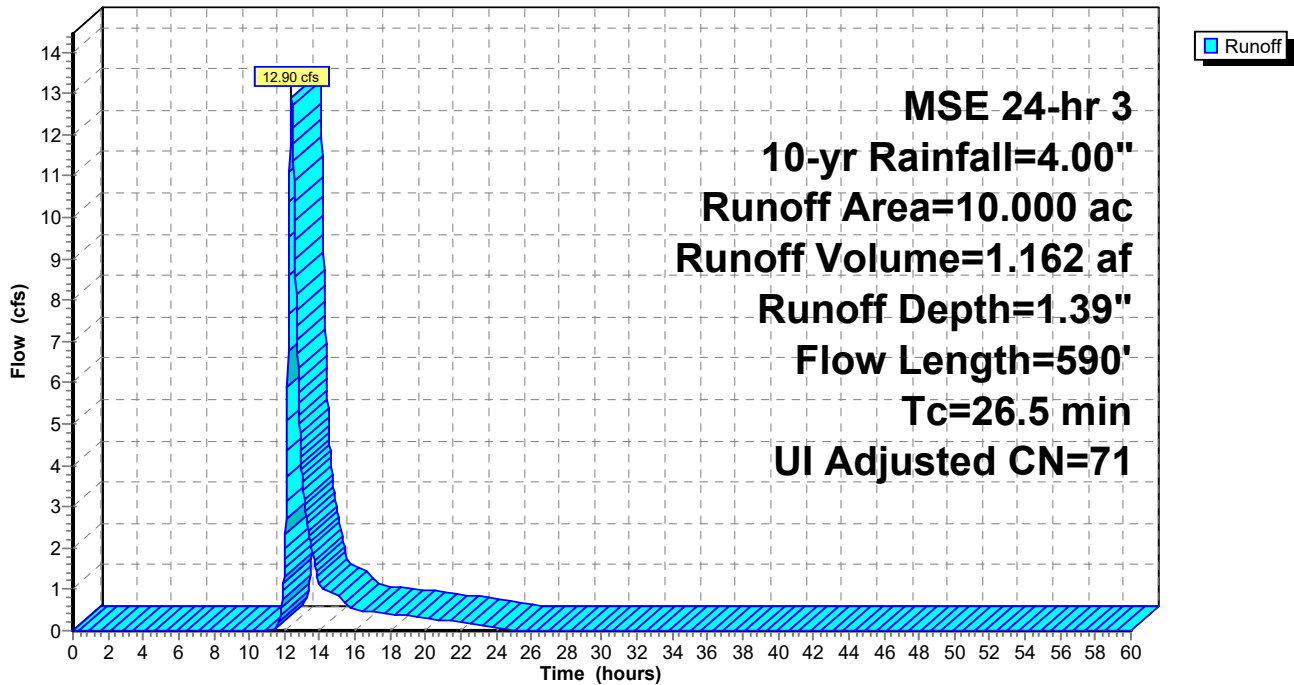
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 10-yr Rainfall=4.00"

Area (ac)	CN	Adj	Description
0.730	98		Unconnected pavement, HSG C
9.270	70		Woods, Good, HSG C
10.000	72	71	Weighted Average, UI Adjusted
9.270			92.70% Pervious Area
0.730			7.30% Impervious Area
0.730			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	100	0.0730	0.18		Sheet Flow, Grass: Dense n= 0.240 P2= 2.70"
17.2	490	0.0360	0.47		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
26.5	590	Total			

Subcatchment EX-DA1:

Hydrograph



Summary for Subcatchment EX-DA2:

Runoff = 45.74 cfs @ 12.63 hrs, Volume= 5.551 af, Depth= 1.33"
 Routed to Pond W1 : NE Wetland

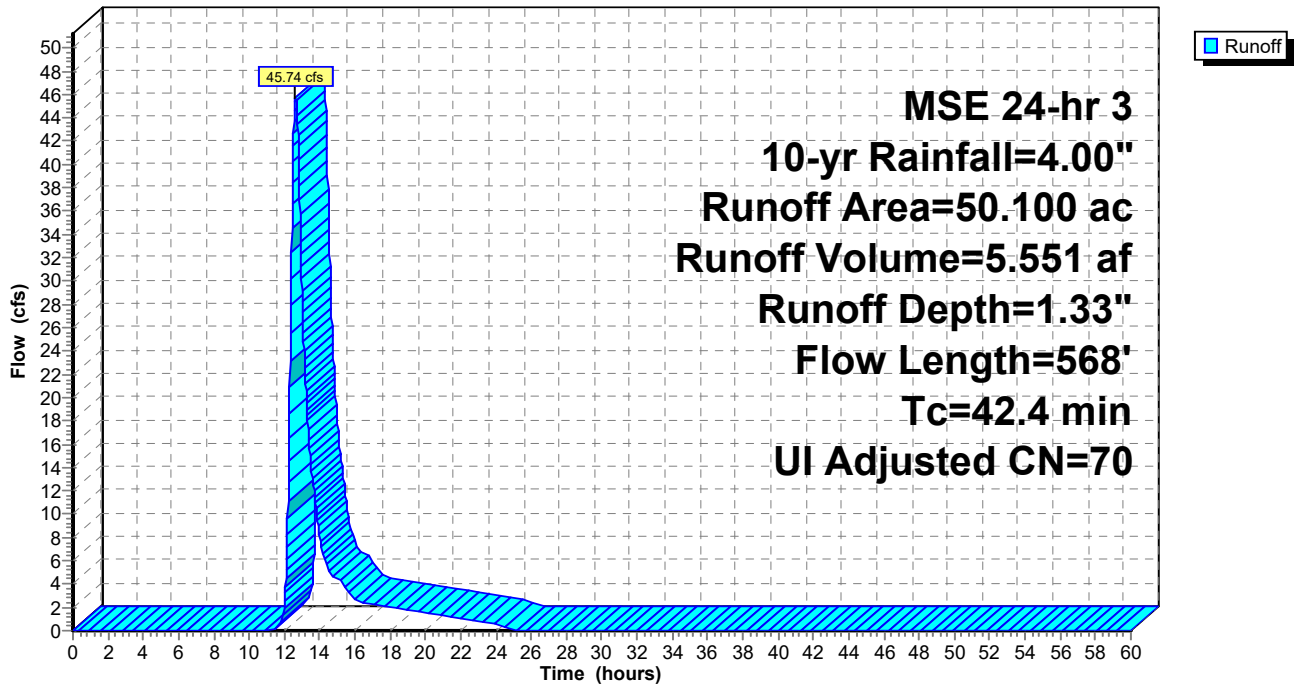
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 10-yr Rainfall=4.00"

Area (ac)	CN	Adj	Description
1.600	98		Unconnected pavement, HSG C
48.500	70		Woods, Good, HSG C
50.100	71	70	Weighted Average, UI Adjusted
48.500			96.81% Pervious Area
1.600			3.19% Impervious Area
1.600			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.2	100	0.0500	0.06		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.70"
14.2	468	0.0480	0.55		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
42.4	568	Total			

Subcatchment EX-DA2:

Hydrograph



Summary for Subcatchment EX-DA3:

Runoff = 3.79 cfs @ 12.49 hrs, Volume= 0.388 af, Depth= 1.33"
 Routed to Pond W4 : Wetland 4

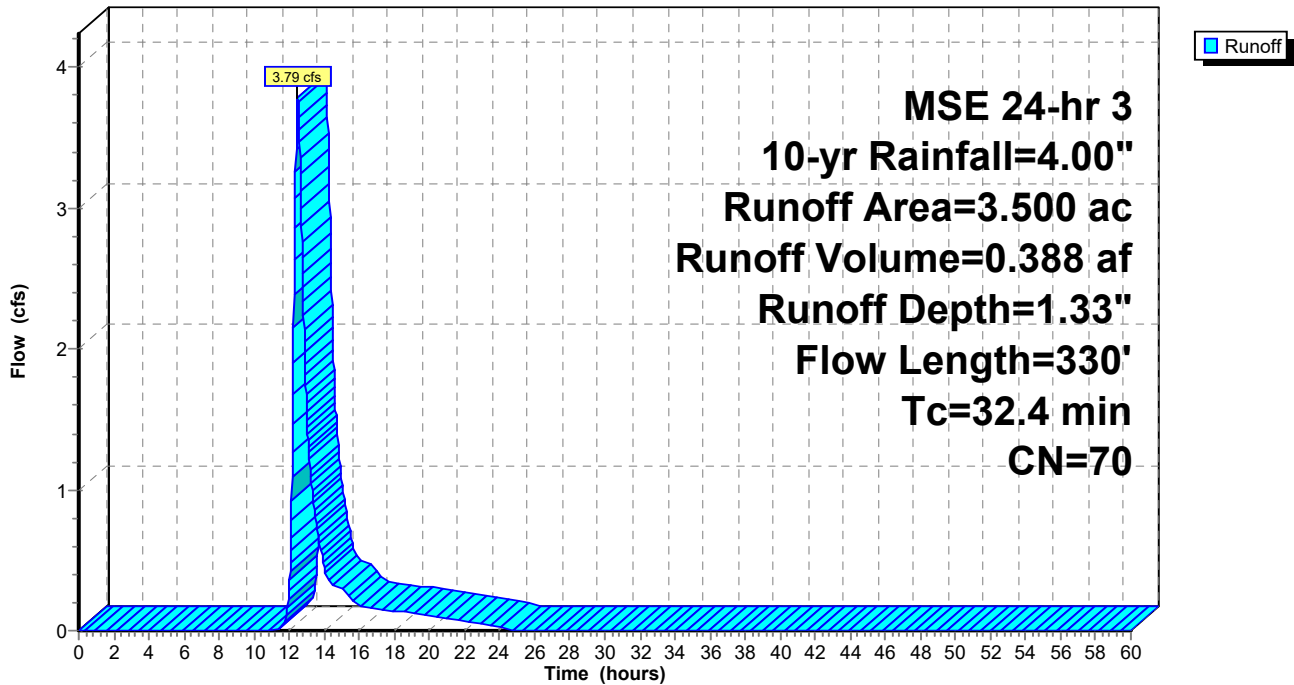
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 10-yr Rainfall=4.00"

Area (ac)	CN	Description
0.000	98	Unconnected pavement, HSG C
3.500	70	Woods, Good, HSG C
3.500	70	Weighted Average
3.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.8	100	0.0520	0.06		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.70"
4.6	230	0.1100	0.83		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
32.4	330	Total			

Subcatchment EX-DA3:

Hydrograph



Summary for Subcatchment EX-DA4:

Runoff = 22.02 cfs @ 13.14 hrs, Volume= 3.989 af, Depth= 1.33"
 Routed to Pond W4 : Wetland 4

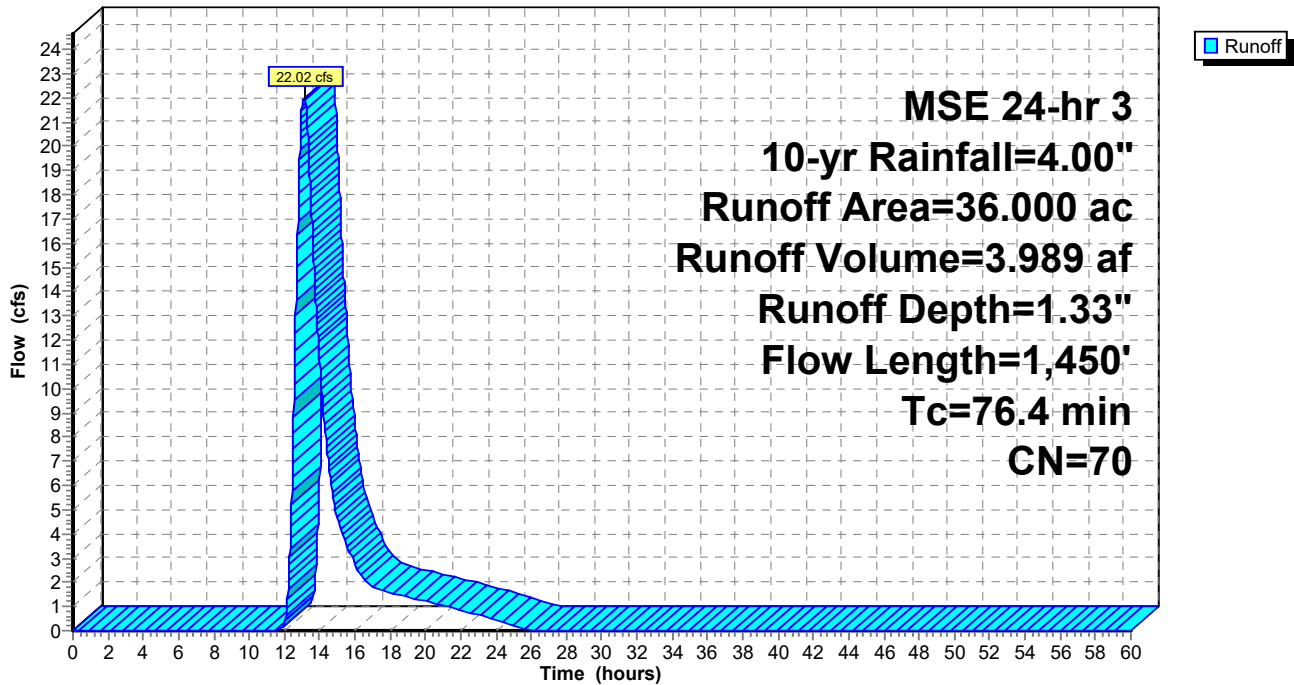
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 10-yr Rainfall=4.00"

Area (ac)	CN	Description
0.280	98	Unconnected pavement, HSG C
35.720	70	Woods, Good, HSG C
36.000	70	Weighted Average
35.720		99.22% Pervious Area
0.280		0.78% Impervious Area
0.280		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.8	100	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 2.70"
45.6	1,350	0.0390	0.49		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
76.4	1,450	Total			

Subcatchment EX-DA4:

Hydrograph



Summary for Subcatchment EX-DA5:

Runoff = 14.10 cfs @ 12.61 hrs, Volume= 1.651 af, Depth= 1.33"
 Routed to Pond W5 : Wetland 5

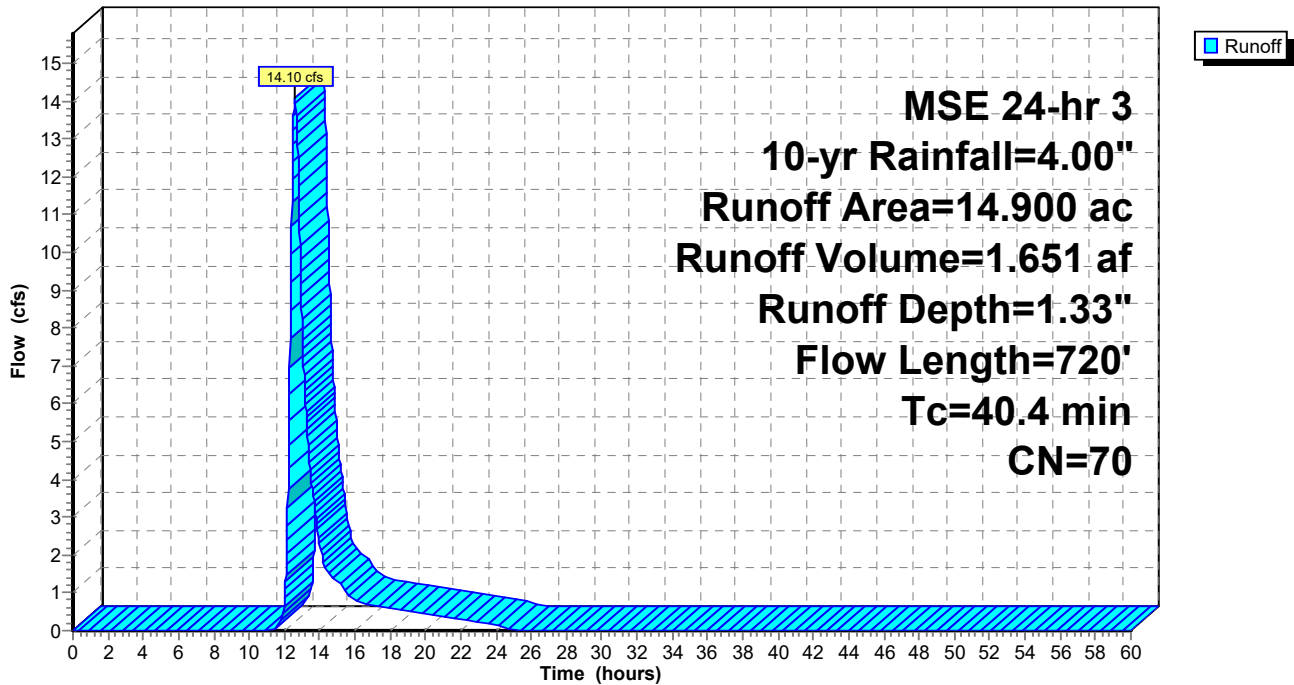
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 10-yr Rainfall=4.00"

Area (ac)	CN	Description
0.000	98	Unconnected pavement, HSG C
14.900	70	Woods, Good, HSG C
14.900	70	Weighted Average
14.900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	100	0.0380	0.05		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.70"
8.9	620	0.0540	1.16		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
40.4	720	Total			

Subcatchment EX-DA5:

Hydrograph



Summary for Subcatchment EX-DA6:

Runoff = 19.28 cfs @ 13.32 hrs, Volume= 4.011 af, Depth= 1.33"
 Routed to Pond W6 : Wetland 6

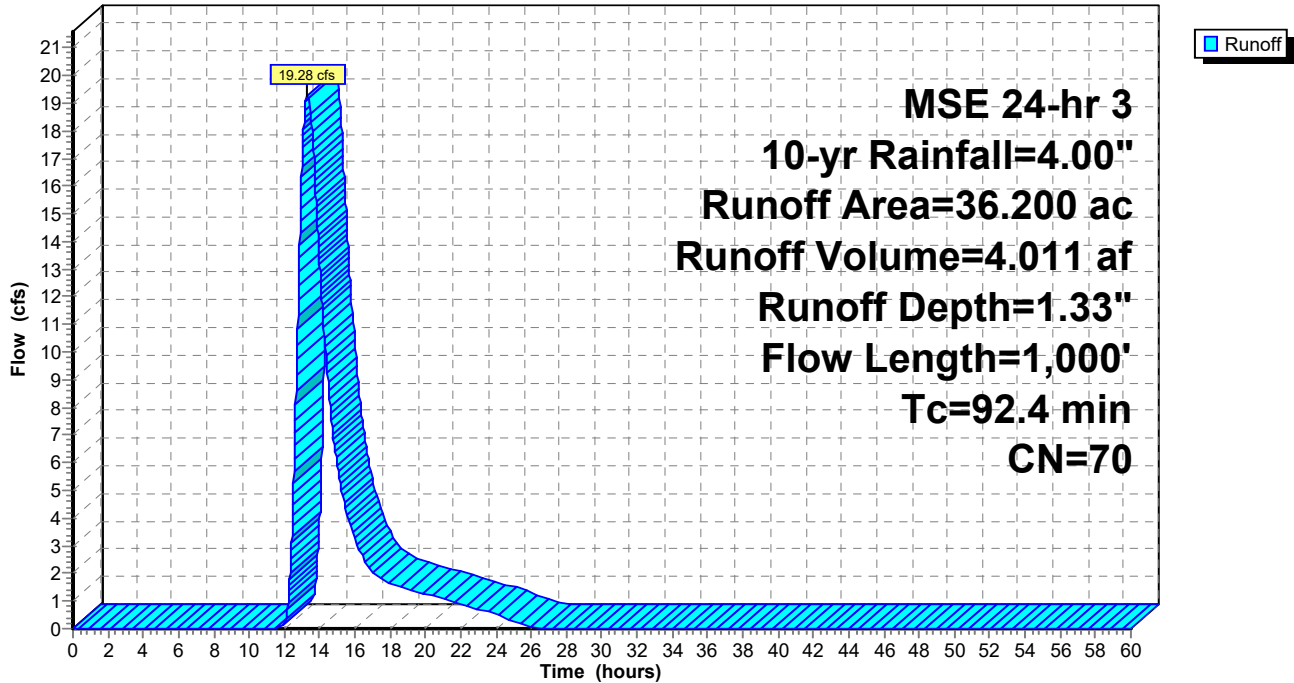
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 10-yr Rainfall=4.00"

Area (ac)	CN	Description
0.350	98	Unconnected pavement, HSG C
35.850	70	Woods, Good, HSG C
36.200	70	Weighted Average
35.850		99.03% Pervious Area
0.350		0.97% Impervious Area
0.350		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
53.7	100	0.0100	0.03		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.70"
38.7	900	0.0240	0.39		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
92.4	1,000	Total			

Subcatchment EX-DA6:

Hydrograph



Summary for Subcatchment EX-DA7:

Runoff = 40.11 cfs @ 13.56 hrs, Volume= 9.230 af, Depth= 1.33"
 Routed to Pond W7 : Wetland 7

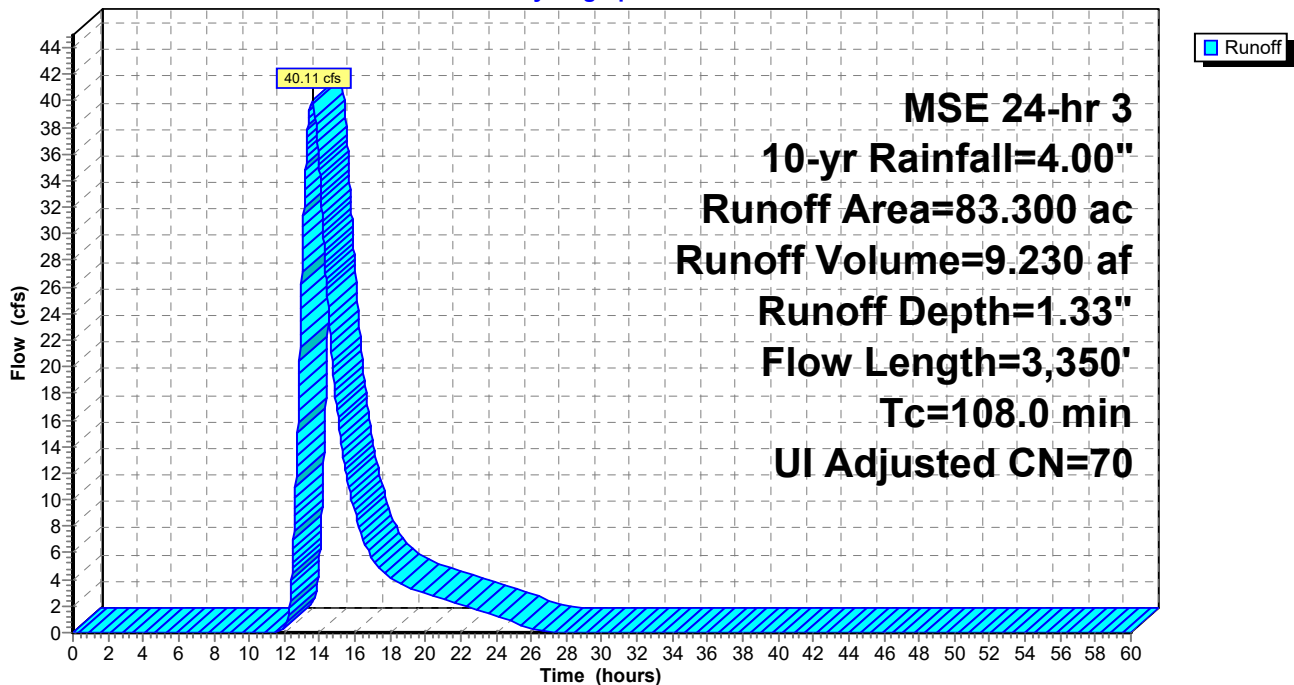
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 10-yr Rainfall=4.00"

Area (ac)	CN	Adj	Description
2.770	98		Unconnected pavement, HSG C
80.530	70		Woods, Good, HSG C
83.300	71	70	Weighted Average, UI Adjusted
80.530			96.67% Pervious Area
2.770			3.33% Impervious Area
2.770			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
39.2	100	0.0220	0.04		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.70"
51.4	1,400	0.0330	0.45		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
17.4	1,850	0.0140	1.77		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
108.0	3,350	Total			

Subcatchment EX-DA7:

Hydrograph



Summary for Pond W1: NE Wetland

Inflow Area = 60.100 ac, 3.88% Impervious, Inflow Depth = 1.34" for 10-yr event
 Inflow = 55.21 cfs @ 12.58 hrs, Volume= 6.713 af
 Outflow = 19.38 cfs @ 13.38 hrs, Volume= 6.713 af, Atten= 65%, Lag= 47.7 min
 Primary = 19.38 cfs @ 13.38 hrs, Volume= 6.713 af
 Routed to Link 10L : Outlet northeast accross Midway Rd

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,273.92' @ 13.38 hrs Surf.Area= 200,962 sf Storage= 97,963 cf

Plug-Flow detention time= 50.8 min calculated for 6.711 af (100% of inflow)
 Center-of-Mass det. time= 50.7 min (908.8 - 858.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,272.00'	1,287,831 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,272.00	200	0	0
1,273.00	6,116	3,158	3,158
1,274.00	218,914	112,515	115,673
1,276.00	368,040	586,954	702,627
1,277.00	802,367	585,204	1,287,831

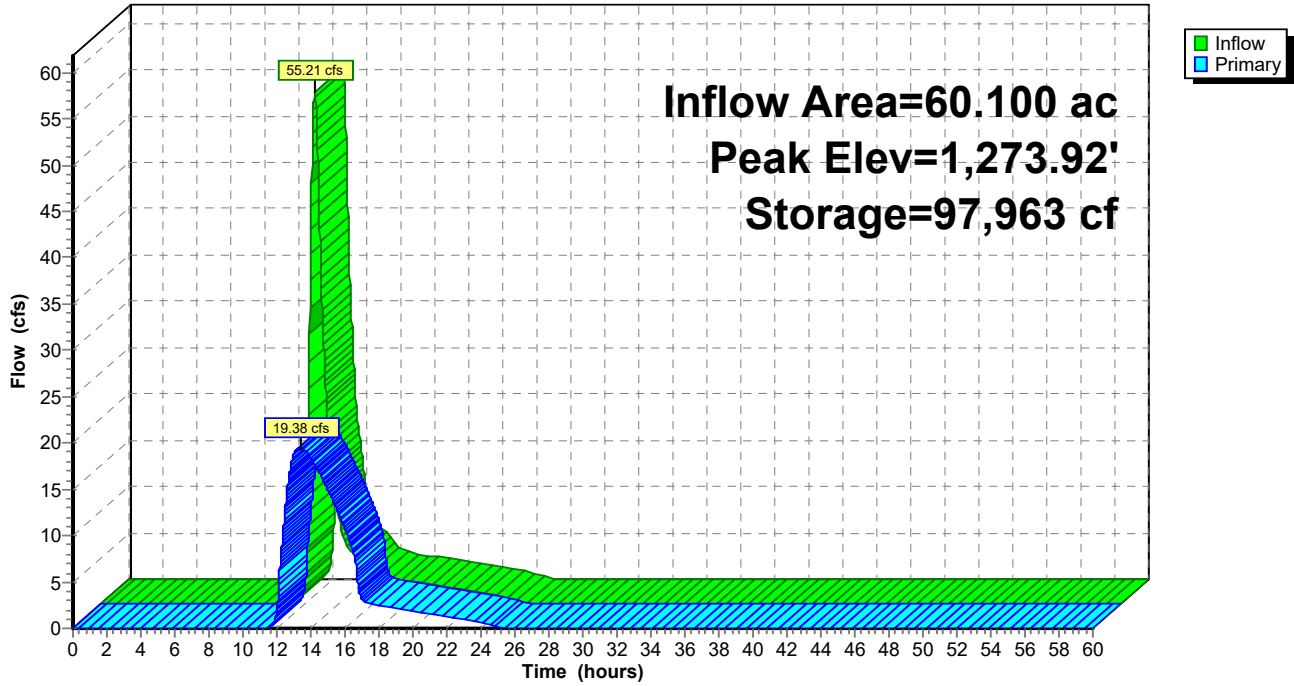
Device	Routing	Invert	Outlet Devices
#1	Primary	1,272.00'	36.0" Round Culvert L= 50.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,272.00' / 1,271.50' S= 0.0100 '/ Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf
#2	Primary	1,276.80'	42.0' long + 10.0 ' SideZ x 50.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=19.38 cfs @ 13.38 hrs HW=1,273.92' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Barrel Controls 19.38 cfs @ 5.80 fps)
- 2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond W1: NE Wetland

Hydrograph



Summary for Pond W4: Wetland 4

Inflow Area = 54.400 ac, 0.51% Impervious, Inflow Depth = 1.33" for 10-yr event
 Inflow = 33.80 cfs @ 12.93 hrs, Volume= 6.028 af
 Outflow = 22.84 cfs @ 13.56 hrs, Volume= 6.025 af, Atten= 32%, Lag= 38.1 min
 Primary = 22.84 cfs @ 13.56 hrs, Volume= 6.025 af
 Routed to Pond W6 : Wetland 6

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,296.34' @ 13.56 hrs Surf.Area= 216,692 sf Storage= 70,331 cf

Plug-Flow detention time= 79.0 min calculated for 6.025 af (100% of inflow)
 Center-of-Mass det. time= 78.5 min (966.2 - 887.8)

Volume	Invert	Avail.Storage	Storage Description
#1	1,296.00'	226,046 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

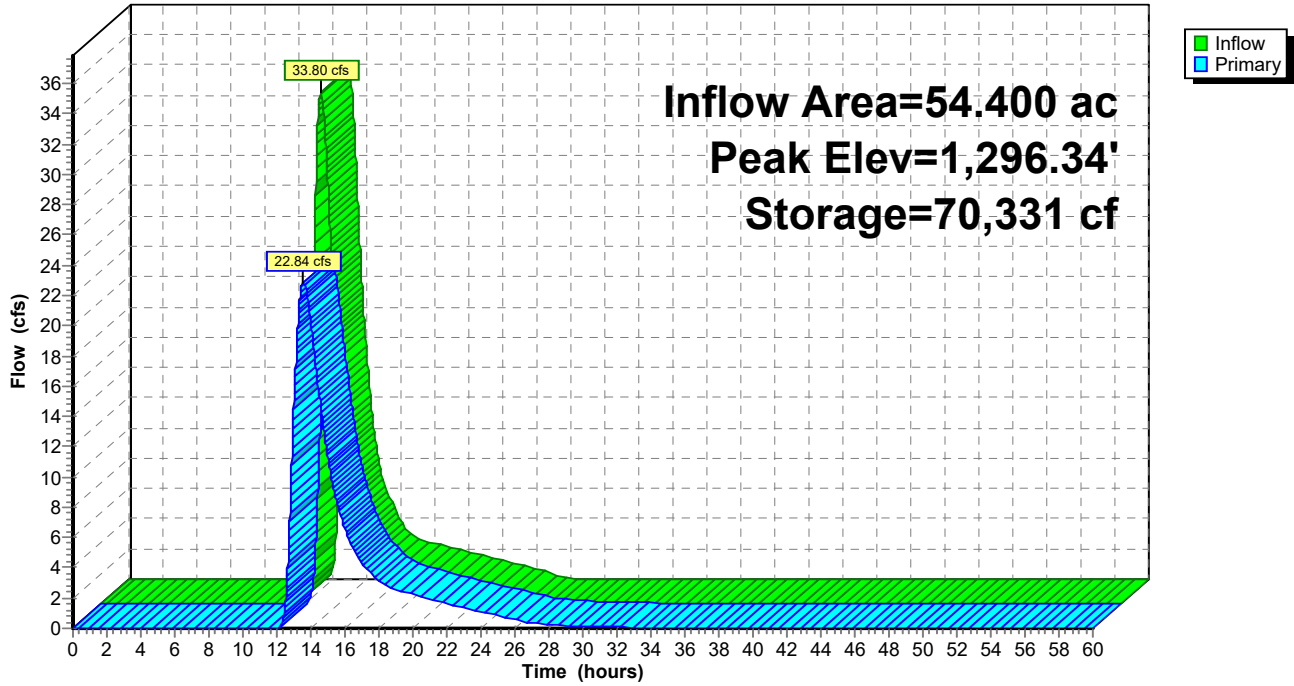
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,296.00	196,780	0	0
1,297.00	255,311	226,046	226,046

Device	Routing	Invert	Outlet Devices
#1	Primary	1,296.00'	40.0' long + 10.0 ' SideZ x 100.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=22.84 cfs @ 13.56 hrs HW=1,296.34' TW=1,285.15' (Dynamic Tailwater)
 ↑1=**Broad-Crested Rectangular Weir**(Weir Controls 22.84 cfs @ 1.55 fps)

Pond W4: Wetland 4

Hydrograph



Summary for Pond W5: Wetland 5

Inflow Area = 14.900 ac, 0.00% Impervious, Inflow Depth = 1.33" for 10-yr event
 Inflow = 14.10 cfs @ 12.61 hrs, Volume= 1.651 af
 Outflow = 12.19 cfs @ 12.79 hrs, Volume= 1.651 af, Atten= 14%, Lag= 10.8 min
 Primary = 12.19 cfs @ 12.79 hrs, Volume= 1.651 af
 Routed to Pond W4 : Wetland 4

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,299.14' @ 12.79 hrs Surf.Area= 77,427 sf Storage= 10,947 cf

Plug-Flow detention time= 25.7 min calculated for 1.651 af (100% of inflow)
 Center-of-Mass det. time= 25.5 min (884.6 - 859.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,299.00'	189,268 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

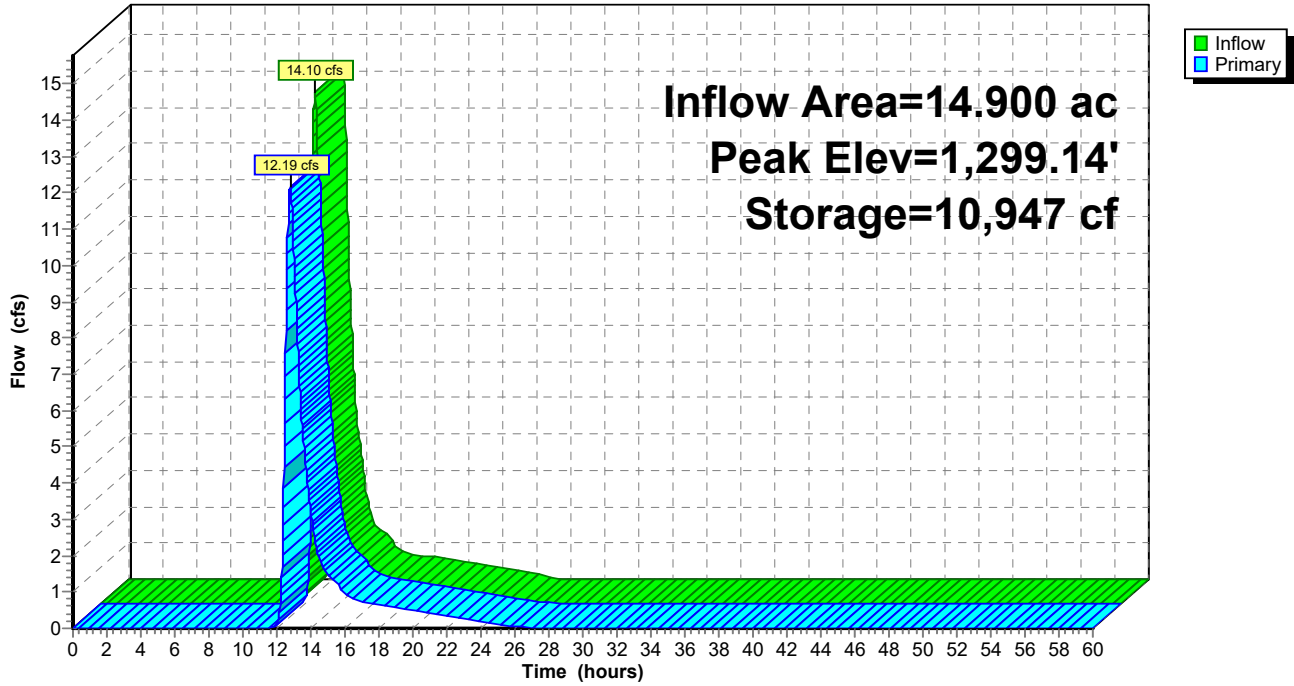
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,299.00	74,530	0	0
1,301.00	114,738	189,268	189,268

Device	Routing	Invert	Outlet Devices
#1	Primary	1,299.00'	82.0' long + 10.0 ' SideZ x 25.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=12.18 cfs @ 12.79 hrs HW=1,299.14' TW=1,296.17' (Dynamic Tailwater)
 ↑1=**Broad-Crested Rectangular Weir**(Weir Controls 12.18 cfs @ 1.01 fps)

Pond W5: Wetland 5

Hydrograph



Summary for Pond W6: Wetland 6

Inflow Area = 90.600 ac, 0.70% Impervious, Inflow Depth = 1.33" for 10-yr event
 Inflow = 41.53 cfs @ 13.45 hrs, Volume= 10.036 af
 Outflow = 41.01 cfs @ 13.58 hrs, Volume= 10.035 af, Atten= 1%, Lag= 7.4 min
 Primary = 41.01 cfs @ 13.58 hrs, Volume= 10.035 af
 Routed to Pond W7 : Wetland 7

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,285.15' @ 13.58 hrs Surf.Area= 165,442 sf Storage= 23,439 cf

Plug-Flow detention time= 14.4 min calculated for 10.032 af (100% of inflow)
 Center-of-Mass det. time= 14.3 min (956.9 - 942.6)

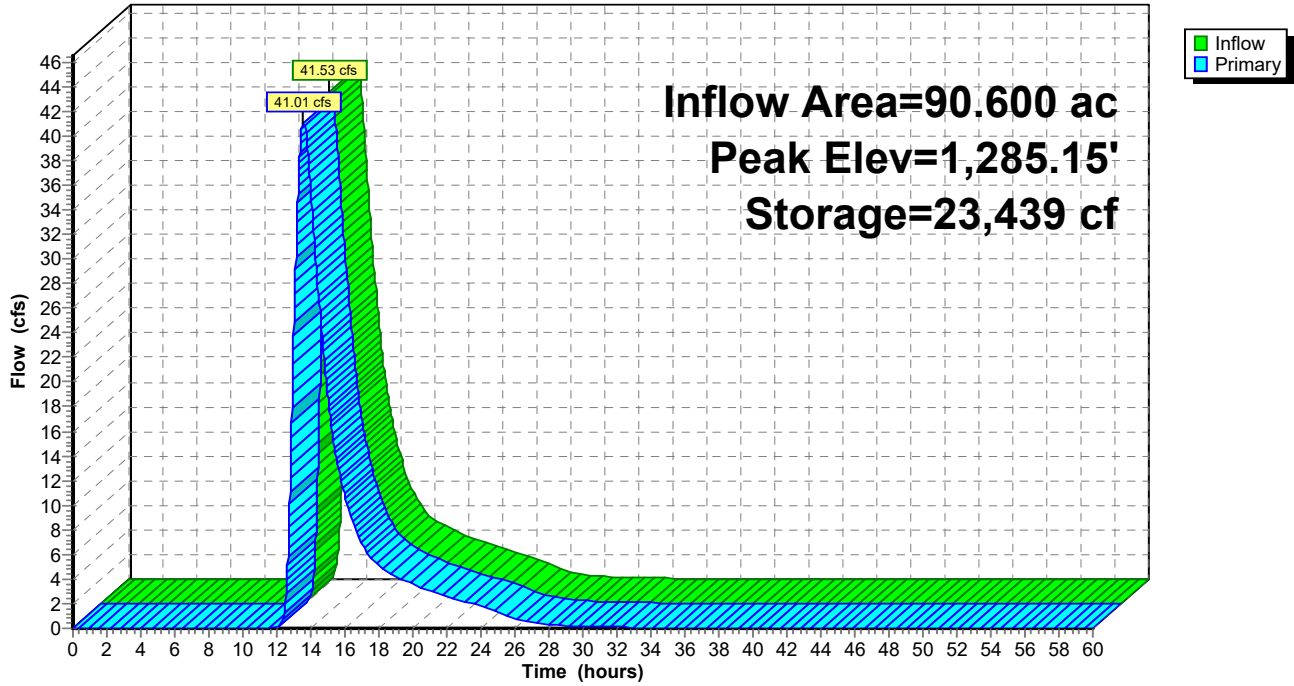
Volume	Invert	Avail.Storage	Storage Description
#1	1,285.00'	208,642 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,285.00	146,915	0	0
1,286.00	270,368	208,642	208,642

Device	Routing	Invert	Outlet Devices
#1	Primary	1,285.00'	262.0' long + 10.0 ' SideZ x 100.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=41.01 cfs @ 13.58 hrs HW=1,285.15' TW=1,260.27' (Dynamic Tailwater)
 ↑1=**Broad-Crested Rectangular Weir**(Weir Controls 41.01 cfs @ 1.04 fps)

Pond W6: Wetland 6

Hydrograph



Summary for Pond W7: Wetland 7

Inflow Area = 173.900 ac, 1.96% Impervious, Inflow Depth = 1.33" for 10-yr event
 Inflow = 81.11 cfs @ 13.56 hrs, Volume= 19.265 af
 Outflow = 62.46 cfs @ 14.20 hrs, Volume= 19.265 af, Atten= 23%, Lag= 37.9 min
 Primary = 62.46 cfs @ 14.20 hrs, Volume= 19.265 af
 Routed to Link 1L : Outlet Southeast access Midway Rd

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,260.87' @ 14.20 hrs Surf.Area= 56,454 sf Storage= 92,229 cf

Plug-Flow detention time= 12.6 min calculated for 19.265 af (100% of inflow)
 Center-of-Mass det. time= 12.6 min (952.9 - 940.3)

Volume	Invert	Avail.Storage	Storage Description
#1	1,256.00'	818,699 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,256.00	201	0	0
1,257.00	2,165	1,183	1,183
1,258.00	8,713	5,439	6,622
1,259.00	21,630	15,172	21,794
1,260.00	37,628	29,629	51,423
1,261.00	59,330	48,479	99,902
1,262.00	105,590	82,460	182,362
1,263.00	164,210	134,900	317,262
1,264.00	253,441	208,826	526,087
1,265.00	331,783	292,612	818,699

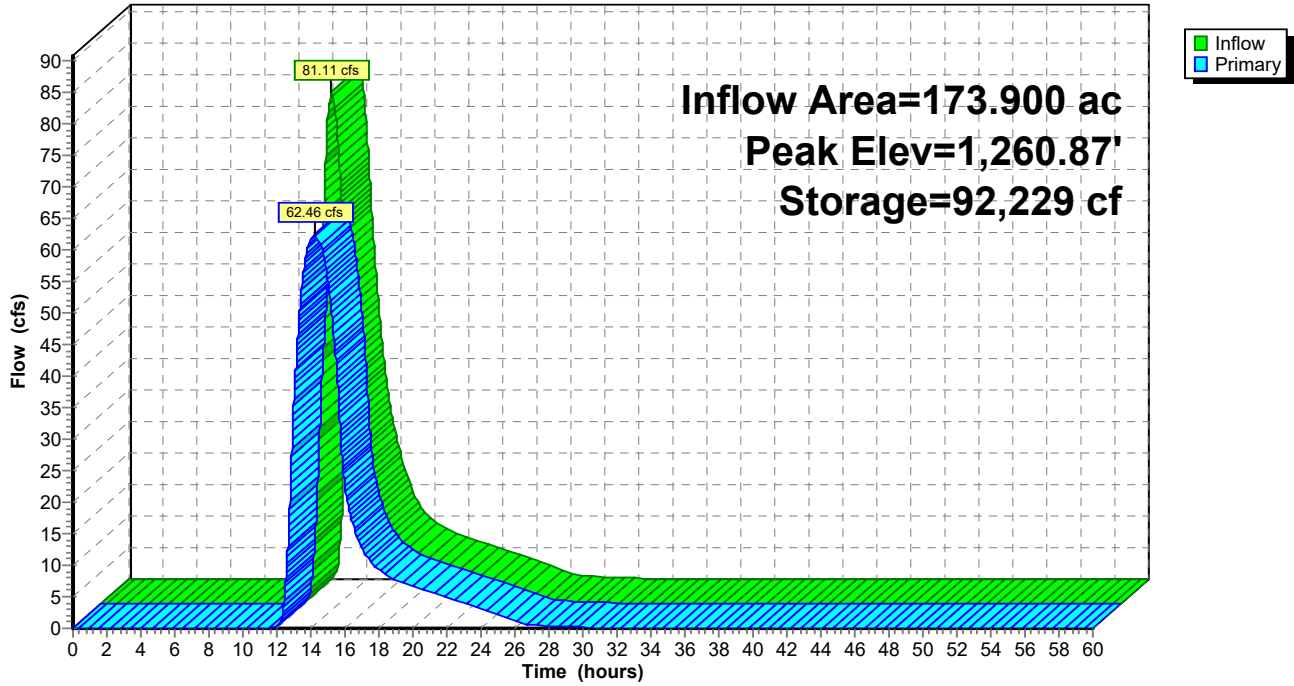
Device	Routing	Invert	Outlet Devices
#1	Primary	1,256.00'	36.0" Round Culvert L= 50.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,256.00' / 1,254.00' S= 0.0400 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf
#2	Primary	1,263.00'	300.0' long + 10.0 ' SideZ x 40.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=62.46 cfs @ 14.20 hrs HW=1,260.87' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Inlet Controls 62.46 cfs @ 8.84 fps)
- 2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond W7: Wetland 7

Hydrograph



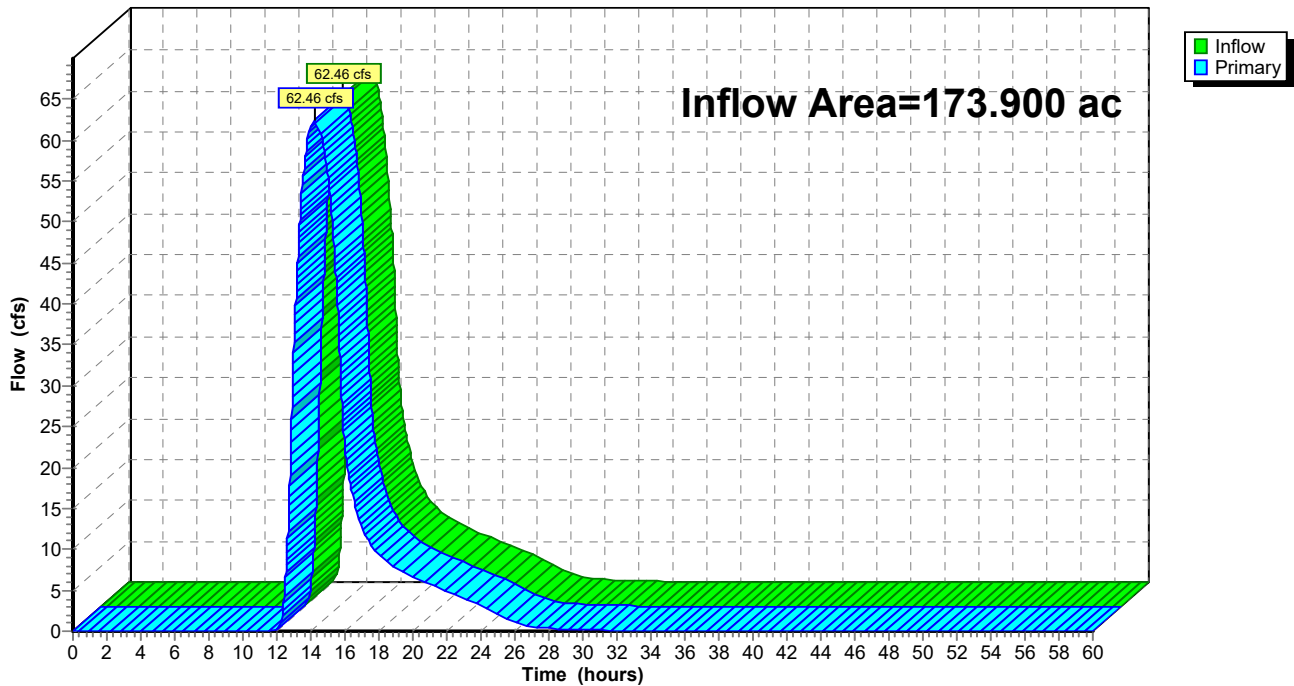
Summary for Link 1L: Outlet Southeast access Midway Rd

Inflow Area = 173.900 ac, 1.96% Impervious, Inflow Depth = 1.33" for 10-yr event
Inflow = 62.46 cfs @ 14.20 hrs, Volume= 19.265 af
Primary = 62.46 cfs @ 14.22 hrs, Volume= 19.265 af, Atten= 0%, Lag= 1.2 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

Link 1L: Outlet Southeast access Midway Rd

Hydrograph



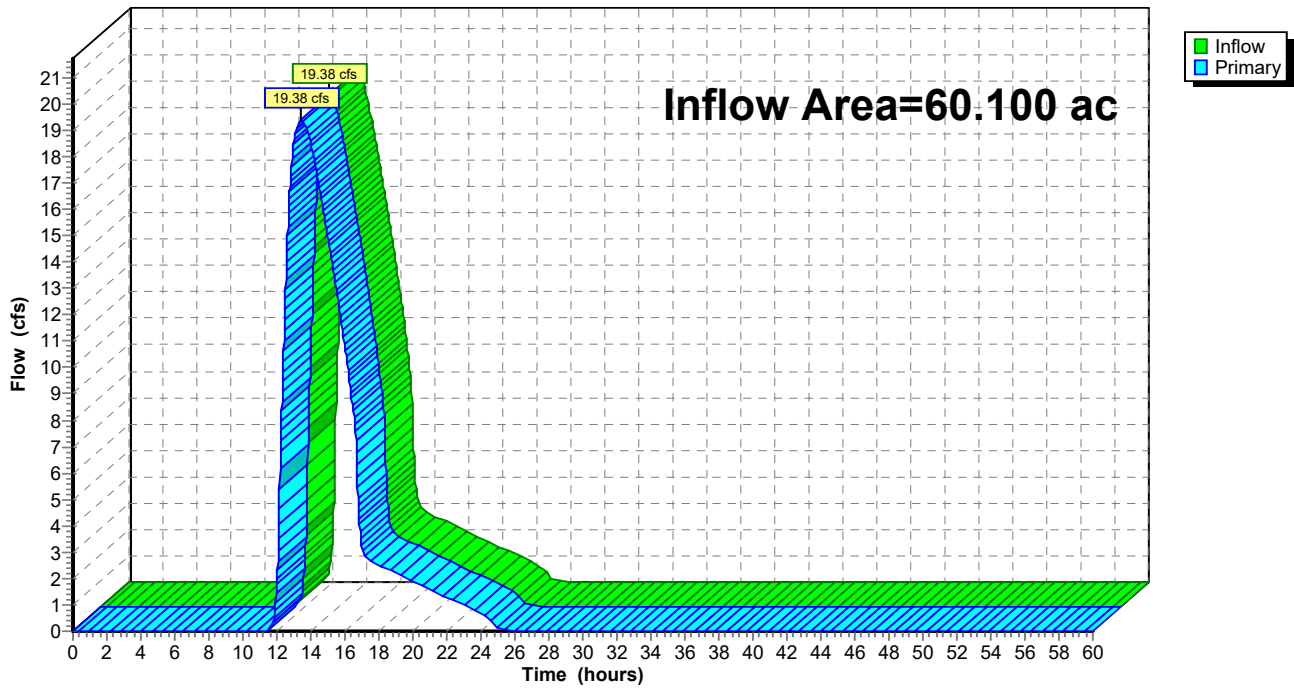
Summary for Link 10L: Outlet northeast accross Midway Rd

Inflow Area = 60.100 ac, 3.88% Impervious, Inflow Depth = 1.34" for 10-yr event
Inflow = 19.38 cfs @ 13.38 hrs, Volume= 6.713 af
Primary = 19.38 cfs @ 13.40 hrs, Volume= 6.713 af, Atten= 0%, Lag= 1.2 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

Link 10L: Outlet northeast accross Midway Rd

Hydrograph



2025-0717- Hermantown Industrial - Existing

Type II 6-hr 25-yr-6hr Rainfall=3.63"

Prepared by Kimley-Horn & Associates

Printed 7/30/2025

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Time span=0.00-60.00 hrs, dt=0.02 hrs, 3001 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Sim-Route method - Pond routing by Sim-Route method

SubcatchmentEX-DA1: Runoff Area=10.000 ac 7.30% Impervious Runoff Depth=1.15"
 Flow Length=590' Tc=26.5 min UI Adjusted CN=71 Runoff=13.90 cfs 0.956 af

SubcatchmentEX-DA2: Runoff Area=50.100 ac 3.19% Impervious Runoff Depth=1.09"
 Flow Length=568' Tc=42.4 min UI Adjusted CN=70 Runoff=46.47 cfs 4.548 af

SubcatchmentEX-DA3: Runoff Area=3.500 ac 0.00% Impervious Runoff Depth=1.09"
 Flow Length=330' Tc=32.4 min CN=70 Runoff=3.95 cfs 0.318 af

SubcatchmentEX-DA4: Runoff Area=36.000 ac 0.78% Impervious Runoff Depth=1.09"
 Flow Length=1,450' Tc=76.4 min CN=70 Runoff=21.54 cfs 3.268 af

SubcatchmentEX-DA5: Runoff Area=14.900 ac 0.00% Impervious Runoff Depth=1.09"
 Flow Length=720' Tc=40.4 min CN=70 Runoff=14.30 cfs 1.353 af

SubcatchmentEX-DA6: Runoff Area=36.200 ac 0.97% Impervious Runoff Depth=1.09"
 Flow Length=1,000' Tc=92.4 min CN=70 Runoff=18.84 cfs 3.286 af

SubcatchmentEX-DA7: Runoff Area=83.300 ac 3.33% Impervious Runoff Depth=1.09"
 Flow Length=3,350' Tc=108.0 min UI Adjusted CN=70 Runoff=38.54 cfs 7.561 af

Pond W1: NE Wetland Peak Elev=1,273.90' Storage=94,212 cf Inflow=55.70 cfs 5.504 af
 Outflow=19.08 cfs 5.504 af

Pond W4: Wetland 4 Peak Elev=1,296.33' Storage=68,147 cf Inflow=32.86 cfs 4.938 af
 Outflow=21.78 cfs 4.936 af

Pond W5: Wetland 5 Peak Elev=1,299.14' Storage=10,864 cf Inflow=14.30 cfs 1.353 af
 Outflow=12.05 cfs 1.352 af

Pond W6: Wetland 6 Peak Elev=1,285.15' Storage=22,824 cf Inflow=40.00 cfs 8.222 af
 Outflow=39.49 cfs 8.222 af

Pond W7: Wetland 7 Peak Elev=1,260.72' Storage=84,220 cf Inflow=78.03 cfs 15.783 af
 Outflow=61.09 cfs 15.783 af

Link 1L: Outlet Southeast accross Midway Rd Inflow=61.09 cfs 15.783 af
 Primary=61.09 cfs 15.783 af

Link 10L: Outlet northeast accross Midway Rd Inflow=19.08 cfs 5.504 af
 Primary=19.08 cfs 5.504 af

Total Runoff Area = 234.000 ac Runoff Volume = 21.289 af Average Runoff Depth = 1.09"
97.55% Pervious = 228.270 ac 2.45% Impervious = 5.730 ac

Summary for Subcatchment EX-DA1:

Runoff = 13.90 cfs @ 3.23 hrs, Volume= 0.956 af, Depth= 1.15"
 Routed to Pond W1 : NE Wetland

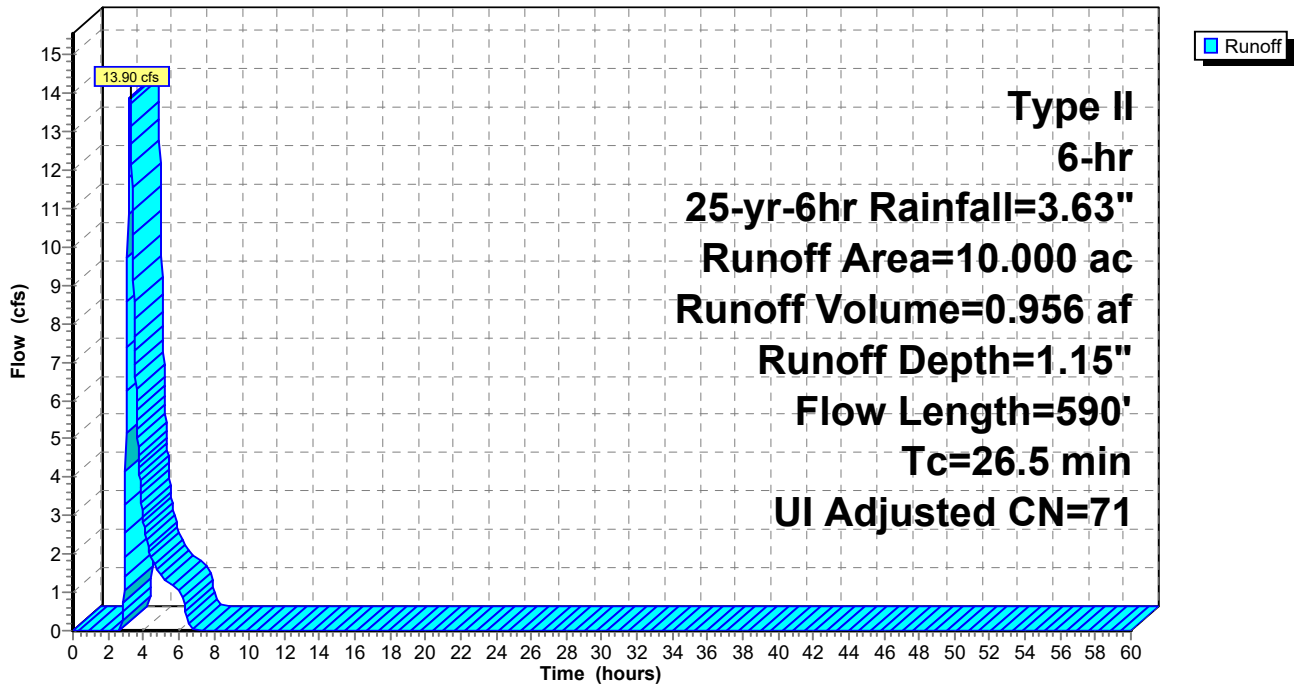
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Type II 6-hr 25-yr-6hr Rainfall=3.63"

Area (ac)	CN	Adj	Description
0.730	98		Unconnected pavement, HSG C
9.270	70		Woods, Good, HSG C
10.000	72	71	Weighted Average, UI Adjusted
9.270			92.70% Pervious Area
0.730			7.30% Impervious Area
0.730			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	100	0.0730	0.18		Sheet Flow, Grass: Dense n= 0.240 P2= 2.70"
17.2	490	0.0360	0.47		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
26.5	590	Total			

Subcatchment EX-DA1:

Hydrograph



Summary for Subcatchment EX-DA2:

Runoff = 46.47 cfs @ 3.45 hrs, Volume= 4.548 af, Depth= 1.09"
 Routed to Pond W1 : NE Wetland

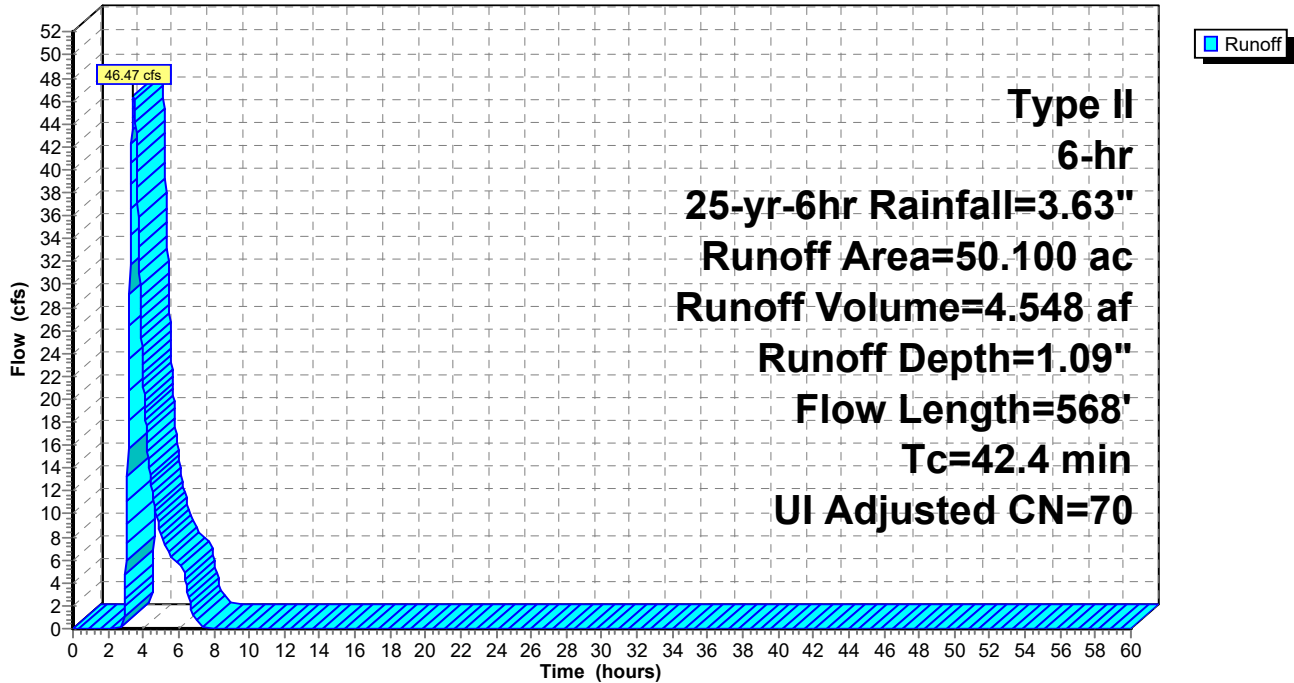
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Type II 6-hr 25-yr-6hr Rainfall=3.63"

Area (ac)	CN	Adj	Description
1.600	98		Unconnected pavement, HSG C
48.500	70		Woods, Good, HSG C
50.100	71	70	Weighted Average, UI Adjusted
48.500			96.81% Pervious Area
1.600			3.19% Impervious Area
1.600			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.2	100	0.0500	0.06		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.70"
14.2	468	0.0480	0.55		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
42.4	568	Total			

Subcatchment EX-DA2:

Hydrograph



Summary for Subcatchment EX-DA3:

Runoff = 3.95 cfs @ 3.32 hrs, Volume= 0.318 af, Depth= 1.09"
 Routed to Pond W4 : Wetland 4

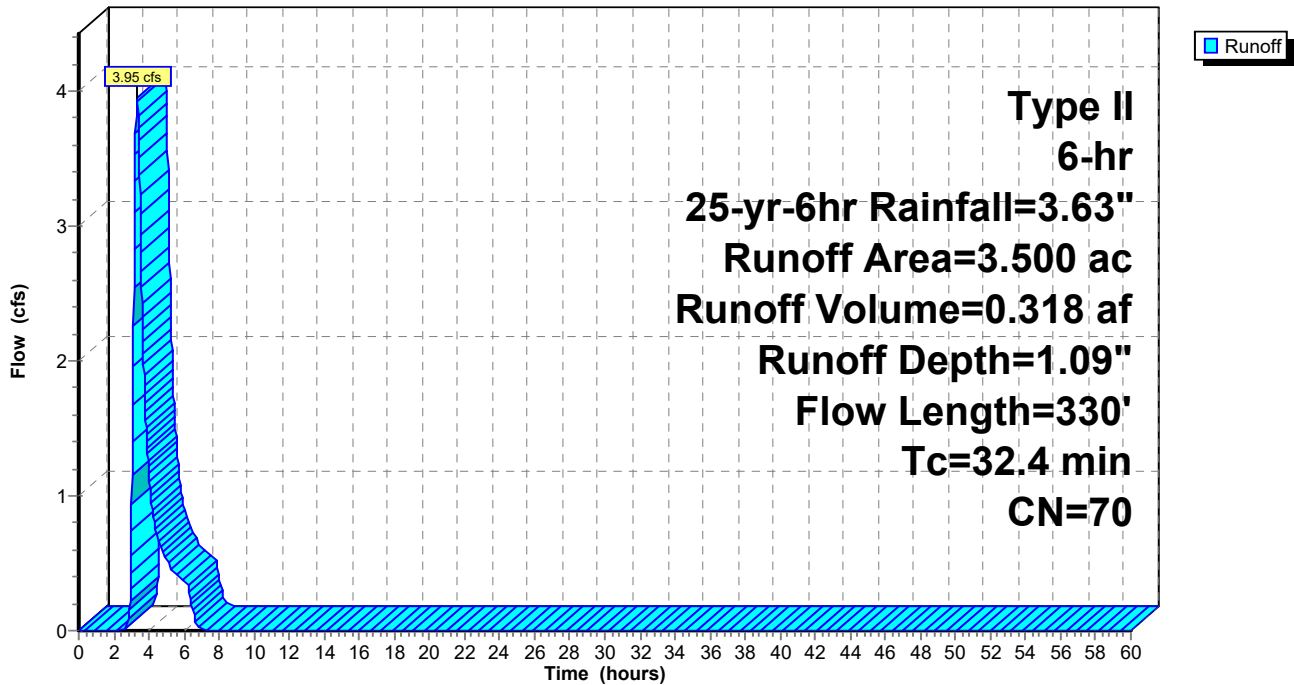
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Type II 6-hr 25-yr-6hr Rainfall=3.63"

Area (ac)	CN	Description
0.000	98	Unconnected pavement, HSG C
3.500	70	Woods, Good, HSG C
3.500	70	Weighted Average
3.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.8	100	0.0520	0.06		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.70"
4.6	230	0.1100	0.83		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
32.4	330	Total			

Subcatchment EX-DA3:

Hydrograph



Summary for Subcatchment EX-DA4:

Runoff = 21.54 cfs @ 3.98 hrs, Volume= 3.268 af, Depth= 1.09"
 Routed to Pond W4 : Wetland 4

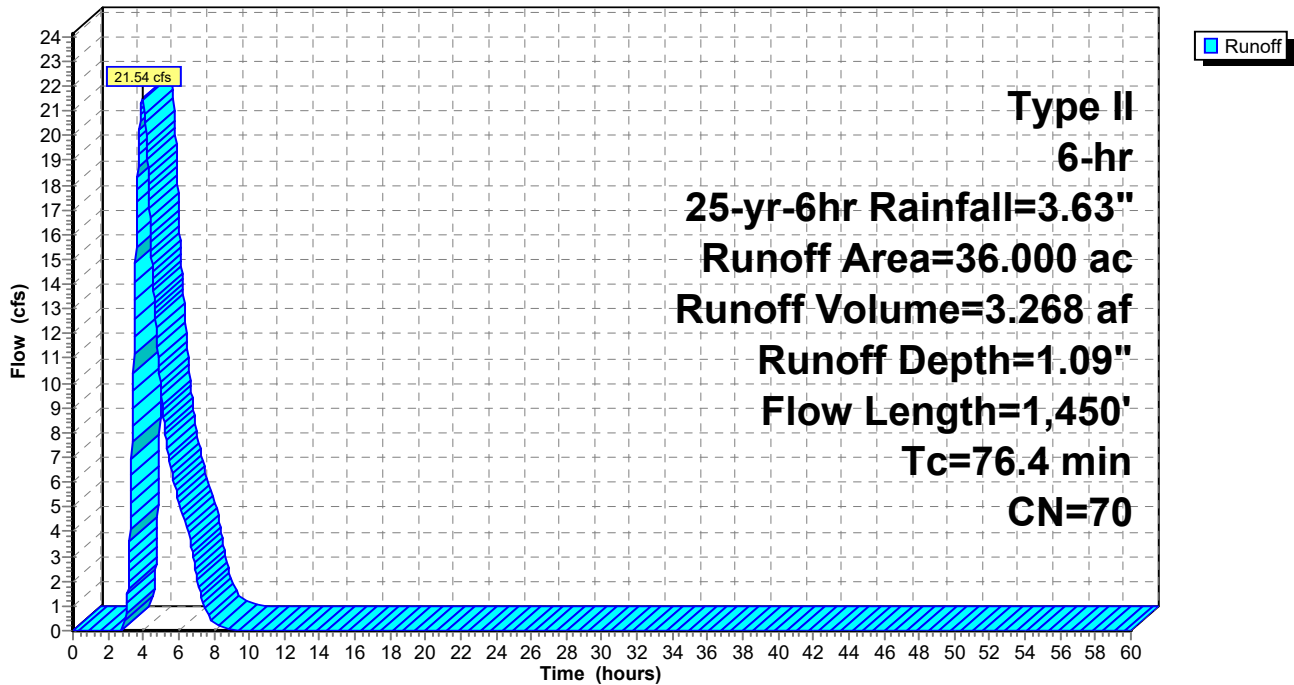
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Type II 6-hr 25-yr-6hr Rainfall=3.63"

Area (ac)	CN	Description
0.280	98	Unconnected pavement, HSG C
35.720	70	Woods, Good, HSG C
36.000	70	Weighted Average
35.720		99.22% Pervious Area
0.280		0.78% Impervious Area
0.280		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.8	100	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 2.70"
45.6	1,350	0.0390	0.49		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
76.4	1,450	Total			

Subcatchment EX-DA4:

Hydrograph



Summary for Subcatchment EX-DA5:

Runoff = 14.30 cfs @ 3.44 hrs, Volume= 1.353 af, Depth= 1.09"
 Routed to Pond W5 : Wetland 5

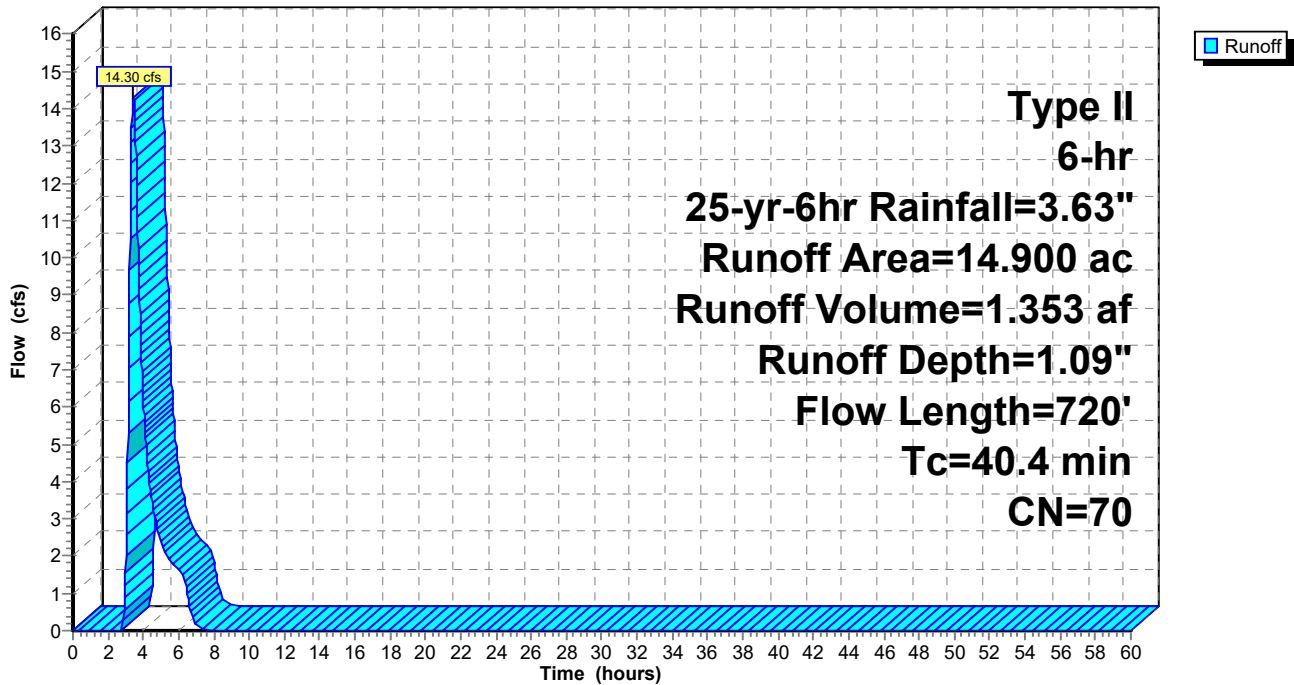
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Type II 6-hr 25-yr-6hr Rainfall=3.63"

Area (ac)	CN	Description
0.000	98	Unconnected pavement, HSG C
14.900	70	Woods, Good, HSG C
14.900	70	Weighted Average
14.900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	100	0.0380	0.05		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.70"
8.9	620	0.0540	1.16		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
40.4	720	Total			

Subcatchment EX-DA5:

Hydrograph



Summary for Subcatchment EX-DA6:

Runoff = 18.84 cfs @ 4.21 hrs, Volume= 3.286 af, Depth= 1.09"
 Routed to Pond W6 : Wetland 6

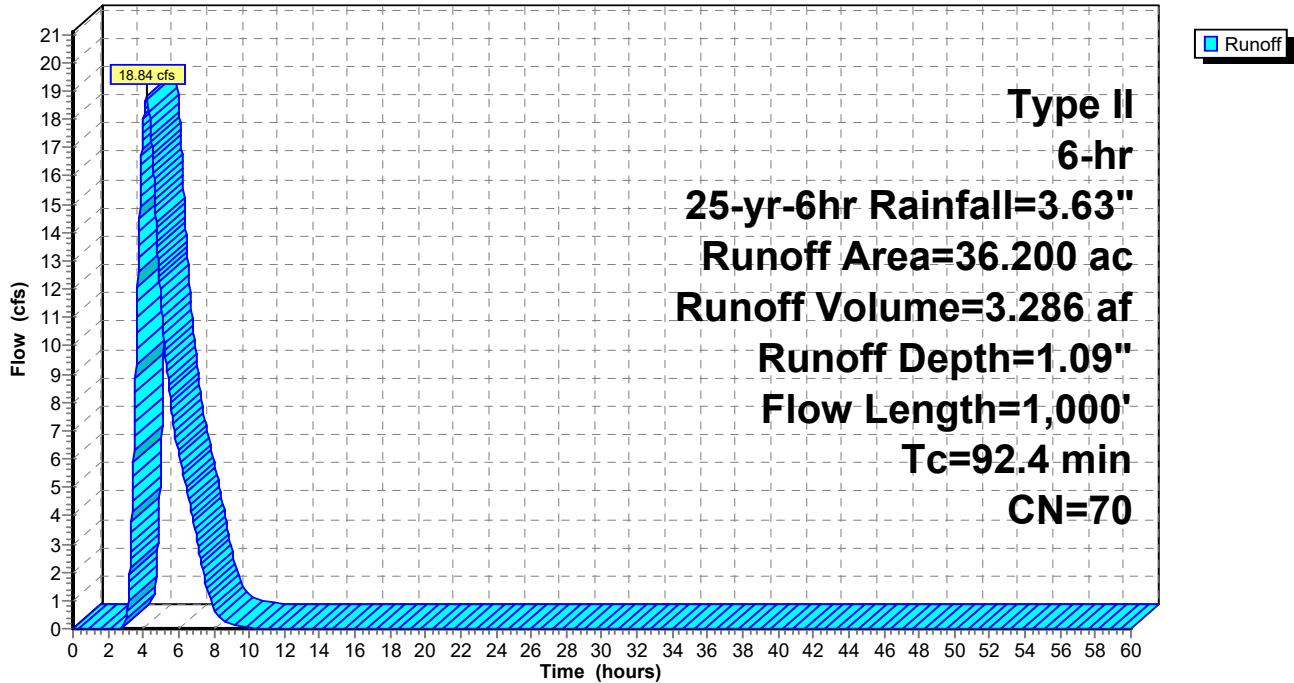
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Type II 6-hr 25-yr-6hr Rainfall=3.63"

Area (ac)	CN	Description
0.350	98	Unconnected pavement, HSG C
35.850	70	Woods, Good, HSG C
36.200	70	Weighted Average
35.850		99.03% Pervious Area
0.350		0.97% Impervious Area
0.350		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
53.7	100	0.0100	0.03		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.70"
38.7	900	0.0240	0.39		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
92.4	1,000	Total			

Subcatchment EX-DA6:

Hydrograph



Summary for Subcatchment EX-DA7:

Runoff = 38.54 cfs @ 4.44 hrs, Volume= 7.561 af, Depth= 1.09"
 Routed to Pond W7 : Wetland 7

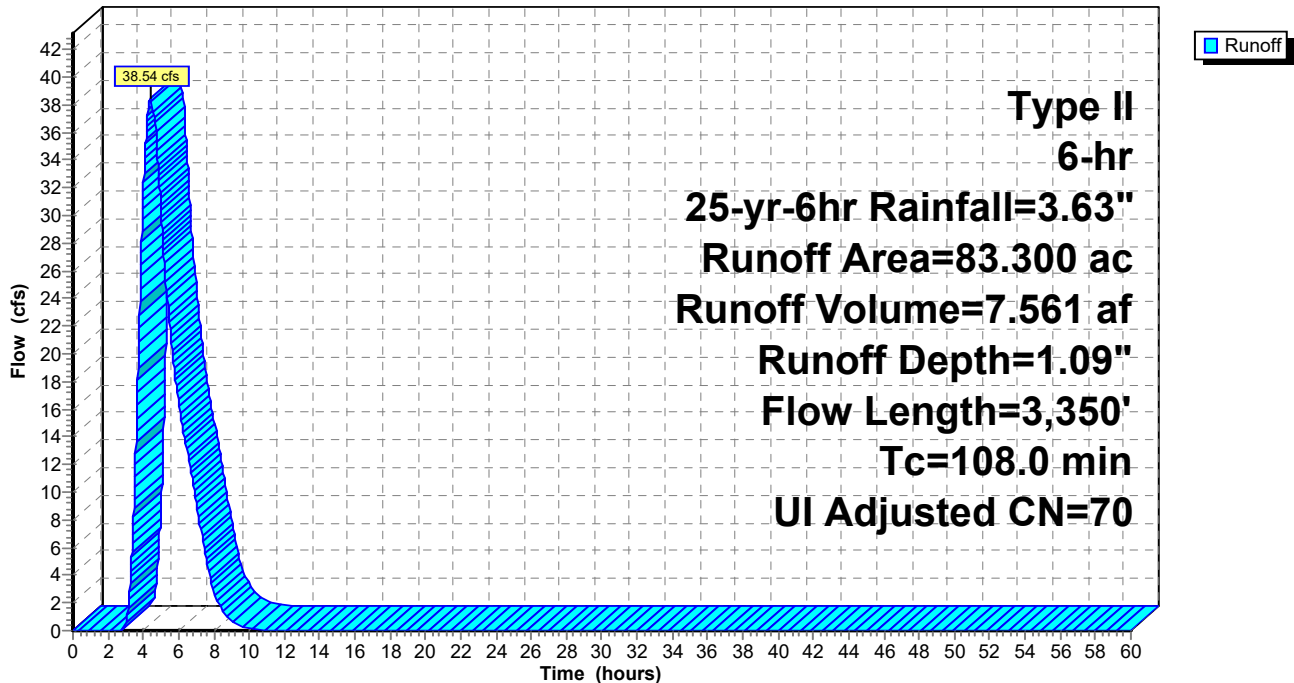
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Type II 6-hr 25-yr-6hr Rainfall=3.63"

Area (ac)	CN	Adj	Description
2.770	98		Unconnected pavement, HSG C
80.530	70		Woods, Good, HSG C
83.300	71	70	Weighted Average, UI Adjusted
80.530			96.67% Pervious Area
2.770			3.33% Impervious Area
2.770			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
39.2	100	0.0220	0.04		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.70"
51.4	1,400	0.0330	0.45		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
17.4	1,850	0.0140	1.77		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
108.0	3,350	Total			

Subcatchment EX-DA7:

Hydrograph



Summary for Pond W1: NE Wetland

Inflow Area = 60.100 ac, 3.88% Impervious, Inflow Depth = 1.10" for 25-yr-6hr event
 Inflow = 55.70 cfs @ 3.41 hrs, Volume= 5.504 af
 Outflow = 19.08 cfs @ 4.20 hrs, Volume= 5.504 af, Atten= 66%, Lag= 47.3 min
 Primary = 19.08 cfs @ 4.20 hrs, Volume= 5.504 af
 Routed to Link 10L : Outlet northeast accross Midway Rd

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,273.90' @ 4.20 hrs Surf.Area= 196,950 sf Storage= 94,212 cf

Plug-Flow detention time= 60.8 min calculated for 5.504 af (100% of inflow)
 Center-of-Mass det. time= 60.3 min (306.7 - 246.4)

Volume	Invert	Avail.Storage	Storage Description
#1	1,272.00'	1,287,831 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,272.00	200	0	0
1,273.00	6,116	3,158	3,158
1,274.00	218,914	112,515	115,673
1,276.00	368,040	586,954	702,627
1,277.00	802,367	585,204	1,287,831

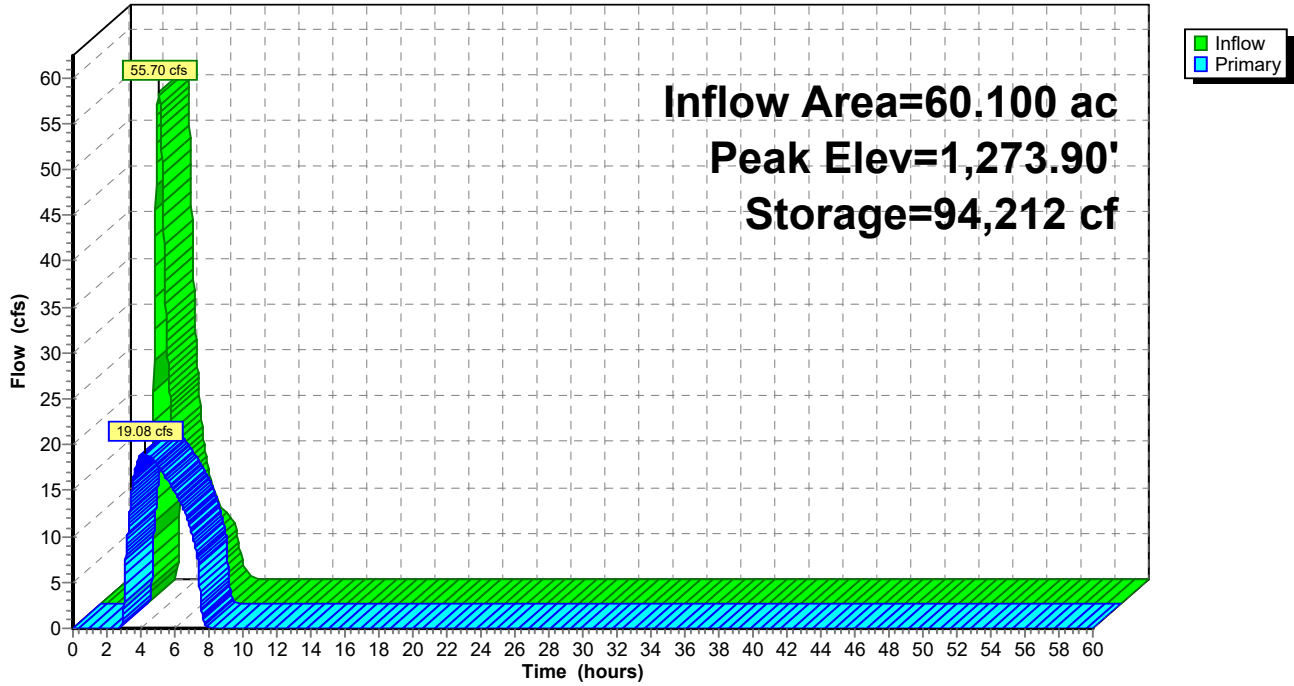
Device	Routing	Invert	Outlet Devices
#1	Primary	1,272.00'	36.0" Round Culvert L= 50.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,272.00' / 1,271.50' S= 0.0100 '/ Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf
#2	Primary	1,276.80'	42.0' long + 10.0 ' SideZ x 50.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=19.08 cfs @ 4.20 hrs HW=1,273.90' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Barrel Controls 19.08 cfs @ 5.78 fps)
- 2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond W1: NE Wetland

Hydrograph



Summary for Pond W4: Wetland 4

Inflow Area = 54.400 ac, 0.51% Impervious, Inflow Depth = 1.09" for 25-yr-6hr event
 Inflow = 32.86 cfs @ 3.80 hrs, Volume= 4.938 af
 Outflow = 21.78 cfs @ 4.42 hrs, Volume= 4.936 af, Atten= 34%, Lag= 37.3 min
 Primary = 21.78 cfs @ 4.42 hrs, Volume= 4.936 af
 Routed to Pond W6 : Wetland 6

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,296.33' @ 4.42 hrs Surf.Area= 216,101 sf Storage= 68,147 cf

Plug-Flow detention time= 72.0 min calculated for 4.935 af (100% of inflow)
 Center-of-Mass det. time= 72.6 min (347.5 - 274.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,296.00'	226,046 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

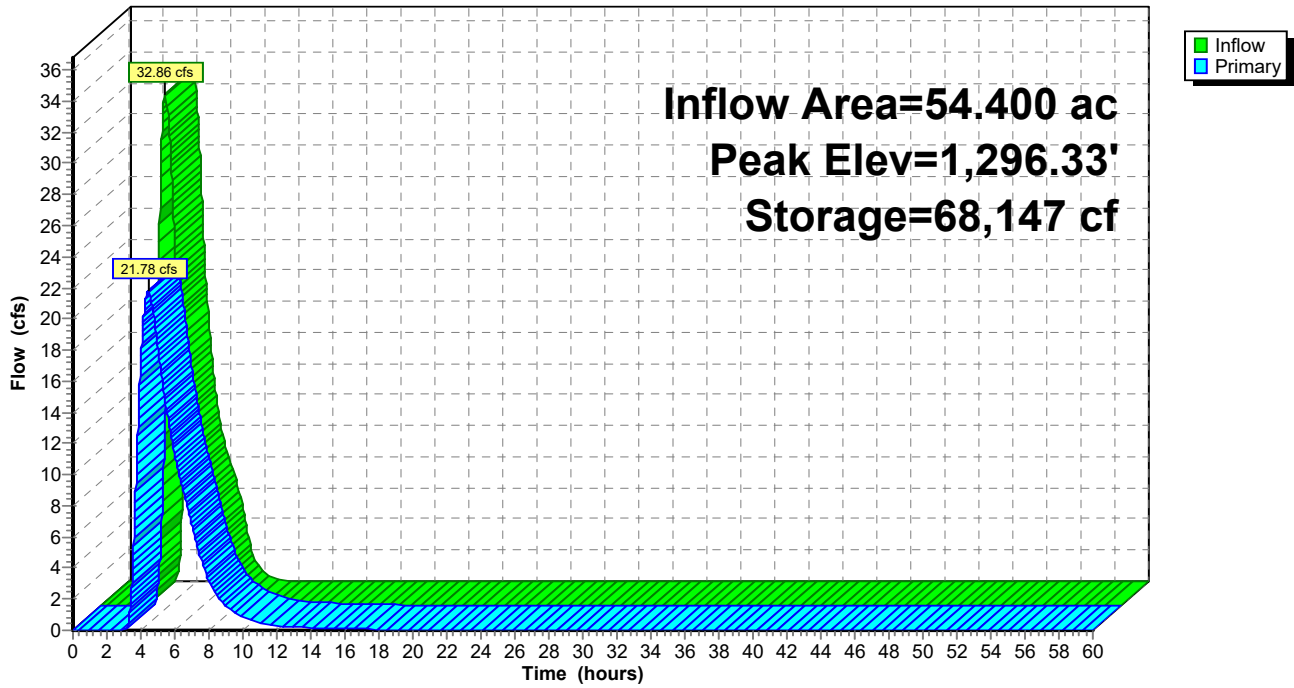
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,296.00	196,780	0	0
1,297.00	255,311	226,046	226,046

Device	Routing	Invert	Outlet Devices
#1	Primary	1,296.00'	40.0' long + 10.0 ' SideZ x 100.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=21.78 cfs @ 4.42 hrs HW=1,296.33' TW=1,285.15' (Dynamic Tailwater)
 ↑1=**Broad-Crested Rectangular Weir**(Weir Controls 21.78 cfs @ 1.52 fps)

Pond W4: Wetland 4

Hydrograph



Summary for Pond W5: Wetland 5

Inflow Area = 14.900 ac, 0.00% Impervious, Inflow Depth = 1.09" for 25-yr-6hr event
 Inflow = 14.30 cfs @ 3.44 hrs, Volume= 1.353 af
 Outflow = 12.05 cfs @ 3.63 hrs, Volume= 1.352 af, Atten= 16%, Lag= 11.2 min
 Primary = 12.05 cfs @ 3.63 hrs, Volume= 1.352 af
 Routed to Pond W4 : Wetland 4

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,299.14' @ 3.63 hrs Surf.Area= 77,405 sf Storage= 10,864 cf

Plug-Flow detention time= 21.4 min calculated for 1.352 af (100% of inflow)
 Center-of-Mass det. time= 21.7 min (268.9 - 247.2)

Volume	Invert	Avail.Storage	Storage Description
#1	1,299.00'	189,268 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

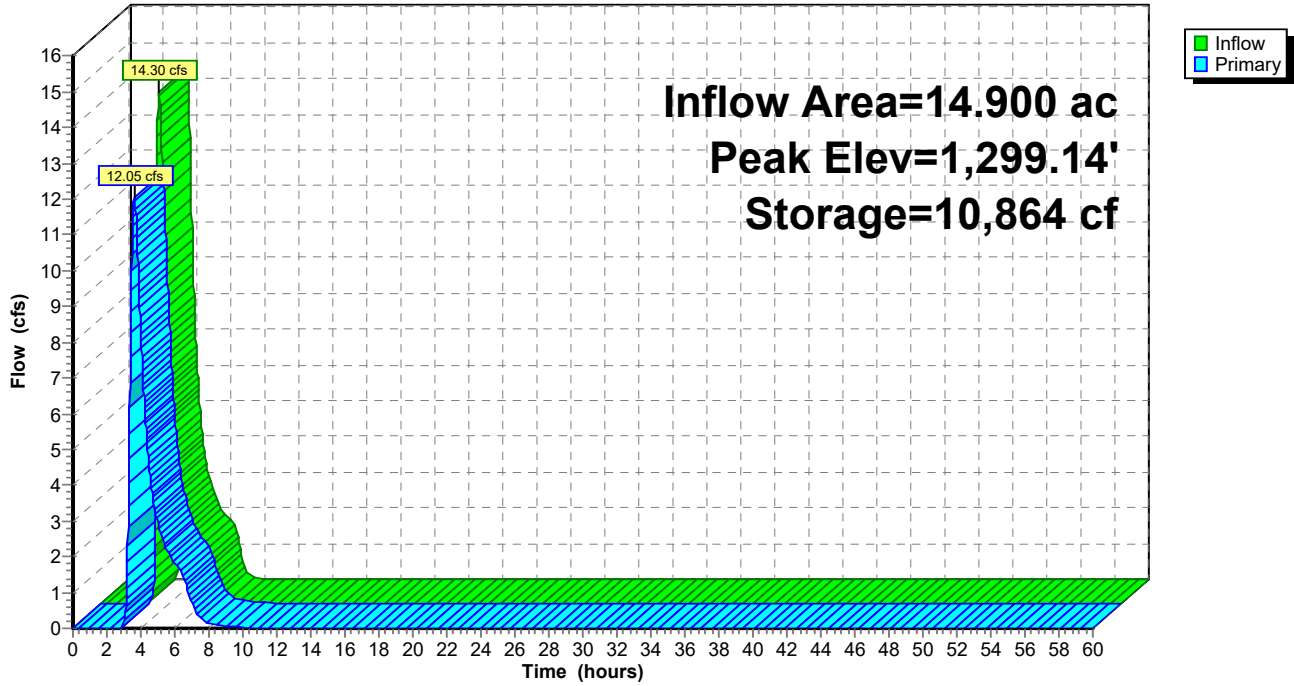
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,299.00	74,530	0	0
1,301.00	114,738	189,268	189,268

Device	Routing	Invert	Outlet Devices
#1	Primary	1,299.00'	82.0' long + 10.0 ' SideZ x 25.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=12.04 cfs @ 3.63 hrs HW=1,299.14' TW=1,296.15' (Dynamic Tailwater)
 ↑1=**Broad-Crested Rectangular Weir**(Weir Controls 12.04 cfs @ 1.01 fps)

Pond W5: Wetland 5

Hydrograph



Summary for Pond W6: Wetland 6

Inflow Area = 90.600 ac, 0.70% Impervious, Inflow Depth = 1.09" for 25-yr-6hr event
 Inflow = 40.00 cfs @ 4.31 hrs, Volume= 8.222 af
 Outflow = 39.49 cfs @ 4.44 hrs, Volume= 8.222 af, Atten= 1%, Lag= 7.5 min
 Primary = 39.49 cfs @ 4.44 hrs, Volume= 8.222 af
 Routed to Pond W7 : Wetland 7

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,285.15' @ 4.44 hrs Surf.Area= 164,983 sf Storage= 22,824 cf

Plug-Flow detention time= 13.2 min calculated for 8.222 af (100% of inflow)
 Center-of-Mass det. time= 13.1 min (339.9 - 326.8)

Volume	Invert	Avail.Storage	Storage Description
#1	1,285.00'	208,642 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

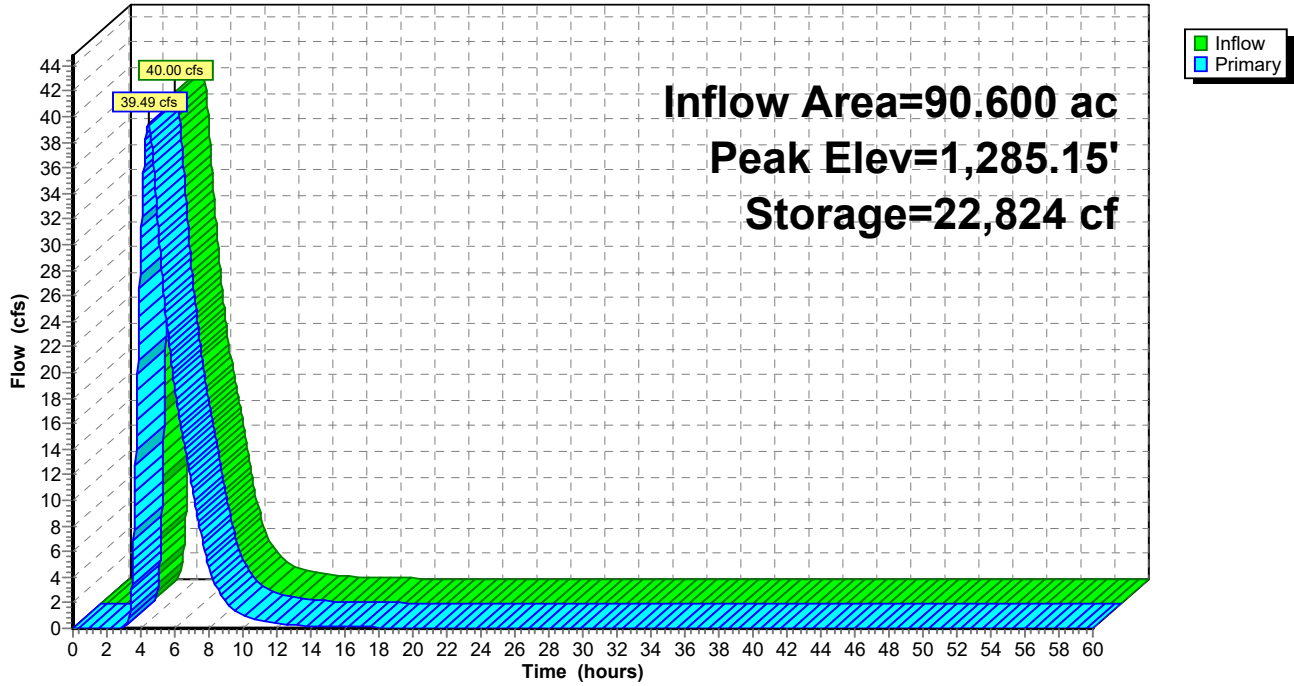
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,285.00	146,915	0	0
1,286.00	270,368	208,642	208,642

Device	Routing	Invert	Outlet Devices
#1	Primary	1,285.00'	262.0' long + 10.0 ' SideZ x 100.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=39.49 cfs @ 4.44 hrs HW=1,285.15' TW=1,260.16' (Dynamic Tailwater)
 ↑1=**Broad-Crested Rectangular Weir**(Weir Controls 39.49 cfs @ 1.02 fps)

Pond W6: Wetland 6

Hydrograph



Summary for Pond W7: Wetland 7

Inflow Area = 173.900 ac, 1.96% Impervious, Inflow Depth = 1.09" for 25-yr-6hr event
 Inflow = 78.03 cfs @ 4.44 hrs, Volume= 15.783 af
 Outflow = 61.09 cfs @ 5.04 hrs, Volume= 15.783 af, Atten= 22%, Lag= 36.1 min
 Primary = 61.09 cfs @ 5.04 hrs, Volume= 15.783 af
 Routed to Link 1L : Outlet Southeast access Midway Rd

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,260.72' @ 5.04 hrs Surf.Area= 53,286 sf Storage= 84,220 cf

Plug-Flow detention time= 14.0 min calculated for 15.778 af (100% of inflow)
 Center-of-Mass det. time= 13.9 min (339.6 - 325.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,256.00'	818,699 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,256.00	201	0	0
1,257.00	2,165	1,183	1,183
1,258.00	8,713	5,439	6,622
1,259.00	21,630	15,172	21,794
1,260.00	37,628	29,629	51,423
1,261.00	59,330	48,479	99,902
1,262.00	105,590	82,460	182,362
1,263.00	164,210	134,900	317,262
1,264.00	253,441	208,826	526,087
1,265.00	331,783	292,612	818,699

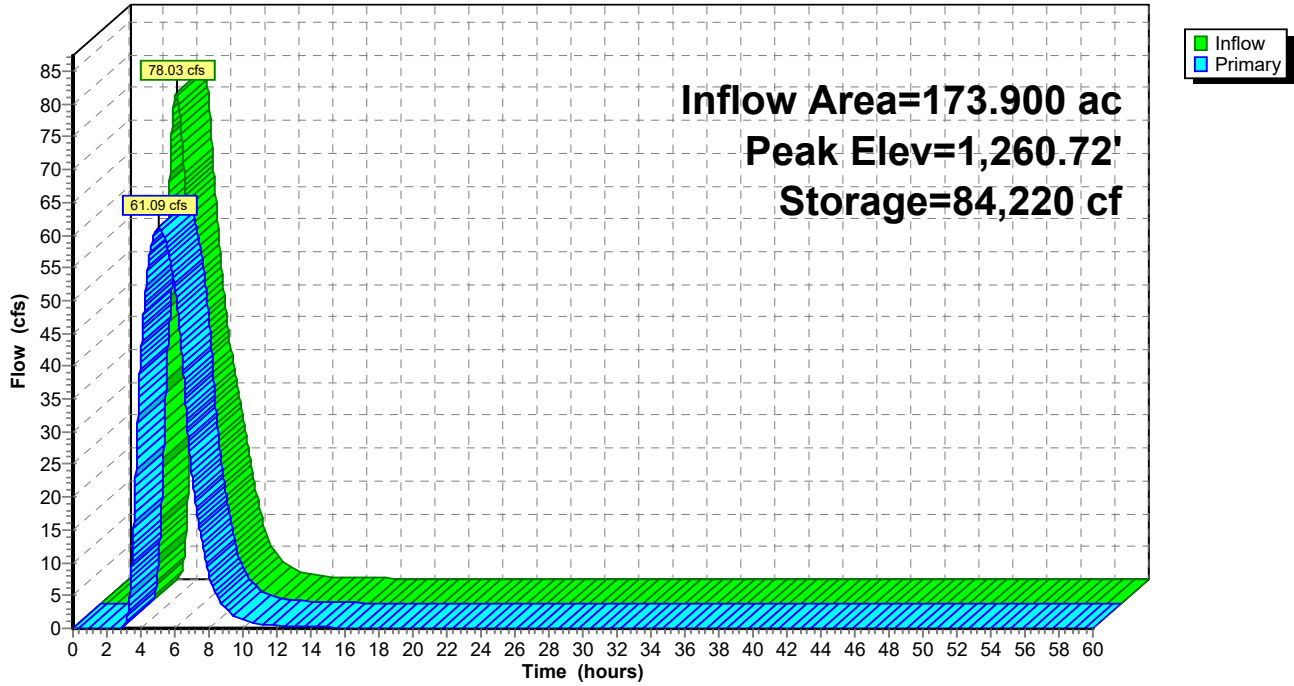
Device	Routing	Invert	Outlet Devices
#1	Primary	1,256.00'	36.0" Round Culvert L= 50.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,256.00' / 1,254.00' S= 0.0400 '/ Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf
#2	Primary	1,263.00'	300.0' long + 10.0 ' SideZ x 40.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=61.09 cfs @ 5.04 hrs HW=1,260.72' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Inlet Controls 61.09 cfs @ 8.64 fps)
- 2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond W7: Wetland 7

Hydrograph



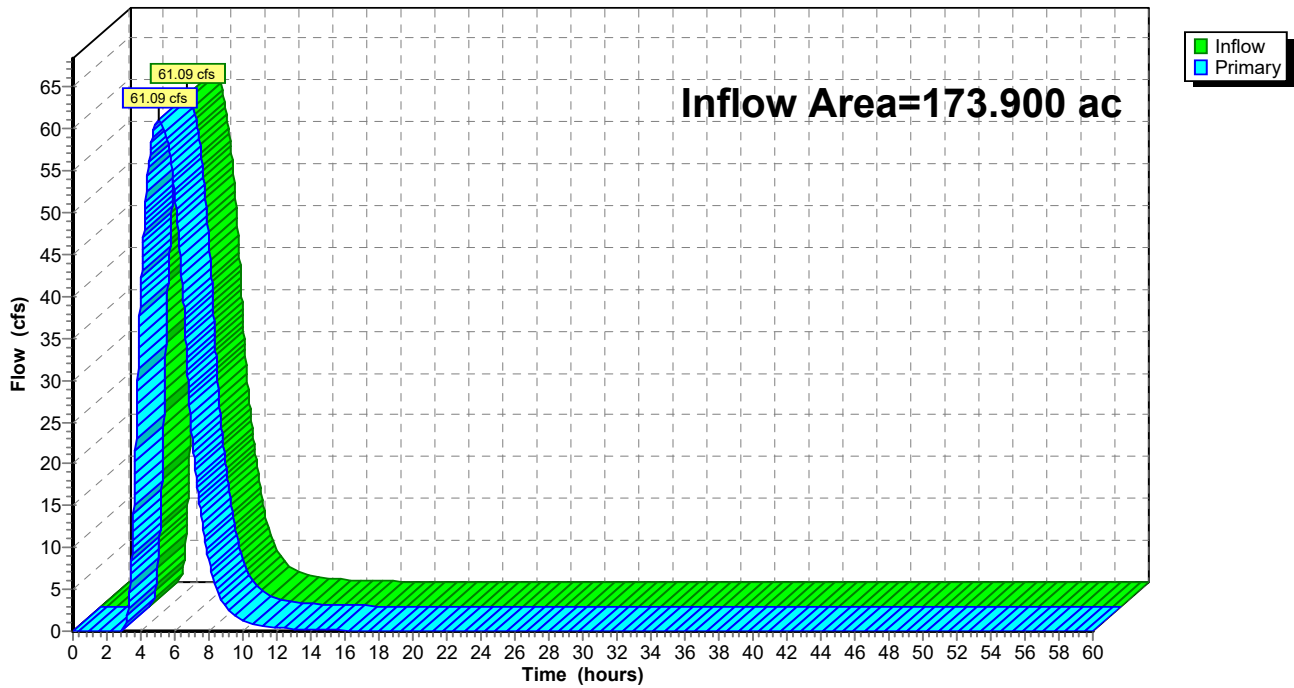
Summary for Link 1L: Outlet Southeast access Midway Rd

Inflow Area = 173.900 ac, 1.96% Impervious, Inflow Depth = 1.09" for 25-yr-6hr event
Inflow = 61.09 cfs @ 5.04 hrs, Volume= 15.783 af
Primary = 61.09 cfs @ 5.06 hrs, Volume= 15.783 af, Atten= 0%, Lag= 1.2 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

Link 1L: Outlet Southeast access Midway Rd

Hydrograph



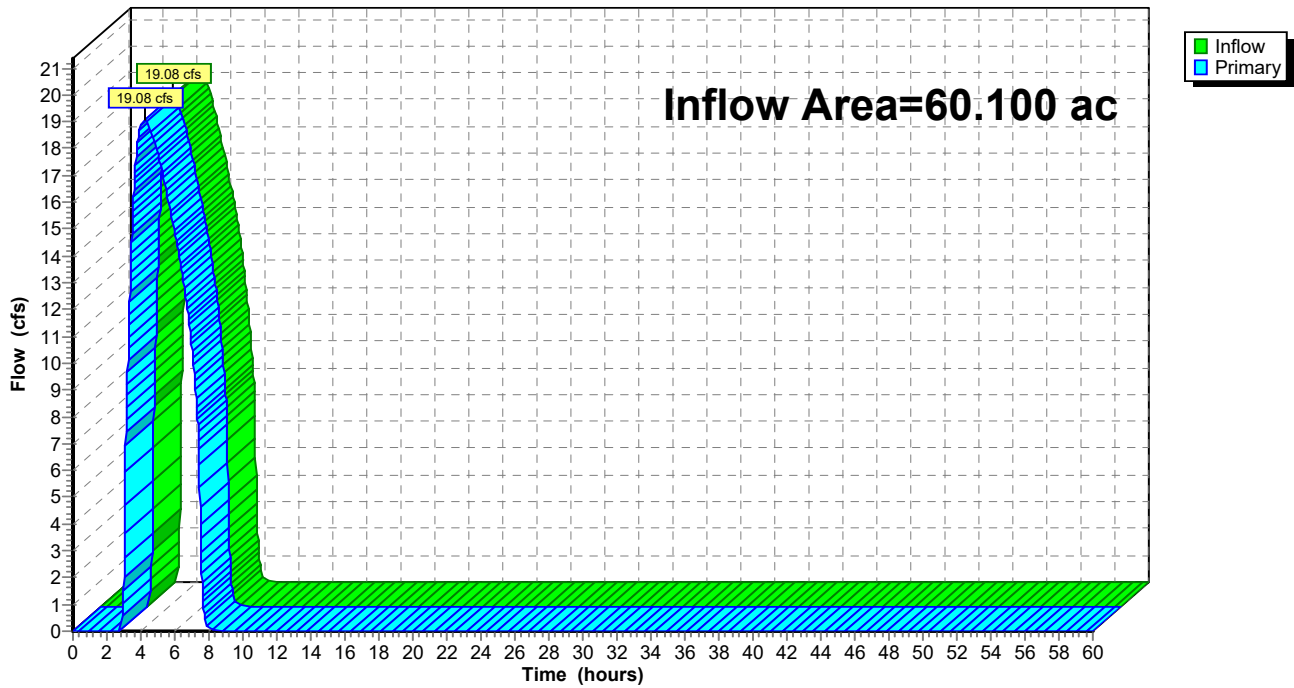
Summary for Link 10L: Outlet northeast accross Midway Rd

Inflow Area = 60.100 ac, 3.88% Impervious, Inflow Depth = 1.10" for 25-yr-6hr event
Inflow = 19.08 cfs @ 4.20 hrs, Volume= 5.504 af
Primary = 19.08 cfs @ 4.22 hrs, Volume= 5.504 af, Atten= 0%, Lag= 1.2 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

Link 10L: Outlet northeast accross Midway Rd

Hydrograph



2025-0717- Hermantown Industrial - Existing

MSE 24-hr 3 100-yr Rainfall=6.40"

Prepared by Kimley-Horn & Associates

Printed 7/30/2025

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Time span=0.00-60.00 hrs, dt=0.02 hrs, 3001 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Sim-Route method - Pond routing by Sim-Route method

SubcatchmentEX-DA1: Runoff Area=10.000 ac 7.30% Impervious Runoff Depth=3.22"
 Flow Length=590' Tc=26.5 min UI Adjusted CN=71 Runoff=30.95 cfs 2.687 af

SubcatchmentEX-DA2: Runoff Area=50.100 ac 3.19% Impervious Runoff Depth=3.13"
 Flow Length=568' Tc=42.4 min UI Adjusted CN=70 Runoff=113.11 cfs 13.051 af

SubcatchmentEX-DA3: Runoff Area=3.500 ac 0.00% Impervious Runoff Depth=3.13"
 Flow Length=330' Tc=32.4 min CN=70 Runoff=9.32 cfs 0.912 af

SubcatchmentEX-DA4: Runoff Area=36.000 ac 0.78% Impervious Runoff Depth=3.13"
 Flow Length=1,450' Tc=76.4 min CN=70 Runoff=54.59 cfs 9.378 af

SubcatchmentEX-DA5: Runoff Area=14.900 ac 0.00% Impervious Runoff Depth=3.13"
 Flow Length=720' Tc=40.4 min CN=70 Runoff=34.70 cfs 3.881 af

SubcatchmentEX-DA6: Runoff Area=36.200 ac 0.97% Impervious Runoff Depth=3.13"
 Flow Length=1,000' Tc=92.4 min CN=70 Runoff=48.19 cfs 9.430 af

SubcatchmentEX-DA7: Runoff Area=83.300 ac 3.33% Impervious Runoff Depth=3.13"
 Flow Length=3,350' Tc=108.0 min UI Adjusted CN=70 Runoff=98.87 cfs 21.699 af

Pond W1: NE Wetland Peak Elev=1,274.76' Storage=303,679 cf Inflow=135.69 cfs 15.738 af
 Outflow=34.03 cfs 15.738 af

Pond W4: Wetland 4 Peak Elev=1,296.66' Storage=142,551 cf Inflow=84.46 cfs 14.171 af
 Outflow=65.07 cfs 14.168 af

Pond W5: Wetland 5 Peak Elev=1,299.27' Storage=21,064 cf Inflow=34.70 cfs 3.881 af
 Outflow=32.20 cfs 3.881 af

Pond W6: Wetland 6 Peak Elev=1,285.29' Storage=48,107 cf Inflow=112.82 cfs 23.597 af
 Outflow=111.99 cfs 23.597 af

Pond W7: Wetland 7 Peak Elev=1,263.27' Storage=364,138 cf Inflow=210.17 cfs 45.296 af
 Outflow=193.22 cfs 45.296 af

Link 1L: Outlet Southeast accross Midway Rd Inflow=193.22 cfs 45.296 af
 Primary=193.22 cfs 45.296 af

Link 10L: Outlet northeast accross Midway Rd Inflow=34.03 cfs 15.738 af
 Primary=34.03 cfs 15.738 af

Total Runoff Area = 234.000 ac Runoff Volume = 61.037 af Average Runoff Depth = 3.13"
97.55% Pervious = 228.270 ac 2.45% Impervious = 5.730 ac

Summary for Subcatchment EX-DA1:

Runoff = 30.95 cfs @ 12.39 hrs, Volume= 2.687 af, Depth= 3.22"
 Routed to Pond W1 : NE Wetland

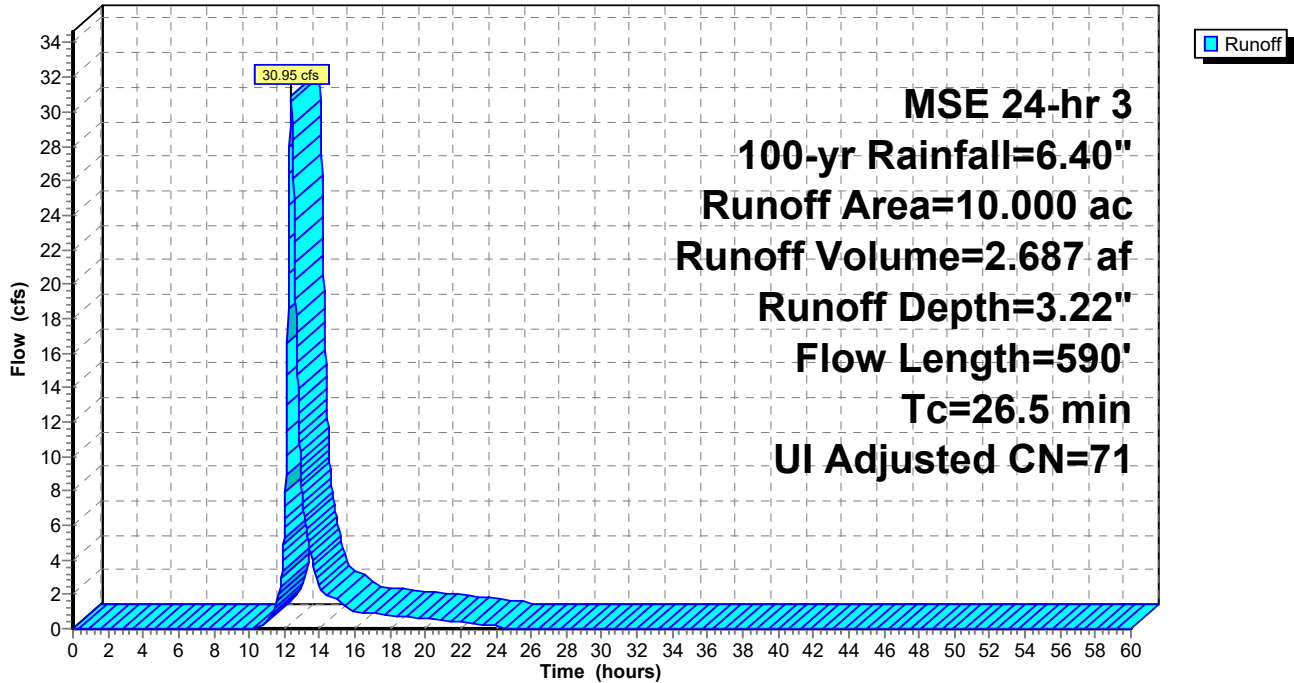
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 100-yr Rainfall=6.40"

Area (ac)	CN	Adj	Description
0.730	98		Unconnected pavement, HSG C
9.270	70		Woods, Good, HSG C
10.000	72	71	Weighted Average, UI Adjusted
9.270			92.70% Pervious Area
0.730			7.30% Impervious Area
0.730			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	100	0.0730	0.18		Sheet Flow, Grass: Dense n= 0.240 P2= 2.70"
17.2	490	0.0360	0.47		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
26.5	590	Total			

Subcatchment EX-DA1:

Hydrograph



Summary for Subcatchment EX-DA2:

Runoff = 113.11 cfs @ 12.59 hrs, Volume= 13.051 af, Depth= 3.13"
 Routed to Pond W1 : NE Wetland

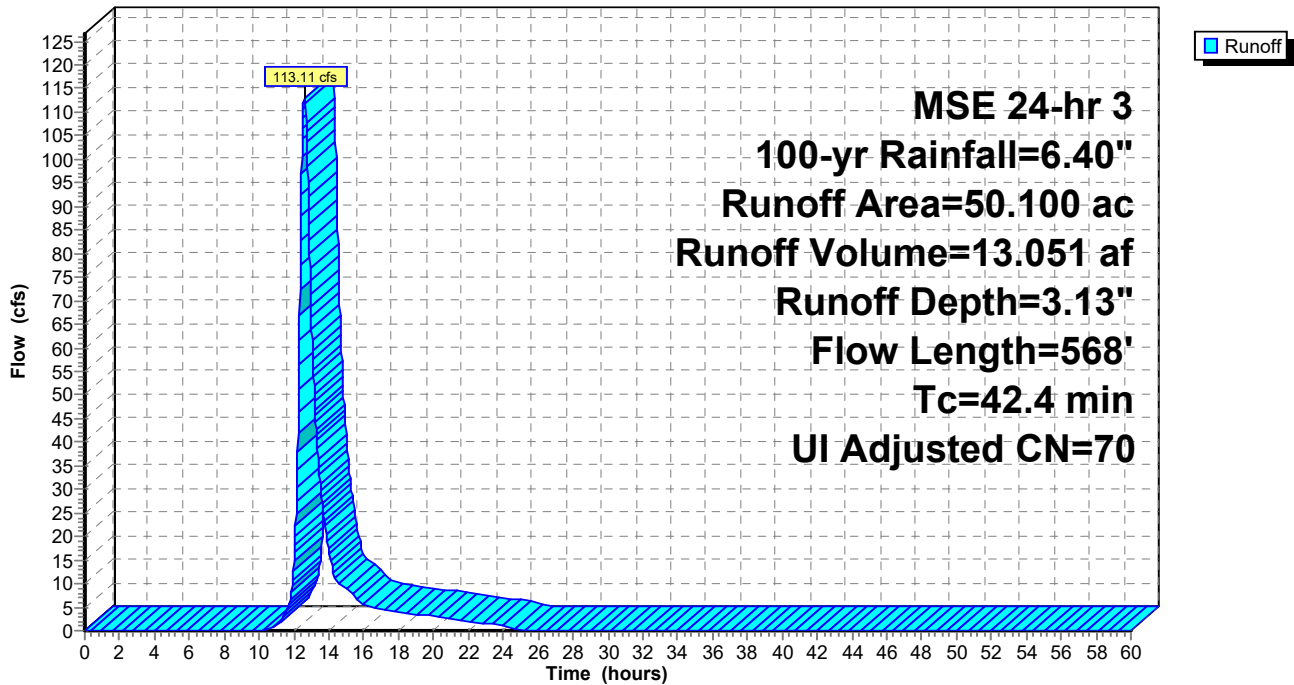
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 100-yr Rainfall=6.40"

Area (ac)	CN	Adj	Description
1.600	98		Unconnected pavement, HSG C
48.500	70		Woods, Good, HSG C
50.100	71	70	Weighted Average, UI Adjusted
48.500			96.81% Pervious Area
1.600			3.19% Impervious Area
1.600			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.2	100	0.0500	0.06		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.70"
14.2	468	0.0480	0.55		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
42.4	568	Total			

Subcatchment EX-DA2:

Hydrograph



Summary for Subcatchment EX-DA3:

Runoff = 9.32 cfs @ 12.47 hrs, Volume= 0.912 af, Depth= 3.13"
 Routed to Pond W4 : Wetland 4

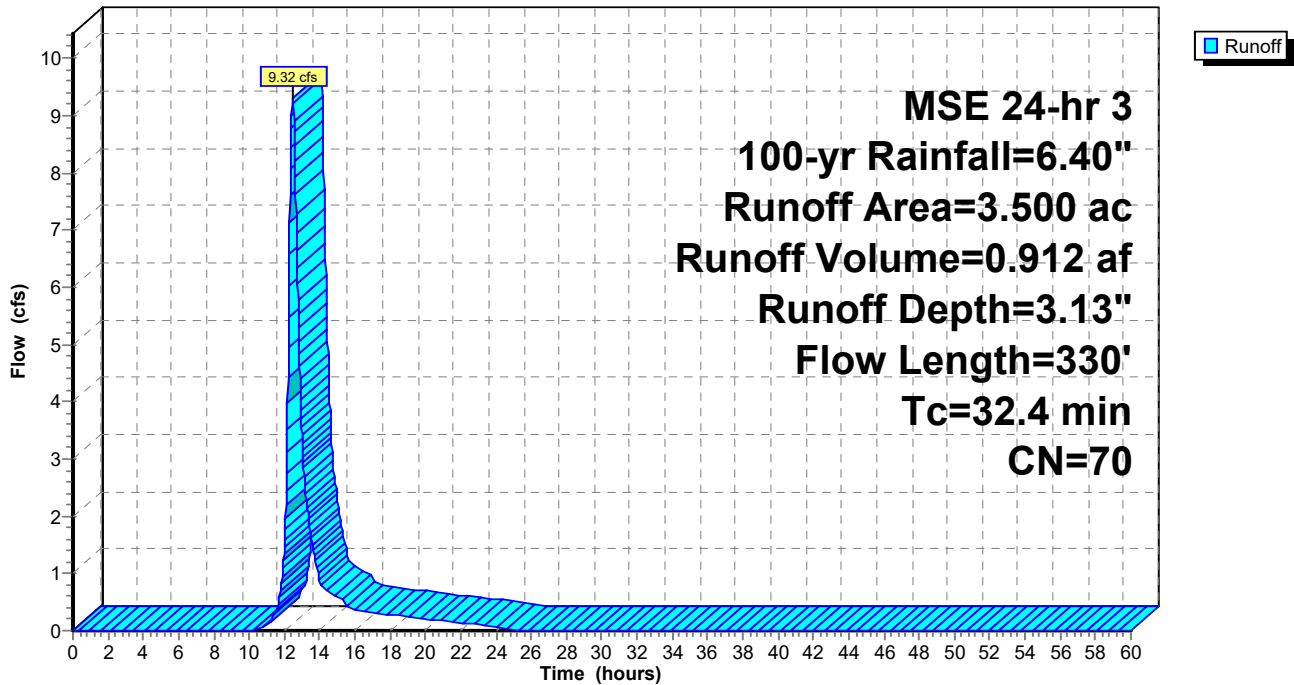
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 100-yr Rainfall=6.40"

Area (ac)	CN	Description
0.000	98	Unconnected pavement, HSG C
3.500	70	Woods, Good, HSG C
3.500	70	Weighted Average
3.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.8	100	0.0520	0.06		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.70"
4.6	230	0.1100	0.83		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
32.4	330	Total			

Subcatchment EX-DA3:

Hydrograph



Summary for Subcatchment EX-DA4:

Runoff = 54.59 cfs @ 13.06 hrs, Volume= 9.378 af, Depth= 3.13"
 Routed to Pond W4 : Wetland 4

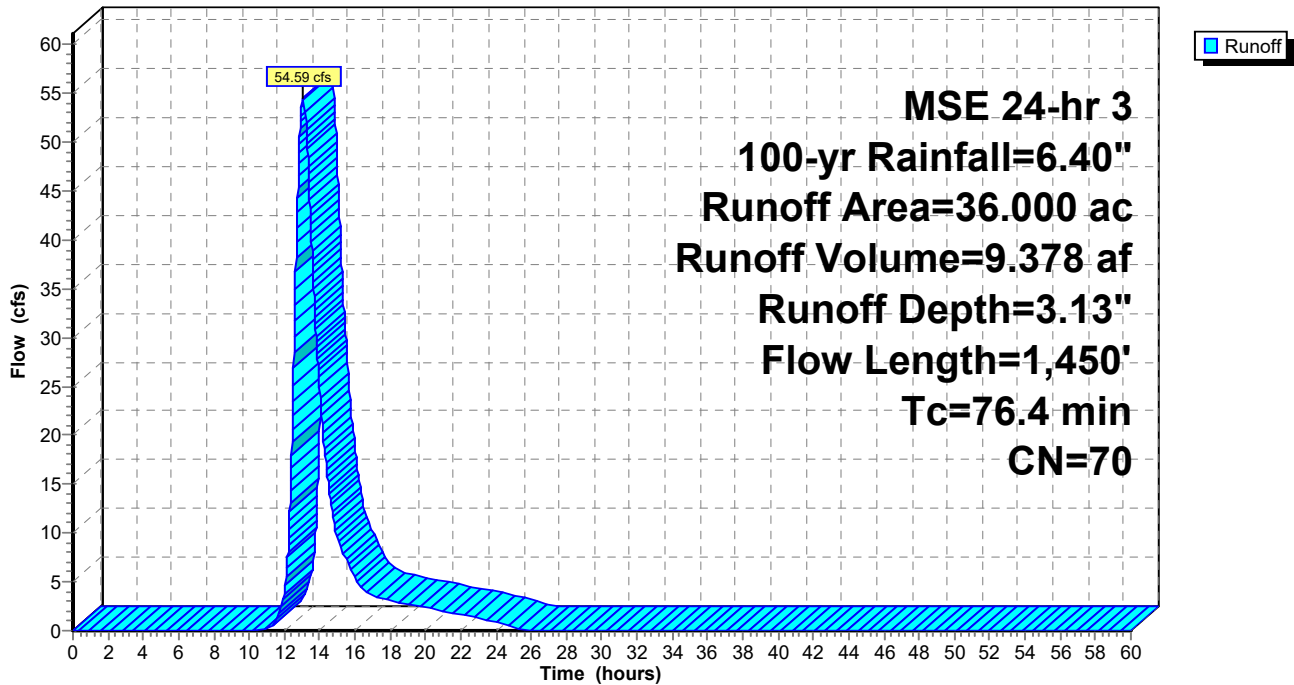
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 100-yr Rainfall=6.40"

Area (ac)	CN	Description
0.280	98	Unconnected pavement, HSG C
35.720	70	Woods, Good, HSG C
36.000	70	Weighted Average
35.720		99.22% Pervious Area
0.280		0.78% Impervious Area
0.280		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.8	100	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 2.70"
45.6	1,350	0.0390	0.49		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
76.4	1,450	Total			

Subcatchment EX-DA4:

Hydrograph



Summary for Subcatchment EX-DA5:

Runoff = 34.70 cfs @ 12.57 hrs, Volume= 3.881 af, Depth= 3.13"
 Routed to Pond W5 : Wetland 5

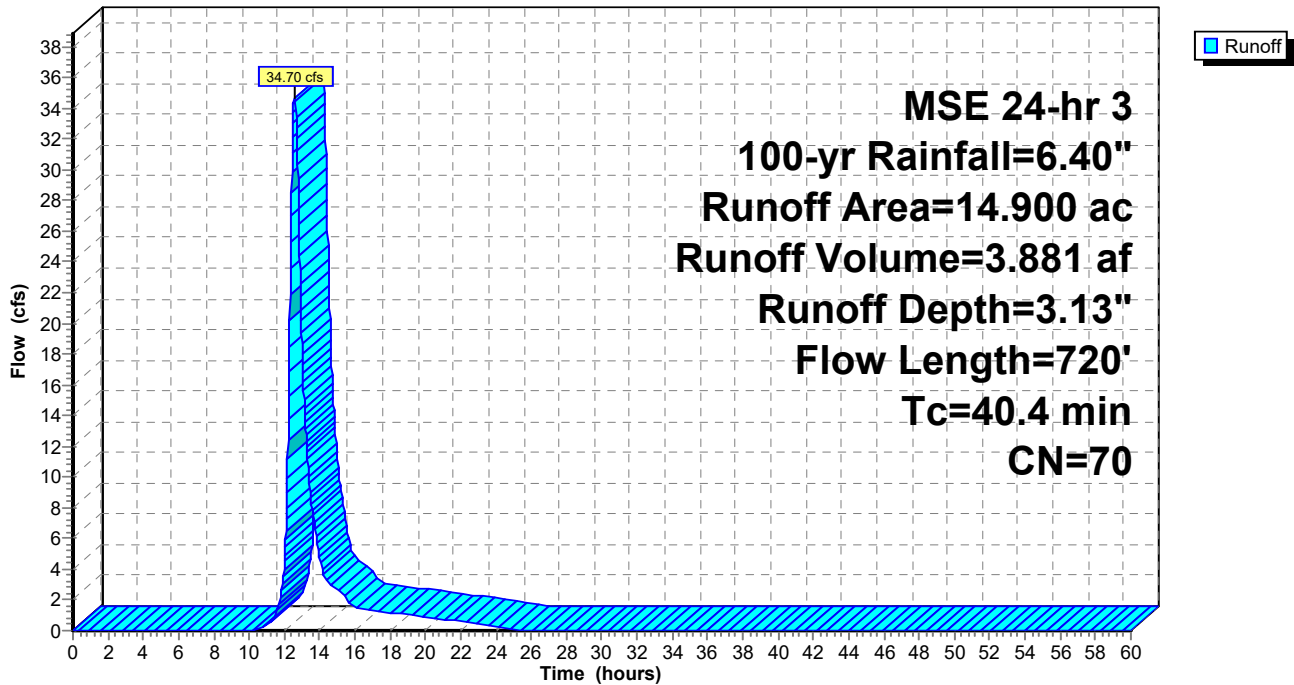
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 100-yr Rainfall=6.40"

Area (ac)	CN	Description
0.000	98	Unconnected pavement, HSG C
14.900	70	Woods, Good, HSG C
14.900	70	Weighted Average
14.900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	100	0.0380	0.05		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.70"
8.9	620	0.0540	1.16		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
40.4	720	Total			

Subcatchment EX-DA5:

Hydrograph



Summary for Subcatchment EX-DA6:

Runoff = 48.19 cfs @ 13.25 hrs, Volume= 9.430 af, Depth= 3.13"
 Routed to Pond W6 : Wetland 6

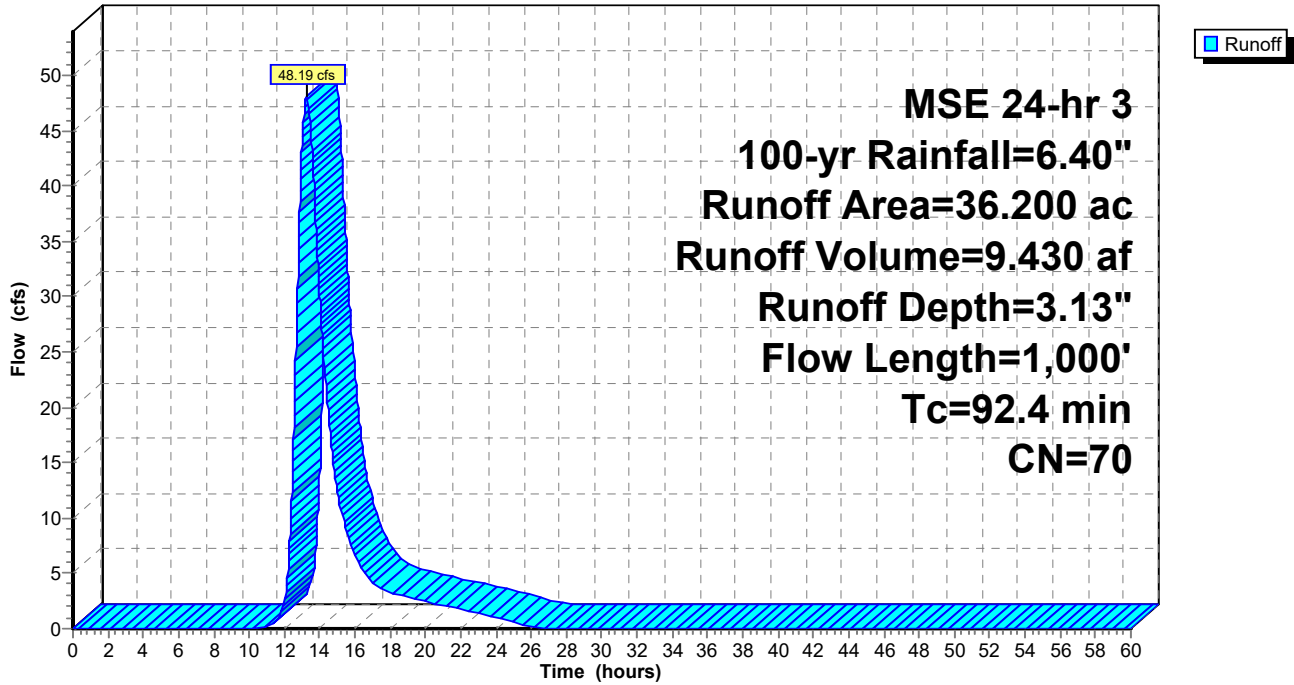
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 100-yr Rainfall=6.40"

Area (ac)	CN	Description
0.350	98	Unconnected pavement, HSG C
35.850	70	Woods, Good, HSG C
36.200	70	Weighted Average
35.850		99.03% Pervious Area
0.350		0.97% Impervious Area
0.350		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
53.7	100	0.0100	0.03		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.70"
38.7	900	0.0240	0.39		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
92.4	1,000	Total			

Subcatchment EX-DA6:

Hydrograph



Summary for Subcatchment EX-DA7:

Runoff = 98.87 cfs @ 13.55 hrs, Volume= 21.699 af, Depth= 3.13"
 Routed to Pond W7 : Wetland 7

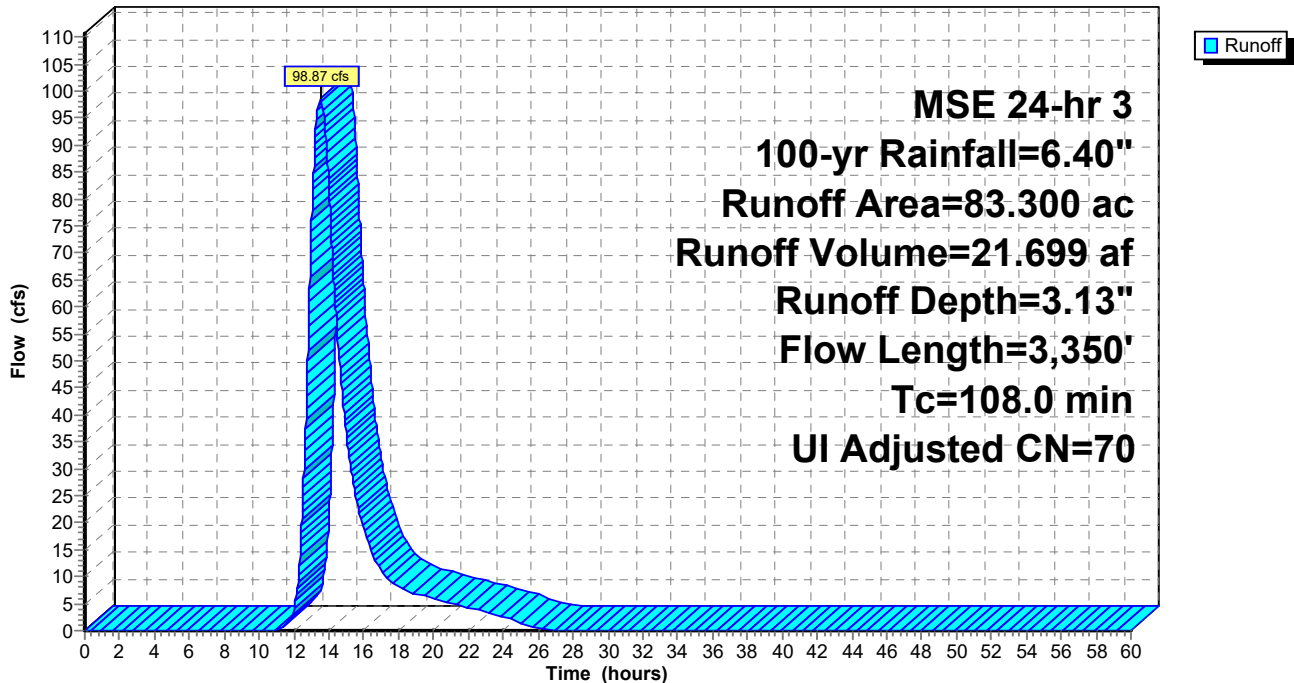
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 100-yr Rainfall=6.40"

Area (ac)	CN	Adj	Description
2.770	98		Unconnected pavement, HSG C
80.530	70		Woods, Good, HSG C
83.300	71	70	Weighted Average, UI Adjusted
80.530			96.67% Pervious Area
2.770			3.33% Impervious Area
2.770			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
39.2	100	0.0220	0.04		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.70"
51.4	1,400	0.0330	0.45		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
17.4	1,850	0.0140	1.77		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
108.0	3,350	Total			

Subcatchment EX-DA7:

Hydrograph



Summary for Pond W1: NE Wetland

Inflow Area = 60.100 ac, 3.88% Impervious, Inflow Depth = 3.14" for 100-yr event
 Inflow = 135.69 cfs @ 12.55 hrs, Volume= 15.738 af
 Outflow = 34.03 cfs @ 13.54 hrs, Volume= 15.738 af, Atten= 75%, Lag= 59.1 min
 Primary = 34.03 cfs @ 13.54 hrs, Volume= 15.738 af
 Routed to Link 10L : Outlet northeast accross Midway Rd

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,274.76' @ 13.54 hrs Surf.Area= 275,608 sf Storage= 303,679 cf

Plug-Flow detention time= 100.2 min calculated for 15.732 af (100% of inflow)
 Center-of-Mass det. time= 100.2 min (940.0 - 839.8)

Volume	Invert	Avail.Storage	Storage Description
#1	1,272.00'	1,287,831 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,272.00	200	0	0
1,273.00	6,116	3,158	3,158
1,274.00	218,914	112,515	115,673
1,276.00	368,040	586,954	702,627
1,277.00	802,367	585,204	1,287,831

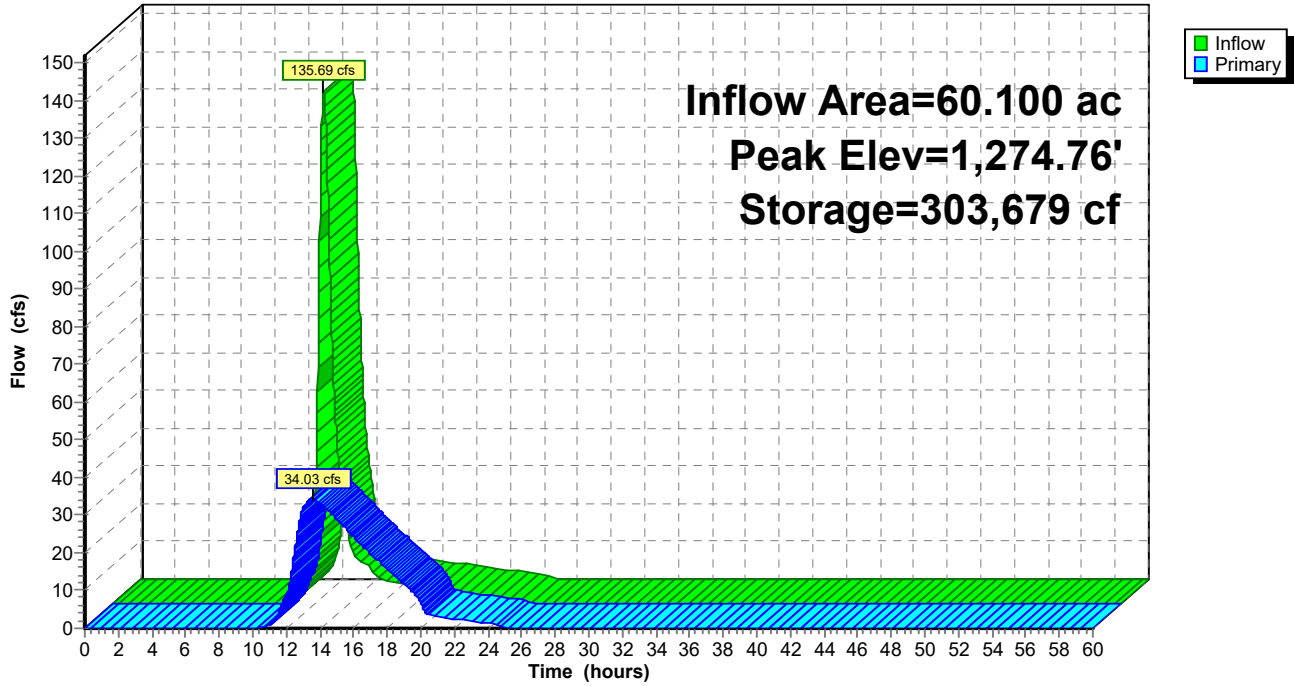
Device	Routing	Invert	Outlet Devices
#1	Primary	1,272.00'	36.0" Round Culvert L= 50.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,272.00' / 1,271.50' S= 0.0100 '/ Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf
#2	Primary	1,276.80'	42.0' long + 10.0 ' SideZ x 50.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=34.03 cfs @ 13.54 hrs HW=1,274.76' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Barrel Controls 34.03 cfs @ 6.54 fps)
- 2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond W1: NE Wetland

Hydrograph



Summary for Pond W4: Wetland 4

Inflow Area = 54.400 ac, 0.51% Impervious, Inflow Depth = 3.13" for 100-yr event
 Inflow = 84.46 cfs @ 12.83 hrs, Volume= 14.171 af
 Outflow = 65.07 cfs @ 13.34 hrs, Volume= 14.168 af, Atten= 23%, Lag= 30.5 min
 Primary = 65.07 cfs @ 13.34 hrs, Volume= 14.168 af
 Routed to Pond W6 : Wetland 6

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,296.66' @ 13.34 hrs Surf.Area= 235,393 sf Storage= 142,551 cf

Plug-Flow detention time= 57.0 min calculated for 14.168 af (100% of inflow)
 Center-of-Mass det. time= 56.7 min (924.3 - 867.6)

Volume	Invert	Avail.Storage	Storage Description
#1	1,296.00'	226,046 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

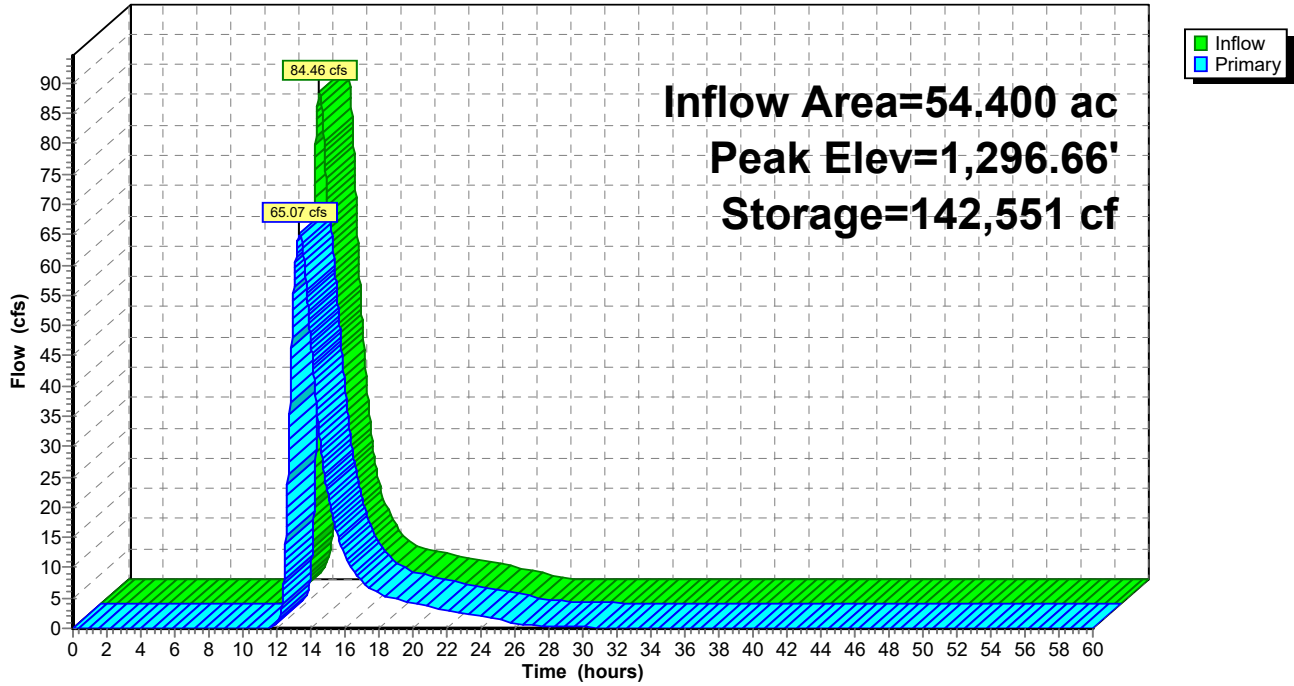
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,296.00	196,780	0	0
1,297.00	255,311	226,046	226,046

Device	Routing	Invert	Outlet Devices
#1	Primary	1,296.00'	40.0' long + 10.0 ' SideZ x 100.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=65.07 cfs @ 13.34 hrs HW=1,296.66' TW=1,285.29' (Dynamic Tailwater)
 ↑1=**Broad-Crested Rectangular Weir**(Weir Controls 65.07 cfs @ 2.12 fps)

Pond W4: Wetland 4

Hydrograph



Summary for Pond W5: Wetland 5

Inflow Area = 14.900 ac, 0.00% Impervious, Inflow Depth = 3.13" for 100-yr event
 Inflow = 34.70 cfs @ 12.57 hrs, Volume= 3.881 af
 Outflow = 32.20 cfs @ 12.71 hrs, Volume= 3.881 af, Atten= 7%, Lag= 8.0 min
 Primary = 32.20 cfs @ 12.71 hrs, Volume= 3.881 af
 Routed to Pond W4 : Wetland 4

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,299.27' @ 12.71 hrs Surf.Area= 80,010 sf Storage= 21,064 cf

Plug-Flow detention time= 18.7 min calculated for 3.880 af (100% of inflow)
 Center-of-Mass det. time= 18.9 min (859.6 - 840.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,299.00'	189,268 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

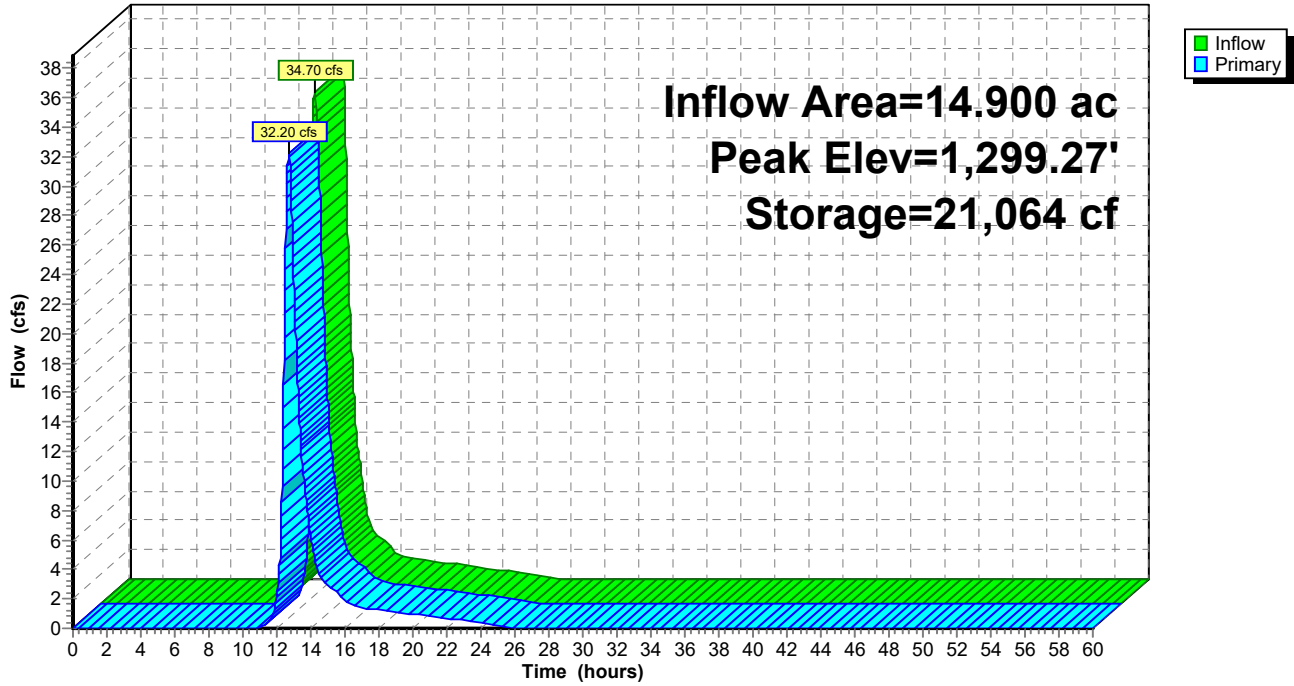
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,299.00	74,530	0	0
1,301.00	114,738	189,268	189,268

Device	Routing	Invert	Outlet Devices
#1	Primary	1,299.00'	82.0' long + 10.0 ' SideZ x 25.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=32.18 cfs @ 12.71 hrs HW=1,299.27' TW=1,296.40' (Dynamic Tailwater)
 ↑1=**Broad-Crested Rectangular Weir**(Weir Controls 32.18 cfs @ 1.39 fps)

Pond W5: Wetland 5

Hydrograph



Summary for Pond W6: Wetland 6

Inflow Area = 90.600 ac, 0.70% Impervious, Inflow Depth = 3.13" for 100-yr event
 Inflow = 112.82 cfs @ 13.29 hrs, Volume= 23.597 af
 Outflow = 111.99 cfs @ 13.39 hrs, Volume= 23.597 af, Atten= 1%, Lag= 6.1 min
 Primary = 111.99 cfs @ 13.39 hrs, Volume= 23.597 af
 Routed to Pond W7 : Wetland 7

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,285.29' @ 13.39 hrs Surf.Area= 182,926 sf Storage= 48,107 cf

Plug-Flow detention time= 10.7 min calculated for 23.597 af (100% of inflow)
 Center-of-Mass det. time= 10.6 min (920.7 - 910.1)

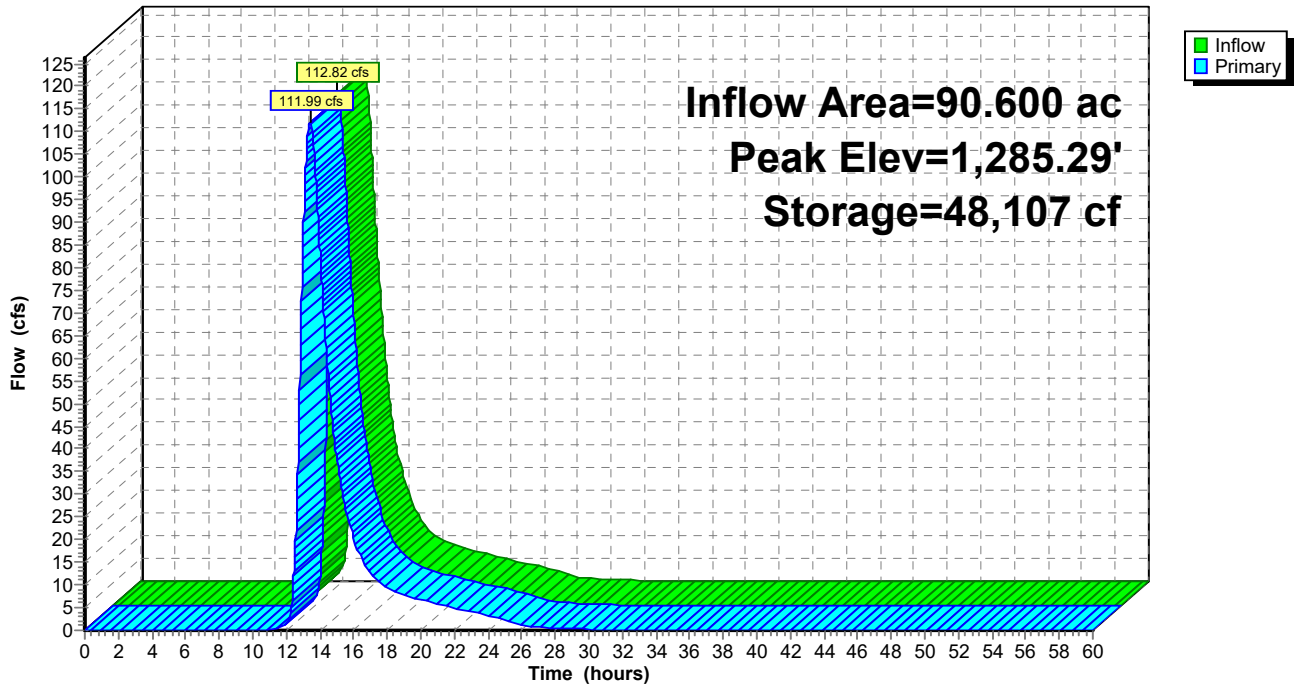
Volume	Invert	Avail.Storage	Storage Description
#1	1,285.00'	208,642 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,285.00	146,915	0	0
1,286.00	270,368	208,642	208,642

Device	Routing	Invert	Outlet Devices
#1	Primary	1,285.00'	262.0' long + 10.0 ' SideZ x 100.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=111.98 cfs @ 13.39 hrs HW=1,285.29' TW=1,262.67' (Dynamic Tailwater)
 ↑1=**Broad-Crested Rectangular Weir**(Weir Controls 111.98 cfs @ 1.45 fps)

Pond W6: Wetland 6

Hydrograph



Summary for Pond W7: Wetland 7

Inflow Area = 173.900 ac, 1.96% Impervious, Inflow Depth = 3.13" for 100-yr event
 Inflow = 210.17 cfs @ 13.44 hrs, Volume= 45.296 af
 Outflow = 193.22 cfs @ 13.76 hrs, Volume= 45.296 af, Atten= 8%, Lag= 19.3 min
 Primary = 193.22 cfs @ 13.76 hrs, Volume= 45.296 af
 Routed to Link 1L : Outlet Southeast access Midway Rd

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,263.27' @ 13.76 hrs Surf.Area= 187,965 sf Storage= 364,138 cf

Plug-Flow detention time= 34.8 min calculated for 45.296 af (100% of inflow)
 Center-of-Mass det. time= 34.8 min (947.4 - 912.6)

Volume	Invert	Avail.Storage	Storage Description
#1	1,256.00'	818,699 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,256.00	201	0	0
1,257.00	2,165	1,183	1,183
1,258.00	8,713	5,439	6,622
1,259.00	21,630	15,172	21,794
1,260.00	37,628	29,629	51,423
1,261.00	59,330	48,479	99,902
1,262.00	105,590	82,460	182,362
1,263.00	164,210	134,900	317,262
1,264.00	253,441	208,826	526,087
1,265.00	331,783	292,612	818,699

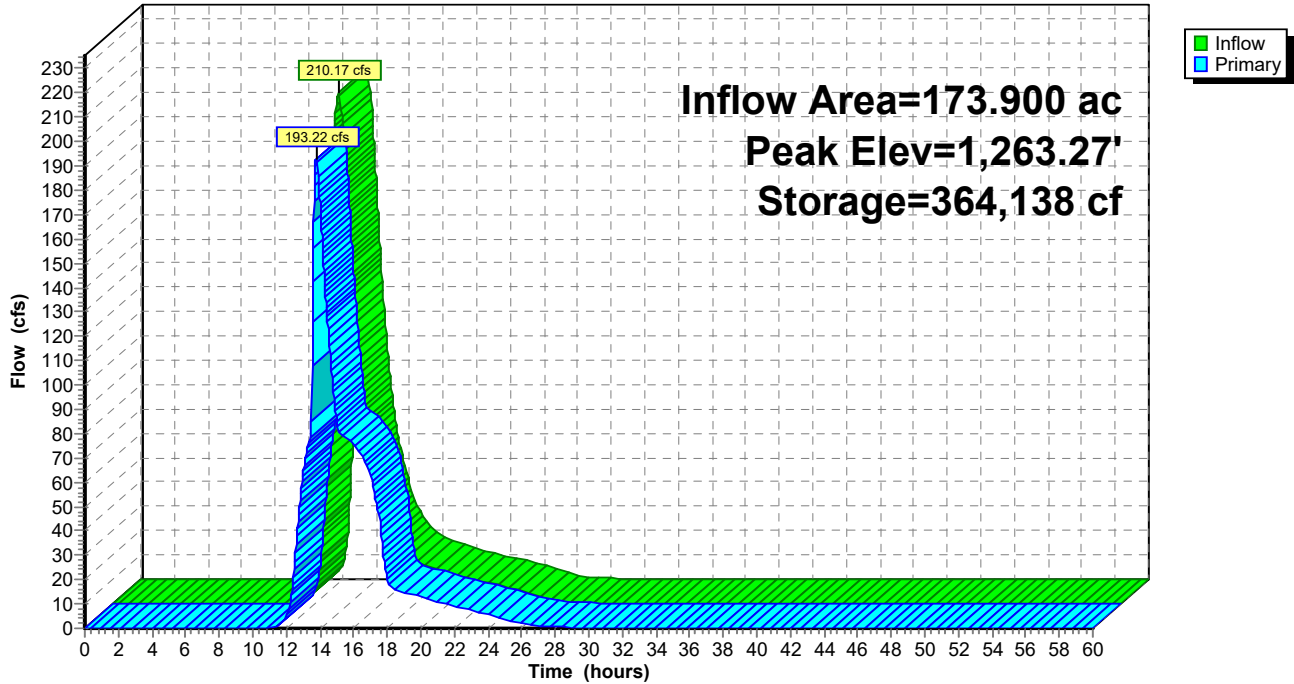
Device	Routing	Invert	Outlet Devices
#1	Primary	1,256.00'	36.0" Round Culvert L= 50.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,256.00' / 1,254.00' S= 0.0400 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf
#2	Primary	1,263.00'	300.0' long + 10.0 ' SideZ x 40.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=193.20 cfs @ 13.76 hrs HW=1,263.27' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Inlet Controls 81.73 cfs @ 11.56 fps)
- 2=Broad-Crested Rectangular Weir (Weir Controls 111.47 cfs @ 1.38 fps)

Pond W7: Wetland 7

Hydrograph



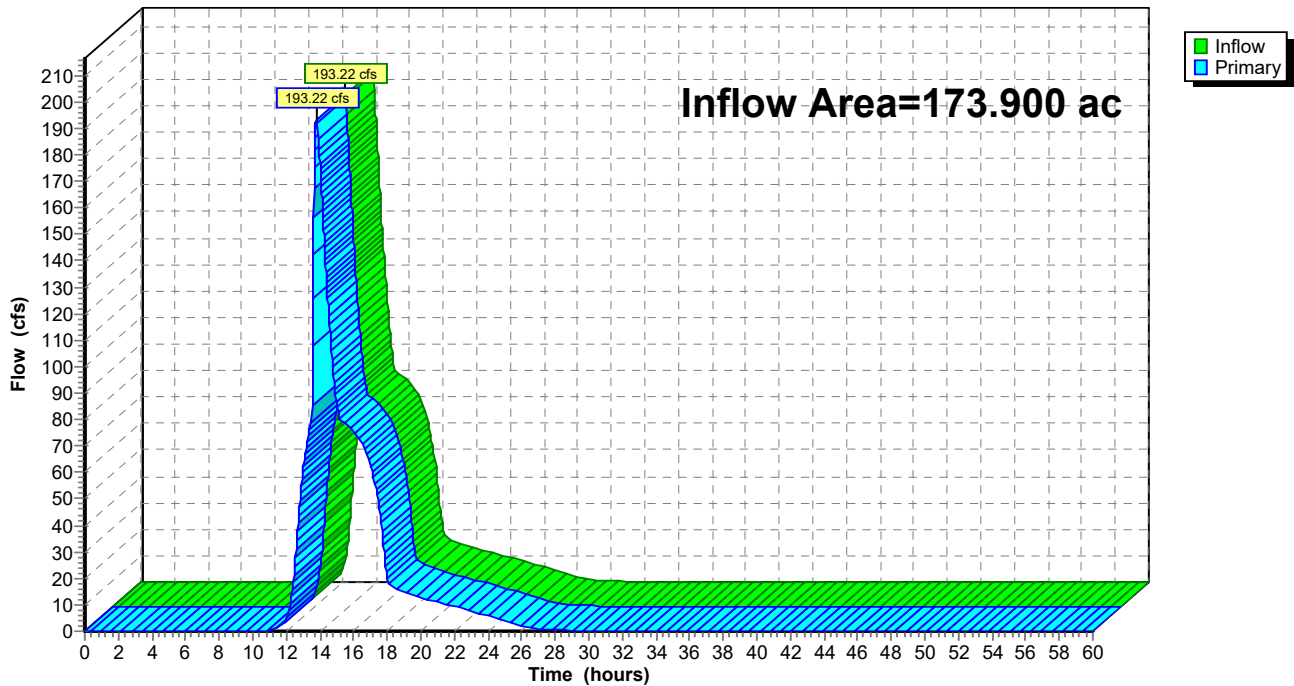
Summary for Link 1L: Outlet Southeast access Midway Rd

Inflow Area = 173.900 ac, 1.96% Impervious, Inflow Depth = 3.13" for 100-yr event
Inflow = 193.22 cfs @ 13.76 hrs, Volume= 45.296 af
Primary = 193.22 cfs @ 13.78 hrs, Volume= 45.296 af, Atten= 0%, Lag= 1.2 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

Link 1L: Outlet Southeast access Midway Rd

Hydrograph



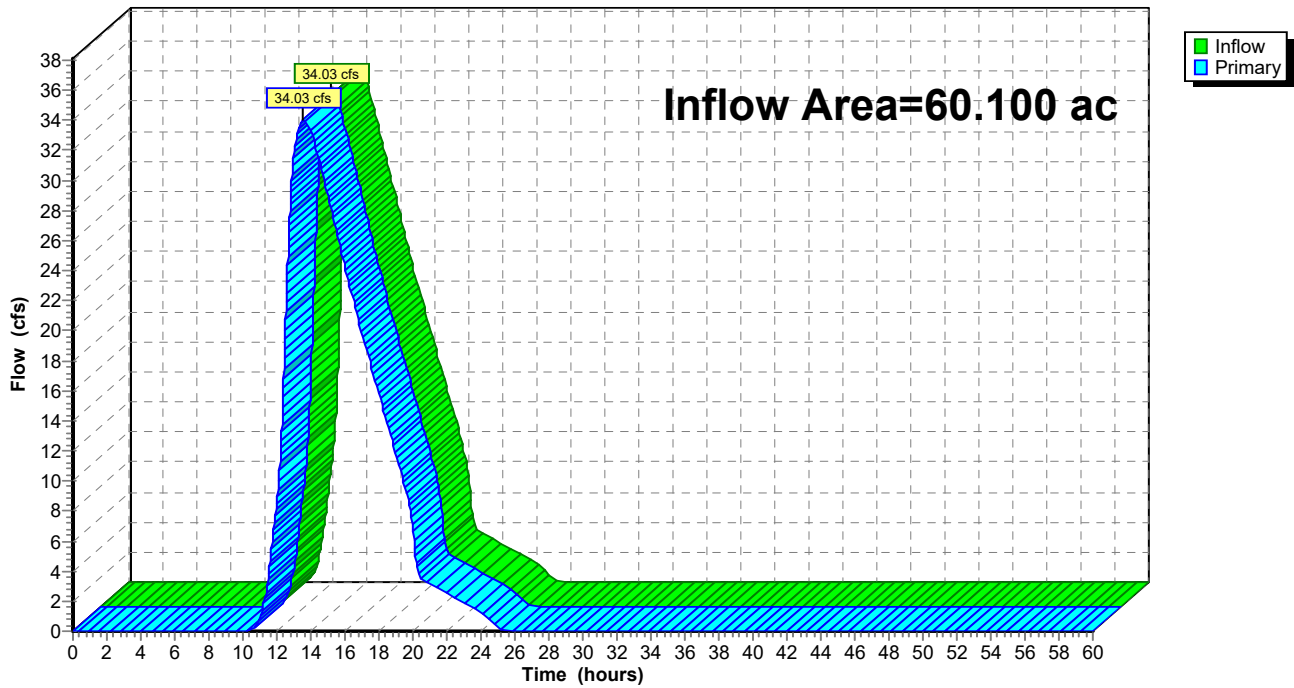
Summary for Link 10L: Outlet northeast accross Midway Rd

Inflow Area = 60.100 ac, 3.88% Impervious, Inflow Depth = 3.14" for 100-yr event
Inflow = 34.03 cfs @ 13.54 hrs, Volume= 15.738 af
Primary = 34.03 cfs @ 13.56 hrs, Volume= 15.738 af, Atten= 0%, Lag= 1.2 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

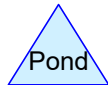
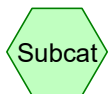
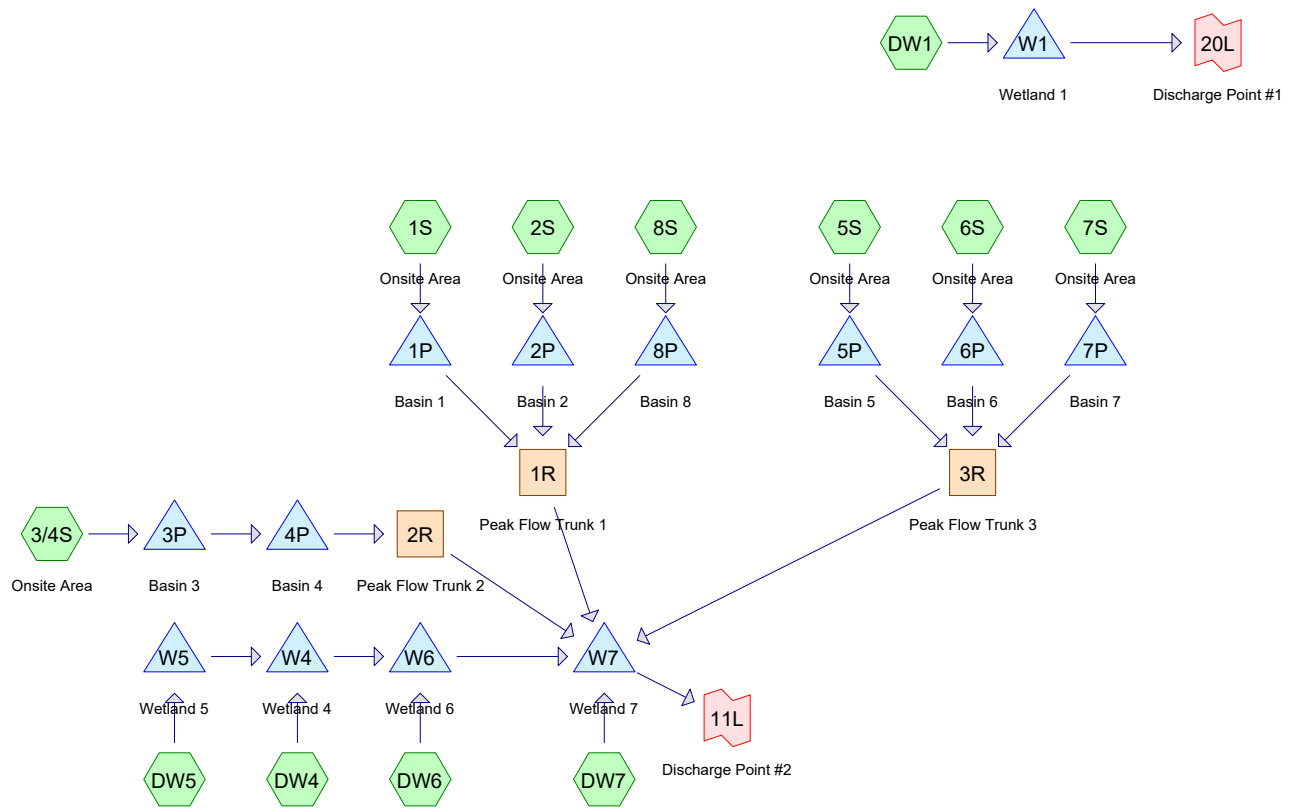
Link 10L: Outlet northeast accross Midway Rd

Hydrograph



Appendix 5. Post Development HydroCAD Model Analysis

"Day N"



Routing Diagram for 2025-0806 - Hermantown Industrial - Proposed

Prepared by Kimley-Horn & Associates, Printed 8/7/2025

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2025-0806 - Hermantown Industrial - Proposed

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Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
111.300	98	Paved parking, HSG D (1S, 2S, 3/4S, 5S, 6S, 7S, 8S)
74.500	76	Woods/grass comb., Fair, HSG C (1S, 2S, 3/4S, 5S, 6S, 7S, 8S)
48.200	79	Woods/grass comb., Good, HSG D (DW1, DW4, DW5, DW6, DW7)
234.000	87	TOTAL AREA

2025-0806 - Hermantown Industrial - Proposed

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Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
74.500	HSG C	1S, 2S, 3/4S, 5S, 6S, 7S, 8S
159.500	HSG D	1S, 2S, 3/4S, 5S, 6S, 7S, 8S, DW1, DW4, DW5, DW6, DW7
0.000	Other	
234.000		TOTAL AREA

2025-0806 - Hermantown Industrial - Proposed

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Ground Covers (selected 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	111.300	0.000	111.300	Paved parking	1S, 2S, 3/4S, 5S, 6S, 7S, 8S
0.000	0.000	74.500	0.000	0.000	74.500	Woods/grass comb., Fair	1S, 2S, 3/4S, 5S, 6S, 7S, 8S
0.000	0.000	0.000	48.200	0.000	48.200	Woods/grass comb., Good	DW1, DW4, DW5, DW6, DW7
0.000	0.000	74.500	159.500	0.000	234.000	TOTAL AREA	

2025-0806 - Hermantown Industrial - Proposed

MSE 24-hr 3 2-yr Rainfall=2.70"

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Time span=0.00-60.00 hrs, dt=0.02 hrs, 3001 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Sim-Route method - Pond routing by Sim-Route method

Subcatchment1S: Onsite Area	Runoff Area=20.700 ac 42.51% Impervious Runoff Depth=1.34" Tc=15.0 min CN=85 Runoff=36.10 cfs 2.311 af
Subcatchment2S: Onsite Area	Runoff Area=8.300 ac 63.86% Impervious Runoff Depth=1.71" Tc=15.0 min CN=90 Runoff=18.36 cfs 1.183 af
Subcatchment3/4S: Onsite Area	Runoff Area=39.000 ac 57.18% Impervious Runoff Depth=1.63" Tc=15.0 min CN=89 Runoff=82.55 cfs 5.301 af
Subcatchment5S: Onsite Area	Runoff Area=56.500 ac 68.14% Impervious Runoff Depth=1.79" Tc=15.0 min CN=91 Runoff=130.56 cfs 8.444 af
Subcatchment6S: Onsite Area	Runoff Area=16.300 ac 71.17% Impervious Runoff Depth=1.88" Tc=15.0 min CN=92 Runoff=39.22 cfs 2.553 af
Subcatchment7S: Onsite Area	Runoff Area=37.100 ac 57.95% Impervious Runoff Depth=1.63" Tc=15.0 min CN=89 Runoff=78.53 cfs 5.042 af
Subcatchment8S: Onsite Area	Runoff Area=7.900 ac 41.77% Impervious Runoff Depth=1.34" Tc=15.0 min CN=85 Runoff=13.78 cfs 0.882 af
SubcatchmentDW1:	Runoff Area=7.100 ac 0.00% Impervious Runoff Depth=0.97" Tc=7.0 min CN=79 Runoff=12.18 cfs 0.576 af
SubcatchmentDW4:	Runoff Area=4.600 ac 0.00% Impervious Runoff Depth=0.97" Tc=7.0 min CN=79 Runoff=7.89 cfs 0.373 af
SubcatchmentDW5:	Runoff Area=2.600 ac 0.00% Impervious Runoff Depth=0.97" Tc=7.0 min CN=79 Runoff=4.46 cfs 0.211 af
SubcatchmentDW6:	Runoff Area=1.800 ac 0.00% Impervious Runoff Depth=0.97" Tc=7.0 min CN=79 Runoff=3.09 cfs 0.146 af
SubcatchmentDW7:	Runoff Area=32.100 ac 0.00% Impervious Runoff Depth=0.97" Flow Length=2,600' Tc=73.0 min CN=79 Runoff=15.21 cfs 2.606 af
Reach 1R: Peak Flow Trunk 1	Inflow=1.18 cfs 2.126 af Outflow=1.18 cfs 2.126 af
Reach 2R: Peak Flow Trunk 2	Inflow=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af
Reach 3R: Peak Flow Trunk 3	Inflow=3.07 cfs 8.845 af Outflow=3.07 cfs 8.845 af
Pond 1P: Basin 1	Peak Elev=1,294.99' Storage=1.700 af Inflow=36.10 cfs 2.311 af Outflow=1.17 cfs 2.071 af

2025-0806 - Hermantown Industrial - Proposed*MSE 24-hr 3 2-yr Rainfall=2.70"*

Prepared by Kimley-Horn & Associates

Printed 8/7/2025

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Pond 2P: Basin 2	Peak Elev=1,288.35'	Storage=1.173 af	Inflow=18.36 cfs	1.183 af	Outflow=0.02 cfs	0.055 af
Pond 3P: Basin 3	Peak Elev=1,288.84'	Storage=5.093 af	Inflow=82.55 cfs	5.301 af	Outflow=0.41 cfs	0.684 af
Pond 4P: Basin 4	Peak Elev=1,285.74'	Storage=0.684 af	Inflow=0.41 cfs	0.684 af	Outflow=0.00 cfs	0.000 af
Pond 5P: Basin 5	Peak Elev=1,288.03'	Storage=7.873 af	Inflow=130.56 cfs	8.444 af	Outflow=1.00 cfs	1.563 af
Pond 6P: Basin 6	Peak Elev=1,282.76'	Storage=1.977 af	Inflow=39.22 cfs	2.553 af	Outflow=0.71 cfs	2.309 af
Pond 7P: Basin 7	Peak Elev=1,274.98'	Storage=3.853 af	Inflow=78.53 cfs	5.042 af	Outflow=1.46 cfs	4.974 af
Pond 8P: Basin 8	Peak Elev=1,279.90'	Storage=0.882 af	Inflow=13.78 cfs	0.882 af	Outflow=0.00 cfs	0.000 af
Pond W1: Wetland 1	Peak Elev=1,273.07'	Storage=0.095 af	Inflow=12.18 cfs	0.576 af	Outflow=7.24 cfs	0.576 af
	36.0" Round Culvert	n=0.013 L=50.0' S=0.0100 '/'				
Pond W4: Wetland 4	Peak Elev=1,296.11'	Storage=0.373 af	Inflow=7.89 cfs	0.373 af	Outflow=0.00 cfs	0.000 af
Pond W5: Wetland 5	Peak Elev=1,299.13'	Storage=0.211 af	Inflow=4.46 cfs	0.211 af	Outflow=0.00 cfs	0.000 af
	12.0" Round Culvert	n=0.012 L=50.0' S=0.0200 '/'				
Pond W6: Wetland 6	Peak Elev=1,285.28'	Storage=0.146 af	Inflow=3.09 cfs	0.146 af	Outflow=0.00 cfs	0.000 af
Pond W7: Wetland 7	Peak Elev=1,257.66'	Storage=0.092 af	Inflow=17.80 cfs	13.575 af	Outflow=17.55 cfs	13.572 af
Link 11L: Discharge Point #2			Inflow=17.55 cfs	13.570 af	Primary=17.55 cfs	13.570 af
Link 20L: Discharge Point #1			Inflow=7.24 cfs	0.576 af	Primary=7.24 cfs	0.576 af

Total Runoff Area = 234.000 ac Runoff Volume = 29.628 af Average Runoff Depth = 1.52"
52.44% Pervious = 122.700 ac 47.56% Impervious = 111.300 ac

Summary for Subcatchment 1S: Onsite Area

Runoff = 36.10 cfs @ 12.24 hrs, Volume= 2.311 af, Depth= 1.34"
 Routed to Pond 1P : Basin 1

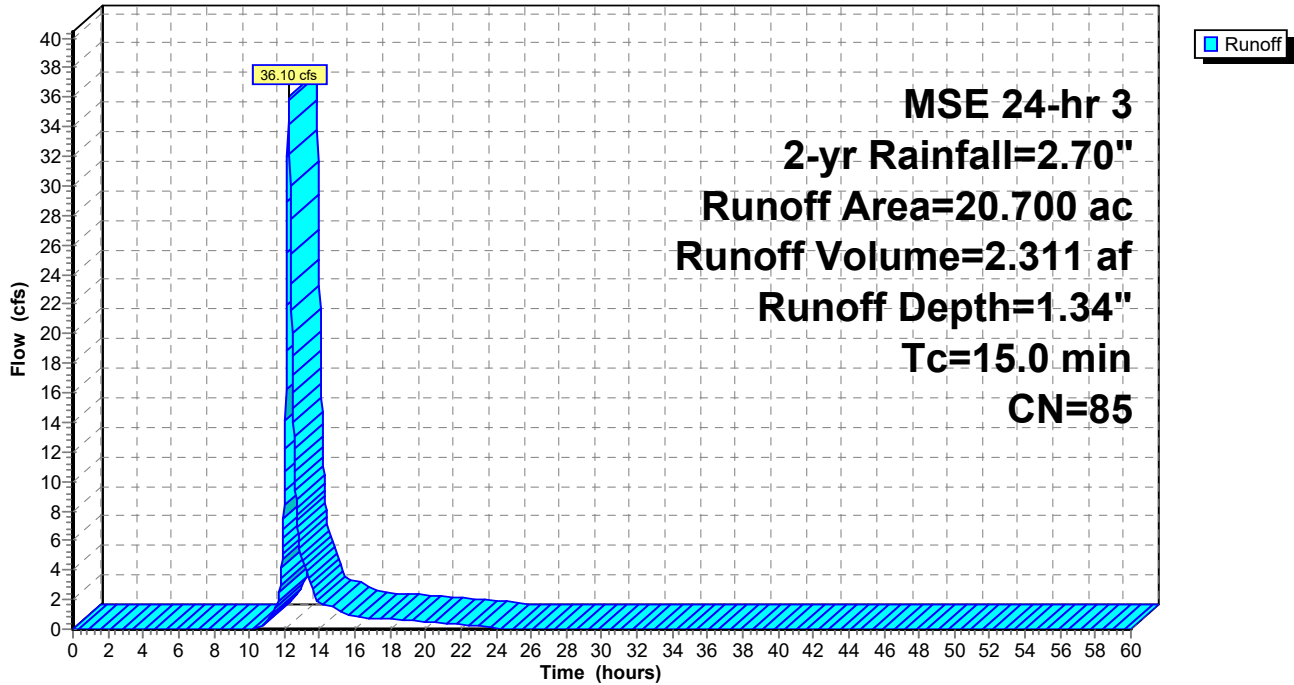
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 2-yr Rainfall=2.70"

Area (ac)	CN	Description
8.800	98	Paved parking, HSG D
11.900	76	Woods/grass comb., Fair, HSG C
20.700	85	Weighted Average
11.900		57.49% Pervious Area
8.800		42.51% Impervious Area

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

Subcatchment 1S: Onsite Area

Hydrograph



Summary for Subcatchment 2S: Onsite Area

Runoff = 18.36 cfs @ 12.23 hrs, Volume= 1.183 af, Depth= 1.71"
 Routed to Pond 2P : Basin 2

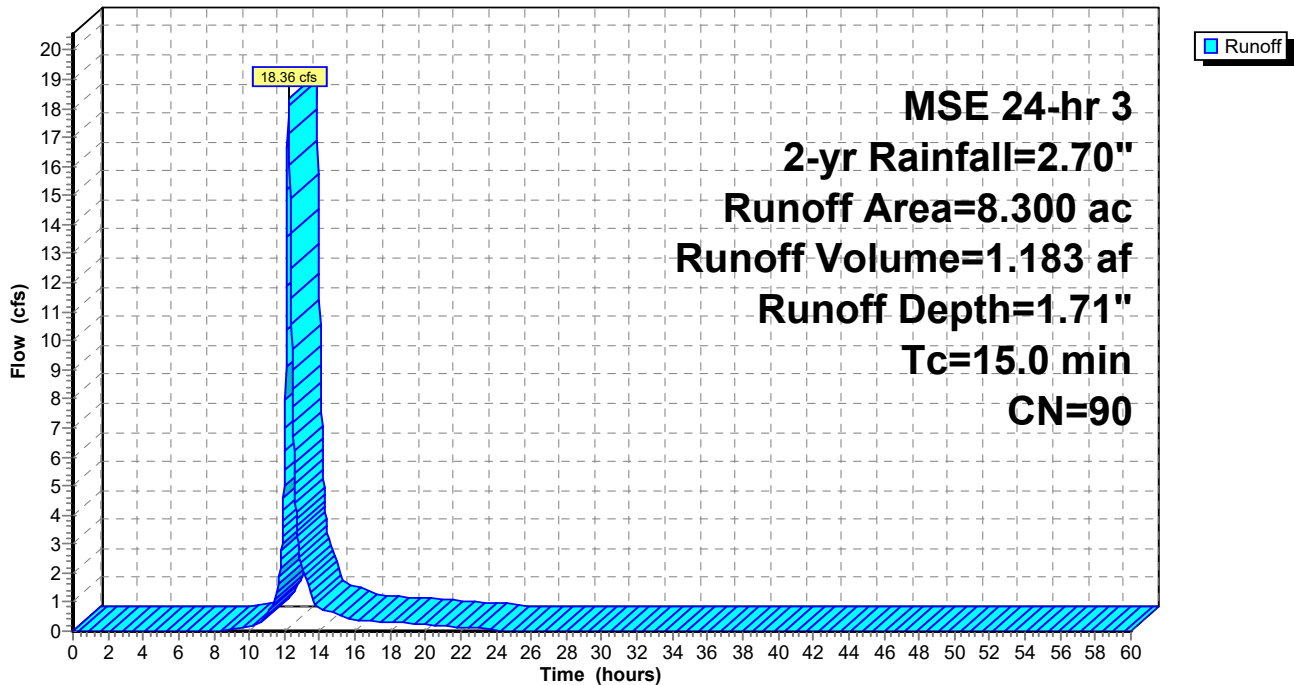
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 2-yr Rainfall=2.70"

Area (ac)	CN	Description
5.300	98	Paved parking, HSG D
3.000	76	Woods/grass comb., Fair, HSG C
8.300	90	Weighted Average
3.000		36.14% Pervious Area
5.300		63.86% Impervious Area

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

Subcatchment 2S: Onsite Area

Hydrograph



Summary for Subcatchment 3/4S: Onsite Area

Runoff = 82.55 cfs @ 12.23 hrs, Volume= 5.301 af, Depth= 1.63"
 Routed to Pond 3P : Basin 3

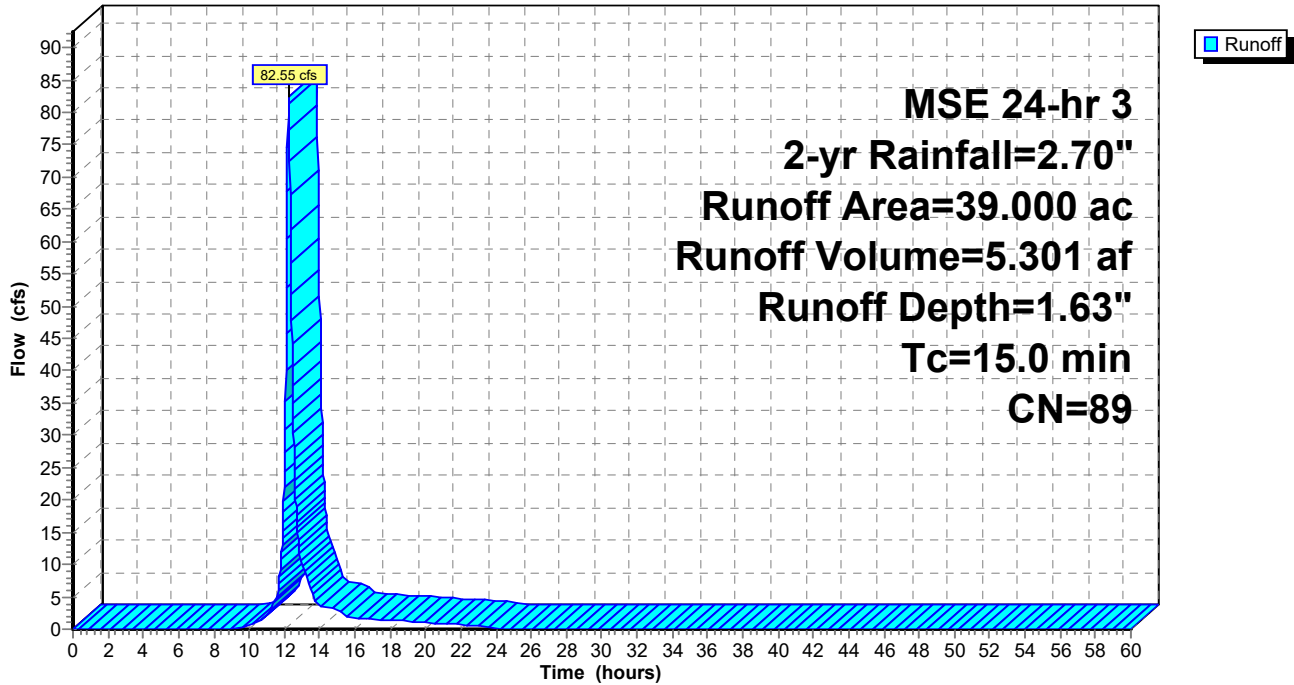
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 2-yr Rainfall=2.70"

Area (ac)	CN	Description
22.300	98	Paved parking, HSG D
16.700	76	Woods/grass comb., Fair, HSG C
39.000	89	Weighted Average
16.700		42.82% Pervious Area
22.300		57.18% Impervious Area

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

Subcatchment 3/4S: Onsite Area

Hydrograph



Summary for Subcatchment 5S: Onsite Area

Runoff = 130.56 cfs @ 12.23 hrs, Volume= 8.444 af, Depth= 1.79"
 Routed to Pond 5P : Basin 5

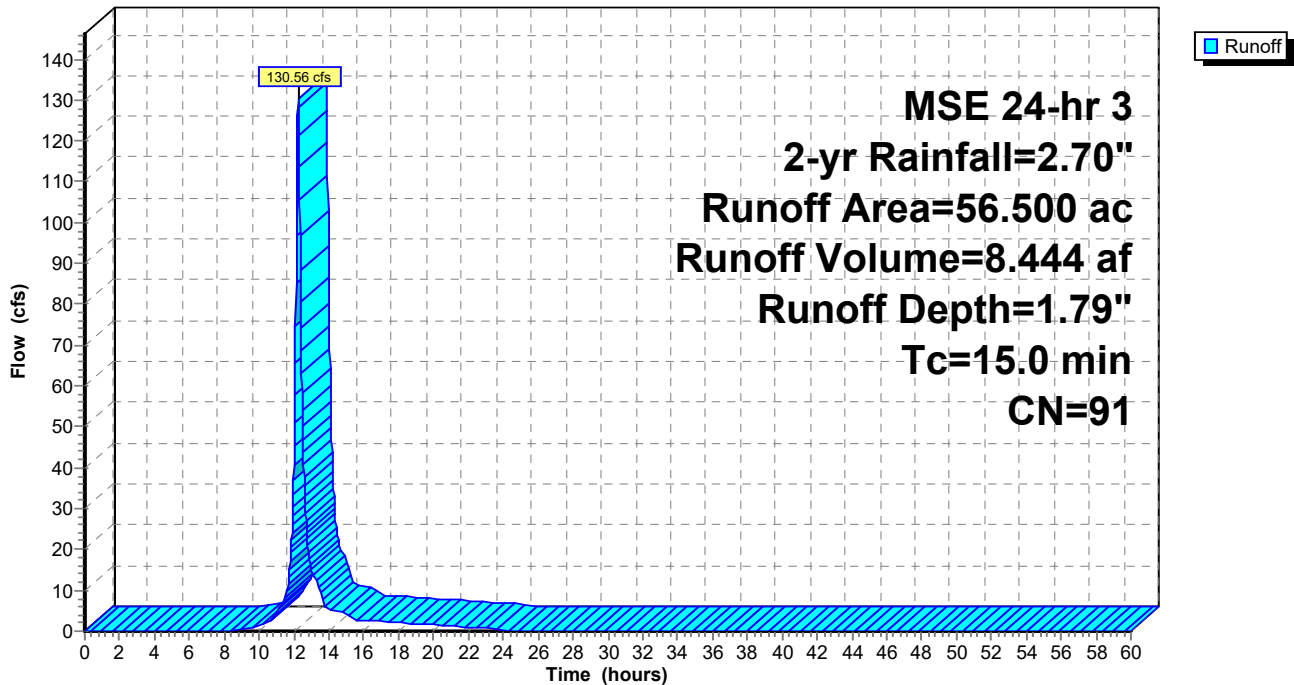
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 2-yr Rainfall=2.70"

Area (ac)	CN	Description
38.500	98	Paved parking, HSG D
18.000	76	Woods/grass comb., Fair, HSG C
56.500	91	Weighted Average
18.000		31.86% Pervious Area
38.500		68.14% Impervious Area

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

Subcatchment 5S: Onsite Area

Hydrograph



Summary for Subcatchment 6S: Onsite Area

Runoff = 39.22 cfs @ 12.23 hrs, Volume= 2.553 af, Depth= 1.88"
 Routed to Pond 6P : Basin 6

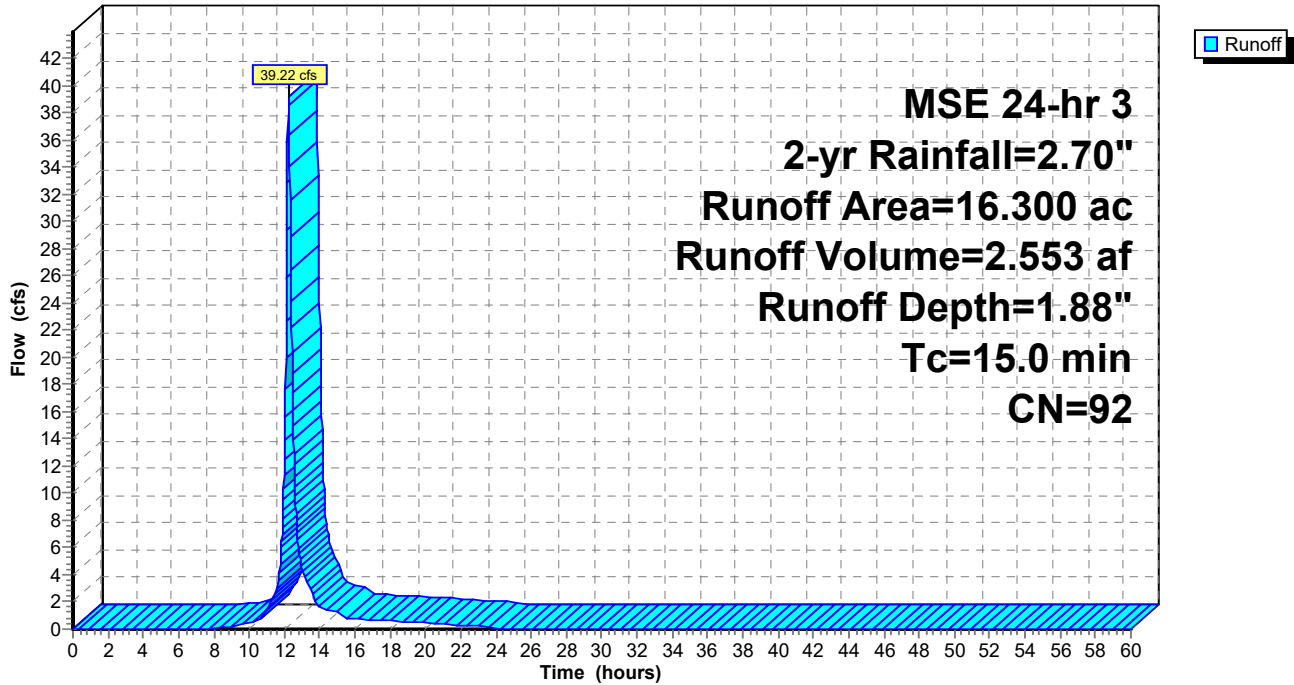
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 2-yr Rainfall=2.70"

Area (ac)	CN	Description
11.600	98	Paved parking, HSG D
4.700	76	Woods/grass comb., Fair, HSG C
16.300	92	Weighted Average
4.700		28.83% Pervious Area
11.600		71.17% Impervious Area

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

Subcatchment 6S: Onsite Area

Hydrograph



Summary for Subcatchment 7S: Onsite Area

Runoff = 78.53 cfs @ 12.23 hrs, Volume= 5.042 af, Depth= 1.63"
 Routed to Pond 7P : Basin 7

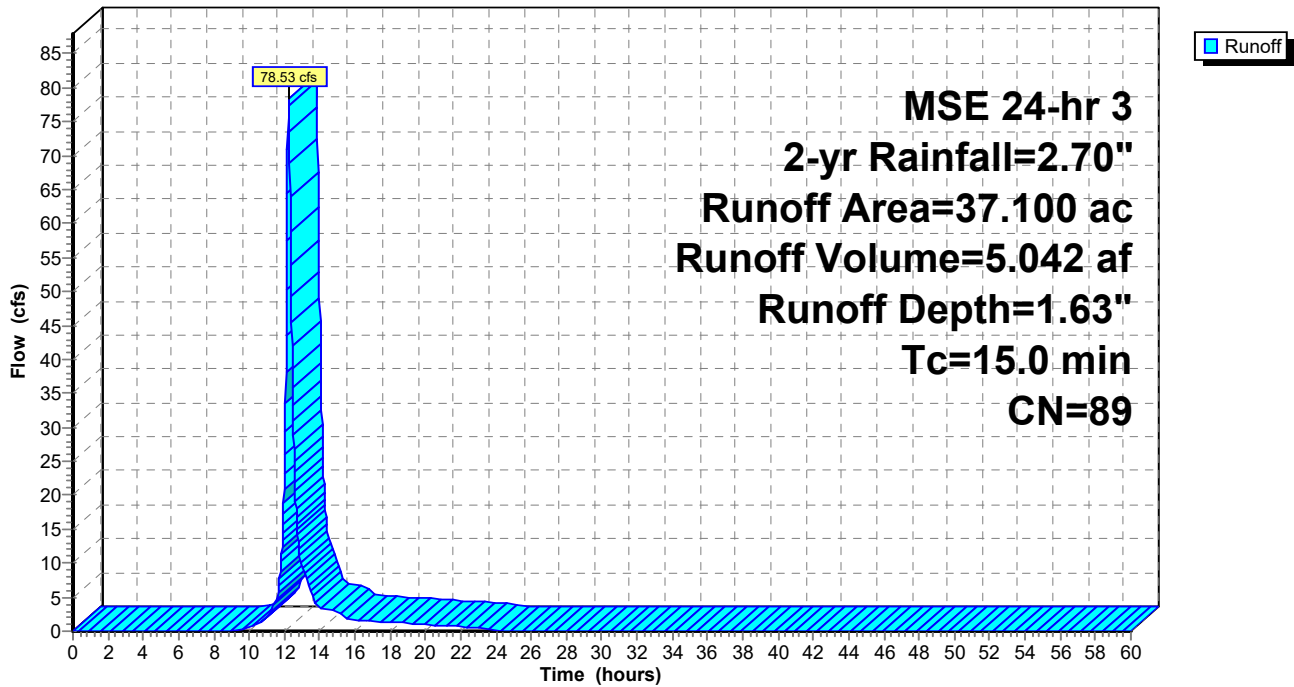
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 2-yr Rainfall=2.70"

Area (ac)	CN	Description
21.500	98	Paved parking, HSG D
15.600	76	Woods/grass comb., Fair, HSG C
37.100	89	Weighted Average
15.600		42.05% Pervious Area
21.500		57.95% Impervious Area

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

Subcatchment 7S: Onsite Area

Hydrograph



Summary for Subcatchment 8S: Onsite Area

Runoff = 13.78 cfs @ 12.24 hrs, Volume= 0.882 af, Depth= 1.34"
 Routed to Pond 8P : Basin 8

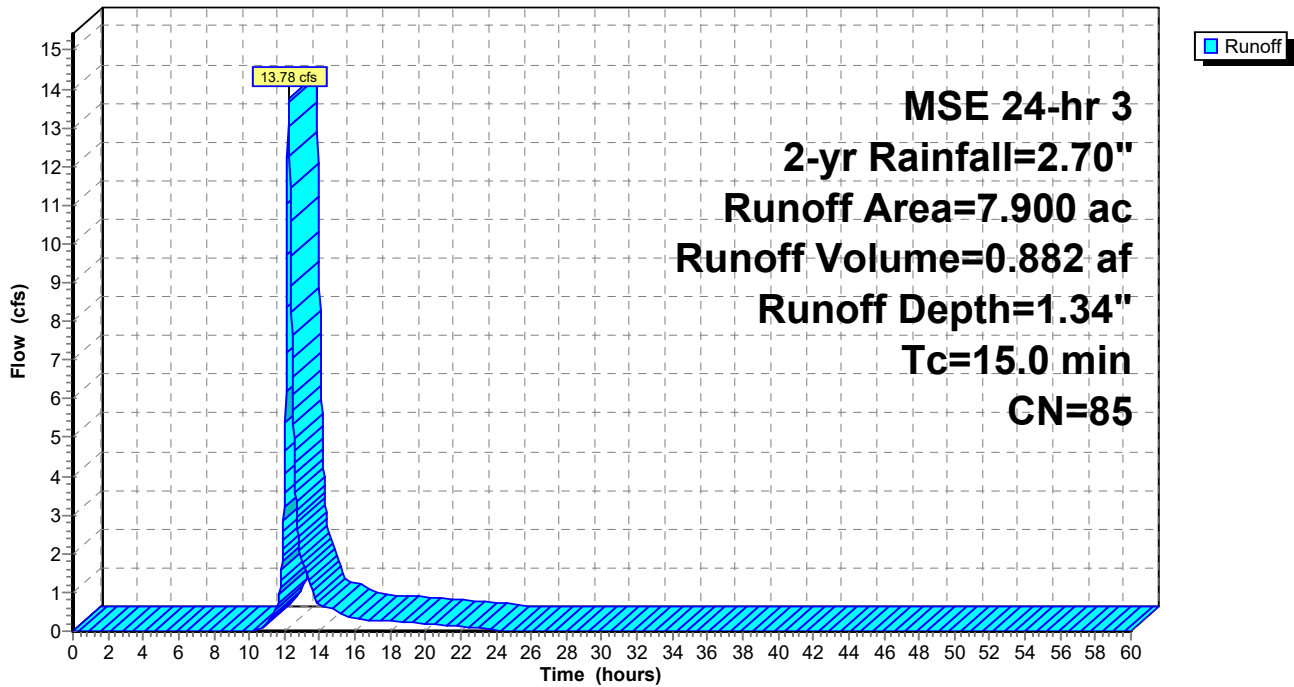
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 2-yr Rainfall=2.70"

Area (ac)	CN	Description
3.300	98	Paved parking, HSG D
4.600	76	Woods/grass comb., Fair, HSG C
7.900	85	Weighted Average
4.600		58.23% Pervious Area
3.300		41.77% Impervious Area

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

Subcatchment 8S: Onsite Area

Hydrograph



Summary for Subcatchment DW1:

Runoff = 12.18 cfs @ 12.15 hrs, Volume= 0.576 af, Depth= 0.97"
 Routed to Pond W1 : Wetland 1

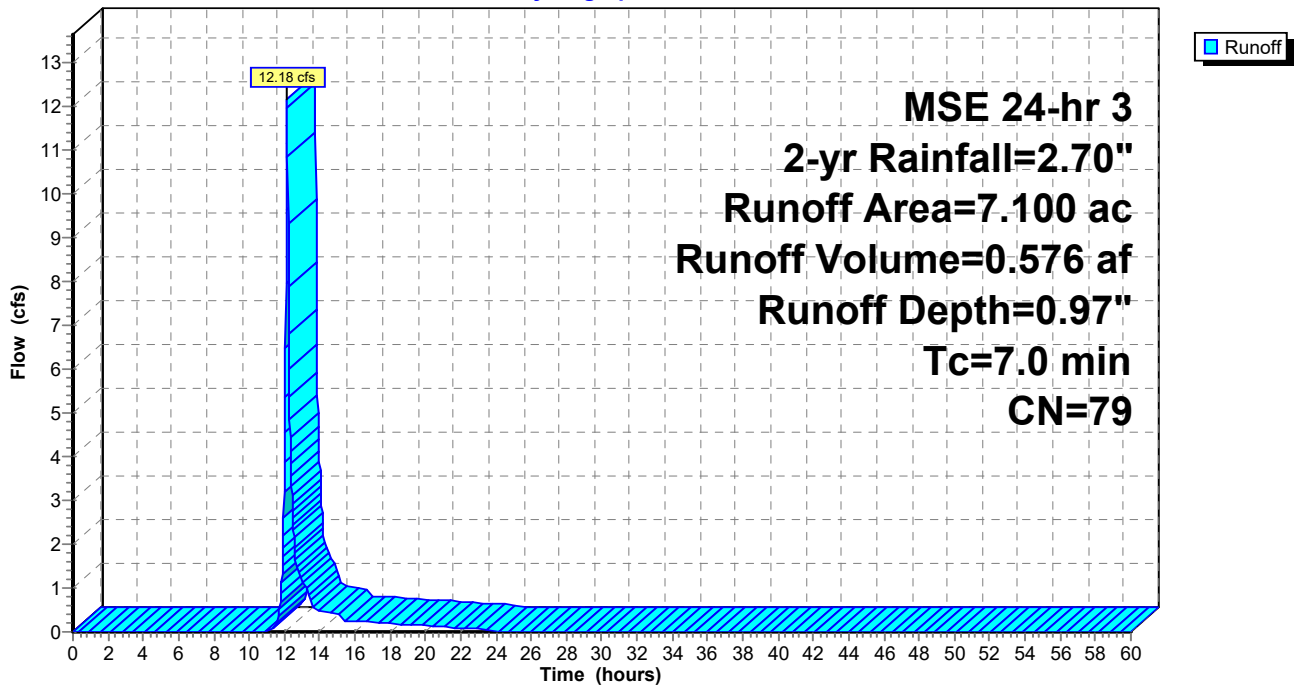
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 2-yr Rainfall=2.70"

Area (ac)	CN	Description
7.100	79	Woods/grass comb., Good, HSG D
7.100		100.00% Pervious Area

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

Subcatchment DW1:

Hydrograph



Summary for Subcatchment DW4:

Runoff = 7.89 cfs @ 12.15 hrs, Volume= 0.373 af, Depth= 0.97"
 Routed to Pond W4 : Wetland 4

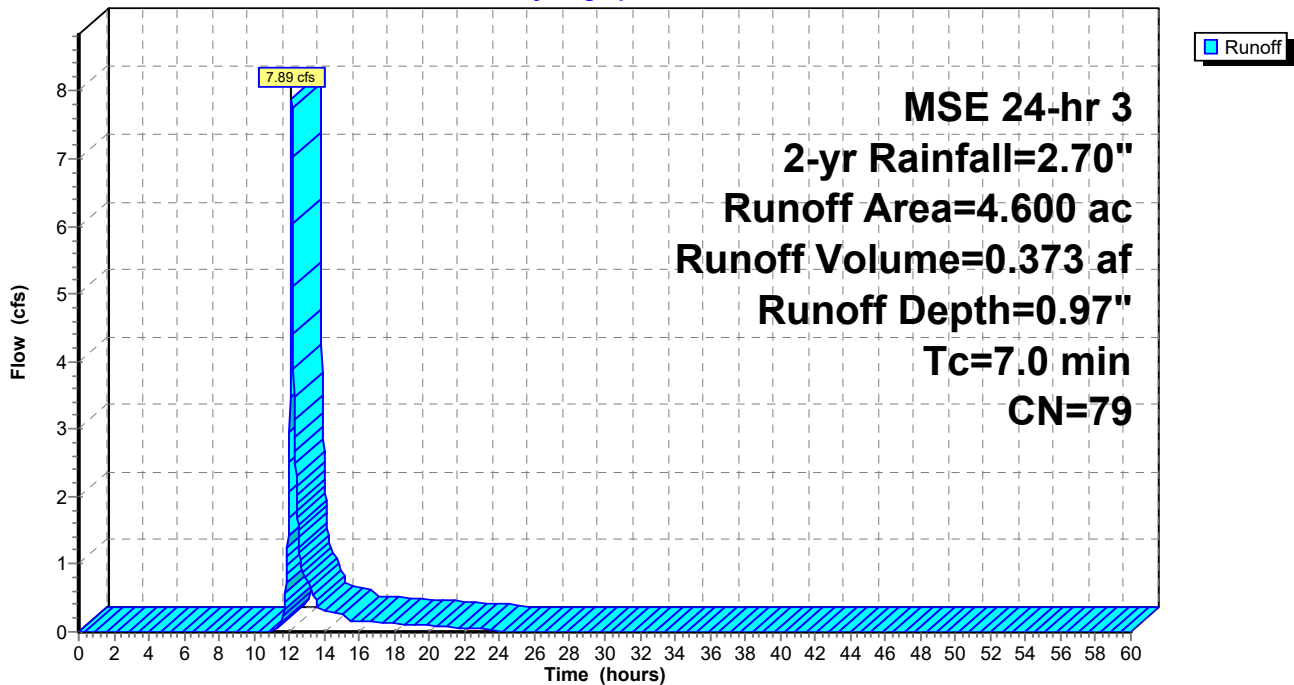
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 2-yr Rainfall=2.70"

Area (ac)	CN	Description
4.600	79	Woods/grass comb., Good, HSG D
4.600		100.00% Pervious Area

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

Subcatchment DW4:

Hydrograph



Summary for Subcatchment DW5:

Runoff = 4.46 cfs @ 12.15 hrs, Volume= 0.211 af, Depth= 0.97"
 Routed to Pond W5 : Wetland 5

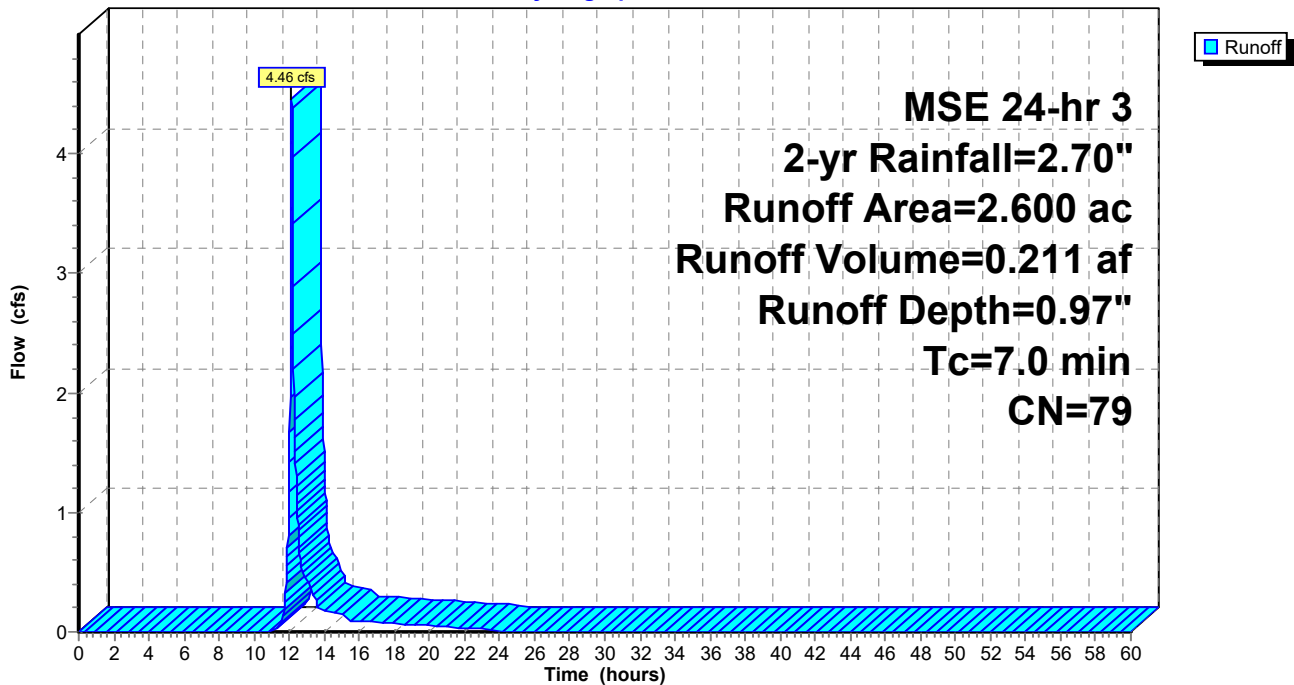
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 2-yr Rainfall=2.70"

Area (ac)	CN	Description
2.600	79	Woods/grass comb., Good, HSG D
2.600		100.00% Pervious Area

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

Subcatchment DW5:

Hydrograph



Summary for Subcatchment DW6:

Runoff = 3.09 cfs @ 12.15 hrs, Volume= 0.146 af, Depth= 0.97"
 Routed to Pond W6 : Wetland 6

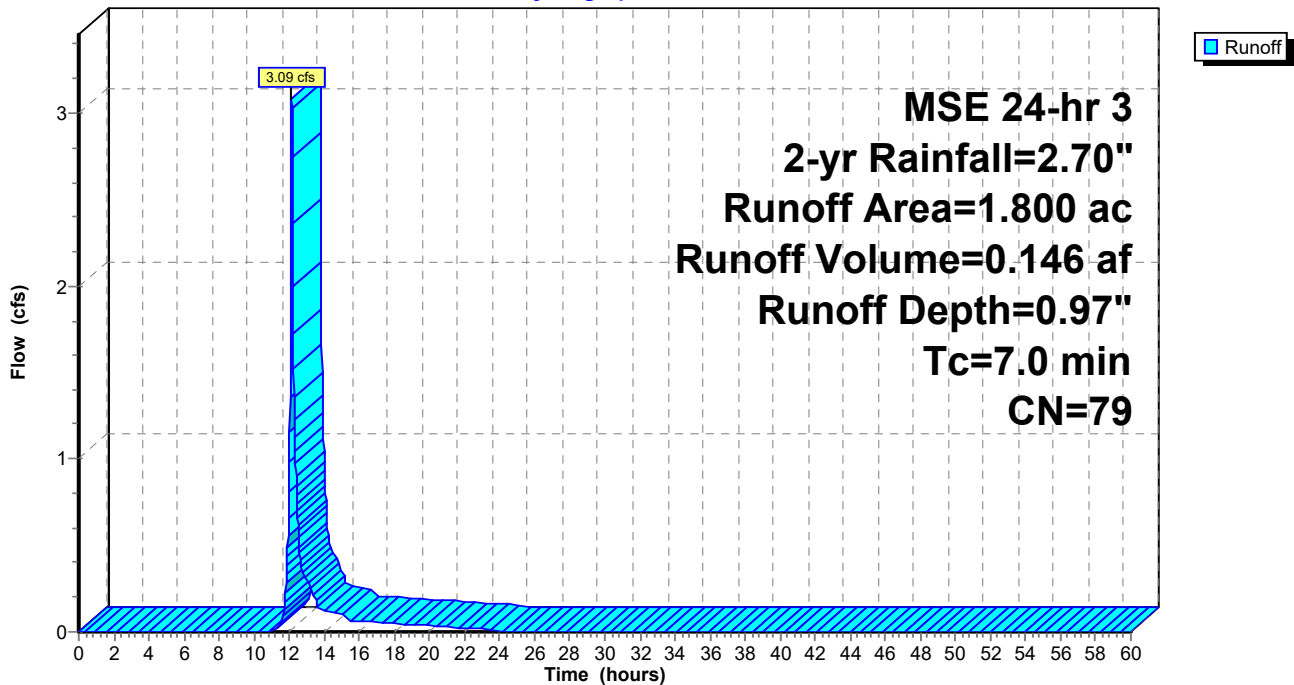
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 2-yr Rainfall=2.70"

Area (ac)	CN	Description
1.800	79	Woods/grass comb., Good, HSG D
1.800		100.00% Pervious Area

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

Subcatchment DW6:

Hydrograph



Summary for Subcatchment DW7:

Runoff = 15.21 cfs @ 13.06 hrs, Volume= 2.606 af, Depth= 0.97"
 Routed to Pond W7 : Wetland 7

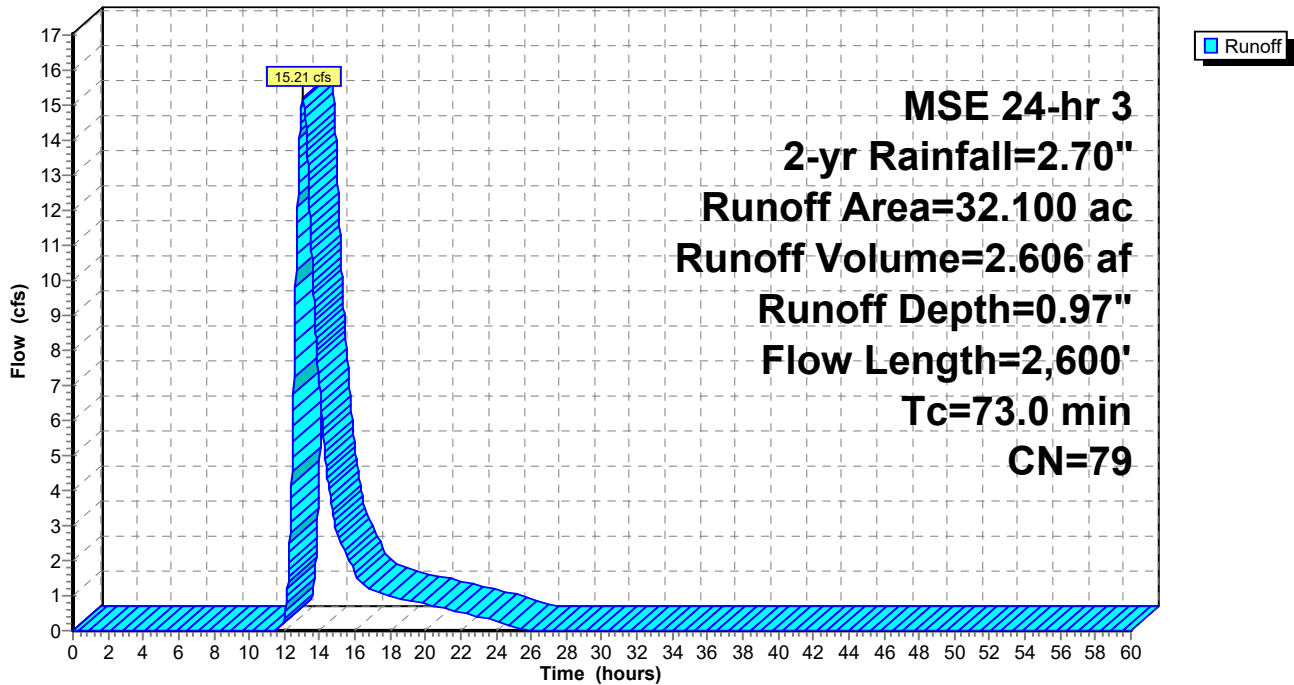
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 2-yr Rainfall=2.70"

Area (ac)	CN	Description
32.100	79	Woods/grass comb., Good, HSG D
32.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.2	100	0.0500	0.06		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.70"
27.4	650	0.0250	0.40		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
17.4	1,850	0.0140	1.77		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
73.0	2,600	Total			

Subcatchment DW7:

Hydrograph

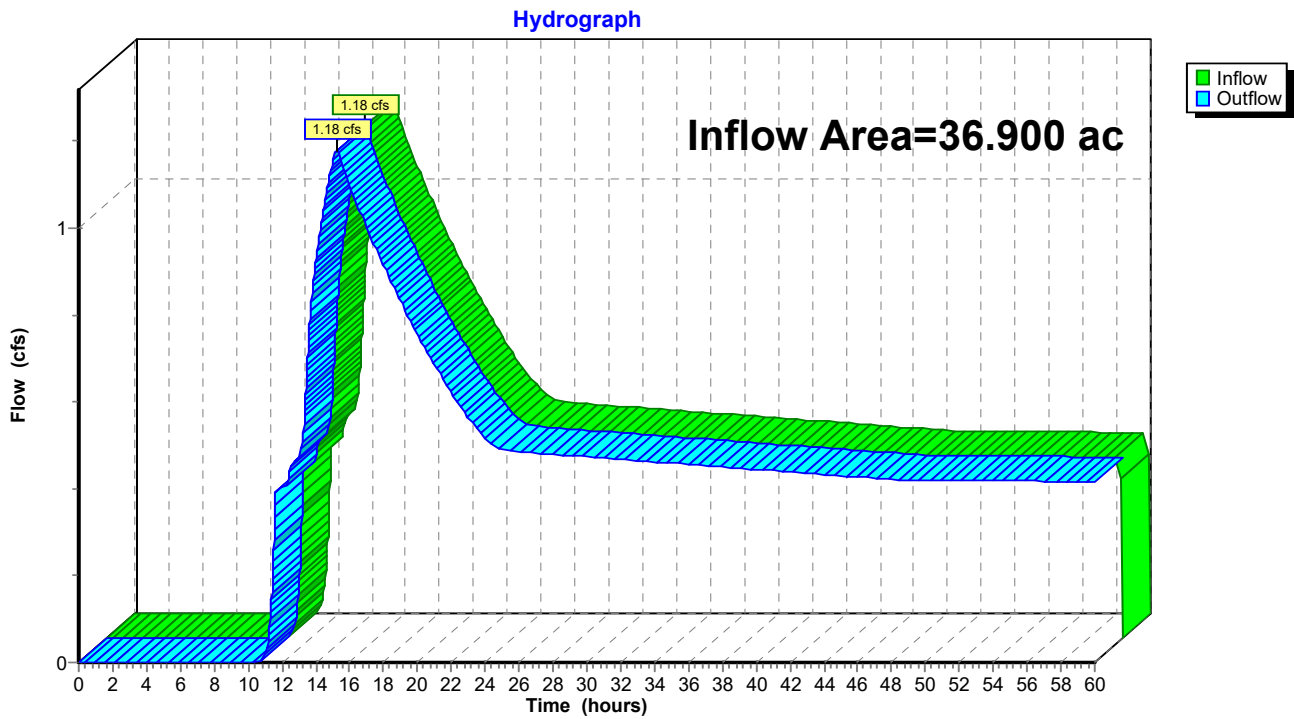


Summary for Reach 1R: Peak Flow Trunk 1

Inflow Area = 36.900 ac, 47.15% Impervious, Inflow Depth > 0.69" for 2-yr event
Inflow = 1.18 cfs @ 15.22 hrs, Volume= 2.126 af
Outflow = 1.18 cfs @ 15.24 hrs, Volume= 2.126 af, Atten= 0%, Lag= 1.2 min
Routed to Pond W7 : Wetland 7

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

Reach 1R: Peak Flow Trunk 1

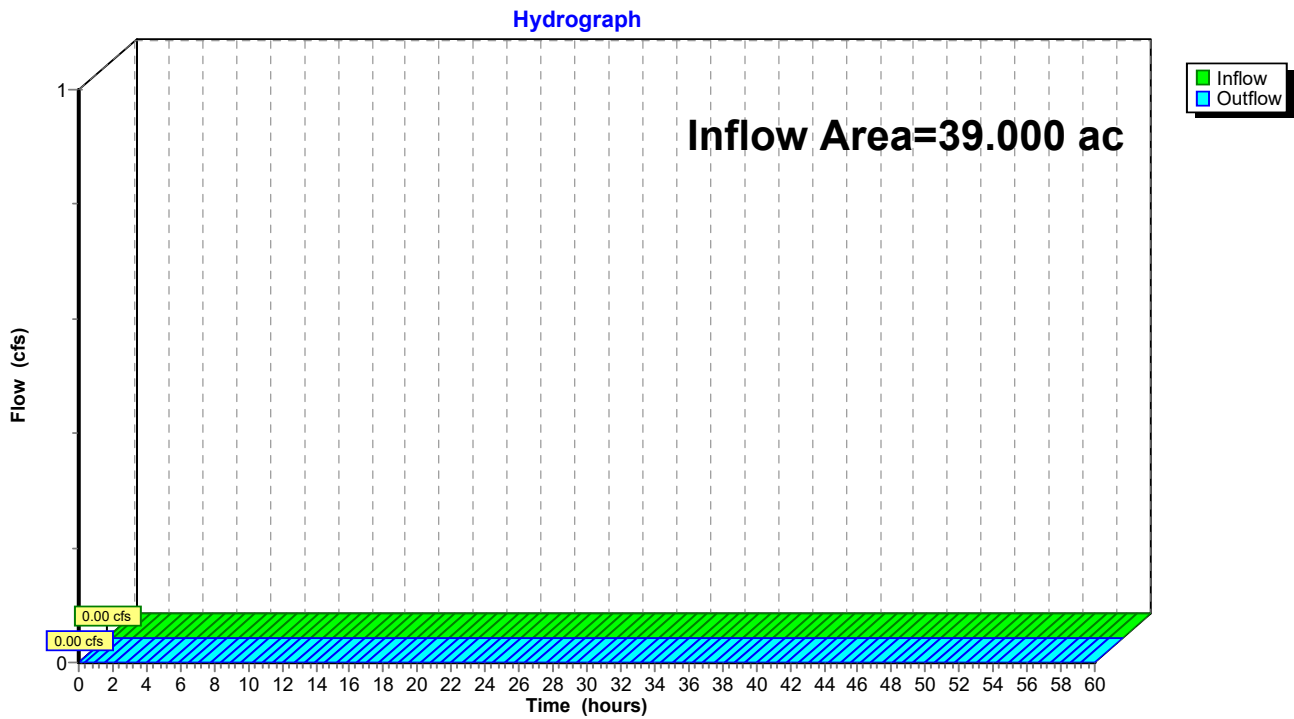


Summary for Reach 2R: Peak Flow Trunk 2

Inflow Area = 39.000 ac, 57.18% Impervious, Inflow Depth = 0.00" for 2-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Routed to Pond W7 : Wetland 7

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

Reach 2R: Peak Flow Trunk 2

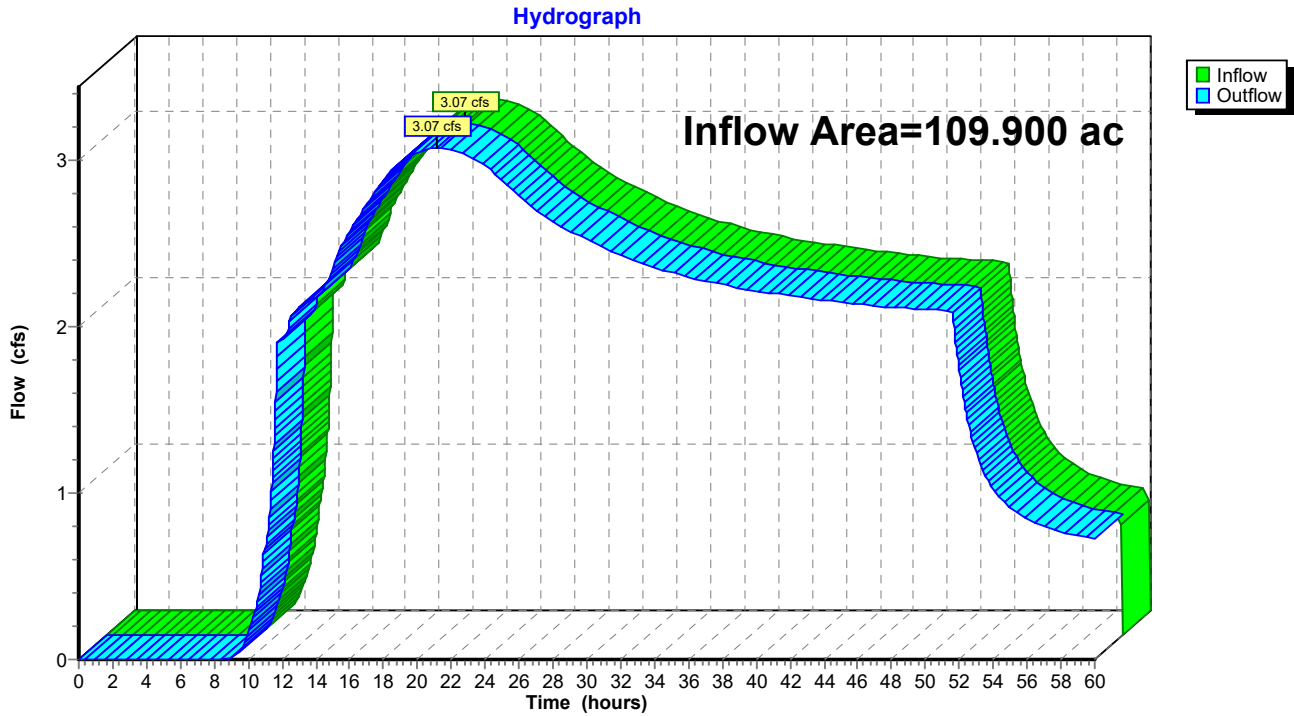


Summary for Reach 3R: Peak Flow Trunk 3

Inflow Area = 109.900 ac, 65.15% Impervious, Inflow Depth > 0.97" for 2-yr event
Inflow = 3.07 cfs @ 21.14 hrs, Volume= 8.845 af
Outflow = 3.07 cfs @ 21.16 hrs, Volume= 8.845 af, Atten= 0%, Lag= 1.2 min
Routed to Pond W7 : Wetland 7

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

Reach 3R: Peak Flow Trunk 3



Summary for Pond 1P: Basin 1

Inflow Area = 20.700 ac, 42.51% Impervious, Inflow Depth = 1.34" for 2-yr event
 Inflow = 36.10 cfs @ 12.24 hrs, Volume= 2.311 af
 Outflow = 1.17 cfs @ 15.22 hrs, Volume= 2.071 af, Atten= 97%, Lag= 179.1 min
 Primary = 1.17 cfs @ 15.22 hrs, Volume= 2.071 af
 Routed to Reach 1R : Peak Flow Trunk 1

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,294.99' @ 15.22 hrs Surf.Area= 0.605 ac Storage= 1.700 af

Plug-Flow detention time= 1,162.0 min calculated for 2.071 af (90% of inflow)
 Center-of-Mass det. time= 1,118.1 min (1,934.4 - 816.4)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,290.00'	9.293 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,290.00	0.500	0.0	0.000	0.000
1,290.01	0.500	40.0	0.002	0.002
1,292.99	0.500	40.0	0.596	0.598
1,293.00	0.500	100.0	0.005	0.603
1,304.00	1.080	100.0	8.690	9.293

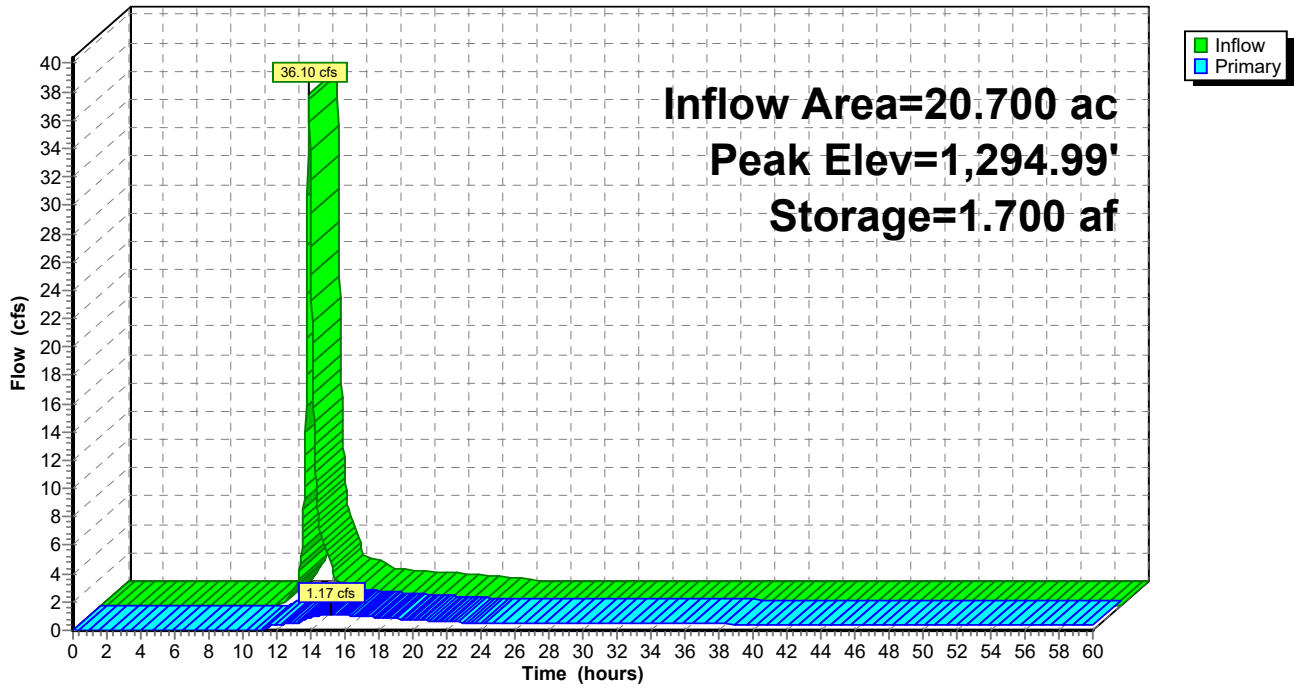
Device	Routing	Invert	Outlet Devices
#1	Primary	1,290.00'	24.0" Round Culvert L= 865.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,290.00' / 1,285.00' S= 0.0058 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Device 1	1,294.60'	15.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,296.30'	24.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Device 1	1,301.00'	6.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#5	Device 1	1,290.00'	0.800 in/hr Exfiltration over Surface area

Primary OutFlow Max=1.17 cfs @ 15.22 hrs HW=1,294.99' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 1.17 cfs of 21.80 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 0.68 cfs @ 2.12 fps)
- 3=Orifice/Grate (Controls 0.00 cfs)
- 4=Sharp-Crested Rectangular Weir(Controls 0.00 cfs)
- 5=Exfiltration (Exfiltration Controls 0.49 cfs)

Pond 1P: Basin 1

Hydrograph



Summary for Pond 2P: Basin 2

Inflow Area = 8.300 ac, 63.86% Impervious, Inflow Depth = 1.71" for 2-yr event
 Inflow = 18.36 cfs @ 12.23 hrs, Volume= 1.183 af
 Outflow = 0.02 cfs @ 24.28 hrs, Volume= 0.055 af, Atten= 100%, Lag= 722.9 min
 Primary = 0.02 cfs @ 24.28 hrs, Volume= 0.055 af
 Routed to Reach 1R : Peak Flow Trunk 1

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,288.35' @ 24.28 hrs Surf.Area= 0.771 ac Storage= 1.173 af

Plug-Flow detention time= 1,615.0 min calculated for 0.055 af (5% of inflow)
 Center-of-Mass det. time= 1,454.4 min (2,256.6 - 802.1)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,285.00'	12.674 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,285.00	0.750	0.0	0.000	0.000
1,285.01	0.750	40.0	0.003	0.003
1,287.99	0.750	40.0	0.894	0.897
1,288.00	0.750	100.0	0.007	0.904
1,299.00	1.390	100.0	11.770	12.674

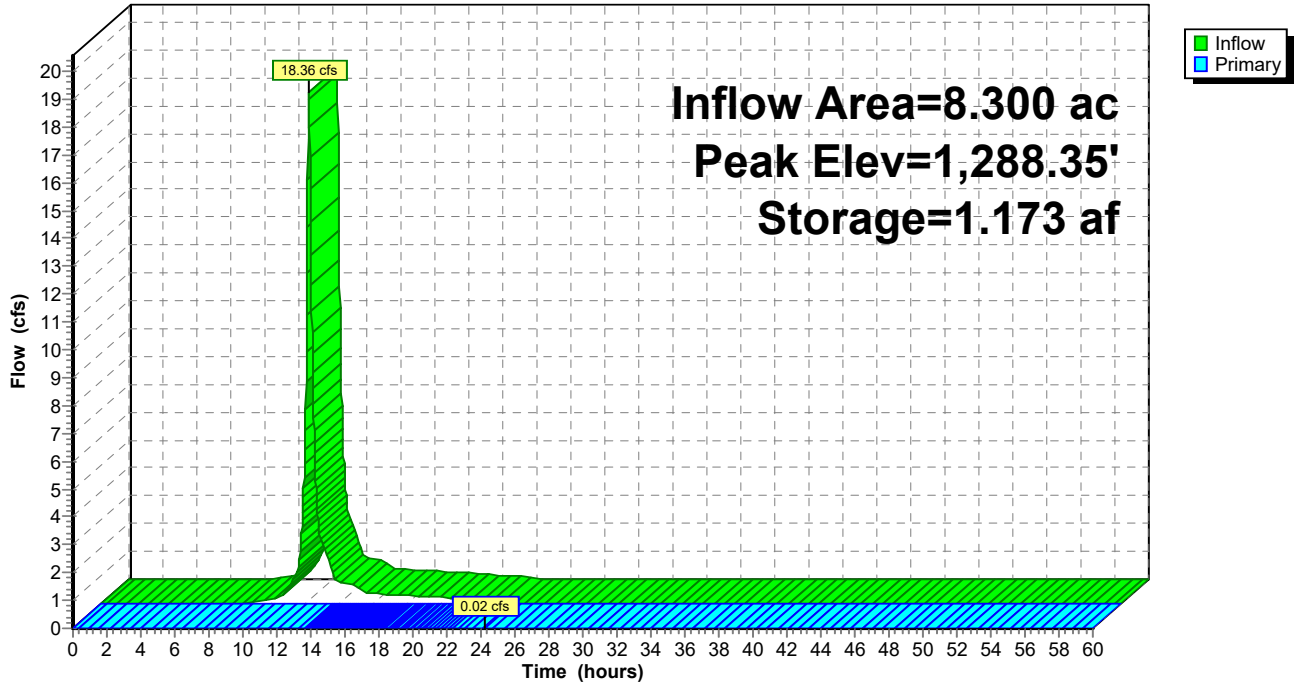
Device	Routing	Invert	Outlet Devices
#1	Primary	1,285.00'	24.0" Round Culvert L= 1,250.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,285.00' / 1,277.00' S= 0.0064 '/ Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Device 1	1,289.60'	15.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,295.00'	6.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 1	1,288.00'	0.800 in/hr Exfiltration over Surface area above 1,288.00' Excluded Surface area = 0.750 ac

Primary OutFlow Max=0.02 cfs @ 24.28 hrs HW=1,288.35' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 0.02 cfs of 20.06 cfs potential flow)
- 2=Orifice/Grate (Controls 0.00 cfs)
- 3=Sharp-Crested Rectangular Weir(Controls 0.00 cfs)
- 4=Exfiltration (Exfiltration Controls 0.02 cfs)

Pond 2P: Basin 2

Hydrograph



Summary for Pond 3P: Basin 3

Inflow Area = 39.000 ac, 57.18% Impervious, Inflow Depth = 1.63" for 2-yr event
 Inflow = 82.55 cfs @ 12.23 hrs, Volume= 5.301 af
 Outflow = 0.41 cfs @ 23.33 hrs, Volume= 0.684 af, Atten= 99%, Lag= 665.7 min
 Primary = 0.41 cfs @ 23.33 hrs, Volume= 0.684 af
 Routed to Pond 4P : Basin 4

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,288.84' @ 23.33 hrs Surf.Area= 1.777 ac Storage= 5.093 af

Plug-Flow detention time= 1,257.3 min calculated for 0.684 af (13% of inflow)
 Center-of-Mass det. time= 1,141.5 min (1,946.7 - 805.2)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,284.00'	24.736 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,284.00	1.630	0.0	0.000	0.000
1,284.01	1.630	40.0	0.007	0.007
1,286.99	1.630	40.0	1.943	1.949
1,287.00	1.630	100.0	0.016	1.966
1,298.00	2.510	100.0	22.770	24.736

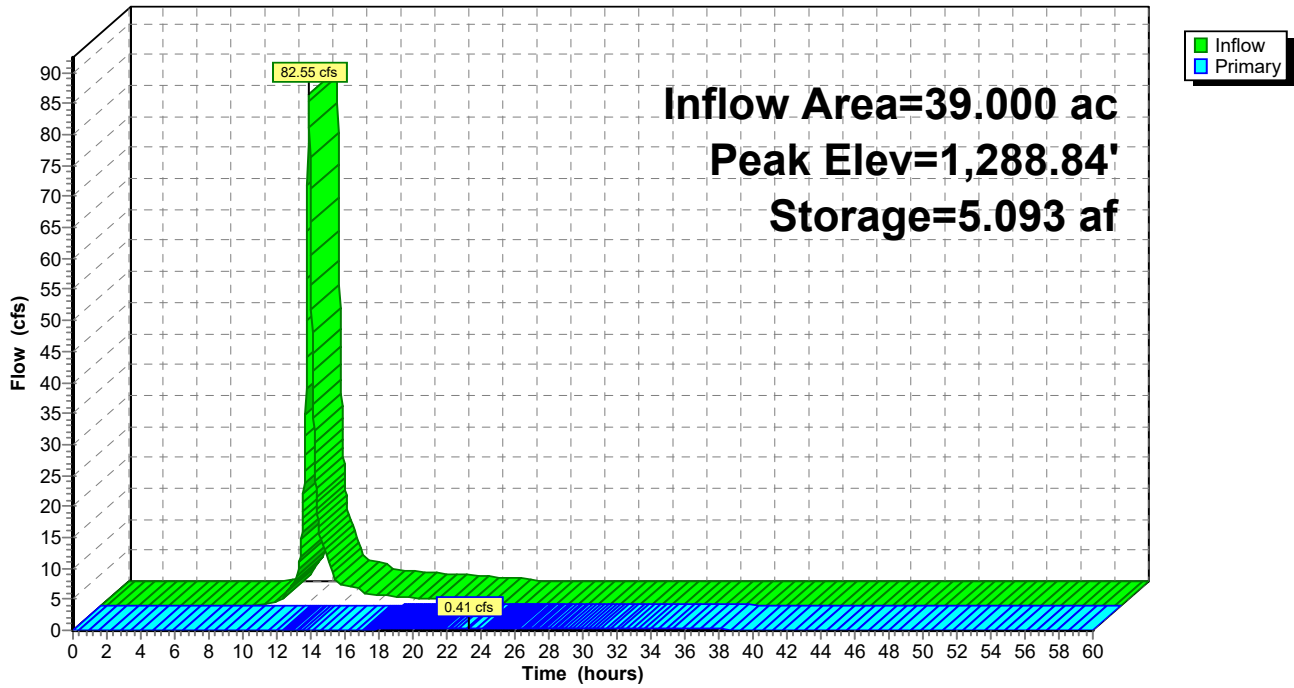
Device	Routing	Invert	Outlet Devices
#1	Primary	1,284.00'	48.0" Round Culvert L= 100.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,284.00' / 1,284.00' S= 0.0000 '/ Cc= 0.900 n= 0.012, Flow Area= 12.57 sf
#2	Device 1	1,288.60'	18.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,287.00'	0.800 in/hr Exfiltration over Surface area above 1,287.00' Excluded Surface area = 1.630 ac

Primary OutFlow Max=0.41 cfs @ 23.33 hrs HW=1,288.84' TW=1,284.46' (Dynamic Tailwater)

- 1=Culvert (Passes 0.41 cfs of 78.01 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 0.29 cfs @ 1.65 fps)
- 3=Exfiltration (Exfiltration Controls 0.12 cfs)

Pond 3P: Basin 3

Hydrograph



Summary for Pond 4P: Basin 4

Inflow Area = 39.000 ac, 57.18% Impervious, Inflow Depth > 0.21" for 2-yr event
 Inflow = 0.41 cfs @ 23.33 hrs, Volume= 0.684 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Reach 2R : Peak Flow Trunk 2

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,285.74' @ 60.00 hrs Surf.Area= 0.980 ac Storage= 0.684 af

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

Volume	Invert	Avail.Storage	Storage Description	
#1	1,284.00'	16.857 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,284.00	0.980	0.0	0.000	0.000
1,284.01	0.980	40.0	0.004	0.004
1,286.99	0.980	40.0	1.168	1.172
1,287.00	0.980	100.0	0.010	1.182
1,298.00	1.870	100.0	15.675	16.857

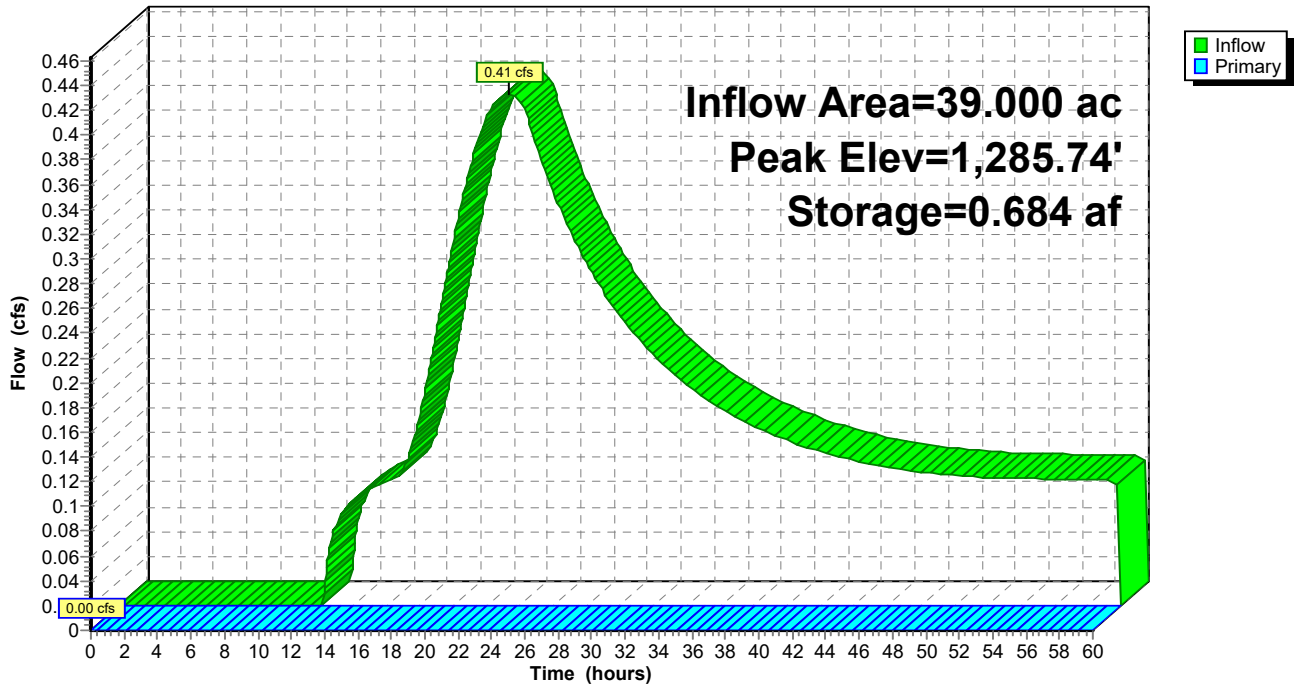
Device	Routing	Invert	Outlet Devices
#1	Primary	1,284.00'	48.0" Round Culvert L= 100.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,284.00' / 1,274.00' S= 0.1000 '/' Cc= 0.900 n= 0.012, Flow Area= 12.57 sf
#2	Device 1	1,288.60'	18.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,293.00'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 1	1,287.00'	0.800 in/hr Exfiltration over Surface area above 1,287.00' Excluded Surface area = 0.980 ac

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,284.00' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Controls 0.00 cfs)
- 2=Orifice/Grate (Controls 0.00 cfs)
- 3=Sharp-Crested Rectangular Weir(Controls 0.00 cfs)
- 4=Exfiltration (Controls 0.00 cfs)

Pond 4P: Basin 4

Hydrograph



Summary for Pond 5P: Basin 5

Inflow Area = 56.500 ac, 68.14% Impervious, Inflow Depth = 1.79" for 2-yr event
 Inflow = 130.56 cfs @ 12.23 hrs, Volume= 8.444 af
 Outflow = 1.00 cfs @ 21.96 hrs, Volume= 1.563 af, Atten= 99%, Lag= 583.8 min
 Primary = 1.00 cfs @ 21.96 hrs, Volume= 1.563 af
 Routed to Reach 3R : Peak Flow Trunk 3

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,288.03' @ 21.96 hrs Surf.Area= 2.568 ac Storage= 7.873 af

Plug-Flow detention time= 1,104.0 min calculated for 1.563 af (19% of inflow)
 Center-of-Mass det. time= 994.4 min (1,793.3 - 798.9)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,283.00'	38.318 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,283.00	2.370	0.0	0.000	0.000
1,283.01	2.370	40.0	0.009	0.009
1,285.99	2.370	40.0	2.825	2.835
1,286.00	2.370	100.0	0.024	2.858
1,298.00	3.540	100.0	35.460	38.318

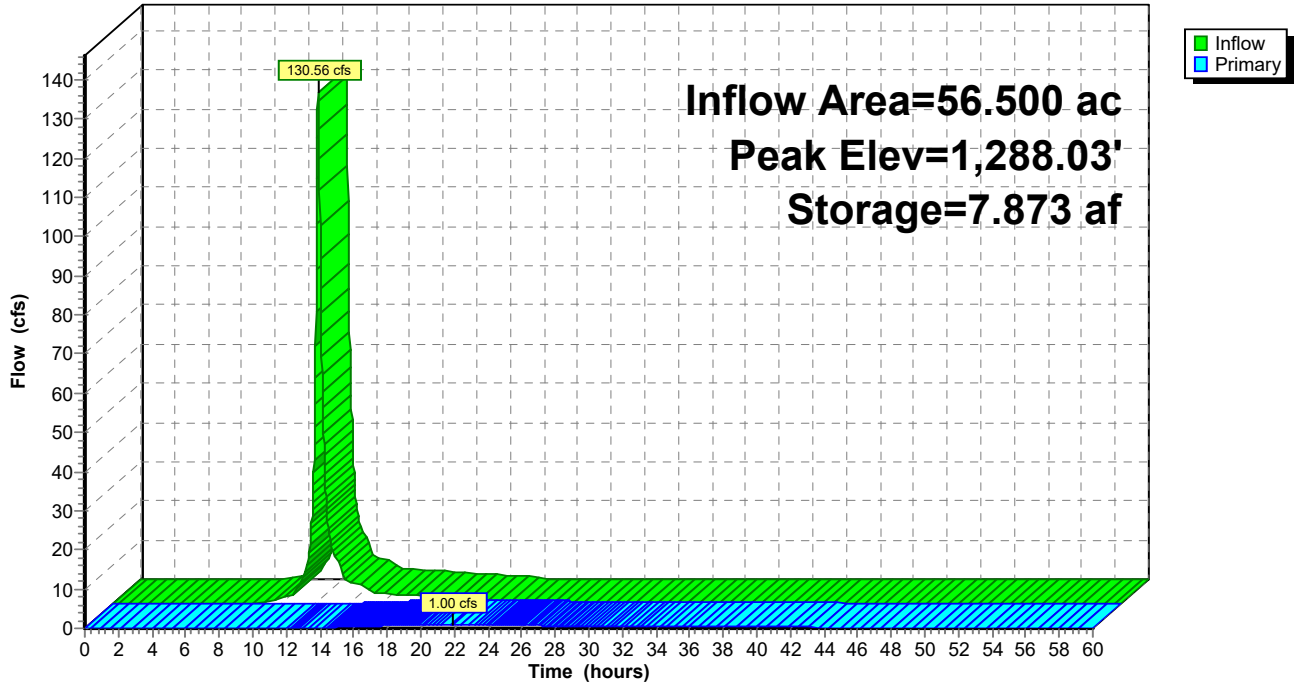
Device	Routing	Invert	Outlet Devices
#1	Primary	1,283.00'	48.0" Round Culvert L= 1,050.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,283.00' / 1,278.00' S= 0.0048 '/' Cc= 0.900 n= 0.012, Flow Area= 12.57 sf
#2	Device 1	1,287.60'	15.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,286.00'	0.800 in/hr Exfiltration over Surface area above 1,286.00' Excluded Surface area = 2.370 ac

Primary OutFlow Max=1.00 cfs @ 21.96 hrs HW=1,288.03' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 1.00 cfs of 105.34 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 0.84 cfs @ 2.23 fps)
- 3=Exfiltration (Exfiltration Controls 0.16 cfs)

Pond 5P: Basin 5

Hydrograph



Summary for Pond 6P: Basin 6

Inflow Area = 16.300 ac, 71.17% Impervious, Inflow Depth = 1.88" for 2-yr event
 Inflow = 39.22 cfs @ 12.23 hrs, Volume= 2.553 af
 Outflow = 0.71 cfs @ 16.75 hrs, Volume= 2.309 af, Atten= 98%, Lag= 271.6 min
 Primary = 0.71 cfs @ 16.75 hrs, Volume= 2.309 af
 Routed to Reach 3R : Peak Flow Trunk 3

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,282.76' @ 16.75 hrs Surf.Area= 0.731 ac Storage= 1.977 af

Plug-Flow detention time= 1,293.0 min calculated for 2.308 af (90% of inflow)
 Center-of-Mass det. time= 1,252.7 min (2,048.1 - 795.4)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,278.00'	10.947 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,278.00	0.640	0.0	0.000	0.000
1,278.01	0.640	40.0	0.003	0.003
1,280.99	0.640	40.0	0.763	0.765
1,281.00	0.640	100.0	0.006	0.772
1,292.00	1.210	100.0	10.175	10.947

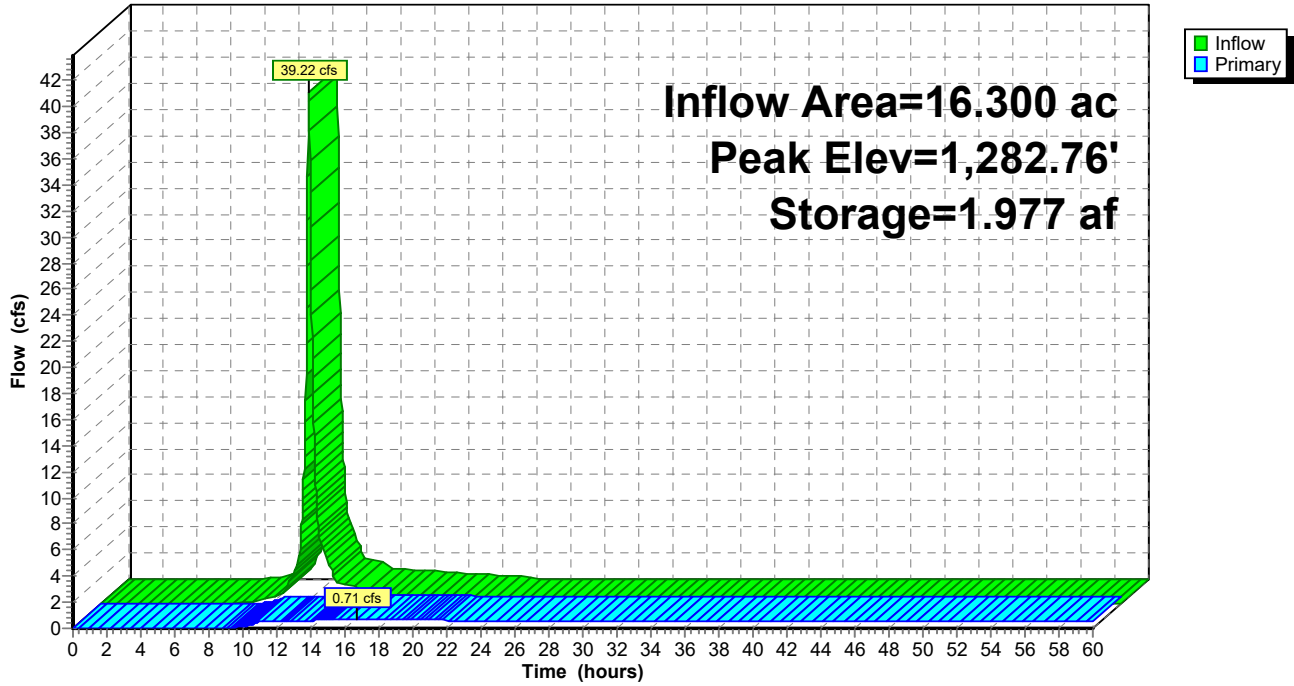
Device	Routing	Invert	Outlet Devices
#1	Primary	1,278.00'	48.0" Round Culvert L= 910.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,278.00' / 1,271.00' S= 0.0077 '/ Cc= 0.900 n= 0.012, Flow Area= 12.57 sf
#2	Primary	1,282.60'	15.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,289.00'	6.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 1	1,278.00'	0.800 in/hr Exfiltration over Surface area

Primary OutFlow Max=0.71 cfs @ 16.75 hrs HW=1,282.76' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 0.59 cfs of 100.49 cfs potential flow)
- 3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 4=Exfiltration (Exfiltration Controls 0.59 cfs)
- 2=Orifice/Grate (Orifice Controls 0.12 cfs @ 1.35 fps)

Pond 6P: Basin 6

Hydrograph



Summary for Pond 7P: Basin 7

Inflow Area = 37.100 ac, 57.95% Impervious, Inflow Depth = 1.63" for 2-yr event
 Inflow = 78.53 cfs @ 12.23 hrs, Volume= 5.042 af
 Outflow = 1.46 cfs @ 17.15 hrs, Volume= 4.974 af, Atten= 98%, Lag= 295.2 min
 Primary = 1.46 cfs @ 17.15 hrs, Volume= 4.974 af
 Routed to Reach 3R : Peak Flow Trunk 3

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,274.98' @ 17.15 hrs Surf.Area= 1.813 ac Storage= 3.853 af

Plug-Flow detention time= 1,141.9 min calculated for 4.972 af (99% of inflow)
 Center-of-Mass det. time= 1,134.3 min (1,939.5 - 805.2)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,271.00'	25.265 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,271.00	1.750	0.0	0.000	0.000
1,271.01	1.750	40.0	0.007	0.007
1,273.99	1.750	40.0	2.086	2.093
1,274.00	1.750	100.0	0.017	2.110
1,285.00	2.460	100.0	23.155	25.265

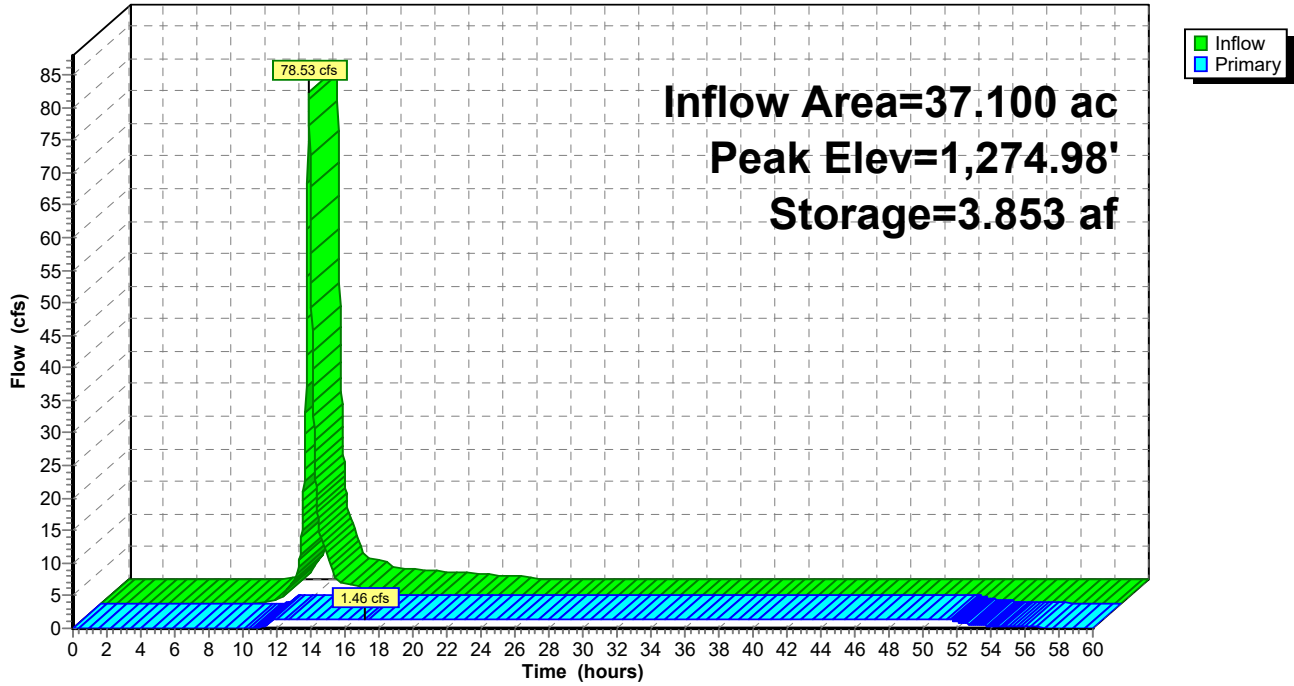
Device	Routing	Invert	Outlet Devices
#1	Primary	1,271.00'	48.0" Round Culvert L= 150.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,271.00' / 1,270.00' S= 0.0067 '/' Cc= 0.900 n= 0.012, Flow Area= 12.57 sf
#2	Device 1	1,275.60'	15.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,284.50'	6.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 1	1,271.00'	0.800 in/hr Exfiltration over Surface area

Primary OutFlow Max=1.46 cfs @ 17.15 hrs HW=1,274.98' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 1.46 cfs of 80.70 cfs potential flow)
- 2=Orifice/Grate (Controls 0.00 cfs)
- 3=Sharp-Crested Rectangular Weir(Controls 0.00 cfs)
- 4=Exfiltration (Exfiltration Controls 1.46 cfs)

Pond 7P: Basin 7

Hydrograph



Summary for Pond 8P: Basin 8

Inflow Area = 7.900 ac, 41.77% Impervious, Inflow Depth = 1.34" for 2-yr event
 Inflow = 13.78 cfs @ 12.24 hrs, Volume= 0.882 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Reach 1R : Peak Flow Trunk 1

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,279.90' @ 24.86 hrs Surf.Area= 0.760 ac Storage= 0.882 af

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

Volume	Invert	Avail.Storage	Storage Description	
#1	1,277.00'	12.797 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,277.00	0.760	0.0	0.000	0.000
1,277.01	0.760	40.0	0.003	0.003
1,279.99	0.760	40.0	0.906	0.909
1,280.00	0.760	100.0	0.008	0.917
1,291.00	1.400	100.0	11.880	12.797

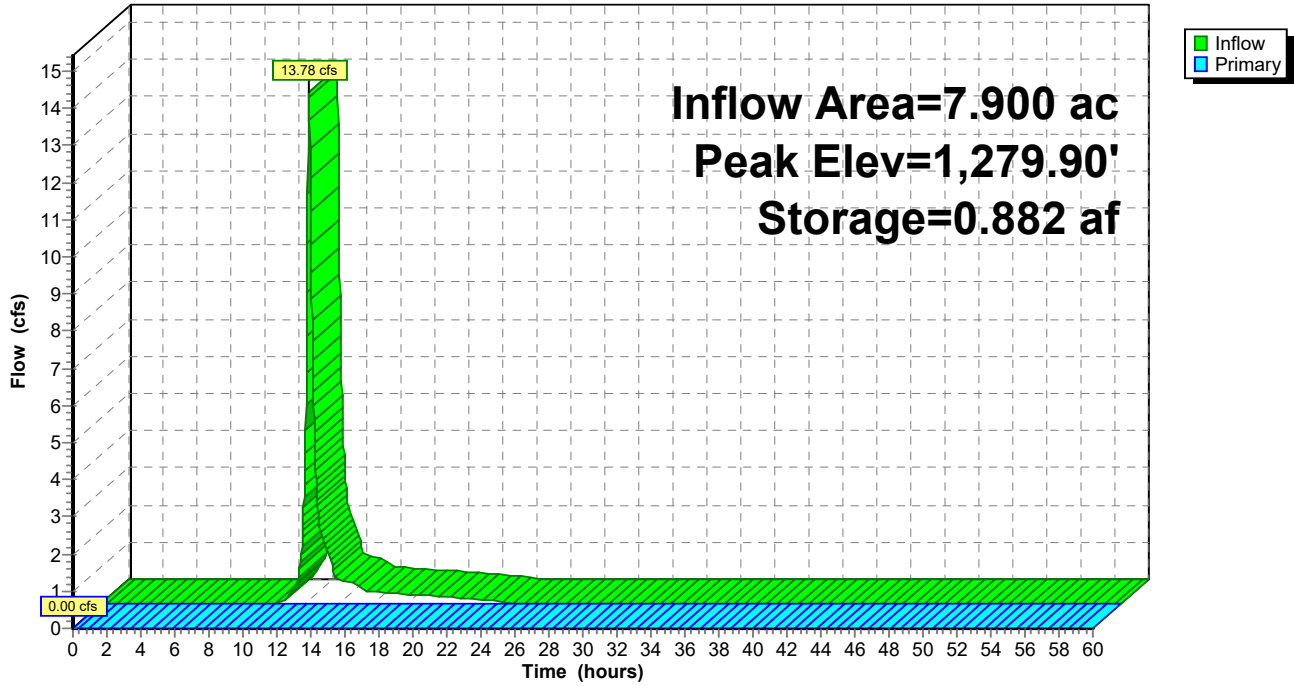
Device	Routing	Invert	Outlet Devices
#1	Primary	1,277.00'	36.0" Round Culvert L= 200.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,277.00' / 1,276.00' S= 0.0050 '/ Cc= 0.900 n= 0.012, Flow Area= 7.07 sf
#2	Device 1	1,281.60'	15.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,289.00'	6.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 1	1,280.00'	0.800 in/hr Exfiltration over Surface area above 1,280.00' Excluded Surface area = 0.760 ac

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,277.00' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Controls 0.00 cfs)
- 2=Orifice/Grate (Controls 0.00 cfs)
- 3=Sharp-Crested Rectangular Weir(Controls 0.00 cfs)
- 4=Exfiltration (Controls 0.00 cfs)

Pond 8P: Basin 8

Hydrograph



Summary for Pond W1: Wetland 1

Inflow Area = 7.100 ac, 0.00% Impervious, Inflow Depth = 0.97" for 2-yr event
 Inflow = 12.18 cfs @ 12.15 hrs, Volume= 0.576 af
 Outflow = 7.24 cfs @ 12.24 hrs, Volume= 0.576 af, Atten= 41%, Lag= 5.7 min
 Primary = 7.24 cfs @ 12.24 hrs, Volume= 0.576 af
 Routed to Link 20L : Discharge Point #1

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,273.07' @ 12.24 hrs Surf.Area= 0.481 ac Storage= 0.095 af

Plug-Flow detention time= 8.6 min calculated for 0.576 af (100% of inflow)
 Center-of-Mass det. time= 8.6 min (833.1 - 824.4)

Volume	Invert	Avail.Storage	Storage Description
#1	1,272.00'	2.603 af	Custom Stage Data (Prismatic) Listed below (Recalc)

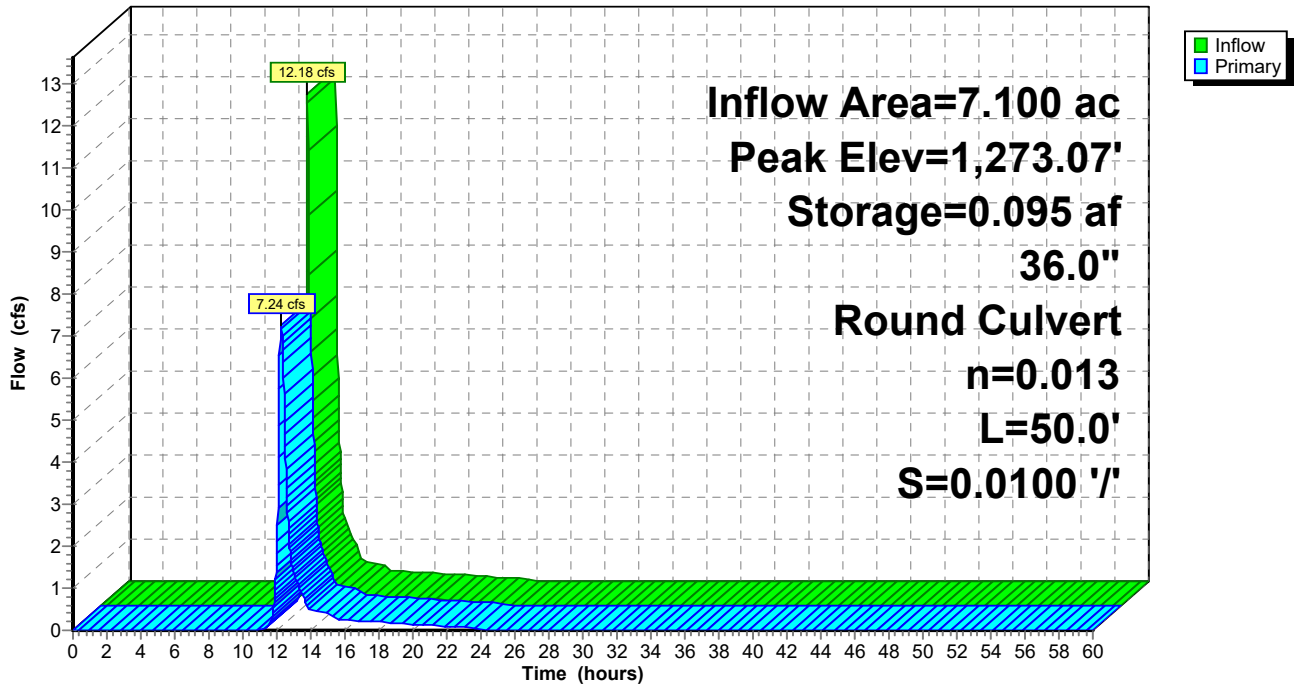
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,272.00	0.005	0.000	0.000
1,273.00	0.140	0.072	0.072
1,274.00	4.921	2.531	2.603

Device	Routing	Invert	Outlet Devices
#1	Primary	1,272.00'	36.0" Round Culvert L= 50.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,272.00' / 1,271.50' S= 0.0100 '/ Cc= 0.900 n= 0.013, Flow Area= 7.07 sf

Primary OutFlow Max=7.24 cfs @ 12.24 hrs HW=1,273.07' TW=0.00' (Dynamic Tailwater)
 ↑**1=Culvert** (Barrel Controls 7.24 cfs @ 4.76 fps)

Pond W1: Wetland 1

Hydrograph



Summary for Pond W4: Wetland 4

Inflow Area = 7.200 ac, 0.00% Impervious, Inflow Depth = 0.62" for 2-yr event
 Inflow = 7.89 cfs @ 12.15 hrs, Volume= 0.373 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

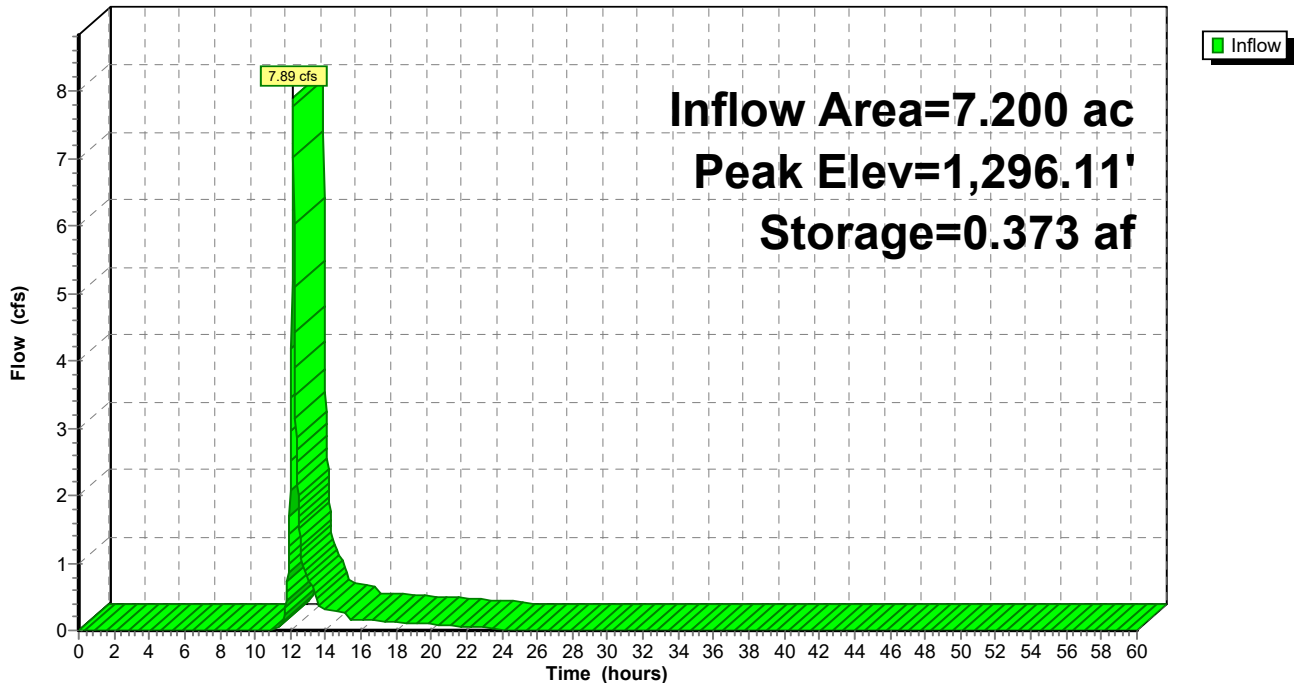
Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,296.11' @ 24.42 hrs Surf.Area= 3.459 ac Storage= 0.373 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	1,296.00'	3.729 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,296.00	3.384	0.000	0.000
1,297.00	4.073	3.729	3.729

Pond W4: Wetland 4

Hydrograph



Summary for Pond W5: Wetland 5

Inflow Area = 2.600 ac, 0.00% Impervious, Inflow Depth = 0.97" for 2-yr event
 Inflow = 4.46 cfs @ 12.15 hrs, Volume= 0.211 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Pond W4 : Wetland 4

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,299.13' @ 24.42 hrs Surf.Area= 1.634 ac Storage= 0.211 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	1,299.00'	3.760 af	Custom Stage Data (Prismatic) Listed below (Recalc)

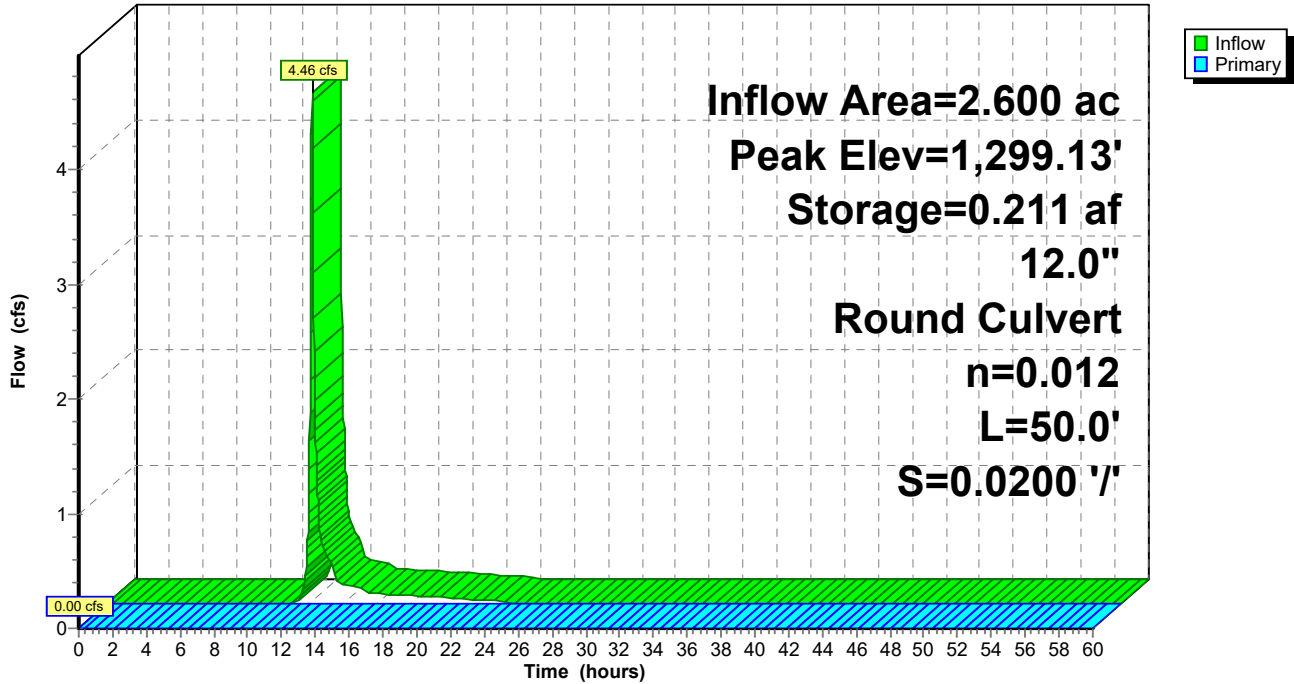
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,299.00	1.597	0.000	0.000
1,301.00	2.163	3.760	3.760

Device	Routing	Invert	Outlet Devices
#1	Primary	1,300.00'	12.0" Round Culvert L= 50.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,300.00' / 1,299.00' S= 0.0200 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,299.00' TW=1,296.00' (Dynamic Tailwater)
 ↑1=Culvert (Controls 0.00 cfs)

Pond W5: Wetland 5

Hydrograph



Summary for Pond W6: Wetland 6

Inflow Area = 9.000 ac, 0.00% Impervious, Inflow Depth = 0.19" for 2-yr event
 Inflow = 3.09 cfs @ 12.15 hrs, Volume= 0.146 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

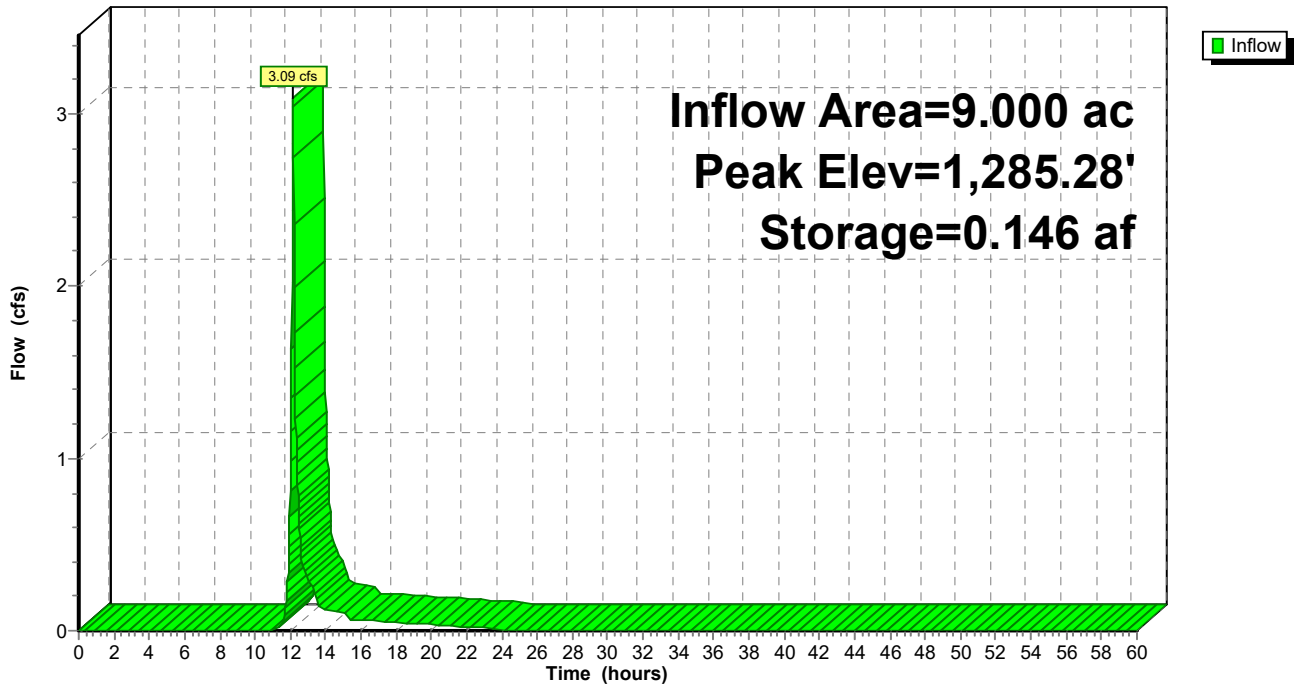
Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,285.28' @ 24.42 hrs Surf.Area= 0.553 ac Storage= 0.146 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	1,285.00'	1.338 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,285.00	0.497	0.000	0.000
1,286.00	0.698	0.598	0.598
1,287.00	0.784	0.741	1.338

Pond W6: Wetland 6

Hydrograph



Summary for Pond W7: Wetland 7

Inflow Area = 226.900 ac, 49.05% Impervious, Inflow Depth > 0.72" for 2-yr event
 Inflow = 17.80 cfs @ 13.06 hrs, Volume= 13.575 af
 Outflow = 17.55 cfs @ 13.15 hrs, Volume= 13.572 af, Atten= 1%, Lag= 5.5 min
 Primary = 17.55 cfs @ 13.15 hrs, Volume= 13.572 af
 Routed to Link 11L : Discharge Point #2

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,257.66' @ 13.15 hrs Surf.Area= 0.148 ac Storage= 0.092 af

Plug-Flow detention time= 3.0 min calculated for 13.567 af (100% of inflow)
 Center-of-Mass det. time= 2.6 min (1,742.5 - 1,739.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,256.00'	18.795 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,256.00	0.005	0.000	0.000
1,257.00	0.050	0.027	0.027
1,258.00	0.200	0.125	0.152
1,259.00	0.497	0.348	0.500
1,260.00	0.864	0.680	1.180
1,261.00	1.362	1.113	2.293
1,262.00	2.424	1.893	4.186
1,263.00	3.770	3.097	7.283
1,264.00	5.818	4.794	12.077
1,265.00	7.617	6.717	18.795

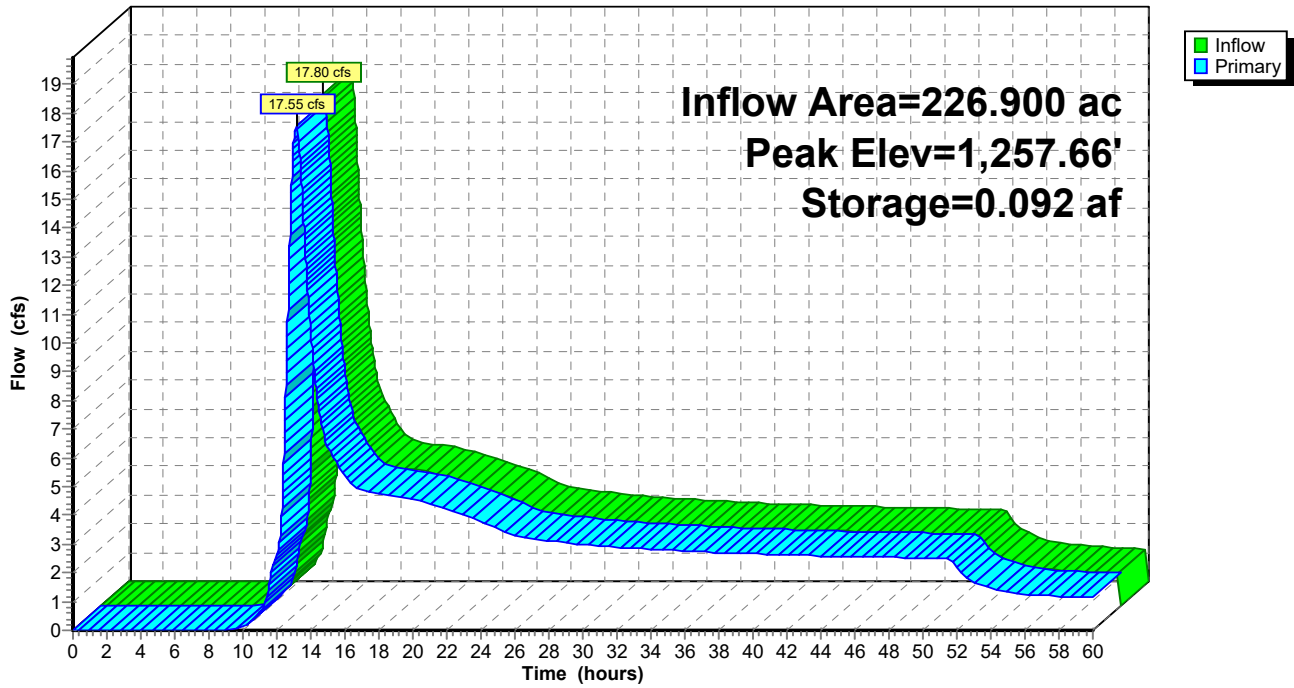
Device	Routing	Invert	Outlet Devices
#1	Primary	1,256.00'	36.0" Round Culvert L= 50.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,256.00' / 1,254.00' S= 0.0400 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf
#2	Primary	1,263.00'	300.0' long + 10.0 ' SideZ x 40.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=17.54 cfs @ 13.15 hrs HW=1,257.66' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Inlet Controls 17.54 cfs @ 4.38 fps)
- 2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond W7: Wetland 7

Hydrograph



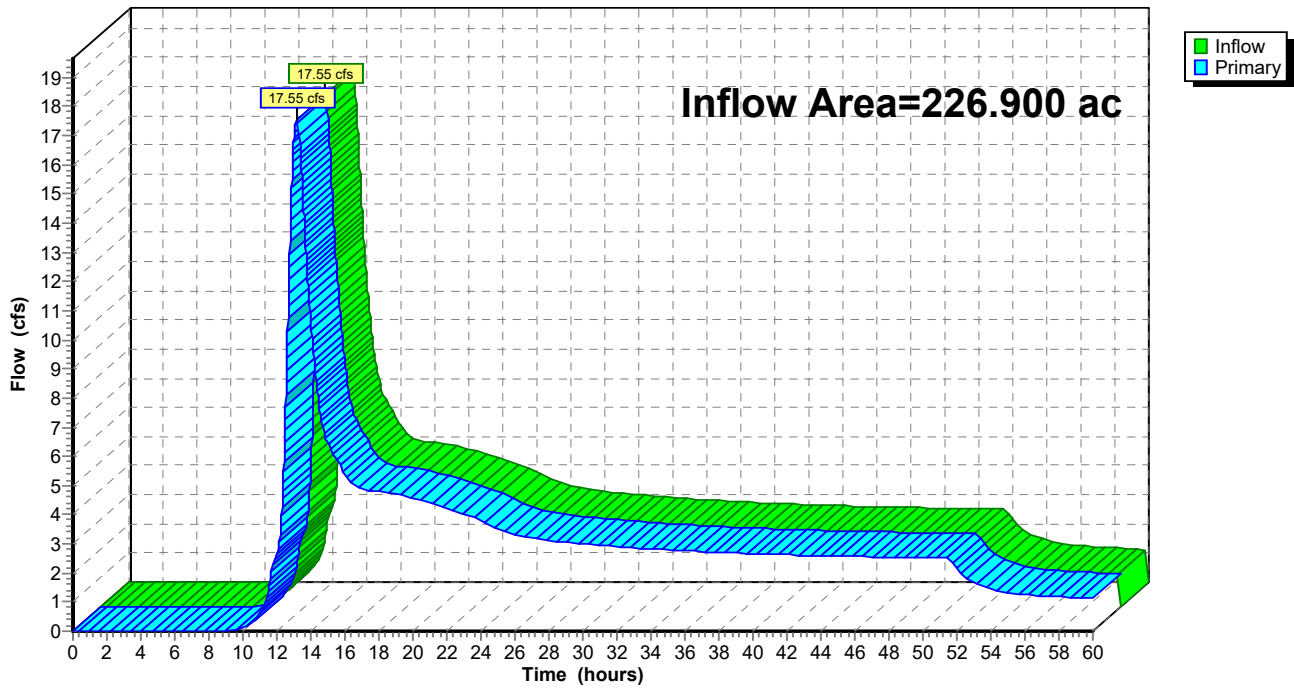
Summary for Link 11L: Discharge Point #2

Inflow Area = 226.900 ac, 49.05% Impervious, Inflow Depth > 0.72" for 2-yr event
Inflow = 17.55 cfs @ 13.15 hrs, Volume= 13.570 af
Primary = 17.55 cfs @ 13.17 hrs, Volume= 13.570 af, Atten= 0%, Lag= 1.2 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

Link 11L: Discharge Point #2

Hydrograph



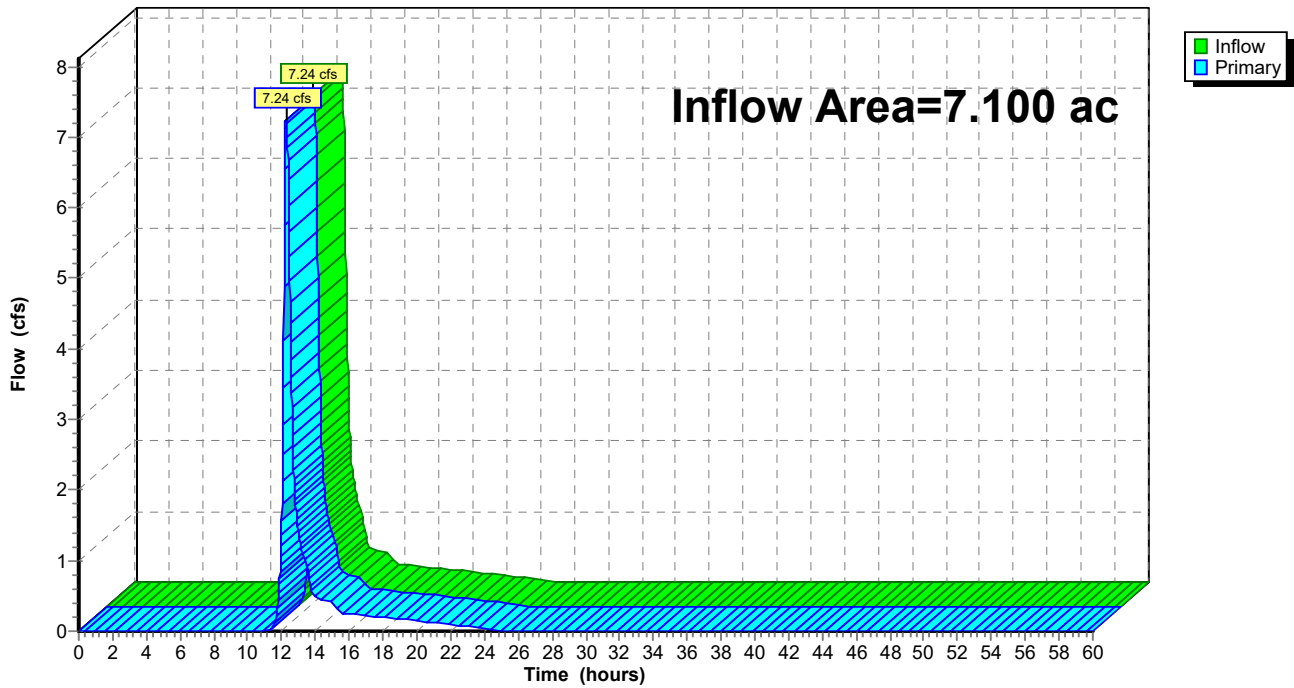
Summary for Link 20L: Discharge Point #1

Inflow Area = 7.100 ac, 0.00% Impervious, Inflow Depth = 0.97" for 2-yr event
Inflow = 7.24 cfs @ 12.24 hrs, Volume= 0.576 af
Primary = 7.24 cfs @ 12.26 hrs, Volume= 0.576 af, Atten= 0%, Lag= 1.2 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

Link 20L: Discharge Point #1

Hydrograph



2025-0806 - Hermantown Industrial - Proposed*MSE 24-hr 3 10-yr Rainfall=4.00"*

Prepared by Kimley-Horn & Associates

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Time span=0.00-60.00 hrs, dt=0.02 hrs, 3001 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Sim-Route method - Pond routing by Sim-Route method

Subcatchment1S: Onsite Area	Runoff Area=20.700 ac 42.51% Impervious Runoff Depth=2.46" Tc=15.0 min CN=85 Runoff=65.96 cfs 4.240 af
Subcatchment2S: Onsite Area	Runoff Area=8.300 ac 63.86% Impervious Runoff Depth=2.92" Tc=15.0 min CN=90 Runoff=30.77 cfs 2.019 af
Subcatchment3/4S: Onsite Area	Runoff Area=39.000 ac 57.18% Impervious Runoff Depth=2.82" Tc=15.0 min CN=89 Runoff=140.67 cfs 9.175 af
Subcatchment5S: Onsite Area	Runoff Area=56.500 ac 68.14% Impervious Runoff Depth=3.02" Tc=15.0 min CN=91 Runoff=215.00 cfs 14.207 af
Subcatchment6S: Onsite Area	Runoff Area=16.300 ac 71.17% Impervious Runoff Depth=3.12" Tc=15.0 min CN=92 Runoff=63.56 cfs 4.235 af
Subcatchment7S: Onsite Area	Runoff Area=37.100 ac 57.95% Impervious Runoff Depth=2.82" Tc=15.0 min CN=89 Runoff=133.82 cfs 8.728 af
Subcatchment8S: Onsite Area	Runoff Area=7.900 ac 41.77% Impervious Runoff Depth=2.46" Tc=15.0 min CN=85 Runoff=25.17 cfs 1.618 af
SubcatchmentDW1:	Runoff Area=7.100 ac 0.00% Impervious Runoff Depth=1.96" Tc=7.0 min CN=79 Runoff=24.76 cfs 1.162 af
SubcatchmentDW4:	Runoff Area=4.600 ac 0.00% Impervious Runoff Depth=1.96" Tc=7.0 min CN=79 Runoff=16.04 cfs 0.753 af
SubcatchmentDW5:	Runoff Area=2.600 ac 0.00% Impervious Runoff Depth=1.96" Tc=7.0 min CN=79 Runoff=9.07 cfs 0.425 af
SubcatchmentDW6:	Runoff Area=1.800 ac 0.00% Impervious Runoff Depth=1.96" Tc=7.0 min CN=79 Runoff=6.28 cfs 0.295 af
SubcatchmentDW7:	Runoff Area=32.100 ac 0.00% Impervious Runoff Depth=1.96" Flow Length=2,600' Tc=73.0 min CN=79 Runoff=31.73 cfs 5.252 af
Reach 1R: Peak Flow Trunk 1	Inflow=6.82 cfs 4.314 af Outflow=6.82 cfs 4.314 af
Reach 2R: Peak Flow Trunk 2	Inflow=1.00 cfs 1.391 af Outflow=1.00 cfs 1.391 af
Reach 3R: Peak Flow Trunk 3	Inflow=14.81 cfs 18.623 af Outflow=14.81 cfs 18.623 af
Pond 1P: Basin 1	Peak Elev=1,296.33' Storage=2.562 af Inflow=65.96 cfs 4.240 af Outflow=6.77 cfs 3.950 af

2025-0806 - Hermantown Industrial - Proposed*MSE 24-hr 3 10-yr Rainfall=4.00"*

Prepared by Kimley-Horn & Associates

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Pond 2P: Basin 2	Peak Elev=1,289.34'	Storage=1.966 af	Inflow=30.77 cfs	2.019 af	Outflow=0.06 cfs	0.225 af
Pond 3P: Basin 3	Peak Elev=1,289.80'	Storage=6.837 af	Inflow=140.67 cfs	9.175 af	Outflow=5.81 cfs	4.343 af
Pond 4P: Basin 4	Peak Elev=1,289.01'	Storage=3.320 af	Inflow=5.81 cfs	4.343 af	Outflow=1.00 cfs	1.391 af
Pond 5P: Basin 5	Peak Elev=1,289.24'	Storage=11.061 af	Inflow=215.00 cfs	14.207 af	Outflow=6.22 cfs	7.215 af
Pond 6P: Basin 6	Peak Elev=1,283.81'	Storage=2.774 af	Inflow=63.56 cfs	4.235 af	Outflow=5.18 cfs	3.884 af
Pond 7P: Basin 7	Peak Elev=1,276.41'	Storage=6.513 af	Inflow=133.82 cfs	8.728 af	Outflow=4.11 cfs	7.527 af
Pond 8P: Basin 8	Peak Elev=1,280.85'	Storage=1.587 af	Inflow=25.17 cfs	1.618 af	Outflow=0.04 cfs	0.140 af
Pond W1: Wetland 1	Peak Elev=1,273.26'	Storage=0.264 af	Inflow=24.76 cfs	1.162 af	Outflow=9.54 cfs	1.162 af
	36.0" Round Culvert	n=0.013 L=50.0' S=0.0100 '/'				
Pond W4: Wetland 4	Peak Elev=1,296.22'	Storage=0.753 af	Inflow=16.04 cfs	0.753 af	Outflow=0.00 cfs	0.000 af
Pond W5: Wetland 5	Peak Elev=1,299.26'	Storage=0.425 af	Inflow=9.07 cfs	0.425 af	Outflow=0.00 cfs	0.000 af
	12.0" Round Culvert	n=0.012 L=50.0' S=0.0200 '/'				
Pond W6: Wetland 6	Peak Elev=1,285.53'	Storage=0.295 af	Inflow=6.28 cfs	0.295 af	Outflow=0.00 cfs	0.000 af
Pond W7: Wetland 7	Peak Elev=1,259.32'	Storage=0.680 af	Inflow=51.41 cfs	29.576 af	Outflow=45.95 cfs	29.569 af
Link 11L: Discharge Point #2			Inflow=45.95 cfs	29.565 af	Primary=45.95 cfs	29.565 af
Link 20L: Discharge Point #1			Inflow=9.54 cfs	1.162 af	Primary=9.54 cfs	1.162 af

Total Runoff Area = 234.000 ac Runoff Volume = 52.108 af Average Runoff Depth = 2.67"
52.44% Pervious = 122.700 ac 47.56% Impervious = 111.300 ac

Summary for Subcatchment 1S: Onsite Area

Runoff = 65.96 cfs @ 12.23 hrs, Volume= 4.240 af, Depth= 2.46"
 Routed to Pond 1P : Basin 1

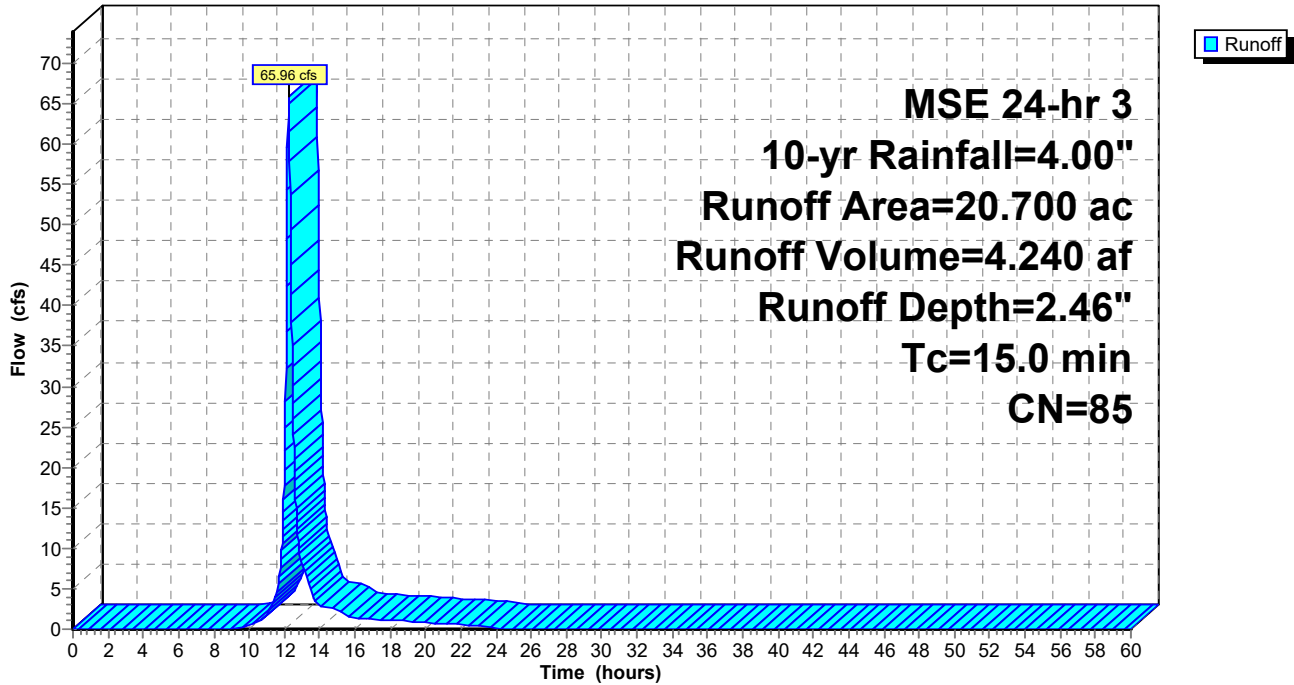
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 10-yr Rainfall=4.00"

Area (ac)	CN	Description
8.800	98	Paved parking, HSG D
11.900	76	Woods/grass comb., Fair, HSG C
20.700	85	Weighted Average
11.900		57.49% Pervious Area
8.800		42.51% Impervious Area

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

Subcatchment 1S: Onsite Area

Hydrograph



Summary for Subcatchment 2S: Onsite Area

Runoff = 30.77 cfs @ 12.23 hrs, Volume= 2.019 af, Depth= 2.92"
 Routed to Pond 2P : Basin 2

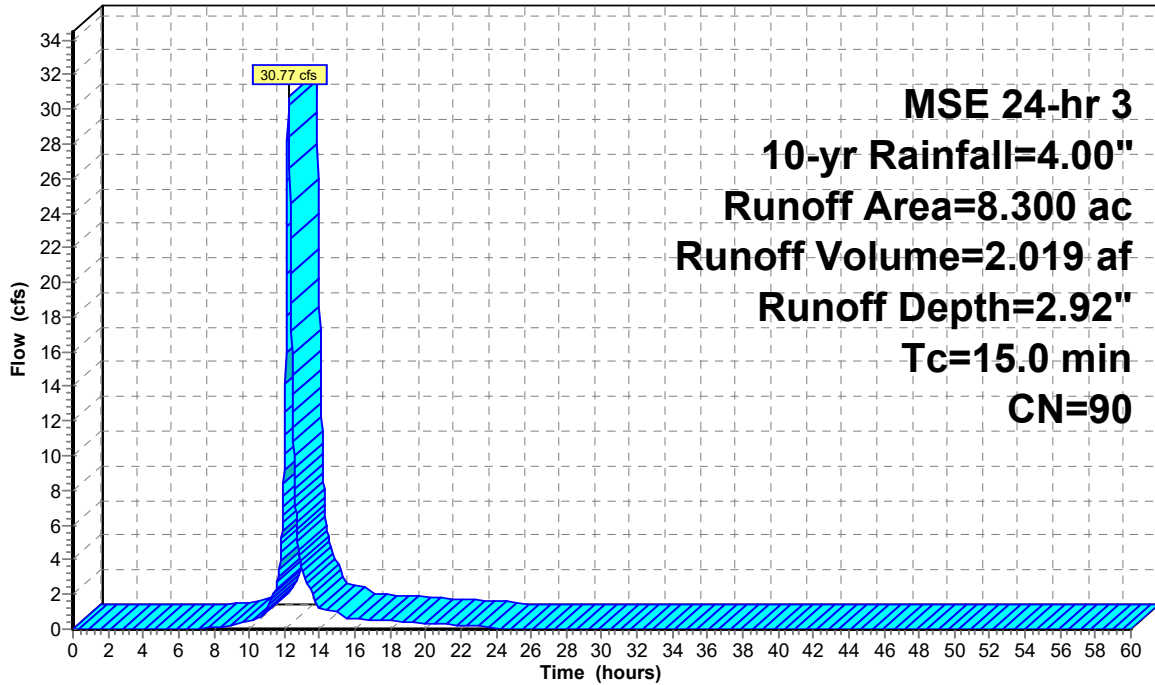
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 10-yr Rainfall=4.00"

Area (ac)	CN	Description
5.300	98	Paved parking, HSG D
3.000	76	Woods/grass comb., Fair, HSG C
8.300	90	Weighted Average
3.000		36.14% Pervious Area
5.300		63.86% Impervious Area

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

Subcatchment 2S: Onsite Area

Hydrograph



Runoff

Summary for Subcatchment 3/4S: Onsite Area

Runoff = 140.67 cfs @ 12.23 hrs, Volume= 9.175 af, Depth= 2.82"
 Routed to Pond 3P : Basin 3

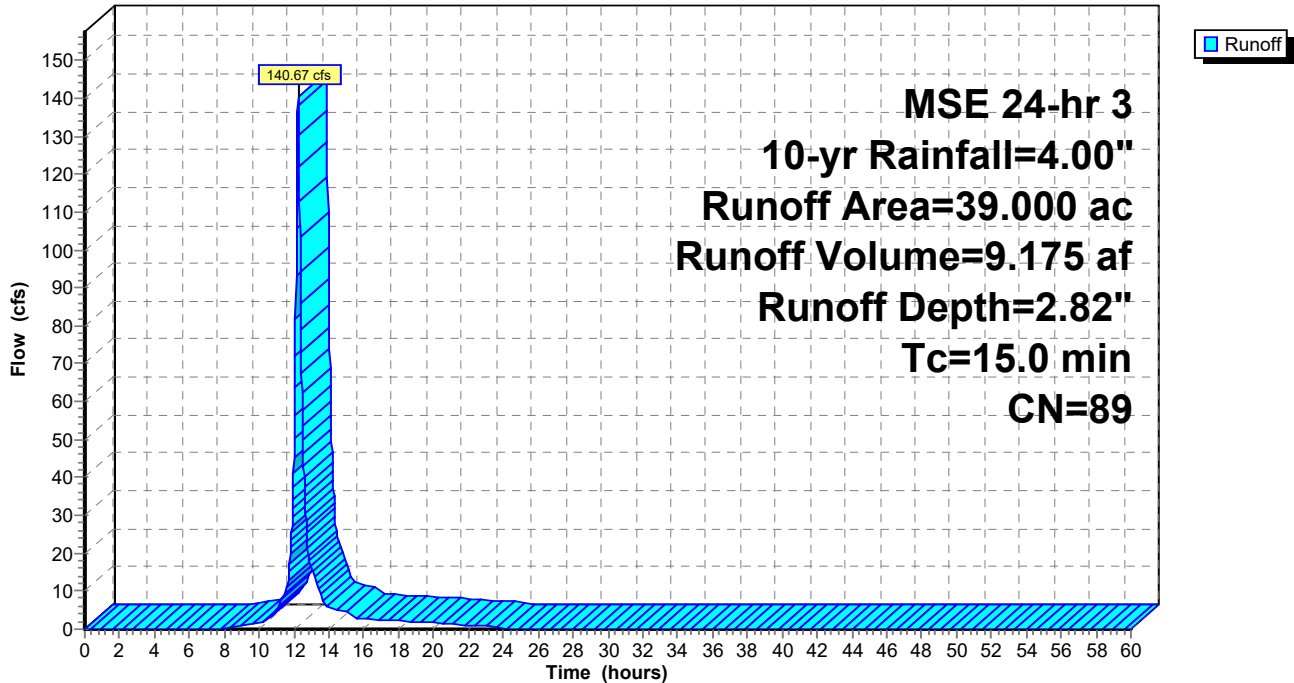
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 10-yr Rainfall=4.00"

Area (ac)	CN	Description
22.300	98	Paved parking, HSG D
16.700	76	Woods/grass comb., Fair, HSG C
39.000	89	Weighted Average
16.700		42.82% Pervious Area
22.300		57.18% Impervious Area

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

Subcatchment 3/4S: Onsite Area

Hydrograph



Summary for Subcatchment 5S: Onsite Area

Runoff = 215.00 cfs @ 12.23 hrs, Volume= 14.207 af, Depth= 3.02"
 Routed to Pond 5P : Basin 5

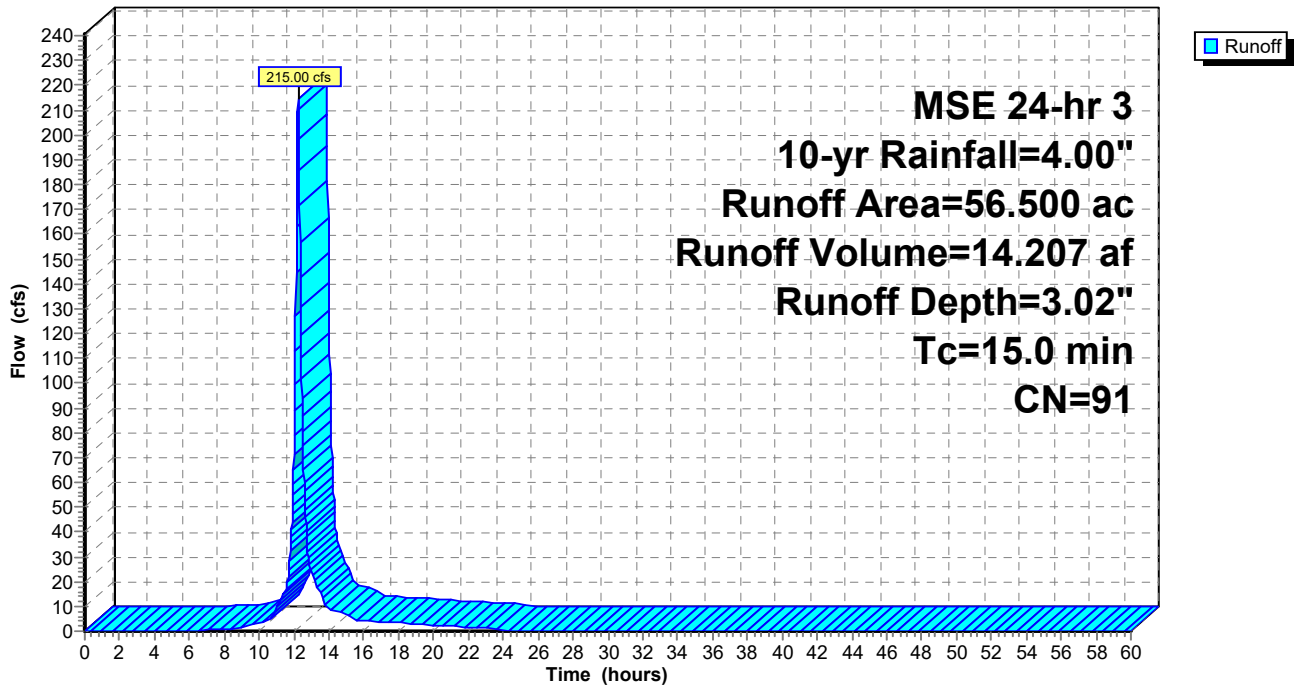
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 10-yr Rainfall=4.00"

Area (ac)	CN	Description
38.500	98	Paved parking, HSG D
18.000	76	Woods/grass comb., Fair, HSG C
56.500	91	Weighted Average
18.000		31.86% Pervious Area
38.500		68.14% Impervious Area

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

Subcatchment 5S: Onsite Area

Hydrograph



Summary for Subcatchment 6S: Onsite Area

Runoff = 63.56 cfs @ 12.23 hrs, Volume= 4.235 af, Depth= 3.12"
 Routed to Pond 6P : Basin 6

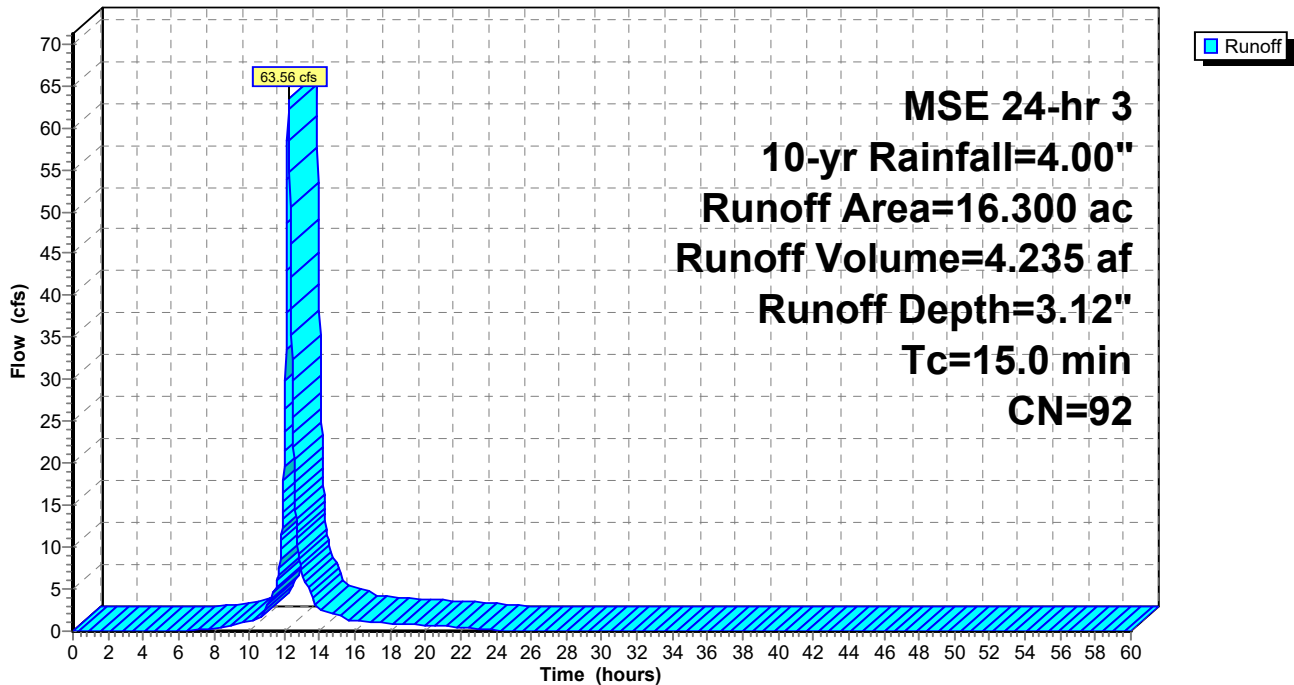
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 10-yr Rainfall=4.00"

Area (ac)	CN	Description
11.600	98	Paved parking, HSG D
4.700	76	Woods/grass comb., Fair, HSG C
16.300	92	Weighted Average
4.700		28.83% Pervious Area
11.600		71.17% Impervious Area

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

Subcatchment 6S: Onsite Area

Hydrograph



Summary for Subcatchment 7S: Onsite Area

Runoff = 133.82 cfs @ 12.23 hrs, Volume= 8.728 af, Depth= 2.82"
 Routed to Pond 7P : Basin 7

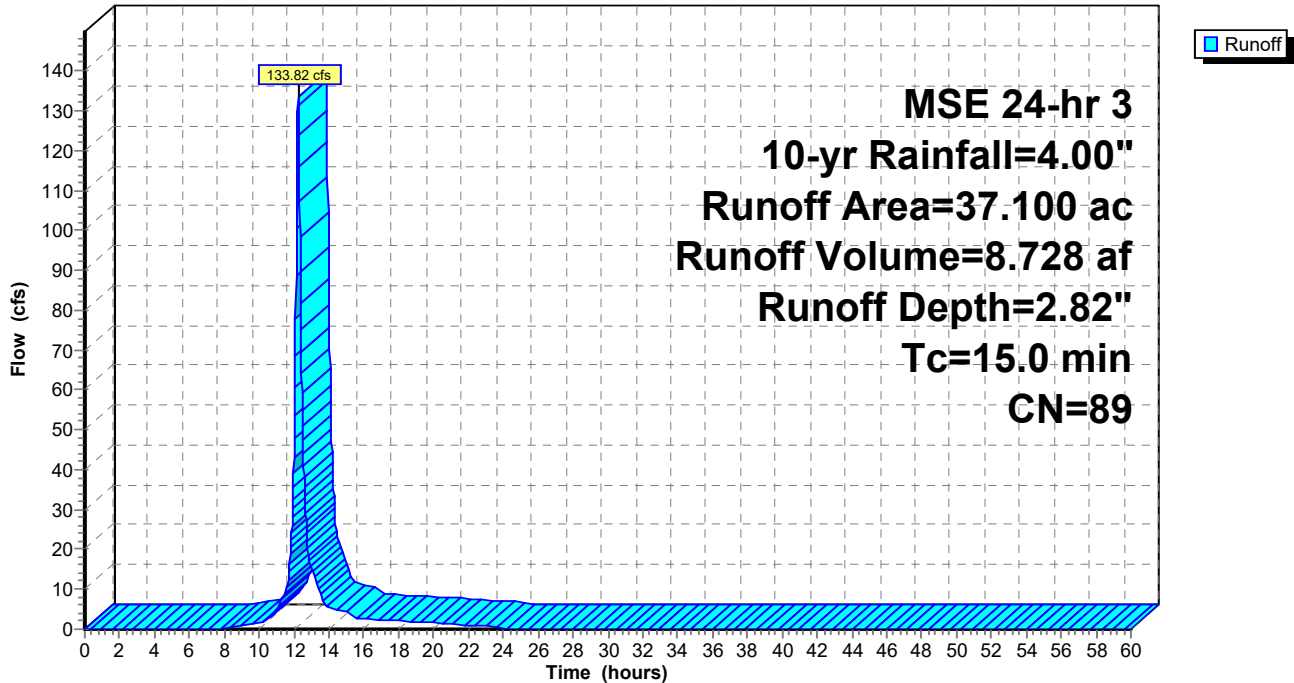
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 10-yr Rainfall=4.00"

Area (ac)	CN	Description
21.500	98	Paved parking, HSG D
15.600	76	Woods/grass comb., Fair, HSG C
37.100	89	Weighted Average
15.600		42.05% Pervious Area
21.500		57.95% Impervious Area

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

Subcatchment 7S: Onsite Area

Hydrograph



Summary for Subcatchment 8S: Onsite Area

Runoff = 25.17 cfs @ 12.23 hrs, Volume= 1.618 af, Depth= 2.46"
 Routed to Pond 8P : Basin 8

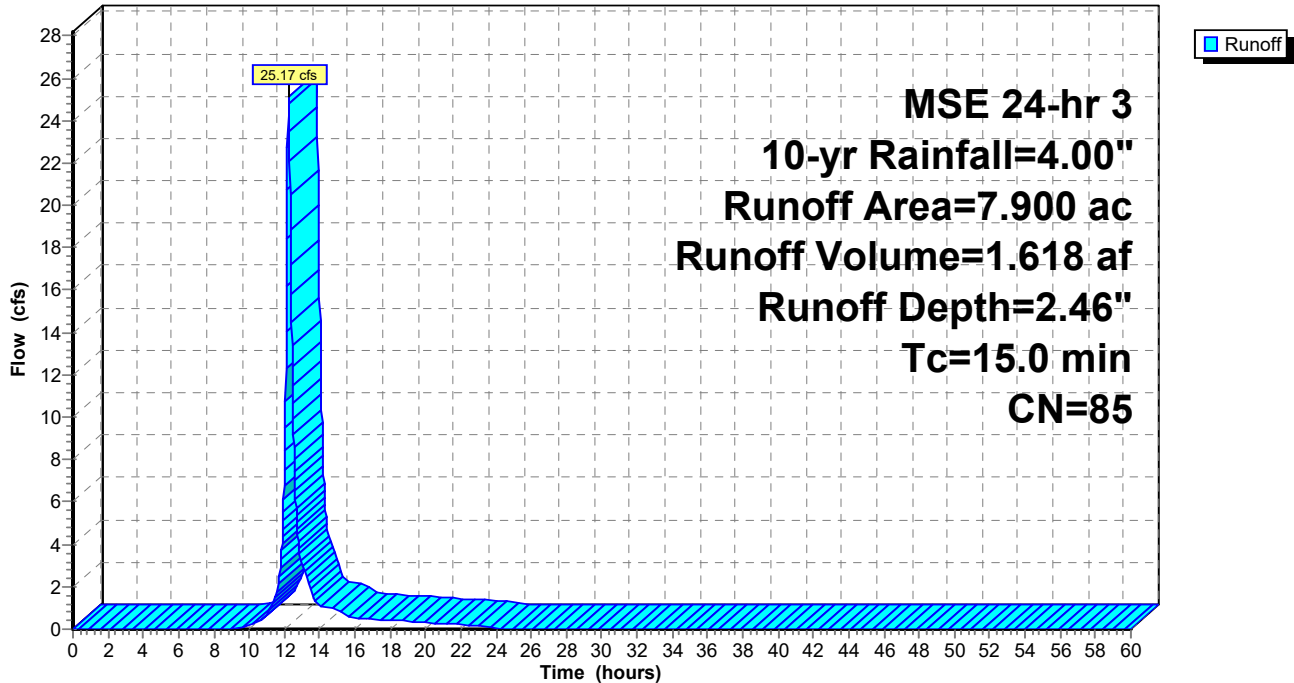
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 10-yr Rainfall=4.00"

Area (ac)	CN	Description
3.300	98	Paved parking, HSG D
4.600	76	Woods/grass comb., Fair, HSG C
7.900	85	Weighted Average
4.600		58.23% Pervious Area
3.300		41.77% Impervious Area

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

Subcatchment 8S: Onsite Area

Hydrograph



Summary for Subcatchment DW1:

Runoff = 24.76 cfs @ 12.14 hrs, Volume= 1.162 af, Depth= 1.96"
 Routed to Pond W1 : Wetland 1

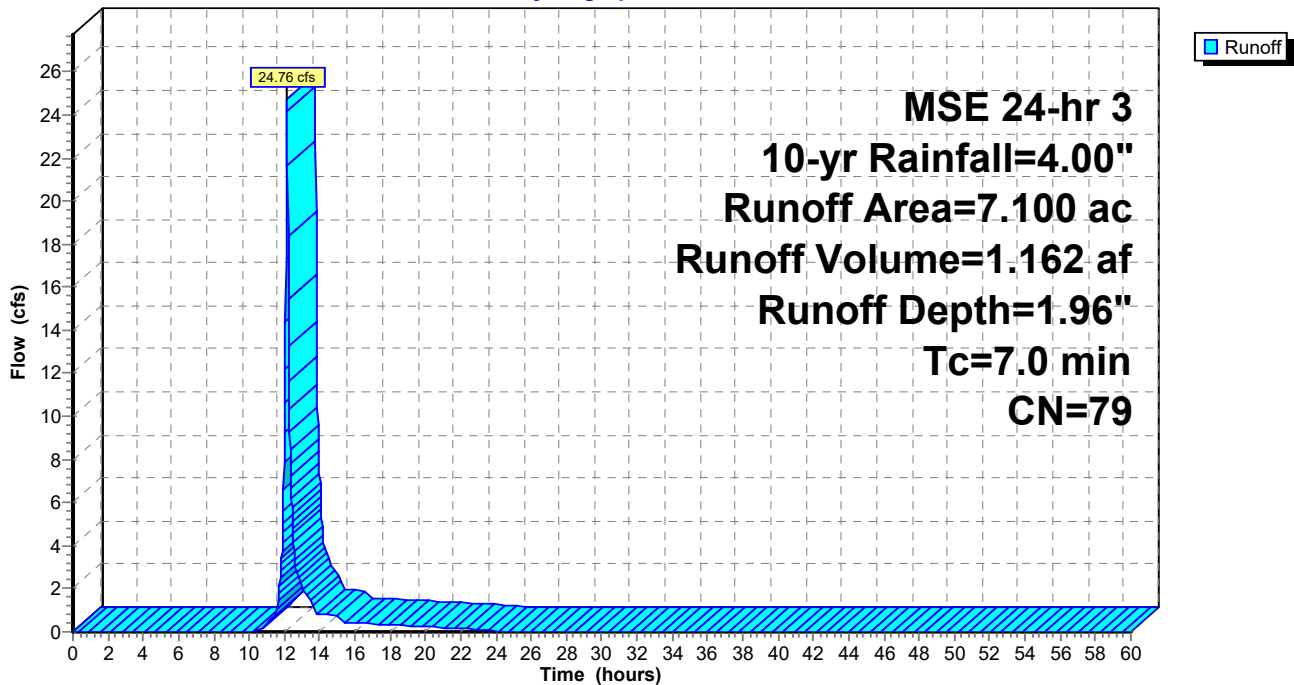
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 10-yr Rainfall=4.00"

Area (ac)	CN	Description
7.100	79	Woods/grass comb., Good, HSG D
7.100		100.00% Pervious Area

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

Subcatchment DW1:

Hydrograph



Summary for Subcatchment DW4:

Runoff = 16.04 cfs @ 12.14 hrs, Volume= 0.753 af, Depth= 1.96"
 Routed to Pond W4 : Wetland 4

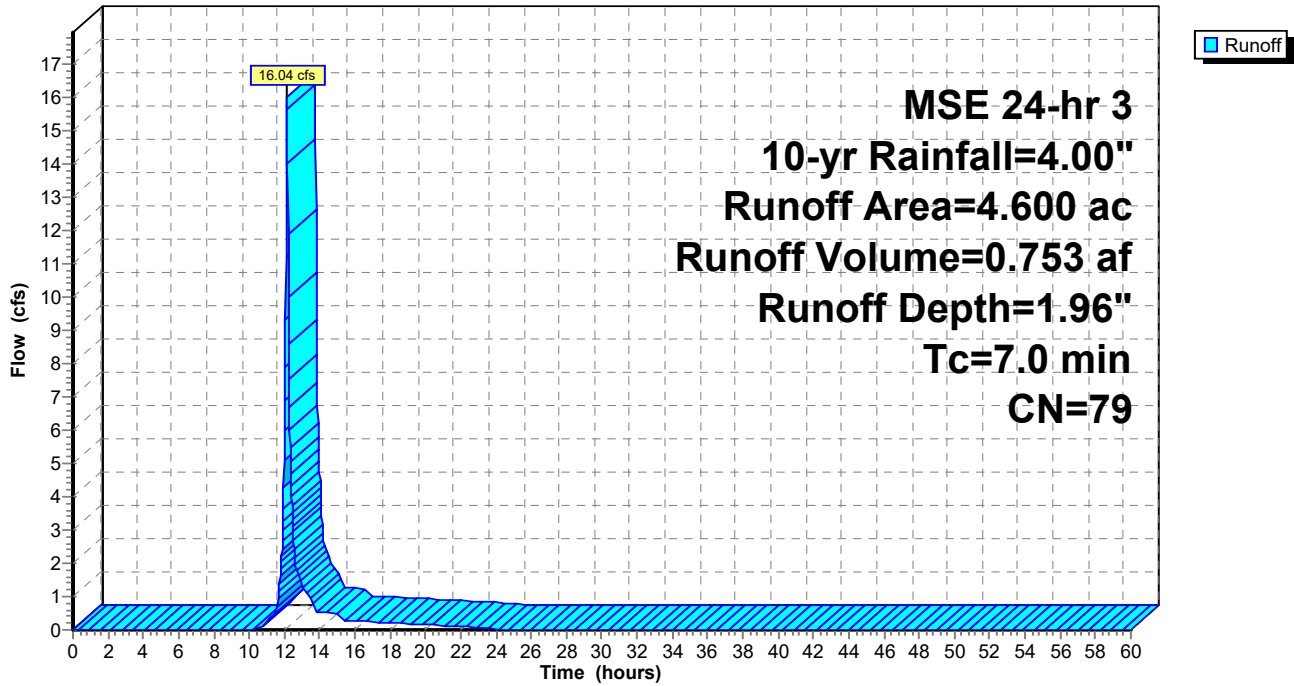
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 10-yr Rainfall=4.00"

Area (ac)	CN	Description
4.600	79	Woods/grass comb., Good, HSG D
4.600		100.00% Pervious Area

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

Subcatchment DW4:

Hydrograph



Summary for Subcatchment DW5:

Runoff = 9.07 cfs @ 12.14 hrs, Volume= 0.425 af, Depth= 1.96"
 Routed to Pond W5 : Wetland 5

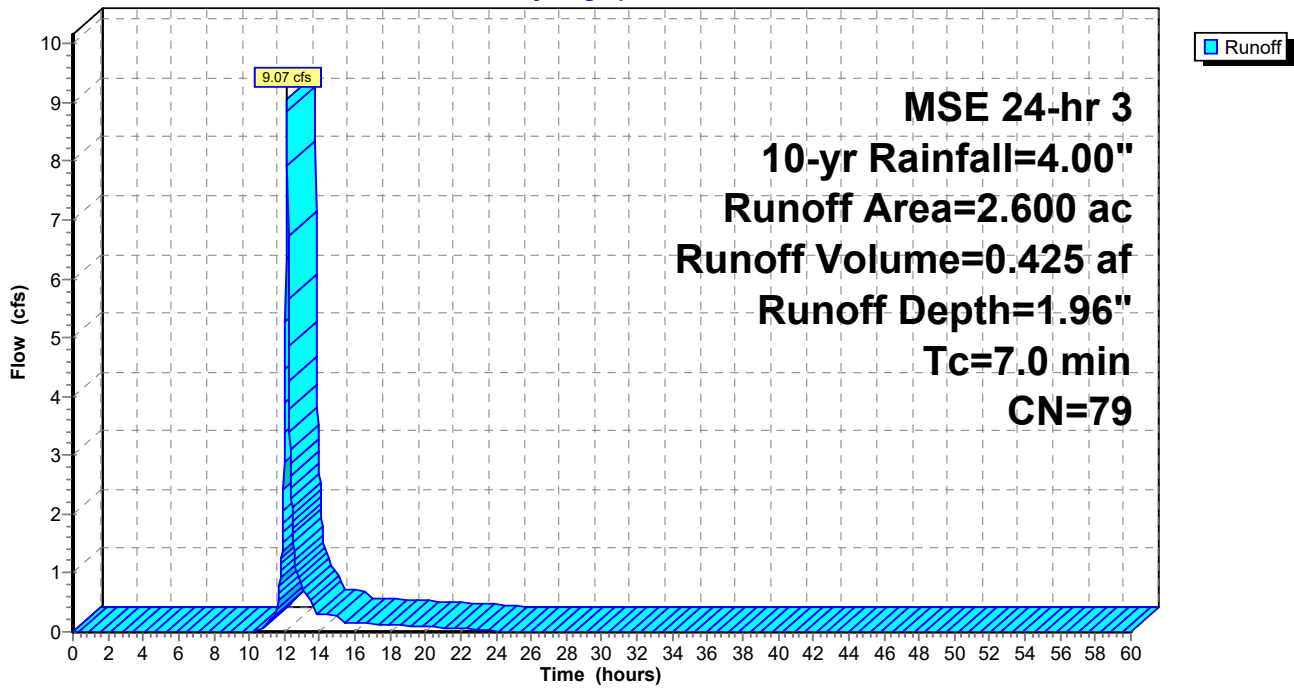
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 10-yr Rainfall=4.00"

Area (ac)	CN	Description
2.600	79	Woods/grass comb., Good, HSG D
2.600		100.00% Pervious Area

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

Subcatchment DW5:

Hydrograph



Summary for Subcatchment DW6:

Runoff = 6.28 cfs @ 12.14 hrs, Volume= 0.295 af, Depth= 1.96"
 Routed to Pond W6 : Wetland 6

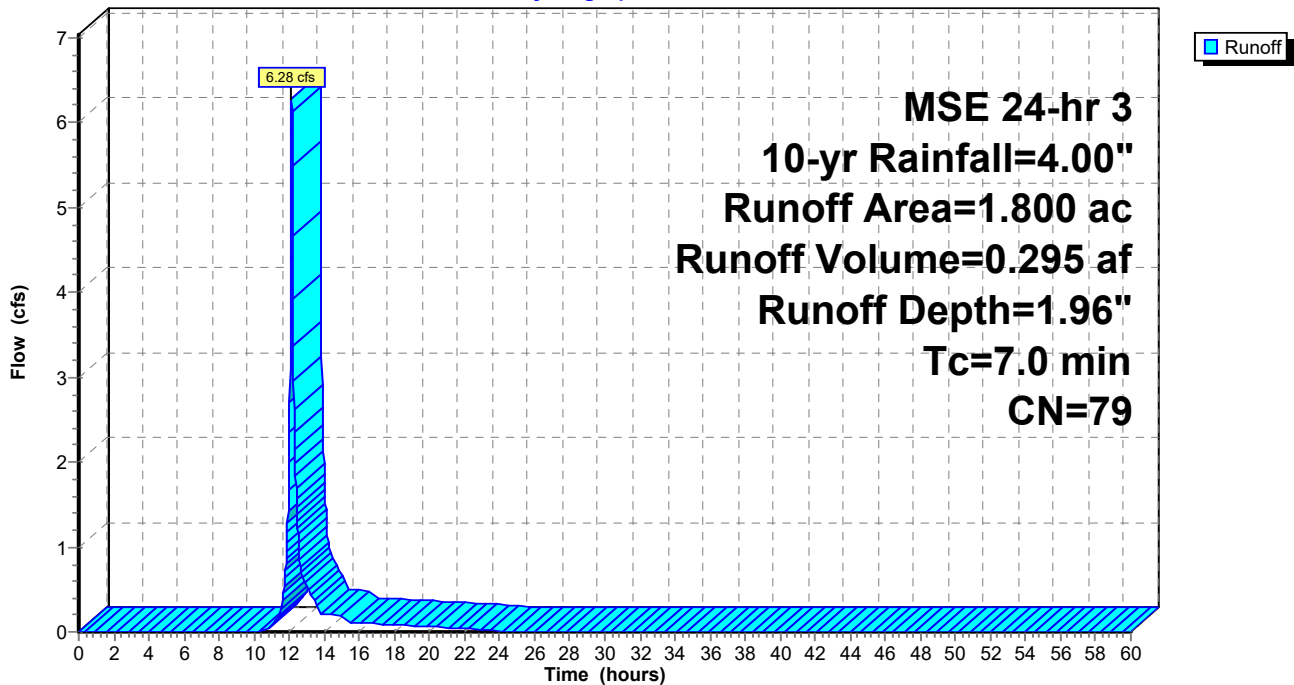
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 10-yr Rainfall=4.00"

Area (ac)	CN	Description
1.800	79	Woods/grass comb., Good, HSG D
1.800		100.00% Pervious Area

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

Subcatchment DW6:

Hydrograph



Summary for Subcatchment DW7:

Runoff = 31.73 cfs @ 13.04 hrs, Volume= 5.252 af, Depth= 1.96"
 Routed to Pond W7 : Wetland 7

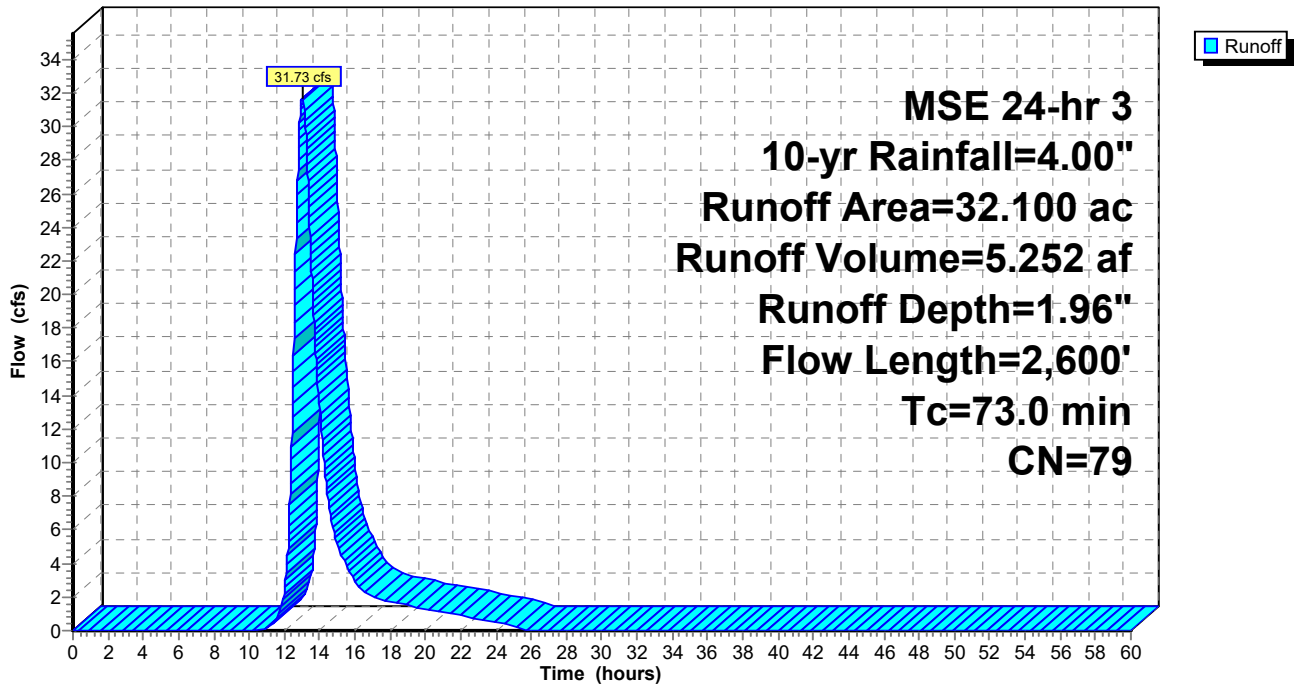
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 10-yr Rainfall=4.00"

Area (ac)	CN	Description
32.100	79	Woods/grass comb., Good, HSG D
32.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.2	100	0.0500	0.06		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.70"
27.4	650	0.0250	0.40		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
17.4	1,850	0.0140	1.77		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
73.0	2,600	Total			

Subcatchment DW7:

Hydrograph



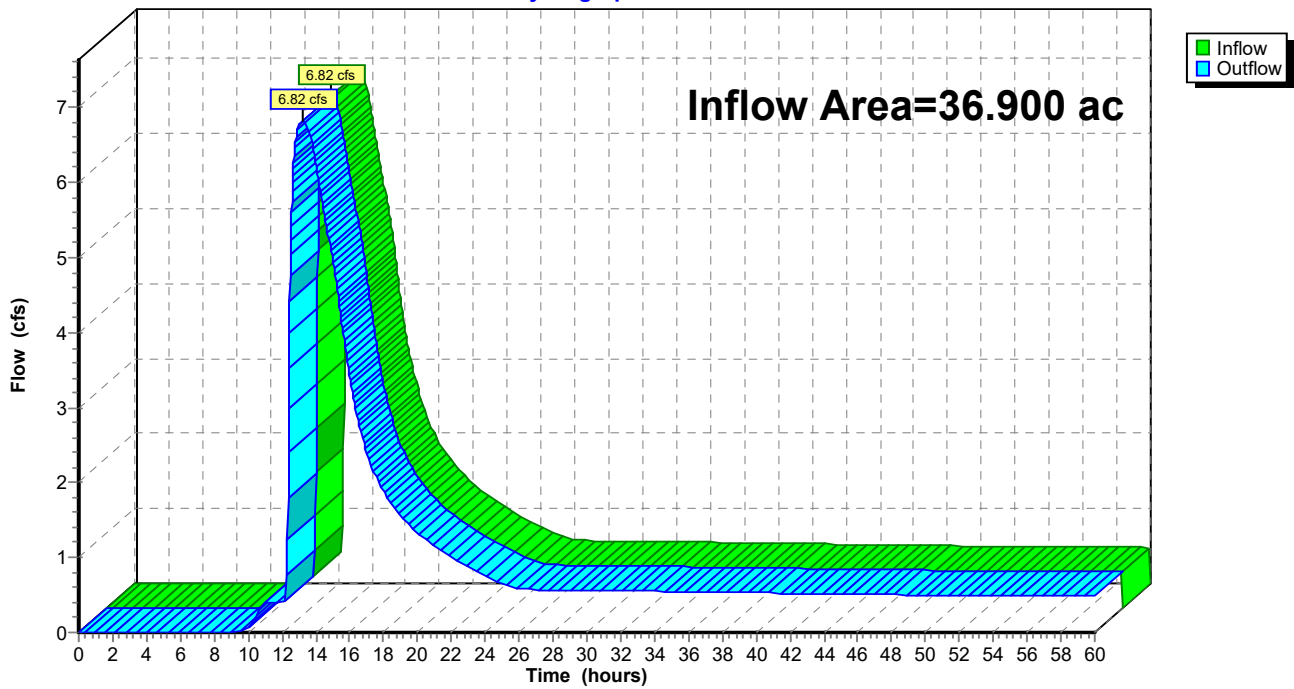
Summary for Reach 1R: Peak Flow Trunk 1

Inflow Area = 36.900 ac, 47.15% Impervious, Inflow Depth > 1.40" for 10-yr event
Inflow = 6.82 cfs @ 13.21 hrs, Volume= 4.314 af
Outflow = 6.82 cfs @ 13.23 hrs, Volume= 4.314 af, Atten= 0%, Lag= 1.2 min
Routed to Pond W7 : Wetland 7

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

Reach 1R: Peak Flow Trunk 1

Hydrograph

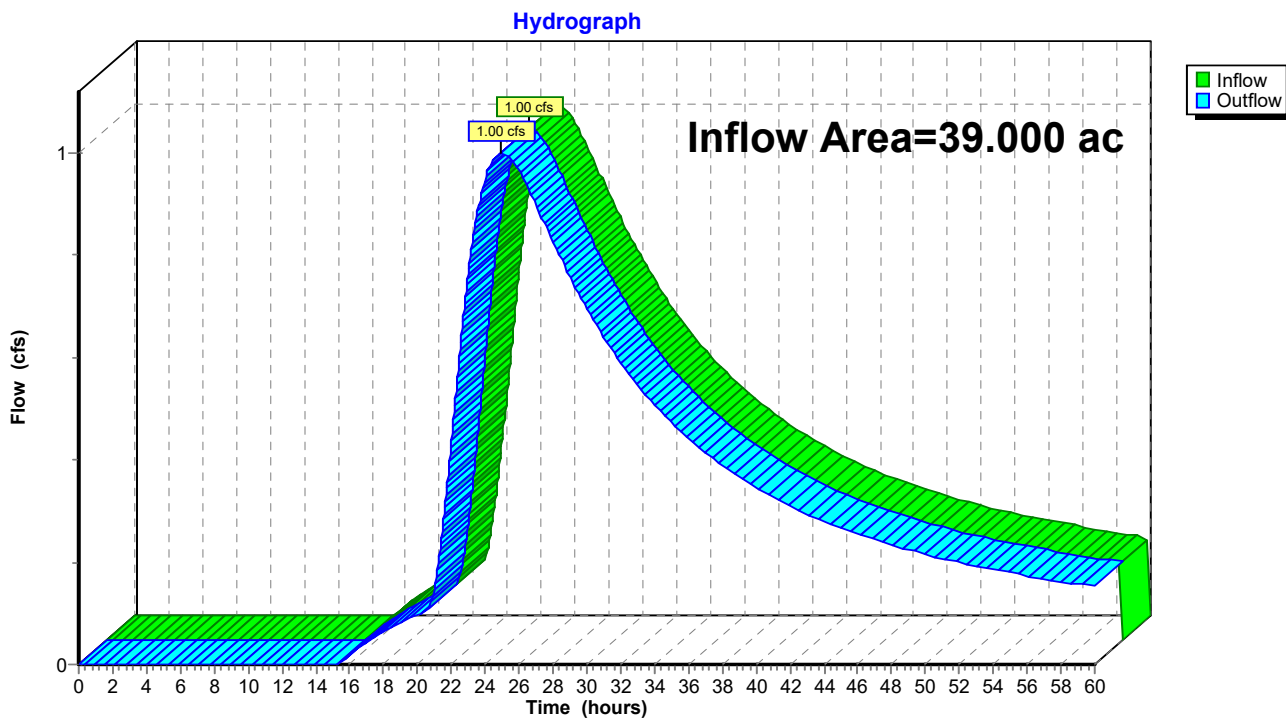


Summary for Reach 2R: Peak Flow Trunk 2

Inflow Area = 39.000 ac, 57.18% Impervious, Inflow Depth > 0.43" for 10-yr event
Inflow = 1.00 cfs @ 24.93 hrs, Volume= 1.391 af
Outflow = 1.00 cfs @ 24.95 hrs, Volume= 1.391 af, Atten= 0%, Lag= 1.2 min
Routed to Pond W7 : Wetland 7

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

Reach 2R: Peak Flow Trunk 2



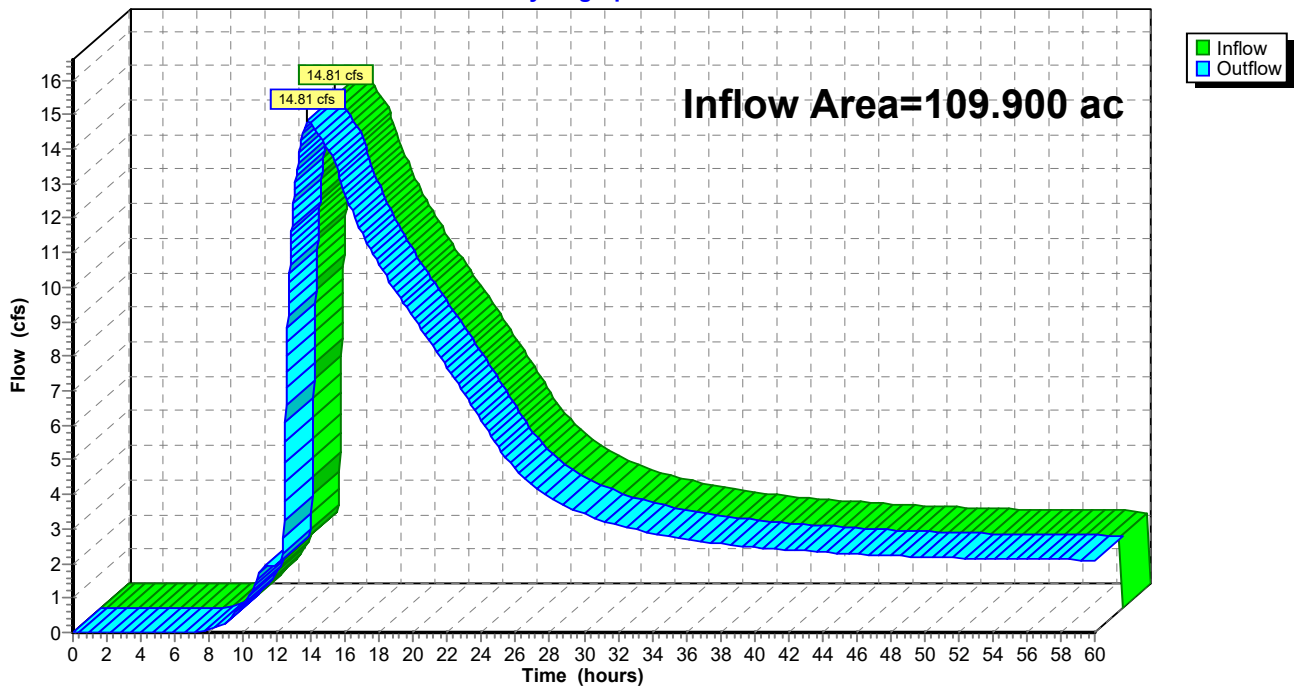
Summary for Reach 3R: Peak Flow Trunk 3

Inflow Area = 109.900 ac, 65.15% Impervious, Inflow Depth > 2.03" for 10-yr event
Inflow = 14.81 cfs @ 13.77 hrs, Volume= 18.623 af
Outflow = 14.81 cfs @ 13.79 hrs, Volume= 18.623 af, Atten= 0%, Lag= 1.2 min
Routed to Pond W7 : Wetland 7

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

Reach 3R: Peak Flow Trunk 3

Hydrograph



Summary for Pond 1P: Basin 1

Inflow Area = 20.700 ac, 42.51% Impervious, Inflow Depth = 2.46" for 10-yr event
 Inflow = 65.96 cfs @ 12.23 hrs, Volume= 4.240 af
 Outflow = 6.77 cfs @ 13.20 hrs, Volume= 3.950 af, Atten= 90%, Lag= 58.2 min
 Primary = 6.77 cfs @ 13.20 hrs, Volume= 3.950 af
 Routed to Reach 1R : Peak Flow Trunk 1

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,296.33' @ 13.20 hrs Surf.Area= 0.676 ac Storage= 2.562 af

Plug-Flow detention time= 673.1 min calculated for 3.950 af (93% of inflow)
 Center-of-Mass det. time= 641.0 min (1,445.1 - 804.1)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,290.00'	9.293 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,290.00	0.500	0.0	0.000	0.000
1,290.01	0.500	40.0	0.002	0.002
1,292.99	0.500	40.0	0.596	0.598
1,293.00	0.500	100.0	0.005	0.603
1,304.00	1.080	100.0	8.690	9.293

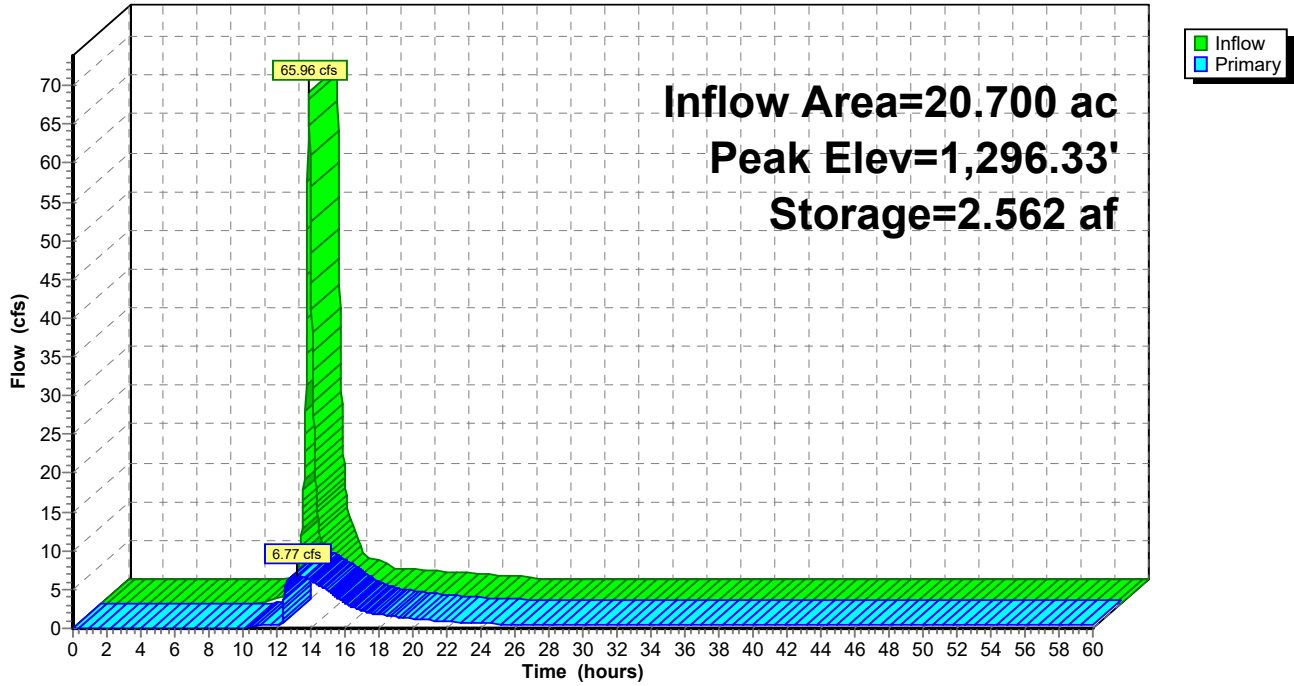
Device	Routing	Invert	Outlet Devices
#1	Primary	1,290.00'	24.0" Round Culvert L= 865.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,290.00' / 1,285.00' S= 0.0058 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Device 1	1,294.60'	15.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,296.30'	24.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Device 1	1,301.00'	6.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#5	Device 1	1,290.00'	0.800 in/hr Exfiltration over Surface area

Primary OutFlow Max=6.77 cfs @ 13.20 hrs HW=1,296.33' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 6.77 cfs of 23.56 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 6.22 cfs @ 5.07 fps)
- 3=Orifice/Grate (Orifice Controls 0.01 cfs @ 0.61 fps)
- 4=Sharp-Crested Rectangular Weir(Controls 0.00 cfs)
- 5=Exfiltration (Exfiltration Controls 0.55 cfs)

Pond 1P: Basin 1

Hydrograph



Summary for Pond 2P: Basin 2

Inflow Area = 8.300 ac, 63.86% Impervious, Inflow Depth = 2.92" for 10-yr event
 Inflow = 30.77 cfs @ 12.23 hrs, Volume= 2.019 af
 Outflow = 0.06 cfs @ 24.17 hrs, Volume= 0.225 af, Atten= 100%, Lag= 716.8 min
 Primary = 0.06 cfs @ 24.17 hrs, Volume= 0.225 af
 Routed to Reach 1R : Peak Flow Trunk 1

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,289.34' @ 24.17 hrs Surf.Area= 0.828 ac Storage= 1.966 af

Plug-Flow detention time= 1,527.9 min calculated for 0.225 af (11% of inflow)
 Center-of-Mass det. time= 1,383.2 min (2,174.7 - 791.5)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,285.00'	12.674 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,285.00	0.750	0.0	0.000	0.000
1,285.01	0.750	40.0	0.003	0.003
1,287.99	0.750	40.0	0.894	0.897
1,288.00	0.750	100.0	0.007	0.904
1,299.00	1.390	100.0	11.770	12.674

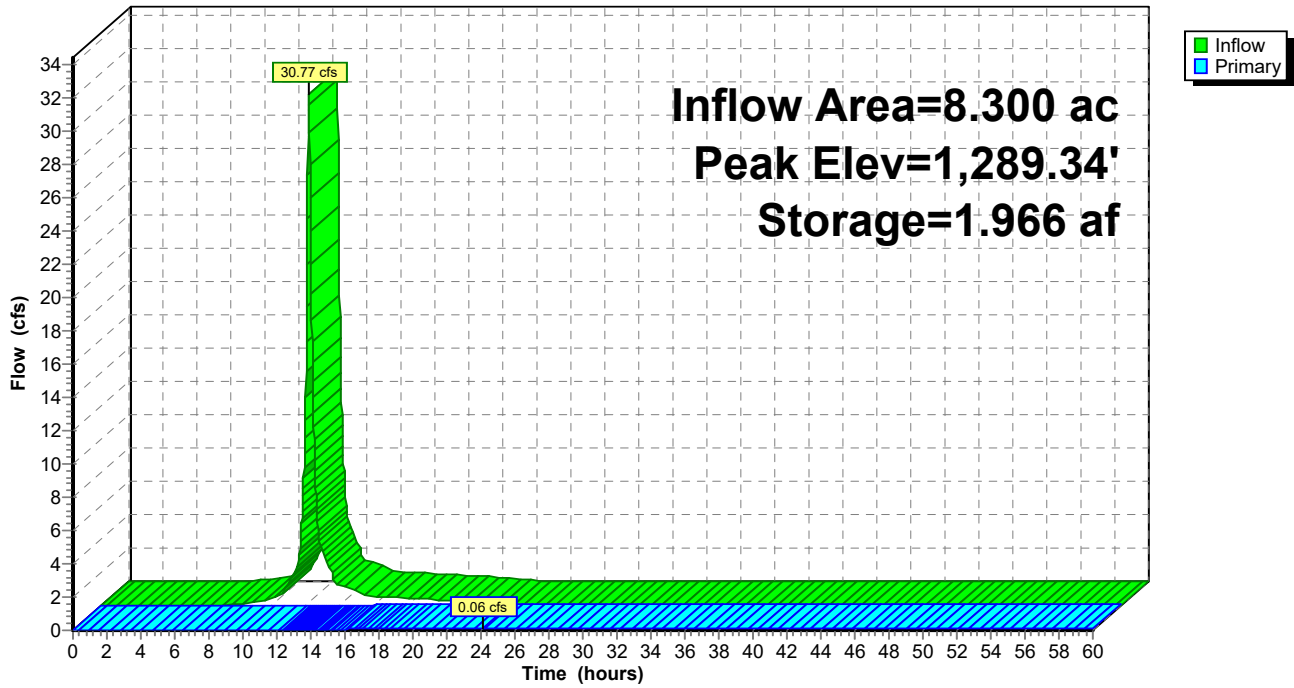
Device	Routing	Invert	Outlet Devices
#1	Primary	1,285.00'	24.0" Round Culvert L= 1,250.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,285.00' / 1,277.00' S= 0.0064 '/ Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Device 1	1,289.60'	15.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,295.00'	6.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 1	1,288.00'	0.800 in/hr Exfiltration over Surface area above 1,288.00' Excluded Surface area = 0.750 ac

Primary OutFlow Max=0.06 cfs @ 24.17 hrs HW=1,289.34' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 0.06 cfs of 21.10 cfs potential flow)
- 2=Orifice/Grate (Controls 0.00 cfs)
- 3=Sharp-Crested Rectangular Weir(Controls 0.00 cfs)
- 4=Exfiltration (Exfiltration Controls 0.06 cfs)

Pond 2P: Basin 2

Hydrograph



Summary for Pond 3P: Basin 3

Inflow Area = 39.000 ac, 57.18% Impervious, Inflow Depth = 2.82" for 10-yr event
 Inflow = 140.67 cfs @ 12.23 hrs, Volume= 9.175 af
 Outflow = 5.81 cfs @ 13.90 hrs, Volume= 4.343 af, Atten= 96%, Lag= 100.5 min
 Primary = 5.81 cfs @ 13.90 hrs, Volume= 4.343 af
 Routed to Pond 4P : Basin 4

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,289.80' @ 13.90 hrs Surf.Area= 1.854 ac Storage= 6.837 af

Plug-Flow detention time= 530.3 min calculated for 4.341 af (47% of inflow)
 Center-of-Mass det. time= 448.2 min (1,242.5 - 794.3)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,284.00'	24.736 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,284.00	1.630	0.0	0.000	0.000
1,284.01	1.630	40.0	0.007	0.007
1,286.99	1.630	40.0	1.943	1.949
1,287.00	1.630	100.0	0.016	1.966
1,298.00	2.510	100.0	22.770	24.736

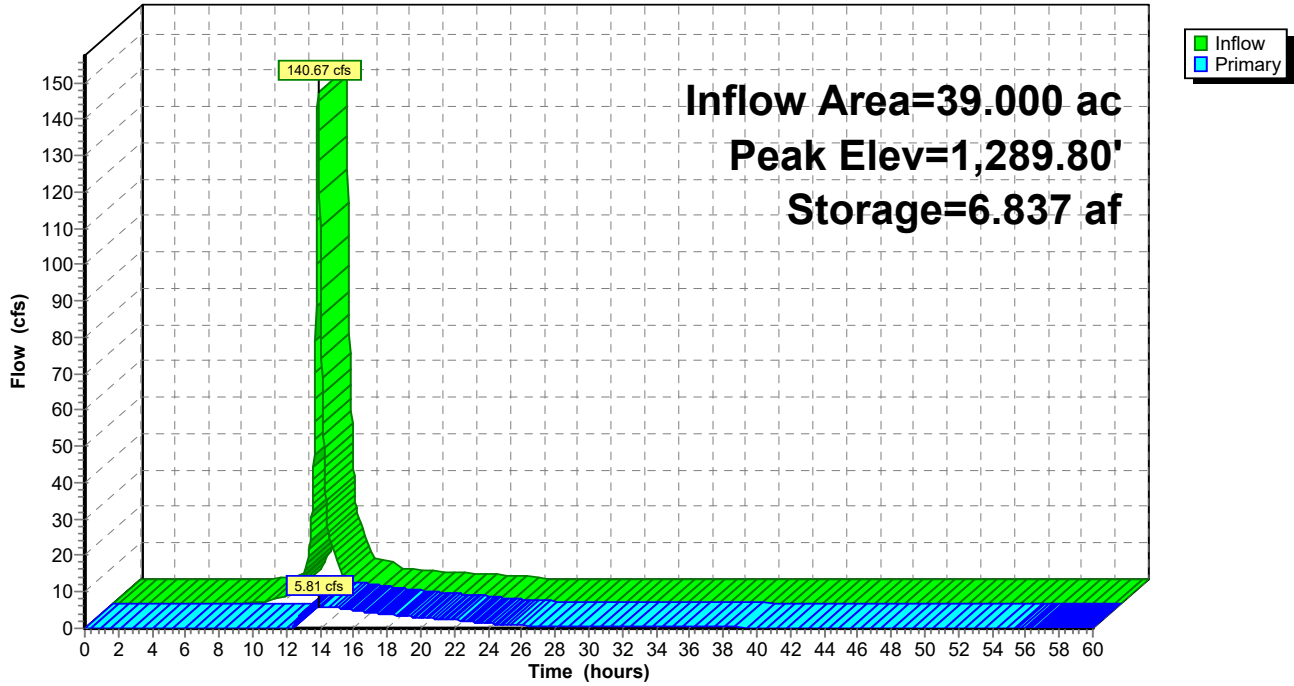
Device	Routing	Invert	Outlet Devices
#1	Primary	1,284.00'	48.0" Round Culvert L= 100.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,284.00' / 1,284.00' S= 0.0000 '/ Cc= 0.900 n= 0.012, Flow Area= 12.57 sf
#2	Device 1	1,288.60'	18.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,287.00'	0.800 in/hr Exfiltration over Surface area above 1,287.00' Excluded Surface area = 1.630 ac

Primary OutFlow Max=5.81 cfs @ 13.90 hrs HW=1,289.80' TW=1,285.32' (Dynamic Tailwater)

- 1=Culvert (Passes 5.81 cfs of 97.51 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 5.63 cfs @ 3.72 fps)
- 3=Exfiltration (Exfiltration Controls 0.18 cfs)

Pond 3P: Basin 3

Hydrograph



Summary for Pond 4P: Basin 4

Inflow Area = 39.000 ac, 57.18% Impervious, Inflow Depth > 1.34" for 10-yr event
 Inflow = 5.81 cfs @ 13.90 hrs, Volume= 4.343 af
 Outflow = 1.00 cfs @ 24.93 hrs, Volume= 1.391 af, Atten= 83%, Lag= 661.6 min
 Primary = 1.00 cfs @ 24.93 hrs, Volume= 1.391 af
 Routed to Reach 2R : Peak Flow Trunk 2

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,289.01' @ 24.93 hrs Surf.Area= 1.143 ac Storage= 3.320 af

Plug-Flow detention time= 1,203.0 min calculated for 1.391 af (32% of inflow)
 Center-of-Mass det. time= 815.5 min (2,058.0 - 1,242.5)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,284.00'	16.857 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,284.00	0.980	0.0	0.000	0.000
1,284.01	0.980	40.0	0.004	0.004
1,286.99	0.980	40.0	1.168	1.172
1,287.00	0.980	100.0	0.010	1.182
1,298.00	1.870	100.0	15.675	16.857

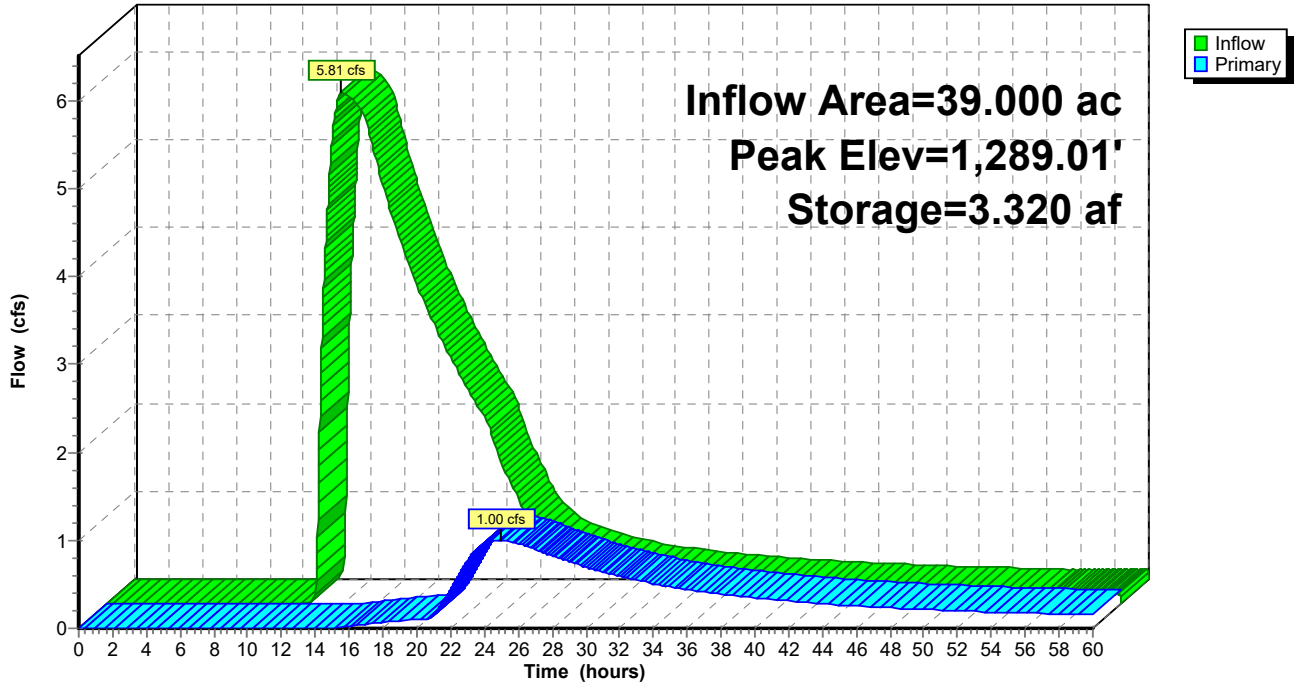
Device	Routing	Invert	Outlet Devices
#1	Primary	1,284.00'	48.0" Round Culvert L= 100.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,284.00' / 1,274.00' S= 0.1000 '/' Cc= 0.900 n= 0.012, Flow Area= 12.57 sf
#2	Device 1	1,288.60'	18.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,293.00'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 1	1,287.00'	0.800 in/hr Exfiltration over Surface area above 1,287.00' Excluded Surface area = 0.980 ac

Primary OutFlow Max=1.00 cfs @ 24.93 hrs HW=1,289.01' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 1.00 cfs of 105.04 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 0.87 cfs @ 2.19 fps)
- 3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 4=Exfiltration (Exfiltration Controls 0.13 cfs)

Pond 4P: Basin 4

Hydrograph



Summary for Pond 5P: Basin 5

Inflow Area = 56.500 ac, 68.14% Impervious, Inflow Depth = 3.02" for 10-yr event
 Inflow = 215.00 cfs @ 12.23 hrs, Volume= 14.207 af
 Outflow = 6.22 cfs @ 15.18 hrs, Volume= 7.215 af, Atten= 97%, Lag= 177.1 min
 Primary = 6.22 cfs @ 15.18 hrs, Volume= 7.215 af
 Routed to Reach 3R : Peak Flow Trunk 3

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,289.24' @ 15.18 hrs Surf.Area= 2.686 ac Storage= 11.061 af

Plug-Flow detention time= 648.2 min calculated for 7.215 af (51% of inflow)
 Center-of-Mass det. time= 567.6 min (1,356.1 - 788.5)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,283.00'	38.318 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,283.00	2.370	0.0	0.000	0.000
1,283.01	2.370	40.0	0.009	0.009
1,285.99	2.370	40.0	2.825	2.835
1,286.00	2.370	100.0	0.024	2.858
1,298.00	3.540	100.0	35.460	38.318

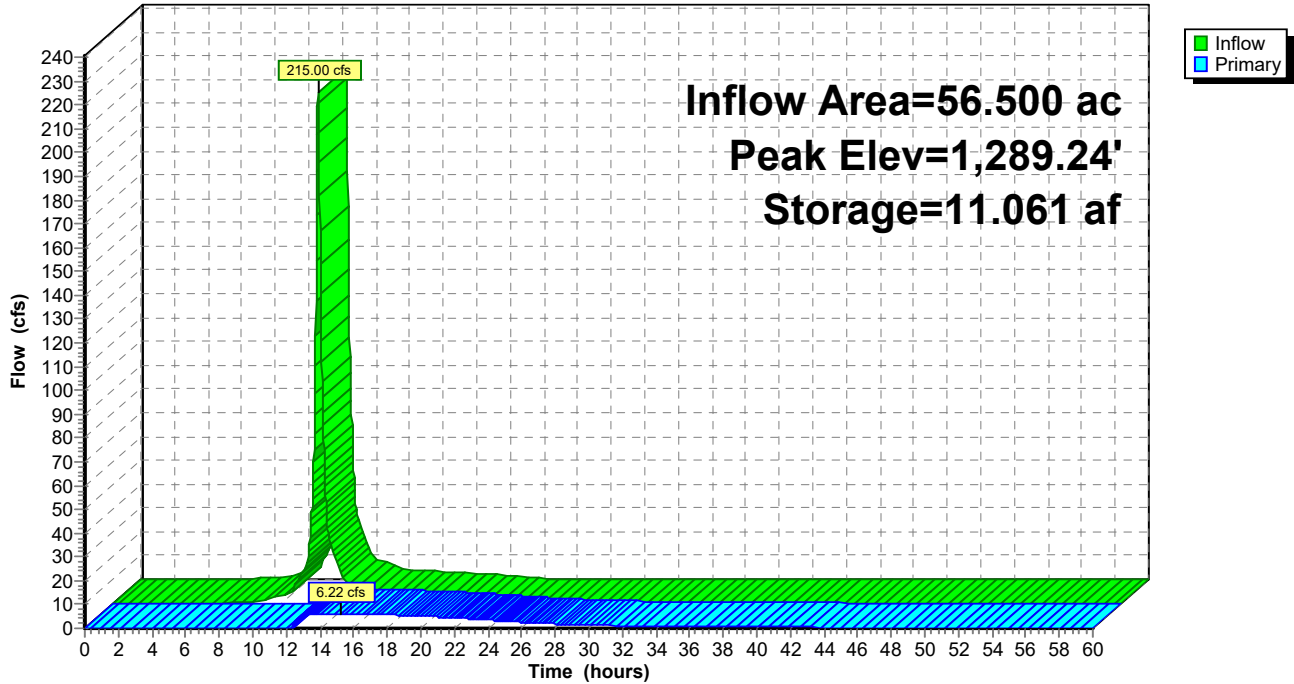
Device	Routing	Invert	Outlet Devices
#1	Primary	1,283.00'	48.0" Round Culvert L= 1,050.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,283.00' / 1,278.00' S= 0.0048 '/' Cc= 0.900 n= 0.012, Flow Area= 12.57 sf
#2	Device 1	1,287.60'	15.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,286.00'	0.800 in/hr Exfiltration over Surface area above 1,286.00' Excluded Surface area = 2.370 ac

Primary OutFlow Max=6.22 cfs @ 15.18 hrs HW=1,289.24' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 6.22 cfs of 111.50 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 5.97 cfs @ 4.86 fps)
- 3=Exfiltration (Exfiltration Controls 0.26 cfs)

Pond 5P: Basin 5

Hydrograph



Summary for Pond 6P: Basin 6

Inflow Area = 16.300 ac, 71.17% Impervious, Inflow Depth = 3.12" for 10-yr event
 Inflow = 63.56 cfs @ 12.23 hrs, Volume= 4.235 af
 Outflow = 5.18 cfs @ 13.36 hrs, Volume= 3.884 af, Atten= 92%, Lag= 67.9 min
 Primary = 5.18 cfs @ 13.36 hrs, Volume= 3.884 af
 Routed to Reach 3R : Peak Flow Trunk 3

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,283.81' @ 13.36 hrs Surf.Area= 0.786 ac Storage= 2.774 af

Plug-Flow detention time= 842.3 min calculated for 3.884 af (92% of inflow)
 Center-of-Mass det. time= 805.7 min (1,591.0 - 785.4)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,278.00'	10.947 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,278.00	0.640	0.0	0.000	0.000
1,278.01	0.640	40.0	0.003	0.003
1,280.99	0.640	40.0	0.763	0.765
1,281.00	0.640	100.0	0.006	0.772
1,292.00	1.210	100.0	10.175	10.947

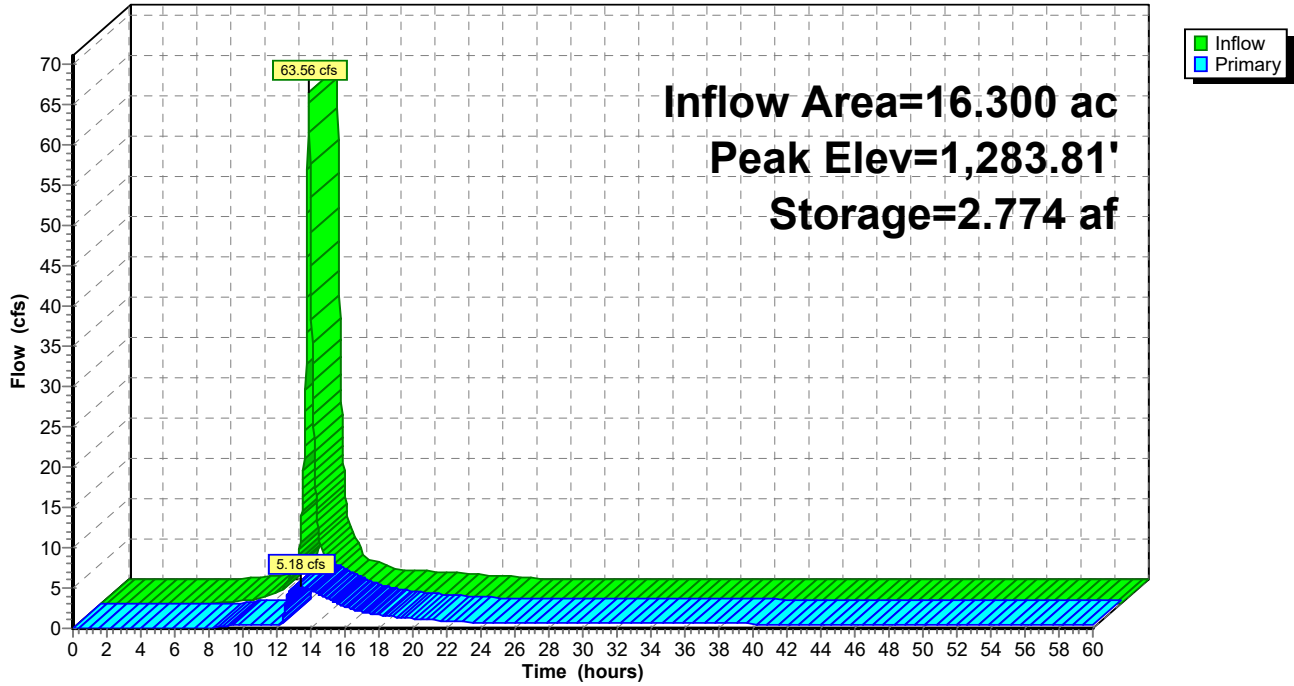
Device	Routing	Invert	Outlet Devices
#1	Primary	1,278.00'	48.0" Round Culvert L= 910.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,278.00' / 1,271.00' S= 0.0077 '/' Cc= 0.900 n= 0.012, Flow Area= 12.57 sf
#2	Primary	1,282.60'	15.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,289.00'	6.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 1	1,278.00'	0.800 in/hr Exfiltration over Surface area

Primary OutFlow Max=5.18 cfs @ 13.36 hrs HW=1,283.81' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 0.63 cfs of 118.09 cfs potential flow)
- 3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 4=Exfiltration (Exfiltration Controls 0.63 cfs)
- 2=Orifice/Grate (Orifice Controls 4.55 cfs @ 3.74 fps)

Pond 6P: Basin 6

Hydrograph



Summary for Pond 7P: Basin 7

Inflow Area = 37.100 ac, 57.95% Impervious, Inflow Depth = 2.82" for 10-yr event
 Inflow = 133.82 cfs @ 12.23 hrs, Volume= 8.728 af
 Outflow = 4.11 cfs @ 15.16 hrs, Volume= 7.527 af, Atten= 97%, Lag= 176.1 min
 Primary = 4.11 cfs @ 15.16 hrs, Volume= 7.527 af
 Routed to Reach 3R : Peak Flow Trunk 3

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,276.41' @ 15.16 hrs Surf.Area= 1.905 ac Storage= 6.513 af

Plug-Flow detention time= 1,137.9 min calculated for 7.527 af (86% of inflow)
 Center-of-Mass det. time= 1,087.1 min (1,881.4 - 794.3)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,271.00'	25.265 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,271.00	1.750	0.0	0.000	0.000
1,271.01	1.750	40.0	0.007	0.007
1,273.99	1.750	40.0	2.086	2.093
1,274.00	1.750	100.0	0.017	2.110
1,285.00	2.460	100.0	23.155	25.265

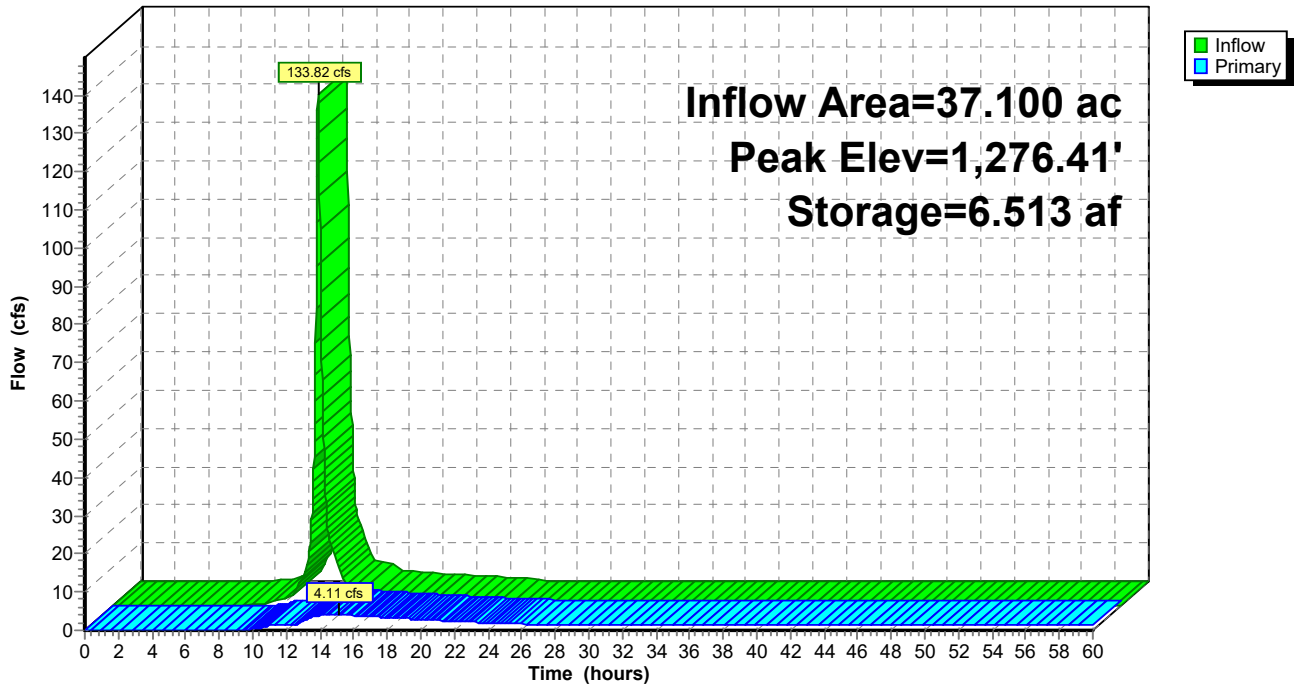
Device	Routing	Invert	Outlet Devices
#1	Primary	1,271.00'	48.0" Round Culvert L= 150.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,271.00' / 1,270.00' S= 0.0067 '/' Cc= 0.900 n= 0.012, Flow Area= 12.57 sf
#2	Device 1	1,275.60'	15.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,284.50'	6.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 1	1,271.00'	0.800 in/hr Exfiltration over Surface area

Primary OutFlow Max=4.11 cfs @ 15.16 hrs HW=1,276.41' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 4.11 cfs of 107.18 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 2.57 cfs @ 3.06 fps)
- 3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 4=Exfiltration (Exfiltration Controls 1.54 cfs)

Pond 7P: Basin 7

Hydrograph



Summary for Pond 8P: Basin 8

Inflow Area = 7.900 ac, 41.77% Impervious, Inflow Depth = 2.46" for 10-yr event
 Inflow = 25.17 cfs @ 12.23 hrs, Volume= 1.618 af
 Outflow = 0.04 cfs @ 24.22 hrs, Volume= 0.140 af, Atten= 100%, Lag= 719.4 min
 Primary = 0.04 cfs @ 24.22 hrs, Volume= 0.140 af
 Routed to Reach 1R : Peak Flow Trunk 1

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,280.85' @ 24.22 hrs Surf.Area= 0.810 ac Storage= 1.587 af

Plug-Flow detention time= 1,526.5 min calculated for 0.140 af (9% of inflow)
 Center-of-Mass det. time= 1,395.4 min (2,199.5 - 804.1)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,277.00'	12.797 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,277.00	0.760	0.0	0.000	0.000
1,277.01	0.760	40.0	0.003	0.003
1,279.99	0.760	40.0	0.906	0.909
1,280.00	0.760	100.0	0.008	0.917
1,291.00	1.400	100.0	11.880	12.797

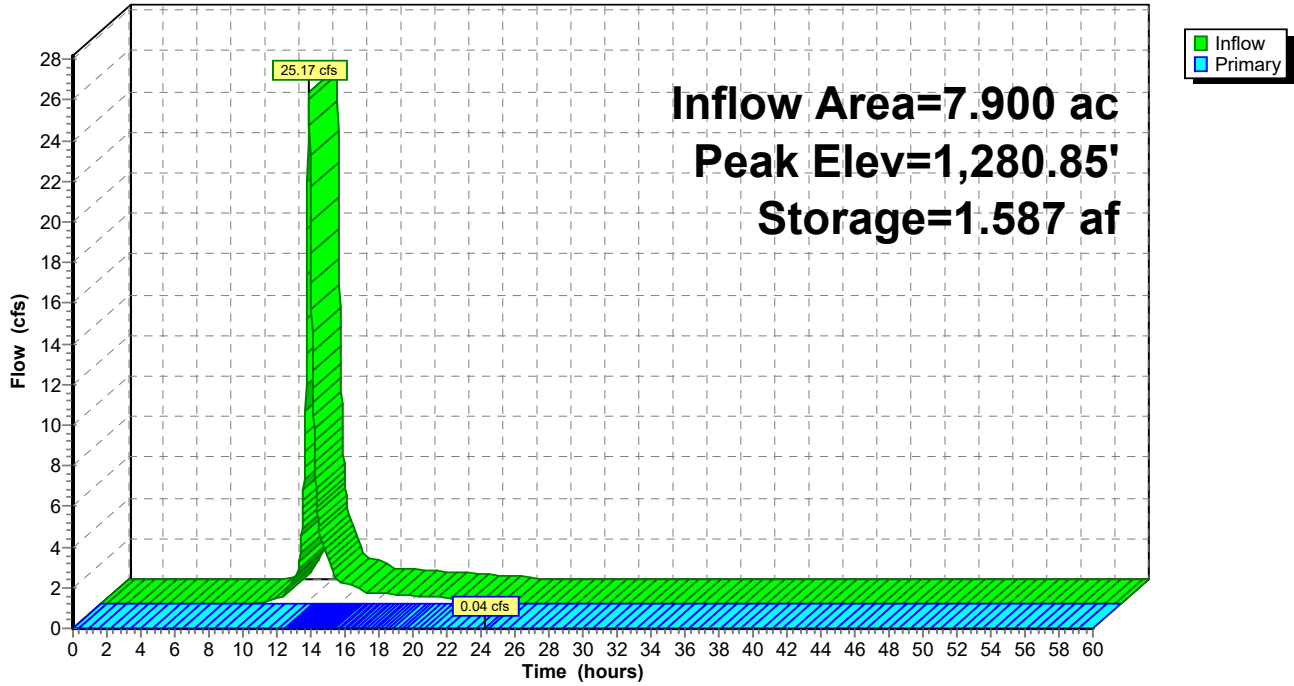
Device	Routing	Invert	Outlet Devices
#1	Primary	1,277.00'	36.0" Round Culvert L= 200.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,277.00' / 1,276.00' S= 0.0050 '/ Cc= 0.900 n= 0.012, Flow Area= 7.07 sf
#2	Device 1	1,281.60'	15.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,289.00'	6.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 1	1,280.00'	0.800 in/hr Exfiltration over Surface area above 1,280.00' Excluded Surface area = 0.760 ac

Primary OutFlow Max=0.04 cfs @ 24.22 hrs HW=1,280.85' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 0.04 cfs of 49.14 cfs potential flow)
- 2=Orifice/Grate (Controls 0.00 cfs)
- 3=Sharp-Crested Rectangular Weir(Controls 0.00 cfs)
- 4=Exfiltration (Exfiltration Controls 0.04 cfs)

Pond 8P: Basin 8

Hydrograph



Summary for Pond W1: Wetland 1

Inflow Area = 7.100 ac, 0.00% Impervious, Inflow Depth = 1.96" for 10-yr event
 Inflow = 24.76 cfs @ 12.14 hrs, Volume= 1.162 af
 Outflow = 9.54 cfs @ 12.30 hrs, Volume= 1.162 af, Atten= 61%, Lag= 9.6 min
 Primary = 9.54 cfs @ 12.30 hrs, Volume= 1.162 af
 Routed to Link 20L : Discharge Point #1

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,273.26' @ 12.30 hrs Surf.Area= 1.361 ac Storage= 0.264 af

Plug-Flow detention time= 12.2 min calculated for 1.162 af (100% of inflow)
 Center-of-Mass det. time= 11.9 min (821.4 - 809.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,272.00'	2.603 af	Custom Stage Data (Prismatic) Listed below (Recalc)

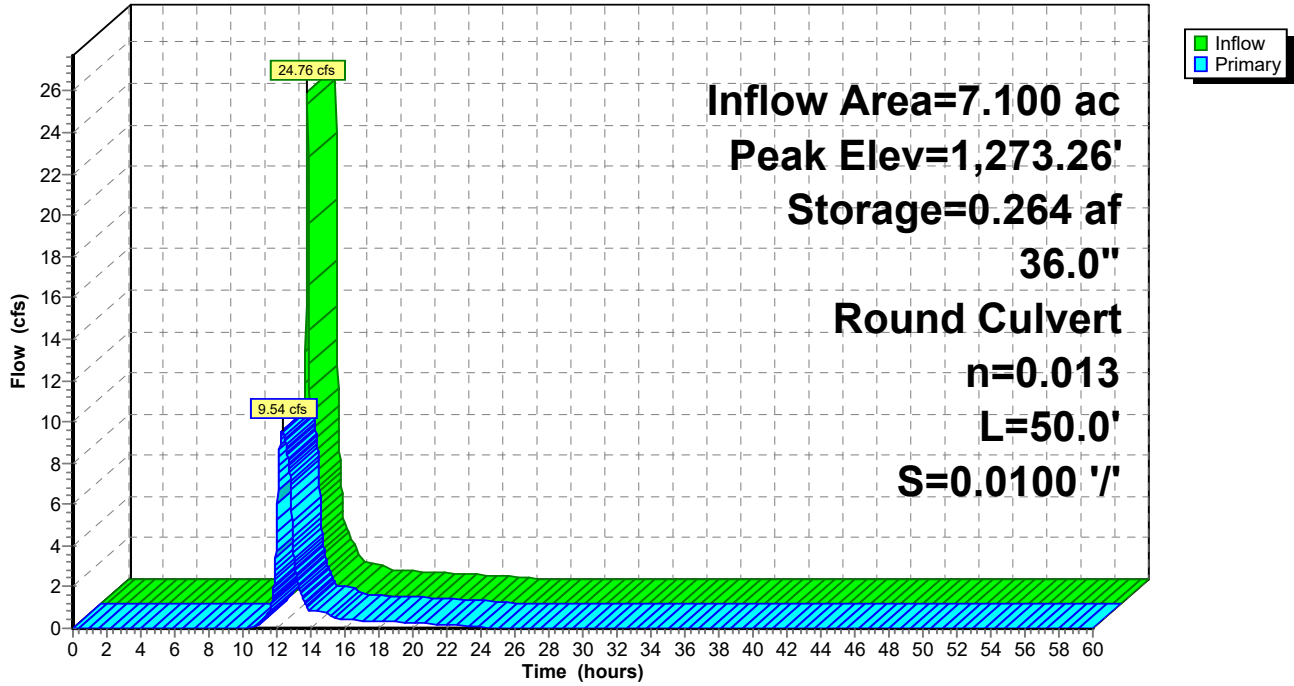
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,272.00	0.005	0.000	0.000
1,273.00	0.140	0.072	0.072
1,274.00	4.921	2.531	2.603

Device	Routing	Invert	Outlet Devices
#1	Primary	1,272.00'	36.0" Round Culvert L= 50.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,272.00' / 1,271.50' S= 0.0100 '/ Cc= 0.900 n= 0.013, Flow Area= 7.07 sf

Primary OutFlow Max=9.54 cfs @ 12.30 hrs HW=1,273.26' TW=0.00' (Dynamic Tailwater)
 ↑**1=Culvert** (Barrel Controls 9.54 cfs @ 5.03 fps)

Pond W1: Wetland 1

Hydrograph



Summary for Pond W4: Wetland 4

Inflow Area = 7.200 ac, 0.00% Impervious, Inflow Depth = 1.25" for 10-yr event
 Inflow = 16.04 cfs @ 12.14 hrs, Volume= 0.753 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

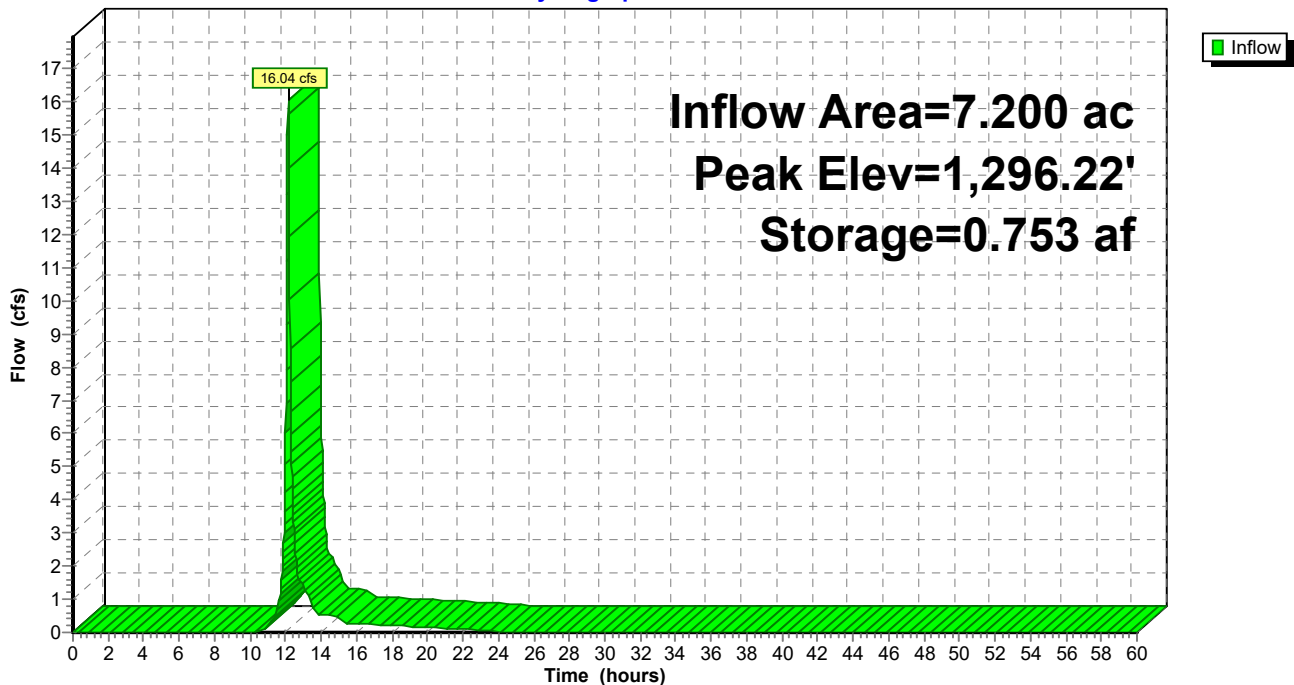
Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,296.22' @ 24.42 hrs Surf.Area= 3.534 ac Storage= 0.753 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	1,296.00'	3.729 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,296.00	3.384	0.000	0.000
1,297.00	4.073	3.729	3.729

Pond W4: Wetland 4

Hydrograph



Summary for Pond W5: Wetland 5

Inflow Area = 2.600 ac, 0.00% Impervious, Inflow Depth = 1.96" for 10-yr event
 Inflow = 9.07 cfs @ 12.14 hrs, Volume= 0.425 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Pond W4 : Wetland 4

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,299.26' @ 24.42 hrs Surf.Area= 1.671 ac Storage= 0.425 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	1,299.00'	3.760 af	Custom Stage Data (Prismatic) Listed below (Recalc)

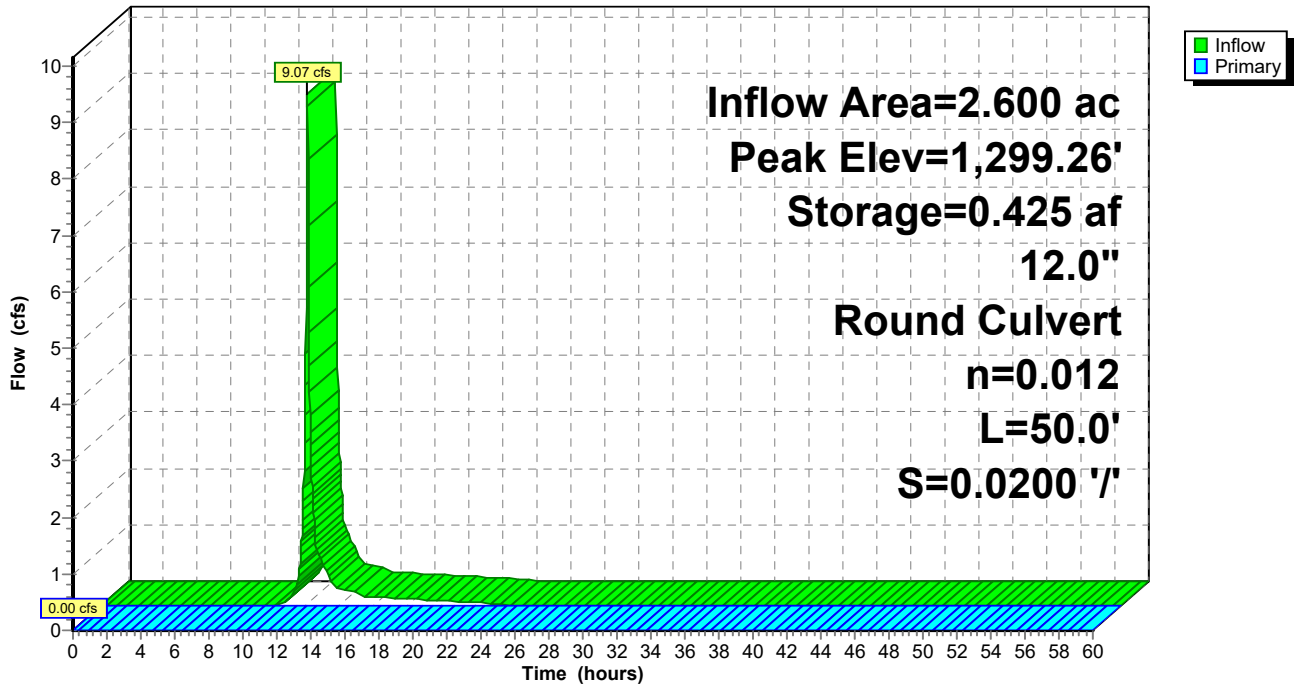
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,299.00	1.597	0.000	0.000
1,301.00	2.163	3.760	3.760

Device	Routing	Invert	Outlet Devices
#1	Primary	1,300.00'	12.0" Round Culvert L= 50.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,300.00' / 1,299.00' S= 0.0200 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,299.00' TW=1,296.00' (Dynamic Tailwater)
 ↑1=Culvert (Controls 0.00 cfs)

Pond W5: Wetland 5

Hydrograph



Summary for Pond W6: Wetland 6

Inflow Area = 9.000 ac, 0.00% Impervious, Inflow Depth = 0.39" for 10-yr event
 Inflow = 6.28 cfs @ 12.14 hrs, Volume= 0.295 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

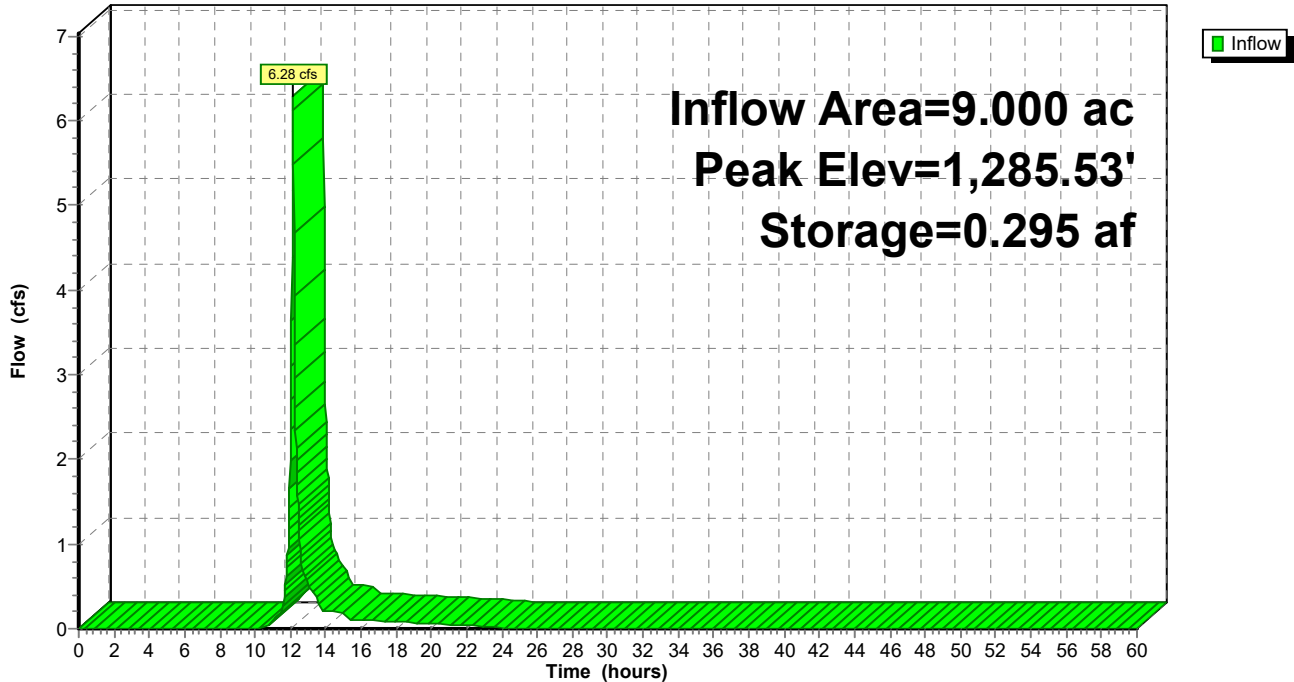
Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,285.53' @ 24.42 hrs Surf.Area= 0.604 ac Storage= 0.295 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	1,285.00'	1.338 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,285.00	0.497	0.000	0.000
1,286.00	0.698	0.598	0.598
1,287.00	0.784	0.741	1.338

Pond W6: Wetland 6

Hydrograph



Summary for Pond W7: Wetland 7

Inflow Area = 226.900 ac, 49.05% Impervious, Inflow Depth > 1.56" for 10-yr event
 Inflow = 51.41 cfs @ 13.06 hrs, Volume= 29.576 af
 Outflow = 45.95 cfs @ 13.42 hrs, Volume= 29.569 af, Atten= 11%, Lag= 21.6 min
 Primary = 45.95 cfs @ 13.42 hrs, Volume= 29.569 af
 Routed to Link 11L : Discharge Point #2

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,259.32' @ 13.42 hrs Surf.Area= 0.615 ac Storage= 0.680 af

Plug-Flow detention time= 4.4 min calculated for 29.569 af (100% of inflow)
 Center-of-Mass det. time= 4.0 min (1,493.8 - 1,489.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,256.00'	18.795 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,256.00	0.005	0.000	0.000
1,257.00	0.050	0.027	0.027
1,258.00	0.200	0.125	0.152
1,259.00	0.497	0.348	0.500
1,260.00	0.864	0.680	1.180
1,261.00	1.362	1.113	2.293
1,262.00	2.424	1.893	4.186
1,263.00	3.770	3.097	7.283
1,264.00	5.818	4.794	12.077
1,265.00	7.617	6.717	18.795

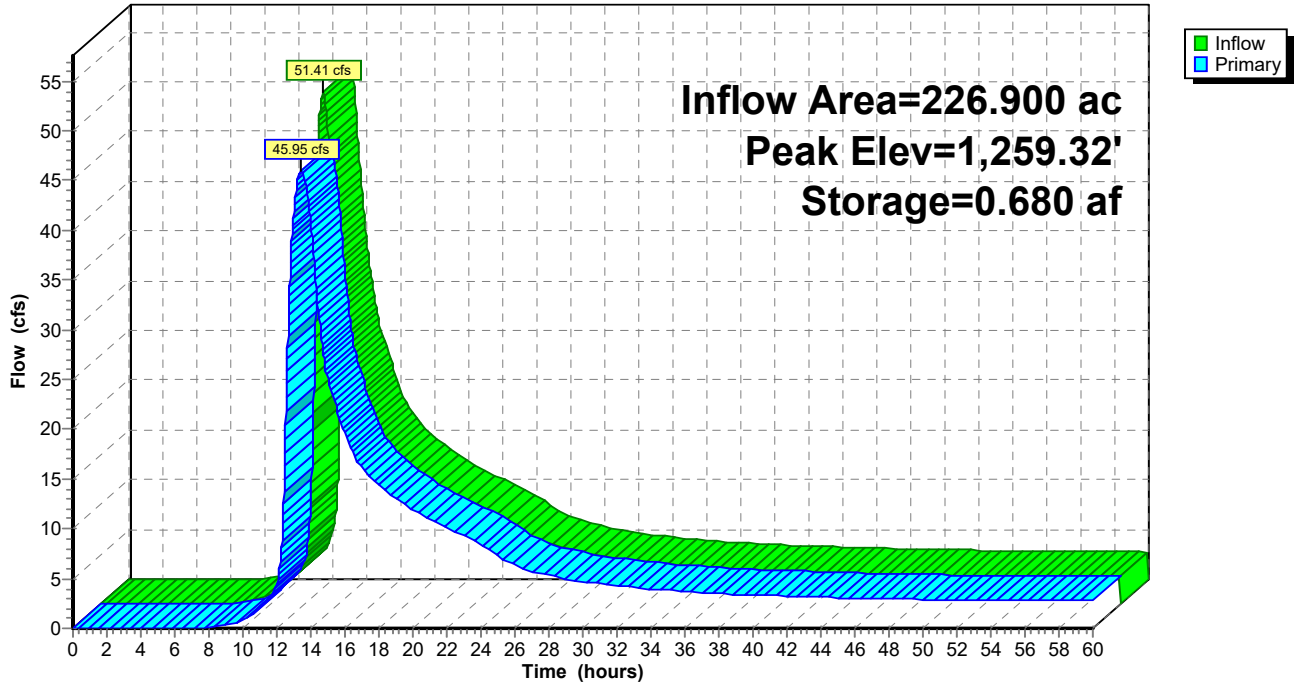
Device	Routing	Invert	Outlet Devices
#1	Primary	1,256.00'	36.0" Round Culvert L= 50.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,256.00' / 1,254.00' S= 0.0400 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf
#2	Primary	1,263.00'	300.0' long + 10.0 ' SideZ x 40.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=45.95 cfs @ 13.42 hrs HW=1,259.32' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Inlet Controls 45.95 cfs @ 6.50 fps)
- 2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond W7: Wetland 7

Hydrograph



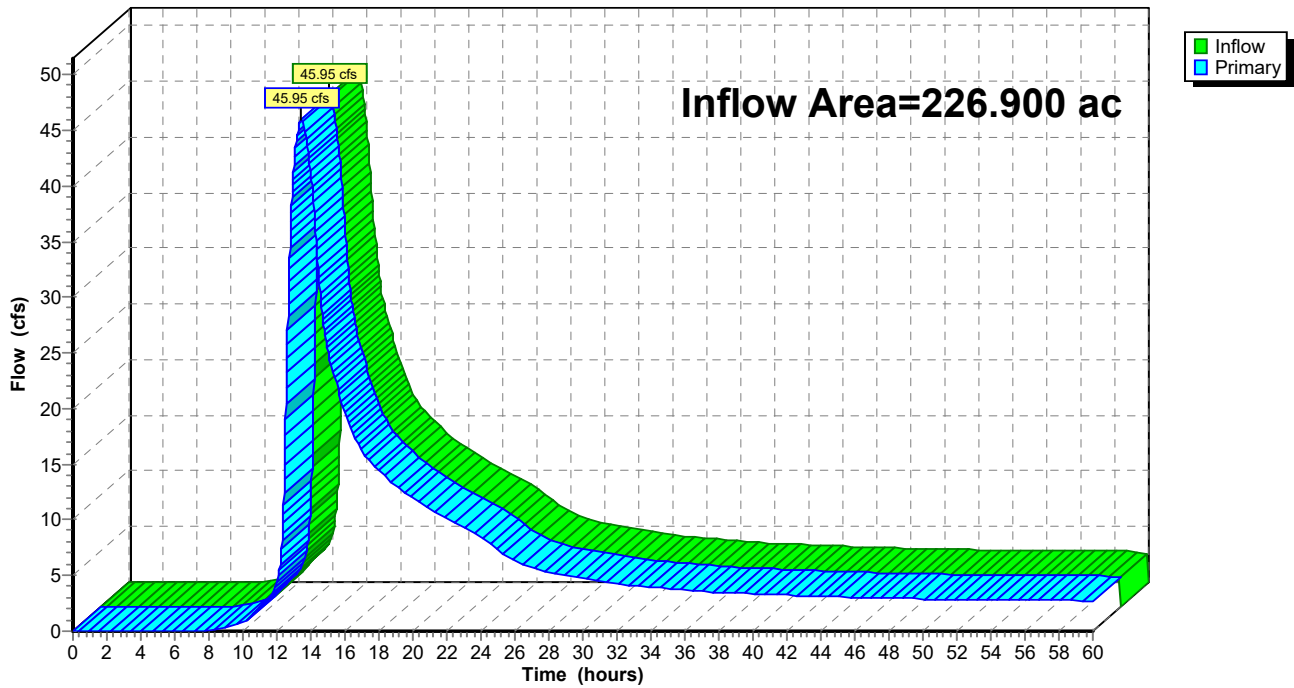
Summary for Link 11L: Discharge Point #2

Inflow Area = 226.900 ac, 49.05% Impervious, Inflow Depth > 1.56" for 10-yr event
Inflow = 45.95 cfs @ 13.42 hrs, Volume= 29.565 af
Primary = 45.95 cfs @ 13.44 hrs, Volume= 29.565 af, Atten= 0%, Lag= 1.2 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

Link 11L: Discharge Point #2

Hydrograph



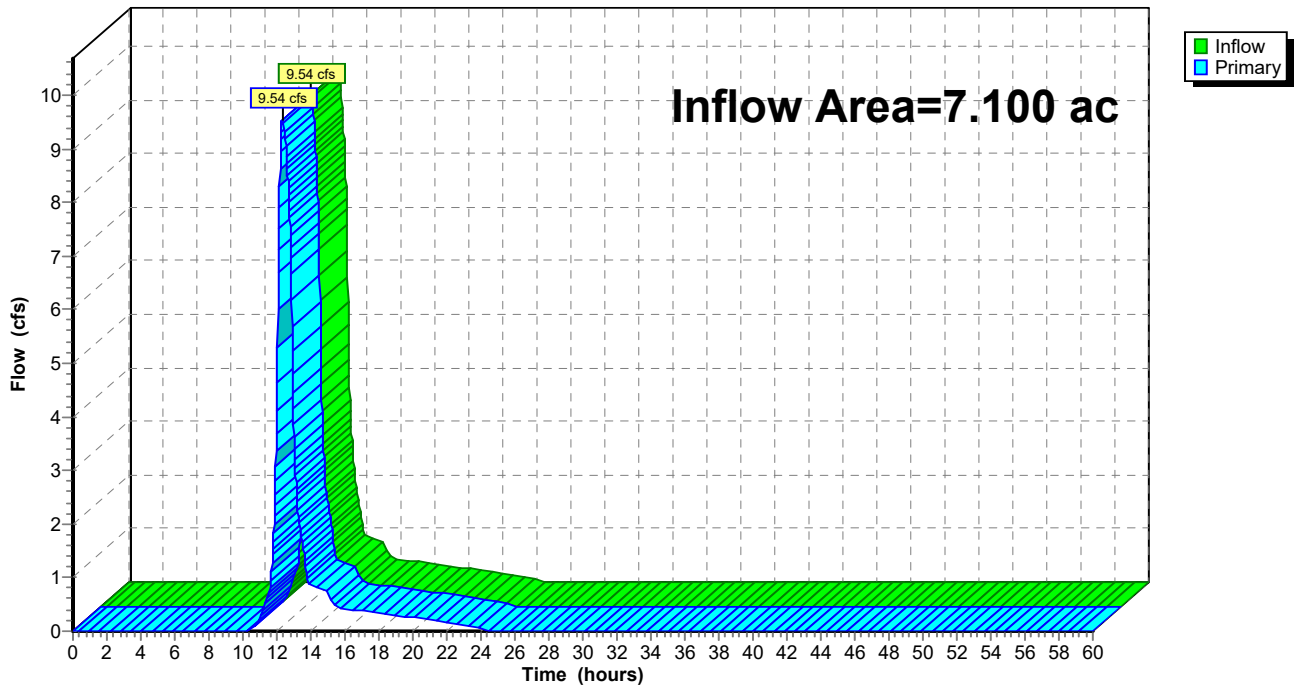
Summary for Link 20L: Discharge Point #1

Inflow Area = 7.100 ac, 0.00% Impervious, Inflow Depth = 1.96" for 10-yr event
Inflow = 9.54 cfs @ 12.30 hrs, Volume= 1.162 af
Primary = 9.54 cfs @ 12.32 hrs, Volume= 1.162 af, Atten= 0%, Lag= 1.2 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

Link 20L: Discharge Point #1

Hydrograph



2025-0806 - Hermantown Industrial - Proposed

Type II 6-hr 25-yr-6hr Rainfall=3.63"

Prepared by Kimley-Horn & Associates

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Time span=0.00-60.00 hrs, dt=0.02 hrs, 3001 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Sim-Route method - Pond routing by Sim-Route method

Subcatchment1S: Onsite Area	Runoff Area=20.700 ac 42.51% Impervious Runoff Depth=2.13" Tc=15.0 min CN=85 Runoff=80.12 cfs 3.674 af
Subcatchment2S: Onsite Area	Runoff Area=8.300 ac 63.86% Impervious Runoff Depth=2.57" Tc=15.0 min CN=90 Runoff=38.02 cfs 1.777 af
Subcatchment3/4S: Onsite Area	Runoff Area=39.000 ac 57.18% Impervious Runoff Depth=2.48" Tc=15.0 min CN=89 Runoff=173.18 cfs 8.052 af
Subcatchment5S: Onsite Area	Runoff Area=56.500 ac 68.14% Impervious Runoff Depth=2.66" Tc=15.0 min CN=91 Runoff=266.64 cfs 12.545 af
Subcatchment6S: Onsite Area	Runoff Area=16.300 ac 71.17% Impervious Runoff Depth=2.76" Tc=15.0 min CN=92 Runoff=79.12 cfs 3.751 af
Subcatchment7S: Onsite Area	Runoff Area=37.100 ac 57.95% Impervious Runoff Depth=2.48" Tc=15.0 min CN=89 Runoff=164.74 cfs 7.660 af
Subcatchment8S: Onsite Area	Runoff Area=7.900 ac 41.77% Impervious Runoff Depth=2.13" Tc=15.0 min CN=85 Runoff=30.58 cfs 1.402 af
SubcatchmentDW1:	Runoff Area=7.100 ac 0.00% Impervious Runoff Depth=1.67" Tc=7.0 min CN=79 Runoff=29.33 cfs 0.987 af
SubcatchmentDW4:	Runoff Area=4.600 ac 0.00% Impervious Runoff Depth=1.67" Tc=7.0 min CN=79 Runoff=19.00 cfs 0.639 af
SubcatchmentDW5:	Runoff Area=2.600 ac 0.00% Impervious Runoff Depth=1.67" Tc=7.0 min CN=79 Runoff=10.74 cfs 0.361 af
SubcatchmentDW6:	Runoff Area=1.800 ac 0.00% Impervious Runoff Depth=1.67" Tc=7.0 min CN=79 Runoff=7.44 cfs 0.250 af
SubcatchmentDW7:	Runoff Area=32.100 ac 0.00% Impervious Runoff Depth=1.67" Flow Length=2,600' Tc=73.0 min CN=79 Runoff=32.48 cfs 4.461 af
Reach 1R: Peak Flow Trunk 1	Inflow=6.60 cfs 3.993 af Outflow=6.60 cfs 3.993 af
Reach 2R: Peak Flow Trunk 2	Inflow=0.17 cfs 0.526 af Outflow=0.17 cfs 0.526 af
Reach 3R: Peak Flow Trunk 3	Inflow=15.06 cfs 17.014 af Outflow=15.06 cfs 17.014 af
Pond 1P: Basin 1	Peak Elev=1,296.26' Storage=2.514 af Inflow=80.12 cfs 3.674 af Outflow=6.56 cfs 3.663 af

2025-0806 - Hermantown Industrial - Proposed

Type II 6-hr 25-yr-6hr Rainfall=3.63"

Prepared by Kimley-Horn & Associates

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Pond 2P: Basin 2	Peak Elev=1,289.10'	Storage=1.766 af	Inflow=38.02 cfs	1.777 af	Outflow=0.05 cfs	0.213 af
Pond 3P: Basin 3	Peak Elev=1,289.82'	Storage=6.878 af	Inflow=173.18 cfs	8.052 af	Outflow=5.96 cfs	3.378 af
Pond 4P: Basin 4	Peak Elev=1,288.70'	Storage=2.966 af	Inflow=5.96 cfs	3.378 af	Outflow=0.17 cfs	0.527 af
Pond 5P: Basin 5	Peak Elev=1,289.30'	Storage=11.200 af	Inflow=266.64 cfs	12.545 af	Outflow=6.38 cfs	5.709 af
Pond 6P: Basin 6	Peak Elev=1,283.81'	Storage=2.773 af	Inflow=79.12 cfs	3.751 af	Outflow=5.18 cfs	3.738 af
Pond 7P: Basin 7	Peak Elev=1,276.50'	Storage=6.688 af	Inflow=164.74 cfs	7.660 af	Outflow=4.60 cfs	7.567 af
Pond 8P: Basin 8	Peak Elev=1,280.62'	Storage=1.397 af	Inflow=30.58 cfs	1.402 af	Outflow=0.03 cfs	0.118 af
Pond W1: Wetland 1	Peak Elev=1,273.30'	Storage=0.323 af	Inflow=29.33 cfs	0.987 af	Outflow=10.08 cfs	0.987 af
	36.0" Round Culvert	n=0.013	L=50.0'	S=0.0100 '/		
Pond W4: Wetland 4	Peak Elev=1,296.19'	Storage=0.639 af	Inflow=19.00 cfs	0.639 af	Outflow=0.00 cfs	0.000 af
Pond W5: Wetland 5	Peak Elev=1,299.22'	Storage=0.361 af	Inflow=10.74 cfs	0.361 af	Outflow=0.00 cfs	0.000 af
	12.0" Round Culvert	n=0.012	L=50.0'	S=0.0200 '/		
Pond W6: Wetland 6	Peak Elev=1,285.46'	Storage=0.250 af	Inflow=7.44 cfs	0.250 af	Outflow=0.00 cfs	0.000 af
Pond W7: Wetland 7	Peak Elev=1,259.30'	Storage=0.668 af	Inflow=51.22 cfs	25.993 af	Outflow=45.72 cfs	25.992 af
Link 11L: Discharge Point #2			Inflow=45.72 cfs	25.991 af	Primary=45.72 cfs	25.991 af
Link 20L: Discharge Point #1			Inflow=10.08 cfs	0.987 af	Primary=10.08 cfs	0.987 af

Total Runoff Area = 234.000 ac Runoff Volume = 45.560 af Average Runoff Depth = 2.34"
52.44% Pervious = 122.700 ac 47.56% Impervious = 111.300 ac

Summary for Subcatchment 1S: Onsite Area

Runoff = 80.12 cfs @ 3.07 hrs, Volume= 3.674 af, Depth= 2.13"
 Routed to Pond 1P : Basin 1

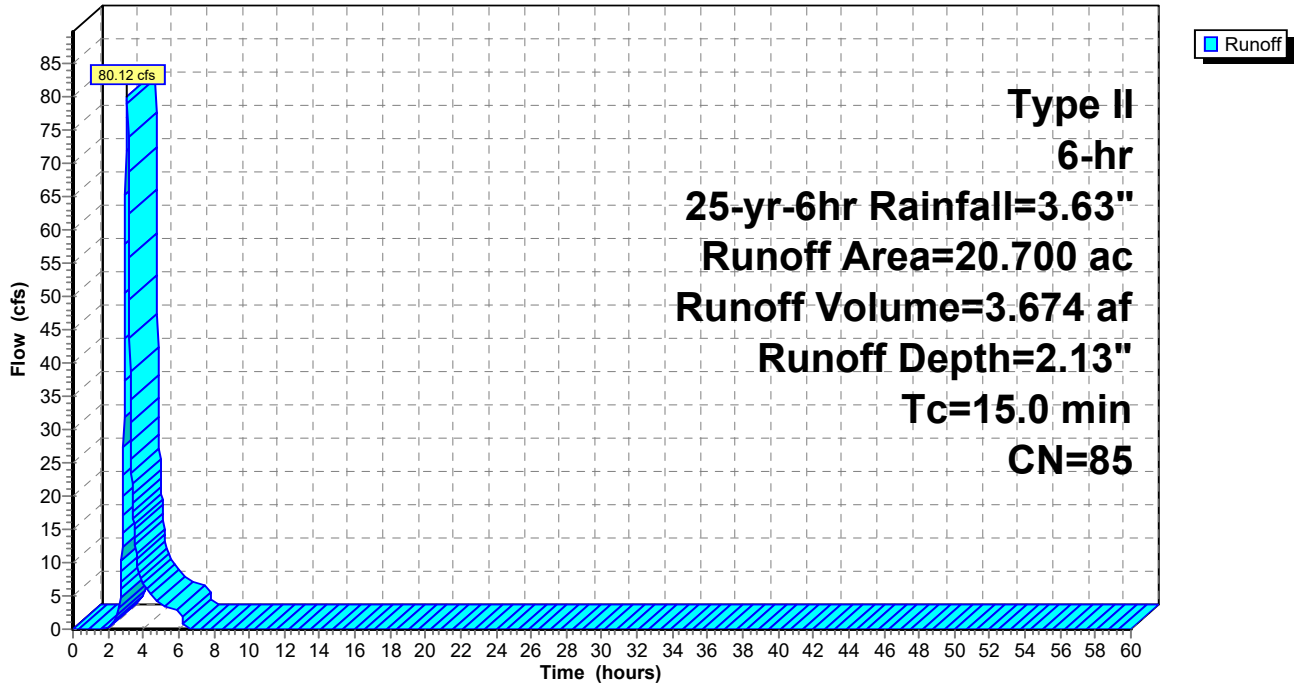
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Type II 6-hr 25-yr-6hr Rainfall=3.63"

Area (ac)	CN	Description
8.800	98	Paved parking, HSG D
11.900	76	Woods/grass comb., Fair, HSG C
20.700	85	Weighted Average
11.900		57.49% Pervious Area
8.800		42.51% Impervious Area

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

Subcatchment 1S: Onsite Area

Hydrograph



Summary for Subcatchment 2S: Onsite Area

Runoff = 38.02 cfs @ 3.07 hrs, Volume= 1.777 af, Depth= 2.57"
 Routed to Pond 2P : Basin 2

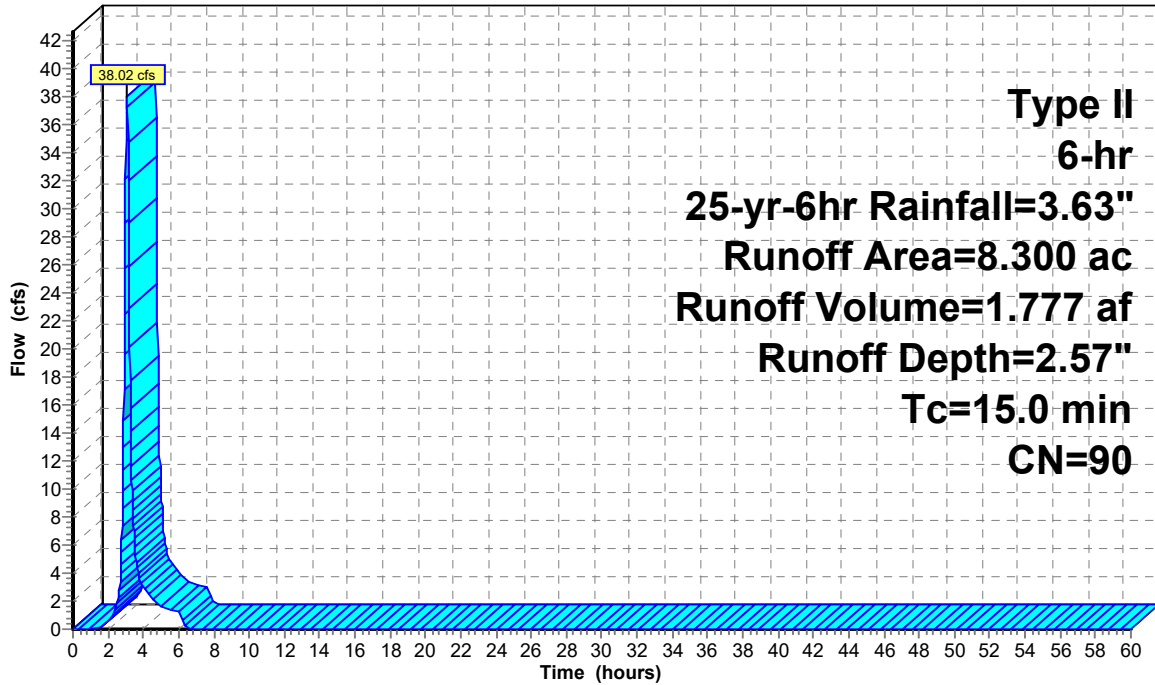
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Type II 6-hr 25-yr-6hr Rainfall=3.63"

Area (ac)	CN	Description
5.300	98	Paved parking, HSG D
3.000	76	Woods/grass comb., Fair, HSG C
8.300	90	Weighted Average
3.000		36.14% Pervious Area
5.300		63.86% Impervious Area

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

Subcatchment 2S: Onsite Area

Hydrograph



Runoff

**Type II
 6-hr
 25-yr-6hr Rainfall=3.63"
 Runoff Area=8.300 ac
 Runoff Volume=1.777 af
 Runoff Depth=2.57"
 Tc=15.0 min
 CN=90**

Summary for Subcatchment 3/4S: Onsite Area

Runoff = 173.18 cfs @ 3.07 hrs, Volume= 8.052 af, Depth= 2.48"
 Routed to Pond 3P : Basin 3

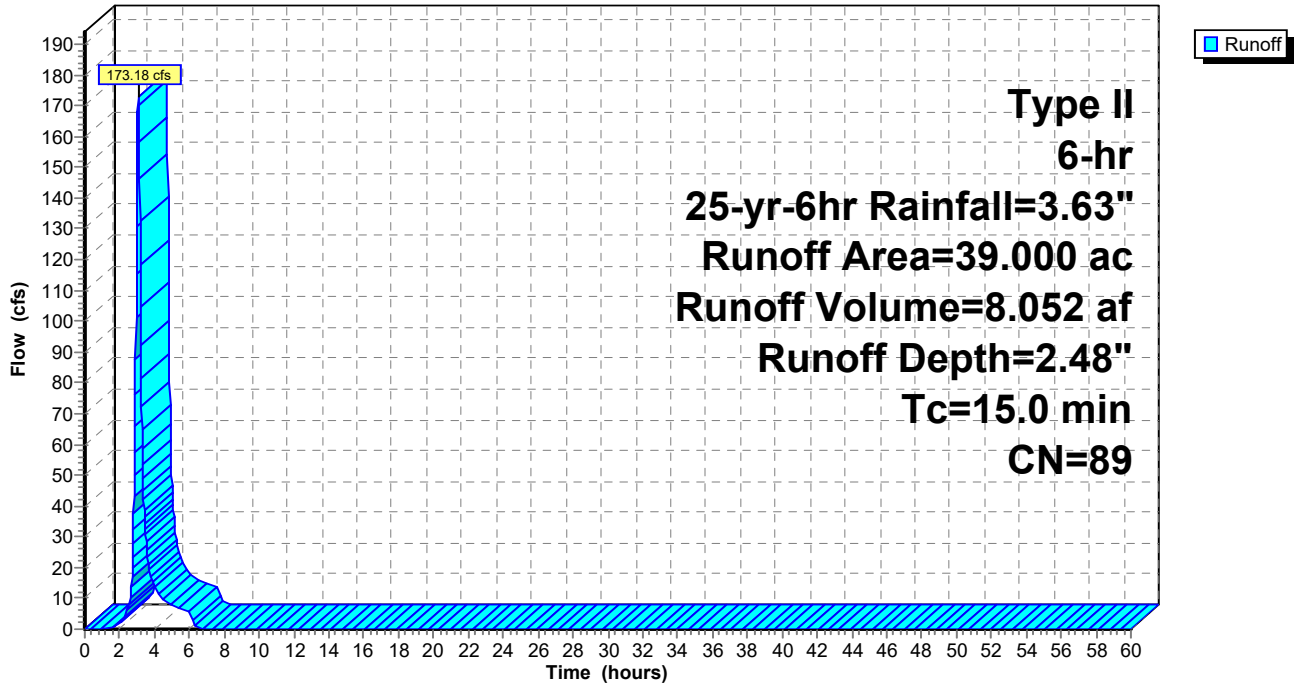
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Type II 6-hr 25-yr-6hr Rainfall=3.63"

Area (ac)	CN	Description
22.300	98	Paved parking, HSG D
16.700	76	Woods/grass comb., Fair, HSG C
39.000	89	Weighted Average
16.700		42.82% Pervious Area
22.300		57.18% Impervious Area

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

Subcatchment 3/4S: Onsite Area

Hydrograph



Summary for Subcatchment 5S: Onsite Area

Runoff = 266.64 cfs @ 3.07 hrs, Volume= 12.545 af, Depth= 2.66"
 Routed to Pond 5P : Basin 5

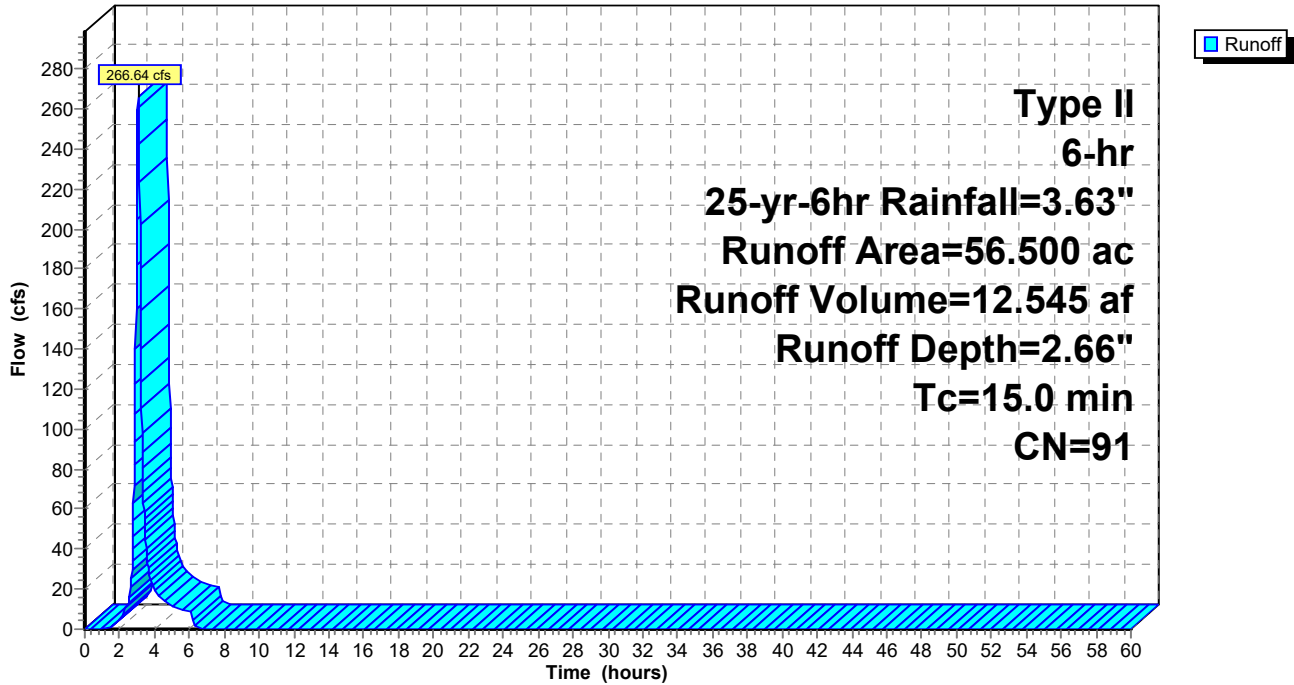
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Type II 6-hr 25-yr-6hr Rainfall=3.63"

Area (ac)	CN	Description
38.500	98	Paved parking, HSG D
18.000	76	Woods/grass comb., Fair, HSG C
56.500	91	Weighted Average
18.000		31.86% Pervious Area
38.500		68.14% Impervious Area

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

Subcatchment 5S: Onsite Area

Hydrograph



Summary for Subcatchment 6S: Onsite Area

Runoff = 79.12 cfs @ 3.07 hrs, Volume= 3.751 af, Depth= 2.76"
 Routed to Pond 6P : Basin 6

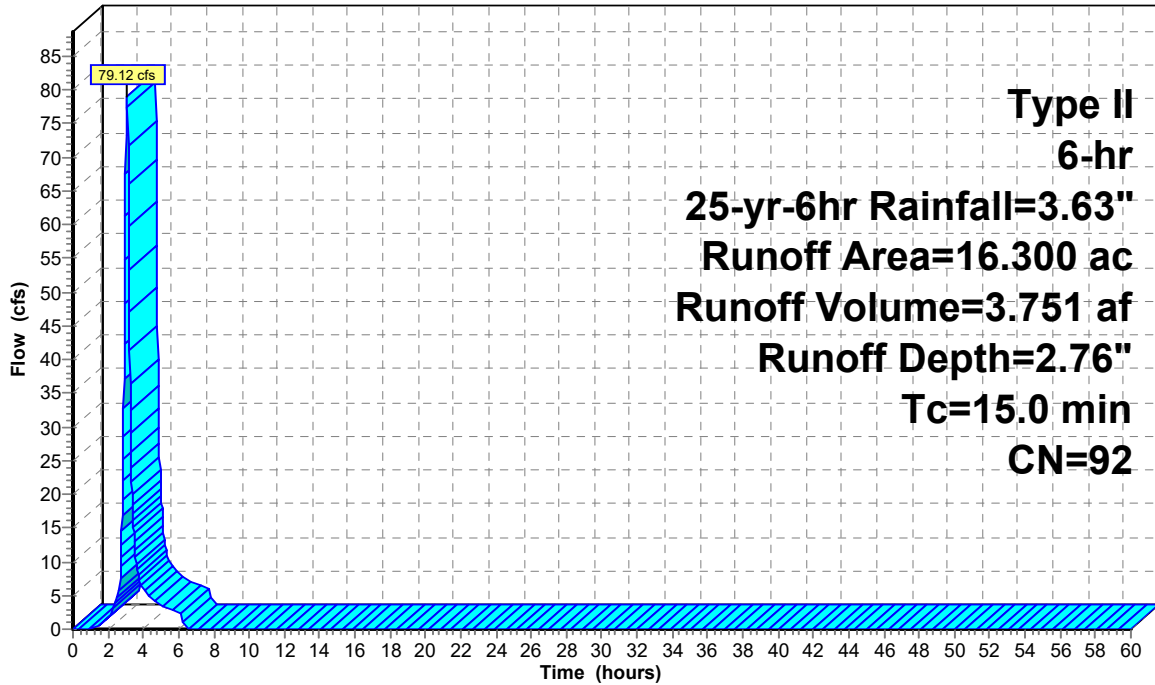
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Type II 6-hr 25-yr-6hr Rainfall=3.63"

Area (ac)	CN	Description
11.600	98	Paved parking, HSG D
4.700	76	Woods/grass comb., Fair, HSG C
16.300	92	Weighted Average
4.700		28.83% Pervious Area
11.600		71.17% Impervious Area

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

Subcatchment 6S: Onsite Area

Hydrograph



Runoff

**Type II
 6-hr
 25-yr-6hr Rainfall=3.63"
 Runoff Area=16.300 ac
 Runoff Volume=3.751 af
 Runoff Depth=2.76"
 Tc=15.0 min
 CN=92**

Summary for Subcatchment 7S: Onsite Area

Runoff = 164.74 cfs @ 3.07 hrs, Volume= 7.660 af, Depth= 2.48"
 Routed to Pond 7P : Basin 7

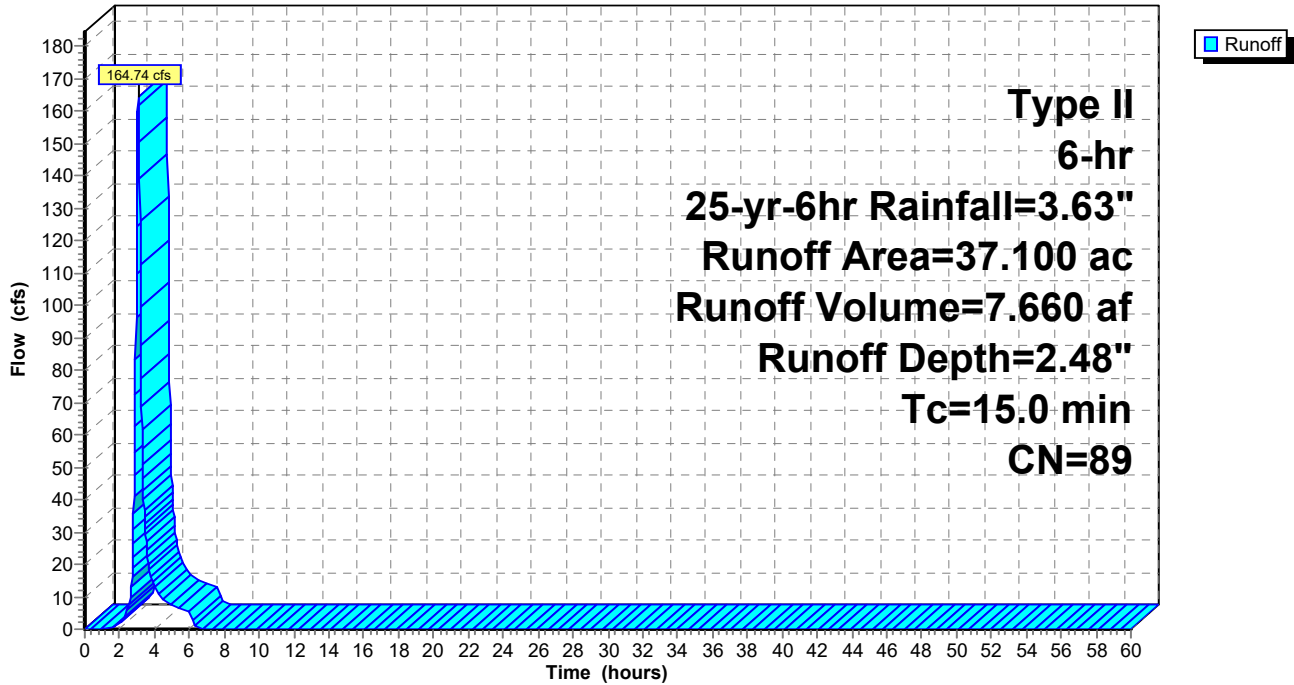
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Type II 6-hr 25-yr-6hr Rainfall=3.63"

Area (ac)	CN	Description
21.500	98	Paved parking, HSG D
15.600	76	Woods/grass comb., Fair, HSG C
37.100	89	Weighted Average
15.600		42.05% Pervious Area
21.500		57.95% Impervious Area

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

Subcatchment 7S: Onsite Area

Hydrograph



Summary for Subcatchment 8S: Onsite Area

Runoff = 30.58 cfs @ 3.07 hrs, Volume= 1.402 af, Depth= 2.13"
 Routed to Pond 8P : Basin 8

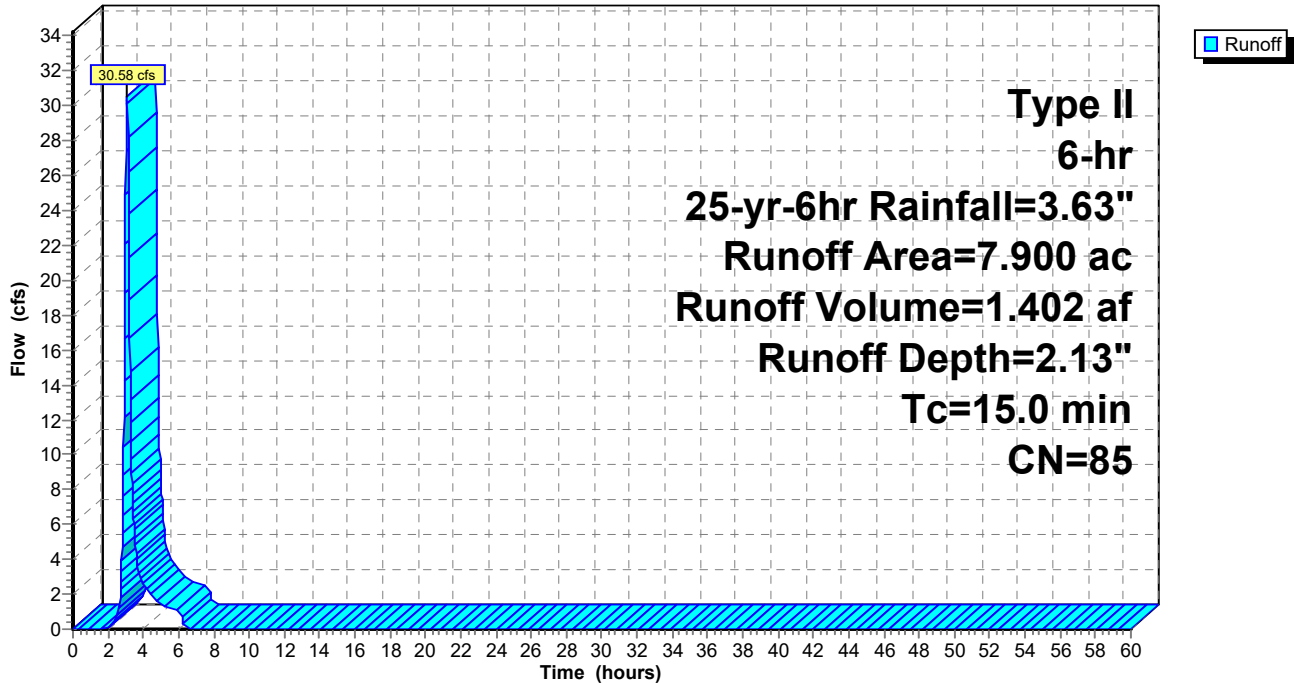
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Type II 6-hr 25-yr-6hr Rainfall=3.63"

Area (ac)	CN	Description
3.300	98	Paved parking, HSG D
4.600	76	Woods/grass comb., Fair, HSG C
7.900	85	Weighted Average
4.600		58.23% Pervious Area
3.300		41.77% Impervious Area

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

Subcatchment 8S: Onsite Area

Hydrograph



Summary for Subcatchment DW1:

Runoff = 29.33 cfs @ 2.99 hrs, Volume= 0.987 af, Depth= 1.67"
 Routed to Pond W1 : Wetland 1

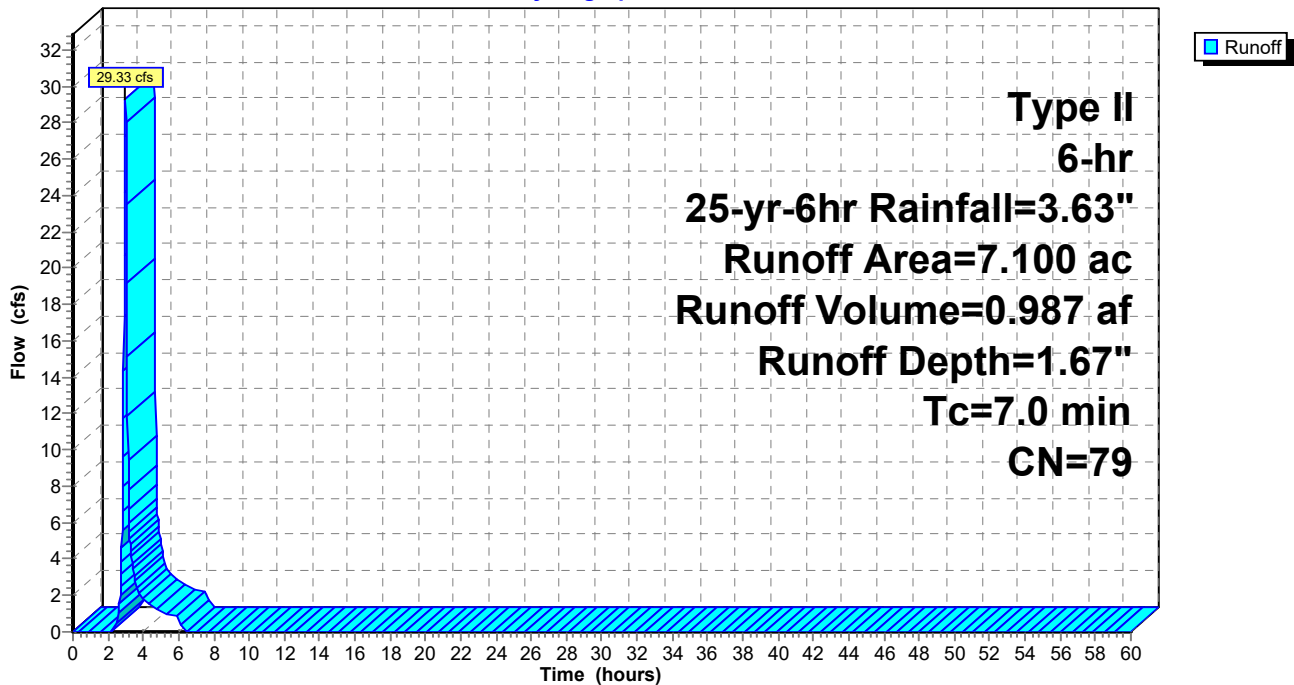
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Type II 6-hr 25-yr-6hr Rainfall=3.63"

Area (ac)	CN	Description
7.100	79	Woods/grass comb., Good, HSG D
7.100		100.00% Pervious Area

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

Subcatchment DW1:

Hydrograph



Summary for Subcatchment DW4:

Runoff = 19.00 cfs @ 2.99 hrs, Volume= 0.639 af, Depth= 1.67"
 Routed to Pond W4 : Wetland 4

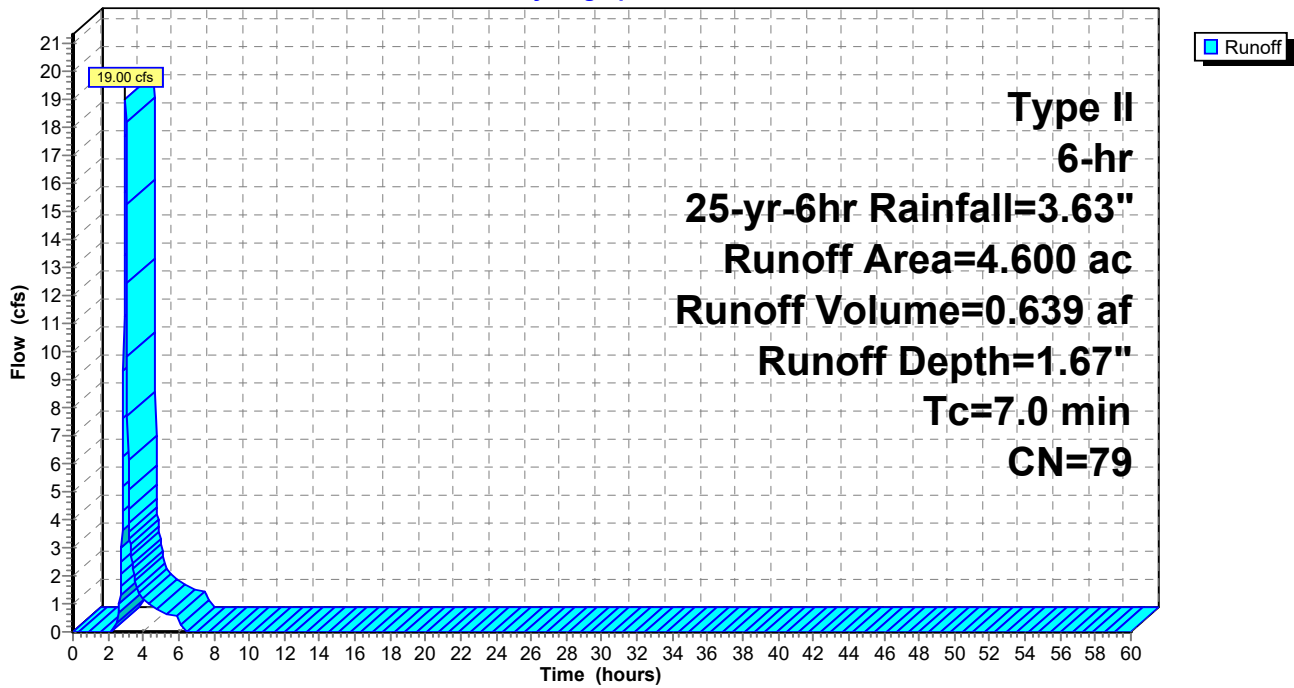
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Type II 6-hr 25-yr-6hr Rainfall=3.63"

Area (ac)	CN	Description
4.600	79	Woods/grass comb., Good, HSG D
4.600		100.00% Pervious Area

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

Subcatchment DW4:

Hydrograph



Summary for Subcatchment DW5:

Runoff = 10.74 cfs @ 2.99 hrs, Volume= 0.361 af, Depth= 1.67"
 Routed to Pond W5 : Wetland 5

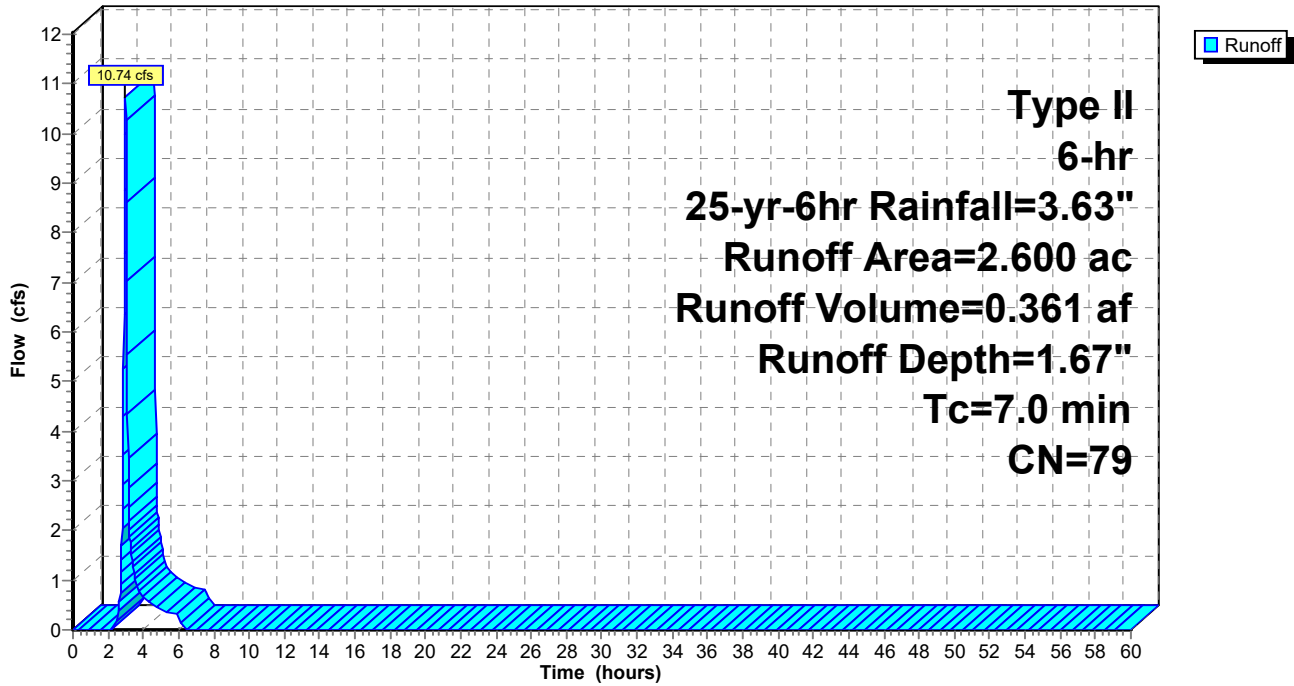
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Type II 6-hr 25-yr-6hr Rainfall=3.63"

Area (ac)	CN	Description
2.600	79	Woods/grass comb., Good, HSG D
2.600		100.00% Pervious Area

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

Subcatchment DW5:

Hydrograph



Summary for Subcatchment DW6:

Runoff = 7.44 cfs @ 2.99 hrs, Volume= 0.250 af, Depth= 1.67"
 Routed to Pond W6 : Wetland 6

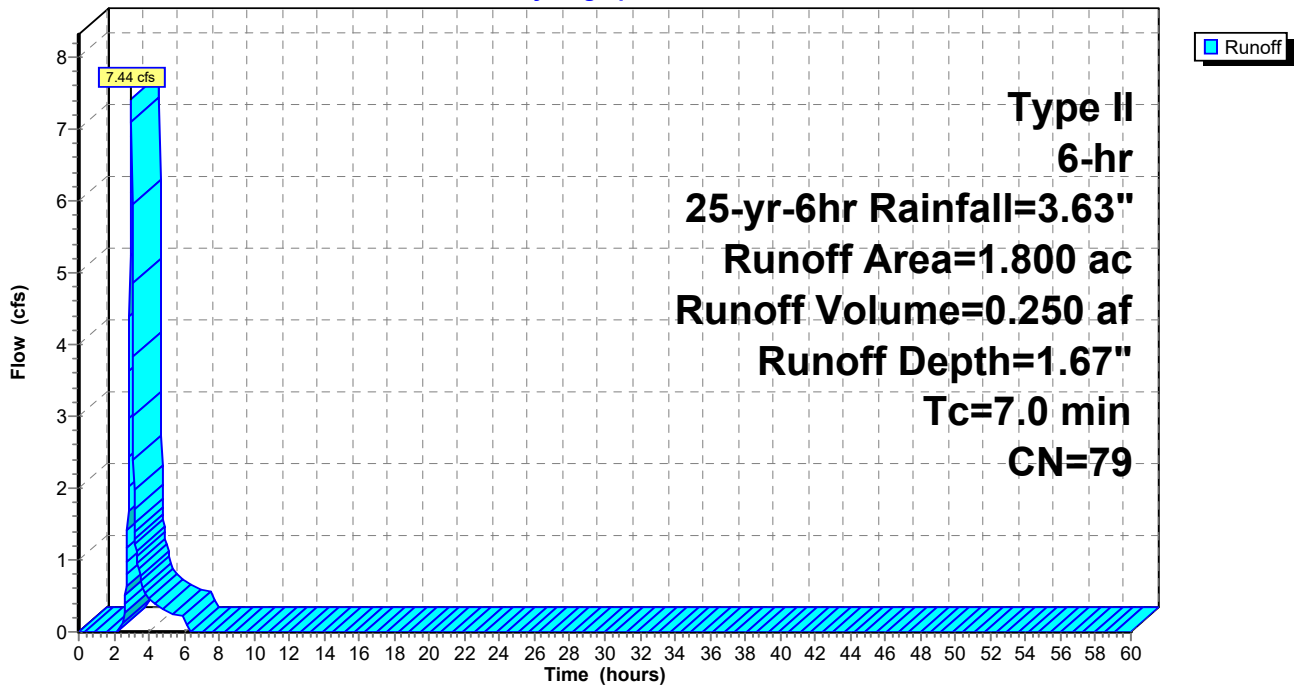
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Type II 6-hr 25-yr-6hr Rainfall=3.63"

Area (ac)	CN	Description
1.800	79	Woods/grass comb., Good, HSG D
1.800		100.00% Pervious Area

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

Subcatchment DW6:

Hydrograph



Summary for Subcatchment DW7:

Runoff = 32.48 cfs @ 3.82 hrs, Volume= 4.461 af, Depth= 1.67"
 Routed to Pond W7 : Wetland 7

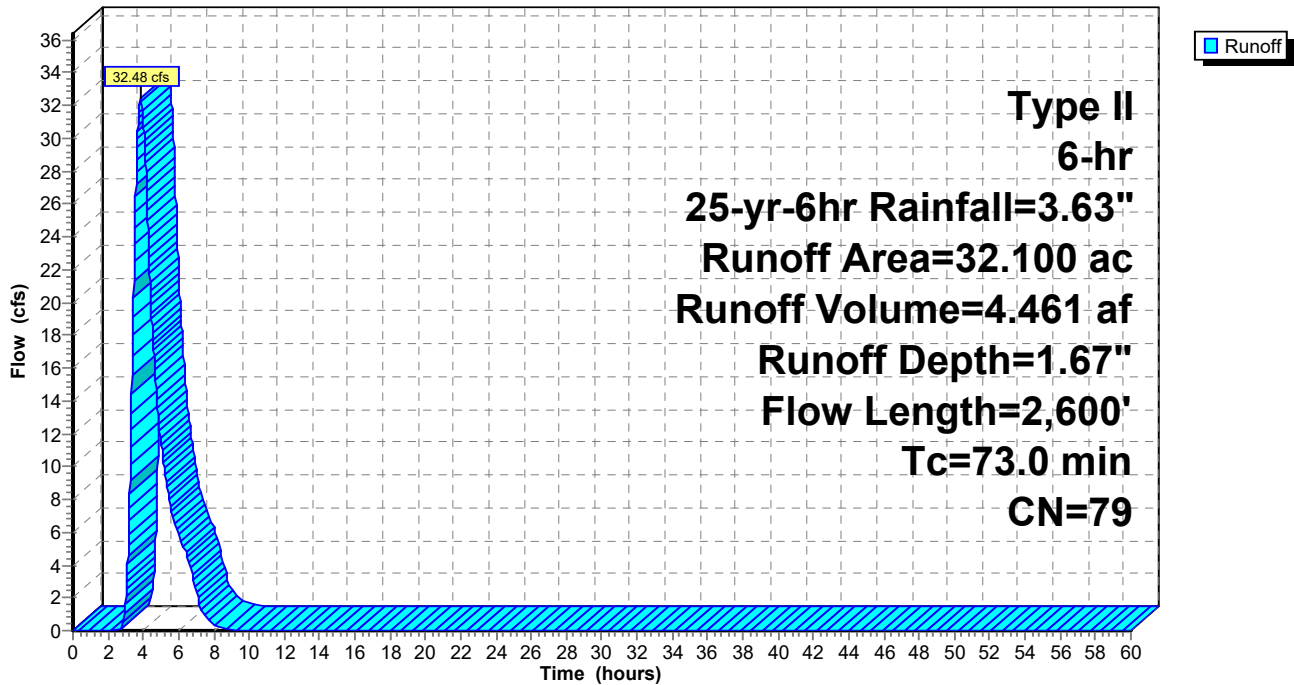
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Type II 6-hr 25-yr-6hr Rainfall=3.63"

Area (ac)	CN	Description
32.100	79	Woods/grass comb., Good, HSG D
32.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.2	100	0.0500	0.06		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.70"
27.4	650	0.0250	0.40		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
17.4	1,850	0.0140	1.77		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
73.0	2,600	Total			

Subcatchment DW7:

Hydrograph



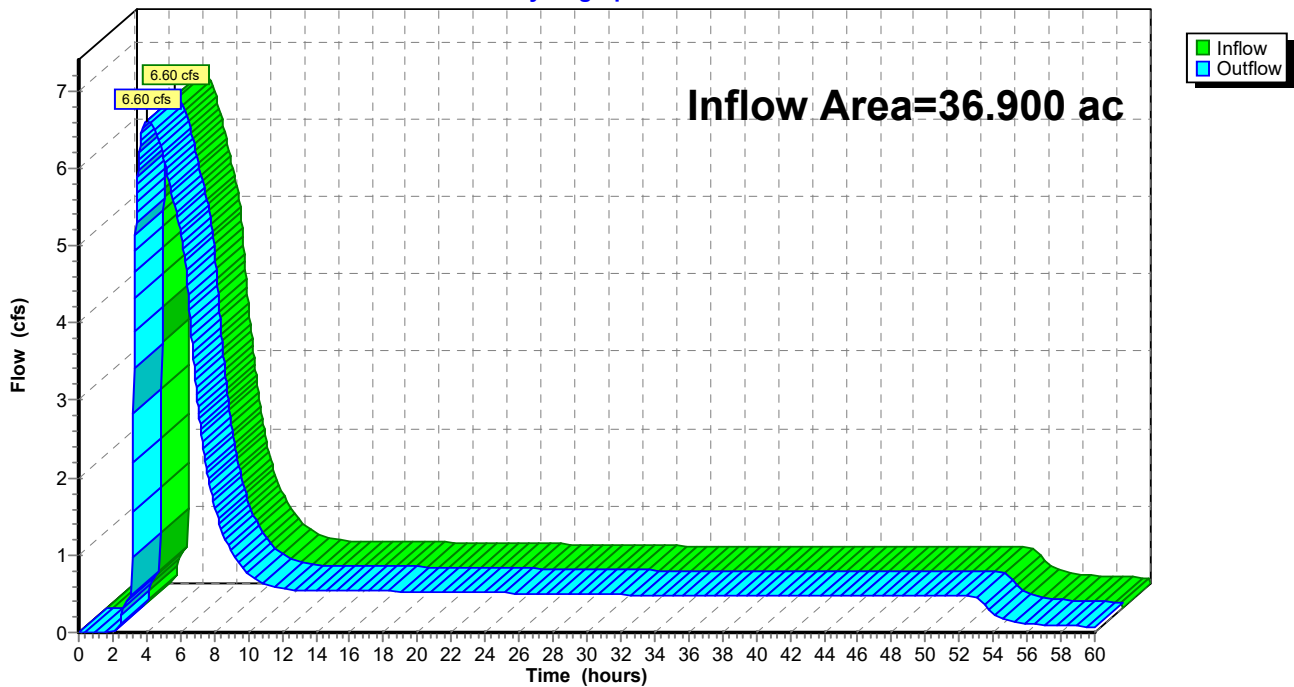
Summary for Reach 1R: Peak Flow Trunk 1

Inflow Area = 36.900 ac, 47.15% Impervious, Inflow Depth > 1.30" for 25-yr-6hr event
Inflow = 6.60 cfs @ 4.05 hrs, Volume= 3.993 af
Outflow = 6.60 cfs @ 4.07 hrs, Volume= 3.993 af, Atten= 0%, Lag= 1.2 min
Routed to Pond W7 : Wetland 7

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

Reach 1R: Peak Flow Trunk 1

Hydrograph

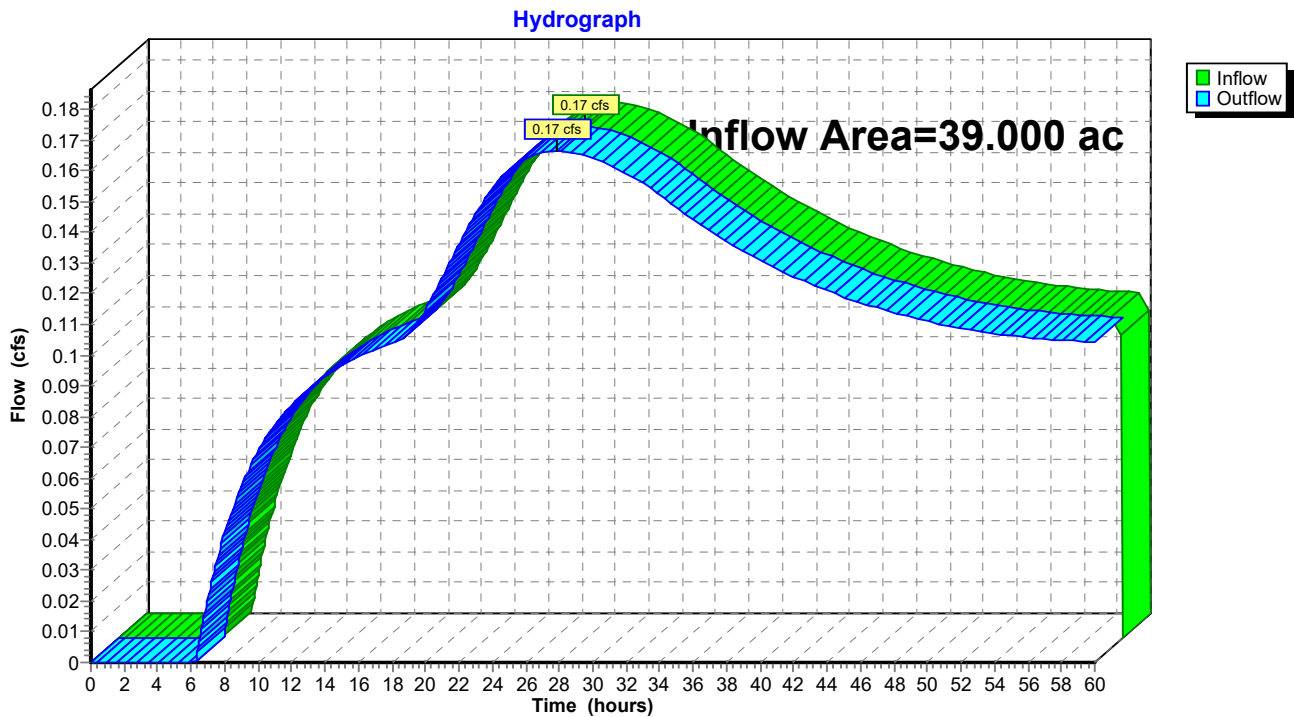


Summary for Reach 2R: Peak Flow Trunk 2

Inflow Area = 39.000 ac, 57.18% Impervious, Inflow Depth > 0.16" for 25-yr-6hr event
Inflow = 0.17 cfs @ 27.82 hrs, Volume= 0.526 af
Outflow = 0.17 cfs @ 27.84 hrs, Volume= 0.526 af, Atten= 0%, Lag= 1.2 min
Routed to Pond W7 : Wetland 7

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

Reach 2R: Peak Flow Trunk 2



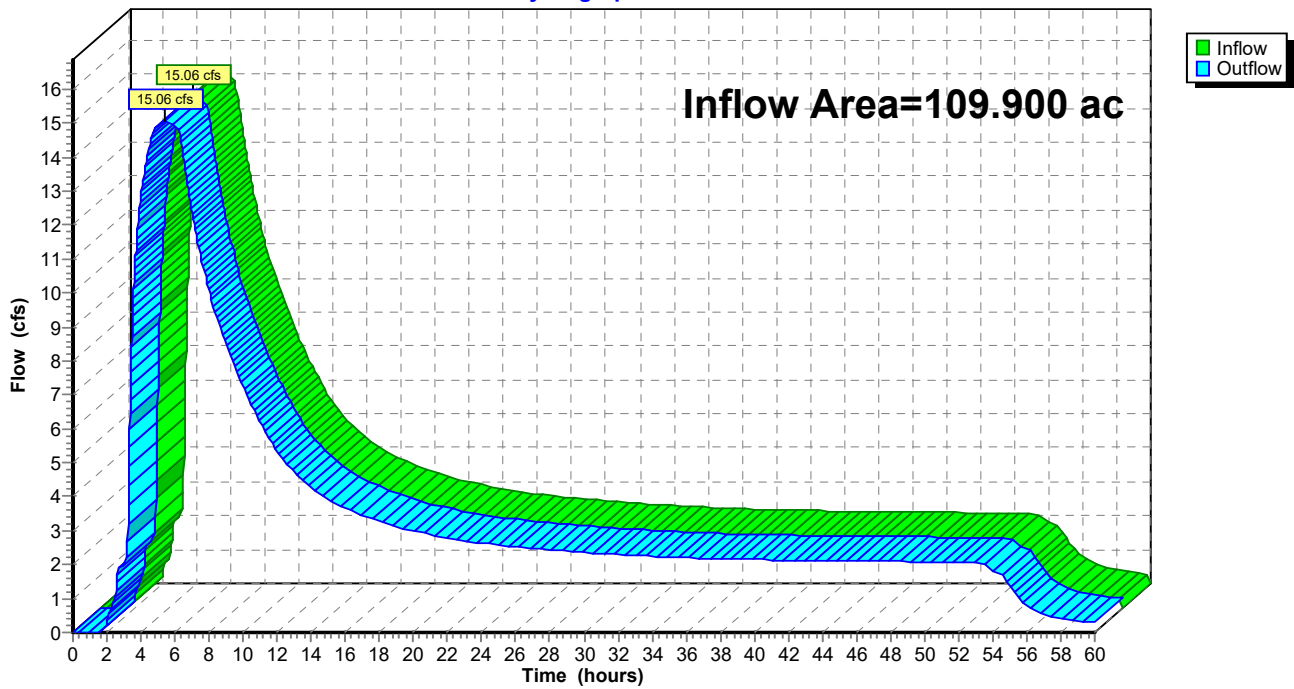
Summary for Reach 3R: Peak Flow Trunk 3

Inflow Area = 109.900 ac, 65.15% Impervious, Inflow Depth > 1.86" for 25-yr-6hr event
Inflow = 15.06 cfs @ 5.35 hrs, Volume= 17.014 af
Outflow = 15.06 cfs @ 5.37 hrs, Volume= 17.014 af, Atten= 0%, Lag= 1.2 min
Routed to Pond W7 : Wetland 7

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

Reach 3R: Peak Flow Trunk 3

Hydrograph



Summary for Pond 1P: Basin 1

Inflow Area = 20.700 ac, 42.51% Impervious, Inflow Depth = 2.13" for 25-yr-6hr event
 Inflow = 80.12 cfs @ 3.07 hrs, Volume= 3.674 af
 Outflow = 6.56 cfs @ 4.04 hrs, Volume= 3.663 af, Atten= 92%, Lag= 57.8 min
 Primary = 6.56 cfs @ 4.04 hrs, Volume= 3.663 af
 Routed to Reach 1R : Peak Flow Trunk 1

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,296.26' @ 4.04 hrs Surf.Area= 0.672 ac Storage= 2.514 af

Plug-Flow detention time= 787.3 min calculated for 3.663 af (100% of inflow)
 Center-of-Mass det. time= 786.7 min (998.2 - 211.5)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,290.00'	9.293 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,290.00	0.500	0.0	0.000	0.000
1,290.01	0.500	40.0	0.002	0.002
1,292.99	0.500	40.0	0.596	0.598
1,293.00	0.500	100.0	0.005	0.603
1,304.00	1.080	100.0	8.690	9.293

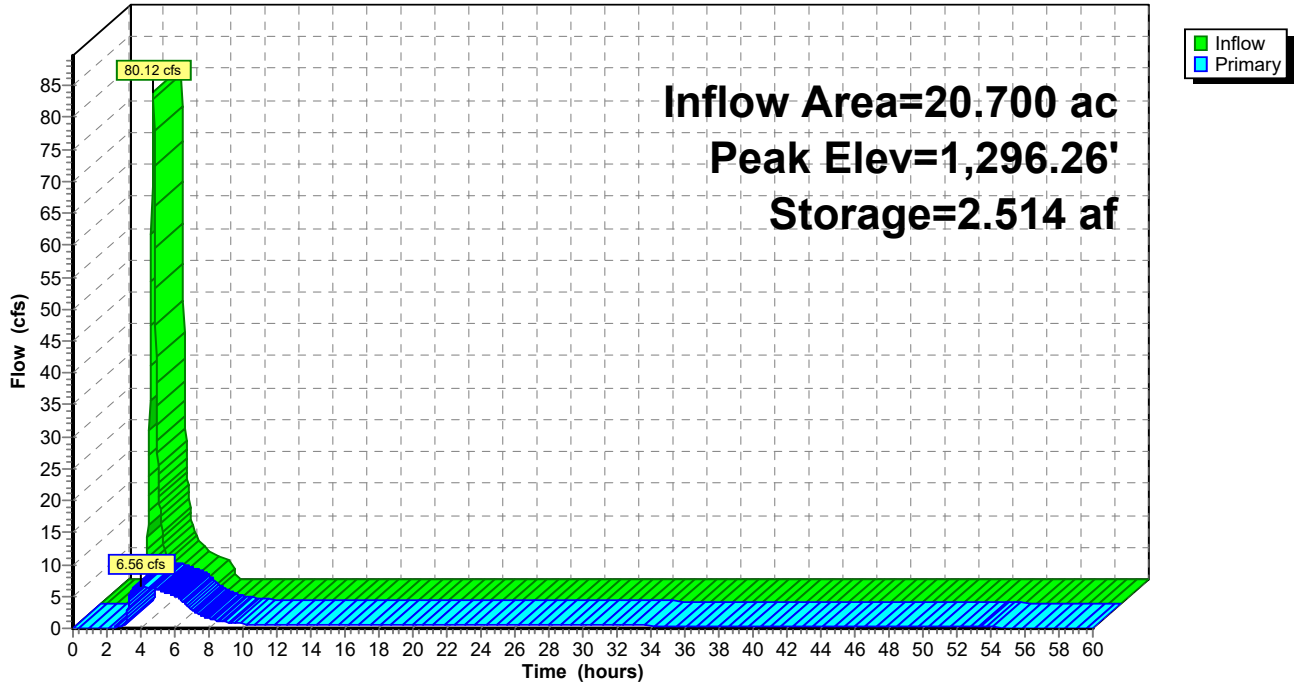
Device	Routing	Invert	Outlet Devices
#1	Primary	1,290.00'	24.0" Round Culvert L= 865.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,290.00' / 1,285.00' S= 0.0058 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Device 1	1,294.60'	15.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,296.30'	24.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Device 1	1,301.00'	6.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#5	Device 1	1,290.00'	0.800 in/hr Exfiltration over Surface area

Primary OutFlow Max=6.56 cfs @ 4.04 hrs HW=1,296.26' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 6.56 cfs of 23.47 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 6.02 cfs @ 4.90 fps)
- 3=Orifice/Grate (Controls 0.00 cfs)
- 4=Sharp-Crested Rectangular Weir(Controls 0.00 cfs)
- 5=Exfiltration (Exfiltration Controls 0.54 cfs)

Pond 1P: Basin 1

Hydrograph



Summary for Pond 2P: Basin 2

Inflow Area = 8.300 ac, 63.86% Impervious, Inflow Depth = 2.57" for 25-yr-6hr event
 Inflow = 38.02 cfs @ 3.07 hrs, Volume= 1.777 af
 Outflow = 0.05 cfs @ 6.47 hrs, Volume= 0.213 af, Atten= 100%, Lag= 204.3 min
 Primary = 0.05 cfs @ 6.47 hrs, Volume= 0.213 af
 Routed to Reach 1R : Peak Flow Trunk 1

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,289.10' @ 6.47 hrs Surf.Area= 0.814 ac Storage= 1.766 af

Plug-Flow detention time= 1,687.9 min calculated for 0.213 af (12% of inflow)
 Center-of-Mass det. time= 1,637.0 min (1,843.7 - 206.8)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,285.00'	12.674 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,285.00	0.750	0.0	0.000	0.000
1,285.01	0.750	40.0	0.003	0.003
1,287.99	0.750	40.0	0.894	0.897
1,288.00	0.750	100.0	0.007	0.904
1,299.00	1.390	100.0	11.770	12.674

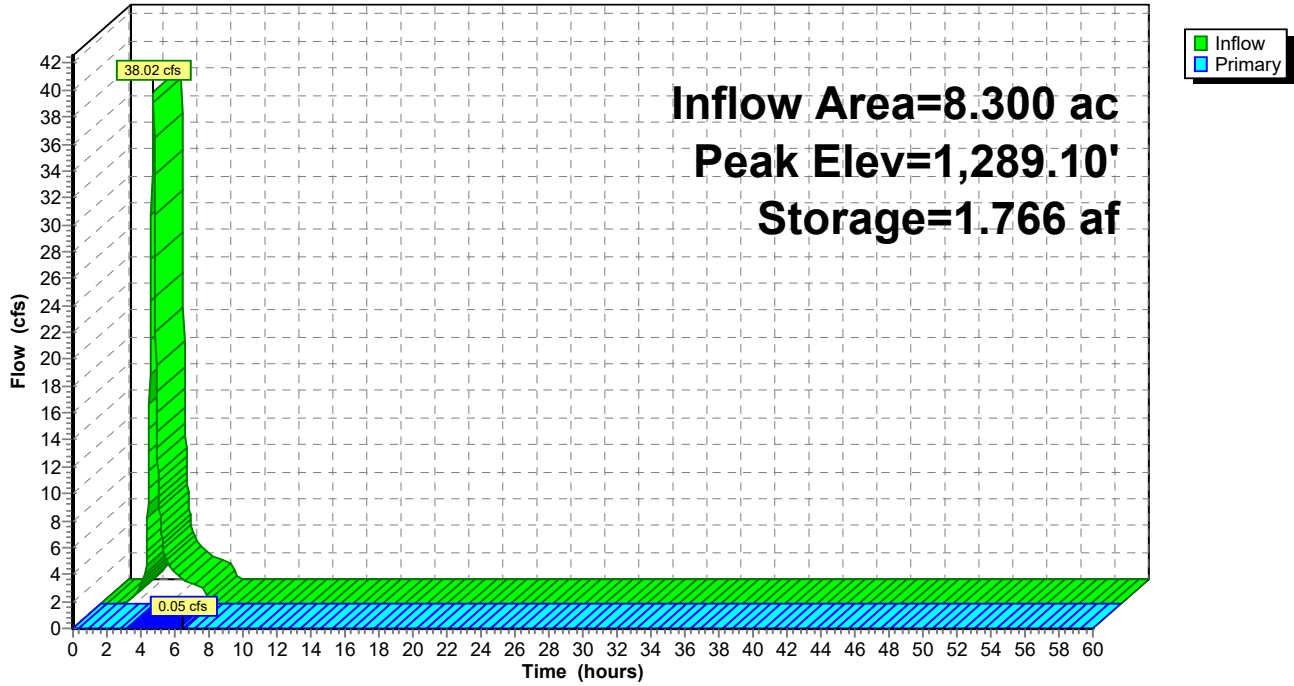
Device	Routing	Invert	Outlet Devices
#1	Primary	1,285.00'	24.0" Round Culvert L= 1,250.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,285.00' / 1,277.00' S= 0.0064 '/ Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Device 1	1,289.60'	15.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,295.00'	6.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 1	1,288.00'	0.800 in/hr Exfiltration over Surface area above 1,288.00' Excluded Surface area = 0.750 ac

Primary OutFlow Max=0.05 cfs @ 6.47 hrs HW=1,289.10' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 0.05 cfs of 20.85 cfs potential flow)
- 2=Orifice/Grate (Controls 0.00 cfs)
- 3=Sharp-Crested Rectangular Weir(Controls 0.00 cfs)
- 4=Exfiltration (Exfiltration Controls 0.05 cfs)

Pond 2P: Basin 2

Hydrograph



Summary for Pond 3P: Basin 3

Inflow Area = 39.000 ac, 57.18% Impervious, Inflow Depth = 2.48" for 25-yr-6hr event
 Inflow = 173.18 cfs @ 3.07 hrs, Volume= 8.052 af
 Outflow = 5.96 cfs @ 5.98 hrs, Volume= 3.378 af, Atten= 97%, Lag= 174.7 min
 Primary = 5.96 cfs @ 5.98 hrs, Volume= 3.378 af
 Routed to Pond 4P : Basin 4

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,289.82' @ 5.98 hrs Surf.Area= 1.856 ac Storage= 6.878 af

Plug-Flow detention time= 487.5 min calculated for 3.377 af (42% of inflow)
 Center-of-Mass det. time= 454.9 min (662.7 - 207.8)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,284.00'	24.736 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,284.00	1.630	0.0	0.000	0.000
1,284.01	1.630	40.0	0.007	0.007
1,286.99	1.630	40.0	1.943	1.949
1,287.00	1.630	100.0	0.016	1.966
1,298.00	2.510	100.0	22.770	24.736

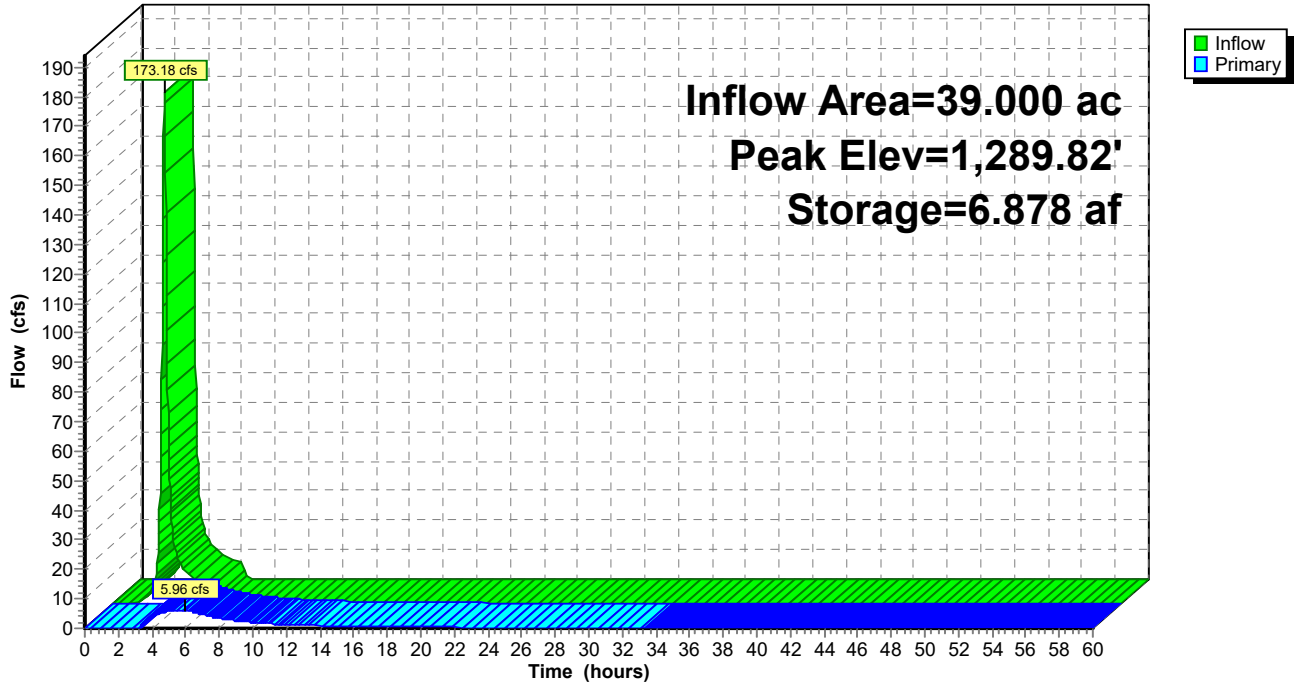
Device	Routing	Invert	Outlet Devices
#1	Primary	1,284.00'	48.0" Round Culvert L= 100.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,284.00' / 1,284.00' S= 0.0000 '/ Cc= 0.900 n= 0.012, Flow Area= 12.57 sf
#2	Device 1	1,288.60'	18.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,287.00'	0.800 in/hr Exfiltration over Surface area above 1,287.00' Excluded Surface area = 1.630 ac

Primary OutFlow Max=5.96 cfs @ 5.98 hrs HW=1,289.82' TW=1,286.67' (Dynamic Tailwater)

- 1=Culvert (Passes 5.96 cfs of 98.11 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 5.78 cfs @ 3.76 fps)
- 3=Exfiltration (Exfiltration Controls 0.18 cfs)

Pond 3P: Basin 3

Hydrograph



Summary for Pond 4P: Basin 4

Inflow Area = 39.000 ac, 57.18% Impervious, Inflow Depth > 1.04" for 25-yr-6hr event
 Inflow = 5.96 cfs @ 5.98 hrs, Volume= 3.378 af
 Outflow = 0.17 cfs @ 27.82 hrs, Volume= 0.527 af, Atten= 97%, Lag= 1,310.6 min
 Primary = 0.17 cfs @ 27.82 hrs, Volume= 0.527 af
 Routed to Reach 2R : Peak Flow Trunk 2

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,288.70' @ 27.82 hrs Surf.Area= 1.118 ac Storage= 2.966 af

Plug-Flow detention time= 1,800.4 min calculated for 0.527 af (16% of inflow)
 Center-of-Mass det. time= 1,393.1 min (2,055.7 - 662.6)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,284.00'	16.857 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,284.00	0.980	0.0	0.000	0.000
1,284.01	0.980	40.0	0.004	0.004
1,286.99	0.980	40.0	1.168	1.172
1,287.00	0.980	100.0	0.010	1.182
1,298.00	1.870	100.0	15.675	16.857

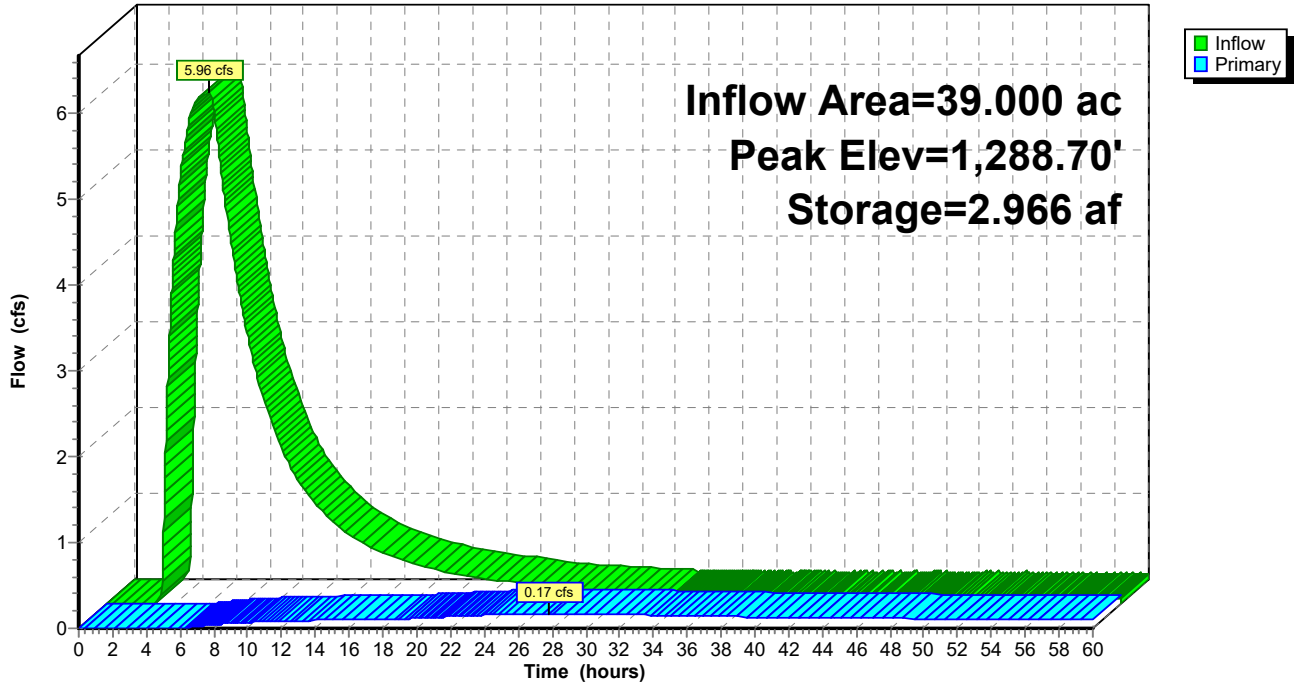
Device	Routing	Invert	Outlet Devices
#1	Primary	1,284.00'	48.0" Round Culvert L= 100.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,284.00' / 1,274.00' S= 0.1000 '/ Cc= 0.900 n= 0.012, Flow Area= 12.57 sf
#2	Device 1	1,288.60'	18.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,293.00'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 1	1,287.00'	0.800 in/hr Exfiltration over Surface area above 1,287.00' Excluded Surface area = 0.980 ac

Primary OutFlow Max=0.17 cfs @ 27.82 hrs HW=1,288.70' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 0.17 cfs of 99.44 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 0.06 cfs @ 1.08 fps)
- 3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 4=Exfiltration (Exfiltration Controls 0.11 cfs)

Pond 4P: Basin 4

Hydrograph



Summary for Pond 5P: Basin 5

Inflow Area = 56.500 ac, 68.14% Impervious, Inflow Depth = 2.66" for 25-yr-6hr event
 Inflow = 266.64 cfs @ 3.07 hrs, Volume= 12.545 af
 Outflow = 6.38 cfs @ 6.17 hrs, Volume= 5.709 af, Atten= 98%, Lag= 185.9 min
 Primary = 6.38 cfs @ 6.17 hrs, Volume= 5.709 af
 Routed to Reach 3R : Peak Flow Trunk 3

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,289.30' @ 6.17 hrs Surf.Area= 2.691 ac Storage= 11.200 af

Plug-Flow detention time= 634.5 min calculated for 5.709 af (46% of inflow)
 Center-of-Mass det. time= 602.0 min (807.7 - 205.7)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,283.00'	38.318 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,283.00	2.370	0.0	0.000	0.000
1,283.01	2.370	40.0	0.009	0.009
1,285.99	2.370	40.0	2.825	2.835
1,286.00	2.370	100.0	0.024	2.858
1,298.00	3.540	100.0	35.460	38.318

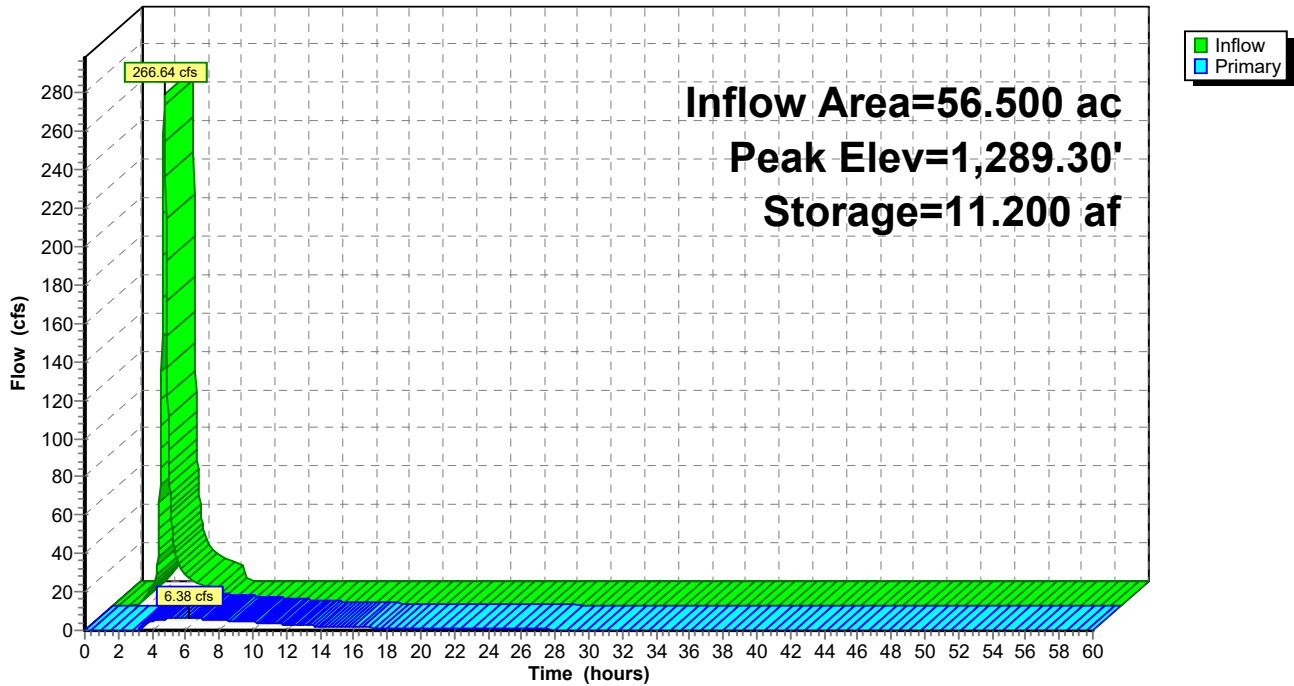
Device	Routing	Invert	Outlet Devices
#1	Primary	1,283.00'	48.0" Round Culvert L= 1,050.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,283.00' / 1,278.00' S= 0.0048 '/' Cc= 0.900 n= 0.012, Flow Area= 12.57 sf
#2	Device 1	1,287.60'	15.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,286.00'	0.800 in/hr Exfiltration over Surface area above 1,286.00' Excluded Surface area = 2.370 ac

Primary OutFlow Max=6.38 cfs @ 6.17 hrs HW=1,289.30' TW=0.00' (Dynamic Tailwater)

- ↑ **1=Culvert** (Passes 6.38 cfs of 111.90 cfs potential flow)
- ↑ **2=Orifice/Grate** (Orifice Controls 6.12 cfs @ 4.98 fps)
- ↑ **3=Exfiltration** (Exfiltration Controls 0.26 cfs)

Pond 5P: Basin 5

Hydrograph



Summary for Pond 6P: Basin 6

Inflow Area = 16.300 ac, 71.17% Impervious, Inflow Depth = 2.76" for 25-yr-6hr event
 Inflow = 79.12 cfs @ 3.07 hrs, Volume= 3.751 af
 Outflow = 5.18 cfs @ 4.18 hrs, Volume= 3.738 af, Atten= 93%, Lag= 66.8 min
 Primary = 5.18 cfs @ 4.18 hrs, Volume= 3.738 af
 Routed to Reach 3R : Peak Flow Trunk 3

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,283.81' @ 4.18 hrs Surf.Area= 0.786 ac Storage= 2.773 af

Plug-Flow detention time= 967.0 min calculated for 3.738 af (100% of inflow)
 Center-of-Mass det. time= 966.4 min (1,171.0 - 204.5)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,278.00'	10.947 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,278.00	0.640	0.0	0.000	0.000
1,278.01	0.640	40.0	0.003	0.003
1,280.99	0.640	40.0	0.763	0.765
1,281.00	0.640	100.0	0.006	0.772
1,292.00	1.210	100.0	10.175	10.947

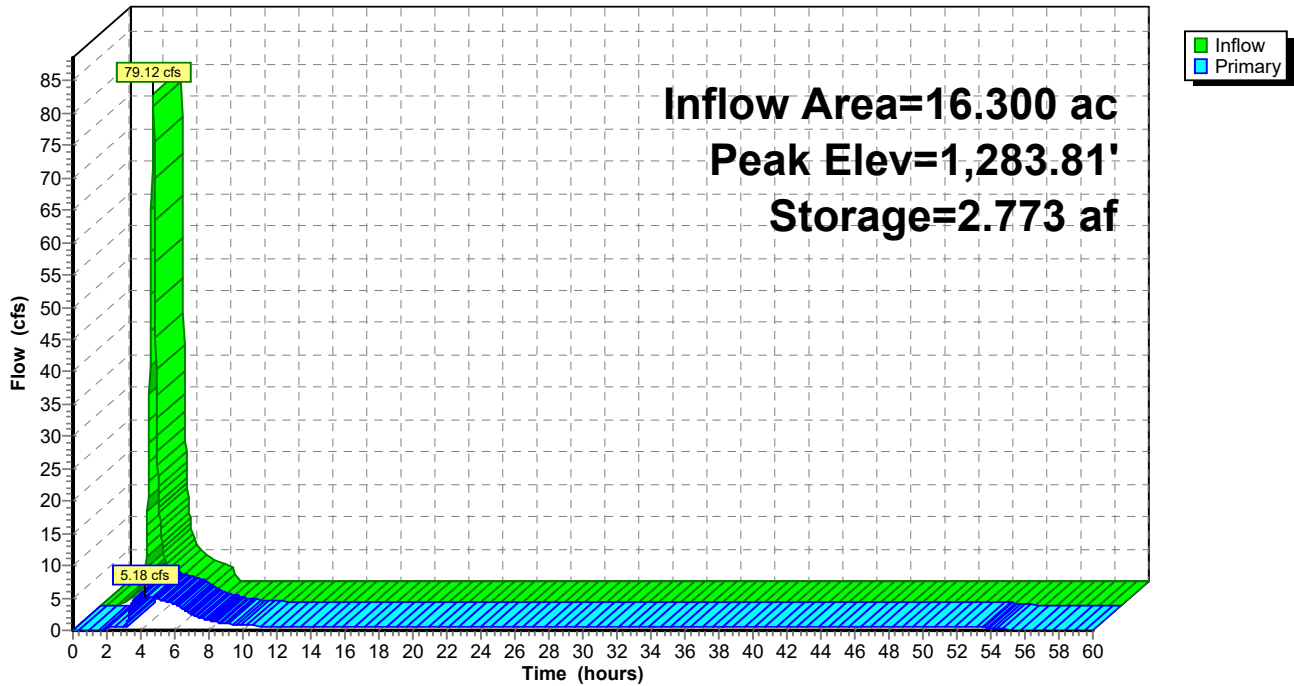
Device	Routing	Invert	Outlet Devices
#1	Primary	1,278.00'	48.0" Round Culvert L= 910.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,278.00' / 1,271.00' S= 0.0077 '/ Cc= 0.900 n= 0.012, Flow Area= 12.57 sf
#2	Primary	1,282.60'	15.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,289.00'	6.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 1	1,278.00'	0.800 in/hr Exfiltration over Surface area

Primary OutFlow Max=5.18 cfs @ 4.18 hrs HW=1,283.81' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 0.63 cfs of 118.08 cfs potential flow)
- 3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 4=Exfiltration (Exfiltration Controls 0.63 cfs)
- 2=Orifice/Grate (Orifice Controls 4.55 cfs @ 3.74 fps)

Pond 6P: Basin 6

Hydrograph



Summary for Pond 7P: Basin 7

Inflow Area = 37.100 ac, 57.95% Impervious, Inflow Depth = 2.48" for 25-yr-6hr event
 Inflow = 164.74 cfs @ 3.07 hrs, Volume= 7.660 af
 Outflow = 4.60 cfs @ 6.14 hrs, Volume= 7.567 af, Atten= 97%, Lag= 184.4 min
 Primary = 4.60 cfs @ 6.14 hrs, Volume= 7.567 af
 Routed to Reach 3R : Peak Flow Trunk 3

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,276.50' @ 6.14 hrs Surf.Area= 1.911 ac Storage= 6.688 af

Plug-Flow detention time= 1,341.9 min calculated for 7.564 af (99% of inflow)
 Center-of-Mass det. time= 1,340.6 min (1,548.4 - 207.8)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,271.00'	25.265 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,271.00	1.750	0.0	0.000	0.000
1,271.01	1.750	40.0	0.007	0.007
1,273.99	1.750	40.0	2.086	2.093
1,274.00	1.750	100.0	0.017	2.110
1,285.00	2.460	100.0	23.155	25.265

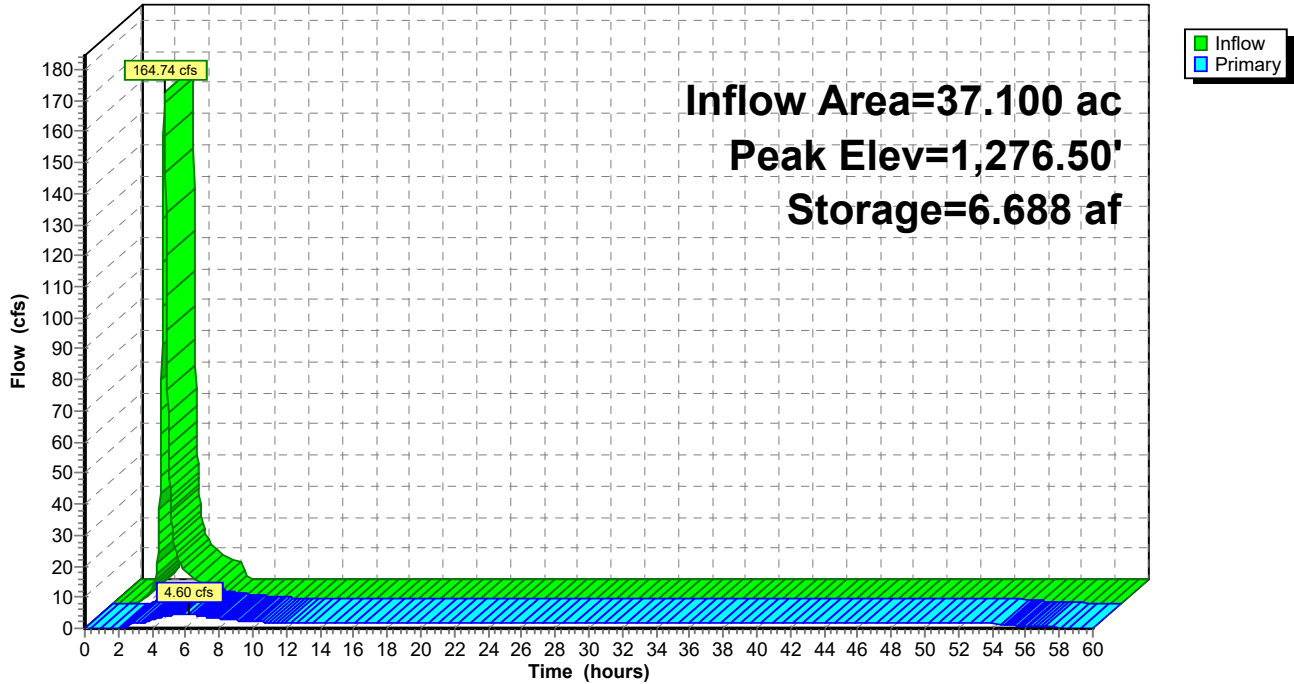
Device	Routing	Invert	Outlet Devices
#1	Primary	1,271.00'	48.0" Round Culvert L= 150.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,271.00' / 1,270.00' S= 0.0067 '/' Cc= 0.900 n= 0.012, Flow Area= 12.57 sf
#2	Device 1	1,275.60'	15.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,284.50'	6.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 1	1,271.00'	0.800 in/hr Exfiltration over Surface area

Primary OutFlow Max=4.60 cfs @ 6.14 hrs HW=1,276.50' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 4.60 cfs of 109.20 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 3.06 cfs @ 3.23 fps)
- 3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 4=Exfiltration (Exfiltration Controls 1.54 cfs)

Pond 7P: Basin 7

Hydrograph



Summary for Pond 8P: Basin 8

Inflow Area = 7.900 ac, 41.77% Impervious, Inflow Depth = 2.13" for 25-yr-6hr event
 Inflow = 30.58 cfs @ 3.07 hrs, Volume= 1.402 af
 Outflow = 0.03 cfs @ 6.52 hrs, Volume= 0.118 af, Atten= 100%, Lag= 206.7 min
 Primary = 0.03 cfs @ 6.52 hrs, Volume= 0.118 af
 Routed to Reach 1R : Peak Flow Trunk 1

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,280.62' @ 6.52 hrs Surf.Area= 0.796 ac Storage= 1.397 af

Plug-Flow detention time= 1,694.4 min calculated for 0.118 af (8% of inflow)
 Center-of-Mass det. time= 1,645.2 min (1,856.7 - 211.5)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,277.00'	12.797 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,277.00	0.760	0.0	0.000	0.000
1,277.01	0.760	40.0	0.003	0.003
1,279.99	0.760	40.0	0.906	0.909
1,280.00	0.760	100.0	0.008	0.917
1,291.00	1.400	100.0	11.880	12.797

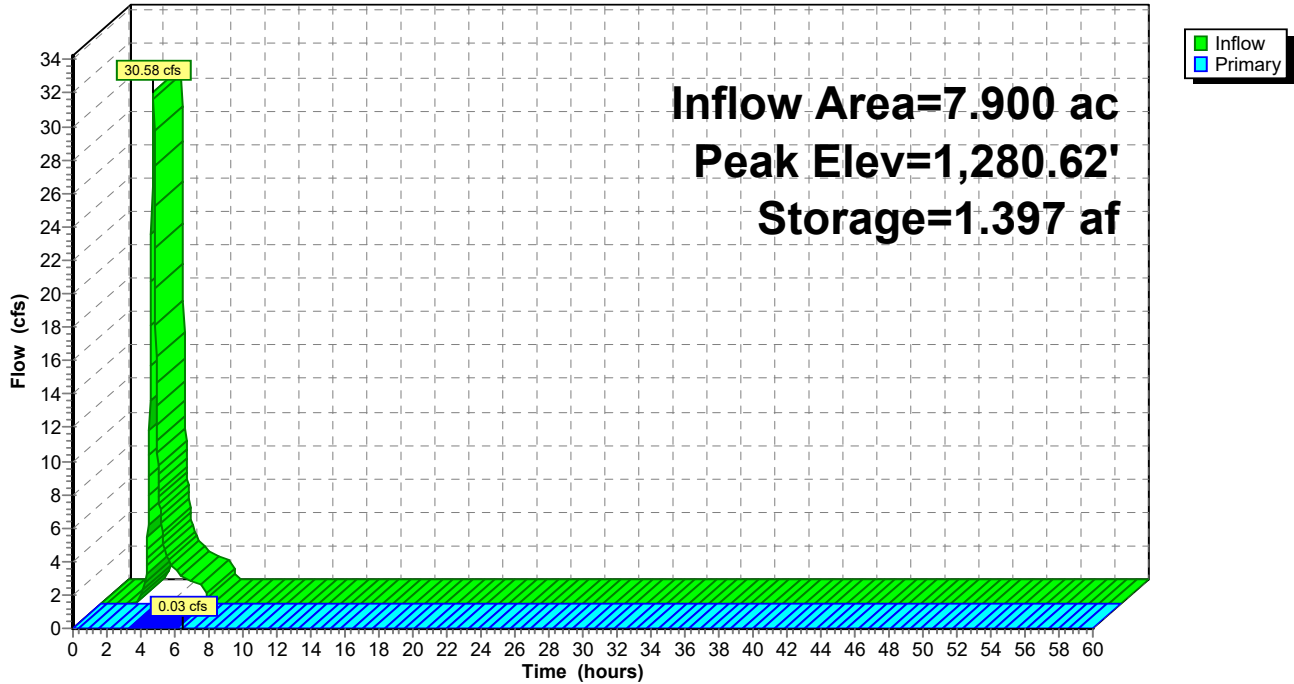
Device	Routing	Invert	Outlet Devices
#1	Primary	1,277.00'	36.0" Round Culvert L= 200.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,277.00' / 1,276.00' S= 0.0050 '/ Cc= 0.900 n= 0.012, Flow Area= 7.07 sf
#2	Device 1	1,281.60'	15.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,289.00'	6.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 1	1,280.00'	0.800 in/hr Exfiltration over Surface area above 1,280.00' Excluded Surface area = 0.760 ac

Primary OutFlow Max=0.03 cfs @ 6.52 hrs HW=1,280.62' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 0.03 cfs of 47.27 cfs potential flow)
- 2=Orifice/Grate (Controls 0.00 cfs)
- 3=Sharp-Crested Rectangular Weir(Controls 0.00 cfs)
- 4=Exfiltration (Exfiltration Controls 0.03 cfs)

Pond 8P: Basin 8

Hydrograph



Summary for Pond W1: Wetland 1

Inflow Area = 7.100 ac, 0.00% Impervious, Inflow Depth = 1.67" for 25-yr-6hr event
 Inflow = 29.33 cfs @ 2.99 hrs, Volume= 0.987 af
 Outflow = 10.08 cfs @ 3.12 hrs, Volume= 0.987 af, Atten= 66%, Lag= 8.1 min
 Primary = 10.08 cfs @ 3.12 hrs, Volume= 0.987 af
 Routed to Link 20L : Discharge Point #1

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,273.30' @ 3.12 hrs Surf.Area= 1.555 ac Storage= 0.323 af

Plug-Flow detention time= 14.2 min calculated for 0.987 af (100% of inflow)
 Center-of-Mass det. time= 13.7 min (222.6 - 209.0)

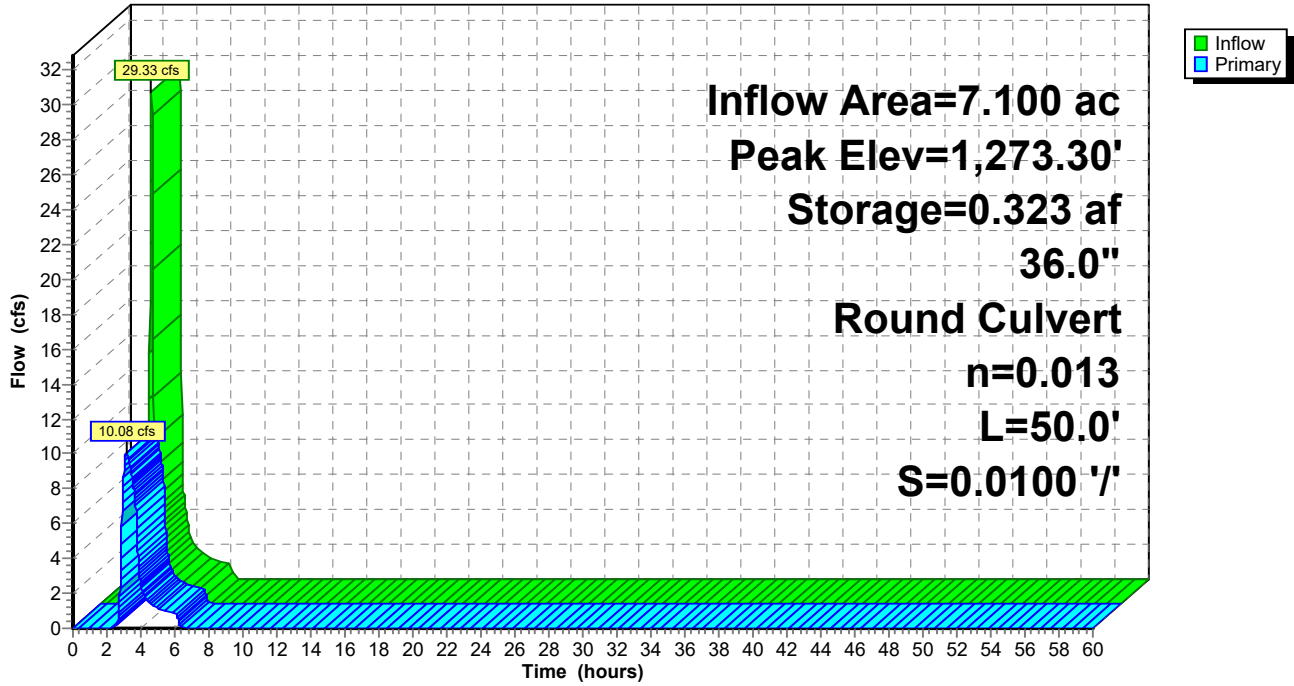
Volume	Invert	Avail.Storage	Storage Description
#1	1,272.00'	2.603 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,272.00	0.005	0.000	0.000
1,273.00	0.140	0.072	0.072
1,274.00	4.921	2.531	2.603

Device	Routing	Invert	Outlet Devices
#1	Primary	1,272.00'	36.0" Round Culvert L= 50.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,272.00' / 1,271.50' S= 0.0100 '/ Cc= 0.900 n= 0.013, Flow Area= 7.07 sf

Primary OutFlow Max=10.08 cfs @ 3.12 hrs HW=1,273.30' TW=0.00' (Dynamic Tailwater)
 ↑**1=Culvert** (Barrel Controls 10.08 cfs @ 5.08 fps)

Pond W1: Wetland 1

Hydrograph



Summary for Pond W4: Wetland 4

Inflow Area = 7.200 ac, 0.00% Impervious, Inflow Depth = 1.07" for 25-yr-6hr event
 Inflow = 19.00 cfs @ 2.99 hrs, Volume= 0.639 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

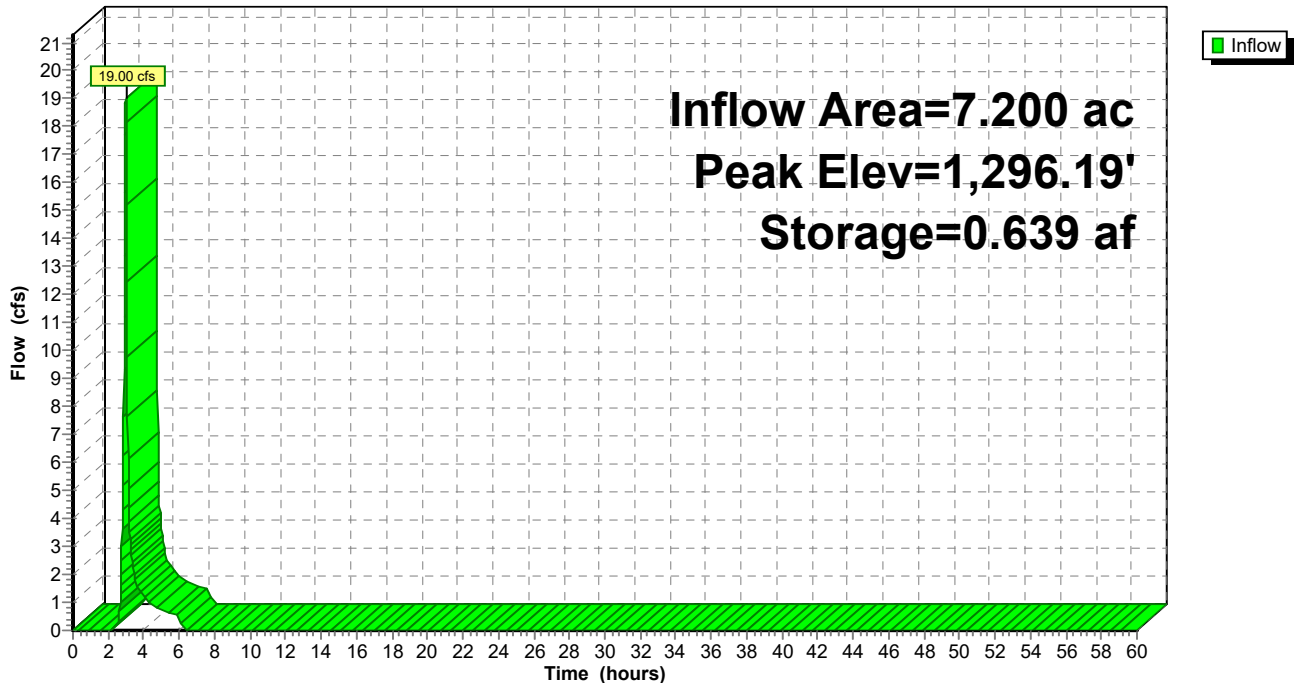
Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,296.19' @ 6.42 hrs Surf.Area= 3.512 ac Storage= 0.639 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	1,296.00'	3.729 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,296.00	3.384	0.000	0.000
1,297.00	4.073	3.729	3.729

Pond W4: Wetland 4

Hydrograph



Summary for Pond W5: Wetland 5

Inflow Area = 2.600 ac, 0.00% Impervious, Inflow Depth = 1.67" for 25-yr-6hr event
 Inflow = 10.74 cfs @ 2.99 hrs, Volume= 0.361 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Pond W4 : Wetland 4

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,299.22' @ 6.42 hrs Surf.Area= 1.660 ac Storage= 0.361 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	1,299.00'	3.760 af	Custom Stage Data (Prismatic) Listed below (Recalc)

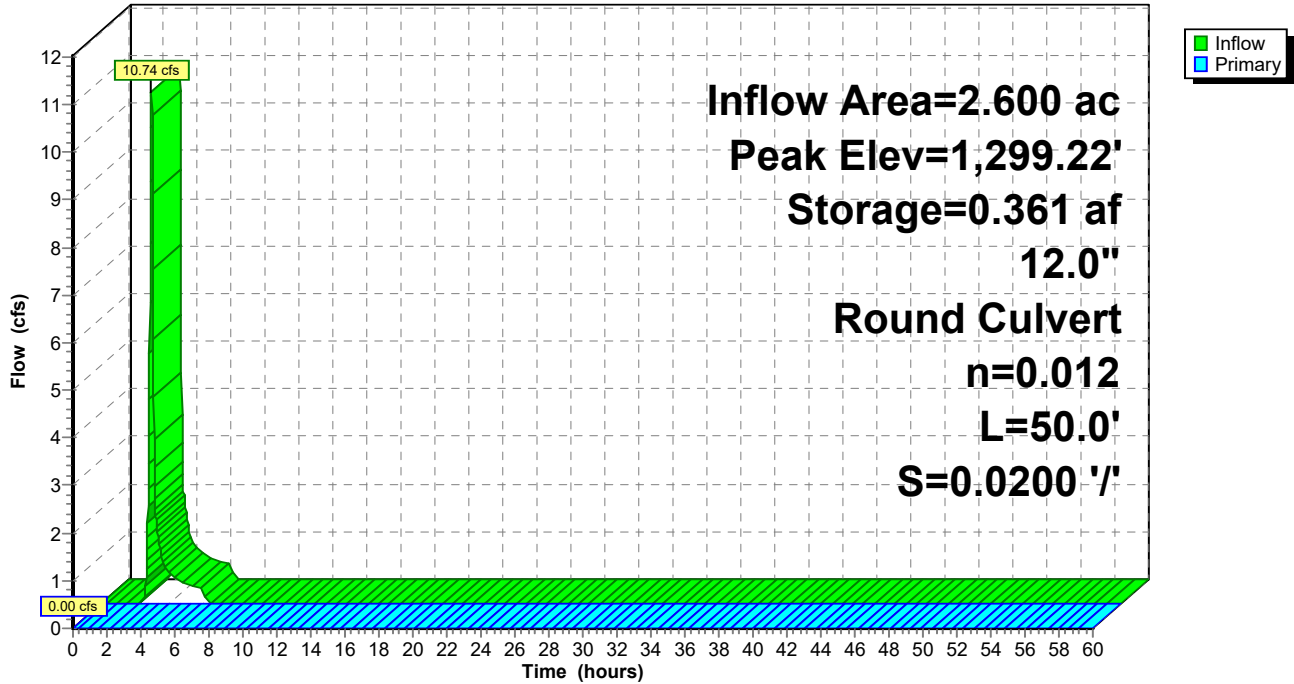
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,299.00	1.597	0.000	0.000
1,301.00	2.163	3.760	3.760

Device	Routing	Invert	Outlet Devices
#1	Primary	1,300.00'	12.0" Round Culvert L= 50.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,300.00' / 1,299.00' S= 0.0200 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,299.00' TW=1,296.00' (Dynamic Tailwater)
 ↑1=Culvert (Controls 0.00 cfs)

Pond W5: Wetland 5

Hydrograph



Summary for Pond W6: Wetland 6

Inflow Area = 9.000 ac, 0.00% Impervious, Inflow Depth = 0.33" for 25-yr-6hr event
 Inflow = 7.44 cfs @ 2.99 hrs, Volume= 0.250 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

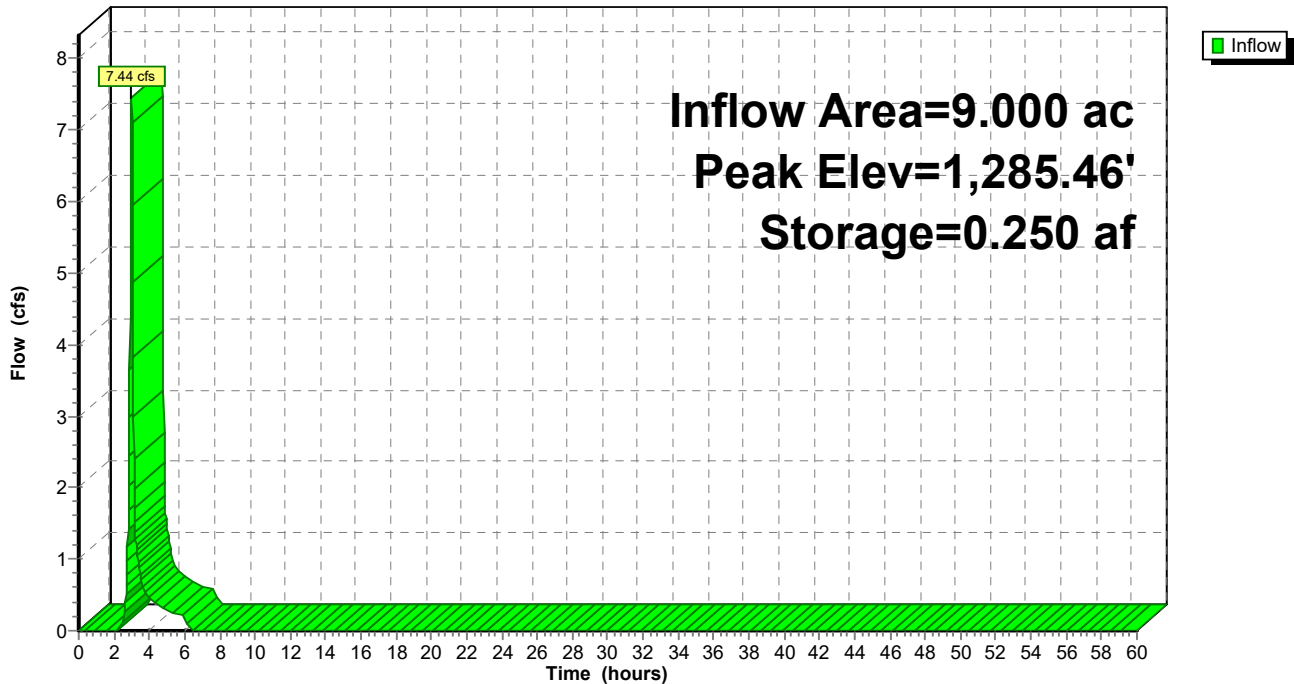
Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,285.46' @ 6.42 hrs Surf.Area= 0.590 ac Storage= 0.250 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	1,285.00'	1.338 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,285.00	0.497	0.000	0.000
1,286.00	0.698	0.598	0.598
1,287.00	0.784	0.741	1.338

Pond W6: Wetland 6

Hydrograph



Summary for Pond W7: Wetland 7

Inflow Area = 226.900 ac, 49.05% Impervious, Inflow Depth > 1.37" for 25-yr-6hr event
 Inflow = 51.22 cfs @ 3.89 hrs, Volume= 25.993 af
 Outflow = 45.72 cfs @ 4.23 hrs, Volume= 25.992 af, Atten= 11%, Lag= 20.8 min
 Primary = 45.72 cfs @ 4.23 hrs, Volume= 25.992 af
 Routed to Link 11L : Discharge Point #2

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,259.30' @ 4.23 hrs Surf.Area= 0.608 ac Storage= 0.668 af

Plug-Flow detention time= 4.6 min calculated for 25.992 af (100% of inflow)
 Center-of-Mass det. time= 4.4 min (1,053.9 - 1,049.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,256.00'	18.795 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,256.00	0.005	0.000	0.000
1,257.00	0.050	0.027	0.027
1,258.00	0.200	0.125	0.152
1,259.00	0.497	0.348	0.500
1,260.00	0.864	0.680	1.180
1,261.00	1.362	1.113	2.293
1,262.00	2.424	1.893	4.186
1,263.00	3.770	3.097	7.283
1,264.00	5.818	4.794	12.077
1,265.00	7.617	6.717	18.795

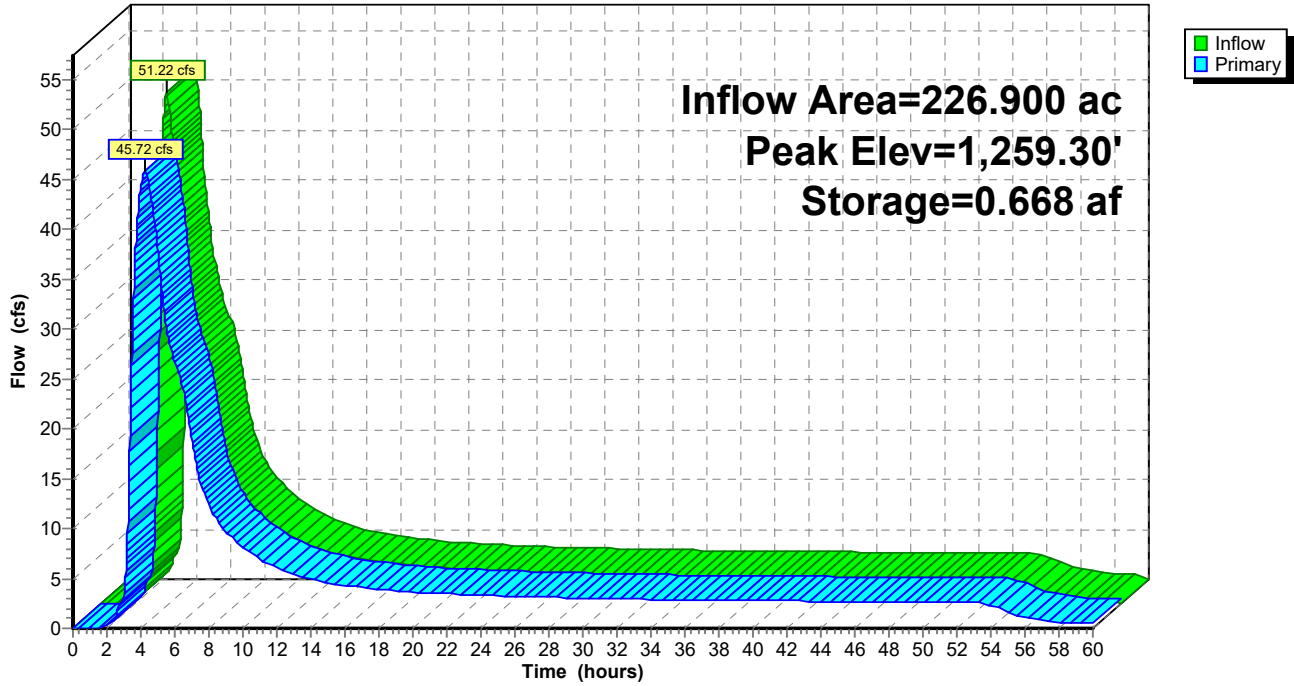
Device	Routing	Invert	Outlet Devices
#1	Primary	1,256.00'	36.0" Round Culvert L= 50.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,256.00' / 1,254.00' S= 0.0400 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf
#2	Primary	1,263.00'	300.0' long + 10.0 ' SideZ x 40.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=45.71 cfs @ 4.23 hrs HW=1,259.30' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Inlet Controls 45.71 cfs @ 6.47 fps)
- 2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond W7: Wetland 7

Hydrograph



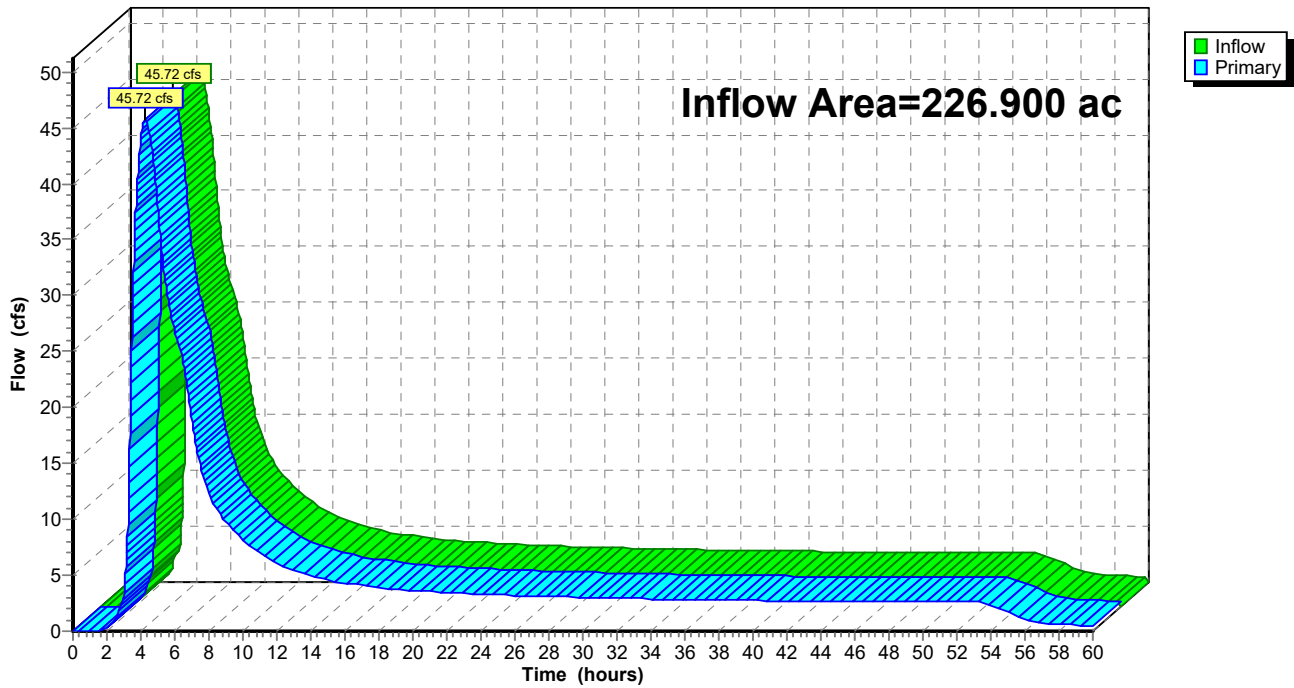
Summary for Link 11L: Discharge Point #2

Inflow Area = 226.900 ac, 49.05% Impervious, Inflow Depth > 1.37" for 25-yr-6hr event
Inflow = 45.72 cfs @ 4.23 hrs, Volume= 25.991 af
Primary = 45.72 cfs @ 4.25 hrs, Volume= 25.991 af, Atten= 0%, Lag= 1.2 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

Link 11L: Discharge Point #2

Hydrograph



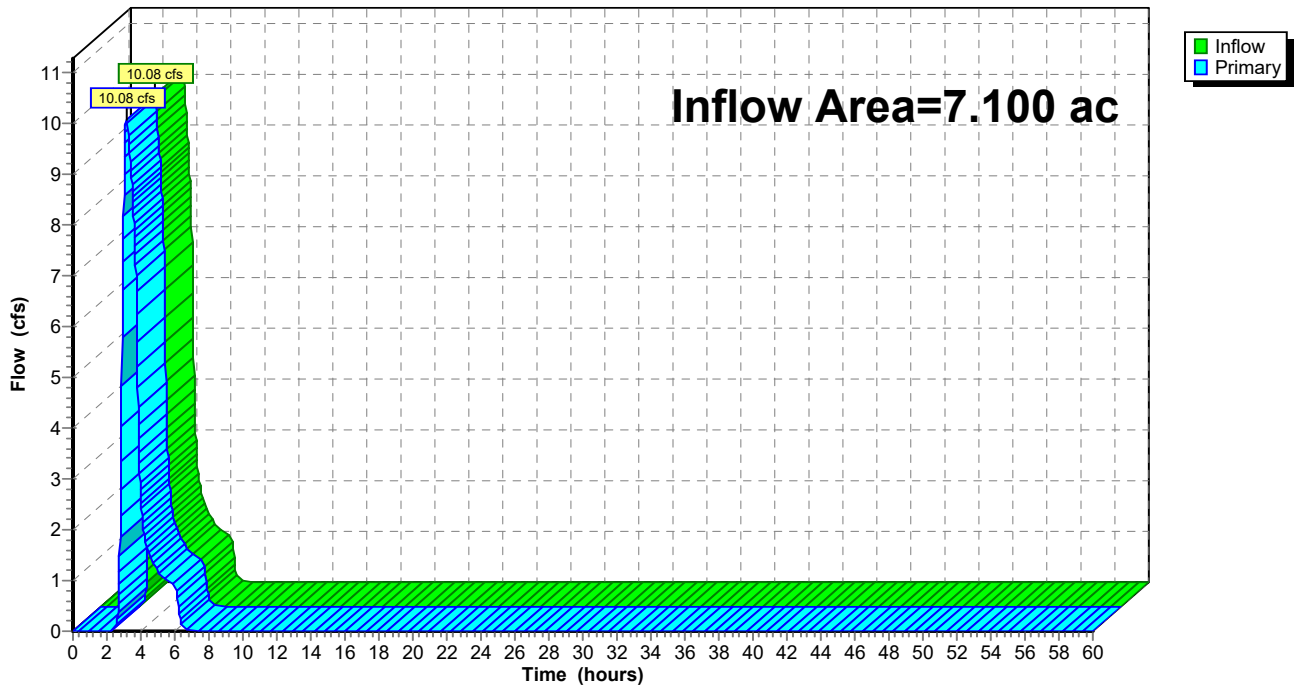
Summary for Link 20L: Discharge Point #1

Inflow Area = 7.100 ac, 0.00% Impervious, Inflow Depth = 1.67" for 25-yr-6hr event
Inflow = 10.08 cfs @ 3.12 hrs, Volume= 0.987 af
Primary = 10.08 cfs @ 3.14 hrs, Volume= 0.987 af, Atten= 0%, Lag= 1.2 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

Link 20L: Discharge Point #1

Hydrograph



2025-0806 - Hermantown Industrial - Proposed*MSE 24-hr 3 100-yr Rainfall=6.40"*

Prepared by Kimley-Horn & Associates

Printed 8/7/2025

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Time span=0.00-60.00 hrs, dt=0.02 hrs, 3001 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Sim-Route method - Pond routing by Sim-Route method

Subcatchment1S: Onsite Area	Runoff Area=20.700 ac 42.51% Impervious Runoff Depth=4.68" Tc=15.0 min CN=85 Runoff=123.01 cfs 8.075 af
Subcatchment2S: Onsite Area	Runoff Area=8.300 ac 63.86% Impervious Runoff Depth=5.24" Tc=15.0 min CN=90 Runoff=53.56 cfs 3.622 af
Subcatchment3/4S: Onsite Area	Runoff Area=39.000 ac 57.18% Impervious Runoff Depth=5.12" Tc=15.0 min CN=89 Runoff=248.01 cfs 16.652 af
Subcatchment5S: Onsite Area	Runoff Area=56.500 ac 68.14% Impervious Runoff Depth=5.35" Tc=15.0 min CN=91 Runoff=369.56 cfs 25.186 af
Subcatchment6S: Onsite Area	Runoff Area=16.300 ac 71.17% Impervious Runoff Depth=5.46" Tc=15.0 min CN=92 Runoff=107.96 cfs 7.421 af
Subcatchment7S: Onsite Area	Runoff Area=37.100 ac 57.95% Impervious Runoff Depth=5.12" Tc=15.0 min CN=89 Runoff=235.93 cfs 15.840 af
Subcatchment8S: Onsite Area	Runoff Area=7.900 ac 41.77% Impervious Runoff Depth=4.68" Tc=15.0 min CN=85 Runoff=46.95 cfs 3.082 af
SubcatchmentDW1:	Runoff Area=7.100 ac 0.00% Impervious Runoff Depth=4.04" Tc=7.0 min CN=79 Runoff=50.00 cfs 2.390 af
SubcatchmentDW4:	Runoff Area=4.600 ac 0.00% Impervious Runoff Depth=4.04" Tc=7.0 min CN=79 Runoff=32.40 cfs 1.548 af
SubcatchmentDW5:	Runoff Area=2.600 ac 0.00% Impervious Runoff Depth=4.04" Tc=7.0 min CN=79 Runoff=18.31 cfs 0.875 af
SubcatchmentDW6:	Runoff Area=1.800 ac 0.00% Impervious Runoff Depth=4.04" Tc=7.0 min CN=79 Runoff=12.68 cfs 0.606 af
SubcatchmentDW7:	Runoff Area=32.100 ac 0.00% Impervious Runoff Depth=4.04" Flow Length=2,600' Tc=73.0 min CN=79 Runoff=65.85 cfs 10.804 af
Reach 1R: Peak Flow Trunk 1	Inflow=27.65 cfs 10.263 af Outflow=27.65 cfs 10.263 af
Reach 2R: Peak Flow Trunk 2	Inflow=7.98 cfs 8.707 af Outflow=7.98 cfs 8.707 af
Reach 3R: Peak Flow Trunk 3	Inflow=33.69 cfs 39.085 af Outflow=33.69 cfs 39.085 af
Pond 1P: Basin 1	Peak Elev=1,298.74' Storage=4.345 af Inflow=123.01 cfs 8.075 af Outflow=26.43 cfs 7.747 af

2025-0806 - Hermantown Industrial - Proposed*MSE 24-hr 3 100-yr Rainfall=6.40"*

Prepared by Kimley-Horn & Associates

Printed 8/7/2025

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Pond 2P: Basin 2	Peak Elev=1,290.31' Storage=2.795 af Inflow=53.56 cfs 3.622 af Outflow=2.19 cfs 1.541 af
Pond 3P: Basin 3	Peak Elev=1,292.33' Storage=11.784 af Inflow=248.01 cfs 16.652 af Outflow=15.02 cfs 11.718 af
Pond 4P: Basin 4	Peak Elev=1,290.18' Storage=4.712 af Inflow=15.02 cfs 11.718 af Outflow=7.98 cfs 8.708 af
Pond 5P: Basin 5	Peak Elev=1,292.15' Storage=19.263 af Inflow=369.56 cfs 25.186 af Outflow=12.18 cfs 18.030 af
Pond 6P: Basin 6	Peak Elev=1,286.09' Storage=4.700 af Inflow=107.96 cfs 7.421 af Outflow=10.73 cfs 7.004 af
Pond 7P: Basin 7	Peak Elev=1,278.76' Storage=11.179 af Inflow=235.93 cfs 15.840 af Outflow=11.07 cfs 14.054 af
Pond 8P: Basin 8	Peak Elev=1,282.02' Storage=2.572 af Inflow=46.95 cfs 3.082 af Outflow=0.90 cfs 0.975 af
Pond W1: Wetland 1	Peak Elev=1,273.49' Storage=0.724 af Inflow=50.00 cfs 2.390 af 36.0" Round Culvert n=0.013 L=50.0' S=0.0100 '/ Outflow=12.84 cfs 2.390 af
Pond W4: Wetland 4	Peak Elev=1,296.44' Storage=1.548 af Inflow=32.40 cfs 1.548 af Outflow=0.00 cfs 0.000 af
Pond W5: Wetland 5	Peak Elev=1,299.52' Storage=0.875 af Inflow=18.31 cfs 0.875 af 12.0" Round Culvert n=0.012 L=50.0' S=0.0200 '/ Outflow=0.00 cfs 0.000 af
Pond W6: Wetland 6	Peak Elev=1,286.01' Storage=0.606 af Inflow=12.68 cfs 0.606 af Outflow=0.00 cfs 0.000 af
Pond W7: Wetland 7	Peak Elev=1,262.45' Storage=5.418 af Inflow=126.24 cfs 68.854 af Outflow=75.73 cfs 68.847 af
Link 11L: Discharge Point #2	Inflow=75.73 cfs 68.842 af Primary=75.73 cfs 68.842 af
Link 20L: Discharge Point #1	Inflow=12.84 cfs 2.390 af Primary=12.84 cfs 2.390 af

Total Runoff Area = 234.000 ac Runoff Volume = 96.099 af Average Runoff Depth = 4.93"
52.44% Pervious = 122.700 ac 47.56% Impervious = 111.300 ac

Summary for Subcatchment 1S: Onsite Area

Runoff = 123.01 cfs @ 12.23 hrs, Volume= 8.075 af, Depth= 4.68"
 Routed to Pond 1P : Basin 1

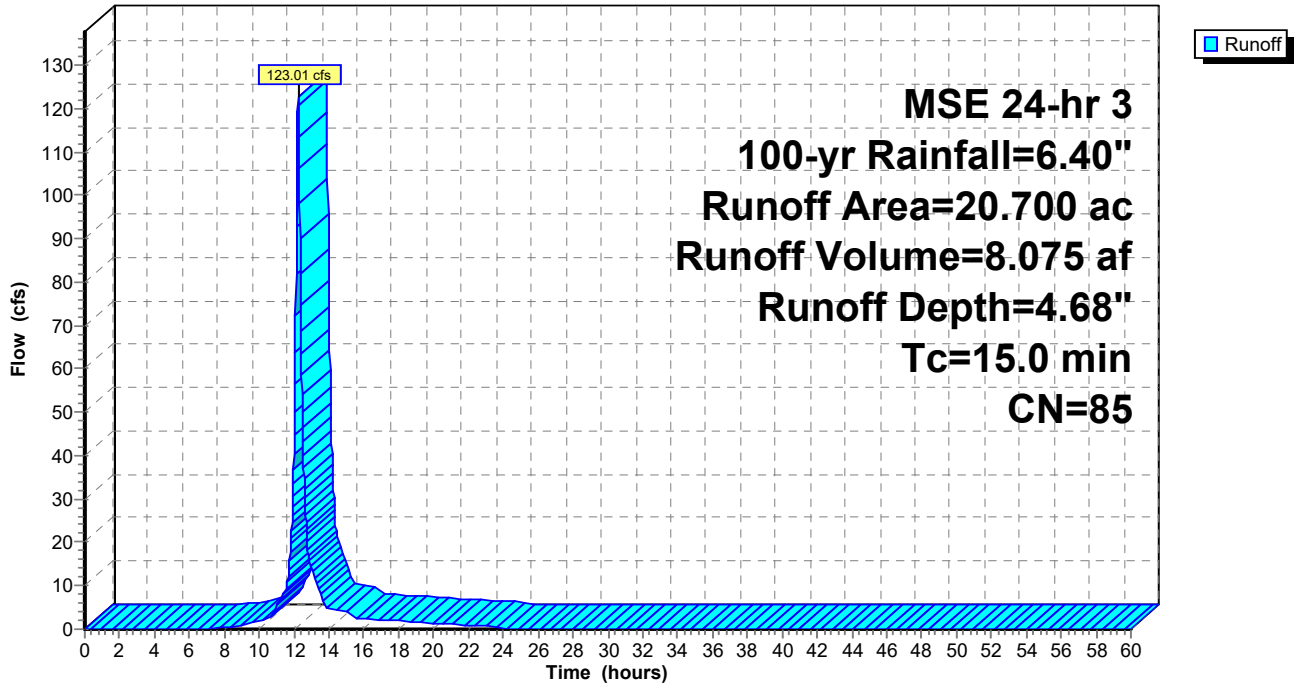
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 100-yr Rainfall=6.40"

Area (ac)	CN	Description
8.800	98	Paved parking, HSG D
11.900	76	Woods/grass comb., Fair, HSG C
20.700	85	Weighted Average
11.900		57.49% Pervious Area
8.800		42.51% Impervious Area

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

Subcatchment 1S: Onsite Area

Hydrograph



Summary for Subcatchment 2S: Onsite Area

Runoff = 53.56 cfs @ 12.23 hrs, Volume= 3.622 af, Depth= 5.24"
 Routed to Pond 2P : Basin 2

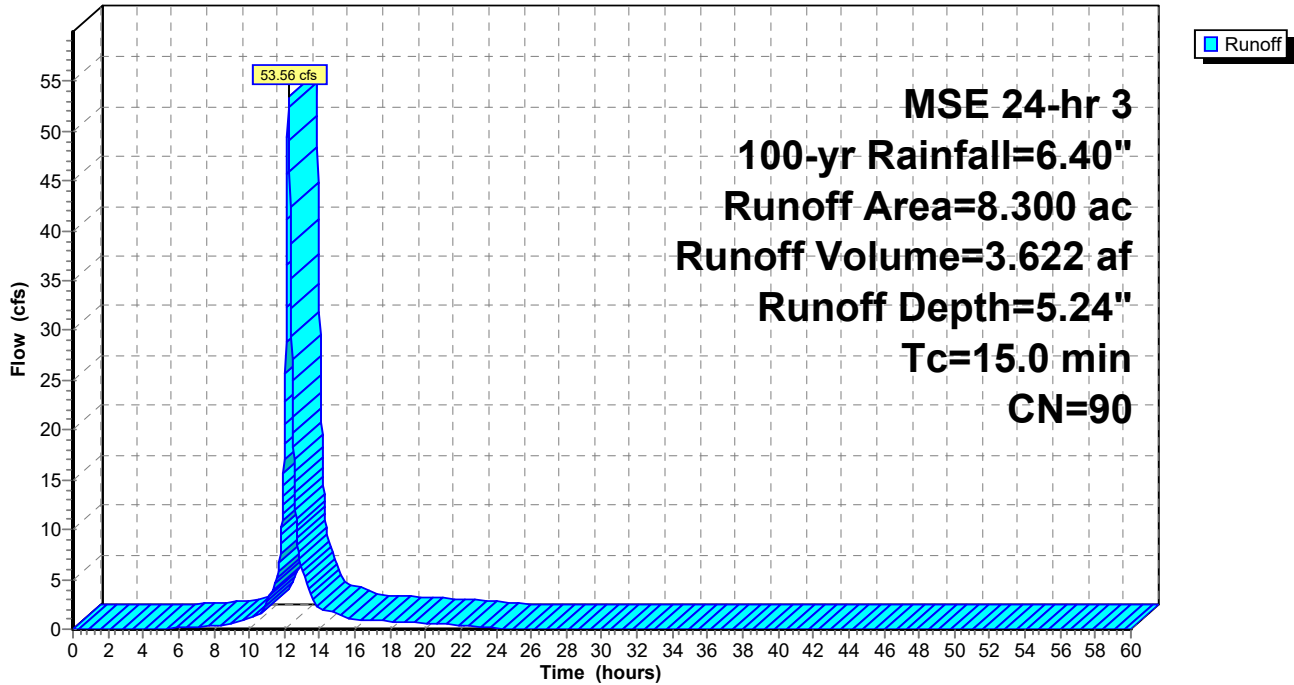
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 100-yr Rainfall=6.40"

Area (ac)	CN	Description
5.300	98	Paved parking, HSG D
3.000	76	Woods/grass comb., Fair, HSG C
8.300	90	Weighted Average
3.000		36.14% Pervious Area
5.300		63.86% Impervious Area

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

Subcatchment 2S: Onsite Area

Hydrograph



Summary for Subcatchment 3/4S: Onsite Area

Runoff = 248.01 cfs @ 12.23 hrs, Volume= 16.652 af, Depth= 5.12"
 Routed to Pond 3P : Basin 3

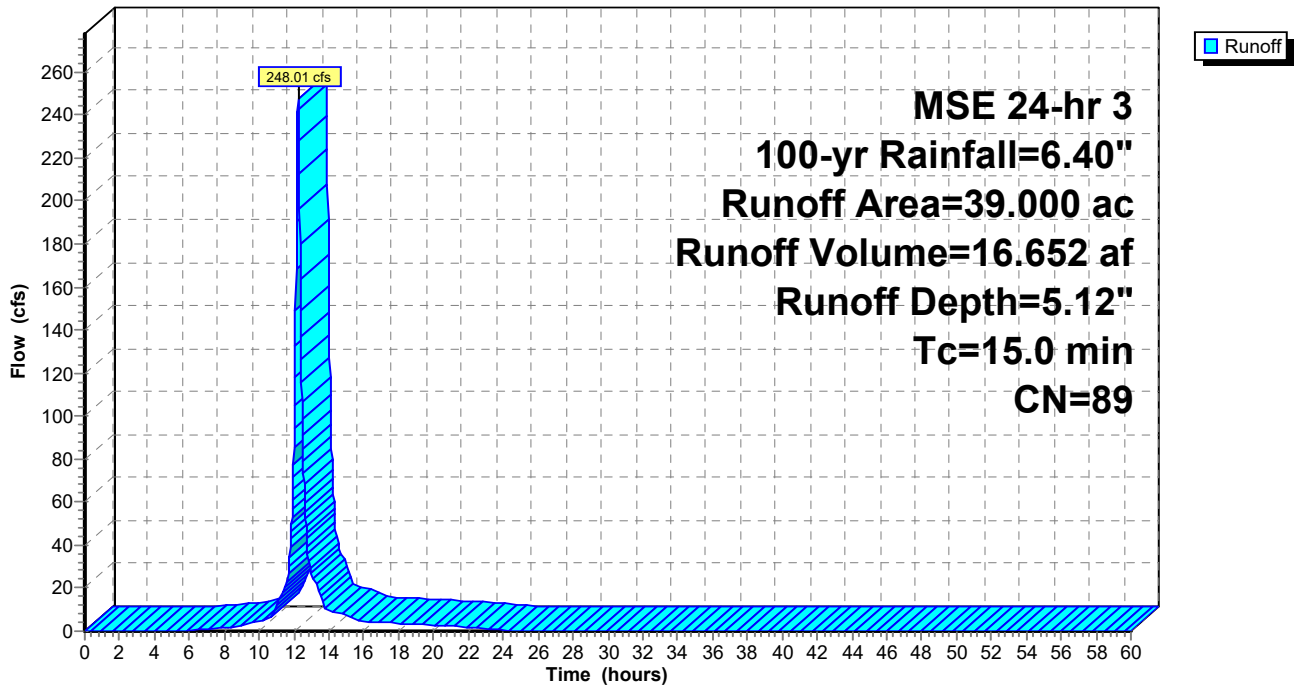
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 100-yr Rainfall=6.40"

Area (ac)	CN	Description
22.300	98	Paved parking, HSG D
16.700	76	Woods/grass comb., Fair, HSG C
39.000	89	Weighted Average
16.700		42.82% Pervious Area
22.300		57.18% Impervious Area

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

Subcatchment 3/4S: Onsite Area

Hydrograph



Summary for Subcatchment 5S: Onsite Area

Runoff = 369.56 cfs @ 12.23 hrs, Volume= 25.186 af, Depth= 5.35"
 Routed to Pond 5P : Basin 5

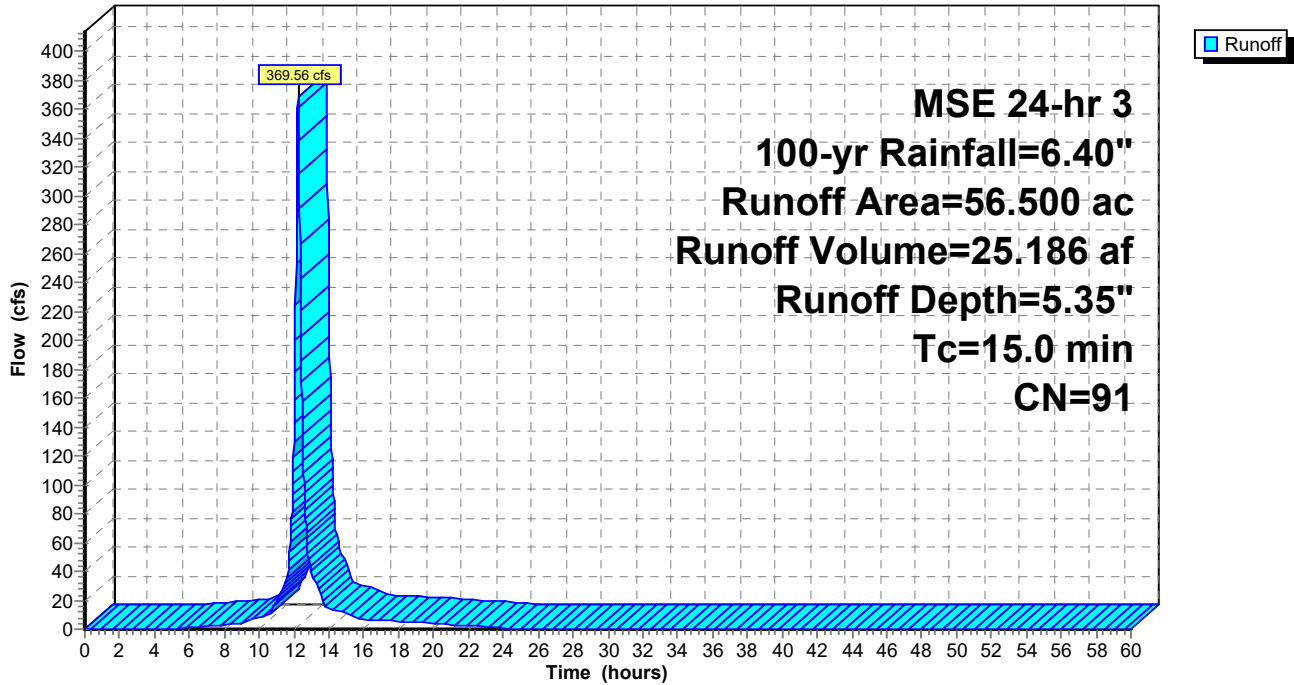
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 100-yr Rainfall=6.40"

Area (ac)	CN	Description
38.500	98	Paved parking, HSG D
18.000	76	Woods/grass comb., Fair, HSG C
56.500	91	Weighted Average
18.000		31.86% Pervious Area
38.500		68.14% Impervious Area

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

Subcatchment 5S: Onsite Area

Hydrograph



Summary for Subcatchment 6S: Onsite Area

Runoff = 107.96 cfs @ 12.23 hrs, Volume= 7.421 af, Depth= 5.46"
 Routed to Pond 6P : Basin 6

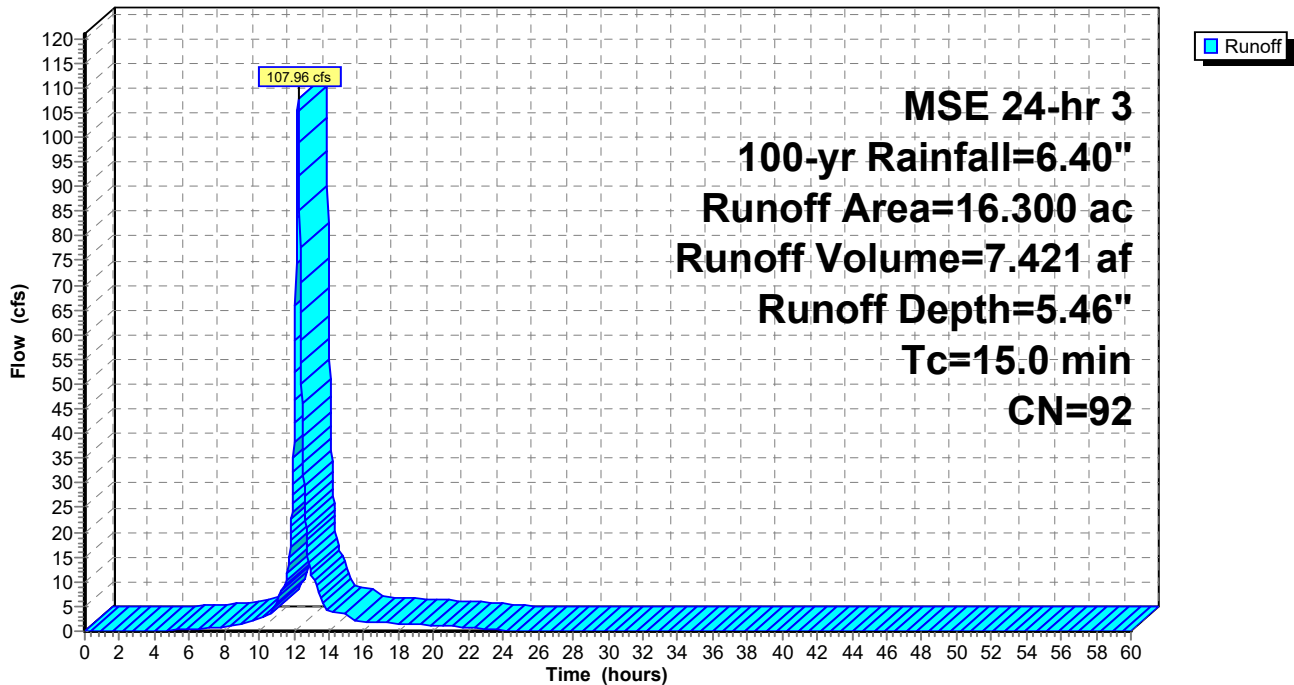
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 100-yr Rainfall=6.40"

Area (ac)	CN	Description
11.600	98	Paved parking, HSG D
4.700	76	Woods/grass comb., Fair, HSG C
16.300	92	Weighted Average
4.700		28.83% Pervious Area
11.600		71.17% Impervious Area

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

Subcatchment 6S: Onsite Area

Hydrograph



Summary for Subcatchment 7S: Onsite Area

Runoff = 235.93 cfs @ 12.23 hrs, Volume= 15.840 af, Depth= 5.12"
 Routed to Pond 7P : Basin 7

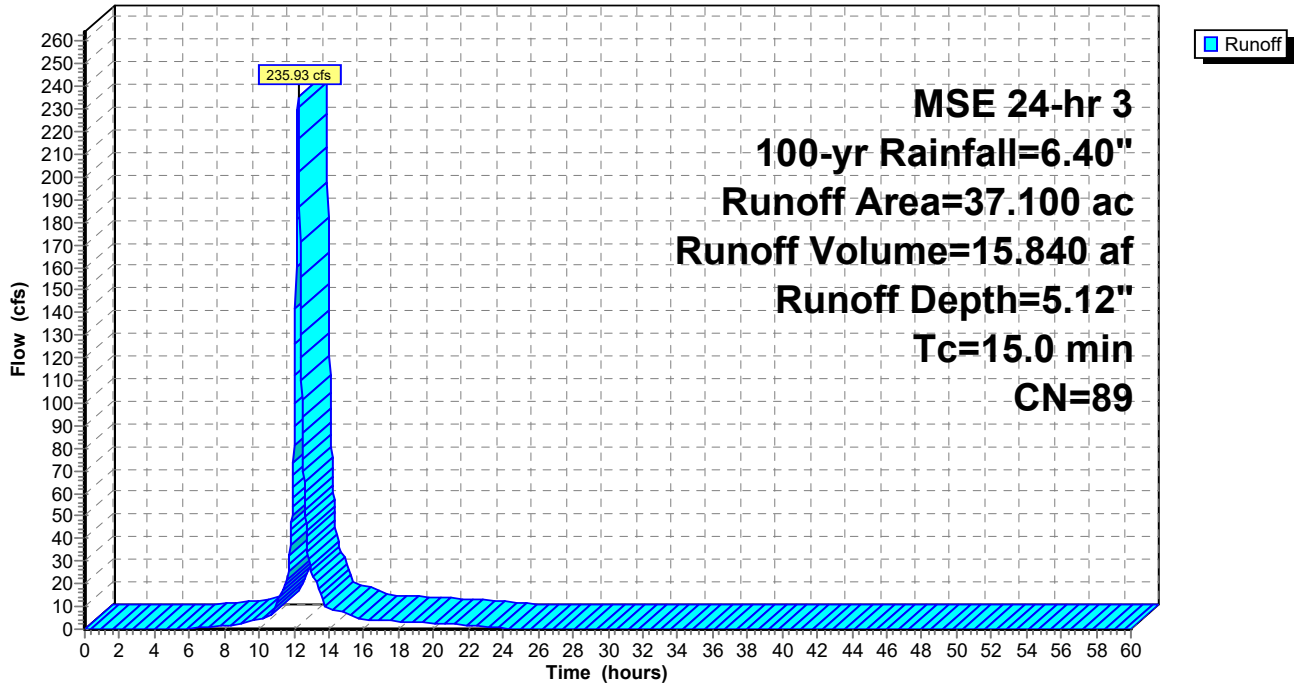
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 100-yr Rainfall=6.40"

Area (ac)	CN	Description
21.500	98	Paved parking, HSG D
15.600	76	Woods/grass comb., Fair, HSG C
37.100	89	Weighted Average
15.600		42.05% Pervious Area
21.500		57.95% Impervious Area

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

Subcatchment 7S: Onsite Area

Hydrograph



Summary for Subcatchment 8S: Onsite Area

Runoff = 46.95 cfs @ 12.23 hrs, Volume= 3.082 af, Depth= 4.68"
 Routed to Pond 8P : Basin 8

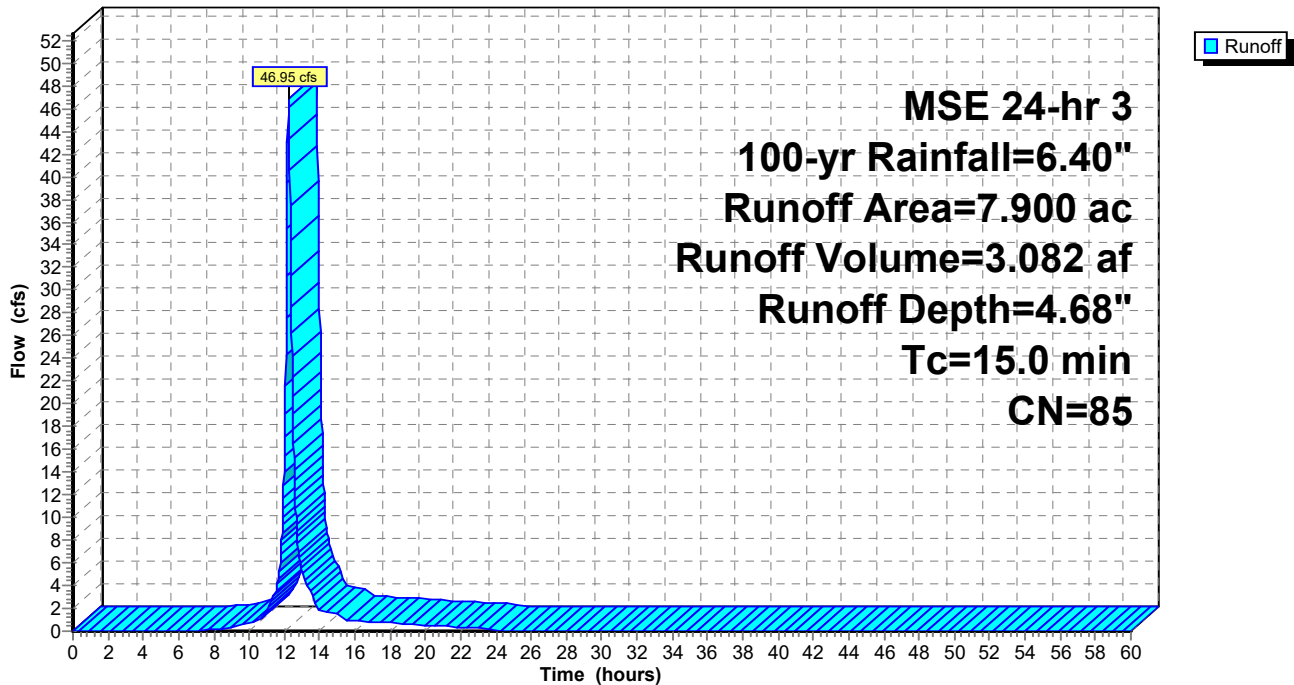
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 100-yr Rainfall=6.40"

Area (ac)	CN	Description
3.300	98	Paved parking, HSG D
4.600	76	Woods/grass comb., Fair, HSG C
7.900	85	Weighted Average
4.600		58.23% Pervious Area
3.300		41.77% Impervious Area

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

Subcatchment 8S: Onsite Area

Hydrograph



Summary for Subcatchment DW1:

Runoff = 50.00 cfs @ 12.14 hrs, Volume= 2.390 af, Depth= 4.04"
 Routed to Pond W1 : Wetland 1

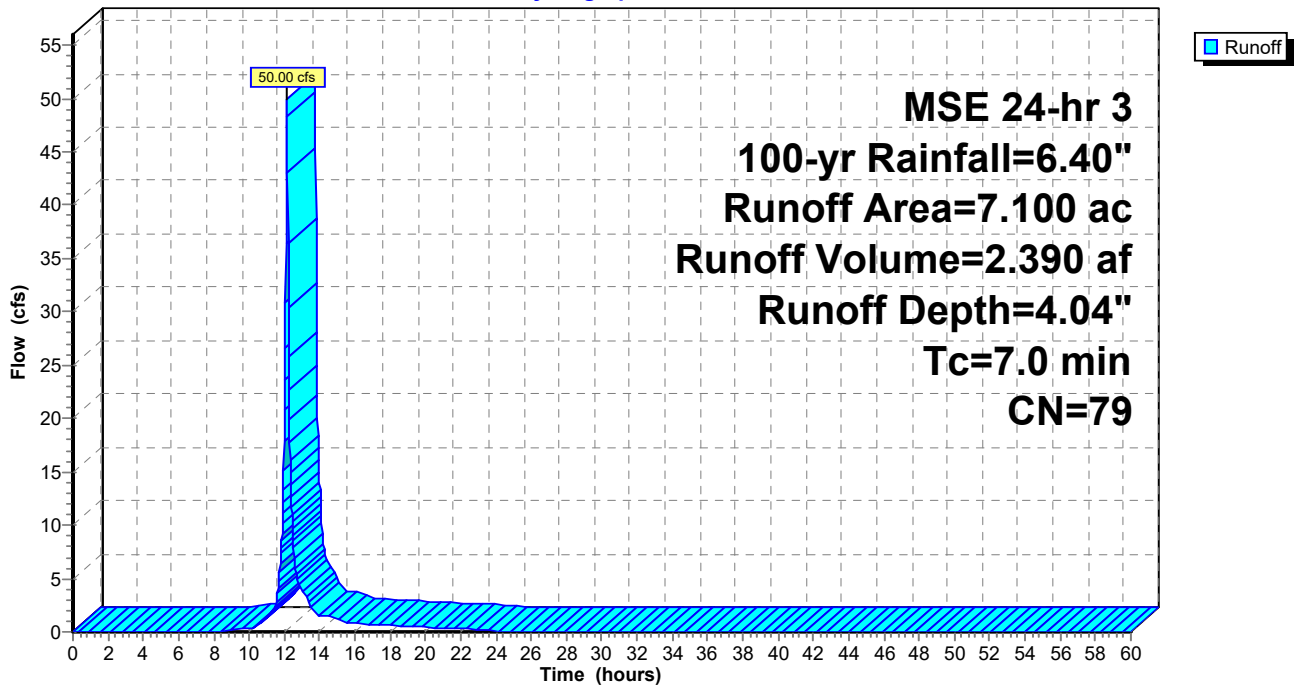
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 100-yr Rainfall=6.40"

Area (ac)	CN	Description
7.100	79	Woods/grass comb., Good, HSG D
7.100		100.00% Pervious Area

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

Subcatchment DW1:

Hydrograph



Summary for Subcatchment DW4:

Runoff = 32.40 cfs @ 12.14 hrs, Volume= 1.548 af, Depth= 4.04"
 Routed to Pond W4 : Wetland 4

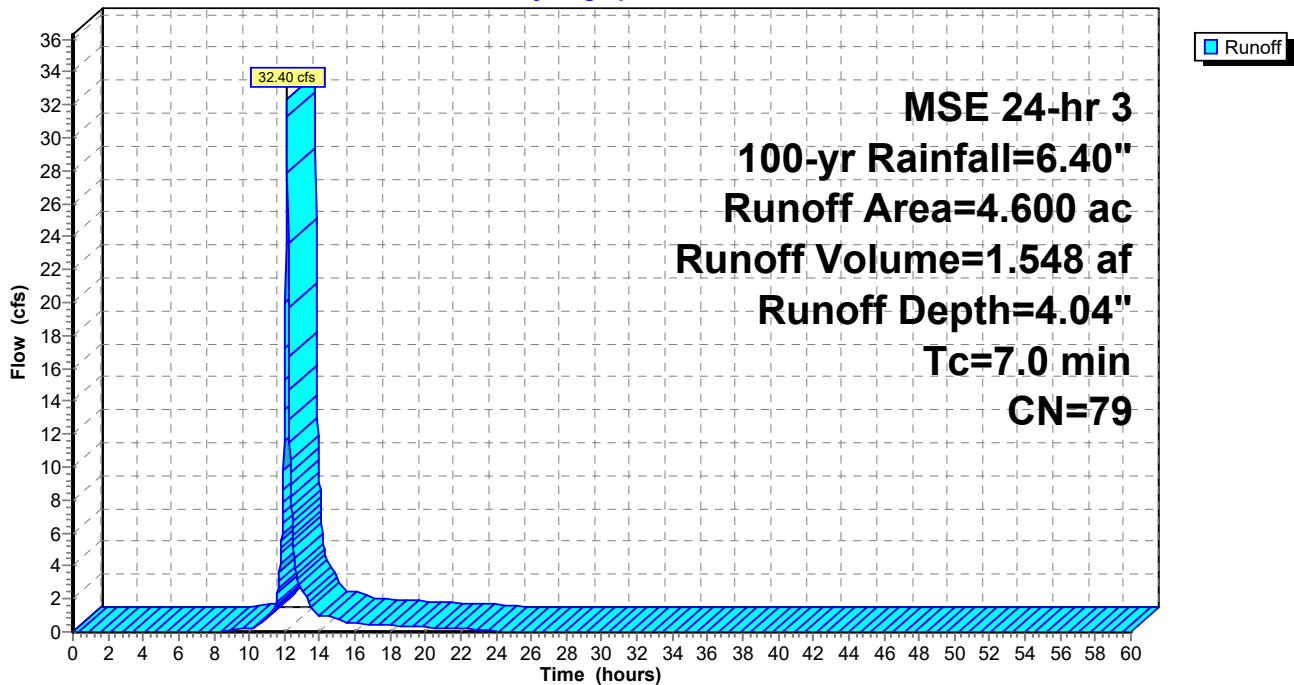
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 100-yr Rainfall=6.40"

Area (ac)	CN	Description
4.600	79	Woods/grass comb., Good, HSG D
4.600		100.00% Pervious Area

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

Subcatchment DW4:

Hydrograph



Summary for Subcatchment DW5:

Runoff = 18.31 cfs @ 12.14 hrs, Volume= 0.875 af, Depth= 4.04"
 Routed to Pond W5 : Wetland 5

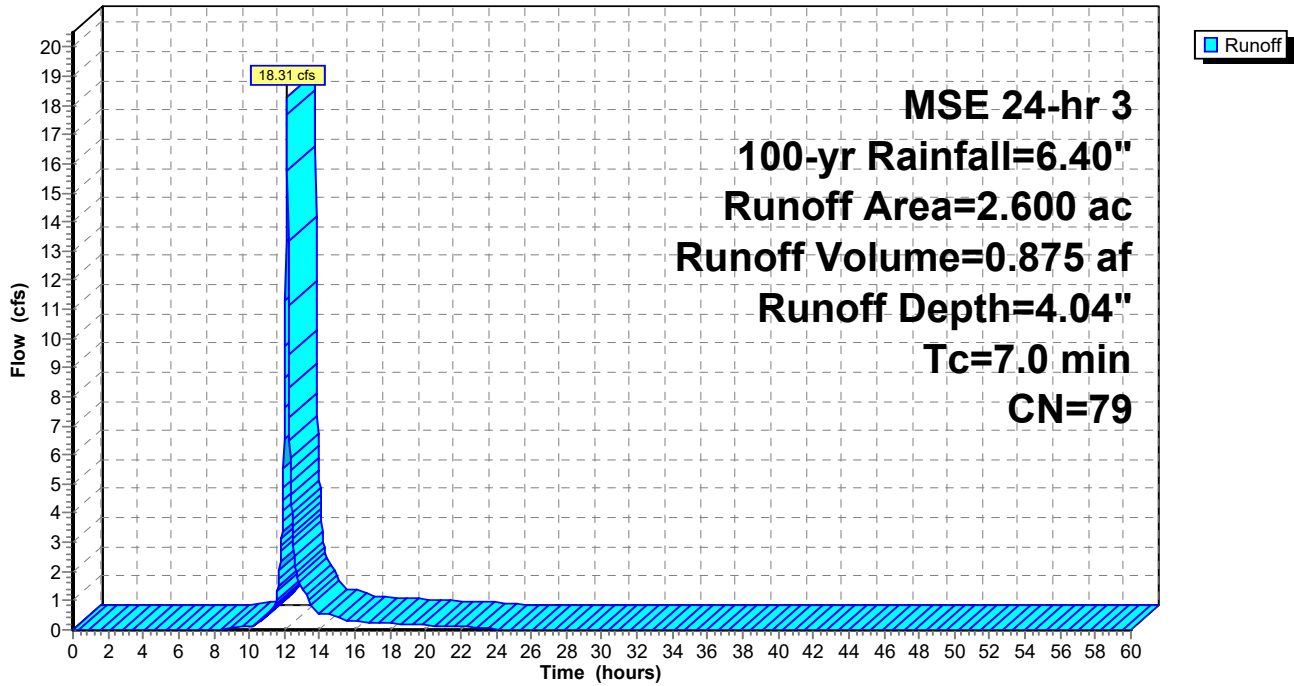
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 100-yr Rainfall=6.40"

Area (ac)	CN	Description
2.600	79	Woods/grass comb., Good, HSG D
2.600		100.00% Pervious Area

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

Subcatchment DW5:

Hydrograph



Summary for Subcatchment DW6:

Runoff = 12.68 cfs @ 12.14 hrs, Volume= 0.606 af, Depth= 4.04"
 Routed to Pond W6 : Wetland 6

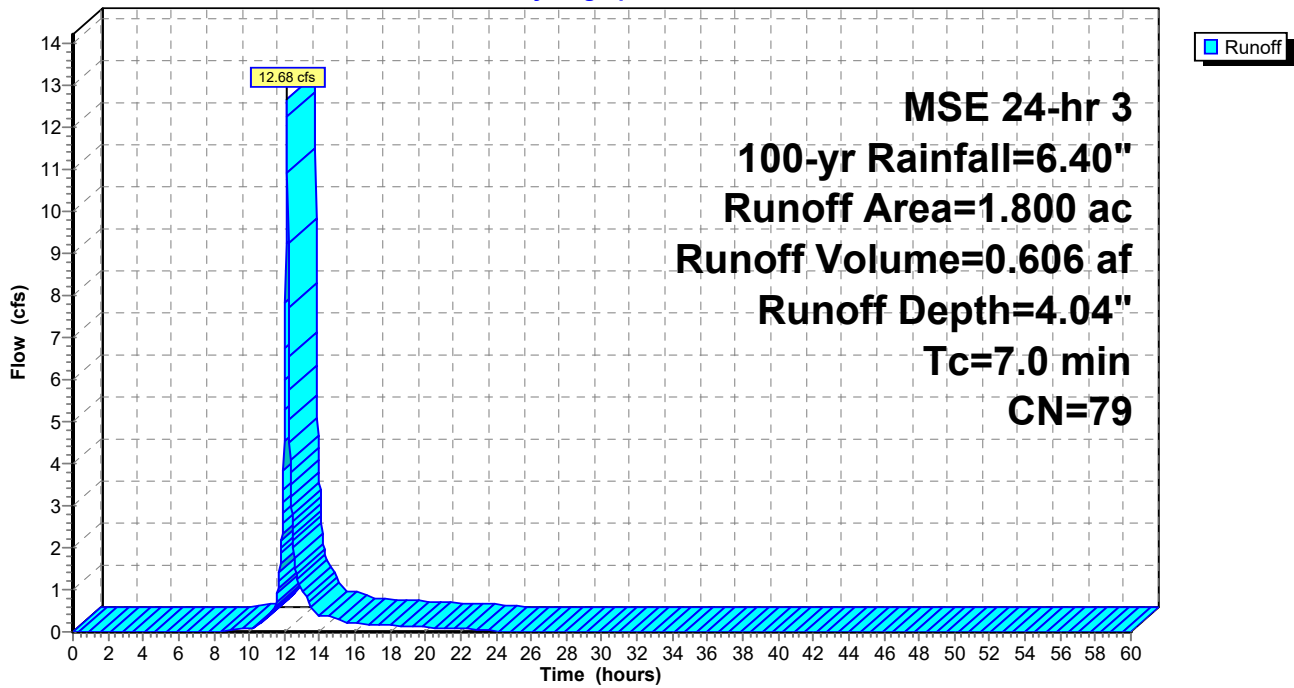
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 100-yr Rainfall=6.40"

Area (ac)	CN	Description
1.800	79	Woods/grass comb., Good, HSG D
1.800		100.00% Pervious Area

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

Subcatchment DW6:

Hydrograph



Summary for Subcatchment DW7:

Runoff = 65.85 cfs @ 12.98 hrs, Volume= 10.804 af, Depth= 4.04"
 Routed to Pond W7 : Wetland 7

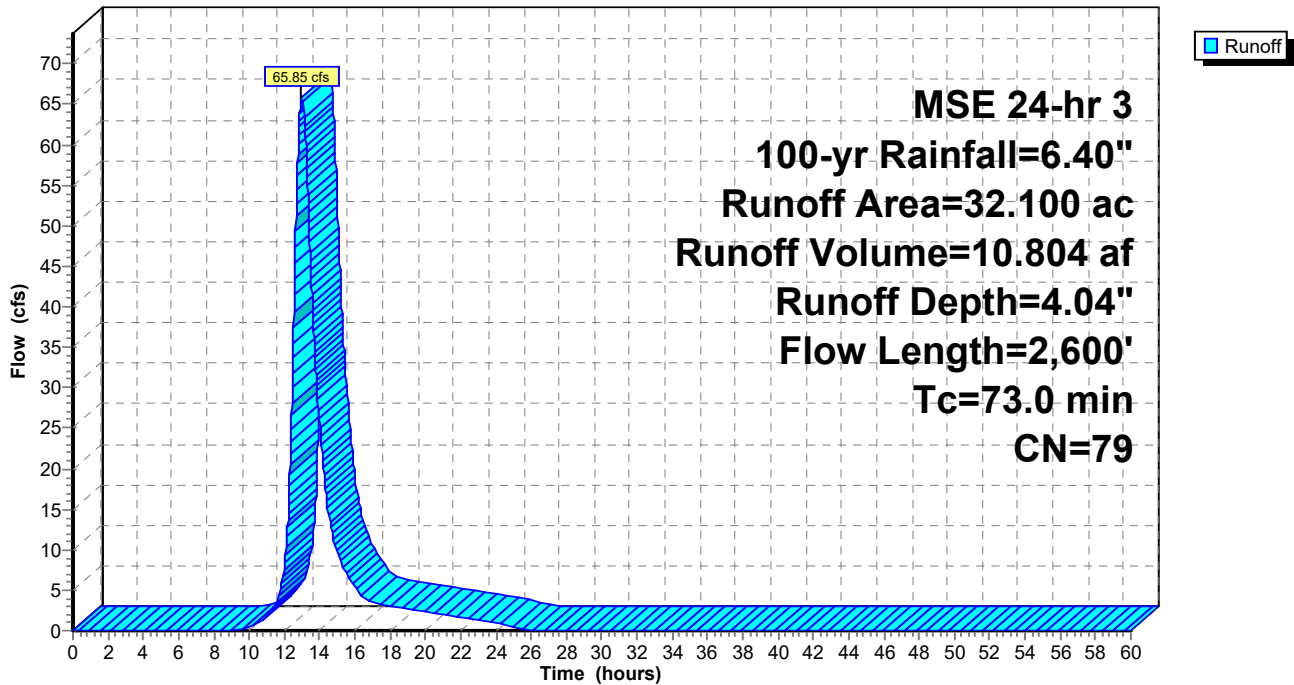
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 MSE 24-hr 3 100-yr Rainfall=6.40"

Area (ac)	CN	Description
32.100	79	Woods/grass comb., Good, HSG D
32.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.2	100	0.0500	0.06		Sheet Flow, Woods: Dense underbrush n= 0.800 P2= 2.70"
27.4	650	0.0250	0.40		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
17.4	1,850	0.0140	1.77		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
73.0	2,600	Total			

Subcatchment DW7:

Hydrograph



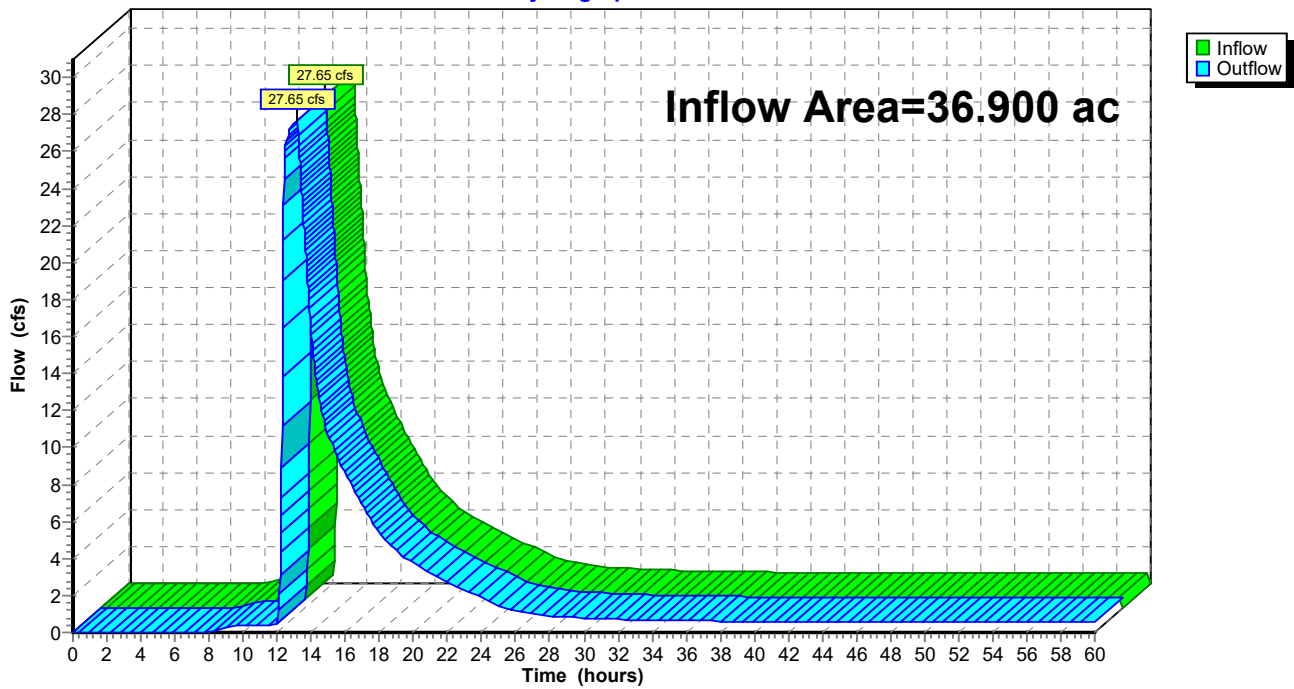
Summary for Reach 1R: Peak Flow Trunk 1

Inflow Area = 36.900 ac, 47.15% Impervious, Inflow Depth > 3.34" for 100-yr event
Inflow = 27.65 cfs @ 13.14 hrs, Volume= 10.263 af
Outflow = 27.65 cfs @ 13.16 hrs, Volume= 10.263 af, Atten= 0%, Lag= 1.2 min
Routed to Pond W7 : Wetland 7

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

Reach 1R: Peak Flow Trunk 1

Hydrograph



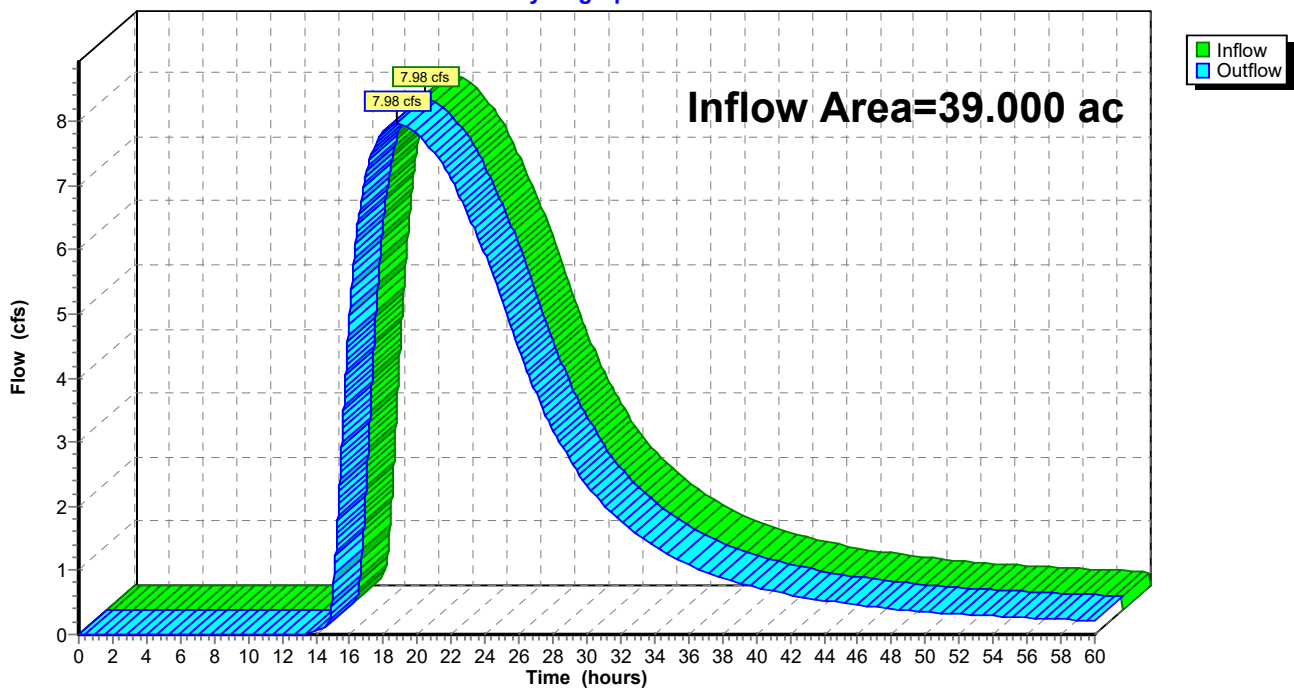
Summary for Reach 2R: Peak Flow Trunk 2

Inflow Area = 39.000 ac, 57.18% Impervious, Inflow Depth > 2.68" for 100-yr event
Inflow = 7.98 cfs @ 18.80 hrs, Volume= 8.707 af
Outflow = 7.98 cfs @ 18.82 hrs, Volume= 8.707 af, Atten= 0%, Lag= 1.2 min
Routed to Pond W7 : Wetland 7

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

Reach 2R: Peak Flow Trunk 2

Hydrograph



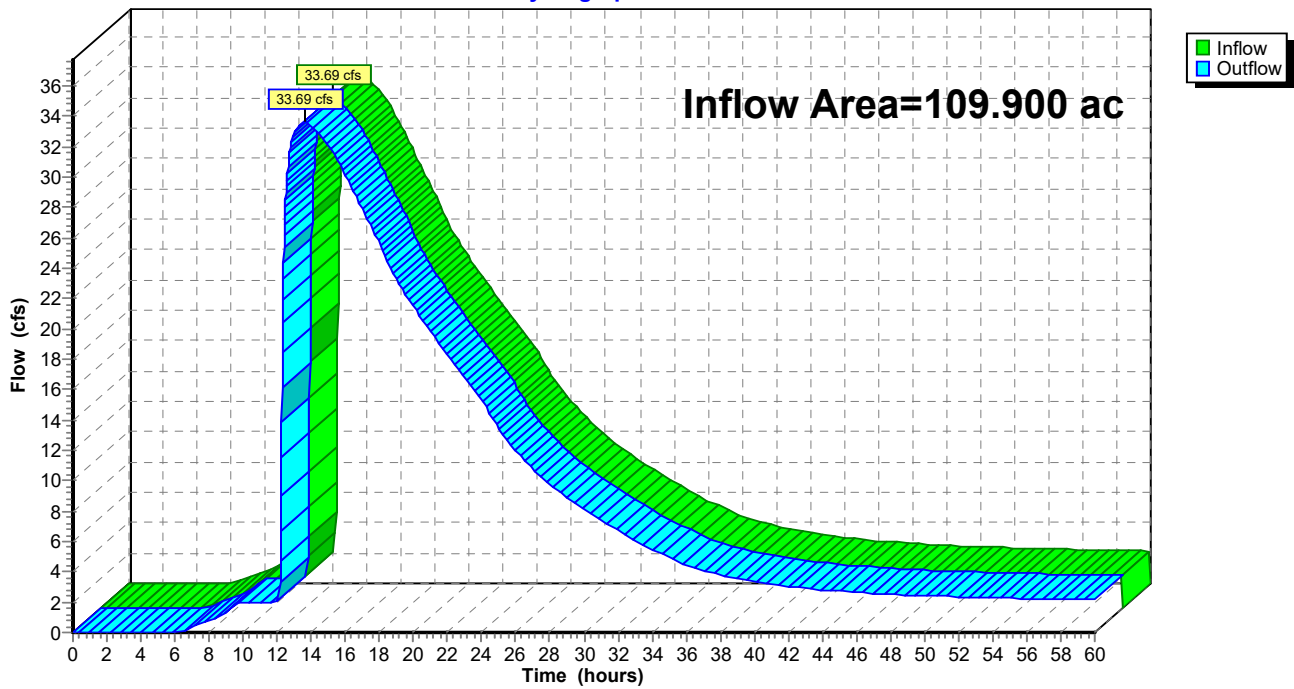
Summary for Reach 3R: Peak Flow Trunk 3

Inflow Area = 109.900 ac, 65.15% Impervious, Inflow Depth > 4.27" for 100-yr event
Inflow = 33.69 cfs @ 13.62 hrs, Volume= 39.085 af
Outflow = 33.69 cfs @ 13.64 hrs, Volume= 39.085 af, Atten= 0%, Lag= 1.2 min
Routed to Pond W7 : Wetland 7

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

Reach 3R: Peak Flow Trunk 3

Hydrograph



Summary for Pond 1P: Basin 1

Inflow Area = 20.700 ac, 42.51% Impervious, Inflow Depth = 4.68" for 100-yr event
 Inflow = 123.01 cfs @ 12.23 hrs, Volume= 8.075 af
 Outflow = 26.43 cfs @ 12.67 hrs, Volume= 7.747 af, Atten= 79%, Lag= 26.5 min
 Primary = 26.43 cfs @ 12.67 hrs, Volume= 7.747 af
 Routed to Reach 1R : Peak Flow Trunk 1

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,298.74' @ 12.67 hrs Surf.Area= 0.803 ac Storage= 4.345 af

Plug-Flow detention time= 389.1 min calculated for 7.745 af (96% of inflow)
 Center-of-Mass det. time= 368.7 min (1,160.0 - 791.3)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,290.00'	9.293 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,290.00	0.500	0.0	0.000	0.000
1,290.01	0.500	40.0	0.002	0.002
1,292.99	0.500	40.0	0.596	0.598
1,293.00	0.500	100.0	0.005	0.603
1,304.00	1.080	100.0	8.690	9.293

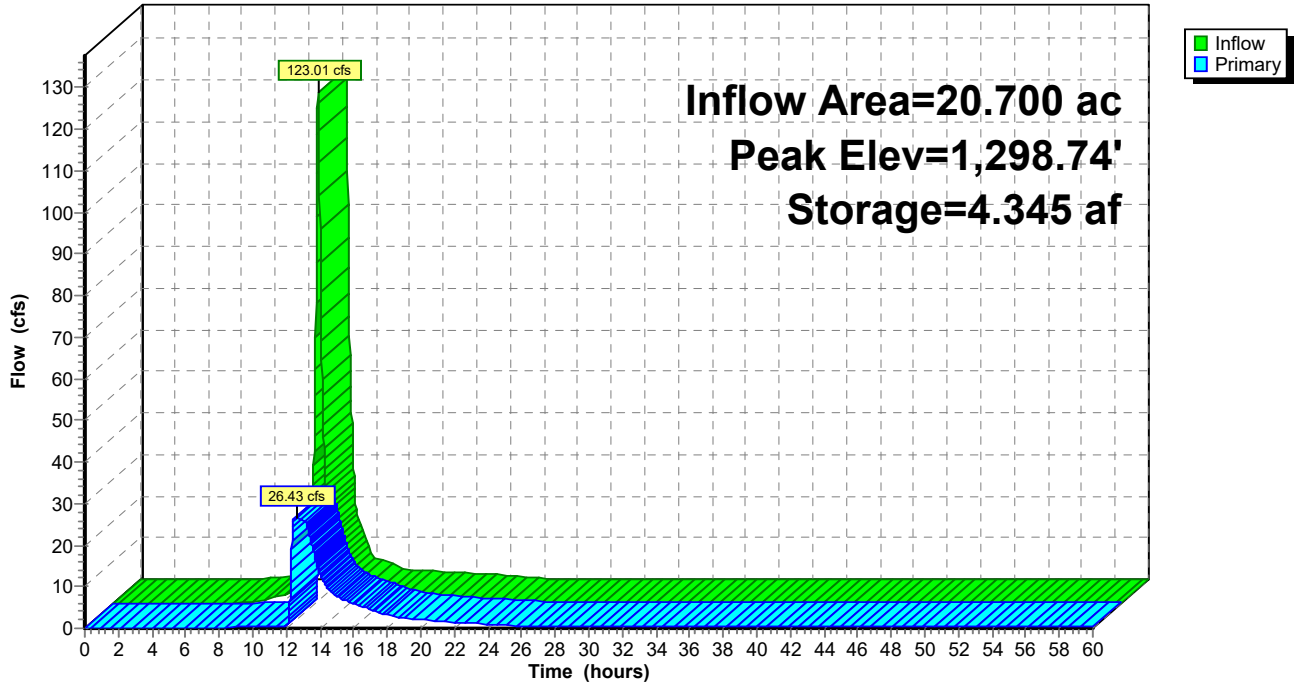
Device	Routing	Invert	Outlet Devices
#1	Primary	1,290.00'	24.0" Round Culvert L= 865.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,290.00' / 1,285.00' S= 0.0058 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Device 1	1,294.60'	15.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,296.30'	24.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Device 1	1,301.00'	6.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#5	Device 1	1,290.00'	0.800 in/hr Exfiltration over Surface area

Primary OutFlow Max=26.43 cfs @ 12.67 hrs HW=1,298.74' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Barrel Controls 26.43 cfs @ 8.41 fps)
- 2=Orifice/Grate (Passes < 11.08 cfs potential flow)
- 3=Orifice/Grate (Passes < 18.18 cfs potential flow)
- 4=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 5=Exfiltration (Passes < 0.65 cfs potential flow)

Pond 1P: Basin 1

Hydrograph



Summary for Pond 2P: Basin 2

Inflow Area = 8.300 ac, 63.86% Impervious, Inflow Depth = 5.24" for 100-yr event
 Inflow = 53.56 cfs @ 12.23 hrs, Volume= 3.622 af
 Outflow = 2.19 cfs @ 13.84 hrs, Volume= 1.541 af, Atten= 96%, Lag= 96.7 min
 Primary = 2.19 cfs @ 13.84 hrs, Volume= 1.541 af
 Routed to Reach 1R : Peak Flow Trunk 1

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,290.31' @ 13.84 hrs Surf.Area= 0.885 ac Storage= 2.795 af

Plug-Flow detention time= 600.1 min calculated for 1.541 af (43% of inflow)
 Center-of-Mass det. time= 511.7 min (1,291.7 - 780.0)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,285.00'	12.674 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,285.00	0.750	0.0	0.000	0.000
1,285.01	0.750	40.0	0.003	0.003
1,287.99	0.750	40.0	0.894	0.897
1,288.00	0.750	100.0	0.007	0.904
1,299.00	1.390	100.0	11.770	12.674

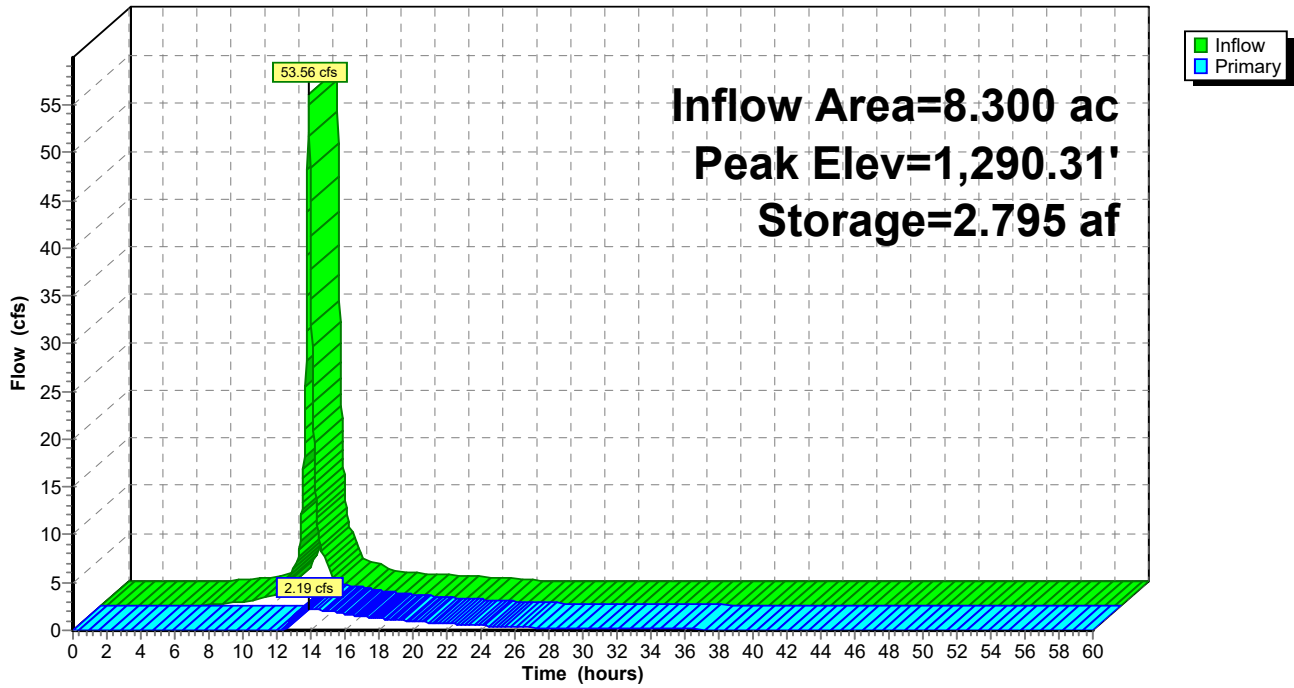
Device	Routing	Invert	Outlet Devices
#1	Primary	1,285.00'	24.0" Round Culvert L= 1,250.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,285.00' / 1,277.00' S= 0.0064 '/ Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Device 1	1,289.60'	15.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,295.00'	6.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 1	1,288.00'	0.800 in/hr Exfiltration over Surface area above 1,288.00' Excluded Surface area = 0.750 ac

Primary OutFlow Max=2.19 cfs @ 13.84 hrs HW=1,290.31' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 2.19 cfs of 22.06 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 2.08 cfs @ 2.88 fps)
- 3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 4=Exfiltration (Exfiltration Controls 0.11 cfs)

Pond 2P: Basin 2

Hydrograph



Summary for Pond 3P: Basin 3

Inflow Area = 39.000 ac, 57.18% Impervious, Inflow Depth = 5.12" for 100-yr event
 Inflow = 248.01 cfs @ 12.23 hrs, Volume= 16.652 af
 Outflow = 15.02 cfs @ 13.62 hrs, Volume= 11.718 af, Atten= 94%, Lag= 83.6 min
 Primary = 15.02 cfs @ 13.62 hrs, Volume= 11.718 af
 Routed to Pond 4P : Basin 4

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,292.33' @ 13.62 hrs Surf.Area= 2.056 ac Storage= 11.784 af

Plug-Flow detention time= 492.5 min calculated for 11.718 af (70% of inflow)
 Center-of-Mass det. time= 424.6 min (1,207.1 - 782.5)

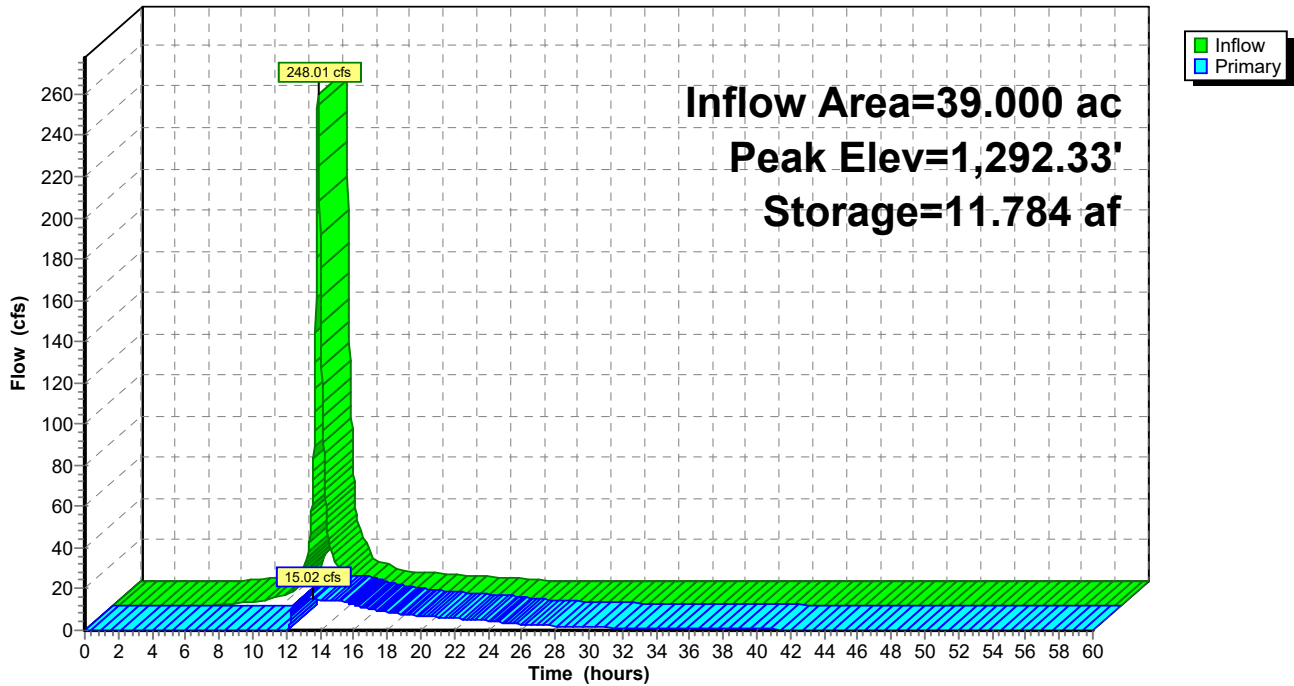
Volume	Invert	Avail.Storage	Storage Description	
#1	1,284.00'	24.736 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,284.00	1.630	0.0	0.000	0.000
1,284.01	1.630	40.0	0.007	0.007
1,286.99	1.630	40.0	1.943	1.949
1,287.00	1.630	100.0	0.016	1.966
1,298.00	2.510	100.0	22.770	24.736

Device	Routing	Invert	Outlet Devices
#1	Primary	1,284.00'	48.0" Round Culvert L= 100.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,284.00' / 1,284.00' S= 0.0000 '/ Cc= 0.900 n= 0.012, Flow Area= 12.57 sf
#2	Device 1	1,288.60'	18.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,287.00'	0.800 in/hr Exfiltration over Surface area above 1,287.00' Excluded Surface area = 1.630 ac

Primary OutFlow Max=15.02 cfs @ 13.62 hrs HW=1,292.33' TW=1,287.39' (Dynamic Tailwater)
 1=Culvert (Passes 15.02 cfs of 134.49 cfs potential flow)
 2=Orifice/Grate (Orifice Controls 14.68 cfs @ 8.31 fps)
 3=Exfiltration (Exfiltration Controls 0.34 cfs)

Pond 3P: Basin 3

Hydrograph



Summary for Pond 4P: Basin 4

Inflow Area = 39.000 ac, 57.18% Impervious, Inflow Depth > 3.61" for 100-yr event
 Inflow = 15.02 cfs @ 13.62 hrs, Volume= 11.718 af
 Outflow = 7.98 cfs @ 18.80 hrs, Volume= 8.708 af, Atten= 47%, Lag= 311.0 min
 Primary = 7.98 cfs @ 18.80 hrs, Volume= 8.708 af
 Routed to Reach 2R : Peak Flow Trunk 2

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,290.18' @ 18.80 hrs Surf.Area= 1.238 ac Storage= 4.712 af

Plug-Flow detention time= 519.2 min calculated for 8.705 af (74% of inflow)
 Center-of-Mass det. time= 301.4 min (1,508.4 - 1,207.1)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,284.00'	16.857 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,284.00	0.980	0.0	0.000	0.000
1,284.01	0.980	40.0	0.004	0.004
1,286.99	0.980	40.0	1.168	1.172
1,287.00	0.980	100.0	0.010	1.182
1,298.00	1.870	100.0	15.675	16.857

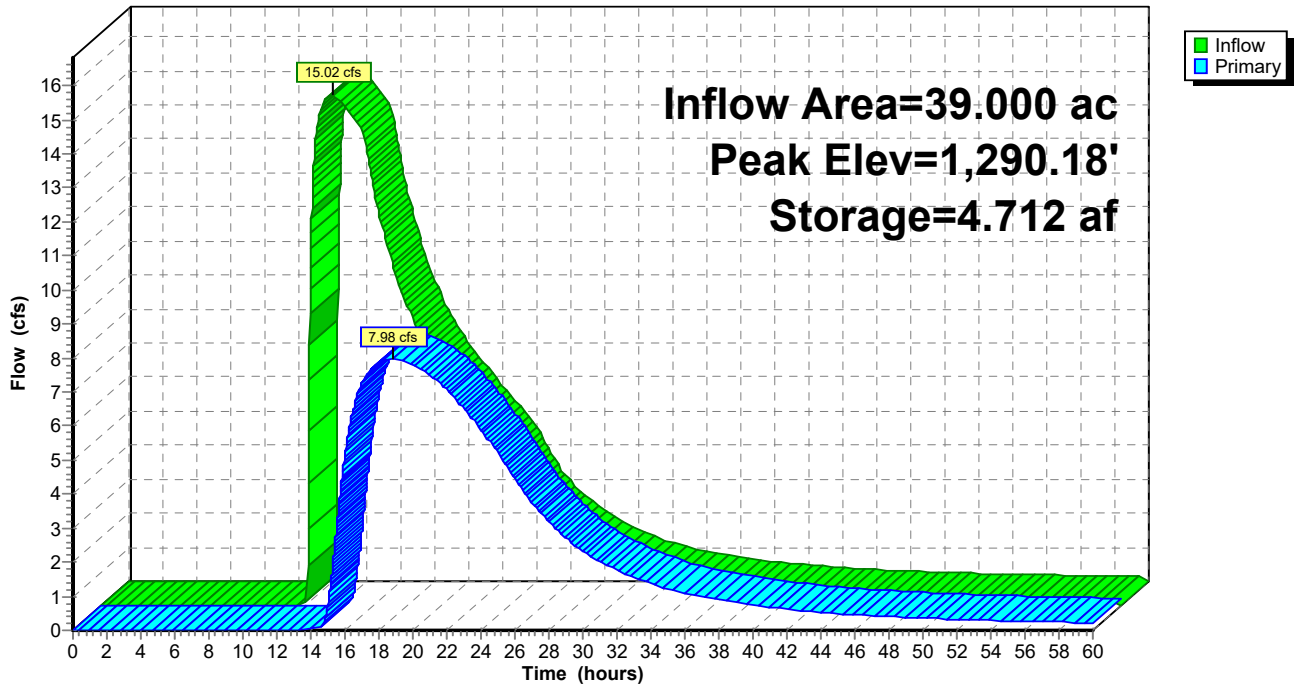
Device	Routing	Invert	Outlet Devices
#1	Primary	1,284.00'	48.0" Round Culvert L= 100.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,284.00' / 1,274.00' S= 0.1000 '/ Cc= 0.900 n= 0.012, Flow Area= 12.57 sf
#2	Device 1	1,288.60'	18.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,293.00'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 1	1,287.00'	0.800 in/hr Exfiltration over Surface area above 1,287.00' Excluded Surface area = 0.980 ac

Primary OutFlow Max=7.98 cfs @ 18.80 hrs HW=1,290.18' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 7.98 cfs of 123.76 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 7.77 cfs @ 4.40 fps)
- 3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 4=Exfiltration (Exfiltration Controls 0.21 cfs)

Pond 4P: Basin 4

Hydrograph



Summary for Pond 5P: Basin 5

Inflow Area = 56.500 ac, 68.14% Impervious, Inflow Depth = 5.35" for 100-yr event
 Inflow = 369.56 cfs @ 12.23 hrs, Volume= 25.186 af
 Outflow = 12.18 cfs @ 14.78 hrs, Volume= 18.030 af, Atten= 97%, Lag= 153.0 min
 Primary = 12.18 cfs @ 14.78 hrs, Volume= 18.030 af
 Routed to Reach 3R : Peak Flow Trunk 3

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,292.15' @ 14.78 hrs Surf.Area= 2.969 ac Storage= 19.263 af

Plug-Flow detention time= 701.3 min calculated for 18.030 af (72% of inflow)
 Center-of-Mass det. time= 634.7 min (1,412.1 - 777.4)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,283.00'	38.318 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,283.00	2.370	0.0	0.000	0.000
1,283.01	2.370	40.0	0.009	0.009
1,285.99	2.370	40.0	2.825	2.835
1,286.00	2.370	100.0	0.024	2.858
1,298.00	3.540	100.0	35.460	38.318

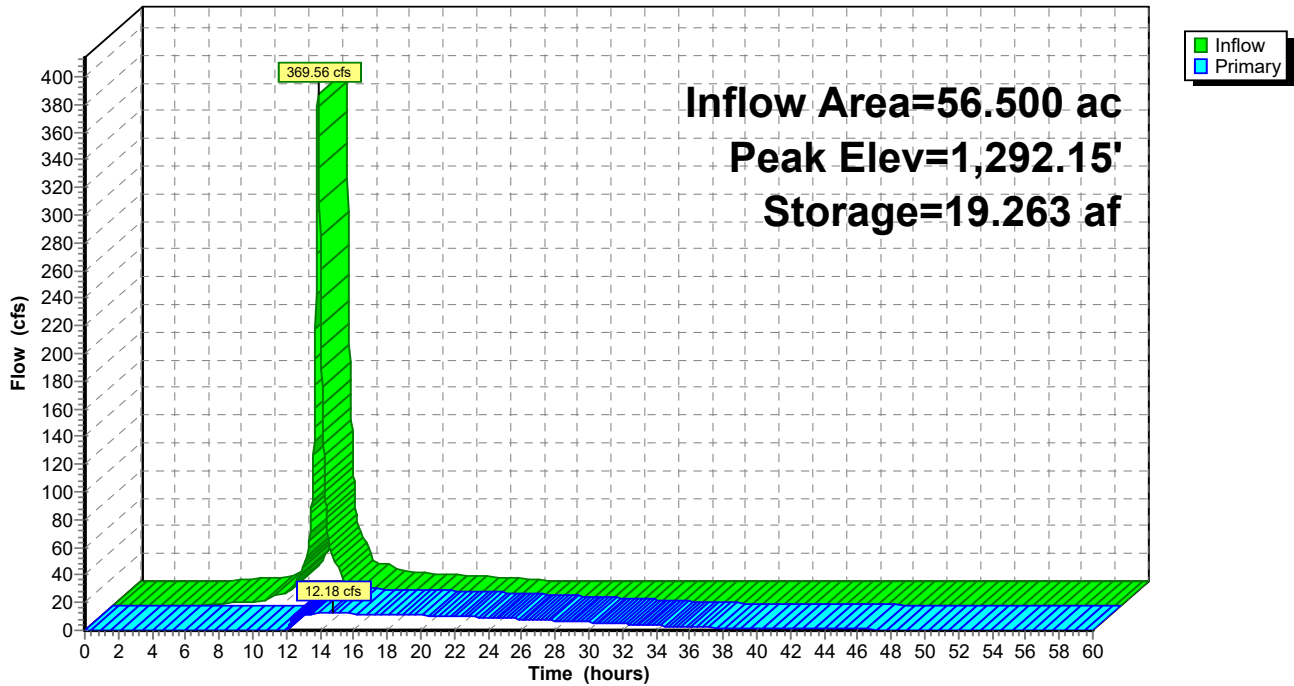
Device	Routing	Invert	Outlet Devices
#1	Primary	1,283.00'	48.0" Round Culvert L= 1,050.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,283.00' / 1,278.00' S= 0.0048 '/' Cc= 0.900 n= 0.012, Flow Area= 12.57 sf
#2	Device 1	1,287.60'	15.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,286.00'	0.800 in/hr Exfiltration over Surface area above 1,286.00' Excluded Surface area = 2.370 ac

Primary OutFlow Max=12.18 cfs @ 14.78 hrs HW=1,292.15' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 12.18 cfs of 131.95 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 11.70 cfs @ 9.53 fps)
- 3=Exfiltration (Exfiltration Controls 0.48 cfs)

Pond 5P: Basin 5

Hydrograph



Summary for Pond 6P: Basin 6

Inflow Area = 16.300 ac, 71.17% Impervious, Inflow Depth = 5.46" for 100-yr event
 Inflow = 107.96 cfs @ 12.23 hrs, Volume= 7.421 af
 Outflow = 10.73 cfs @ 13.09 hrs, Volume= 7.004 af, Atten= 90%, Lag= 51.6 min
 Primary = 10.73 cfs @ 13.09 hrs, Volume= 7.004 af
 Routed to Reach 3R : Peak Flow Trunk 3

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,286.09' @ 13.09 hrs Surf.Area= 0.904 ac Storage= 4.700 af

Plug-Flow detention time= 554.7 min calculated for 7.004 af (94% of inflow)
 Center-of-Mass det. time= 527.1 min (1,301.7 - 774.6)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,278.00'	10.947 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,278.00	0.640	0.0	0.000	0.000
1,278.01	0.640	40.0	0.003	0.003
1,280.99	0.640	40.0	0.763	0.765
1,281.00	0.640	100.0	0.006	0.772
1,292.00	1.210	100.0	10.175	10.947

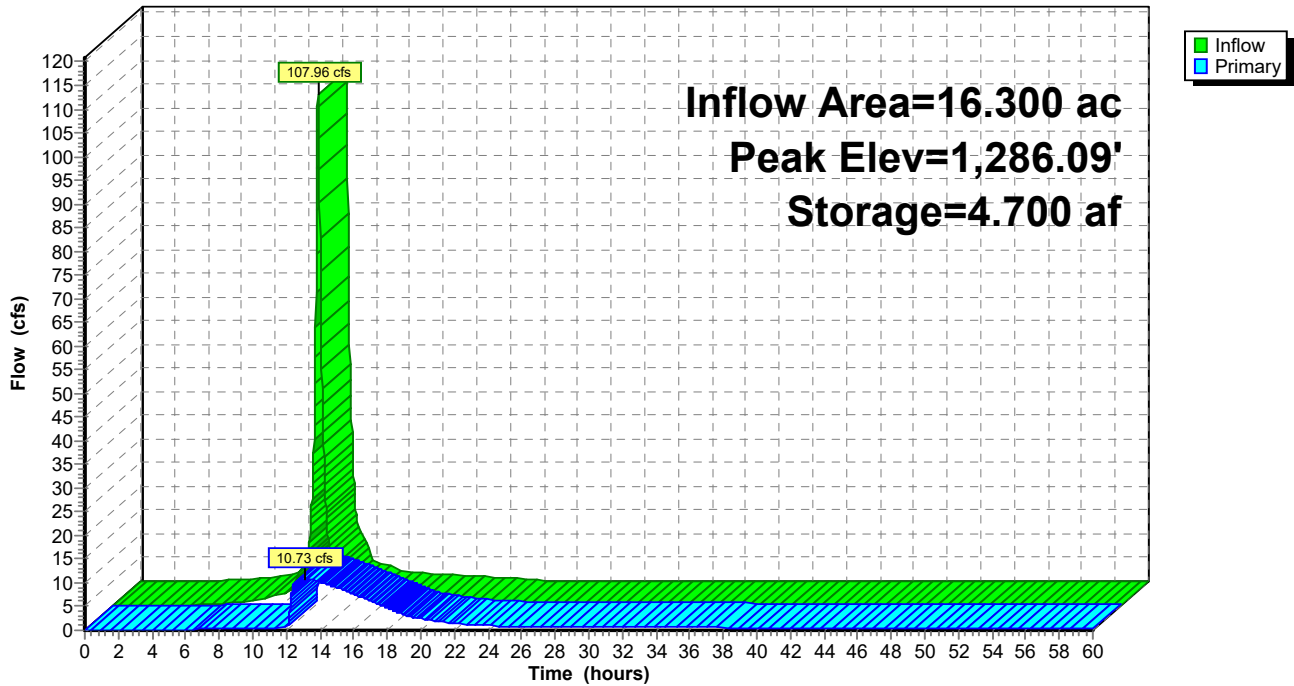
Device	Routing	Invert	Outlet Devices
#1	Primary	1,278.00'	48.0" Round Culvert L= 910.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,278.00' / 1,271.00' S= 0.0077 '/ Cc= 0.900 n= 0.012, Flow Area= 12.57 sf
#2	Primary	1,282.60'	15.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,289.00'	6.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 1	1,278.00'	0.800 in/hr Exfiltration over Surface area

Primary OutFlow Max=10.73 cfs @ 13.09 hrs HW=1,286.09' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 0.73 cfs of 145.38 cfs potential flow)
- 3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 4=Exfiltration (Exfiltration Controls 0.73 cfs)
- 2=Orifice/Grate (Orifice Controls 10.00 cfs @ 8.15 fps)

Pond 6P: Basin 6

Hydrograph



Summary for Pond 7P: Basin 7

Inflow Area = 37.100 ac, 57.95% Impervious, Inflow Depth = 5.12" for 100-yr event
 Inflow = 235.93 cfs @ 12.23 hrs, Volume= 15.840 af
 Outflow = 11.07 cfs @ 13.75 hrs, Volume= 14.054 af, Atten= 95%, Lag= 91.1 min
 Primary = 11.07 cfs @ 13.75 hrs, Volume= 14.054 af
 Routed to Reach 3R : Peak Flow Trunk 3

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,278.76' @ 13.75 hrs Surf.Area= 2.057 ac Storage= 11.179 af

Plug-Flow detention time= 776.7 min calculated for 14.049 af (89% of inflow)
 Center-of-Mass det. time= 732.6 min (1,515.1 - 782.5)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,271.00'	25.265 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,271.00	1.750	0.0	0.000	0.000
1,271.01	1.750	40.0	0.007	0.007
1,273.99	1.750	40.0	2.086	2.093
1,274.00	1.750	100.0	0.017	2.110
1,285.00	2.460	100.0	23.155	25.265

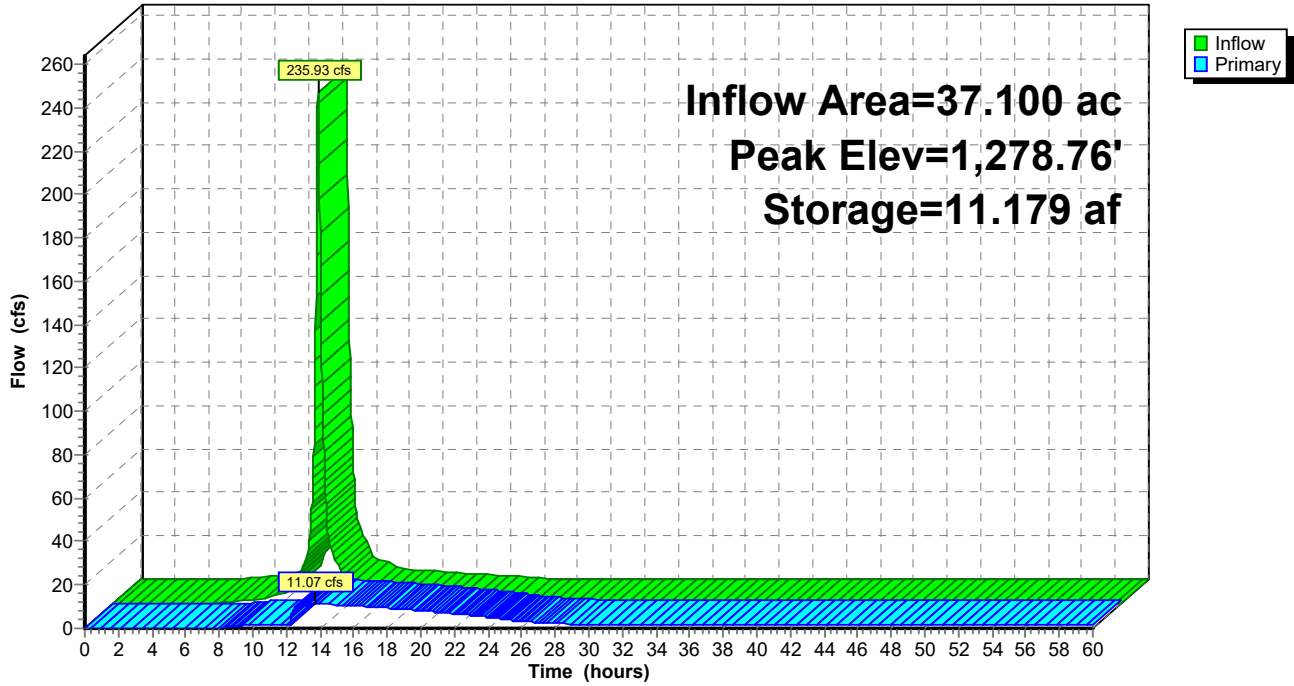
Device	Routing	Invert	Outlet Devices
#1	Primary	1,271.00'	48.0" Round Culvert L= 150.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,271.00' / 1,270.00' S= 0.0067 '/' Cc= 0.900 n= 0.012, Flow Area= 12.57 sf
#2	Device 1	1,275.60'	15.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,284.50'	6.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 1	1,271.00'	0.800 in/hr Exfiltration over Surface area

Primary OutFlow Max=11.07 cfs @ 13.75 hrs HW=1,278.76' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 11.07 cfs of 145.26 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 9.41 cfs @ 7.67 fps)
- 3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 4=Exfiltration (Exfiltration Controls 1.66 cfs)

Pond 7P: Basin 7

Hydrograph



Summary for Pond 8P: Basin 8

Inflow Area = 7.900 ac, 41.77% Impervious, Inflow Depth = 4.68" for 100-yr event
 Inflow = 46.95 cfs @ 12.23 hrs, Volume= 3.082 af
 Outflow = 0.90 cfs @ 16.02 hrs, Volume= 0.975 af, Atten= 98%, Lag= 227.5 min
 Primary = 0.90 cfs @ 16.02 hrs, Volume= 0.975 af
 Routed to Reach 1R : Peak Flow Trunk 1

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,282.02' @ 16.02 hrs Surf.Area= 0.878 ac Storage= 2.572 af

Plug-Flow detention time= 792.5 min calculated for 0.974 af (32% of inflow)
 Center-of-Mass det. time= 697.2 min (1,488.5 - 791.3)

Volume	Invert	Avail.Storage	Storage Description	
#1	1,277.00'	12.797 af	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,277.00	0.760	0.0	0.000	0.000
1,277.01	0.760	40.0	0.003	0.003
1,279.99	0.760	40.0	0.906	0.909
1,280.00	0.760	100.0	0.008	0.917
1,291.00	1.400	100.0	11.880	12.797

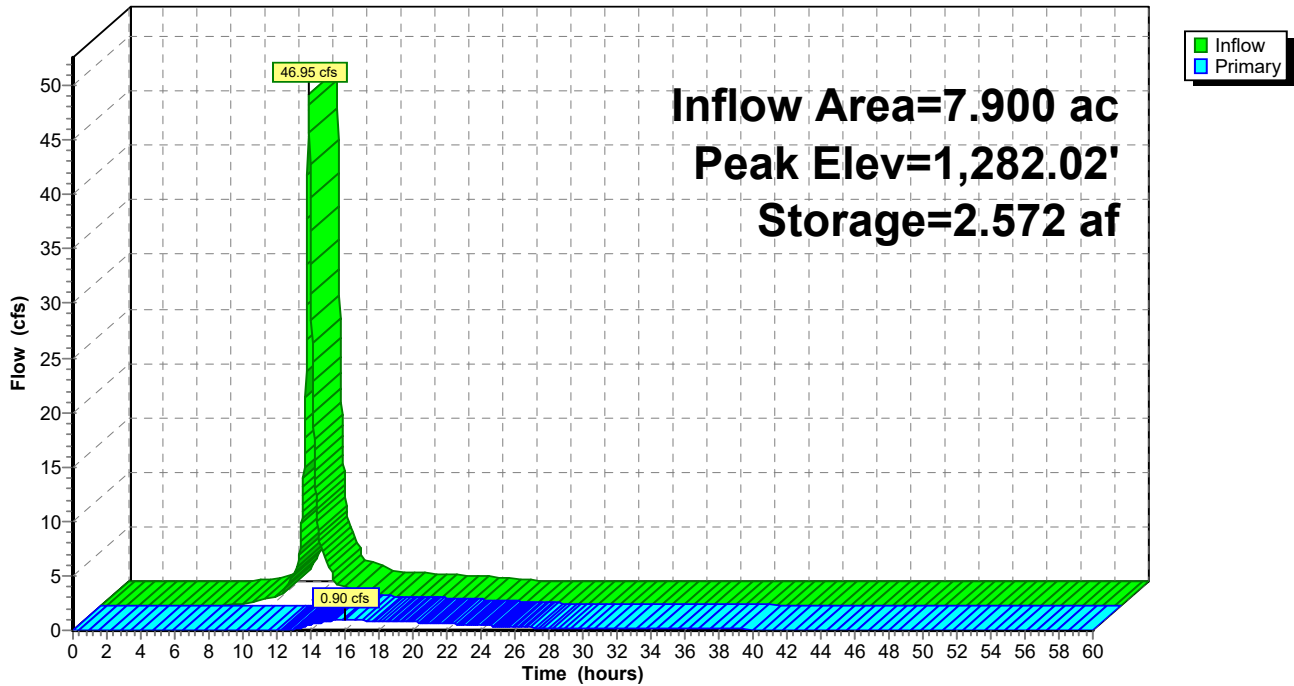
Device	Routing	Invert	Outlet Devices
#1	Primary	1,277.00'	36.0" Round Culvert L= 200.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,277.00' / 1,276.00' S= 0.0050 '/ Cc= 0.900 n= 0.012, Flow Area= 7.07 sf
#2	Device 1	1,281.60'	15.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,289.00'	6.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 1	1,280.00'	0.800 in/hr Exfiltration over Surface area above 1,280.00' Excluded Surface area = 0.760 ac

Primary OutFlow Max=0.90 cfs @ 16.02 hrs HW=1,282.02' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 0.90 cfs of 59.61 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 0.81 cfs @ 2.21 fps)
- 3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 4=Exfiltration (Exfiltration Controls 0.09 cfs)

Pond 8P: Basin 8

Hydrograph



Summary for Pond W1: Wetland 1

Inflow Area = 7.100 ac, 0.00% Impervious, Inflow Depth = 4.04" for 100-yr event
 Inflow = 50.00 cfs @ 12.14 hrs, Volume= 2.390 af
 Outflow = 12.84 cfs @ 12.39 hrs, Volume= 2.390 af, Atten= 74%, Lag= 14.7 min
 Primary = 12.84 cfs @ 12.39 hrs, Volume= 2.390 af
 Routed to Link 20L : Discharge Point #1

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,273.49' @ 12.39 hrs Surf.Area= 2.500 ac Storage= 0.724 af

Plug-Flow detention time= 21.4 min calculated for 2.389 af (100% of inflow)
 Center-of-Mass det. time= 21.4 min (816.4 - 795.0)

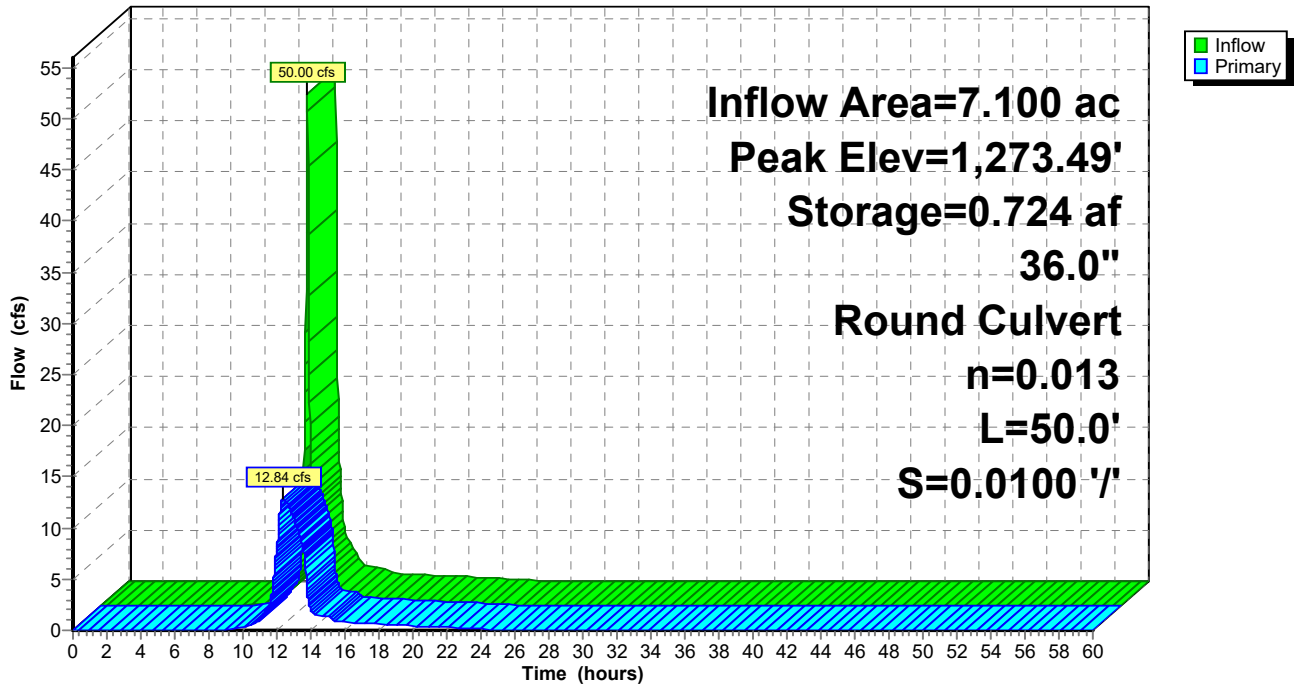
Volume	Invert	Avail.Storage	Storage Description
#1	1,272.00'	2.603 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,272.00	0.005	0.000	0.000
1,273.00	0.140	0.072	0.072
1,274.00	4.921	2.531	2.603

Device	Routing	Invert	Outlet Devices
#1	Primary	1,272.00'	36.0" Round Culvert L= 50.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,272.00' / 1,271.50' S= 0.0100 '/ Cc= 0.900 n= 0.013, Flow Area= 7.07 sf

Primary OutFlow Max=12.84 cfs @ 12.39 hrs HW=1,273.49' TW=0.00' (Dynamic Tailwater)
 ↑**1=Culvert** (Barrel Controls 12.84 cfs @ 5.33 fps)

Pond W1: Wetland 1

Hydrograph



Summary for Pond W4: Wetland 4

Inflow Area = 7.200 ac, 0.00% Impervious, Inflow Depth = 2.58" for 100-yr event
 Inflow = 32.40 cfs @ 12.14 hrs, Volume= 1.548 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

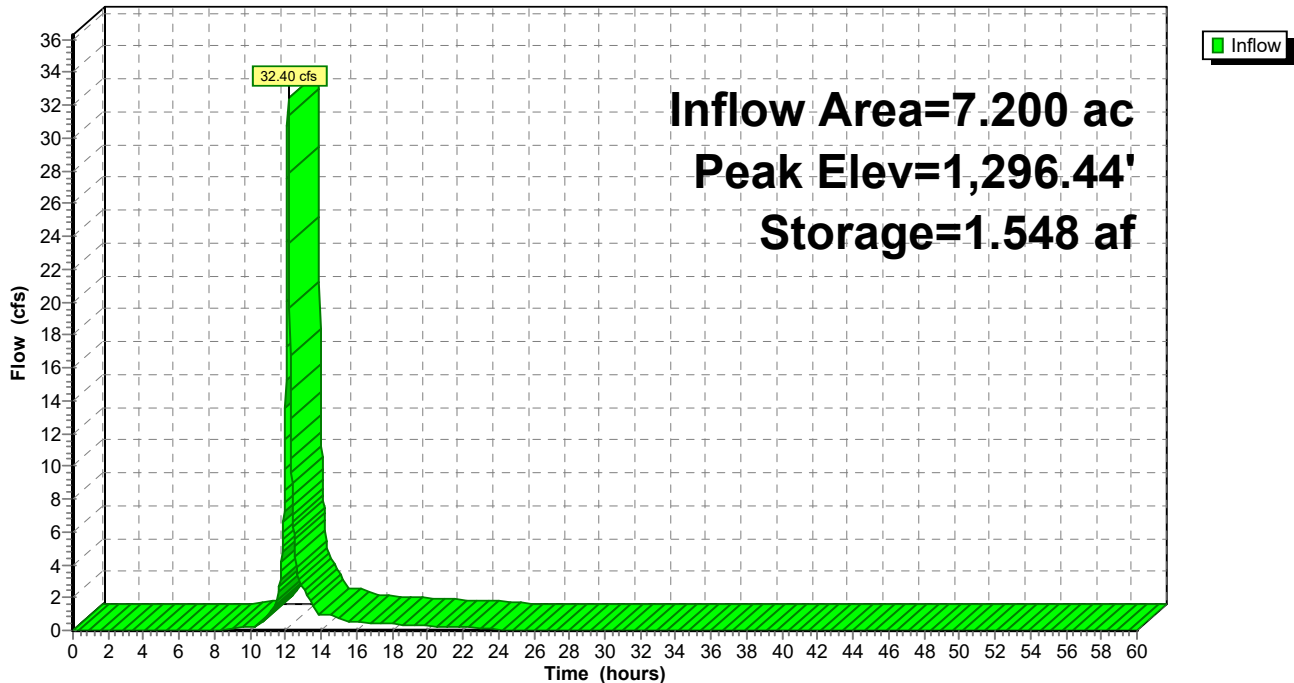
Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,296.44' @ 24.42 hrs Surf.Area= 3.686 ac Storage= 1.548 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	1,296.00'	3.729 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,296.00	3.384	0.000	0.000
1,297.00	4.073	3.729	3.729

Pond W4: Wetland 4

Hydrograph



Summary for Pond W5: Wetland 5

Inflow Area = 2.600 ac, 0.00% Impervious, Inflow Depth = 4.04" for 100-yr event
 Inflow = 18.31 cfs @ 12.14 hrs, Volume= 0.875 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Pond W4 : Wetland 4

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,299.52' @ 24.42 hrs Surf.Area= 1.745 ac Storage= 0.875 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	1,299.00'	3.760 af	Custom Stage Data (Prismatic) Listed below (Recalc)

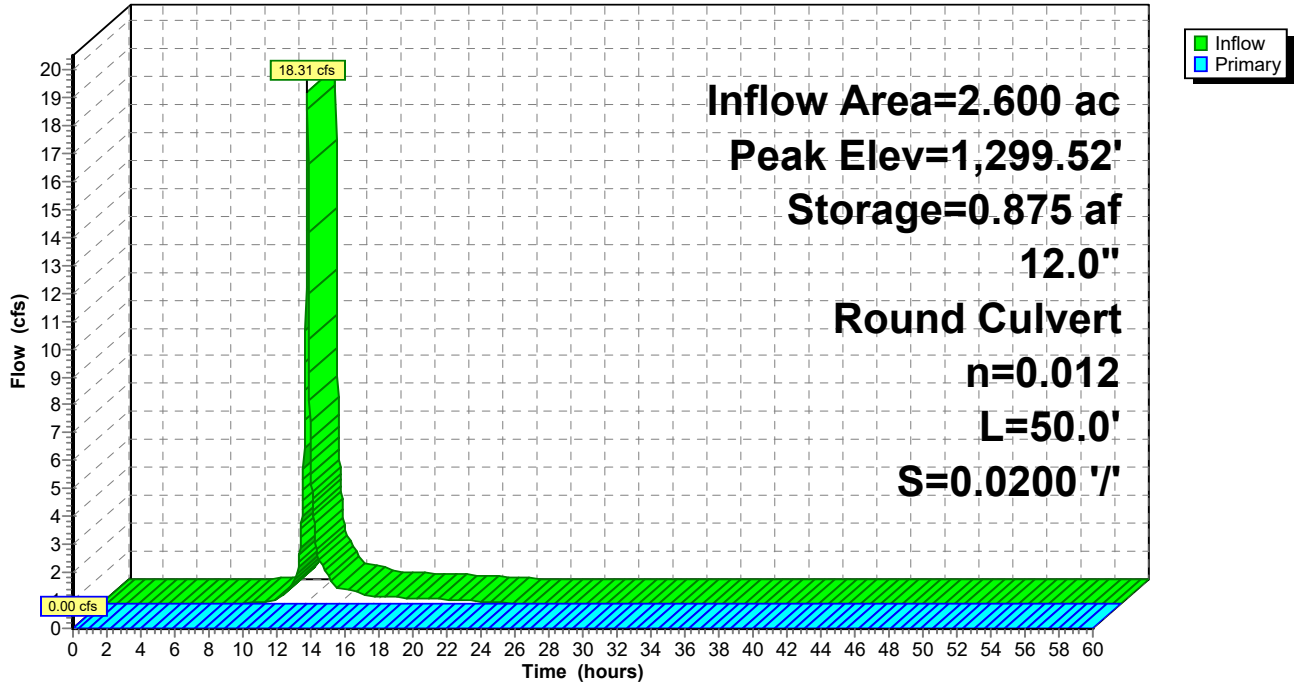
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,299.00	1.597	0.000	0.000
1,301.00	2.163	3.760	3.760

Device	Routing	Invert	Outlet Devices
#1	Primary	1,300.00'	12.0" Round Culvert L= 50.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,300.00' / 1,299.00' S= 0.0200 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,299.00' TW=1,296.00' (Dynamic Tailwater)
 ↑1=Culvert (Controls 0.00 cfs)

Pond W5: Wetland 5

Hydrograph



Summary for Pond W6: Wetland 6

Inflow Area = 9.000 ac, 0.00% Impervious, Inflow Depth = 0.81" for 100-yr event
 Inflow = 12.68 cfs @ 12.14 hrs, Volume= 0.606 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

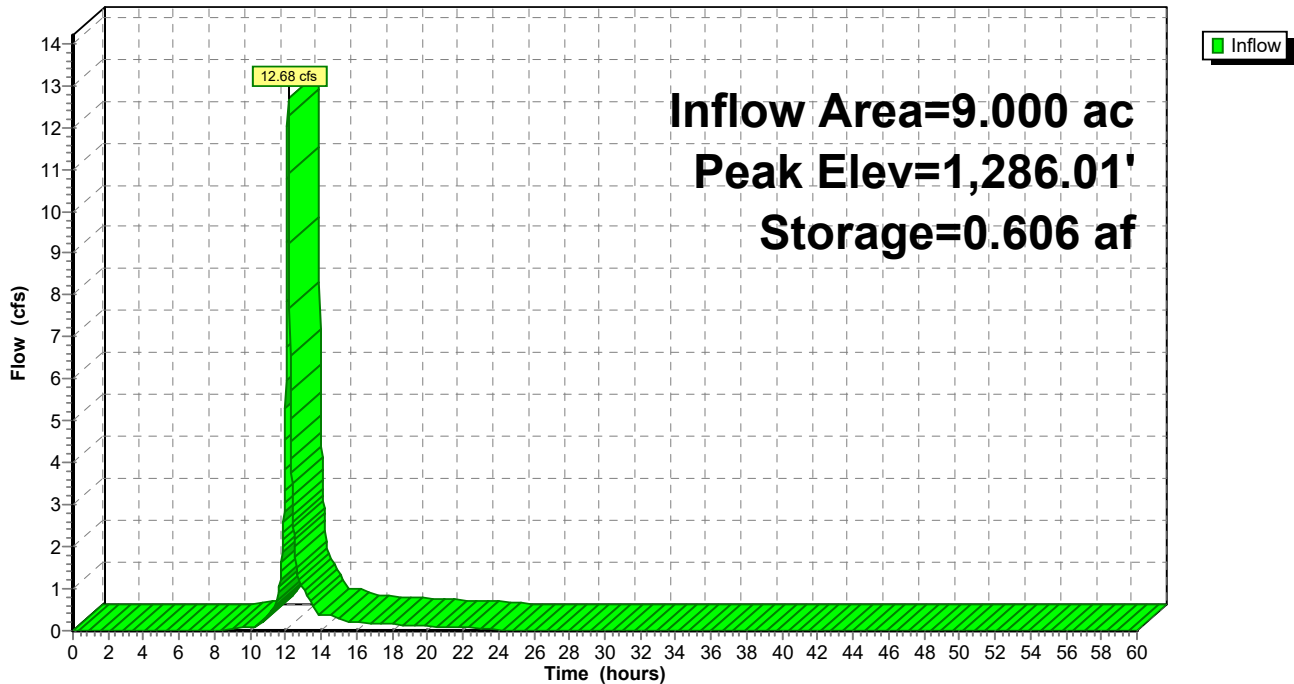
Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,286.01' @ 24.42 hrs Surf.Area= 0.699 ac Storage= 0.606 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	1,285.00'	1.338 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,285.00	0.497	0.000	0.000
1,286.00	0.698	0.598	0.598
1,287.00	0.784	0.741	1.338

Pond W6: Wetland 6

Hydrograph



Summary for Pond W7: Wetland 7

Inflow Area = 226.900 ac, 49.05% Impervious, Inflow Depth > 3.64" for 100-yr event
 Inflow = 126.24 cfs @ 12.99 hrs, Volume= 68.854 af
 Outflow = 75.73 cfs @ 13.99 hrs, Volume= 68.847 af, Atten= 40%, Lag= 60.1 min
 Primary = 75.73 cfs @ 13.99 hrs, Volume= 68.847 af
 Routed to Link 11L : Discharge Point #2

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs
 Peak Elev= 1,262.45' @ 13.99 hrs Surf.Area= 3.031 ac Storage= 5.418 af

Plug-Flow detention time= 17.9 min calculated for 68.847 af (100% of inflow)
 Center-of-Mass det. time= 17.7 min (1,335.3 - 1,317.6)

Volume	Invert	Avail.Storage	Storage Description
#1	1,256.00'	18.795 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,256.00	0.005	0.000	0.000
1,257.00	0.050	0.027	0.027
1,258.00	0.200	0.125	0.152
1,259.00	0.497	0.348	0.500
1,260.00	0.864	0.680	1.180
1,261.00	1.362	1.113	2.293
1,262.00	2.424	1.893	4.186
1,263.00	3.770	3.097	7.283
1,264.00	5.818	4.794	12.077
1,265.00	7.617	6.717	18.795

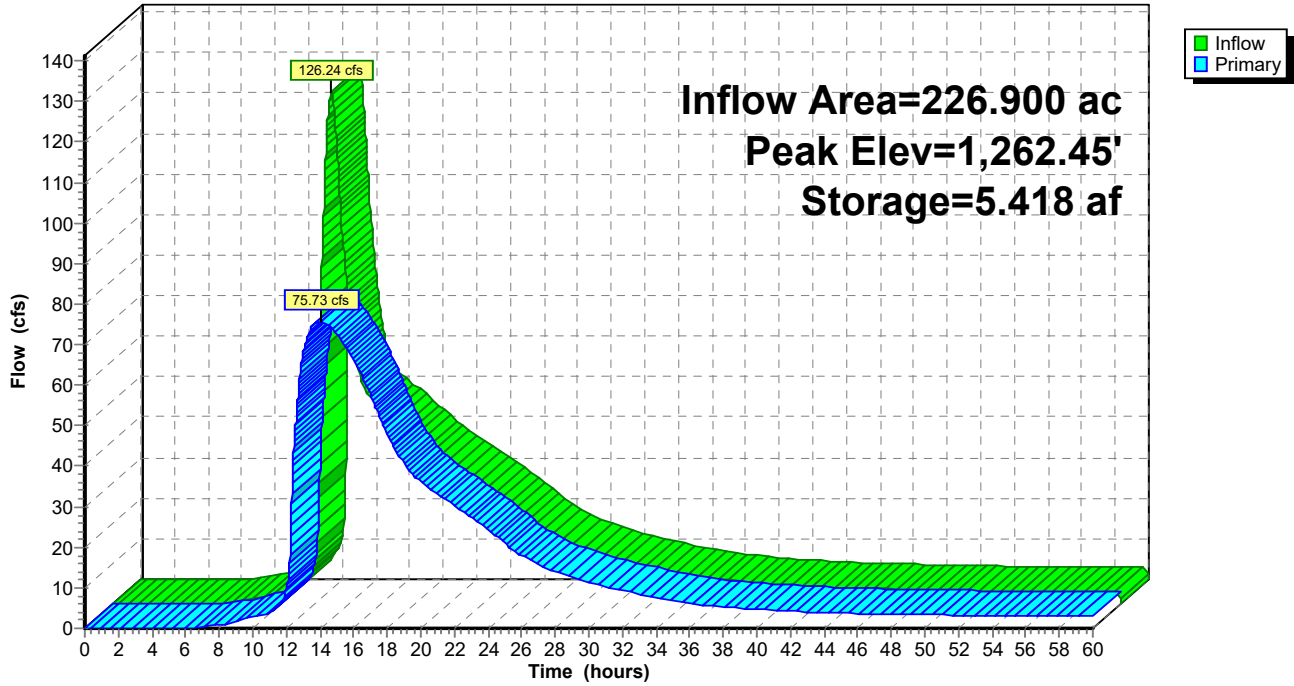
Device	Routing	Invert	Outlet Devices
#1	Primary	1,256.00'	36.0" Round Culvert L= 50.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,256.00' / 1,254.00' S= 0.0400 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 7.07 sf
#2	Primary	1,263.00'	300.0' long + 10.0 ' SideZ x 40.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=75.73 cfs @ 13.99 hrs HW=1,262.45' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Inlet Controls 75.73 cfs @ 10.71 fps)
- 2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond W7: Wetland 7

Hydrograph



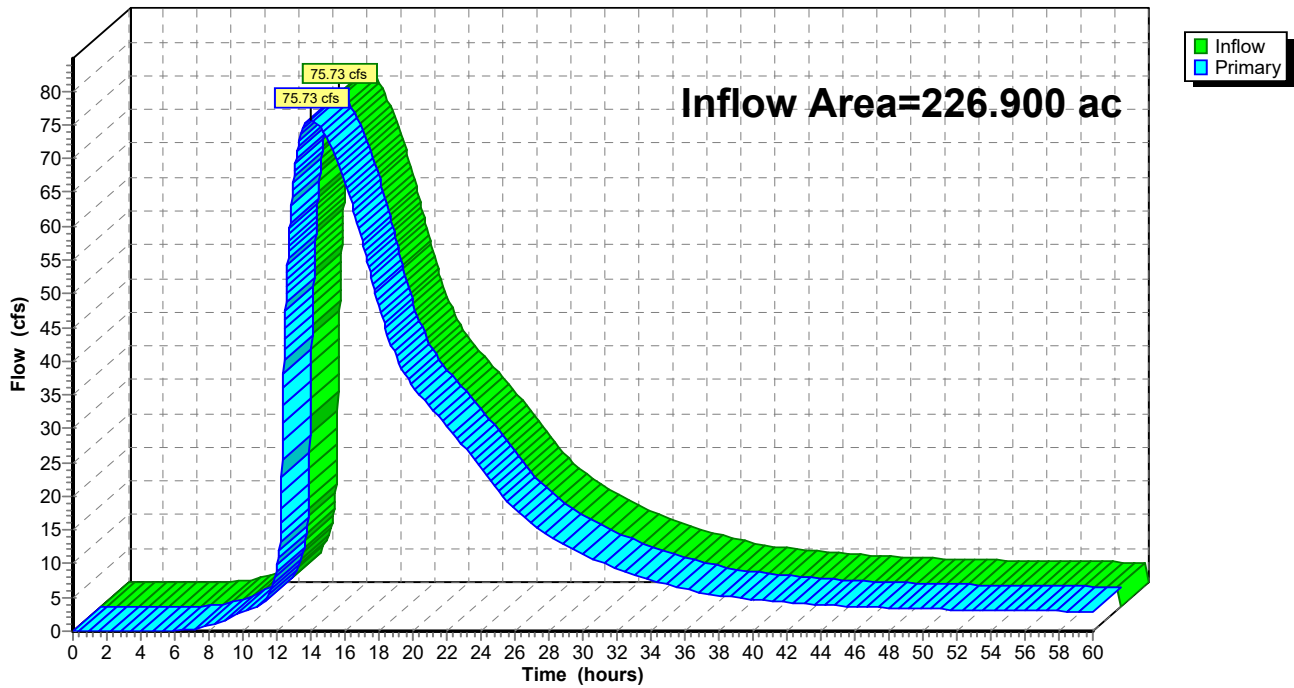
Summary for Link 11L: Discharge Point #2

Inflow Area = 226.900 ac, 49.05% Impervious, Inflow Depth > 3.64" for 100-yr event
Inflow = 75.73 cfs @ 13.99 hrs, Volume= 68.842 af
Primary = 75.73 cfs @ 14.01 hrs, Volume= 68.842 af, Atten= 0%, Lag= 1.2 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

Link 11L: Discharge Point #2

Hydrograph



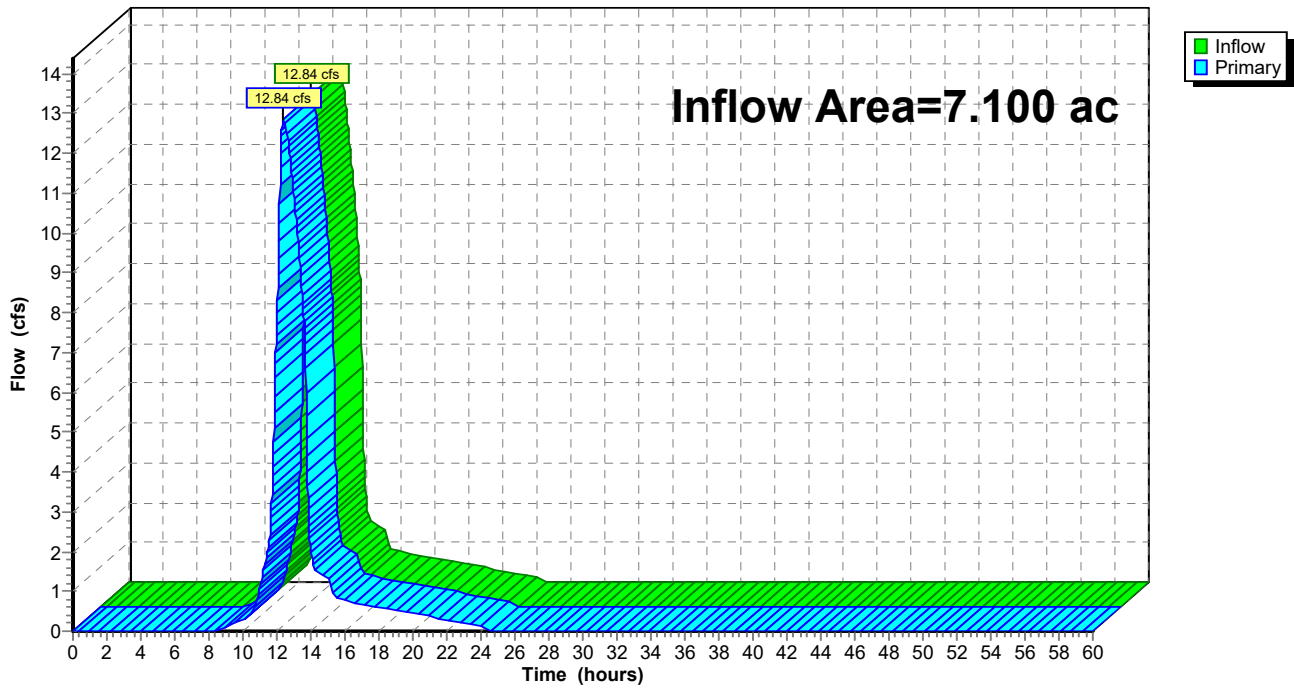
Summary for Link 20L: Discharge Point #1

Inflow Area = 7.100 ac, 0.00% Impervious, Inflow Depth = 4.04" for 100-yr event
Inflow = 12.84 cfs @ 12.39 hrs, Volume= 2.390 af
Primary = 12.84 cfs @ 12.41 hrs, Volume= 2.390 af, Atten= 0%, Lag= 1.2 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.02 hrs

Link 20L: Discharge Point #1

Hydrograph



Appendix 6. MIDs Calculator Results

Project Information

Calculator Version:	Version 4: July 2020	
Project Name:	Hermantown Industrial	
User Name / Company Name:		
Date:	07-02-2025	
Project Description:	Existing Conditions and TP effluent	- Baseline for TSS
Construction Permit?:	No	

Site Information

Retention Requirement (inches):	1.1
Site's Zip Code:	55810
Annual Rainfall (inches):	30
Phosphorus EMC (mg/l):	0.3
TSS EMC (mg/l):	54.5

Total Site Area

Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)
Forest/Open Space - Undisturbed, protected forest/open space or reforested land			148.57	48.2	196.77
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed			31.5		31.5
			Impervious Area (acres)		5.73
			Total Area (acres)		234

Site Areas Routed to BMPs

Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)
Forest/Open Space - Undisturbed, protected forest/open space or reforested land					0
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed					0
			Impervious Area (acres)		
			Total Area (acres)		0

Summary Information

Performance Goal Requirement

Performance goal volume retention requirement:	22880	ft ³
Volume removed by BMPs towards performance goal:		ft ³
Percent volume removed towards performance goal		%

Annual Volume and Pollutant Load Reductions

Post development annual runoff volume	46.6342	acre-ft
Annual runoff volume removed by BMPs:		acre-ft
Percent annual runoff volume removed:		%

Post development annual particulate P load:	20.9294	lbs
Annual particulate P removed by BMPs:		lbs
Post development annual dissolved P load:	17.124	lbs
Annual dissolved P removed by BMPs:	0	lbs
Total P removed by BMPs	0	lbs
Percent annual total phosphorus removed:		%

Post development annual TSS load:	6913	lbs
Annual TSS removed by BMPs:		lbs
Percent annual TSS removed:		%

BMP Summary

Performance Goal Summary

BMP Name	BMP Volume Capacity (ft ³)	Volume Received (ft ³)	Volume Retained (ft ³)	Volume Outflow (ft ³)	Percent Retained (%)

Annual Volume Summary

BMP Name	Volume From Direct Watershed (acre-ft)	Volume From Upstream BMPs (acre-ft)	Volume Retained (acre-ft)	Volume outflow (acre-ft)	Percent Retained (%)

Particulate Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)

Dissolved Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
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Total Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
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TSS Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
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BMP Schematic

Project Information

Calculator Version: Version 4: July 2020
 Project Name: Hermantown Industrial
 User Name / Company Name:
 Date: 07-07-2025
 Project Description: Proposed Conditions Project Loon Day N with Phosphorus Adjustment
 - PP:TP = 0.75 and DP:TP = 0.25
 Construction Permit?: No

Site Information

Retention Requirement (inches): 1.1
 Site's Zip Code: 55810
 Annual Rainfall (inches): 30
 Phosphorus EMC (mg/l): 0.2
 TSS EMC (mg/l): 54.5

Total Site Area

Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)
Forest/Open Space - Undisturbed, protected forest/open space or reforested land				48.2	48.2
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed			74.5		74.5
			Impervious Area (acres)		111.3
			Total Area (acres)		234

Site Areas Routed to BMPs

Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)
Forest/Open Space - Undisturbed, protected forest/open space or reforested land					0
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed			74.5		74.5
			Impervious Area (acres)		111.3
			Total Area (acres)		185.8

Summary Information

Performance Goal Requirement

Performance goal volume retention requirement:	444419	ft ³
Volume removed by BMPs towards performance goal:	11051	ft ³
Percent volume removed towards performance goal	2	%

Annual Volume and Pollutant Load Reductions

Post development annual runoff volume	280.2038	acre-ft
Annual runoff volume removed by BMPs:	2.1673	acre-ft
Percent annual runoff volume removed:	1	%

Post development annual particulate P load:	114.3231	lbs
Annual particulate P removed by BMPs:	104.169	lbs
Post development annual dissolved P load:	38.108	lbs
Annual dissolved P removed by BMPs:	10.483	lbs
Total P removed by BMPs	114.652	lbs
Percent annual total phosphorus removed:	75	%

Post development annual TSS load:	41537.4	lbs
Annual TSS removed by BMPs:	37848	lbs
Percent annual TSS removed:	91	%

BMP Summary

Performance Goal Summary

BMP Name	BMP Volume Capacity (ft ³)	Volume Recieved (ft ³)	Volume Retained (ft ³)	Volume Outflow (ft ³)	Percent Retained (%)
1 - Bioretention basin (with underdrain)	544	35138	544	34594	2
2 - Bioretention basin (with underdrain)	816	21163	816	20347	4
3 - Bioretention basin (with underdrain)	1774	89044	1774	87269	2
4 - Bioretention basin (with underdrain)	1072	87269	1072	86197	1
5 - Bioretention basin (with underdrain)	2586	153730	2586	151144	2
6 - Bioretention basin (with underdrain)	693	46319	693	45626	1
7 - Bioretention basin (with underdrain)	2738	85849	2738	83111	3
8 - Bioretention basin (with underdrain)	827	13177	827	12350	6
Pretreatment - 1	0	35138	0	35138	0
Pretreatment - 2	0	21163	0	21163	0
Pretreatment - 8	0	13177	0	13177	0
Pretreatment - 5	0	153730	0	153730	0
Pretreatment - 3	0	89044	0	89044	0
Pretreatment - 6	0	46319	0	46319	0
Pretreatment - 7	0	85849	0	85849	0

Annual Volume Summary

BMP Name	Volume From Direct Watershed (acre-ft)	Volume From Upstream BMPs (acre-ft)	Volume Retained (acre-ft)	Volume outflow (acre-ft)	Percent Retained (%)
1 - Bioretention basin (with underdrain)	0	24.7005	0.9317	23.7688	4
2 - Bioretention basin (with underdrain)	0	12.8138	1.2355	11.5783	10
3 - Bioretention basin (with underdrain)	0	0	0	0	5
4 - Bioretention basin (with underdrain)	0	-49284.3497	-1551.544	-47732.8057	3
5 - Bioretention basin (with underdrain)	0	0	0	0	4
6 - Bioretention basin (with underdrain)	0	0	0	0	4
7 - Bioretention basin (with underdrain)	0	0	0	0	8
8 - Bioretention basin (with underdrain)	0	0	0	0	14
Pretreatment - 1	24.7005	0	0	24.7005	0
Pretreatment - 2	12.8138	0	0	12.8138	0
Pretreatment - 8	9.3308	0	0	9.3308	0
Pretreatment - 5	91.2038	0	0	91.2038	0
Pretreatment - 3	55.9328	0	0	55.9328	0
Pretreatment - 6	27.1215	0	0	27.1215	0
Pretreatment - 7	53.6782	0	0	53.6782	0

Particulate Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
1 - Bioretention basin (with underdrain)	0	4.535	3.6622	0.8728	81
2 - Bioretention basin (with underdrain)	0	2.3526	1.9274	0.4252	82
3 - Bioretention basin (with underdrain)	0	10.2693	8.3203	1.949	81
4 - Bioretention basin (with underdrain)	0	1.949	1.5715	0.3775	81
5 - Bioretention basin (with underdrain)	0	16.745	13.5434	3.2016	81
6 - Bioretention basin (with underdrain)	0	4.9795	4.0227	0.9568	81
7 - Bioretention basin (with underdrain)	0	9.8553	8.0411	1.8142	82
8 - Bioretention basin (with underdrain)	0	1.7131	1.4192	0.2939	83
Pretreatment - 1	10.0778	0	5.5428	4.535	55
Pretreatment - 2	5.228	0	2.8754	2.3526	55
Pretreatment - 8	3.8069	0	2.0938	1.7131	55
Pretreatment - 5	37.2111	0	20.4661	16.745	55
Pretreatment - 3	22.8206	0	12.5513	10.2693	55
Pretreatment - 6	11.0656	0	6.0861	4.9795	55
Pretreatment - 7	21.9007	0	12.0454	9.8553	55

Dissolved Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
1 - Bioretention basin (with underdrain)	0	3.3593	0.7732	2.5861	23
2 - Bioretention basin (with underdrain)	0	1.7427	0.483	1.2597	28
3 - Bioretention basin (with underdrain)	0	7.6069	1.8321	5.7748	24
4 - Bioretention basin (with underdrain)	0	5.7748	1.3004	4.4744	23
5 - Bioretention basin (with underdrain)	0	12.4037	2.9176	9.4861	24
6 - Bioretention basin (with underdrain)	0	3.6885	0.8536	2.8349	23
7 - Bioretention basin (with underdrain)	0	7.3002	1.9247	5.3755	26
8 - Bioretention basin (with underdrain)	0	1.269	0.3981	0.8709	31
Pretreatment - 1	3.3593	0	0	3.3593	0
Pretreatment - 2	1.7427	0	0	1.7427	0
Pretreatment - 8	1.269	0	0	1.269	0
Pretreatment - 5	12.4037	0	0	12.4037	0
Pretreatment - 3	7.6069	0	0	7.6069	0
Pretreatment - 6	3.6885	0	0	3.6885	0
Pretreatment - 7	7.3002	0	0	7.3002	0

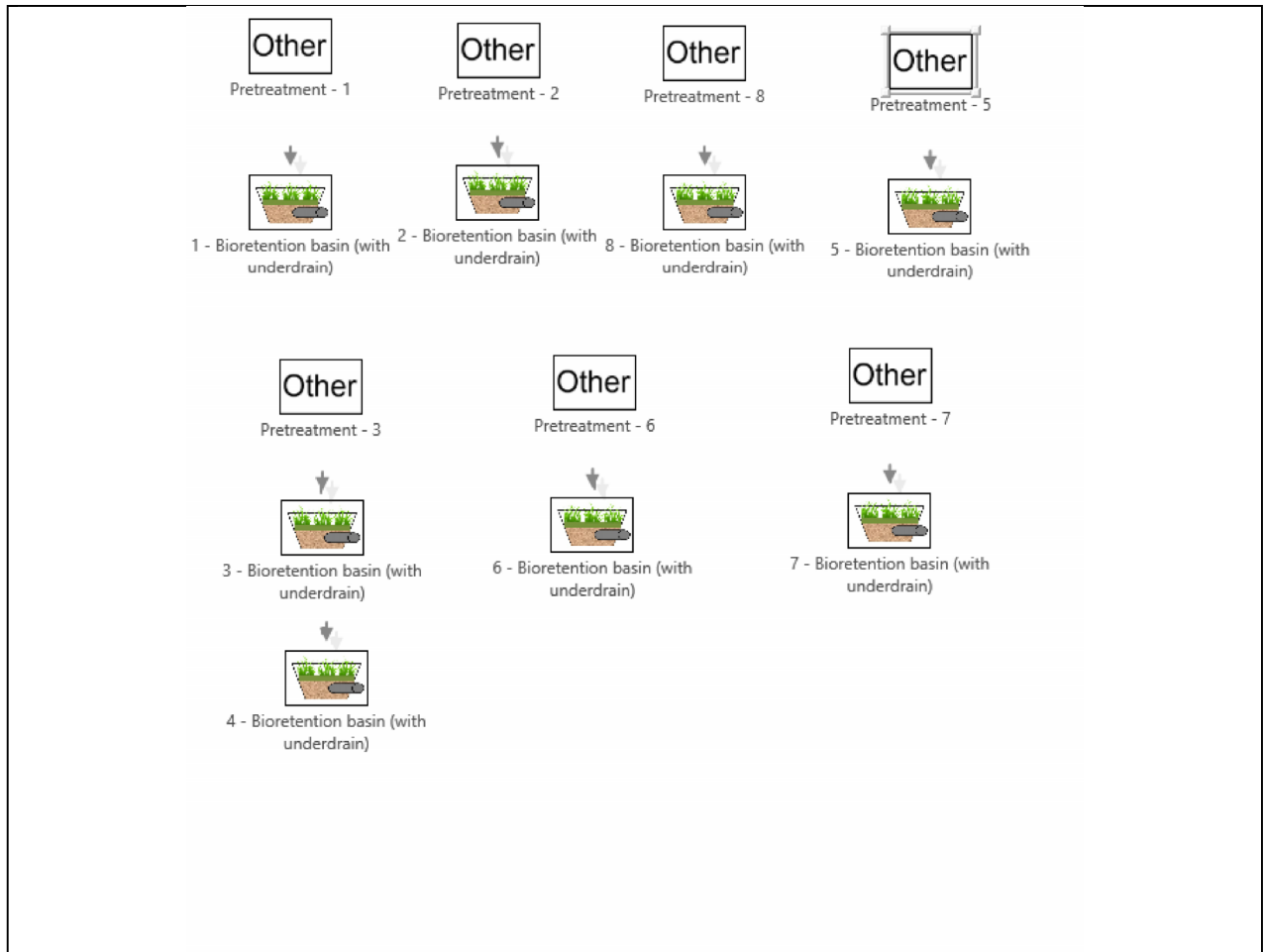
Total Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
1 - Bioretention basin (with underdrain)	0	7.8943	4.4354	3.4589	52
2 - Bioretention basin (with underdrain)	0	4.0953	2.4104	1.6849	55
3 - Bioretention basin (with underdrain)	0	17.8762	10.1524	7.7238	52
4 - Bioretention basin (with underdrain)	0	7.7238	2.8719	4.8519	52
5 - Bioretention basin (with underdrain)	0	29.1487	16.461	12.6877	52
6 - Bioretention basin (with underdrain)	0	8.668	4.8763	3.7917	52
7 - Bioretention basin (with underdrain)	0	17.1555	9.9658	7.1897	54
8 - Bioretention basin (with underdrain)	0	2.9821	1.8173	1.1648	57
Pretreatment - 1	13.4371	0	5.5428	7.8943	28
Pretreatment - 2	6.9707	0	2.8754	4.0953	28
Pretreatment - 8	5.0759	0	2.0938	2.9821	28
Pretreatment - 5	49.6148	0	20.4661	29.1487	28
Pretreatment - 3	30.4275	0	12.5513	17.8762	28
Pretreatment - 6	14.7541	0	6.0861	8.668	28
Pretreatment - 7	29.2009	0	12.0454	17.1555	28

TSS Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
1 - Bioretention basin (with underdrain)	0	1647.72	1330.61	317.11	81
2 - Bioretention basin (with underdrain)	0	854.78	700.31	154.47	82
3 - Bioretention basin (with underdrain)	0	3731.16	3023.04	708.11999999	81
4 - Bioretention basin (with underdrain)	0	708.11999999	570.95	137.16999999	81
5 - Bioretention basin (with underdrain)	0	6084.02	4920.79	1163.23	81
6 - Bioretention basin (with underdrain)	0	1809.22	1461.59	347.63	81
7 - Bioretention basin (with underdrain)	0	3580.77	2921.6	659.17000000	82
8 - Bioretention basin (with underdrain)	0	622.44	515.65	106.79	83
Pretreatment - 1	3661.6	0	2013.88	1647.72	55
Pretreatment - 2	1899.51	0	1044.73	854.78	55
Pretreatment - 8	1383.19	0	760.75	622.44	55
Pretreatment - 5	13520.04	0	7436.02	6084.02	55
Pretreatment - 3	8291.47	0	4560.31	3731.16	55
Pretreatment - 6	4020.49	0	2211.27	1809.22	55
Pretreatment - 7	7957.26	0	4376.49	3580.77	55

BMP Schematic



Appendix 7. Soil Boring Logs

Updated Revised Preliminary Geotechnical Evaluation Report

Hermantown Site
3589 Midway Road
Hermantown, Minnesota

Prepared for

Kimley-Horn and Associates, Inc.

Mortenson Development, Inc.

and

Harmony Group LLC

Professional Certification:

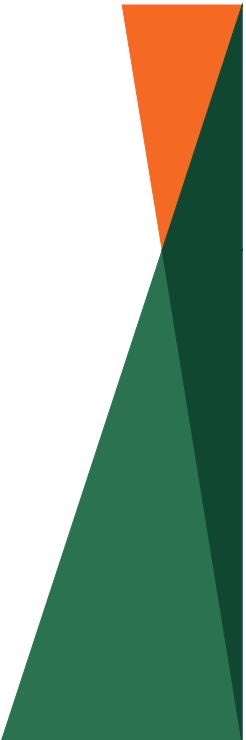
I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly licensed Professional Engineer under the laws of the State of Minnesota.

Ryan M. Benson, PE
Director, Principal Engineer
License Number: 42724
March 19, 2025

Project B2409404

Braun Intertec Corporation

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Drawing Information

Project No:
B2409404

Drawing No:
B2409404

Drawn By: JAG
Date Drawn: 10/14/24
Checked By: BR
Last Modified: 11/15/24

Project Information

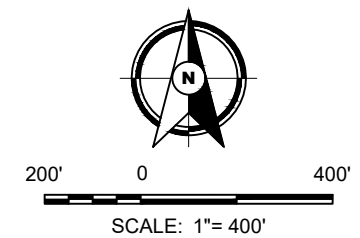
Hermantown Site

3589 Midway Road

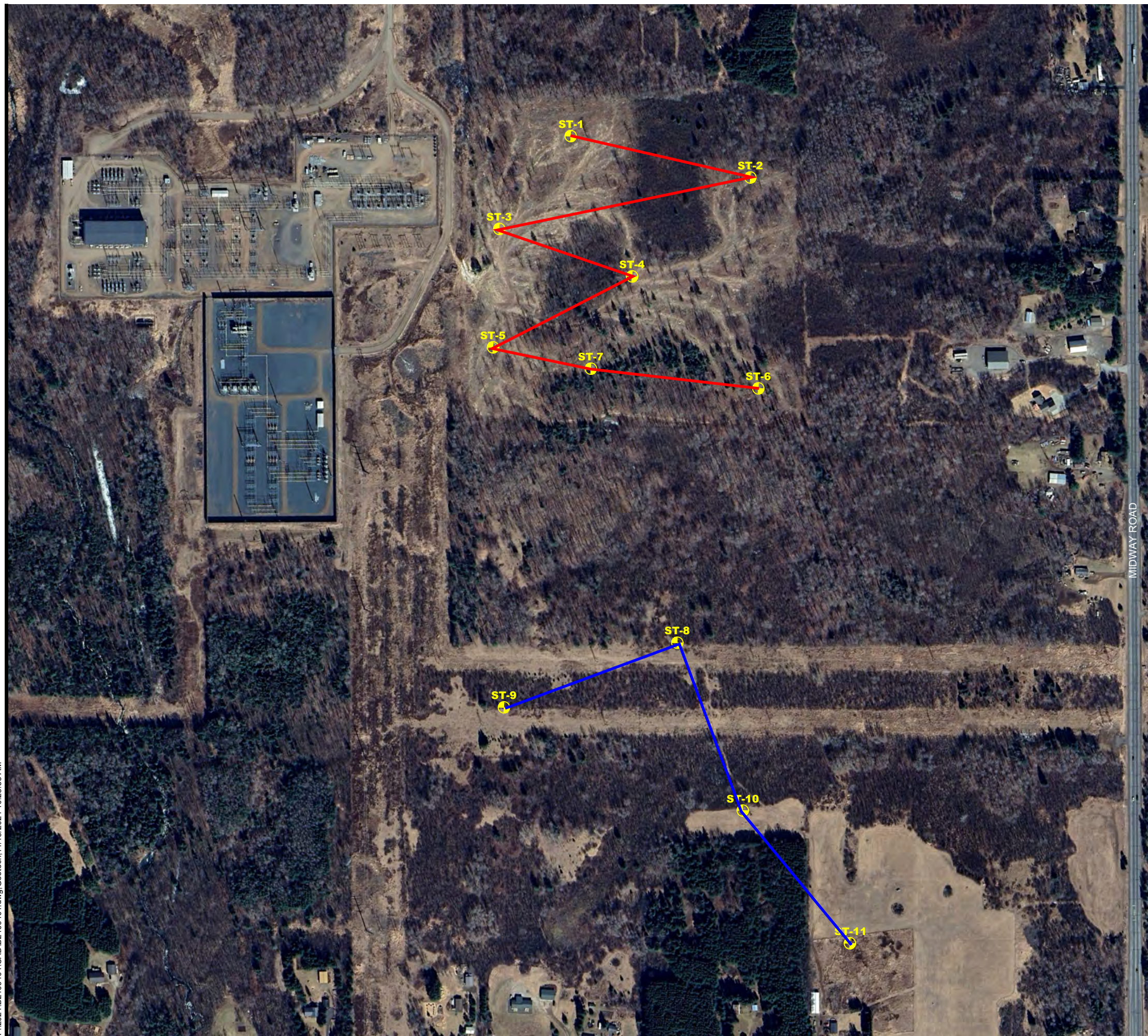
Hermantown, Minnesota

**Soil Boring
Location Sketch**

 **DENOTES APPROXIMATE LOCATION OF
STANDARD PENETRATION TEST BORING**

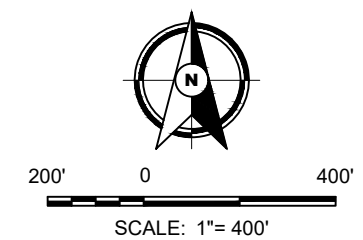


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Fence Diagram Sketch:
 — Fence 1
 — Fence 2

 **DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING**



Drawing Information

Project No:
B2409404

Drawing No:
B2409404

Drawn By: JAG
 Date Drawn: 10/14/24
 Checked By: BR
 Last Modified: 11/15/24

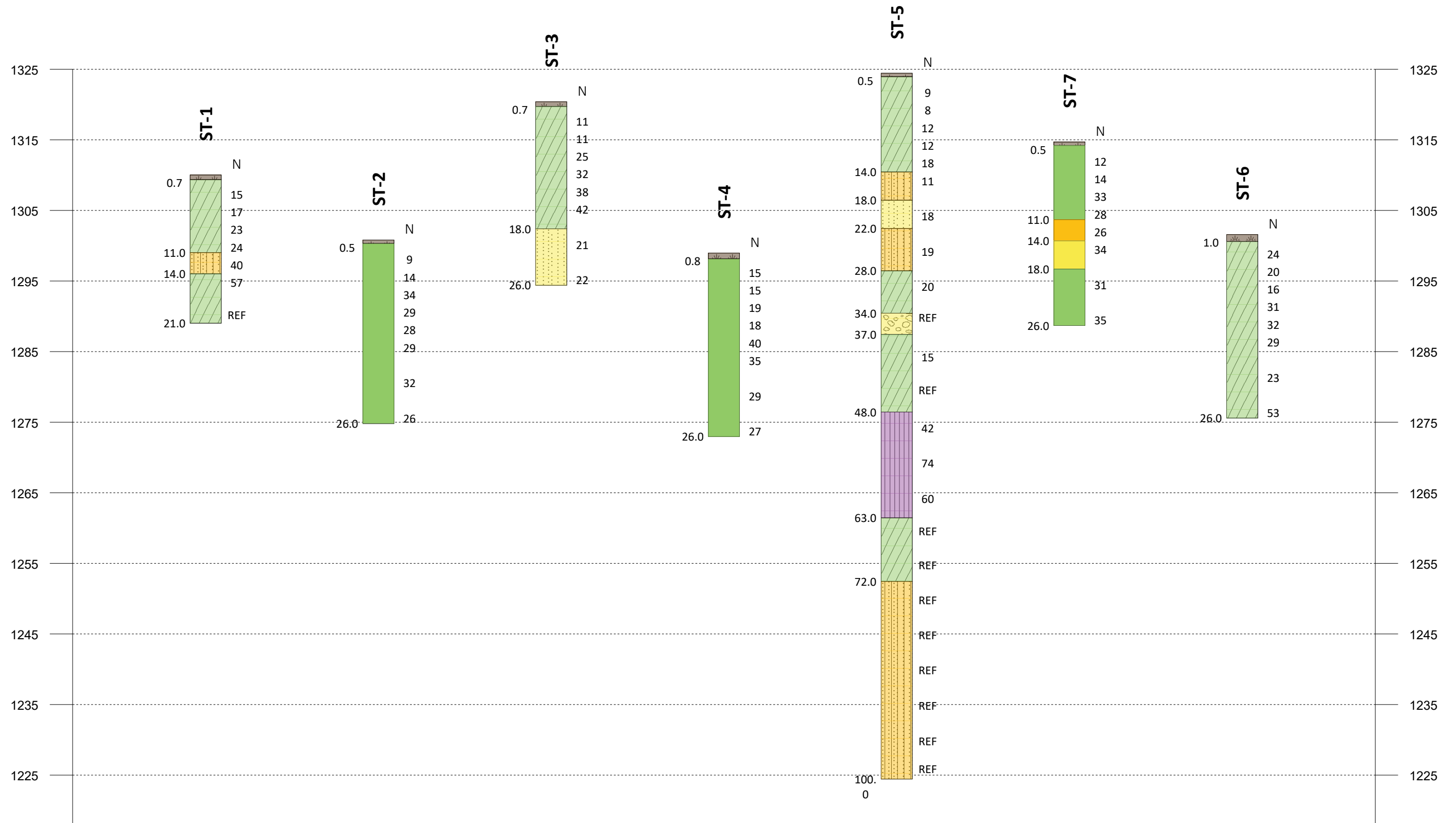
Project Information

Hermantown Site

3589 Midway Road

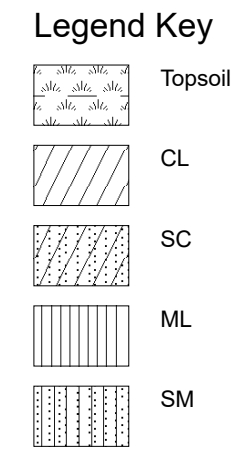
Hermantown, Minnesota

**Soil Boring
Location Sketch**



Fence Diagram #1
 Fence Diagram
 Geotechnical Evaluation
 3589 Midway Road
 Hermantown, Minnesota

Project ID: B2409404
 Vert. Scale: 1"= 10'
 Hor. Scale: NTS
 Date: 01/06/2025



Fence Diagram #2
 Fence Diagram
 Geotechnical Evaluation
 3589 Midway Road
 Hermantown, Minnesota

Project ID: B2409404
 Vert. Scale: 1"= 5'
 Hor. Scale: NTS
 Date: 01/06/2025



See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2409404				BORING: ST-1	
Geotechnical Evaluation				LOCATION: Captured with RTK GPS.	
3589 Midway Road				DATUM: NAD 1983 HARN Adj MN St Louis South (US Feet)	
Hermantown, Minnesota				NORTHING: 145472.9	EASTING: 540308.9
DRILLER: M. Hoppe	LOGGED BY: S. Niraula		START DATE: 10/22/24	END DATE: 10/22/24	
SURFACE ELEVATION: 1310.0 ft	RIG: 7504	METHOD: 3 1/4" HSA	SURFACING: Soil	WEATHER: Sunny	

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
1309.4 0.7		SANDY LEAN CLAY (CL), trace roots, trace Gravel, brown, moist (TOPSOIL)					
		SANDY LEAN CLAY (CL), trace Gravel, reddish brown and brown, moist, stiff to very stiff (GLACIAL TILL)	5	6-7-8 (15) 14"			
			10	5-7-10 (17) 10"			
				8-11-12 (23) 12"			
1299.0 11.0		SILTY SAND (SM), trace Gravel, reddish brown, moist, dense (GLACIAL TILL)		10-11-13 (24) 14"			
				12-16-24 (40) 12"			
1296.0 14.0		SANDY LEAN CLAY (CL), trace Gravel, reddish brown, moist, hard (GLACIAL TILL)		12-24-33 (57) 14"			
			20	14-50/2" (REF) 10"			Auger refusal at 21 feet
1289.0 21.0		END OF BORING Boring immediately grouted					Water not observed while drilling.
			25				
			30				

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2409404				BORING: ST-2	
Geotechnical Evaluation				LOCATION: Captured with RTK GPS.	
3589 Midway Road				DATUM: NAD 1983 HARN Adj MN St Louis South (US Feet)	
Hermantown, Minnesota				NORTHING: 145305.9	EASTING: 541032.0
DRILLER: M. Hoppe	LOGGED BY: S. Niraula		START DATE: 10/22/24	END DATE: 10/22/24	
SURFACE ELEVATION: 1300.8 ft	RIG: 7504	METHOD: 3 1/4" HSA	SURFACING: Soil	WEATHER: Cloudy	

Elev./Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
1300.3							
0.5		SANDY LEAN CLAY (CL), trace roots, trace Gravel, reddish brown, moist (TOPSOIL)					
		SANDY LEAN CLAY (CL), trace Gravel, reddish brown, moist, stiff to hard (GLACIAL TILL)		3-4-5 (9) 14"			
			5	3-6-8 (14) 16"			
				14-16-18 (34) 14"			
		<i>With Silty Sand at 10 feet</i>	10	8-12-17 (29) 14"			
				6-12-16 (28) 16"			
			15	12-14-15 (29) 16"			
				6-14-18 (32) 16"			
			20				Auger chatter at 22 to 23 feet
				11-11-15 (26) 14"			
1274.8		END OF BORING	25				Water not observed while drilling.
26.0		Boring immediately grouted					
			30				

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2409404				BORING: ST-3	
Geotechnical Evaluation				LOCATION: Captured with RTK GPS.	
3589 Midway Road				DATUM: NAD 1983 HARN Adj MN St Louis South (US Feet)	
Hermantown, Minnesota				NORTHING: 145099.3	EASTING: 540021.9
DRILLER: M. Hoppe	LOGGED BY: S. Niraula		START DATE: 10/21/24	END DATE: 10/21/24	
SURFACE ELEVATION: 1320.4 ft	RIG: 7504	METHOD: 3 1/4" HSA	SURFACING: Soil	WEATHER: Sunny	

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
1319.7 0.7		SANDY LEAN CLAY (CL), trace roots, trace Gravel, brown, moist (TOPSOIL)					
		SANDY LEAN CLAY (CL), trace Gravel, reddish brown, moist, stiff to hard (GLACIAL TILL)	4-5-6	(11) 12"			
			5	5-5-6 (11) 14"			
				7-12-13 (25) 16"			
			10	10-14-18 (32) 14"			
				12-16-22 (38) 14"			
			15	7-19-23 (42) 16"			
1302.4 18.0		POORLY GRADED SAND (SP), fine-grained, brown and reddish brown, moist, medium dense (GLACIAL OUTWASH)	20	8-10-11 (21) 14"			
1294.4 26.0		END OF BORING Boring immediately grouted	25	10-10-12 (22) 16"			Water not observed while drilling.
			30				

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2409404				BORING: ST-4	
Geotechnical Evaluation				LOCATION: Captured with RTK GPS.	
3589 Midway Road				DATUM: NAD 1983 HARN Adj MN St Louis South (US Feet)	
Hermantown, Minnesota				NORTHING: 144908.1	EASTING: 540556.5
DRILLER: M. Hoppe	LOGGED BY: S. Niraula		START DATE: 10/22/24	END DATE: 10/22/24	
SURFACE ELEVATION: 1299.0 ft	RIG: 7504	METHOD: 3 1/4" HSA	SURFACING: Soil	WEATHER: Cloudy	

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
1298.1		SANDY LEAN CLAY (CL), trace roots, trace Gravel, dark brown, moist (TOPSOIL)					
0.8		SANDY LEAN CLAY (CL), trace Gravel, reddish brown and brown, moist, stiff to hard (GLACIAL TILL)		6-7-8 (15) 12"			
			5	4-7-8 (15) 14"			
				7-9-10 (19) 16"			
			10	6-9-9 (18) 14"			
				14-16-24 (40) 12"			
			15	12-16-19 (35) 16"			
				12-14-15 (29) 16"			
			20				
				8-12-15 (27) 16"			
1273.0		END OF BORING					Water not observed while drilling.
26.0		Boring immediately grouted					
			30				

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2409404				BORING: ST-5	
Geotechnical Evaluation				LOCATION: Captured with RTK GPS.	
3589 Midway Road				DATUM: NAD 1983 HARN Adj MN St Louis South (US Feet)	
Hermantown, Minnesota				NORTHING: 144622.7	EASTING: 539996.1
DRILLER: M. Hoppe		LOGGED BY: S. Niraula		START DATE: 10/22/24	END DATE: 10/22/24
SURFACE ELEVATION: 1324.4 ft		RIG: 7504	METHOD: 3 1/4" HSA	SURFACING: Soil	WEATHER: Cloudy

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
1323.9 0.5		LEAN CLAY (CL), trace Sand, brown, moist (TOPSOIL)					
		SANDY LEAN CLAY (CL), trace Gravel, reddish brown, moist, medium to very stiff (GLACIAL TILL)		3-4-5 (9) 12"			
			5	2-4-4 (8) 14"			
				4-5-7 (12) 16"			
			10	5-6-6 (12) 14"			
				7-8-10 (18) 12"			
1310.4 14.0		SILTY SAND (SM), fine-grained, reddish brown, moist, medium dense (GLACIAL TILL)		4-5-6 (11) 16"			
			15				
1306.4 18.0		POORLY GRADED SAND (SP), with Gravel, dark brown and brown, moist, medium dense (GLACIAL OUTWASH)		7-8-10 (18) 12"			
			20				
1302.4 22.0		SILTY SAND (SM), fine-grained, reddish brown, moist, medium dense (GLACIAL TILL)		5-9-10 (19) 14"			
			25				
1296.4 28.0		SANDY LEAN CLAY (CL), contains seams of Silt, reddish brown, moist, very stiff (GLACIAL TILL)		4-8-12 (20) 12"			
			30				

Continued on next page

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2409404				BORING: ST-5	
Geotechnical Evaluation				LOCATION: Captured with RTK GPS.	
3589 Midway Road				DATUM: NAD 1983 HARN Adj MN St Louis South (US Feet)	
Hermantown, Minnesota				NORTHING: 144622.7	EASTING: 539996.1
DRILLER: M. Hoppe	LOGGED BY: S. Niraula		START DATE: 10/22/24	END DATE: 10/22/24	
SURFACE ELEVATION: 1324.4 ft	RIG: 7504	METHOD: 3 1/4" HSA	SURFACING: Soil	WEATHER: Cloudy	

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
1290.4		SANDY LEAN CLAY (CL), contains seams of Silt, reddish brown, moist, very stiff (GLACIAL TILL)					
34.0		POORLY GRADED GRAVEL (GP), gray, very dense (GLACIAL TILL)	35	50/2" (REF) 2"			Probable Boulder.
1287.4		SANDY LEAN CLAY (CL), trace to with Gravel, reddish brown, wet, stiff to hard (GLACIAL TILL)					Switched to mud rotary drilling method at 35 feet.
37.0			40	8-7-8 (15) 16"			
		<i>Little Gravel at 45 feet</i>	45	36-50/3" (REF) 10"			
		<i>Boulder at 46 feet</i>					
		<i>Boulder at 47 feet</i>					
1276.4		SANDY SILT (ML), trace Clay lenses, reddish brown, wet, very dense (GLACIAL TILL)					
48.0			50	20-23-19 (42) 12"			
			55	27-36-38 (74) 16"			
			60	24-27-33 (60) 10"			
		<i>A 2 foot Boulder at 61 to 62 feet</i>					
1261.4		SANDY LEAN CLAY (CL), contains seams of Silt, reddish brown, wet, hard (GLACIAL TILL)					
63.0							

Continued on next page

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2409404				BORING: ST-5	
Geotechnical Evaluation				LOCATION: Captured with RTK GPS.	
3589 Midway Road				DATUM: NAD 1983 HARN Adj MN St Louis South (US Feet)	
Hermantown, Minnesota				NORTHING: 144622.7	EASTING: 539996.1
DRILLER: M. Hoppe	LOGGED BY: S. Niraula		START DATE: 10/22/24	END DATE: 10/22/24	
SURFACE ELEVATION: 1324.4 ft	RIG: 7504	METHOD: 3 1/4" HSA	SURFACING: Soil	WEATHER: Cloudy	

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
		SANDY LEAN CLAY (CL), contains seams of Silt, reddish brown, wet, hard (GLACIAL TILL)	65	45-50/3" (REF) 10"			
		<i>Little Gravel at 70 feet</i>	70	50/4" (REF) 10"			
1252.4		SILTY SAND (SM), fine to coarse-grained, little Gravel, very dense (GLACIAL OUTWASH)	75	50/3" (REF) 4"			
72.0			80	50/2" (REF) 2"			
			85	50/2" (REF) 2"			
		<i>Probable Boulder at 92 to 93 feet</i>	90	50/2" (REF) 0"			
			95	50/2" (REF) 0"			

Continued on next page

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2409404				BORING: ST-5	
Geotechnical Evaluation				LOCATION: Captured with RTK GPS.	
3589 Midway Road				DATUM: NAD 1983 HARN Adj MN St Louis South (US Feet)	
Hermantown, Minnesota				NORTHING: 144622.7	EASTING: 539996.1
DRILLER: M. Hoppe	LOGGED BY: S. Niraula		START DATE: 10/22/24	END DATE: 10/22/24	
SURFACE ELEVATION: 1324.4 ft	RIG: 7504	METHOD: 3 1/4" HSA	SURFACING: Soil	WEATHER: Cloudy	

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
1224.4		SILTY SAND (SM), fine to coarse-grained, little Gravel, very dense (GLACIAL OUTWASH)					
100.0		<i>Probable Boulder at 96 to 98 feet</i>		50/2" (REF)			
		END OF BORING		0"			Water level obscured due to mud rotary drilling method.
		Boring immediately grouted					

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2409404				BORING: ST-6	
Geotechnical Evaluation				LOCATION: Captured with RTK GPS.	
3589 Midway Road				DATUM: NAD 1983 HARN Adj MN St Louis South (US Feet)	
Hermantown, Minnesota				NORTHING: 144457.4	EASTING: 541064.2
DRILLER: M. Hoppe	LOGGED BY: S. Niraula		START DATE: 10/22/24	END DATE: 10/22/24	
SURFACE ELEVATION: 1301.6 ft	RIG: 7504	METHOD: 3 1/4" HSA	SURFACING: Soil	WEATHER: Cloudy	

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
1300.6		SANDY LEAN CLAY (CL), trace roots, trace Gravel, reddish brown, moist (TOPSOIL)					
1.0		SANDY LEAN CLAY (CL), trace Gravel, reddish brown and brown, moist, very stiff to hard (GLACIAL TILL)		10-12-12 (24) 12"			
			5	8-10-10 (20) 14"			
				7-6-10 (16) 16"			
			10	8-12-19 (31) 14"			
				7-14-18 (32) 16"			
			15	16-14-15 (29) 14"			
				9-12-11 (23) 16"			
			25	12-37-16 (53) 14"			
1275.6		END OF BORING					Water not observed while drilling.
26.0		Boring immediately backfilled					
			30				

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2409404				BORING: ST-7			
Geotechnical Evaluation				LOCATION: Captured with RTK GPS.			
3589 Midway Road				DATUM: NAD 1983 HARN Adj MN St Louis South (US Feet)			
Hermantown, Minnesota				NORTHING: 144536.9	EASTING: 540390.1		
DRILLER: M. Hoppe		LOGGED BY: S. Niraula		START DATE: 10/22/24	END DATE: 10/22/24		
SURFACE ELEVATION: 1314.7 ft		RIG: 7504	METHOD: 3 1/4" HSA	SURFACING: Soil	WEATHER: Cloudy		
Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
1314.2 0.5		LEAN CLAY (CL), trace roots, trace Sand, dark brown, moist (TOPSOIL)					
		SANDY LEAN CLAY (CL), trace Gravel, reddish brown, moist, stiff to hard (GLACIAL TILL)	5	5-6-6 (12) 14"			
			10	4-6-8 (14) 12"			
				12-17-16 (33) 16"			
				14-12-16 (28) 16"			
1303.7 11.0		SILTY SAND (SM), fine-grained, trace Gravel, reddish brown, moist, medium dense (GLACIAL OUTWASH)					
			15	8-12-14 (26) 16"			
1300.7 14.0		POORLY GRADED SAND (SP), fine-grained, reddish brown, moist, dense (GLACIAL OUTWASH)					
			20	12-16-18 (34) 16"			
1296.7 18.0		SANDY LEAN CLAY (CL), trace Gravel, reddish brown, moist, hard (GLACIAL TILL)					
			25	14-15-16 (31) 14"			
			30	14-16-19 (35) 16"			
1288.7 26.0		END OF BORING Boring immediately grouted					Water not observed while drilling.

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2409404				BORING: ST-8	
Geotechnical Evaluation				LOCATION: Captured with RTK GPS.	
3589 Midway Road				DATUM: NAD 1983 HARN Adj MN St Louis South (US Feet)	
Hermantown, Minnesota				NORTHING: 143434.4	EASTING: 540738.2
DRILLER: M. Hoppe	LOGGED BY: S. Niraula		START DATE: 10/24/24	END DATE: 10/24/24	
SURFACE ELEVATION: 1299.5 ft	RIG: 7504	METHOD: 3 1/4" HSA	SURFACING: Soil	WEATHER: Sunny	

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
1298.7		LEAN CLAY (CL), trace Sand, trace roots, brown, moist (TOPSOIL)					
0.8		SANDY LEAN CLAY (CL), trace Gravel, reddish brown, moist to wet, stiff to hard (GLACIAL TILL)		7-8-9 (17) 14"			
			5	7-8-12 (20) 16"			
				5-7-8 (15) 16"			
			10	10-8-8 (16) 16"			
				6-7-7 (14) 0"			No recovery at 12 feet
			15	4-5-8 (13) 10"			
			20	50/3" (REF) 6"			
		Probable Boulder at 21 feet					
			25	4-6-12 (18) 6"			
			30	5-6-5 (11) 14"			

Continued on next page

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2409404				BORING: ST-8	
Geotechnical Evaluation				LOCATION: Captured with RTK GPS.	
3589 Midway Road				DATUM: NAD 1983 HARN Adj MN St Louis South (US Feet)	
Hermantown, Minnesota				NORTHING: 143434.4	EASTING: 540738.2
DRILLER: M. Hoppe	LOGGED BY: S. Niraula		START DATE: 10/24/24	END DATE: 10/24/24	
SURFACE ELEVATION: 1299.5 ft	RIG: 7504	METHOD: 3 1/4" HSA	SURFACING: Soil	WEATHER: Sunny	

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
		SANDY LEAN CLAY (CL), trace Gravel, reddish brown, moist to wet, stiff to hard (GLACIAL TILL)					
		<i>Probable Boulder at 36 feet</i>	35	4-5-7 (12) 14"			
1259.5 40.0		END OF BORING	40	50/1" (REF) 0"			Water observed at 24.5 feet while drilling.
		Boring immediately grouted					
			45				
			50				
			55				
			60				

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2409404				BORING: ST-9	
Geotechnical Evaluation				LOCATION: Captured with RTK GPS.	
3589 Midway Road				DATUM: NAD 1983 HARN Adj MN St Louis South (US Feet)	
Hermantown, Minnesota				NORTHING: 143174.4	EASTING: 540040.7
DRILLER: M. Hoppe	LOGGED BY: S. Niraula		START DATE: 10/24/24	END DATE: 10/24/24	
SURFACE ELEVATION: 1304.2 ft	RIG: 7504	METHOD: 3 1/4" HSA	SURFACING: Soil	WEATHER: Cloudy	

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
1303.6		SANDY LEAN CLAY (CL), trace roots, trace Gravel, brown, moist (TOPSOIL)					
0.7		SANDY LEAN CLAY (CL), trace Gravel, reddish brown, moist, stiff to very stiff (GLACIAL TILL)		4-5-8 (13) 14"			
			5	3-5-7 (12) 14"			
				7-10-14 (24) 16"			
			10	8-10-14 (24) 12"			
		With Gravel at 12 1/2 feet		9-12-15 (27) 10"			
			15	12-11-16 (27) 14"			
			20	7-8-12 (20) 14"			
1281.2		Probable Boulder at 22 feet					
23.0		SILTY SAND (SM), fine-grained, trace Gravel, reddish brown, moist, very dense (GLACIAL TILL)		9-19-50/3" (REF) 14"			
1279.5		END OF BORING	25				Water not observed while drilling.
24.8		Boring immediately grouted					
			30				

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2409404				BORING: ST-10	
Geotechnical Evaluation				LOCATION: Captured with RTK GPS.	
3589 Midway Road				DATUM: NAD 1983 HARN Adj MN St Louis South (US Feet)	
Hermantown, Minnesota				NORTHING: 142758.8	EASTING: 541001.8
DRILLER: M. Hoppe	LOGGED BY: S. Niraula		START DATE: 10/24/24	END DATE: 10/24/24	
SURFACE ELEVATION: 1284.5 ft	RIG: 7504	METHOD: 3 1/4" HSA	SURFACING: Cloudy	WEATHER: Cloudy	

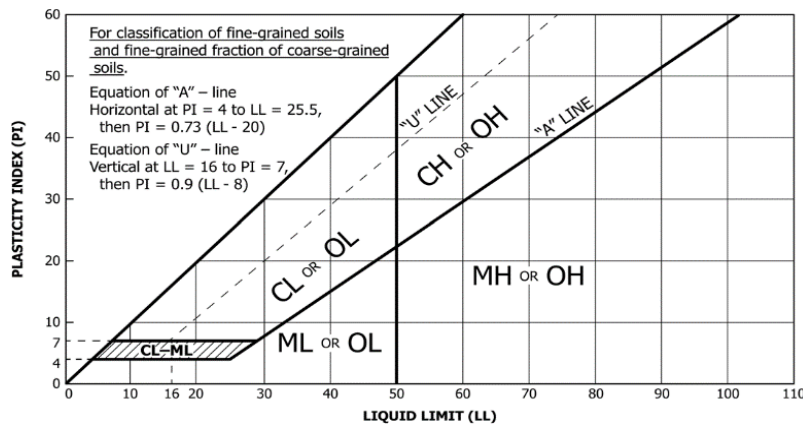
Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
1284.0 0.5		SANDY LEAN CLAY (CL), trace roots, trace Gravel, brown, moist (TOPSOIL)					
		SANDY LEAN CLAY (CL), trace Gravel, reddish brown, moist to wet, stiff to hard (GLACIAL TILL)		4-5-6 (11) 12"			
			5	5-6-8 (14) 12"			
				7-8-7 (15) 14"			
			10	4-4-5 (9) 16"			
				7-9-30 (39) 14"			
			15	25-50/2" (REF) 6"			Probable Boulder
			20	12-18-20 (38) 0"			No recovery
1260.3 24.2		END OF BORING		18-50/2" (REF) 0"			No recovery Water observed at 7.5 feet while drilling.
		Boring immediately grouted	25				
			30				

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2409404				BORING: ST-11			
Geotechnical Evaluation				LOCATION: Captured with RTK GPS.			
3589 Midway Road				DATUM: NAD 1983 HARN Adj MN St Louis South (US Feet)			
Hermantown, Minnesota				NORTHING: 142225.3	EASTING: 541433.0		
DRILLER: M. Hoppe		LOGGED BY: S. Niraula		START DATE: 11/04/24	END DATE: 11/04/24		
SURFACE ELEVATION: 1301.2 ft		RIG: 7504	METHOD: 3 1/4" HSA	SURFACING: Soil	WEATHER: Rain		
Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
1300.9 0.3		SANDY LEAN CLAY (CL), reddish brown, moist (TOPSOIL)					
		SANDY LEAN CLAY (CL), trace Gravel, reddish brown, moist, stiff (GLACIAL TILL)	4-5-6 (11) 12"				
1295.2 6.0		CLAYEY SAND (SC), trace Gravel, intermixed with Silt, reddish brown, moist, very stiff to hard (GLACIAL TILL)	5	7-6-5 (11) 14"			
			10	7-8-20 (28) 16"			
			15	12-28-16 (44) 14"			
			20	14-15-15 (30) 14"			
			25	16-23-19 (42) 16"			
1283.2 18.0		SANDY SILT (ML), contains lenses of Lean Clay, brown, wet, medium dense (GLACIAL TILL)	20	6-7-8 (15) 14"			
1275.2 26.0		END OF BORING Boring immediately grouted	25	6-8-10 (18) 16"			Water observed at 18.0 feet while drilling.
			30				

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A			Soil Classification		
			Group Symbol	Group Name ^B	
Coarse-grained Soils (more than 50% retained on No. 200 sieve)	Gravels (More than 50% of coarse fraction retained on No. 4 sieve)	Clean Gravels (Less than 5% fines ^C)	$C_u \geq 4$ and $1 \leq C_c \leq 3^D$	GW	Well-graded gravel ^E
		Gravels with Fines (More than 12% fines ^C)	$C_u < 4$ and/or ($C_c < 1$ or $C_c > 3^D$)	GP	Poorly graded gravel ^E
			Fines classify as ML or MH	GM	Silty gravel ^{EFG}
		Sands (50% or more coarse fraction passes No. 4 sieve)	Clean Sands (Less than 5% fines ^H)	$C_u \geq 6$ and $1 \leq C_c \leq 3^D$	SW
	Sands with Fines (More than 12% fines ^H)		$C_u < 6$ and/or ($C_c < 1$ or $C_c > 3^D$)	SP	Poorly graded sand ^I
			Fines classify as ML or MH	SM	Silty sand ^{FGI}
	Fines classify as CL or CH		SC	Clayey sand ^{FGI}	
	Fine-grained Soils (50% or more passes the No. 200 sieve)	Silts and Clays (Liquid limit less than 50)	Inorganic	PI > 7 and plots on or above "A" line ^J	CL
PI < 4 or plots below "A" line ^J				ML	Silt ^{KLM}
Organic			Liquid Limit - oven dried	OH	Organic clay ^{KLMN}
			Liquid Limit - not dried < 0.75		
Silts and Clays (Liquid limit 50 or more)		Inorganic	PI plots on or above "A" line	CH	Fat clay ^{KLM}
			PI plots below "A" line	MH	Elastic silt ^{KLM}
		Organic	Liquid Limit - oven dried	OH	Organic clay ^{KLMN}
			Liquid Limit - not dried < 0.75		
Highly Organic Soils	Primarily organic matter, dark in color, and organic odor		PT	Peat	

- A. Based on the material passing the 3-inch (75-mm) sieve.
- B. If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
- C. Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay
- D. $C_u = D_{60} / D_{10}$ $C_c = (D_{30})^2 / (D_{10} \times D_{60})$
- E. If soil contains $\geq 15\%$ sand, add "with sand" to group name.
- F. If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
- G. If fines are organic, add "with organic fines" to group name.
- H. Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay
- I. If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.
- J. If Atterberg limits plot in hatched area, soil is CL-ML, silty clay.
- K. If soil contains 15 to < 30% plus No. 200, add "with sand" or "with gravel", whichever is predominant.
- L. If soil contains $\geq 30\%$ plus No. 200, predominantly sand, add "sandy" to group name.
- M. If soil contains $\geq 30\%$ plus No. 200 predominantly gravel, add "gravelly" to group name.
- N. PI ≥ 4 and plots on or above "A" line.
- O. PI < 4 or plots below "A" line.
- P. PI plots on or above "A" line.
- Q. PI plots below "A" line.



- Laboratory Tests**
- DD Dry density, pcf
 - WD Wet density, pcf
 - P200 % Passing #200 sieve
 - MC Moisture content, %
 - OC Organic content, %
 - q_p Pocket penetrometer strength, tsf
 - q_u Unconfined compression test, tsf
 - LL Liquid limit
 - PL Plastic limit
 - PI Plasticity index

Particle Size Identification

- Boulders..... over 12"
- Cobbles..... 3" to 12"
- Gravel
Coarse..... 3/4" to 3" (19.00 mm to 75.00 mm)
Fine..... No. 4 to 3/4" (4.75 mm to 19.00 mm)
- Sand
Coarse..... No. 10 to No. 4 (2.00 mm to 4.75 mm)
Medium..... No. 40 to No. 10 (0.425 mm to 2.00 mm)
Fine..... No. 200 to No. 40 (0.075 mm to 0.425 mm)
- Silt..... No. 200 (0.075 mm) to .005 mm
- Clay..... < .005 mm

Relative Proportions^{L-M}

- trace..... 0 to 5%
- little..... 6 to 14%
- with..... $\geq 15\%$

Inclusion Thicknesses

- lens..... 0 to 1/8"
- seam..... 1/8" to 1"
- layer..... over 1"

Apparent Relative Density of Cohesionless Soils

- Very loose 0 to 4 BPF
- Loose 5 to 10 BPF
- Medium dense..... 11 to 30 BPF
- Dense..... 31 to 50 BPF
- Very dense..... over 50 BPF

Consistency of Cohesive Soils Blows Per Foot Approximate Unconfined Compressive Strength

- Very soft..... 0 to 1 BPF..... < 0.25 tsf
- Soft..... 2 to 4 BPF..... 0.25 to 0.5 tsf
- Medium..... 5 to 8 BPF..... 0.5 to 1 tsf
- Stiff..... 9 to 15 BPF..... 1 to 2 tsf
- Very Stiff..... 16 to 30 BPF..... 2 to 4 tsf
- Hard..... over 30 BPF..... > 4 tsf

Moisture Content:

- Dry:** Absence of moisture, dusty, dry to the touch.
- Moist:** Damp but no visible water.
- Wet:** Visible free water, usually soil is below water table.

Drilling Notes:

Blows/N-value: Blows indicate the driving resistance recorded for each 6-inch interval. The reported N-value is the blows per foot recorded by summing the second and third interval in accordance with the Standard Penetration Test, ASTM D1586.

Partial Penetration: If the sampler could not be driven through a full 6-inch interval, the number of blows for that partial penetration is shown as #/x" (i.e. 50/2"). The N-value is reported as "REF" indicating refusal.

Recovery: Indicates the inches of sample recovered from the sampled interval. For a standard penetration test, full recovery is 18", and is 24" for a thinwall/shelby tube sample.

WOH: Indicates the sampler penetrated soil under weight of hammer and rods alone; driving not required.

WOR: Indicates the sampler penetrated soil under weight of rods alone; hammer weight and driving not required.

Water Level: Indicates the water level measured by the drillers either while drilling (\sphericalangle), at the end of drilling (\blacktriangledown), or at some time after drilling (\sphericalangle).

Sample Symbols

- Standard Penetration Test
- Modified California (MC)
- Auger
- Grab Sample
- Rock Core
- Thinwall (TW)/Shelby Tube (SH)
- Texas Cone Penetrometer
- Dynamic Cone Penetrometer