

**MICRO STORMWATER
DRAINAGE STUDY
FOR
LONGVIEW PICKLEBALL COMPLEX
3801 SW LONGVIEW RD**

LEE'S SUMMIT, JACKSON COUNTY, MISSOURI

Prepared For:

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September, 2025

Olsson Project No. A24-02865



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1. GENERAL INFORMATION

The Longview Pickleball Complex is a proposed recreational development located in Lee's Summit, Jackson County, Missouri. This project will serve as an addition to the existing Longview Community College campus and will include 12 pickleball courts, an overhead shade canopy, and new sidewalks. The development is entirely contained within the college's property, covering a total area of 3.65 acres. The entire site drains into a tributary of an existing creek, which ultimately flows southwest into Longview Lake. This micro stormwater drainage study will provide an analysis of stormwater runoff rates and water quality impacts associated with the project.

1.1 Project Location

The proposed Longview Pickleball Complex is located entirely within the property of Longview Community College at 3801 SW Longview Rd, Lee's Summit, MO. The site is bounded by the Longview Community Center to the north, an existing baseball complex to the west, an existing creek to the south, and a parking lot to the east, as illustrated in Figure 1 below. Parcel data for the project area is provided in Table 1-1.



Figure 1. Project Location Map

Table 1-1. Parcel Data

County APN #
63-600-01-04-02-3-00-000

1.2 Federal Emergency Management Agency Floodplain Classification

All of the project area lies within areas determined to be outside the 0.2% annual chance floodplain (unshaded Zone X) as shown on the FEMA Flood Insurance Rate Map (FIRM) Map No. 29095C0412G (Jackson County, MO), Effective Date January 20th, 2017. A copy of the FEMA Map is included in Appendix F with the site location depicted in the upper half of the map.

1.3 Soil Classifications

A geotechnical investigation has not yet been completed for this site. However, soil maps published by the NRCS Web Soil Survey for Jackson County, Missouri categorize the soils within the project area as:

Table 1-2. Soil Classifications

Symbol	Name	Slopes	Hydrologic Soil Group
10129	Sharpsburg-Urban land complex	5-9%	D
10180	Udarents-Urban land-Sampsel complex	2-5%	C/D

NRCS Runoff Curve Numbers (CN's) in this study have been assigned to tributary areas onsite based upon these Hydrologic Soil Groups and associated existing and proposed land use. Land uses were determined using zoning maps, aerial photos, and visual observation. A copy of the geotechnical report and NRCS printout is included in Appendix E.

2. METHODOLOGY

This micro storm drainage study has been prepared in accordance with the February 16, 2011 edition of the Kansas City Metropolitan Chapter of the American Public Works Association (KCAPWA) Construction and Material Specifications, Section 5600, as currently adopted by the City of Lee's Summit.

Existing Conditions hydrology will be evaluated in Section 3, while Proposed Conditions hydrology will be analyzed in Section 4. The peak flow rates under Proposed Conditions are expected to be lower than those under Existing Conditions; therefore, a stormwater management waiver will be requested.

Section 3 assumes current land use within the tributary sub-watersheds and pre-development conditions within the project boundary. Section 4 assumes developed conditions within the project area, including the pickleball courts and associated improvements. It should be noted that additional development is planned within the site, at which time a separate stormwater study will be conducted.

Runoff rates and detention hydraulics were analyzed using Autodesk Storm and Sanitary Analysis 2018 (SSA). SSA utilizes the following approved methods to model Existing and Proposed Conditions for stormwater runoff.

- NRCS TR-55 Unit Hydrograph Method
- 2-, 10-, and 100-year Return Frequency, 24-hr. Storm Precip. Depths (TP-40)
- ARC Type II Soil Moisture Conditions
- 24-Hour NRCS Type II Rainfall Distribution
- Runoff Curve Numbers per NRCS TR-55 (Tables 2-2a - 2-2c) and KCAPWA Section 5602.3
- NRCS TR-55 Methods for determination of Time of Concentration and Travel Time.

In addition to the hydrologic evaluation, this study includes an analysis to ensure water quality treatment for the site, in accordance with the Mid-America Regional Council's "Manual for Best Management Practices for Stormwater Quality" (September 2003 edition), commonly referred to as the BMP Manual. The primary objective of implementing stormwater BMPs is "to manage stormwater quantity and protect water quality." Recommended BMPs for the project will be evaluated using Level of Service (LOS) calculations as outlined in the BMP Manual. Similar to peak runoff control, BMP design will also consider interim developed conditions within the project area.

The general overview of the proposed Stormwater BMP's is provided in Section 4.2 of this Micro Stormwater Drainage Study. The worksheets (Worksheets 1&2) establishing the Level of Service requirements and mitigation packages are provided in Appendix C of this report.

Stormwater runoff models were created for the 1%, 10%, and 50% design storm events. The precipitation depths used in the analyses have been interpolated from the "Technical Paper No.40 Rainfall Frequency Atlas of the United States" (TP-40) isopluvial maps (May 1961). The following Table 2 summarizes the rainfall depths used in this analysis:

Table 2. Precipitation Depths.

Return Period	24-Hour Precipitation Depth (in.)
2-Year (50% Storm)	3.50
10-Year (10% Storm)	5.30
100-Year (1% Storm)	7.70

3. EXISTING CONDITIONS

The existing site is currently developed and consists primarily of a baseball field with intermittent grass coverage. As described in Section 1, the site is bounded by several adjacent developments. The total onsite project area encompasses 3.65 acres, with the majority of the area exhibiting sheet flow toward an existing drainage creek located to the south.

Runoff Curve Numbers (CNs) have been established for the site based on current land use, which was determined through survey data, aerial photography, and visual observation. A summary of the existing site model input data is provided in Table 3-1 below. A detailed land cover map (Exhibit A) is included in Appendix A.

Table 3-1. Existing Conditions Runoff Results for Subbasins

Subbasin	Drainage Area (ac)	Time of Concentration (min)	Curve Number
Project Area	3.65	7.04	82.71

The routing paths, drainage areas, Runoff Curve Numbers (CNs), and Time of Concentration (Tc) values for the respective sub-areas were used as input for the Existing Conditions hydrologic model to evaluate the site's current stormwater behavior. The resulting peak flow rates from the hydrologic routing are summarized in Table 3-2 below. Supporting hydrographs are included in Appendix B, and the complete model output data is provided in Appendix D.

Table 3-2. Existing Conditions Runoff Results at Points of Interest

Subbasin	50% Chance Event Peak Q (cfs)	10% Chance Event Peak Q (cfs)	1% Chance Event Peak Q (cfs)
Project Area	10.00	18.36	29.75

4. PROPOSED CONDITIONS ANALYSIS

Under Proposed Conditions, the majority of the existing baseball field will be removed and replaced with site improvements and high-quality grass seed or sod. This section of the study analyzes the developed conditions, excluding any future additions, to generate runoff results for comparison against Existing Conditions. Drainage patterns and tributary areas will remain unchanged. Refer to Exhibit B in Appendix B for the Proposed Land Cover Map.

4.1 Proposed Site Hydrology

The proposed model, as in the Existing model, is analyzed at the outfall in the existing creek.

Tables 4-1 through 4-3, below, provide a summary of the proposed site tributary area and corresponding model results. Refer to the Proposed Land Cover Map (Exhibit B) located in Appendix A and model calculations located in Appendix D for Runoff Curve Number (CN) and Time of Concentration (Tc) calculations.

Table 4-1. Proposed Site Data

Subbasin	Drainage Area (ac)	Time of Concentration (min)	Curve Number
Project Area	3.65	11.00	84.84

Table 4-2. Proposed Conditions Updated Subbasin Runoff Results

Subbasin	50% Chance Event Peak Q (cfs)	10% Chance Event Peak Q (cfs)	1% Chance Event Peak Q (cfs)
Project Area	9.93	17.65	28.01

It should be noted that peak flow rates under Proposed Conditions are lower than those under Existing Conditions (refer to Table 4-3 below), despite an increase in impervious surface area, as indicated by a higher combined Runoff Curve Number (CN). Several factors contribute to this outcome:

- The existing land cover within the project area is classified as open space (turf). However, the current grass coverage is sparse (fair), which typically corresponds to a lower CN value. In contrast, the proposed improvements will include healthy, dense grass in good condition, which warrants a higher CN value.
- The existing site grades are relatively steep, resulting in a lower Time of Concentration (Tc) and faster surface runoff. The proposed pickleball courts and associated improvements will feature flatter grades, which slow down surface runoff and increase Tc, thereby reducing peak flow rates.

Table 4-3. Proposed Conditions vs Existing Conditions Comparison

Outfall	50% Chance Existing Peak Q (cfs)	50% Chance Proposed Peak Q (cfs)	10% Chance Existing Peak Q (cfs)	10% Chance Proposed Peak Q (cfs)	1% Chance Existing Peak Q (cfs)	1% Chance Proposed Peak Q (cfs)
Outfall 1	10.00	9.93	18.36	17.65	29.75	28.01

As shown in Table 3-2, Proposed Conditions peak flow rates are lower than those under Existing Conditions across all storm events. Additionally, the existing creek that receives stormwater runoff from the site discharges into Longview Lake, approximately 1,500 linear feet downstream. There are no existing developments downstream of the site that would be at risk of flooding due to the proposed improvements.

For these reasons, this stormwater letter formally requests a waiver from providing stormwater detention, in accordance with APWA Section 5601.6.A.

4.2 Stormwater Quality

Water quality treatment design is in conformance with the KCAPWA “Manual for Best Management Practices for Stormwater Quality”, September 2003 edition (BMP Manual), Level of Service guidelines. Due to the improvements proposed across the developed area, impervious surface areas are increased from existing conditions. These increases result in a required Level of Service of 5.0 for the Longview Pickleball Courts development (see Worksheet 1 in Appendix C).

The Level of Service for the development will be met using native vegetation along the creek, which will also act as a vegetated filter strip for surface runoff. Refer to Exhibit C in Appendix A for proposed BMP Plan.

Worksheets 1 and 2 from the BMP Manual, along with BMP sizing calculations for the proposed development devices are included in Appendix C.

5. RESULTS

As shown in the previous sections, the proposed improvements do not negatively impact stormwater peak flowrates. Thus, a stormwater management waiver is being requested.

Table 5-1. Proposed Conditions vs Existing Conditions Comparison

Outfall	50% Chance Existing Peak Q (cfs)	50% Chance Proposed Peak Q (cfs)	10% Chance Existing Peak Q (cfs)	10% Chance Proposed Peak Q (cfs)	1% Chance Existing Peak Q (cfs)	1% Chance Proposed Peak Q (cfs)
Outfall 1	10.00	9.93	18.36	17.65	29.75	28.01

6. CONCLUSION

This Micro Stormwater Drainage Study has been prepared for the proposed Longview Pickleball Complex project to request a stormwater management waiver and establish BMP Plan for the site.

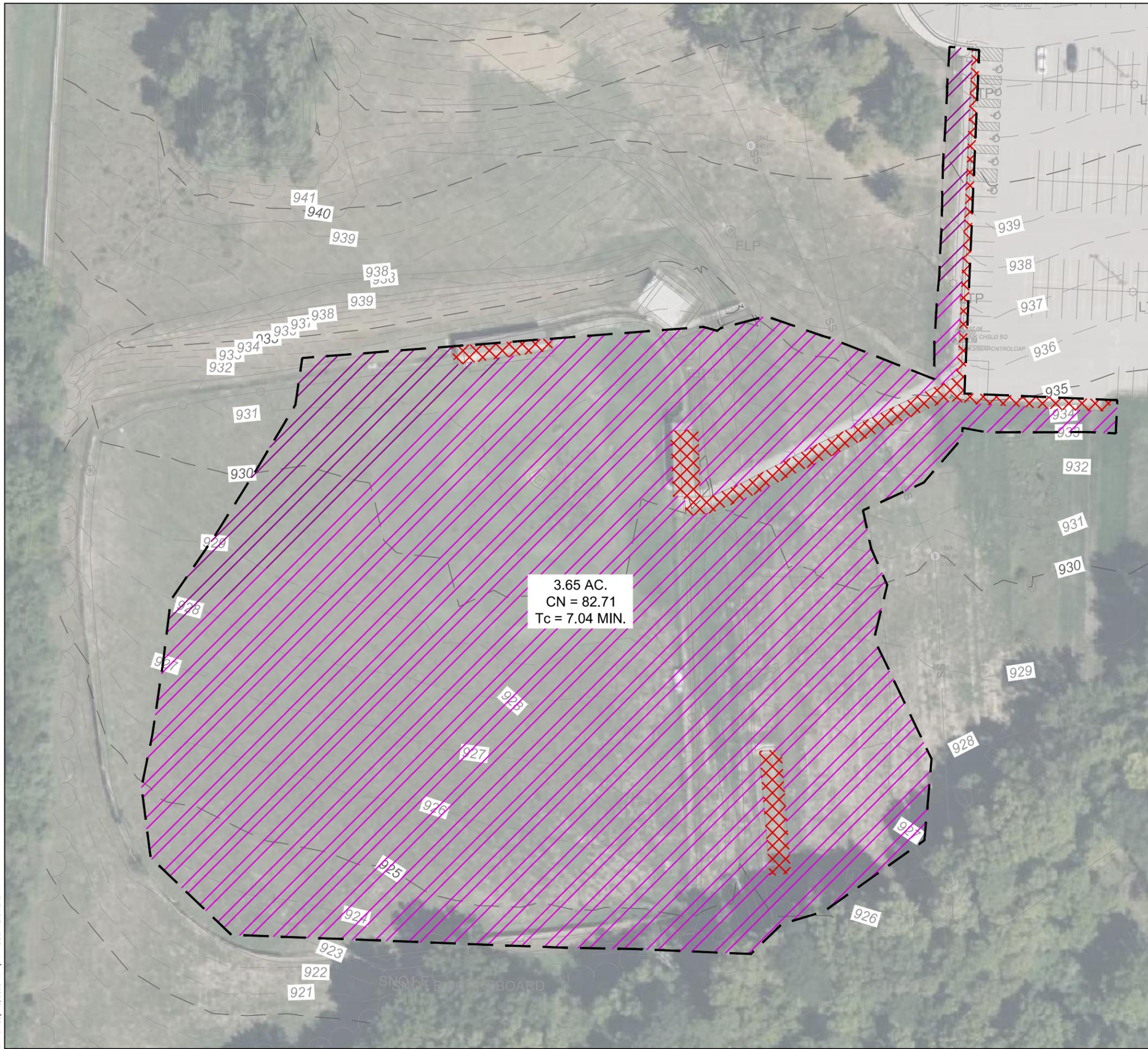
Required Level of Service is 5.00 for the proposed development was provided with the proposed BMP Plan.

This study demonstrated the overall compliance with KCAPWA Section 5600.

APPENDIX A

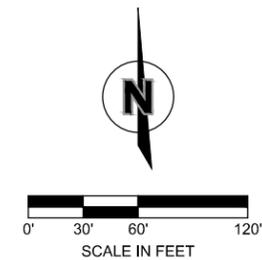
Exhibits

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PLAN LEGEND

-  STUDY LIMITS
-  EXISTING GRADE MAJOR CONTOUR
-  EXISTING GRADE MINOR CONTOUR
-  IMPERVIOUS COVER, CN 98
-  OPEN SPACE, FAIR HSG C/D; CN 82
-  OPEN SPACE, FAIR HSG D; CN 84



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 Missouri COA #001592

REV. NO.	DATE	DESCRIPTION	BY

EXISTING CONDITIONS LAND COVER MAP
 EXHIBIT

LONGVIEW PICKLEBALL COMPLEX
 3801 SW LONGVIEW RD

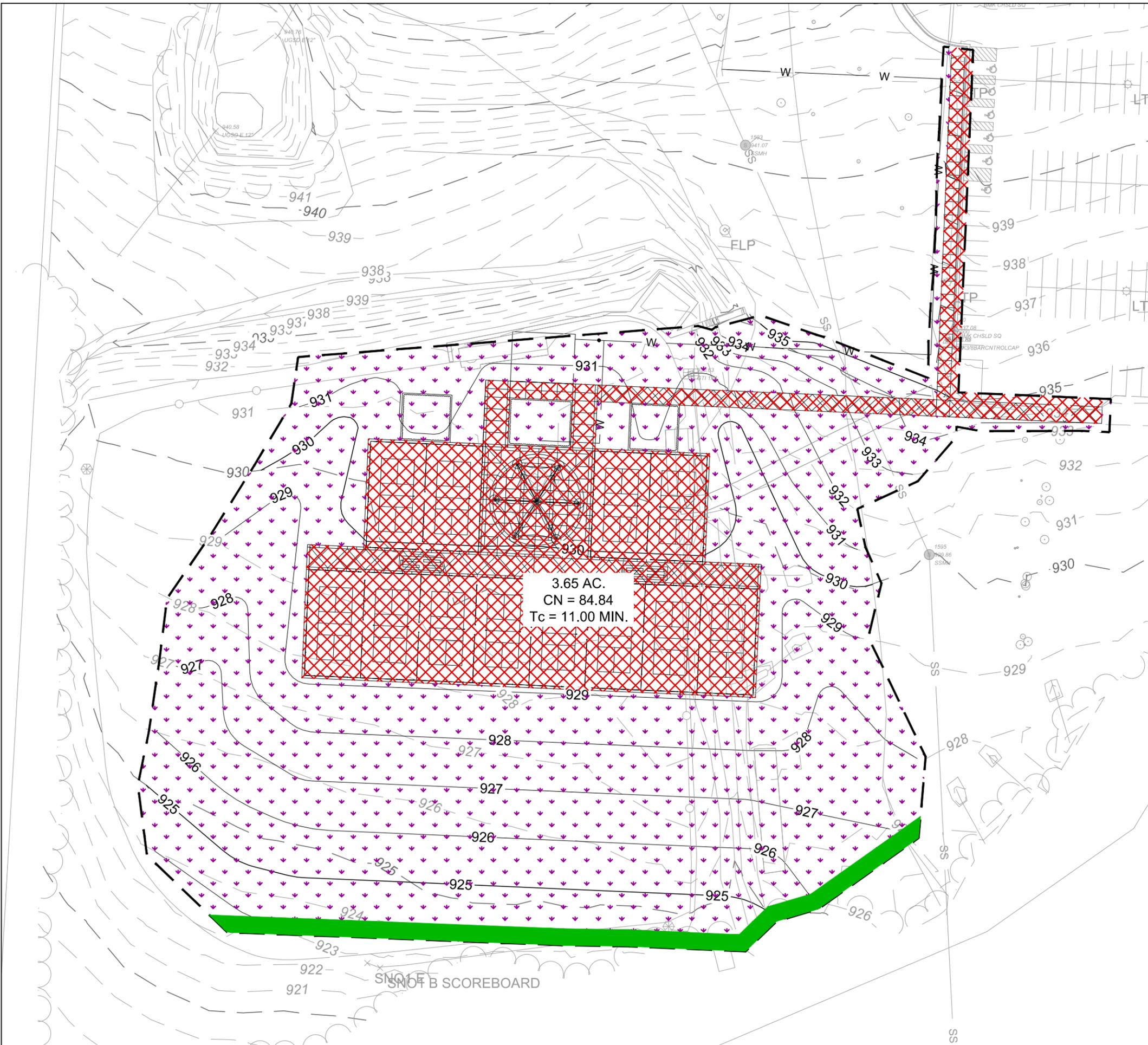
LEE'S SUMMIT, MO

2025

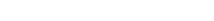
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 designed by: AR
 project no.: A24-02856
 date: 9/10/2025

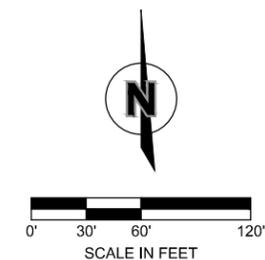
SHEET
 EXH-A

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PLAN LEGEND

-  STUDY LIMITS
-  EXISTING GRADE MAJOR CONTOUR
-  EXISTING GRADE MINOR CONTOUR
-  PROPOSED GRADE MAJOR CONTOUR
-  PROPOSED GRADE MINOR CONTOUR
-  IMPERVIOUS COVER, CN 98
-  OPEN SPACE, GOOD HSG D; CN 80
-  NATIVE VEGETATION HSG D; CN 77



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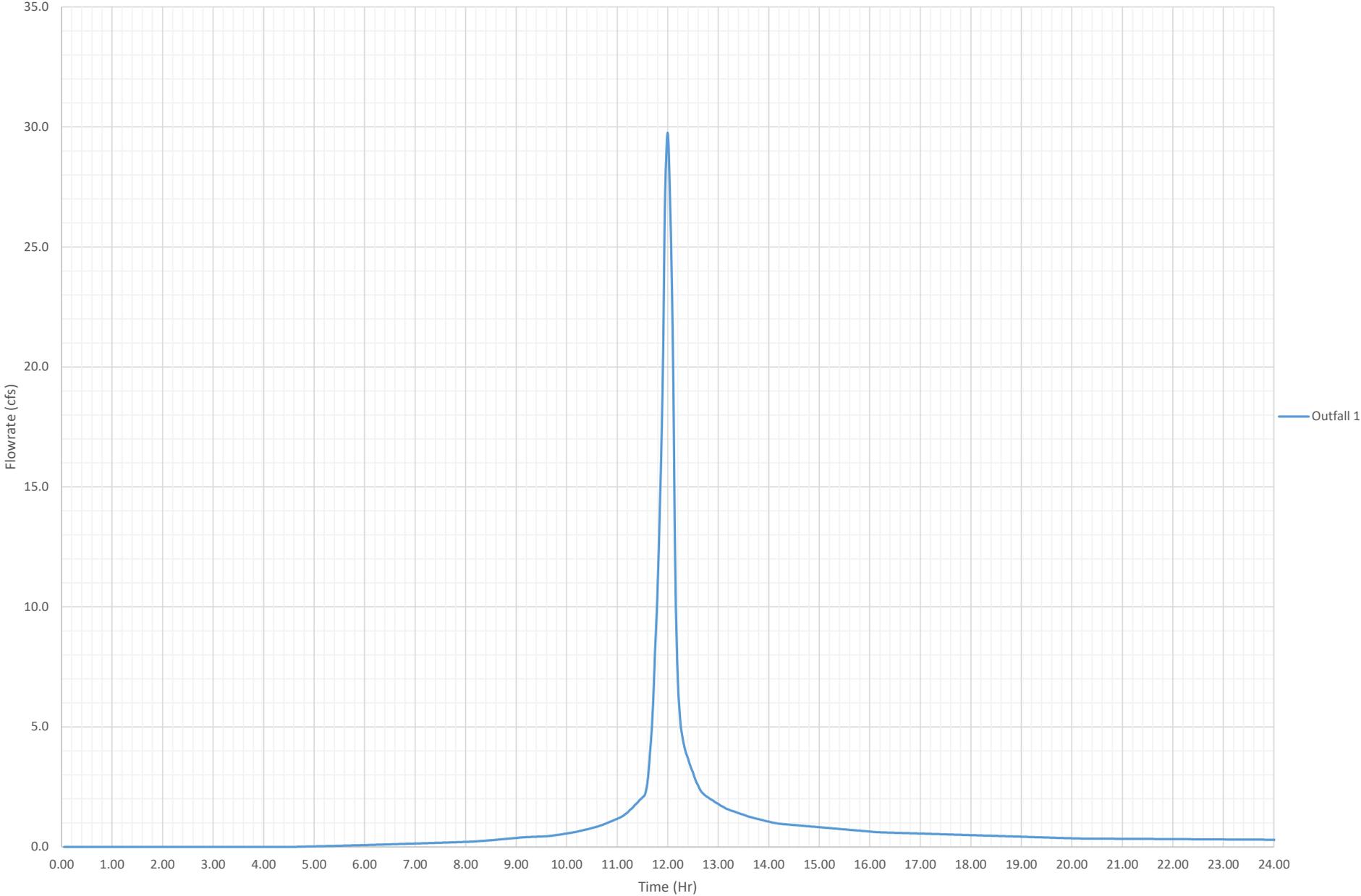
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REV. NO.	DATE	DESCRIPTION	BY

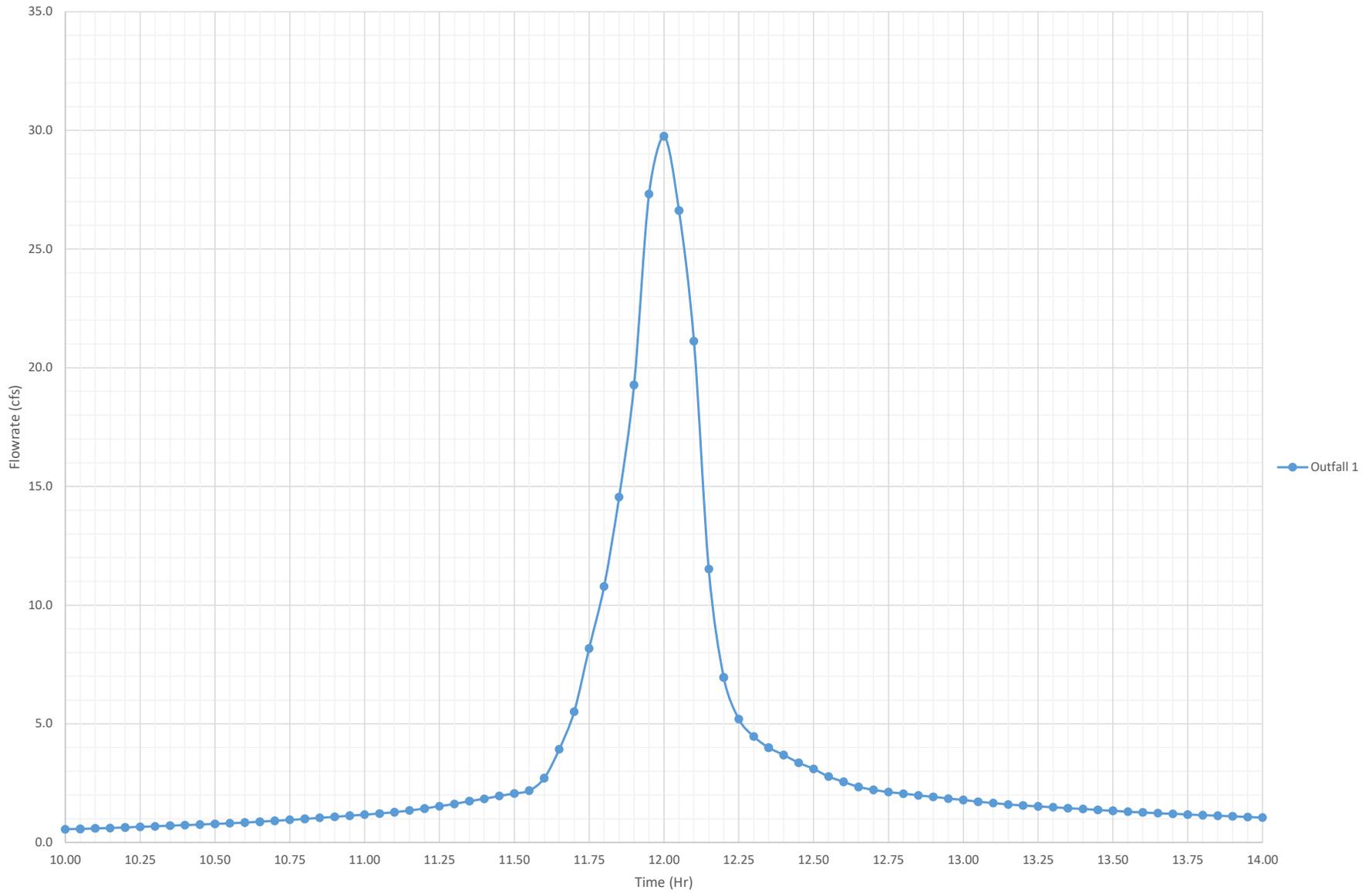
PROPOSED CONDITIONS LAND COVER MAP EXHIBIT	2025
LONGVIEW PICKLEBALL COMPLEX 3801 SW LONGVIEW RD	
LEE'S SUMMIT, MO	
drawn by: _____ AR	
designed by: _____ AR	
project no.: A24-02856	
date: 9/22/2025	
SHEET EXH-B	

APPENDIX B
Hydrographs

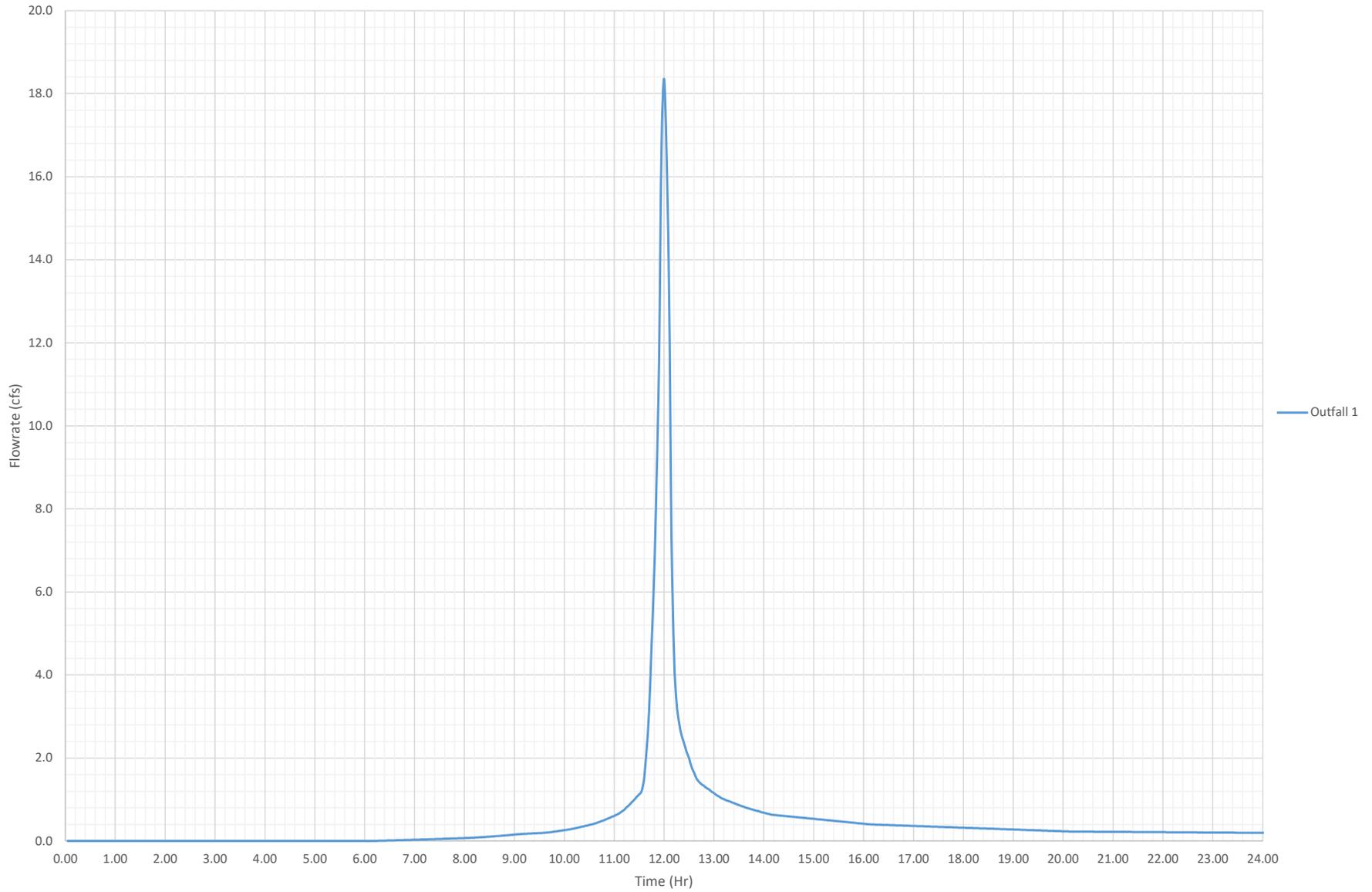
1% Chance Event - Existing Peak 24-Hr Flowrate



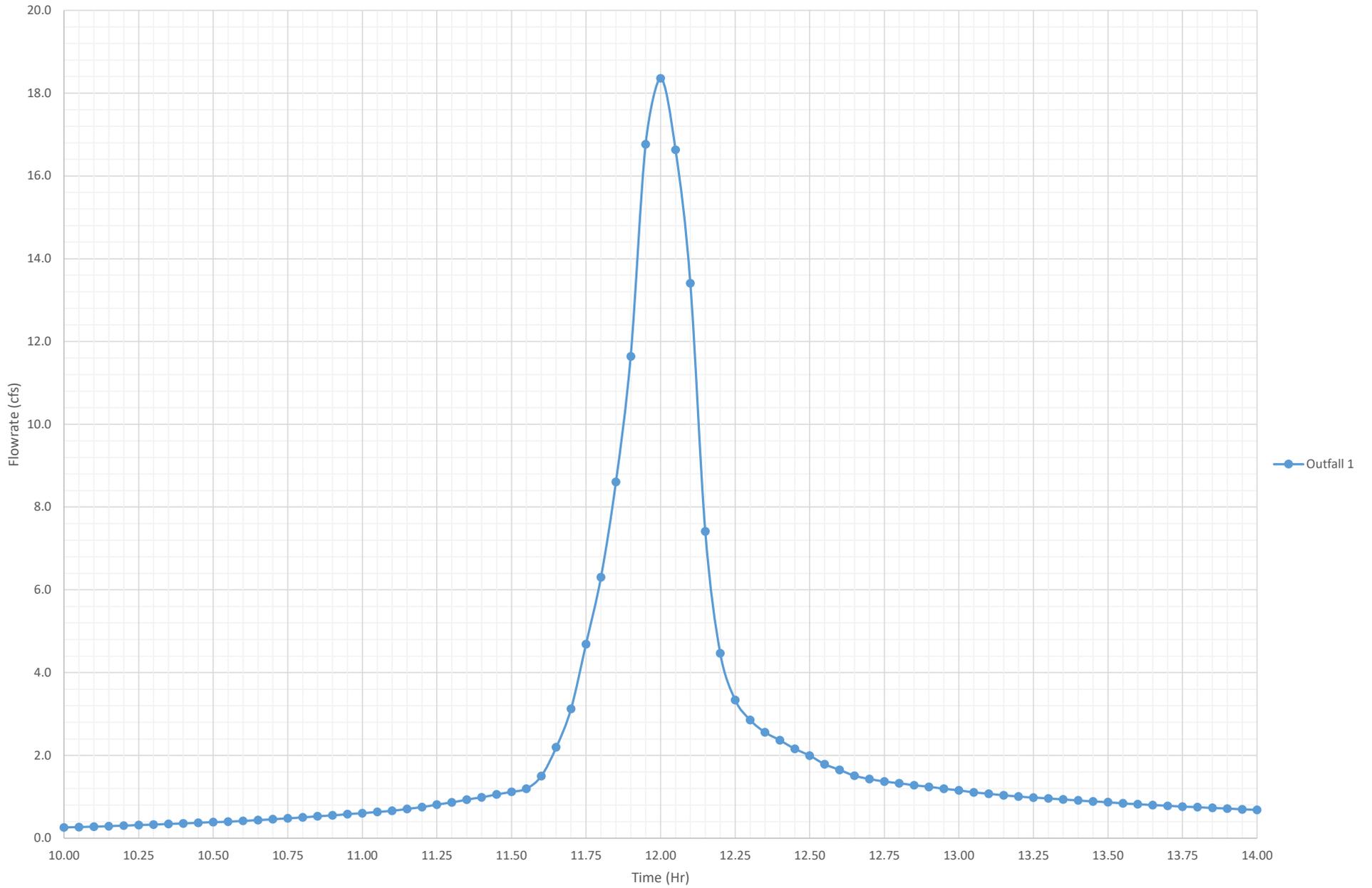
1% Chance Event - Existing Peak 4-Hr Flowrate



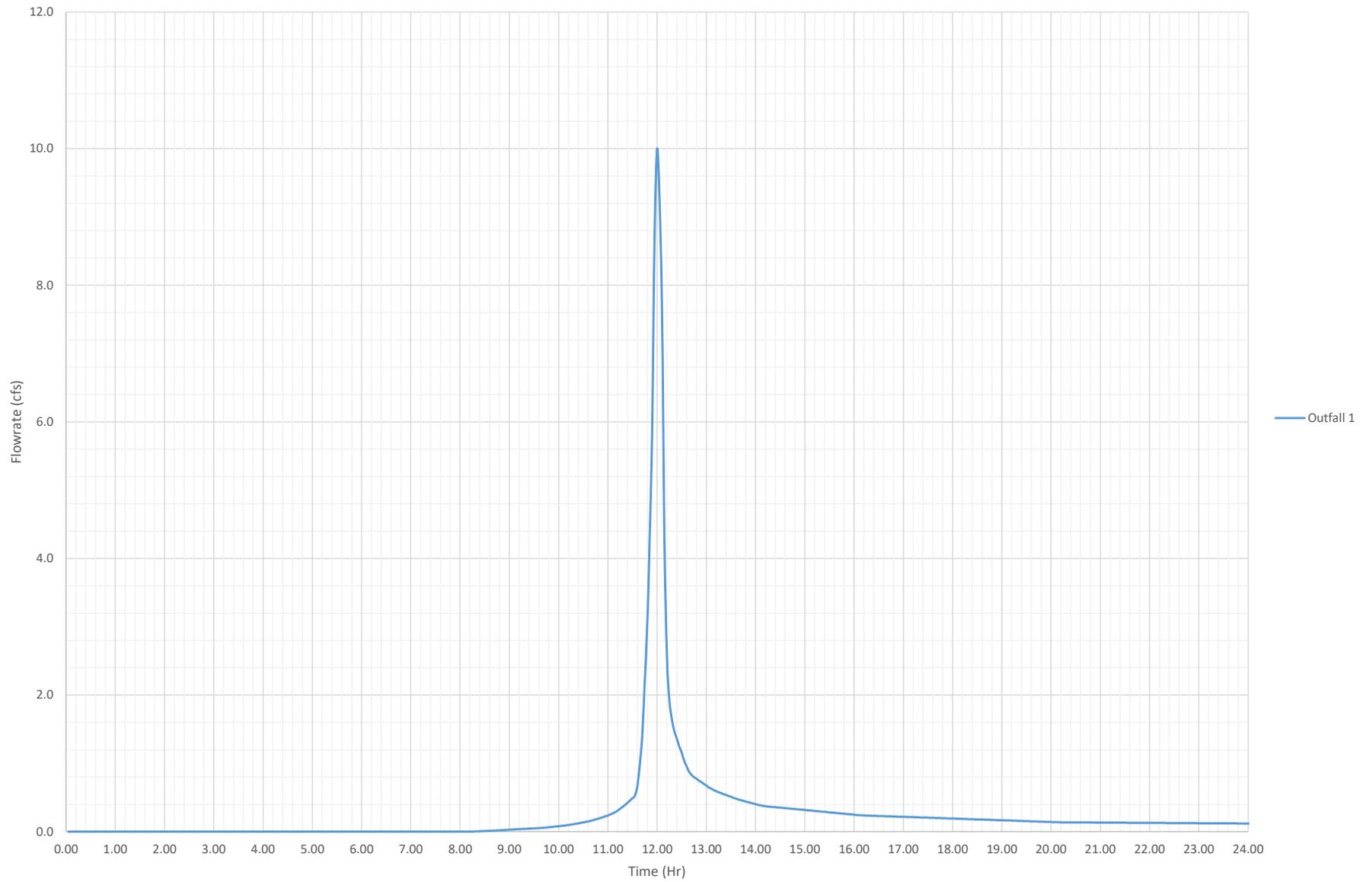
10% Chance Event - Existing Peak 24-Hr Flowrate



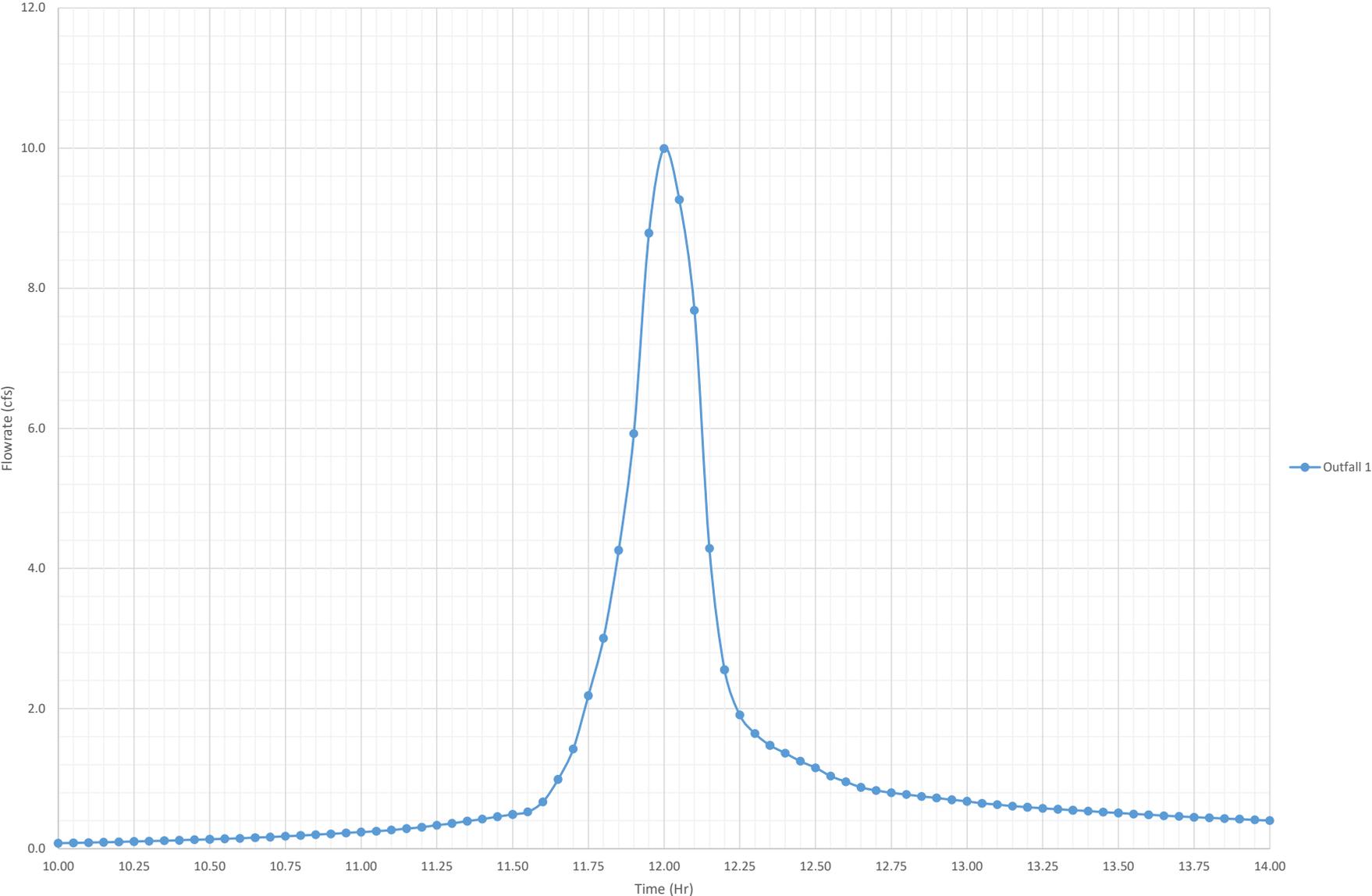
10% Chance Event - Existing Peak 4-Hr Flowrate



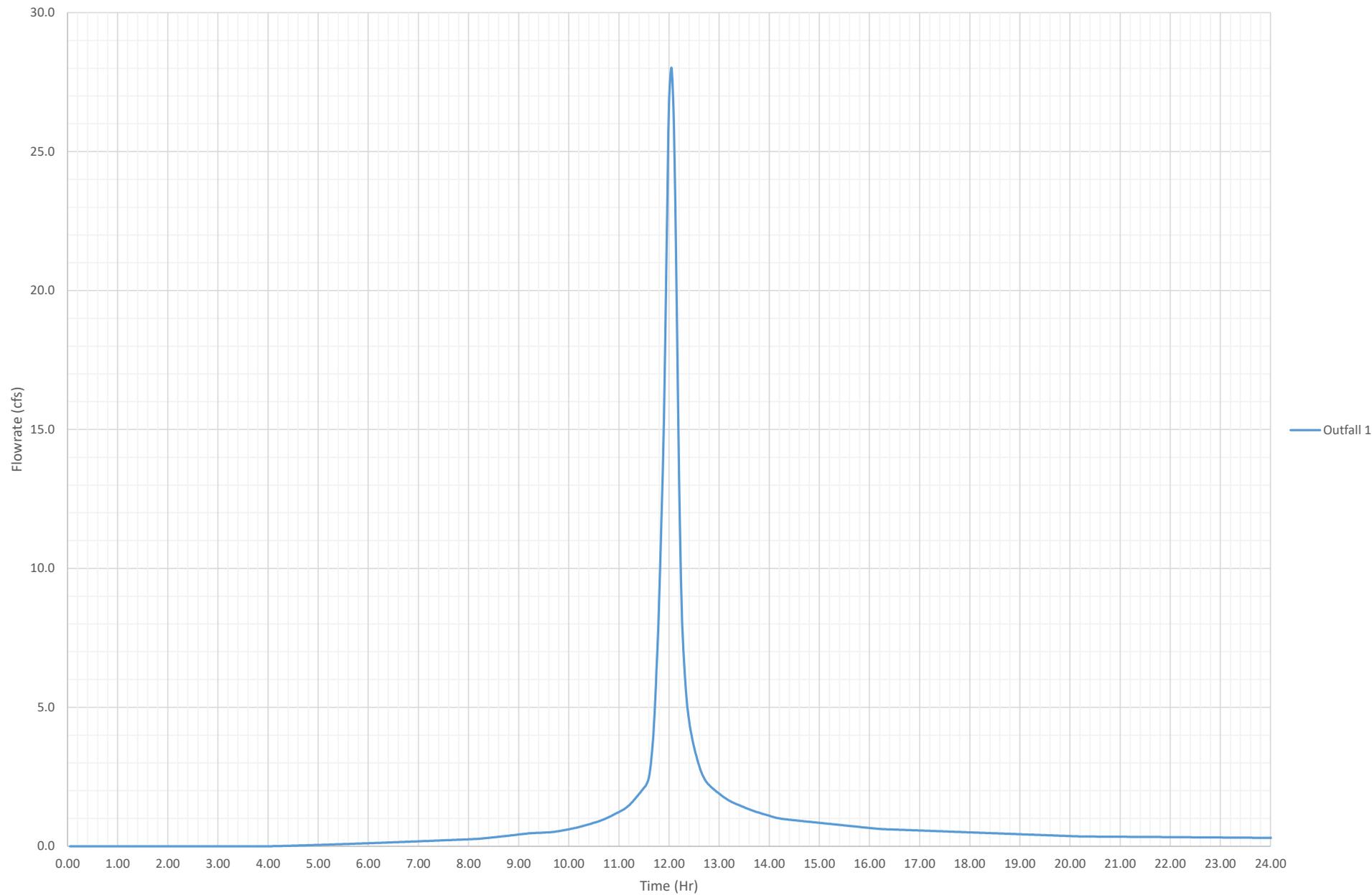
50% Chance Event - Existing Peak 24-Hr Flowrate



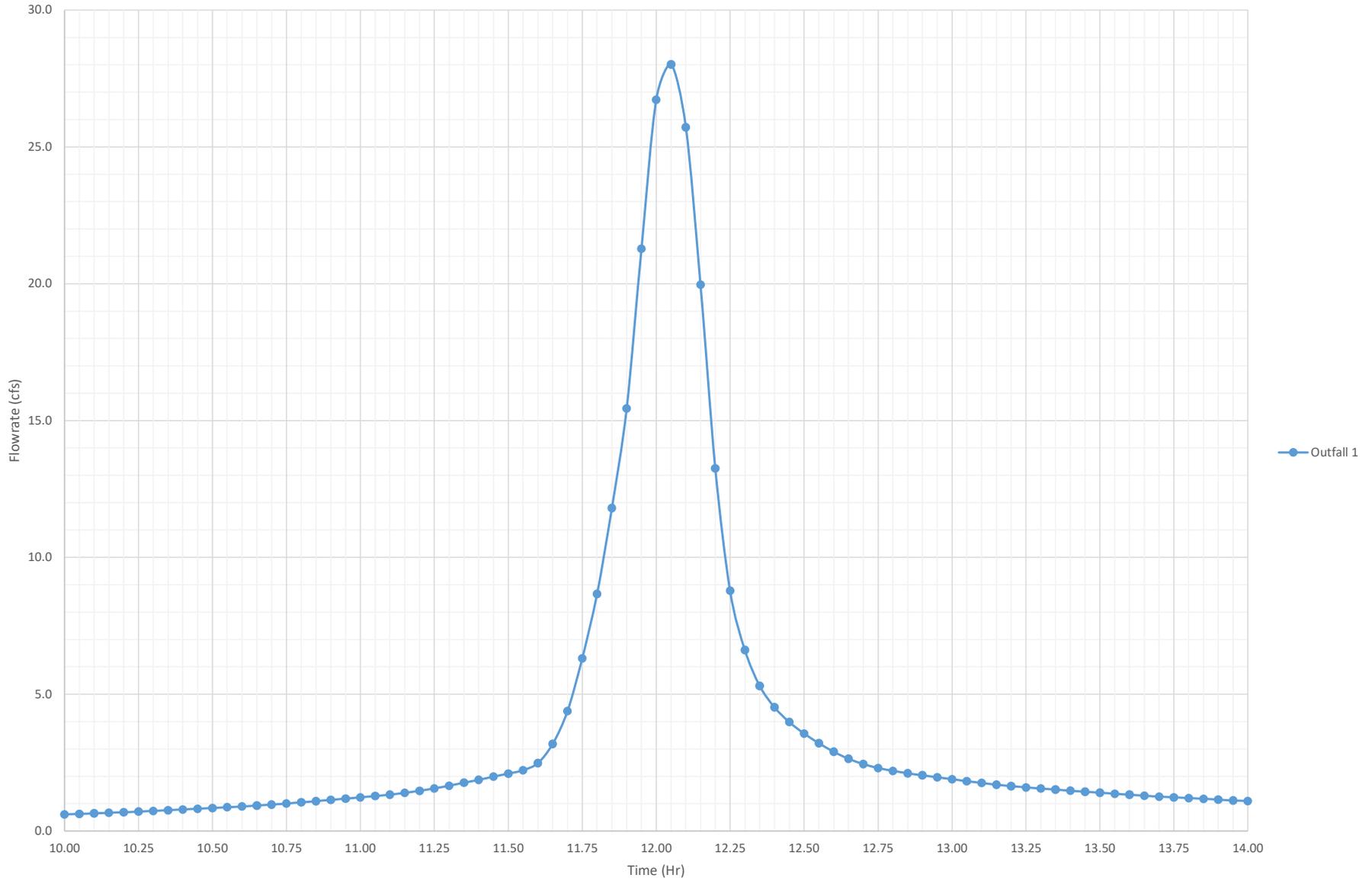
50% Chance Event - Existing Peak 4-Hr Flowrate



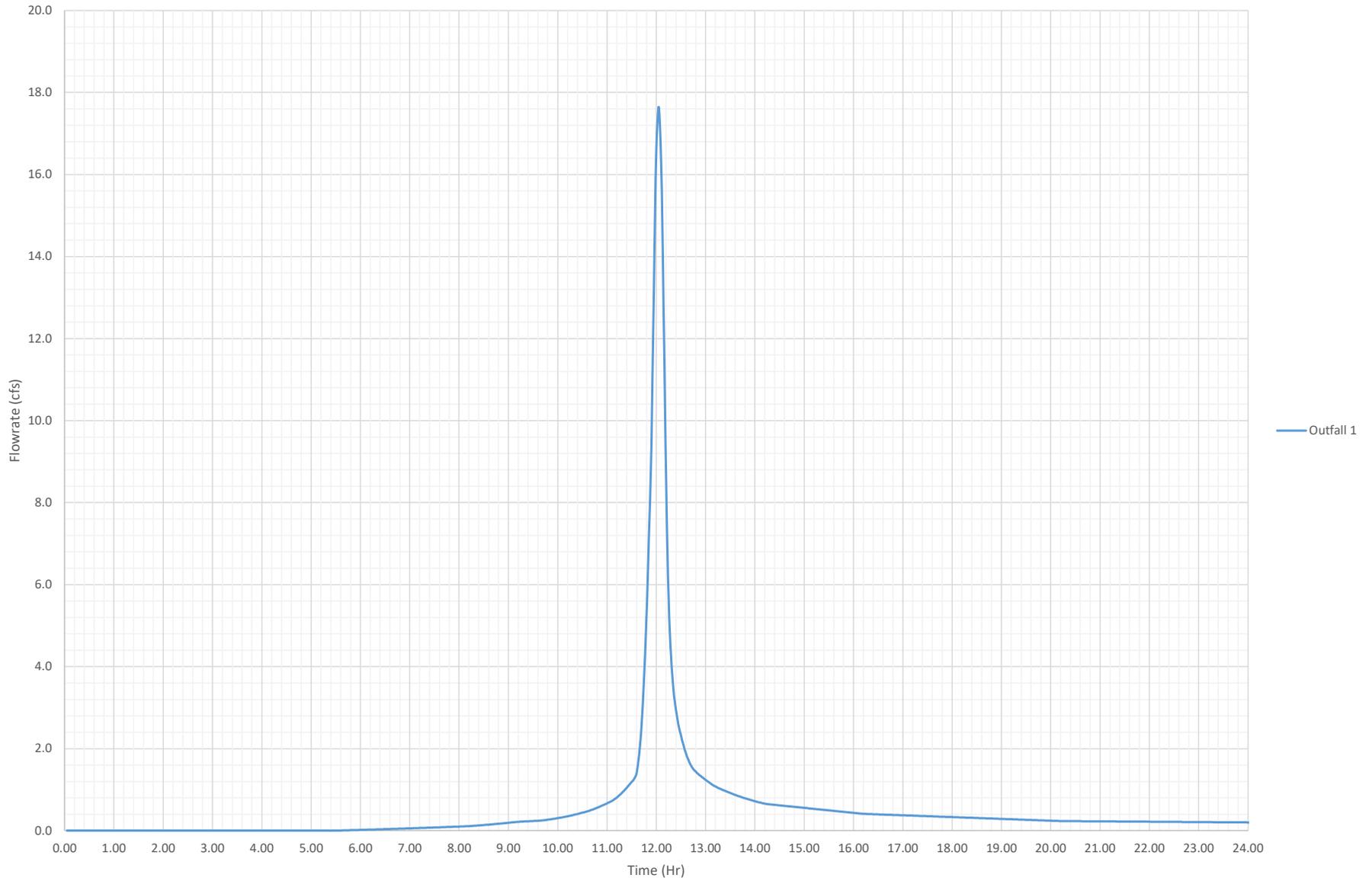
1% Chance Event - Proposed Peak 24-Hr Flowrate



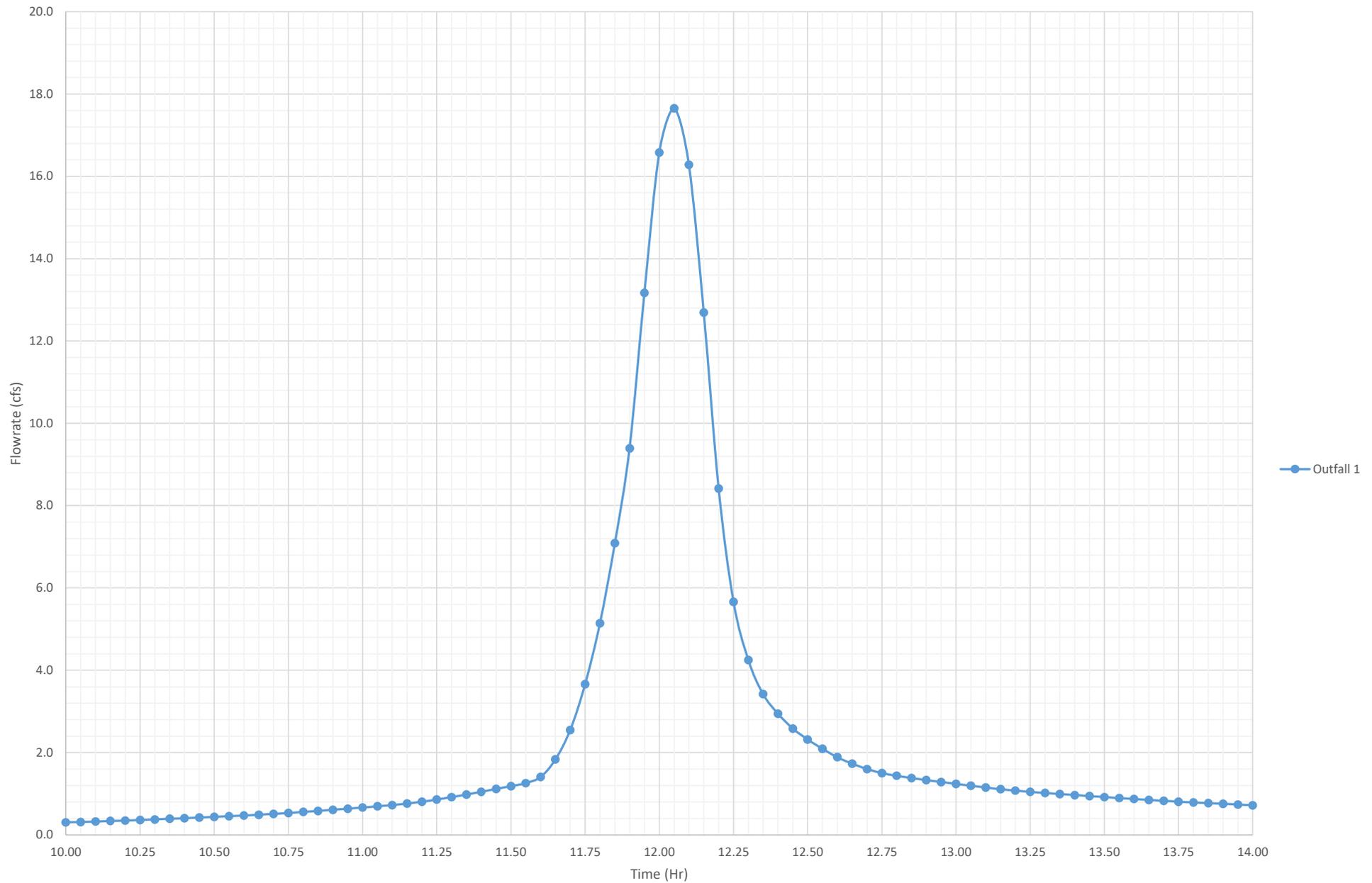
1% Chance Event - Proposed Peak 4-Hr Flowrate



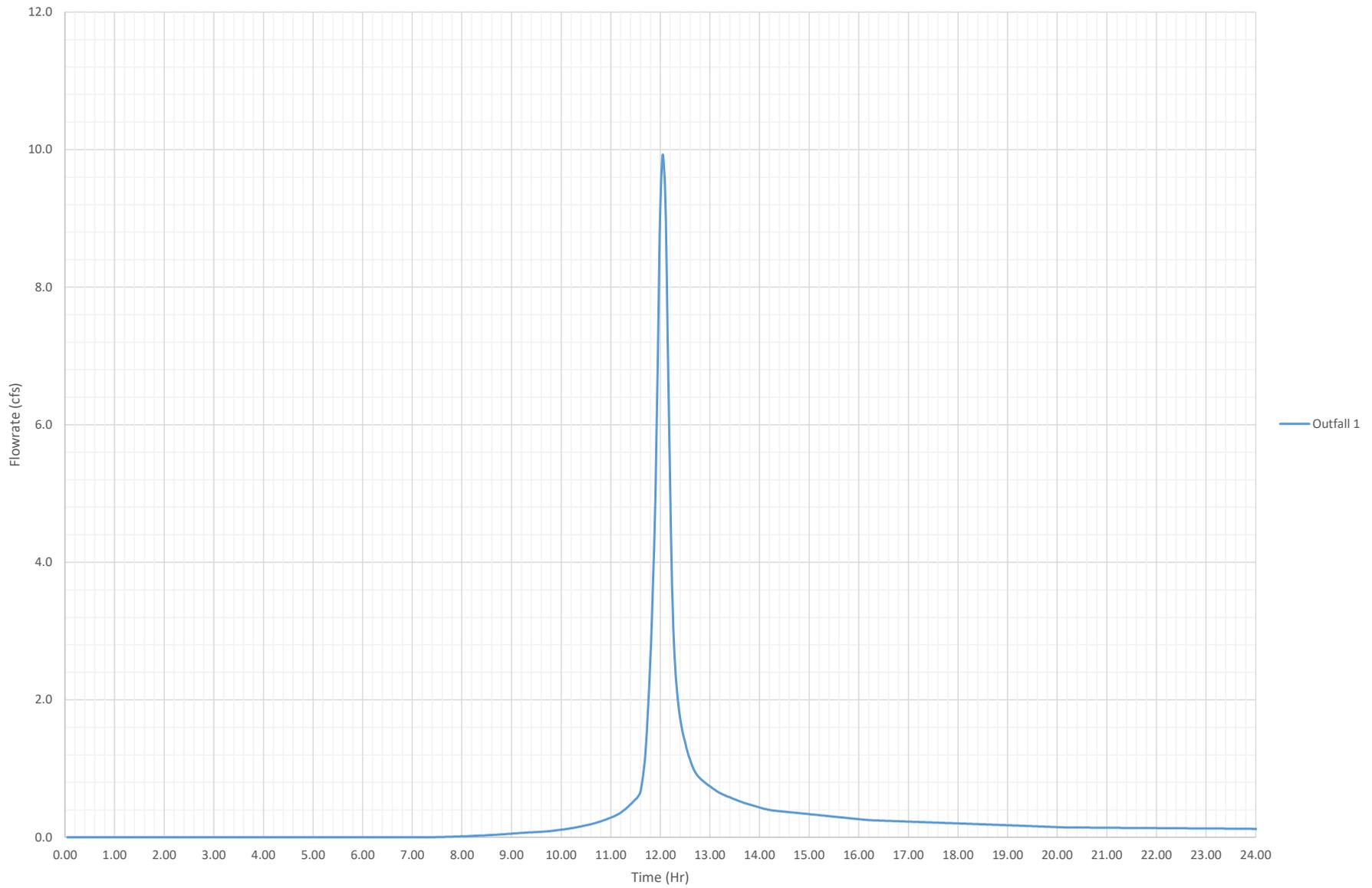
10% Chance Event - Proposed Peak 24-Hr Flowrate



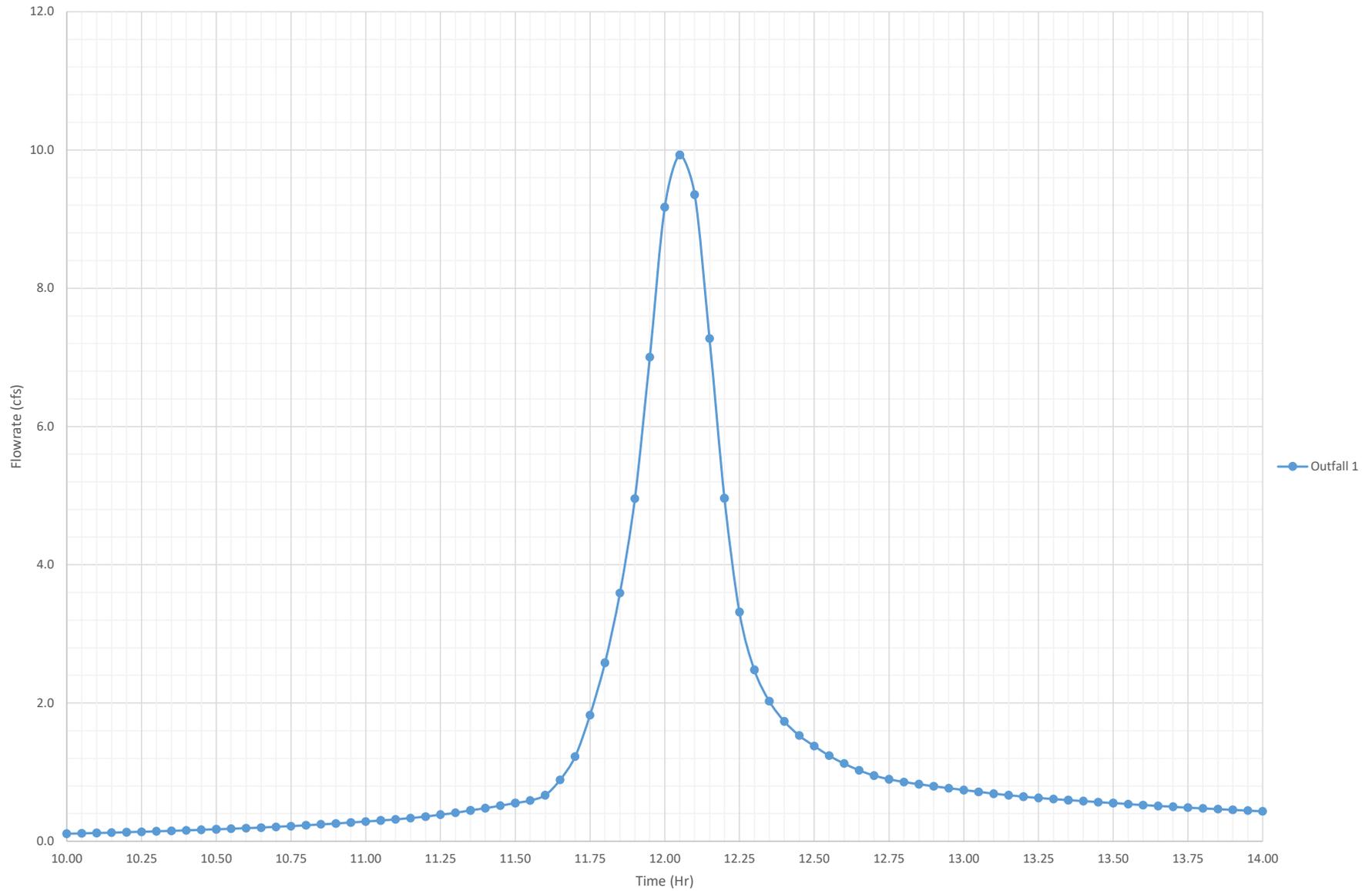
10% Chance Event - Proposed Peak 4-Hr Flowrate



50% Chance Event - Proposed Peak 24-Hr Flowrate



50% Chance Event - Proposed Peak 4-Hr Flowrate



APPENDIX C
Water Quality

WORKSHEET 1A: REQUIRED LEVEL OF SERVICE - DEVELOPED SITE

Project : Longview Pickleball Complex
Location: 3801 SW Longview Rd
By: AR **Date:** 9/10/2025
Checked: **Date:**

1. Required Treatment Area

A. Total Area Disturbed by Redevelopment Activity

<u>Disturbed Area Description</u>	<u>Area (ac)</u>
Impervious	0.12
Open Space (Turf)	3.53
	0.00
"1A" Total:	3.65

B. Existing Impervious Area Inside Disturbed Area

<u>Existing Impervious Area Description</u>	<u>Area (ac)</u>
Impervious	0.12
	0.00
	0.00
"1B" Total:	0.12

C. Required Treatment Area (ac)

"1A" Total Less "1B" Total= "1C" = 3.53

2. Percent Impervious In Postdevelopment Condition and Level of Service (LOS)

A. Total Postdevelopment Impervious Area Inside Disturbed Area

<u>Proposed Impervious Area Description</u>	<u>Area (ac)</u>
Impervious	1.00
	0.00
	0.00
"2A" Total:	1.00

B. Existing Impervious Area Inside Disturbed Area (ac)

"1B" Total: 0.12

C. Net Increase in Impervious Area (ac)

"2A" Total Less "1B" Total= "2C" = 0.87

D. Percent Impervious

Net Increase in Impervious Area/Required Treatment Area= Imp = 24.79

E. Level of Service (LOS)

Use Percent Impervious to enter Table 4.3 LOS = 5

3. Minimum Required Total Value Rating of BMP Package

Total Value Rating = LS x Required Treatment Area VR = 17.63

WORKSHEET 2: DEVELOP MITIGATION PACKAGE(S) THAT MEET THE REQUIRED LS

Project :
 Location:
 By:
 Checked:

Date:
 Date:

1. Required LS (from Table 1 or 1A or Worksheet 1 or 1A, as appropriate): 5.00

2. Proposed BMP Option Package No. 1

<u>Plan ID</u>	<u>BMP #</u>	<u>Cover/BMP Description</u>	<u>Treatment Area</u>	<u>VR from Table 5 or 6</u>	<u>Product of VR x Area</u>
	1	Native Vegetation	0.10	9.25	0.94
	2	Vegetated Filter Strip	0.91	5.00	4.55
	3		0.00	0.00	0.00
	4		0.00	0.00	0.00
	5		0.00	0.00	0.00
	6		0.00	0.00	0.00
	7		0.00	0.00	0.00
	8		0.00	0.00	0.00
	-	Untreated Area	2.64	-	-
Total:			3.65	Total:	5.49

Meets required LS (Yes/No)?

YES

(if No, or if additional options are being tested, proceed below)

APPENDIX D

Model Results

Project Description

File Name Existing Conditions.SPF

Project Options

Flow Units CFS
 Elevation Type Elevation
 Hydrology Method SCS TR-55
 Time of Concentration (TOC) Method SCS TR-55
 Link Routing Method Kinematic Wave
 Enable Overflow Ponding at Nodes YES
 Skip Steady State Analysis Time Periods YES

Analysis Options

Start Analysis On 00:00:00 0:00:00
 End Analysis On 00:00:00 0:03:00
 Start Reporting On 00:00:00 0:00:00
 Antecedent Dry Days 0 days
 Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
 Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
 Reporting Time Step 0 00:03:00 days hh:mm:ss
 Routing Time Step 30 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins.....	1
Nodes.....	2
<i>Junctions</i>	1
<i>Outfalls</i>	1
<i>Flow Diversions</i>	0
<i>Inlets</i>	0
<i>Storage Nodes</i>	0
Links.....	1
<i>Channels</i>	0
<i>Pipes</i>	1
<i>Pumps</i>	0
<i>Orifices</i>	0
<i>Weirs</i>	0
<i>Outlets</i>	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage	Data	Data Source	Rainfall	Rain	State	County	Return	Rainfall	Rainfall
	ID	Source	ID	Type	Units			Period	Depth	Distributic

Subbasin Summary

SN Subbasin ID	Area (ac)	Peak Rate Factor	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1 Proposed Site	3.65	484.00	82.71	7.70	5.66	20.65	30.01	0 00:07:02

Node Summary

SN ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft ²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	(d)
1	Jun-A Junction	750.00	760.00	0.00	0.00	0.00	29.75	750.00	0.00	10.00	
2	Outfall_A Outfall	700.00					29.75	700.00			

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Diameter or Height (in)	Manning's Roughness	Peak Flow (cfs)	Design Flow Capacity (cfs)	Peak Flow/Design Flow Ratio	Peak Flow Velocity (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/Total Depth Ratio	T Su
1	Link-32	Pipe	Jun-A	Outfall_A	116.27	0.00	700.00	-602.0500			29.75	0.00	0.00	0.00	0.00	0.00	

Subbasin Hydrology

Subbasin : Proposed Site

Input Data

Area (ac) 3.65
 Peak Rate Factor 484
 Weighted Curve Number 82.71
 Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
32			
Paved parking & roofs	0.12	D	98
< 50% grass cover, Poor	3.23	C/D	82
50 - 75% grass cover, Fair	0.3	D	84
Composite Area & Weighted CN	3.65		82.71

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8}) / ((P^{0.5}) * (S_f^{0.4})))$$

Where :

T_c = Time of Concentration (hr)
 n = Manning's roughness
 L_f = Flow Length (ft)
 P = 2 yr, 24 hr Rainfall (inches)
 S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (S_f^{0.5}) (unpaved surface)
 V = 20.3282 * (S_f^{0.5}) (paved surface)
 V = 15.0 * (S_f^{0.5}) (grassed waterway surface)
 V = 10.0 * (S_f^{0.5}) (nearly bare & untilled surface)
 V = 9.0 * (S_f^{0.5}) (cultivated straight rows surface)
 V = 7.0 * (S_f^{0.5}) (short grass pasture surface)
 V = 5.0 * (S_f^{0.5}) (woodland surface)
 V = 2.5 * (S_f^{0.5}) (forest w/heavy litter surface)
 T_c = (L_f / V) / (3600 sec/hr)

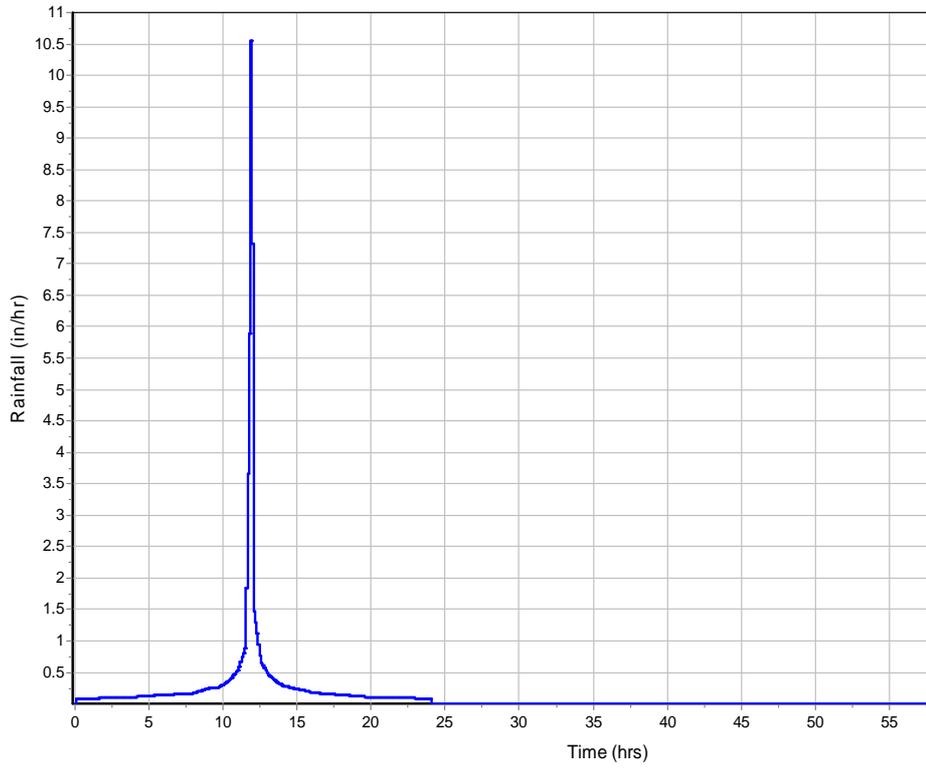
Where:

T_c = Time of Concentration (hr)

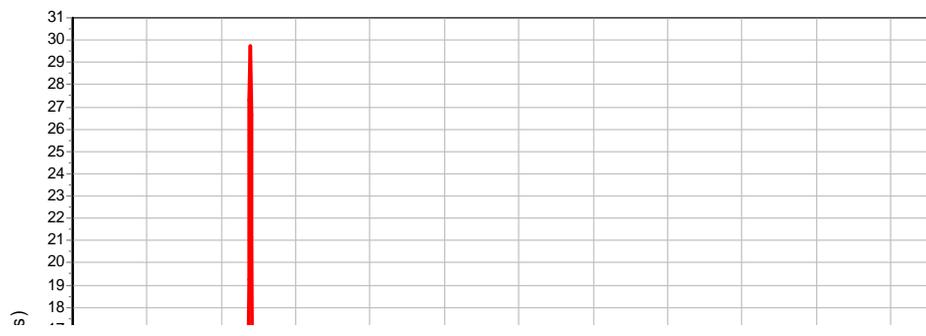
Peak Runoff (cfs)	30.01
Weighted Curve Number	82.71
Time of Concentration (days hh:mm:ss)	0 00:07:02

Subbasin : Proposed Site

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft ²)	Minimum Pipe Cover (in)
1 Jun-A	750.00	760.00	10.00	0.00	-750.00	0.00	-760.00	0.00	

Junction Results

SN Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation (ft)	Max HGL Depth (ft)	Max Surcharge Depth (ft)	Min Freeboard (ft)	Average HGL Elevation (ft)	Average HGL Depth (ft)	Time of Max HGL Occurrence (days hh:mm)	FI (days f)
1 Jun-A	29.75	29.75	750.00	0.00	0.00	10.00	750.00	0.00	0 00:00	C

Pipe Input

SN Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Pipe Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness
1 Link-32	116.27	0.00	-750.00	700.00	0.00	-700.00	-602.0500	Dummy			

Pipe Results

SN Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/Total Depth Ratio	Total Time Surcharged (min)	Fro Nurr
1 Link-32	29.75	0 12:00	0.00	0.00	0.00		0.00	0.00	0.00	

Project Description

File Name Existing Conditions.SPF

Project Options

Flow Units CFS
 Elevation Type Elevation
 Hydrology Method SCS TR-55
 Time of Concentration (TOC) Method SCS TR-55
 Link Routing Method Kinematic Wave
 Enable Overflow Ponding at Nodes YES
 Skip Steady State Analysis Time Periods YES

Analysis Options

Start Analysis On 00:00:00 0:00:00
 End Analysis On 00:00:00 0:03:00
 Start Reporting On 00:00:00 0:00:00
 Antecedent Dry Days 0 days
 Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
 Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
 Reporting Time Step 0 00:03:00 days hh:mm:ss
 Routing Time Step 30 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins.....	1
Nodes.....	2
<i>Junctions</i>	1
<i>Outfalls</i>	1
<i>Flow Diversions</i>	0
<i>Inlets</i>	0
<i>Storage Nodes</i>	0
Links.....	1
<i>Channels</i>	0
<i>Pipes</i>	1
<i>Pumps</i>	0
<i>Orifices</i>	0
<i>Weirs</i>	0
<i>Outlets</i>	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage	Data	Data Source	Rainfall	Rain	State	County	Return	Rainfall	Rainfall
	ID	Source	ID	Type	Units			Period	Depth	Distributor

Subbasin Summary

SN Subbasin ID	Area (ac)	Peak Rate Factor	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1 Proposed Site	3.65	484.00	82.71	5.30	3.42	12.48	18.47	0 00:07:02

Node Summary

SN ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft ²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	(d)
1	Jun-A Junction	750.00	760.00	0.00	0.00	0.00	18.36	750.00	0.00	10.00	
2	Outfall_A Outfall	700.00					18.36	700.00			

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Diameter or Height (in)	Manning's Roughness	Peak Flow (cfs)	Design Flow Capacity (cfs)	Peak Flow/Design Flow Ratio	Peak Flow Velocity (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/Total Depth Ratio	T Su
1	Link-32	Pipe	Jun-A	Outfall_A	116.27	0.00	700.00	-602.0500			18.36	0.00	0.00	0.00	0.00	0.00	

Subbasin Hydrology

Subbasin : Proposed Site

Input Data

Area (ac) 3.65
 Peak Rate Factor 484
 Weighted Curve Number 82.71
 Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
32			
Paved parking & roofs	0.12	D	98
< 50% grass cover, Poor	3.23	C/D	82
50 - 75% grass cover, Fair	0.3	D	84
Composite Area & Weighted CN	3.65		82.71

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8}) / ((P^{0.5}) * (S_f^{0.4})))$$

Where :

T_c = Time of Concentration (hr)
 n = Manning's roughness
 L_f = Flow Length (ft)
 P = 2 yr, 24 hr Rainfall (inches)
 S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (S_f^{0.5}) (unpaved surface)
 V = 20.3282 * (S_f^{0.5}) (paved surface)
 V = 15.0 * (S_f^{0.5}) (grassed waterway surface)
 V = 10.0 * (S_f^{0.5}) (nearly bare & untilled surface)
 V = 9.0 * (S_f^{0.5}) (cultivated straight rows surface)
 V = 7.0 * (S_f^{0.5}) (short grass pasture surface)
 V = 5.0 * (S_f^{0.5}) (woodland surface)
 V = 2.5 * (S_f^{0.5}) (forest w/heavy litter surface)
 T_c = (L_f / V) / (3600 sec/hr)

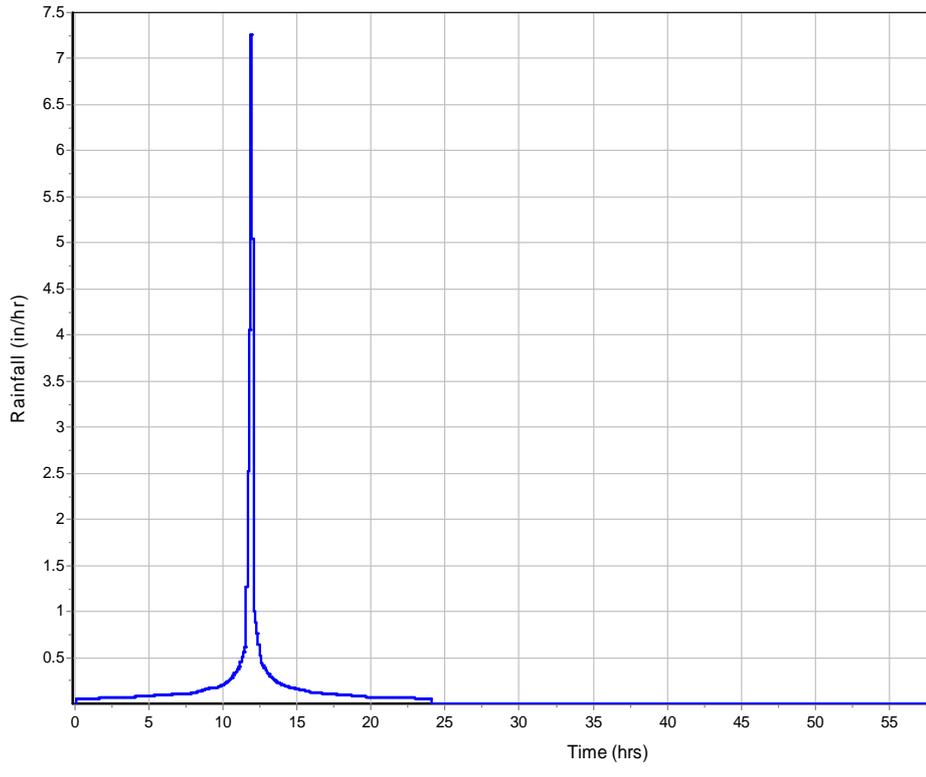
Where:

T_c = Time of Concentration (hr)

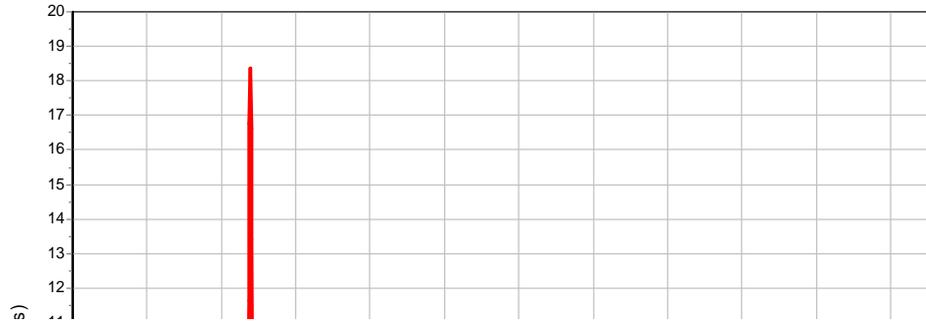
Peak Runoff (cfs)	18.47
Weighted Curve Number	82.71
Time of Concentration (days hh:mm:ss)	0 00:07:02

Subbasin : Proposed Site

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft ²)	Minimum Pipe Cover (in)
1 Jun-A	750.00	760.00	10.00	0.00	-750.00	0.00	-760.00	0.00	

Junction Results

SN Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	FI (days f)
1 Jun-A	18.36	18.36	750.00	0.00	0.00	10.00	750.00	0.00	0 00:00	C

Pipe Input

SN Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Pipe Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness
1 Link-32	116.27	0.00	-750.00	700.00	0.00	-700.00	-602.0500	Dummy			

Pipe Results

SN Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/Total Depth Ratio	Total Time Surcharged (min)	Fro Nurr
1 Link-32	18.36	0 12:00	0.00	0.00	0.00		0.00	0.00	0.00	

Project Description

File Name Existing Conditions.SPF

Project Options

Flow Units CFS
 Elevation Type Elevation
 Hydrology Method SCS TR-55
 Time of Concentration (TOC) Method SCS TR-55
 Link Routing Method Kinematic Wave
 Enable Overflow Ponding at Nodes YES
 Skip Steady State Analysis Time Periods YES

Analysis Options

Start Analysis On 00:00:00 0:00:00
 End Analysis On 00:00:00 0:03:00
 Start Reporting On 00:00:00 0:00:00
 Antecedent Dry Days 0 days
 Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
 Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
 Reporting Time Step 0 00:03:00 days hh:mm:ss
 Routing Time Step 30 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins.....	1
Nodes.....	2
<i>Junctions</i>	1
<i>Outfalls</i>	1
<i>Flow Diversions</i>	0
<i>Inlets</i>	0
<i>Storage Nodes</i>	0
Links.....	1
<i>Channels</i>	0
<i>Pipes</i>	1
<i>Pumps</i>	0
<i>Orifices</i>	0
<i>Weirs</i>	0
<i>Outlets</i>	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage	Data	Data Source	Rainfall	Rain	State	County	Return	Rainfall	Rainfall
	ID	Source	ID	Type	Units			Period	Depth	Distributor

Subbasin Summary

SN Subbasin ID	Area (ac)	Peak Rate Factor	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1 Proposed Site	3.65	484.00	82.71	3.50	1.84	6.70	10.01	0 00:07:02

Node Summary

SN ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft ²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	(d)
1	Jun-A Junction	750.00	760.00	0.00	0.00	0.00	10.00	750.00	0.00	10.00	
2	Outfall_A Outfall	700.00					10.00	700.00			

Subbasin Hydrology

Subbasin : Proposed Site

Input Data

Area (ac) 3.65
 Peak Rate Factor 484
 Weighted Curve Number 82.71
 Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
32			
Paved parking & roofs	0.12	D	98
< 50% grass cover, Poor	3.23	C/D	82
50 - 75% grass cover, Fair	0.3	D	84
Composite Area & Weighted CN	3.65		82.71

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8}) / ((P^{0.5}) * (S_f^{0.4})))$$

Where :

T_c = Time of Concentration (hr)
 n = Manning's roughness
 L_f = Flow Length (ft)
 P = 2 yr, 24 hr Rainfall (inches)
 S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (S_f^{0.5}) (unpaved surface)
 V = 20.3282 * (S_f^{0.5}) (paved surface)
 V = 15.0 * (S_f^{0.5}) (grassed waterway surface)
 V = 10.0 * (S_f^{0.5}) (nearly bare & untilled surface)
 V = 9.0 * (S_f^{0.5}) (cultivated straight rows surface)
 V = 7.0 * (S_f^{0.5}) (short grass pasture surface)
 V = 5.0 * (S_f^{0.5}) (woodland surface)
 V = 2.5 * (S_f^{0.5}) (forest w/heavy litter surface)
 T_c = (L_f / V) / (3600 sec/hr)

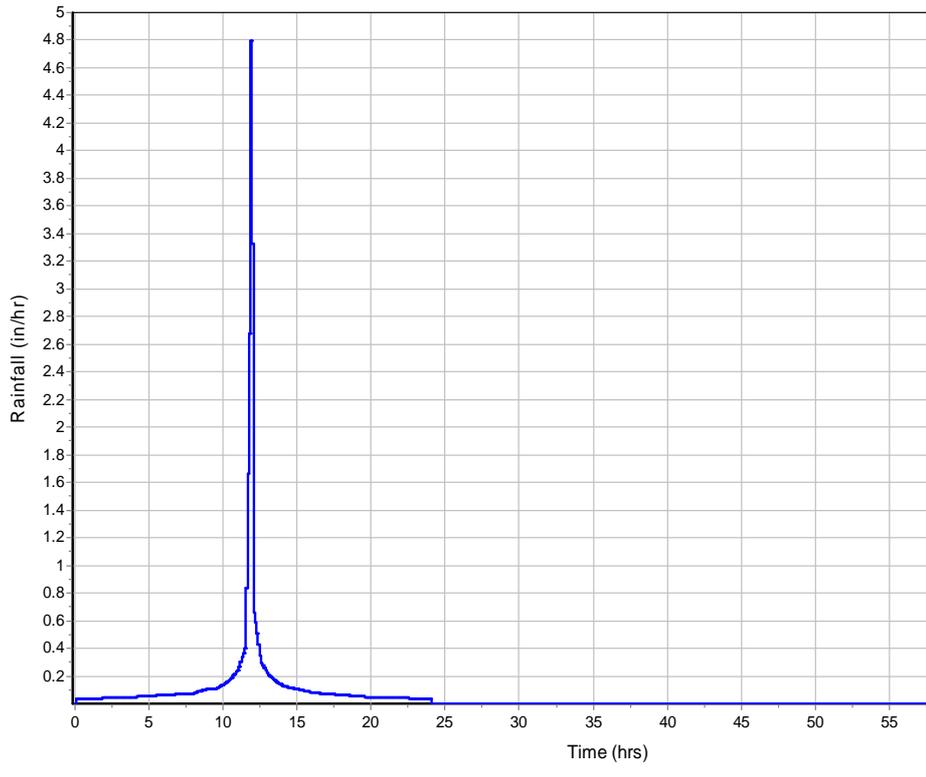
Where:

T_c = Time of Concentration (hr)

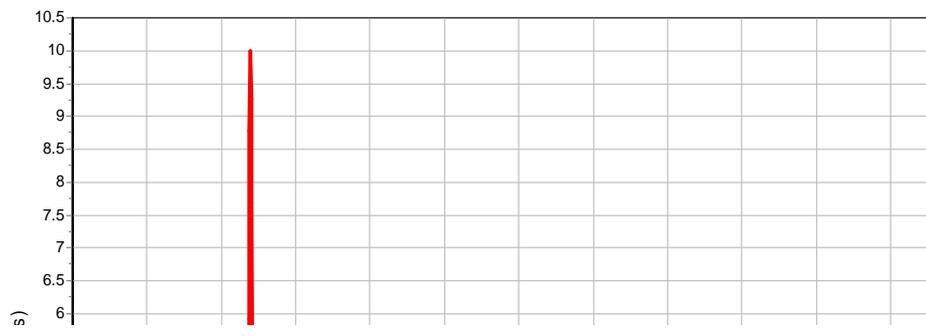
Peak Runoff (cfs)	10.01
Weighted Curve Number	82.71
Time of Concentration (days hh:mm:ss)	0 00:07:02

Subbasin : Proposed Site

Rainfall Intensity Graph



Runoff Hydrograph



5)

Junction Input

SN Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft ²)	Minimum Pipe Cover (in)
1 Jun-A	750.00	760.00	10.00	0.00	-750.00	0.00	-760.00	0.00	

Junction Results

SN Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation (ft)	Max HGL Depth (ft)	Max Surcharge Depth (ft)	Min Freeboard (ft)	Average HGL Elevation (ft)	Average HGL Depth (ft)	Time of Max HGL Occurrence (days hh:mm)	FI Occ (days f)
1 Jun-A	10.00	10.00	750.00	0.00	0.00	10.00	750.00	0.00	0 00:00	C

Pipe Input

SN Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Pipe Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness
1 Link-32	116.27	0.00	-750.00	700.00	0.00	-700.00	-602.0500	Dummy			

Pipe Results

SN Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/Total Depth Ratio	Total Time Surcharged (min)	Fro Nurr
1 Link-32	10.00	0 12:00	0.00	0.00	0.00		0.00	0.00	0.00	

Project Description

File Name Proposed Conditions.SPF

Project Options

Flow Units CFS
 Elevation Type Elevation
 Hydrology Method SCS TR-55
 Time of Concentration (TOC) Method SCS TR-55
 Link Routing Method Kinematic Wave
 Enable Overflow Ponding at Nodes YES
 Skip Steady State Analysis Time Periods YES

Analysis Options

Start Analysis On 00:00:00 0:00:00
 End Analysis On 00:00:00 0:03:00
 Start Reporting On 00:00:00 0:00:00
 Antecedent Dry Days 0 days
 Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
 Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
 Reporting Time Step 0 00:03:00 days hh:mm:ss
 Routing Time Step 30 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins.....	1
Nodes.....	2
<i>Junctions</i>	1
<i>Outfalls</i>	1
<i>Flow Diversions</i>	0
<i>Inlets</i>	0
<i>Storage Nodes</i>	0
Links.....	1
<i>Channels</i>	0
<i>Pipes</i>	1
<i>Pumps</i>	0
<i>Orifices</i>	0
<i>Weirs</i>	0
<i>Outlets</i>	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage	Data	Data Source	Rainfall	Rain	State	County	Return	Rainfall	Rainfall
	ID	Source	ID	Type	Units			Period	Depth	Distributic

Subbasin Summary

SN Subbasin ID	Area (ac)	Peak Rate Factor	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1 Proposed Site	3.65	484.00	84.92	7.70	5.92	21.59	28.08	0 00:11:00

Node Summary

SN ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft ²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	(d)
1	Jun-A Junction	750.00	760.00	0.00	0.00	0.00	28.01	750.00	0.00	10.00	
2	Outfall_A Outfall	700.00					28.01	700.00			

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Diameter or Height (in)	Manning's Roughness	Peak Flow (cfs)	Design Flow Capacity (cfs)	Peak Flow/Design Flow Ratio	Peak Flow Velocity (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/Total Depth Ratio	T Su
1	Link-32	Pipe	Jun-A	Outfall_A	116.27	0.00	700.00	-602.0500			28.01	0.00	0.00	0.00	0.00	0.00	

Subbasin Hydrology

Subbasin : Proposed Site

Input Data

Area (ac) 3.65
 Peak Rate Factor 484
 Weighted Curve Number 84.92
 Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
32			
Paved parking & roofs	1	D	98
> 75% grass cover, Good	2.65	D	80
< 50% grass cover, Poor	0	D	89
Composite Area & Weighted CN	3.65		84.92

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8}) / ((P^{0.5}) * (S_f^{0.4})))$$

Where :

T_c = Time of Concentration (hr)
 n = Manning's roughness
 L_f = Flow Length (ft)
 P = 2 yr, 24 hr Rainfall (inches)
 S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (S_f^{0.5}) (unpaved surface)
 V = 20.3282 * (S_f^{0.5}) (paved surface)
 V = 15.0 * (S_f^{0.5}) (grassed waterway surface)
 V = 10.0 * (S_f^{0.5}) (nearly bare & untilled surface)
 V = 9.0 * (S_f^{0.5}) (cultivated straight rows surface)
 V = 7.0 * (S_f^{0.5}) (short grass pasture surface)
 V = 5.0 * (S_f^{0.5}) (woodland surface)
 V = 2.5 * (S_f^{0.5}) (forest w/heavy litter surface)
 T_c = (L_f / V) / (3600 sec/hr)

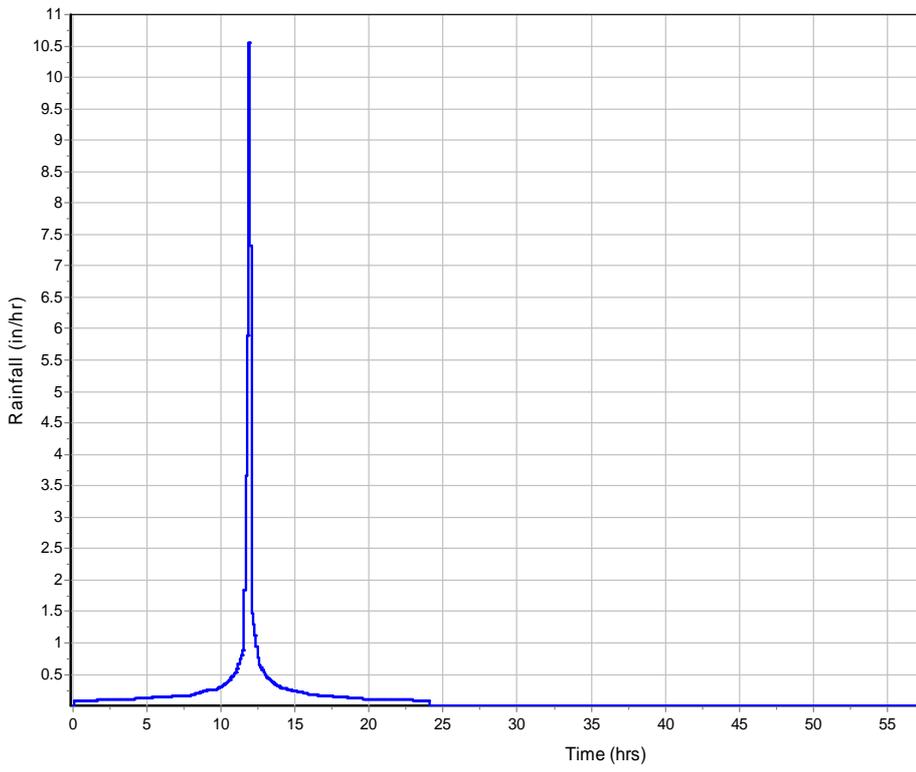
Where:

T_c = Time of Concentration (hr)

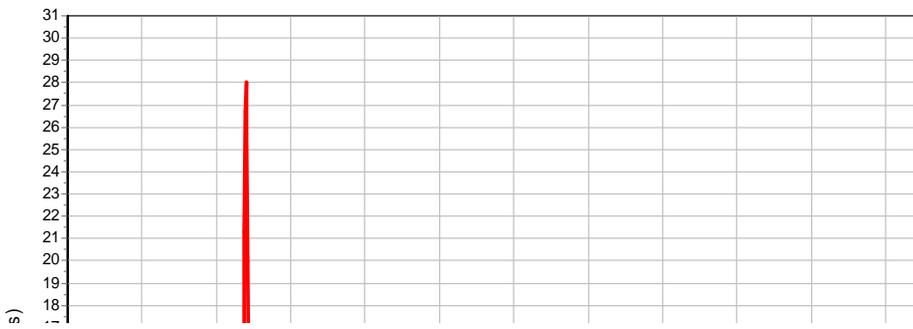
Peak Runoff (cfs)	28.08
Weighted Curve Number	84.92
Time of Concentration (days hh:mm:ss)	0 00:11:00

Subbasin : Proposed Site

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft ²)	Minimum Pipe Cover (in)
1 Jun-A	750.00	760.00	10.00	0.00	-750.00	0.00	-760.00	0.00	

Junction Results

SN Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation (ft)	Max HGL Depth (ft)	Max Surcharge Depth (ft)	Min Freeboard (ft)	Average HGL Elevation (ft)	Average HGL Depth (ft)	Time of Max HGL Occurrence (days hh:mm)	FI Occ (days f)
1 Jun-A	28.01	28.01	750.00	0.00	0.00	10.00	750.00	0.00	0 00:00	C

Pipe Input

SN Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Pipe Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness
1 Link-32	116.27	0.00	-750.00	700.00	0.00	-700.00	-602.0500	Dummy			

Pipe Results

SN Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/Total Depth Ratio	Total Time Surcharged (min)	Fro Nurr
1 Link-32	28.01	0 12:03	0.00	0.00	0.00		0.00	0.00	0.00	

Project Description

File Name Proposed Conditions.SPF

Project Options

Flow Units CFS
 Elevation Type Elevation
 Hydrology Method SCS TR-55
 Time of Concentration (TOC) Method SCS TR-55
 Link Routing Method Kinematic Wave
 Enable Overflow Ponding at Nodes YES
 Skip Steady State Analysis Time Periods YES

Analysis Options

Start Analysis On 00:00:00 0:00:00
 End Analysis On 00:00:00 0:03:00
 Start Reporting On 00:00:00 0:00:00
 Antecedent Dry Days 0 days
 Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
 Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
 Reporting Time Step 0 00:03:00 days hh:mm:ss
 Routing Time Step 30 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins.....	1
Nodes.....	2
<i>Junctions</i>	1
<i>Outfalls</i>	1
<i>Flow Diversions</i>	0
<i>Inlets</i>	0
<i>Storage Nodes</i>	0
Links.....	1
<i>Channels</i>	0
<i>Pipes</i>	1
<i>Pumps</i>	0
<i>Orifices</i>	0
<i>Weirs</i>	0
<i>Outlets</i>	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage	Data	Data Source	Rainfall	Rain	State	County	Return	Rainfall	Rainfall
	ID	Source	ID	Type	Units			Period	Depth	Distributor

Subbasin Summary

SN Subbasin ID	Area (ac)	Peak Rate Factor	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1 Proposed Site	3.65	484.00	84.92	5.30	3.64	13.28	17.67	0 00:11:00

Node Summary

SN ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft ²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	(d)
1	Jun-A Junction	750.00	760.00	0.00	0.00	0.00	17.65	750.00	0.00	10.00	
2	Outfall_A Outfall	700.00					17.65	700.00			

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Diameter or Height (in)	Manning's Roughness	Peak Flow (cfs)	Design Flow Capacity (cfs)	Peak Flow/Design Flow Ratio	Peak Flow Velocity (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/Total Depth Ratio	T Su
1	Link-32	Pipe	Jun-A	Outfall_A	116.27	0.00	700.00	-602.0500			17.65	0.00	0.00	0.00	0.00	0.00	

Subbasin Hydrology

Subbasin : Proposed Site

Input Data

Area (ac) 3.65
 Peak Rate Factor 484
 Weighted Curve Number 84.92
 Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
32			
Paved parking & roofs	1	D	98
> 75% grass cover, Good	2.65	D	80
< 50% grass cover, Poor	0	D	89
Composite Area & Weighted CN	3.65		84.92

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8}) / ((P^{0.5}) * (S_f^{0.4})))$$

Where :

T_c = Time of Concentration (hr)
 n = Manning's roughness
 L_f = Flow Length (ft)
 P = 2 yr, 24 hr Rainfall (inches)
 S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (S_f^{0.5}) (unpaved surface)
 V = 20.3282 * (S_f^{0.5}) (paved surface)
 V = 15.0 * (S_f^{0.5}) (grassed waterway surface)
 V = 10.0 * (S_f^{0.5}) (nearly bare & untilled surface)
 V = 9.0 * (S_f^{0.5}) (cultivated straight rows surface)
 V = 7.0 * (S_f^{0.5}) (short grass pasture surface)
 V = 5.0 * (S_f^{0.5}) (woodland surface)
 V = 2.5 * (S_f^{0.5}) (forest w/heavy litter surface)
 T_c = (L_f / V) / (3600 sec/hr)

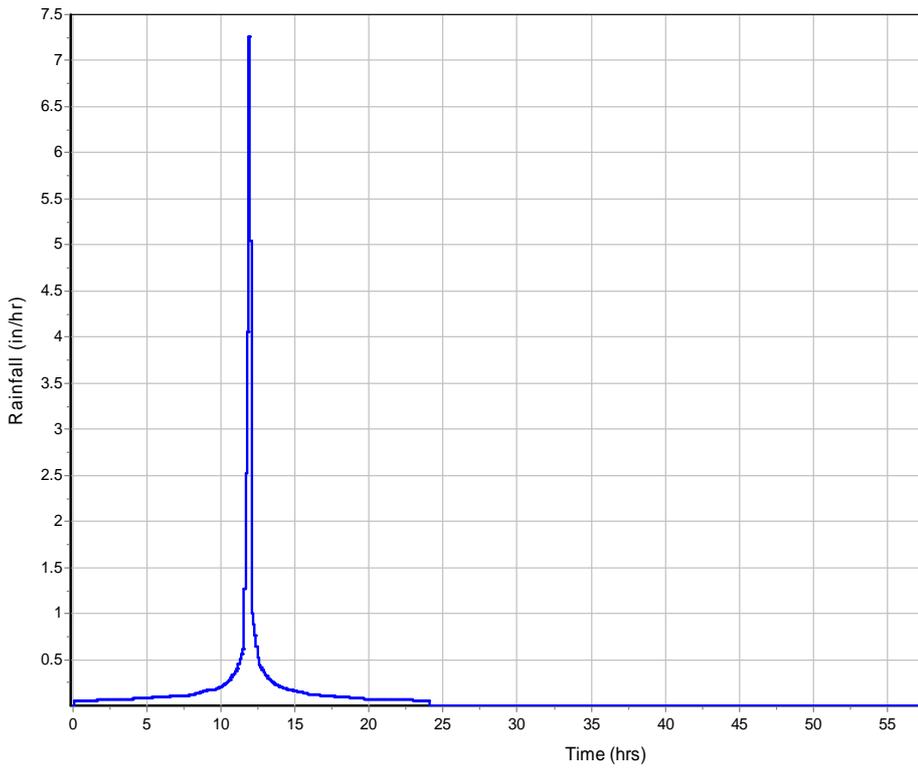
Where:

T_c = Time of Concentration (hr)

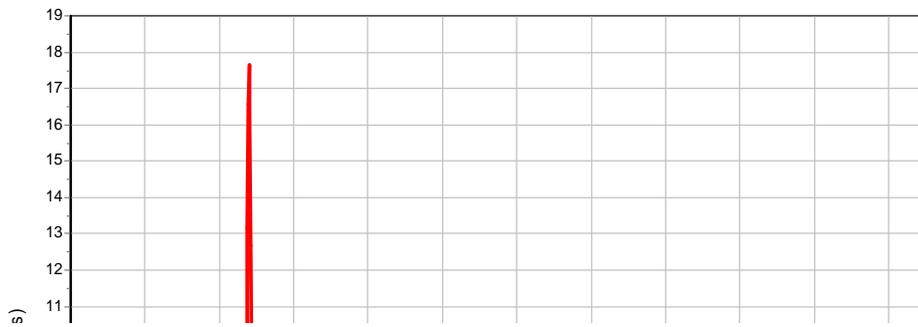
Peak Runoff (cfs) 17.67
Weighted Curve Number 84.92
Time of Concentration (days hh:mm:ss) 0 00:11:00

Subbasin : Proposed Site

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft ²)	Minimum Pipe Cover (in)
1 Jun-A	750.00	760.00	10.00	0.00	-750.00	0.00	-760.00	0.00	

Junction Results

SN Element ID	Peak Inflow	Peak Lateral Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Max HGL Occurrence	FI (days h:mm)
1 Jun-A	17.65 (cfs)	17.65 (cfs)	750.00 (ft)	0.00 (ft)	0.00 (ft)	10.00 (ft)	750.00 (ft)	0.00 (ft)	0 00:00	C

Pipe Input

SN Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Pipe Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness
1 Link-32	116.27	0.00	-750.00	700.00	0.00	-700.00	-602.0500	Dummy			

Pipe Results

SN Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/Total Depth Ratio	Total Time Surcharged (min)	Fro Nurr
1 Link-32	17.65	0 12:03	0.00	0.00	0.00		0.00	0.00	0.00	

Project Description

File Name Proposed Conditions.SPF

Project Options

Flow Units CFS
 Elevation Type Elevation
 Hydrology Method SCS TR-55
 Time of Concentration (TOC) Method SCS TR-55
 Link Routing Method Kinematic Wave
 Enable Overflow Ponding at Nodes YES
 Skip Steady State Analysis Time Periods YES

Analysis Options

Start Analysis On 00:00:00 0:00:00
 End Analysis On 00:00:00 0:03:00
 Start Reporting On 00:00:00 0:00:00
 Antecedent Dry Days 0 days
 Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
 Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
 Reporting Time Step 0 00:03:00 days hh:mm:ss
 Routing Time Step 30 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins.....	1
Nodes.....	2
<i>Junctions</i>	1
<i>Outfalls</i>	1
<i>Flow Diversions</i>	0
<i>Inlets</i>	0
<i>Storage Nodes</i>	0
Links.....	1
<i>Channels</i>	0
<i>Pipes</i>	1
<i>Pumps</i>	0
<i>Orifices</i>	0
<i>Weirs</i>	0
<i>Outlets</i>	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage	Data	Data Source	Rainfall	Rain	State	County	Return	Rainfall	Rainfall
	ID	Source	ID	Type	Units			Period	Depth	Distributor

Subbasin Summary

SN Subbasin ID	Area (ac)	Peak Rate Factor	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1 Proposed Site	3.65	484.00	84.92	3.50	2.01	7.34	9.93	0 00:11:00

Node Summary

SN ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft ²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	(d)
1	Jun-A Junction	750.00	760.00	0.00	0.00	0.00	9.93	750.00	0.00	10.00	
2	Outfall_A Outfall	700.00					9.93	700.00			

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Diameter or Height (in)	Manning's Roughness	Peak Flow (cfs)	Design Flow Capacity (cfs)	Peak Flow/Design Flow Ratio	Peak Flow Velocity (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/Total Depth Ratio	To
1	Link-32	Pipe	Jun-A	Outfall_A	116.27	0.00	700.00	-602.0500			9.93	0.00	0.00	0.00	0.00	0.00	

Subbasin Hydrology

Subbasin : Proposed Site

Input Data

Area (ac) 3.65
 Peak Rate Factor 484
 Weighted Curve Number 84.92
 Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
32			
Paved parking & roofs	1	D	98
> 75% grass cover, Good	2.65	D	80
< 50% grass cover, Poor	0	D	89
Composite Area & Weighted CN	3.65		84.92

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8}) / ((P^{0.5}) * (S_f^{0.4})))$$

Where :

T_c = Time of Concentration (hr)
 n = Manning's roughness
 L_f = Flow Length (ft)
 P = 2 yr, 24 hr Rainfall (inches)
 S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (S_f^{0.5}) (unpaved surface)
 V = 20.3282 * (S_f^{0.5}) (paved surface)
 V = 15.0 * (S_f^{0.5}) (grassed waterway surface)
 V = 10.0 * (S_f^{0.5}) (nearly bare & untilled surface)
 V = 9.0 * (S_f^{0.5}) (cultivated straight rows surface)
 V = 7.0 * (S_f^{0.5}) (short grass pasture surface)
 V = 5.0 * (S_f^{0.5}) (woodland surface)
 V = 2.5 * (S_f^{0.5}) (forest w/heavy litter surface)
 T_c = (L_f / V) / (3600 sec/hr)

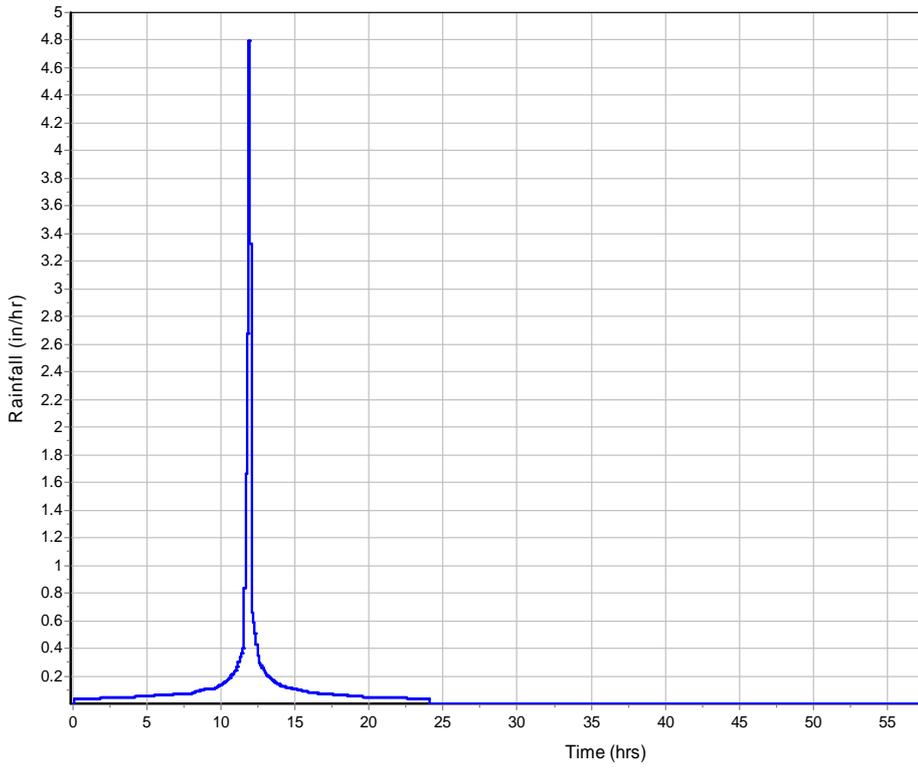
Where:

T_c = Time of Concentration (hr)

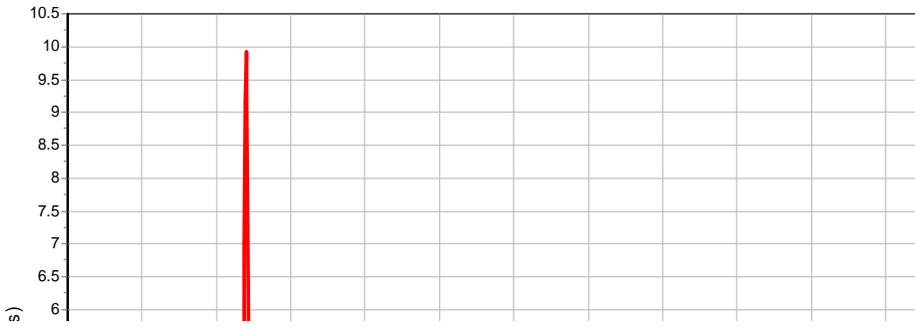
Peak Runoff (cfs) 9.93
Weighted Curve Number 84.92
Time of Concentration (days hh:mm:ss) 0 00:11:00

Subbasin : Proposed Site

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft ²)	Minimum Pipe Cover (in)
1 Jun-A	750.00	760.00	10.00	0.00	-750.00	0.00	-760.00	0.00	

Junction Results

SN Element ID	Peak Inflow	Peak Lateral Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Max HGL Occurrence	FI (days h:mm)
1 Jun-A	9.93	9.93	750.00	0.00	0.00	10.00	750.00	0.00	0 00:00	C

Pipe Input

SN Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Pipe Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness
1 Link-32	116.27	0.00	-750.00	700.00	0.00	-700.00	-602.0500	Dummy			

Pipe Results

SN Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/Total Depth Ratio	Total Time Surcharged (min)	Frou Numt
1 Link-32	9.93	0 12:03	0.00	0.00	0.00		0.00	0.00	0.00	

APPENDIX E

Soils



United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for **Jackson County, Missouri**



Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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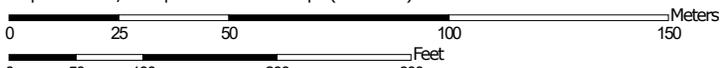
Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report Soil Map



Map Scale: 1:1,710 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

 Blowout

 Borrow Pit

 Clay Spot

 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water

 Perennial Water

 Rock Outcrop

 Saline Spot

 Sandy Spot

 Severely Eroded Spot

 Sinkhole

 Slide or Slip

 Sodic Spot

 Spoil Area

 Stony Spot

 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

Water Features

 Streams and Canals

Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
 Web Soil Survey URL:
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jackson County, Missouri
 Survey Area Data: Version 27, Aug 27, 2024

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 30, 2022—Sep 8, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
10128	Sharpsburg-Urban land complex, 2 to 5 percent slopes	0.2	2.0%
10129	Sharpsburg-Urban land complex, 5 to 9 percent slopes	3.4	32.2%
10180	Udarents-Urban land-Sampsel complex, 2 to 5 percent slopes	7.0	65.8%
Totals for Area of Interest		10.7	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

Custom Soil Resource Report

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Jackson County, Missouri

10128—Sharpsburg-Urban land complex, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2ql09
Elevation: 1,000 to 1,320 feet
Mean annual precipitation: 33 to 41 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 155 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Sharpsburg and similar soils: 60 percent
Urban land: 35 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sharpsburg

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loess

Typical profile

A - 0 to 17 inches: silt loam
Bt - 17 to 55 inches: silty clay loam
C - 55 to 60 inches: silty clay loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 24 to 35 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very high (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D
Ecological site: R109XY002MO - Loess Upland Prairie
Hydric soil rating: No

Description of Urban Land

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Minor Components

Macksburg

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R108XD8601A - Loess Upland Prairie
Hydric soil rating: No

10129—Sharpsburg-Urban land complex, 5 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2q10b
Elevation: 990 to 1,320 feet
Mean annual precipitation: 33 to 41 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 155 to 220 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Sharpsburg and similar soils: 60 percent
Urban land: 35 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sharpsburg

Setting

Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loess

Custom Soil Resource Report

Typical profile

A - 0 to 7 inches: silt loam
Bt - 7 to 48 inches: silty clay loam
C - 48 to 60 inches: silty clay loam

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 24 to 35 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 11.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D
Ecological site: R109XY002MO - Loess Upland Prairie
Hydric soil rating: No

Description of Urban Land

Setting

Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Minor Components

Macksburg

Percent of map unit: 3 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R108XD8601A - Loess Upland Prairie
Hydric soil rating: No

Lagonda, eroded

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: R108XD8601A - Loess Upland Prairie

Custom Soil Resource Report

Hydric soil rating: No

10180—Udarents-Urban land-Sampsel complex, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: 1n85h

Elevation: 600 to 900 feet

Mean annual precipitation: 33 to 43 inches

Mean annual air temperature: 50 to 57 degrees F

Frost-free period: 175 to 220 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Udarents and similar soils: 46 percent

Urban land: 39 percent

Sampsel and similar soils: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udarents

Setting

Landform position (two-dimensional): Summit

Landform position (three-dimensional): Crest

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Mine spoil or earthy fill

Typical profile

C1 - 0 to 5 inches: silt loam

C2 - 5 to 80 inches: silty clay loam

Properties and qualities

Slope: 2 to 5 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat poorly drained

Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 0.57 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water supply, 0 to 60 inches: Moderate (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: C

Ecological site: R107XB002MO - Deep Loess Upland Prairie

Hydric soil rating: No

Description of Urban Land

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Across-slope shape: Convex

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Description of Sampsel

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Residuum weathered from shale

Typical profile

Ap - 0 to 13 inches: silty clay loam
Bt - 13 to 80 inches: silty clay

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C/D
Ecological site: R109XY010MO - Interbedded Sedimentary Upland Savanna
Hydric soil rating: No

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Custom Soil Resource Report

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APPENDIX F

FEMA

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS Report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study Report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Missouri State Plane West Zone (FIPS zone 2403). The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov> or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, NNGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit its website at <http://www.ngs.noaa.gov>.

Base map information shown on this FIRM was derived from the U.S. D.A. Farm Service National Agriculture Imagery Program (NAIP) dated 2014. Produced at scale of 1:24,000.

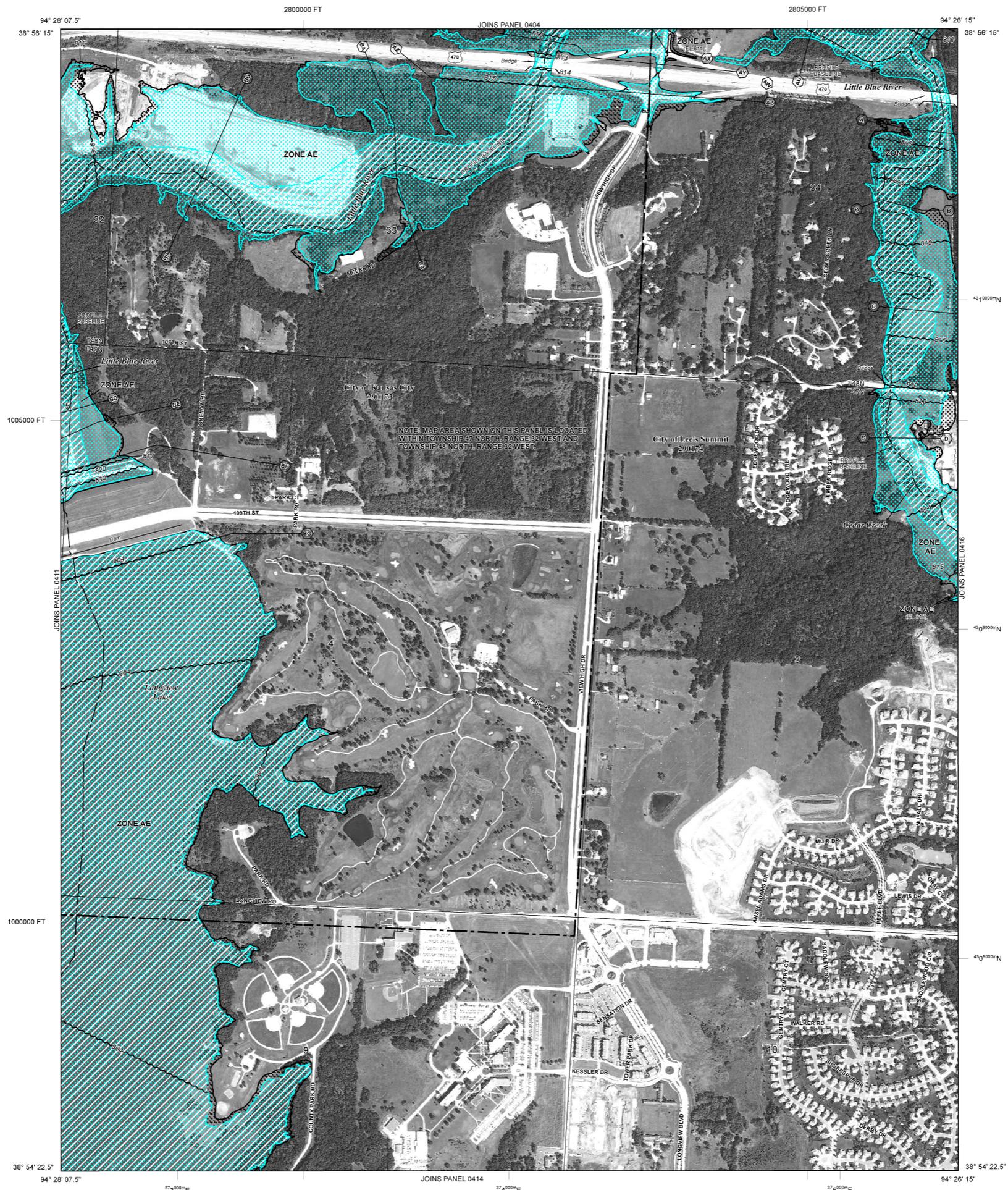
The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels, community map repository addresses, and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at <http://msc.fema.gov>. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.



LEGEND

- SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD. The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equal or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AD, AV, and VE. The Base Flood Elevation is the water surface elevation of the 1% annual chance flood.
- ZONE A** No Base Flood Elevations determined.
- ZONE AE** Base Flood Elevations determined.
- ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- ZONE AD** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined; For areas of alluvial fan flooding, velocities also determined.
- ZONE AR** Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently derelict. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- ZONE AV** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- ZONE VE** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- FLOODWAY AREAS IN ZONE AE. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.
- OTHER FLOOD AREAS
- ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
- OTHER AREAS**
- ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.
- ZONE D** Areas in which flood hazards are undetermined, but possible.
- COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS
- OTHERWISE PROTECTED AREAS (OPAs)
- CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.
- 1% Annual Chance Floodplain Boundary
- 0.2% Annual Chance Floodplain Boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
- Base Flood Elevation line and value; elevation in feet*
- Base Flood Elevation value where uniform within zone; elevation in feet*

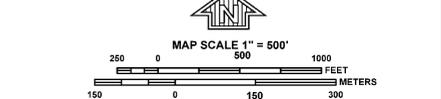
*Referenced to the North American Vertical Datum of 1988

- Cross section line
- Transsect line
- Culvert
- Bridge
- Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
- 5000-foot ticks: Missouri State Plane West Zone (FIPS Zone 2403), Transverse Mercator projection
- Bench mark (see explanation in Notes to Users section of this FIRM panel)
- River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
September 29, 2005

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
January 20, 2017 - to change Special Flood Hazard Areas.



PANEL 0412G

FIRM
FLOOD INSURANCE RATE MAP
JACKSON COUNTY,
MISSOURI
AND INCORPORATED AREAS

PANEL 412 OF 625
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
KANSAS CITY, CITY OF	290173	0412	G
LEE'S SUMMIT, CITY OF	290174	0412	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
29095C0412G
MAP REVISED
JANUARY 20, 2017
Federal Emergency Management Agency

LONGVIEW PICKLEBALL COMPLEX
3801 SW LONGVIEW RD
MICRO STORM DRAINAGE STUDY

Lee's Summit, MO - 2025

September, 2025

Olsson Project No. A24-02856