LEE'S SUMMIT DOWNTOWN MARKET DRAINAGE STUDY

Lee's Summit, Missouri

Prepared for:

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDICES

1. GENERAL INFORMATION

The Lee's Summit Downtown Market is a proposed commercial development on approximately 6 acres. The project is located in the downtown area of Lee's Summit, MO located east of City Hall. The project lies in the southwest 1/4 of Section 5, Township 47N, Range 31W, in Jackson County, Lee's Summit, Missouri.

1.1. Project Location

The Lee's Summit Downtown Market development is located entirely in the city of Lee's Summit, Missouri. The area to be developed is bounded by City Hall and Douglas Street to the West, SE 2nd St to the North, SE Johnson Street to the East, SE 3rd Street to the South. The site ultimately discharges to the northeast, through public storm sewer, into a drainage ditch, ultimately discharging into Lake Jacomo.

Figure 1. Lee's Summit Downtown Market Location Map.

1.2. Federal Emergency Management Agency Floodplain Classification

FEMA Flood Boundary and Floodway Map Community Panel Number 29095C0436G classifies the Lee's Summit Downtown Market property as a "Zone X Unshaded" Area. This is the FEMA flood insurance rate zone that corresponds to areas outside the 0.2% annual chance floodplain. No Base Flood Elevations or depths are shown within this zone. Refer to Appendix F for the FIRM Map.

1.3. Soil Classifications

Soil maps published on the Natural Resources Conservation Service (NRCS) Web Soil Survey categorize soils on the Lee's Summit Downtown Market as shown in Table 1. Refer to Appendix E for a map of soils on the property.

Table 1. Soil Classifications

HSG	Symbol	Name	Slope
C	10082	Arisburg-Urban land complex	1-5%
D	10128	Sharpsburg-Urban land complex	2-5%
C	10180	Udarents-Urban land-Sampsel complex	2-5%
C	10181	Udarents-Urban land-Sampsel complex	5-9%
D	99012	Urban land	5-9%

2. METHODOLOGY

The storm drainage study will be analyzed in accordance with the February 15, 2006 edition of the Kansas City Metropolitan Chapter, American Public Works Association, (KCAPWA) Construction and Material Specifications, Section 5601.5.A.4.

The Existing Conditions hydrology will be evaluated in Section 3, and Proposed Conditions hydrology will be computed in Section 4. The Proposed Conditions discharge data for each stage of development will be compared to the Existing Conditions results; variations in quantity and rate of stormwater discharge between these models will represent the hydrologic impact generated by the proposed development. The overall stormwater management plan will be designed utilizing this information. Section 3 assumes current land use within the tributary sub-watersheds, and pre-development conditions within the project boundary. Section 4 assumes completion of the entire development. The program used is Autodesk Storm & Sanitary Analysis 2018 (SSA).

The following methods were used in this study to model Existing, Proposed (Micro) and Future (Macro) Conditions in for stormwater runoff:

- NRCS TR-55 Unit Hydrograph Method
- 1-,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.
  NOTE: SSA models use "Time of Concentration" rather than "Lag Time" for computing subarea hydrology.

City code follows the February 16, 2011 version of APWA 5600, requiring comprehensive control to reduce flows to maximum allowable release rates. However, after conversations with the city, reaching maximum allowable release rates will cause an undue burden on the project, and a goal has been set of reducing post-development flows to pre-development rates.

Stormwater runoff models were created for the 1%, 10%, and 100% design storm events. The precipitation depths used in the analyses have been interpolated from the NOAA Atlas 14, Volume 8, Ver. The following Table 2 summarizes the rainfall depths used in this analysis:

Table 2. Precipitation Depths.

Return Period	24-Hour Precipitation Depth (in.)
Water Quality Volume	1.37
1-Year (100% Storm)	3.10
2-Year (50% Storm)	3.71
10-Year (10% Storm)	5.67
100-Year (1% Storm)	9.25

3. EXISTING CONDITIONS

To quantify the effects of development of this project, the following area and point of interest has been used for Existing and Proposed Conditions analyses. See Exhibit 301 in Appendix A, Existing Macro Conditions Drainage Area Map.

Watershed A discharges to the northeast through public storm sewer systems. The drainage boundaries begin around SW Market Street, collecting into the public storm sewer, and traveling east. The flows collected are routed through our proposed site, ultimately discharging into a concrete drainage ditch to the northeast of the site. Total area modeled within this watershed is 133.48 acres, 5% of which is within the Lee's Summit Market site and considered "onsite". **Area A** is the entirety of the watershed, excepting the undeveloped, grassed area on the SE corner of SE 2nd St and SE Johnson St. **Undeveloped Area** is the grassed area that will be developed in the proposed conditions. **Outfall A** is the location where Watershed A discharges into a concrete lined channel that contributes to Tributary P4 to Prairie Lee Lake.

The following table summarizes the results of the Existing Conditions analysis. The Proposed Conditions data will be compared to these results in Section 4 of this report. Refer to Appendix D for output from and a schematic of the Existing Conditions model.

Curve Numbers were assumed as follows:

Table 3-1. Lee's Summit Downtown Market – Existing Conditions Subarea

Cover Type	Soil Type	CN Value
Single-Family Residential	C	83
	D	87
Urban Commercial	C	94
	D	95
Multi-Family Residential	C	90
Impervious Pavement	Any	98
Turf	D	84

The following tables summarize the results of the Existing Conditions analysis. The Proposed Conditions data will be compared to these results in Sections 4 of this report. Refer to Appendix D for output from and a schematic of the Existing Conditions model.

Table 3-2. Lee's Summit Downtown Market – Existing Conditions Subarea

Subarea	Area (acres)	T_C (hours)	Weighted Curve Number
A-1	132.96	0.431	91.58
Undeveloped	0.52	0.083	84

Table 3-3 Lee's Summit Downtown Market – Existing Conditions Subarea Results

Subarea	WQv (cfs)	V_{WQv} (ac-ft)	Q_1 (cfs)	V_{R-1} (ac-ft)	Q_2 (cfs)	V_{R-2} (ac-ft)	Q_{10} (cfs)	V_{R-10} (ac-ft)	Q_{100} (cfs)	V_{R-100} (ac-ft)
A-1	85.12	7.41	279.69	24.56	349.78	31.00	574.93	52.07	977.27	91.20
Undeveloped	0.25	0.02	1.32	0.07	1.74	0.09	3.14	0.17	5.72	0.32

* cfs – cubic feet per second

Table 3-4 Lee's Summit Downtown Market – Existing Conditions Outfall Results

Outfall	WQv (cfs)	V_{WQv} (ac-ft)	Q_1 (cfs)	V_{R-1} (ac-ft)	Q_2 (cfs)	V_{R-2} (ac-ft)	Q_{10} (cfs)	V_{R-10} (ac-ft)	Q_{100} (cfs)	V_{R-100} (ac-ft)
A	85.16	7.43	279.96	24.63	350.13	31.09	575.48	52.24	978.28	91.52

4. PROPOSED CONDITIONS

The Future Conditions section of analysis assumes completion of the Lee's Summit Downtown Market site. The mixed-use site includes construction of a multi-story apartment complex, open-air market area, commercial buildings, and associated parking and utilities.

4.1. PROPOSED CONDITIONS

The proposed developments will result in no changes in tributary areas on the site. The impervious area onsite will increase due to the construction of the Market. Area A is unchanged, as the offsite area is unchanged. The onsite area in Area A is already developed, and redevelopment of that area will not alter the land use, as it will remain Urban Commercial.

The following tables summarize the results of the Future Conditions analysis for the revised subareas within Watershed A. Tables 4-2 and 4-3 assume no detention is provided, to demonstrate the effects of development in this watershed. Refer to Appendix A for outputs from the Proposed Conditions SSA model.

Table 4-1. Lee's Summit Downtown Market –Proposed Conditions Subarea Data

Subarea	Area (acres)	T_C (hours)	Weighted Curve Number
A-1	132.96	0.431	91.58
Undeveloped	0.52	0.083	95

Table 4-2 Lee's Summit Downtown Market –Proposed (No Detention) Conditions Subarea Results

Subarea	WQv (cfs)	V_{WQv} (ac-ft)	Q_1 (cfs)	V_{R-1} (ac-ft)	Q_2 (cfs)	V_{R-2} (ac-ft)	Q_{10} (cfs)	V_{R-10} (ac-ft)	Q_{100} (cfs)	V_{R-100} (ac-ft)
A-1	85.12	7.41	279.69	24.56	349.78	31.00	574.93	52.07	977.27	91.20
Undeveloped	0.73	0.06	1.97	0.11	2.40	0.14	3.78	0.22	6.25	0.38

Table 4-3 Lee's Summit Downtown Market –Proposed (No Detention) Conditions Outfall Results

Outfall	WQv (cfs)	V_{WQv} (ac-ft)	Q_1 (cfs)	V_{R-1} (ac-ft)	Q_2 (cfs)	V_{R-2} (ac-ft)	Q_{10} (cfs)	V_{R-10} (ac-ft)	Q_{100} (cfs)	V_{R-100} (ac-ft)
A	85.25	7.47	280.06	24.67	350.22	31.14	575.55	52.29	978.38	91.58

The following table compares the results of the Proposed Conditions analysis to the Existing Conditions from Section 3 at Outfall A. Positive values indicate an increase from Existing to Proposed conditions, while negative values indicate a decrease.

Table 4-4. Lee's Summit Downtown Market –Proposed (No Detention) vs. Existing Conditions Point of Interest Comparison

Point of Interest	WQv (cfs)	V_{WQv} (ac-ft)	Q_1 (cfs)	V_{R-1} (ac-ft)	Q_2 (cfs)	V_{R-2} (ac-ft)	Q_{10} (cfs)	V_{R-10} (ac-ft)	Q_{100} (cfs)	V_{R-100} (ac-ft)
Undeveloped	+0.48	+0.04	+0.65	+0.04	+0.66	+0.05	+0.64	+0.05	+0.53	+0.06
Outfall A	+0.09	+0.04	+0.10	+0.04	+0.09	+0.05	+0.07	+0.05	+0.10	+0.06

As can be seen in the previous table, the flows from the undeveloped area increases noticeably, while the final Outfall A has negligible increases in peak flow. This occurs due to the peak from the undeveloped area having a significantly lower time of concentration, traveling through the system before the peak arrives from the upstream areas. To mitigate for the increases shown in the previous table, detention will be provided within the previously undeveloped area, to be constructed as part of the private development. Detention is intended to be constructed via underground isolator rows that will treat flows from the proposed developed site. The majority of Watershed I flows into the proposed basin, with a portion bypassing it.

The below table shows results for the proposed isolator rows.

Table 4-5. Lee's Summit Downtown Market – Future Conditions Detention Basin Flow and Volume Results

Storm Event	Peak Q In (cfs)	TP In (hr)	Peak Q Out (cfs)	TP Out (hr)	Peak W.S.E. (ft)	Stored Volume (ac-ft)
WQv	0.73	11.93	0.02	14.73	101.10	0.039
1-Year	1.97	11.93	0.21	12.26	101.89	0.064
2-Year	2.40	11.93	0.25	12.38	102.22	0.079
10-Year	3.78	11.93	0.35	12.44	103.27	0.125
100-Year	6.25	11.93	1.05	12.14	105.53	0.191

The following table shows the results of the points of interest that are impacted by the constructed basin.

Table 4-6. Lee's Summit Downtown Market –Proposed (With Detention) Conditions Point of Interest Results

Outfall	WQv (cfs)	V_{WQv} (ac-ft)	Q_1 (cfs)	V_{R-1} (ac-ft)	Q_2 (cfs)	V_{R-2} (ac-ft)	Q_{10} (cfs)	V_{R-10} (ac-ft)	Q_{100} (cfs)	V_{R-100} (ac-ft)
A	85.10	7.47	279.90	24.67	350.02	31.14	575.24	52.29	978.22	91.58

The following table compares the results of the Proposed Conditions analysis with the detention described above to the Existing Conditions from Section 3.

Table 4-7. Lee's Summit Downtown Market –Proposed (With Detention) vs. Existing Conditions Point Data

Subarea	WQv (cfs)	V_{WQv} (ac-ft)	Q_1 (cfs)	V_{R-1} (ac-ft)	Q_2 (cfs)	V_{R-10} (ac-ft)	Q_{10} (cfs)	V_{R-10} (ac-ft)	Q_{100} (cfs)	V_{R-100} (ac-ft)
Undeveloped	-0.23	+0.04	-1.11	+0.04	-1.49	+0.05	-2.79	+0.05	-4.67	+0.06
Outfall A	-0.06	+0.04	-0.06	+0.04	-0.11	+0.05	-0.24	+0.05	-0.06	+0.06

As shown in the table above, the proposed underground isolator system reduces flows in the WQv, 1-, 2-, 10- and 100-year storms to below pre-development conditions at Outfall A.

5. RESULTS

As shown in the discussion and tables in the previous sections, the proposed detention basin adequately reduces the peak stormwater rates and do not negatively impact downstream areas. Table 6-1 below, summarizes the Proposed and Future Conditions results and compares them with Existing conditions.

Table 6-1 Lee's Summit Downtown Market –Points of Interest Discharge Comparison

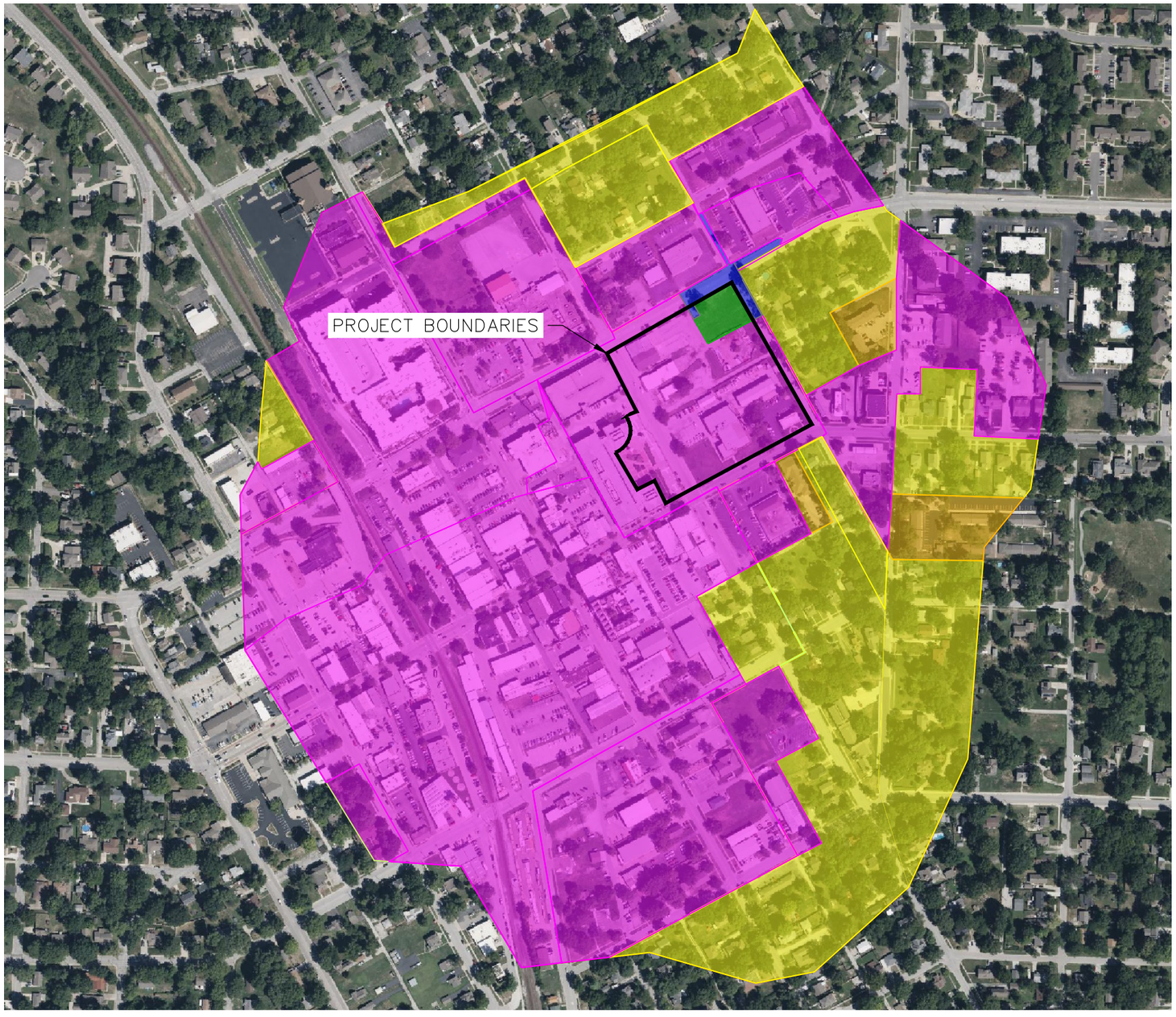
Outfall	Condition	Q_{WQv} (cfs)	Q_1 (cfs)	Q_2 (cfs)	Q_{10} (cfs)	Q_{100} (cfs)
Outfall A	Existing	85.16	279.96	350.13	575.48	978.28
	Proposed	85.10	279.90	350.02	575.24	978.22
	Difference	**-0.06**	**-0.06**	**-0.11**	**-0.24**	**-0.06**

6. CONCLUSION

This Stormwater Drainage Study has been prepared for the proposed project to establish a comprehensive stormwater management plan for the site. The results of this analysis demonstrate that the proposed stormwater management plan for the project achieves compliance the stated goal of reducing peak flows for the WQv, 1-year, 2-year, 10-year and 100 year storm events to below the existing peak flow rates. As mentioned in Section 2, a waiver is requested to achieve pre-vs-post reduction, without achieving allowable rates, per APWA 2011.Based on information received, Olsson requests that this stormwater drainage report be approved.

APPENDIX A

Exhibits



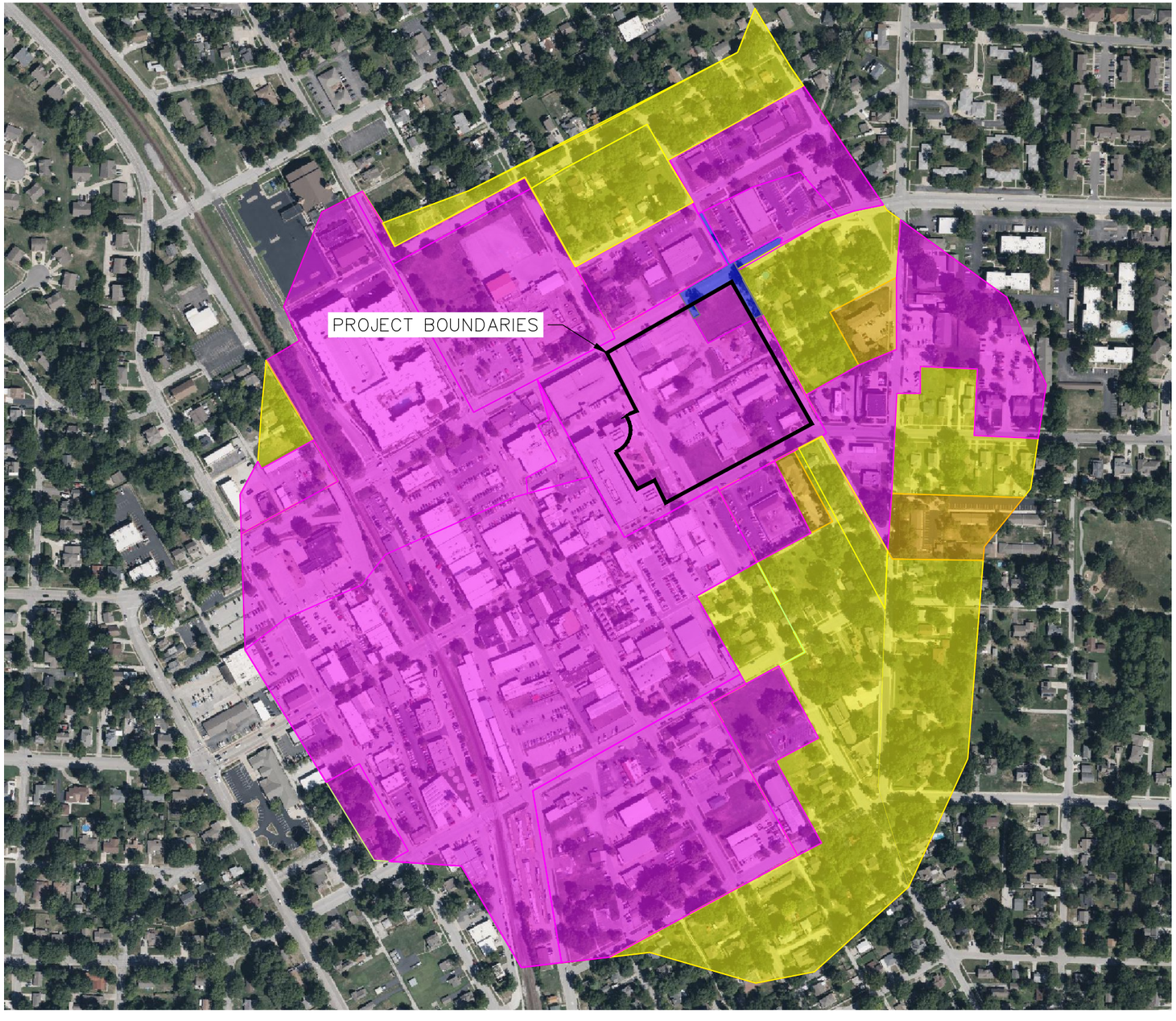
LAND COVER LEGEND		
	TREATMENT	AREA (AC.)
	UNDEVELOPED	0.52
	SINGLE FAMILY RESIDENTIAL	35.72
	COMMERCIAL	93.73
	MULTI FAMILY RESIDENTIAL	3.11
	PAVEMENT	0.40

N

0' 200' 400'
SCALE IN FEET

OLSSON - CIVIL ENGINEERING
MISSOURI CERTIFICATE OF AUTHORITY #

PROJECT NO: 022-03930	EXISTING CONDITIONS	olsson 1301 Burlington Street North Kansas City, MO 64116 TEL 816.361.1177	EXHIBIT EX-301
DRAWN BY: DFG			
DATE: 05/05/2023			



LAND COVER LEGEND		
	TREATMENT	AREA (AC.)
	SINGLE FAMILY RESIDENTIAL	35.72
	COMMERCIAL	94.65
	MULTI FAMILY RESIDENTIAL	3.11
	PAVEMENT	0.40

N

0’ 200’ 400’
SCALE IN FEET

OLSSON - CIVIL ENGINEERING
MISSOURI CERTIFICATE OF AUTHORITY #

PROJECT NO: 022-03930	PROPOSED CONDITIONS	olsson 1301 Burlington Street North Kansas City, MO 64116 TEL 816.361.1177	EXHIBIT EX-302
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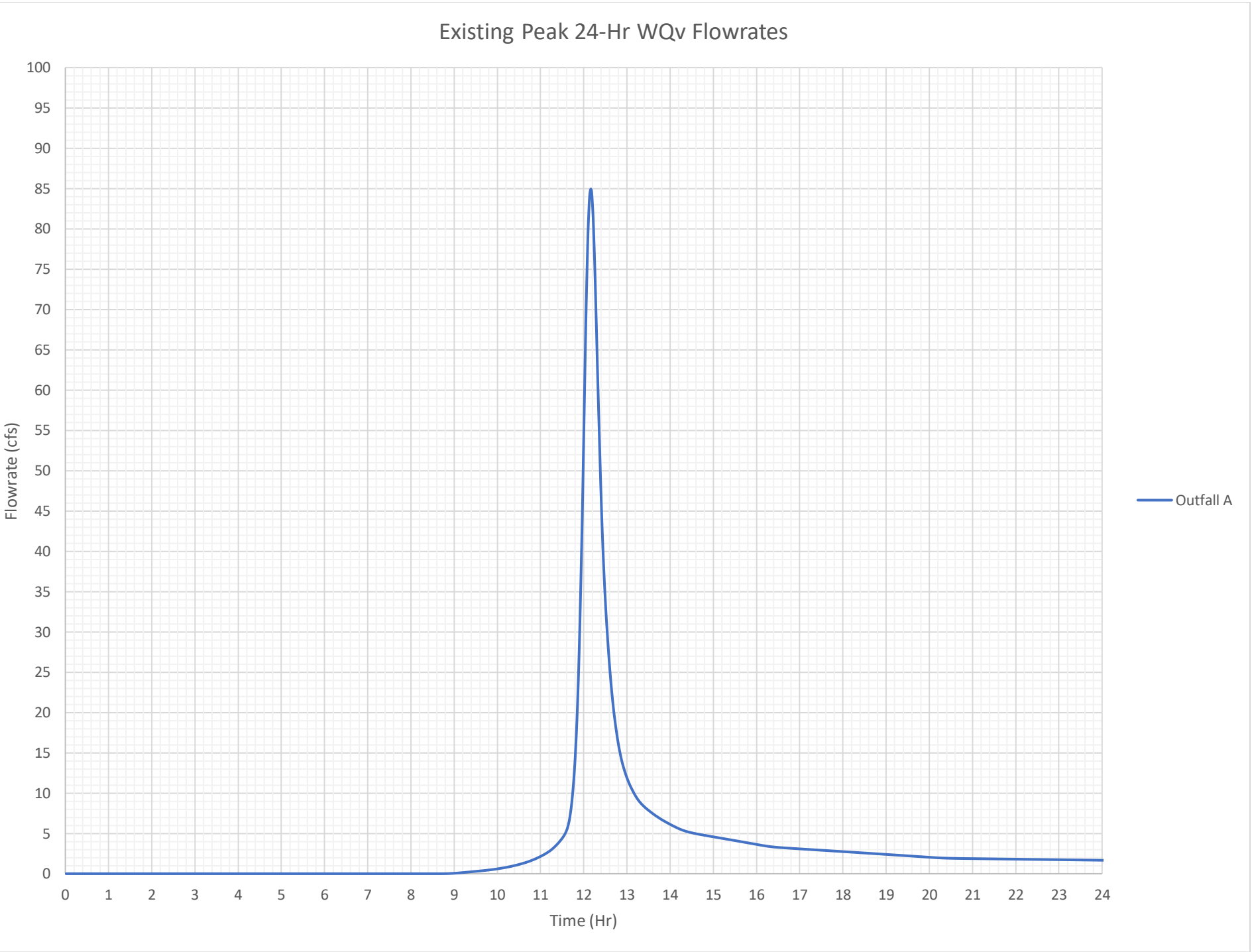
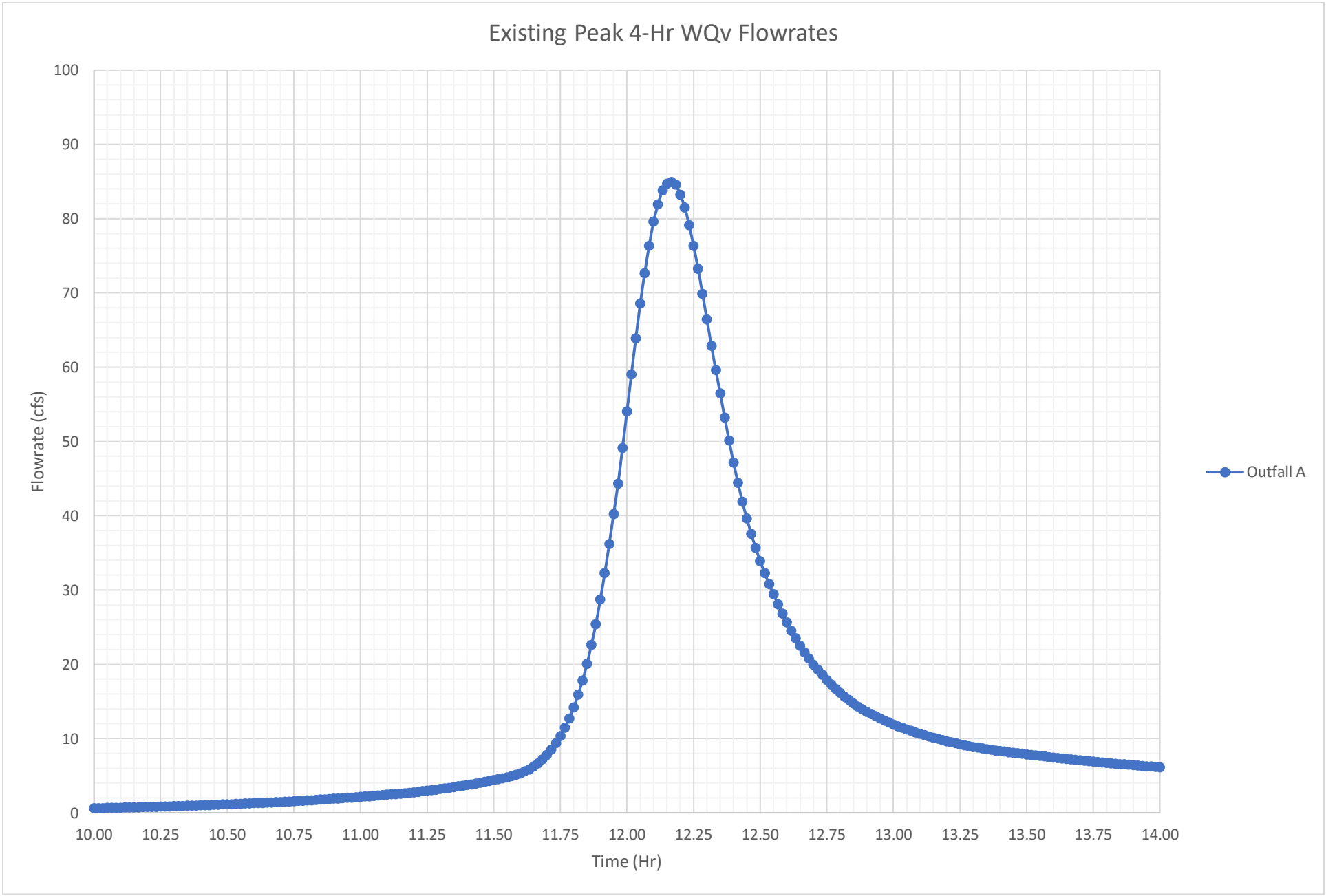
DATE: 05/05/2023			

APPENDIX B

Hydrographs


Existing Peak 24-Hr WQv Flowrates
Flowrate (cfs)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time (Hr)
Outfall A


Existing Peak 4-Hr WQv Flowrates
Flowrate (cfs)
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90
80
70
60
50
40
30
20
10
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10.00
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11.25
11.50
11.75
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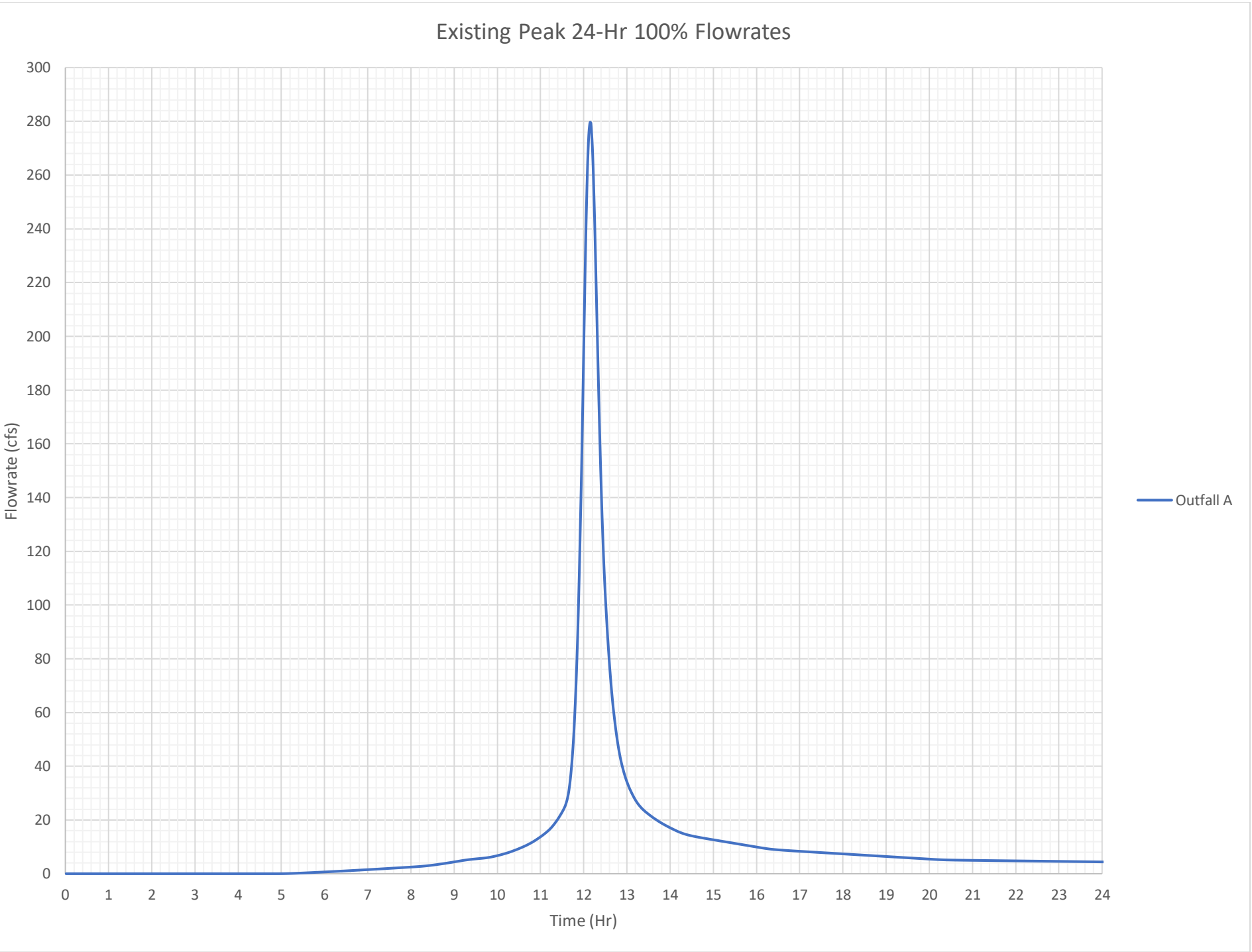
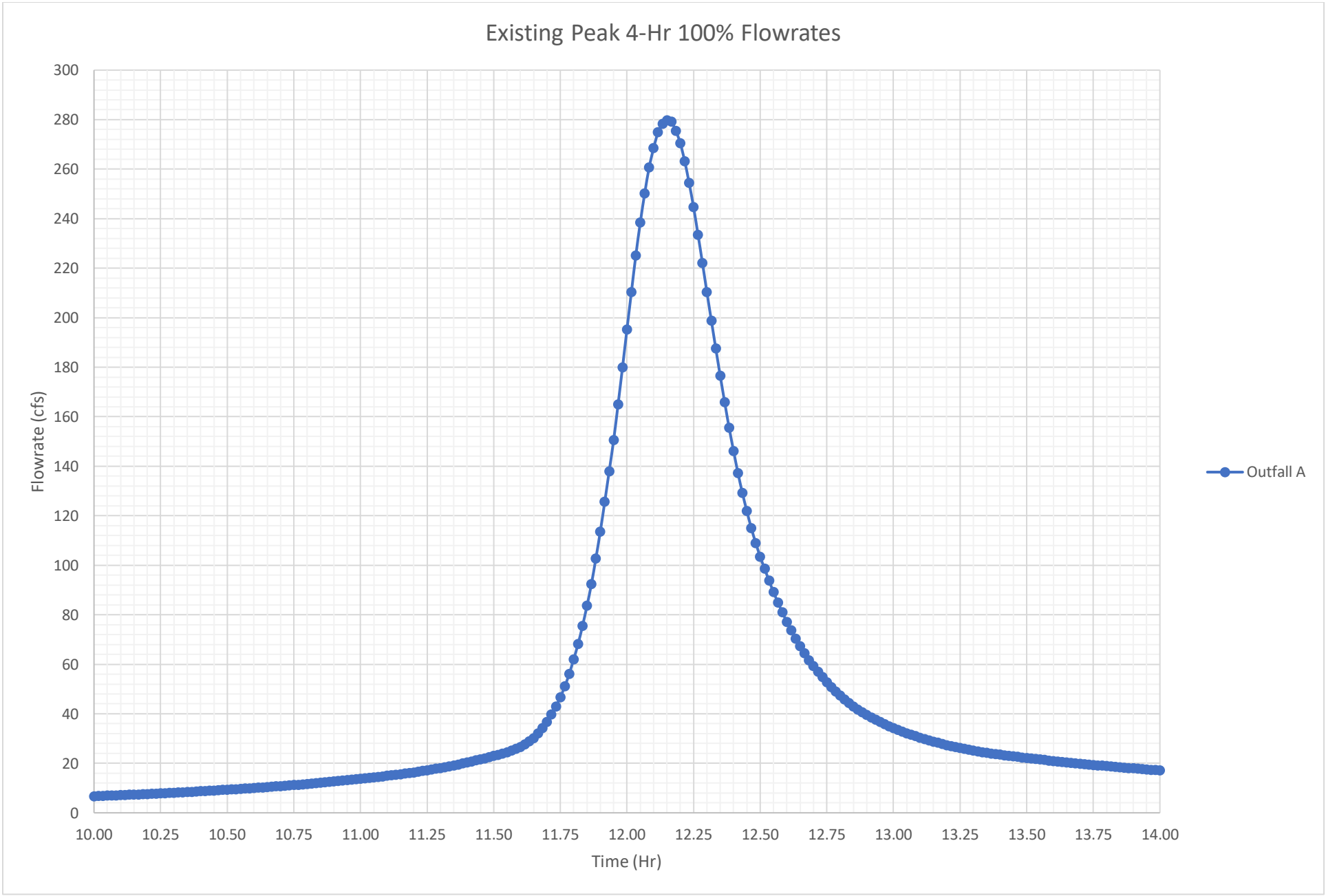
12.50
12.75
13.00
13.25
13.50
13.75
14.00
Time (Hr)
Outfall A


Existing Peak 24-Hr 100% Flowrates
Flowrate (cfs)
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time (Hr)
Outfall A


Existing Peak 4-Hr 100% Flowrates
Flowrate (cfs)
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280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
10.00
10.25
10.50
10.75
11.00
11.25
11.50
11.75
12.00
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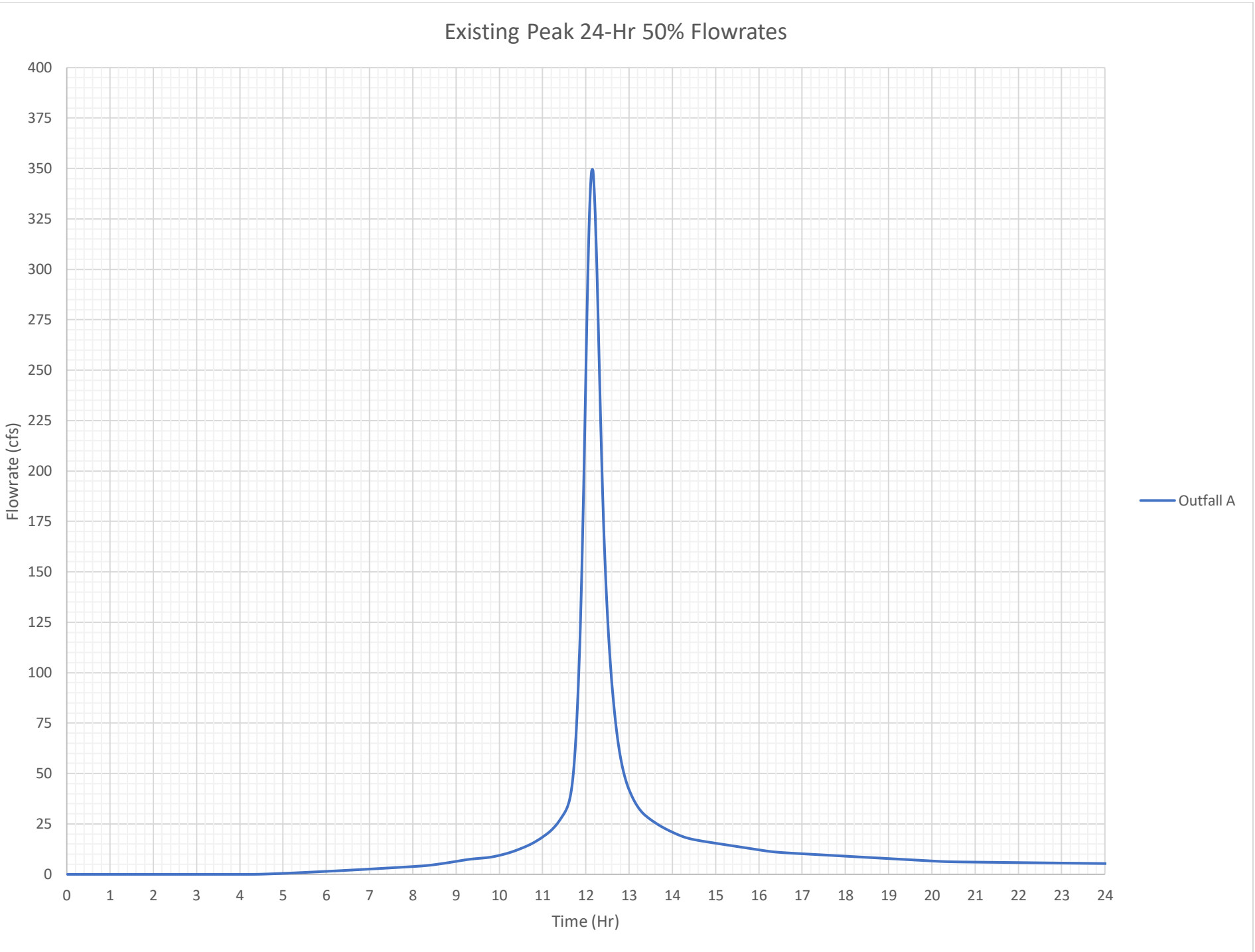
12.50
12.75
13.00
13.25
13.50
13.75
14.00
Time (Hr)
Outfall A


Existing Peak 24-Hr 50% Flowrates
Flowrate (cfs)
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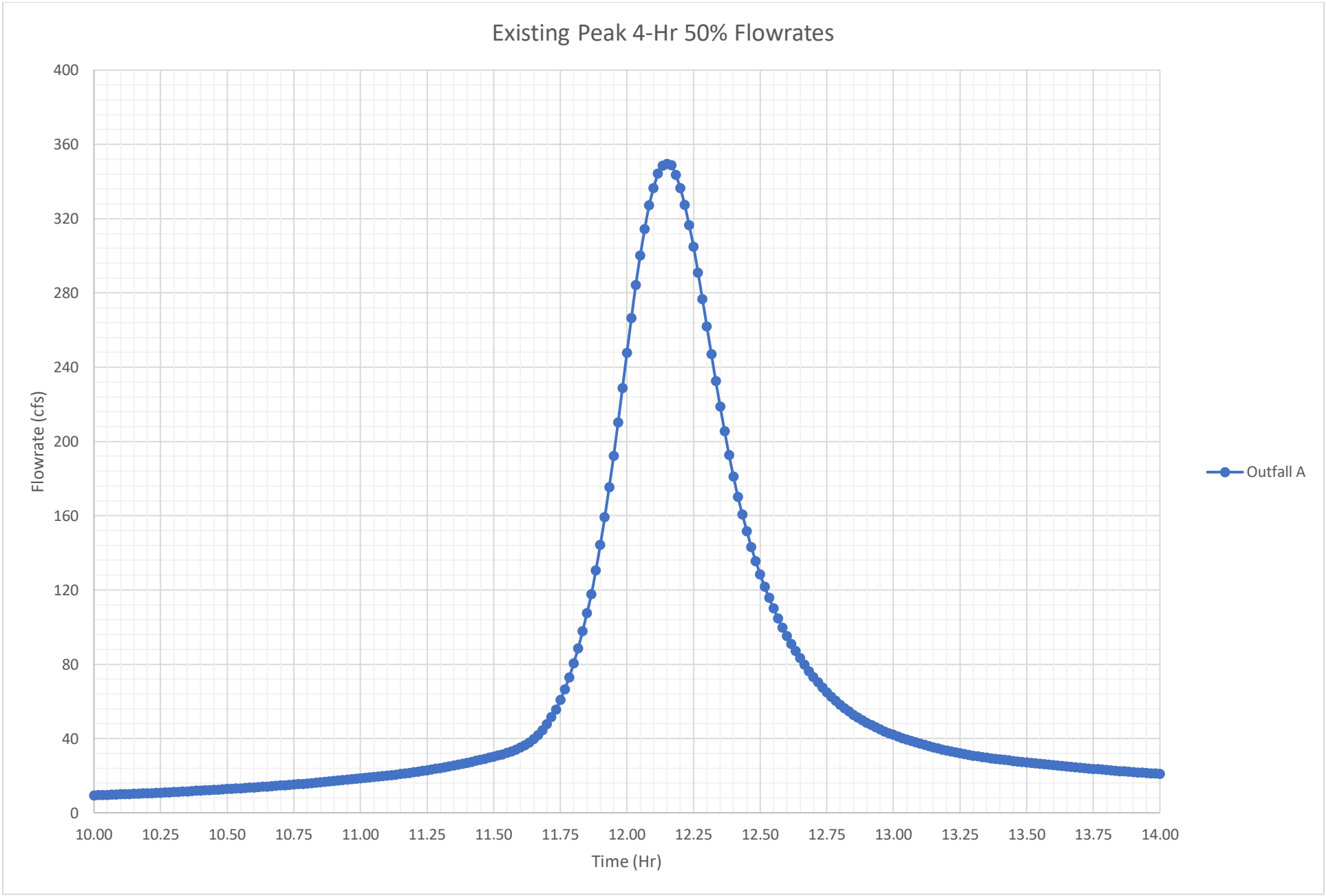
375
350
325
300
275
250
225
200
175
150
125
100
75
50
25
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time (Hr)
Outfall A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Flowrate (cfs)
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360
320
280
240
200
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80
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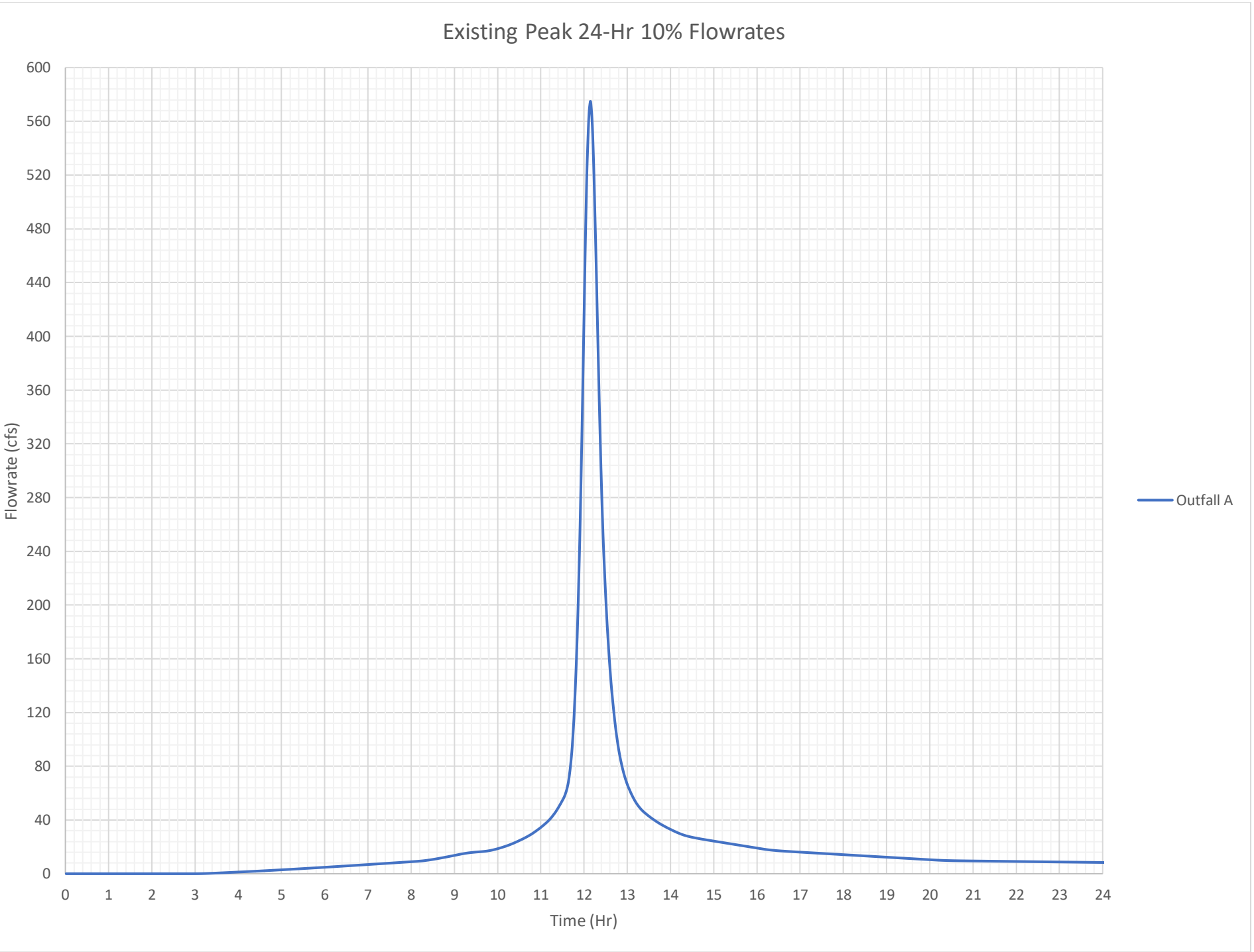
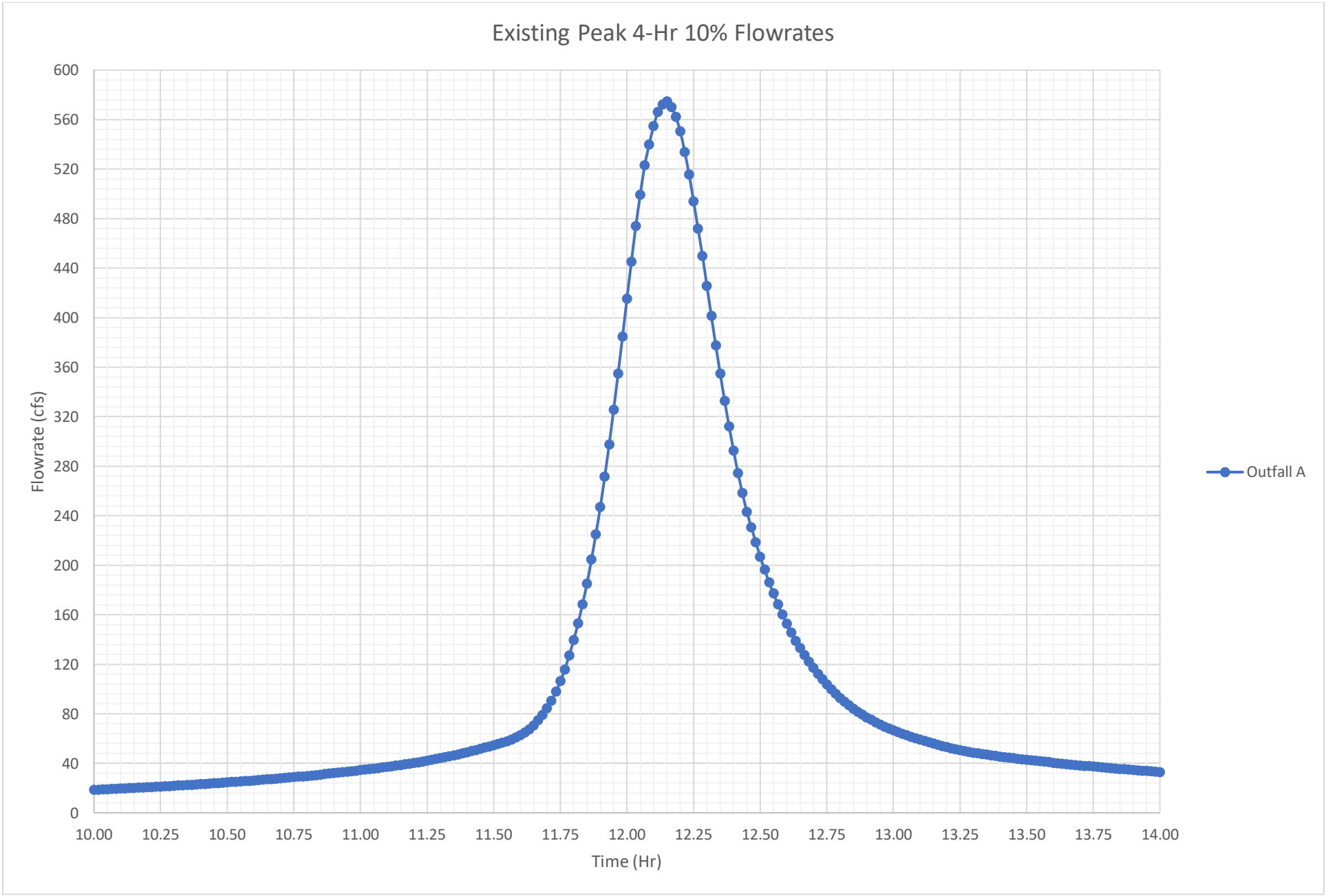
10.25
10.50
10.75
11.00
11.25
11.50
11.75
12.00
12.25
12.50
12.75
13.00
13.25
13.50
13.75
14.00
Time (Hr)
Outfall A


Existing Peak 24-Hr 10% Flowrates
Flowrate (cfs)
600
560
520
480
440
400
360
320
280
240
200
160
120
80
40
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time (Hr)
Outfall A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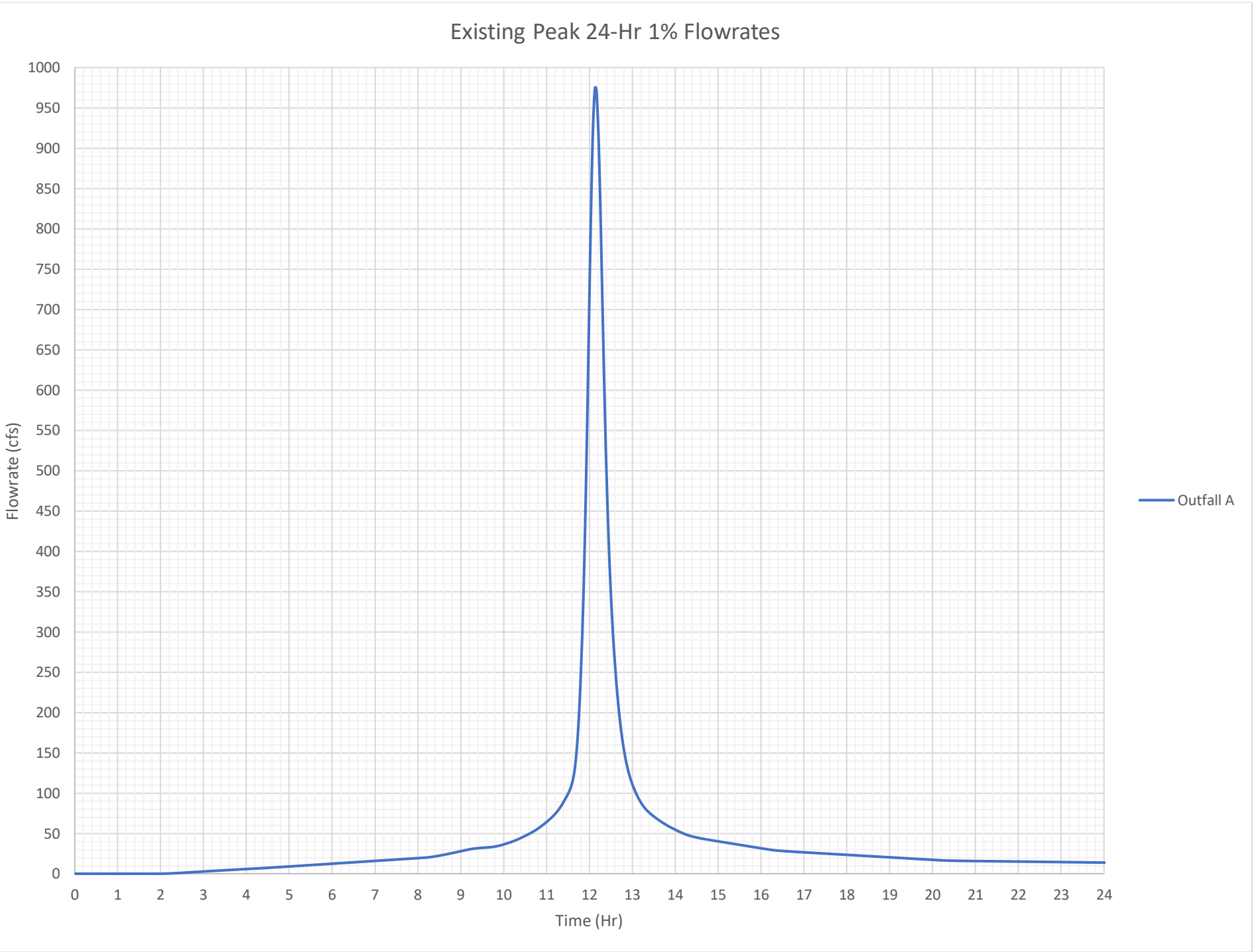
Flowrate (cfs)
600
560
520
480
440
400
360
320
280
240
200
160
120
80
40
0
10.00
10.25
10.50
10.75
11.00
11.25
11.50
11.75
12.00
12.25
12.50
12.75
13.00
13.25
13.50
13.75
14.00
Time (Hr)
Outfall A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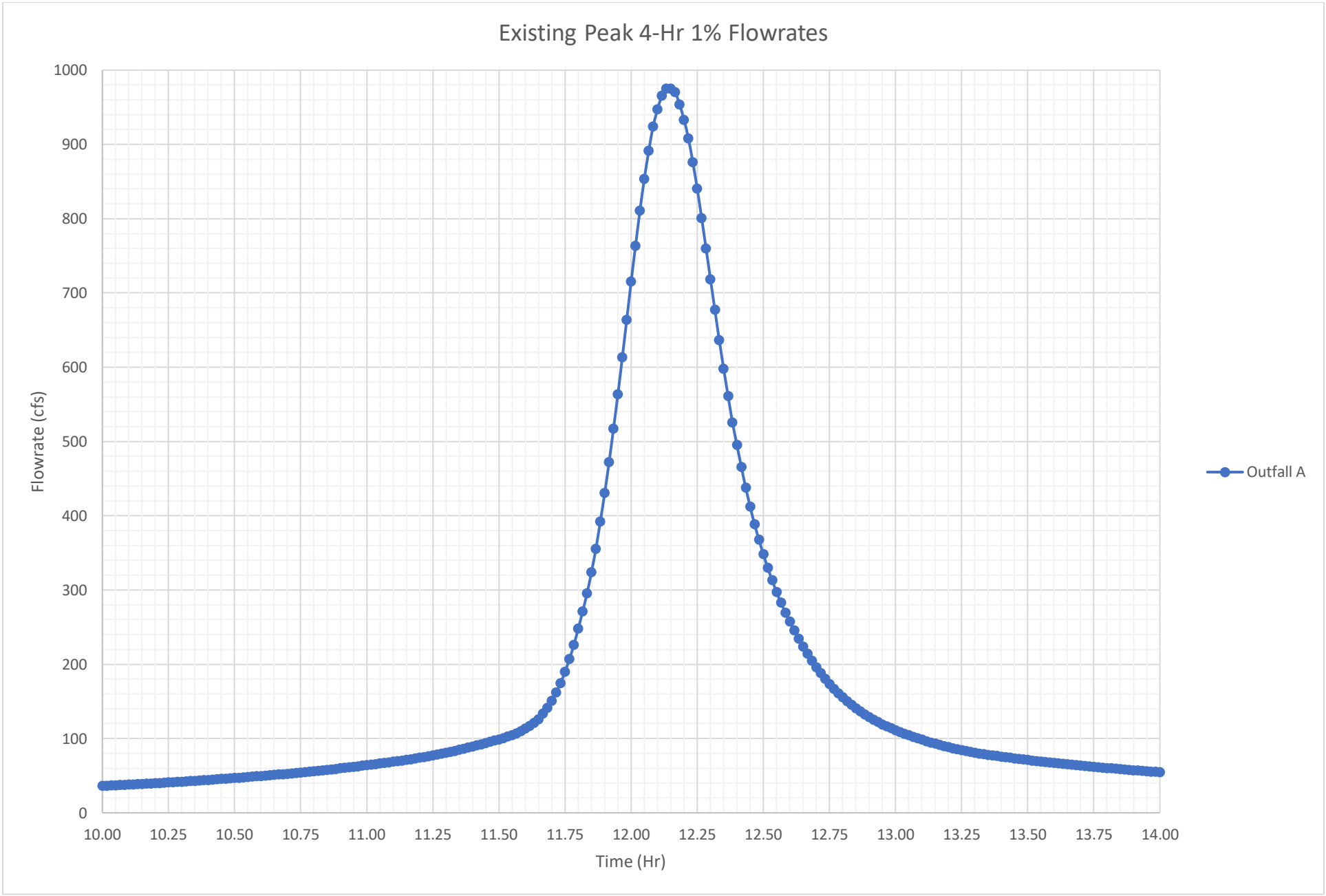
Flowrate (cfs)
1000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time (Hr)
Outfall A


Existing Peak 4-Hr 1% Flowrates
Flowrate (cfs)
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900
800
700
600
500
400
300
200
100
0
10.00
10.25
10.50
10.75
11.00
11.25
11.50
11.75
12.00
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12.50
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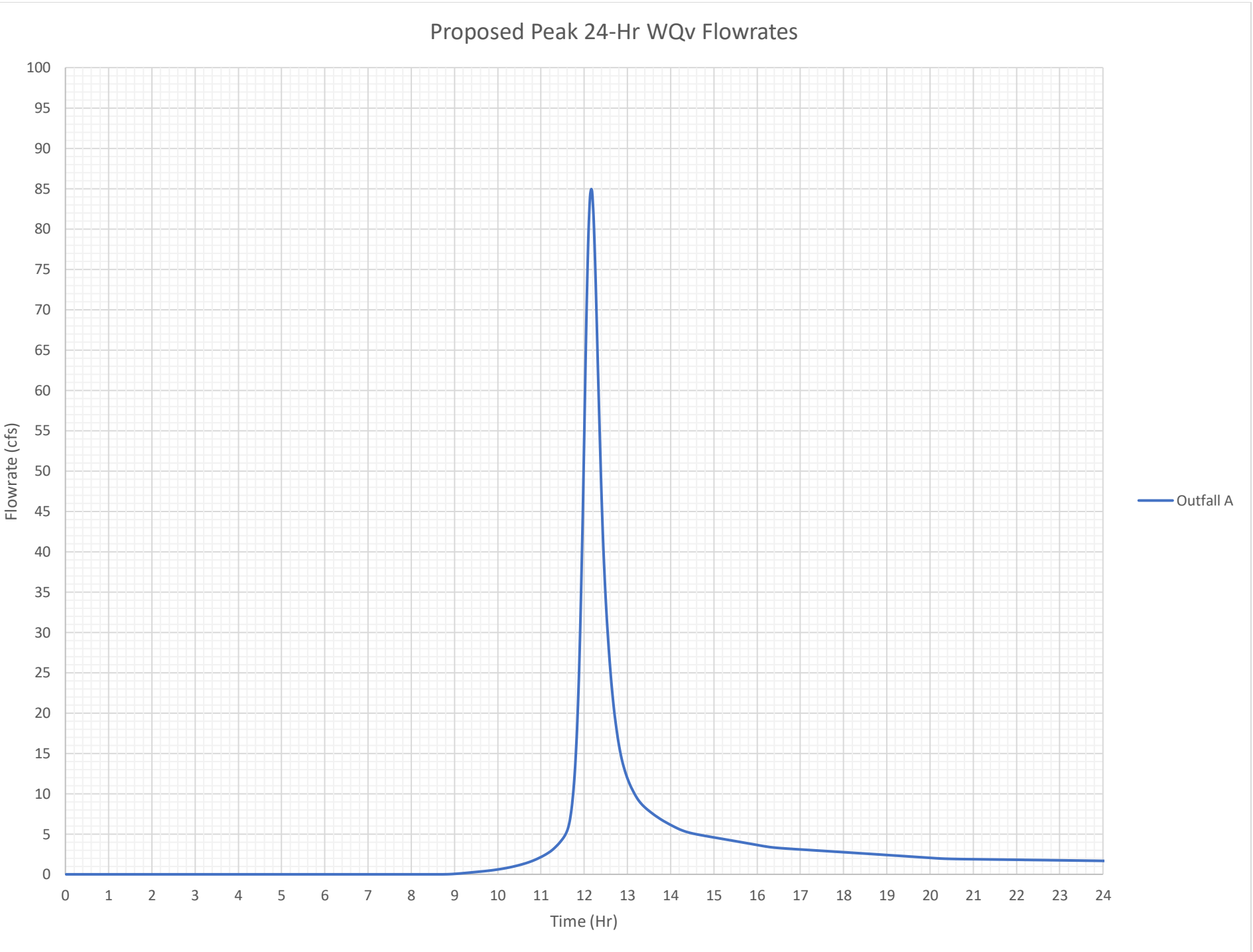
13.00
13.25
13.50
13.75
14.00
Time (Hr)
Outfall A


Proposed Peak 24-Hr WQv Flowrates
Flowrate (cfs)
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95
90
85
80
75
70
65
60
55
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45
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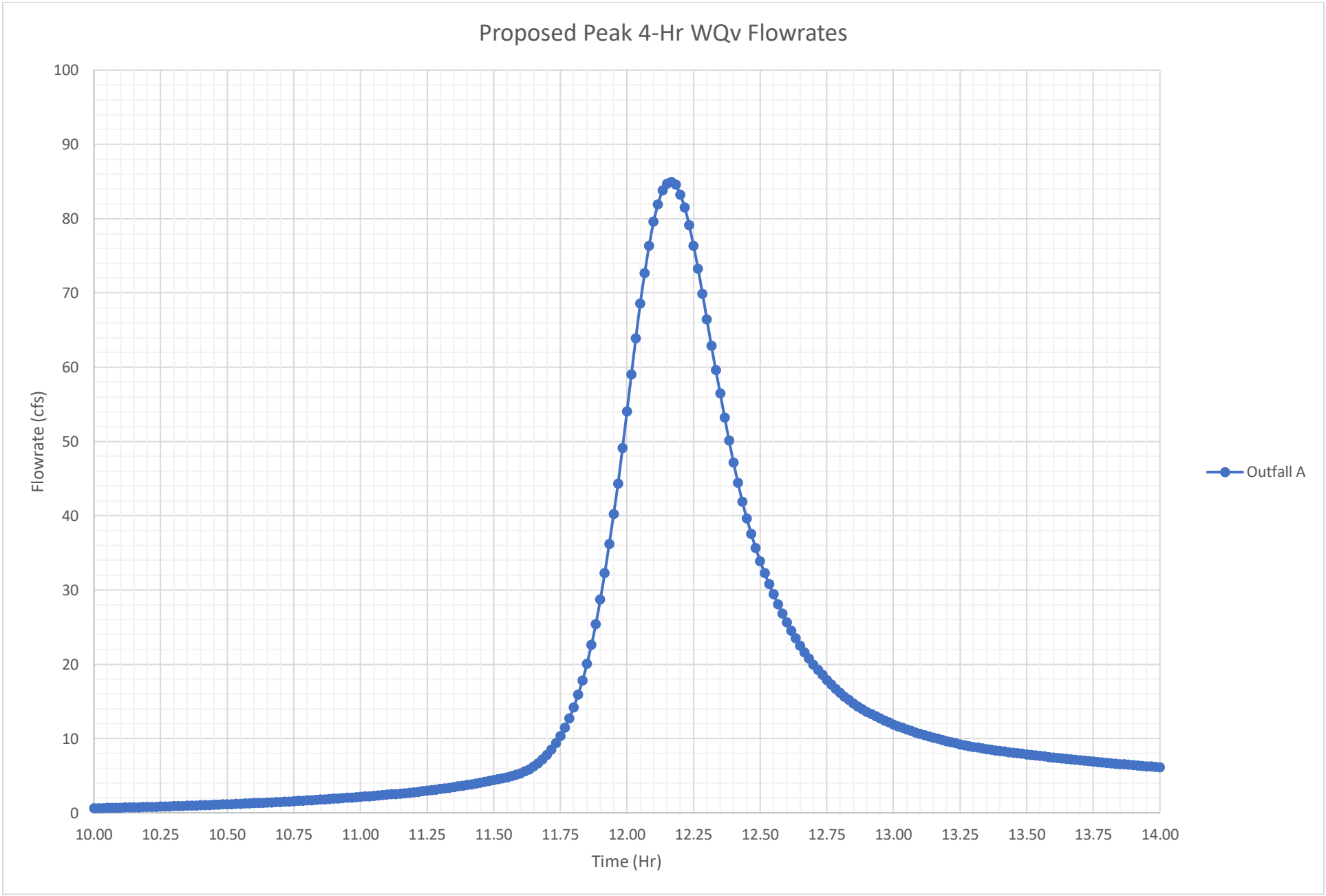
Time (Hr)
Outfall A


Proposed Peak 4-Hr WQv Flowrates
Flowrate (cfs)
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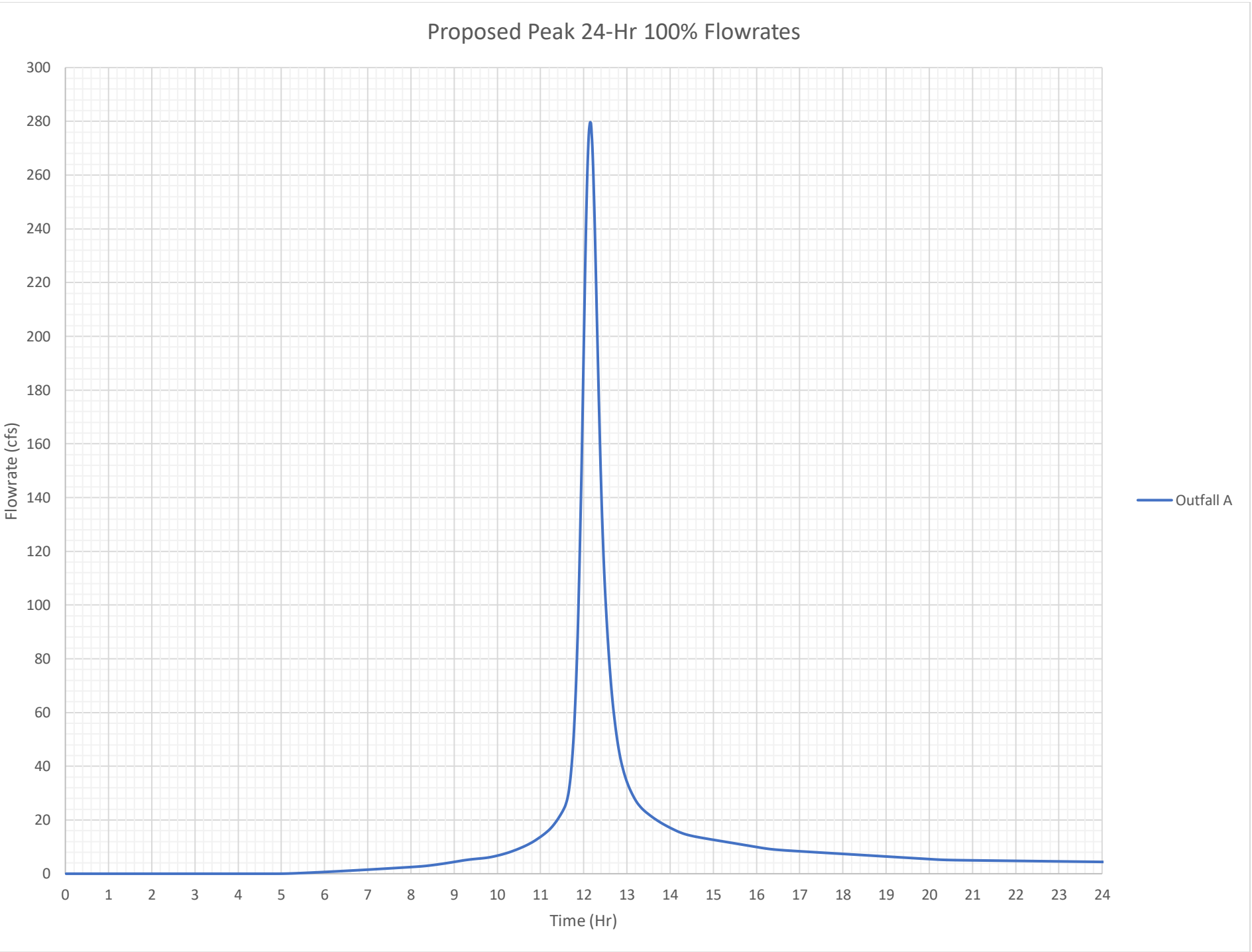
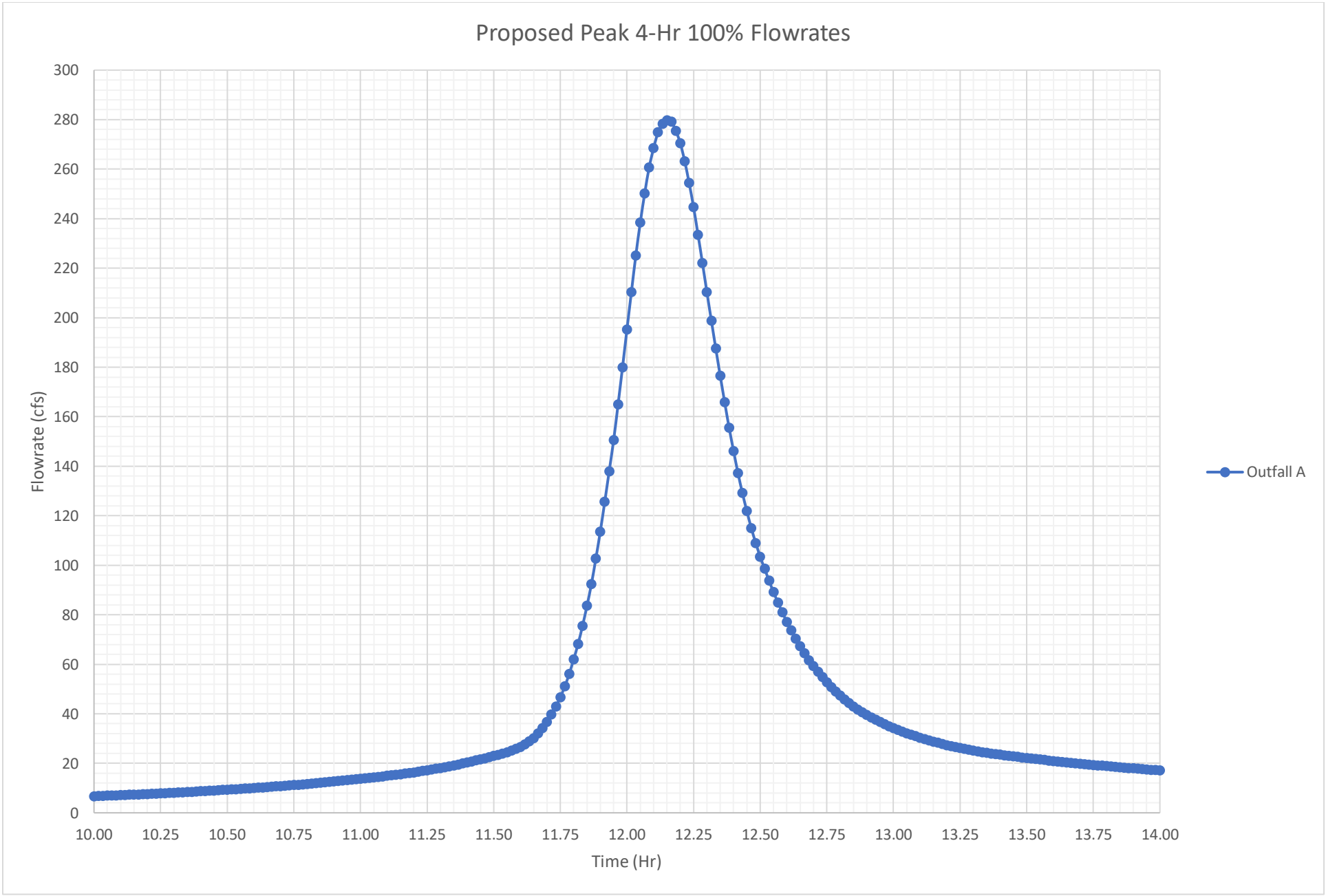
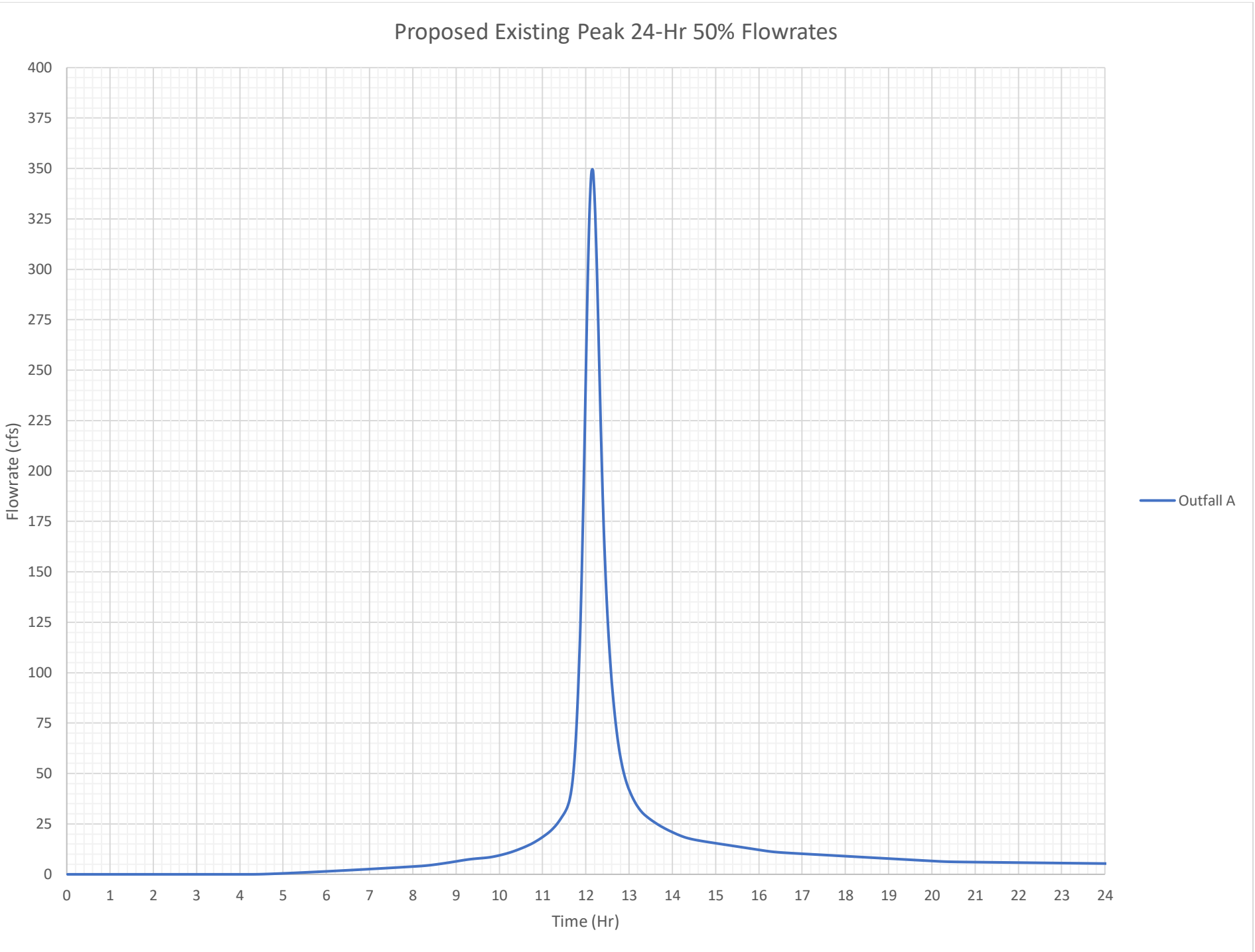
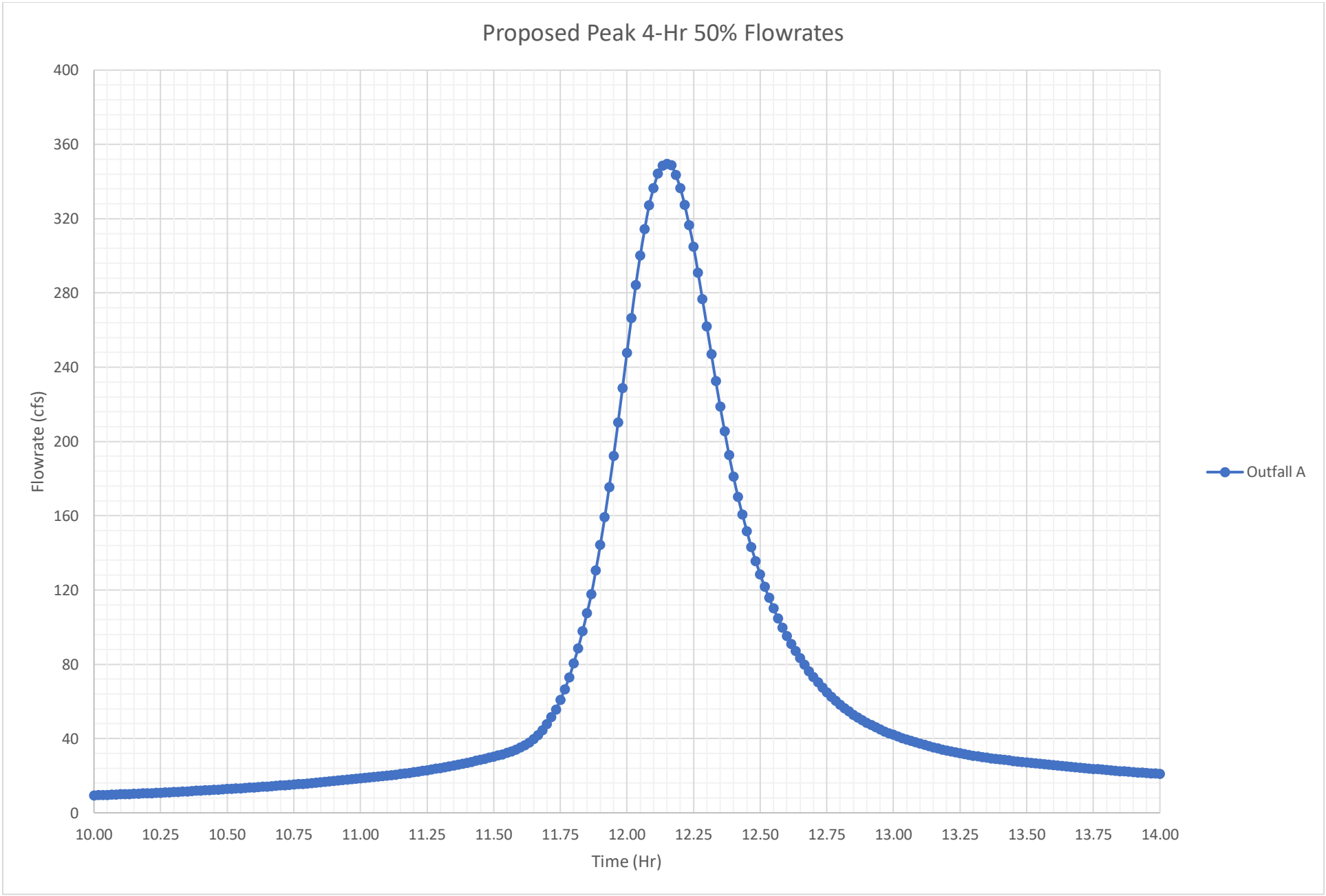
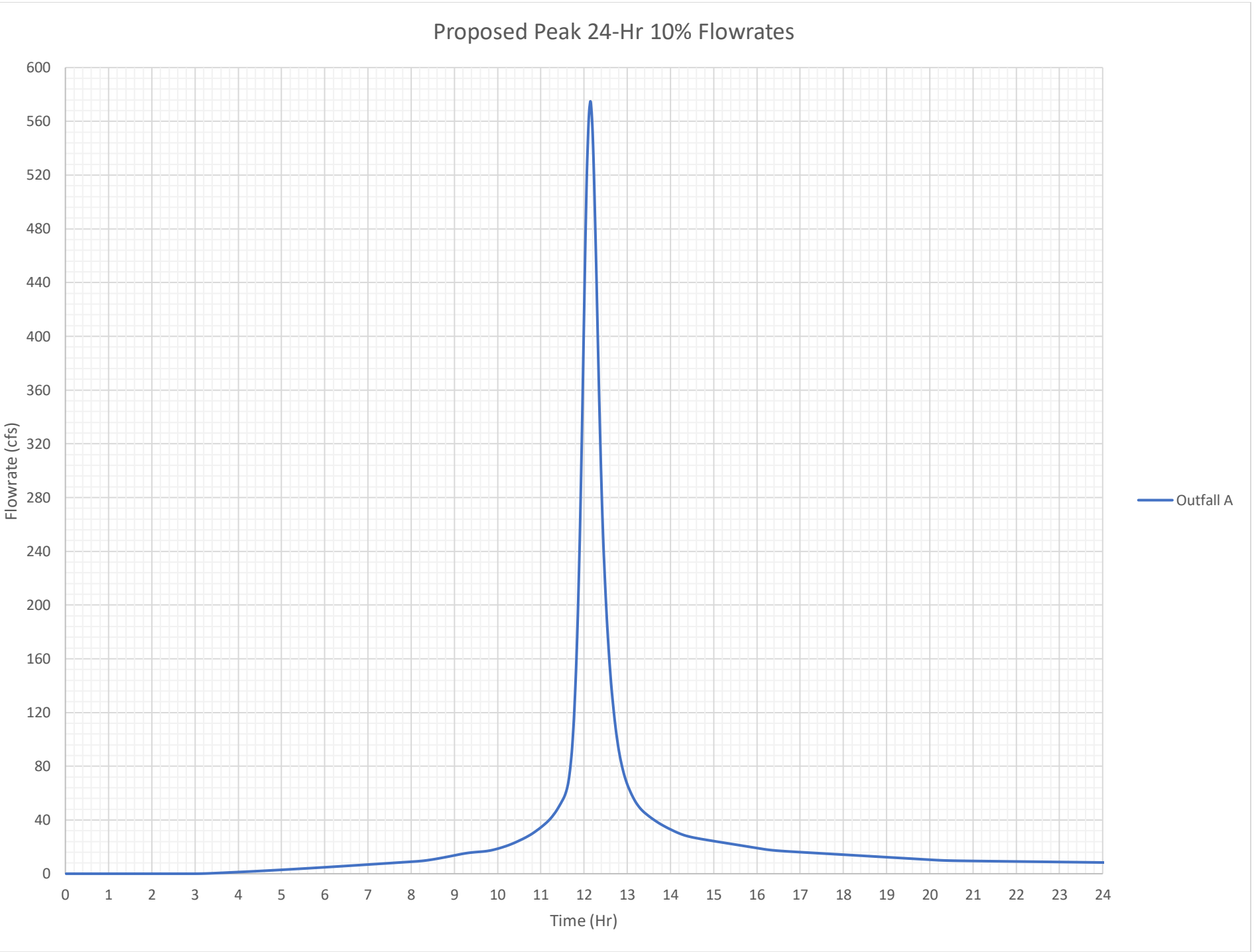
90
80
70
60
50
40
30
20
10
0
10.00
10.25
10.50
10.75
11.00
11.25
11.50
11.75
12.00
12.25
12.50
12.75
13.00
13.25
13.50
13.75
14.00
Time (Hr)
Outfall A

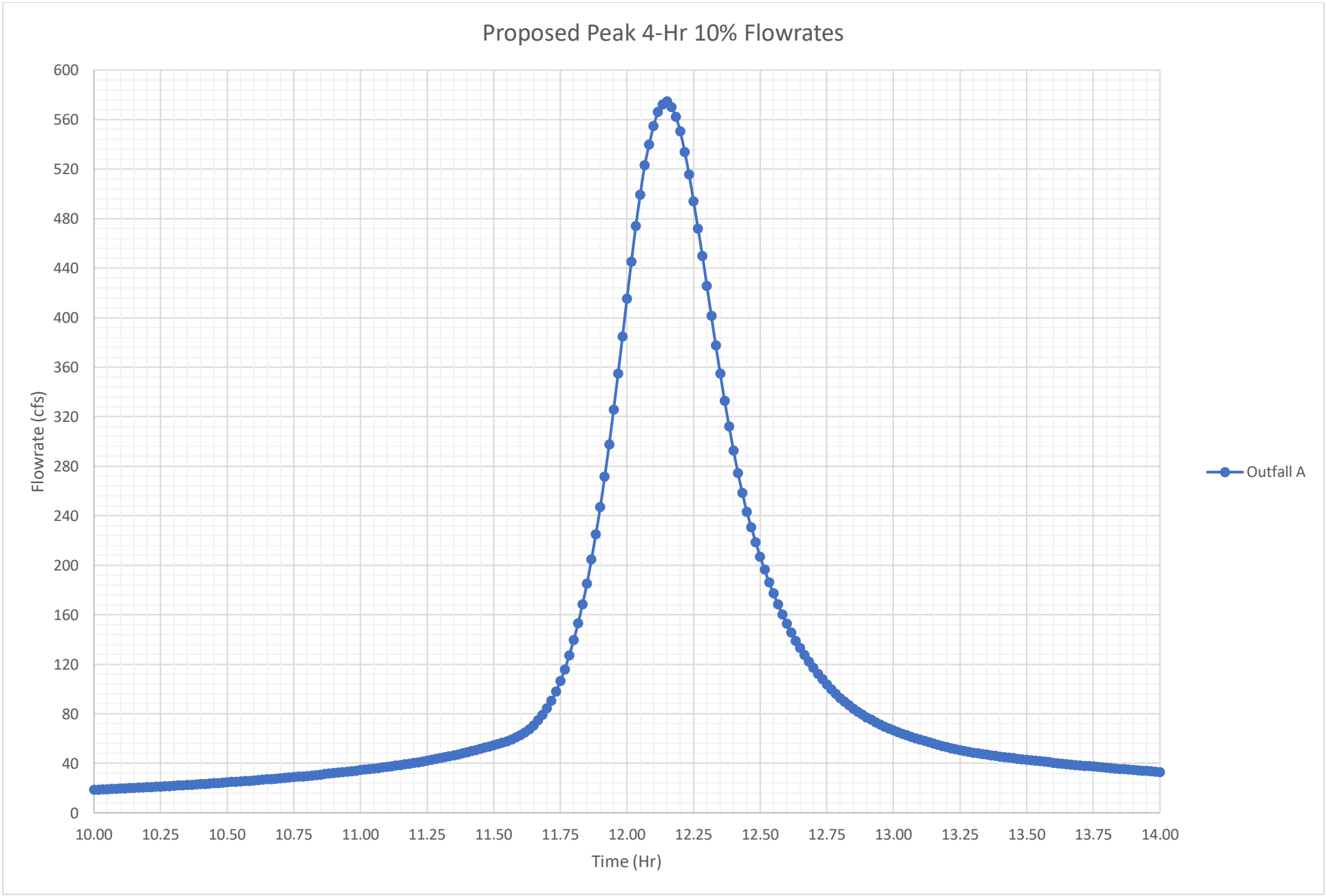

Proposed Peak 24-Hr 100% Flowrates
Flowrate (cfs)
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time (Hr)
Outfall A

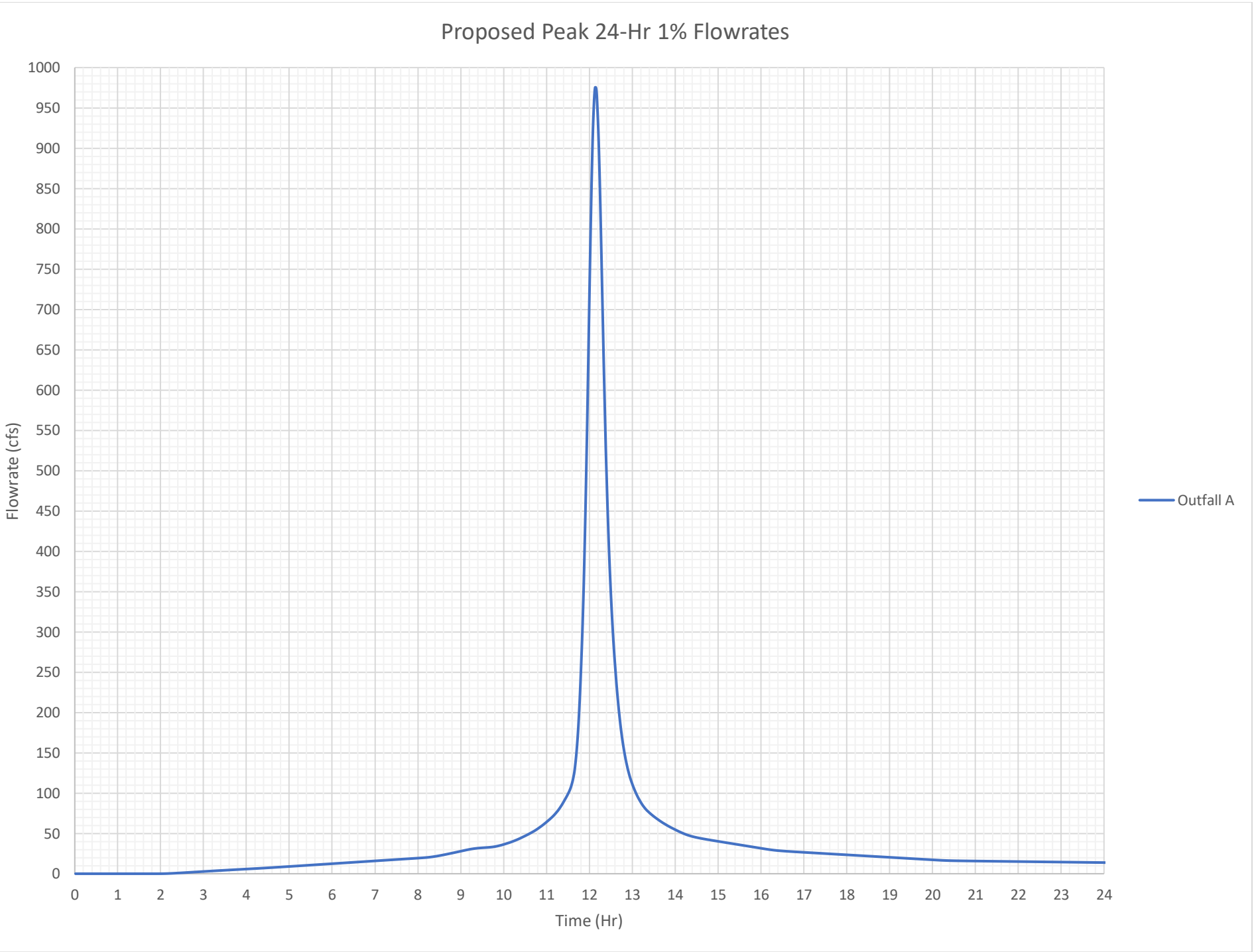

Proposed Peak 4-Hr 100% Flowrates
Flowrate (cfs)
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
10.00
10.25
10.50
10.75
11.00
11.25
11.50
11.75
12.00
12.25
12.50
12.75
13.00
13.25
13.50
13.75
14.00
Time (Hr)
Outfall A

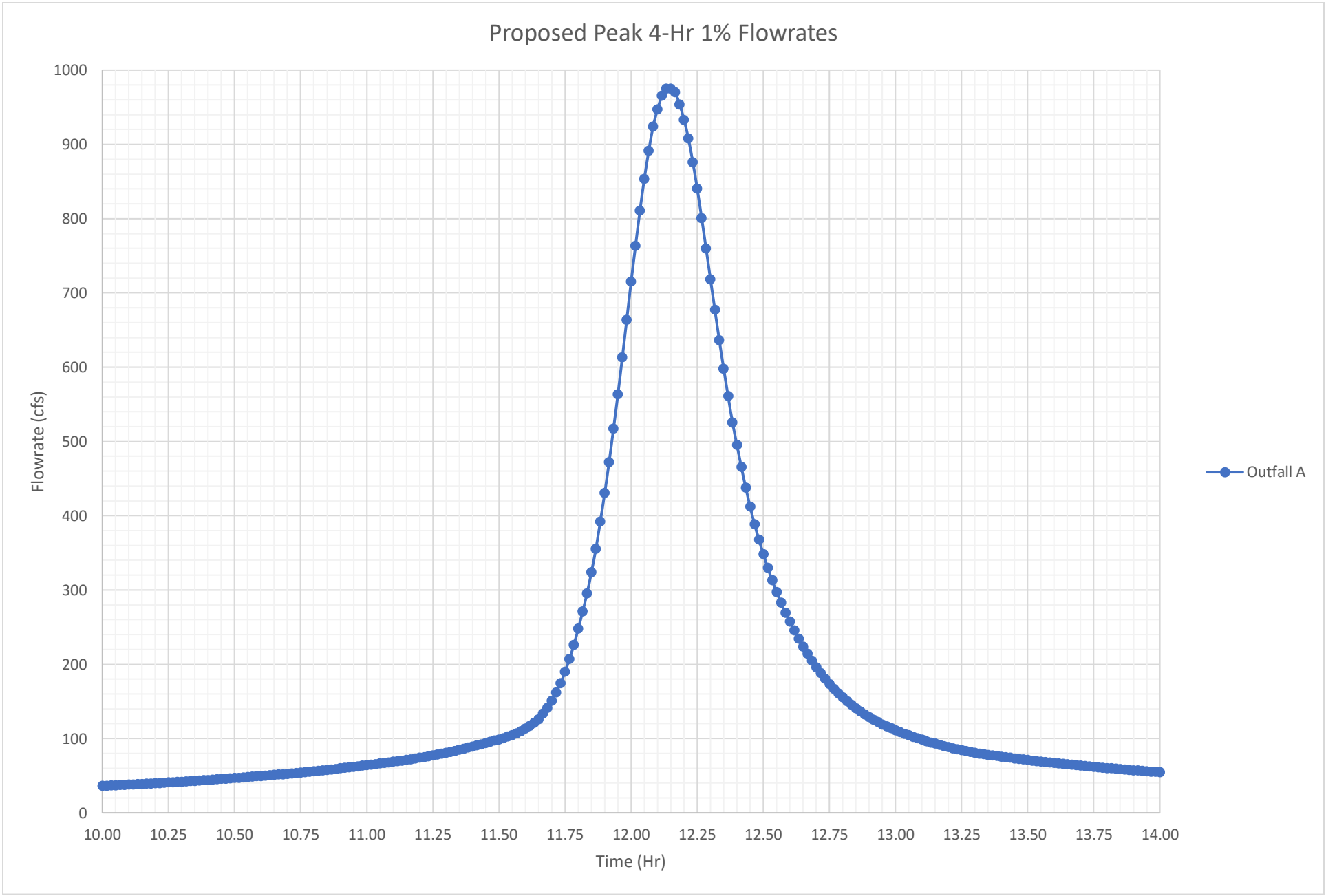

Proposed Existing Peak 24-Hr 50% Flowrates
Flowrate (cfs)
400
375
350
325
300
275
250
225
200
175
150
125
100
75
50
25
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time (Hr)
Outfall A


Proposed Peak 4-Hr 50% Flowrates
Flowrate (cfs)
400
360
320
280
240
200
160
120
80
40
0
10.00
10.25
10.50
10.75
11.00
11.25
11.50
11.75
12.00
12.25
12.50
12.75
13.00
13.25
13.50
13.75
14.00
Time (Hr)
Outfall A


Proposed Peak 24-Hr 10% Flowrates
Flowrate (cfs)
600
560
520
480
440
400
360
320
280
240
200
160
120
80
40
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time (Hr)
Outfall A


Proposed Peak 4-Hr 10% Flowrates
Flowrate (cfs)
600
560
520
480
440
400
360
320
280
240
200
160
120
80
40
0
10.00
10.25
10.50
10.75
11.00
11.25
11.50
11.75
12.00
12.25
12.50
12.75
13.00
13.25
13.50
13.75
14.00
Time (Hr)
Outfall A


Proposed Peak 24-Hr 1% Flowrates
Flowrate (cfs)
1000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time (Hr)
Outfall A


Proposed Peak 4-Hr 1% Flowrates
Flowrate (cfs)
1000
900
800
700
600
500
400
300
200
100
0
10.00
10.25
10.50
10.75
11.00
11.25
11.50
11.75
12.00
12.25
12.50
12.75
13.00
13.25
13.50
13.75
14.00
Time (Hr)
Outfall A

APPENDIX C

Model Results

Existing Conditions Results

WQv Event

Project Description

File Name	Existing Conditions_NOAA.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	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Feb 15, 2023	00:00:00
End Analysis On	Feb 18, 2023	00:00:00
Start Reporting On	Feb 15, 2023	00:00:00
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 00:00:05	days hh:mm:ss
Routing Time Step	1	seconds

Number of Elements

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

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1		Time Series	90% Event (WQv)	Cumulative	inches	Missouri	Jackson	1	1.37	SCS Type II 24-hr

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	A-1	132.96	484.00	91.58	1.37	0.67	88.82	85.12	0 00:25:53
2	Undeveloped	0.52	484.00	84.00	1.37	0.34	0.18	0.25	0 00:05:00

Node Summary

SN	Element 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)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	Junction	0.00	6.00	0.00	6.00	0.00	85.16	0.00	0.00	6.00	0 00:00	0.00	0.00
2	Out-01	Outfall	0.00					85.16	0.00					

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Reported Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)	
1	Link-01	Pipe	Jun-01	Out-01	426.71	0.00	0.00	0.0000	0.000	0.0150	85.16	0.00	0.00	0.00	0.00	0.00	0.00	

Subbasin Hydrology

Subbasin : A-1

Input Data

Area (ac)	132.96
Peak Rate Factor	484.00
Weighted Curve Number	91.58
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
1/4 acre lots, 38% impervious	34.01	C	83.00
1/4 acre lots, 38% impervious	1.71	D	87.00
Urban commercial, 85% imp	19.01	C	94.00
Urban commercial, 85% imp	74.72	D	95.00
Multi-Family	3.11	C	90.00
Paved roads with curbs & sewers	0.40	D	98.00
50 - 75% grass cover, Fair	0.00	D	84.00
Composite Area & Weighted CN	132.96		91.58

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

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

Shallow Concentrated Flow Equation :

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

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.3	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.50	0.00	0.00
Velocity (ft/sec) :	0.10	0.00	0.00
Computed Flow Time (min) :	16.31	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	443	0.00	0.00
Slope (%) :	2	0.00	0.00
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	2.87	0.00	0.00
Computed Flow Time (min) :	2.57	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.013	0.00	0.00
Flow Length (ft) :	2975	0.00	0.00
Channel Slope (%) :	1	0.00	0.00
Cross Section Area (ft²) :	3.425	0.00	0.00
Wetted Perimeter (ft) :	7.06	0.00	0.00
Velocity (ft/sec) :	7.08	0.00	0.00
Computed Flow Time (min) :	7.01	0.00	0.00

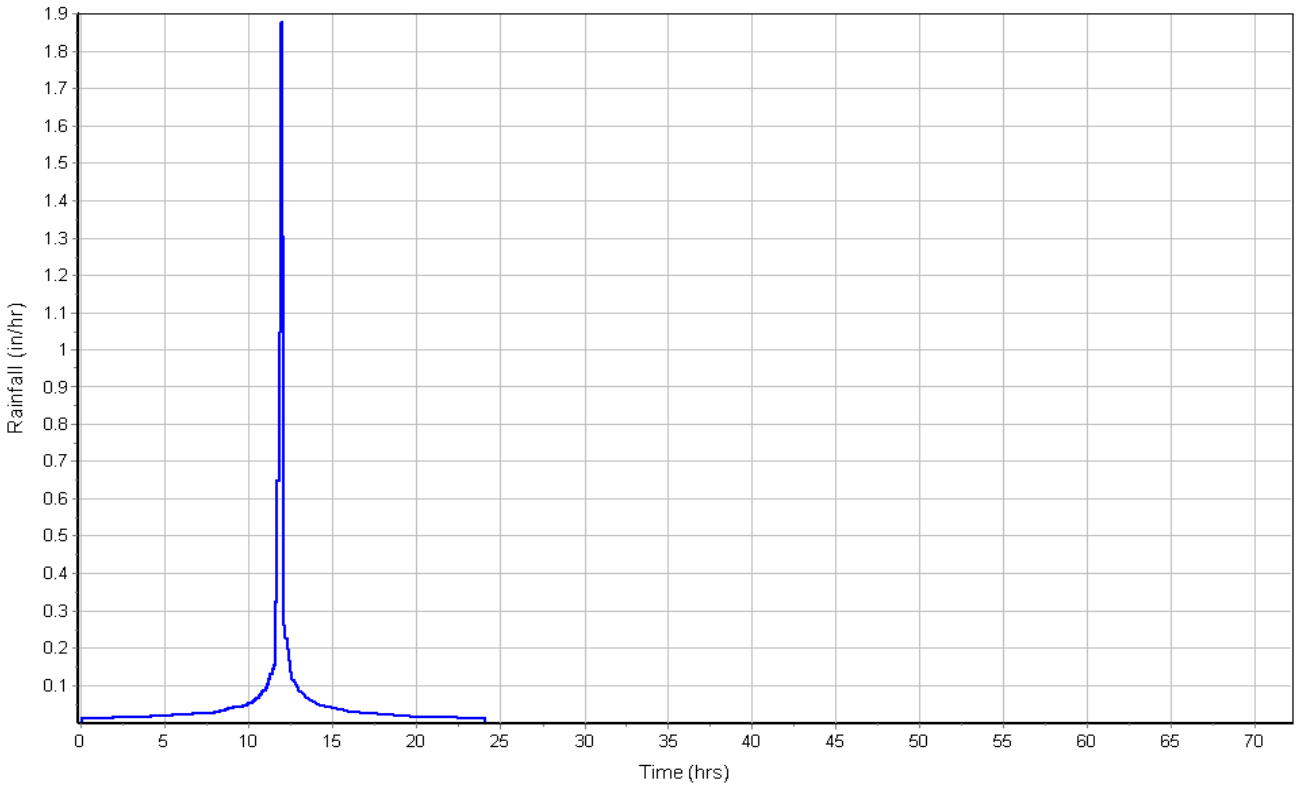
Total TOC (min) 25.89

Subbasin Runoff Results

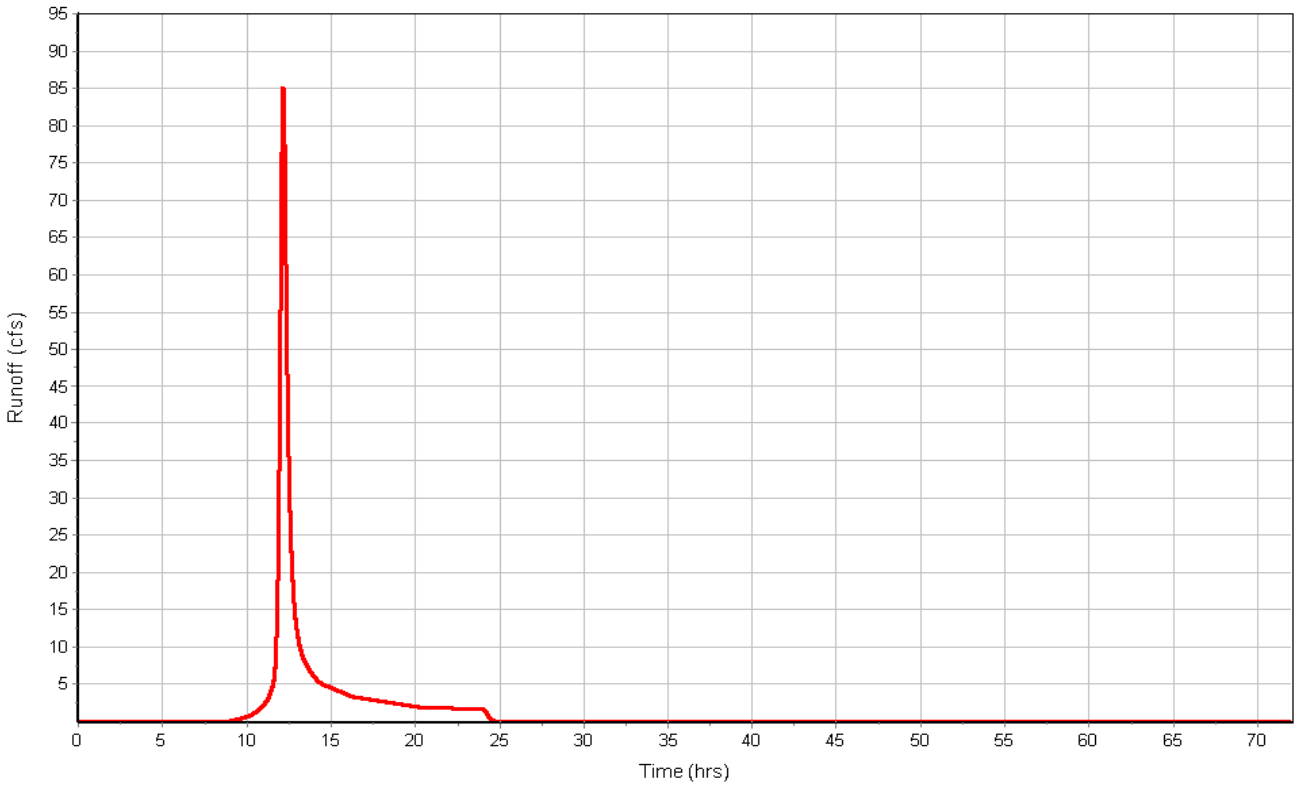
Total Rainfall (in)	1.37
Total Runoff (in)	0.67
Peak Runoff (cfs)	85.12
Weighted Curve Number	91.58
Time of Concentration (days hh:mm:ss)	0 00:25:53

Subbasin : A-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Undeveloped

Input Data

Area (ac) 0.52
Peak Rate Factor 484.00
Weighted Curve Number 84.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.52	-	84.00
Composite Area & Weighted CN	0.52		84.00

Time of Concentration

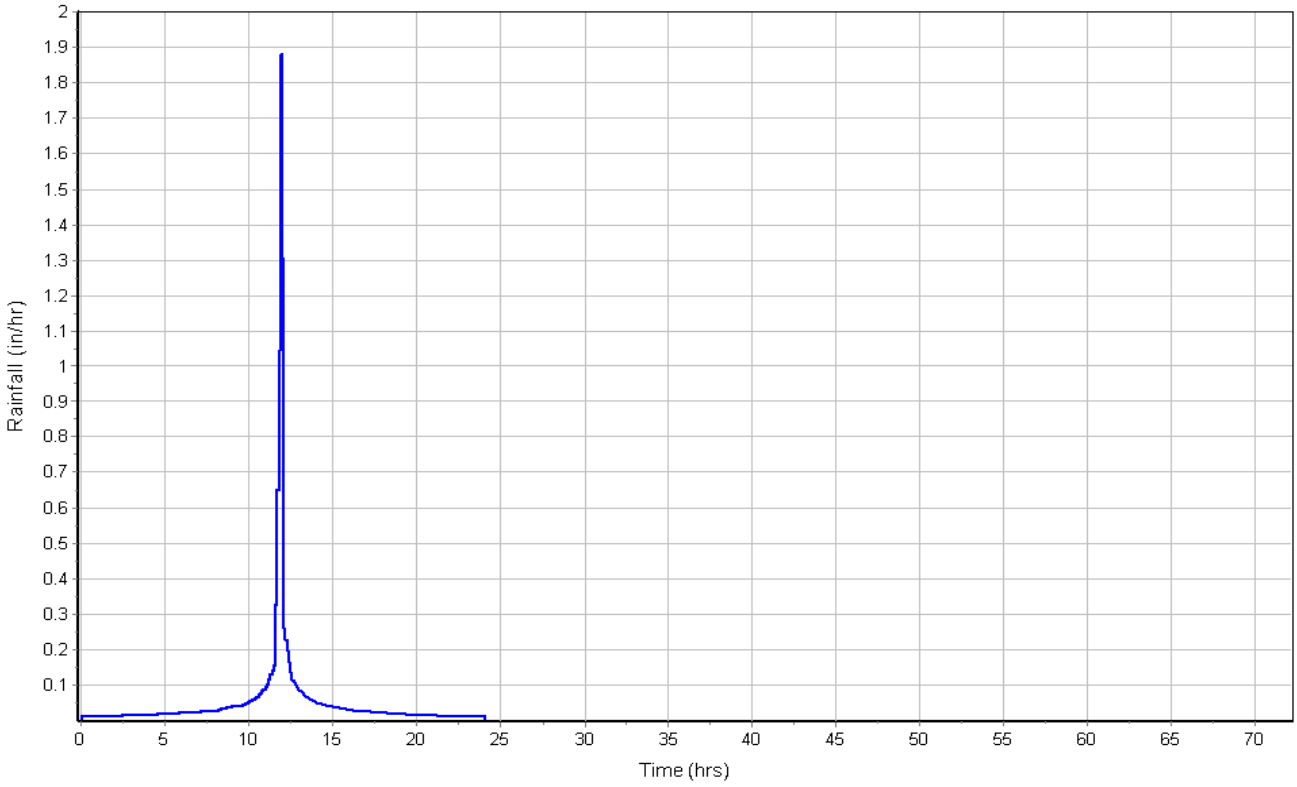
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

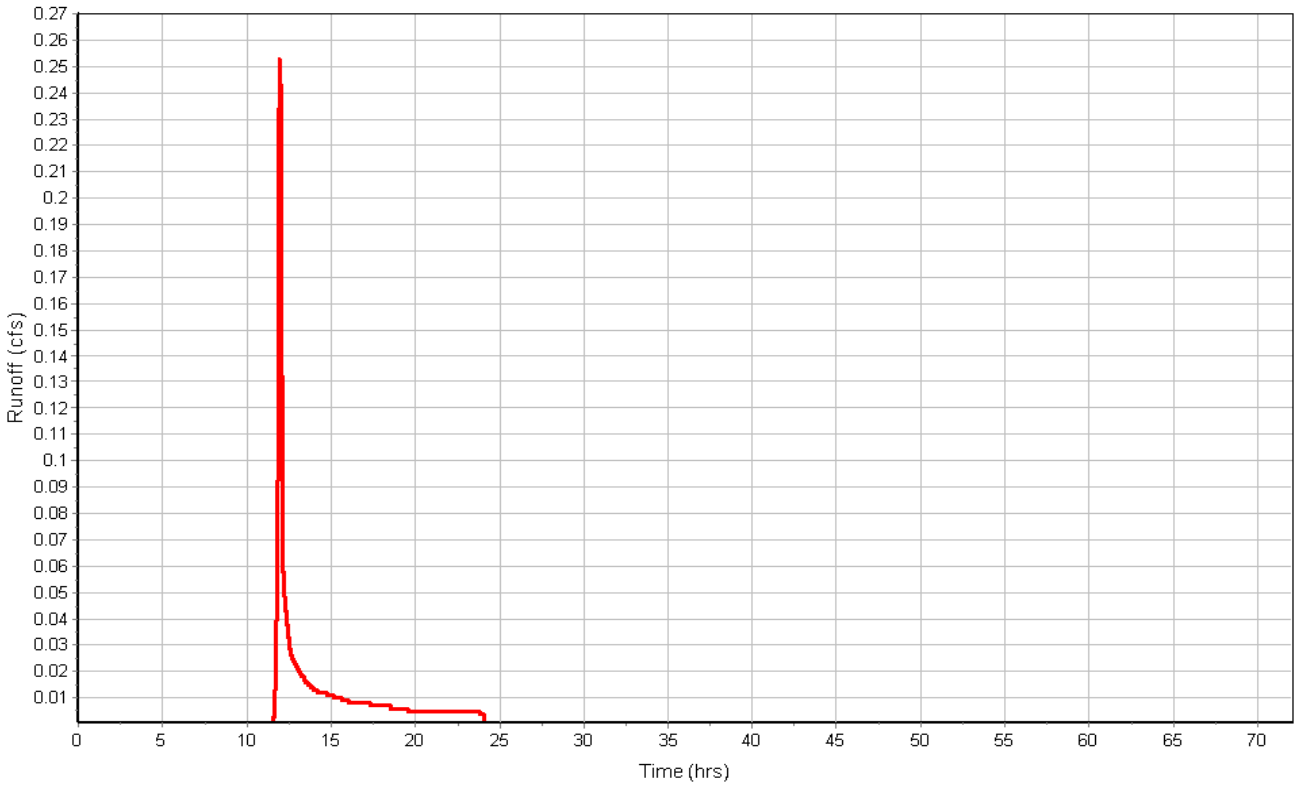
Total Rainfall (in) 1.37
Total Runoff (in) 0.34
Peak Runoff (cfs) 0.25
Weighted Curve Number 84.00
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : Undeveloped

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-01	0.00	6.00	6.00	0.00	0.00	6.00	0.00	0.00	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)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	85.16	85.16	0.00	0.00	0.00	6.00	0.00	0.00	0 00:00	0 00:00	0.00	0.00

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 Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	Link-01	426.71	0.00	0.00	0.00	0.00	0.00	0.0000	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1

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)	Froude Number	Reported Condition
1	Link-01	85.16	0 12:08	0.00	0.00	0.00		0.00	0.00	0.00		

100% Chance Event

Project Description

File Name	Existing Conditions_NOAA.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	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Feb 15, 2023	00:00:00
End Analysis On	Feb 18, 2023	00:00:00
Start Reporting On	Feb 15, 2023	00:00:00
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 00:00:05	days hh:mm:ss
Routing Time Step	1	seconds

Number of Elements

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

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1		Time Series	1 Year	Cumulative	inches	Missouri	Jackson	1	3.10	SCS Type II 24-hr

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	A-1	132.96	484.00	91.58	3.10	2.22	294.77	279.69	0 00:25:53
2	Undeveloped	0.52	484.00	84.00	3.10	1.60	0.83	1.32	0 00:05:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	Junction	0.00	6.00	0.00	6.00	0.00	279.96	0.00	0.00	6.00	0 00:00	0.00	0.00
2	Out-01	Outfall	0.00					279.96	0.00					

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Reported Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)	
1	Link-01	Pipe	Jun-01	Out-01	426.71	0.00	0.00	0.0000	0.000	0.0150	279.96	0.00	0.00	0.00	0.00	0.00	0.00	

Subbasin Hydrology

Subbasin : A-1

Input Data

Area (ac)	132.96
Peak Rate Factor	484.00
Weighted Curve Number	91.58
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
1/4 acre lots, 38% impervious	34.01	C	83.00
1/4 acre lots, 38% impervious	1.71	D	87.00
Urban commercial, 85% imp	19.01	C	94.00
Urban commercial, 85% imp	74.72	D	95.00
Multi-Family	3.11	C	90.00
Paved roads with curbs & sewers	0.40	D	98.00
50 - 75% grass cover, Fair	0.00	D	84.00
Composite Area & Weighted CN	132.96		91.58

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

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

Shallow Concentrated Flow Equation :

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

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.3	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.50	0.00	0.00
Velocity (ft/sec) :	0.10	0.00	0.00
Computed Flow Time (min) :	16.31	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	443	0.00	0.00
Slope (%) :	2	0.00	0.00
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	2.87	0.00	0.00
Computed Flow Time (min) :	2.57	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.013	0.00	0.00
Flow Length (ft) :	2975	0.00	0.00
Channel Slope (%) :	1	0.00	0.00
Cross Section Area (ft²) :	3.425	0.00	0.00
Wetted Perimeter (ft) :	7.06	0.00	0.00
Velocity (ft/sec) :	7.08	0.00	0.00
Computed Flow Time (min) :	7.01	0.00	0.00

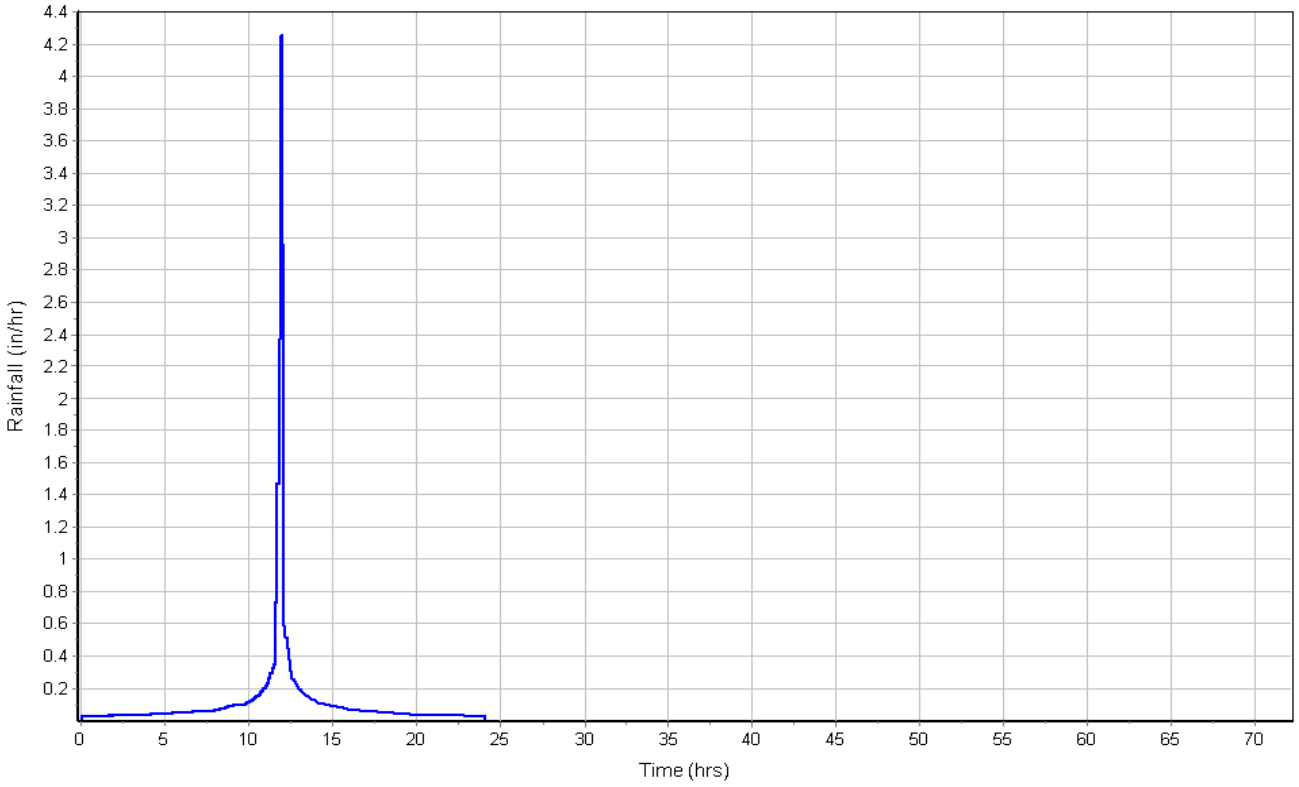
Total TOC (min) 25.89

Subbasin Runoff Results

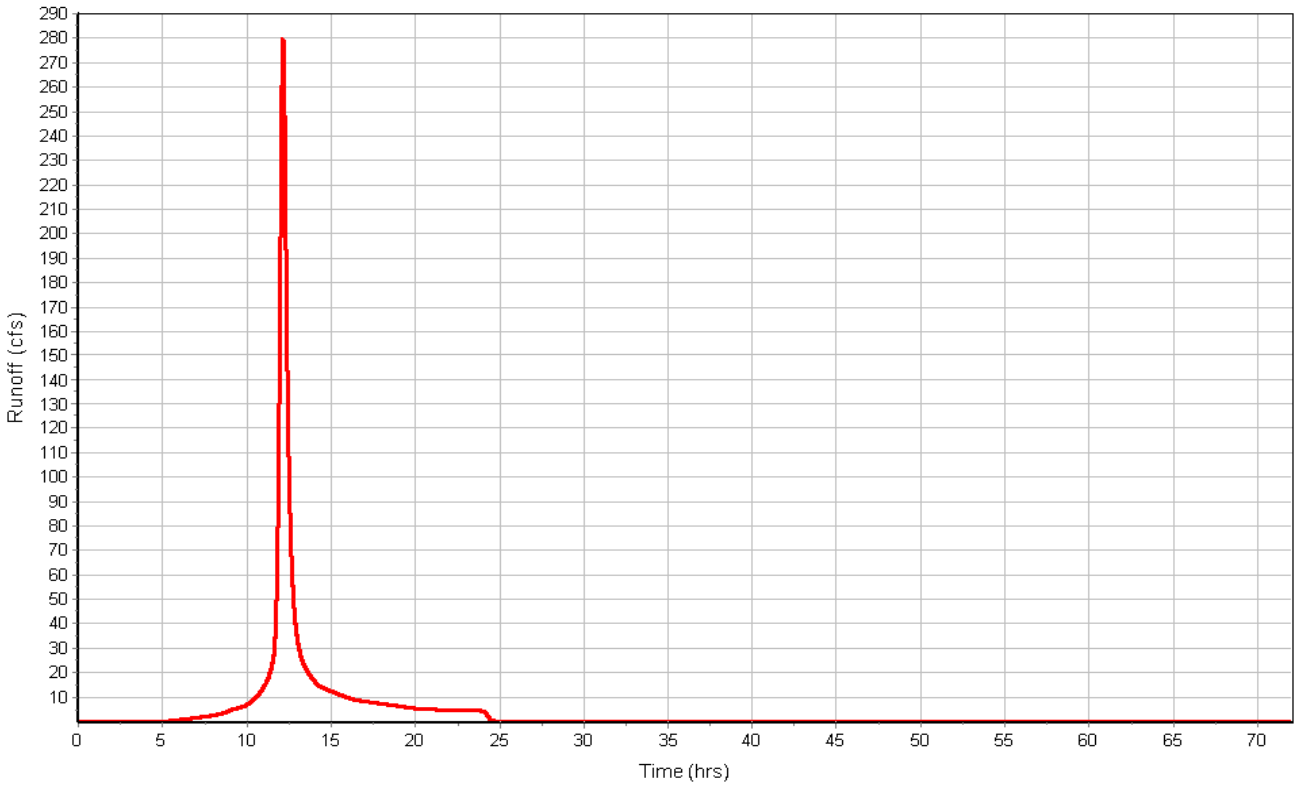
Total Rainfall (in)	3.10
Total Runoff (in)	2.22
Peak Runoff (cfs)	279.69
Weighted Curve Number	91.58
Time of Concentration (days hh:mm:ss)	0 00:25:53

Subbasin : A-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Undeveloped

Input Data

Area (ac) 0.52
Peak Rate Factor 484.00
Weighted Curve Number 84.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.52	-	84.00
Composite Area & Weighted CN	0.52		84.00

Time of Concentration

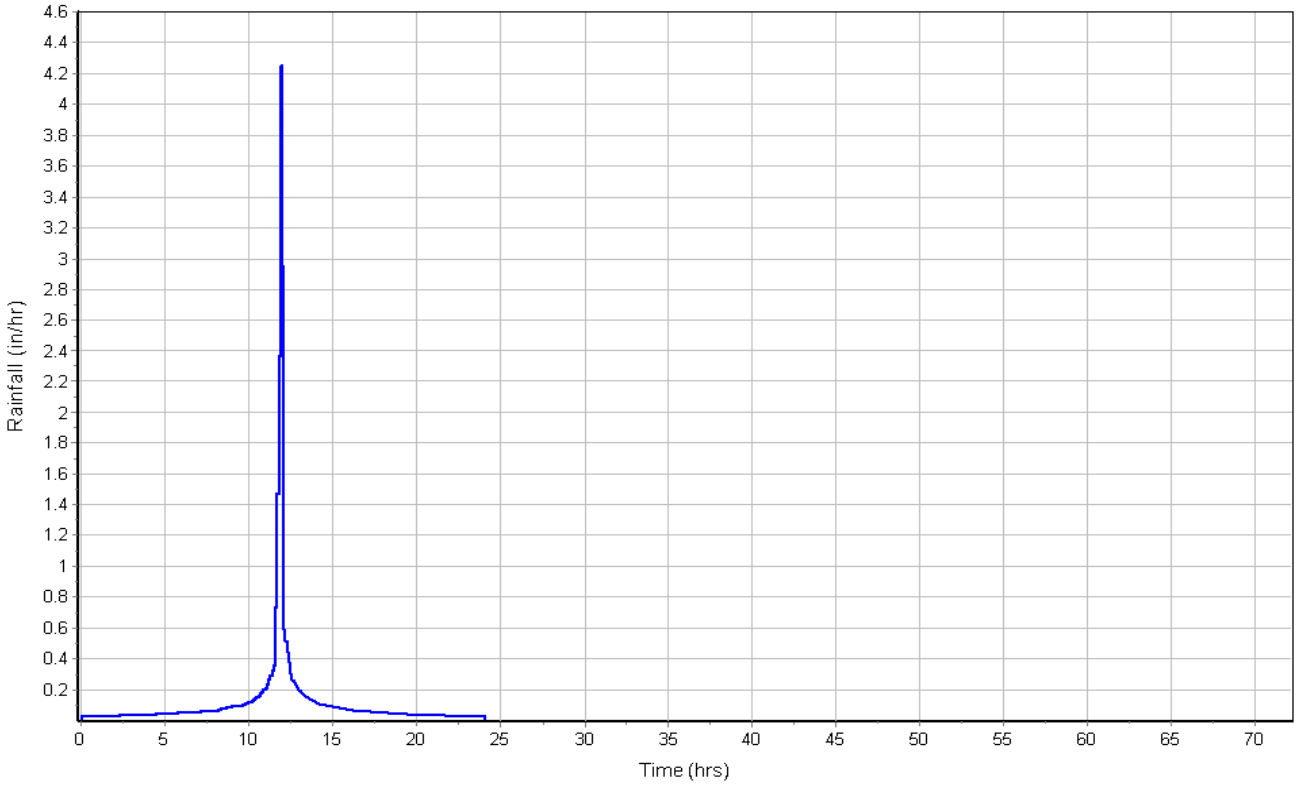
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

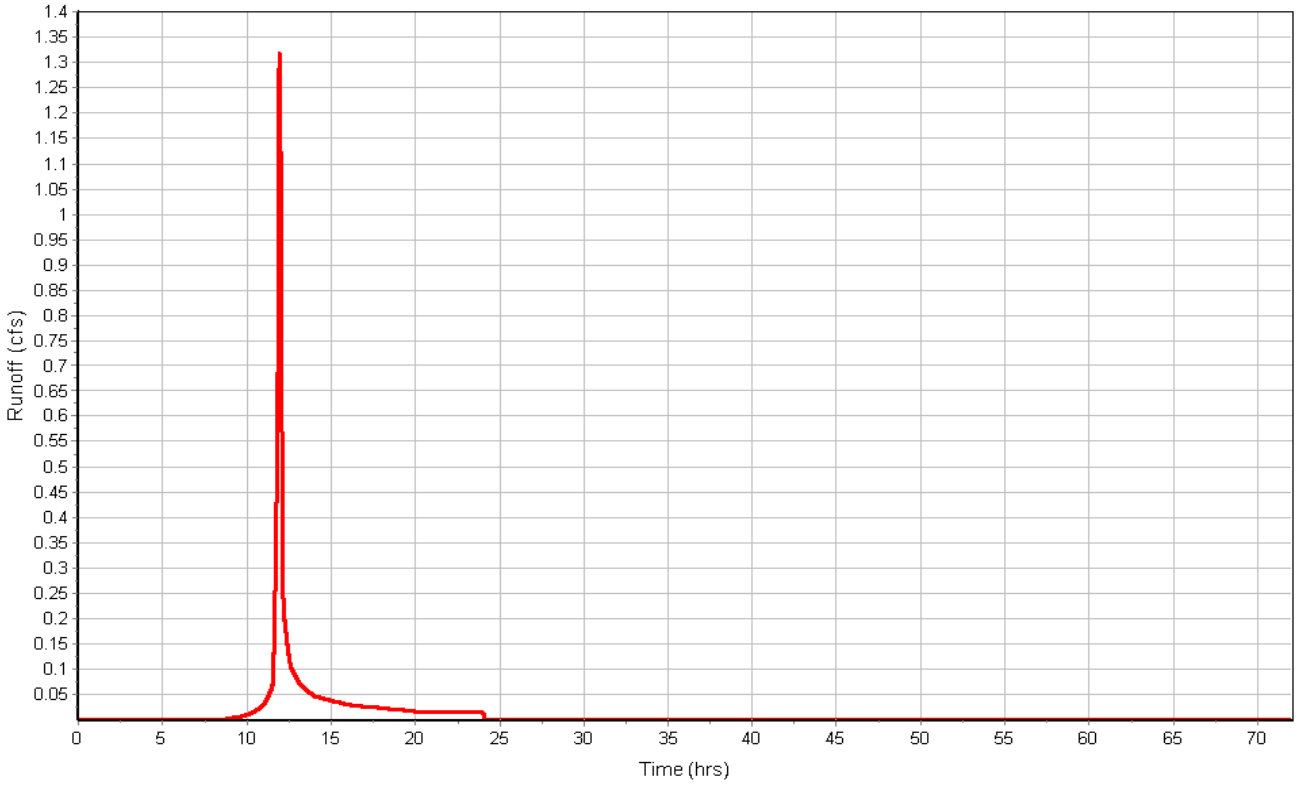
Total Rainfall (in) 3.10
Total Runoff (in) 1.60
Peak Runoff (cfs) 1.32
Weighted Curve Number 84.00
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : Undeveloped

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-01	0.00	6.00	6.00	0.00	0.00	6.00	0.00	0.00	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)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	279.96	279.96	0.00	0.00	0.00	6.00	0.00	0.00	0 00:00	0 00:00	0.00	0.00

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 Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	Link-01	426.71	0.00	0.00	0.00	0.00	0.00	0.0000	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	Link-01	279.96	0 12:07	0.00	0.00	0.00		0.00	0.00	0.00		

50% Chance Event

Project Description

File Name ..... Existing Conditions_NOAA.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 ..... Hydrodynamic
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ... NO

Analysis Options

Start Analysis On ..... Feb 15, 2023 00:00:00
End Analysis On ..... Feb 18, 2023 00:00:00
Start Reporting On ..... Feb 15, 2023 00:00:00
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 00:00:05 days hh:mm:ss
Routing Time Step ..... 1 seconds

Number of Elements

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

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1		Time Series	2-Year	Cumulative	inches	Missouri	Jackson	2	3.71	SCS Type II 24-hr

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	A-1	132.96	484.00	91.58	3.71	2.80	371.89	349.78	0 00:25:53
2	Undeveloped	0.52	484.00	84.00	3.71	2.12	1.10	1.74	0 00:05:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	Junction	0.00	6.00	0.00	6.00	0.00	350.13	0.00	0.00	6.00	0 00:00	0.00	0.00
2	Out-01	Outfall	0.00					350.13	0.00					

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Reported Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)	
1	Link-01	Pipe	Jun-01	Out-01	426.71	0.00	0.00	0.0000	0.000	0.0150	350.13	0.00	0.00	0.00	0.00	0.00	0.00	

Subbasin Hydrology

Subbasin : A-1

Input Data

Area (ac)	132.96
Peak Rate Factor	484.00
Weighted Curve Number	91.58
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
1/4 acre lots, 38% impervious	34.01	C	83.00
1/4 acre lots, 38% impervious	1.71	D	87.00
Urban commercial, 85% imp	19.01	C	94.00
Urban commercial, 85% imp	74.72	D	95.00
Multi-Family	3.11	C	90.00
Paved roads with curbs & sewers	0.40	D	98.00
50 - 75% grass cover, Fair	0.00	D	84.00
Composite Area & Weighted CN	132.96		91.58

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

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

Shallow Concentrated Flow Equation :

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

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.3	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.50	0.00	0.00
Velocity (ft/sec) :	0.10	0.00	0.00
Computed Flow Time (min) :	16.31	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	443	0.00	0.00
Slope (%) :	2	0.00	0.00
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	2.87	0.00	0.00
Computed Flow Time (min) :	2.57	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.013	0.00	0.00
Flow Length (ft) :	2975	0.00	0.00
Channel Slope (%) :	1	0.00	0.00
Cross Section Area (ft²) :	3.425	0.00	0.00
Wetted Perimeter (ft) :	7.06	0.00	0.00
Velocity (ft/sec) :	7.08	0.00	0.00
Computed Flow Time (min) :	7.01	0.00	0.00

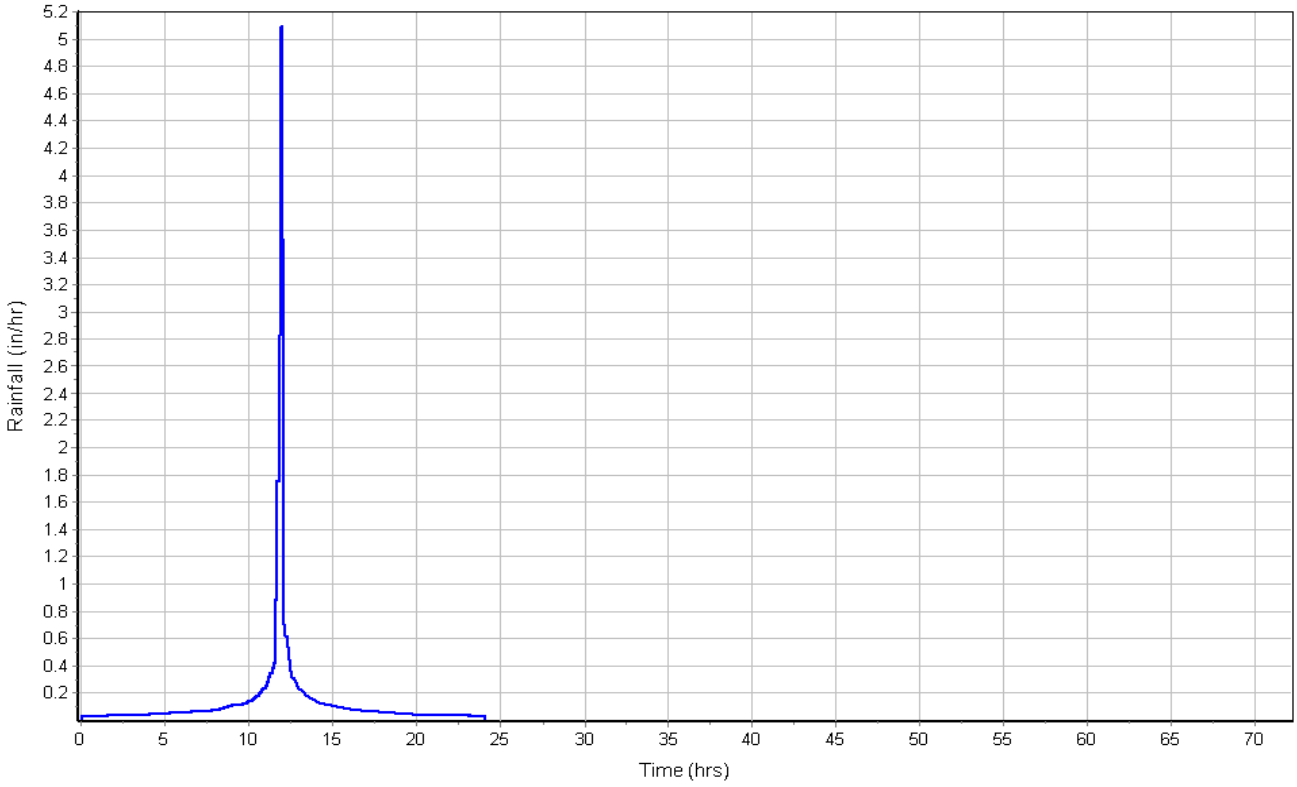
Total TOC (min) 25.89

Subbasin Runoff Results

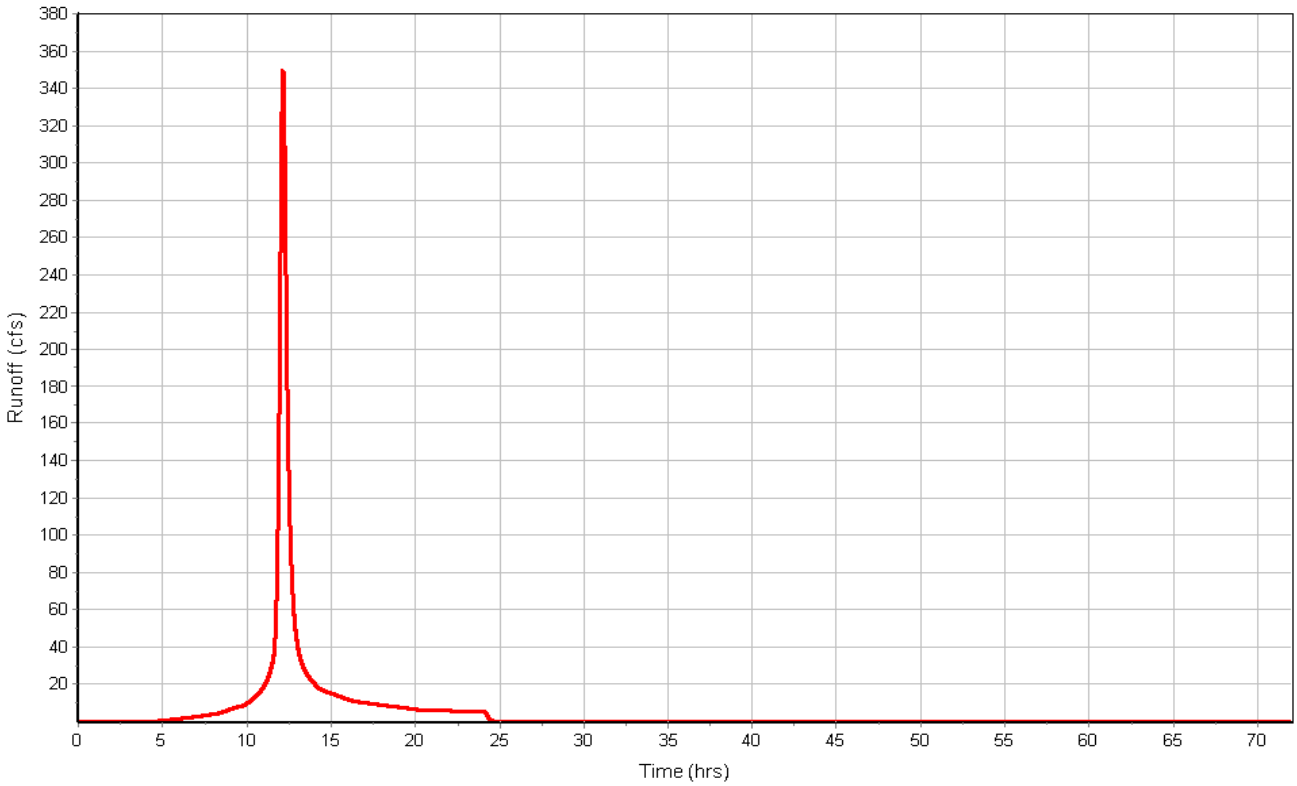
Total Rainfall (in)	3.71
Total Runoff (in)	2.80
Peak Runoff (cfs)	349.78
Weighted Curve Number	91.58
Time of Concentration (days hh:mm:ss)	0 00:25:53

Subbasin : A-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Undeveloped

Input Data

Area (ac)	0.52
Peak Rate Factor	484.00
Weighted Curve Number	84.00
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.52	-	84.00
Composite Area & Weighted CN	0.52		84.00

Time of Concentration

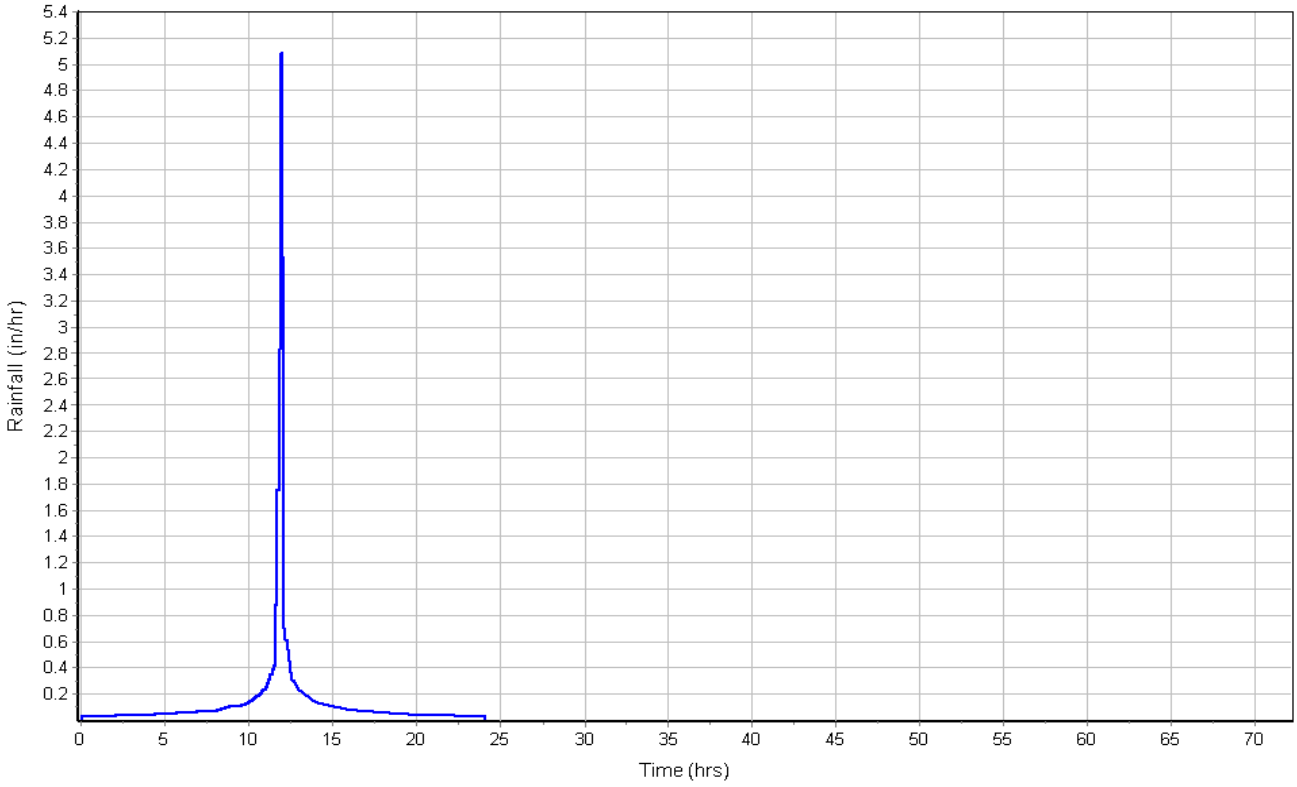
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

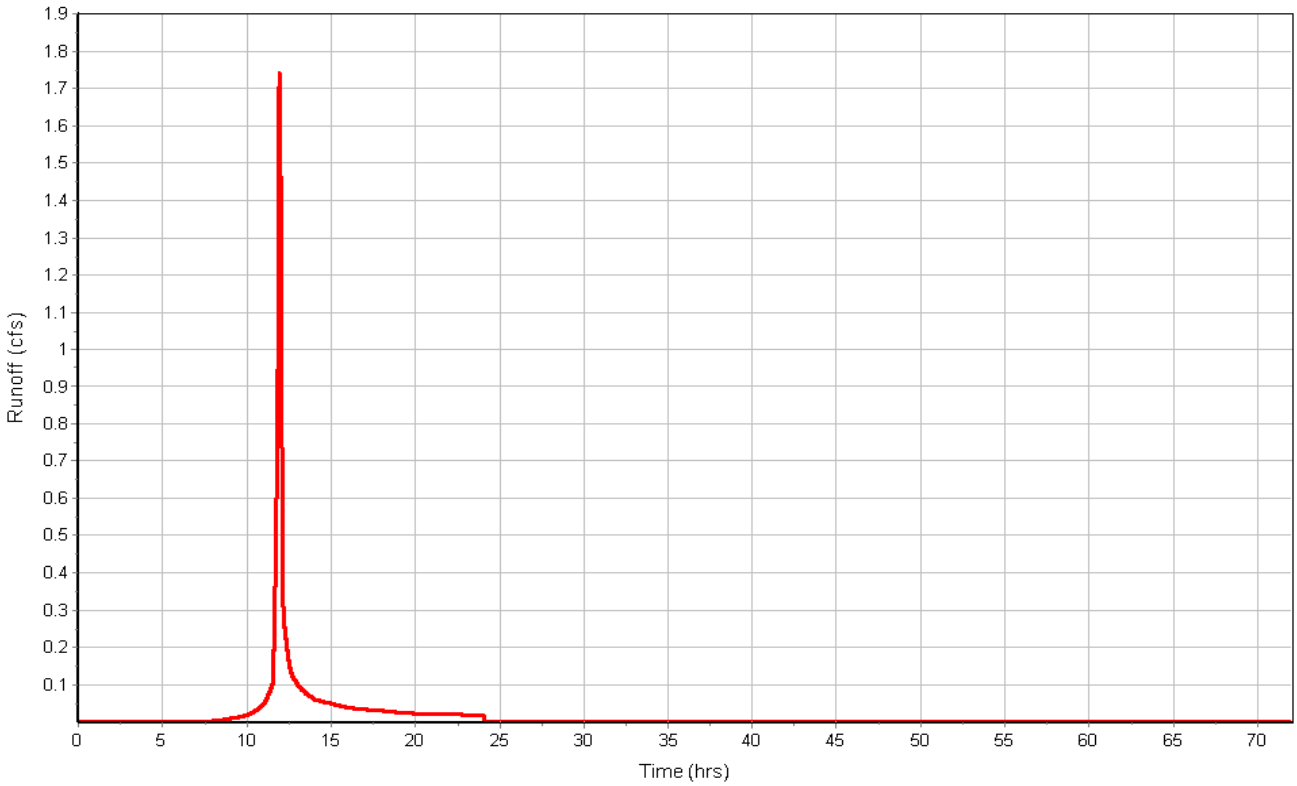
Total Rainfall (in)	3.71
Total Runoff (in)	2.12
Peak Runoff (cfs)	1.74
Weighted Curve Number	84.00
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : Undeveloped

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-01	0.00	6.00	6.00	0.00	0.00	6.00	0.00	0.00	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)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	350.13	350.13	0.00	0.00	0.00	6.00	0.00	0.00	0 00:00	0 00:00	0.00	0.00

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 Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	Link-01	426.71	0.00	0.00	0.00	0.00	0.00	0.0000	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	Link-01	350.13	0 12:07	0.00	0.00	0.00		0.00	0.00	0.00		

10% Chance Event

Project Description

File Name ..... Existing Conditions_NOAA.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 ..... Hydrodynamic
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ... NO

Analysis Options

Start Analysis On ..... Feb 15, 2023 00:00:00
End Analysis On ..... Feb 18, 2023 00:00:00
Start Reporting On ..... Feb 15, 2023 00:00:00
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 00:00:05 days hh:mm:ss
Routing Time Step ..... 1 seconds

Number of Elements

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

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1		Time Series	10 Year	Cumulative	inches	Missouri	Jackson	10	5.67	SCS Type II 24-hr

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	A-1	132.96	484.00	91.58	5.67	4.70	624.78	574.93	0 00:25:53
2	Undeveloped	0.52	484.00	84.00	5.67	3.89	2.02	3.14	0 00:05:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	Junction	0.00	6.00	0.00	6.00	0.00	575.48	0.00	0.00	6.00	0 00:00	0.00	0.00
2	Out-01	Outfall	0.00					575.48	0.00					

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Reported Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)	
1	Link-01	Pipe	Jun-01	Out-01	426.71	0.00	0.00	0.0000	0.000	0.0150	575.48	0.00	0.00	0.00	0.00	0.00	0.00	

Subbasin Hydrology

Subbasin : A-1

Input Data

Area (ac)	132.96
Peak Rate Factor	484.00
Weighted Curve Number	91.58
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
1/4 acre lots, 38% impervious	34.01	C	83.00
1/4 acre lots, 38% impervious	1.71	D	87.00
Urban commercial, 85% imp	19.01	C	94.00
Urban commercial, 85% imp	74.72	D	95.00
Multi-Family	3.11	C	90.00
Paved roads with curbs & sewers	0.40	D	98.00
50 - 75% grass cover, Fair	0.00	D	84.00
Composite Area & Weighted CN	132.96		91.58

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

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

Shallow Concentrated Flow Equation :

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

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.3	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.50	0.00	0.00
Velocity (ft/sec) :	0.10	0.00	0.00
Computed Flow Time (min) :	16.31	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	443	0.00	0.00
Slope (%) :	2	0.00	0.00
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	2.87	0.00	0.00
Computed Flow Time (min) :	2.57	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.013	0.00	0.00
Flow Length (ft) :	2975	0.00	0.00
Channel Slope (%) :	1	0.00	0.00
Cross Section Area (ft²) :	3.425	0.00	0.00
Wetted Perimeter (ft) :	7.06	0.00	0.00
Velocity (ft/sec) :	7.08	0.00	0.00
Computed Flow Time (min) :	7.01	0.00	0.00

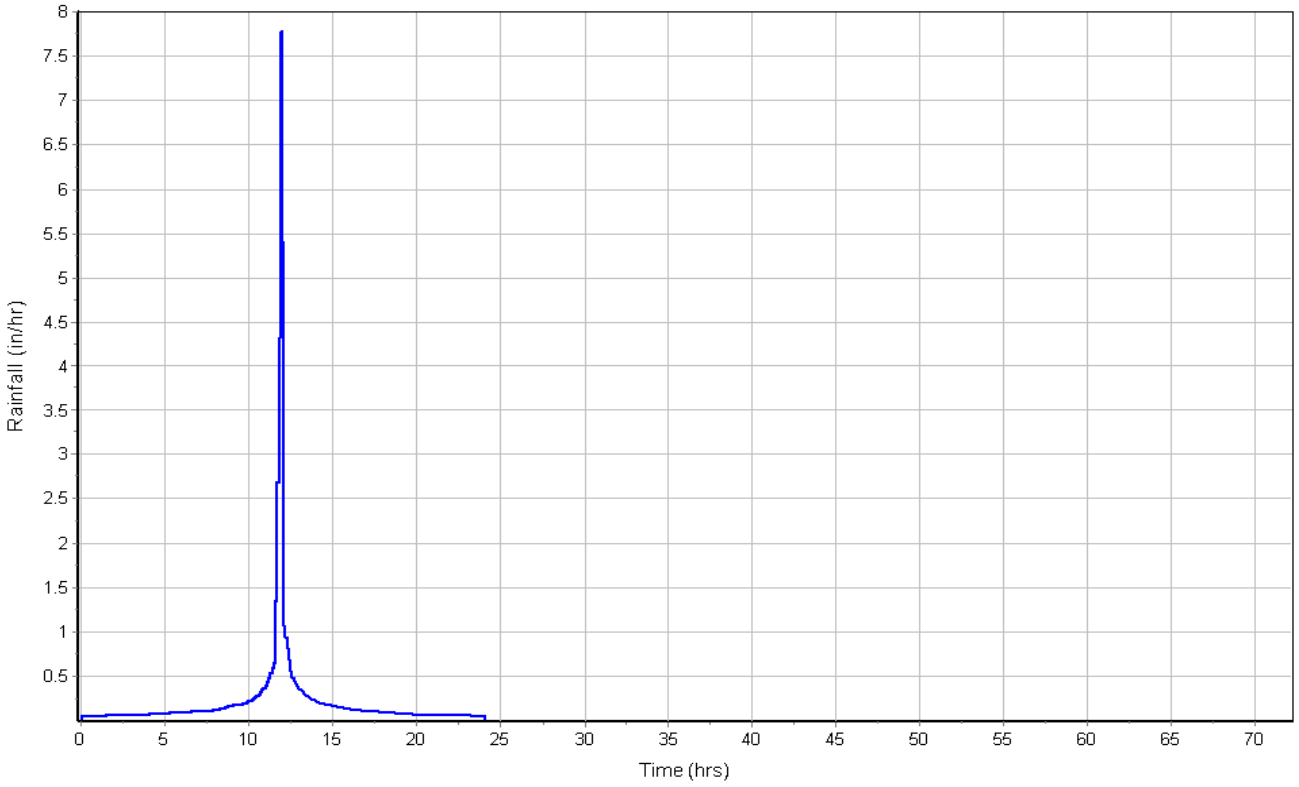
Total TOC (min) 25.89

Subbasin Runoff Results

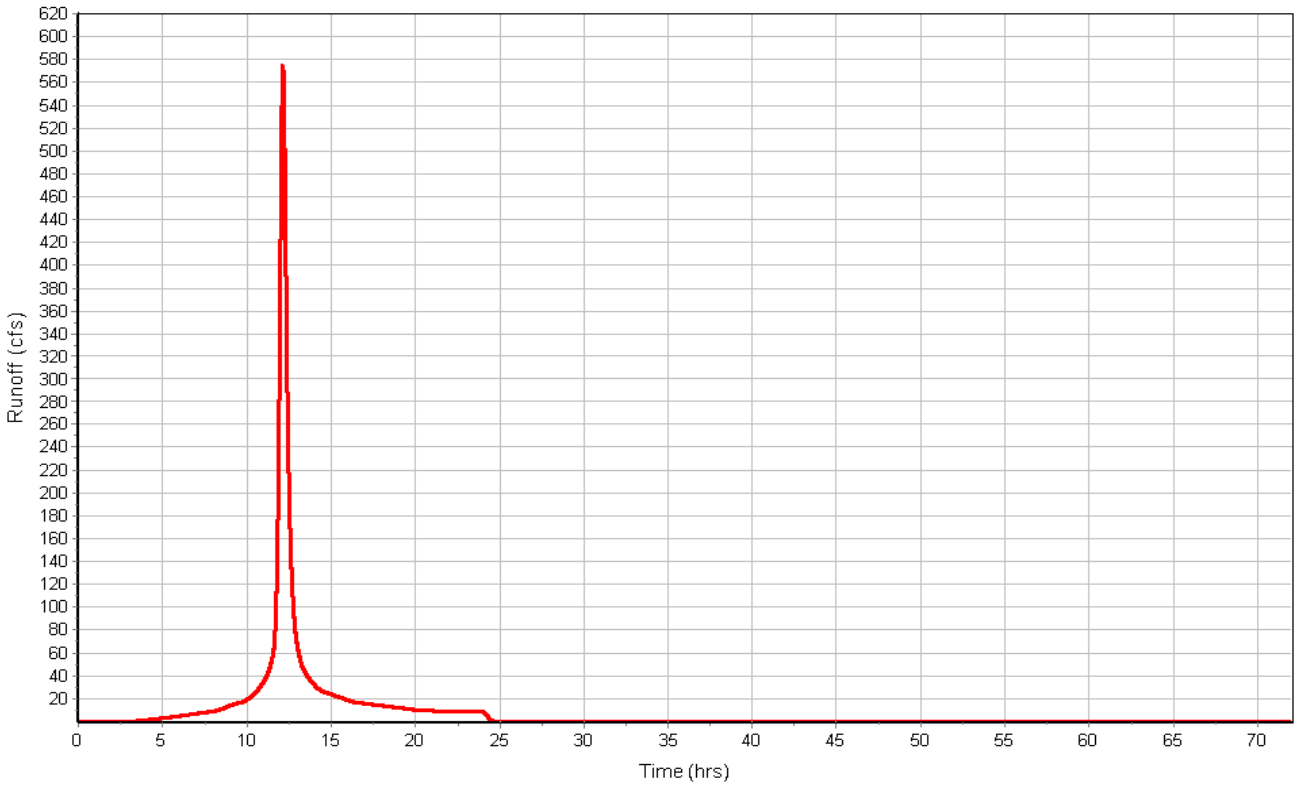
Total Rainfall (in)	5.67
Total Runoff (in)	4.70
Peak Runoff (cfs)	574.93
Weighted Curve Number	91.58
Time of Concentration (days hh:mm:ss)	0 00:25:53

Subbasin : A-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Undeveloped

Input Data

Area (ac) 0.52
Peak Rate Factor 484.00
Weighted Curve Number 84.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.52	-	84.00
Composite Area & Weighted CN	0.52		84.00

Time of Concentration

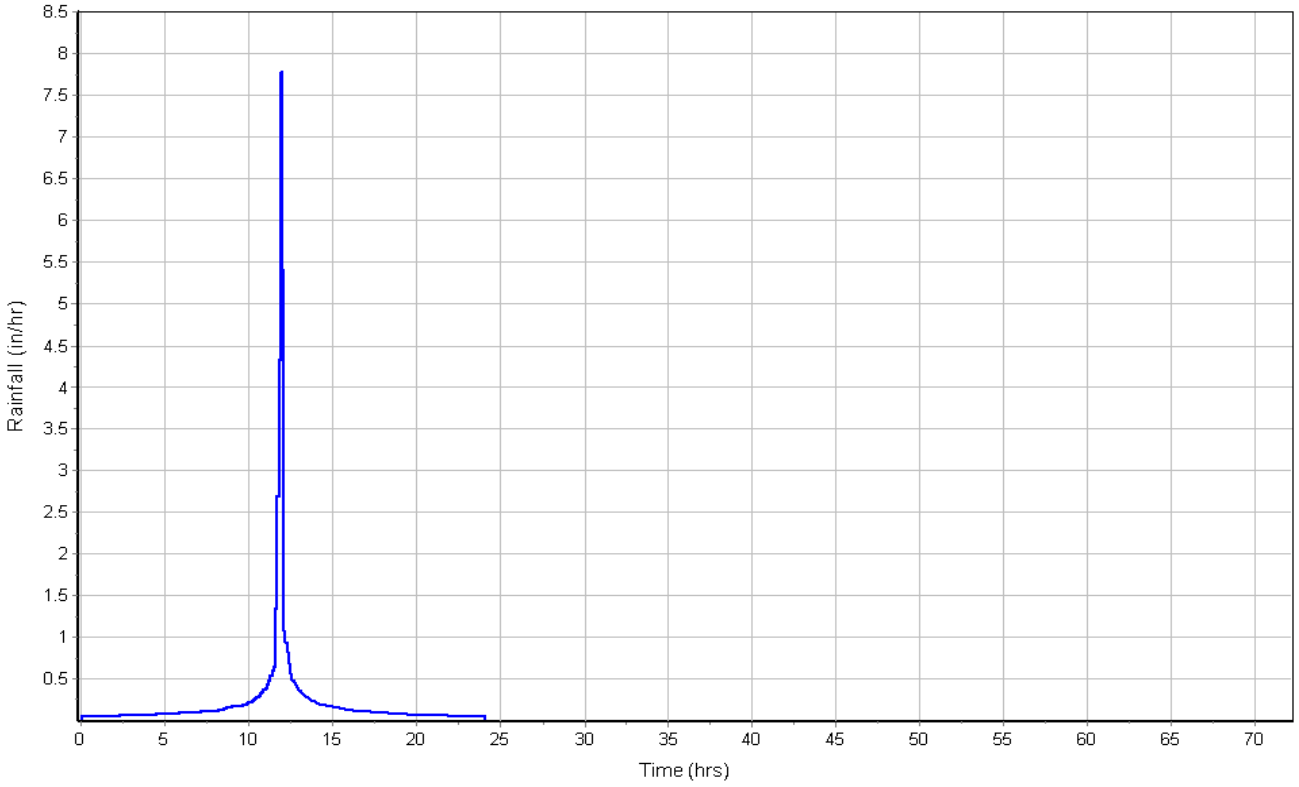
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

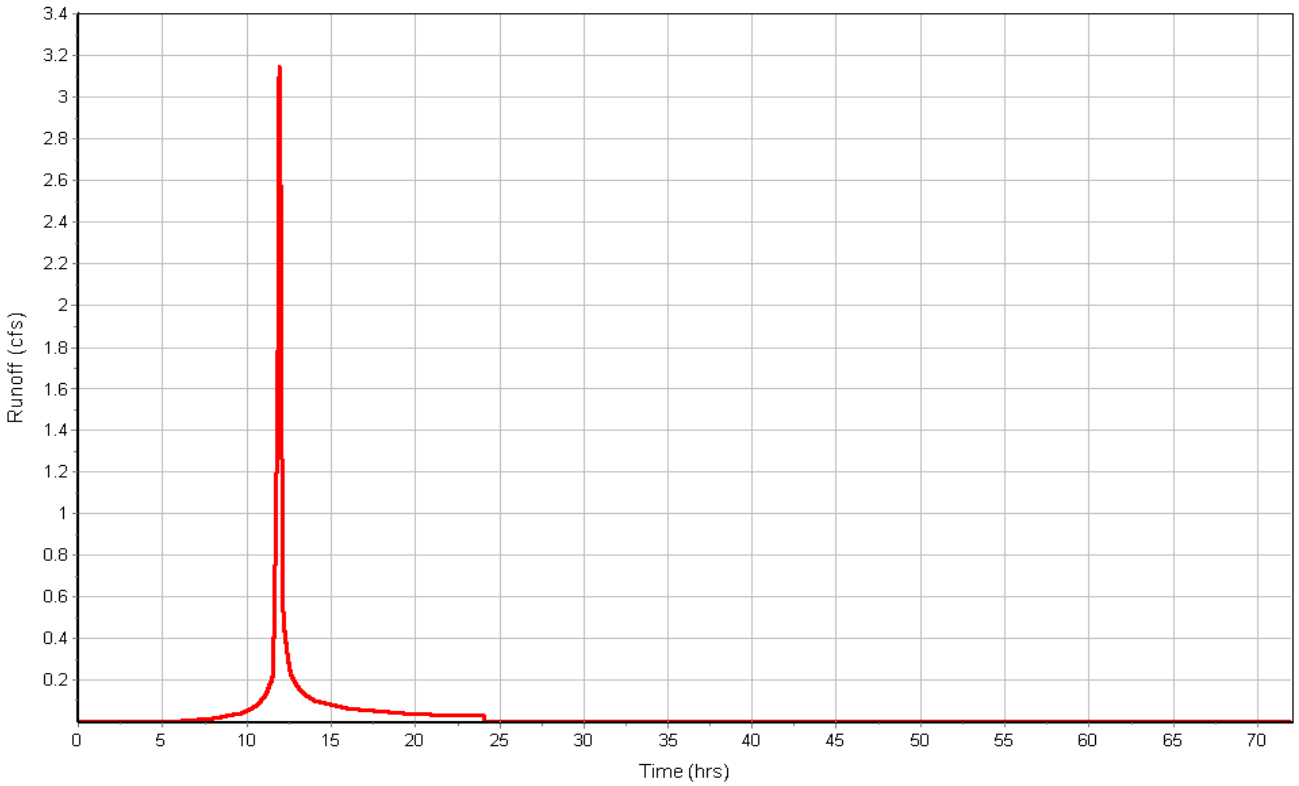
Total Rainfall (in) 5.67
Total Runoff (in) 3.89
Peak Runoff (cfs) 3.14
Weighted Curve Number 84.00
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : Undeveloped

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-01	0.00	6.00	6.00	0.00	0.00	6.00	0.00	0.00	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)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	575.48	575.48	0.00	0.00	0.00	6.00	0.00	0.00	0 00:00	0 00:00	0.00	0.00

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 Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	Link-01	426.71	0.00	0.00	0.00	0.00	0.00	0.0000	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	Link-01	575.48	0 12:07	0.00	0.00	0.00		0.00	0.00	0.00		

1% Chance Event

Project Description

File Name ..... Existing Conditions_NOAA.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 ..... Hydrodynamic
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ... NO

Analysis Options

Start Analysis On ..... Feb 15, 2023 00:00:00
End Analysis On ..... Feb 18, 2023 00:00:00
Start Reporting On ..... Feb 15, 2023 00:00:00
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 00:00:05 days hh:mm:ss
Routing Time Step ..... 1 seconds

Number of Elements

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

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1		Time Series	100 Year	Cumulative	inches	Missouri	Jackson	100	9.25	SCS Type II 24-hr

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	A-1	132.96	484.00	91.58	9.25	8.23	1094.39	977.27	0 00:25:53
2	Undeveloped	0.52	484.00	84.00	9.25	7.30	3.80	5.72	0 00:05:00

Node Summary

SN	Element 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)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	Junction	0.00	6.00	0.00	6.00	0.00	978.28	0.00	0.00	6.00	0 00:00	0.00	0.00
2	Out-01	Outfall	0.00					978.28	0.00					

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Reported Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)	
1	Link-01	Pipe	Jun-01	Out-01	426.71	0.00	0.00	0.0000	0.000	0.0150	978.28	0.00	0.00	0.00	0.00	0.00	0.00	

Subbasin Hydrology

Subbasin : A-1

Input Data

Area (ac)	132.96
Peak Rate Factor	484.00
Weighted Curve Number	91.58
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
1/4 acre lots, 38% impervious	34.01	C	83.00
1/4 acre lots, 38% impervious	1.71	D	87.00
Urban commercial, 85% imp	19.01	C	94.00
Urban commercial, 85% imp	74.72	D	95.00
Multi-Family	3.11	C	90.00
Paved roads with curbs & sewers	0.40	D	98.00
50 - 75% grass cover, Fair	0.00	D	84.00
Composite Area & Weighted CN	132.96		91.58

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

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

Shallow Concentrated Flow Equation :

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

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.3	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.50	0.00	0.00
Velocity (ft/sec) :	0.10	0.00	0.00
Computed Flow Time (min) :	16.31	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	443	0.00	0.00
Slope (%) :	2	0.00	0.00
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	2.87	0.00	0.00
Computed Flow Time (min) :	2.57	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.013	0.00	0.00
Flow Length (ft) :	2975	0.00	0.00
Channel Slope (%) :	1	0.00	0.00
Cross Section Area (ft²) :	3.425	0.00	0.00
Wetted Perimeter (ft) :	7.06	0.00	0.00
Velocity (ft/sec) :	7.08	0.00	0.00
Computed Flow Time (min) :	7.01	0.00	0.00

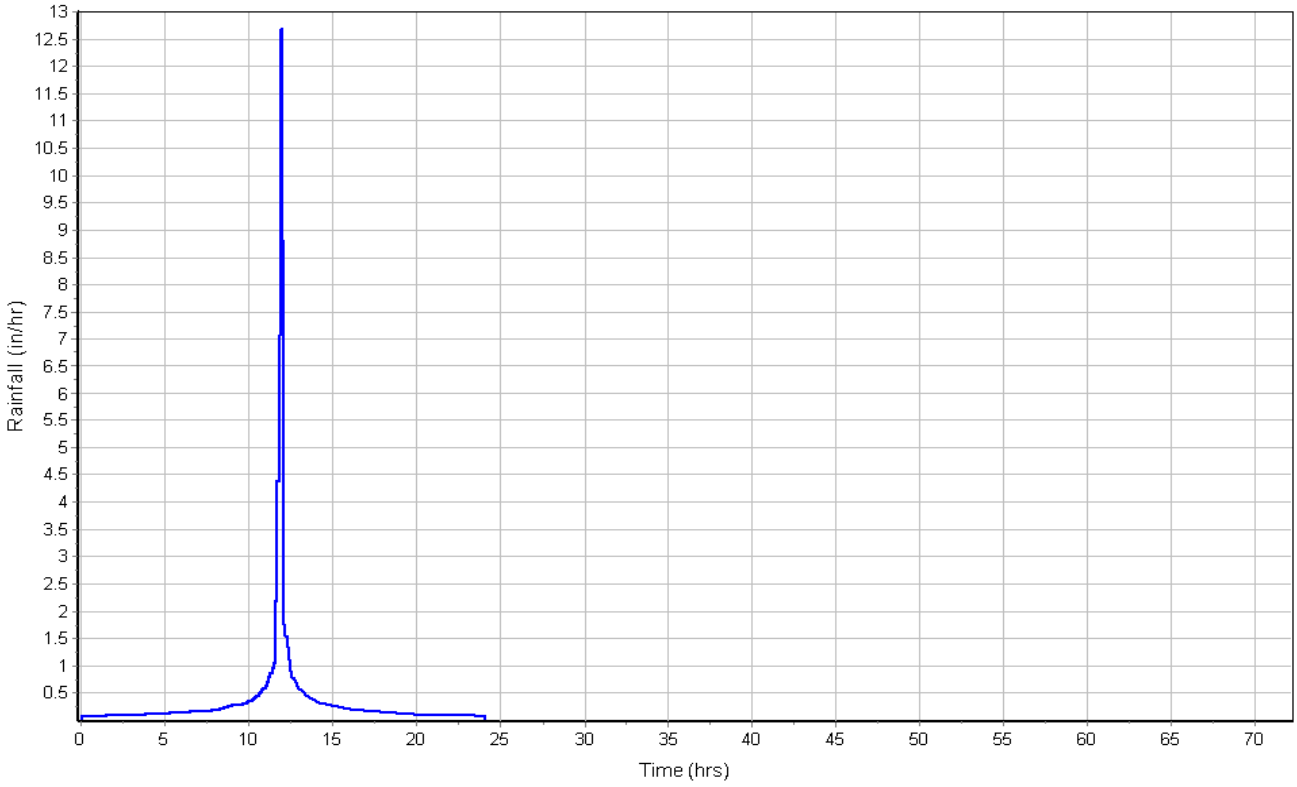
Total TOC (min) 25.89

Subbasin Runoff Results

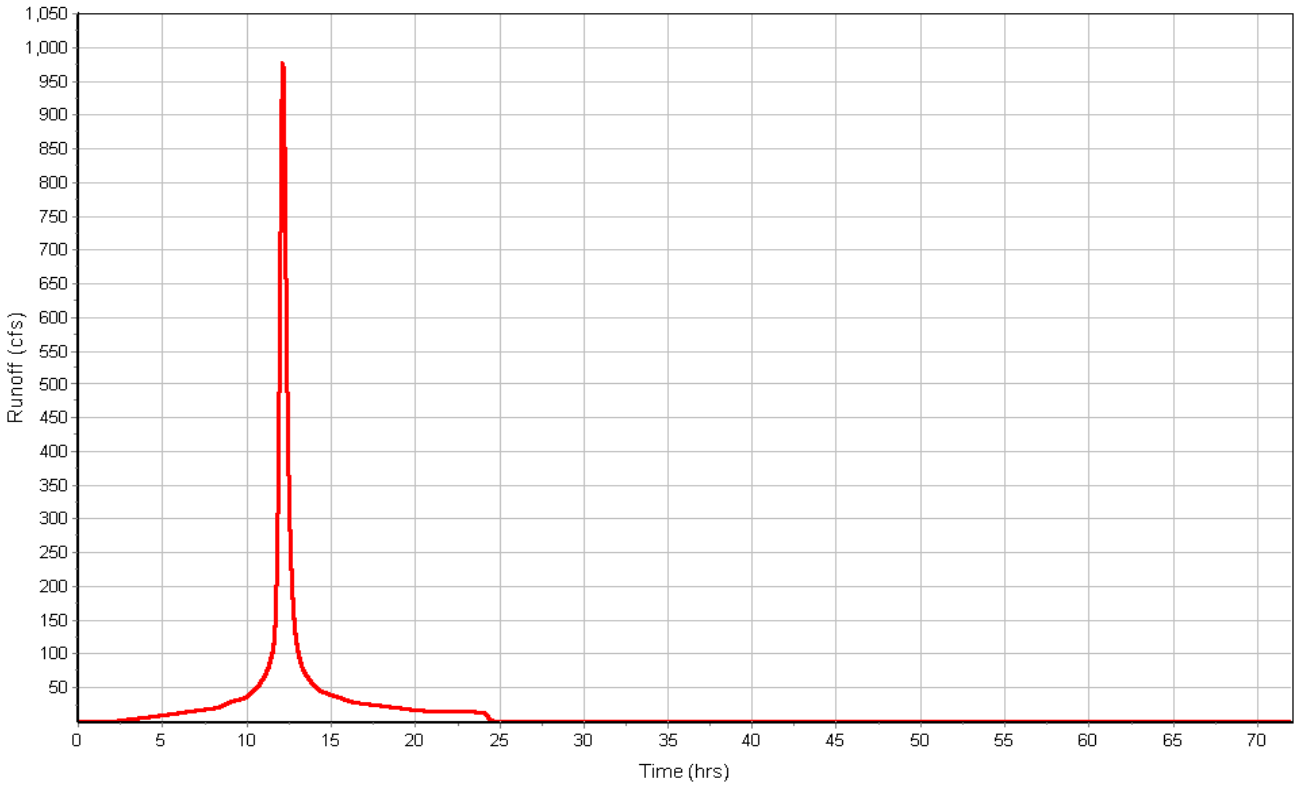
Total Rainfall (in)	9.25
Total Runoff (in)	8.23
Peak Runoff (cfs)	977.27
Weighted Curve Number	91.58
Time of Concentration (days hh:mm:ss)	0 00:25:53

Subbasin : A-1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Undeveloped

Input Data

Area (ac) 0.52
Peak Rate Factor 484.00
Weighted Curve Number 84.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.52	-	84.00
Composite Area & Weighted CN	0.52		84.00

Time of Concentration

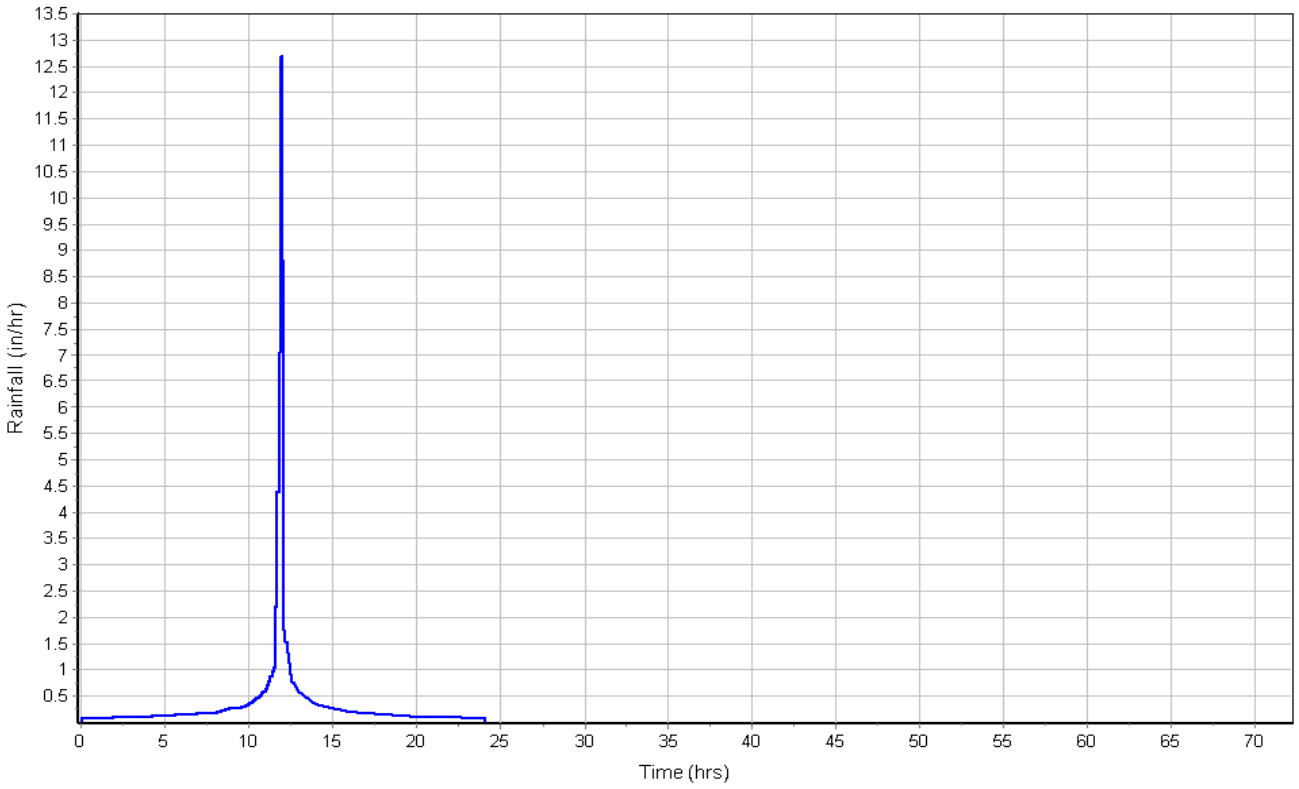
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

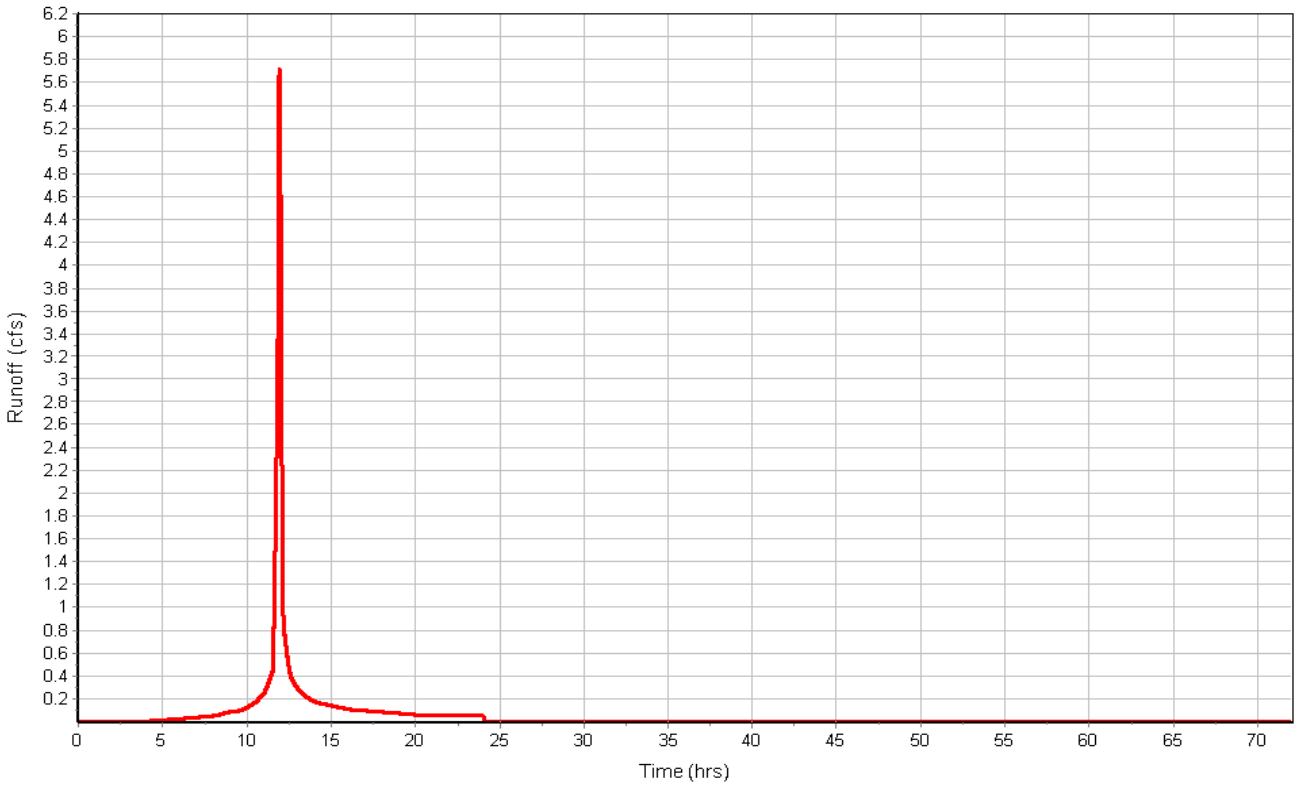
Total Rainfall (in) 9.25
Total Runoff (in) 7.30
Peak Runoff (cfs) 5.72
Weighted Curve Number 84.00
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : Undeveloped

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-01	0.00	6.00	6.00	0.00	0.00	6.00	0.00	0.00	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)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	978.28	978.28	0.00	0.00	0.00	6.00	0.00	0.00	0 00:00	0 00:00	0.00	0.00

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 Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	Link-01	426.71	0.00	0.00	0.00	0.00	0.00	0.0000	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	Link-01	978.28	0 12:07	0.00	0.00	0.00		0.00	0.00	0.00		

Proposed Conditions Results

WQv Event

Project Description

File Name	Proposed Conditions_NOAA.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	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	00:00:00	0:00:00
End Analysis On	00:00:00	0:00:00
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 00:00:05	days hh:mm:ss
Routing Time Step	1	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	2
Nodes	3
Junctions	1
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	1
Links	3
Channels	0
Pipes	1
Pumps	0
Orifices	2
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
49		Time Series	WQv	Cumulative	inches	Missouri	Jackson	1.00	1.37	SCS Type II 24-hr

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	Sub-01	132.96	484.00	91.58	1.37	0.67	88.82	85.12	0 00:25:53
2	Sub-02	0.52	484.00	95.00	1.37	0.89	0.46	0.73	0 00:05:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	1-Jun	Junction	101.00	106.00	0.00	0.00	0.00	0.02	101.04	0.00	4.96	0 00:00	0.00	0.00
2	Out-01	Outfall	100.00					85.10	100.04					
3	Stor-01	Storage Node	100.00	106.00	0.00		0.00	0.73	101.10				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Reported Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)	
1	Link-01	Pipe	1-Jun	Out-01	50.00	101.00	100.00	2.0000	36.000	0.0150	0.02	81.75	0.00	1.19	0.04	0.01	0.00	Calculated
2	Orifice-01	Orifice	Stor-01	1-Jun		100.00	101.00		3.000		0.02							
3	Orifice-04	Orifice	Stor-01	1-Jun		100.00	101.00		4.000		0.00							

Subbasin Hydrology

Subbasin : Sub-01

Input Data

Area (ac) 132.96
Peak Rate Factor 484
Weighted Curve Number 91.58
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

32 Soil/Surface Description	Area (acres)	Soil Group	Curve Number
1/4 acre lots, 38% impervious	34.01	C	83
1/4 acre lots, 38% impervious	1.71	D	87
Urban commercial, 85% imp	19.01	C	94
Urban commercial, 85% imp	74.72	D	95
Multi-Family	3.11	C	90
Paved roads with curbs & sewers	0.4	D	98
Composite Area & Weighted CN	132.96		91.58

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

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

Shallow Concentrated Flow Equation :

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

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	2	0	0
2 yr, 24 hr Rainfall (in) :	3.5	0	0
Velocity (ft/sec) :	0.1	0	0
Computed Flow Time (min) :	16.31	0	0

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	443	0	0
Slope (%) :	2	0	0
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	2.87	0	0
Computed Flow Time (min) :	2.57	0	0

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.013	0	0
Flow Length (ft) :	2975	0	0
Channel Slope (%) :	1	0	0
Cross Section Area (ft²) :	3.425	0	0
Wetted Perimeter (ft) :	7.06	0	0
Velocity (ft/sec) :	7.08	0	0
Computed Flow Time (min) :	7.01	0	0

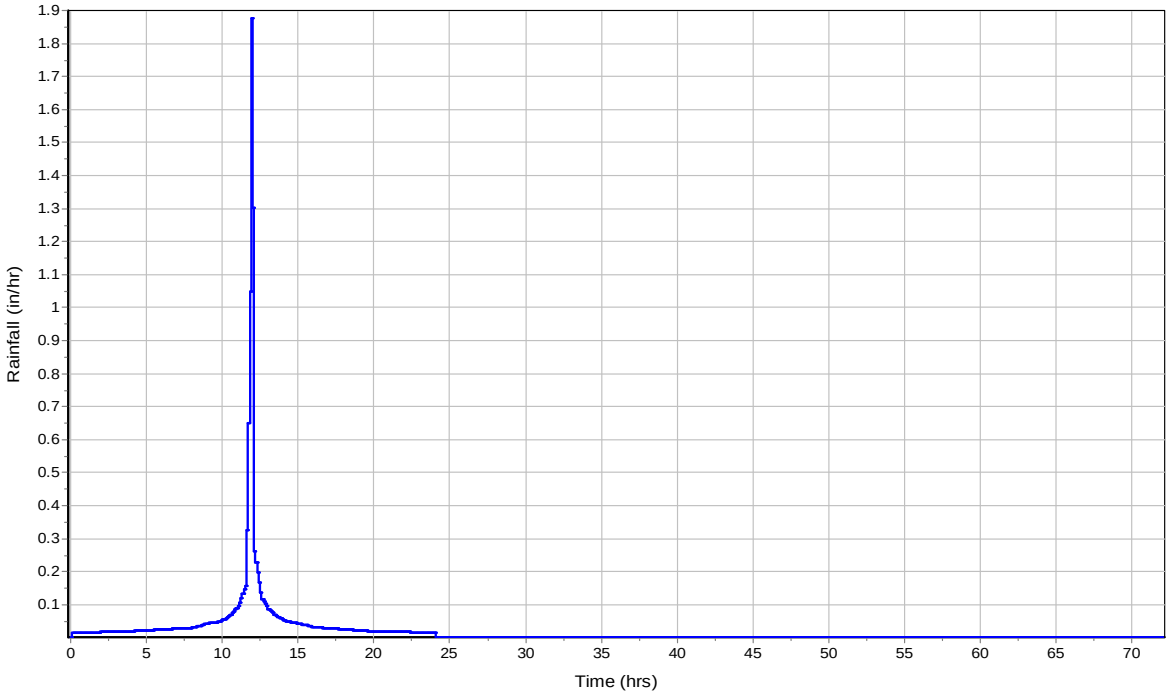
Total TOC (min) 25.89

Subbasin Runoff Results

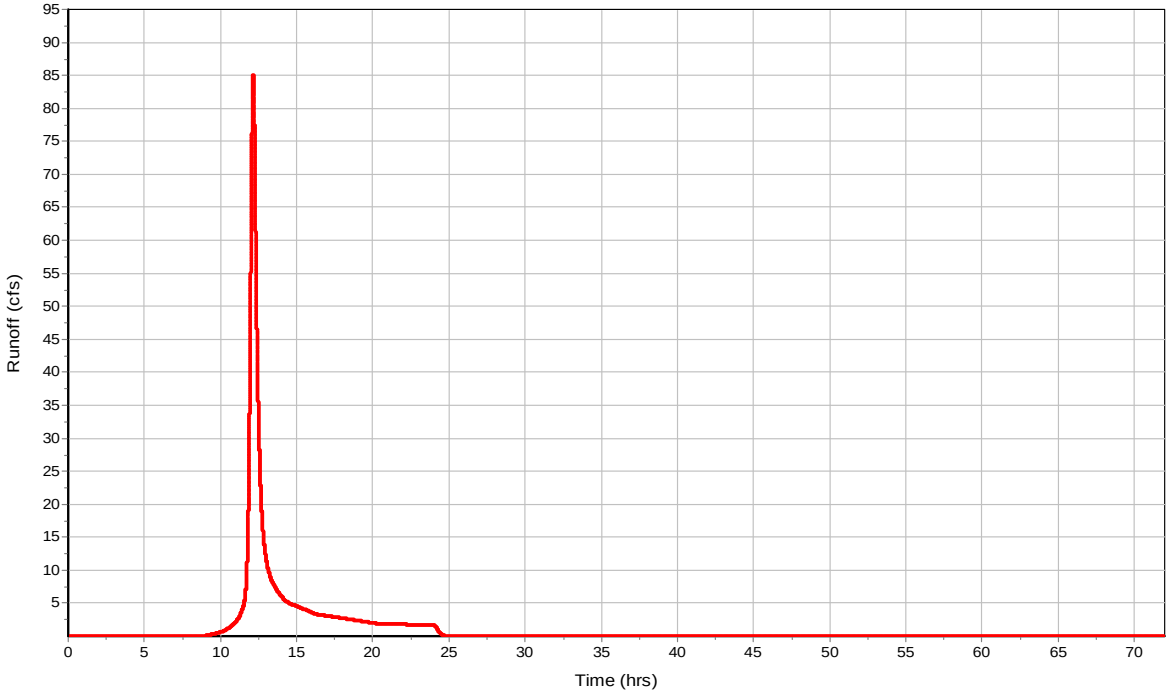
Total Rainfall (in)	1.37
Total Runoff (in)	0.67
Peak Runoff (cfs)	85.12
Weighted Curve Number	91.58
Time of Concentration (days hh:mm:ss)	0 00:25:53

Subbasin : Sub-01

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Sub-02

Input Data

Area (ac)	0.52
Peak Rate Factor	484
Weighted Curve Number	95
Rain Gage ID	Rain Gage-01

Composite Curve Number

32 Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.52	-	95
Composite Area & Weighted CN	0.52		95

Time of Concentration

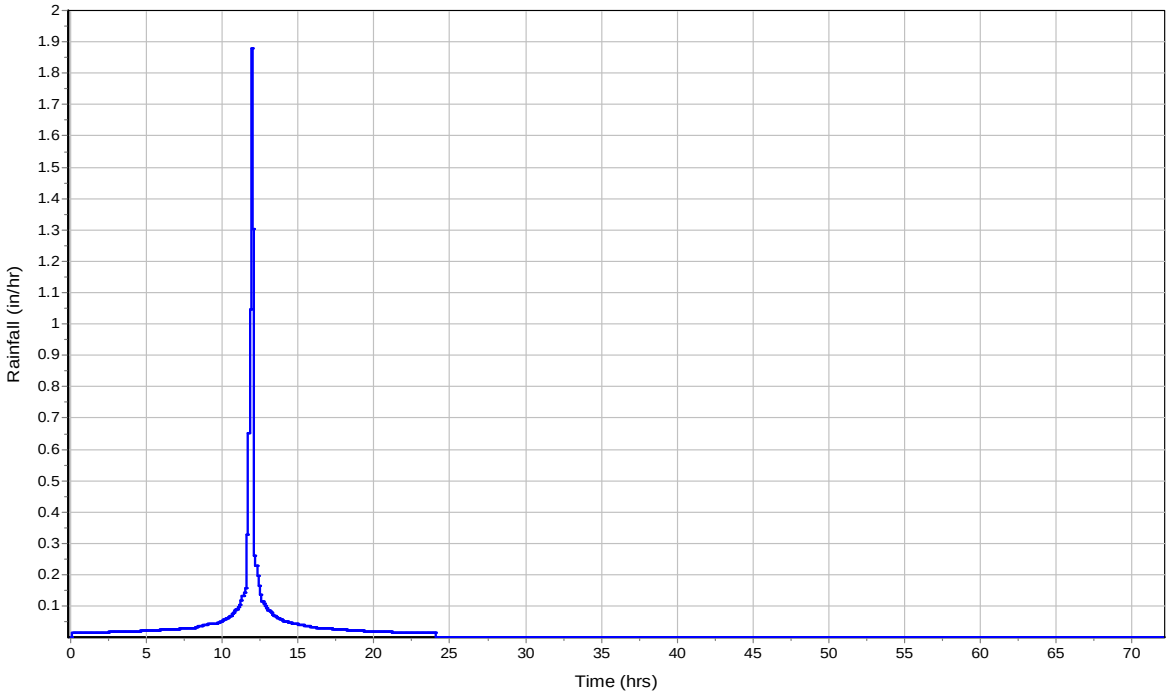
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

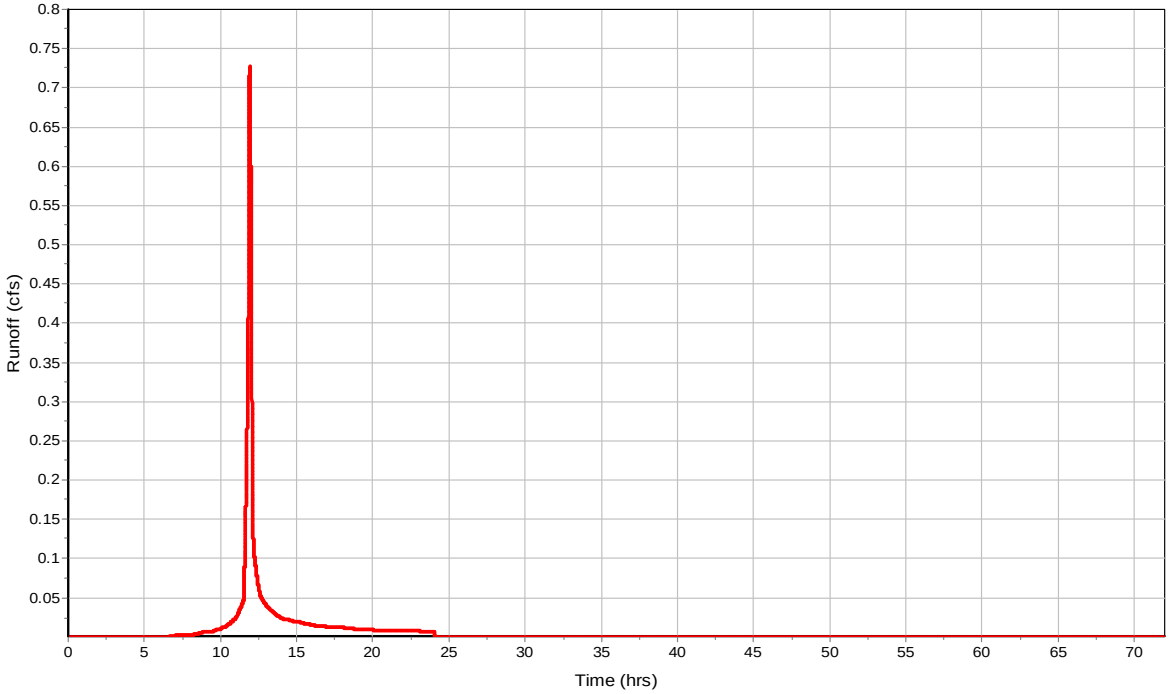
Total Rainfall (in)	1.37
Total Runoff (in)	0.89
Peak Runoff (cfs)	0.73
Weighted Curve Number	95
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : Sub-02

Rainfall Intensity Graph



Runoff Hydrograph



100% Chance Event

Project Description

File Name	Proposed Conditions_NOAA.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	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	00:00:00	0:00:00
End Analysis On	00:00:00	0:00:00
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 00:00:05	days hh:mm:ss
Routing Time Step	1	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	2
Nodes	3
Junctions	1
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	1
Links	3
Channels	0
Pipes	1
Pumps	0
Orifices	2
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
49		Time Series	1 Year	Cumulative	inches	Missouri	Jackson	1.00	3.10	SCS Type II 24-hr

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	Sub-01	132.96	484.00	91.58	3.10	2.22	294.77	279.69	0 00:25:53
2	Sub-02	0.52	484.00	95.00	3.10	2.55	1.32	1.97	0 00:05:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	1-Jun	Junction	101.00	106.00	0.00	0.00	0.00	0.21	101.12	0.00	4.88	0 00:00	0.00	0.00
2	Out-01	Outfall	100.00					279.90	100.11					
3	Stor-01	Storage Node	100.00	106.00	0.00		0.00	1.97	101.89				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Reported Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)	
1	Link-01	Pipe	1-Jun	Out-01	50.00	101.00	100.00	2.0000	36.000	0.0150	0.21	81.75	0.00	2.41	0.11	0.04	0.00	Calculated
2	Orifice-01	Orifice	Stor-01	1-Jun		100.00	101.00		3.000		0.21							
3	Orifice-04	Orifice	Stor-01	1-Jun		100.00	101.00		4.000		0.00							

Subbasin Hydrology

Subbasin : Sub-01

Input Data

Area (ac) 132.96
Peak Rate Factor 484
Weighted Curve Number 91.58
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

32 Soil/Surface Description	Area (acres)	Soil Group	Curve Number
1/4 acre lots, 38% impervious	34.01	C	83
1/4 acre lots, 38% impervious	1.71	D	87
Urban commercial, 85% imp	19.01	C	94
Urban commercial, 85% imp	74.72	D	95
Multi-Family	3.11	C	90
Paved roads with curbs & sewers	0.4	D	98
Composite Area & Weighted CN	132.96		91.58

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

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

Shallow Concentrated Flow Equation :

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

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	2	0	0
2 yr, 24 hr Rainfall (in) :	3.5	0	0
Velocity (ft/sec) :	0.1	0	0
Computed Flow Time (min) :	16.31	0	0

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	443	0	0
Slope (%) :	2	0	0
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	2.87	0	0
Computed Flow Time (min) :	2.57	0	0

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.013	0	0
Flow Length (ft) :	2975	0	0
Channel Slope (%) :	1	0	0
Cross Section Area (ft²) :	3.425	0	0
Wetted Perimeter (ft) :	7.06	0	0
Velocity (ft/sec) :	7.08	0	0
Computed Flow Time (min) :	7.01	0	0

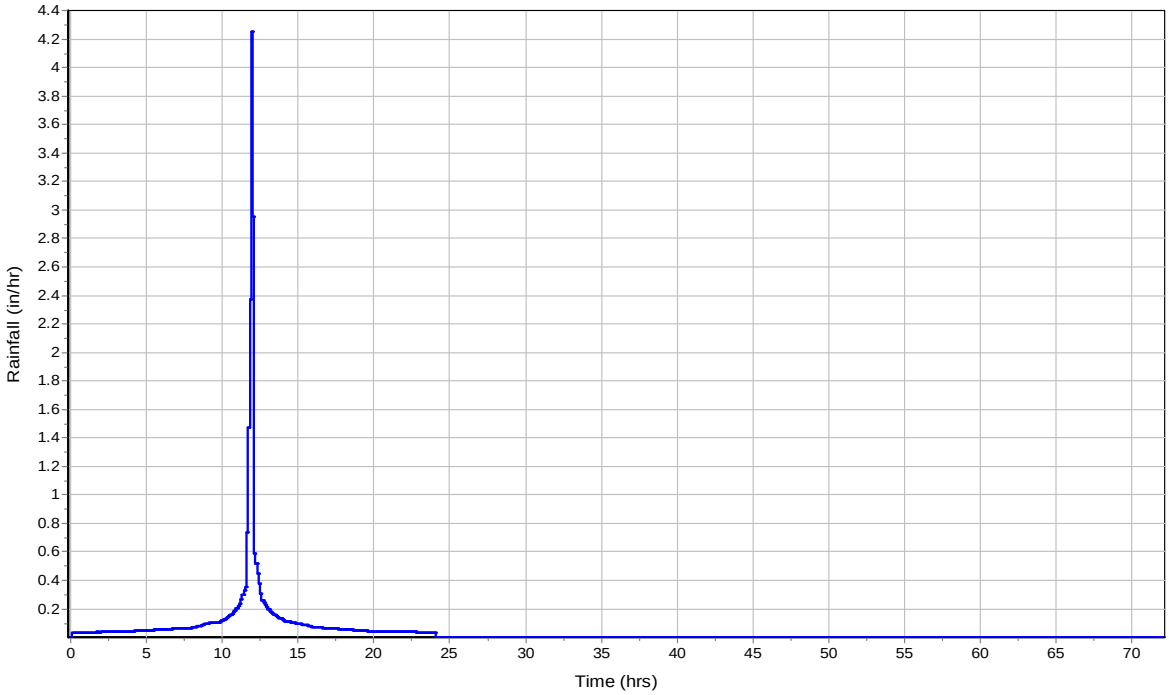
Total TOC (min) 25.89

Subbasin Runoff Results

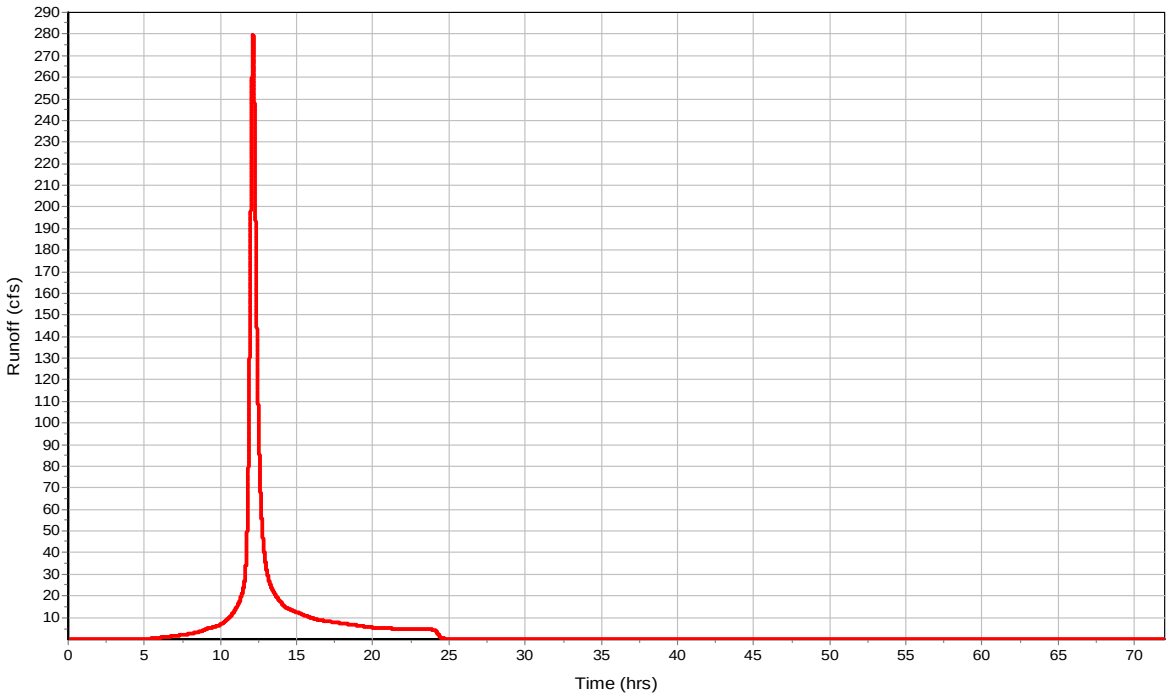
Total Rainfall (in)	3.1
Total Runoff (in)	2.22
Peak Runoff (cfs)	279.69
Weighted Curve Number	91.58
Time of Concentration (days hh:mm:ss)	0 00:25:53

Subbasin : Sub-01

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Sub-02

Input Data

Area (ac)	0.52
Peak Rate Factor	484
Weighted Curve Number	95
Rain Gage ID	Rain Gage-01

Composite Curve Number

32 Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.52	-	95
Composite Area & Weighted CN	0.52		95

Time of Concentration

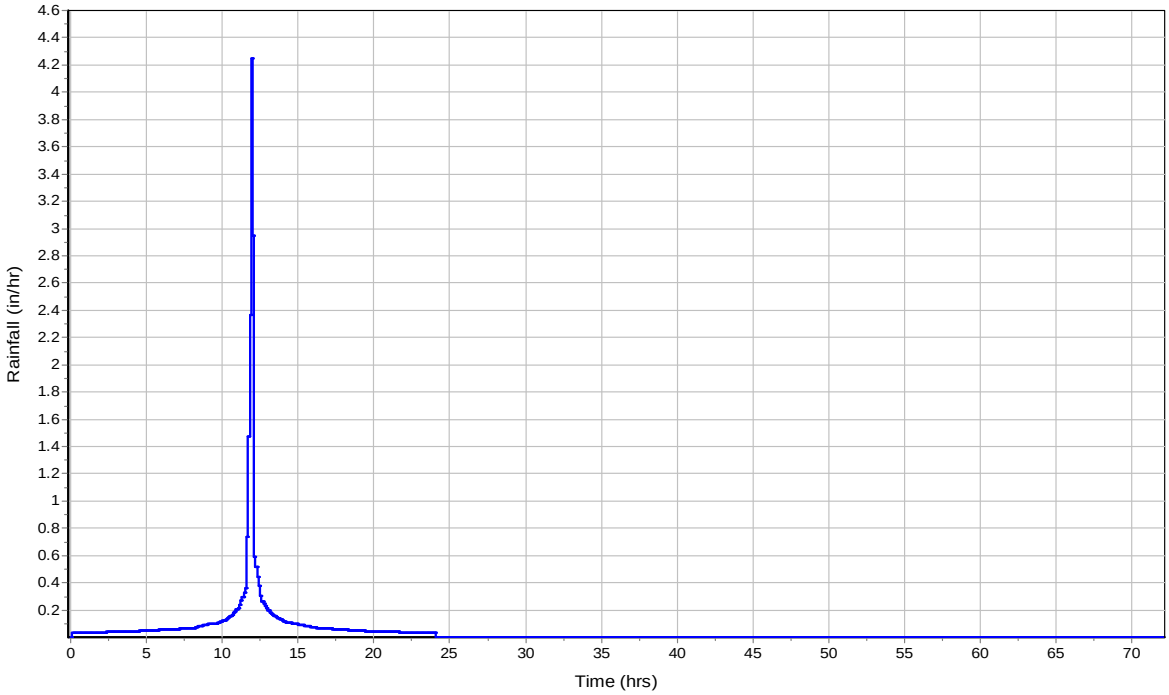
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

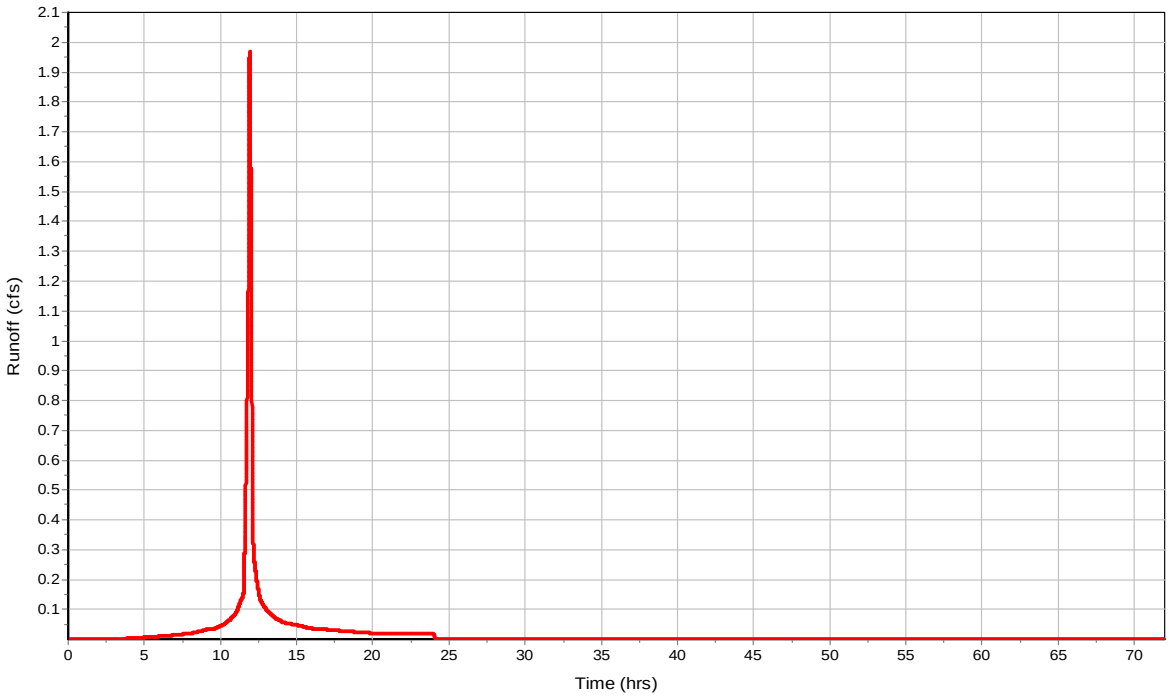
Total Rainfall (in)	3.1
Total Runoff (in)	2.55
Peak Runoff (cfs)	1.97
Weighted Curve Number	95
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : Sub-02

Rainfall Intensity Graph



Runoff Hydrograph



50% Chance Event

Project Description

File Name	Proposed Conditions_NOAA.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	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	00:00:00	0:00:00
End Analysis On	00:00:00	0:00:00
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 00:00:05	days hh:mm:ss
Routing Time Step	1	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	2
Nodes	3
Junctions	1
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	1
Links	3
Channels	0
Pipes	1
Pumps	0
Orifices	2
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
49		Time Series	2-Year	Cumulative	inches	Missouri	Jackson	2.00	3.71	SCS Type II 24-hr

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	Sub-01	132.96	484.00	91.58	3.71	2.80	371.89	349.78	0 00:25:53
2	Sub-02	0.52	484.00	95.00	3.71	3.15	1.64	2.40	0 00:05:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	1-Jun	Junction	101.00	106.00	0.00	0.00	0.00	0.25	101.13	0.00	4.87	0 00:00	0.00	0.00
2	Out-01	Outfall	100.00					350.02	100.12					
3	Stor-01	Storage Node	100.00	106.00	0.00		0.00	2.40	102.22				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Reported Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)	
1	Link-01	Pipe	1-Jun	Out-01	50.00	101.00	100.00	2.0000	36.000	0.0150	0.25	81.75	0.00	2.54	0.12	0.04	0.00	Calculated
2	Orifice-01	Orifice	Stor-01	1-Jun		100.00	101.00		3.000		0.25							
3	Orifice-04	Orifice	Stor-01	1-Jun		100.00	101.00		4.000		0.00							

Subbasin Hydrology

Subbasin : Sub-01

Input Data

Area (ac) 132.96
Peak Rate Factor 484
Weighted Curve Number 91.58
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

32 Soil/Surface Description	Area (acres)	Soil Group	Curve Number
1/4 acre lots, 38% impervious	34.01	C	83
1/4 acre lots, 38% impervious	1.71	D	87
Urban commercial, 85% imp	19.01	C	94
Urban commercial, 85% imp	74.72	D	95
Multi-Family	3.11	C	90
Paved roads with curbs & sewers	0.4	D	98
Composite Area & Weighted CN	132.96		91.58

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

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

Shallow Concentrated Flow Equation :

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

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	2	0	0
2 yr, 24 hr Rainfall (in) :	3.5	0	0
Velocity (ft/sec) :	0.1	0	0
Computed Flow Time (min) :	16.31	0	0

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	443	0	0
Slope (%) :	2	0	0
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	2.87	0	0
Computed Flow Time (min) :	2.57	0	0

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.013	0	0
Flow Length (ft) :	2975	0	0
Channel Slope (%) :	1	0	0
Cross Section Area (ft²) :	3.425	0	0
Wetted Perimeter (ft) :	7.06	0	0
Velocity (ft/sec) :	7.08	0	0
Computed Flow Time (min) :	7.01	0	0

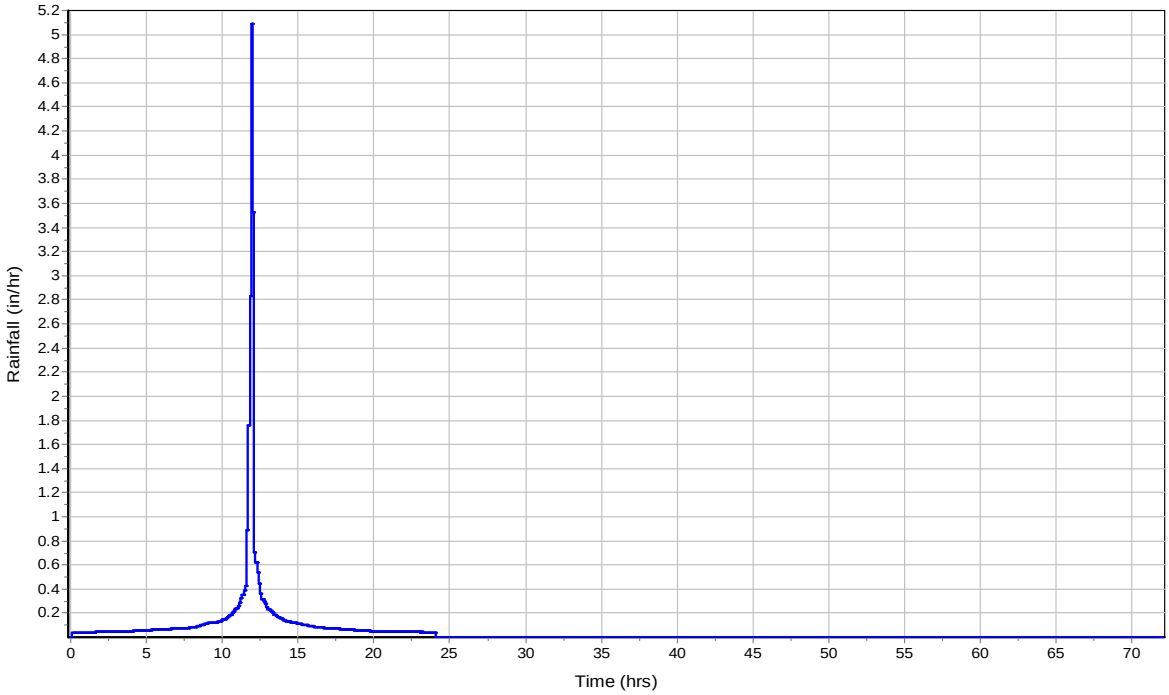
Total TOC (min) 25.89

Subbasin Runoff Results

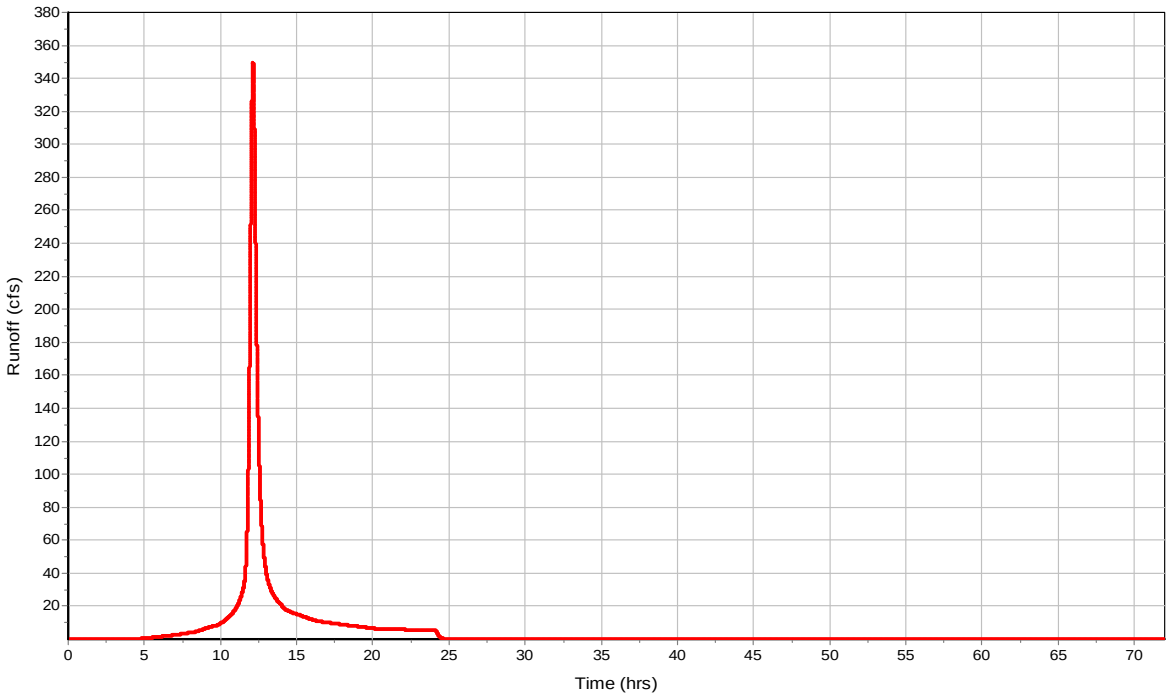
Total Rainfall (in)	3.71
Total Runoff (in)	2.8
Peak Runoff (cfs)	349.78
Weighted Curve Number	91.58
Time of Concentration (days hh:mm:ss)	0 00:25:53

Subbasin : Sub-01

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Sub-02

Input Data

Area (ac)	0.52
Peak Rate Factor	484
Weighted Curve Number	95
Rain Gage ID	Rain Gage-01

Composite Curve Number

32 Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.52	-	95
Composite Area & Weighted CN	0.52		95

Time of Concentration

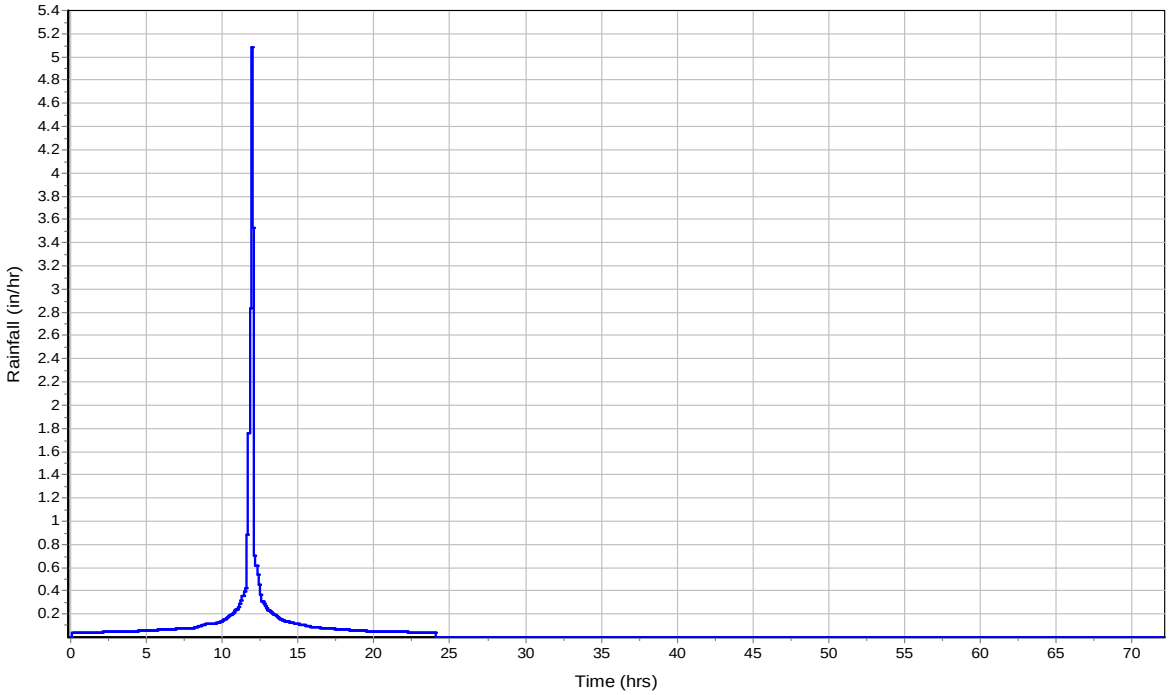
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

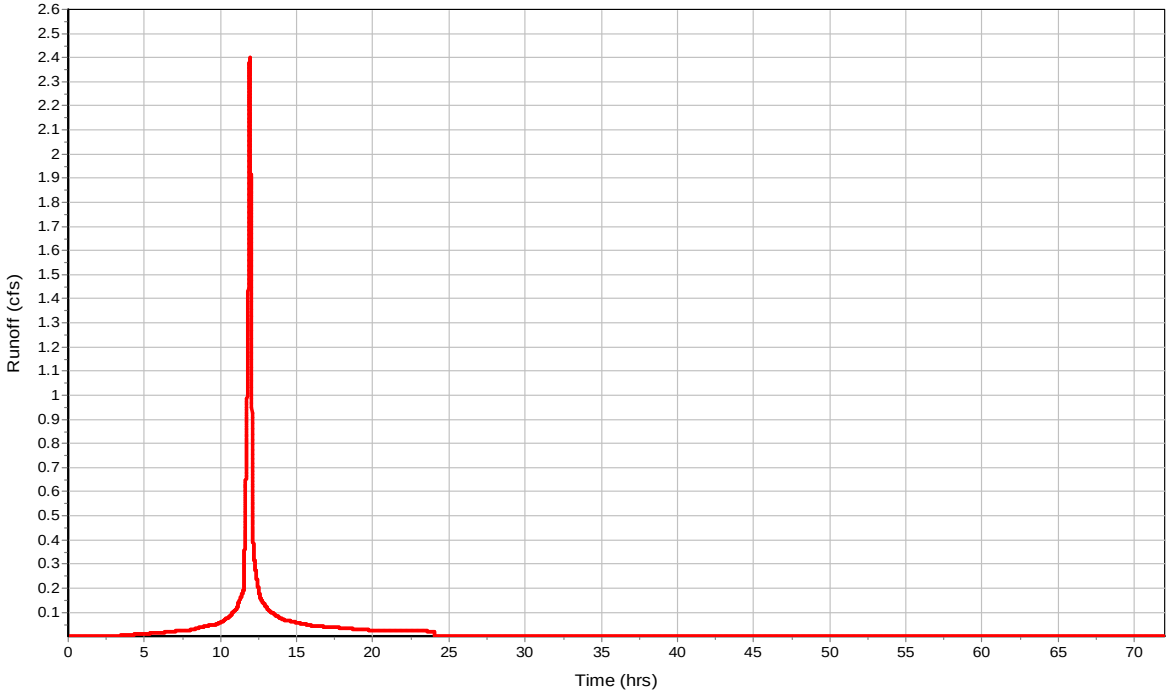
Total Rainfall (in)	3.71
Total Runoff (in)	3.15
Peak Runoff (cfs)	2.4
Weighted Curve Number	95
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : Sub-02

Rainfall Intensity Graph



Runoff Hydrograph



10% Chance Event

Project Description

File Name	Proposed Conditions_NOAA.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	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	00:00:00	0:00:00
End Analysis On	00:00:00	0:00:00
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 00:00:05	days hh:mm:ss
Routing Time Step	1	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	2
Nodes	3
Junctions	1
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	1
Links	3
Channels	0
Pipes	1
Pumps	0
Orifices	2
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
49		Time Series	10 Year	Cumulative	inches	Missouri	Jackson	10.00	5.67	SCS Type II 24-hr

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	Sub-01	132.96	484.00	91.58	5.67	4.70	624.78	574.93	0 00:25:53
2	Sub-02	0.52	484.00	95.00	5.67	5.08	2.64	3.78	0 00:05:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	1-Jun	Junction	101.00	106.00	0.00	0.00	0.00	0.35	101.15	0.00	4.85	0 00:00	0.00	0.00
2	Out-01	Outfall	100.00					575.24	100.14					
3	Stor-01	Storage Node	100.00	106.00	0.00		0.00	3.77	103.27				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Reported Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)	
1	Link-01	Pipe	1-Jun	Out-01	50.00	101.00	100.00	2.0000	36.000	0.0150	0.35	81.75	0.00	2.78	0.14	0.05	0.00	Calculated
2	Orifice-01	Orifice	Stor-01	1-Jun		100.00	101.00		3.000		0.35							
3	Orifice-04	Orifice	Stor-01	1-Jun		100.00	101.00		4.000		0.00							

Subbasin Hydrology

Subbasin : Sub-01

Input Data

Area (ac) 132.96
Peak Rate Factor 484
Weighted Curve Number 91.58
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

32 Soil/Surface Description	Area (acres)	Soil Group	Curve Number
1/4 acre lots, 38% impervious	34.01	C	83
1/4 acre lots, 38% impervious	1.71	D	87
Urban commercial, 85% imp	19.01	C	94
Urban commercial, 85% imp	74.72	D	95
Multi-Family	3.11	C	90
Paved roads with curbs & sewers	0.4	D	98
Composite Area & Weighted CN	132.96		91.58

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

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

Shallow Concentrated Flow Equation :

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

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	2	0	0
2 yr, 24 hr Rainfall (in) :	3.5	0	0
Velocity (ft/sec) :	0.1	0	0
Computed Flow Time (min) :	16.31	0	0

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	443	0	0
Slope (%) :	2	0	0
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	2.87	0	0
Computed Flow Time (min) :	2.57	0	0

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.013	0	0
Flow Length (ft) :	2975	0	0
Channel Slope (%) :	1	0	0
Cross Section Area (ft²) :	3.425	0	0
Wetted Perimeter (ft) :	7.06	0	0
Velocity (ft/sec) :	7.08	0	0
Computed Flow Time (min) :	7.01	0	0

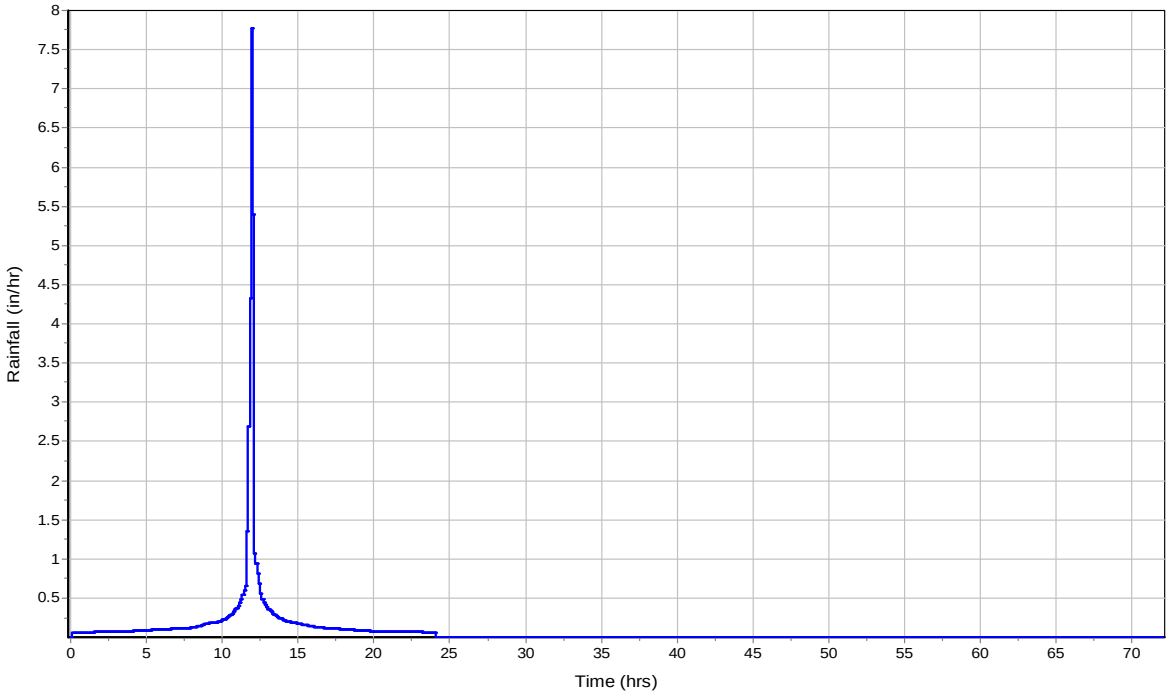
Total TOC (min) 25.89

Subbasin Runoff Results

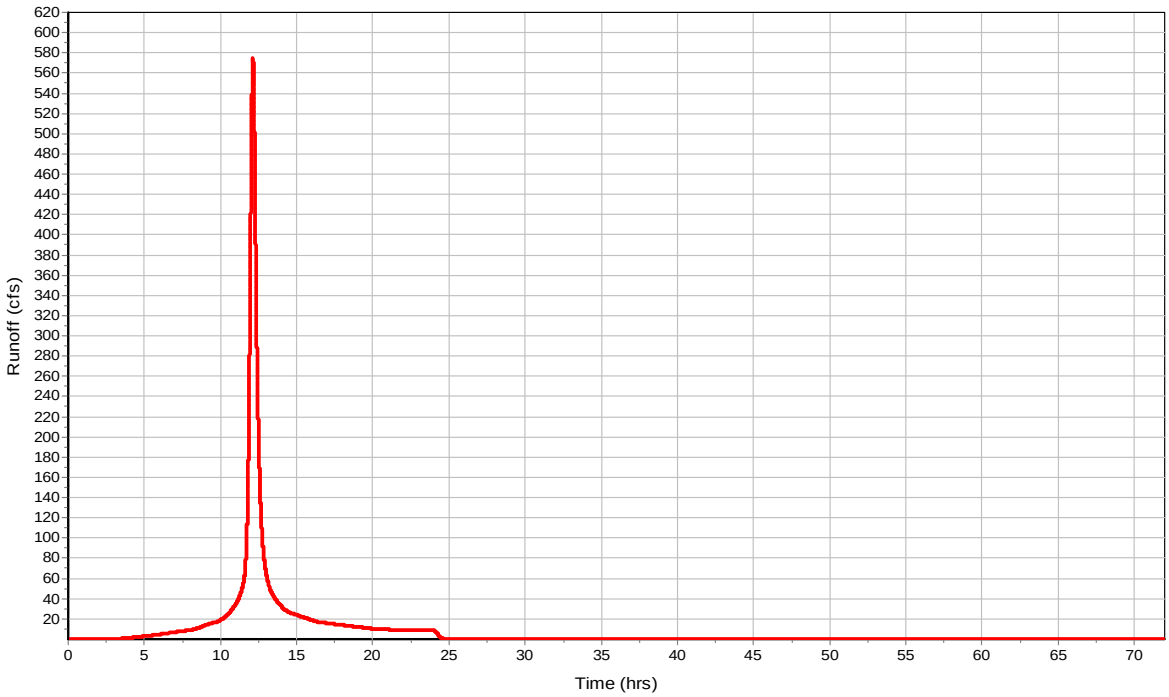
Total Rainfall (in)	5.67
Total Runoff (in)	4.7
Peak Runoff (cfs)	574.93
Weighted Curve Number	91.58
Time of Concentration (days hh:mm:ss)	0 00:25:53

Subbasin : Sub-01

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Sub-02

Input Data

Area (ac)	0.52
Peak Rate Factor	484
Weighted Curve Number	95
Rain Gage ID	Rain Gage-01

Composite Curve Number

32 Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.52	-	95
Composite Area & Weighted CN	0.52		95

Time of Concentration

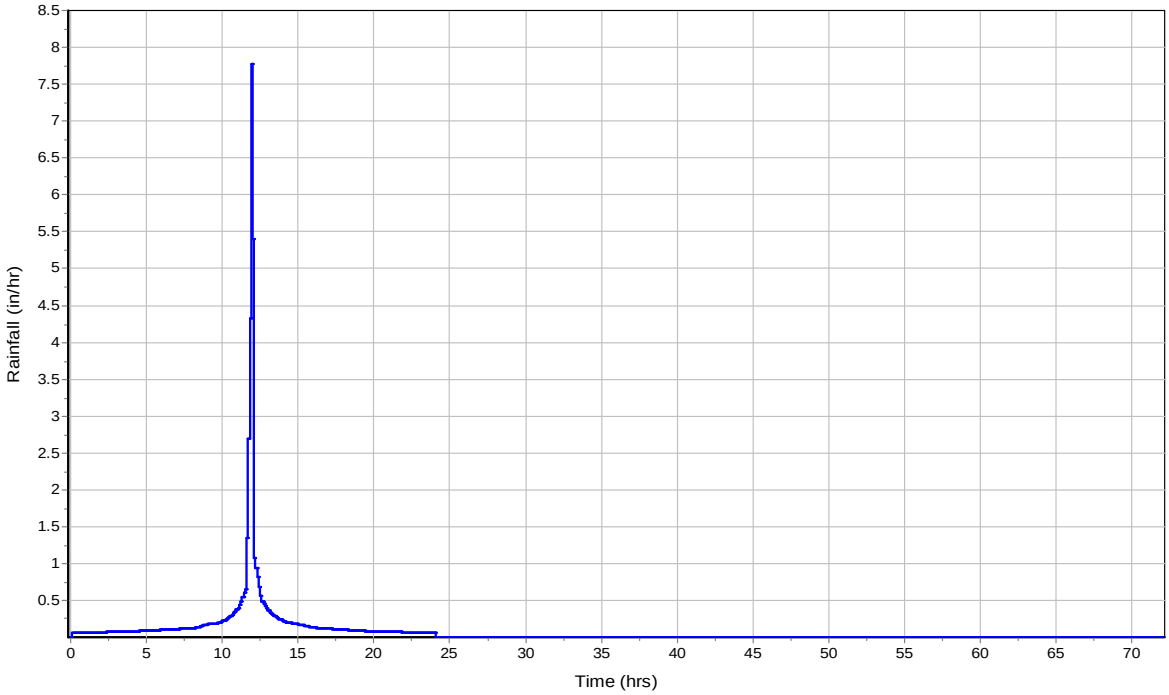
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

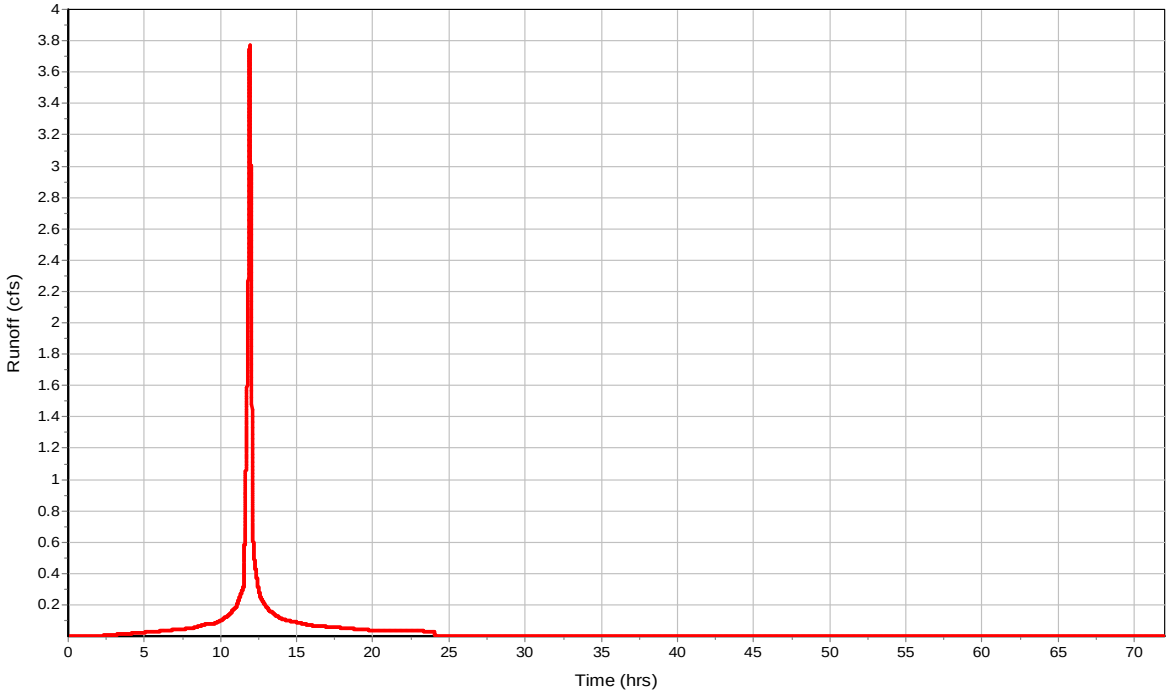
Total Rainfall (in)	5.67
Total Runoff (in)	5.08
Peak Runoff (cfs)	3.78
Weighted Curve Number	95
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : Sub-02

Rainfall Intensity Graph



Runoff Hydrograph



1% Chance Event

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 ..... Hydrodynamic
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ... NO

Analysis Options

Start Analysis On ..... Feb 15, 2023 00:00:00
End Analysis On ..... Feb 18, 2023 00:00:00
Start Reporting On ..... Feb 15, 2023 00:00:00
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 00:01:00 days hh:mm:ss
Routing Time Step ..... 5 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	2
Nodes	3
Junctions	1
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	1
Links	3
Channels	0
Pipes	1
Pumps	0
Orifices	2
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1		Time Series	100 Year	Cumulative	inches	Missouri	Jackson	100	7.70	SCS Type II 24-hr

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	Sub-01	132.96	484.00	91.58	7.70	6.70	890.43	804.27	0 00:25:53
2	Sub-02	0.52	484.00	95.00	7.70	7.10	3.69	5.18	0 00:05:00

Node Summary

SN	Element 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)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	Junction	101.00	106.00	0.00	0.00	0.00	0.82	101.22	0.00	4.78	0 00:00	0.00	0.00
2	Out-01	Outfall	100.00					803.29	100.21					
3	Stor-01	Storage Node	100.00	106.00	0.00		0.00	5.18	105.74				0.00	0.00

Subbasin Hydrology

Subbasin : Sub-01

Input Data

Area (ac)	132.96
Peak Rate Factor	484.00
Weighted Curve Number	91.58
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
1/4 acre lots, 38% impervious	34.01	C	83.00
1/4 acre lots, 38% impervious	1.71	D	87.00
Urban commercial, 85% imp	19.01	C	94.00
Urban commercial, 85% imp	74.72	D	95.00
Multi-Family	3.11	C	90.00
Paved roads with curbs & sewers	0.40	D	98.00
Composite Area & Weighted CN	132.96		91.58

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

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

Shallow Concentrated Flow Equation :

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

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.3	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.50	0.00	0.00
Velocity (ft/sec) :	0.10	0.00	0.00
Computed Flow Time (min) :	16.31	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	443	0.00	0.00
Slope (%) :	2	0.00	0.00
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	2.87	0.00	0.00
Computed Flow Time (min) :	2.57	0.00	0.00

Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.013	0.00	0.00
Flow Length (ft) :	2975	0.00	0.00
Channel Slope (%) :	1	0.00	0.00
Cross Section Area (ft²) :	3.425	0.00	0.00
Wetted Perimeter (ft) :	7.06	0.00	0.00
Velocity (ft/sec) :	7.08	0.00	0.00
Computed Flow Time (min) :	7.01	0.00	0.00

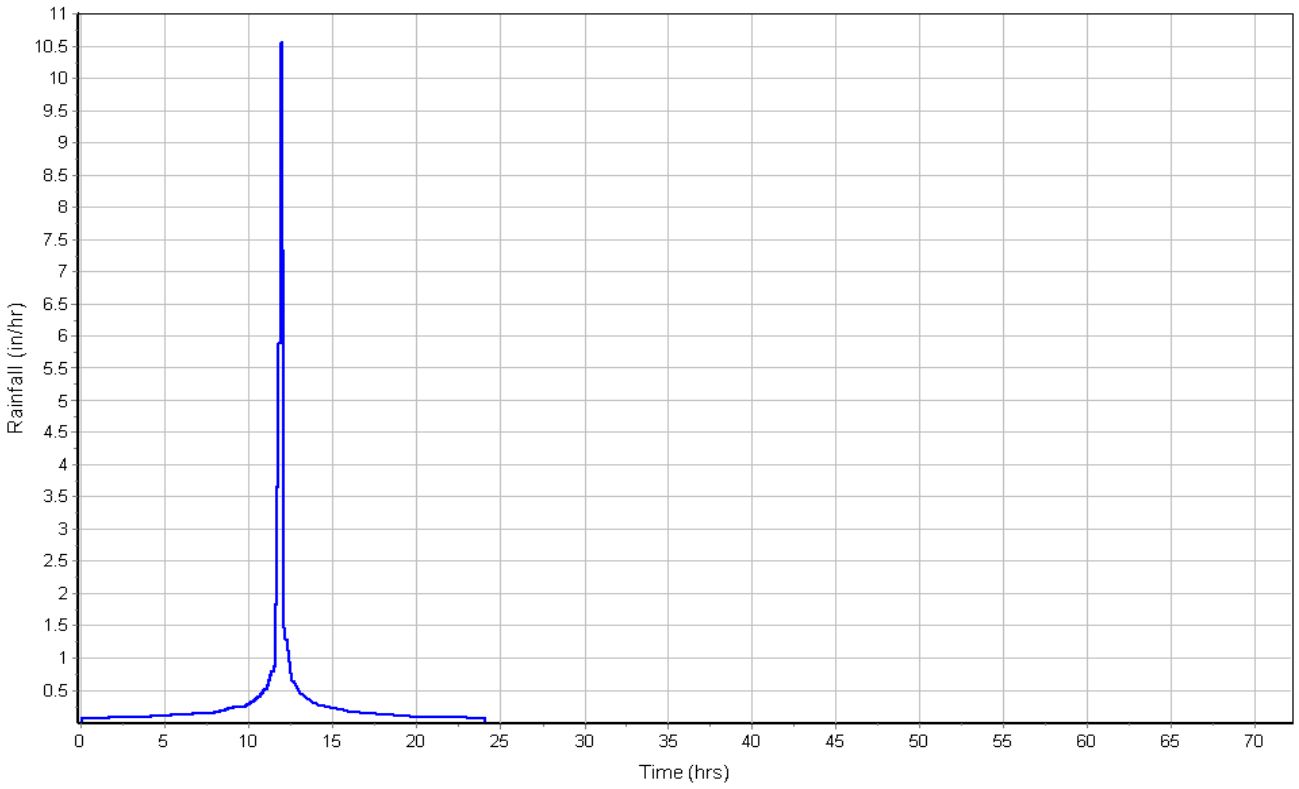
Total TOC (min) 25.89

Subbasin Runoff Results

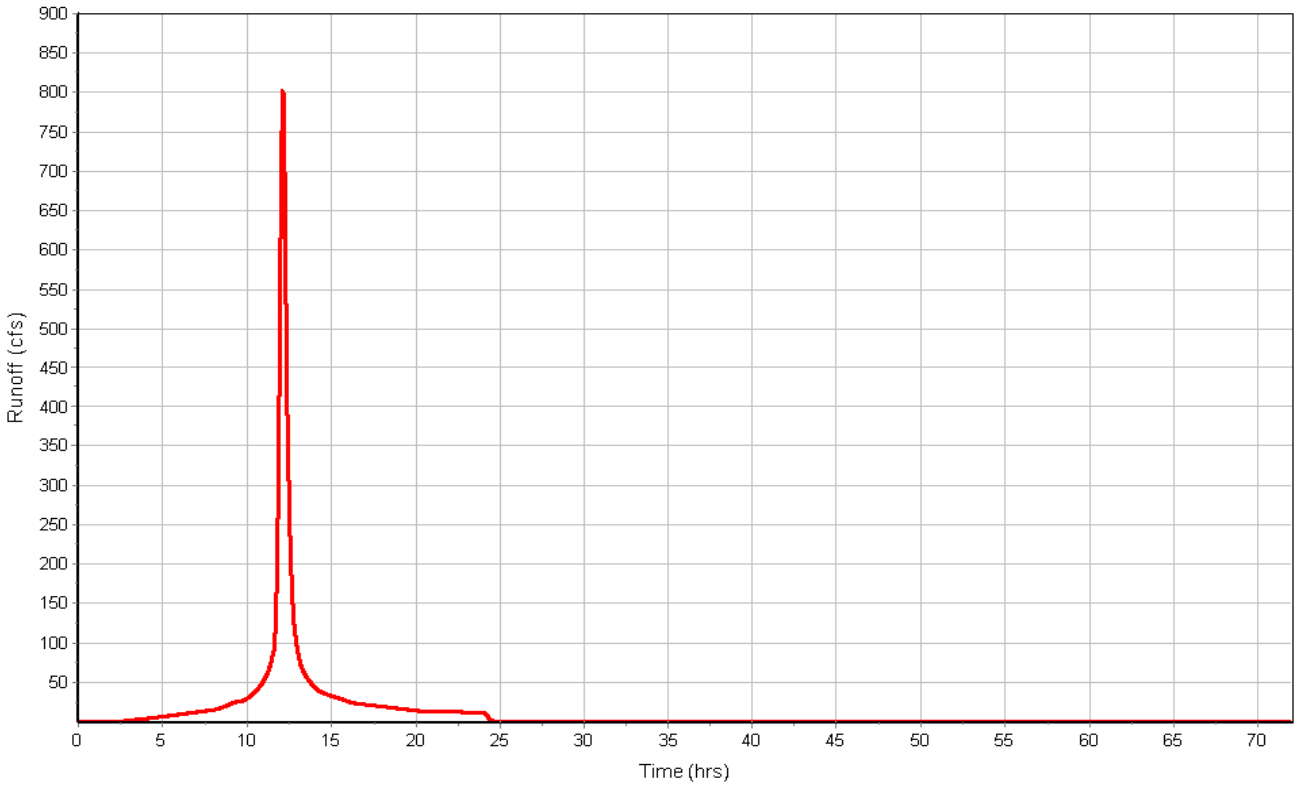
Total Rainfall (in)	7.70
Total Runoff (in)	6.70
Peak Runoff (cfs)	804.27
Weighted Curve Number	91.58
Time of Concentration (days hh:mm:ss)	0 00:25:53

Subbasin : Sub-01

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Sub-02

Input Data

Area (ac) 0.52
Peak Rate Factor 484.00
Weighted Curve Number 95.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.52	-	95.00
Composite Area & Weighted CN	0.52		95.00

Time of Concentration

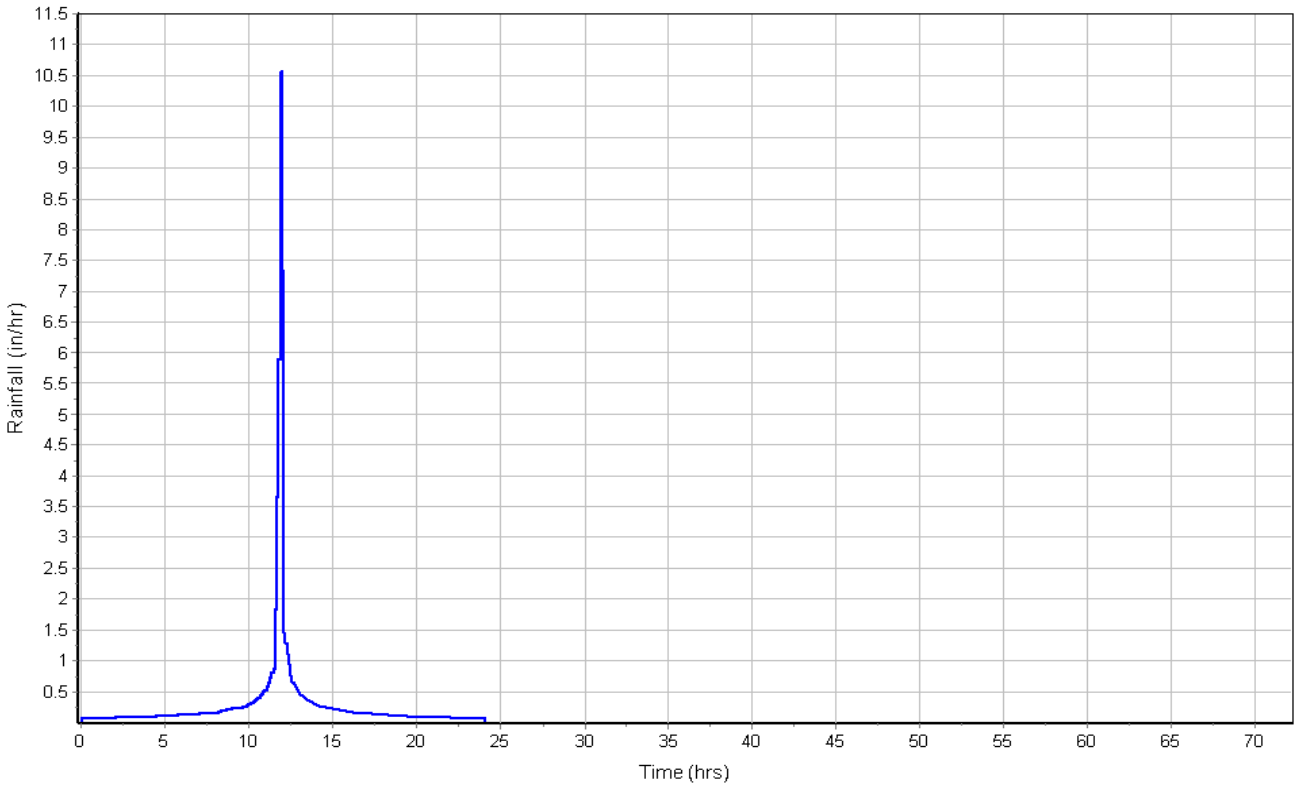
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

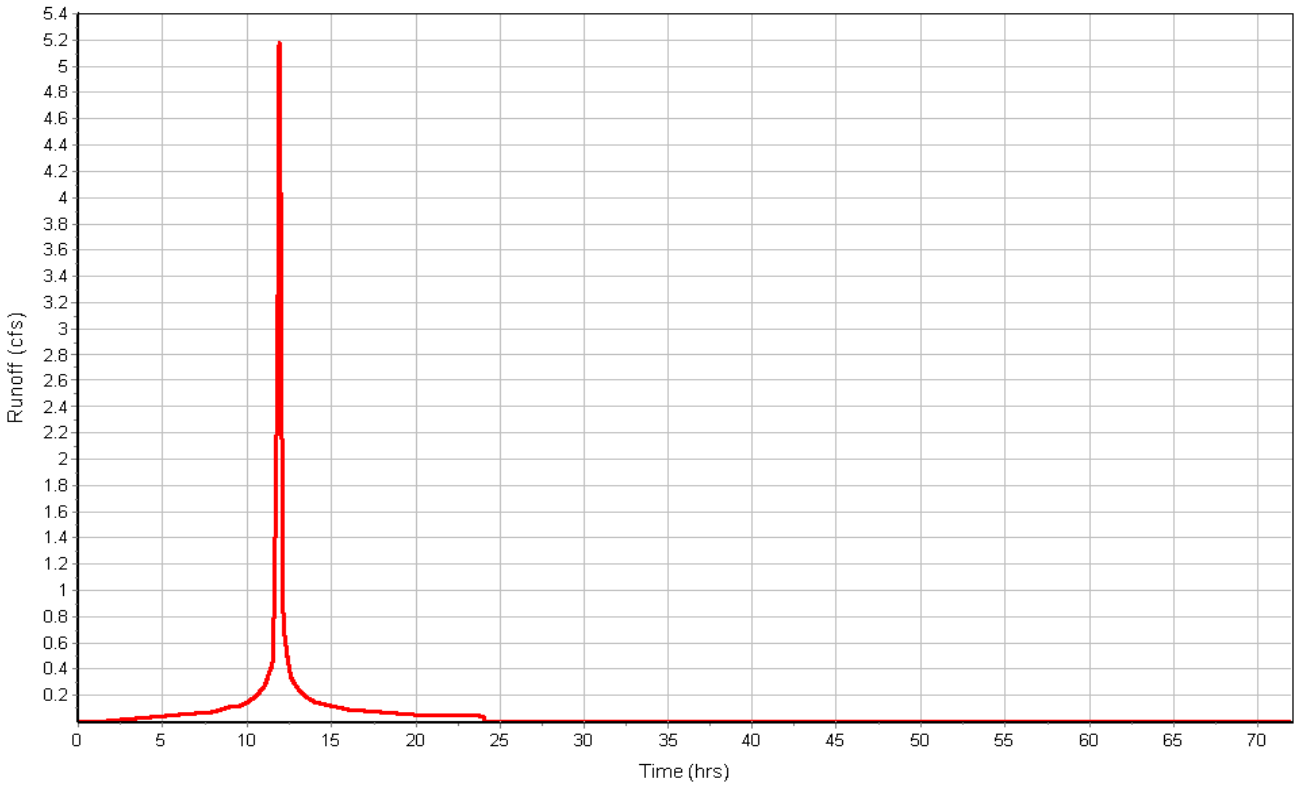
Total Rainfall (in) 7.70
Total Runoff (in) 7.10
Peak Runoff (cfs) 5.18
Weighted Curve Number 95.00
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : Sub-02

Rainfall Intensity Graph



Runoff Hydrograph

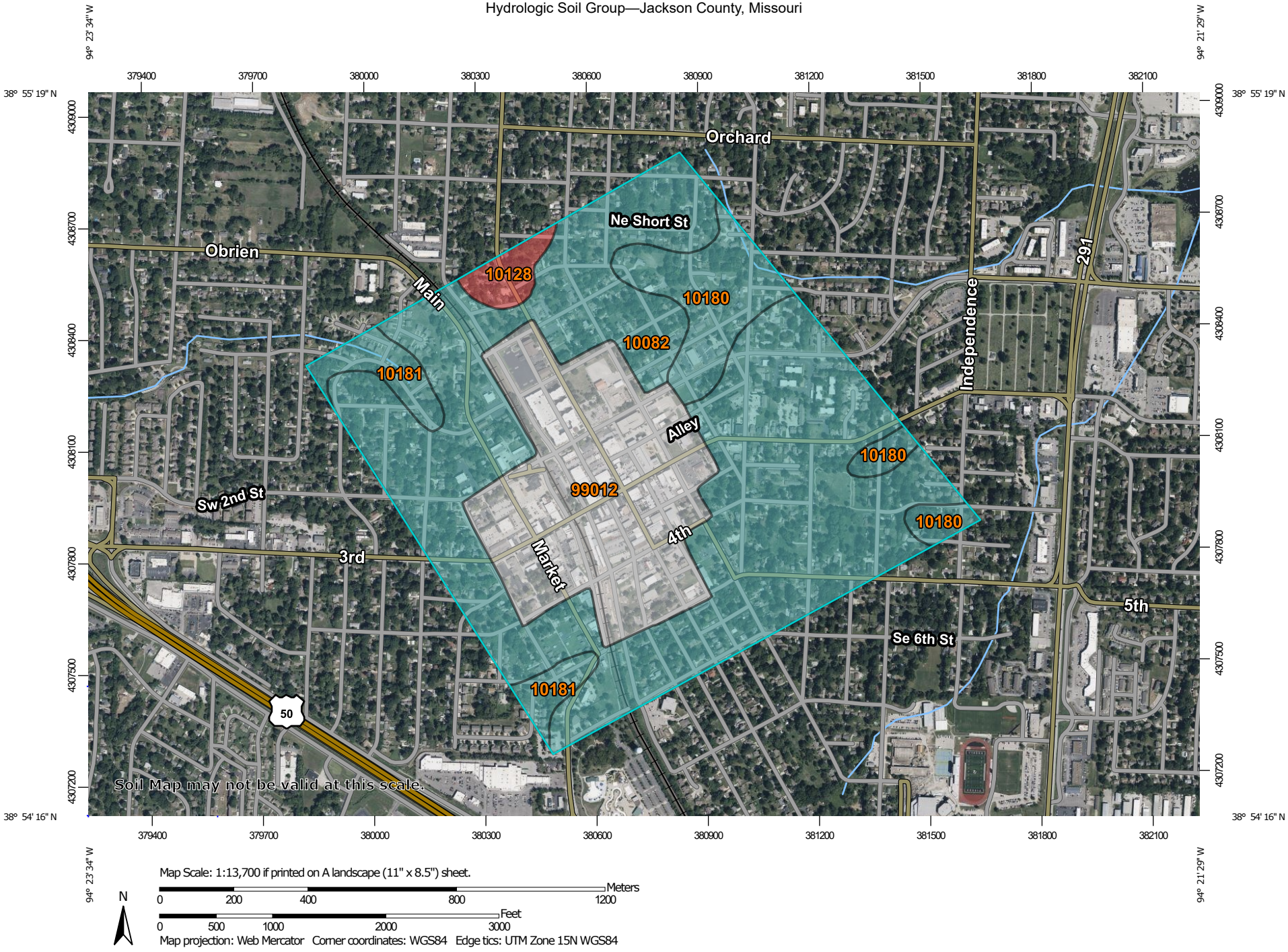


Junction Results

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)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	0.82	0.00	101.22	0.22	0.00	4.78	101.03	0.03	0 12:09	0 00:00	0.00	0.00

APPENDIX D

Soil Maps



Map Scale: 1:13,700 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

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 Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

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 24, Aug 31, 2022

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
10082	Arisburg-Urban land complex, 1 to 5 percent slopes	C	232.8	60.9%
10128	Sharpsburg-Urban land complex, 2 to 5 percent slopes	D	6.9	1.8%
10180	Udarents-Urban land-Sampsel complex, 2 to 5 percent slopes	C	33.7	8.8%
10181	Udarents-Urban land-Sampsel complex, 5 to 9 percent slopes	C	15.5	4.0%
99012	Urban land, upland, 5 to 9 percent slopes		93.4	24.4%
Totals for Area of Interest			**382.3**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

APPENDIX E

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, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1316 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 ImageryProgram (NAIP) dated 2014. Produced at scale of 1:24,000.

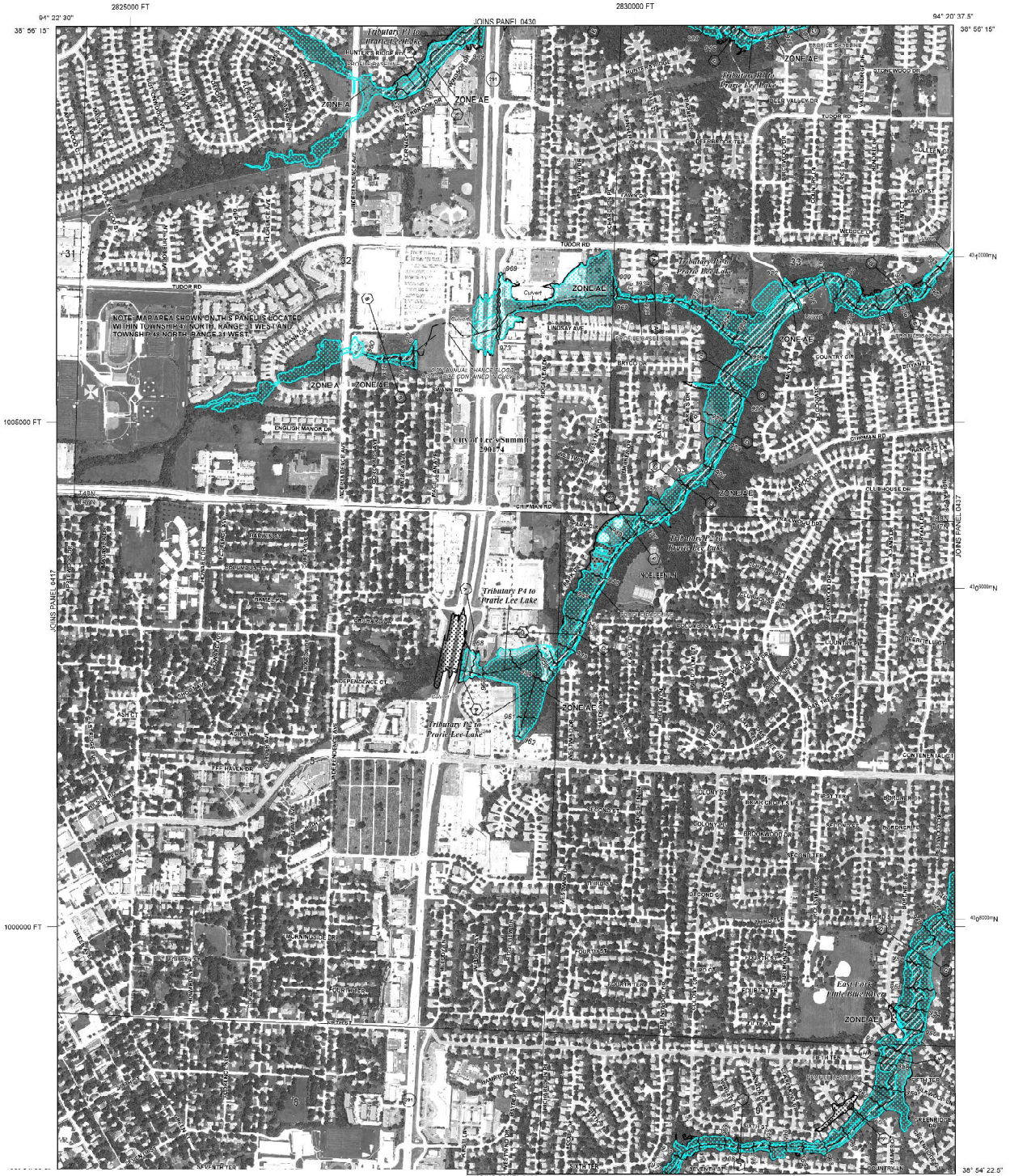
The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

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 equaled 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, AO, AR, A99, V, 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 AO	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 Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); 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.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

- A — A — Cross section line
- 23 — 23 — Transect line
- Culvert
- Bridge
- 45° 02' 08", 93° 02' 13" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
- 3100000 FT — 5000-foot ticks: Missouri State Plane West Zone (FIPS Zone 2403), Transverse Mercator projection
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REVISED: Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP: September 29, 2006

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

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP — NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0436G

FIRM

FLOOD INSURANCE RATE MAP

JACKSON COUNTY, MISSOURI AND INCORPORATED AREAS

PANEL 436 OF 625

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
LEE'S SUMMIT, CITY OF	290174	0436	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 29095C0436G

MAP REVISED JANUARY 20, 2017

Federal Emergency Management Agency

LEE'S SUMMIT DOWNTOWN MARKET DRAINAGE STUDY

Lee's Summit, MO

July 2023

Olsson Project No. 022-00393