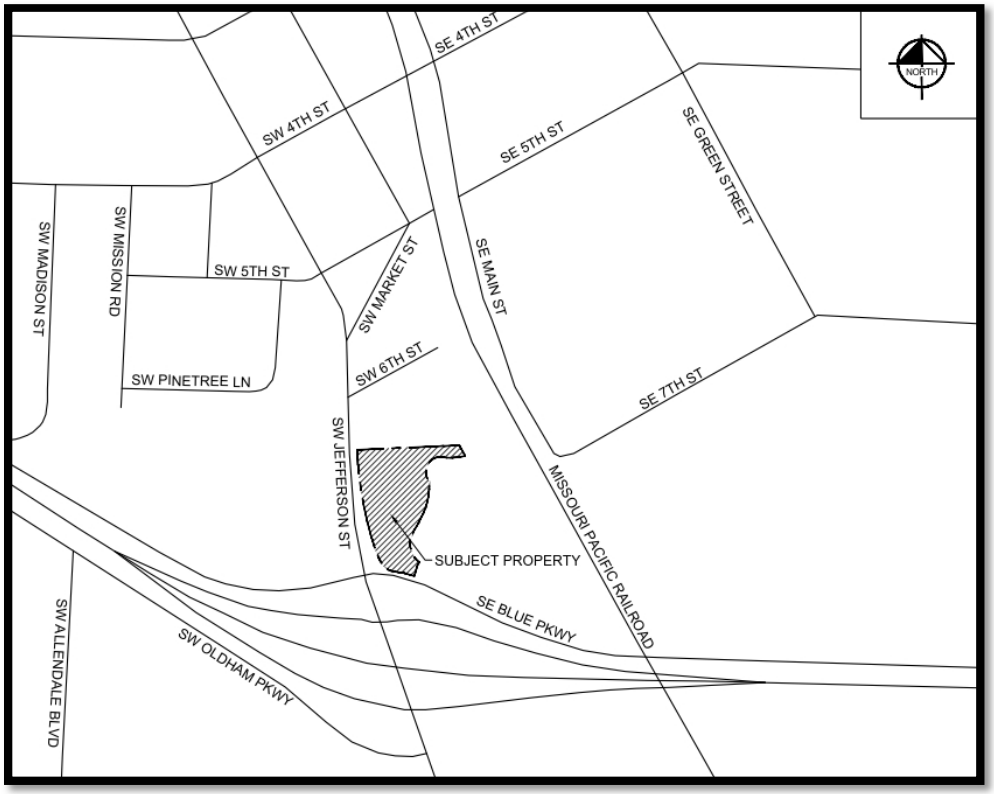
Stormwater Report for Summit Waves – Wave Pool Addition

City of Lee's Summit, Missouri



Prepared for:
City of Lee's Summit, Missouri – Parks and Recreation
220 SE Green Street
Lee's Summit, MO 64063

Prepared by:
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Kimley»Horn

MISSOURI REGISTRATION NUMBER 001512

Table of Contents

List of Tables

Appendices

Appendix A **Hydrology**
Existing Condition Drainage Area Map
Proposed Condition Drainage Area Map
NRCS Soil Map
Hydrologic Calculations
HEC-HMS Output

Appendix B **Digital Files**
Summit Waves – Wave Pool Addition Construction Plans
ADS Storm Tech System Information
HEC-HMS v. 4.1

1.0 Introduction

1.1 AUTHORITY

The City of Lee's Summit Parks and Recreation Board (LSPR) has retained the services of Kimley-Horn and Associates, Inc. (Kimley-Horn) to prepare a stormwater assessment for the proposed wave pool addition in the existing Summit Waves Aquatic Park in Lee's Summit, Missouri. The contacts for the study are as follows:

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Carolyn F. Cox, P.E., CFM (TX)
Deanna H. Abbruzese, E.I.T. (TX)
Kimley-Horn and Associates, Inc.
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1.2 PURPOSE OF STUDY

The subject property is located at the northeast corner of SW Jefferson Street and SE Blue Parkway in the City of Lee's Summit, Missouri. The subject property is located adjacent to the existing Summit Waves Aquatic Park and is proposed to be a wave pool addition to the existing park. This study was performed to evaluate the impacts of the proposed development on the peak flow rates within the watershed and to design detention and water quality in accordance with City criteria.

1.3 SITE DESCRIPTION

The subject property is approximately 3.27 acres and the limits of disturbance for the proposed project is approximately 1.92 acres. In existing conditions, the site drains in four different directions and ultimately to three different existing storm sewer systems. There are no FEMA classifications associated with this site. The site consists of all Type C soil, which can be seen on the NRCS Soil Map in **Appendix A**. See **Table 1** below for the soil classification information.

Table 1. Subject Property Soil Classification

Symbol	Name	Slopes	HSG
10082	Arisburg-Urban land complex	1-5%	C
10180	Udarents-Urban land-Sampsel complex	2-5%	C
10181	Udarents-Urban land-Sampsel complex	5-9%	C
99012	Urban land, upland	5-9%	C
99033	Udarents-Urban land complex	2-9%	C

1.4 METHODOLOGY

This study was completed using unit hydrograph modeling methods in accordance with The Kansas City Metropolitan Chapter American Public Works Association Standard Specifications and Design Criteria Section 5600 (APWA 5600) published in February 2011. Hydrologic modeling was performed using HEC-HMS version 4.1. More details on methodologies are provided in the following sections.

The following criteria was used for the hydrologic model:

- Hydrologic Method: Unit Hydrograph
- Return Frequency Storms: 2-year, 10-year, and 100-year
- Soil Moisture Conditions: AMC II
- Transform Method: SCS Unit Hydrograph, Lag Time
- Loss Method: SCS Curve Number
- Curve Number Reference: Kansas City APWA 5600
- Rainfall Distribution: 24-Hour Frequency Storm
- Rainfall Depths: NOAA Atlas 14 Point Precipitation Frequency Estimates, September 2018

2.0 Hydrology

2.1 EXISTING CONDITION ANALYSIS

The existing subject property is an undeveloped tract of land adjacent to the existing Summit Waves Aquatic Park. The majority of the site consists of short grass with a few trees and an existing asphalt sidewalk connecting the aquatic park to a playground located north of the subject property. There is an existing hill located in the middle of the subject property.

The subject property drains in four different directions and ultimately to three different existing storm sewer systems. Each of the four outfall locations are shown as Points of Interest (POI) on the *Existing Condition Drainage Area Map* in **Appendix A**. Each existing drainage basin was analyzed for only the on-site areas in order to determine the excess runoff at each outfall from the proposed site alone. The northwest corner of the site drains to an existing grassed ditch along SW Jefferson Street, which drains to the storm sewer and the curb inlet along SW 6th Street (Outfall A). A small portion of the northeast corner of the site drains through the existing park/playground north of the subject property and directly into the curb inlet along SW 6th street (Outfall B). The eastern portion of the site drains to the existing grate inlet located in the existing aquatic park connecting to the Summit Waves storm sewer system (Outfall C). The southern portion of the site drains to two curb inlets and a catch basin which connect to the storm sewer system underneath Jefferson Street just north of Blue Parkway (Outfall D).

Curve numbers were determined from Table 5602-3 in APWA 5600 based on a hydrologic soil type of C. Times of concentration were determined using SCS TR-55 methods. Where times of concentration were less than 5 minutes, a minimum inlet time of 5 minutes was used per APWA 5600. **Table 2** below summarizes the existing condition input data for each on-site drainage basin and its corresponding POI.

Table 2. Summary of Existing Condition Hydrologic Parameters

Outfall	POI	Drainage Area	Area (ac)	Area (mi^2)	CN	TC (min)	T_{lag} (min)
Ditch along SW Jefferson Street	A	A	1.17	0.00183	75.2	4.52	2.71
Curb Inlet on SW 6th Street	B	B	0.16	0.00025	75.5	4.22	2.53
Existing Summit Waves Aquatic Park Storm Sewer	C	C1	0.13	0.00020	77.7	7.64	4.58
		C2	0.38	0.00059	75.3	5.91	3.54
Storm Sewer at Jefferson Street North of Blue Parkway	D	D	1.42	0.00222	75.5	7.20	4.32

The peak flows for each POI were analyzed to determine existing release rates. The existing condition 2-, 10- and 100-year peak flows leaving the subject property are summarized in **Table 3**.

Table 3. Summary of Existing Condition Peak Flows

POI	2-Year (cfs)	10-Year (cfs)	100-Year (cfs)
A	2.2	5.7	10.8
B	0.3	0.8	1.5
C	0.9	2.3	4.3
D	2.4	6.1	11.6

The allowable release rates were determined per APWA Section 5608.4 which states that post-development peak discharge rates from the site shall not exceed those indicated below:

- 50% storm peak rate less than or equal to 0.5 cfs per site acre
- 10% storm peak rate less than or equal to 2.0 cfs per site acre
- 1% storm peak rate less than or equal to 3.0 cfs per site acre

An allowable release rate was calculated for each POI. The peak flow rates for the project area considered bypass were determined from the proposed condition hydrologic model since the land use condition of these areas will be the same in proposed as they are in existing. The release rates for the wave pool site area were calculated based on the criteria stated above. The wave pool site area allowable release rates were added to the bypass peak flow rates to calculate the total allowable peak flow rate for each POI. **Table 4** below summarizes the allowable peak flow rates for each POI.

Table 4. Summary of Allowable Peak Flows

POI	DA	Area (ac)	Classification	Allowable Release Rate (cfs)			Total Allowable Release Rate (cfs)		
				Q2	Q10	Q100	Q2	Q10	Q100
A	A1	0.86	Bypass	1.8*	4.3*	8.1*	2.2	6.2	11.0
	A2	0.07	Site	0.0	0.1	0.2			
	A3	0.24	Site	0.1	0.5	0.7			
	A4	0.23	Site	0.1	0.5	0.7			
	A5	0.32	Site	0.2	0.6	1.0			
	A6	0.11	Site	0.1	0.2	0.3			
B	B	0.13	Bypass	0.3*	0.6*	1.2*	0.3	0.6	1.2
C	C1	0.14	Site	0.1	0.3	0.4	0.1	0.4	0.6
	C2	0.05	Site	0.0	0.1	0.2			
D	D	0.88	Bypass	1.6*	3.9*	7.3*	1.6	3.9	7.3
A	Pool	0.22	-	-	-	-	-	-	-

Allowable release rate values calculated using the APWA Section 5608.4 criteria.
*Allowable release rate values determined from proposed condition hydrologic model.

2.2 PROPOSED CONDITION ANALYSIS

A wave pool addition to the existing Summit Waves Aquatic Park is proposed within the subject property. The development consists of a wave pool, a paved patio, a mechanical/restroom building, service drives, parking, and shade structures.

The drainage from the subject property is proposed to drain to the same four locations as in existing conditions. The proposed grading associated with the development will create a hill on the south side of the existing hill in the middle of the subject property. The site walk will be reconstructed to follow the base of the new hill. The amount of sidewalk concrete will remain the same as existing.

The majority of the proposed wave pool site will be sent to Outfall A and the ditch along the western boundary of the subject property. The pool surface area was not considered to contribute to the on-site drainage. When the pool is in operation, it will drain to the sanitary sewer system. The pool drainage area was included in the HEC-HMS model for reference, but it is not shown as going to any of the POI.

Table 5 below summarizes the input data for the proposed condition drainage areas.

Table 5. Summary of Proposed Condition Hydrologic Parameters

Outfall	POI	Drainage Area	Area (ac)	Area (mi^2)	CN	TC (min)	T_{lag} (min)
Ditch along SW Jefferson Street	A	A1	0.86	0.00134	75.7	3.97	2.38
		A2	0.07	0.00011	98.0	5.00	3.00
		A3	0.24	0.00038	92.0	5.23	3.14
		A4	0.23	0.00036	98.0	5.35	3.21
		A5	0.32	0.00050	88.3	5.98	3.59
		A6	0.11	0.00017	89.3	5.62	3.37
		Pool	0.22	0.00034	98.0	5.19	3.11
Curb Inlet on SW 6th Street	B	B	0.13	0.00020	75.8	4.09	2.45
Existing Summit Waves Aquatic Park Storm Sewer	C	C1	0.14	0.00022	87.7	7.49	4.49
		C2	0.05	0.00008	83.6	5.00	3.00
Storm Sewer at Jefferson Street North of Blue Parkway	D	D	0.88	0.00138	76.5	7.24	4.35

The majority of the runoff from the subject property will be detained in an underground detention system located in the northeast corner of the site. In all storm events, the peak flow rates at each outfall will either match the allowable release rate or be below the existing condition peak flow rate.

Detention system details can be seen in the attached ADS Storm Tech System Information included digitally in **Appendix B**. **Table 6** below summarizes the peak flow rates at each outfall location. **Table 7** compares the proposed condition flow rates to the allowable flow rates at each outfall location. A digital copy of the model is included in **Appendix B**.

Table 6. Summary of Existing, Allowable, and Proposed Condition Peak Flows

POI	Existing Peak Flow (cfs)			Allowable Peak Flow (cfs)			Proposed Peak Flow (cfs)		
	Q2	Q10	Q100	Q2	Q10	Q100	Q2	Q10	Q100
A	2.2	5.7	10.8	2.2	6.2	11.0	2.2	5.5	10.8
B	0.3	0.8	1.5	0.3	0.6	1.2	0.3	0.6	1.2
C	0.9	2.3	4.3	0.1	0.4	0.6	0.6	1.1	1.8
D	2.4	6.1	11.6	1.6	3.9	7.3	1.6	3.9	7.3

Table 7. Comparison of Allowable and Proposed Condition Peak Flows

POI	2-Year (Prop-Allow) (cfs)	10-Year (Prop-Allow) (cfs)	100-Year (Prop-Allow) (cfs)
A	0.0	-0.7	-0.2
B	0.0	0.0	0.0
C	0.5	0.7	1.2
D	0.0	0.0	0.0

At POI C, proposed condition peak flows do not meet APWA Section 5608.4 criteria, but they are less than existing condition flow rates. The drainage design for the existing Summit Waves Aquatic Park Wave accounted for existing condition peak flows. At point A, where a detention facility is required, peak flow rates are at or below the allowable flow rates shown in **Table 4**.

2.3 WATER QUALITY

The proposed subject property includes water quality in accordance with APWA 5600 and the Manual of Best Management Practices for Stormwater Quality published by Kansas City Metropolitan Chapter APWA in October 2012 (APWA/MARC BMP Manual). A Level of Service was calculated at each of the outfall locations for the proposed site.

At outfalls B and D there is minimal change in curve number from existing to proposed conditions therefore there are no water quality measures required at these locations per criteria. At outfall C the proposed runoff drains to the existing aquatic park which includes existing water quality elements, so no new water quality elements were proposed.

At outfall A, there is a change in curve number of 16.6 for the disturbed project area, which corresponds to a Level of Service of 8. In order to achieve this Level of Service, there will be an isolator row within the ADS Storm Tech detention system. The water quality performance explanation of the isolator row can be seen in the attached ADS Storm Tech System Information included digitally in **Appendix B**. In addition to the isolator row, a hydrodynamic separator will be installed downstream of the outfall for the detention system. The hydrodynamic separator will achieve an efficiency of 80% removal of total suspended solids. A detail for the hydrodynamic separator can be seen in the attached Summit Waves – Wave Pool Addition Construction Plans included digitally in **Appendix B**. The combination of these Best Management Practices (BMPs) will achieve an overall water quality rating of 8.92, exceeding the required water quality rating value of 8. Water quality calculations are included in the hydrologic calculations.

3.0 Conclusion

This stormwater report has been prepared to evaluate the hydrologic and water quality impacts from the proposed development of Summit Waves – Wave Pool Addition. The proposed development includes an underground detention facility to reduce peak discharge rates from the wave pool site in the 2-, 10-, and 100-year storm events. The results of the study support that the peak stormwater discharge from the subject property will not increase at the offsite outfalls above the allowable release rates based on APWA Section 5608.4 criteria at POI A, B, and D as a result of the development. At POI C, proposed condition peak flows do not meet APWA Section 5608.4 criteria, but they are less than existing condition flow rates. Additionally, water quality features will be constructed to ensure that the required water quality Level of Service is being met. These water quality features include the Storm Tech isolator row and a hydrodynamic separator.

4.0 References

Chow, Ven Te. *Open Channel Hydraulics*. McGraw-Hill, 1959.

Kansas City Metropolitan Chapter American Public Works Association Standard Specifications and Design Criteria. *Storm Drainage Systems and Facilities, Section 5600.* APWA, February 2011.

Kansas City Metropolitan Chapter American Public Works Association. *Manual of Best Management Practices For Stormwater Quality.* APWA / MARC, October 2012.

U.S. Army Corps of Engineers. *HEC-HMS, v. 4.1 (software package)*. U.S. Army Corps of Engineers, July 2015.

Appendix A:
Hydrology

Existing Condition Drainage Area Map
Proposed Condition Drainage Area Map
NRCS Soil Map
Hydrologic Calculations
HEC-HMS Output

Existing Condition Hydrologic Parameters

Outfall	POI	DA	Area (ac)	Area (mi^2)	CN	TC (min)	T_{lag} (min)	Q_{2yr} (cfs)	Q_{10yr} (cfs)	Q_{100yr} (cfs)
Ditch along SW Jefferson Street	A	A	1.17	0.00183	75.2	4.52	2.71	2.2	5.7	10.8
Curb Inlet on SW 6th Street	B	B	0.16	0.00025	75.5	4.22	2.53	0.3	0.8	1.5
Existing Summit Waves Aquatic Park Storm Sewer	C	C1	0.13	0.00020	77.7	7.64	4.58	0.2	0.6	1.1
		C2	0.38	0.00059	75.3	5.91	3.54	0.7	1.7	3.2
Storm Sewer at Jefferson Street North of Blue Parkway	D	D	1.42	0.00222	75.5	7.20	4.32	2.4	6.1	11.6

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MISSOURI REGISTRATION NUMBER 001512

STATE OF MISSOURI
KEVIN SCOTT GASKEY
NUMBER E 28441
REGISTERED PROFESSIONAL ENGINEER

SUMMIT WAVES WAVE POOL ADDITION LEE'S SUMMIT, MO

EXISTING CONDITION DRAINAGE AREA MAP

Scale: AS SHOWN
Designed by: DHA
Drawn by: DHA
Checked by: CFC
Date: 06/16/2020
Project No. 064538700

SHEET
A.1

File: K:\DAL_Hydro\064538700 – Lee's Summit Wave Pool\DWG\EXH\Drainage Area Map.dwg [Existing] 6/12/2020 9:07am
Xrefs: xAerial x24x36 – h&h xDAM xGrad xBndy xsite xLIDAR xPond Images: EPSG32614_Date20180628_Lat38.905247_Lon-94.375754_Mpp0.597.jpg

Proposed Condition Hydrologic Parameters

Outfall	POI	DA	Area (ac)	Area (mi^2)	CN	TC (min)	T_{lag} (min)	Q_{2yr} (cfs)	Q_{10yr} (cfs)	Q_{100yr} (cfs)
Ditch along SW Jefferson Street	A	A1	0.86	0.00134	75.7	3.97	2.38	1.8	4.3	8.1
		A2	0.07	0.00011	98.0	5.00	3.00	0.3	0.5	0.8
		A3	0.24	0.00038	92.0	5.23	3.14	1.0	1.7	2.7
		A4	0.23	0.00036	98.0	5.35	3.21	1.0	1.7	2.6
		A5	0.32	0.00050	88.3	5.98	3.59	1.1	2.0	3.3
		A6	0.11	0.00017	89.3	5.62	3.37	0.4	0.7	1.1
Curb Inlet on SW 6th Street	B	B	0.13	0.00020	75.8	4.09	2.45	0.3	0.6	1.2
Existing Summit Waves Aquatic Park Storm Sewer	C	C1	0.14	0.00022	87.7	7.49	4.49	0.4	0.8	1.3
		C2	0.05	0.00008	83.6	5.00	3.00	0.2	0.3	0.5
Storm Sewer at SE Blue Parkway	D	D	0.88	0.00138	76.5	7.24	4.35	1.6	3.9	7.3
Sanitary Sewer/Ditch along SW Jefferson Street	-	Pool	0.22	0.00034	98.0	5.19	3.11	1.0	1.6	2.4

LEGEND

- PROPOSED DRAINAGE AREA BOUNDARY
- PROPERTY BOUNDARY
- PROPOSED DETENTION POND
- 1-FT ON-GROUND TOPOGRAPHY (ANDERSON SURVEY COMPANY, 2018)
- 1-FT AERIAL TOPOGRAPHY (MISSOURI LIDAR)
- PROPOSED CONTOURS (KIMLEY-HORN, 2019)

VERTICAL DATUM: NAVD88

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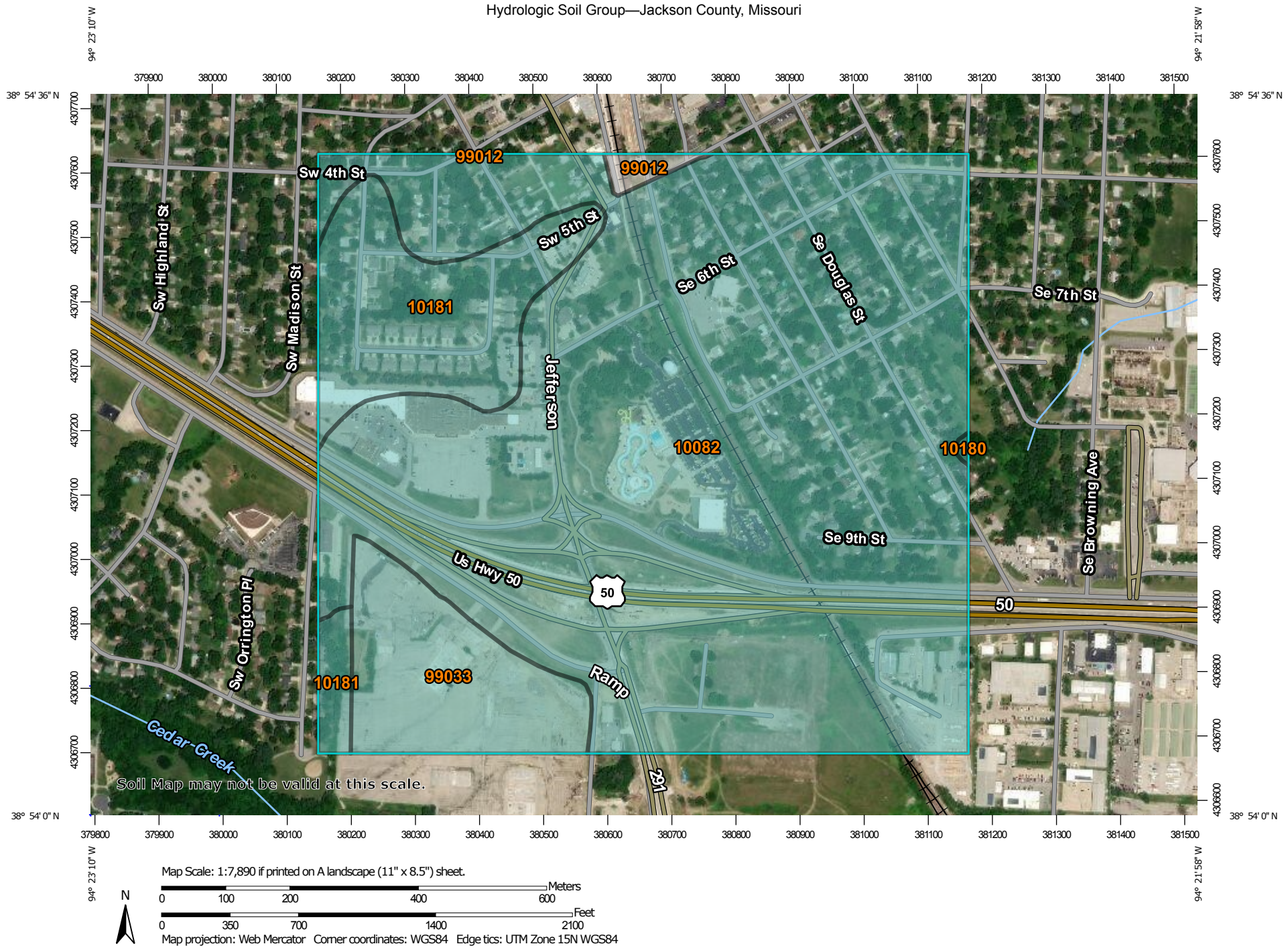
STATE OF MISSOURI
KEVIN SCOTT GASKEY
NUMBER E 28441
PROFESSIONAL ENGINEER

SUMMIT WAVES WAVE POOL ADDITION LEE'S SUMMIT, MO

PROPOSED CONDITION DRAINAGE AREA MAP

Scale:	AS SHOWN
Designed by:	DHA
Drawn by:	DHA
Checked by:	CFC
Date:	06/16/2020
Project No.	064538700

SHEET
A.2



Map Scale: 1:7,890 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 350 700 1400 2100

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 19, Sep 13, 2018

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

Date(s) aerial images were photographed: Jun 11, 2017—Sep 22, 2017

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	186.2	79.4%
10180	Udarents-Urban land-Sampsel complex, 2 to 5 percent slopes	C	0.2	0.1%
10181	Udarents-Urban land-Sampsel complex, 5 to 9 percent slopes	C	27.0	11.5%
99012	Urban land, upland, 5 to 9 percent slopes		1.4	0.6%
99033	Udarents-Urban land complex, 2 to 9 percent slopes	C	19.7	8.4%
Totals for Area of Interest			**234.4**	**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

Existing Condition Hydrologic Parameters										
Outfall	POI	DA	Area (ac)	Area (mi^2)	CN	TC (min)	T_{lag} (min)	Q_{2yr} (cfs)	Q_{10yr} (cfs)	Q_{100yr} (cfs)
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Proposed Condition Hydrologic Parameters										
Outfall	POI	DA	Area (ac)	Area (mi^2)	CN	TC (min)	T_{lag} (min)	Q_{2yr} (cfs)	Q_{10yr} (cfs)	Q_{100yr} (cfs)
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		A2	0.07	0.00011	98.0	5.00	3.00	0.3	0.5	0.8
		A3	0.24	0.00038	92.0	5.23	3.14	1.0	1.7	2.7
		A4	0.23	0.00036	98.0	5.35	3.21	1.0	1.7	2.6
		A5	0.32	0.00050	88.3	5.98	3.59	1.1	2.0	3.3
		A6	0.11	0.00017	89.3	5.62	3.37	0.4	0.7	1.1
Curb Inlet on SW 6th Street	B	B	0.13	0.00020	75.8	4.09	2.45	0.3	0.6	1.2
Existing Summit Waves Aquatic Park Storm Sewer	C	C1	0.14	0.00022	87.7	7.49	4.49	0.4	0.8	1.3
		C2	0.05	0.00008	83.6	5.00	3.00	0.2	0.3	0.5
Storm Sewer at SE Blue Parkway	D	D	0.88	0.00138	76.5	7.24	4.35	1.6	3.9	7.3
Sanitary Sewer/Ditch along SW Jefferson Street	-	Pool	0.22	0.00034	98.0	5.19	3.11	1.0	1.6	2.4

TIME OF CONCENTRATION & LAG TIME
EXISTING
TR-55 Methodology

Basin	SHEET FLOW Tc = (0.007(nL)^0.8)/(P2^0.5)(s^0.4) 2-year/24-hr Rainfall Depth (in.) = 3.71						SHALLOW CONCENTRATED FLOW Tc = L / 60*V							STORM SEWER FLOW Assumed Velocity = 4 ft/s (swale)					TOTAL	
	Length (ft)	$Elev_1$ (ft)	$Elev_2$ (ft)	Slope (ft/ft)	Manning's "n"	T_{c1} (min)	Length (ft)	$Elev_2$ (ft)	$Elev_3$ (ft)	Slope (ft/ft)	Condition TR-55 Fig. 3-1	V_{avg} (ft/s)	T_{c2} (min)	Inlet Time (min)	Travel Length (ft)	Travel Velocity (ft/s)	Travel Time (min)	T_{c3} (min)	T_{cTOTAL} (min)	T_{lag} (min)
A	50	1066.0	1063.0	0.0600	0.150	3.4	137	1063.0	1052.0	0.080	Unpaved	4.57	0.5		156	4.0	0.7	0.7	4.5	2.7
B	50	1063.0	1061.0	0.0400	0.150	4.0	40	1061.0	1060.0	0.025	Unpaved	2.55	0.3						4.2	2.5
C1	50	1061.5	1061.0	0.0100	0.150	6.9	116	1061.0	1058.0	0.026	Unpaved	2.59	0.7						7.6	4.6
C2	50	1066.0	1065.0	0.0200	0.150	5.2	145	1065.0	1058.0	0.048	Unpaved	3.55	0.7						5.9	3.5
D	50	1066.0	1065.0	0.0200	0.150	5.2	342	1065.0	1054.0	0.032	Unpaved	2.89	2.0						7.2	4.3

TIME OF CONCENTRATION & LAG TIME
PROPOSED
TR-55 Methodology

Basin	SHEET FLOW Tc = (0.007(nL)^0.8)/(P2^0.5)(s^0.4) 2-year/24-hr Rainfall Depth (in.) = 3.71						SHALLOW CONCENTRATED FLOW Tc = L / 60*V							STORM SEWER FLOW Assumed Velocity = 4 ft/s (swale) Assumed Velocity = 6 ft/s (storm sewer) Assumed Velocity = 3 ft/s (bioretention)					TOTAL	
	Length (ft)	$Elev_1$ (ft)	$Elev_2$ (ft)	Slope (ft/ft)	Manning's "n"	T_{c1} (min)	Length (ft)	$Elev_2$ (ft)	$Elev_3$ (ft)	Slope (ft/ft)	Condition TR-55 Fig. 3-1	V_{avg} (ft/s)	T_{c2} (min)	Inlet Time (min)	Travel Length (ft)	Travel Velocity (ft/s)	Travel Time (min)	T_{c3} (min)	T_{cTOTAL} (min)	T_{lag} (min)
A1	50	1059.5	1056.0	0.0700	0.150	3.2	44	1056.0	1052.0	0.091	Unpaved	4.86	0.2		156	4.0	0.7	0.7	4.0	2.4
A2														5.0					5.0	3.0
A3														5.0	81	6.0	0.2	5.2	5.2	3.1
A4														5.0	127	6.0	0.4	5.4	5.4	3.2
A5														5.0	176	3.0	1.0	6.0	6.0	3.6
A6														5.0	112	3.0	0.6	5.6	5.6	3.4
B	50	1062.5	1060.5	0.0400	0.150	4.0	20	1060.5	1060.0	0.025	Unpaved	2.55	0.1						4.1	2.5
C1	50	1061.5	1061.0	0.0100	0.150	6.9	116	1061.0	1058.0	0.026	Paved	3.27	0.6						7.5	4.5
C2														5.0					5.0	3.0
D	50	1059.0	1058.0	0.0200	0.150	5.2	248	1058.0	1054.0	0.016	Unpaved	2.05	2.0						7.2	4.3
Pool														5.0	67	6.0	0.2	5.2	5.2	3.1

Existing Condition Curve Number Calculations				
Drainage Area	Surface Description/Soil Type	CN	Area (ac)	Weighed CN
A	Undeveloped Area HSG C	74	1.11	75.2
	Parking lots, roofs, streets/HSG C	98	0.06	
B	Undeveloped Area HSG C	74	0.15	75.5
	Parking lots, roofs, streets/HSG C	98	0.01	
C	Undeveloped Area HSG C	74	0.11	77.7
	Parking lots, roofs, streets/HSG C	98	0.02	
D	Undeveloped Area HSG C	74	0.36	75.3
	Parking lots, roofs, streets/HSG C	98	0.02	

Proposed Condition Curve Number Calculations				
Drainage Area	Surface Description/Soil Type	CN	Area (ac)	Weighed CN
A1	Undeveloped Area HSG C	74	0.80	75.7
	Parking lots, roofs, streets/HSG C	98	0.06	
A2	Undeveloped Area HSG C	74	0.00	98.0
	Parking lots, roofs, streets/HSG C	98	0.07	
A3	Undeveloped Area HSG C	74	0.06	92.0
	Parking lots, roofs, streets/HSG C	98	0.18	
A4	Undeveloped Area HSG C	74	0.00	98.0
	Parking lots, roofs, streets/HSG C	98	0.23	
A5	Undeveloped Area HSG C	74	0.13	88.3
	Parking lots, roofs, streets/HSG C	98	0.19	
A6	Undeveloped Area HSG C	74	0.04	89.3
	Parking lots, roofs, streets/HSG C	98	0.07	
B	Undeveloped Area HSG C	74	0.12	75.8
	Parking lots, roofs, streets/HSG C	98	0.01	
C1	Undeveloped Area HSG C	74	0.07	87.7
	Parking lots, roofs, streets/HSG C	98	0.08	
C2	Undeveloped Area HSG C	74	0.03	83.6
	Parking lots, roofs, streets/HSG C	98	0.02	
D	Undeveloped Area HSG C	74	0.79	76.5
	Parking lots, roofs, streets/HSG C	98	0.09	
Pool	Undeveloped Area HSG C	74	0.00	98.0
	Parking lots, roofs, streets/HSG C	98	0.22	

Water Quality Calculations - Outfall A (Disturbed Area):

A. Predevelopment CN

Land Use	Area	CN	CN*A
Grass	1.27	74	93.98
Pavement	0.01	98	0.98
		$CN_{PreWeighted}$ =	74.2

B. Postdevelopment CN

Land Use	Area	CN	CN*A
Grass	0.32	74	23.68
Pavement	0.75	98	73.5
		$CN_{PostWeighted}$ =	90.8

C. Level of Service (LS) Calculation

$CN_{PreWeighted}$ =	74.2
$CN_{PostWeighted}$ =	90.8
Difference =	16.6
LS Requried (Table 4.2)=	8

D. Proposed BMP Package

DA	Cover/BMP Description	Treatment Area	VR	VR*Area
A1 (Bypass, Disturbed)	None	0.10	0.00	0.00
A2 (Bypass)	None	0.07	0.00	0.00
A3	Hydrodynamic Seperator	0.24	4.00	0.96
A4	StormTech Isolator Row + Hydrodynamic Seperator	0.23	13.00	2.99
A5	StormTech Isolator Row + Hydrodynamic Seperator	0.32	13.00	4.16
A6	StormTech Isolator Row + Hydrodynamic Seperator	0.11	13.00	1.43
			Total =	9.54
			Weighted VR =	8.92
			Required VR =	8.00

E. Water Quality Volume

% Site Impervious	70%
Rv	0.68
WQV (in)	0.93
WQV (ac-ft)	0.08
Release Rate (hr)	40
Q_{WQV} (cfs)	0.03

Water Quality Calculations - Outfall B:

A. Predevelopment CN

Land Use	Area	CN	CN*A
Grass	0.15	74	11.1
Pavement	0.01	98	0.98
		$CN_{PreWeighted}$ =	75.5

B. Postdevelopment CN

Land Use	Area	CN	CN*A
Grass	0.12	74	8.88
Pavement	0.01	98	0.98
		$CN_{PostWeighted}$ =	75.8

C. Level of Service (LS) Calculation

$CN_{PreWeighted}$ =	75.5
$CN_{PostWeighted}$ =	75.8
Difference =	0.3
LS Requried (Table 4.2)=	n/a

Water Quality Calculations - Outfall D:

A. Predevelopment CN

Land Use	Area	CN	CN*A
Grass	1.33	74	98.42
Pavement	0.09	98	8.82
		$CN_{PreWeighted}$ =	75.5

B. Postdevelopment CN

Land Use	Area	CN	CN*A
Grass	0.80	74	59.2
Pavement	0.09	98	8.82
		$CN_{PostWeighted}$ =	76.4

C. Level of Service (LS) Calculation

$CN_{PreWeighted}$ =	75.5
$CN_{PostWeighted}$ =	76.4
Difference =	0.9
LS Requried (Table 4.2)=	n/a

TABLE 4.2
LS for Previously Undeveloped Sites

Change in CN	Impact	LS
17 or greater	High water quality impact	8
7 to 16	Moderate water quality impact	7
4 to 6	Low water quality impact	6
1 to 3	Minimal water quality impact	5

Water Quality Calculations - Outfall C:

A. Predevelopment CN

Land Use	Area	CN	CN*A
Grass	0.47	74	34.78
Pavement	0.04	98	3.92
		$CN_{PreWeighted}$ =	75.9

B. Postdevelopment CN

Land Use	Area	CN	CN*A
Grass	0.09	74	6.66
Pavement	0.10	98	9.8
		$CN_{PostWeighted}$ =	86.6

C. Level of Service (LS) Calculation

$CN_{PreWeighted}$ =	75.9
$CN_{PostWeighted}$ =	86.6
Difference =	10.7
LS Requried (Table 4.2)=	7

Outfall Structure Summary											
			Opening #1			Opening #2			Opening #3			Total
Design Storm	Volume (ac-ft)	Elevation (ft)	Weir	Orifice	Actual	Weir	Orifice	Actual	Weir	Orifice	Actual	Actual
2-year	0.09	1052.50	1.63	0.19	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.19
10-year	0.15	1053.80	3.27	0.25	0.25	1.97	1.17	1.17	0.00	0.00	0.00	1.42
100-year	0.23	1056.00	6.80	0.32	0.32	9.40	2.14	2.14	1.52	0.19	0.19	2.64

Elevation Discharge Summary Table										
Elevation	Opening #1			Opening #2			Opening #3			Total
	Weir	Orifice	Actual	Weir	Orifice	Actual	Weir	Orifice	Actual	Actual
1050.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1050.38	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01
1051.38	0.56	0.13	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.13
1052.38	1.50	0.19	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.19
1053.38	2.70	0.23	0.23	1.03	0.88	0.88	0.00	0.00	0.00	1.11
1054.38	4.12	0.27	0.27	3.56	1.49	1.49	0.17	0.08	0.08	1.84
1055.38	5.72	0.30	0.30	6.95	1.91	1.91	0.90	0.16	0.16	2.37
1056.38	7.50	0.33	0.33	11.02	2.26	2.26	1.95	0.21	0.21	2.80
1057.05	8.77	0.35	0.35	14.08	2.47	2.47	2.80	0.23	0.23	3.05

Stage Storage Summary Table		
Elevation (ft)	Volume (ft3)	Volume (ac-ft)
1050.30	0.00	0.000
1050.38	89.17	0.002
1051.38	1514.03	0.035
1052.38	3606.70	0.083
1053.38	5603.83	0.129
1054.38	7451.36	0.171

Detention Outfall Calculations

g (ft^2/s) = 32.2

$C_{Orifice}$ = 0.6

C_{weir} = 3

Opening #1

Shape = Rectangular

Height (ft)= 0.17 = 2.00 inches

Length (ft) = 0.17 = 2.00 inches

Area (ft)= 0.028

Centroid (ft) = 1050.38

Invert Elevation (ft) = 1050.30

Top of Pipe Elevation (ft) = 1050.47

Opening #2

Shape = Rectangular

Height (ft)= 0.50 = 6.0 inches

Length (ft) = 0.50 = 6.0 inches

Area (ft^2)= 0.250

Centroid (ft) = 1052.85

Invert Elevation (ft) = 1052.60

Top of Pipe Elevation (ft) = 1053.10

Opening #3

Shape = Rectangular

Height (ft)= 0.17 = 2.0 inches

Length (ft) = 0.17 = 2.0 inches

Area (ft)= 0.03

Centroid (ft) = 1053.98

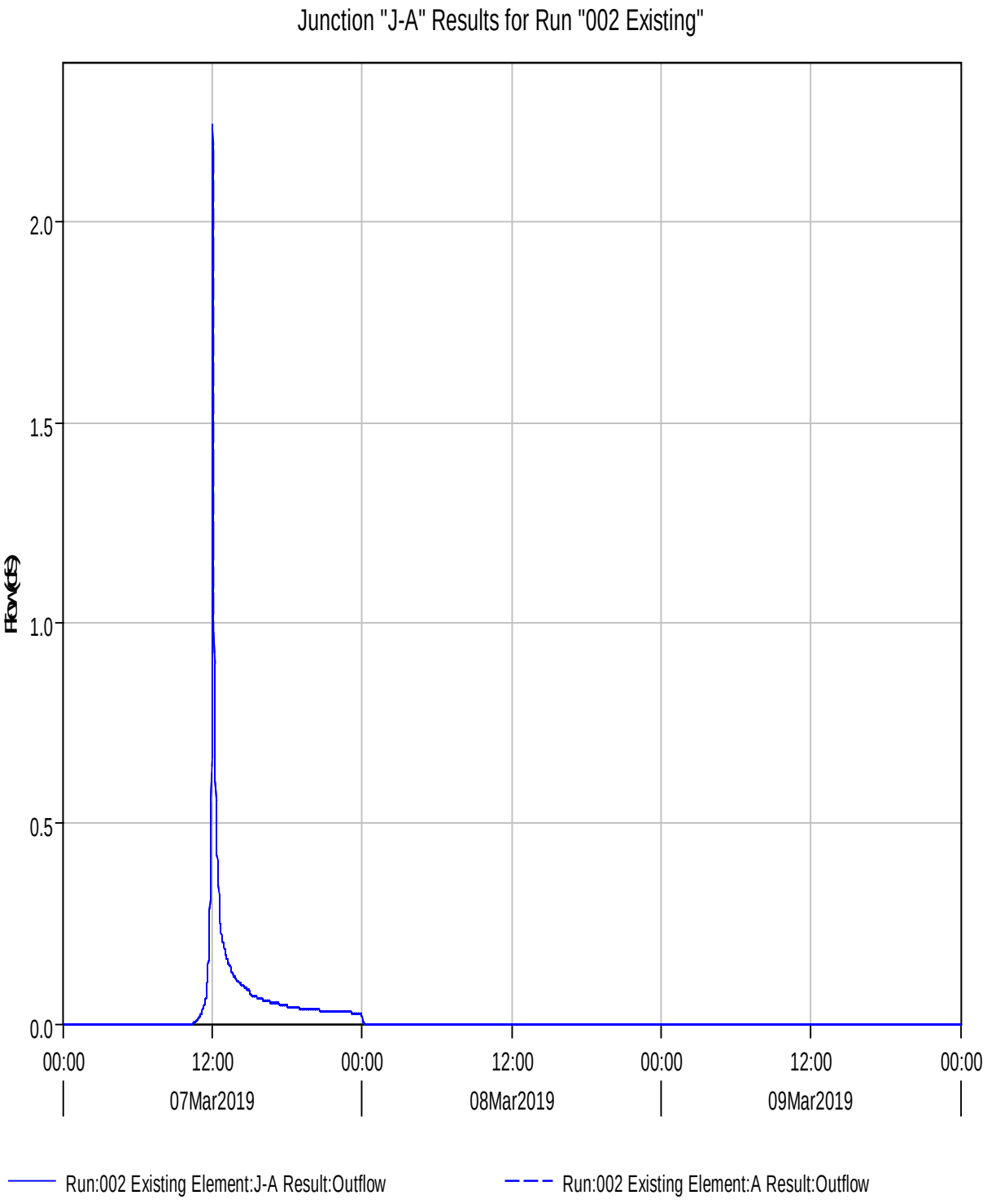
Invert Elevation (ft) = 1053.90

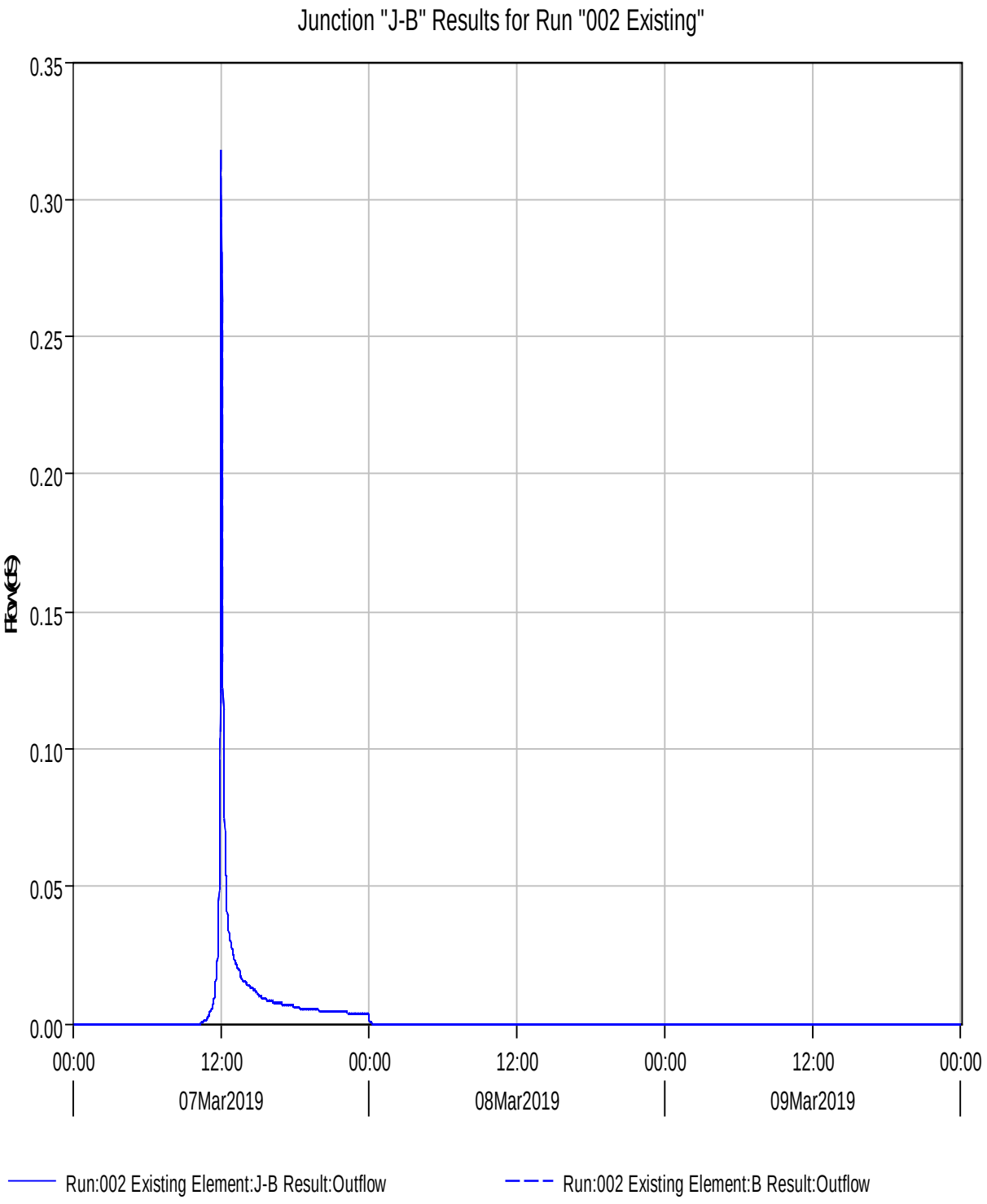
Top of Pipe Elevation (ft) = 1054.07

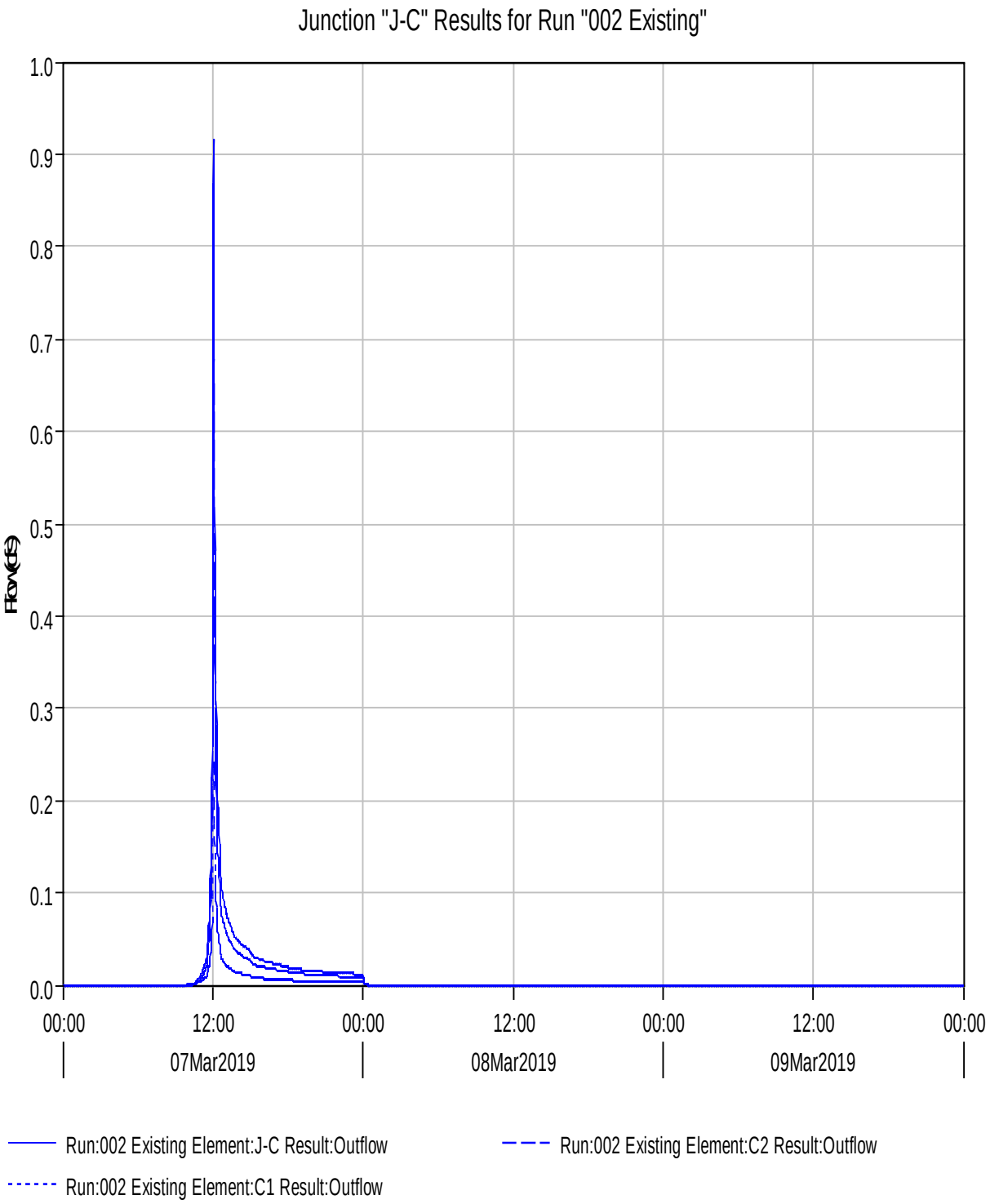
Project: Lee's Summit Simulation Run: 002 Existing

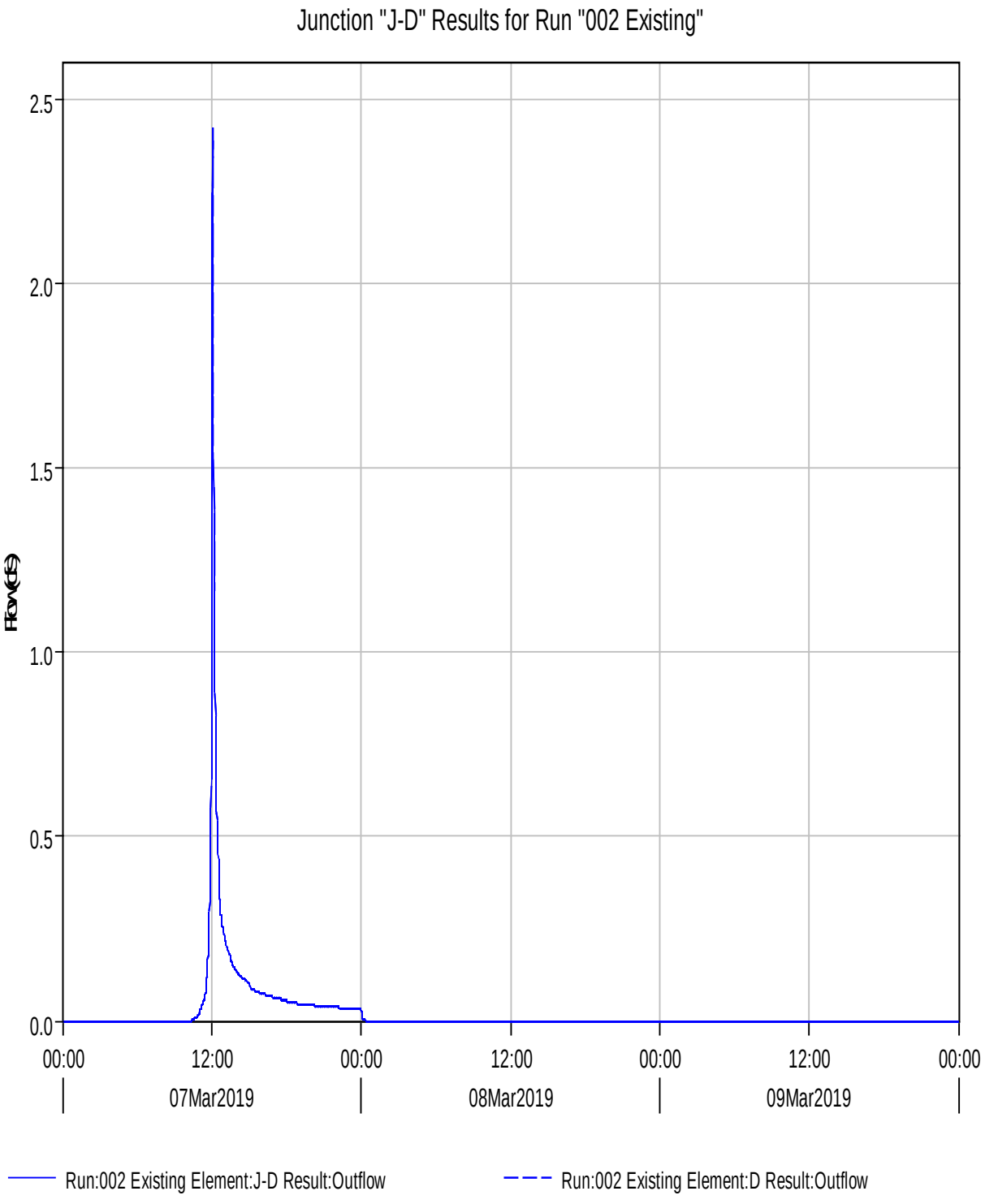
Start of Run: 07Mar2019, 00:00 Basin Model: Existing
End of Run: 10Mar2019, 00:00 Meteorologic Model: 002-Year
Compute Time: 22May2019, 16:43:09 Control Specifications: 72-Hour

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
A	0.00183	2.24	07Mar2019, 12:04	0.11
B	0.00025	0.32	07Mar2019, 12:04	0.02
C1	0.00020	0.24	07Mar2019, 12:06	0.01
C2	0.00059	0.68	07Mar2019, 12:05	0.04
D	0.00222	2.42	07Mar2019, 12:06	0.14
J-A	0.00183	2.24	07Mar2019, 12:04	0.11
J-B	0.00025	0.32	07Mar2019, 12:04	0.02
J-C	0.00079	0.92	07Mar2019, 12:05	0.05
J-D	0.00222	2.42	07Mar2019, 12:06	0.14


Junction "J-A" Results for Run "002 Existing"
2.0
1.5
1.0
0.5
0.0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:002 Existing Element:J-A Result:Outflow
Run:002 Existing Element:A Result:Outflow


Junction "J-B" Results for Run "002 Existing"
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:002 Existing Element:J-B Result:Outflow
Run:002 Existing Element:B Result:Outflow

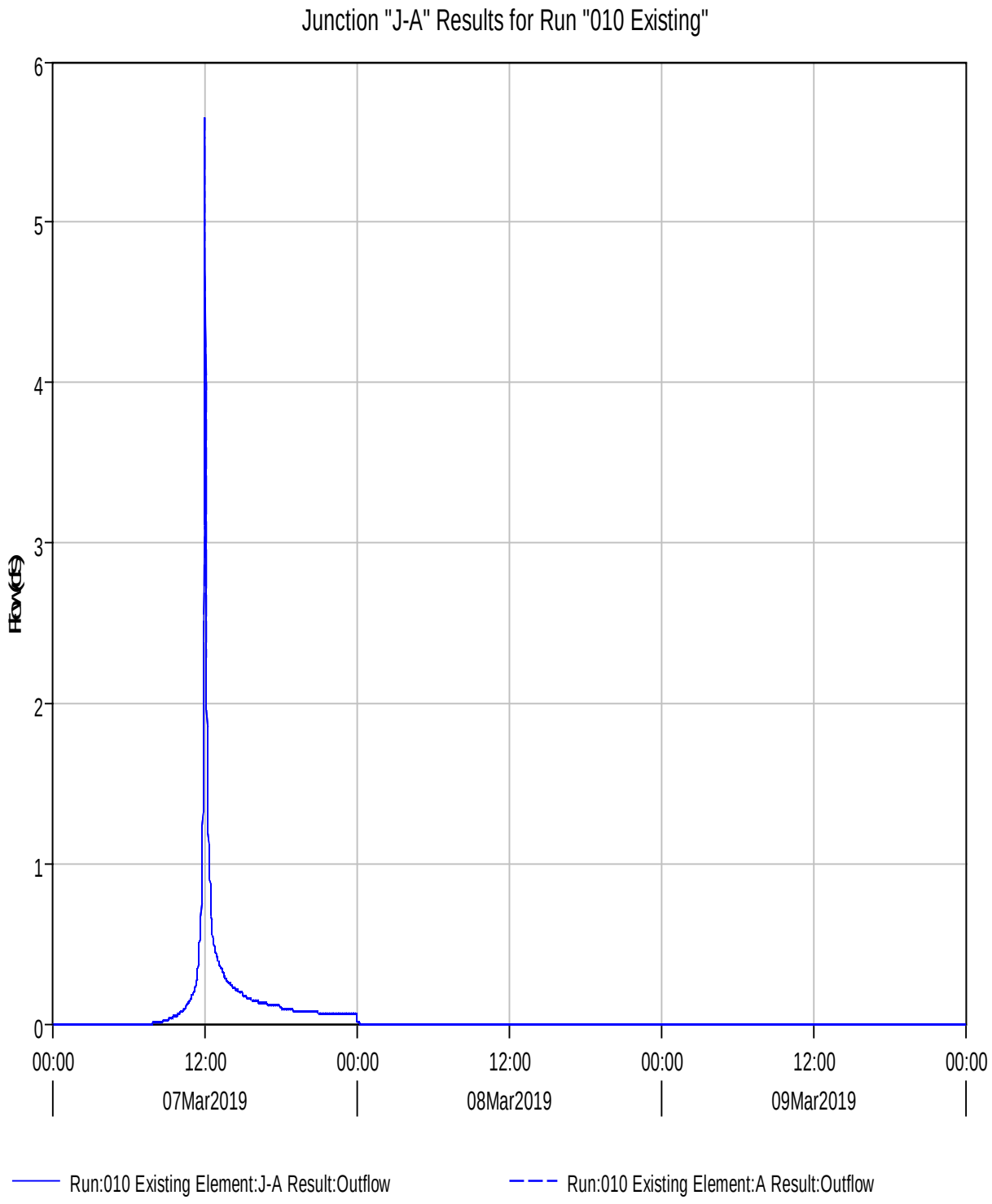

Junction "J-C" Results for Run "002 Existing"
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Flow(cfs)
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:002 Existing Element:J-C Result:Outflow
Run:002 Existing Element:C2 Result:Outflow
Run:002 Existing Element:C1 Result:Outflow

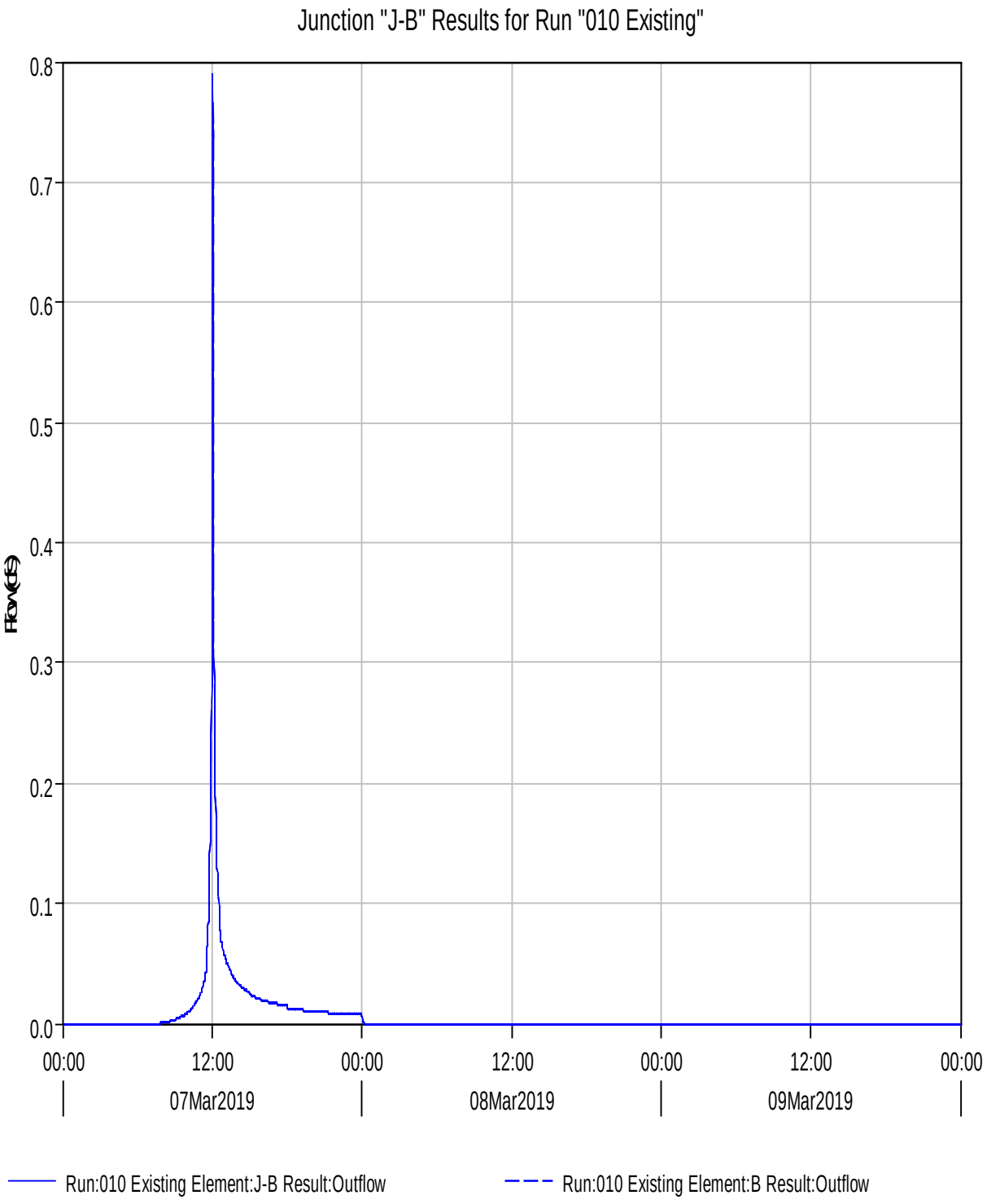

Junction "J-D" Results for Run "002 Existing"
2.5
2.0
1.5
1.0
0.5
0.0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:002 Existing Element:J-D Result:Outflow
Run:002 Existing Element:D Result:Outflow

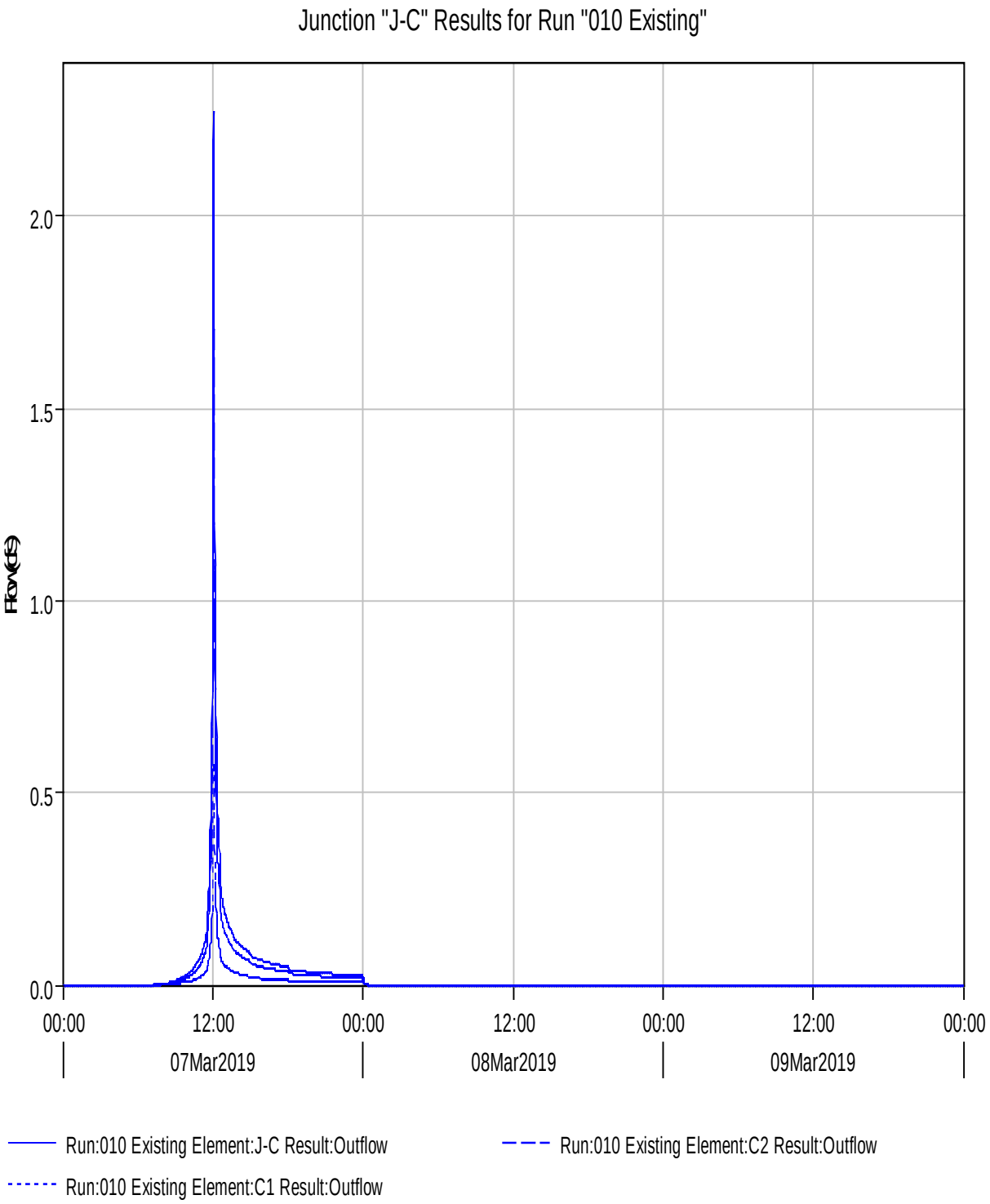
Project: Lee's Summit Simulation Run: 010 Existing

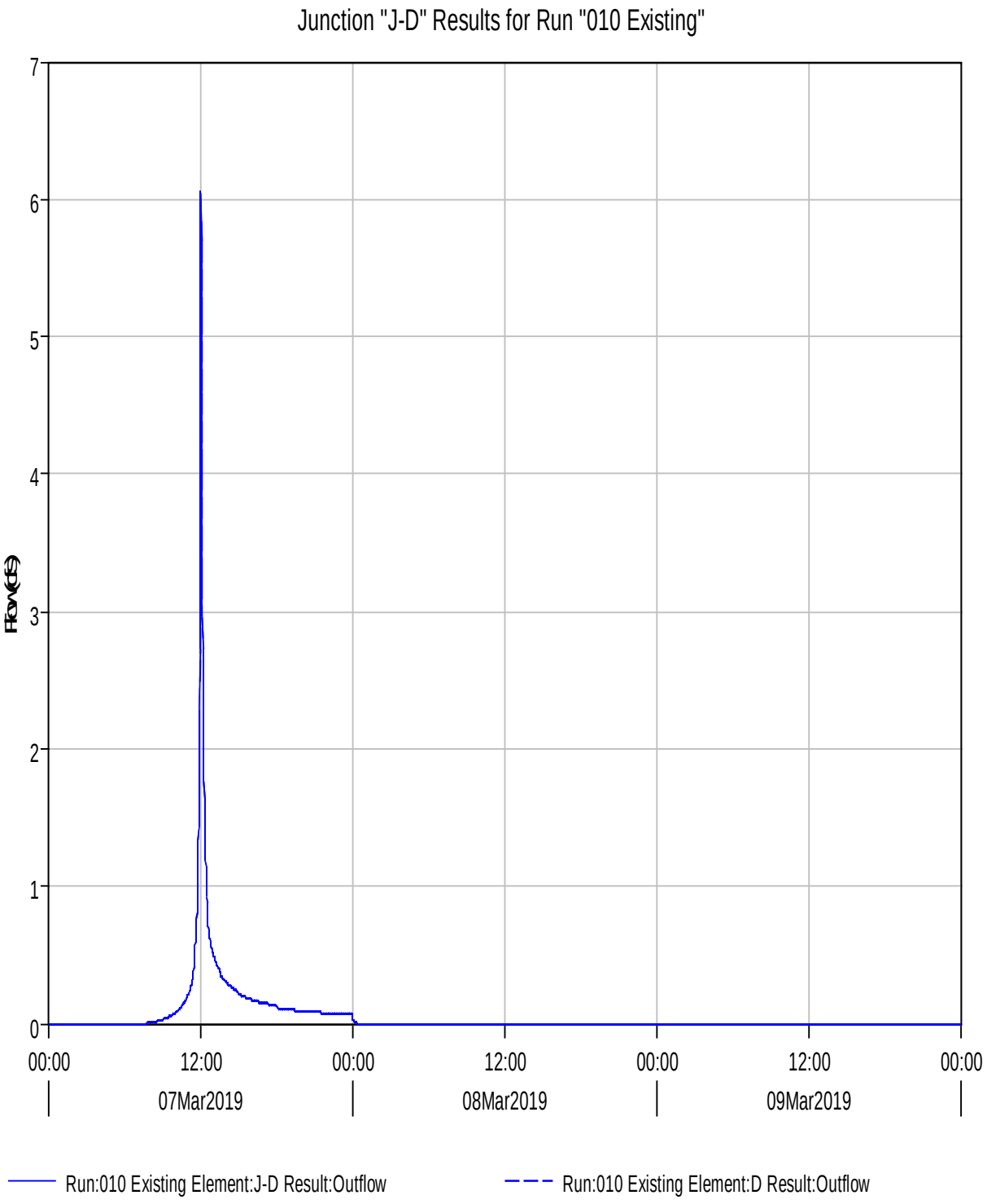
Start of Run: 07Mar2019, 00:00 Basin Model: Existing
End of Run: 10Mar2019, 00:00 Meteorologic Model: 010-Year
Compute Time: 22May2019, 16:43:12 Control Specifications: 72-Hour

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
A	0.00183	5.65	07Mar2019, 12:04	0.29
B	0.00025	0.79	07Mar2019, 12:04	0.04
C1	0.00020	0.57	07Mar2019, 12:06	0.03
C2	0.00059	1.71	07Mar2019, 12:05	0.09
D	0.00222	6.05	07Mar2019, 12:05	0.36
J-A	0.00183	5.65	07Mar2019, 12:04	0.29
J-B	0.00025	0.79	07Mar2019, 12:04	0.04
J-C	0.00079	2.27	07Mar2019, 12:05	0.13
J-D	0.00222	6.05	07Mar2019, 12:05	0.36


Junction "J-A" Results for Run "010 Existing"
6
5
4
3
2
1
0
Flow (CFS)
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:010 Existing Element:J-A Result:Outflow
Run:010 Existing Element:A Result:Outflow


Junction "J-B" Results for Run "010 Existing"
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:010 Existing Element:J-B Result:Outflow
Run:010 Existing Element:B Result:Outflow

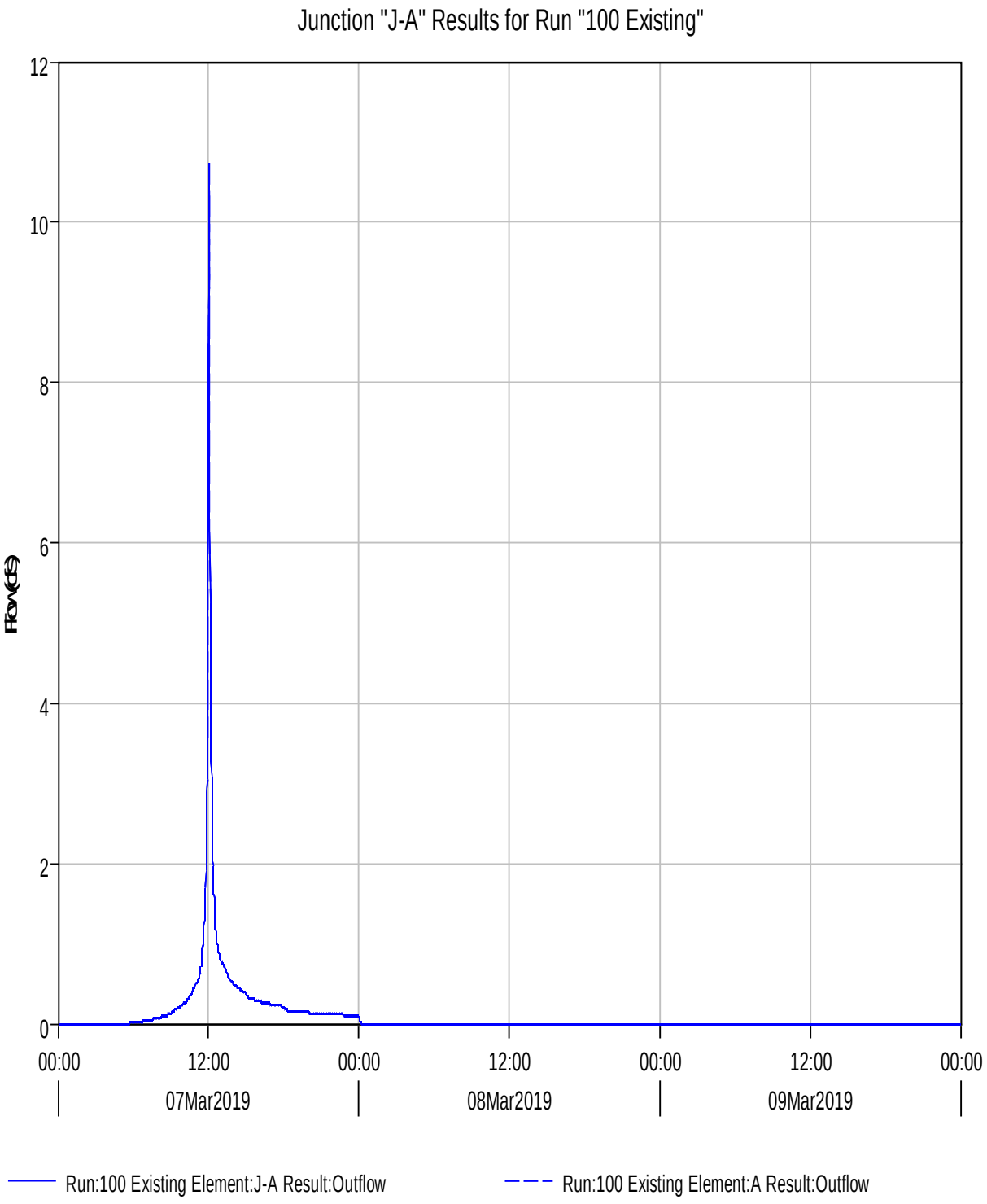

Junction "J-C" Results for Run "010 Existing"
2.0
1.5
1.0
0.5
0.0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:010 Existing Element:J-C Result:Outflow
Run:010 Existing Element:C2 Result:Outflow
Run:010 Existing Element:C1 Result:Outflow

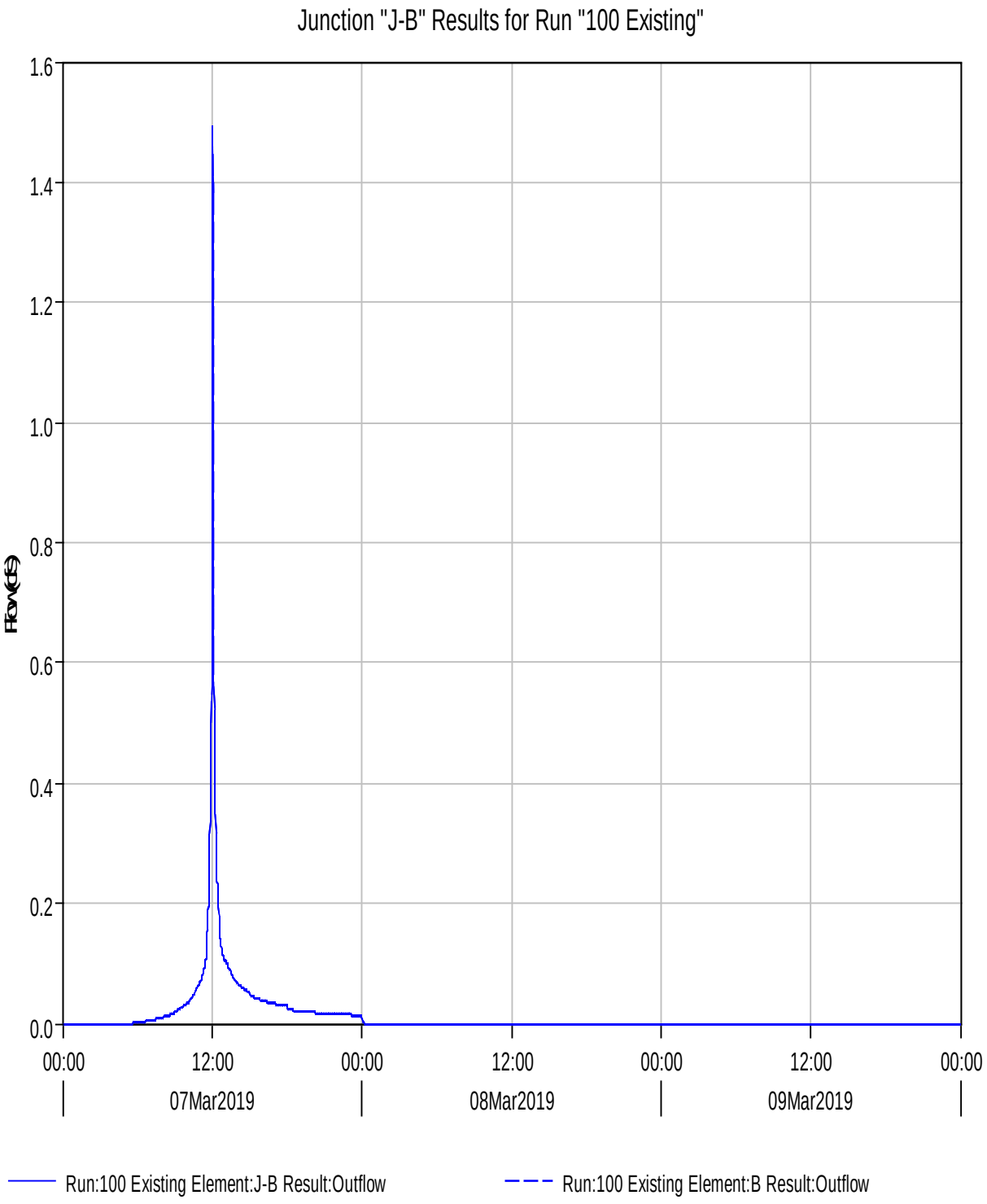

Junction "J-D" Results for Run "010 Existing"
7
6
5
4
3
2
1
0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:010 Existing Element:J-D Result:Outflow
Run:010 Existing Element:D Result:Outflow

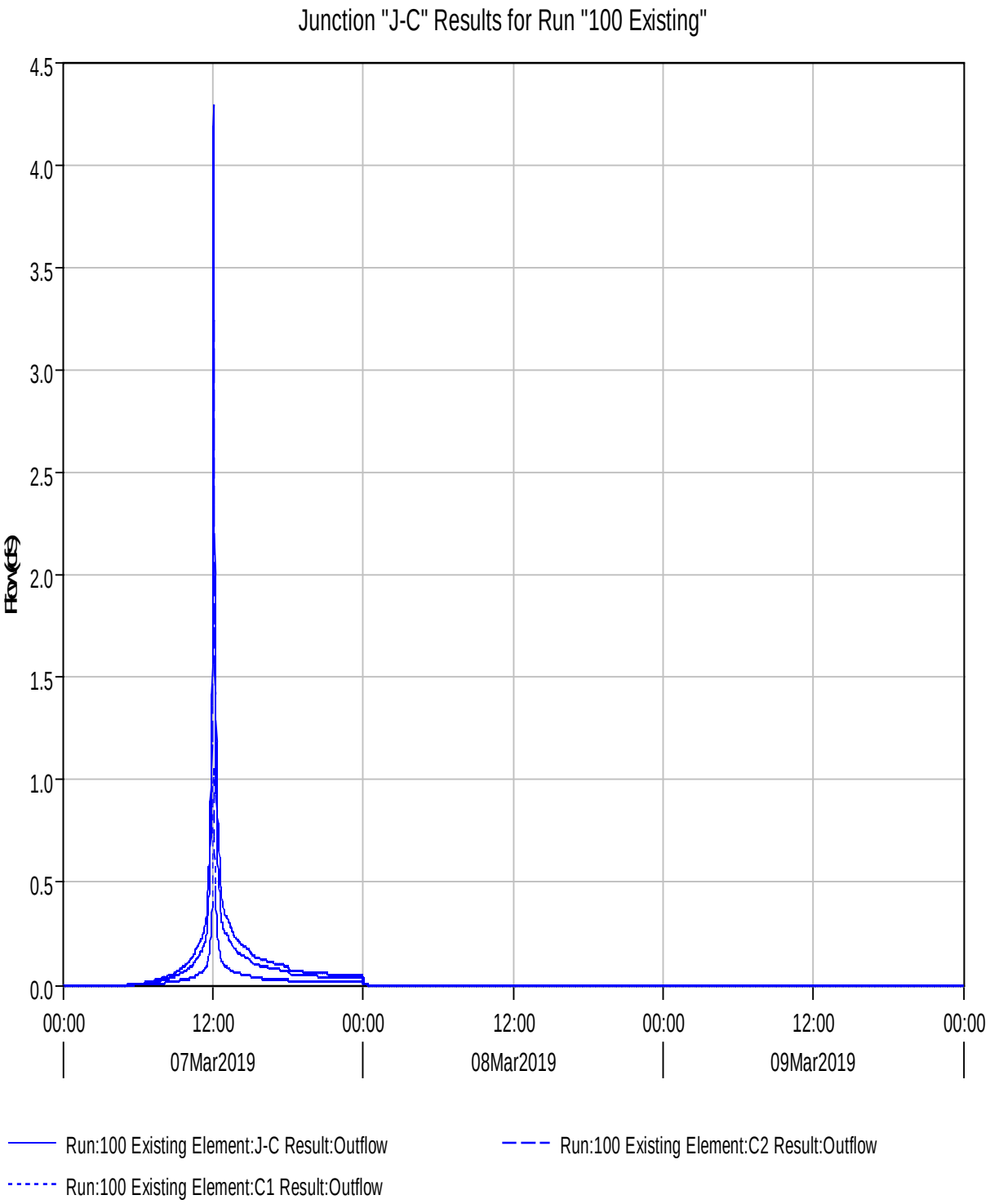
Project: Lee's Summit Simulation Run: 100 Existing

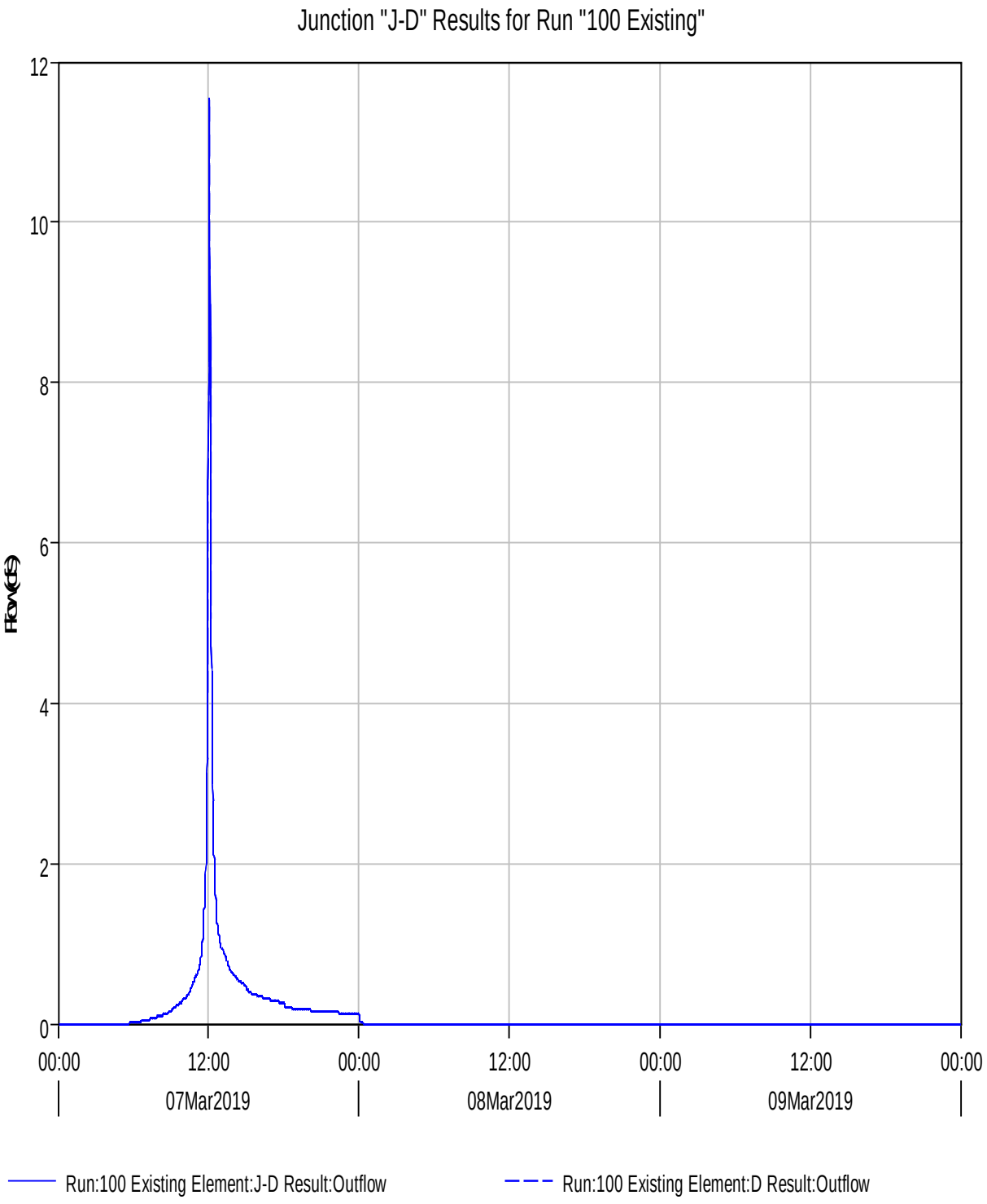
Start of Run: 07Mar2019, 00:00 Basin Model: Existing
End of Run: 10Mar2019, 00:00 Meteorologic Model: 100-Year
Compute Time: 22May2019, 16:43:16 Control Specifications: 72-Hour

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
A	0.00183	10.75	07Mar2019, 12:04	0.60
B	0.00025	1.49	07Mar2019, 12:04	0.08
C1	0.00020	1.06	07Mar2019, 12:06	0.07
C2	0.00059	3.24	07Mar2019, 12:05	0.20
D	0.00222	11.57	07Mar2019, 12:05	0.74
J-A	0.00183	10.75	07Mar2019, 12:04	0.60
J-B	0.00025	1.49	07Mar2019, 12:04	0.08
J-C	0.00079	4.30	07Mar2019, 12:05	0.26
J-D	0.00222	11.57	07Mar2019, 12:05	0.74


Junction "J-A" Results for Run "100 Existing"
12
10
8
6
4
2
0
Flow (CFS)
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:100 Existing Element:J-A Result:Outflow
Run:100 Existing Element:A Result:Outflow


Junction "J-B" Results for Run "100 Existing"
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:100 Existing Element:J-B Result:Outflow
Run:100 Existing Element:B Result:Outflow

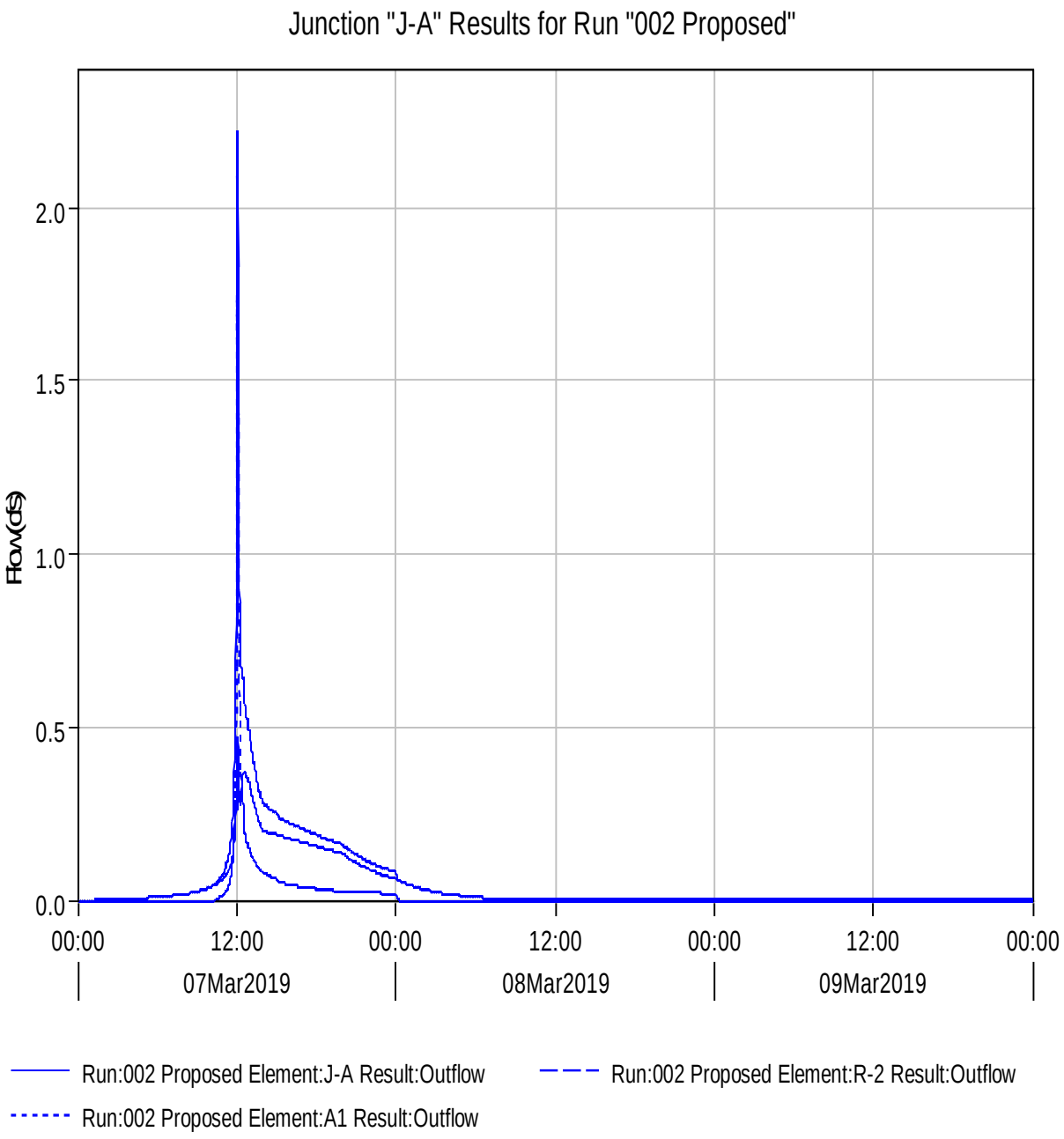

Junction "J-C" Results for Run "100 Existing"
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:100 Existing Element:J-C Result:Outflow
Run:100 Existing Element:C2 Result:Outflow
Run:100 Existing Element:C1 Result:Outflow

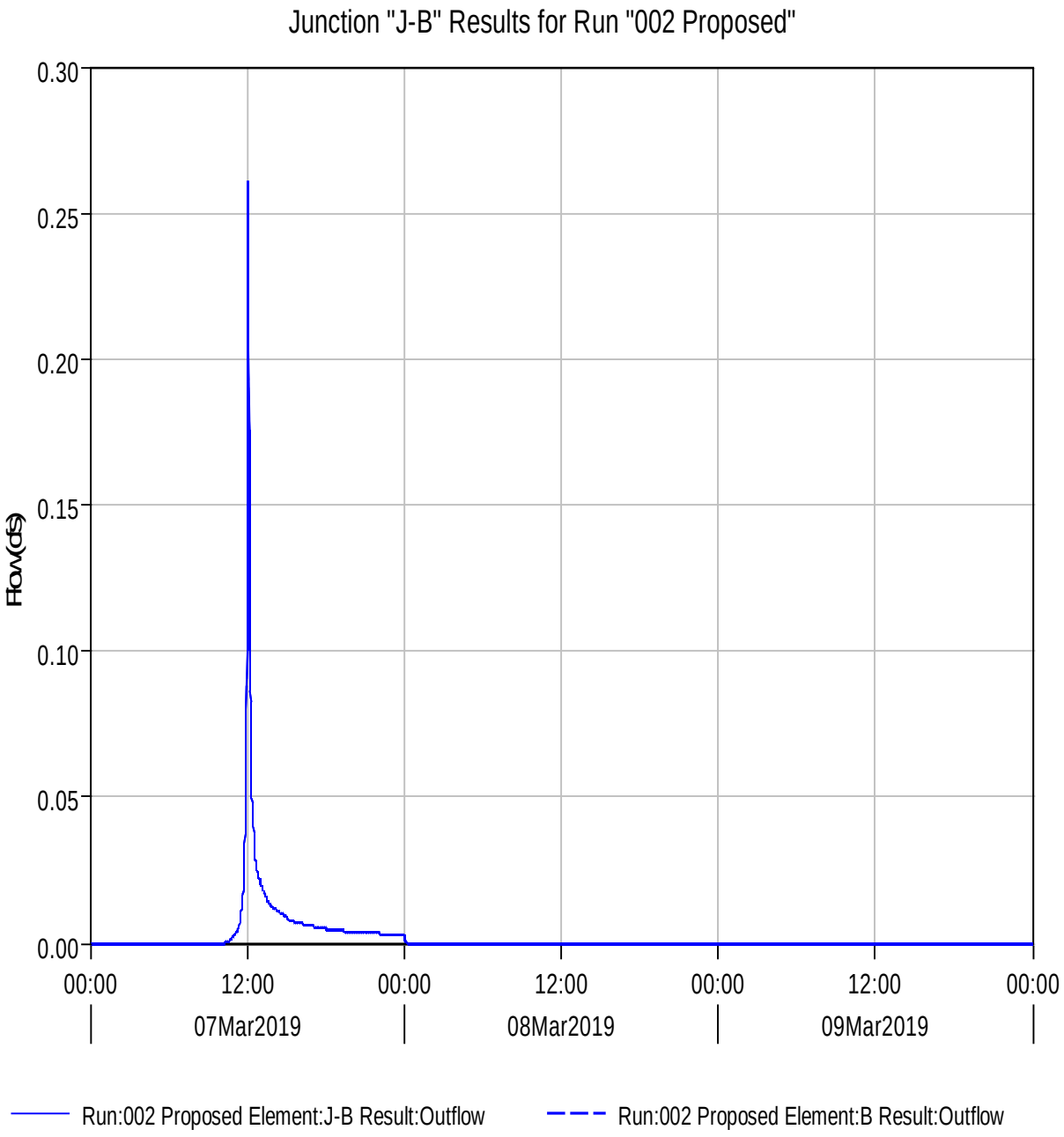

Junction "J-D" Results for Run "100 Existing"
12
10
8
6
4
2
0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:100 Existing Element:J-D Result:Outflow
Run:100 Existing Element:D Result:Outflow

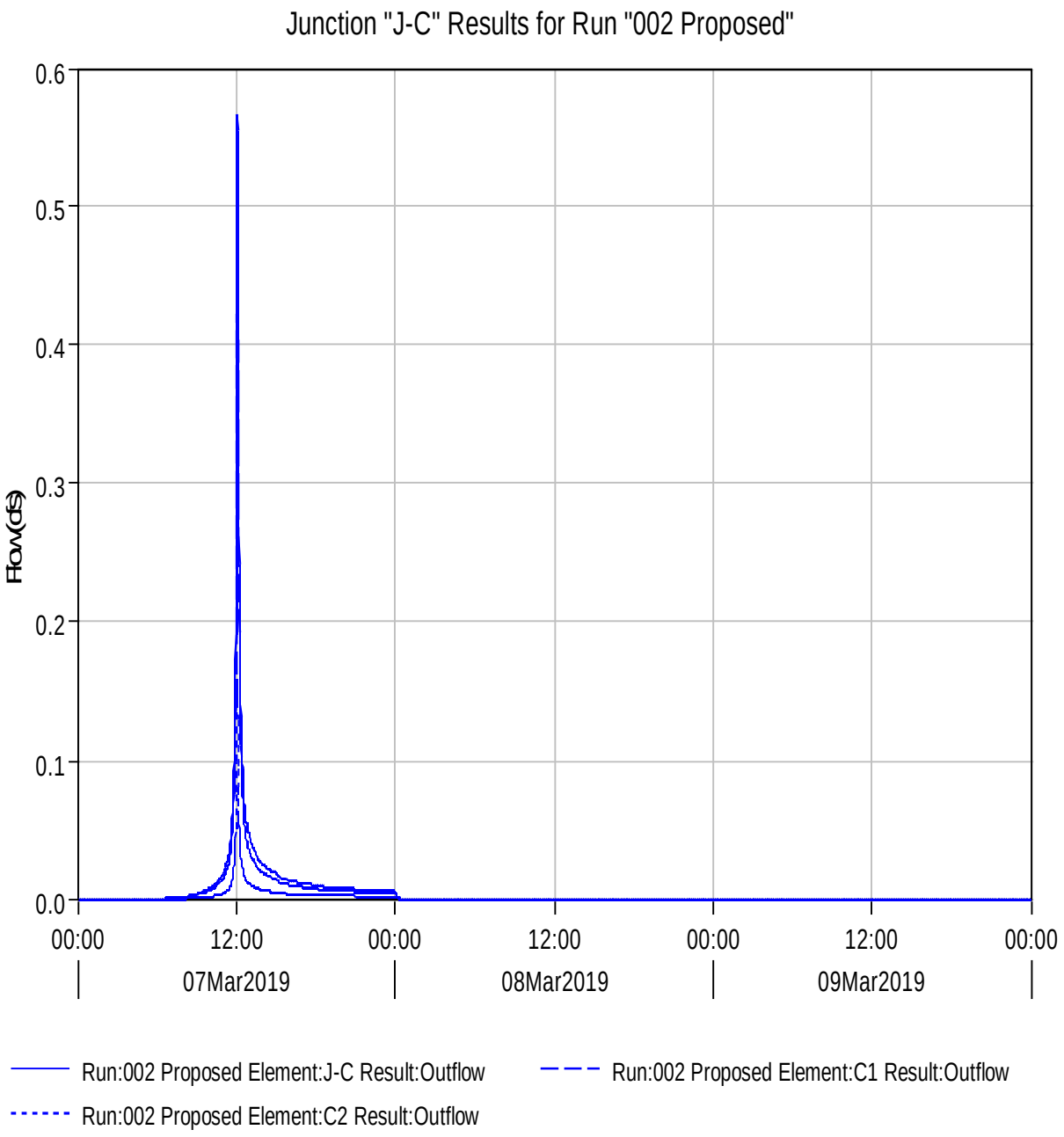
Project: Lee's Summit Simulation Run: 002 Proposed

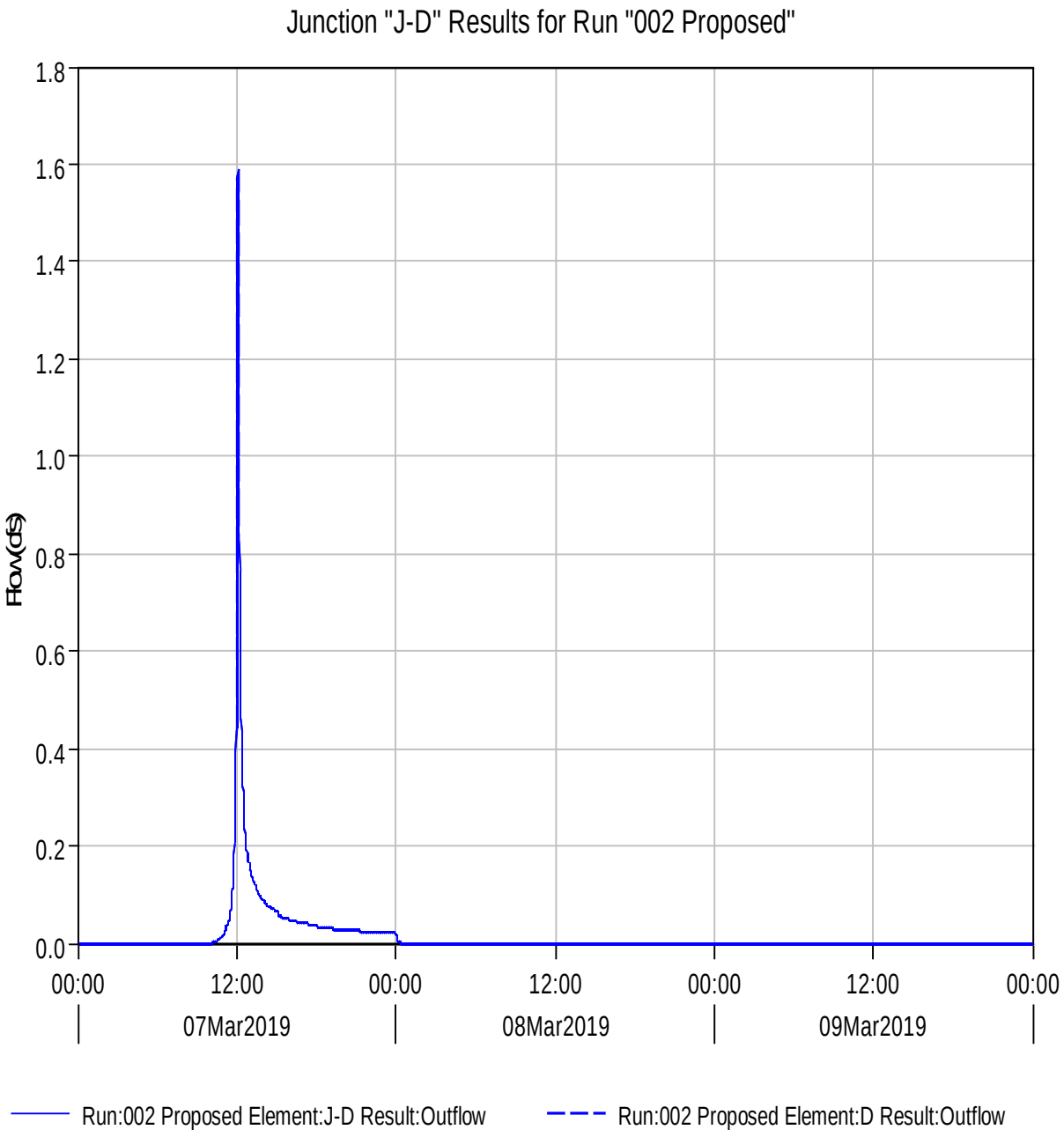
Start of Run: 07Mar2019, 00:00 Basin Model: Proposed
End of Run: 10Mar2019, 00:00 Meteorologic Model: 002-Year
Compute Time: 12Jun2020, 07:53:34 Control Specifications: 72-Hour

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
A1	0.00134	1.7	07Mar2019, 12:04	0.08
A2	0.00011	0.3	07Mar2019, 12:04	0.02
A3	0.00038	0.9	07Mar2019, 12:04	0.05
A4	0.00036	1.0	07Mar2019, 12:04	0.06
A5	0.00050	1.1	07Mar2019, 12:05	0.06
A6	0.00017	0.4	07Mar2019, 12:05	0.02
B	0.00020	0.3	07Mar2019, 12:04	0.01
C1	0.00022	0.4	07Mar2019, 12:06	0.02
C2	0.00008	0.1	07Mar2019, 12:04	0.01
D	0.00138	1.6	07Mar2019, 12:06	0.09
Detention	0.00141	0.3	07Mar2019, 12:37	0.18
J-A	0.00286	2.2	07Mar2019, 12:04	0.28
J-A1	0.00034	1.0	07Mar2019, 12:04	0.05
J-B	0.00020	0.3	07Mar2019, 12:04	0.01
J-C	0.00030	0.6	07Mar2019, 12:05	0.03
J-D	0.00138	1.6	07Mar2019, 12:06	0.09
J-1	0.00141	0.3	07Mar2019, 12:37	0.18
J-2	0.00152	0.5	07Mar2019, 12:04	0.20
Pool	0.00034	1.0	07Mar2019, 12:04	0.05
R-1	0.00141	0.3	07Mar2019, 12:37	0.18
R-2	0.00152	0.5	07Mar2019, 12:04	0.20


Junction "J-A" Results for Run "002 Proposed"
Flow(cfs)
2.0
1.5
1.0
0.5
0.0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:002 Proposed Element:J-A Result:Outflow
Run:002 Proposed Element:R-2 Result:Outflow
Run:002 Proposed Element:A1 Result:Outflow


Junction "J-B" Results for Run "002 Proposed"
Flow(cfs)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:002 Proposed Element:J-B Result:Outflow
Run:002 Proposed Element:B Result:Outflow

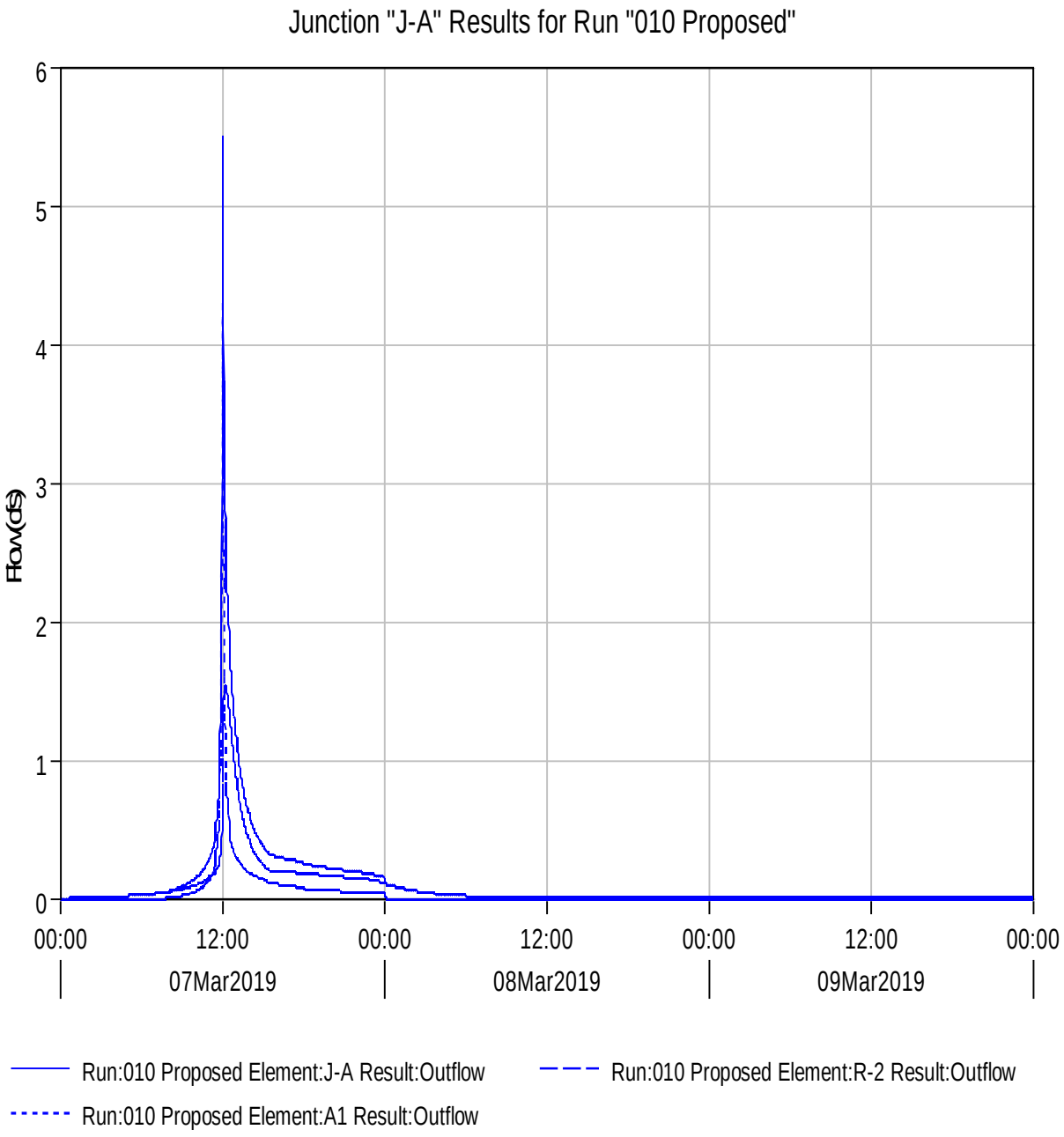

Junction "J-C" Results for Run "002 Proposed"
Flow(cfs)
0.6
0.5
0.4
0.3
0.2
0.1
0.0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:002 Proposed Element:J-C Result:Outflow
Run:002 Proposed Element:C1 Result:Outflow
Run:002 Proposed Element:C2 Result:Outflow

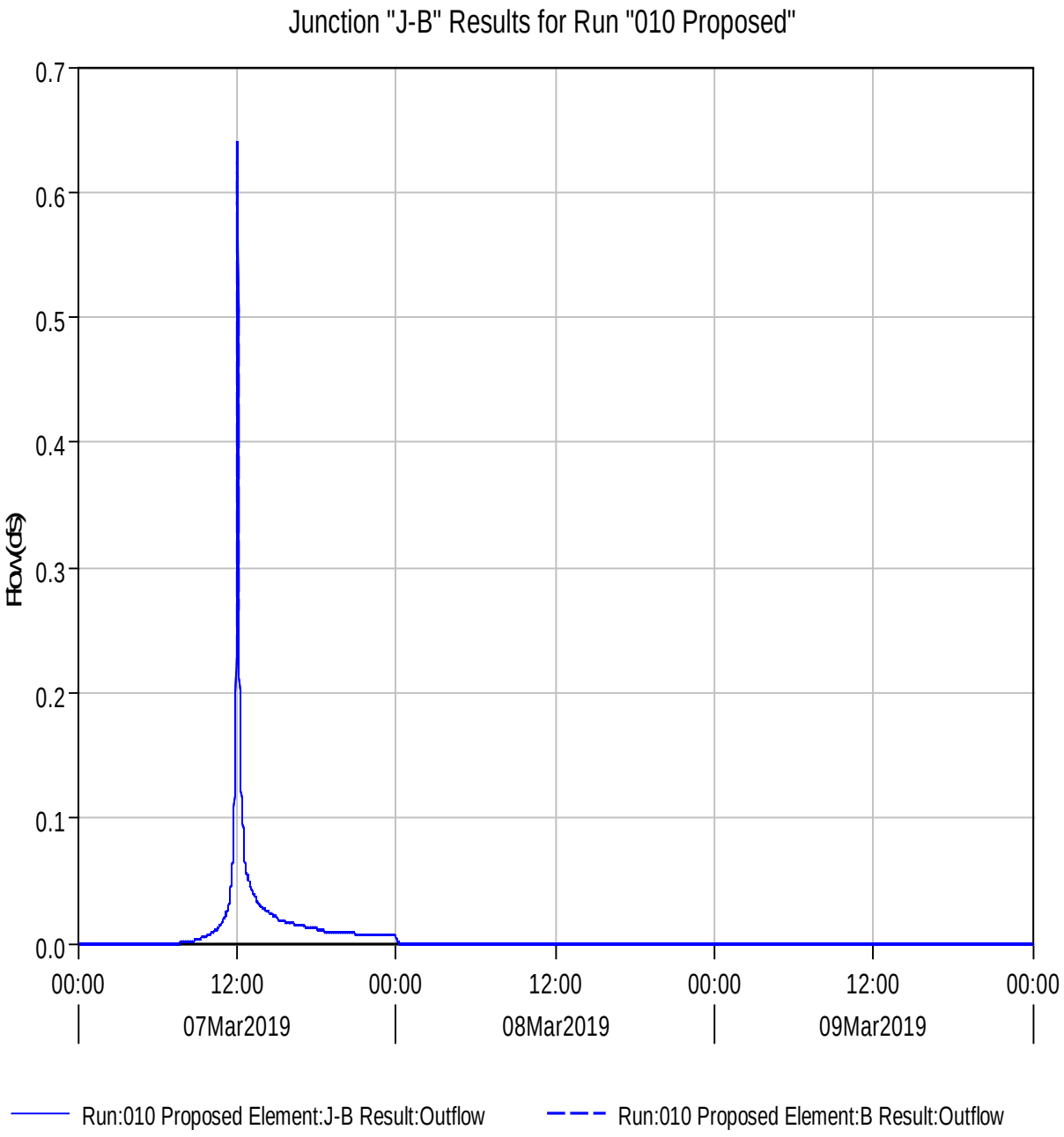

Junction "J-D" Results for Run "002 Proposed"
Flow(cfs)
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:002 Proposed Element:J-D Result:Outflow
Run:002 Proposed Element:D Result:Outflow

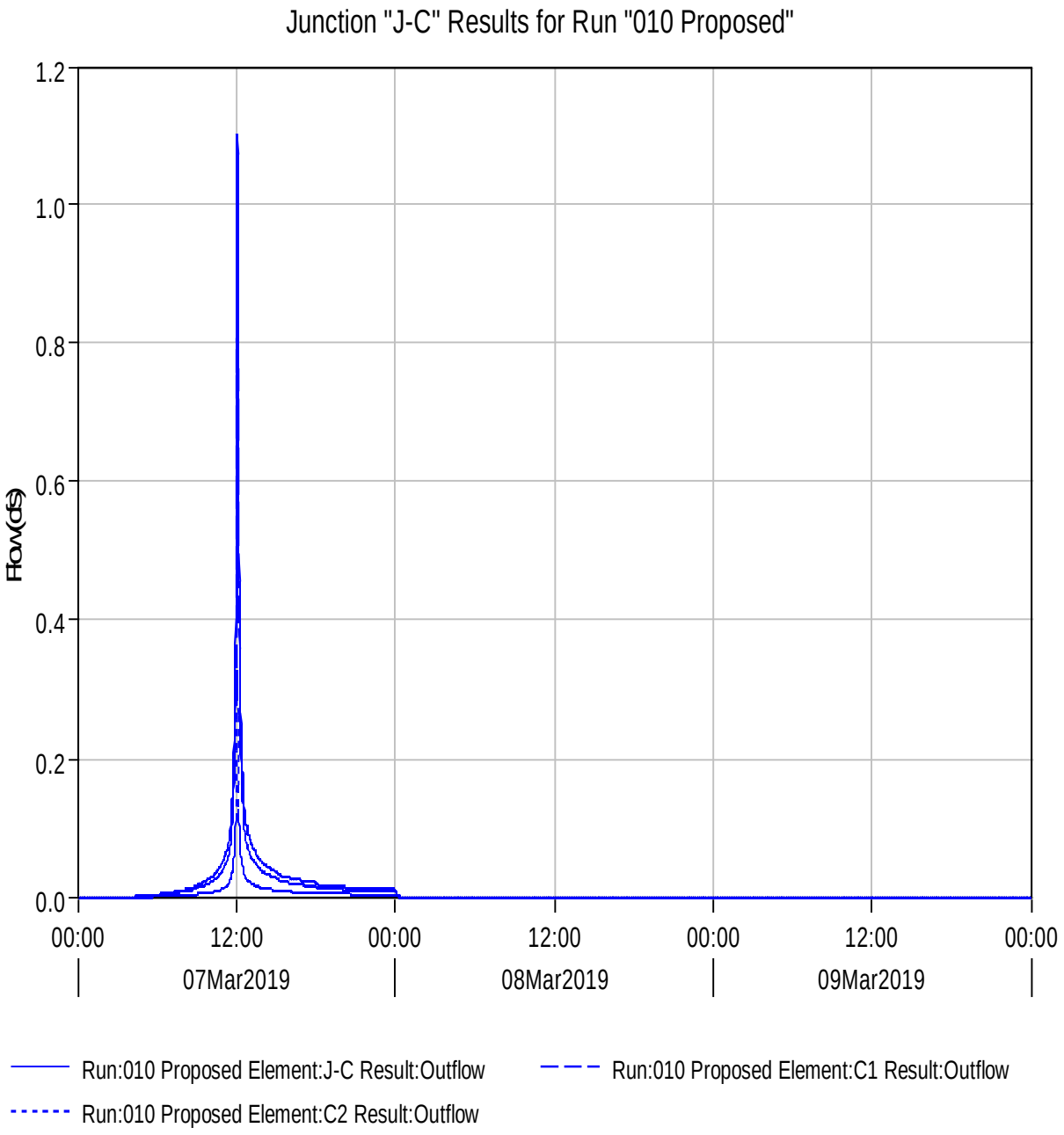
Project: Lee's Summit Simulation Run: 010 Proposed

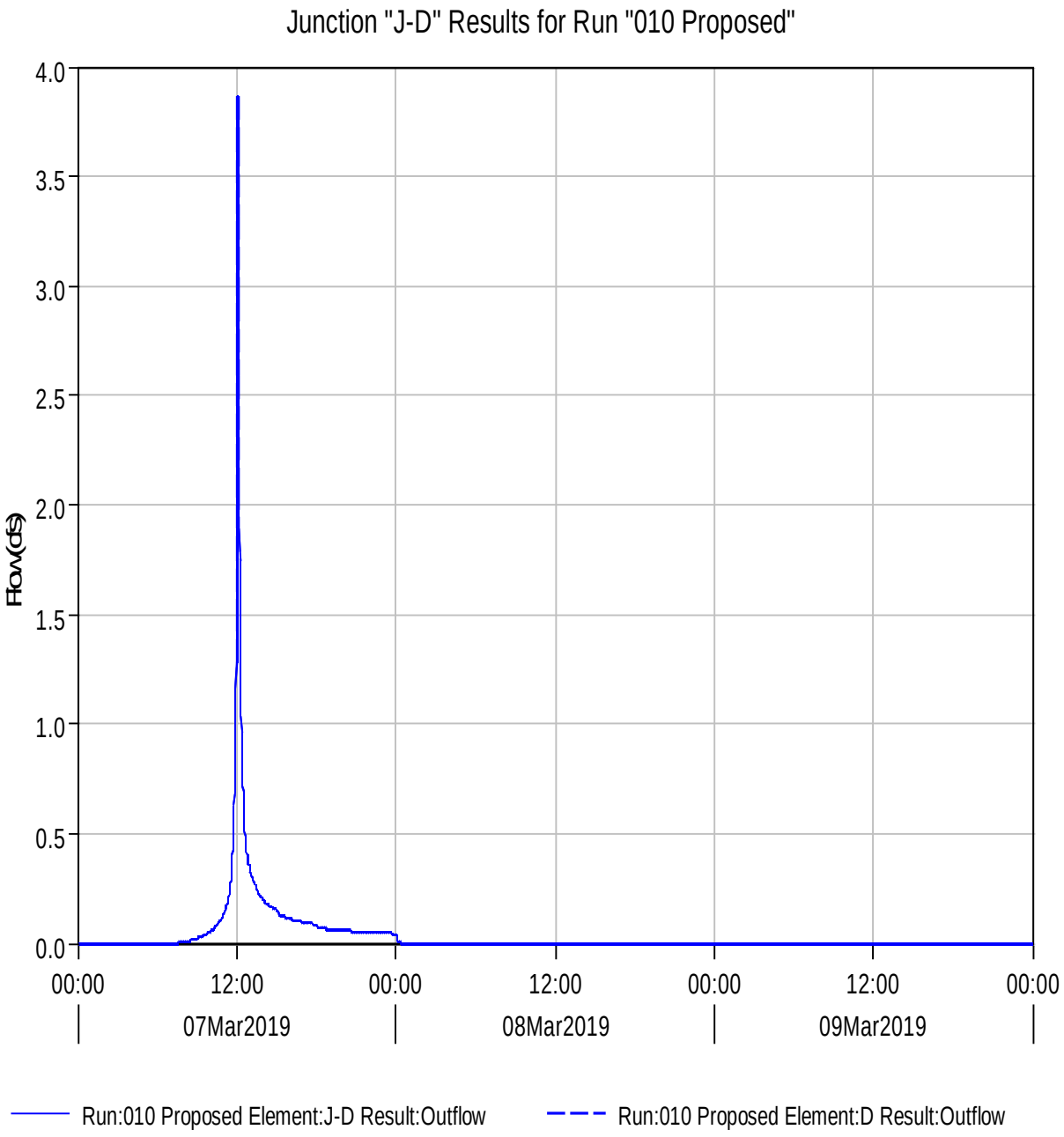
Start of Run: 07Mar2019, 00:00 Basin Model: Proposed
End of Run: 10Mar2019, 00:00 Meteorologic Model: 010-Year
Compute Time: 12Jun2020, 07:56:22 Control Specifications: 72-Hour

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
A1	0.00134	4.3	07Mar2019, 12:04	0.22
A2	0.00011	0.5	07Mar2019, 12:04	0.03
A3	0.00038	1.7	07Mar2019, 12:04	0.10
A4	0.00036	1.7	07Mar2019, 12:04	0.10
A5	0.00050	2.0	07Mar2019, 12:05	0.11
A6	0.00017	0.7	07Mar2019, 12:04	0.04
B	0.00020	0.6	07Mar2019, 12:04	0.03
C1	0.00022	0.8	07Mar2019, 12:05	0.05
C2	0.00008	0.3	07Mar2019, 12:04	0.02
D	0.00138	3.9	07Mar2019, 12:05	0.23
Detention	0.00141	1.4	07Mar2019, 12:19	0.35
J-A	0.00286	5.5	07Mar2019, 12:04	0.60
J-A1	0.00034	1.6	07Mar2019, 12:04	0.10
J-B	0.00020	0.6	07Mar2019, 12:04	0.03
J-C	0.00030	1.1	07Mar2019, 12:05	0.07
J-D	0.00138	3.9	07Mar2019, 12:05	0.23
J-1	0.00141	1.4	07Mar2019, 12:19	0.35
J-2	0.00152	1.5	07Mar2019, 12:16	0.38
Pool	0.00034	1.6	07Mar2019, 12:04	0.10
R-1	0.00141	1.4	07Mar2019, 12:19	0.35
R-2	0.00152	1.5	07Mar2019, 12:16	0.38


Junction "J-A" Results for Run "010 Proposed"
Flow(cfs)
6
5
4
3
2
1
0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:010 Proposed Element:J-A Result:Outflow
Run:010 Proposed Element:R-2 Result:Outflow
Run:010 Proposed Element:A1 Result:Outflow


Junction "J-B" Results for Run "010 Proposed"
Flow(cfs)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:010 Proposed Element:J-B Result:Outflow
Run:010 Proposed Element:B Result:Outflow

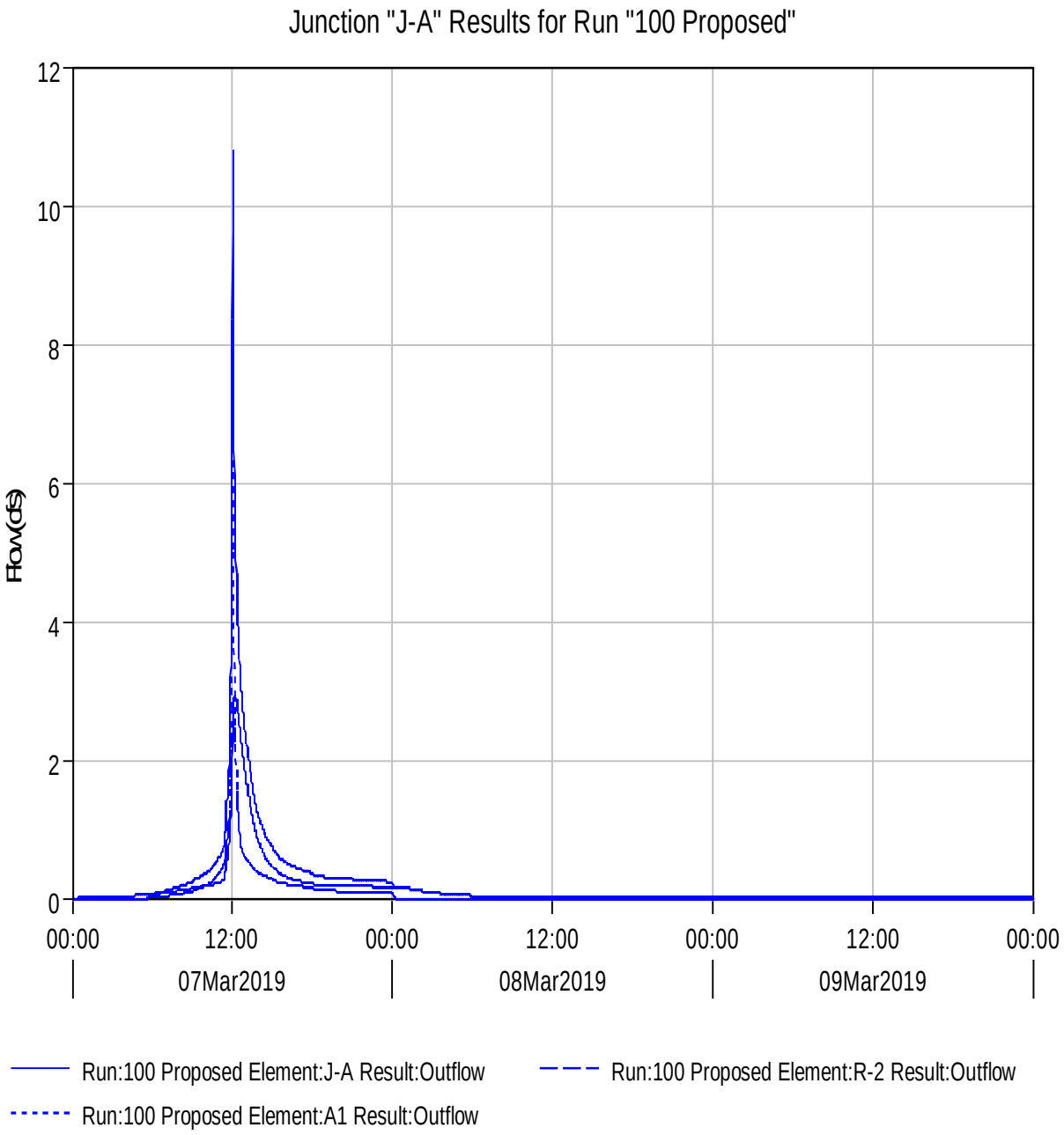

Junction "J-C" Results for Run "010 Proposed"
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Flow(cfs)
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:010 Proposed Element:J-C Result:Outflow
Run:010 Proposed Element:C1 Result:Outflow
Run:010 Proposed Element:C2 Result:Outflow

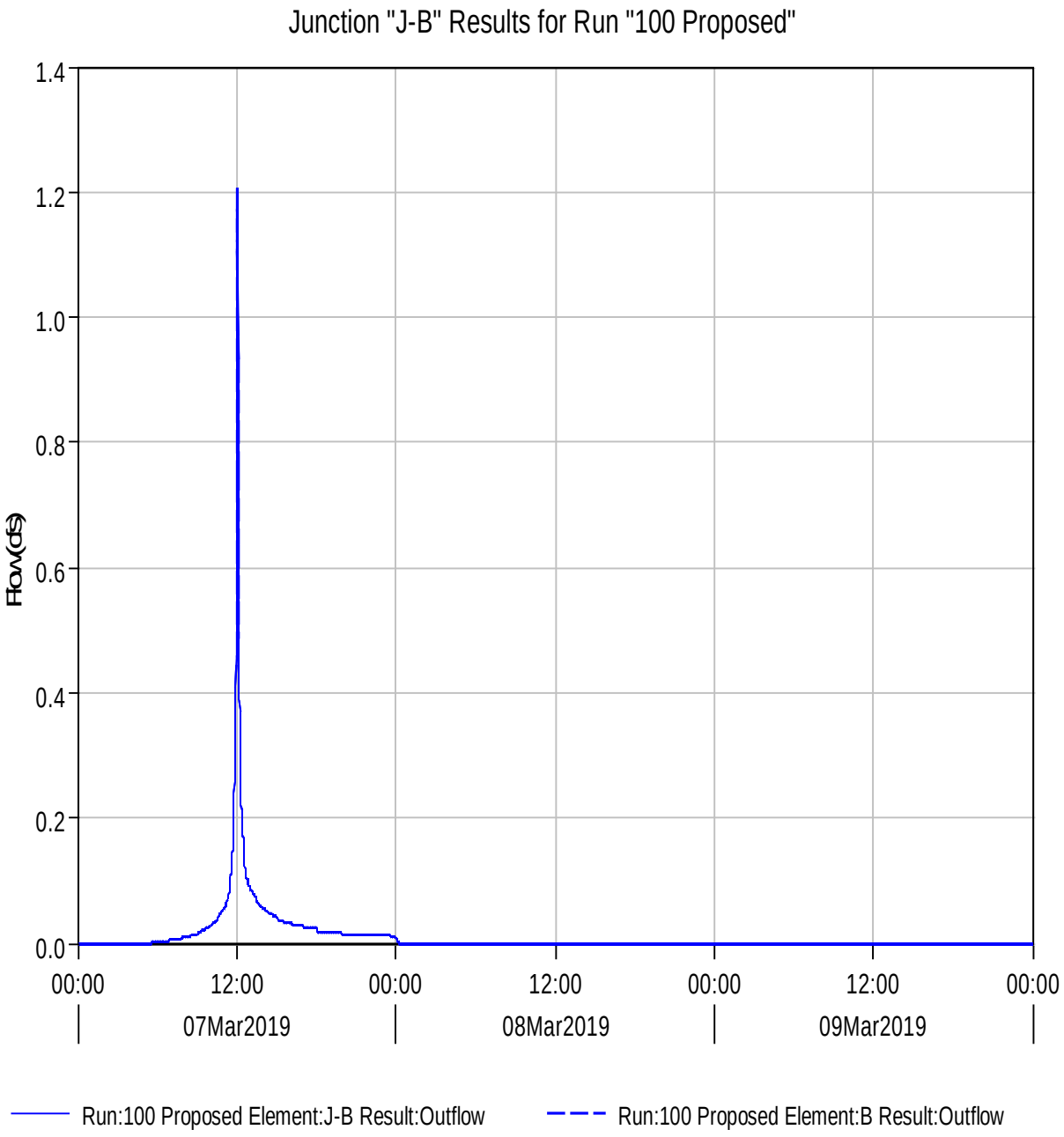

Junction "J-D" Results for Run "010 Proposed"
Flow(cfs)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:010 Proposed Element:J-D Result:Outflow
Run:010 Proposed Element:D Result:Outflow

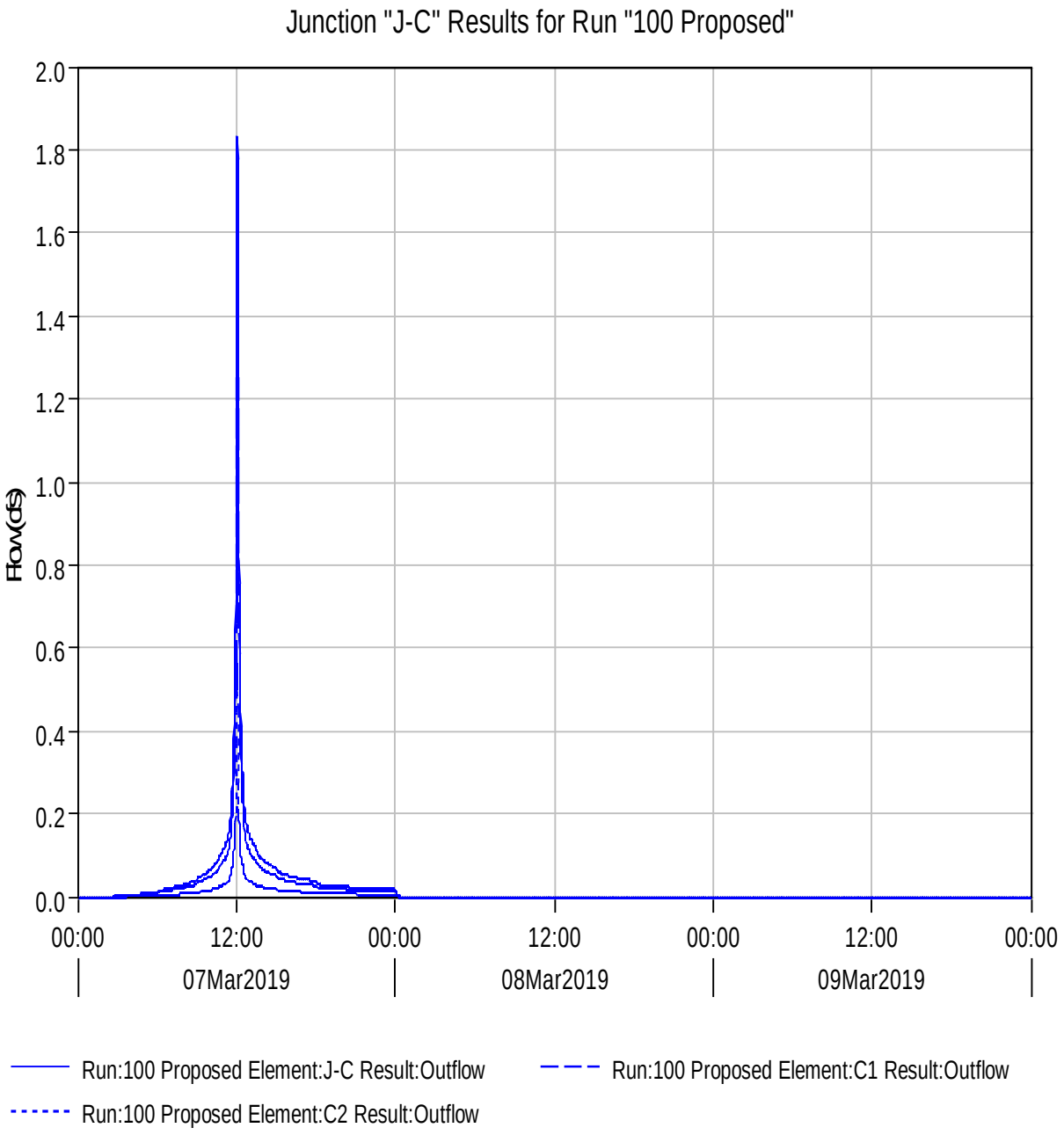
Project: Lee's Summit Simulation Run: 100 Proposed

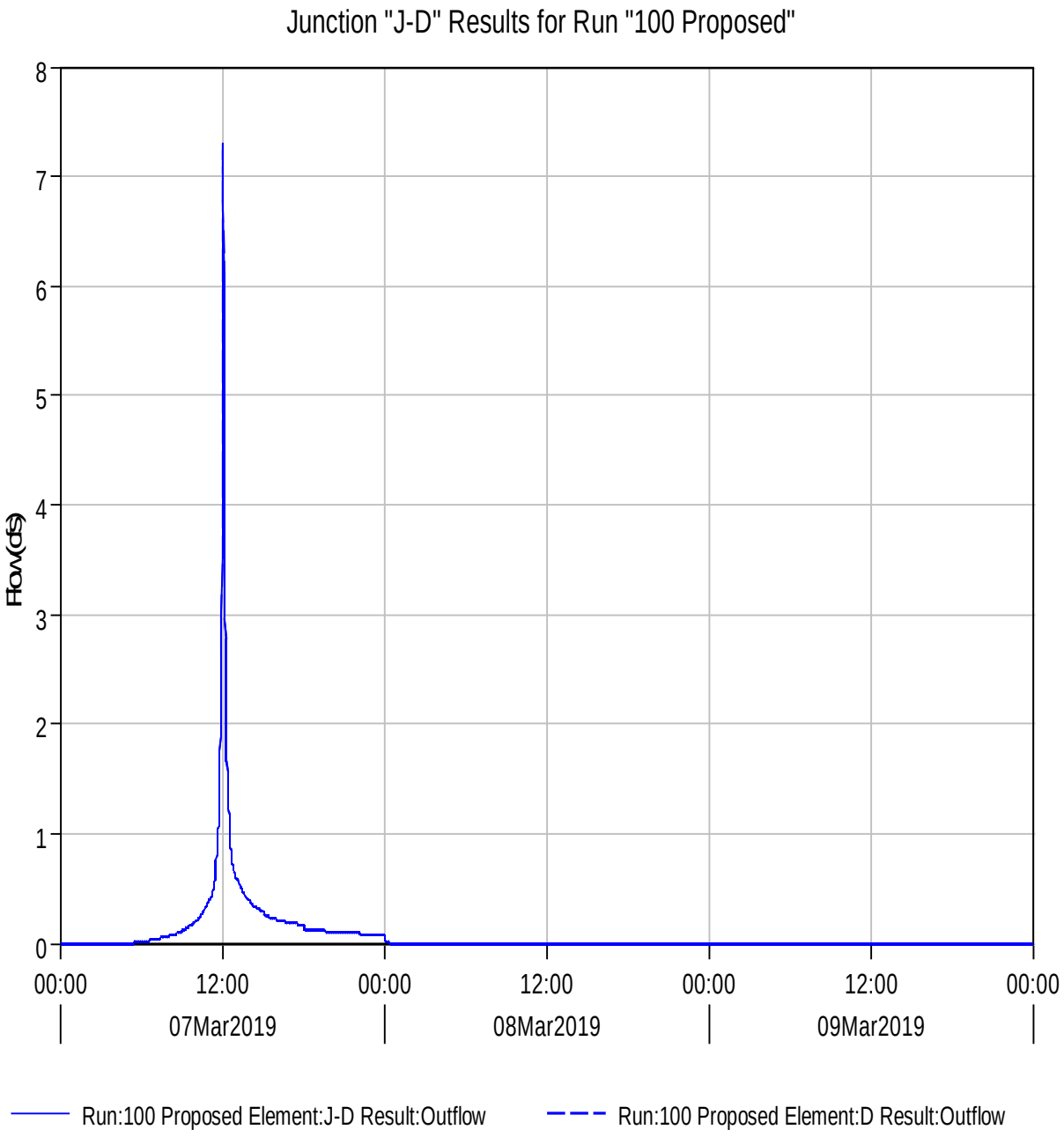
Start of Run: 07Mar2019, 00:00 Basin Model: Proposed
End of Run: 10Mar2019, 00:00 Meteorologic Model: 100-Year
Compute Time: 12Jun2020, 07:50:04 Control Specifications: 72-Hour

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
A1	0.00134	8.1	07Mar2019, 12:04	0.45
A2	0.00011	0.8	07Mar2019, 12:04	0.05
A3	0.00038	2.6	07Mar2019, 12:04	0.17
A4	0.00036	2.6	07Mar2019, 12:04	0.17
A5	0.00050	3.3	07Mar2019, 12:05	0.21
A6	0.00017	1.1	07Mar2019, 12:04	0.07
B	0.00020	1.2	07Mar2019, 12:04	0.07
C1	0.00022	1.3	07Mar2019, 12:05	0.09
C2	0.00008	0.5	07Mar2019, 12:04	0.03
D	0.00138	7.3	07Mar2019, 12:05	0.47
Detention	0.00141	2.7	07Mar2019, 12:17	0.62
J-A	0.00286	10.8	07Mar2019, 12:04	1.12
J-A1	0.00034	2.4	07Mar2019, 12:04	0.16
J-B	0.00020	1.2	07Mar2019, 12:04	0.07
J-C	0.00030	1.8	07Mar2019, 12:05	0.12
J-D	0.00138	7.3	07Mar2019, 12:05	0.47
J-1	0.00141	2.7	07Mar2019, 12:17	0.62
J-2	0.00152	2.9	07Mar2019, 12:13	0.67
Pool	0.00034	2.4	07Mar2019, 12:04	0.16
R-1	0.00141	2.7	07Mar2019, 12:17	0.62
R-2	0.00152	2.9	07Mar2019, 12:13	0.67


Junction "J-A" Results for Run "100 Proposed"
Flow(cfs)
12
10
8
6
4
2
0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:100 Proposed Element:J-A Result:Outflow
Run:100 Proposed Element:R-2 Result:Outflow
Run:100 Proposed Element:A1 Result:Outflow


Junction "J-B" Results for Run "100 Proposed"
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Flow(cfs)
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:100 Proposed Element:J-B Result:Outflow
Run:100 Proposed Element:B Result:Outflow


Junction "J-C" Results for Run "100 Proposed"
Flow(cfs)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:100 Proposed Element:J-C Result:Outflow
Run:100 Proposed Element:C1 Result:Outflow
Run:100 Proposed Element:C2 Result:Outflow


Junction "J-D" Results for Run "100 Proposed"
Flow(cfs)
8
7
6
5
4
3
2
1
0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:100 Proposed Element:J-D Result:Outflow
Run:100 Proposed Element:D Result:Outflow

Appendix B:

Digital Files

Summit Waves – Wave Pool Addition Construction Plans
ADS Storm Tech System Information
HEC-HMS v. 4.1