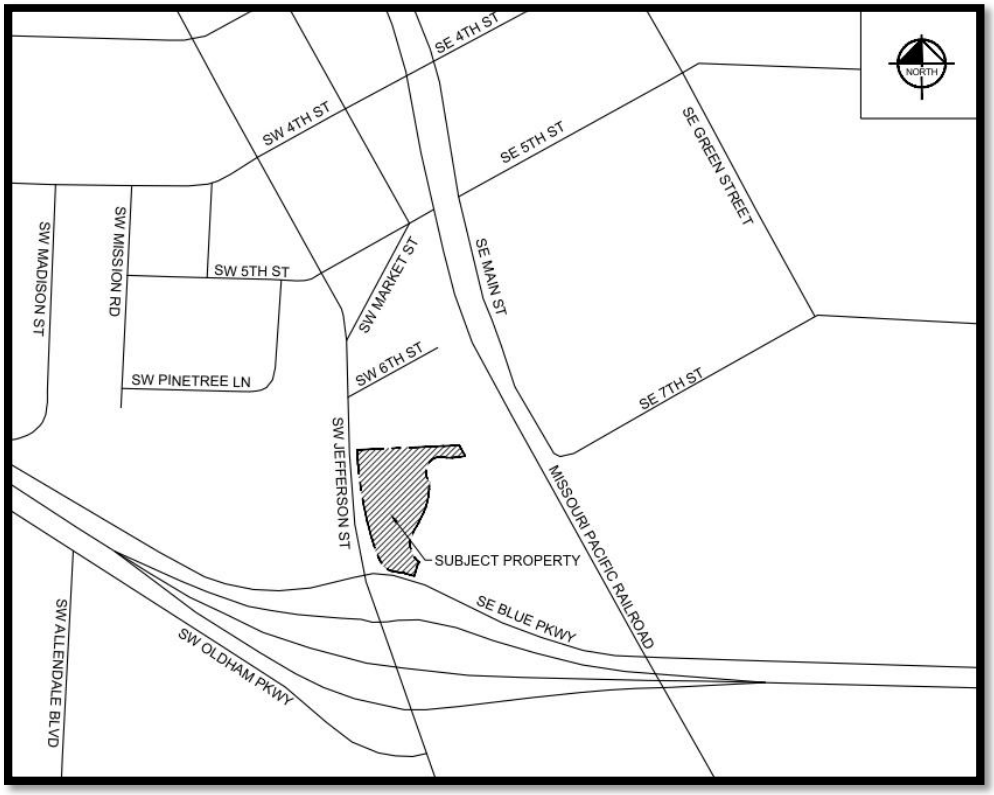
Stormwater Report for Summit Waves – Wave Pool Addition

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

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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 vault located in the northeast corner of the site. Runoff will collect from two proposed bioretention areas through a proposed 24" RCP running along the eastern and southern portion of the pool deck. 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 pond details can be seen in the attached Summit Waves – Wave Pool Addition Construction Plans included in **Appendix A**. **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	5.6	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	-0.6	-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 two bioretention swales located along the west and south edges of the site. The pool deck will drain directly to the bioretention swales and then drain into a 24" RCP by means of a perforated pipe beneath the length of each bioretention swale. The underground detention vault will provide extended dry detention, releasing the runoff from the local 90% mean annual event (1.37"/24-hour rainfall) over a 40-hour time period. The proposed wave pool site is 70% impervious, resulting in a water quality volume of 0.08 acre-feet. In addition to the bioretention and extended dry detention, a hydrodynamic separator will be installed downstream of the outfall of the detention vault. 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 in **Appendix A**. The combination of these 3 Best Management Practices (BMPs) will achieve an overall water quality rating of 10.14, exceeding the required water quality rating value of 8. Water quality calculations are included in the hydrologic calculations and the attached Summit Waves – Wave Pool Addition Construction Plans included in **Appendix A**.

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 as a result of the development. Additionally, multiple water quality features will be constructed to ensure that the required water quality Level of Service is being met. These water quality features include bioretention swales, extended dry detention, 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
Summit Waves – Wave Pool Addition Construction Plan Excerpts

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 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: 05/24/2019
Project No. 064538700

SHEET
A.1

File: K:\DAL_Hydro\064538700 - Lee's Summit Wave Pool\DWG\EXH\Drainage Area Map.dwg [Existing] 5/23/2019
Xrefs: xAerial x24x36 - h&h xDAM xGrad xBndy xsite xLiDAR xPond Images: EPSG32614_Date20...

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
- PROPOSED BIOSWALE
- 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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REGISTERED 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:	05/24/2019
Project No.	064538700

SHEET
A.2

File: K:\DAL_Hydro\064538700 - Lee's Summit Wave Pool\DWG\EXH\Drainage Area Map.dwg [Proposed] 5/23/2019
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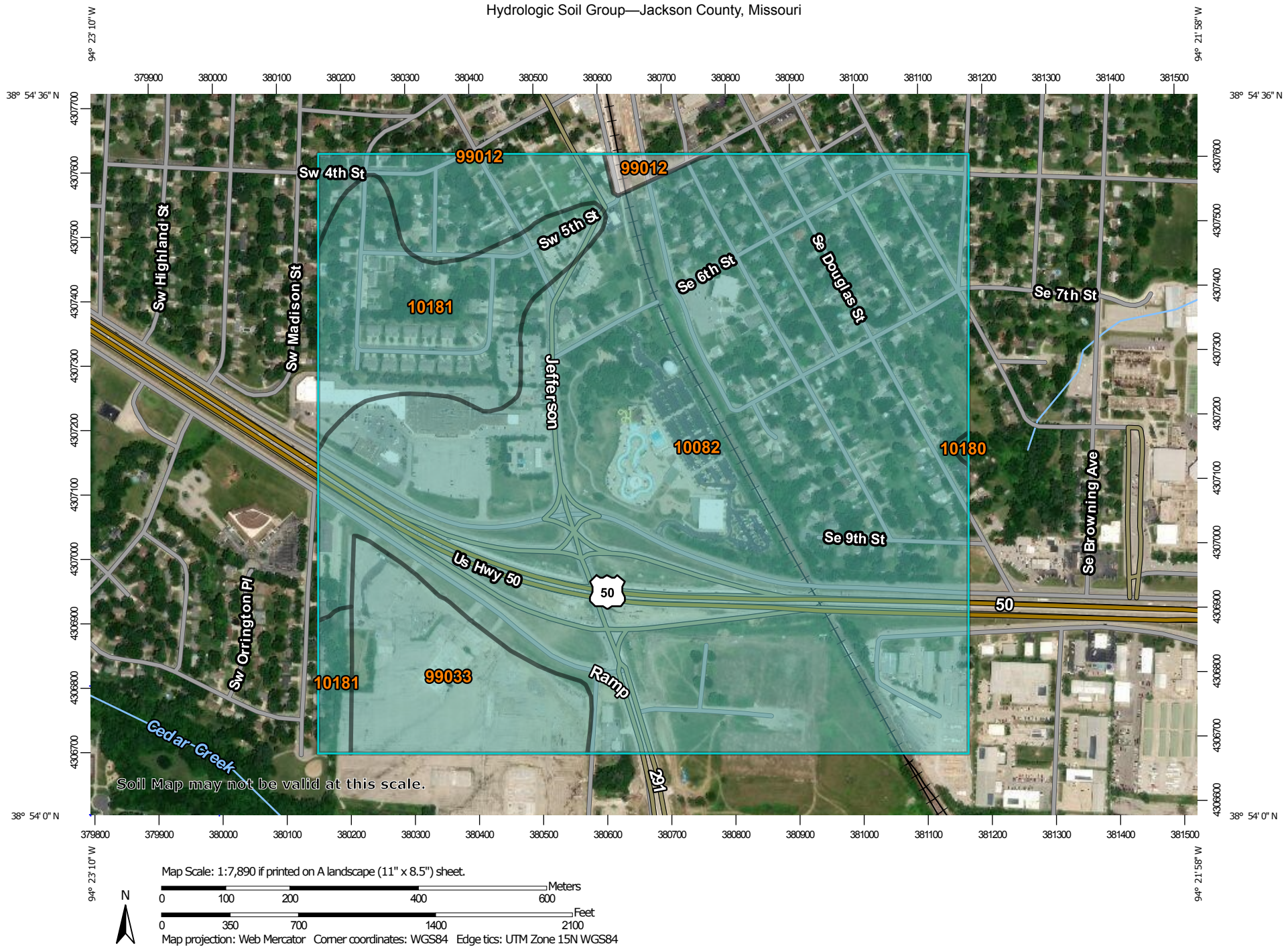
Images: EPSG32614_Date20



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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		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	Extended Dry Detention + Hydrodynamic Seperator	0.24	8.00	1.92
A4	Extended Dry Detention + Hydrodynamic Seperator	0.23	8.00	1.84
A5	Bioretention, Extended Dry Detention, + Hydrodynamic	0.32	16.50	5.28
A6	Bioretention, Extended Dry Detention, + Hydrodynamic	0.11	16.50	1.82
			Total =	10.86
			Weighted VR =	10.14
			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
WQV	0.08	1051.79	0.34	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02
2-year	0.10	1051.97	0.40	0.02	0.02	0.12	0.00	0.12	0.00	0.00	0.00	0.14
10-year	0.16	1053.02	0.84	0.03	0.03	2.06	1.36	1.36	0.00	0.00	0.00	1.39
100-year	0.24	1054.30	1.50	0.04	0.04	5.98	2.09	2.09	1.64	0.35	0.35	2.48

Elevation Discharge Summary Table										
Elevation	Opening #1			Opening #2			Opening #3			Total
	Weir	Orifice	Actual	Weir	Orifice	Actual	Weir	Orifice	Actual	Actual
1050.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1051.3	0.19	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02
1052.3	0.53	0.03	0.03	0.55	0.66	0.55	0.00	0.00	0.00	0.58
1053.3	0.97	0.03	0.03	2.80	1.55	1.55	0.11	0.11	0.11	1.70
1054.3	1.50	0.04	0.04	5.98	2.09	2.09	1.64	0.35	0.35	2.48
1054.80	1.79	0.04	0.04	7.85	2.32	2.32	2.77	0.43	0.43	2.78

Stage Storage Summary Table		
Elevation (ft)	Area (ac)	Volume (ac-ft)
1050.30	0.06	0.00
1054.80	0.06	0.25

Detention Outfall Calculations

g (ft^2/s) = 32.2

$C_{Orifice}$ = 0.6

C_{weir} = 3

Opening #1 (WQV)

Shape = Rectangular

Height (ft)= 0.06 = 0.75 inches

Length (ft) = 0.06 = 0.75 inches

Area (ft)= 0.004

Centroid (ft) = 1050.33

Invert Elevation (ft) = 1050.30

Top of Pipe Elevation (ft) = 1050.36

Opening #2

Shape = Rectangular

Height (ft)= 0.58 = 7.0 inches

Length (ft) = 0.50 = 6.0 inches

Area (ft^2)= 0.292

Centroid (ft) = 1052.08

Invert Elevation (ft) = 1051.79

Top of Pipe Elevation (ft) = 1052.37

Opening #3

Shape = Rectangular

Height (ft)= 0.17 = 2.0 inches

Length (ft) = 0.42 = 5.0 inches

Area (ft)= 0.07

Centroid (ft) = 1053.18

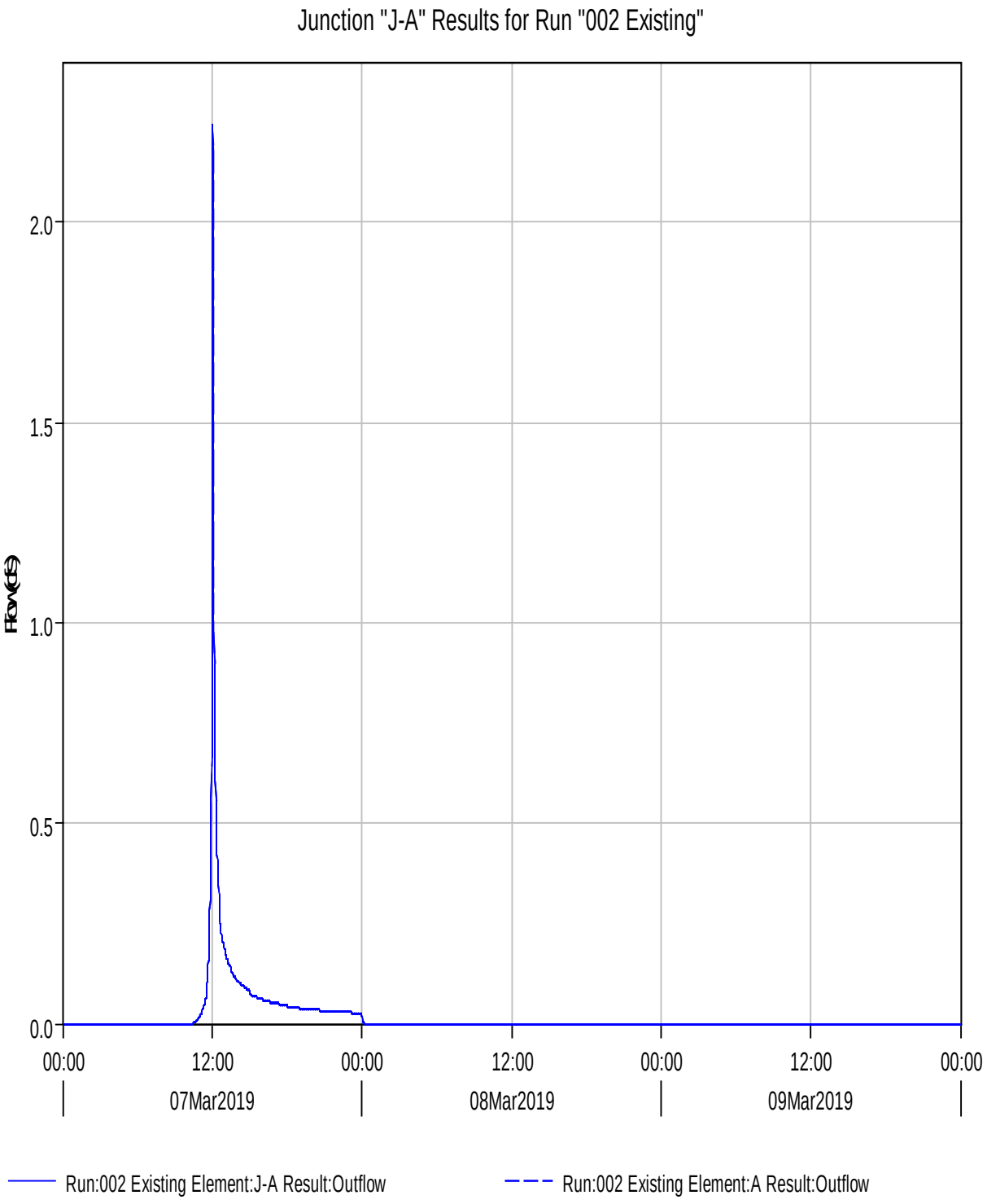
Invert Elevation (ft) = 1053.10

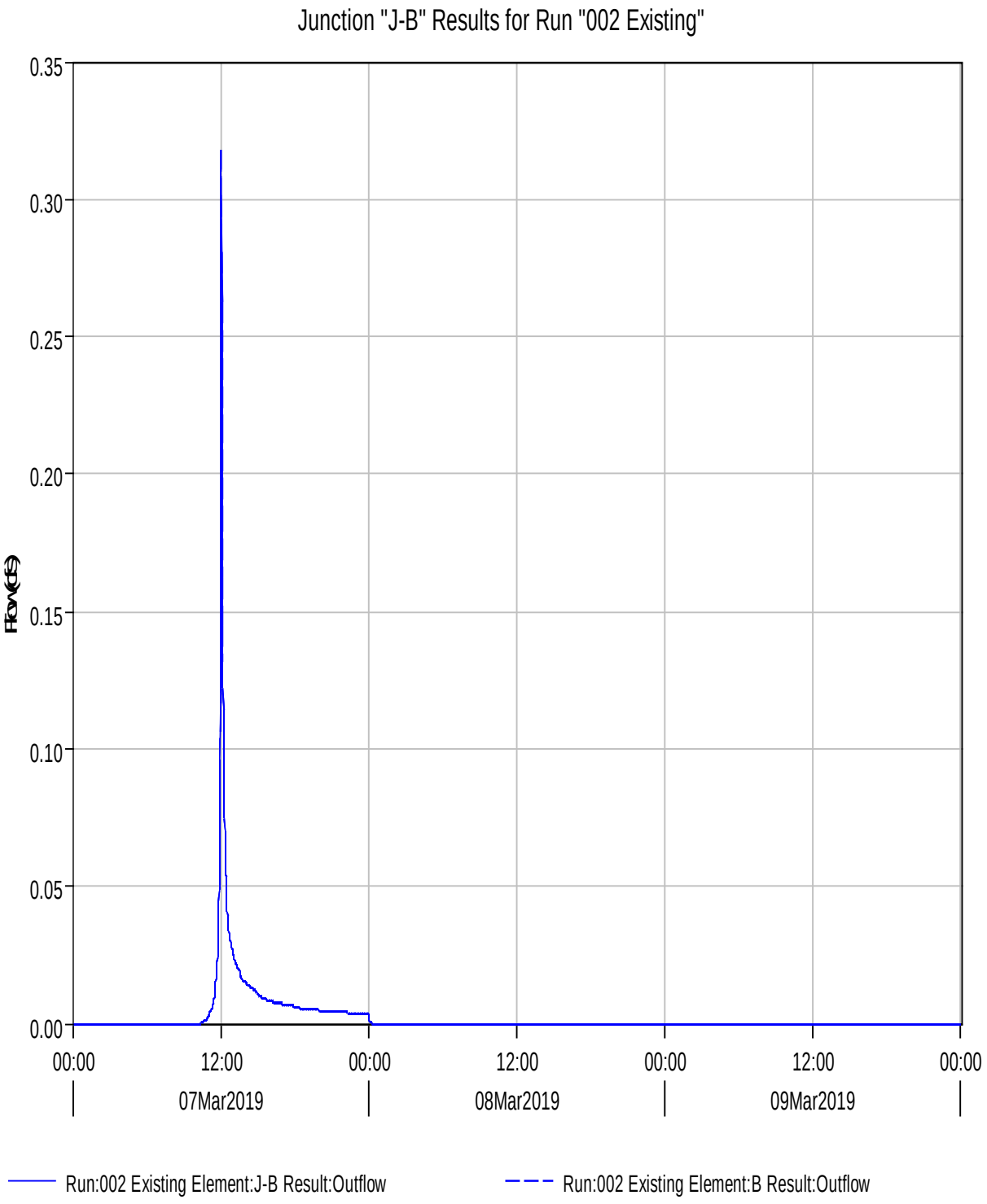
Top of Pipe Elevation (ft) = 1053.27

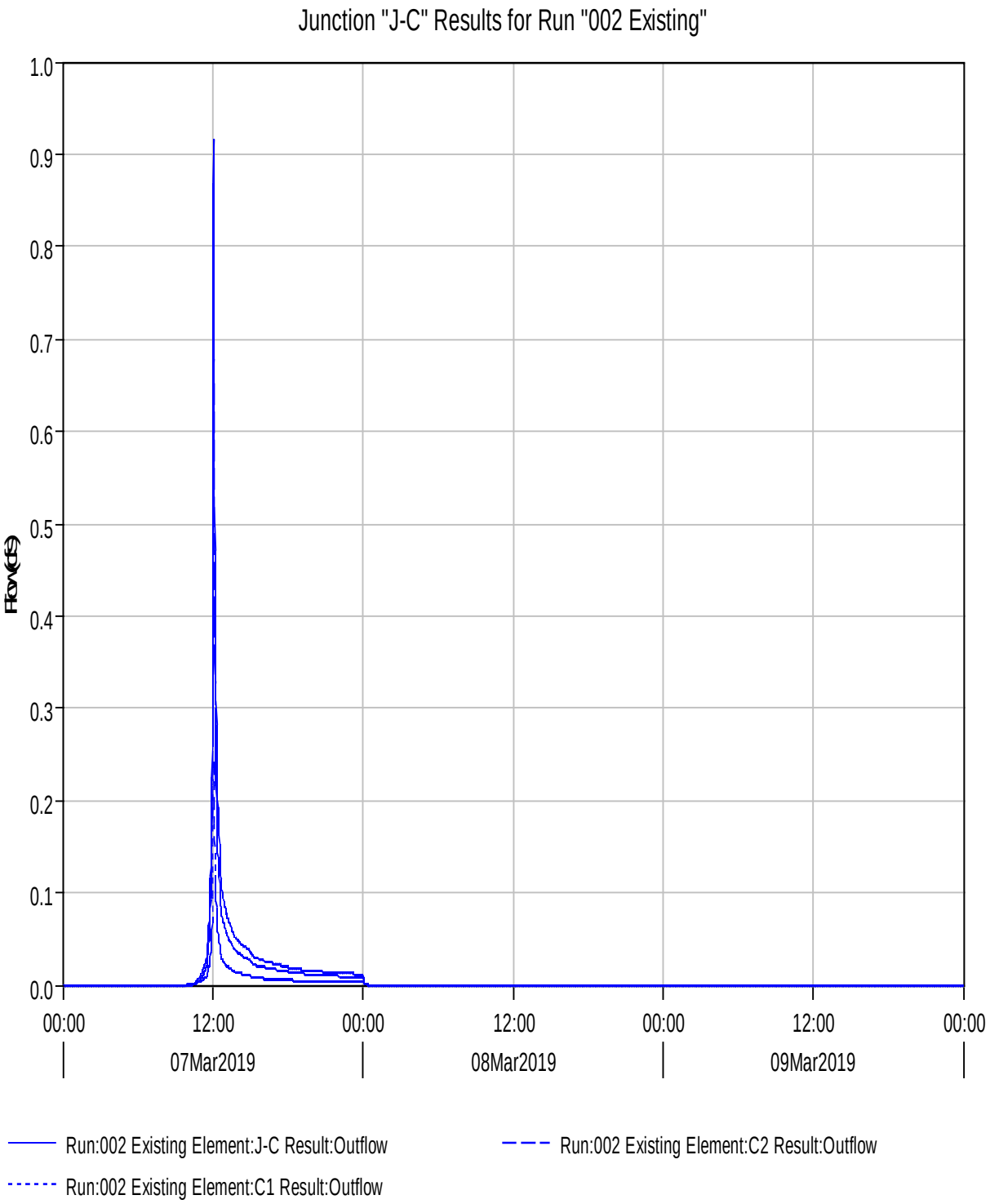
Project: Lee's Summit Simulation Run: 002 Existing

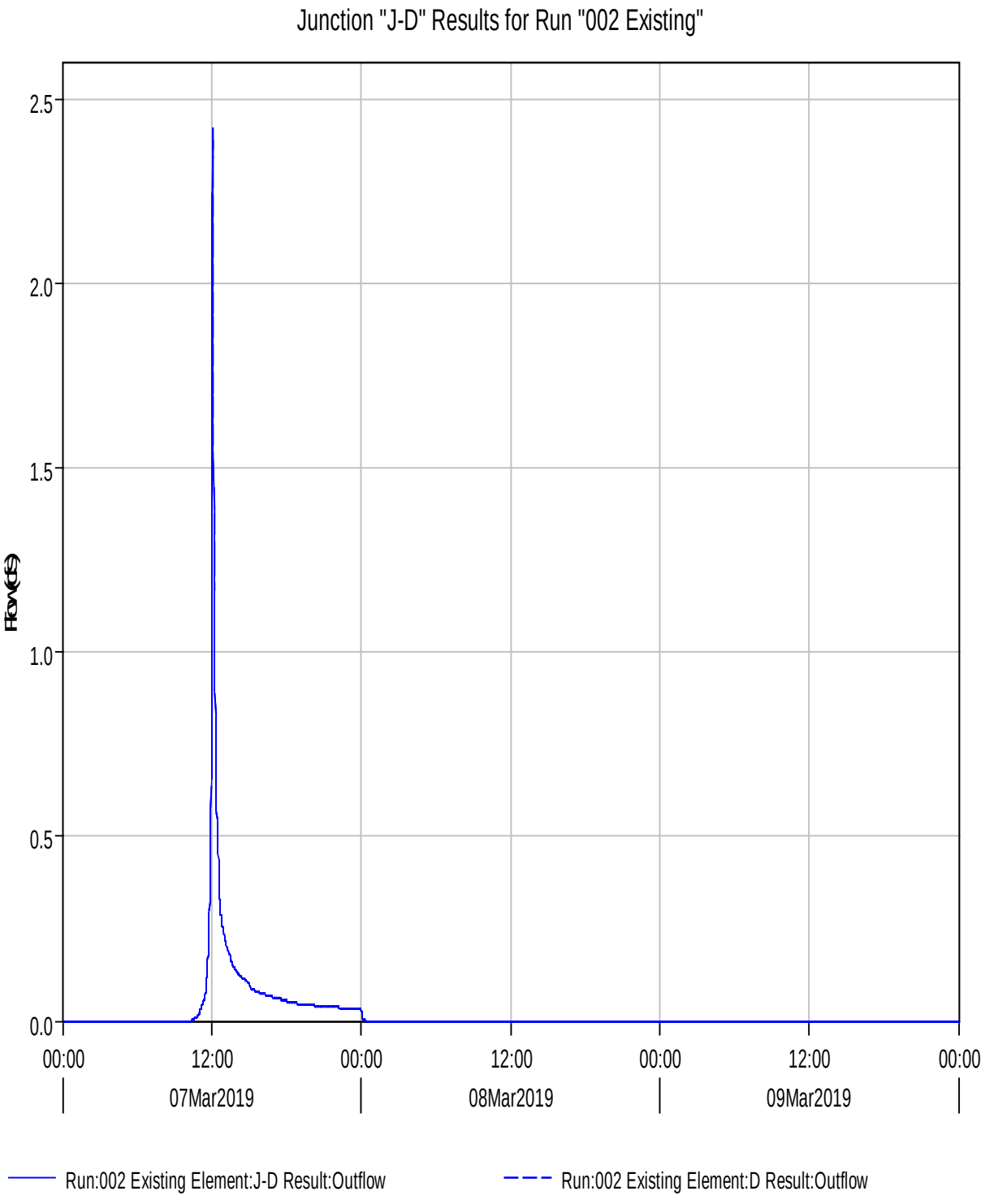
Start of Run: 07Mar2019, 00:00 Basin Model: Existing
End of Run: 10Mar2019, 00:00 Meteorologic Model: 002-Year
Compute Time: 22May2019, 16:43:09 Control Specifications: 72-Hour

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

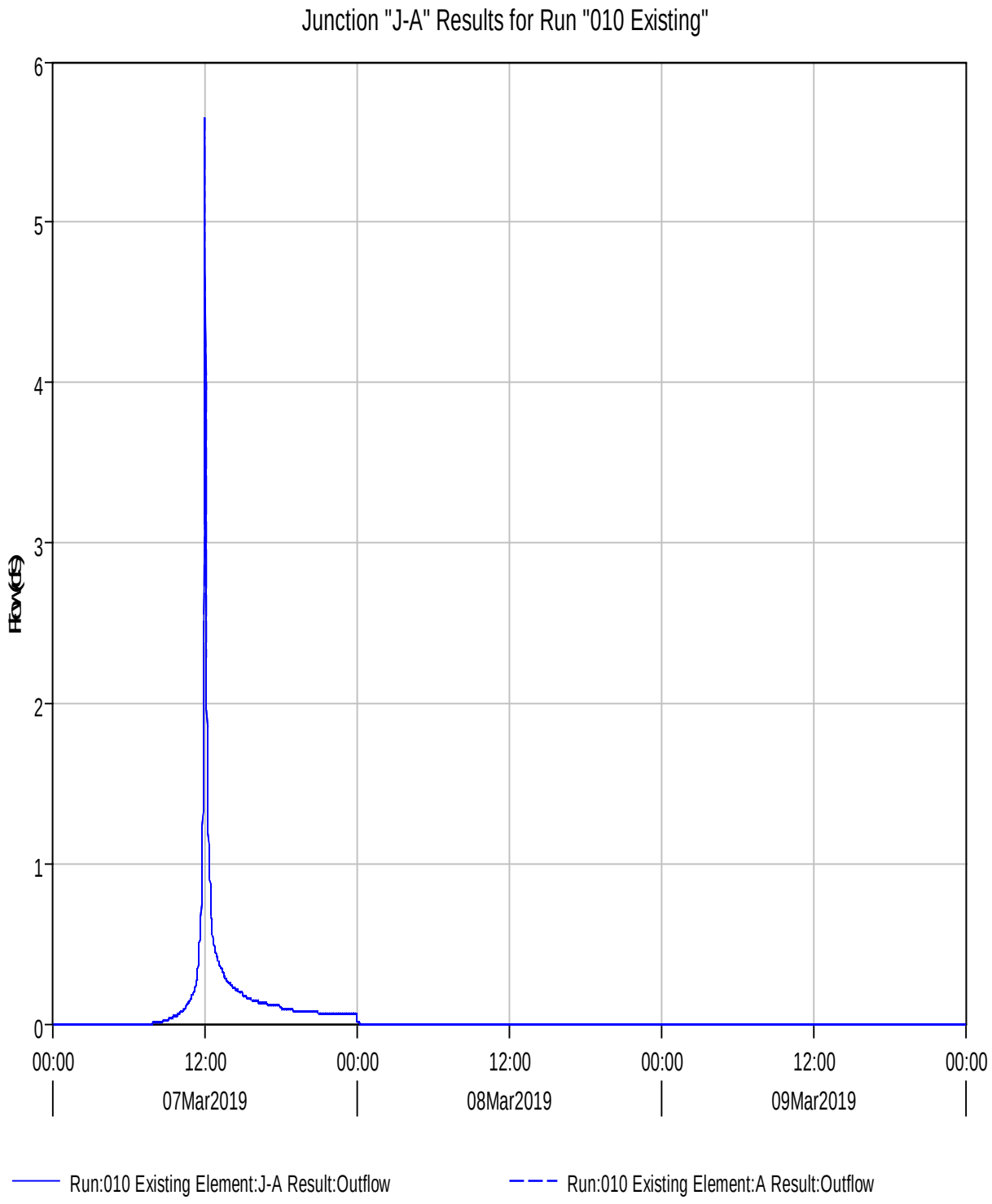

Junction "J-C" Results for Run "002 Existing"
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:002 Existing Element:J-C Result:Outflow
Run:002 Existing Element:C2 Result:Outflow
Run:002 Existing Element:C1 Result:Outflow

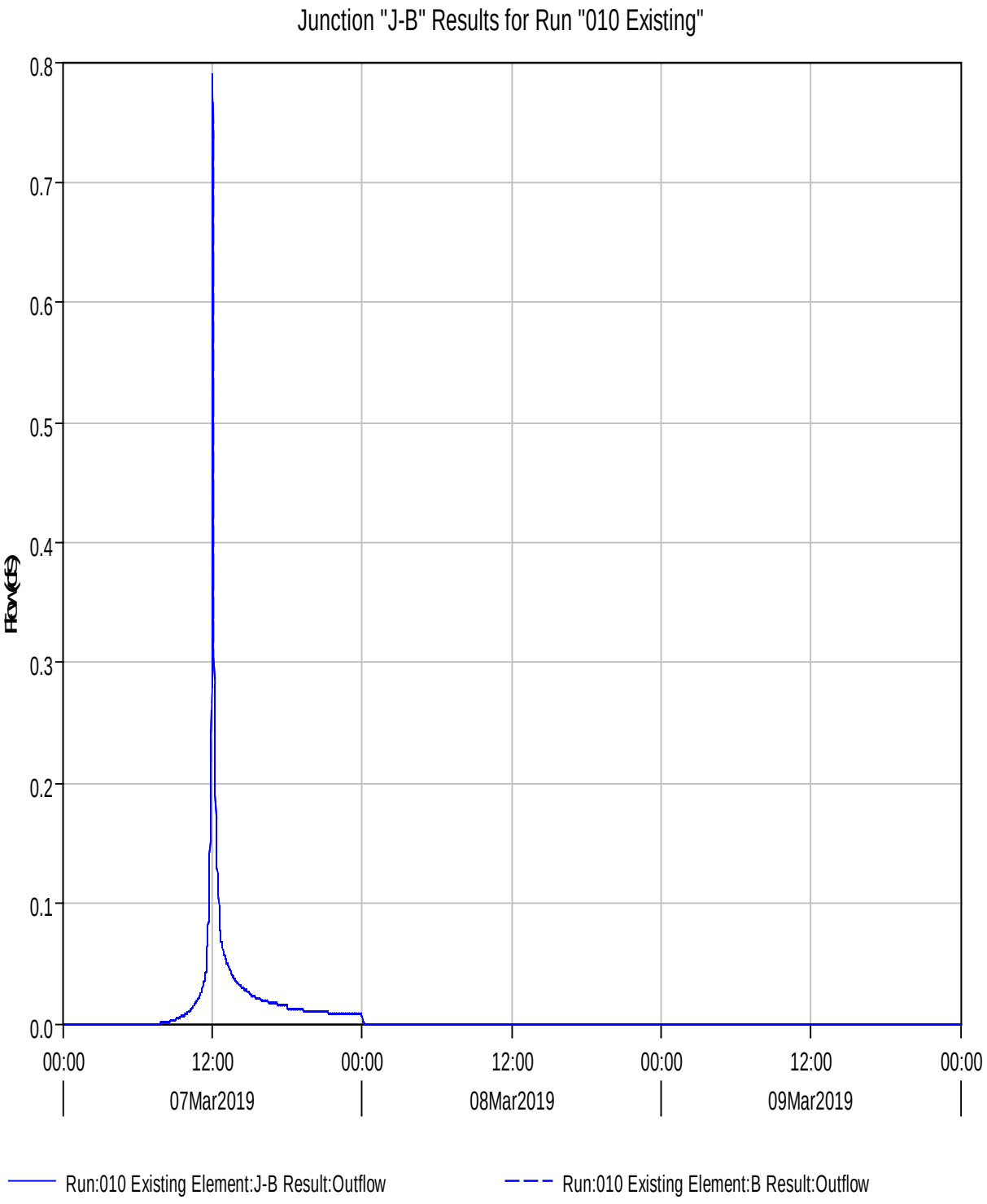

Junction "J-D" Results for Run "002 Existing"
2.5
2.0
1.5
1.0
0.5
0.0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:002 Existing Element:J-D Result:Outflow
Run:002 Existing Element:D Result:Outflow

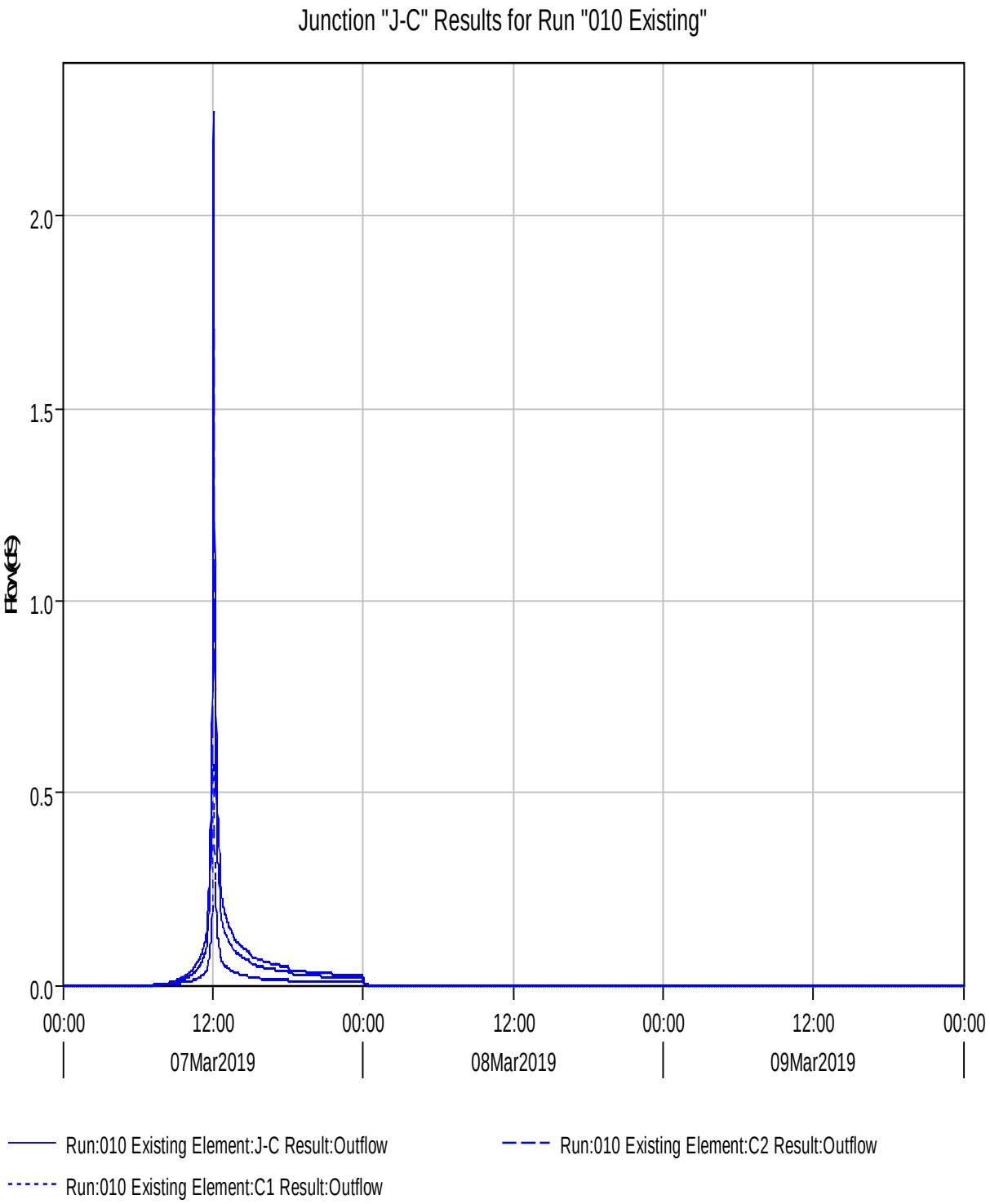
Project: Lee's Summit Simulation Run: 010 Existing

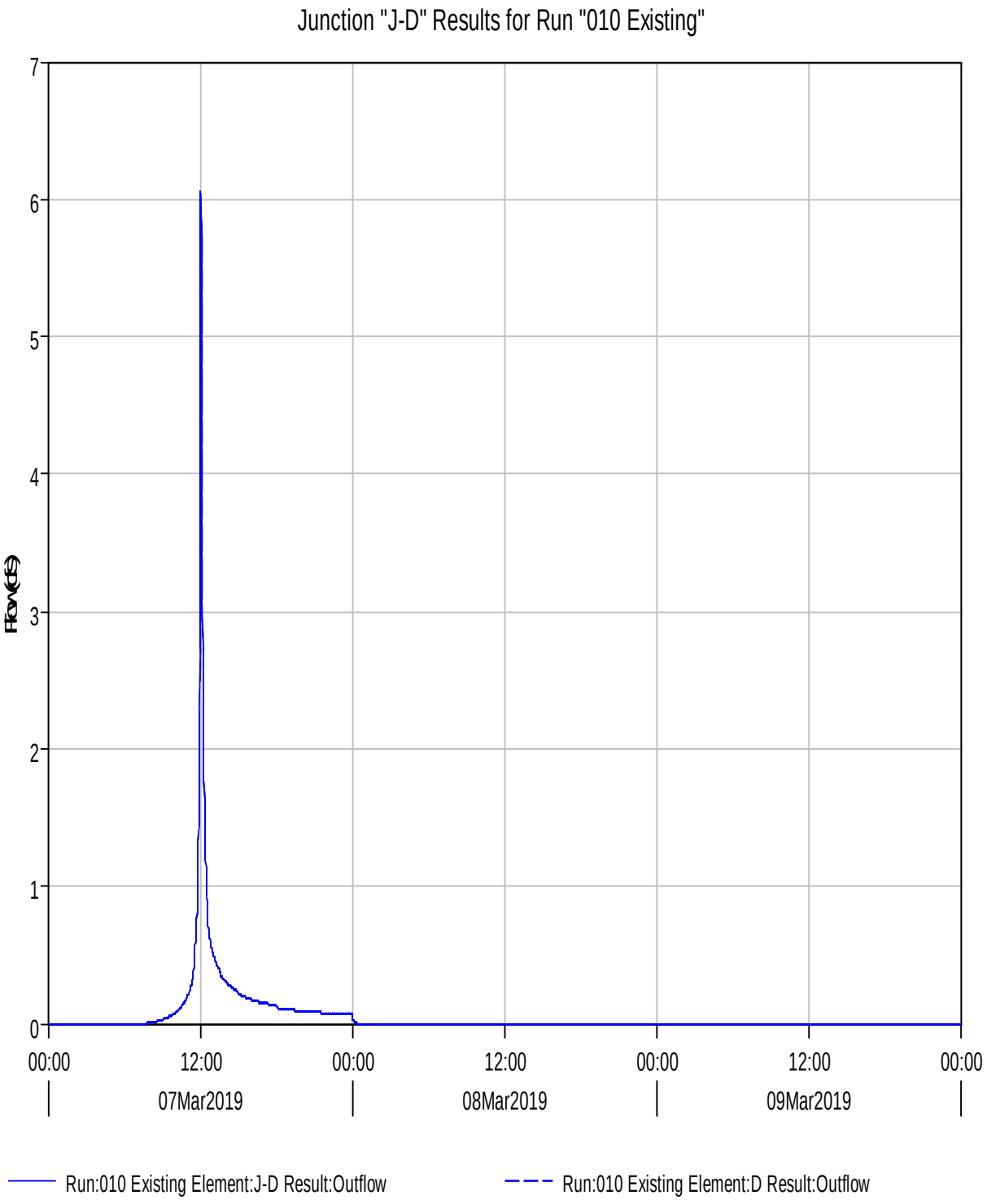
Start of Run: 07Mar2019, 00:00 Basin Model: Existing
End of Run: 10Mar2019, 00:00 Meteorologic Model: 010-Year
Compute Time: 22May2019, 16:43:12 Control Specifications: 72-Hour

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

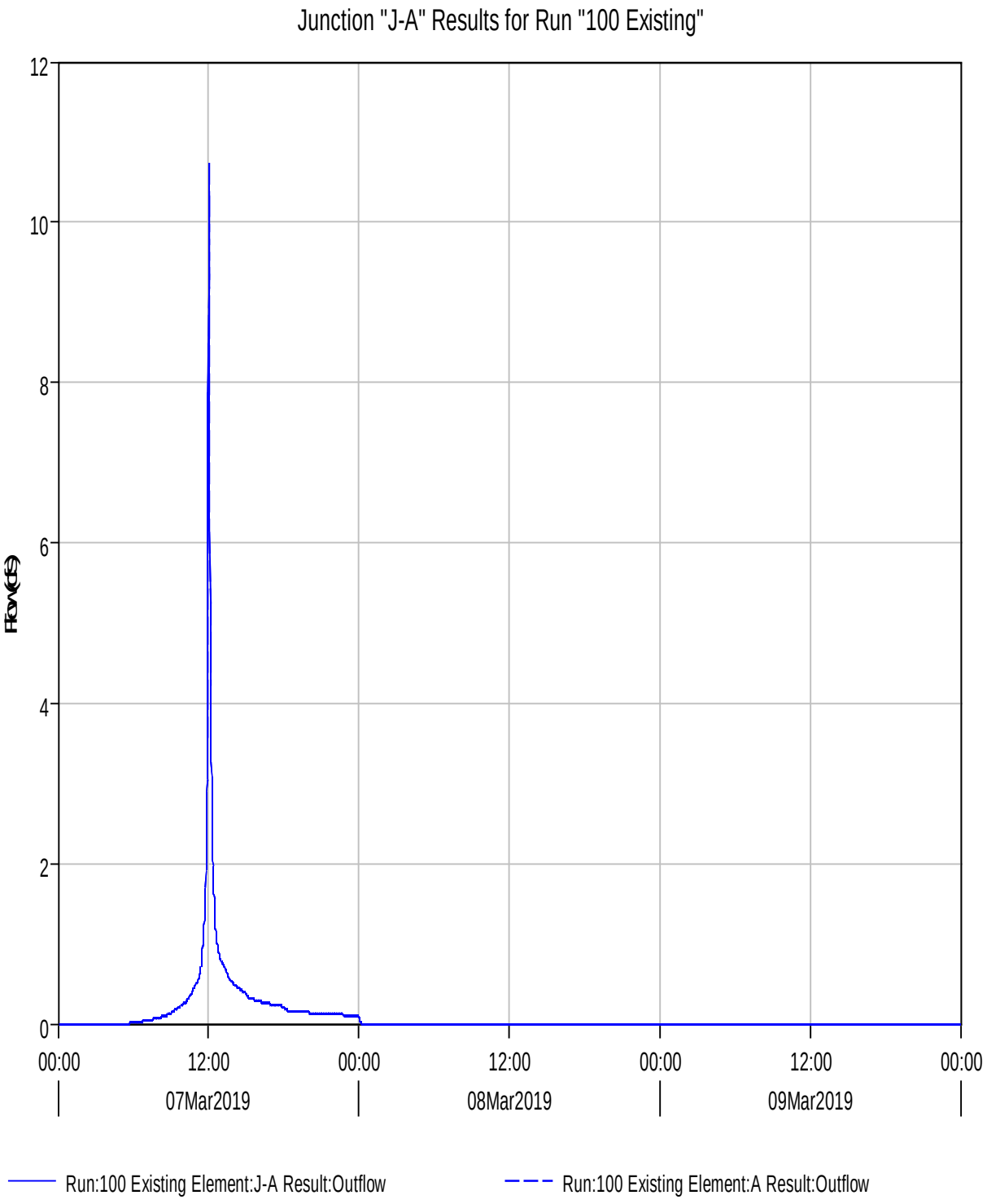

Junction "J-C" Results for Run "010 Existing"
2.0
1.5
1.0
0.5
0.0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:010 Existing Element:J-C Result:Outflow
Run:010 Existing Element:C2 Result:Outflow
Run:010 Existing Element:C1 Result:Outflow

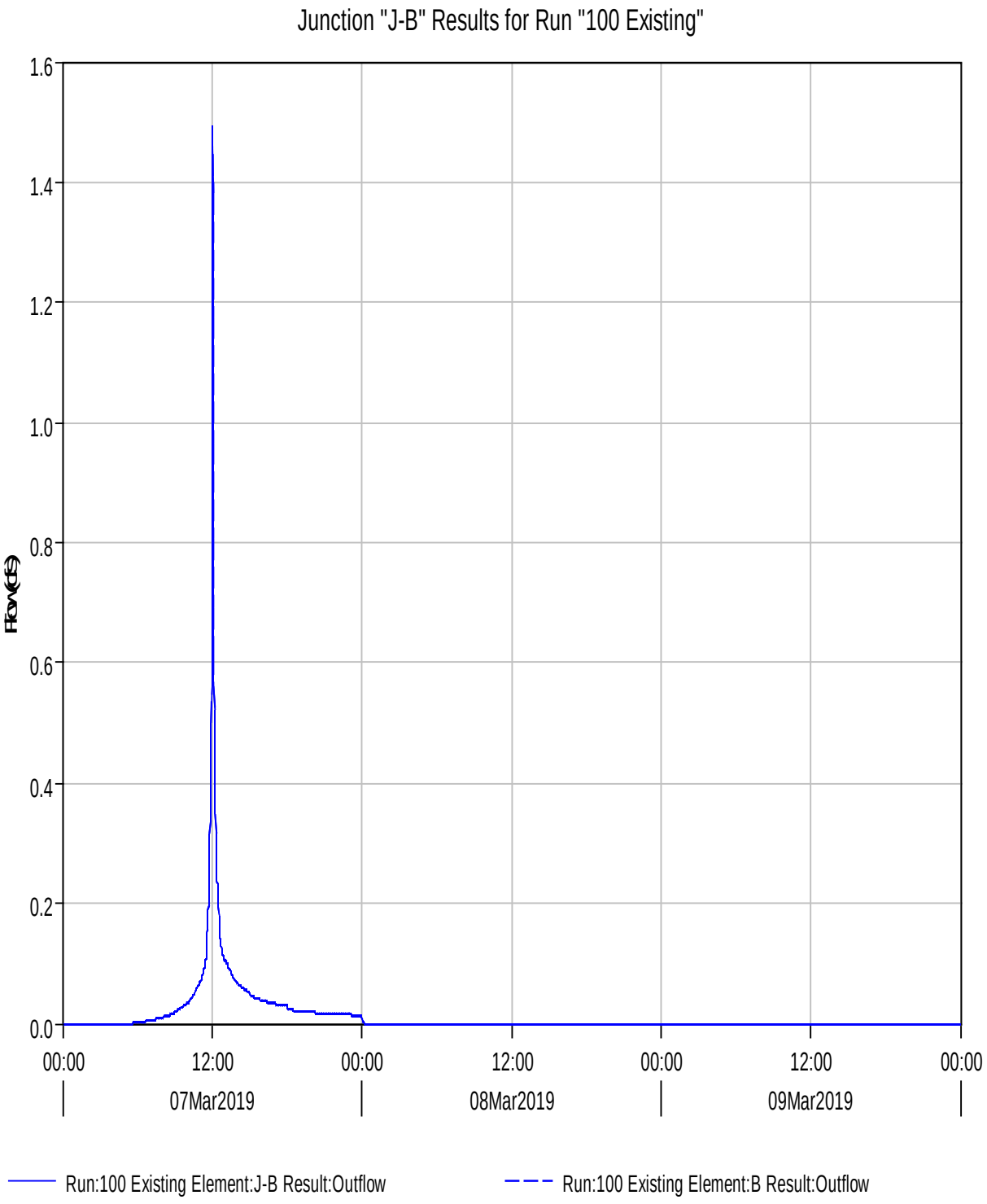

Junction "J-D" Results for Run "010 Existing"
7
6
5
4
3
2
1
0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:010 Existing Element:J-D Result:Outflow
Run:010 Existing Element:D Result:Outflow

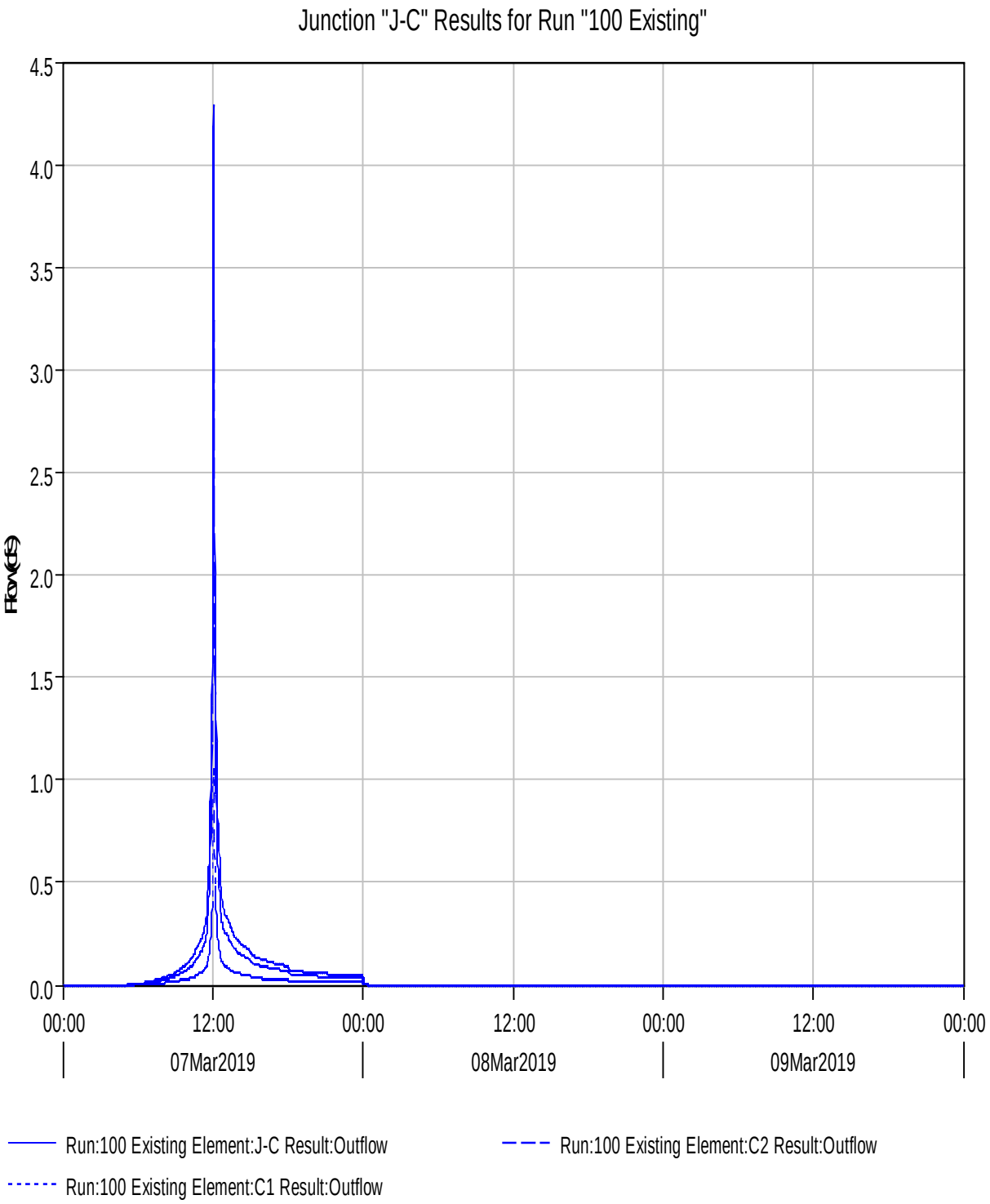
Project: Lee's Summit Simulation Run: 100 Existing

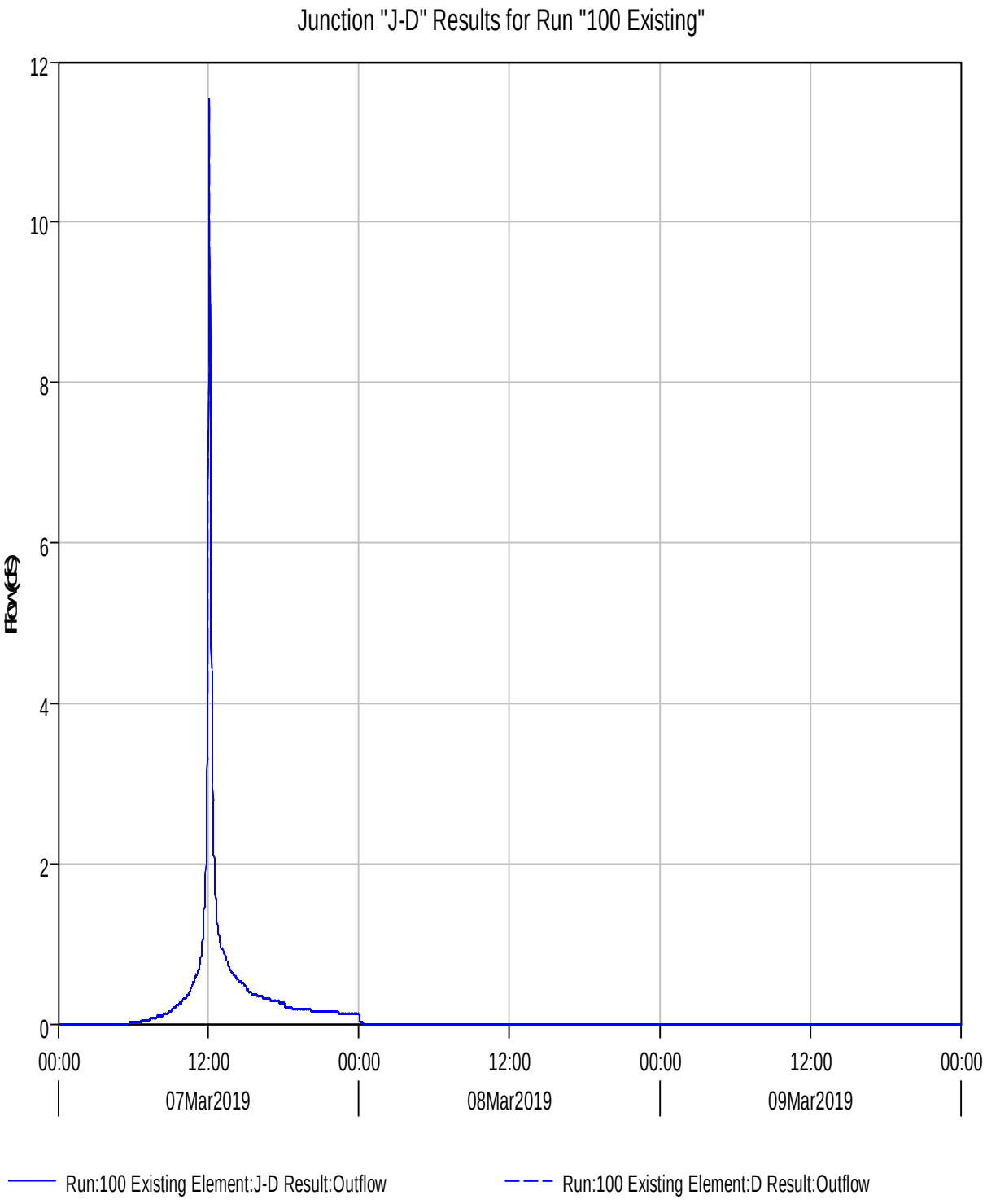
Start of Run: 07Mar2019, 00:00 Basin Model: Existing
End of Run: 10Mar2019, 00:00 Meteorologic Model: 100-Year
Compute Time: 22May2019, 16:43:16 Control Specifications: 72-Hour

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

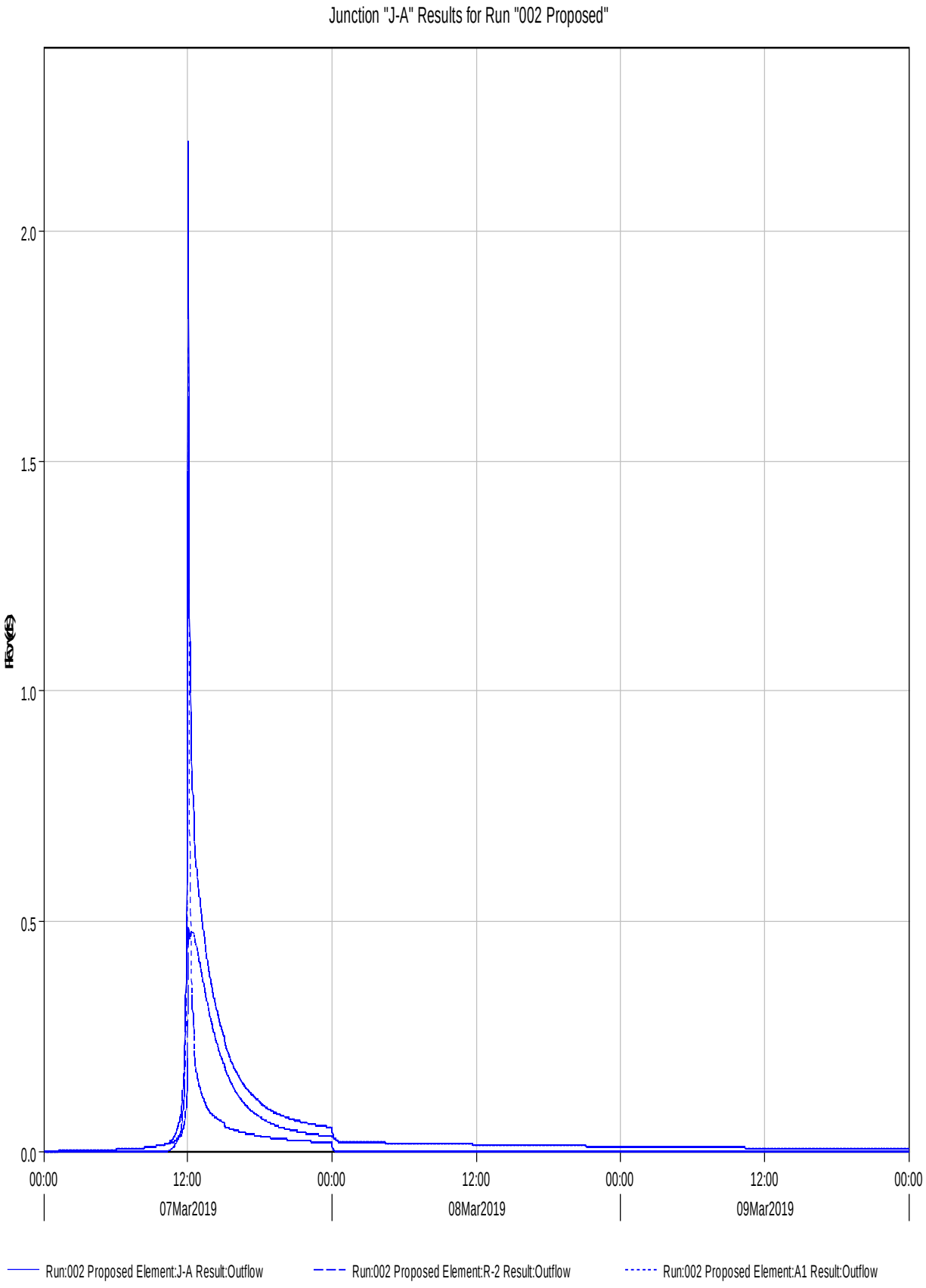

Junction "J-C" Results for Run "100 Existing"
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:100 Existing Element:J-C Result:Outflow
Run:100 Existing Element:C2 Result:Outflow
Run:100 Existing Element:C1 Result:Outflow

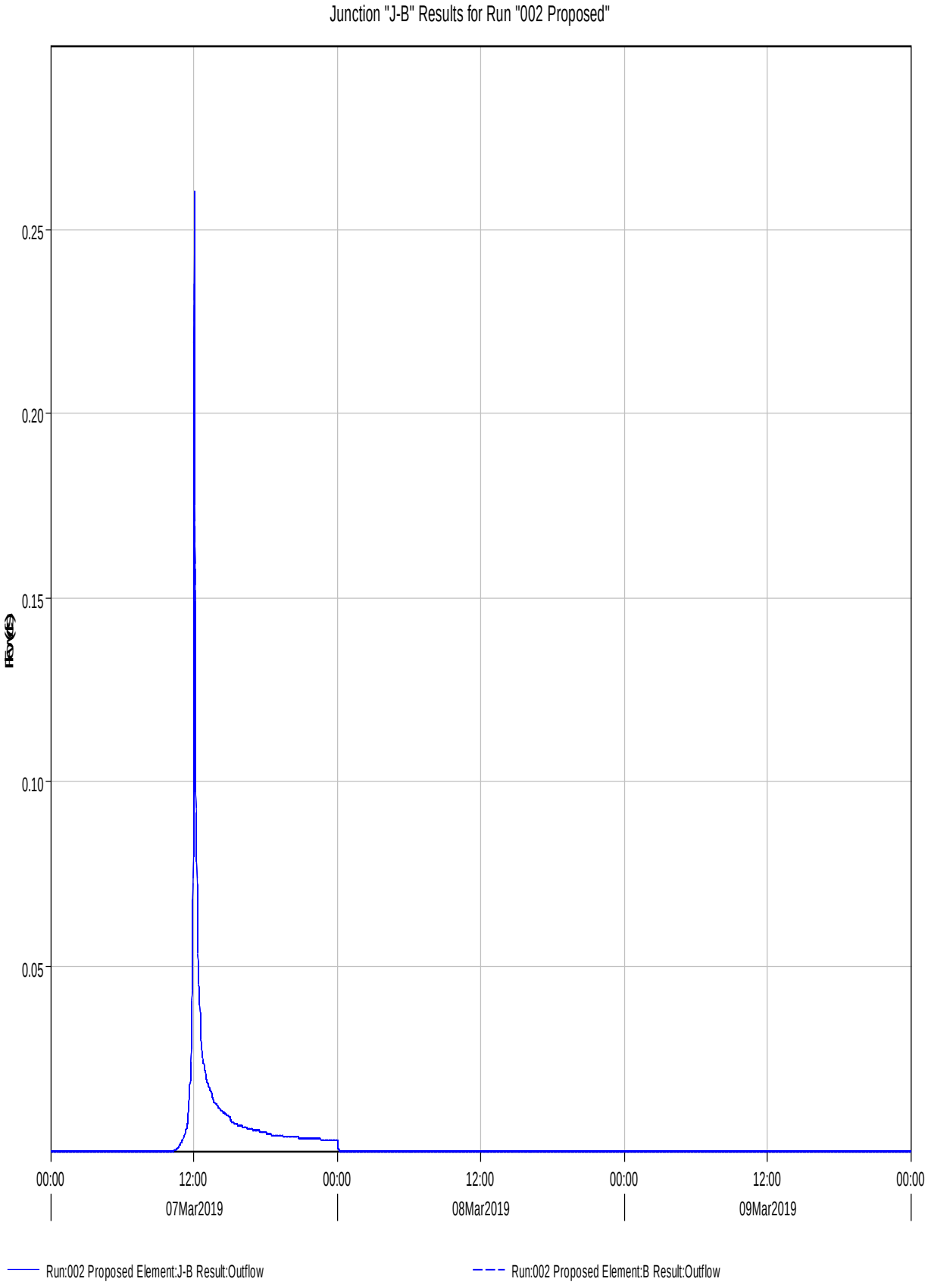

Junction "J-D" Results for Run "100 Existing"
12
10
8
6
4
2
0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:100 Existing Element:J-D Result:Outflow
Run:100 Existing Element:D Result:Outflow

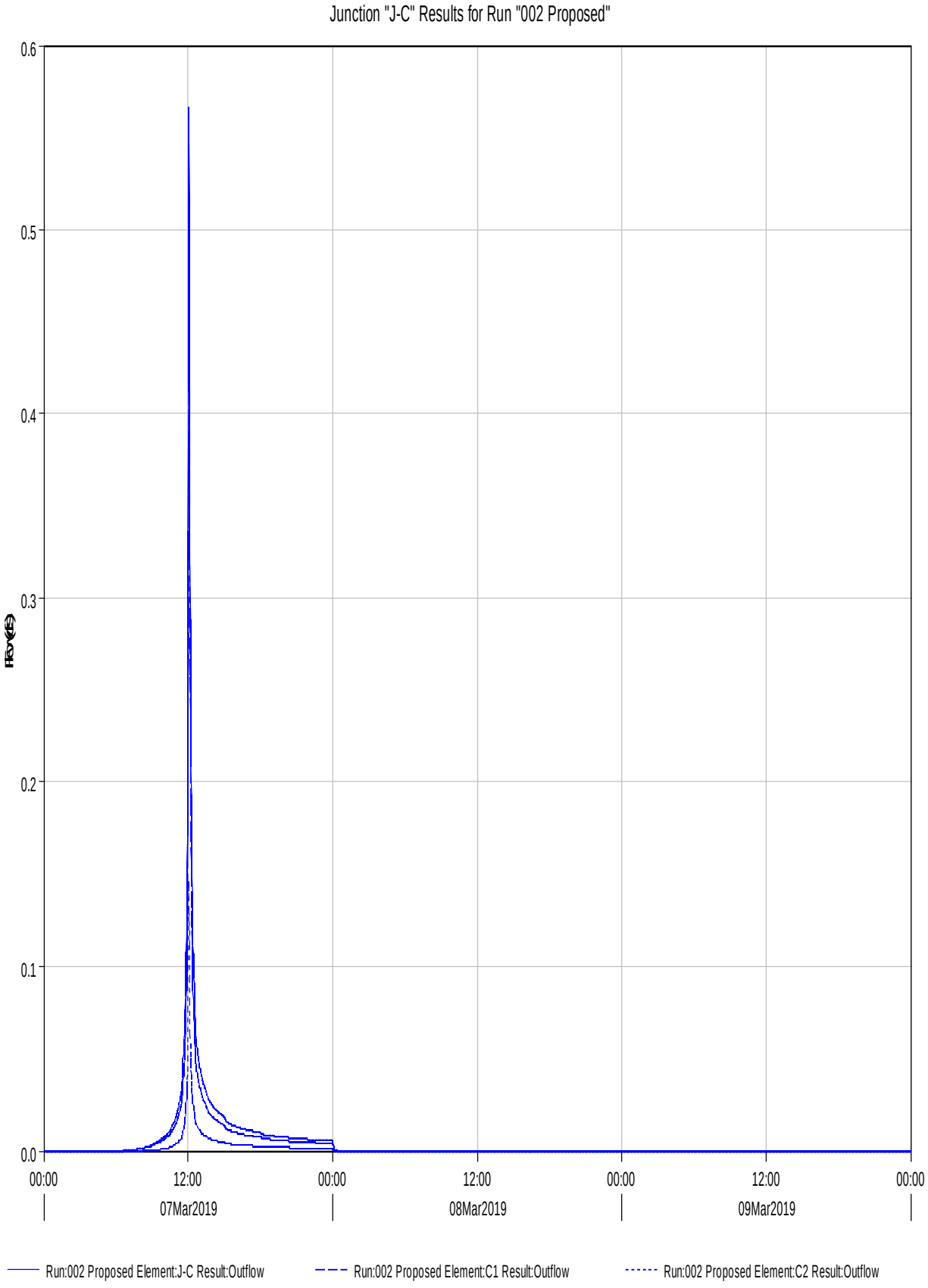
Project: Lee's Summit Simulation Run: 002 Proposed

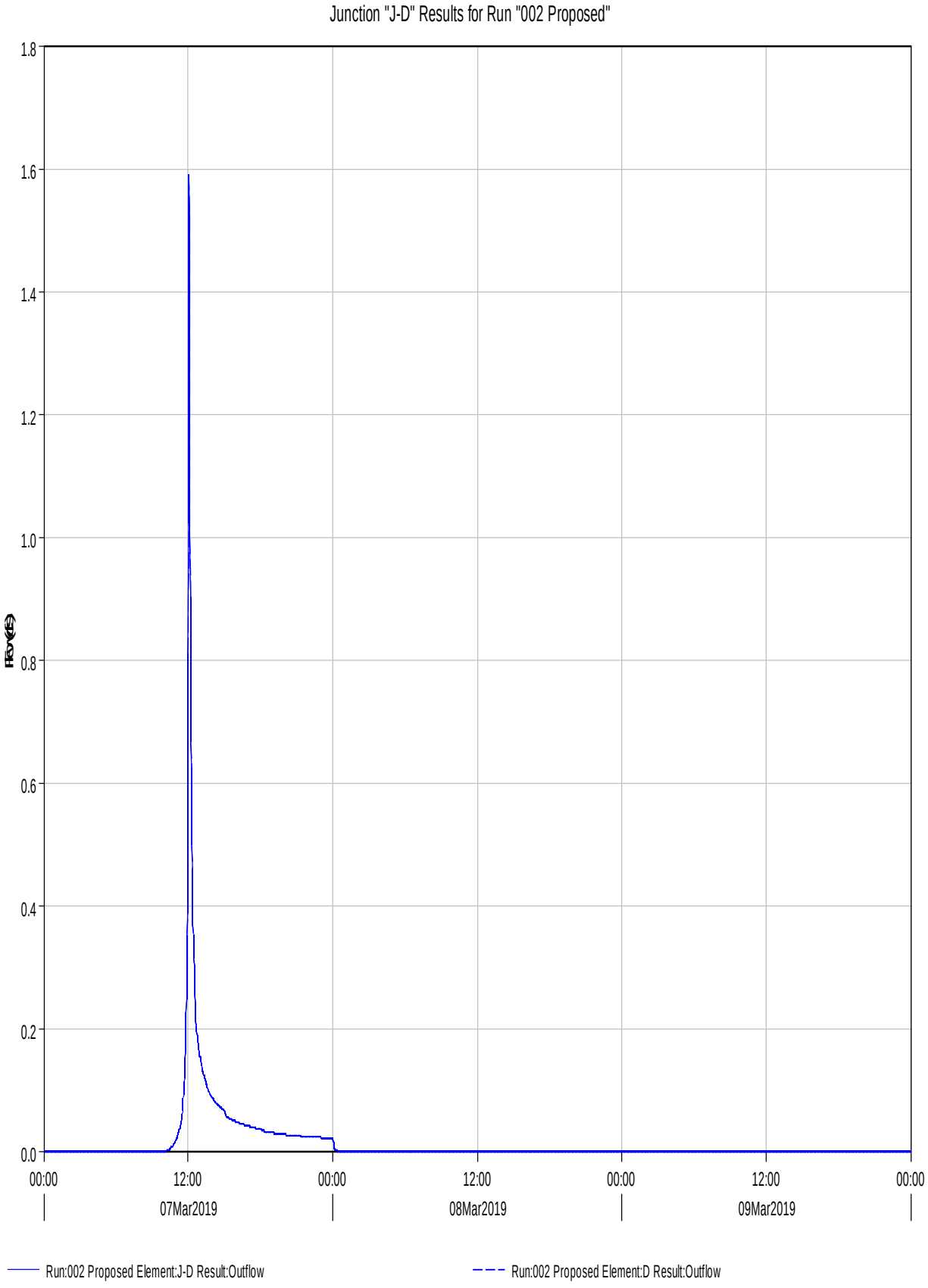
Start of Run: 07Mar2019, 00:00 Basin Model: Proposed
End of Run: 10Mar2019, 00:00 Meteorologic Model: 002-Year
Compute Time: 23May2019, 10:46:30 Control Specifications: 72-Hour

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
A1	0.00134	1.75	07Mar2019, 12:04	0.08
A2	0.00011	0.32	07Mar2019, 12:04	0.02
A3	0.00038	0.95	07Mar2019, 12:04	0.05
A4	0.00036	1.02	07Mar2019, 12:04	0.06
A5	0.00050	1.06	07Mar2019, 12:05	0.06
A6	0.00017	0.38	07Mar2019, 12:05	0.02
B	0.00020	0.26	07Mar2019, 12:04	0.01
C1	0.00022	0.42	07Mar2019, 12:06	0.02
C2	0.00008	0.15	07Mar2019, 12:04	0.01
D	0.00138	1.59	07Mar2019, 12:06	0.09
Detention	0.00141	0.43	07Mar2019, 12:32	0.17
J-A	0.00286	2.20	07Mar2019, 12:04	0.27
J-A1	0.00034	0.98	07Mar2019, 12:04	0.05
J-B	0.00020	0.26	07Mar2019, 12:04	0.01
J-C	0.00030	0.57	07Mar2019, 12:05	0.03
J-D	0.00138	1.59	07Mar2019, 12:06	0.09
J-1	0.00141	0.43	07Mar2019, 12:32	0.17
J-2	0.00152	0.48	07Mar2019, 12:06	0.19
Pool	0.00034	0.98	07Mar2019, 12:04	0.05
R-1	0.00141	0.43	07Mar2019, 12:32	0.17
R-2	0.00152	0.48	07Mar2019, 12:06	0.19


Junction "J-A" Results for Run "002 Proposed"
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"
0.25
0.20
0.15
0.10
0.05
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

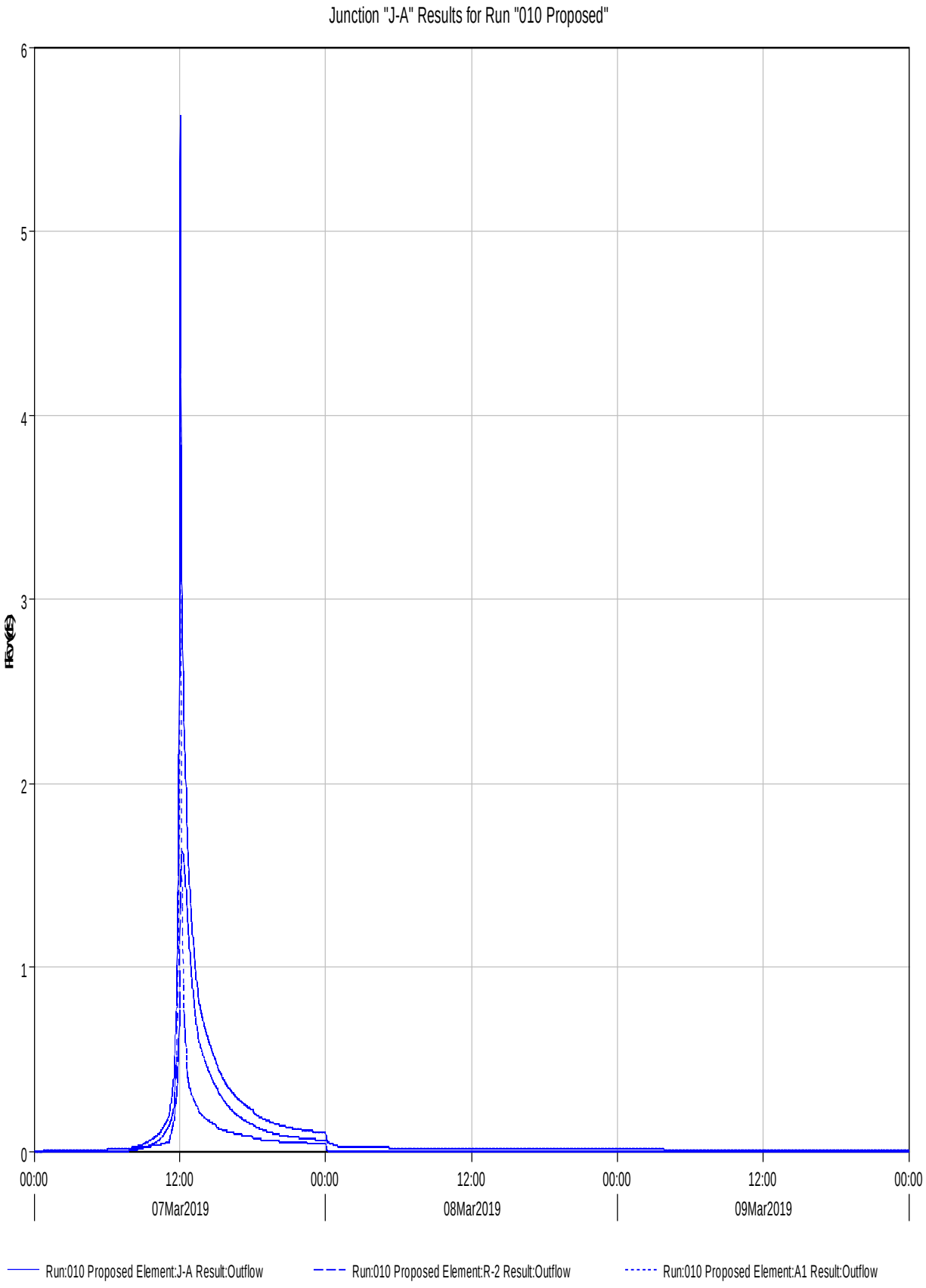

Junction "J-C" Results for Run "002 Proposed"
0.6
0.5
0.4
0.3
0.2
0.1
0.0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:002 Proposed Element:J-C Result:Outflow
Run:002 Proposed Element:C1 Result:Outflow
Run:002 Proposed Element:C2 Result:Outflow

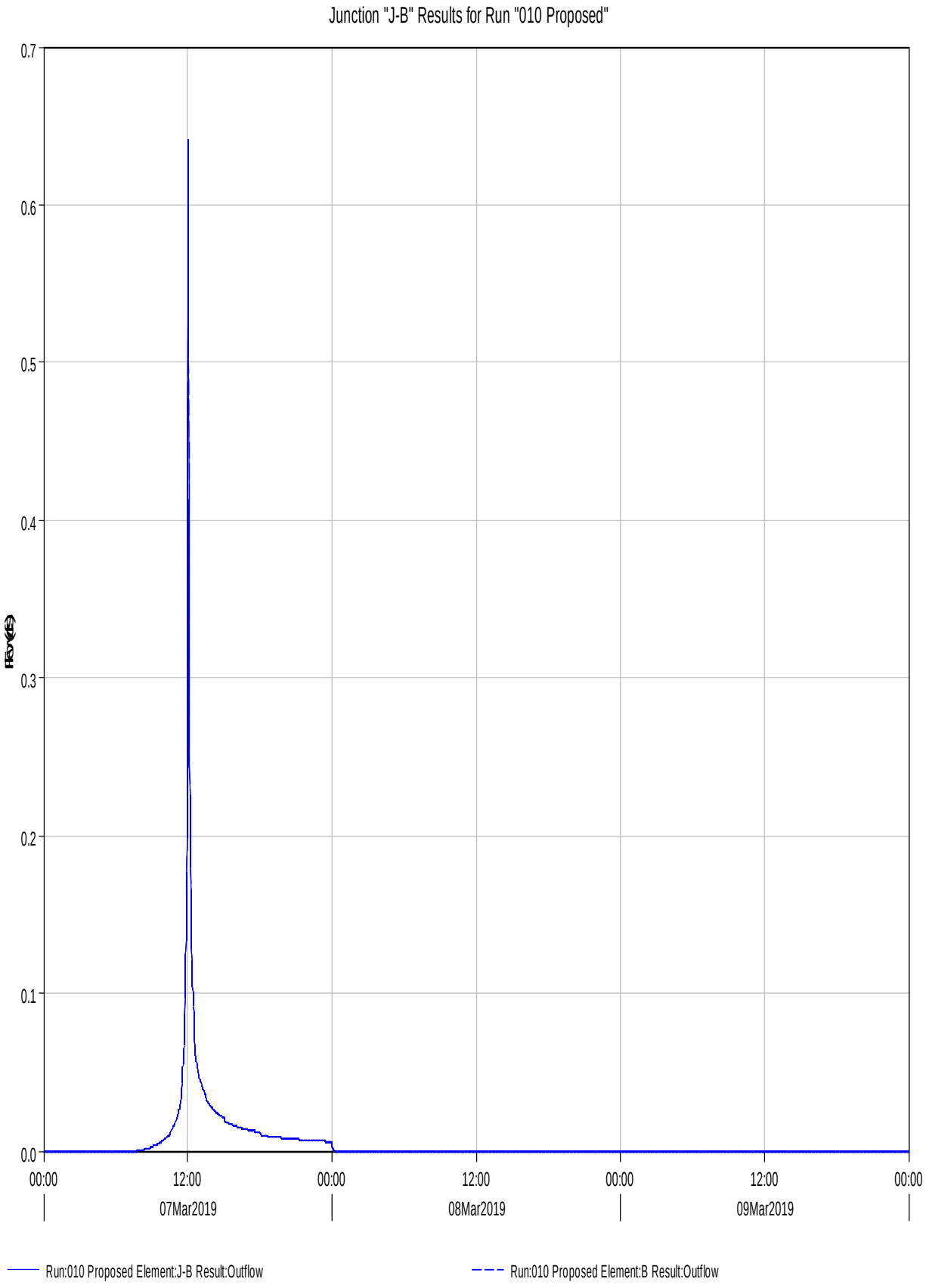

Junction "J-D" Results for Run "002 Proposed"
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:002 Proposed Element:J-D Result:Outflow
Run:002 Proposed Element:D Result:Outflow

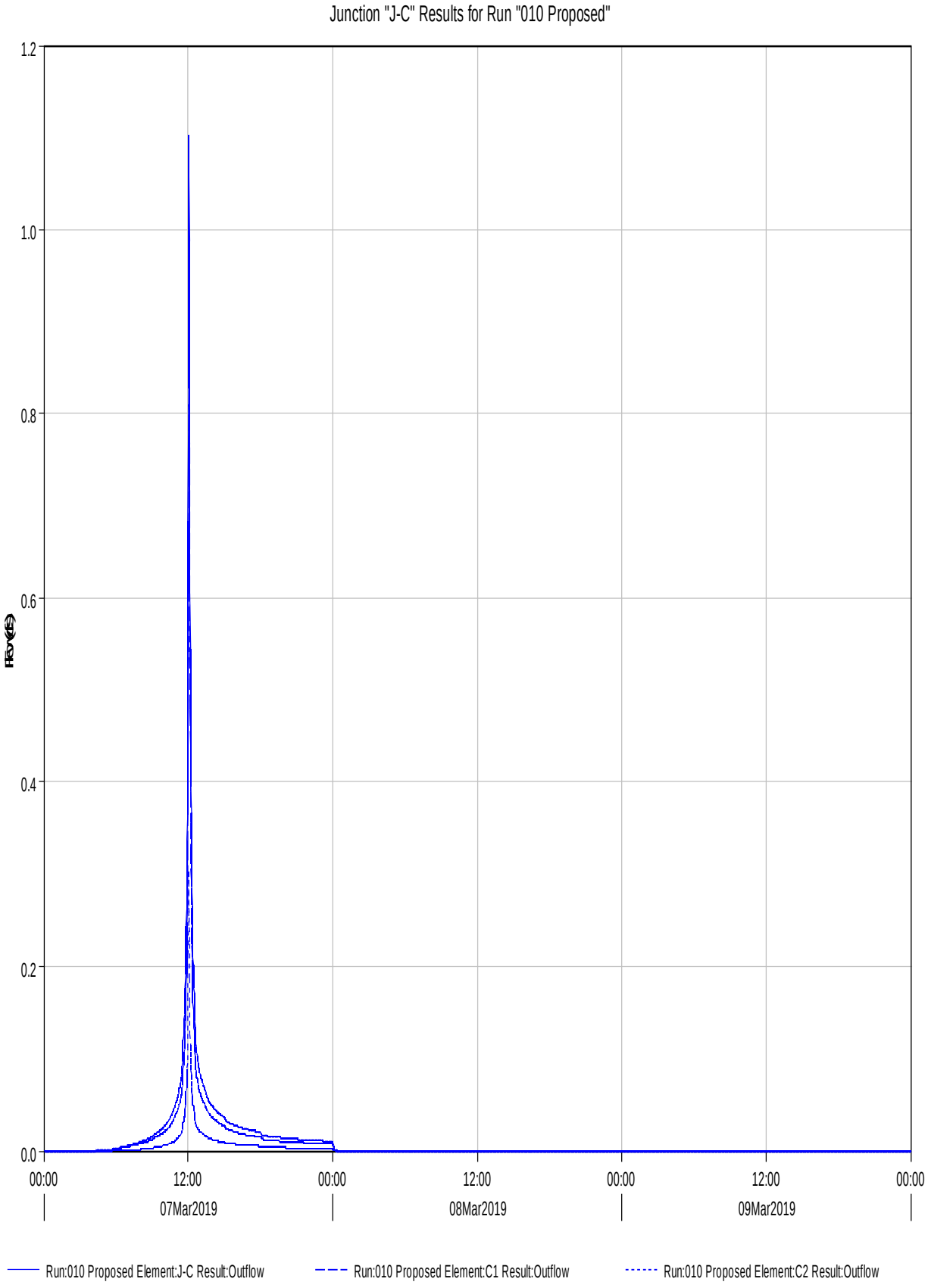
Project: Lee's Summit Simulation Run: 010 Proposed

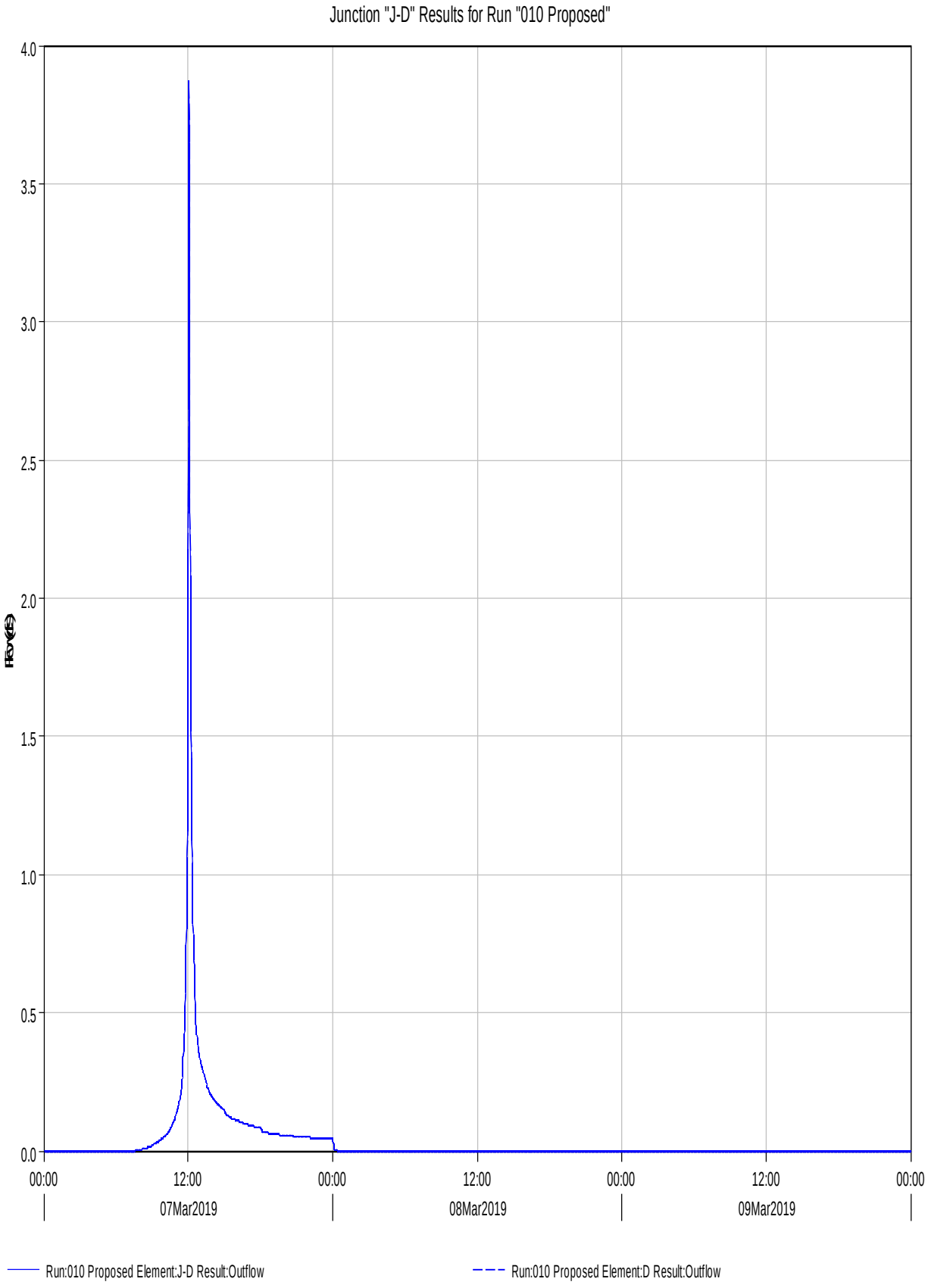
Start of Run: 07Mar2019, 00:00 Basin Model: Proposed
End of Run: 10Mar2019, 00:00 Meteorologic Model: 010-Year
Compute Time: 23May2019, 10:44:27 Control Specifications: 72-Hour

A1	0.00134	4.30	07Mar2019, 12:04	0.22
A2	0.00011	0.52	07Mar2019, 12:04	0.03
A3	0.00038	1.67	07Mar2019, 12:04	0.10
A4	0.00036	1.67	07Mar2019, 12:04	0.10
A5	0.00050	1.99	07Mar2019, 12:05	0.11
A6	0.00017	0.70	07Mar2019, 12:04	0.04
B	0.00020	0.64	07Mar2019, 12:04	0.03
C1	0.00022	0.81	07Mar2019, 12:05	0.05
C2	0.00008	0.30	07Mar2019, 12:04	0.02
D	0.00138	3.87	07Mar2019, 12:05	0.23
Detention	0.00141	1.50	07Mar2019, 12:18	0.34
J-A	0.00286	5.63	07Mar2019, 12:04	0.59
J-A1	0.00034	1.59	07Mar2019, 12:04	0.10
J-B	0.00020	0.64	07Mar2019, 12:04	0.03
J-C	0.00030	1.10	07Mar2019, 12:05	0.07
J-D	0.00138	3.87	07Mar2019, 12:05	0.23
J-1	0.00141	1.50	07Mar2019, 12:18	0.34
J-2	0.00152	1.63	07Mar2019, 12:16	0.37
Pool	0.00034	1.59	07Mar2019, 12:04	0.10
R-1	0.00141	1.50	07Mar2019, 12:18	0.34
R-2	0.00152	1.63	07Mar2019, 12:16	0.37


Junction "J-A" Results for Run "010 Proposed"
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"
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

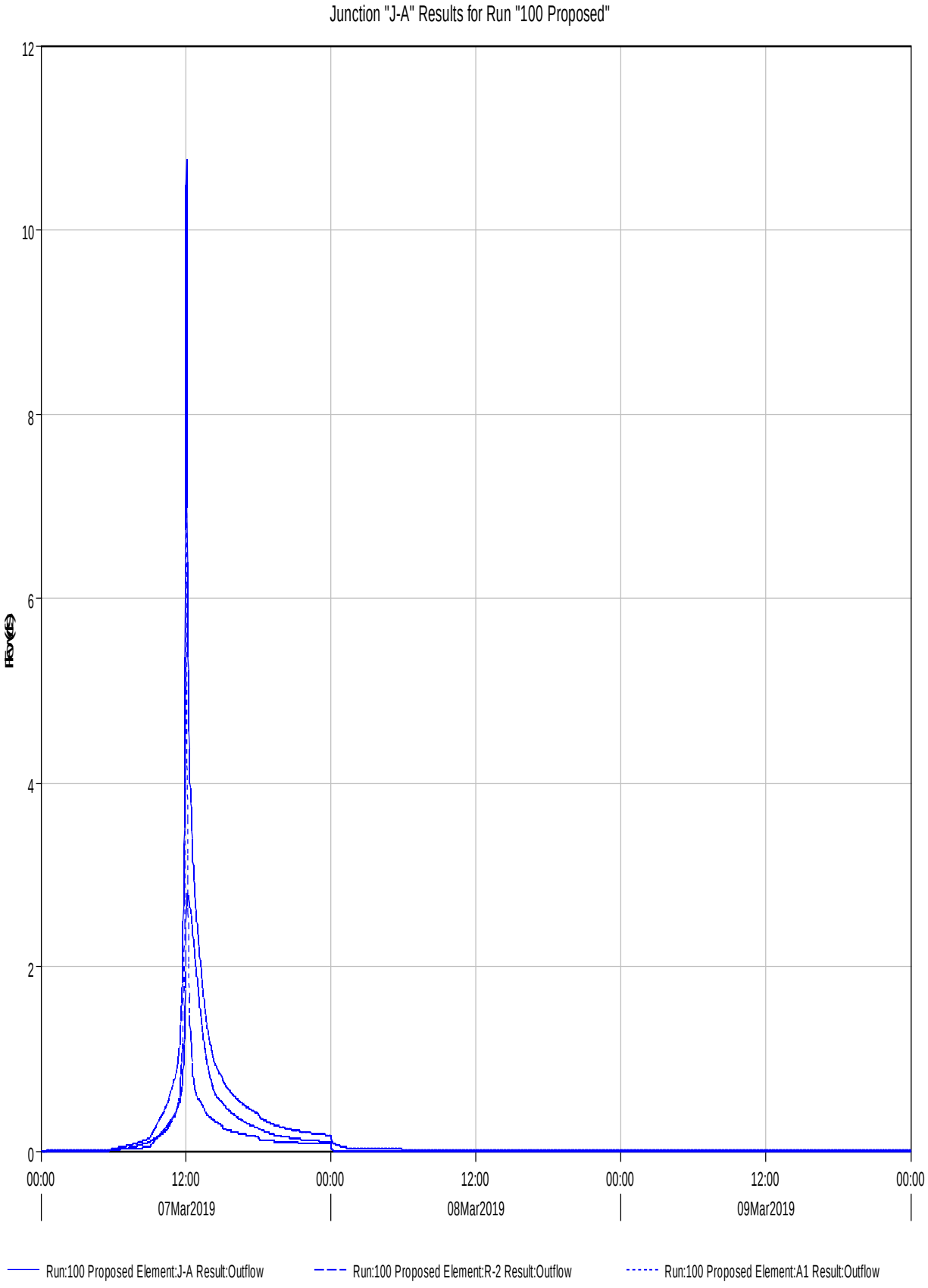

Junction "J-C" Results for Run "010 Proposed"
1.2
1.0
0.8
0.6
0.4
0.2
0.0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:010 Proposed Element:J-C Result:Outflow
Run:010 Proposed Element:C1 Result:Outflow
Run:010 Proposed Element:C2 Result:Outflow

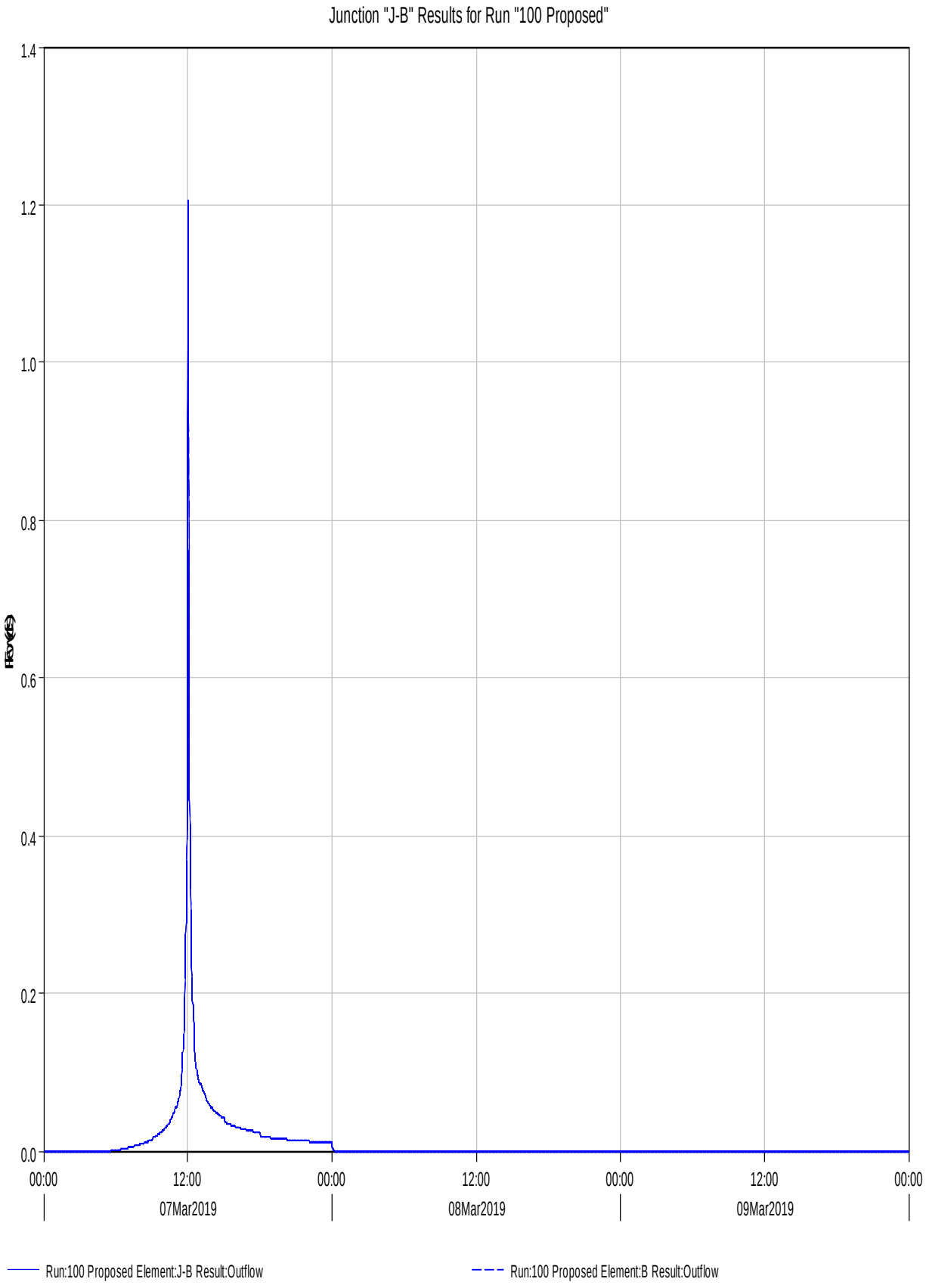

Junction "J-D" Results for Run "010 Proposed"
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:010 Proposed Element:J-D Result:Outflow
Run:010 Proposed Element:D Result:Outflow

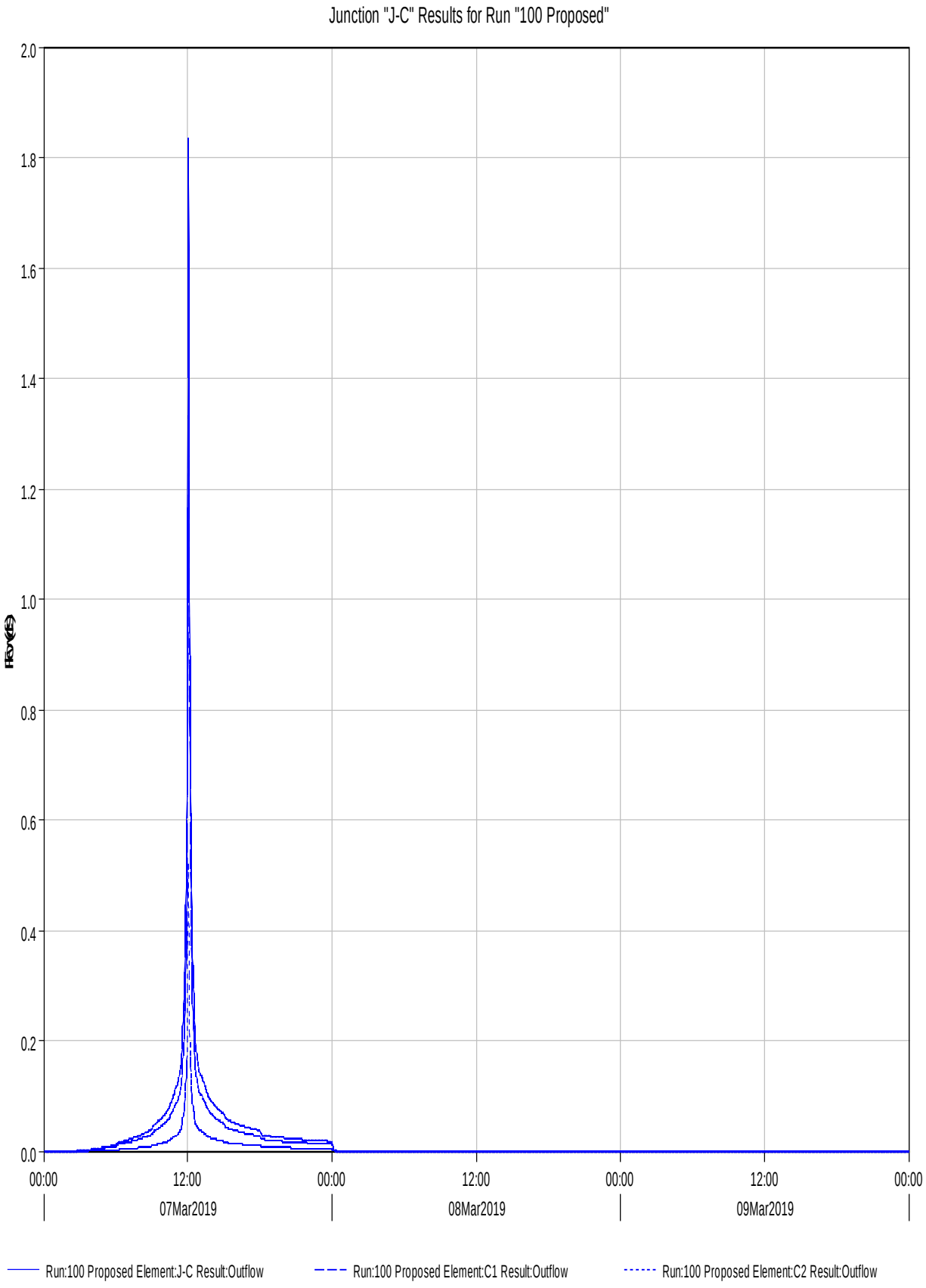
Project: Lee's Summit Simulation Run: 100 Proposed

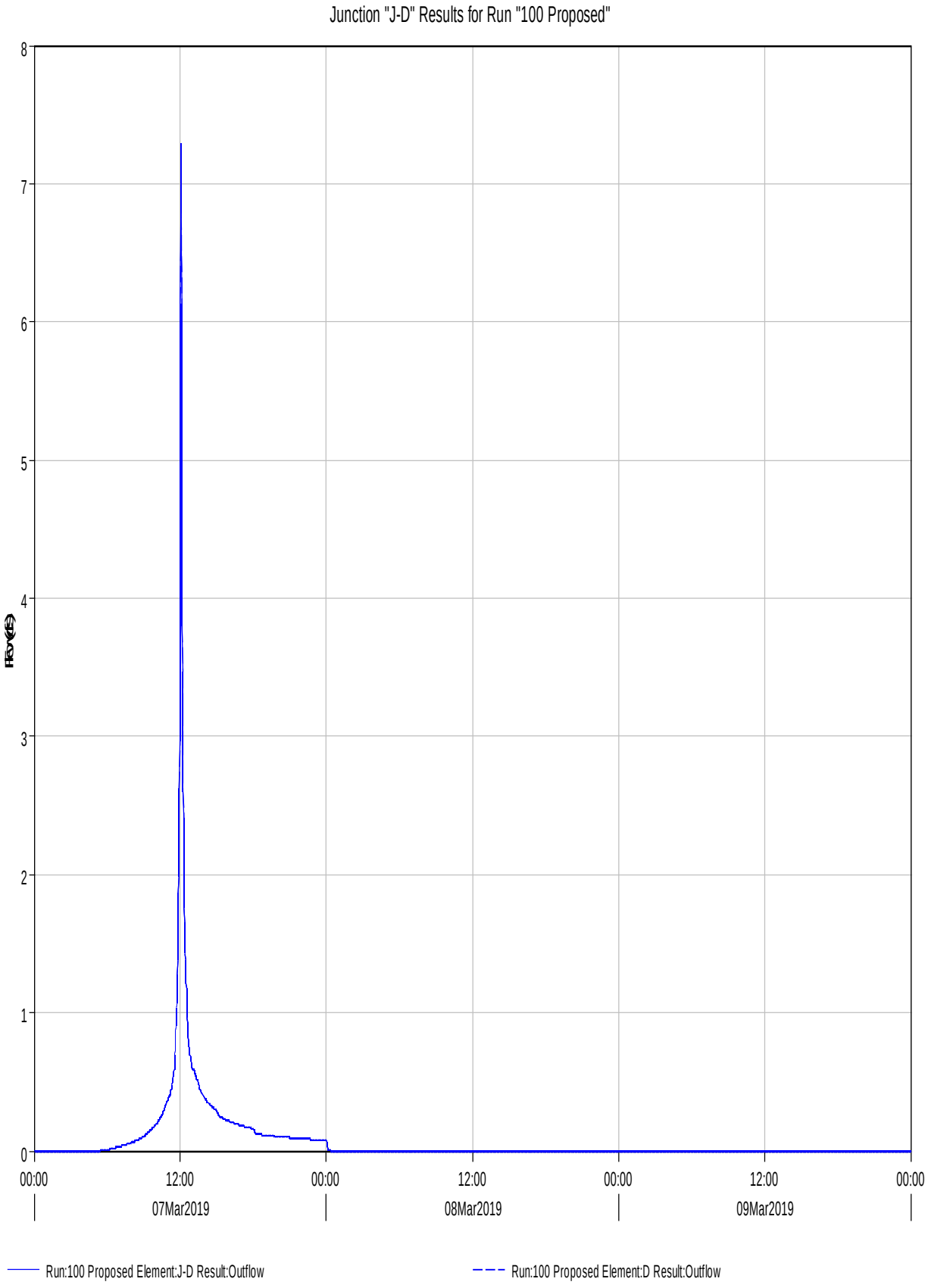
Start of Run: 07Mar2019, 00:00 Basin Model: Proposed
End of Run: 10Mar2019, 00:00 Meteorologic Model: 100-Year
Compute Time: 23May2019, 10:44:04 Control Specifications: 72-Hour

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
A1	0.00134	8.10	07Mar2019, 12:04	0.45
A2	0.00011	0.79	07Mar2019, 12:04	0.05
A3	0.00038	2.65	07Mar2019, 12:04	0.17
A4	0.00036	2.56	07Mar2019, 12:04	0.17
A5	0.00050	3.26	07Mar2019, 12:05	0.21
A6	0.00017	1.13	07Mar2019, 12:04	0.07
B	0.00020	1.21	07Mar2019, 12:04	0.07
C1	0.00022	1.33	07Mar2019, 12:05	0.09
C2	0.00008	0.52	07Mar2019, 12:04	0.03
D	0.00138	7.29	07Mar2019, 12:05	0.47
Detention	0.00141	2.53	07Mar2019, 12:18	0.61
J-A	0.00286	10.76	07Mar2019, 12:04	1.11
J-A1	0.00034	2.43	07Mar2019, 12:04	0.16
J-B	0.00020	1.21	07Mar2019, 12:04	0.07
J-C	0.00030	1.84	07Mar2019, 12:05	0.12
J-D	0.00138	7.29	07Mar2019, 12:05	0.47
J-1	0.00141	2.53	07Mar2019, 12:18	0.61
J-2	0.00152	2.81	07Mar2019, 12:07	0.66
Pool	0.00034	2.43	07Mar2019, 12:04	0.16
R-1	0.00141	2.53	07Mar2019, 12:18	0.61
R-2	0.00152	2.81	07Mar2019, 12:07	0.66

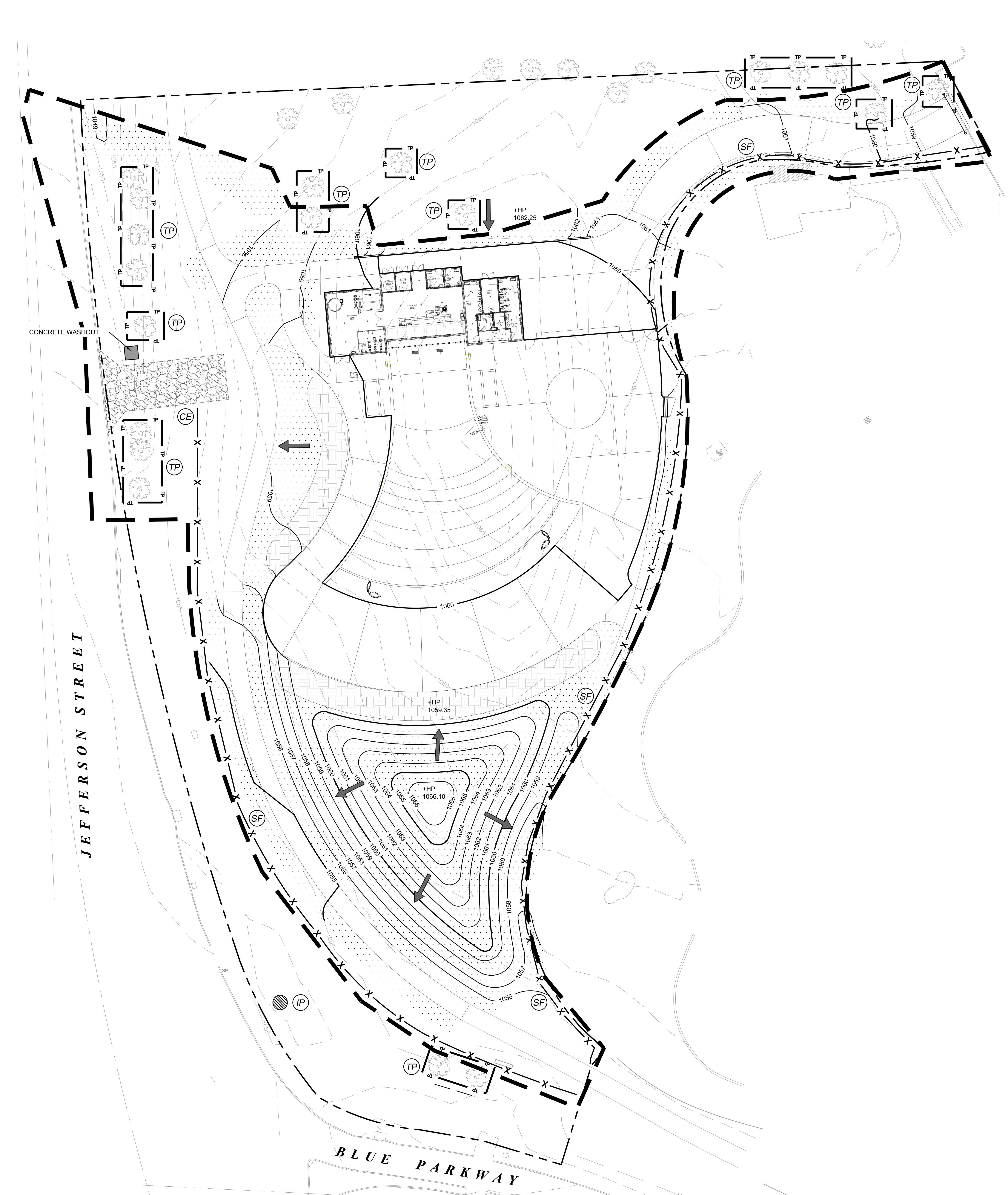

Junction "J-A" Results for Run "100 Proposed"
12
10
8
6
4
2
0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:100 Proposed Element:J-A Result:Outflow
Run:100 Proposed Element:R-2 Result:Outflow
Run:100 Proposed Element:A1 Result:Outflow

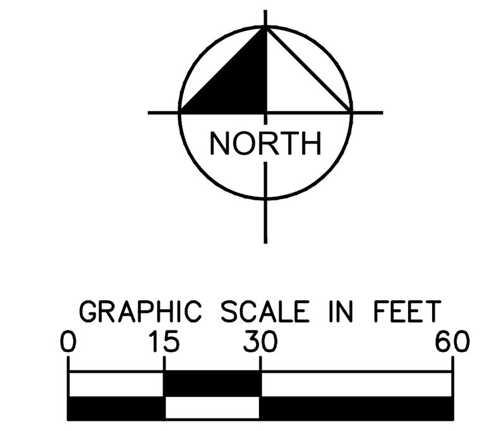

Junction "J-B" Results for Run "100 Proposed"
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
07Mar2019
08Mar2019
09Mar2019
Run:100 Proposed Element:J-B Result:Outflow
Run:100 Proposed Element:B Result:Outflow


Junction "J-C" Results for Run "100 Proposed"
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"
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

STOP!
CALL BEFORE YOU DIG
MISSOURI ONE CALL SYSTEM
1-800-344-7483 or 811
(@ least 72 hours prior to digging)





LEGEND

- 1055 — PROPOSED CONTOUR
- 1055 — EXISTING CONTOUR
- LIMITS OF DISTURBED AREA
- (CE) PROPOSED STABILIZED CONSTRUCTION ENTRANCE
- PROPOSED LANDSCAPE AREA
- PROPOSED BIOSWALE
- (SF) FILTER BARRIER
- (TP) TREE PROTECTION
- FLOW ARROW
- (IP) INLET PROTECTION

SITE MAP-GENERAL NOTES

1. CONTRACTOR IS SOLELY RESPONSIBLE FOR SELECTION, IMPLEMENTATION, MAINTENANCE, AND EFFECTIVENESS OF ALL SWPPP CONTROLS - CONTROLS SHOWN ON THIS SITE MAP ARE SUGGESTED CONTROLS ONLY.
2. CONTRACTOR SHALL RECORD INSTALLATION, MAINTENANCE OR MODIFICATION, AND REMOVAL DATES FOR EACH BMP EMPLOYED (WHETHER CALLED OUT ON ORIGINAL SWPPP OR NOT) DIRECTLY ON THE SITE MAP.
3. DRAINAGE PATTERNS ARE SHOWN ON THIS PLAN BY PROPOSED AND EXISTING CONTOURS, FLOW ARROWS, AND SLOPES.
4. TEMPORARY AND PERMANENT STABILIZATION PRACTICES AND BMP'S SHALL BE INSTALLED AS PER THE STORM WATER POLLUTION PREVENTION PLAN. AS AN EXAMPLE, PERIMETER SILT FENCE SHALL BE INSTALLED BEFORE COMMENCEMENT OF ANY GRADING ACTIVITIES. OTHER BMP'S SHALL BE INSTALLED AS SOON AS PRACTICABLE AND SHALL BE MAINTAINED UNTIL FINAL SITE STABILIZATION IS ATTAINED. CONTRACTOR SHALL ALSO REFERENCE CIVIL AND LANDSCAPE PLANS SINCE PERMANENT STABILIZATION IS PROVIDED BY LANDSCAPING, THE BUILDING(S), AND SITE PAVING.
5. BMP'S HAVE BEEN LOCATED AS INDICATED ON THIS PLAN IN ACCORDANCE WITH GENERALLY ACCEPTED ENGINEERING PRACTICES IN ORDER TO MINIMIZE SEDIMENT TRANSFER. FOR EXAMPLE: SILT FENCES LOCATED AT TOE OF SLOPE AND INLET PROTECTION FOR INLETS RECEIVING SEDIMENT FROM SITE RUN-OFF.
6. SANITARY SEWER EFFLUENT IS DISPOSED OF VIA AN ON-SITE SEWER SYSTEM CONNECTED TO A MUNICIPAL SEWER SYSTEM.

EROSION CONTROL SCHEDULE AND SEQUENCING

A. NOTIFY ALL APPLICABLE AUTHORITIES AT LEAST 48 HOURS PRIOR TO BEGINNING ANY WORK; CALL THE 'MISSOURI ONE CALL CENTER' AT1-800-344-7482 FOR UTILITY LOCATIONS.
B. INSTALL TEMPORARY EROSION CONTROLS AND TREE PROTECTION FENCING PRIOR TO ANY CLEARING AND GRUBBING.
C. DEMOLISH AREAS INDICATED ON EXISTING CONDITIONS AND REMOVAL ITEMS SHEET. (IF APPLICABLE)
D. CLEAR AND GRUB AND STRIP TOPSOIL. STOCKPILE TOPSOIL FOR LATER USE.
E. CONSTRUCT TEMPORARY RETENTION/DETENTION POND. (IF APPLICABLE)
F. ROUGH GRADE SITE PER GRADING PLAN.
G. INSTALL STORM SEWER LINES AND APPURTENANCES.
H. INSTALL TEMPORARY EROSION/SEDIMENTATION Controls ON NEW STORM SEWER INLETS.
I. INSTALL WATER AND WASTE WATER LINES AND APPURTENANCES.
J. ENSURE THAT ALL UNDERGROUND UTILITY CROSSINGS ARE COMPLETED.
K. RAISE MANHOLE FRAMES AND COVERS TO TOP OF NATURAL GROUND.
L. CONSTRUCT PAVED AREAS, CURBS. ISLANDS AND INSTALL INLET EROSION PROTECTION.
M. COMPLETE RESTORATION OF SITE VEGETATION.
N. WRITE CONCURRENCE LETTER AND SCHEDULE FINAL INSPECTION WITH INSPECTOR.
O. REMOVE AND DISPOSE OF TEMPORARY EROSION CONTROLS WHEN RESTORATION HAS BEEN ACCEPTED.
P. COMPLETE ANY NECESSARY FINAL DRESS UP OF AREAS DISTURBED BY ITEM “O”

TOTAL STATION LAYOUT

KIMLEY-HORN WILL PROVIDE AN AUTOCAD FILE OF THIS PLAN TO THE CONTRACTOR'S SURVEYOR TO USE FOR LAYOUT, VIA TOTAL STATION.

SITE MAP-SITE SPECIFIC NOTES

1. CONSTRUCTION ENTRANCE SHALL BE LOCATED SO AS TO PROVIDE THE LEAST AMOUNT OF DISTURBANCE TO THE FLOW OF TRAFFIC IN AND OUT OF THE SITE. ADDITIONALLY, CONSTRUCTION ENTRANCE SHALL BE LOCATED TO COINCIDE WITH THE PHASING OF THE PAVEMENT REPLACEMENT.
2. THE NATURE OF THIS SITE'S CONSTRUCTION CONSISTS OF:
   A. DEMOLITION
   B. PRELIMINARY GRADING
   C. UTILITY INSTALLATION
   D. PAVEMENT CONSTRUCTION
   E. FINAL GRADING AND STABILIZATION
3. CONTRACTOR TO REFERENCE GEOTECHNICAL REPORT PREPARED BY INTERTEK PSI (PROJECT NO. 03381842 DATED DECEMBER 14, 2018) FOR SOIL CONDITIONS.
4. ALL STORM WATER ON-SITE WILL SHEET FLOW INTO THE ON-SITE UNDERGROUND STORM DRAINAGE SYSTEM OR CONTINUE ALONG EXISTING DRAINAGE ROUTE
5. NO SEDIMENTATION BASINS HAVE BEEN PROVIDED ON THIS SITE BECAUSE THE AREA OF DISTURBANCE IS LESS THAN 10.0 ACRES.
6. POST CONSTRUCTION STORM WATER POLLUTION CONTROL MEASURES INCLUDE STABILIZATION BY PERMANENT PAVING, DRAINAGE SYSTEM STRUCTURE, OR LANDSCAPING.
7. VELOCITY DISSIPATION DEVICES (RIP-RAP) WILL NOT BE USED.
8. DISTURBED PORTIONS OF SITE MUST BE STABILIZED. STABILIZATION PRACTICES MUST BE INITIATED WITHIN 14 DAYS IN PORTIONS OF THE SITE WHERE CONSTRUCTION HAS BEEN EITHER TEMPORARILY OR PERMANENTLY CEASED, UNLESS EXCEPTED WITHIN THE NPDES PERMIT. CONTRACTOR SHALL REMOVE TEMPORARY EROSION CONTROL DEVICES UPON COMPLETION OF STABILIZATION OR PERMANENT DRAINAGE FACILITIES.
9. PER FIRM MAP NO. 29095C0417G EFFECTIVE 01-20-2017, THE SITE IS LOCATED WITHIN FEMA DESIGNATED "X" FLOODPLAIN.
10. CONTRACTOR IS RESPONSIBLE FOR MODIFYING THE SWPPP/SITE MAP TO INCLUDE BMP'S FOR ANY OFF-SITE MATERIAL WASTE, BORROW OR EQUIPMENT STORAGE AREAS.
11. CONTRACTOR SHALL INSPECT DISTURBED AREAS, MATERIAL STORAGE AREAS EXPOSED TO PRECIPITATION, STRUCTURAL CONTROL MEASURES, AND VEHICLE ENTRY AND EXIT AREAS AT LEAST ONCE EVERY 14 CALENDAR DAYS AND WITHIN 24 HOURS OF A STORM EVENT OF 0.5 INCHES OR GREATER.

Kimley»Horn
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WWW.KIMLEY-HORN.COM
MISSOURI REGISTRATION NUMBER 001612

95% REVIEW SET
FOR REVIEW ONLY
Not for construction or permit purposes.
Kimley»Horn
Engineer KEVIN S. GASKEY
P.E. No. 28441 Date MAY 2019

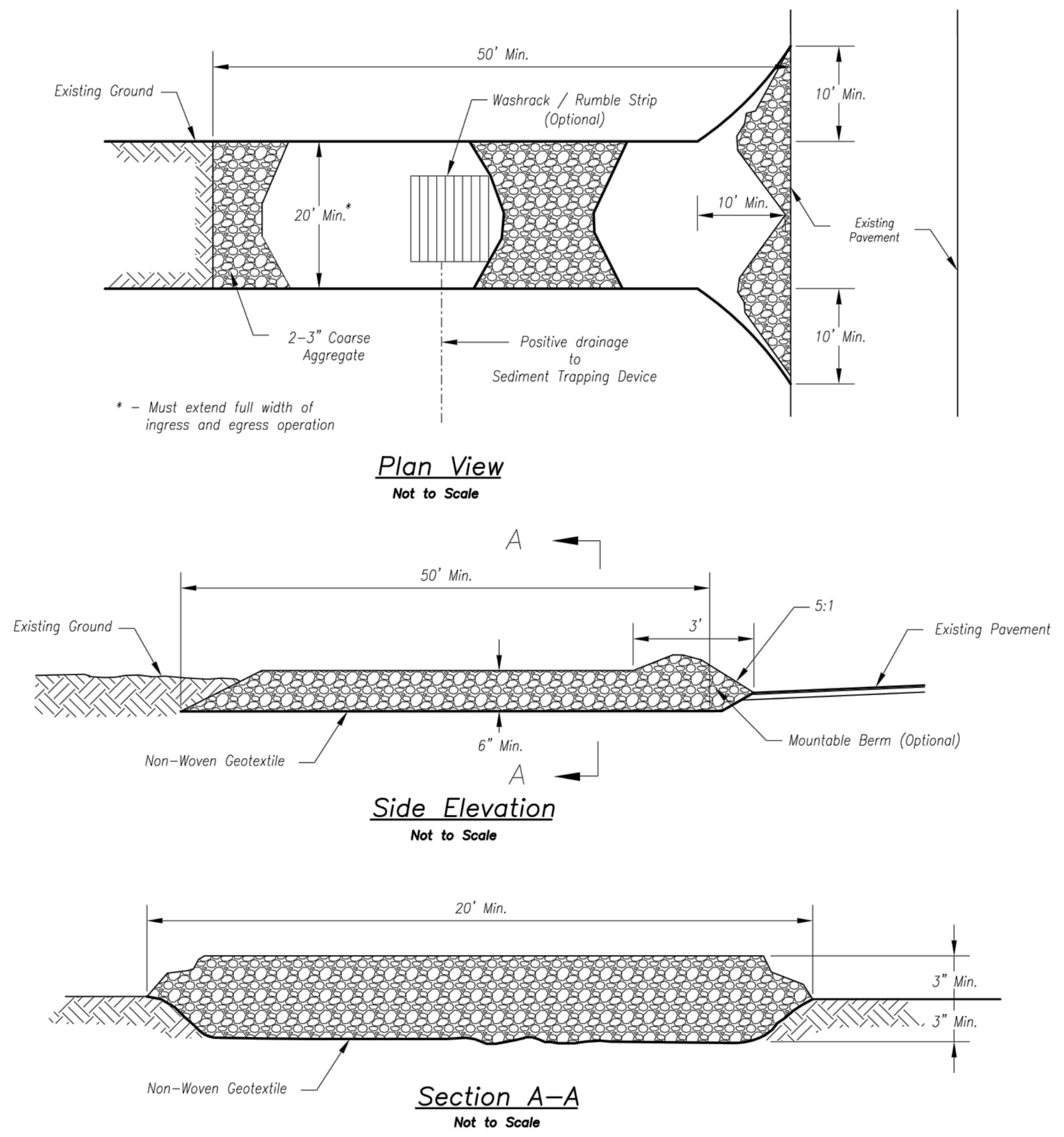
SUMMIT WAVES WAVE POOL ADDITION LEE'S SUMMIT, MO

EROSION CONTROL PLAN

Scale:	AS SHOWN
Designed by:	ABP
Drawn by:	ABO
Checked by:	SEG
Date:	MAY 2019
Project No.	064538700

SHEET

C-1



Notes for Construction Entrance:

1. Avoid locating on steep slopes, at curves on public roads, or downhill of disturbed area.
2. Remove all vegetation and other unsuitable material from the foundation area, grade, and crown for positive drainage.
3. If slope towards the public road exceeds 2%, construct a 6– to 8–inch high ridge with 3H:1V side slopes across the foundation approximately 15 feet from the edge of the public road to divert runoff from it.
4. Install pipe under the entrance if needed to maintain drainage ditches along public roads.
5. Place stone to dimensions and grade as shown on plans. Leave surface sloped for drainage.
6. Divert all surface runoff and drainage from the entrance to a sediment control device.
7. If conditions warrant, place geotextile fabric on the graded foundation to improve stability.

Maintenance for Construction Entrance:

1. Reshape entrance as needed to maintain function and integrity of Installation. Top dress with clean aggregate as needed.

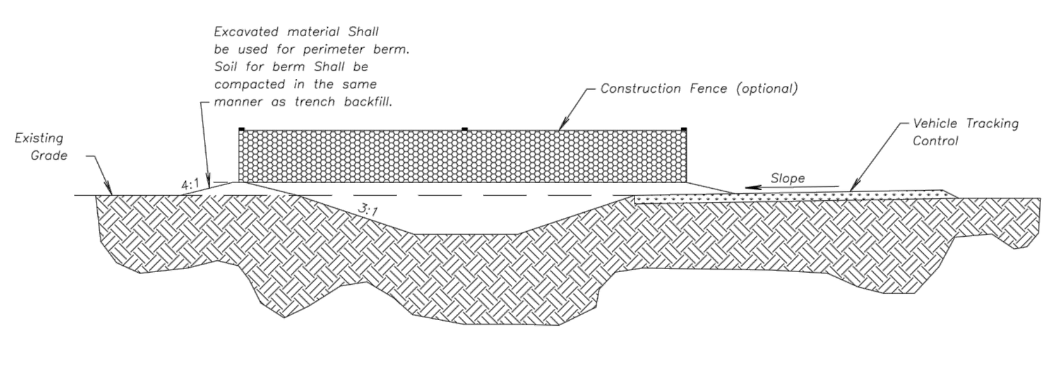
CONSTRUCTION ENTRANCE

Notes for Concrete Washout:

1. Concrete washout areas shall be installed prior to any concrete placement on site.
2. Concrete washout area shall include a flat subsurface pit sized relative to the amount of concrete to be placed on site. The slopes leading out of the subsurface pit shall be 3:1. The vehicle tracking pad shall be sloped towards the concrete washout area.
3. Vehicle tracking control is required at the access point to all concrete washout areas.
4. Signs shall be placed at the construction site entrance, washout area and elsewhere as necessary to clearly indicate the location(s) of the concrete washout area(s) to operators of concrete truck and pump rigs.
5. A one–piece impervious liner may be required along the bottom and sides of the subsurface pit in sandy or gravelly soils.

Maintenance for Concrete Washout:

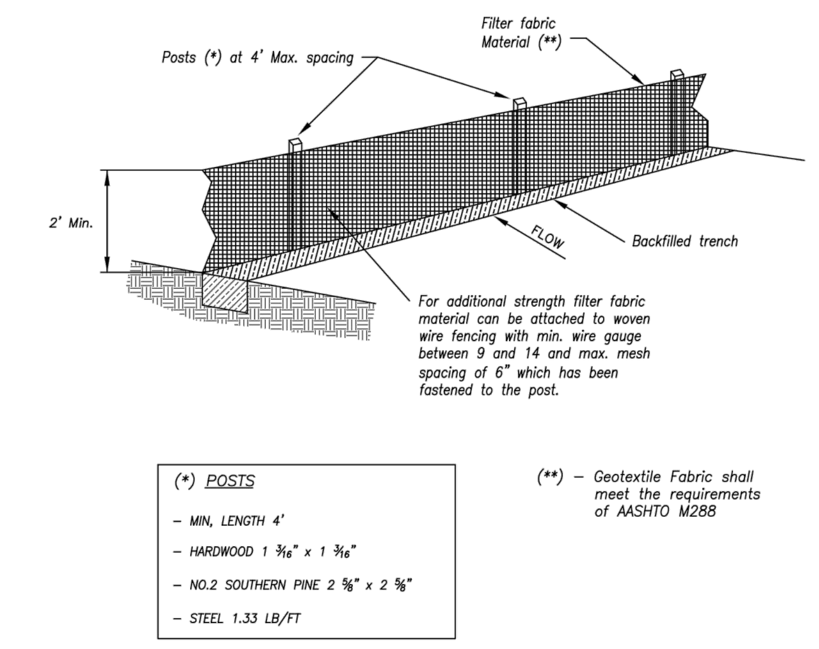
1. Concrete washout materials shall be removed once the materials have filled the washout to approximately 75% full.
2. Concrete washout areas shall be enlarged as necessary to maintain capacity for wasted concrete.
3. Concrete washout water, wasted pieces of concrete and all other debris in the subsurface pit shall be transported from the job site in a water–tight container and disposed of properly.
4. Concrete washout areas shall remain in place until all concrete for the project is placed.
5. When concrete washout areas are removed, excavations shall be filled with suitable compacted backfill and topsoil, any disturbed areas associated with the installation, maintenance, and/or removal of the concrete washout areas shall be stabilized.



CONCRETE WASHOUT

Construction Entrance modified from 2015 Overland Park Standard Details for Erosion and Sediment Control; Concrete Washout modified from 2009 City of Great Bend Standard Drawings.

AMERICAN PUBLIC WORKS ASSOCIATION	
APWA Kansas City Metro Chapter	KANSAS CITY METRO CHAPTER
CONSTRUCTION ENTRANCE AND CONCRETE WASHOUT	STANDARD DRAWING NUMBER ESC-01 ADOPTED: 10/24/2016



SILT FENCE DETAILS
Not to Scale

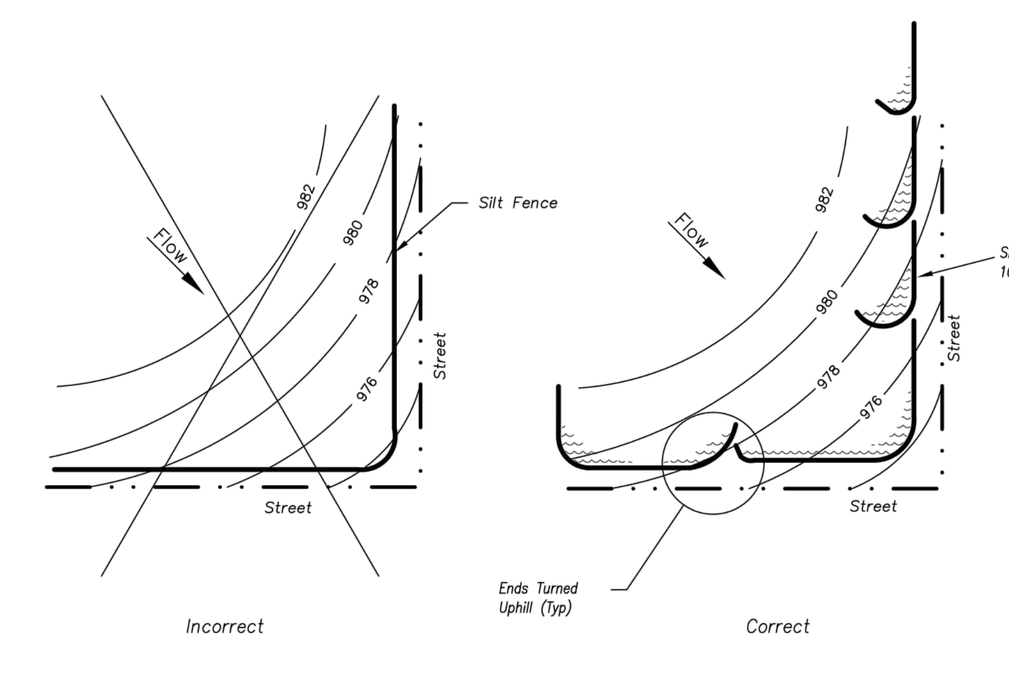
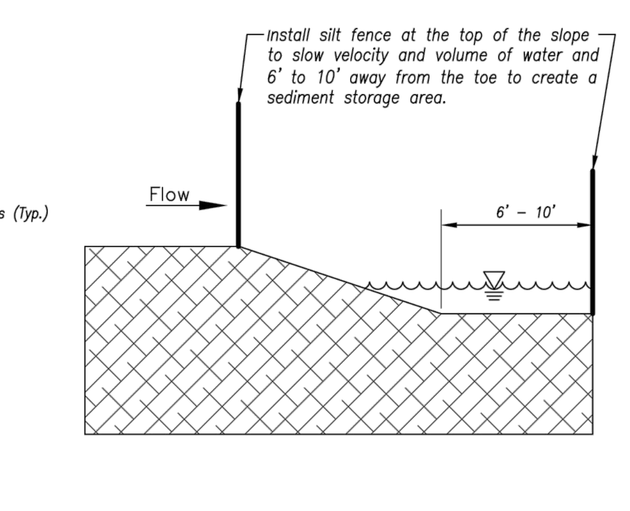


Figure A

SILT FENCE LAYOUT
Not to Scale

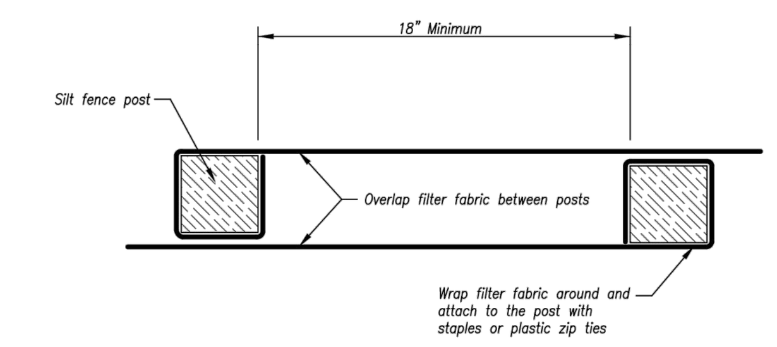


Notes:

1. In order to contain water, the ends of the silt fence must be turned uphill (Figure A).
2. Long perimeter runs of silt fence must be limited to 100'. Runs should be broken up into several smaller segments to minimize water concentrations (Figure A).
3. Long slopes should be broken up with intermediate rows of silt fence to slow runoff velocities.
4. Attach fabric to upstream side of post.
5. Install posts a minimum of 2' into the ground.
6. Trenching will only be allowed for small or difficult installation, where slicing machine cannot be reasonably used.

Maintenance:

1. Remove and dispose of sediment deposits when the deposit approaches ⅓ the height of silt fence.
2. Repair as necessary to maintain function and structure.

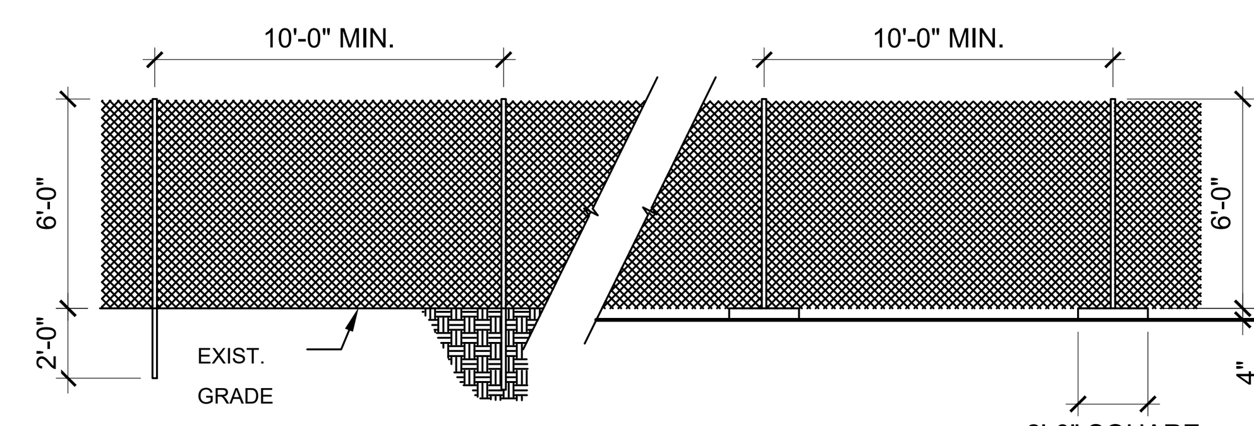


JOINING FENCE SECTIONS
Not to Scale

Modified from 2015 Overland Park Standard Details for Erosion and Sediment Control.

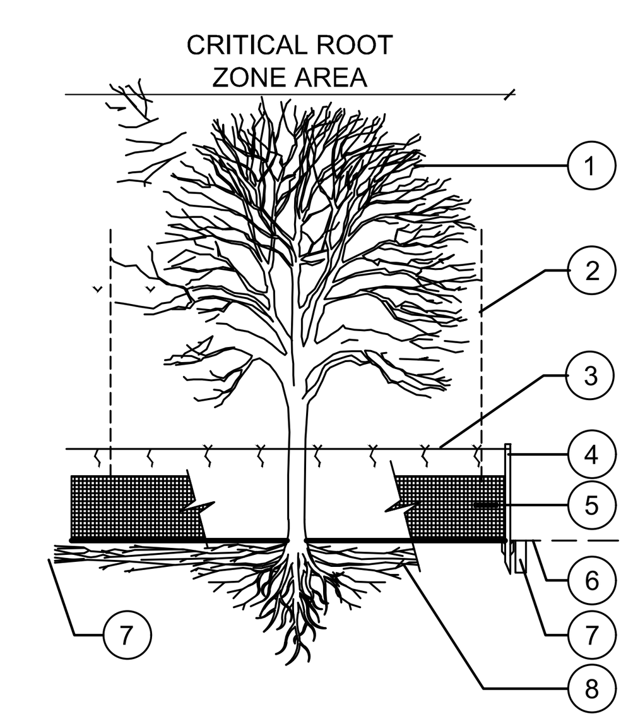
AMERICAN PUBLIC WORKS ASSOCIATION	
APWA Kansas City Metro Chapter	KANSAS CITY METRO CHAPTER
SILT FENCE	STANDARD DRAWING NUMBER ESC-03 ADOPTED: 10/24/2016

CHAIN LINK FENCE FABRIC IS TO BE 11 GAUGE HOT DIPPED ZINC COATED (GALVANIZED) IRON OR STEEL 8'-0" HIGH W/2 1/2" SQUARE DIAMOND. USE 8'-0" x 1 5/8" DIA. O.D. GALVANIZED IRON POSTS. CORNER AND GATE POSTS WILL BE 8'-0" x 2 3/4" DIA. O.D. ALL NON-MOVABLE FENCE POSTS TO BE SET IN A MIN. 2'-0" IN GROUND OR SET IN 4" THICK CONCRETE PAD 2'-0" SQUARE OR 2'-6" ROUND W/CORNER & GATE POSTS ADEQUATELY BRACED.



CONSTRUCTION FENCE

N.T.S.



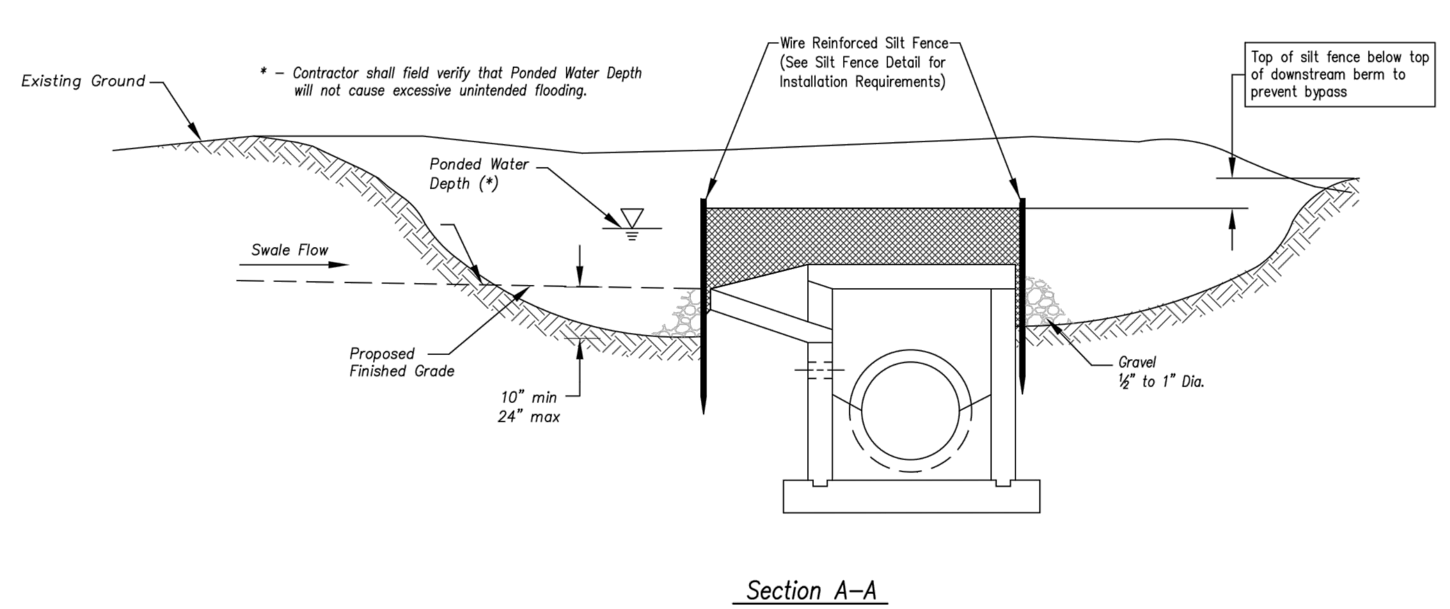
1. EXISTING TREE(S) TO REMAIN.
2. DRIPLINE OF EXISTING TREE (TYP)
3. CONTINUOUS NYLON TIE STRING TIED TO STAKE TOPS W/ 2' TUNDRA WEIGHT ORANGE STREAMERS @ 3' O.C.
4. 8' METAL T-STAKES: 8' O.C. MIN., DRIVEN 2' INTO GROUND AT (OR OUTSIDE) TREE DRIPLINE
5. 4' MIN. HEIGHT ORANGE PLASTIC FENCING INSTALLED PER MANF. RECOMMENDATIONS (TYP). SUPPLEMENT W/ SILT FENCE FABRIC @ PRUNING TRENCH AS REQ'D.
6. EXISTING GRADE TO BE DISTURBED.
7. ROOT PRUNING TRENCH 12" OUTSIDE FENCE - SEE NOTES.
8. EXISTING GRADE TO REMAIN.

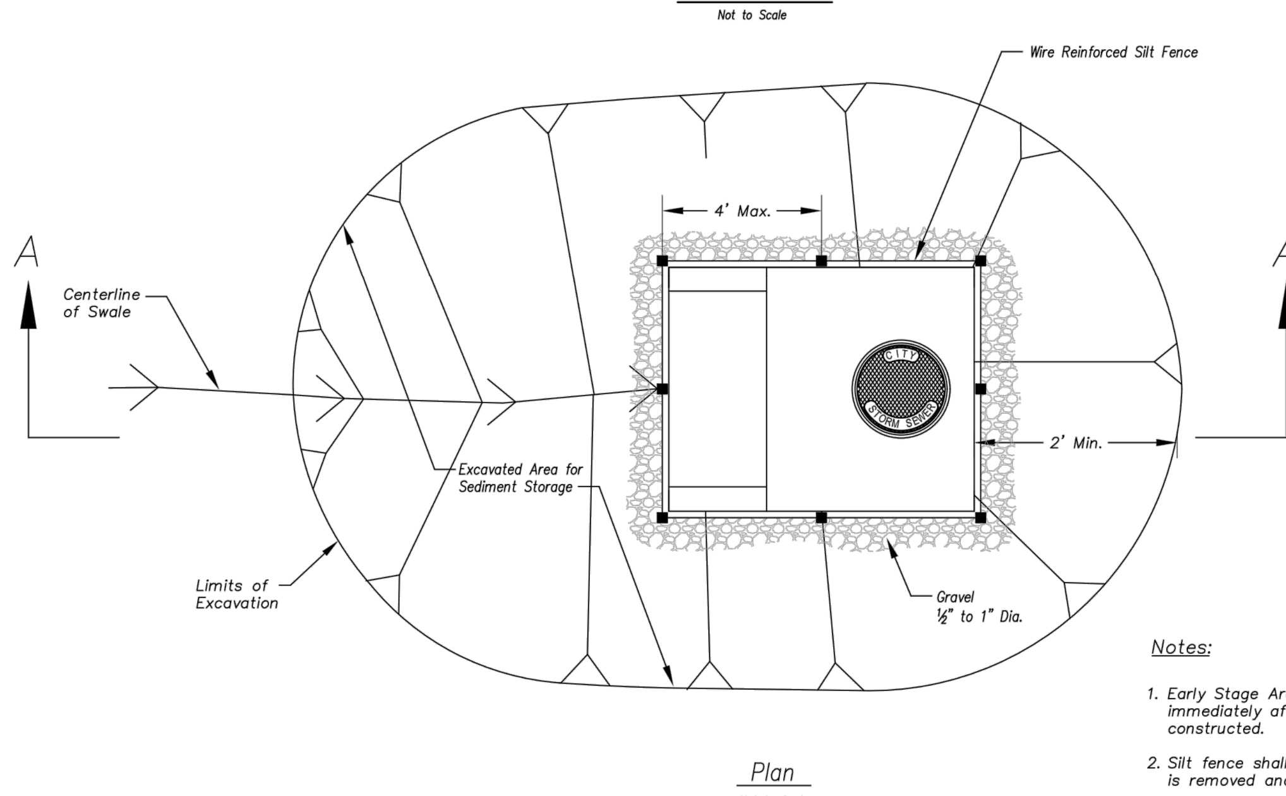
NOTES:

1. PERFORM ROOT PRUNING ON ALL EXISTING TREES TO REMAIN WHERE CONSTRUCTION ACTIVITY FALLS WITHIN DRIP LINE OF EXISTING TREES.
2. ROOT PRUNING METHOD: 2 MONTHS MIN. PRIOR TO EXCAVATION & CONSTRUCTION ACTIVITIES, HAND CUT ROOTS BY DIGGING A 18"-24" DEEP x 8" WIDE TRENCH ALONG THE OUTSIDE PERIMETER OF EXISTING TREE(S) ADJACENT TO CONSTRUCTION AREAS. MAXIMIZE PRUNING TRENCH DISTANCE FROM TRUNK TO THE FULLEST EXTENT POSSIBLE, W/ THE ROOT PRUNING LINE PLACED @ THE EDGE OF CONSTRUCTION LIMITS.

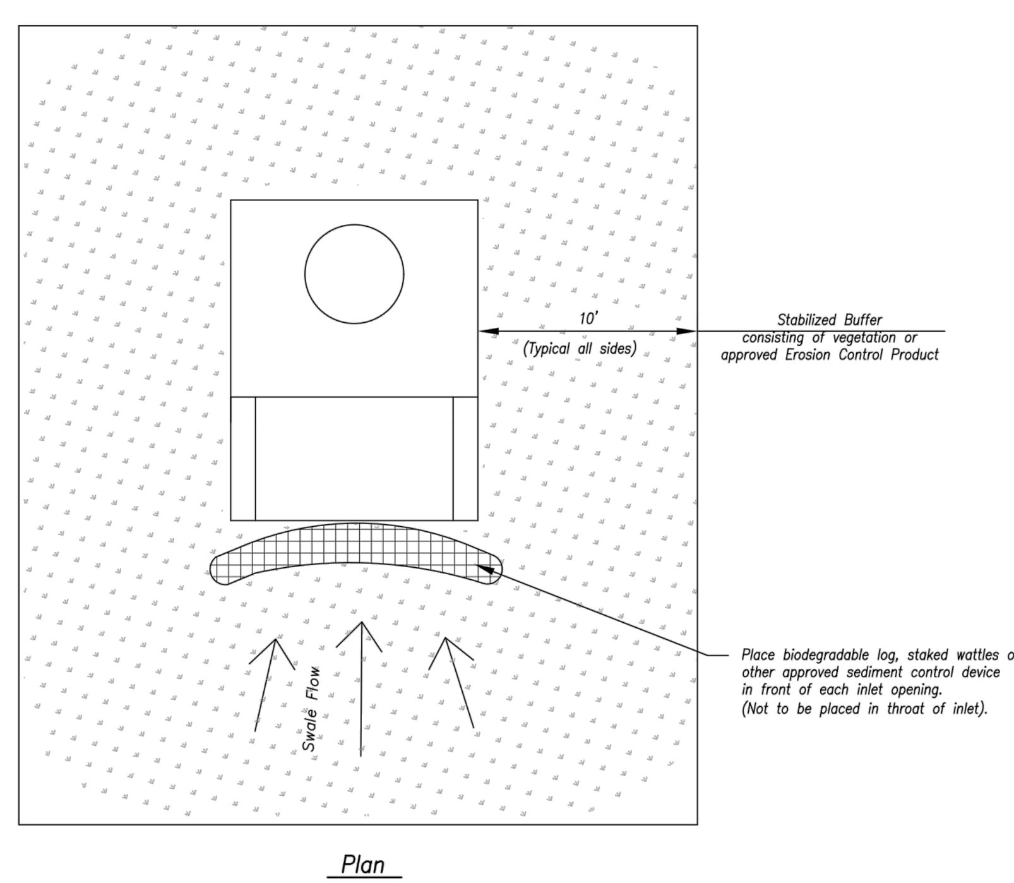
TREE PROTECTION DETAIL

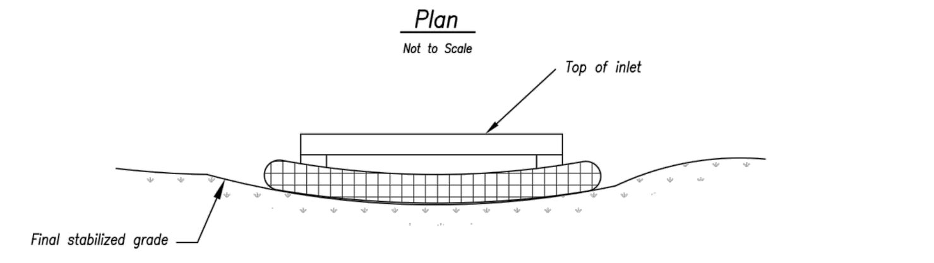
N.T.S.





EARLY STAGE AREA INLET
(All open boxes and inlets not at final grade)





LATE STAGE AREA INLET
(Area inlets at final grade and existing inlets)

Notes:

1. Early Stage Area Inlet Sediment Barrier to be installed immediately after inlet or junction box is constructed.
2. Silt fence shall remain in place until excavated area is removed and Late Stage Area Inlet is being installed.
3. Backfill excavated area ONLY after final grading of the site. Stabilization of the site is to immediately follow.
4. Wire reinforced silt fence may be used in place of silt fence attached to wood frame.

Maintenance:

1. Remove deposited sediment from excavated storage areas when available storage has been reduced by 20%.
2. Remove deposited sediment from filter socks or similar when any accumulation of sediment is visible.
3. Repair or replace as necessary to maintain function and integrity of installation.

Modified from 2015 Overland Park Standard Details for Erosion and Sediment Control.

AMERICAN PUBLIC WORKS ASSOCIATION	
APWA Kansas City Metro Chapter	KANSAS CITY METRO CHAPTER
AREA INLET AND JUNCTION BOX PROTECTION	STANDARD DRAWING NUMBER ESC-07 ADOPTED: 10/24/2016

VEGETATIVE STABILIZATION REQUIREMENTS

TEMPORARY SEEDING

ALL DISTURBED AREAS WHICH WILL BE LEFT DORMANT FOR GREATER THAN 14 DAYS SHALL BE SEEDED WITH FAST-GERMINATING TEMPORARY VEGETATION IMMEDIATELY FOLLOWING GRADING OPERATIONS. SELECTION OF THE SEED WILL DEPEND ON THE TIME OF YEAR IT IS APPLIED (SEE DESCRIPTIONS IN TABLE 2). REFERENCE LANDSCAPE PLAN FOR PERMANENT STABILIZATION REQUIREMENTS.

TABLE 2
VEGETATION TABLE*

TEMPORARY SEEDING

SPECIES	PLANTING RATE	PLANTING–DATES
CRIMSON CLOVER	7#/ACRE	8/15 – 11/30
MILLET, FOXTAIL	30#/ACRE	5/1 – 8/31
RYEGRASS, ANNUAL	30#/ACRE	8/15 – 9/30
SPRANGLETOP, GREEN	2.5#/ACRE	2/1 – 5/1
TALL FESCUE	7#–10#/1000 SF	9/1 – 10/15

*USE ONLY USDA CERTIFIED SEED.

SURFACE PREPARATION FOR TEMPORARY SEEDING

1. INSTALL EROSION STRUCTURES SUCH AS DIKES, DIVERSIONS, ETC. PRIOR TO SEEDING.
2. FURROW SLOPES STEEPER THAN 3:1 ON THE CONTOUR LINE BEFORE SEEDING.
3. ENSURE SEED BED IS PULVERIZED, LOOSE, AND UNIFORM.

APPLICATION

1. WHEN HYDROMULCHING IS USED, DO NOT MIX SEED AND FERTILIZER MORE THAN 30 MINUTES PRIOR TO APPLICATION.
2. APPLY SEED EVENLY USING PROPER EQUIPMENT AND WATER TO AID VEGETATION GROWTH.
3. EROSION CONTROL NETTING SHALL BE INSTALLED OVER FILL SLOPES WHICH HAVE BEEN BROUGHT TO FINAL GRADE AND HAVE BEEN SEEDED TO PROTECT AGAINST EROSION. MULCH (STRAW OR FIBER) SHALL BE USED ON RELATIVELY FLAT SLOPES.

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MISSOURI REGISTRATION NUMBER 001512

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Kimley»Horn
Engineer KEVIN S. GASKEY
P.E. No. 28441 Date MAY 2019

SUMMIT WAVES
WAVE POOL ADDITION
LEE'S SUMMIT, MO

EROSION CONTROL DETAILS

Scale:	AS SHOWN
Designed by:	ABP
Drawn by:	ABO
Checked by:	SEG
Date:	MAY 2019
Project No.	064538700

SHEET
C-2

STOP!
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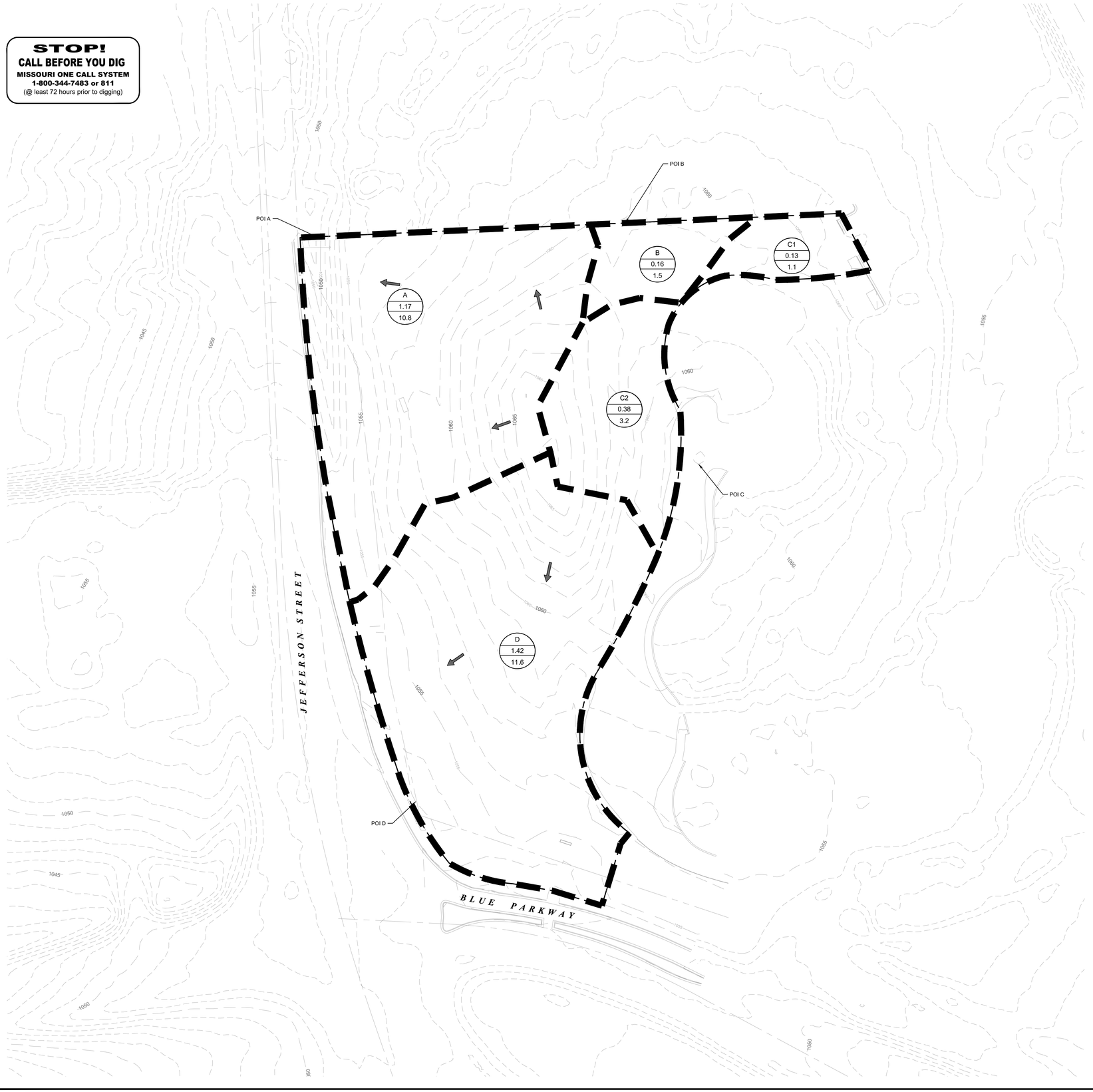

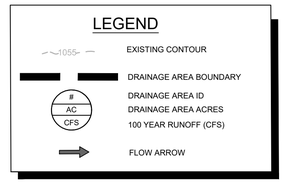

Existing Condition Hydrologic Parameters

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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SUMMIT WAVES WAVE POOL ADDITION LEE'S SUMMIT, MO

EXISTING DRAINAGE AREA MAP

Scale:	AS SHOWN
Designed by:	ABP
Drawn by:	ABO
Checked by:	SEG
Date:	MAY 2019
Project No.	064538700

SHEET
C-3

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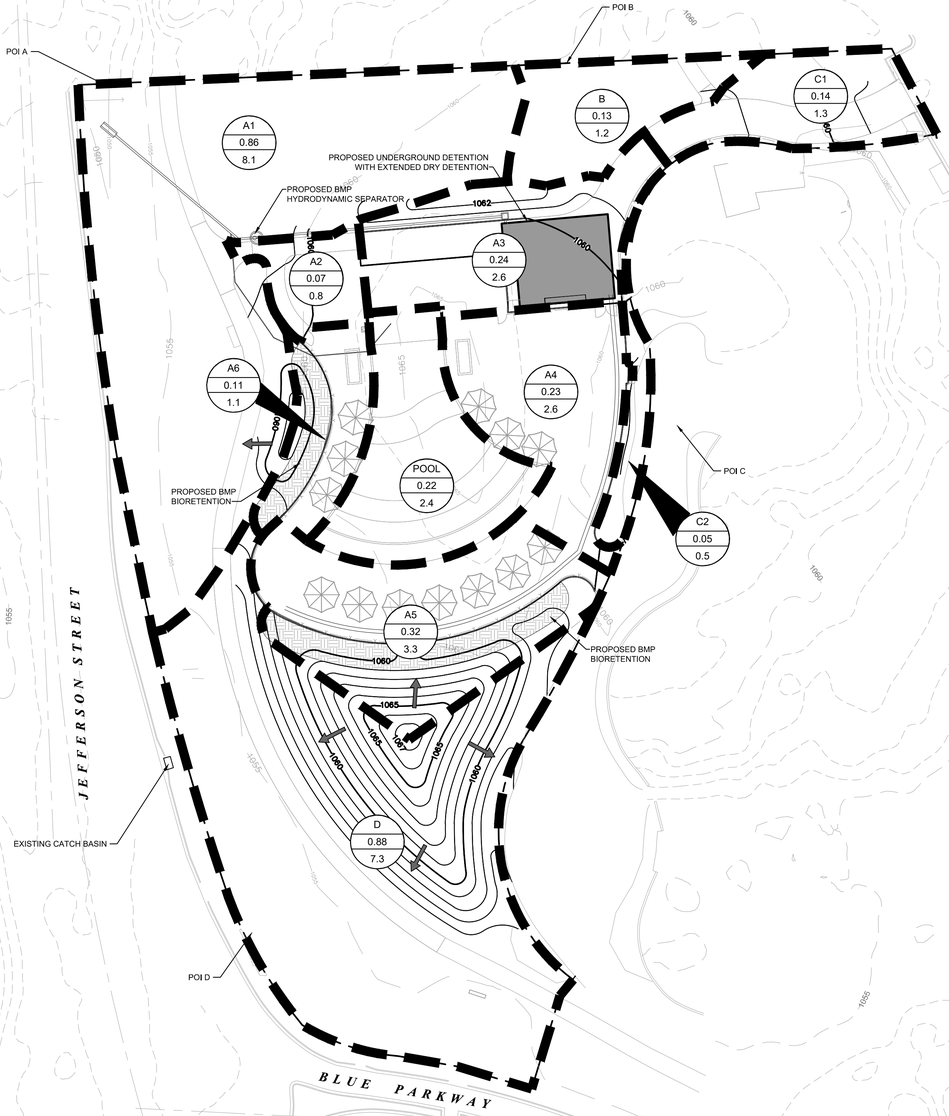

GRAPHIC SCALE IN FEET
0 20 40 80

LEGEND

1055	PROPOSED CONTOUR
1055	EXISTING CONTOUR
	DRAINAGE AREA BOUNDARY
	FLOW ARROW
# / AC / CFS	DRAINAGE AREA ID DRAINAGE AREA ACRES 100 YEAR RUNOFF (CFS)
	PROPOSED DETENTION POND
	PROPOSED BIOSWALE

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

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SUMMIT WAVES WAVE POOL ADDITION LEE'S SUMMIT, MO

PROPOSED DRAINAGE AREA MAP

Scale:	AS SHOWN
Designed by:	ABP
Drawn by:	ABO
Checked by:	SEG
Date:	MAY 2019
Project No.	064538700

SHEET
C-4

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Images:

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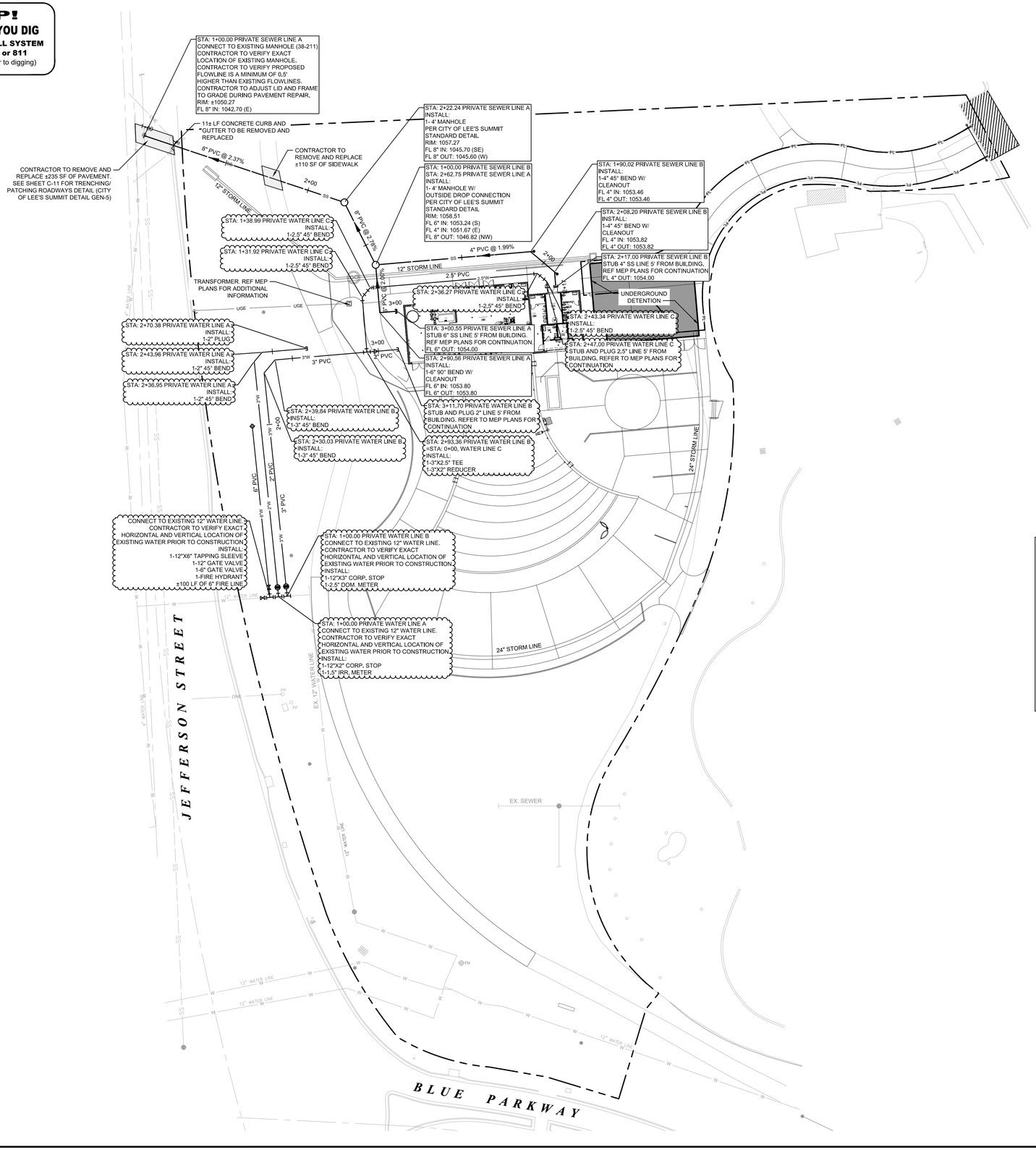

GRAPHIC SCALE IN FEET
0 15 30 60

LEGEND

- W — EXISTING WATER LINE
- SAN — EXISTING SEWER LINE
- EXISTING WATER VALVE
- EXISTING SS MANHOLE
- PROPOSED SS MANHOLE
- EXISTING FIRE HYDRANT
- PROPOSED STORM LINE
- 2" W — PROPOSED WATER LINE
- PROPOSED SS LINE
- UGE — PROPOSED UGE LINE
- PROPOSED GATE VALVE

NOTES:
1. CONTRACTOR TO FIELD VERIFY LOCATION AND THE FLOWLINES OF ALL EXISTING UTILITIES.
2. WATER & WASTEWATER SERVICE TO BE PROVIDED BY CITY OF LEE'S SUMMIT CONTRACTOR TO COORDINATE WITH M.E.P. PLANS AT ALL UTILITY STUBOUTS.
3. CONTRACTOR TO ENSURE NO FIRE HYDRANTS. METERS OR VALVES ARE PLACED IN SIDEWALKS.

GENERAL NOTES:
1. CONTRACTOR TO FIELD VERIFY LOCATION AND THE FLOWLINES OF ALL EXISTING UTILITIES.
2. WATER AND WASTEWATER SERVICE TO BE PROVIDED BY THE CITY.
3. CONTRACTOR TO COORDINATE WITH MEP PLANS AT ALL UTILITY STUBOUTS.
4. CONTRACTOR TO ENSURE NO METERS OR VALVES ARE PLACED IN SIDEWALKS.
5. CONTRACTOR TO REFERENCE GEOTECHNICAL REPORT PREPARED BY INTERTEK PSI (PSI PROJECT NO. 03381842 DATED DECEMBER 14, 2018 FOR UTILITY TRENCH RECOMMENDATIONS.

SITE UTILITY NOTES:
1. THE LOCATION AND / OR ELEVATION OF EXISTING UTILITIES AS SHOWN ON THESE PLANS IS BASED ON RECORDS OF THE VARIOUS UTILITY COMPANIES, AND WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THE INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE CONTRACTOR MUST CONTACT THE APPROPRIATE UTILITY COMPANIES AT LEAST 72 HOURS BEFORE ANY EXCAVATION TO REQUEST EXACT FIELD LOCATION OF EXISTING UTILITIES ON SITE OR IN RIGHT-OF-WAY.
2. CONTRACTOR SHALL NOTIFY THE UTILITY AUTHORITIES INSPECTORS 72 HOURS BEFORE CONNECTION TO ANY EXISTING LINES. CONTRACTOR SHALL COORDINATE AND SCHEDULE TIE-INS/CONNECTIONS WITH ALL UTILITY COMPANIES
3. ALL UNDERGROUND LINES SHALL BE INSTALLED, INSPECTED AND APPROVED PRIOR TO BACKFILLING.
4. ALL NECESSARY INSPECTION AND/OR CERTIFICATIONS REQUIRED BY CODES AND/OR UTILITY SERVICE COMPANIES SHALL BE PERFORMED PRIOR TO ANNOUNCED BUILDING POSSESSION AND THE FINAL CONNECTION OF SERVICE.
5. GENERAL CONTRACTOR IS TO COORDINATE WITH APPROPRIATE UTILITY COMPANIES PRIOR TO CONSTRUCTION, ADJUSTMENT, OR RELOCATION OF EXISTING UTILITIES AS DESIGNATED ON PLANS.
6. ALL SEWER LINES TO HAVE 48" COVER MINIMUM.
7. ALL WATERLINES AND SANITARY SEWER LINES, AND WATERLINES AND STORM SEWER LINES SHOULD BE KEPT TEN FEET (10') APART WHEN PARALLEL OR 24" VERTICAL CLEARANCE WHEN CROSSING (OUTSIDE OF PIPE TO OUTSIDE OF PIPE). IF 24" OF VERTICAL CLEARANCE CAN NOT BE MAINTAINED, SANITARY SEWER LINE TO BE ENCASED IN CONCRETE FOR 20' CENTERED ON CROSSING.
8. ALL TRENCHING, PIPE LAYING AND BACKFILLING SHALL BE IN ACCORDANCE WITH FEDERAL OSHA REGULATIONS
9. ALL MATERIALS, CONSTRUCTION, AND INSPECTION FOR WATER AND SANITARY SEWER LINES SHALL BE PER CITY OF ST. CHARLES STANDARD SPECIFICATIONS.
10. DAMAGE TO ALL EXISTING CONDITIONS TO REMAIN WILL BE REPLACED AT THE CONTRACTORS EXPAND.
11. CONTRACTOR SHALL REFER TO MEP PLANS AND SP SHEETS FOR EXACT UTILITY ENTRANCE/CONNECTION LOCATIONS.
12. GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR ALL TAP AN TIE ON FEES REQUIRED. AS WELL AS COSTS OF UNDERGROUND SERVICE CONNECTIONS TO BE BUILDINGS.
13. THE CONTRACTOR SHALL INCLUDE IN THE BID PRICE THE DAILY RECORD KEEPING OF THE AS-BUILT CONDITION OF ALL THE UNDERGROUND UTILITIES.

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WAVE POOL ADDITION
LEE'S SUMMIT, MO

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SHEET
C-5

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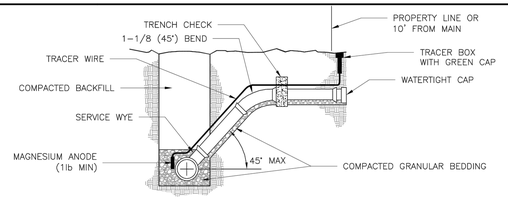
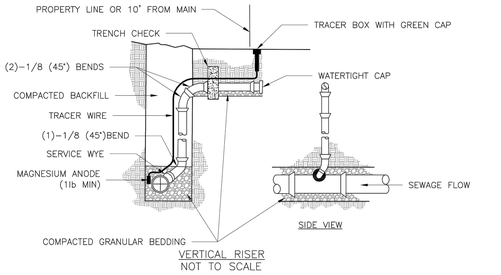


STANDARD INSTALLATION
NOT TO SCALE



VERTICAL RISER
NOT TO SCALE

NOTES:
1. ALL SEWER STUBS SHALL BE CONSTRUCTED TO PROPERTY LINE OR 10' MINIMUM FROM THE MAIN. WHERE SIDEWALKS ARE PRESENT, CONTRACTOR SHALL EXTEND SERVICE LINE UNDER EXISTING SIDEWALK TO TWO FEET BEYOND.
2. ALL NEW CONSTRUCTION OFF SEWER STUBS SHALL BE TEMPORARILY MARKED WITH A MARKING STAKE, 36" ABOVE GROUND AND PAINTED GREEN.
3. IMPERVIOUS TRENCH CHECKS SHALL BE PLACED ON BUILDING SEWER STUBS (AT LEAST 5' AWAY FROM THE SANITARY SEWER MAIN).
4. TRENCH CHECKS ON THE BUILDING SEWER STUBS SHALL EXTEND 6" BELOW THE BOTTOM OF THE PIPE. LENGTH SHALL BE A MINIMUM OF 12". THE HEIGHT OF THE TRENCH CHECK SHALL EXTEND 12" ABOVE THE TOP OF THE PIPE. THE WIDTH OF THE TRENCH CHECK SHALL BE THE WIDTH OF THE TRENCH.
5. SEE SPECIFICATION SECTION 2100 FOR SEWER MAIN BEDDING AND BACKFILL.
6. #12 GAUGE GREEN INSULATED COPPER TRACER WIRE SHALL BE INSTALLED. TRACER WIRE TERMINAL BOXES SHALL BE INSTALLED DIRECTLY ABOVE THE SEWER SERVICE OR AS DETERMINED BY THE ENGINEER.
7. FOR SERVICES, TRACER WIRE SHALL RUN FROM THE WYE AND TERMINATE IN A FLUSH MOUNTED TRACER BOX WITH A GREEN CAST IRON LOCKABLE TOP. WIRE SHALL BE TAPED OR TIED TO THE PIPE AT 5' INTERVALS.
8. TRACER WIRE BOX SHALL BE INSTALLED WITHIN 1.0' OF PROPERTY LINE.
9. THE TRACER WIRE SHALL REMAIN CONTINUOUS TO THE GREATEST EXTENT POSSIBLE. SPLICES IN THE TRACER WIRE SHOULD BE MADE WITH SPLIT BOLT CONNECTORS. WIRE NUTS SHALL NOT BE USED. A WATER-PROOF CONNECTION IS NECESSARY TO PREVENT CORROSION.

LEE'S SUMMIT
MISSOURI
PUBLIC WORKS ENGINEERING DIVISION | 220 SE GREEN STREET | LEE'S SUMMIT, MO 64063

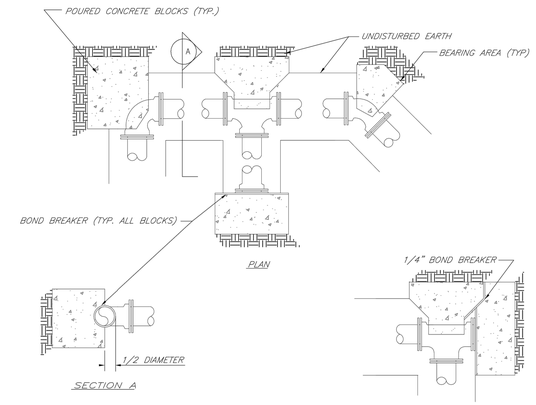
BUILDING SEWER STUB AND RISER

Date: 04/17
Drawn By: MJF
Checked By: DL
SAN-1

REQUIRED CONCRETE BEARING AREA (SQUARE FEET – SF)

NOM. DIA. (INCHES)	180 TEE, PLUG	90 BEND	45 BEND	22.5 BEND	11.25 BEND
6	4.7	6.7	4.0	4.0	4.0
8	8.4	11.8	6.4	4.0	4.0
10	13.1	18.5	10.0	5.1	4.0
12	18.8	26.7	14.4	7.4	4.0
14	25.7	36.3	19.6	10.0	5.0
16	33.5	47.4	25.6	13.1	6.6
18	42.4	REST. JT.	32.5	16.5	8.3
20	REST. JT.	REST. JT.	40.1	20.4	10.3
24	REST. JT.	REST. JT.	REST. JT.	29.4	14.8

NOTES:
1. ALL BENDS WITHOUT RESTRAINED JOINTS SHALL HAVE CONCRETE THRUST BLOCKS INSTALLED FOR RESTRAINT.
2. MEGA LUGS MAY BE USED ONLY IN CONJUNCTION WITH CONCRETE THRUST BLOCKING.
3. BEARING AREA MUST BE AGAINST UNDISTURBED SOIL.
4. DO NOT COVER JOINTS OR BOLTS (WHERE APPLICABLE) WITH CONCRETE.



LEE'S SUMMIT
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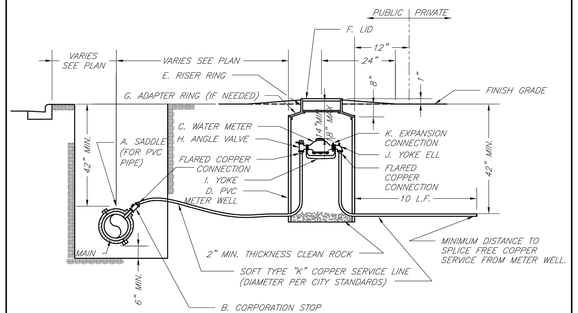
PUBLIC WORKS ENGINEERING DIVISION | 220 SE GREEN STREET | LEE'S SUMMIT, MO 64063

HORIZONTAL THRUST BLOCKS

Date: 02/13
Drawn By: JN
Checked By: DL
FILE: WAT-1
Rev: 1/14
Rev:



TYPICAL METER INSTALLATION – 2" AND SMALLER
NOT TO SCALE

NOTES:
1. METER INSTALLATION SHALL NOT BE LOCATED IN AREAS SUBJECT TO VEHICULAR TRAFFIC OR IN CONCRETE PAVEMENT WITHOUT CITY APPROVAL.
2. IF METER IS TO BE LOCATED OTHER THAN IN FRONT OF PROPERTY LINE, CITY APPROVAL SHALL BE OBTAINED.
3. CITY TO FURNISH ITEMS A-K.
4. NO OTHER EQUIPMENT SHALL BE INSTALLED IN THIS PIT.
5. 42" MINIMUM BURY DEPTH FOR ALL SERVICE LINES.
6. EXCAVATION FOR TAP TO EXPOSE 4 LINEAR FEET OF MAIN.
7. NO SPLICES ALLOWED BETWEEN METER AND MAIN.
8. SERVICE CONNECTION TAP AT APPROXIMATELY 45 DEGREES.
9. LID AND RISER RING SHALL BE SET SO THAT GROUND WATER WILL DRAIN AWAY FROM THE WELL.
10. CONTACT WATER UTILITIES, 816-969-1900, FOR REQUIREMENTS OF A METER LARGER THAN 2"

LEE'S SUMMIT
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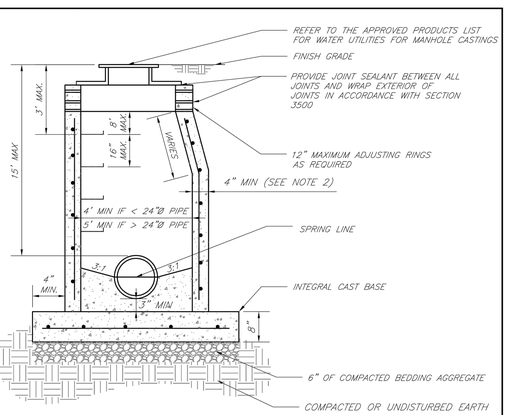
SERVICE CONNECTION/METER WELL

Date: 02/13
Drawn By: JN
Checked By: DL
FILE: WAT-11
Rev: 1/14
Rev:

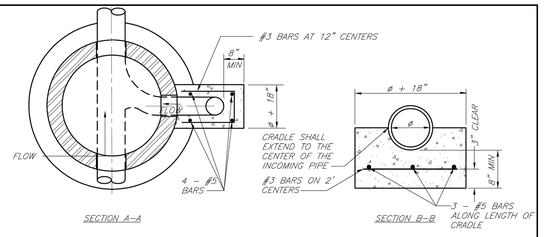


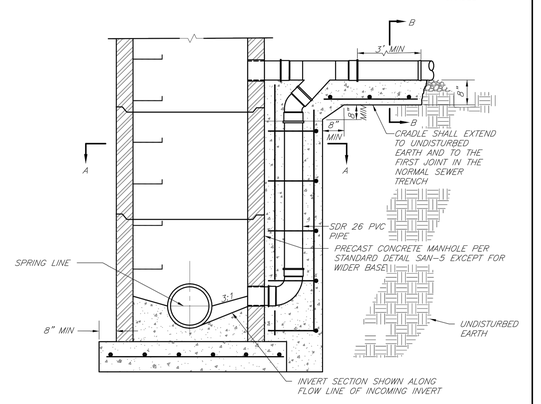
NOTES:
1. PRECAST CONCRETE MANHOLES SHALL CONFORM TO ASTM C478 EXCEPT AS MODIFIED BY THE SPECIFICATIONS.
2. A WALL THICKNESS NOT LESS THAN ONE-TWELFTH ($1/12$) OF THE INSIDE DIAMETER OR 4", WHICHEVER IS GREATER, SHALL BE USED WHEN THE MANHOLE DEPTH IS LESS THEN 15'.
3. WATERPROOFING SHALL BE REQUIRED ON THE OUTSIDE OF MANHOLES. THE WATERPROOFING SHALL CONSIST OF A TOTAL DRY FILM THICKNESS OF NOT LESS THAN 14 MILS OF BITUMINOUS COATING.
4. ONLY ECCENTRIC MANHOLE CONES WILL BE ALLOWED UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER.
5. THE FILL CONCRETE, FLOW CHANNEL FOR SIDE BRANCHES SHALL BE PLACED TO PROVIDE A SMOOTH TRANSITION INTO THE FLOW LINE.
6. REFER TO THE APPROVED PRODUCTS LIST FOR WATER UTILITIES FOR APPROVED MANHOLE GASKET MODELS.
7. REFER TO THE APPROVED PRODUCTS LIST FOR APPROVED STEPS.

LEE'S SUMMIT
MISSOURI
PUBLIC WORKS ENGINEERING DIVISION | 220 SE GREEN STREET | LEE'S SUMMIT, MO 64063

STANDARD PRECAST MANHOLE – SANITARY SEWER

Date: 02/13
Drawn By: JN
Checked By: DL
FILE: SAN-2
Rev: 1/14
Rev:





NOTE:
REFER TO DRAWING SAN-2 FOR MANHOLE DETAILS NOT SHOWN.

LEE'S SUMMIT
MISSOURI
PUBLIC WORKS ENGINEERING DIVISION | 220 SE GREEN STREET | LEE'S SUMMIT, MO 64063

DROP SANITARY SEWER MANHOLE

Date: 02/13
Drawn By: JN
Checked By: DL
FILE: SAN-4
Rev: 1/14
Rev:

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MISSOURI REGISTRATION NUMBER 001512

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Kimley»Horn
Engineer KEVIN S. GASKEY
P.E. No. 28441 Date MAY 2019

SUMMIT WAVES
WAVE POOL ADDITION
LEE'S SUMMIT, MO

UTILITY DETAILS

Scale: AS SHOWN
Designed by: ABP
Drawn by: ABO
Checked by: SEG
Date: MAY 2019
Project No. 064538700

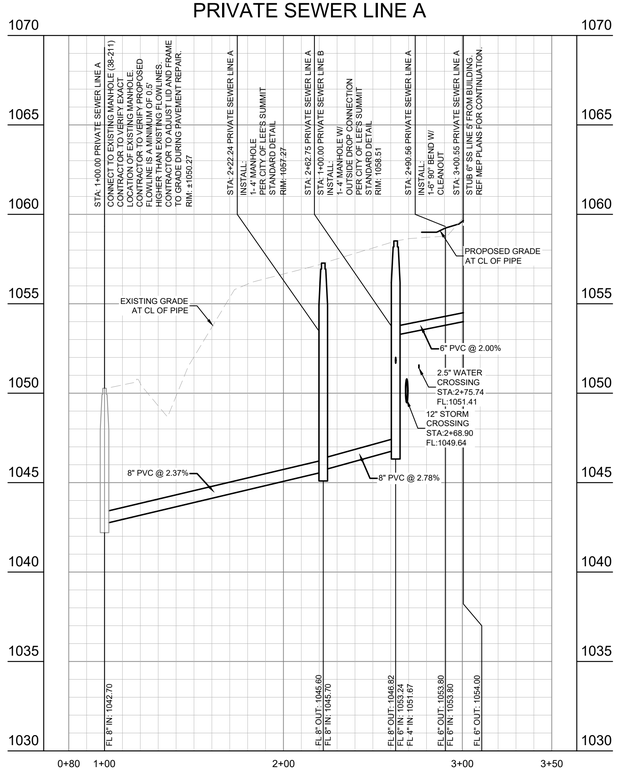
SHEET
C-6

File: K:\DAL_LAP\DAL_LAP\064538700_Lees Summit\Dwg\Sheet\Cover\C-UTILITY DETAILS.dwg [Layout1] 5/24/2019 8:28am
Xrefs: 20100325x2436
Images:

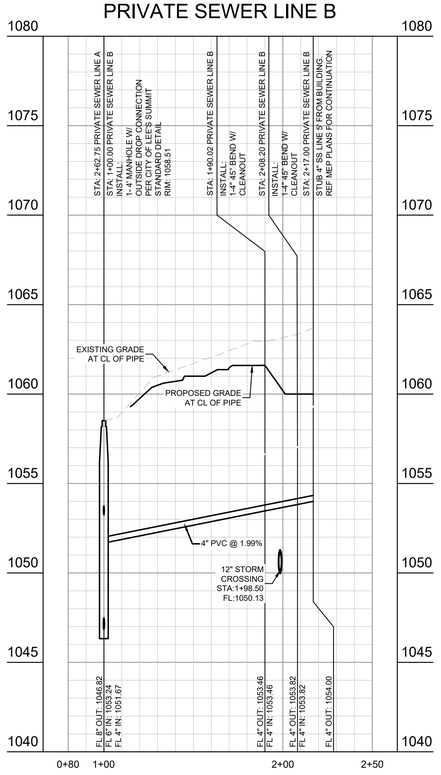
HORIZONTAL SCALE: 1"= 40'
VERTICAL SCALE: 1"= 4'

CONTRACTOR TO ADJUST ALL RIM ELEVATIONS TO MATCH FINISHED GRADE

PRIVATE SEWER LINE A



PRIVATE SEWER LINE B



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Kimley»Horn
Engineer: KEVIN S. GASKEY
P.E. No. 2641 Date: MAY 2019

SUMMIT WAVES
WAVE POOL ADDITION
LEE'S SUMMIT, MO

UTILITY PROFILES

Scale:	AS SHOWN
Designed by:	ABP
Drawn by:	ABO
Checked by:	SEG
Date:	MAY 2019
Project No.	064538700

SHEET
C-7

File: K:\DAL_LAP\DAL_LAP\064538700_Lees Summit\Sheet\Cadd\C-UTILITY PROFILES.dwg [Utility] 5/24/2019 8:29am
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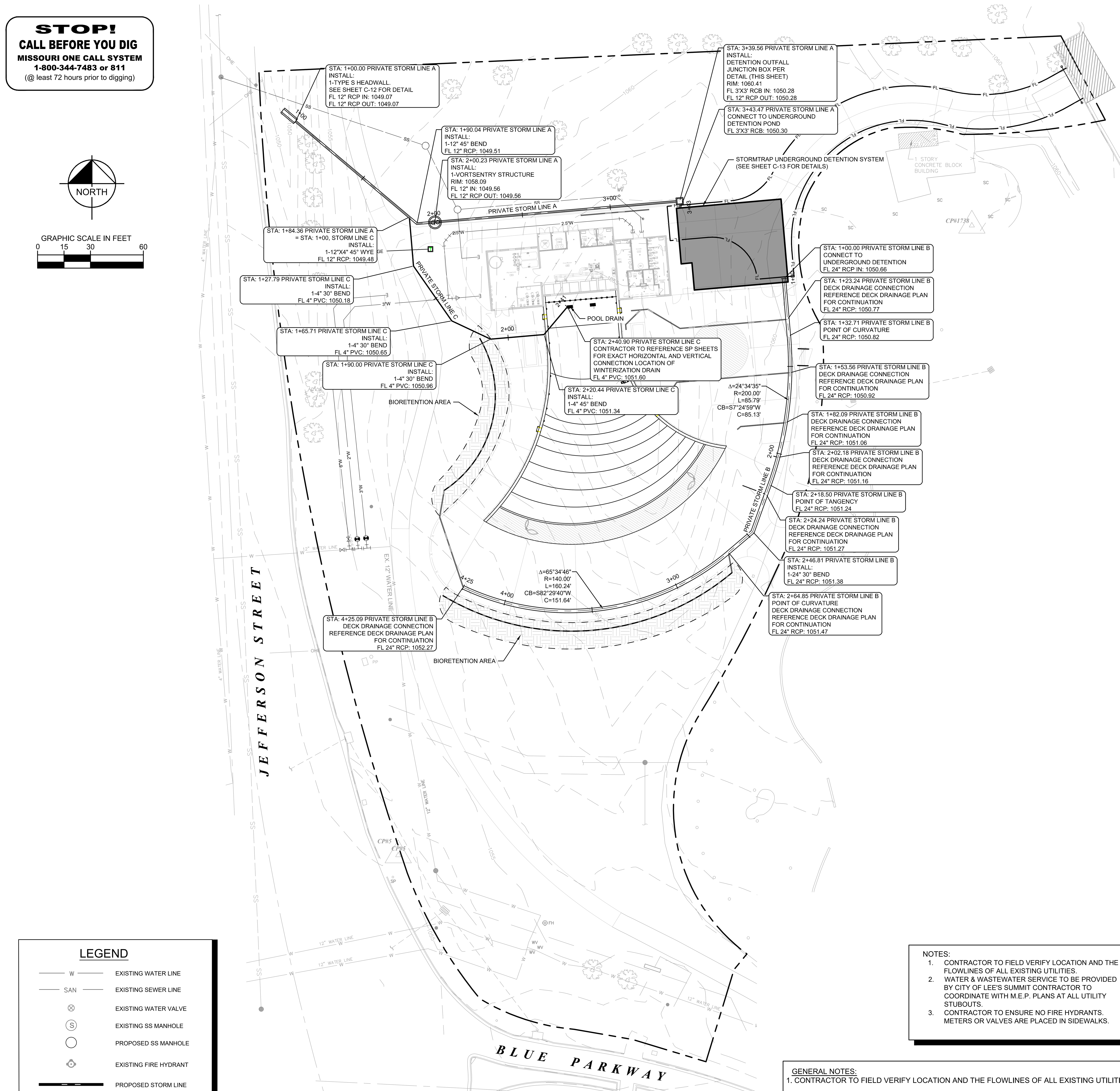


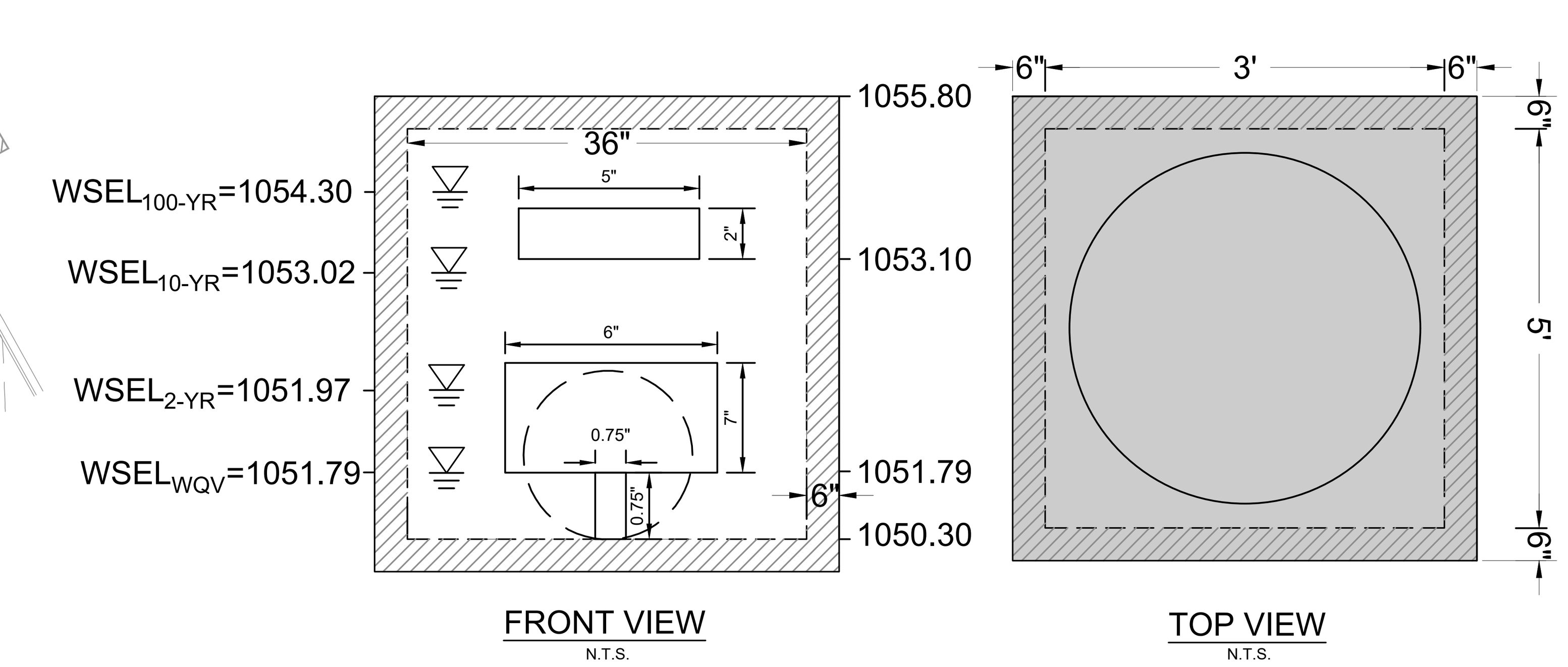
LEGEND

— W —	EXISTING WATER LINE
— SAN —	EXISTING SEWER LINE
⊗	EXISTING WATER VALVE
Ⓢ	EXISTING SS MANHOLE
○	PROPOSED SS MANHOLE
	EXISTING FIRE HYDRANT
	PROPOSED STORM LINE
— 2" W —	PROPOSED WATER LINE
	PROPOSED SS LINE
— UGE —	PROPOSED UGE LINE
⋈	PROPOSED GATE VALVE

NOTES:
1. CONTRACTOR TO FIELD VERIFY LOCATION AND THE FLOWLINES OF ALL EXISTING UTILITIES.
2. WATER & WASTEWATER SERVICE TO BE PROVIDED BY CITY OF LEE'S SUMMIT CONTRACTOR TO COORDINATE WITH M.E.P. PLANS AT ALL UTILITY STUBOUTS.
3. CONTRACTOR TO ENSURE NO FIRE HYDRANTS. METERS OR VALVES ARE PLACED IN SIDEWALKS.

GENERAL NOTES:
1. CONTRACTOR TO FIELD VERIFY LOCATION AND THE FLOWLINES OF ALL EXISTING UTILITIES.
2. WATER AND WASTEWATER SERVICE TO BE PROVIDED BY THE CITY.
3. CONTRACTOR TO COORDINATE WITH MEP PLANS AT ALL UTILITY STUBOUTS.
4. CONTRACTOR TO ENSURE NO METERS OR VALVES ARE PLACED IN SIDEWALKS.
5. CONTRACTOR TO REFERENCE GEOTECHNICAL REPORT PREPARED BY INTERTEK PSI (PSI PROJECT NO. 03381842 DATED DECEMBER 14, 2018 FOR UTILITY TRENCH RECOMMENDATIONS.

DETENTION OUTFALL JUNCTION BOX DETAILS



WEIR CALCULATIONS:

$Q = C*L*H^{1.5}$
$C = 3.0$

ORIFICE CALCULATIONS:

$Q = C*A*(2*g*H)^{0.5}$
$C = 0.6$
$g = 32.2\ FT/S^2$

OPENING #1 (WQV)
H = 0.75 IN
L = 0.75 IN
A = 0.004 FT^2
INVERT ELEVATION = 1050.30
HEAD = WSEL - CENTROID

OPENING #2
H = 7.0 IN
L = 6.0 IN
A = 0.29 FT^2
INVERT ELEVATION = 1051.79
HEAD = WSEL - CENTROID

OPENING #3
H = 2.0 IN
D = 5.0 IN
A = 0.07 FT^2
INVERT ELEVATION = 1053.10
HEAD = WSEL - CENTROID

Outfall Structure Summary

Design Storm	Volume (ac-ft)	Elevation (ft)	Opening #1			Opening #2			Opening #3			Total
			Weir	Orifice	Actual	Weir	Orifice	Actual	Weir	Orifice	Actual	Actual
WQV	0.08	1051.79	0.34	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02
2-year	0.10	1051.97	0.40	0.02	0.02	0.12	0.00	0.12	0.00	0.00	0.00	0.14
10-year	0.16	1053.02	0.84	0.03	0.03	2.06	1.36	1.36	0.00	0.00	0.00	1.39
100-year	0.24	1054.30	1.50	0.04	0.04	5.98	2.09	2.09	1.64	0.35	0.35	2.48

Elevation Discharge Summary Table

Elevation	Opening #1			Opening #2			Opening #3			Total
	Weir	Orifice	Actual	Weir	Orifice	Actual	Weir	Orifice	Actual	Actual
1050.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1051.3	0.19	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02
1052.3	0.53	0.03	0.03	0.55	0.66	0.55	0.00	0.00	0.00	0.58
1053.3	0.97	0.03	0.03	2.80	1.55	1.55	0.11	0.11	0.11	1.70
1054.3	1.50	0.04	0.04	5.98	2.09	2.09	1.64	0.35	0.35	2.48
1054.80	1.79	0.04	0.04	7.85	2.32	2.32	2.77	0.43	0.43	2.78

Stage Storage Summary Table

Elevation (ft)	Area (ac)	Volume (ac-ft)
1050.30	0.06	0.00
1054.80	0.06	0.25

SITE UTILITY NOTES:
1. THE LOCATION AND / OR ELEVATION OF EXISTING UTILITIES AS SHOWN ON THESE PLANS IS BASED ON RECORDS OF THE VARIOUS UTILITY COMPANIES, AND WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THE INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE CONTRACTOR MUST CONTACT THE APPROPRIATE UTILITY COMPANIES AT LEAST 72 HOURS BEFORE ANY EXCAVATION TO REQUEST EXACT FIELD LOCATION OF EXISTING UTILITIES ON SITE OR IN RIGHT-OF-WAY.
2. CONTRACTOR SHALL NOTIFY THE UTILITY AUTHORITIES INSPECTORS 72 HOURS BEFORE CONNECTION TO ANY EXISTING LINES. CONTRACTOR SHALL COORDINATE AND SCHEDULE TIE-INS/CONNECTIONS WITH ALL UTILITY COMPANIES
3. ALL UNDERGROUND LINES SHALL BE INSTALLED, INSPECTED AND APPROVED PRIOR TO BACKFILLING.
4. ALL NECESSARY INSPECTION AND/OR CERTIFICATIONS REQUIRED BY CODES AND/OR UTILITY SERVICE COMPANIES SHALL BE PERFORMED PRIOR TO ANNOUNCED BUILDING POSSESSION AND THE FINAL CONNECTION OF SERVICE.
5. GENERAL CONTRACTOR IS TO COORDINATE WITH APPROPRIATE UTILITY COMPANIES PRIOR TO CONSTRUCTION, ADJUSTMENT, OR RELOCATION OF EXISTING UTILITIES AS DESIGNATED ON PLANS.
6. ALL SEWER LINES TO HAVE 48" COVER MINIMUM.
7. ALL WATERLINES AND SANITARY SEWER LINES, AND WATERLINES AND STORM SEWER LINES SHOULD BE KEPT TEN FEET (10') APART WHEN PARALLEL OR 24" VERTICAL CLEARANCE WHEN CROSSING (OUTSIDE OF PIPE TO OUTSIDE OF PIPE). IF 24" OF VERTICAL CLEARANCE CAN NOT BE MAINTAINED, SANITARY SEWER LINE TO BE ENCASED IN CONCRETE FOR 20' CENTERED ON CROSSING.
8. ALL TRENCHING, PIPE LAYING AND BACKFILLING SHALL BE IN ACCORDANCE WITH FEDERAL OSHA REGULATIONS
9. ALL MATERIALS, CONSTRUCTION, AND INSPECTION FOR WATER AND SANITARY SEWER LINES SHALL BE PER CITY OF ST. CHARLES STANDARD SPECIFICATIONS.
10. DAMAGE TO ALL EXISTING CONDITIONS TO REMAIN WILL BE REPLACED AT THE CONTRACTORS EXPAND.
11. CONTRACTOR SHALL REFER TO MEP PLANS AND SP SHEETS FOR EXACT UTILITY ENTRANCE/CONNECTION LOCATIONS.
12. GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR ALL TAP AN TIE ON FEES REQUIRED. AS WELL AS COSTS OF UNDERGROUND SERVICE CONNECTIONS TO BE BUILDINGS.
13. THE CONTRACTOR SHALL INCLUDE IN THE BID PRICE THE DAILY RECORD KEEPING OF THE AS-BUILT CONDITION OF ALL THE UNDERGROUND UTILITIES.

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Kimley»Horn
Engineer KEVIN S. GASKEY
P.E. No. 28441 Date MAY 2019

SUMMIT WAVES WAVE POOL ADDITION LEE'S SUMMIT, MO

DRAINAGE AND DETENTION POND PLAN

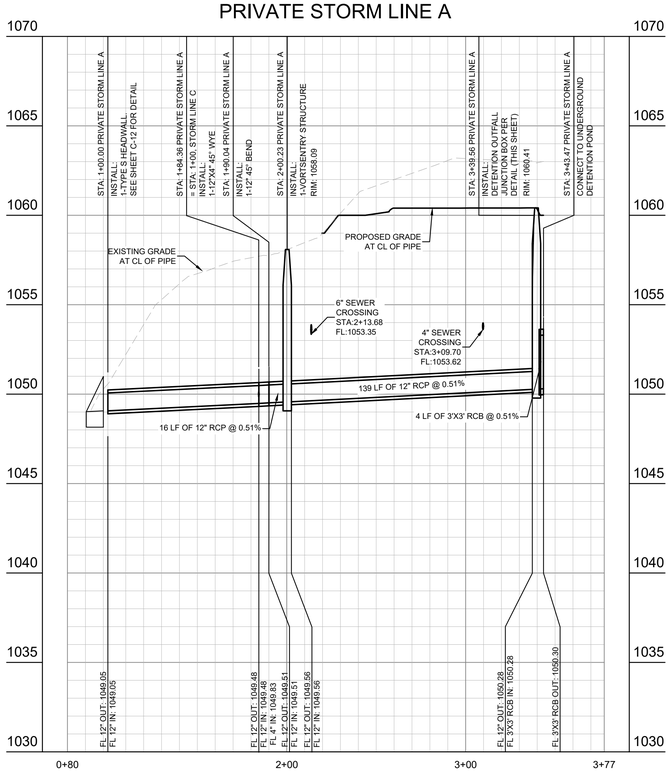
Scale:	AS SHOWN
Designed by:	ABP
Drawn by:	ABO
Checked by:	SEG
Date:	MAY 2019
Project No.	064538700

SHEET
C-8

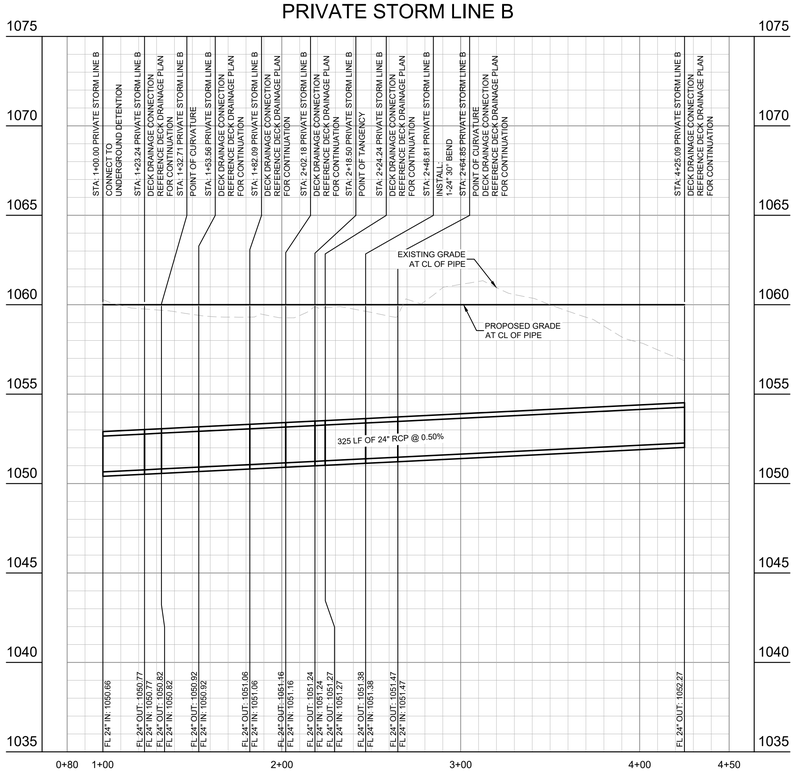
HORIZONTAL SCALE: 1"= 40'
VERTICAL SCALE: 1"= 4'

CONTRACTOR TO ADJUST ALL RIM ELEVATIONS TO MATCH FINISHED GRADE

PRIVATE STORM LINE A



PRIVATE STORM LINE B



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Kimley»Horn
Engineer: KEVIN S. GASKEY
P.E. No. 28441 Date: MAY 2019

SUMMIT WAVES
WAVE POOL ADDITION
LEE'S SUMMIT, MO

STORM PROFILES

Scale:	AS SHOWN
Designed by:	ABP
Drawn by:	ABO
Checked by:	SEG
Date:	MAY 2019
Project No.	064538700

SHEET
C-9

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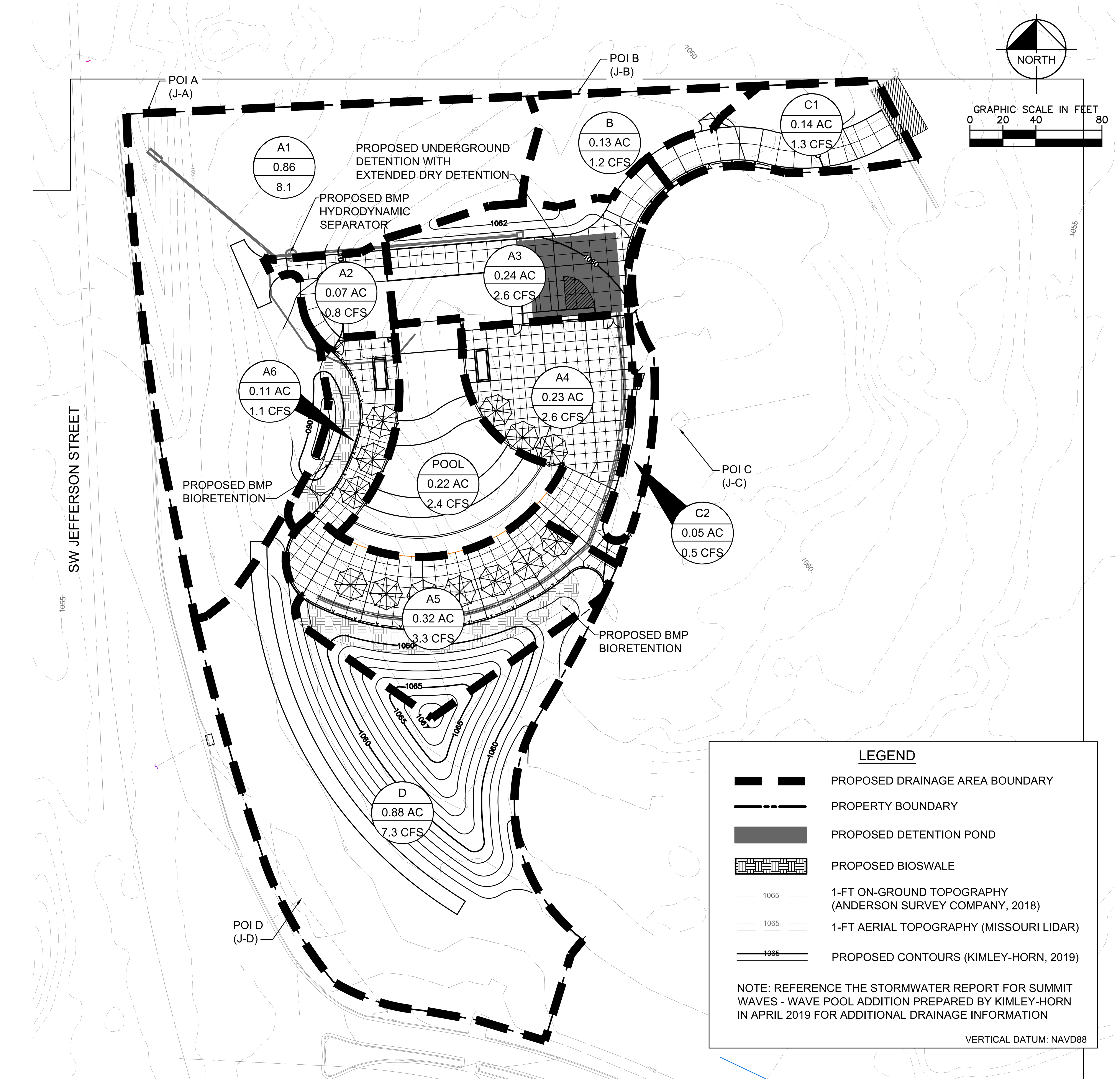


HYDROLOGIC CALCULATIONS – EXISTING CONDITIONS

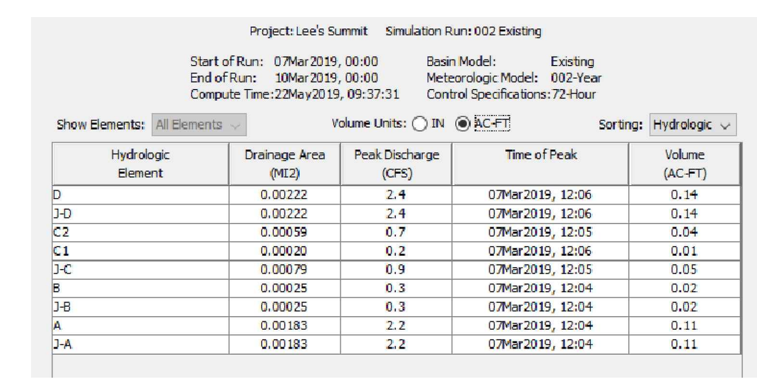
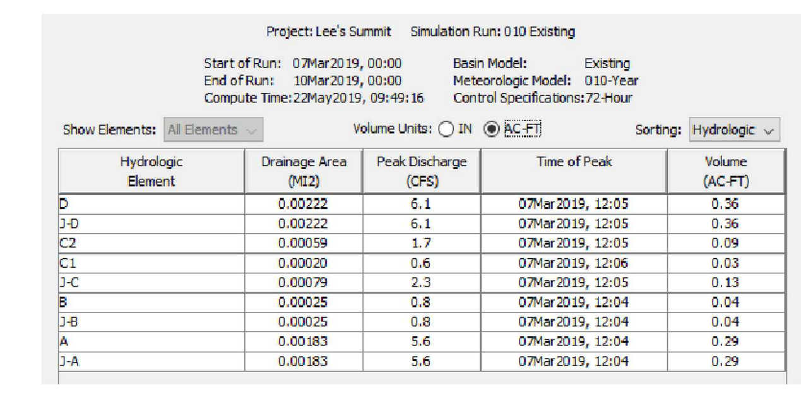
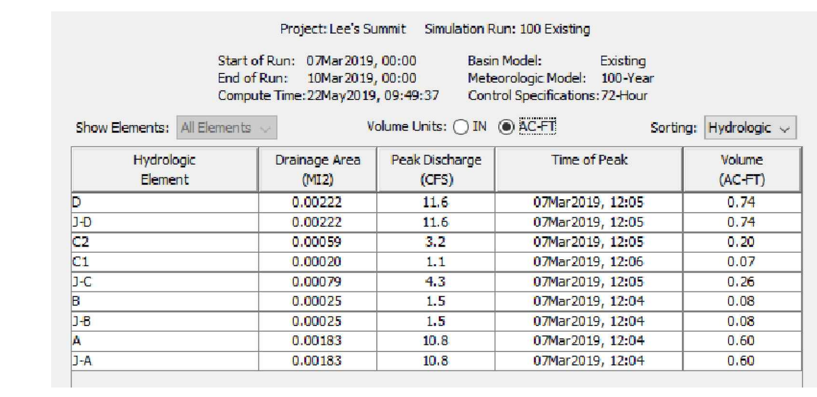
Existing Condition Hydrologic Parameters

POI	DA	Area (ac)	Area (mi^2)	CN	TC (min)	T_{lag} (min)	Q_{2yr} (cfs)	Q_{10yr} (cfs)	Q_{100yr} (cfs)
A	A	1.17	0.00183	75.2	4.52	2.71	2.2	5.7	10.8
B	B	0.16	0.00025	75.5	4.22	2.53	0.3	0.8	1.5
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
D	D	1.42	0.00222	75.5	7.20	4.32	2.4	6.1	11.6

TIME OF CONCENTRATION & LAG TIME
EXISTING
TR-55 Methodology

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)

Basin	Sheet Length (ft)	$Elev_1$	$Elev_2$	Slope (ft/ft)	Manning's "n"	T_{c1} (min)	Shallow Length (ft)	$Elev_2$	$Elev_3$	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

HYDROLOGIC CALCULATIONS – PROPOSED CONDITIONS

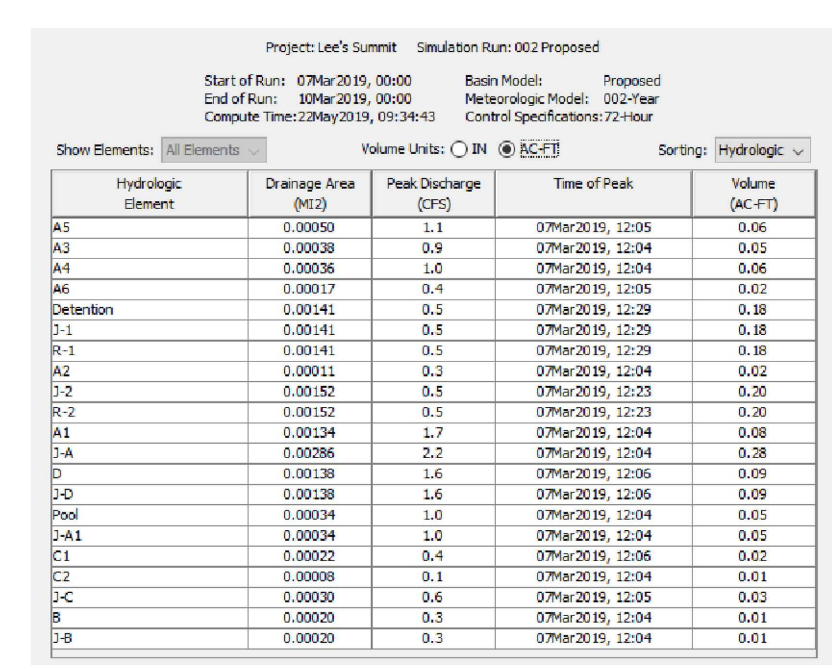
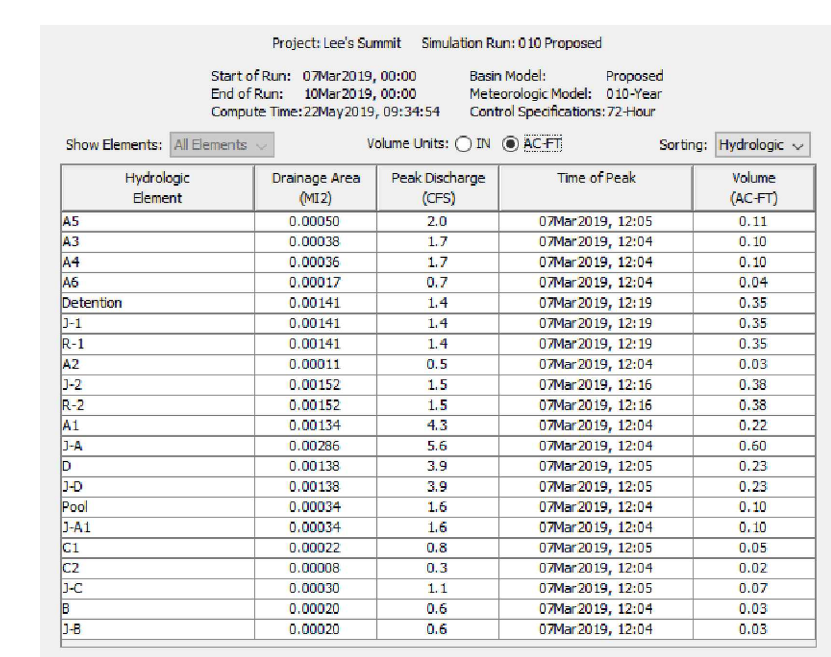
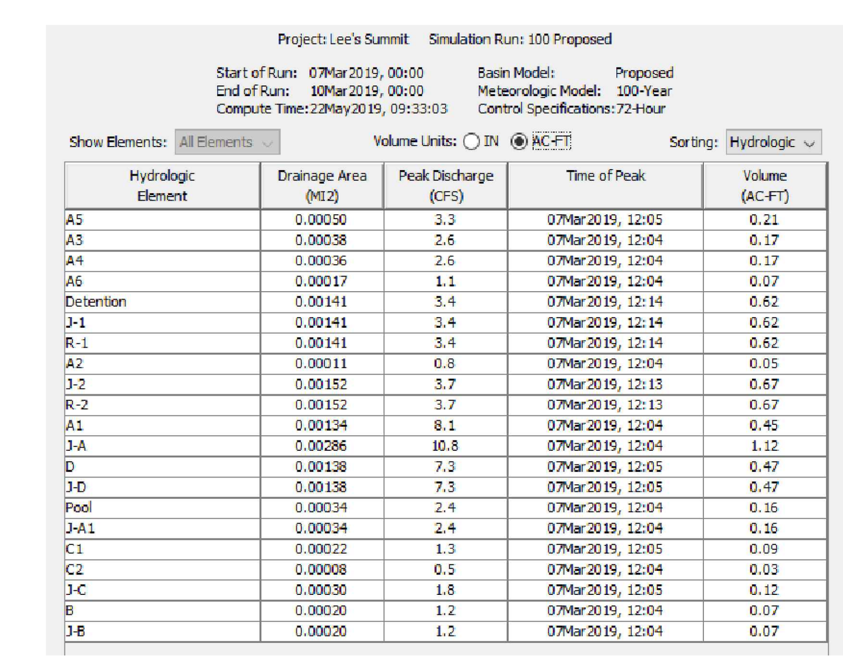
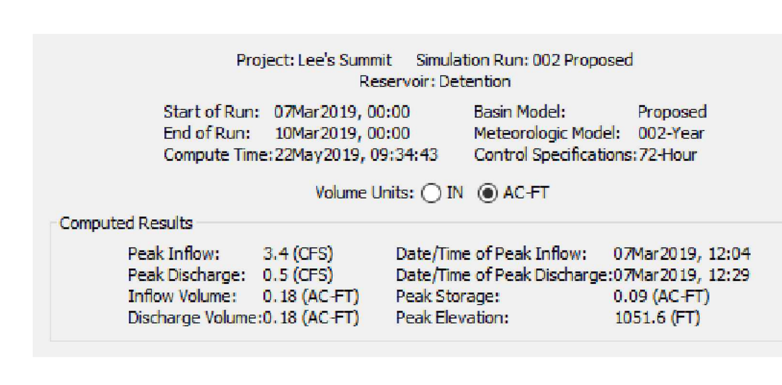
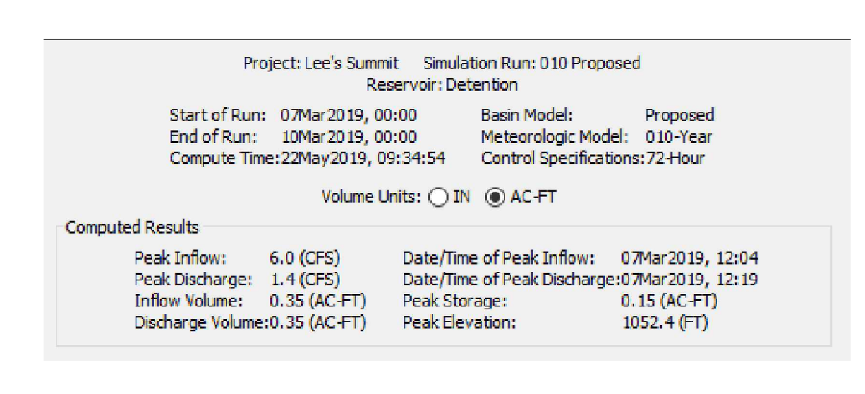
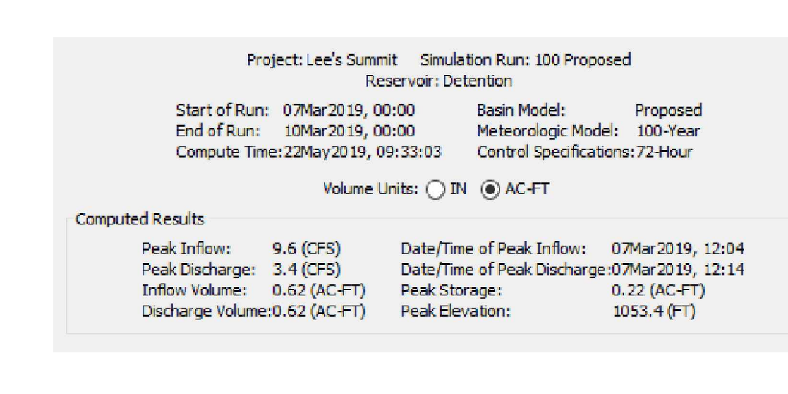
Proposed Condition Hydrologic Parameters

POI	DA	Area (ac)	Area (mi^2)	CN	TC (min)	T_{lag} (min)	Q_{2yr} (cfs)	Q_{10yr} (cfs)	Q_{100yr} (cfs)
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
B	B	0.13	0.00020	75.8	4.09	2.45	0.3	0.6	1.2
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
D	D	0.88	0.00138	76.5	7.24	4.35	1.6	3.9	7.3
-	Pool	0.22	0.00034	98.0	5.19	3.11	1.0	1.6	2.4

TIME OF CONCENTRATION & LAG TIME
PROPOSED
TR-55 Methodology

SHEET FLOW: Tc = (0.007(nL)^0.8)/(P2^0.5)(s^0.4); n = 0.24 (dense grass)
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)

Basin	Sheet Length (ft)	$Elev_1$	$Elev_2$	Slope (ft/ft)	Manning's "n"	T_{c1} (min)	Shallow Length (ft)	$Elev_2$	$Elev_3$	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

Junction	2 YR			10 YR			100 YR		
	Existing	Proposed	Difference	Existing	Proposed	Difference	Existing	Proposed	Difference
J-A	2.2	2.2	0.0	5.6	5.6	0.0	10.8	10.8	0.0
J-B	0.3	0.3	0.0	0.8	0.6	-0.2	1.5	1.2	-0.3
J-C	0.9	0.6	-0.3	2.3	1.1	-1.2	4.3	1.8	-2.5
J-D	2.4	1.6	-0.8	6.1	3.9	-2.2	11.6	7.3	-4.3

WATER QUALITY CALCULATIONS – PROPOSED CONDITIONS

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	Extended Dry Detention + Hydrodynamic Seperator	0.24	8.00	1.92
A4	Extended Dry Detention + Hydrodynamic Seperator	0.23	8.00	1.84
A5	Bioretention, Extended Dry Detention, + Hydrodynamic	0.32	16.50	5.28
A6	Bioretention, Extended Dry Detention, + Hydrodynamic	0.11	16.50	1.82
			Total =	10.86
			Weighted VR =	10.14
			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 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

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

Kimley»Horn
13455 Noel Road, Suite 700, Dallas, Texas 75240
PHONE: 214-420-5600 FAX: 214-420-5680
WWW.KIMLEY-HORN.COM
MISSOURI REGISTRATION NUMBER 001512

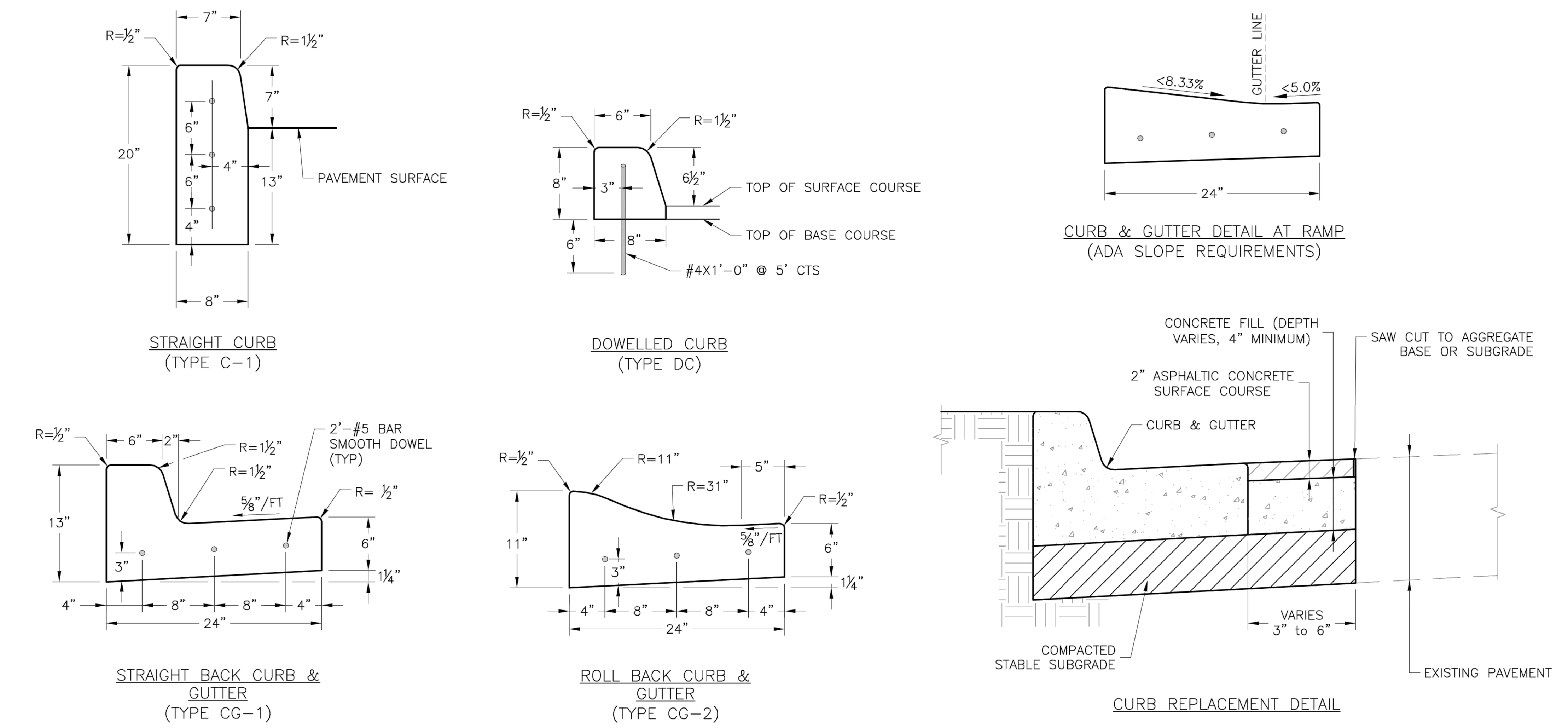
95% REVIEW SET
FOR REVIEW ONLY

SUMMIT WAVES
WAVE POOL ADDITION
LEE'S SUMMIT, MO

DRAINAGE CALCULATIONS

Scale: AS SHOWN
Designed by: ABP
Drawn by: ABO
Checked by: SEG
Date: MAY 2019
Project No. 064538700

SHEET
C-10



CURB REPLACEMENT DETAIL

GENERAL NOTES

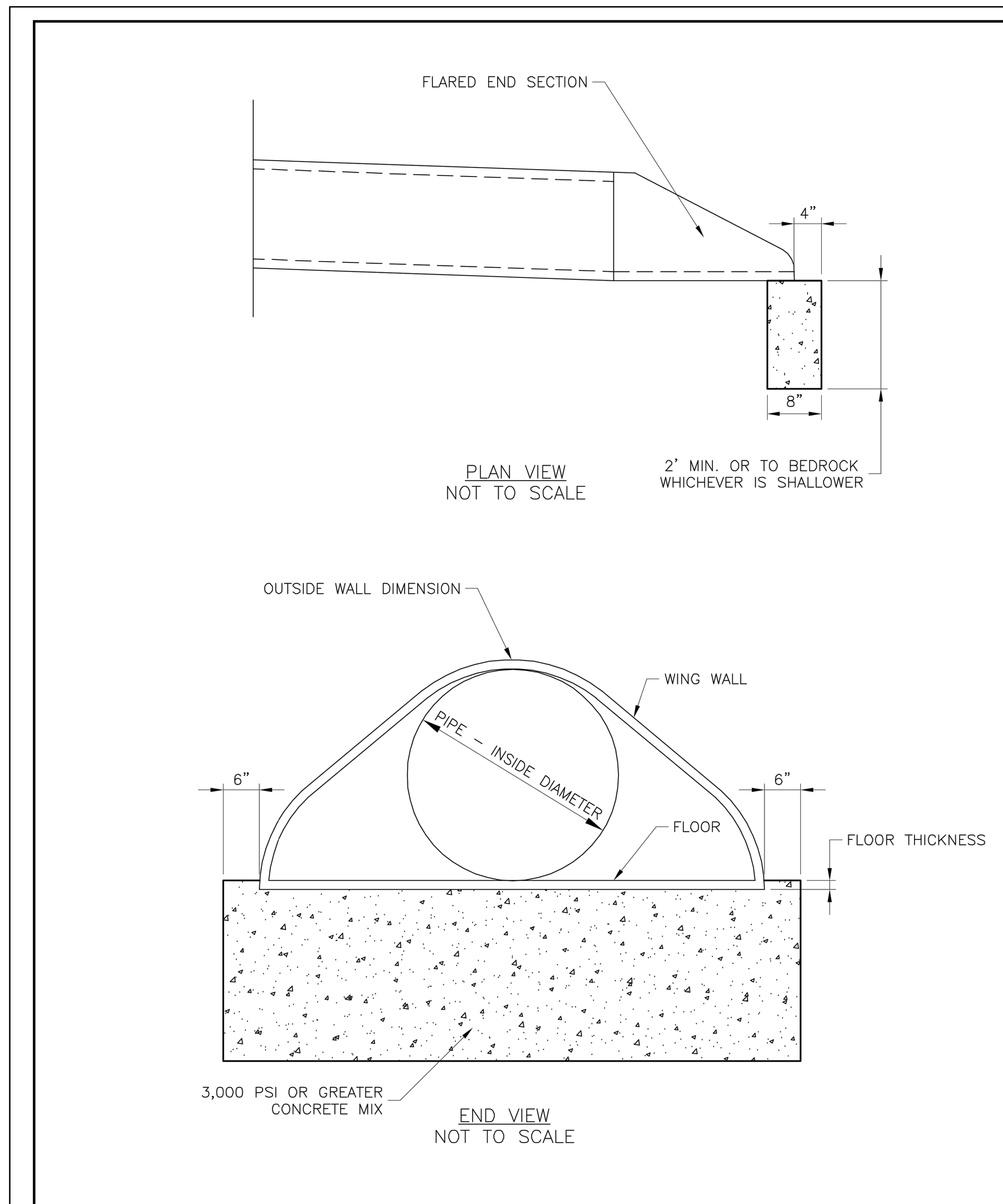
1. ¾" ISOLATION JOINTS WITH 3 (2'–#5 BAR) SMOOTH DOWELS SHALL BE PLACED AT RADIUS POINTS AND AT 150' INTERVALS. THESE DOWEL BARS SHALL BE GREASED AND WRAPPED ON ONE END WITH EXPANSION TUBES.
2. 3" DEEP CONTRACTION JOINTS SHALL BE INSTALLED AT APROXIMATELY 10' INTERVALS. THESE JOINTS SHALL PASS ACROSS THE ENTIRE CURB SECTION.
3. CONCRETE FILL SHALL HAVE UNIFORM AND SMOOTH FINISH
4. KCMMB 4K CONCRETE SHALL BE USED FOR ALL CURB.
5. ASPHALTIC CONCRETE SURFACE COURSE SHALL CONFORM TO STANDARD SPECIFICATIONS SECTION 2205.2.
6. CURBS FOR NEW STREETS SHALL BE BUILT ON ASPHALT OR AGGREGATE BASE AS SHOWN IN TYPICAL SECTION DETAIL.
7. WHITE CURING COMPOUND MUST BE APPLIED UNIFORMLY TO THE CONCRETE SURFACE IMMEDIATELY AFTER FINAL FINISHING.

LEE'S SUMMIT MISSOURI
PUBLIC WORKS ENGINEERING DIVISION | 220 SE GREEN STREET | LEE'S SUMMIT, MO 64063

Project: STANDARD DETAILS CITY OF LEE'S SUMMIT, MO LEE'S SUMMIT, JACKSON COUNTY, MO
CURB & GUTTER DETAIL

Drawn By: MJF
Checked By: DL
Date: 04/17
Proj. #:

GEN-4



PLAN VIEW
NOT TO SCALE

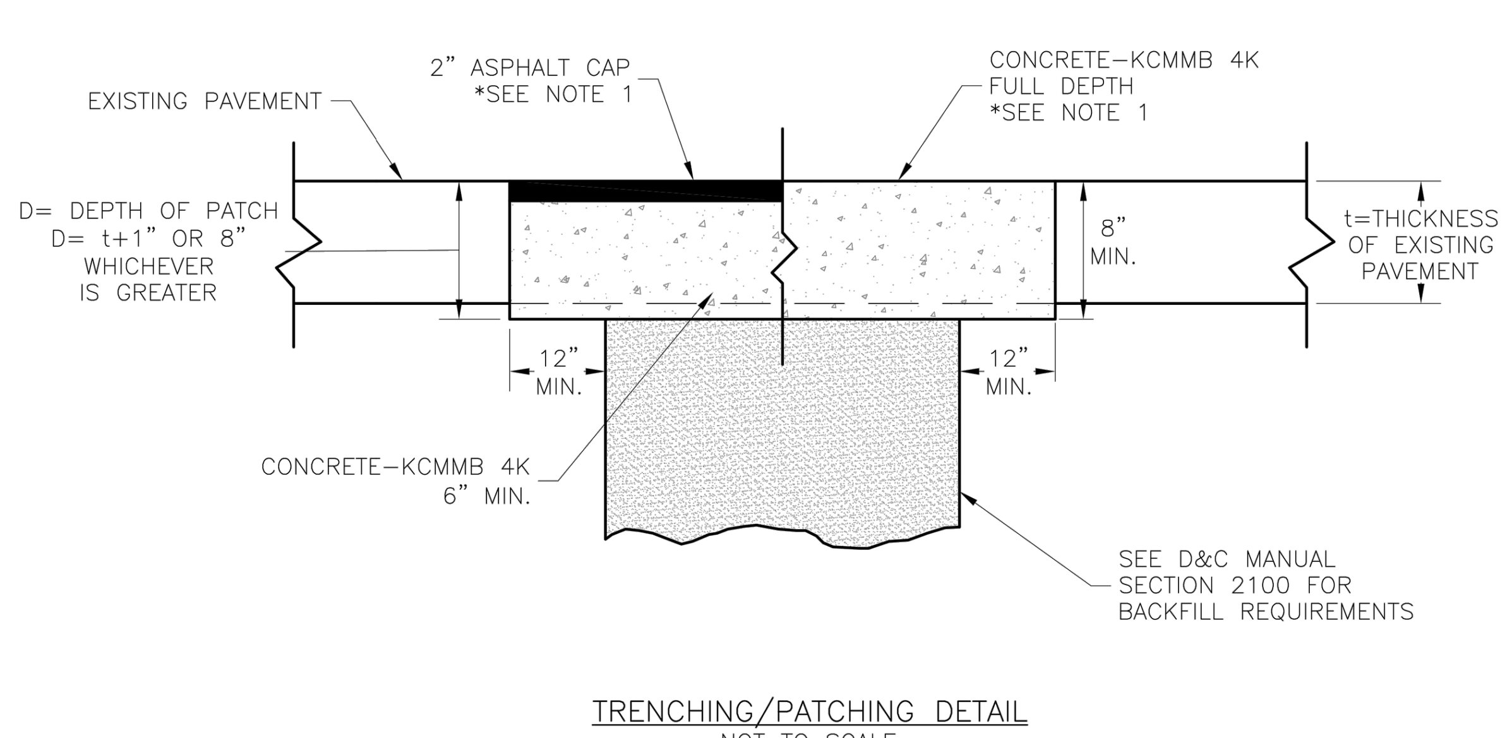
END VIEW
NOT TO SCALE

LEE'S SUMMIT MISSOURI
PUBLIC WORKS ENGINEERING DIVISION | 220 SE GREEN STREET | LEE'S SUMMIT, MO 64063

FLARED END SECTION SUPPORT DETAIL

Date: 04/17
Drawn By: MJF
Checked By: DL

STM-5



TRENCHING/PATCHING DETAIL
NOT TO SCALE

NOTE:

1. ASPHALT CAP OR FULL DEPTH CONCRETE SHALL BE DETERMINED BY CITY INSPECTOR.

LEE'S SUMMIT MISSOURI
PUBLIC WORKS ENGINEERING DIVISION | 220 SE GREEN STREET | LEE'S SUMMIT, MO 64063

TRENCHING/PATCHING ROADWAYS DETAIL

Date: 04/17
Drawn By: MJF
Checked By: DL

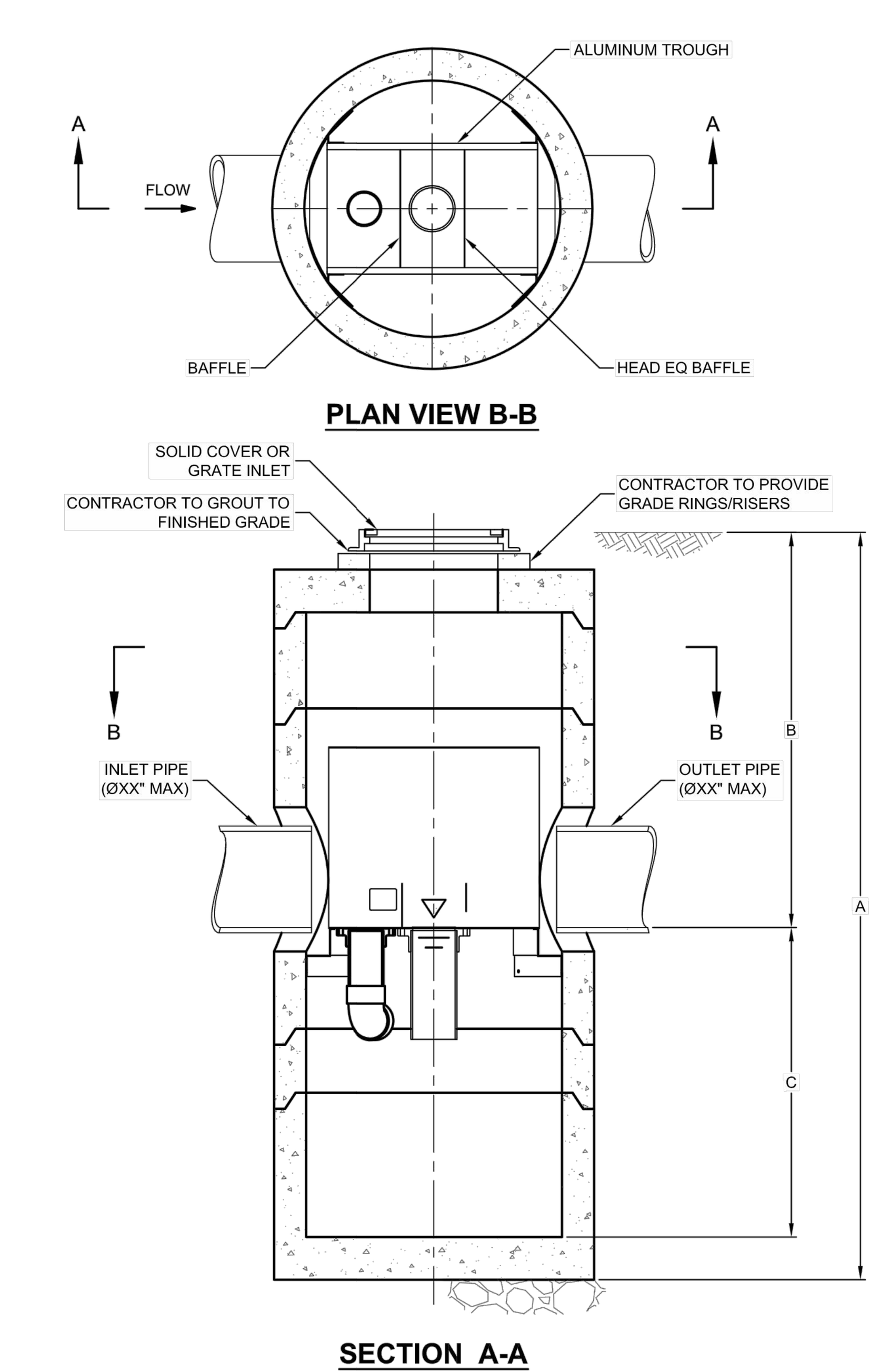
GEN-5

VORTSENTRY HS DESIGN NOTES

VSHS RATED TREATMENT CAPACITY IS SHOWN IN THE TABLE BELOW, OR PER LOCAL REGULATIONS. MAXIMUM HYDRAULIC INTERNAL BYPASS CAPACITY VARIES. CONTACT YOUR CONTECH REPRESENTATIVE FOR ADITIONAL INFORMATION.

THE STANDARD SOLID COVER CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW.

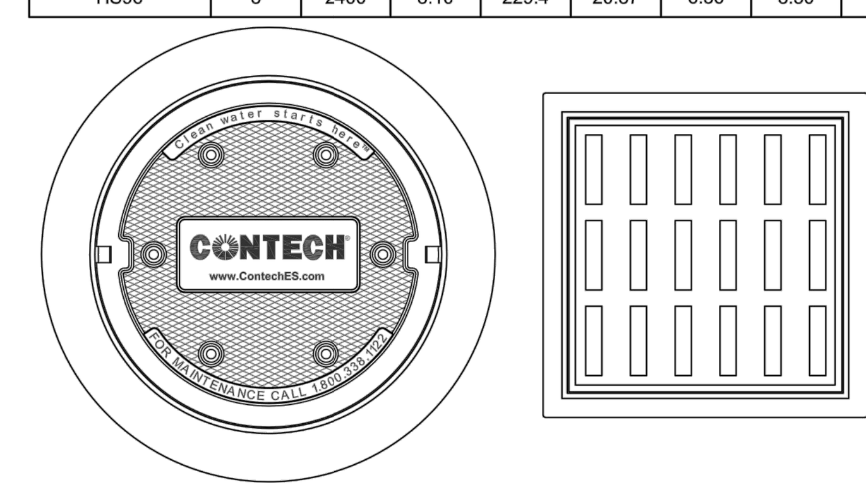
	CONFIGURATION OPTION DESCRIPTION
	GRATE INLET (NO INLET PIPE)
	GRATE INLET WITH INLET PIPE



VortSentry

VORTSENTRY HS GENERAL INFORMATION

Model	Manhole Diameter (ID)		Total Treatment Flow Rate		Typical Total Distance Rim to Outside Bottom A		Typical Distance Rim to Invert B		Typical Depth Below Invert (inside) C		Approximate Minimum Distance Rim to Invert		Maximum Pipe Diameter (ID)	
	FT	mm	CFS	L/S	FT	m	FT	m	FT	mm	FT	m	IN	mm
HS36	3	900	0.55	15.6	10.16	3.10	4.08	1.24	5.58	1702	3.00	0.91	18	450
HS48	4	1200	1.20	34.0	13.25	4.04	6.00	1.83	6.75	2057	4.00	1.22	24	600
HS60	5	1500	2.20	62.3	15.13	4.61	6.50	1.98	7.96	2426	4.82	1.47	30	750
HS72	6	1800	3.70	104.8	16.56	5.05	6.75	2.06	9.15	2788	5.59	1.70	36	900
HS84	7	2100	5.60	158.6	18.85	5.75	7.75	2.36	10.35	3156	5.00	1.52	42	1050
HS96	8	2400	8.10	229.4	20.87	6.36	8.50	2.59	11.54	3518	6.91	2.11	48	1200



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

FRAME AND GRATE
(24" SQUARE)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID			
WATER QUALITY FLOW RATE (CFS)	*		
PEAK FLOW RATE (CFS)	*		
RETURN PERIOD OF PEAK FLOW (YRS)	*		
PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
OUTLET PIPE	*	*	*
RIM ELEVATION	*		
ANTI-FLOTATION BALLAST	WIDTH	HEIGHT	
	*	*	
NOTES/SPECIAL REQUIREMENTS:			

* PER ENGINEER OF RECORD

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
4. VORTSENTRY HS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET AASHTO M306 LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.

INSTALLATION NOTES
1. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
2. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE VORTSENTRY HS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
3. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
4. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
5. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

VORTSENTRY HS
STANDARD DETAIL

Kimley»Horn
13455 Noel Road, Suite 700, Dallas, Texas 75240
PHONE: 214-420-5600 FAX: 214-420-5680
WWW.KIMLEY-HORN.COM
MISSOURI REGISTRATION NUMBER 001512

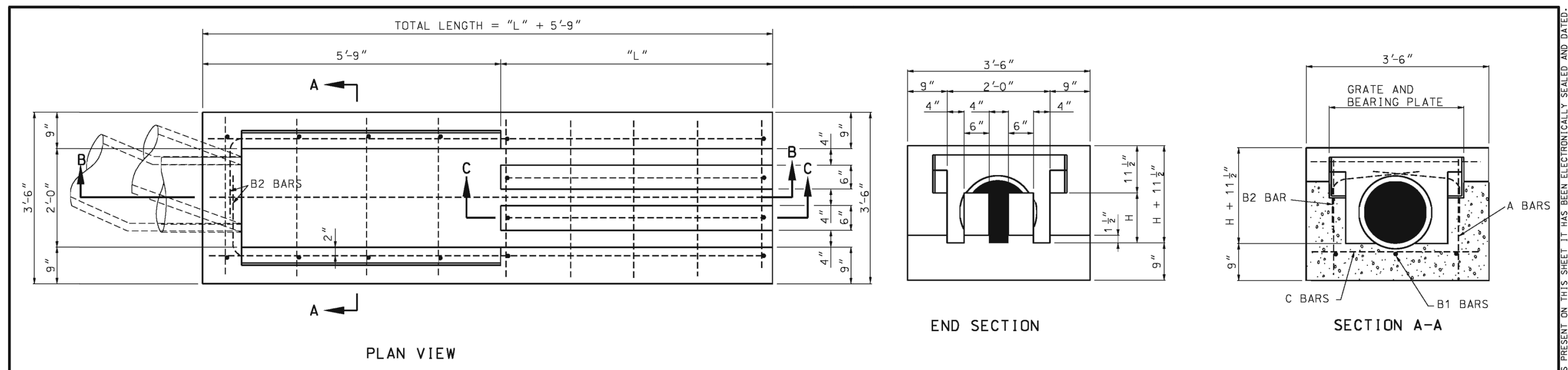
95% REVIEW SET
FOR REVIEW ONLY
Not for construction or permit purposes.
Kimley»Horn
Engineer: KEVIN S. GASKEY
P.E. No. 28441 Date: MAY 2019

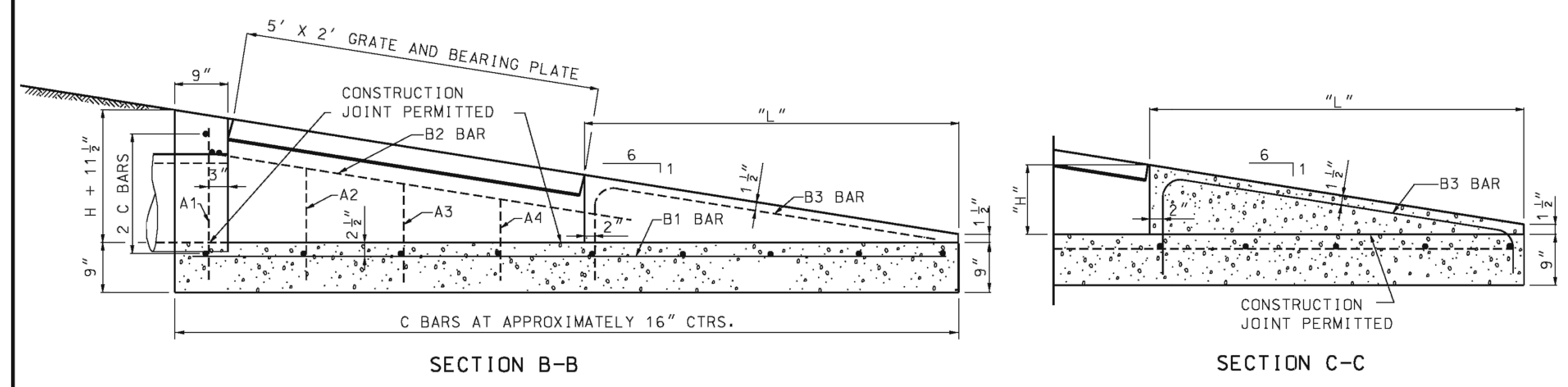
SUMMIT WAVES WAVE POOL ADDITION LEE'S SUMMIT, MO

CONSTRUCTION DETAILS

Scale: AS SHOWN
Designed by: ABP
Drawn by: ABO
Checked by: SEG
Date: MAY 2019
Project No. 064538700

SHEET
C-11





GENERAL NOTES:

USE RIGHT ANGLE HEADWALL FOR ALL INSTALLATIONS. SKEW PIPE BY USING A BEVELED END OR ELBOW ON PIPE. IN SPECIAL CASES, HEADWALL MAY BE TURNED TO FIT PIPE SKEW AND 1V TO 6H SLOPE WARPED TO FIT HEADWALL.

ALL CONCRETE SHALL BE CLASS "B".

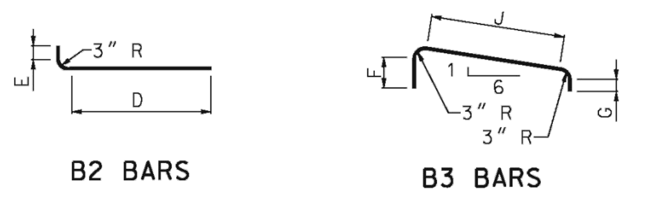
THIS DRAWING AND THE CONCRETE QUANTITIES SHOWN ARE BASED ON THE USE OF CONCRETE PIPE. QUANTITIES OF CONCRETE SHOWN WILL BE USED FOR PAYMENT REGARDLESS OF ANY QUANTITY CHANGES NECESSARY DUE TO THE USE OF ANY OTHER TYPE PIPE SPECIFIED OR PERMITTED.

FLOW LINE OF HEADWALL IS TO BE PLACED HORIZONTALLY.

PRECAST NOTES:

THE CONTRACTOR MAY, SUBJECT TO APPROVAL OF THE ENGINEER, FURNISH PRECAST UNITS IN LIEU OF CAST-IN-PLACE. IF A PRECAST UNIT IS FURNISHED, IT SHALL CONFORM IN ALL RESPECTS TO THE THE REQUIREMENTS FOR CAST-IN-PLACE UNITS INCLUDING DIMENSIONS AND REINFORCEMENT, EXCEPT THAT THE FORMS MAY BE TAPERED TO FACILITATE REMOVAL OF THE UNIT FROM THE FORMS. SHOP DRAWINGS OF THE PRECAST UNIT SHALL BE SUBMITTED FOR APPROVAL PRIOR TO FIRST USE OF THE PRECASTING FORMS.

PIPE SIZE	DIMENSIONS			QUANTITIES		REINFORCING																			
						#4 A1 BARS		#4 A2 BARS		#4 A3 BARS		#4 A4 BARS		#4 B1 BARS		#4 B2 BARS				#4 B3 BARS					#4 C BARS	
	"H"	"L"	TOTAL LENGTH	CONC. C. Y.	STEEL LBS.	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	E	D	LENGTH	NO.	F	G	J	LENGTH	NO.	LENGTH
12"	9"	3'-9"	9'-6"	1.5	70	2	2'-0"	2	1'-6"	2	1'-3"	2	1'-0"	3	9'-3"	2	1'-5"	5'-8"	7'-6"	4	11"	5"	2'-11"	5'-0"	8	3'-3"
15"	1'-0"	5'-3"	11'-0"	1.8	80	2	2'-3"	2	1'-9"	2	1'-6"	2	1'-3"	3	10'-9"	2	1'-5"	5'-8"	7'-6"	4	1'-2"	5"	4'-5"	6'-9"	9	3'-3"
18"	1'-3"	6'-9"	12'-6"	2.2	90	2	2'-6"	2	2'-0"	2	1'-9"	2	1'-6"	3	12'-3"	2	1'-5"	5'-8"	7'-6"	4	1'-5"	5"	5'-11"	8'-6"	10	3'-3"
21"	1'-6"	8'-3"	14'-0"	2.6	100	2	2'-9"	2	2'-3"	2	2'-0"	2	1'-9"	3	13'-9"	2	1'-5"	5'-8"	7'-6"	4	1'-8"	5"	7'-5"	10'-3"	11	3'-3"
24"	1'-9"	9'-9"	15'-6"	3.0	110	2	3'-0"	2	2'-6"	2	2'-3"	2	2'-0"	3	15'-3"	2	1'-5"	5'-8"	7'-6"	4	1'-11"	5"	8'-11"	12'-0"	12	3'-3"



BENDING DETAILS

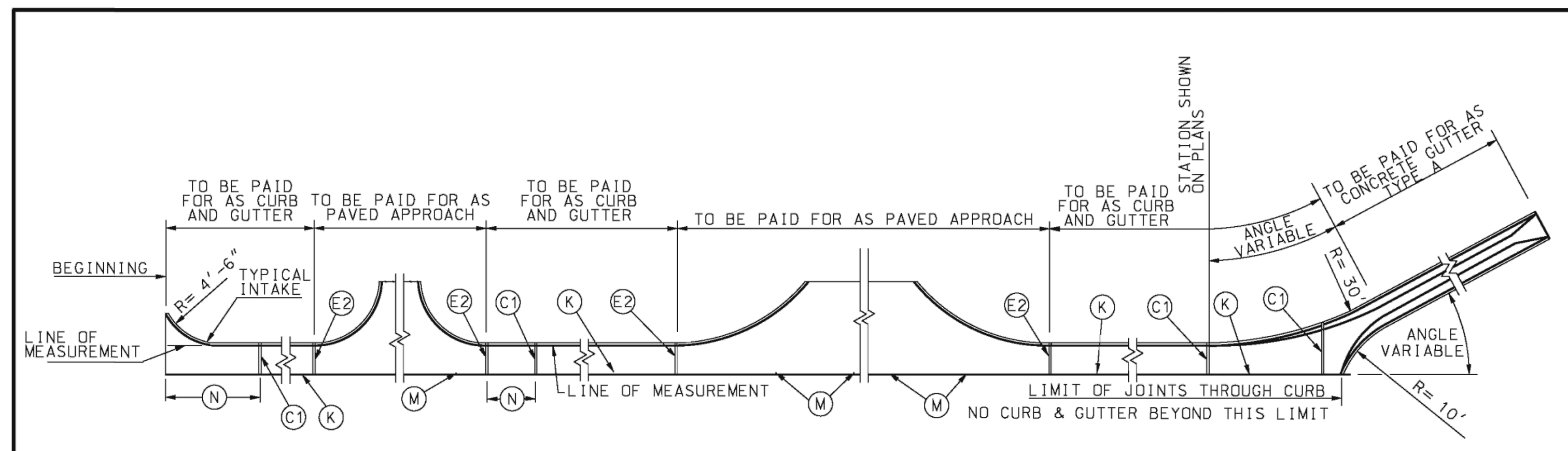
MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION
105 WEST CAPITOL
JEFFERSON CITY, MO 65102
1-888-ASK-MODOT (1-888-275-6636)

STATE OF MISSOURI — DENNIS W. HECKMAN — NUMBER PE-27141 — PROFESSIONAL ENGINEER
THIS SHEET HAS BEEN SIGNED, SEALED AND DATED ELECTRONICALLY.

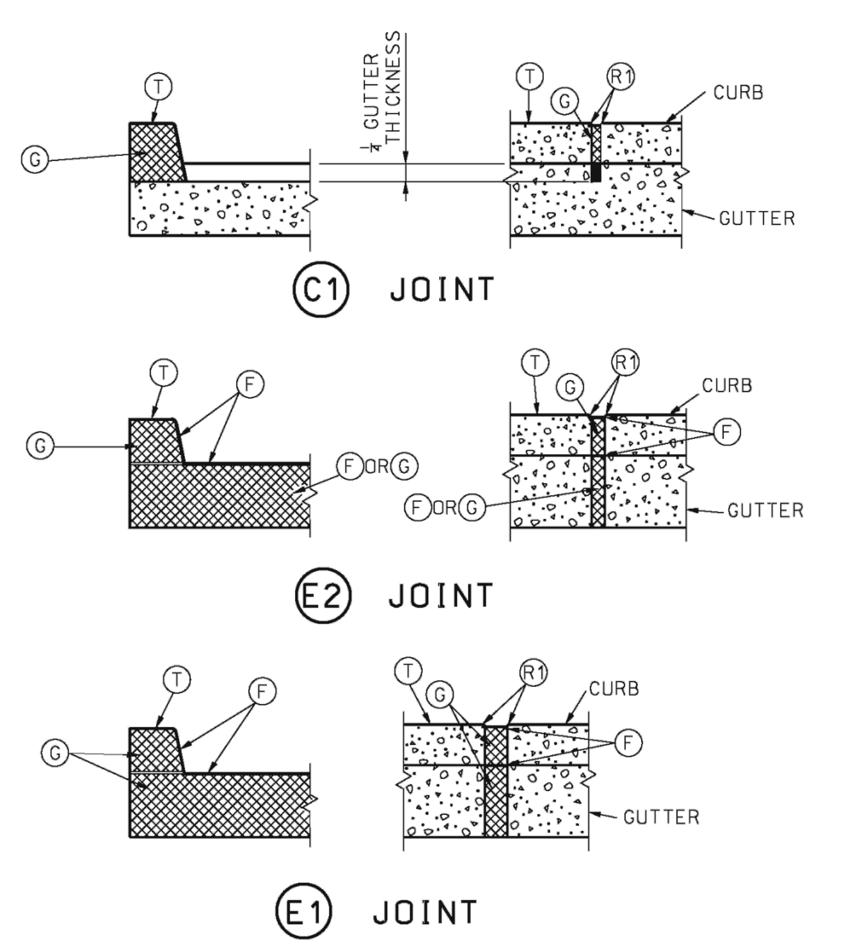
PIPE CULVERT HEADWALLS
TYPE S
12" TO 24" DIAMETERS
- 1V:6H SLOPES

DATE EFFECTIVE: 08/01/2006
DATE PREPARED: 9/3/2009
604.05D
SHEET NO. 1 OF 2

IF A SEAL IS PRESENT ON THIS SHEET IT HAS BEEN ELECTRONICALLY SEALED AND DATED.



PLAN OF MEASUREMENT OF CURB & GUTTER AND JOINT PLAN



GNERAL NOTES:

A MINIMUM 4" TYPE 1 OR 5 AGGREGATE BASE SHALL BE PLACED BENEATH ALL CURB AND GUTTER SECTIONS AND INCLUDED WITHIN THE MAINLINE BASE PAY LIMITS.

WHEN CURBS ARE CONSTRUCTED DIRECTLY BENEATH GUARDRAIL, CURB HEIGHT SHALL BE 4 INCH BARRIER CURB, AS SHOWN ON STANDARD PLAN 606.00.

CURB, GUTTER AND CURB AND CUTTER CONSTRUCTED ALONG AND ATTACHED TO CONCRETE PAVEMENT OR BASE SHALL HAVE:

1. JOINT (C1) ONE-QUARTER DEPTH OF CURB AND GUTTER THICKNESS AS A CONTINUATION OF EACH CONTRACTION JOINT IN THE BASE OR PAVEMENT.
2. JOINT (E1) AS CONTINUATION OF 2" EXPANSION JOINT (E) IN THE CONCRETE BASE OR PAVEMENT SHALL EXTEND AND CONTINUE THROUGH THE CURB, CUTTER AND CURB AND GUTTER.
3. JOINT (E2) THROUGH CURB AND CURB AND CUTTER AT THE BEGINNING AND END OF EACH PAVED APPROACH.

CURB, CURB AND GUTTER AND GUTTER CONSTRUCTED APART OR SEPARATED FROM CONCRETE BASE OR PAVEMENT OR AS A FORM FOR ASPHALTIC CONCRETE PAVEMENT SHALL HAVE A JOINT (E2) ENTIRELY THROUGH THE CURB, CURB AND GUTTER AND GUTTER, AT THE BEGINNING AND END OF EACH "PAVED APPROACH" AND A JOINT (C1) TO ¼ DEPTH OF CURB AND GUTTER THICKNESS AT INTERVALS OF 30 FEET BETWEEN APPROACHES.

JOINTS (E1) AND (E2) THROUGH CURB SHALL BE FILLED WITH PREFORMED FILLER MATERIAL AND SEALED WITH HOT POURED FILLER FOR JOINTS.

JOINT (E1) IN GUTTER SHALL BE FILLED WITH PREFORMED FILLER AND SEALED WITH HOT FILLER MATERIAL.

JOINT (E2) IN GUTTER SHALL BE FILLED WITH PREFORMED FILLER AND SEALED WITH FILLER OR FILLED WITH HOT POURED FILLER.

PREFORMED FILLER MATERIAL SHALL BE PLACED TO PROVIDE 1" HOT POURED FILLER FOR JOINTS.

THE BARRIER CLASS CURBS MAY BE CONSTRUCTED WITHOUT BATTER WHEN CONSTRUCTED ON A RADIUS OF 6 FEET OR LESS. THE (R2) WILL BE REQUIRED.

WHERE A SIDEWALK INTERSECTS A CURB. THE SIDEWALK SHALL BE RAMPED NO STEEPER THAN 12:1 SLOPE TO PROVIDED ACCESS FOR WHEELCHAIR ACROSS APPROACHES.

WHEN ALLOWED BY THE ENGINEER, TYPES A AND B GUTTER MAY BE PRECAST TO CONFORM TO THE DIMENSIONS SHOWN. THE PRECASTER SHALL SUBMIT SHOP DRAWINGS INDICATING THE SECTION LENGTH. SECTION CONNECTION, AND PROPOSED JOINT SEALING SYSTEM. WHEN PRECAST SECTIONS CANNOT CONFORM TO ANY VERTICAL OR HORIZONTAL CURVE DESIGNATED ON THE PLANS. THE GUTTER SHALL BE CAST-IN-PLACE. A COMBINATION OF CAST-IN-PLACE AND PRECAST GUTTER MAY BE PERMITTED.

LEGEND

- (C1) ⅛" MAXIMUM WIDTH TRANSVERSE CONTRACTION JOINT (PREFORMED OR SAWED).
- (E1) 2" TRANSVERSE EXPANSION JOINT. (PREFORMED OR SAWED)
- (E2) ½" TRANSVERSE EXPANSION JOINT. (PREFORMED OR SAWED)
- (F) FILLER FOR JOINTS - HOT POURED.
- (G) PREFORMED JOINT FILLER MATERIAL.
- (K) TONGUE & GROOVE JOINT WITH TIE BAR - SEE DETAIL.
- (M) TONGUE & GROOVE JOINT WITHOUT TIE BARS - SEE DETAIL.
- (N) NOT LESS THAN 10' OR MORE THAN 30'.
- (T) TOP OF CURB.
- (R1) ROUND TO ¼" RADIUS. (EXCEPT FOR SAWED JOINTS)

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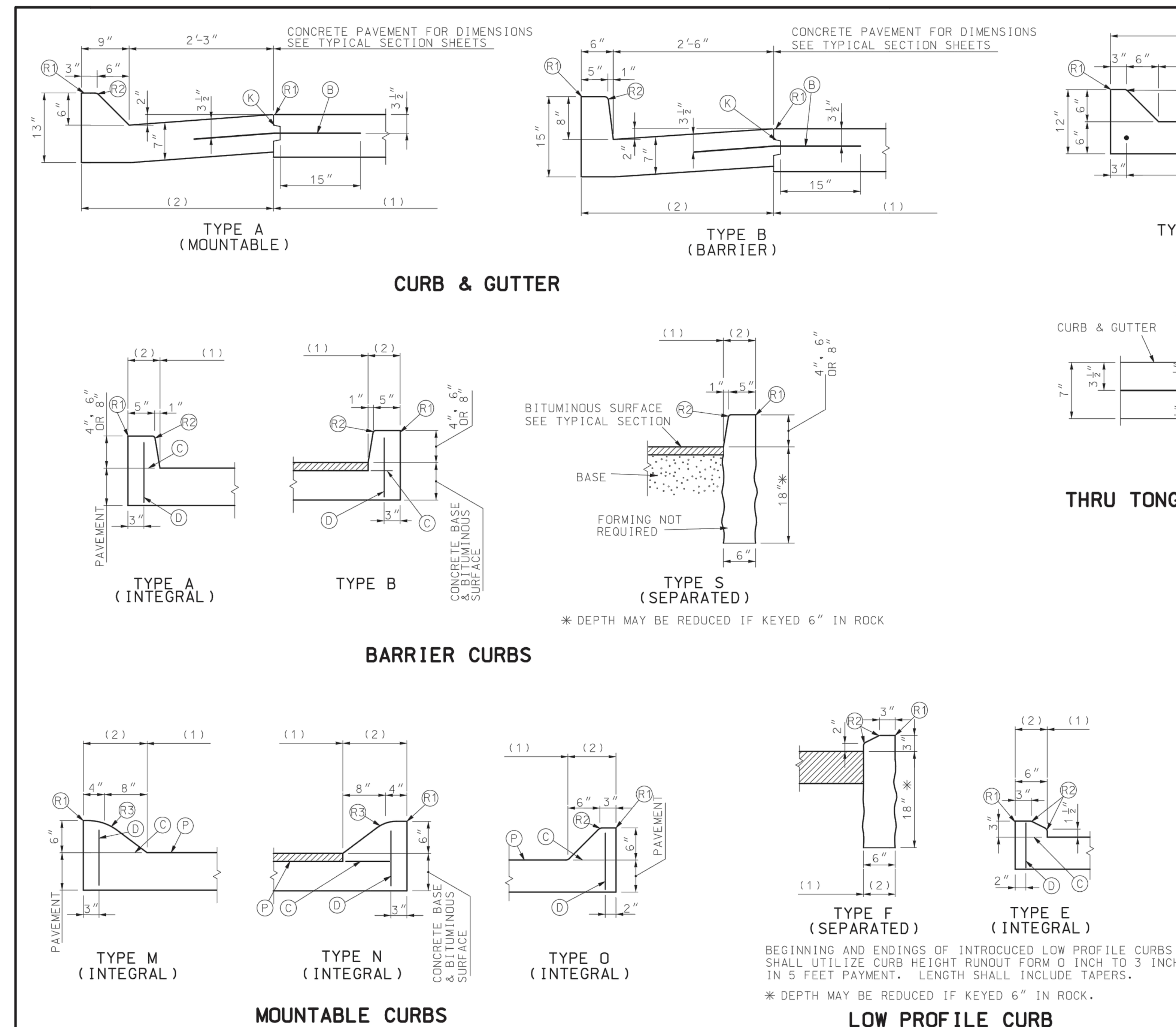
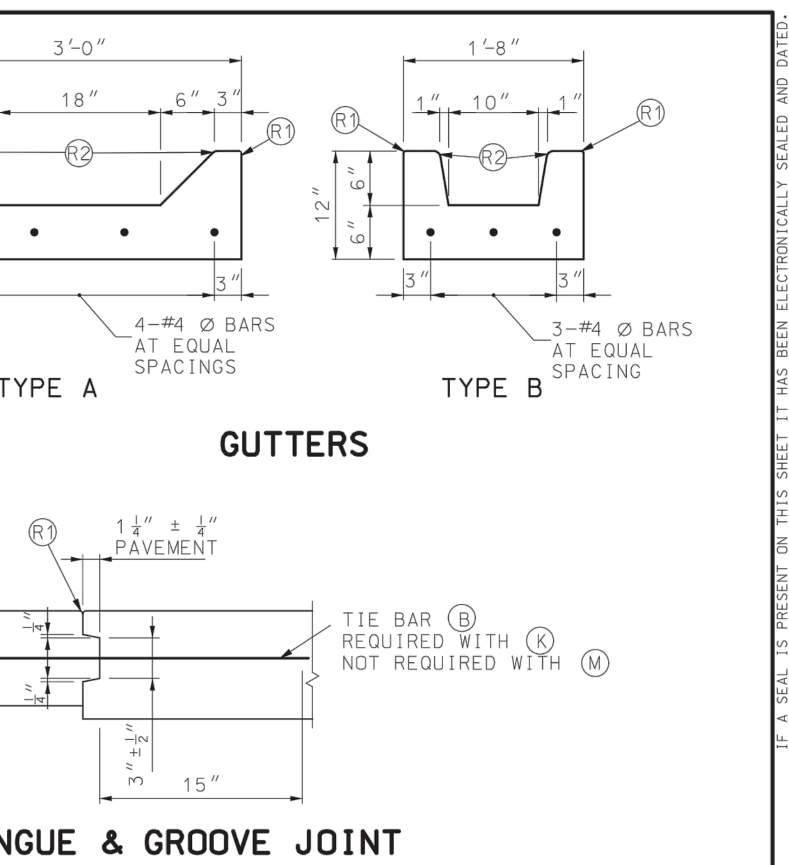
STATE OF MISSOURI — KATHRYN PHILLIPS HARVEY — PROFESSIONAL ENGINEER
THIS SHEET HAS BEEN SIGNED, SEALED AND DATED ELECTRONICALLY.

CONCRETE CURB, CURB AND GUTTER AND GUTTER

DATE EFFECTIVE: 08/01/2008
DATE PREPARED: 12/29/2011
609.00P
SHEET NO. 1 OF 2

IF A SEAL IS PRESENT ON THIS SHEET IT HAS BEEN ELECTRONICALLY SEALED AND DATED.





LEGEND

- (B) TIE BARS - 30" X #5 Ø AT 30" CTRS.
- (C) PERMISSIBLE CONSTRUCTION JOINT. IF CONSTRUCTED IN THIS MANNER TIE BARS MUST BE USED.
- (D) #4 Ø TIE BAR AT 24" CENTERS LENGTH OF THE TIE BARS EQUALS THICKNESS OF PAVEMENT PLUS HEIGHT OF CURB, LESS 3 INCHES.
- (K) TONGUE & GROOVE JOINT WITH TIE BAR - SEE DETAIL.
- (P) TOP OF PAVEMENT OR CONCRETE BASE.
- (R1) ROUND TO ¼" RADIUS. (EXCEPT FOR SAWED JOINTS)
- (R2) ROUND TO ¾" RADIUS.
- (R3) CONSTRUCT TO 9" RADIUS
- (1) PAY LIMIT FOR PAVEMENT
- (2) PAY LIMIT FOR CURB, OR CURB & GUTTER.

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STATE OF MISSOURI — ERIC E. SCHROETER — NUMBER PE-28411 — PROFESSIONAL ENGINEER
THIS SHEET HAS BEEN SIGNED, SEALED AND DATED ELECTRONICALLY.

CONCRETE CURB, CURB AND GUTTER AND GUTTER

DATE EFFECTIVE: 07/01/2018
DATE PREPARED: 5/3/2018
609.00P
SHEET NO. 2 OF 2

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Kimley-Horn
Engineer: KEVIN S. GASKEY
P.E. No. 28441 Date MAY 2019

SUMMIT WAVES WAVE POOL ADDITION LEE'S SUMMIT, MO

CONSTRUCTION DETAILS

Scale:	AS SHOWN
Designed by:	ABP
Drawn by:	ABO
Checked by:	SEG
Date:	MAY 2019
Project No.	064538700

SHEET
C-12

File: K:\DAL_LALP\LAC_LALP\064538700_Lees Summit\Dwg\Sheet\Civils\C-CONSTRUCTION DETAILS.dwg [Layout1]
Xrefs: 20190325x2436
Images:

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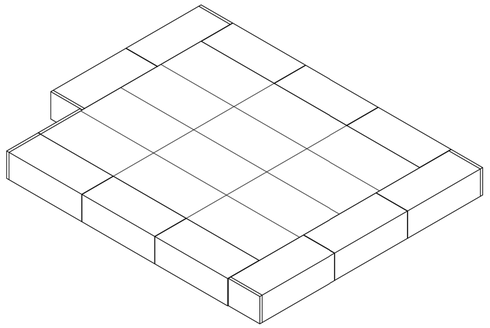
MODULAR CONCRETE
STORMWATER MANAGEMENT



SUMMIT WAVES - OPTION 2
LEES SUMMIT, MO

SHEET INDEX

STORMTRAP CONTACT INFORMATION

STORM TRAP SUPPLIER: STORMTRAP
CONTACT NAME: DAVID MCRAE
CELL PHONE: 601-814-0730
SALES EMAIL: DMCRAE@STORMTRAP.COM

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TWO GALLERIA OFFICE
TOWER STE 700

PROJECT INFORMATION:
SUMMIT WAVES
OPTION 2
LEES SUMMIT, MO

CURRENT ISSUE DATE:
5/7/2019

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1	4/15/2019	PRELIMINARY	JH

SCALE:
NTS

SHEET TITLE:
COVER SHEET

SHEET NUMBER:
0.0

STRUCTURAL DESIGN LOADING CRITERIA

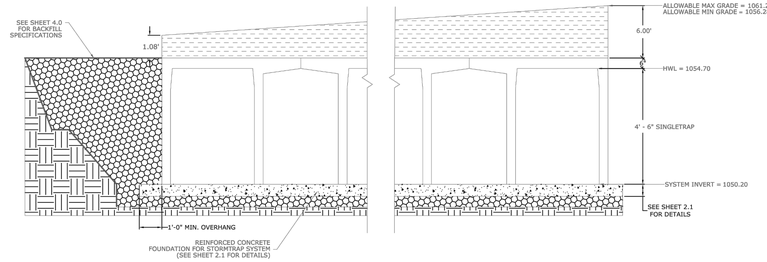
LIVE LOADING: AASHTO HS-20 HIGHWAY LOADING
GROUND WATER TABLE: BELOW INVERT OF SYSTEM
SOIL BEARING PRESSURE: 3000 PSF
SOIL DENSITY: 120 PCF
EQUIVALENT UNSATURATED LATERAL ACTIVE EARTH PRESSURE: 35 PSF / FT.
EQUIVALENT SATURATED LATERAL ACTIVE EARTH PRESSURE: 80 PSF/FT. (IF WATER TABLE PRESENT)
APPLICABLE CODES: ASTM C857, ACI-318
BACKFILL TYPE: SEE SHEET 4.0 FOR BACKFILL OPTIONS

STORMTRAP SYSTEM INFORMATION

WATER STORAGE PROV: 10,979.88 CUBIC FEET
UNIT HEADROOM: 4' - 6" SINGLETRAP
UNIT QUANTITY: 23 TOTAL PIECES

SITE SPECIFIC DESIGN CRITERIA

1. STORMTRAP UNITS SHALL BE MANUFACTURED AND INSTALLED ACCORDING TO SHOP DRAWINGS APPROVED BY THE INSTALLING CONTRACTOR AND ENGINEER OF RECORD. THE SHOP DRAWINGS SHALL INDICATE SIZE AND LOCATION OF ROOF OPENINGS AND INLET/ OUTLET PIPE TYPES, SIZES, INVERT ELEVATIONS AND SIZE OF OPENINGS.
2. COVER RANGE: MIN. 1.08' MAX. 6.00' CONSULT STORMTRAP FOR ADDITIONAL COVER OPTIONS.
3. ALL DIMENSIONS AND SOIL CONDITIONS, INCLUDING BUT NOT LIMITED TO GROUNDWATER AND SOIL BEARING CAPACITY ARE REQUIRED TO BE VERIFIED IN THE FIELD BY OTHERS PRIOR TO STORMTRAP INSTALLATION.
4. FOR STRUCTURAL CALCULATIONS THE GROUND WATER TABLE IS ASSUMED TO BE BELOW INVERT OF SYSTEM . IF WATER TABLE IS DIFFERENT THAN ASSUMED, CONTACT STORMTRAP.
5. SYSTEM DESIGN MAY ALLOW FOR INCIDENTAL LEAKAGE AND WILL NOT BE SUBJECT TO LEAKAGE TESTING.



4' - 6" SINGLETRAP

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TWO GALLERIA OFFICE
TOWER STE 700

PROJECT INFORMATION:
SUMMIT WAVES
OPTION 2
LEES SUMMIT, MO

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SCALE:
NTS

SHEET TITLE:
SINGLETRAP DESIGN CRITERIA

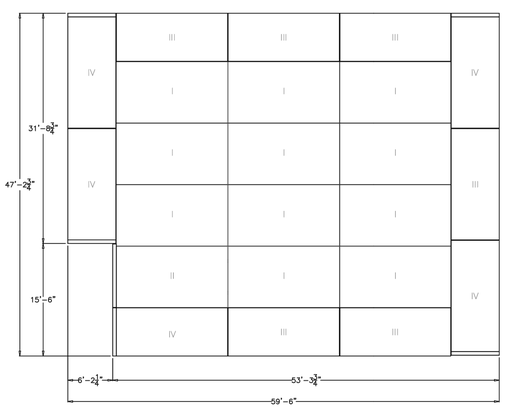
SHEET NUMBER:
1.0

BILL OF MATERIALS

QTY.	UNIT TYPE	DESCRIPTION	WEIGHT
11	I	4' - 6" SINGLETRAP	15188
1	II	4' - 6" SINGLETRAP	17263
6	III	4' - 6" SINGLETRAP	14779
5	IV	4' - 6" SINGLETRAP	15817
0	VII	4' - 6" SINGLETRAP	14365
0	SPIV	4' - 6" SINGLETRAP	VARIES
6	PANEL	6" THICK PANELS	VARIES
5	JOINT WRAP	150' PER ROLL	
16	JOINT TAPE	14.5' PER ROLL	

LOADING DISCLAIMER:

STORMTRAP IS NOT DESIGNED TO ACCEPT ANY ADDITIONAL LOADINGS FROM NEARBY STRUCTURES NEXT TO OR OVER THE TOP OF STORMTRAP. IF ADDITIONAL LOADING CONSIDERATIONS ARE REQUIRED FOR STRUCTURAL DESIGN OF STORMTRAP, PLEASE CONTACT STORMTRAP IMMEDIATELY.



DESIGN CRITERIA
ALLOWABLE MAX GRADE = 1061.20
ALLOWABLE MIN GRADE = 1056.28
INSIDE HEIGHT ELEVATION = 1054.70
SYSTEM INVERT = 1050.20

NOTES:
1. DIMENSIONING OF STORMTRAP SYSTEM SHOWN BELOW ALLOW FOR A 3/4" GAP BETWEEN EACH MODULE.
2. ALL DIMENSIONS TO BE VERIFIED IN THE FIELD BY OTHERS.
3. SEE SHEET 3.0 FOR INSTALLATION SPECIFICATIONS.
4. SP - INDICATES A MODULE WITH MODIFICATIONS.
5. P - INDICATES A MODULE WITH A PANEL ATTACHMENT.
6. CONTRACTORS RESPONSIBILITY TO ENSURE CONSISTENCY/ACCURACY TO FINAL ENGINEER OF RECORD PLAN SET.

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TOWER STE 700

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SUMMIT WAVES
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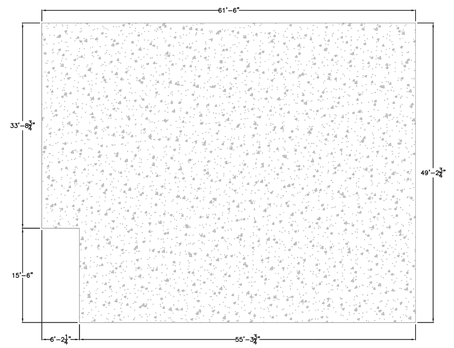
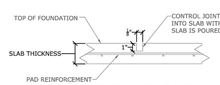
SHEET TITLE:
SINGLETRAP SYSTEM LAYOUT

SHEET NUMBER:
2.0



NOTES:
1. CONCRETE STRENGTH @ 28 DAYS, 5%-8% ENTRAINED AIR, 4" MAX. SLUMP.
2. NET ALLOWABLE SOIL PRESSURE AS INDICATED ON SHEET 1.0.
3. SOIL CONDITIONS TO BE VERIFIED ON SITE BY OTHERS.
4. REBAR: ASTM A-615 GRADE 60, BLACK BAR.
5. DIMENSION OF FOUNDATION MUST HAVE 1'-0" OVERHANG BEYOND EXTERNAL FACE OF MODULE.
6. DIMENSION OF STORMTRAP SYSTEM ALLOW FOR A 3/4" GAP BETWEEN EACH MODULE.
7. ALL DIMENSIONS TO BE VERIFIED IN THE FIELD BY OTHERS.
8. THE CONTROL JOINTS SHALL BE BETWEEN (IF REQUIRED BY ENGINEER OF RECORD) 16'-0" TO 24'-0" MAX APART.
9. SEE SHEET 3.0 FOR INSTALLATION SPECIFICATIONS.



CONTROL JOINT DETAIL

STORMTRAP FOUNDATION DETAIL

MAXIMUM SYSTEM COVER	SLAB THICKNESS	CONCRETE STRENGTH	REINFORCEMENT (BOTH DIRECTIONS)	'A' CLEAR COVER
0' - 12"	0'-8"	4000 PSI	#4 @ 18" O.C.	3.5"
>1'-0" - 2'-0"	0'-8"	4000 PSI	#4 @ 16" O.C.	3.5"
>2'-0" - 3'-0"	0'-8"	4000 PSI	#4 @ 12" O.C.	3.5"
>3'-0" - 4'-0"	0'-8"	4000 PSI	#4 @ 12" O.C.	3.5"
>4'-0" - 5'-0"	0'-8"	4000 PSI	#5 @ 18" O.C.	3.375"
>5'-0" - 6'-0"	0'-8"	4000 PSI	#5 @ 16" O.C.	3.375"
>6'-0" - 7'-0"	0'-8"	4000 PSI	#5 @ 16" O.C.	3.375"
>7'-0" - 8'-0"	0'-9"	4000 PSI	#5 @ 12" O.C.	3.875"
>8'-0" - 9'-0"	0'-10"	4000 PSI	#5 @ 12" O.C.	4.375"
>9'-0" - 10'-0"	0'-10"	4500 PSI	#5 @ 12" O.C.	4.375"

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SUMMIT WAVES
OPTION 2
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SHEET TITLE:
SINGLETRAP FOUNDATION LAYOUT

SHEET NUMBER:
2.1

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Kimley»Horn
Engineer KEVIN S. GASKEY
P.E. No. 28441 Date MAY 2019

SUMMIT WAVES
WAVE POOL ADDITION
LEE'S SUMMIT, MO

DETENTION DETAILS

Scale: AS SHOWN
Designed by: ABP
Drawn by: ABO
Checked by: SEG
Date: MAY 2019
Project No. 064538700

SHEET
C-13

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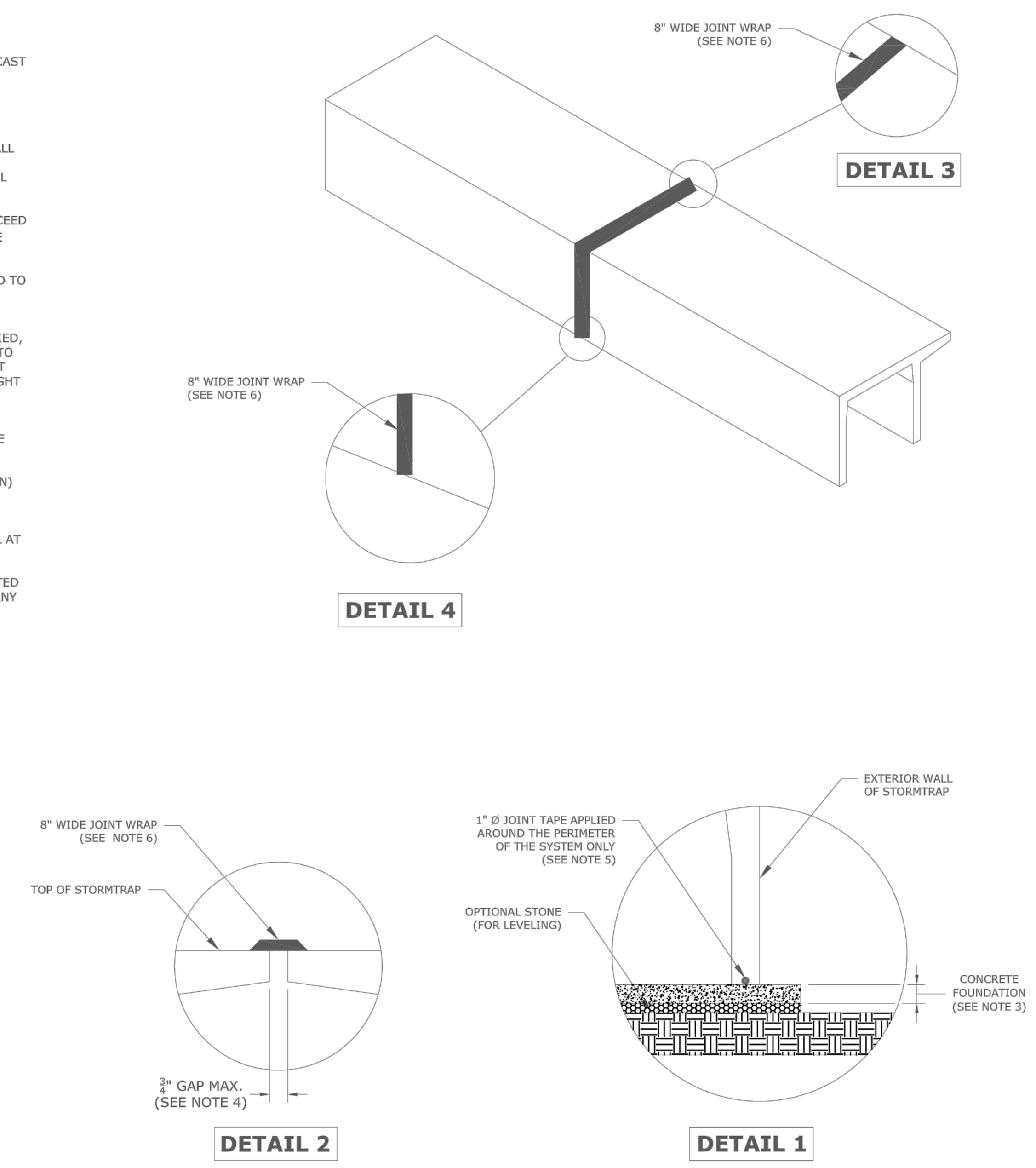
Xrefs: 20190325x436
Images:

STORMTRAP INSTALLATION SPECIFICATIONS

1. STORMTRAP SHALL BE INSTALLED IN ACCORDANCE WITH ASTM C891, STANDARD FOR INSTALLATION OF UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURES, THE FOLLOWING ADDITIONS AND/OR EXCEPTIONS SHALL APPLY:
2. IT IS THE RESPONSIBILITY OF THE INSTALLING CONTRACTOR TO ENSURE THAT PROPER/ADEQUATE EQUIPMENT IS USED TO SET/INSTALL THE MODULES.
3. STORMTRAP MODULES SHALL BE PLACED ON A LEVEL CONCRETE FOUNDATION (SEE SHEET 2.1) WITH A 1'-0" OVERHANG ON ALL SIDES THAT SHALL BE POURED IN PLACE BY INSTALLING CONTRACTOR. A QUALIFIED GEOTECHNICAL ENGINEER WILL BE EMPLOYED, BY OWNER, TO PROVIDE ASSISTANCE IN EVALUATING THE EXISTING SOIL CONDITIONS TO ENSURE THAT THE SOIL BEARING PRESSURE MEETS OR EXCEEDS THE STRUCTURAL DESIGN LOADING CRITERIA AS SPECIFIED ON SHEET 1.0.
4. THE STORMTRAP MODULES SHALL BE PLACED SUCH THAT THE MAXIMUM SPACE BETWEEN ADJACENT MODULES DOES NOT EXCEED $\frac{3}{4}$" (SEE DETAIL 2). IF THE SPACE EXCEEDS $\frac{3}{4}$", THE MODULES SHALL BE RESET WITH APPROPRIATE ADJUSTMENT MADE TO LINE AND GRADE TO BRING THE SPACE INTO SPECIFICATION.
5. THE PERIMETER HORIZONTAL JOINT BETWEEN THE STORMTRAP MODULES AND THE CONCRETE FOUNDATION SHALL BE SEALED TO THE FOUNDATION WITH PRE-FORMED MASTIC JOINT SEALER ACCORDING TO ASTM C891, 8.8 AND 8.12 (SEE DETAIL 1). THE MASTIC JOINT TAPE DOES NOT PROVIDE A WATERTIGHT SEAL.
6. ALL EXTERIOR JOINTS BETWEEN ADJACENT STORMTRAP MODULES SHALL BE SEALED WITH 8" WIDE PRE-FORMED, COLD-APPLIED, SELF-ADHERING ELASTOMERIC RESIN, BONDED TO A WOVEN , HIGHLY PUNCTURE RESISTANT POLYMER WRAP, CONFORMING TO ASTM C891 AND SHALL BE INTEGRATED WITH PRIMER SEALANT AS APPROVED BY STORMTRAP (SEE DETAILS 3 & 4). THE JOINT WRAP DOES NOT PROVIDE A WATERTIGHT SEAL. THE SOLE PURPOSE OF THE JOINT WRAP IS TO PROVIDE A SILT AND SOIL TIGHT SYSTEM. THE ADHESIVE EXTERIOR JOINT WRAP SHALL BE INSTALLED ACCORDING TO THE FOLLOWING INSTALLATION INSTRUCTIONS:
   - 6.1. USE A BRUSH OR WET CLOTH TO THOROUGHLY CLEAN THE OUTSIDE SURFACE AT THE POINT WHERE JOINT WRAP IS TO BE APPLIED.
   - 6.2. A RELEASE PAPER PROTECTS THE ADHESIVE SIDE OF THE JOINT WRAP. PLACE THE ADHESIVE TAPE (ADHESIVE SIDE DOWN) AROUND THE STRUCTURE, REMOVING THE RELEASE PAPER AS YOU GO. PRESS THE JOINT WRAP FIRMLY AGAINST THE STORMTRAP MODULE SURFACE WHEN APPLYING.
7. IF THE CONTRACTOR NEEDS TO CANCEL ANY SHIPMENTS, THEY MUST DO SO 48 HOURS PRIOR TO THEIR SCHEDULED ARRIVAL AT THE JOB SITE. IF CANCELED AFTER THAT TIME, PLEASE CONTACT THE PROJECT MANAGER.
8. IF THE STORMTRAP MODULE(S) IS DAMAGED IN ANY WAY PRIOR, DURING, OR AFTER INSTALL, STORMTRAP MUST BE CONTACTED IMMEDIATELY TO ASSESS THE DAMAGE AND DETERMINE WHETHER OR NOT THE MODULE(S) WILL NEED TO BE REPLACED. IF ANY MODULE ARRIVES AT THE JOBSITE DAMAGED DO NOT UNLOAD IT; CONTACT STORMTRAP IMMEDIATELY. ANY DAMAGE NOT REPORTED BEFORE THE TRUCK IS UNLOADED WILL BE THE CONTRACTOR'S RESPONSIBILITY.
9. STORMTRAP MODULES CANNOT BE ALTERED IN ANY WAY AFTER MANUFACTURING WITHOUT WRITTEN CONSENT FROM STORMTRAP.



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PROJECT INFORMATION:
SUMMIT WAVES
OPTION 2
LEES SUMMIT, MO

CURRENT ISSUE DATE: 5/7/2019

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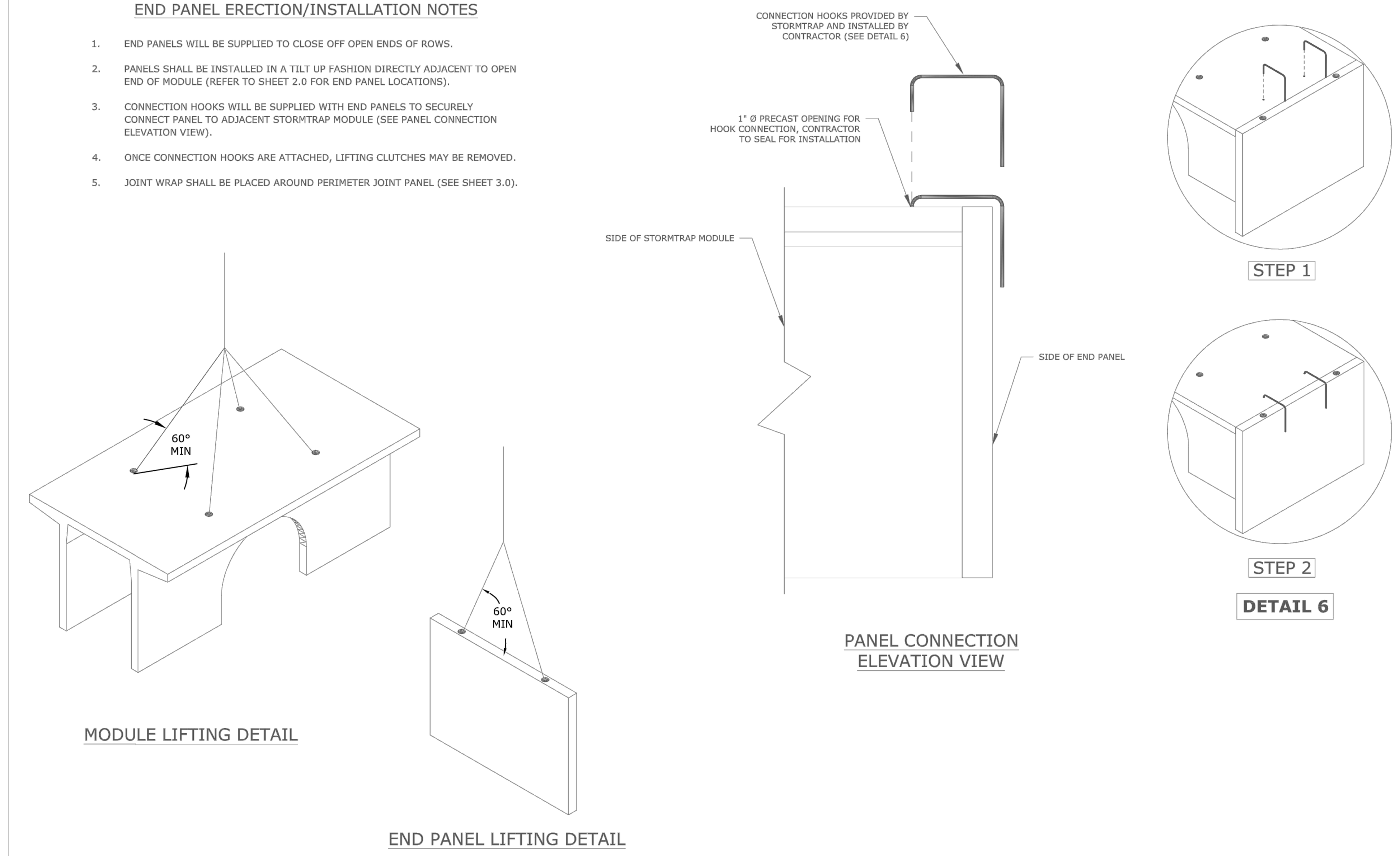
SCALE: NTS

SHEET TITLE: SINGLETRAP INSTALLATION SPECIFICATIONS

SHEET NUMBER: 3.0

END PANEL ERECTION/INSTALLATION NOTES

1. END PANELS WILL BE SUPPLIED TO CLOSE OFF OPEN ENDS OF ROWS.
2. PANELS SHALL BE INSTALLED IN A TILT UP FASHION DIRECTLY ADJACENT TO OPEN END OF MODULE (REFER TO SHEET 2.0 FOR END PANEL LOCATIONS).
3. CONNECTION HOOKS WILL BE SUPPLIED WITH END PANELS TO SECURELY CONNECT PANEL TO ADJACENT STORMTRAP MODULE (SEE PANEL CONNECTION ELEVATION VIEW).
4. ONCE CONNECTION HOOKS ARE ATTACHED, LIFTING CLUTCHES MAY BE REMOVED.
5. JOINT WRAP SHALL BE PLACED AROUND PERIMETER JOINT PANEL (SEE SHEET 3.0).



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SHEET TITLE: SINGLETRAP INSTALLATION SPECIFICATIONS

SHEET NUMBER: 3.1

ZONE CHART

ZONES	ZONE DESCRIPTIONS	REMARKS
ZONE 1	FOUNDATION AGGREGATE	#5 ($\frac{3}{4}$") STONE AGGREGATE (SEE NOTE 4 FOR DESCRIPTION)
ZONE 2	BACKFILL	UNIFIED SOILS CLASSIFICATION (GW, GP, SW, SP) - SEE BELOW FOR APPROVED BACKFILL OPTIONS
ZONE 3	FINAL COVER OVERTOP	MATERIALS NOT TO EXCEED 120 PCF

FILL DEPTH	TRACK WIDTH	MAX VEHICLE WEIGHT (KIPS)	MAX GROUND PRESSURE
12"	12"	51.8	1690 psf
	18"	56.1	1219 psf
	24"	68.1	1111 psf
	30"	76.7	1000 psf
	36"	85.0	924 psf

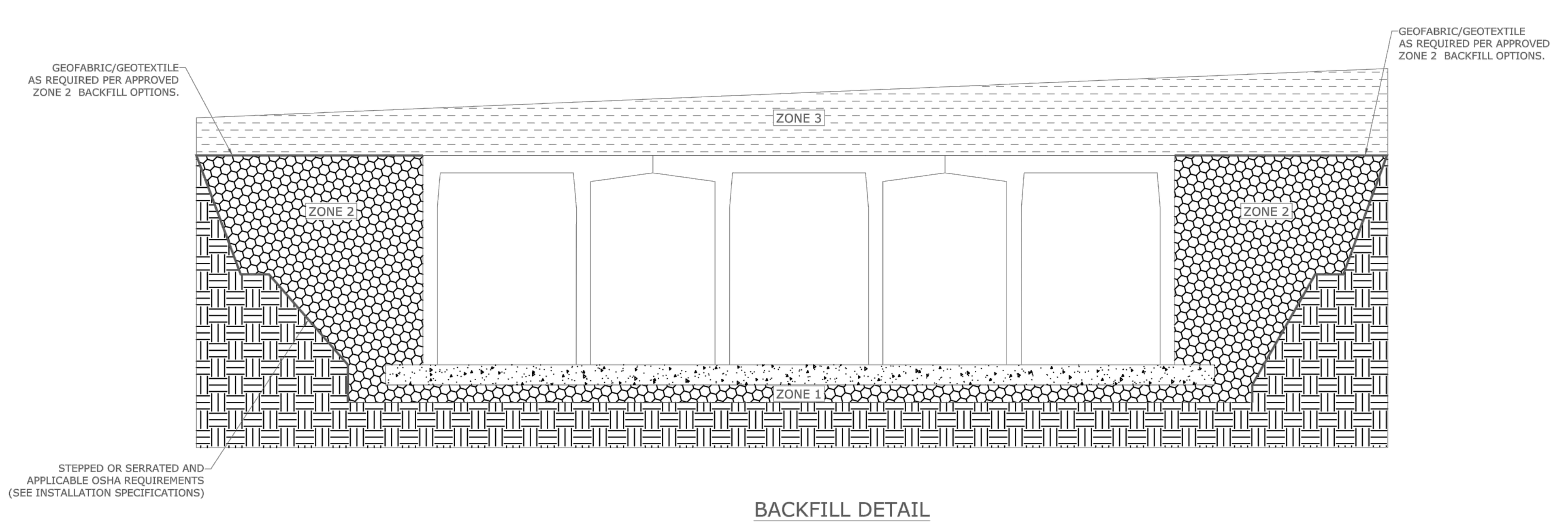
NOTE:
TRACK LENGTH NOT TO EXCEED 15'-4".
ONLY TWO TRACKS PER VEHICLE.

APPROVED ZONE 2 BACKFILL OPTIONS

OPTION	REMARKS
$\frac{3}{4}$" STONE AGGREGATE	THE STONE AGGREGATE SHALL CONSIST OF WASHED, CLEAN AND FREE DRAINING ANGULAR MATERIAL. THE SIZE OF THIS MATERIAL SHALL HAVE 100% PASSING THE 1" SIEVE WITH 0% TO 5% PASSING THE #8 SIEVE. THIS MATERIAL SHALL BE SEPARATED FROM NATIVE MATERIAL USING GEOFABRIC AROUND THE PERIMETER OF THE BACKFILL (ASTM SIZE #57) AS DETERMINED BY THE GEOTECHNICAL ENGINEER.
SAND	IMPORTED PURE SAND IS PERMITTED TO BE USED AS BACKFILL IF IT IS CLEAN AND FREE DRAINING. THE SAND USED FOR BACKFILLING SHALL HAVE LESS THAN 40% PASSING #40 SIEVE AND LESS THAN 5% PASSING #200 SIEVE. THIS MATERIAL SHALL BE SEPARATED FROM NATIVE MATERIAL USING GEOFABRIC AROUND THE PERIMETER OF THE SAND BACKFILL.
CRUSHED CONCRETE AGGREGATE	CLEAN, FREE DRAINING CRUSHED CONCRETE AGGREGATE MATERIAL CAN BE USED AS BACKFILL FOR STORMTRAP'S MODULES. THE SIZE OF THIS MATERIAL SHALL HAVE 100% PASSING THE 1" SIEVE WITH 0% TO 5% PASSING THE #8 SIEVE. THIS MATERIAL SHALL BE SEPARATED FROM NATIVE MATERIAL USING GEOFABRIC AROUND THE PERIMETER OF THE BACKFILL.
ROAD PACK	STONE AGGREGATE 100% PASSING THE 1-1/2" SIEVE WITH LESS THAN 12% PASSING THE #200 SIEVE (ASTM SIZE #467). GEOFABRIC AS PER GEOTECHNICAL ENGINEER RECOMMENDATION.

STORMTRAP ZONE INSTALLATION SPECIFICATIONS/PROCEDURES

1. THE FILL PLACED AROUND THE STORMTRAP MODULES MUST DEPOSITED ON BOTH SIDES AT THE SAME TIME AND TO APPROXIMATELY THE SAME ELEVATION. AT NO TIME SHALL THE FILL BEHIND ONE SIDE WALL BE MORE THAN 2'-0" HIGHER THAN THE FILL ON THE OPPOSITE SIDE. BACKFILL SHALL EITHER BE COMPACTED AND/OR VIBRATED TO ENSURE THAT BACKFILL AGGREGATE/STONE MATERIAL IS WELL SEATED AND PROPERLY INTER LOCKED. CARE SHALL BE TAKEN TO PREVENT ANY WEDGING ACTION AGAINST THE STRUCTURE, AND ALL SLOPES WITHIN THE AREA TO BE BACKFILLED MUST BE STEPPED OR SERRATED TO PREVENT WEDGING ACTION. CARE SHALL ALSO BE TAKEN AS NOT TO DISRUPT THE JOINT WRAP FROM THE JOINT DURING THE BACKFILL PROCESS. BACKFILL MUST BE FREE-DRAINING MATERIAL. SEE ZONE 2 BACKFILL CHART ON THIS PAGE FOR APPROVED BACKFILL OPTIONS. IF NATIVE EARTH IS SUSCEPTIBLE TO MIGRATION, CONFIRM WITH GEOTECHNICAL ENGINEER AND PROVIDE PROTECTION AS REQUIRED (PROVIDED BY OTHERS).
2. DURING PLACEMENT OF MATERIAL OVERTOP THE SYSTEM, AT NO TIME SHALL MACHINERY BE USED OVERTOP THAT EXCEEDS THE DESIGN LIMITATIONS OF THE SYSTEM. WHEN PLACEMENT OF MATERIAL OVERTOP, MATERIAL SHALL BE PLACED SUCH THAT THE DIRECTION OF PLACEMENT IS PARALLEL WITH THE OVERALL LONGITUDINAL DIRECTION OF THE SYSTEM WHENEVER POSSIBLE.
3. THE FILL PLACED OVERTOP THE SYSTEM SHALL BE PLACED AT A MINIMUM OF 6" LIFTS. AT NO TIME SHALL MACHINERY OR VEHICLES GREATER THAN THE DESIGN HS-20 LOADING CRITERIA TRAVEL OVERTOP THE SYSTEM WITHOUT THE MINIMUM DESIGN COVERAGE. IF TRAVEL IS NECESSARY OVERTOP THE SYSTEM PRIOR TO ACHIEVING THE MINIMUM DESIGN COVER, IT MAY BE NECESSARY TO REDUCE THE ULTIMATE LOAD/BURDEN OF THE OPERATING MACHINERY SO AS TO NOT EXCEED THE DESIGN CAPACITY OF THE SYSTEM. IN SOME CASES, IN ORDER TO ACHIEVE REQUIRED COMPACTION, HAND COMPACTION MAY BE NECESSARY IN ORDER NOT TO EXCEED THE ALLOTTED DESIGN LOADING. SEE CHART FOR TRACKED VEHICLE WIDTH AND ALLOWABLE MAXIMUM PRESSURE PER TRACK.
4. STONE AGGREGATE FOUNDATION IN ZONE 1 IS RECOMMENDED FOR LEVELING PURPOSES ONLY (OPTIONAL).



BACKFILL DETAIL

StormTrap®
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13455 NOEL RD
TWO GALLERIA OFFICE
TOWER STE 700
PROJECT INFORMATION:
SUMMIT WAVES
OPTION 2
LEES SUMMIT, MO
CURRENT ISSUE DATE: 5/7/2019
ISSUED FOR: PRELIMINARY

REV.	DATE:	ISSUED FOR:	DWN BY:
2	5/7/2019	PRELIMINARY	JPH
1	4/15/2019	PRELIMINARY	JH

SCALE: NTS

SHEET TITLE: SINGLETRAP BACKFILL SPECIFICATIONS

SHEET NUMBER: 4.0

RECOMMENDED ACCESS OPENING SPECIFICATION

1. A TYPICAL ACCESS OPENING FOR THE STORMTRAP SYSTEM ARE 2'-0" IN DIAMETER. ACCESS OPENINGS LARGER THAN 3'-0" IN DIAMETER NEED TO BE APPROVED BY STORMTRAP. ALL OPENINGS MUST RETAIN AT LEAST 1'-0" OF CLEARANCE FROM THE END OF THE STORMTRAP MODULE UNLESS NOTED OTHERWISE. ALL ACCESS OPENINGS TO BE LOCATED ON INSIDE LEG UNLESS OTHERWISE SPECIFIED.
2. PLASTIC COATED STEEL STEPS PRODUCED BY M.A. INDUSTRIES PART #PS3-PFC OR APPROVED EQUAL (SEE STEP DETAIL) ARE PROVIDED INSIDE ANY MODULE WHERE DEEMED NECESSARY. THE HIGHEST STEP IN THE MODULE IS TO BE PLACED A DISTANCE OF 1'-0" FROM THE INSIDE EDGE OF THE STORMTRAP MODULES. ALL ENSUING STEPS SHALL BE PLACED AT A DISTANCE BETWEEN 10" MIN AND 14" MAX BETWEEN THEM. STEPS MAY BE MOVED OR ALTERED TO AVOID OPENINGS OR OTHER IRREGULARITIES IN THE MODULE.
3. STORMTRAP LIFTING INSERTS MAY BE RELOCATED TO AVOID INTERFERENCE WITH ACCESS OPENINGS OR THE CENTER OF GRAVITY OF THE MODULE AS NEEDED.
4. STORMTRAP ACCESS OPENINGS MAY BE RELOCATED TO AVOID INTERFERENCE WITH INLET AND/OR OUTLET PIPE OPENINGS SO PLACEMENT OF STEPS IS ATTAINABLE.
5. ACCESS OPENINGS SHOULD BE LOCATED IN ORDER TO MEET THE APPROPRIATE MUNICIPAL REQUIREMENTS. STORMTRAP RECOMMENDS AT LEAST TWO ACCESS OPENINGS PER SYSTEM FOR ACCESS AND INSPECTION.
6. USE PRECAST ADJUSTING RINGS AS NEEDED TO MEET GRADE. STORMTRAP RECOMMENDS FOR COVER OVER 2' TO USE PRECAST BARREL OR CONE INSPECTIONS. (PROVIDED BY OTHERS)

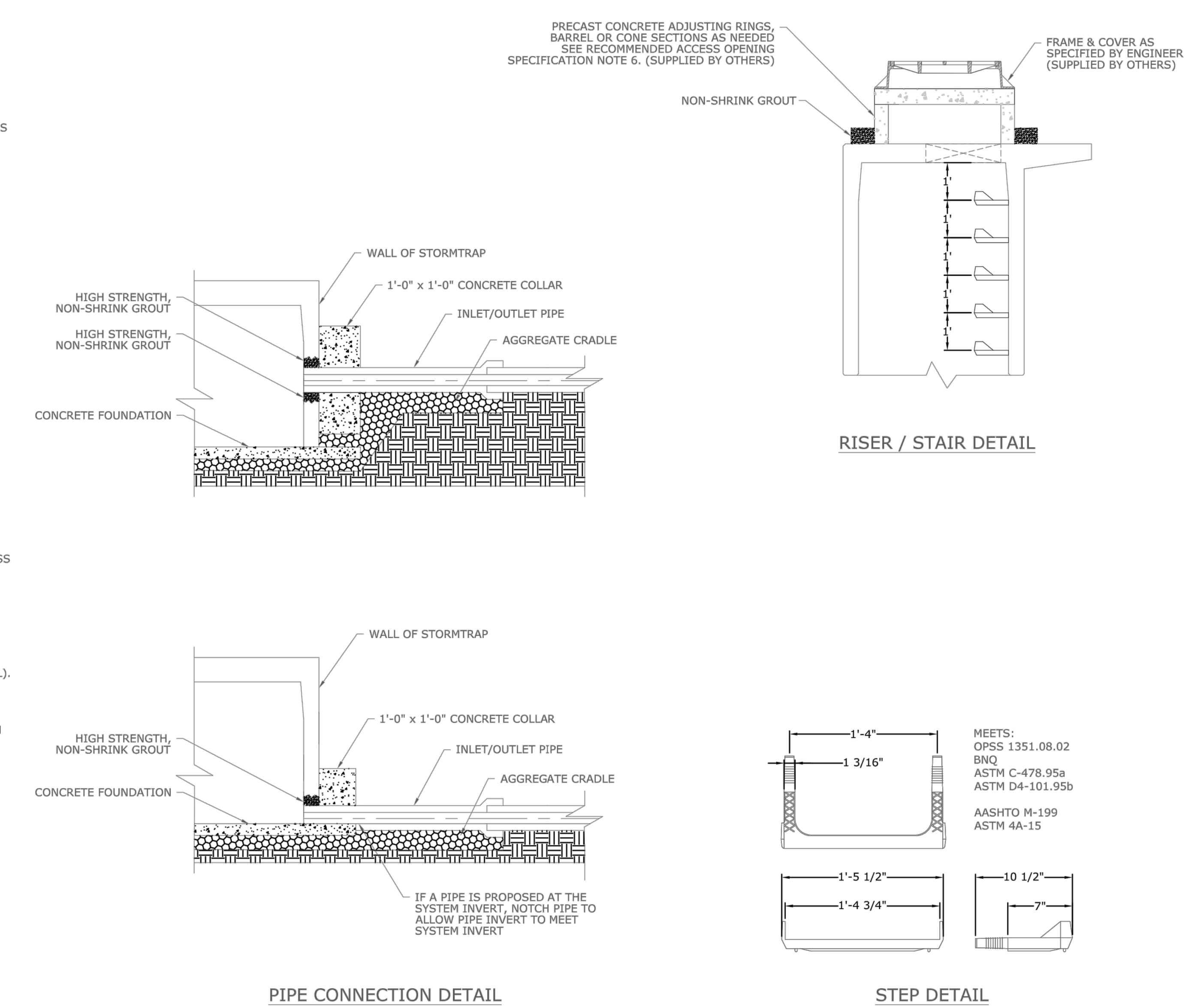
RECOMMENDED PIPE OPENING SPECIFICATION

1. MINIMUM EDGE DISTANCE FOR AN OPENING ON THE OUTSIDE WALL SHALL BE NO LESS THAN 1'-0".
2. MAXIMUM OPENING SIZE TO BE DETERMINED BY THE MODULE HEIGHT. PREFERRED OPENING SIZE Ø 36" OR LESS. ANY OPENING NEEDED THAT DOES NOT FIT THIS CRITERIA SHALL BE BROUGHT TO THE ATTENTION OF STORMTRAP FOR REVIEW.
3. CONNECTING PIPES SHALL BE INSTALLED WITH A 1'-0" CONCRETE COLLAR, AND AN AGGREGATE CRADLE FOR AT LEAST ONE PIPE LENGTH (SEE PIPE CONNECTION DETAIL). A STRUCTURAL GRADE CONCRETE OR HIGH STRENGTH, NON-SHRINK GROUT WITH A MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 3000 PSI SHALL BE USED.
4. THE ANNULAR SPACE BETWEEN THE PIPE AND THE HOLE SHALL BE FILLED WITH HIGH STRENGTH NON-SHRINK GROUT.

RECOMMENDED PIPE INSTALLATION INSTRUCTIONS

1. CLEAN AND LIGHTLY LUBRICATE ALL OF THE PIPE TO BE INSERTED INTO STORMTRAP.
2. IF PIPE IS CUT, CARE SHOULD BE TAKEN TO ALLOW NO SHARP EDGES. BEVEL AND LUBRICATE LEAD END OF PIPE.
3. ALIGN CENTER OF PIPE TO CORRECT ELEVATION AND INSERT INTO OPENING.

NOTE: ALL ANCILLARY PRODUCTS/SPECIFICATIONS RECOMMENDED AND SHOWN ON THIS SHEET ARE RECOMMENDATIONS ONLY AND SUBJECT TO CHANGE PER THE INSTALLING CONTRACTOR AND/OR PER LOCAL MUNICIPAL CODE/REQUIREMENTS.



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TWO GALLERIA OFFICE
TOWER STE 700
PROJECT INFORMATION:
SUMMIT WAVES
OPTION 2
LEES SUMMIT, MO
CURRENT ISSUE DATE: 5/7/2019
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REV.	DATE:	ISSUED FOR:	DWN BY:
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1	4/15/2019	PRELIMINARY	JH

SCALE: NTS

SHEET TITLE: RECOMMENDED PIPE / ACCESS OPENING SPECIFICATIONS

SHEET NUMBER: 5.0

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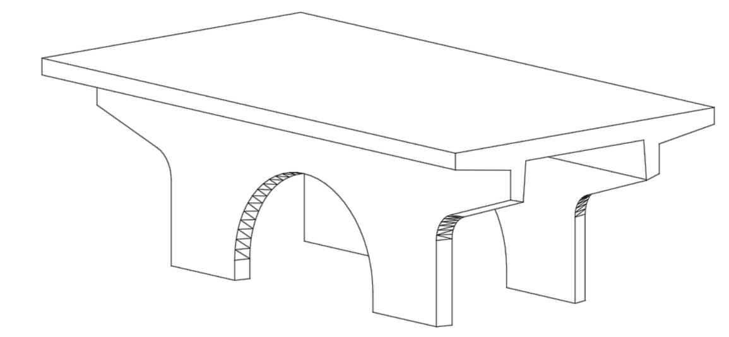
Kimley»Horn
Engineer: KEVIN S. GASKEY
P.E. No. 28441 Date: MAY 2019

SUMMIT WAVES WAVE POOL ADDITION LEE'S SUMMIT, MO

DETENTION DETAILS

Scale:	AS SHOWN
Designed by:	ABP
Drawn by:	ABO
Checked by:	SEG
Date:	MAY 2019
Project No.	064538700

SHEET C-14



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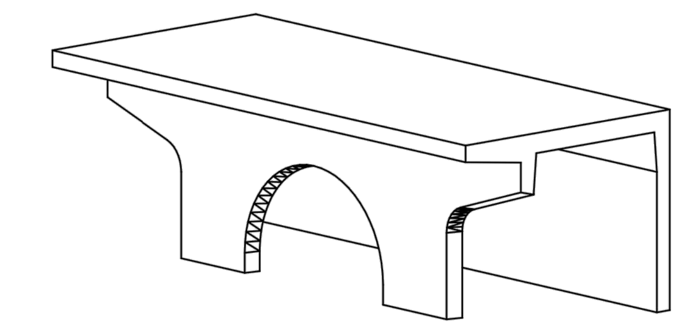

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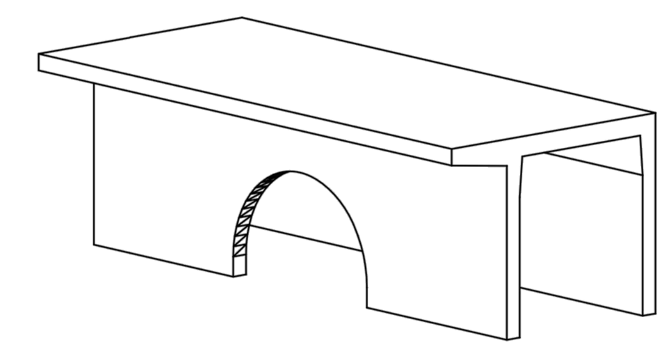

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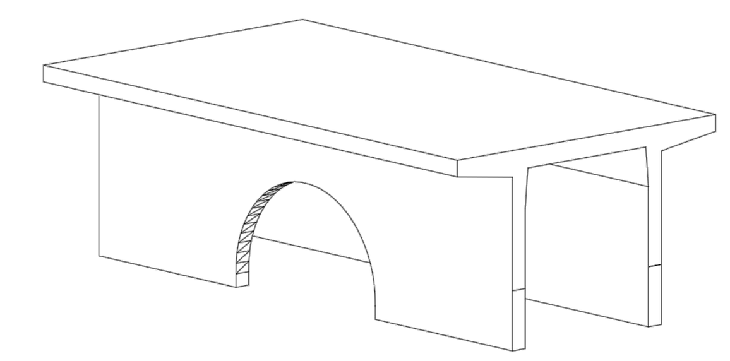

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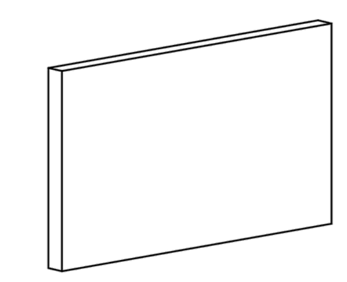

TYPE II
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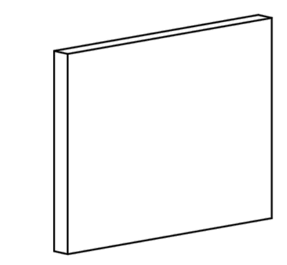

TYPE IV
END PANEL

NOTES:
1. OPENING LOCATIONS AND SHAPES MAY VARY.
2. SP - INDICATES A MODULE WITH MODIFICATIONS.
3. P - INDICATES A MODULE WITH A PANEL ATTACHMENT.
4. POCKET WINDOW OPENINGS ARE OPTIONAL.

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TOWER STE 700

PROJECT INFORMATION:
SUMMIT WAVES
OPTION 2
LEES SUMMIT, MO

CURRENT ISSUE DATE:
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2	5/7/2019	PRELIMINARY	JPH
1	4/15/2019	PRELIMINARY	JH

SCALE:
NTS

SHEET TITLE:
SINGLETRAP MODULE TYPES

SHEET NUMBER:
6.0

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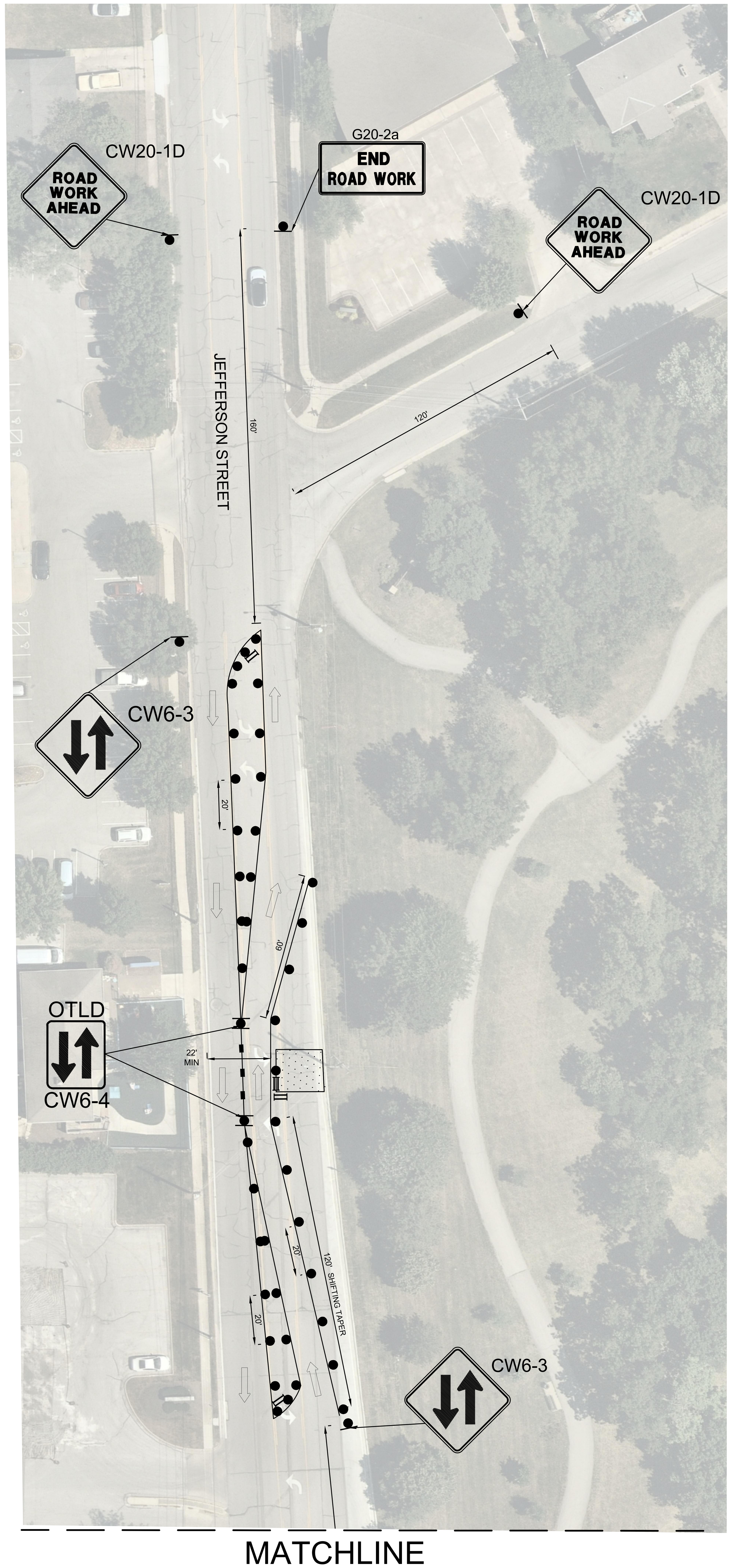
Kimley»Horn
Engineer KEVIN S. GASKEY
P.E. No. 28441 Date MAY 2019

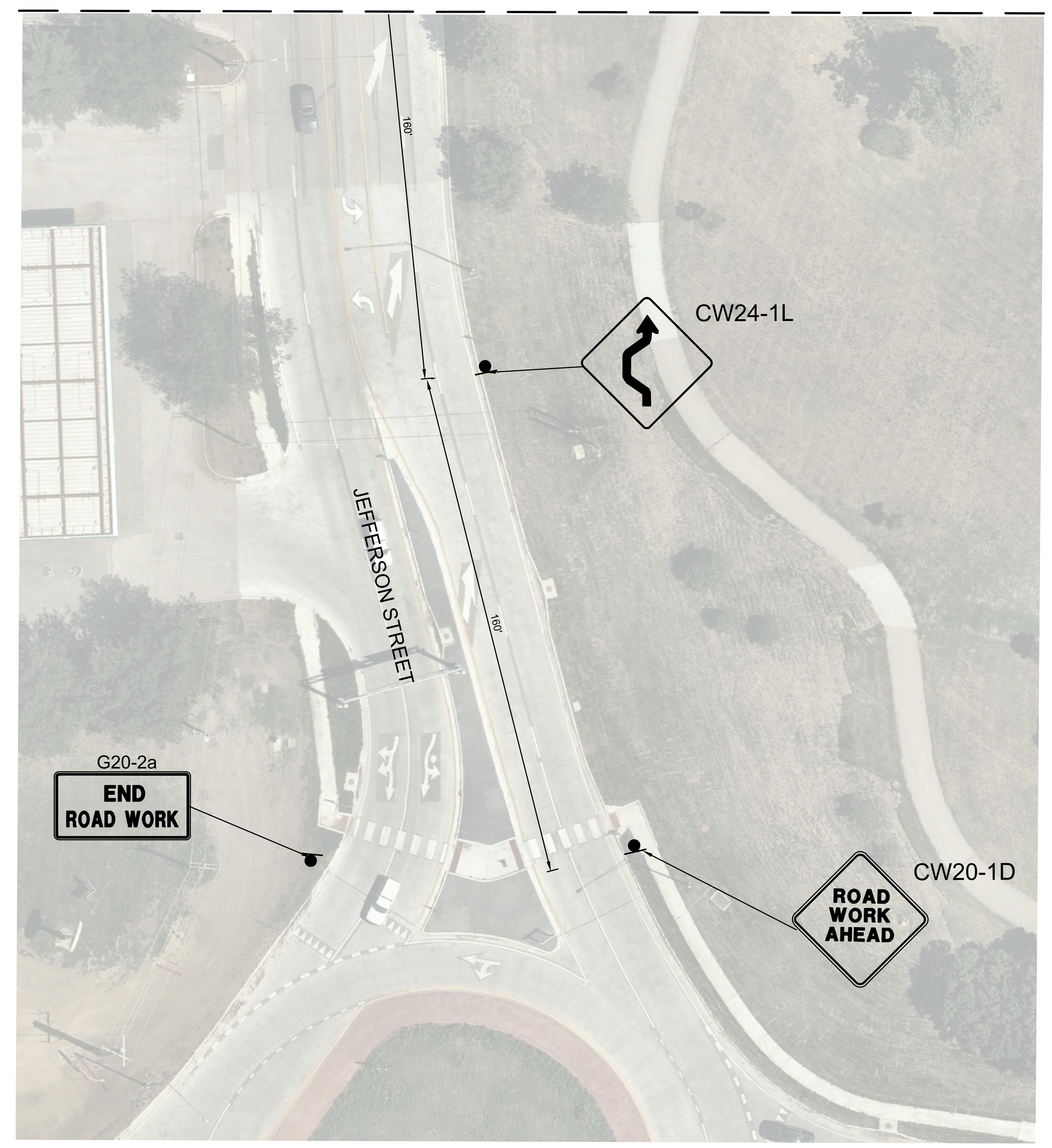
SUMMIT WAVES
WAVE POOL ADDITION
LEE'S SUMMIT, MO

DETENTION DETAILS

Scale:	AS SHOWN
Designed by:	ABP
Drawn by:	ABO
Checked by:	SEG
Date:	MAY 2019
Project No.	064538700

SHEET
C-15





TRAFFIC CONTROL NOTES

1. ALL TRAFFIC CONTROL SHALL CONFORM TO THE LATEST VERSION OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD). FIELD MODIFICATIONS MAY BE MADE TO ADDRESS LOCAL CONDITIONS WITH THE APPROVAL OF THE ENGINEER.

2. DESIGN SPEED ON JEFFEROSN STREET IS 35 MPH. MINIMUM SIGN SPACING, CHANNELIZATION DEVICE SPACING AND TAPER LENGTHS ARE AS SHOWN.

3. CONTRACTOR IS RESPONSIBLE FOR INSTALLATION, MAINTENANCE, AND REMOVAL OF TRAFFIC CONTROL DEVICES. TRAFFIC CONTROL DEVICES SHOULD BE INSPECTED DAILY AND REPAIRED OR REPLACED AS NECESSARY. AFTER REMOVAL, CONTRACTOR IS RESPONSIBLE FOR RESTORATION OF MODIFICATIONS TO ROADWAY AND SIDEWALK SURFACES, ROADWAY MARKINGS, AND SIGNAGE DUE TO TRAFFIC CONTROL DEVICES OR CONSTRUCTION ACTIVITY.

4. CHANNELIZATION DRUMS ARE THE MINIMUM LEVEL OF CHANNELIZATION DEVICE WHICH SHALL BE USED ON THE OUTSIDE EDGES OF THE TRAVEL LANES. NARROW CHANNELIZATION DEVICES ON THE CENTERLINE SEPARATING OPPOSITE LANES OF TRAFFIC SHALL BE VERTICAL PANELS, TABULAR MARKERS, OR NAVIGATOR/NAVICADE DELINEATORS OR EQUIVALENT 12”-WIDE DEVICES. OPPOSING TRAFFIC LANE DIVIDER (OTLD) DEVICES WITH CW6-4 “TWO WAY TRAFFIC” SIGNS SHALL BE USED AT 200 FT INTERVALS.

5. IF THE TCP IS ACTIVE DURING THE HOURS OF DARKNESS, ALL CHANNELIZATION DEVICES SHALL HAVE A TYPE "C" STEADY-BURN WARNING LIGHT OR EQUIVALENT REFLECTOR, AND ALL WARNING SIGNS SHALL HAVE A TYPE "A" LOW-INTENSITY FLASHING WARNING LIGHT, AS REQUIRED IN ACCORDANCE WITH THE CURRENT EDITION OF MUTCD.

6. TWO-WAY VEHICULAR TRAFFIC FLOW AND ACCESS TO ALL OCCUPIED PROPERTIES SHALL BE MAINTAINED AT ALL TIMES UNLESS NOTED.

7. PEDESTRIAN PATHWAYS SHALL BE PROVIDED ACROSS OR AROUND THE WORK AREA IN ACCORDANCE WITH THE MUTCD. CONTRACTOR SHALL PROVIDE SIDEWALK CLOSURE, CROSSWALK CLOSURE, AND/OR WALKWAY BYPASS WHEREVER PEDESTRIAN MOVEMENTS ARE AFFECTED BY CONSTRUCTION ACTIVITIES. ALL SIDEWALKS AND CROSSWALKS SHALL BE ACCESSIBLE WHEN CONTRACTOR IS NOT WORKING UNLESS OTHERWISE APPROVED BY THE CITY TRAFFIC ENGINEER.

8. WHEN THE TCP IS NOT IN EFFECT, ALL CHANNELIZING DEVICES SHALL BE REMOVED FROM THE TRAVEL LANES AND ALL SIGNS SHALL BE COVERED OR TURNED AWAY FROM THE DIRECTION OF TRAFFIC. THE TRAVEL LANE SURFACES SHALL BE RESTORED WITH STEEL PLATES OR TEMPORARY PAVEMENT. WHERE A SAW CUT OR PAVEMENT REMOVAL RESULTS IN MORE THAN A 2" DROP-OFF ADJACENT TO AN ACTIVE TRAVEL LANE, THE EDGE SHALL BE MARKED WITH VERTICAL PANELS OR CHANNELIZATION DRUMS AT 25' SPACING, AND WARNING SIGN CW 8-9a "SHOULDER DROP-OFF" SHALL BE POSTED 240' IN ADVANCE OF THE DROP-OFF CONDITION.

NORTH

GRAPHIC SCALE IN FEET
0 15 30 60

LEGEND

- LINE OF DELINEATORS
- CENTER LANE DEVICE S WITH OTLD
- SIGN
- TYPE 3 BARRICADE
- DIRECTION OF TRAVEL
- WORK AREA

STOP!
CALL BEFORE YOU DIG
MISSOURI ONE CALL SYSTEM
1-800-344-7483 or 811
(@ least 72 hours prior to digging)

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Engineer KEVIN S. GASKEY
P.E. No. 28441 Date MAY 2019

SUMMIT WAVES WAVE POOL ADDITION LEE'S SUMMIT, MO

TRAFFIC CONTROL PLAN

Scale:	AS SHOWN
Designed by:	ABP
Drawn by:	ABO
Checked by:	SEG
Date:	MAY 2019
Project No.	064538700

SHEET
C-16

Appendix B:

Digital Files