DRAINAGE DESIGN SUMMARY

FOR

DCI Lee's Summit

Lee's Summit, Jackson County, Missouri

July 25, 2019
Revised August 23, 2019; November 6, 2019; November 26, 2019; January 8, 2020; June 23, 2020; June 29, 2020

Prepared for:
Dialysis Clinic, Inc.
1633 Church Street, Suite 500
Nashville, TN 37203
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DCI Lee's Summit

Lee's Summit, Jackson County, Missouri

Table of Contents

DCI Lee's Summit

Lee's Summit, Jackson County, Missouri

Drainage Design Summary

General Information

The proposed project consists of constructing a 10,220 sf +/- dialysis clinic with associated parking and site improvements. The existing site is located at 2023 NW Shamrock Avenue in Lee's Summit on Parcel ID 62-240-99-04-00-0-00-000. The property is bordered by NW Shamrock Avenue to the North and NW Pryor Road to the East. The project site is located within the southeast corner of Section 2, Township 47N, Range 32W in the Little Blue River watershed of Kansas City.

Methodology

The following methods were used in this drainage design study to model existing and proposed conditions for stormwater runoff:

- Hydraflow Hydrographs 2018 software
    - SCS/NRCS Curve Number Method
    - 24-Hour SCS Type II Rainfall Distribution
    - SCS TR-55 Method for Time of Concentration

Existing Conditions Analysis

Currently, the ±2.225-acre site is undeveloped with pasture-like land cover. The site is generally drains via sheet flow and shallow concentrated flow from the North to the Southeast corner of the property. Stormwater runoff exiting the site discharges into the existing public stormwater system in NW Pryor Road which eventually discharges into the Little Blue River.

In analyzing the existing conditions, the site was split into two drainage areas. The majority of the site is included in the North Drainage Area with the site outfall point in the Southeast corner of the property. Runoff from the North Drainage Area discharges into the public storm system in NW Pryor Road. The southern edge of the site is included in the South Drainage Area also with the site outfall point in the Southeast corner of the property. Runoff from the South Drainage Area discharges towards the neighboring property to the South and enters the public storm system further south along NW Pryor Road. Since both drainage areas discharge to the same final outfall, the public storm system in NW Pryor Road, the peak flows for the North and South Drainage Areas were combined in the analysis of the pre vs. post peak flows.

The North Drainage Area is 1.94 acres with a curve number of 84 and a time of concentration of 10.0 minutes. The South Drainage Area is 0.29 acres with a curve number of 84 and a time of concentration of 9.7 minutes.

The project site does not lie within a special flood hazard area per the federal emergency management agency, (FIRM) map no. 29095C0416G dated January 20, 2017.

The majority of the existing soil within the project site is Greenton-Urban land complex. A sliver of the existing soil near the Northwest corner of the property is Sharpsburg-Urban land complex. Both soil types are classified as Type D soil. The NRCS Soils Map can be found in Attachment 5.

A pre-developed drainage area map is included in Attachment 1 for a detailed view of the pre-developed site. Routing calculations produced by Autodesk Storm and Sanitary Analysis 2019 software are included in Attachment 2. Modeling has been performed using Autodesk Storm and Sanitary Analysis software so that the revised pond outlet structure in the post developed condition could be modeled effectively. The previous software

used, Hydraflow Hydrographs 2018, does not have the capability to model the revised design of the outlet structure.

The pre-development flows to the site outfall point is as follows:

Pre-Development Peak Flows	
Storm Event	*Existing Site Peak Flows (cfs)*
2-year	6.2
10-year	11.3
100-year	18.1

Proposed Conditions Analysis

The proposed project consists of constructing a 10,220 sf +/- dialysis clinic with associated parking and site improvements. The proposed dialysis clinic is to be located centrally on the site. Proposed stormwater runoff is to be directed via sheet flow, shallow concentrated flow, and channel flow to an extended dry detention pond that is to be located at the south end of the site. A small portion of the south and eastern edge of the site will bypass the proposed extended dry detention pond and discharge to the public storm system along NW Pryor Road as in the existing conditions. A post-developed drainage area map is included in Attachment 1 for a detailed view of the post-developed site.

Detention and Water Quality Analysis

Per Section 5600 of the Kansas City Metropolitan Chapter APWA Standard Specification & Design Criteria manual, the maximum post-developed peak discharge rates from any development shall not exceed those as follows:

- 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

Also, for comprehensive control a 40-hour extended detention of runoff from the local 90% mean annual event (1.37"/24-hour rainfall) must be achieved for the water quality volume.

The required water quality treatment volume was calculated to be 5,015 cf (0.115 ac-ft). See Attachment 4 for the water quality treatment volume calculations.

The proposed BMP practice chosen for this site is the extended dry detention basin. Calculations were generated following Chapter 8.10 of the Manual of Best Management Practices for Stormwater Quality. The proposed extended dry detention pond has a volume of 19,672 cf. The water quality treatment volume to be discharged over 40 hours is met at the elevation 963.5 in the proposed pond. The proposed outlet structure in the pond is to consist of a perforated riser with 5 holes with 4" vertical spacing up to the treatment volume elevation. Stormwater runoff exceeding the water quality treatment volume will discharge through four 4" orifices at an elevation of 963.8 and then a 24" pipe to the existing storm system in NW Pryor Road. The grated casting of the outlet structure is set at 966.20 to serve as an additional emergency overflow weir at the 100 year storm elevation calculated to be 966.2 per the Storm and Sanitary Analysis model which provides 2.6' of freeboard in normal operation. This grated casting on the primary outlet is also designed to operate in conjunction with an emergency spillway located on the East edge of the pond set at elevation 966.7 to pass the 100-Year storm from the contributing drainage area, however to be conservative the grated inlet was not utilized in the routing of the 100-year clogged/zero available storage condition and is solely routed through the earthern berm emergency spillway which result in a maximum water elevation of 967.0. The top of berm elevation for the proposed pond is 968.8 providing 1.8' of freeboard exceeding the minimum 1'of freeboard to the top of the berm assuming zero available storage in the ponds and zero flow through the primary outlet. See Attachment 2 for detention routing calculations. An additional Hydraflow Hydrographs Report has been provided for the clogged/zero available storage condition.

The overall post-development peak flows to the outfall are as follows:

Post-Development Peak Flows	
Storm Event	*Proposed Site Peak Flows (cfs)*
2-year	1.0
10-year	3.1
100-year	4.9

Storm Drainage Design

All stormwater pipes and structures have been designed to convey the 10-year storm event. Tailwater elevations were considered to be between the crown and critical depth of the pipes.

Pipe and structures calculations were compiled using Hydraflow Storm Sewers 2018 software and are included as Attachment 3. An Inlet Drainage Area Map detailing the areas discharging to each proposed inlet is included in Attachment 1.

Downstream Structure Analysis

The receiving storm system has been analyzed to ensure that the proposed development will not adversely impact the existing downstream system. The Inlet Drainage Area Map in Attachment 1 includes the drainage area for the receiving storm system, which is the 24" RCP leaving the proposed tie in structure (AI #1202) that runs south. The system has a capacity of 22.62 CFS at 1% slope. This capacity was calculated per Manning's Equation for full pipe flow as shown below:

$$Qcap = VA$$

$$V = \frac{k}{n}\left(\frac{A}{P}\right)^{2/3} s^{1/2}$$

Where:

$Qcap$ = *full flow capacity*
V = Average velocity in the pipe
A = *Area of pipe*
k = Unit conversion factor: k=1.49 for English units
P = Perimeter of pipe
s = *Downward slope of pipe*
n = *Manning's Roughness Coefficient*

For the 10-Year Storm Event, the Lee's Summit Fire Station #3 (to the west of the site) is expected to send 2.16 cfs to structure AI #1202, per the development's Storm Water Drainage Study dated 01/16/2018. In addition, per this study the DCI project is expected to send 3.4 cfs to structure AI #1202 for the 10-year storm event. The 3.95-acre offsite drainage area is expected to send approximately 8.96 cfs to structure AI #1202 for the 10-year storm event. In total, the receiving storm system is expected to have a flow rate of 14.52 cfs for the 10-year storm event, which is well below the pipe's capacity.

Conclusions and Recommendations

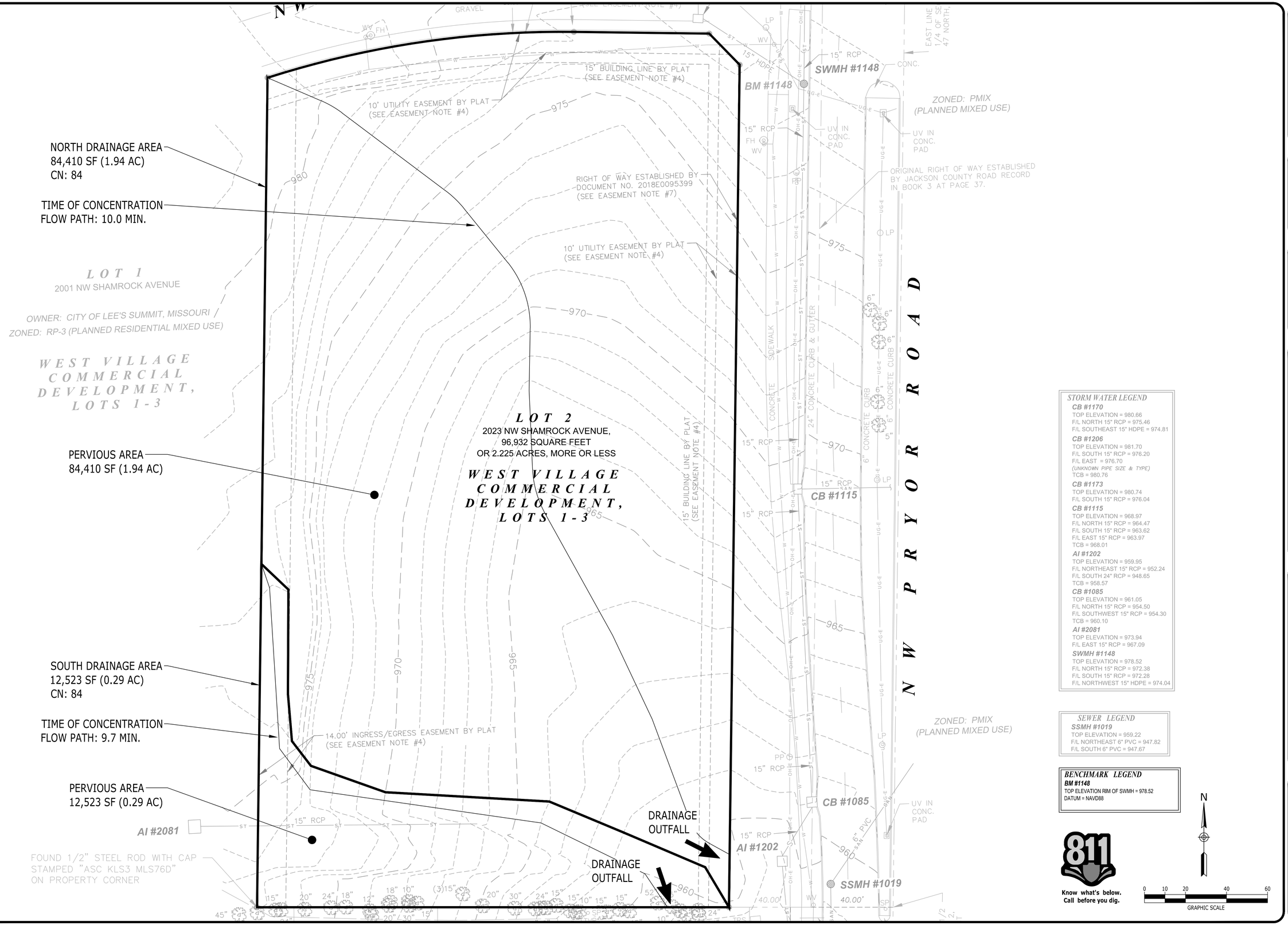
The stormwater management system for the proposed development has been designed per Section 5600 of the Kansas City Metropolitan Chapter APWA Standard Specifications Design Criteria and the Manual of Best Management Practices for Stormwater Quality. Due to the increase in impervious area for the proposed development, water quality and detention requirements are to be met by the use of a proposed extended dry detention basin located on the South portion of the project site. The water quality treatment volume calculated to be 5,015 cf is to be released over 40 hours through a perforated riser. The detention requirements specify maximum release rates based on the lesser of either pre-developed peak flow rates or a predetermined flow rate per site acreage. The post-developed peak flow rates calculated for the 2-year, 10-year, and 100-year storm events are less than their respective allowable peak flow rates. The extended dry detention pond also has more than 2 feet of freeboard for all storm events in order to provide exceptional flood protection during extreme storm events.

Pre- and Post- Peak Flows Comparison					
Storm Event	*Pre-dev. Peak Flow (cfs)*	*Allowable Post-Dev. Peak Flow (cfs)*		*Post-Dev. Peak Flows (cfs)*	*Difference (+/-)*
2-year	6.2	(0.5 cfs/2.225 ac)	1.1	1.0	-0.1
10-year	11.3	(2.0 cfs/2.225 ac)	4.5	3.1	-1.4
100-year	18.1	(3.0 cfs/2.225 ac)	6.7	4.9	-1.8

Attachments:

Attachment 1 Site Drainage Area Maps
Attachment 2 *Autodesk Storm and Sanitary Analysis* Routing Calculations
Attachment 3 *Hydraflow Storm Sewers* Calculations
Attachment 4 Water Quality Calculations
Attachment 5 Supporting Documents

Attachment 1
Site Drainage Area Maps



STORM WATER LEGEND

CB #1170
TOP ELEVATION = 980.66
F/L NORTH 15" RCP = 975.46
F/L SOUTHEAST 15" HDPE = 974.81

CB #1206
TOP ELEVATION = 981.70
F/L SOUTH 15" RCP = 976.20
F/L EAST = 976.70
(UNKNOWN PIPE SIZE & TYPE)
TCB = 980.76

CB #1173
TOP ELEVATION = 980.74
F/L SOUTH 15" RCP = 976.04

CB #1115
TOP ELEVATION = 968.97
F/L NORTH 15" RCP = 964.47
F/L SOUTH 15" RCP = 963.62
F/L EAST 15" RCP = 963.97
TCB = 968.01

AI #1202
TOP ELEVATION = 959.95
F/L NORTHEAST 15" RCP = 952.24
F/L SOUTH 24" RCP = 948.65
TCB = 958.57

CB #1085
TOP ELEVATION = 961.05
F/L NORTH 15" RCP = 954.50
F/L SOUTHWEST 15" RCP = 954.30
TCB = 960.10

AI #2081
TOP ELEVATION = 973.94
F/L EAST 15" RCP = 967.09

SWMH #1148
TOP ELEVATION = 978.52
F/L NORTH 15" RCP = 972.38
F/L SOUTH 15" RCP = 972.28
F/L NORTHWEST 15" HDPE = 974.04

SEWER LEGEND

SSMH #1019
TOP ELEVATION = 959.22
F/L NORTHEAST 6" PVC = 947.82
F/L SOUTH 6" PVC = 947.67

BENCHMARK LEGEND

BM #1148
TOP ELEVATION RIM OF SWMH = 978.52
DATUM = NAVD88

Know what's below. Call before you dig.

0 10 20 40 60
GRAPHIC SCALE

Catalyst DESIGN GROUP
5016 CENTENNIAL BLVD, SUITE 200, NASHVILLE, TN 37209
(615) 866-2410 | WWW.CATALYST-DG.COM

DIALYSIS CLINIC, INC.
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NASHVILLE, TN 37203
615.327.3061

STATE OF MISSOURI
JACK T. PARKER
NUMBER PE-2017040852
PROFESSIONAL ENGINEER
11/15/19

PRELIMINARY

DCI - LEE'S SUMMIT

2023 NW SHAMROCK AVENUE
LEE'S SUMMIT, MISSOURI, 64081
JACKSON COUNTY

NO.	DATE	DESCRIPTION

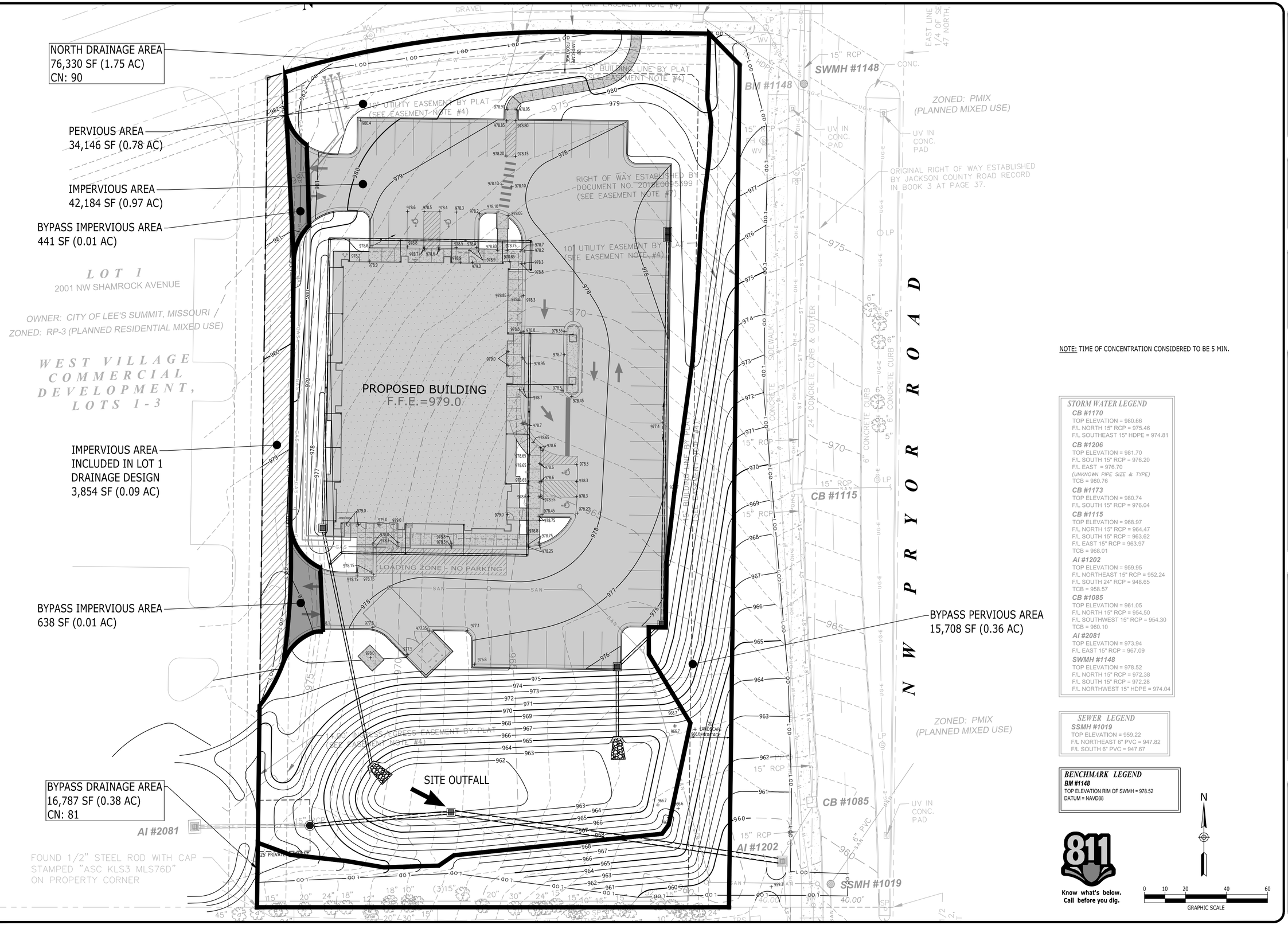
DRAWING TITLE

PRE DEVELOPED DRAINAGE AREA MAP

PROJECT NUMBER
20180111

DRAWING NUMBER
PRE

P:\2018\20180111\Engineering\dwg\20180111_Pre Drainage Area Map.dwg-PRE Jul 24, 2019 cwalker



NOTE: TIME OF CONCENTRATION CONSIDERED TO BE 5 MIN.

STORM WATER LEGEND

CB #1170
TOP ELEVATION = 980.66
F/L NORTH 15" RCP = 975.46
F/L SOUTHEAST 15" HDPE = 974.81

CB #1206
TOP ELEVATION = 981.70
F/L SOUTH 15" RCP = 976.20
F/L EAST = 976.70
(UNKNOWN PIPE SIZE & TYPE)
TCB = 980.76

CB #1173
TOP ELEVATION = 980.74
F/L SOUTH 15" RCP = 976.04

CB #1115
TOP ELEVATION = 968.97
F/L NORTH 15" RCP = 964.47
F/L SOUTH 15" RCP = 963.62
F/L EAST 15" RCP = 963.97
TCB = 968.01

AI #1202
TOP ELEVATION = 959.95
F/L NORTHEAST 15" RCP = 952.24
F/L SOUTH 24" RCP = 948.65
TCB = 958.57

CB #1085
TOP ELEVATION = 961.05
F/L NORTH 15" RCP = 954.50
F/L SOUTHWEST 15" RCP = 954.30
TCB = 960.10

AI #2081
TOP ELEVATION = 973.94
F/L EAST 15" RCP = 967.09

SWMH #1148
TOP ELEVATION = 978.52
F/L NORTH 15" RCP = 972.38
F/L SOUTH 15" RCP = 972.28
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SEWER LEGEND

SSMH #1019
TOP ELEVATION = 959.22
F/L NORTHEAST 6" PVC = 947.82
F/L SOUTH 6" PVC = 947.67

BENCHMARK LEGEND

BM #1148
TOP ELEVATION RIM OF SWMH = 978.52
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811
Know what's below.
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GRAPHIC SCALE

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11/6/19

CONSTRUCTION DRAWINGS

DCI - LEE'S SUMMIT

2001 NW SHAMROCK AVENUE
LEE'S SUMMIT, MISSOURI, 64081
JACKSON COUNTY

NO.	DATE	DESCRIPTION

DRAWING TITLE

POST DEVELOPED DRAINAGE AREA MAP

PROJECT NUMBER
20180111

DRAWING NUMBER
POST

P:\2018\20180111\Engineering\dwg\20180111_2019-11-01_Post Drainage Area Map.dwg-POST Nov 01, 2019 cwalker

B6 DRAINAGE AREA
1,115 SF (0.03 AC)
C VALUE: 0.95

B5 DRAINAGE AREA
241 SF (0.006 AC)
C VALUE: 0.95

B4 DRAINAGE AREA
2,332 SF (0.05 AC)
C VALUE: 0.95

LOT 1
2001 NW SHAMROCK AVENUE

OWNER: CITY OF LEE'S SUMMIT, MISSOURI /
ZONED: RP-3 (PLANNED RESIDENTIAL MIXED USE)

WEST VILLAGE COMMERCIAL DEVELOPMENT, LOTS 1-3

B3 DRAINAGE AREA
5,756 SF (0.13 AC)
C VALUE: 0.60

C1 DRAINAGE AREA
195 SF (0.005 AC)
C VALUE: 0.95

D2 DRAINAGE AREA
7,363 SF (0.17 AC)
C VALUE: 0.95

FOUND 1/2" STEEL ROD WITH CAP STAMPED "ASC KLS3 MLS76D" ON PROPERTY CORNER

D4 DRAINAGE AREA
26,446 SF (0.61 AC)
C VALUE: 0.60

ZONED: PMIX
(PLANNED MIXED USE)

B7 DRAINAGE AREA
287 SF (0.01 AC)
C VALUE: 0.95

B9 DRAINAGE AREA
186 SF (0.004 AC)
C VALUE: 0.95

C5 DRAINAGE AREA
1,774 SF (0.04 AC)
C VALUE: 0.95

C4 DRAINAGE AREA
1,621 SF (0.04 AC)
C VALUE: 0.95

C3 DRAINAGE AREA
1,834 SF (0.04 AC)
C VALUE: 0.95

C2 DRAINAGE AREA
1,461 SF (0.03 AC)
C VALUE: 0.95

D3 DRAINAGE AREA
6,486 SF (0.15 AC)
C VALUE: 0.95

EX AI#1202
DRAINAGE AREA
14,971 SF (0.34 AC)
C VALUE: 0.35

ZONED: PMIX
(PLANNED MIXED USE)

PROPOSED BUILDING
F.F.E. = 979.0

LOADING ZONE - NO PARKING

AI #2081

SWMH #1148

BM #1148

CB #1115

CB #1085

AI #1202

SSMH #1019

15' BUILDING LINE BY PLAT (SEE EASEMENT NOTE #4)

10' UTILITY EASEMENT BY PLAT (SEE EASEMENT NOTE #4)

RIGHT OF WAY ESTABLISHED BY DOCUMENT NO. 2018E0095599 (SEE EASEMENT NOTE #7)

30' INGRESS-EGRESS EASEMENT BY PLAT (SEE EASEMENT NOTE #4)

25' PRIVATE EASEMENT

PIPE TABLE

FROM CODE	FROM INV	TO CODE	TO INV.	GRADE (%)	SIZE (INCHES)	LENGTH (L.F.)	TYPE
A1	958.00	EX AI#1202	948.85	5.61%	24"	163	RCP
A2	966.58	A1	958.20	12.13%	15"	69	RCP
B2	972.32	B1	963.50	8.82%	12"	100	HDPE
B3	972.50	B2	972.32	1.01%	12"	18	HDPE
B4	973.39	B3	972.70	1.00%	10"	69	HDPE
B5	974.11	B4	973.39	1.00%	10"	73	HDPE
B6	974.36	B5	974.11	1.00%	10"	25	HDPE
B7	974.77	B6	974.36	1.00%	10"	41	HDPE
B8	975.09	B7	974.77	1.00%	10"	32	HDPE
B9	975.23	B8	975.09	1.00%	10"	14	HDPE
C1	973.31	B2	972.32	12.63%	10"	8	HDPE
C2	973.62	C1	973.31	1.00%	10"	31	HDPE
C3	974.22	C2	973.62	1.00%	10"	59	HDPE
C4	974.92	C3	974.22	1.00%	10"	70	HDPE
C5	975.30	C4	974.92	1.00%	10"	38	HDPE
D2	969.00	D1	963.50	15.89%	12"	35	HDPE
D3	971.30	D2	969.20	6.99%	12"	30	HDPE
D4	973.50	D3	971.50	1.05%	12"	190	HDPE
EX AI #2081	967.09	A2	966.58	0.91%	15"	56	RCP

STRUCTURE TABLE

CODE	DESCRIPTION	TOP GRATE
A1	POND OUTLET	966.20
A2	JUNCTION MANHOLE	971.20
B1	HEADWALL	NA
B2	CLEANOUT	978.70
B3	CATCH BASIN	976.50
B4	CLEANOUT	977.10
B5	CLEANOUT	979.00
B6	CLEANOUT	978.75
B7	CLEANOUT	978.40
B8	CLEANOUT	978.15
B9	CLEANOUT	978.30
C1	CLEANOUT	978.70
C2	CLEANOUT	978.28
C3	CLEANOUT	978.25
C4	CLEANOUT	978.67
C5	CLEANOUT	NA
D1	HEADWALL	965.60
D2	SINGLE CURB INLET	975.80
D3	SINGLE CURB INLET	975.80
D4	DOUBLE CURB INLET	977.60
EX AI #2081	EXISTING POND OUTLET	973.94
EX AL#1202	EXISTING CATCH BASIN	959.95

STORM WATER LEGEND

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BENCHMARK LEGEND

BM #1148
TOP ELEVATION RIM OF SWMH = 978.52
DATUM = NAVD88

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0 10 20 40 60
GRAPHIC SCALE

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STATE OF MISSOURI
JACK J. PARKER
NUMBER PE-2017040852
PROFESSIONAL ENGINEER
11/6/19

NO.	DATE	DESCRIPTION

DRAWING TITLE
INLET DRAINAGE AREA MAP

PROJECT NUMBER
20180111

DRAWING NUMBER
INLET

CONSTRUCTION DRAWINGS
DCI - LEE'S SUMMIT
2001 NW SHAMROCK AVENUE
LEE'S SUMMIT, MISSOURI, 64081
JACKSON COUNTY

P:\2018\20180111\Engineering\dwg\20180111_2019-11-01_Inlet Drainage Area Map.dwg-INLET Nov 01, 2019 cvalker

OFFSITE AREA
AREA = 3.95 ACRES
I = 3.49 IN/HR (10-YEAR 30-MIN)
C = 0.65
Q = 8.96 CFS

DCI PROJECT
10-YEAR STORM EVENT
Q = 3.40 CFS

FIRE STATION
10-YEAR STORM EVENT
Q = 2.16 CFS

RECEIVING STORM SYSTEM

NOTE: FLOWS FOR FIRE STATION AND DCI TAKEN FROM RESPECTIVE DRAINAGE REPORTS.

STORM WATER LEGEND

CB #1170
TOP ELEVATION = 980.66
F/L NORTH 15" RCP = 975.46
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F/L EAST = 976.70
(UNKNOWN PIPE SIZE & TYPE)
TCB = 980.76

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SEWER LEGEND

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F/L SOUTH 6" PVC = 947.67

BENCHMARK LEGEND

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TOP ELEVATION RIM OF SWMH = 978.52
DATUM = NAVD88

Know what's below.
Call before you dig.

N

0 20 40 80 120
GRAPHIC SCALE

Catalyst DESIGN GROUP
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(615) 866-2410 | WWW.CATALYST-DG.COM

DIALYSIS CLINIC, INC.
1633 CHURCH STREET, STE 500
NASHVILLE, TN 37203
615.327.3061

NO.	DATE	DESCRIPTION

CONSTRUCTION DRAWINGS

DCI - LEE'S SUMMIT

2001 NW SHAMROCK AVENUE
LEE'S SUMMIT, MISSOURI, 64081
JACKSON COUNTY

DRAWING TITLE
OFFSITE DRAINAGE AREA MAP

PROJECT NUMBER
20180111

DRAWING NUMBER
OFFSITE

P:\2018\20180111\Engineering\dwg\20180111_2020-01-07_Offsite Drainage Area Map.dwg-OFFSITE Jan 07, 2020 jbrownlitecary

Attachment 2
Autodesk Storm and Sanitary Analysis Routing Calculations

Project Description

File Name ..... 20180111_2020-06-29 Pre.SPF

Project Options

Flow Units ..... CFS
Elevation Type ..... Elevation
Hydrology Method ..... SCS TR-55
Time of Concentration (TOC) Method ..... SCS TR-55
Link Routing Method ..... Hydrodynamic
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ..... NO

Analysis Options

Start Analysis On	Jun 29, 2020	00:00:00
End Analysis On	Jul 02, 2020	00:05:00
Start Reporting On	Jun 29, 2020	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

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

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	2 year	Cumulative	inches	Missouri	Jackson	2	3.50	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	ExistingNorth	1.94	84.00	3.50	1.94	3.76	5.46	0 00:08:02
2	ExistingSouth	0.29	84.00	3.50	1.94	0.56	0.77	0 00:10:09

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft^2)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Outfall	Outfall	960.00					0.00	0.00					

Project Description

File Name ..... 20180111_2020-06-29 Pre.SPF

Project Options

Flow Units ..... CFS
Elevation Type ..... Elevation
Hydrology Method ..... SCS TR-55
Time of Concentration (TOC) Method ..... SCS TR-55
Link Routing Method ..... Hydrodynamic
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ..... NO

Analysis Options

Start Analysis On	Jun 29, 2020	00:00:00
End Analysis On	Jul 02, 2020	00:05:00
Start Reporting On	Jun 29, 2020	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

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

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	10 year	Cumulative	inches	Missouri	Jackson	10	5.30	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	ExistingNorth	1.94	84.00	5.30	3.55	6.88	9.87	0 00:08:02
2	ExistingSouth	0.29	84.00	5.30	3.55	1.03	1.39	0 00:10:09

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft^2)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Outfall	Outfall	960.00					0.00	0.00					

Project Description

File Name ..... 20180111_2020-06-29 Pre.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	SCS TR-55
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Jun 29, 2020	00:00:00
End Analysis On	Jul 02, 2020	00:05:00
Start Reporting On	Jun 29, 2020	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

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

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	100 year	Cumulative	inches	Missouri	Jackson	100	7.70	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	ExistingNorth	1.94	84.00	7.70	5.81	11.27	15.84	0 00:08:02
2	ExistingSouth	0.29	84.00	7.70	5.81	1.68	2.23	0 00:10:09

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft^2)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Outfall	Outfall	960.00					0.00	0.00					

Project Description

File Name ..... 20180111_2020-06-29 Post.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	SCS TR-55
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Jun 29, 2020	00:00:00
End Analysis On	Jul 02, 2020	00:05:00
Start Reporting On	Jun 29, 2020	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	2
Nodes	3
Junctions	1
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	1
Links	10
Channels	0
Pipes	1
Pumps	0
Orifices	9
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	2 year	Cumulative	inches	Missouri	Jackson	2	3.50	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	BYPASS	0.32	81.13	3.50	1.72	0.55	0.87	0 00:05:00
2	ProposedNorth	1.75	89.98	3.50	2.45	4.28	6.65	0 00:05:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft^2)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	A1	Junction	957.84	966.20	0.00	0.00	0.00	0.87	958.03	0.00	8.17	0 00:00	0.00	0.00
2	OUTFALL	Outfall	948.85					1.02	949.04					
3	POND	Storage Node	961.00	6.00	961.00		0.00	6.64	964.23				0.00	4011.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Reported Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)	
1	Link-03	Pipe	A1	OUTFALL	160.20	957.84	948.85	5.6100	24.000	0.0150	0.87	46.45	0.02	5.60	0.19	0.10	0.00	Calculated
2	Orifice1	Orifice	POND	A1		961.00	957.84		1.000		0.04							
3	Orifice2	Orifice	POND	A1		961.00	957.84		1.000		0.04							
4	Orifice3	Orifice	POND	A1		961.00	957.84		1.000		0.04							
5	Orifice4	Orifice	POND	A1		961.00	957.84		1.000		0.03							
6	Orifice5	Orifice	POND	A1		961.00	957.84		1.000		0.03							
7	Orifice6	Orifice	POND	A1		961.00	957.84		4.000		0.17							
8	Orifice7	Orifice	POND	A1		961.00	957.84		4.000		0.17							
9	Orifice8	Orifice	POND	A1		961.00	957.84		4.000		0.17							
10	Orifice9	Orifice	POND	A1		961.00	957.84		4.000		0.17							

Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft^2)	Minimum Pipe Cover (in)
1	A1	957.84	966.20	8.36	0.00	-957.84	0.00	-966.20	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	A1	0.87	0.00	958.03	0.19	0.00	8.17	957.87	0.03	0 12:20	0 00:00	0.00	0.00

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	Link-03	160.20	957.84	0.00	948.85	0.00	8.99	5.6100	CIRCULAR	24.000	24.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	Link-03	0.87	0 12:20	46.45	0.02	5.60	0.48	0.19	0.10	0.00		Calculated

Storage Nodes

Storage Node : POND

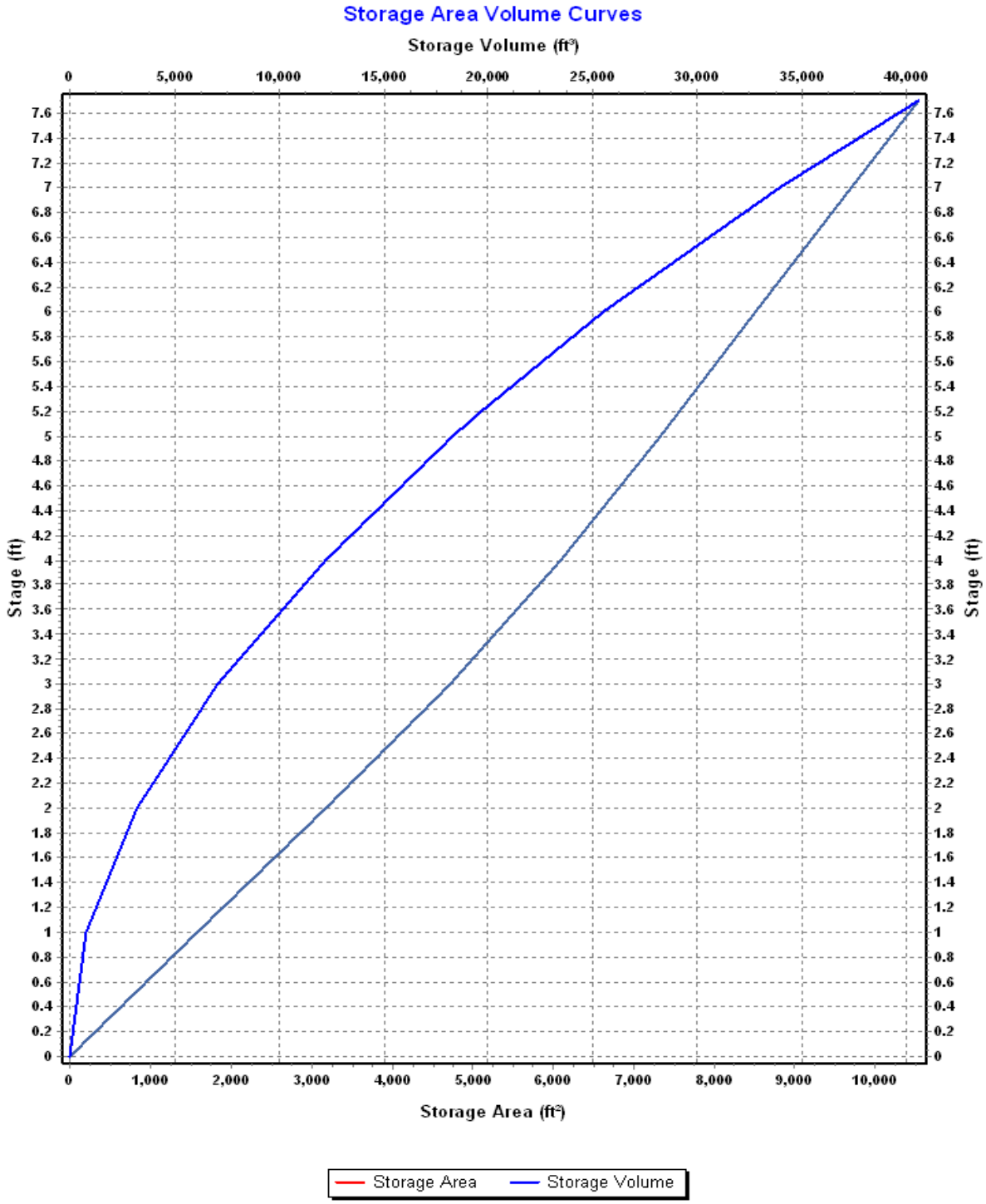
Input Data

Invert Elevation (ft)	961.00
Max (Rim) Elevation (ft)	6.00
Max (Rim) Offset (ft)	-955.00
Initial Water Elevation (ft)	961.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Pond

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	0	0
1	1586.00	793
2	3180.00	3180
3	4723.33	7085
4	6092.50	12185
5	7326.00	18315
5.2	7566.15	19672
6	8517.67	25553
7	9702.57	33959
7.7	10536.10	40564


Storage Area Volume Curves
Storage Volume (ft³)
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
Stage (ft)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
3.2
3.4
3.6
3.8
4
4.2
4.4
4.6
4.8
5
5.2
5.4
5.6
5.8
6
6.2
6.4
6.6
6.8
7
7.2
7.4
7.6
Storage Area (ft²)
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
10,000
Storage Area
Storage Volume

Storage Node : POND (continued)

Outflow Orifices

SN	Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1	Orifice1	Side	CIRCULAR	No	1.00			961.52	0.61
2	Orifice2	Side	CIRCULAR	No	1.00			961.85	0.61
3	Orifice3	Side	CIRCULAR	No	1.00			962.18	0.61
4	Orifice4	Side	CIRCULAR	No	1.00			962.51	0.61
5	Orifice5	Side	CIRCULAR	No	1.00			962.84	0.61
6	Orifice6	Side	CIRCULAR	No	4.00			963.90	0.61
7	Orifice7	Side	CIRCULAR	No	4.00			963.90	0.61
8	Orifice8	Side	CIRCULAR	No	4.00			963.90	0.61
9	Orifice9	Side	CIRCULAR	No	4.00			963.90	0.61

Output Summary Results

Peak Inflow (cfs)	6.64
Peak Lateral Inflow (cfs)	6.64
Peak Outflow (cfs)	0.87
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	964.23
Max HGL Depth Attained (ft)	3.23
Average HGL Elevation Attained (ft)	962.14
Average HGL Depth Attained (ft)	1.14
Time of Max HGL Occurrence (days hh:mm)	0 12:20
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	4011
Total Retention Time (sec)	0.00

Project Description

File Name ..... 20180111_2020-06-29 Post.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	SCS TR-55
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Jun 29, 2020	00:00:00
End Analysis On	Jul 02, 2020	00:05:00
Start Reporting On	Jun 29, 2020	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	2
Nodes	3
Junctions	1
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	1
Links	10
Channels	0
Pipes	1
Pumps	0
Orifices	9
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	10 year	Cumulative	inches	Missouri	Jackson	10	5.30	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	BYPASS	0.32	81.13	5.30	3.26	1.04	1.65	0 00:05:00
2	ProposedNorth	1.75	89.98	5.30	4.16	7.29	11.02	0 00:05:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft^2)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	A1	Junction	957.84	966.20	0.00	0.00	0.00	2.01	958.13	0.00	8.07	0 00:00	0.00	0.00
2	OUTFALL	Outfall	948.85					3.14	949.13					
3	POND	Storage Node	961.00	6.00	961.00		0.00	11.01	965.13				0.00	4101.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Reported Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)	
1	Link-03	Pipe	A1	OUTFALL	160.20	957.84	948.85	5.6100	24.000	0.0150	2.02	46.45	0.04	7.29	0.29	0.14	0.00	Calculated
2	Orifice1	Orifice	POND	A1		961.00	957.84		1.000		0.05							
3	Orifice2	Orifice	POND	A1		961.00	957.84		1.000		0.05							
4	Orifice3	Orifice	POND	A1		961.00	957.84		1.000		0.05							
5	Orifice4	Orifice	POND	A1		961.00	957.84		1.000		0.04							
6	Orifice5	Orifice	POND	A1		961.00	957.84		1.000		0.04							
7	Orifice6	Orifice	POND	A1		961.00	957.84		4.000		0.44							
8	Orifice7	Orifice	POND	A1		961.00	957.84		4.000		0.44							
9	Orifice8	Orifice	POND	A1		961.00	957.84		4.000		0.44							
10	Orifice9	Orifice	POND	A1		961.00	957.84		4.000		0.44							

Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft^2)	Minimum Pipe Cover (in)
1	A1	957.84	966.20	8.36	0.00	-957.84	0.00	-966.20	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	A1	2.01	0.00	958.13	0.29	0.00	8.07	957.88	0.04	0 12:15	0 00:00	0.00	0.00

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	Link-03	160.20	957.84	0.00	948.85	0.00	8.99	5.6100	CIRCULAR	24.000	24.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	Link-03	2.02	0 12:15	46.45	0.04	7.29	0.37	0.29	0.14	0.00		Calculated

Storage Nodes

Storage Node : POND

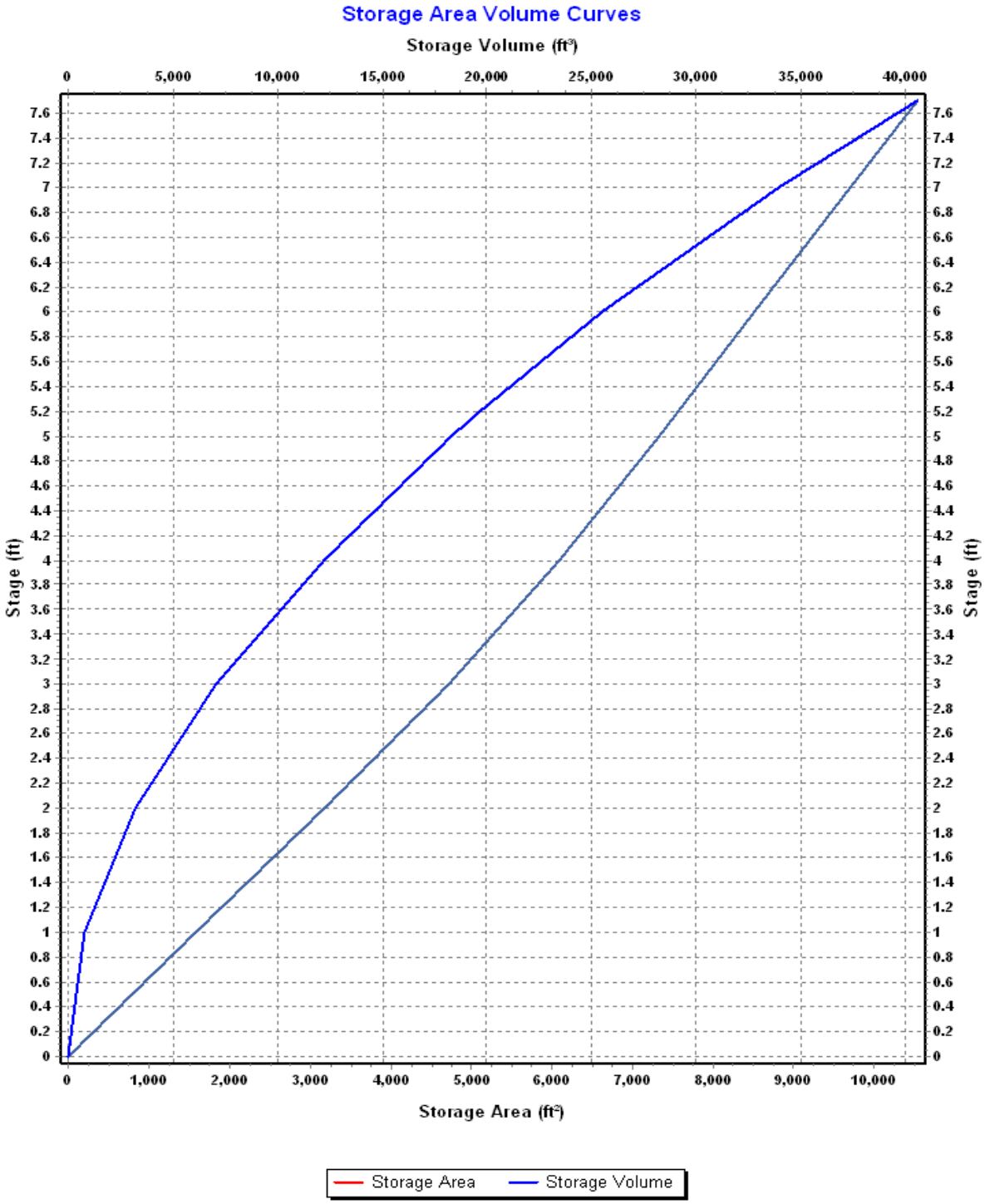
Input Data

Invert Elevation (ft)	961.00
Max (Rim) Elevation (ft)	6.00
Max (Rim) Offset (ft)	-955.00
Initial Water Elevation (ft)	961.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Pond

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	0	0
1	1586.00	793
2	3180.00	3180
3	4723.33	7085
4	6092.50	12185
5	7326.00	18315
5.2	7566.15	19672
6	8517.67	25553
7	9702.57	33959
7.7	10536.10	40564


Storage Area Volume Curves
Storage Volume (ft³)
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
Stage (ft)
Stage (ft)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
3.2
3.4
3.6
3.8
4
4.2
4.4
4.6
4.8
5
5.2
5.4
5.6
5.8
6
6.2
6.4
6.6
6.8
7
7.2
7.4
7.6
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
10,000
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : POND (continued)

Outflow Orifices

SN	Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1	Orifice1	Side	CIRCULAR	No	1.00			961.52	0.61
2	Orifice2	Side	CIRCULAR	No	1.00			961.85	0.61
3	Orifice3	Side	CIRCULAR	No	1.00			962.18	0.61
4	Orifice4	Side	CIRCULAR	No	1.00			962.51	0.61
5	Orifice5	Side	CIRCULAR	No	1.00			962.84	0.61
6	Orifice6	Side	CIRCULAR	No	4.00			963.90	0.61
7	Orifice7	Side	CIRCULAR	No	4.00			963.90	0.61
8	Orifice8	Side	CIRCULAR	No	4.00			963.90	0.61
9	Orifice9	Side	CIRCULAR	No	4.00			963.90	0.61

Output Summary Results

Peak Inflow (cfs)	11.01
Peak Lateral Inflow (cfs)	11.01
Peak Outflow (cfs)	2.01
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	965.13
Max HGL Depth Attained (ft)	4.13
Average HGL Elevation Attained (ft)	962.28
Average HGL Depth Attained (ft)	1.28
Time of Max HGL Occurrence (days hh:mm)	0 12:14
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	4101
Total Retention Time (sec)	0.00

Project Description

File Name ..... 20180111_2020-06-29 Post.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	SCS TR-55
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Jun 29, 2020	00:00:00
End Analysis On	Jul 02, 2020	00:05:00
Start Reporting On	Jun 29, 2020	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	2
Nodes	3
Junctions	1
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	1
Links	10
Channels	0
Pipes	1
Pumps	0
Orifices	9
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	100 year	Cumulative	inches	Missouri	Jackson	100	7.70	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	BYPASS	0.32	81.13	7.70	5.47	1.75	2.72	0 00:05:00
2	ProposedNorth	1.75	89.98	7.70	6.51	11.39	16.77	0 00:05:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft^2)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	A1	Junction	957.84	966.20	0.00	0.00	0.00	2.78	958.18	0.00	8.02	0 00:00	0.00	0.00
2	OUTFALL	Outfall	948.85					4.91	949.18					
3	POND	Storage Node	961.00	6.00	961.00		0.00	16.76	966.20				0.00	4166.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Reported Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)	
1	Link-03	Pipe	A1	OUTFALL	160.20	957.84	948.85	5.6100	24.000	0.0150	2.78	46.45	0.06	7.92	0.34	0.17	0.00	Calculated
2	Orifice1	Orifice	POND	A1		961.00	957.84		1.000		0.06							
3	Orifice2	Orifice	POND	A1		961.00	957.84		1.000		0.06							
4	Orifice3	Orifice	POND	A1		961.00	957.84		1.000		0.05							
5	Orifice4	Orifice	POND	A1		961.00	957.84		1.000		0.05							
6	Orifice5	Orifice	POND	A1		961.00	957.84		1.000		0.05							
7	Orifice6	Orifice	POND	A1		961.00	957.84		4.000		0.63							
8	Orifice7	Orifice	POND	A1		961.00	957.84		4.000		0.63							
9	Orifice8	Orifice	POND	A1		961.00	957.84		4.000		0.63							
10	Orifice9	Orifice	POND	A1		961.00	957.84		4.000		0.63							

Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft^2)	Minimum Pipe Cover (in)
1	A1	957.84	966.20	8.36	0.00	-957.84	0.00	-966.20	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	A1	2.78	0.00	958.18	0.34	0.00	8.02	957.90	0.06	0 12:14	0 00:00	0.00	0.00

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	Link-03	160.20	957.84	0.00	948.85	0.00	8.99	5.6100	CIRCULAR	24.000	24.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	Link-03	2.78	0 12:14	46.45	0.06	7.92	0.34	0.34	0.17	0.00		Calculated

Storage Nodes

Storage Node : POND

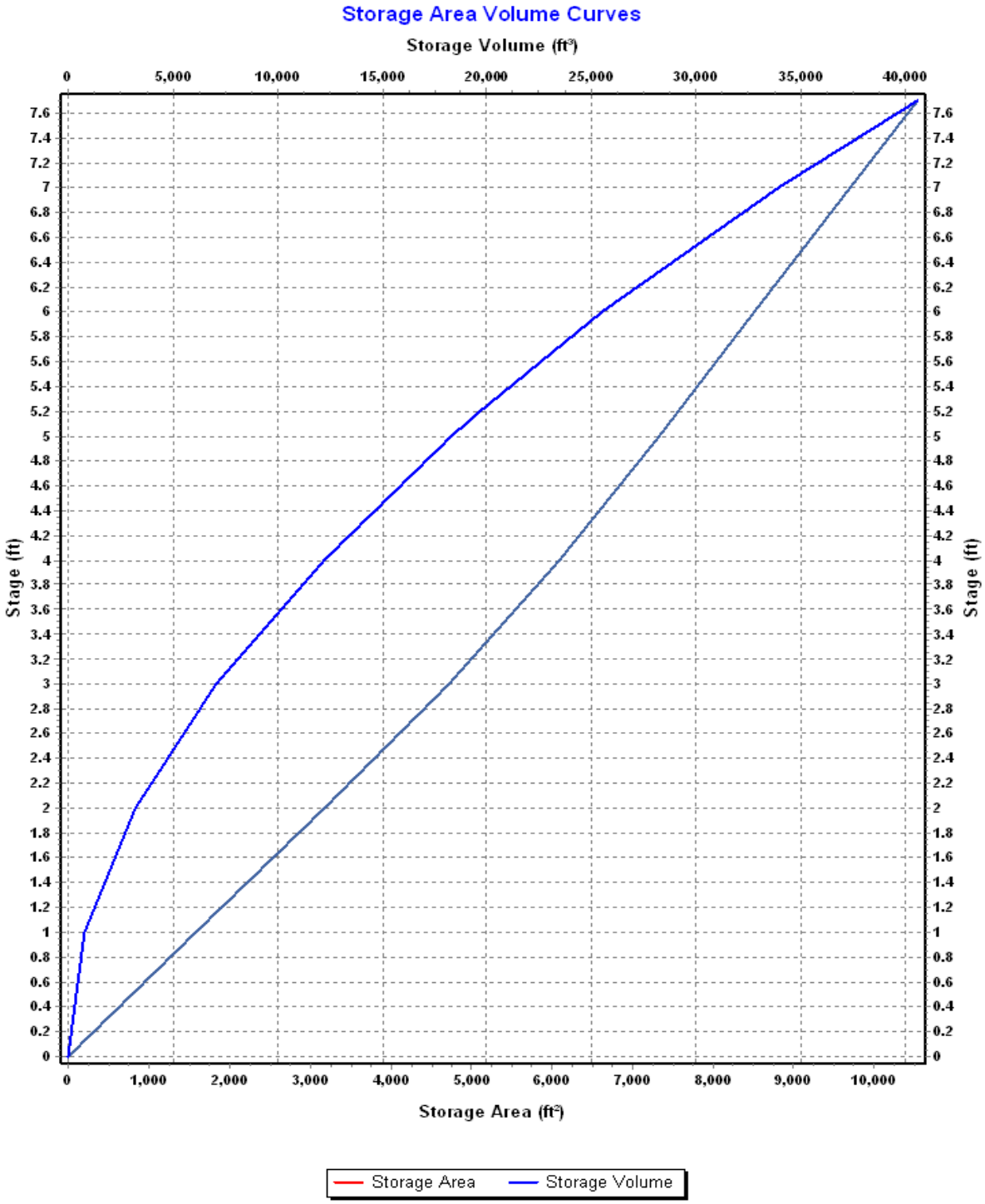
Input Data

Invert Elevation (ft)	961.00
Max (Rim) Elevation (ft)	6.00
Max (Rim) Offset (ft)	-955.00
Initial Water Elevation (ft)	961.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Pond

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	0	0
1	1586.00	793
2	3180.00	3180
3	4723.33	7085
4	6092.50	12185
5	7326.00	18315
5.2	7566.15	19672
6	8517.67	25553
7	9702.57	33959
7.7	10536.10	40564


Storage Area Volume Curves
Storage Volume (ft³)
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
Stage (ft)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
3.2
3.4
3.6
3.8
4
4.2
4.4
4.6
4.8
5
5.2
5.4
5.6
5.8
6
6.2
6.4
6.6
6.8
7
7.2
7.4
7.6
Storage Area (ft²)
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
10,000
Storage Area
Storage Volume

Storage Node : POND (continued)

Outflow Orifices

SN	Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1	Orifice1	Side	CIRCULAR	No	1.00			961.52	0.61
2	Orifice2	Side	CIRCULAR	No	1.00			961.85	0.61
3	Orifice3	Side	CIRCULAR	No	1.00			962.18	0.61
4	Orifice4	Side	CIRCULAR	No	1.00			962.51	0.61
5	Orifice5	Side	CIRCULAR	No	1.00			962.84	0.61
6	Orifice6	Side	CIRCULAR	No	4.00			963.90	0.61
7	Orifice7	Side	CIRCULAR	No	4.00			963.90	0.61
8	Orifice8	Side	CIRCULAR	No	4.00			963.90	0.61
9	Orifice9	Side	CIRCULAR	No	4.00			963.90	0.61

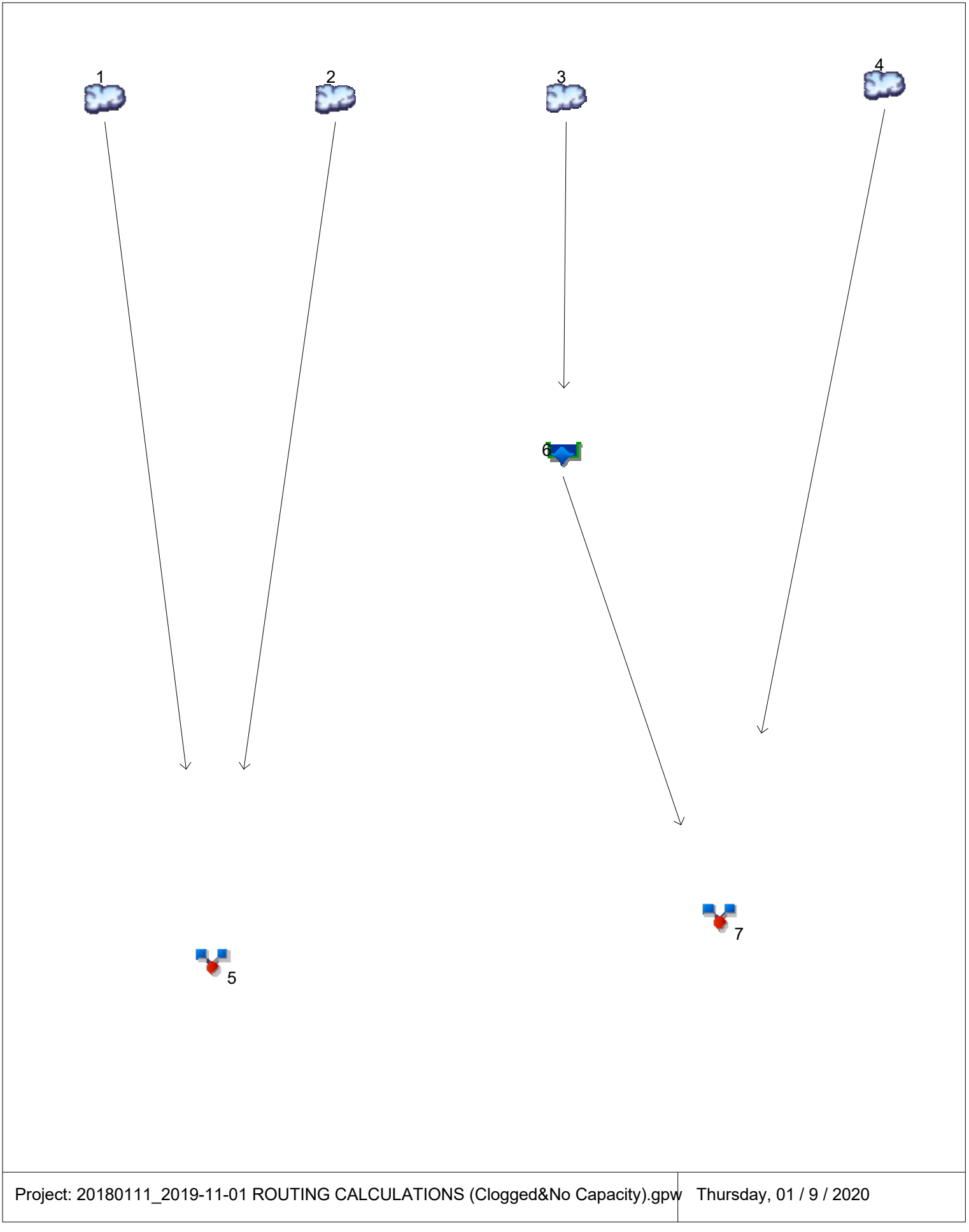
Output Summary Results

Peak Inflow (cfs)	16.76
Peak Lateral Inflow (cfs)	16.76
Peak Outflow (cfs)	2.78
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	966.20
Max HGL Depth Attained (ft)	5.2
Average HGL Elevation Attained (ft)	962.52
Average HGL Depth Attained (ft)	1.52
Time of Max HGL Occurrence (days hh:mm)	0 12:14
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	4166
Total Retention Time (sec)	0.00

CLOGGED/ ZERO AVAILABLE STORAGE ROUTING
100-YEAR EVENT

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	17.14	2	718	40,898	------	------	------	EXISTING NORTH
2	SCS Runoff	2.350	2	720	6,305	------	------	------	EXISTING SOUTH
3	SCS Runoff	17.48	2	716	38,772	------	------	------	PROPOSED NORTH
4	SCS Runoff	2.838	2	716	5,946	------	------	------	PROPOSED BYPASS
5	Combine	19.36	2	718	47,203	1, 2,	------	------	EXISTING SITE
6	Reservoir	16.85	2	718	35,243	3	967.00	25,531	PROPOSED TO DET
7	Combine	19.60	2	718	41,189	4, 6	------	------	PROPOSED SITE

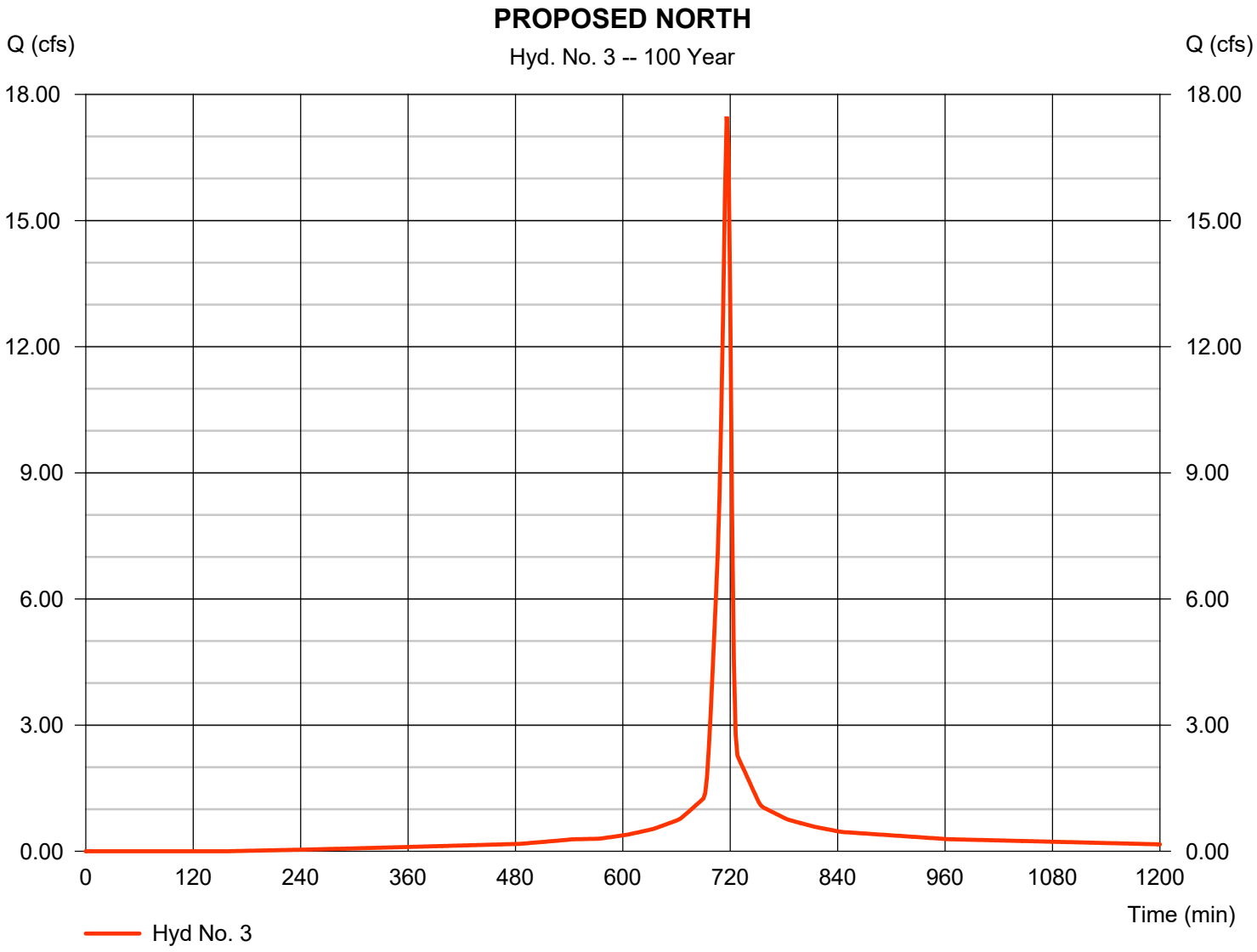
Hydrograph Report

Hyd. No. 3

PROPOSED NORTH

Hydrograph type	=	SCS Runoff	Peak discharge	=	17.48 cfs
Storm frequency	=	100 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	38,772 cuft
Drainage area	=	1.750 ac	Curve number	=	90*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.780 x 80) + (0.970 x 98)] / 1.750



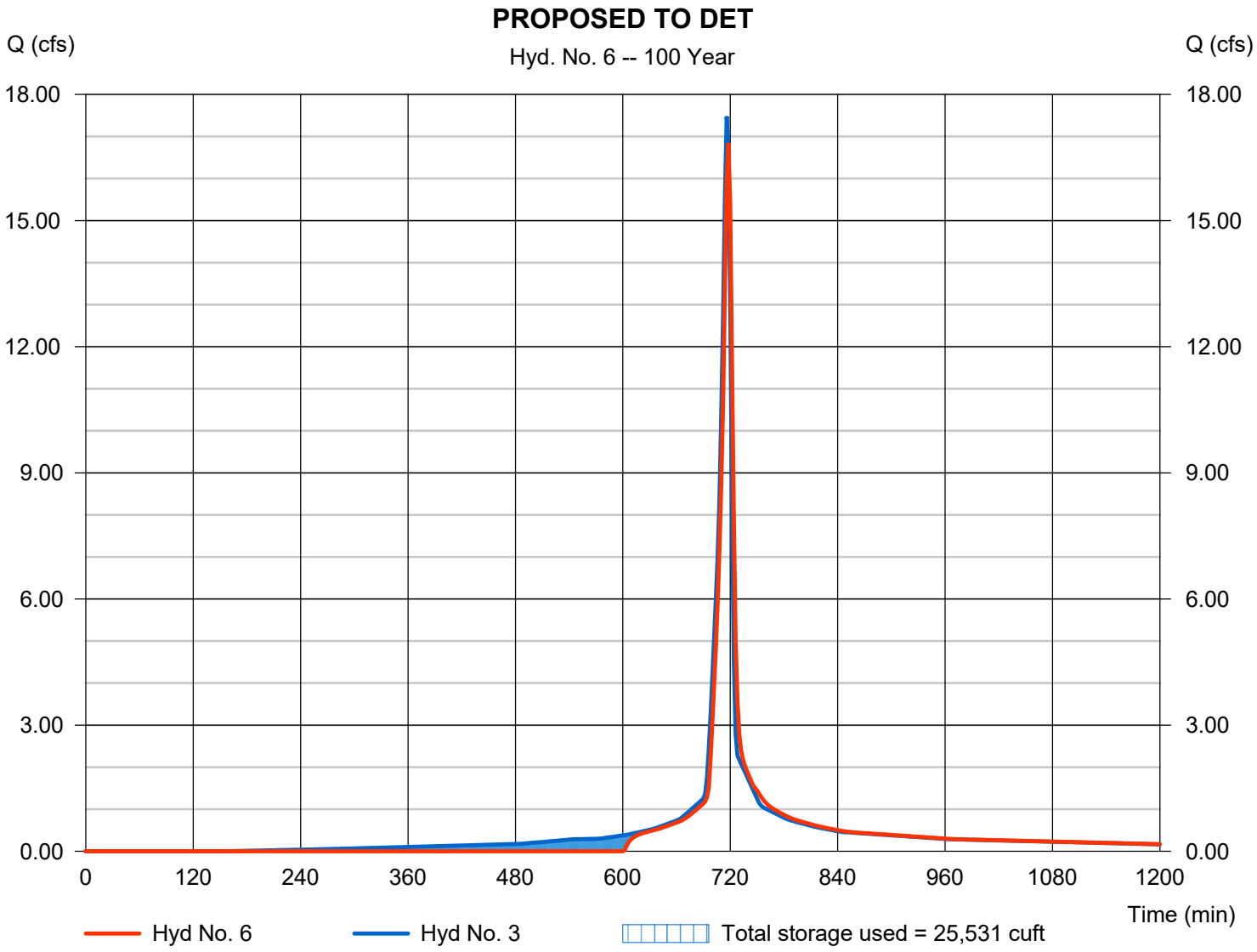
Hydrograph Report

Hyd. No. 6

PROPOSED TO DET

Hydrograph type	=	Reservoir	Peak discharge	=	16.85 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	35,243 cuft
Inflow hyd. No.	=	3 - PROPOSED NORTH	Max. Elevation	=	967.00 ft
Reservoir name	=	Detention Pond	Max. Storage	=	25,531 cuft

Storage Indication method used. Wet pond routing start elevation = 966.20 ft.



Pond Report

Pond No. 1 - Detention Pond

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 961.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	961.00	10	0	0
1.00	962.00	1,575	793	793
2.00	963.00	3,200	2,388	3,180
3.00	964.00	4,610	3,905	7,085
4.00	965.00	5,590	5,100	12,185
5.00	966.00	6,670	6,130	18,315
5.20	966.20	6,895	1,357	19,672
6.00	967.00	7,809	5,881	25,553
7.00	968.00	9,002	8,405	33,958
7.70	968.70	9,869	6,605	40,563

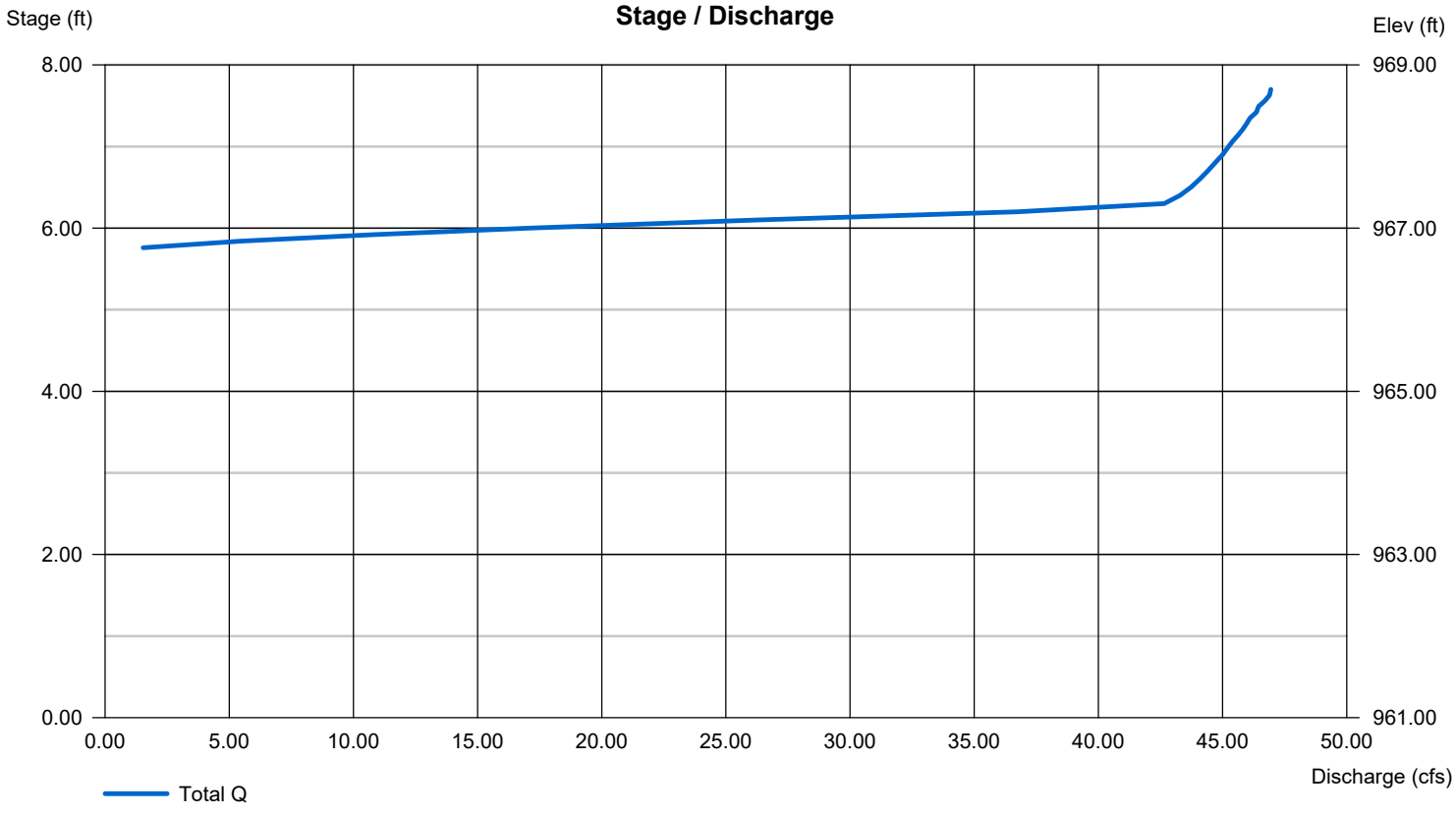
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	Inactive	Inactive	Inactive
Span (in)	= 24.00	8.00	0.00	1.00
No. Barrels	= 1	1	0	6
Invert El. (ft)	= 958.00	963.80	0.00	961.52
Length (ft)	= 162.00	1.00	0.00	1.65
Slope (%)	= 5.61	0.50	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	Yes

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	Inactive	40.00	Inactive	Inactive
Crest El. (ft)	= 966.20	966.70	0.00	0.00
Weir Coeff.	= 2.60	2.60	3.33	3.33
Weir Type	= Broad	Broad	---	---
Multi-Stage	= Yes	Yes	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

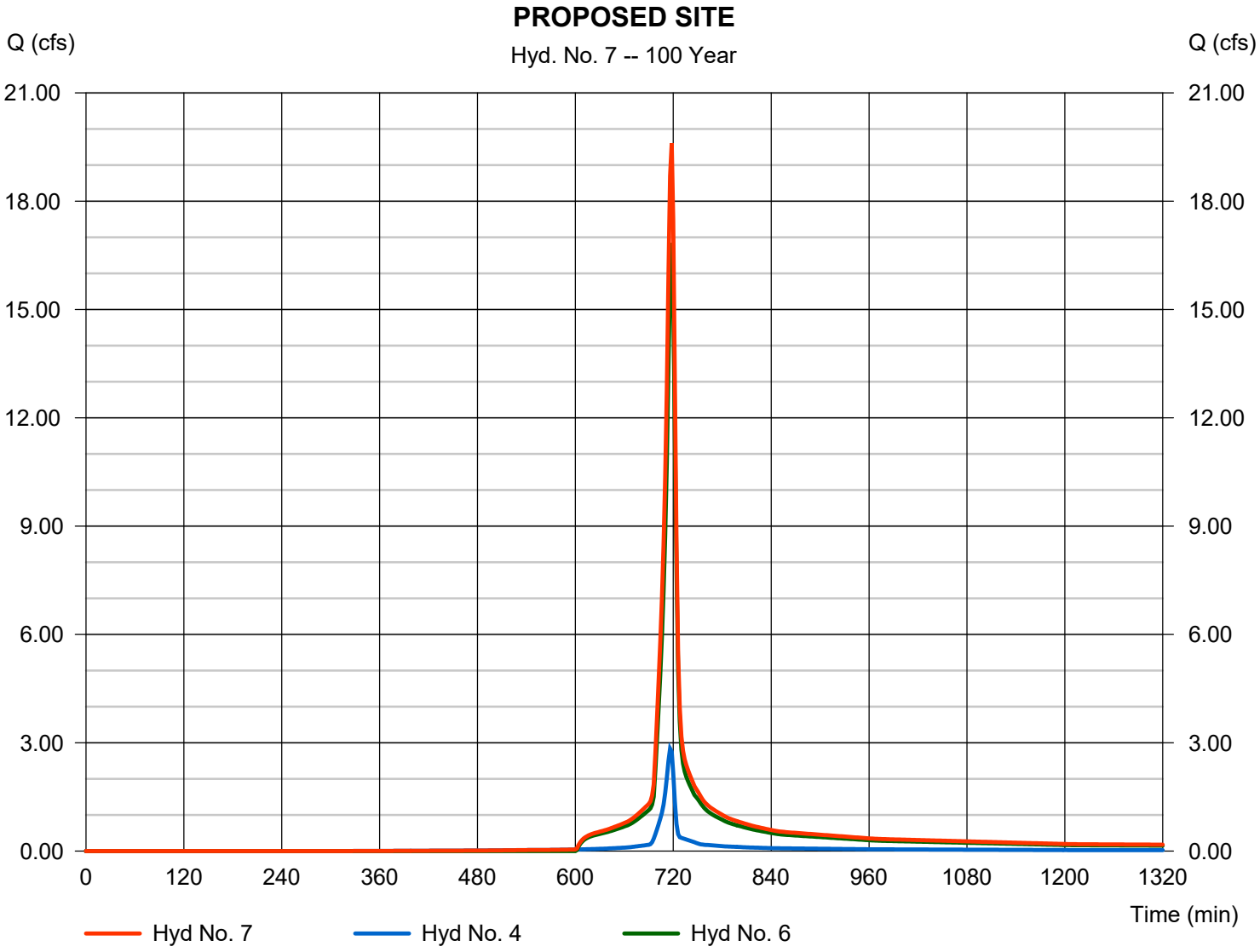


Hydrograph Report

Hyd. No. 7

PROPOSED SITE

Hydrograph type	= Combine	Peak discharge	= 19.60 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 41,189 cuft
Inflow hyds.	= 4, 6	Contrib. drain. area	= 0.320 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	26.1250	4.3000	0.6753	--------
3	0.0000	0.0000	0.0000	--------
5	32.4010	4.4000	0.6735	--------
10	37.8784	4.5000	0.6734	--------
25	42.5803	4.1000	0.6577	--------
50	45.8000	3.8000	0.6449	--------
100	48.9298	3.5000	0.6340	--------

File name: Lee's Summit IDF.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	5.79	4.33	3.54	3.03	2.67	2.40	2.19	2.02	1.88	1.76	1.66	1.57
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	7.16	5.38	4.40	3.77	3.32	2.99	2.73	2.52	2.34	2.20	2.07	1.96
10	8.32	6.26	5.12	4.39	3.88	3.49	3.19	2.94	2.74	2.57	2.42	2.29
25	9.97	7.47	6.12	5.25	4.64	4.18	3.82	3.53	3.29	3.09	2.91	2.76
50	11.27	8.43	6.90	5.93	5.24	4.73	4.33	4.00	3.73	3.50	3.31	3.14
100	12.60	9.39	7.69	6.61	5.85	5.28	4.83	4.47	4.18	3.92	3.71	3.52

Tc = time in minutes. Values may exceed 60.

Precip. file name: P:\2018\20180111\Engineering\Hydraflow\Lee's Summit Precipitation.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	3.50	0.00	0.00	5.30	0.00	0.00	7.70
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Aug 22 2019

Emergency Spillway

Trapezoidal

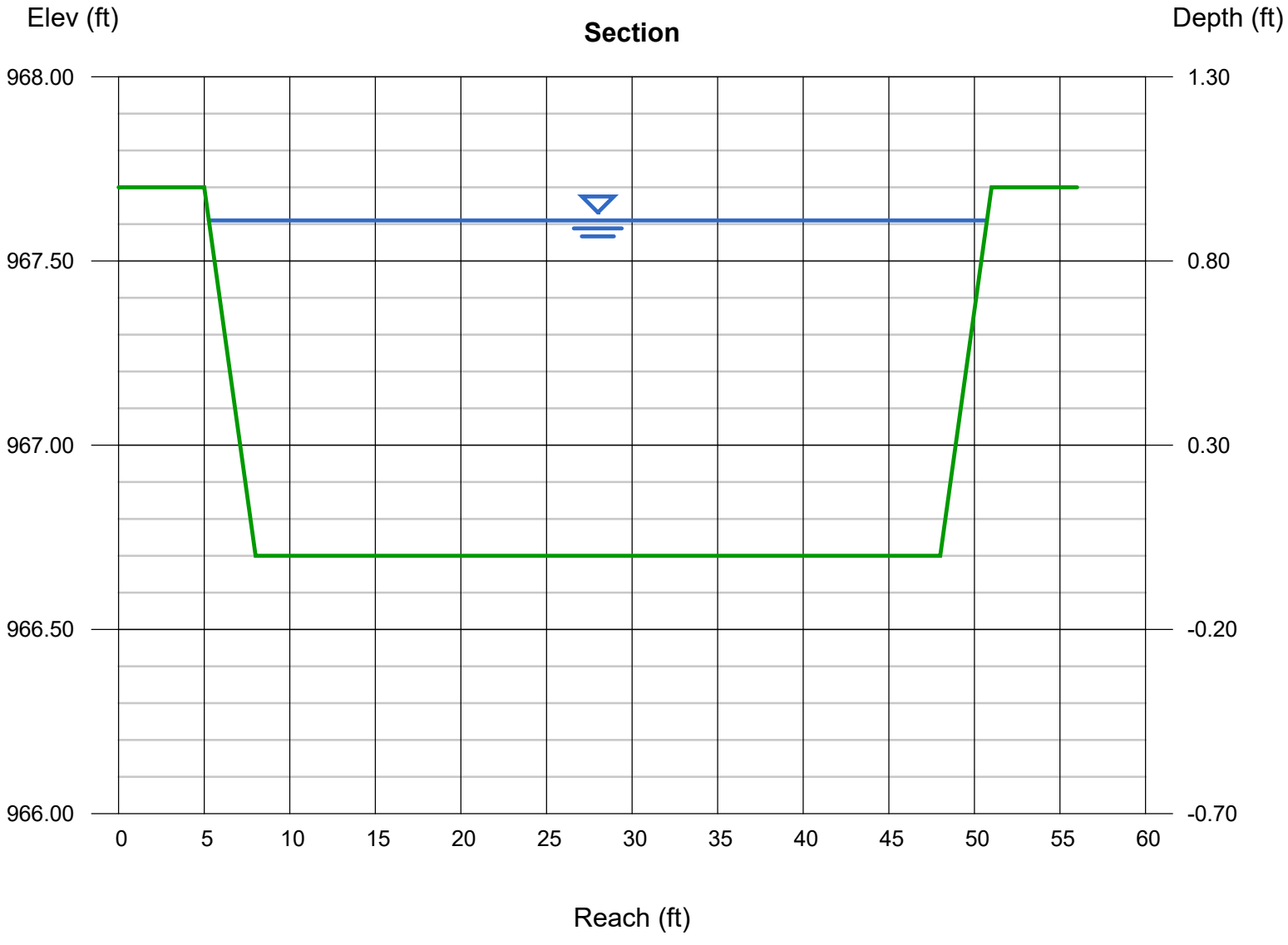
Bottom Width (ft)	= 40.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 966.70
Slope (%)	= 1.00
N-Value	= 0.150

Calculations

Compute by:	Known Q
Known Q (cfs)	= 34.51

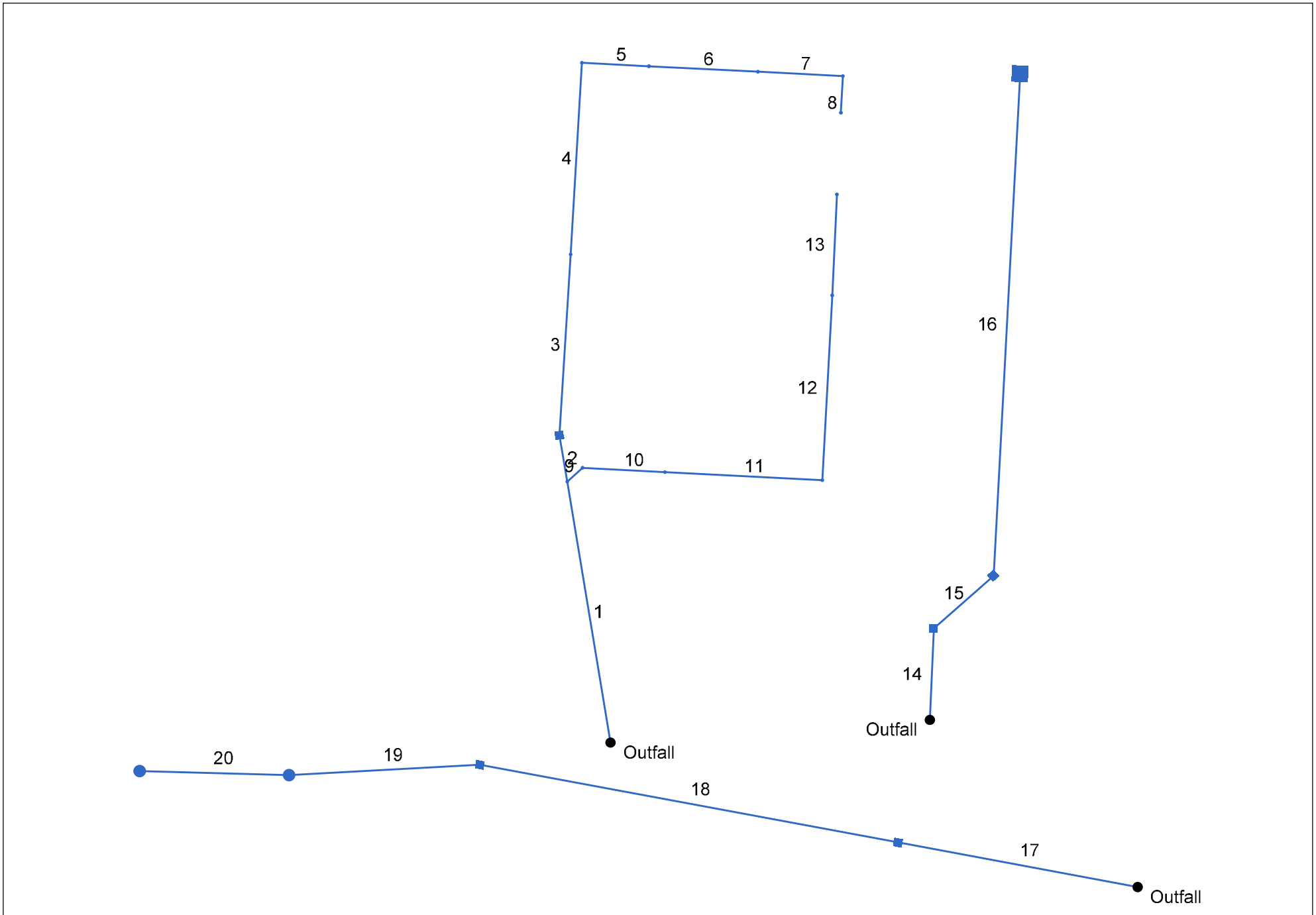
Highlighted

Depth (ft)	= 0.91
Q (cfs)	= 34.51
Area (sqft)	= 38.88
Velocity (ft/s)	= 0.89
Wetted Perim (ft)	= 45.76
Crit Depth, Yc (ft)	= 0.29
Top Width (ft)	= 45.46
EGL (ft)	= 0.92



Attachment 3
Hydraflow Storm Sewers Calculations

Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: 20180111_2020-06-23 Storm Sewers-field conditions.stm	Number of lines: 20	Date: 6/23/2020

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	B2-B1	2.29	12	Cir	99.99	963.50	972.32	8.821	964.32	972.97	n/a	972.97 j	End	Manhole
2	B3-B2	1.23	12	Cir	17.74	972.32	972.50	1.015	972.97	972.97	n/a	972.97 j	1	Grate
3	B4-B3	0.69	10	Cir	68.55	972.70	973.39	1.007	973.02	973.76	0.02	973.76	2	Manhole
4	B5-B4	0.36	10	Cir	72.55	973.39	974.11	0.992	973.76	974.37	n/a	974.37 j	3	Manhole
5	B6-B5	0.29	10	Cir	25.08	974.11	974.36	0.997	974.37	974.59	n/a	974.59 j	4	Manhole
6	B7-B6	0.09	10	Cir	41.25	974.36	974.77	0.994	974.59	974.90	n/a	974.90 j	5	Manhole
7	B8-B7	0.03	10	Cir	32.00	974.77	975.09	1.000	974.90	975.16	n/a	975.16 j	6	Manhole
8	B9-B8	0.03	10	Cir	13.88	975.09	975.23	1.009	975.16	975.30	n/a	975.30	7	Manhole
9	C1-B2	1.06	10	Cir	7.84	972.32	973.31	12.631	972.97	973.77	n/a	973.77 j	1	Manhole
10	C2-C1	0.99	10	Cir	31.16	973.31	973.62	0.995	973.77	974.06	n/a	974.06 j	9	Manhole
11	C3-C2	0.79	10	Cir	59.30	973.62	974.22	1.012	974.06	974.61	n/a	974.61 j	10	Manhole
12	C4-C3	0.53	10	Cir	70.00	974.22	974.92	1.000	974.61	975.24	n/a	975.24 j	11	Manhole
13	C5-C4	0.26	10	Cir	38.21	974.92	975.30	0.994	975.24	975.52	n/a	975.52 j	12	Manhole
14	D2-D1	4.67	12	Cir	34.62	963.50	969.00	15.888	964.45	969.90	n/a	969.90 j	End	Curb-Horiz
15	D3-D2	3.54	12	Cir	30.05	969.20	971.30	6.988	969.90	972.10	n/a	972.10	14	Curb-Horiz
16	D4-D3	2.55	12	Cir	190.01	971.50	973.50	1.053	972.12	974.18	n/a	974.18	15	Curb-Horiz
17	EX AL#1202-OUTFALL	8.04	24	Cir	91.74	947.73	948.65	1.003	949.23	949.66	n/a	949.66 j	End	Grate
18	A1-EX AL#1202	5.20	24	Cir	160.20	948.85	957.84	5.612	949.66	958.64	n/a	958.64 j	17	Grate
19	A2-A1	2.16	15	Cir	72.03	958.04	962.63	6.372	958.64	963.22	n/a	963.22 j	18	Manhole
20	EX A3-A2	2.16	15	Cir	56.15	966.58	967.09	0.908	967.09	967.68	n/a	967.68	19	Grate

Project File: 20180111_2020-06-23 Storm Sewers-field conditions.stm

Number of lines: 20

Run Date: 6/23/2020

NOTES: Return period = 10 Yrs. ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	99.99	0.00	0.39	0.00	0.00	0.33	0.0	5.0	7.0	2.29	10.58	3.79	12	8.82	963.50	972.32	964.32	972.97	965.10	978.70	B2-B1
2	1	17.74	0.13	0.23	0.60	0.08	0.18	5.0	5.0	7.0	1.23	3.59	2.85	12	1.01	972.32	972.50	972.97	972.97	978.70	977.67	B3-B2
3	2	68.55	0.05	0.10	0.95	0.05	0.10	5.0	5.0	7.0	0.69	2.20	3.28	10	1.01	972.70	973.39	973.02	973.76	977.67	977.10	B4-B3
4	3	72.55	0.01	0.05	0.95	0.01	0.05	5.0	5.0	7.0	0.36	2.18	2.01	10	0.99	973.39	974.11	973.76	974.37	977.10	979.00	B5-B4
5	4	25.08	0.03	0.04	0.95	0.03	0.04	5.0	5.0	7.0	0.29	2.19	2.16	10	1.00	974.11	974.36	974.37	974.59	979.00	978.75	B6-B5
6	5	41.25	0.01	0.01	0.95	0.01	0.01	5.0	5.0	7.0	0.09	2.18	1.22	10	0.99	974.36	974.77	974.59	974.90	978.75	978.40	B7-B6
7	6	32.00	0.00	0.00	0.00	0.00	0.00	0.0	5.0	7.0	0.03	2.19	0.86	10	1.00	974.77	975.09	974.90	975.16	978.40	978.15	B8-B7
8	7	13.88	0.00	0.00	0.95	0.00	0.00	5.0	5.0	7.0	0.03	2.20	1.23	10	1.01	975.09	975.23	975.16	975.30	978.15	978.30	B9-B8
9	1	7.84	0.01	0.16	0.95	0.01	0.15	5.0	5.0	7.0	1.06	7.78	2.89	10	12.63	972.32	973.31	972.97	973.77	978.70	978.70	C1-B2
10	9	31.16	0.03	0.15	0.95	0.03	0.14	5.0	5.0	7.0	0.99	2.18	3.31	10	0.99	973.31	973.62	973.77	974.06	978.70	978.28	C2-C1
11	10	59.30	0.04	0.12	0.95	0.04	0.11	5.0	5.0	7.0	0.79	2.20	2.92	10	1.01	973.62	974.22	974.06	974.61	978.28	978.25	C3-C2
12	11	70.00	0.04	0.08	0.95	0.04	0.08	5.0	5.0	7.0	0.53	2.19	2.43	10	1.00	974.22	974.92	974.61	975.24	978.25	978.67	C4-C3
13	12	38.21	0.04	0.04	0.95	0.04	0.04	5.0	5.0	7.0	0.26	2.18	1.82	10	0.99	974.92	975.30	975.24	975.52	978.67	978.80	C5-C4
14	End	34.62	0.17	0.93	0.95	0.16	0.67	5.0	5.0	7.0	4.67	14.19	6.18	12	15.89	963.50	969.00	964.45	969.90	965.60	976.30	D2-D1
15	14	30.05	0.15	0.76	0.95	0.14	0.51	5.0	5.0	7.0	3.54	9.41	5.65	12	6.99	969.20	971.30	969.90	972.10	976.30	976.30	D3-D2
16	15	190.01	0.61	0.61	0.60	0.37	0.37	5.0	5.0	7.0	2.55	3.65	4.74	12	1.05	971.50	973.50	972.12	974.18	976.30	977.60	D4-D3
17	End	91.74	0.00	0.00	0.00	0.00	0.00	5.0	5.0	0.0	8.04	22.65	4.12	24	1.00	947.73	948.65	949.23	949.66	950.00	959.95	EX AL#1202-OUT
18	17	160.20	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	5.20	53.58	4.39	24	5.61	948.85	957.84	949.66	958.64	959.95	966.20	A1-EX AL#1202
19	18	72.03	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	2.16	16.30	3.75	15	6.37	958.04	962.63	958.64	963.22	966.20	971.20	A2-A1
20	19	56.15	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	2.16	6.15	4.20	15	0.91	966.58	967.09	967.09	967.68	971.20	973.94	EX A3-A2

Project File: 20180111_2020-06-23 Storm Sewers-field conditions.stm

Number of lines: 20

Run Date: 6/23/2020

NOTES:Intensity = 66.71 / (Inlet time + 12.50) ^ 0.79; Return period =Yrs. 10 ; Pipe travel time suppressed. ; c = cir e = ellip b = box

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	B2-B1	3.20	12	Cir	99.99	963.50	972.32	8.821	964.38	973.09	n/a	973.09 j	End	Manhole
2	B3-B2	1.72	12	Cir	17.74	972.32	972.50	1.015	973.09	973.06	n/a	973.06 j	1	Grate
3	B4-B3	0.96	10	Cir	68.55	972.70	973.39	1.007	973.09	973.82	0.03	973.82	2	Manhole
4	B5-B4	0.50	10	Cir	72.55	973.39	974.11	0.992	973.82	974.42	n/a	974.42 j	3	Manhole
5	B6-B5	0.41	10	Cir	25.08	974.11	974.36	0.997	974.42	974.64	n/a	974.64 j	4	Manhole
6	B7-B6	0.13	10	Cir	41.25	974.36	974.77	0.994	974.64	974.92	n/a	974.92 j	5	Manhole
7	B8-B7	0.04	10	Cir	32.00	974.77	975.09	1.000	974.92	975.17	n/a	975.17 j	6	Manhole
8	B9-B8	0.04	10	Cir	13.88	975.09	975.23	1.009	975.17	975.31	0.03	975.31	7	Manhole
9	C1-B2	1.48	10	Cir	7.84	972.32	973.31	12.631	973.09	973.85	n/a	973.85 j	1	Manhole
10	C2-C1	1.38	10	Cir	31.16	973.31	973.62	0.995	973.85	974.15	n/a	974.15 j	9	Manhole
11	C3-C2	1.11	10	Cir	59.30	973.62	974.22	1.012	974.15	974.69	n/a	974.69 j	10	Manhole
12	C4-C3	0.74	10	Cir	70.00	974.22	974.92	1.000	974.69	975.30	n/a	975.30 j	11	Manhole
13	C5-C4	0.37	10	Cir	38.21	974.92	975.30	0.994	975.30	975.56	n/a	975.56 j	12	Manhole
14	D2-D1	6.51	12	Cir	34.62	963.50	969.00	15.888	964.48	969.97	n/a	969.97 j	End	Curb-Horiz
15	D3-D2	4.94	12	Cir	30.05	969.20	971.30	6.988	969.97	972.21	0.76	972.21	14	Curb-Horiz
16	D4-D3	3.56	12	Cir	190.01	971.50	973.50	1.053	972.30	974.30	n/a	974.30	15	Curb-Horiz
17	EX AL#1202-OUTFALL	9.26	24	Cir	91.74	947.73	948.65	1.003	949.27	949.74	n/a	949.74 j	End	Grate
18	A1-EX AL#1202	6.42	24	Cir	160.20	948.85	957.84	5.612	949.74	958.74	n/a	958.74	17	Grate
19	A2-A1	3.38	15	Cir	72.03	958.04	962.63	6.372	958.74	963.37	n/a	963.37	18	Manhole
20	EX A3-A2	3.38	15	Cir	56.15	966.58	967.09	0.908	967.24	967.83	n/a	967.83	19	Grate

Project File: 20180111_2020-06-23 Storm Sewers-field conditions.stm

Number of lines: 20

Run Date: 6/23/2020

NOTES: Return period = 100 Yrs. ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	99.99	0.00	0.39	0.00	0.00	0.33	0.0	5.0	9.7	3.20	10.58	4.66	12	8.82	963.50	972.32	964.38	973.09	965.10	978.70	B2-B1
2	1	17.74	0.13	0.23	0.60	0.08	0.18	5.0	5.0	9.7	1.72	3.59	3.24	12	1.01	972.32	972.50	973.09	973.06	978.70	977.67	B3-B2
3	2	68.55	0.05	0.10	0.95	0.05	0.10	5.0	5.0	9.7	0.96	2.20	3.62	10	1.01	972.70	973.39	973.09	973.82	977.67	977.10	B4-B3
4	3	72.55	0.01	0.05	0.95	0.01	0.05	5.0	5.0	9.7	0.50	2.18	2.22	10	0.99	973.39	974.11	973.82	974.42	977.10	979.00	B5-B4
5	4	25.08	0.03	0.04	0.95	0.03	0.04	5.0	5.0	9.7	0.41	2.19	2.38	10	1.00	974.11	974.36	974.42	974.64	979.00	978.75	B6-B5
6	5	41.25	0.01	0.01	0.95	0.01	0.01	5.0	5.0	9.7	0.13	2.18	1.34	10	0.99	974.36	974.77	974.64	974.92	978.75	978.40	B7-B6
7	6	32.00	0.00	0.00	0.00	0.00	0.00	0.0	5.0	9.7	0.04	2.19	0.94	10	1.00	974.77	975.09	974.92	975.17	978.40	978.15	B8-B7
8	7	13.88	0.00	0.00	0.95	0.00	0.00	5.0	5.0	9.7	0.04	2.20	1.34	10	1.01	975.09	975.23	975.17	975.31	978.15	978.30	B9-B8
9	1	7.84	0.01	0.16	0.95	0.01	0.15	5.0	5.0	9.7	1.48	7.78	3.37	10	12.63	972.32	973.31	973.09	973.85	978.70	978.70	C1-B2
10	9	31.16	0.03	0.15	0.95	0.03	0.14	5.0	5.0	9.7	1.38	2.18	3.75	10	0.99	973.31	973.62	973.85	974.15	978.70	978.28	C2-C1
11	10	59.30	0.04	0.12	0.95	0.04	0.11	5.0	5.0	9.7	1.11	2.20	3.28	10	1.01	973.62	974.22	974.15	974.69	978.28	978.25	C3-C2
12	11	70.00	0.04	0.08	0.95	0.04	0.08	5.0	5.0	9.7	0.74	2.19	2.70	10	1.00	974.22	974.92	974.69	975.30	978.25	978.67	C4-C3
13	12	38.21	0.04	0.04	0.95	0.04	0.04	5.0	5.0	9.7	0.37	2.18	2.01	10	0.99	974.92	975.30	975.30	975.56	978.67	978.80	C5-C4
14	End	34.62	0.17	0.93	0.95	0.16	0.67	5.0	5.0	9.7	6.51	14.19	8.35	12	15.89	963.50	969.00	964.48	969.97	965.60	976.30	D2-D1
15	14	30.05	0.15	0.76	0.95	0.14	0.51	5.0	5.0	9.7	4.94	9.41	7.11	12	6.99	969.20	971.30	969.97	972.21	976.30	976.30	D3-D2
16	15	190.01	0.61	0.61	0.60	0.37	0.37	5.0	5.0	9.7	3.56	3.65	5.28	12	1.05	971.50	973.50	972.30	974.30	976.30	977.60	D4-D3
17	End	91.74	0.00	0.00	0.00	0.00	0.00	5.0	5.0	0.0	9.26	22.65	4.44	24	1.00	947.73	948.65	949.27	949.74	950.00	959.95	EX AL#1202-OUT
18	17	160.20	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	6.42	53.58	4.74	24	5.61	948.85	957.84	949.74	958.74	959.95	966.20	A1-EX AL#1202
19	18	72.03	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	3.38	16.30	4.64	15	6.37	958.04	962.63	958.74	963.37	966.20	971.20	A2-A1
20	19	56.15	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	3.38	6.15	4.80	15	0.91	966.58	967.09	967.24	967.83	971.20	973.94	EX A3-A2

Project File: 20180111_2020-06-23 Storm Sewers-field conditions.stm

Number of lines: 20

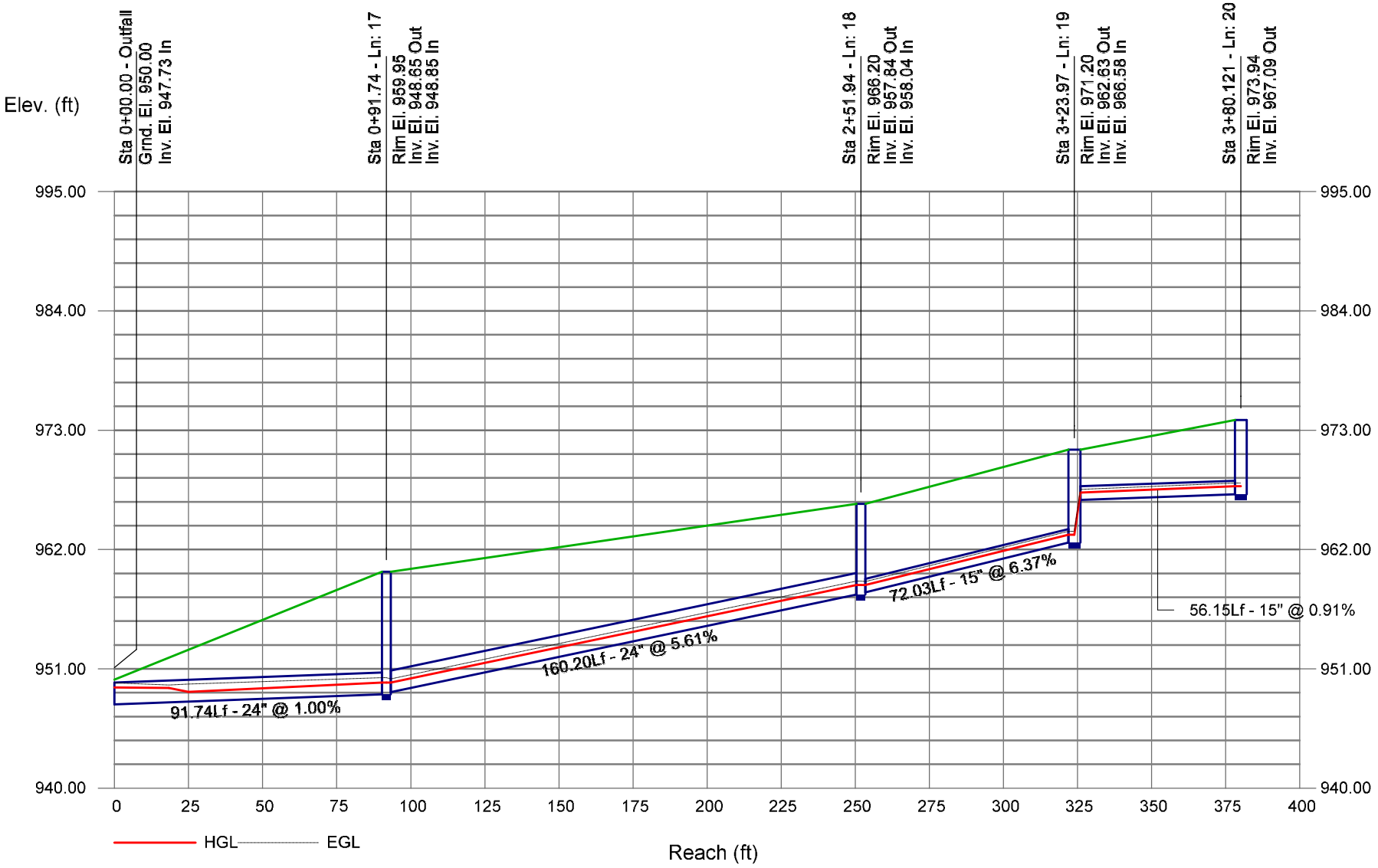
Run Date: 6/23/2020

NOTES:Intensity = 170.80 / (Inlet time + 18.20) ^ 0.91; Return period =Yrs. 100 ; Pipe travel time suppressed. ; c = cir e = ellip b = box

Storm Sewer Profile

Proj. file: 20180111_2020-06-23 Storm Sewers-field conditions.stm

100-YR Hydraulic Profile
EXISTING POND TO EXISTING OUTLET THROUGH PROPOSED POND



Attachment 4
Water Quality Calculations

DCI Lee's Summit
CDG #20180111

Date: 7/25/2019
Revised: 8/23/2019; 11/1/2019; 06/29/2020

Proposed Conditions

Drainage Area	Pervious Area (ac)	Impervious Area (ac)	Total Area, DA (ac)	Total Area, DA (sf)	Percent Site Impervious, I	Volumetric Runoff Coefficient, Rv = .05+.009I	Required WQ Treatment Volume, WQv=P(Rv) (in)	Required WQ Treatment Volume, WQv=P(Rv)(DA) (cf)
North	0.78	0.97	1.75	76,330	56.0%	0.554	0.759	4,827.75
Bypass	0.36	0.02	0.38	16,756	5.3%	0.098	0.134	186.90
							Sum=	**5014.64**

Extended Dry Detention Pond

Elevation-Area-Volume Table			
Elevation	Area (sf)	Volume (cf)	
961	10	0	
962	1,575	793	
963	3,200	3,180	
963.5	3,905	5,132	*WQv elevation
964	4,610	7,085	
965	5,590	12,185	
966	6,670	18,315	
966.2	6,895	19,672	

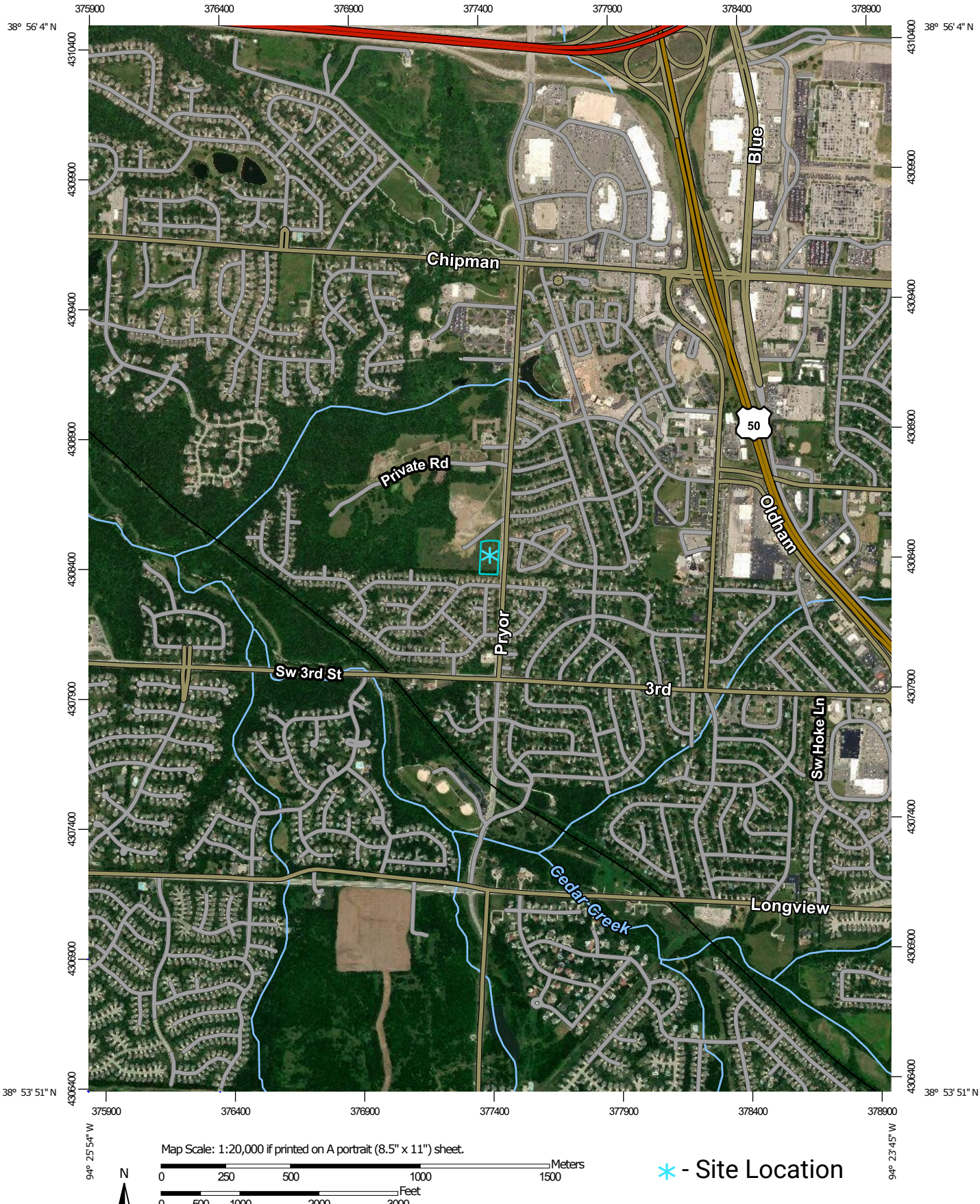
	Return Event (years)	Max Water Surface Elevation (ft)	Freeboard (ft)
Extended Dry Detention Pond	2	964.23	4.47
	10	965.13	3.57
	100	966.2	2.5

Perforated Riser

WQv Treatment Depth Above Lowest Orifice, Zwq	2.5 ft
Water Quality Volume	5,132 cf
Water Quality Volume	0.118 ac-ft
Recommended Max Outlet Area per Row, Ao $A_o = \frac{WQ_v}{(0.013(Z_{wq}{}^2 + 0.22(Z_{wq}) - 0.10)}$	1.35 sq. in
Number of columns, nc	1 column
Design circular perforation diameter, Dperf	1 in
Number of rows (4" vertical spacing), nr	5 rows
Perforation 1 Elevation	961.52
Perforation 2 Elevation	961.85
Perforation 3 Elevation	962.18
Perforation 4 Elevation	962.51
Perforation 5 Elevation	962.84

Attachment 5
Supporting Documents

Hydrologic Soil Group—Jackson County, Missouri
(DCI Lee's Summit Location Map)



Hydrologic Soil Group—Jackson County, Missouri
(DCI Lee's Summit)

Map Scale: 1:766 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 10 20 40 60

Feet
0 35 70 140 210

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
10024	Greenton-Urban land complex, 5 to 9 percent slopes	D	2.2	97.6%
10128	Sharpsburg-Urban land complex, 2 to 5 percent slopes	D	0.1	2.4%
Totals for Area of Interest			**2.2**	**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

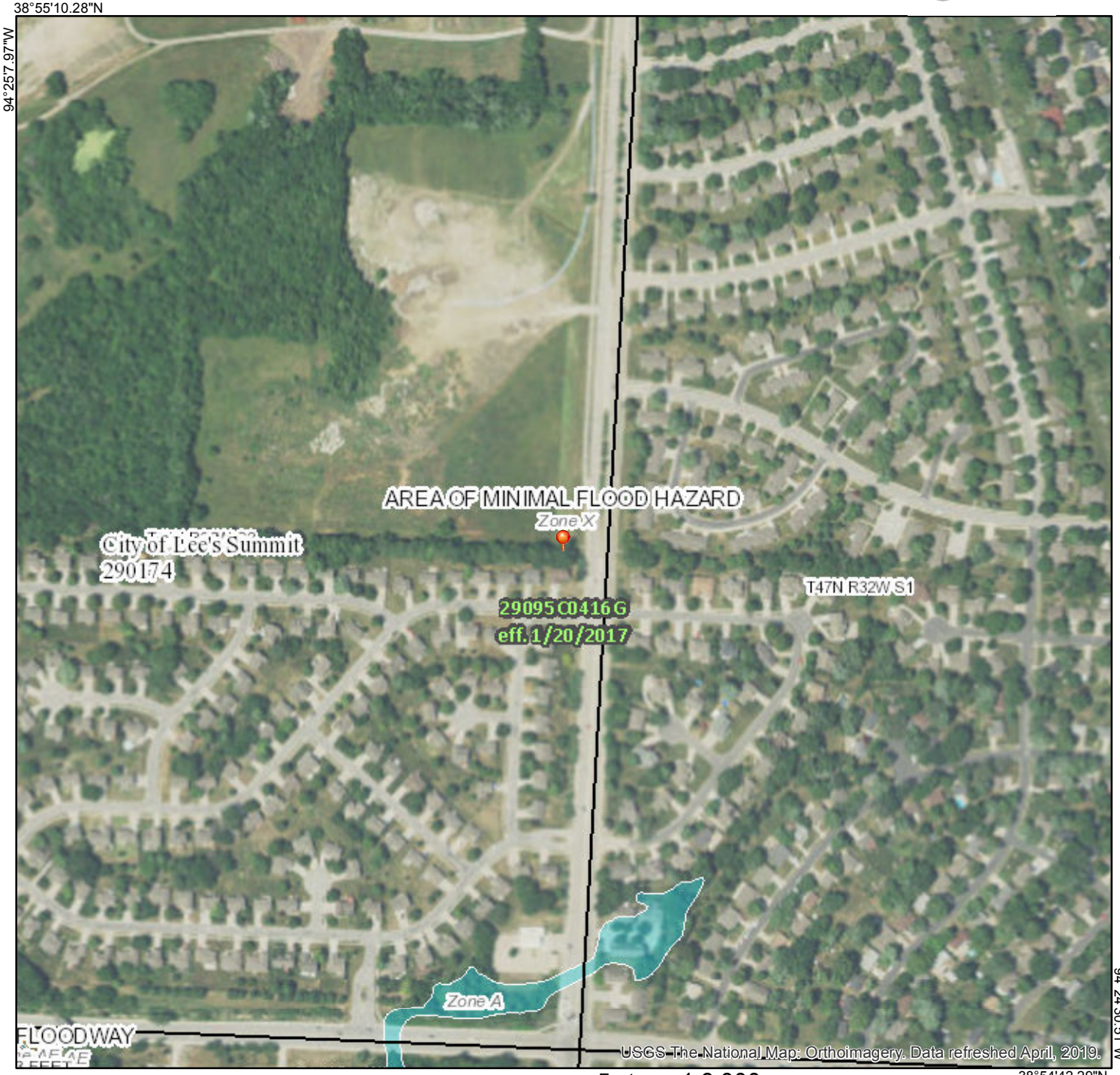
Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

National Flood Hazard Layer FIRMette

FEMA



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 7/9/2019 at 8:48:53 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.