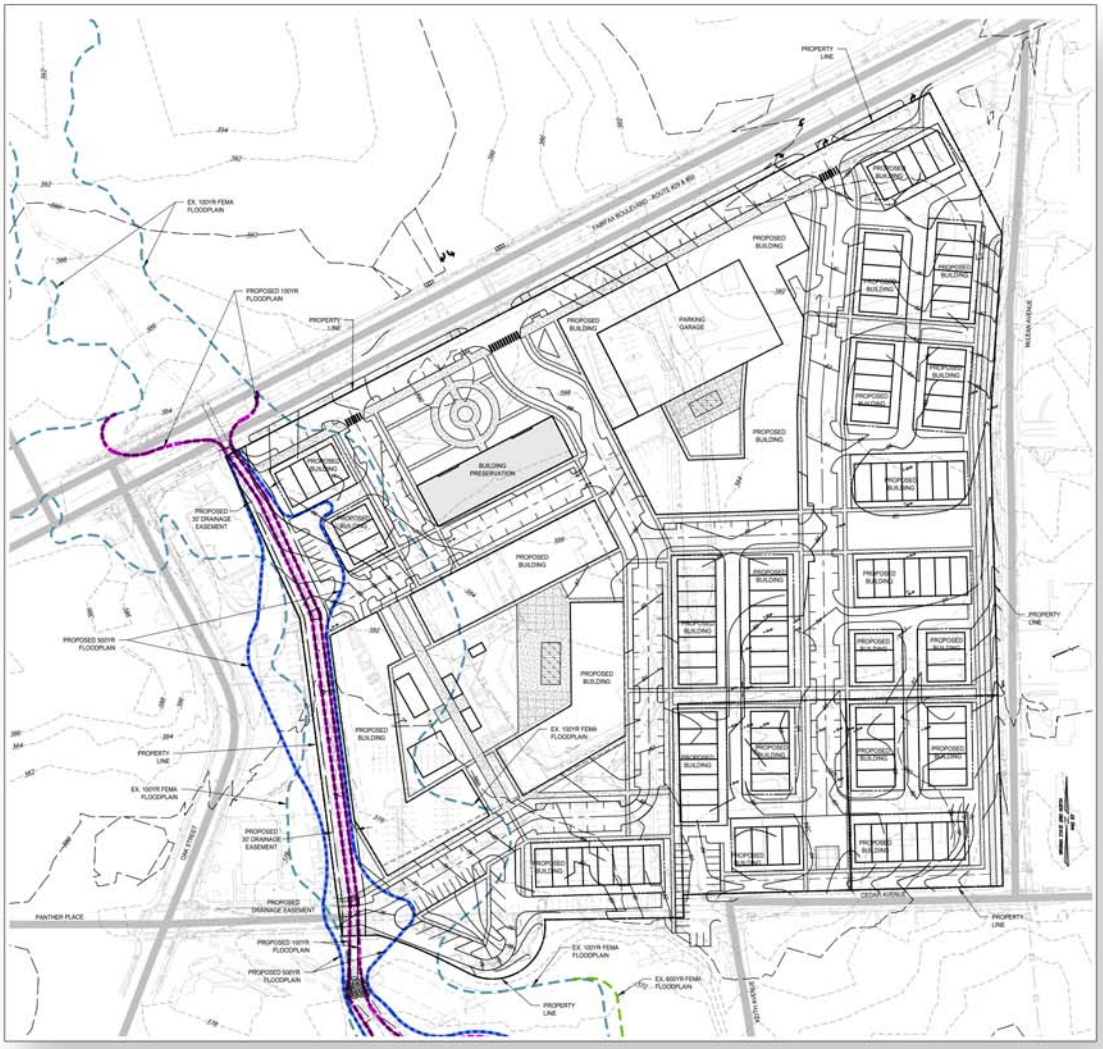
PAUL VI FLOODPLAIN STUDY

PREPARED BY

christopher consultants

engineering · surveying · land planning



christopher Project #15010.003.00

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FLOODPLAIN STUDY NARRATIVE

Floodplain Study Background and Scope

The purpose of this study is to evaluate the existing Federal Emergency Management Agency (FEMA) floodplain along the west side of the Paul VI property and to evaluate proposed improvements associated with the Paul VI Redevelopment Project along the existing floodway. The proposed improvement will be evaluated to assist the City in alleviating the existing flooding problems at an existing storm crossing east of the existing Oak Street intersection with Fairfax Boulevard. As part of this evaluation the study utilizes data from a Draft Preliminary Engineering Report titled Fairfax Blvd. & Oak St. Stormwater Improvements dated June 5, 2015 developed for the City of Fairfax by Woolpert Associates. In addition, data from the FEMA Flood Insurance Study for The City of Fairfax dated June 2, 2006 accompanied by the FEMA provided HECRAS model for Accotink Creek, Tusico Branch was utilized in the development of the existing and proposed hydraulic models for this study.

The Woolpert Study states that "Currently, during relatively small rainfall events flooding occurs along Fairfax Boulevard. Based on our research and investigations this flooding has been caused by increased development upstream of the Fairfax Boulevard stormwater crossing. When this development was constructed in 1998 the crossing of Fairfax Boulevard and the outfall were not upgraded to handle the additional flow. To make the problem worse the original installation of the culvert crossing was not installed properly causing backwater issues at this location". The existing 72"x 48" elliptical corrugated metal pipe, downstream from this crossing, in a 20' drainage easement along the east side of the Paul VI site, is deteriorated and partially blocked in several locations based on the Woolpert investigation as well as observation during the performance of this study. The existing FEMA FIRM Map 5155240001D shows the Paul VI development site is shown in Zone AO which assumes a 2' water depth along the pipe and outfall for the site. FEMA engineering analysis and associated calculated water surface profile elevations end at the existing 72" x 48" CMP outfall just south of Panther Place roadway crossing approximately 570' upstream of Keith Avenue. The existing FEMA 100 and 500 yr. flood plains are shown on the Topographic Work Map Exhibit B for the study with the 100 yr. floodplain continuing through the Paul VI site across Fairfax Boulevard and north into the commercial and residential development based on the Zone AO 2' depth assumptions to its terminus approximately 2,500 lf upstream. The purpose of this study is to only revise the FEMA floodplain associated within the limits of the Paul VI Redevelopment site.

Hydrologic Analysis

Stormwater runoff and associated flows for the 2,10,25, 50,100 and 500 yr. storms were reviewed for the Woolpert study and compared with available flow information downstream at FEMA cross section 2443.764 upstream of the Keith Avenue crossing. The Woolpert study flows were developed using previously approved drainage areas and updated rainfall intensities using the rational runoff method. The FEMA flows were developed using NRCS TR-55 graphical peak discharge methodology and older topographic information from a 2003 FEMA revision study. The comparison shows a discrepancy between the flows at the downstream crossing as shown in Table 1 below.

Table 1

Flow at FEMA XSECTION 2443.764

Interval	christopher	Woolpert	FEMA
	(cfs)	(cfs)	(cfs)
2 Yr.	143	273	N/A
10 Yr.	336	370	650
25 Yr.	489	467	N/A
50 yr.	630	574	970
100 yr.	794	643	1100
500 yr.	1278	N/A	1460

This study developed new hydrologic data and associated drainage mapping included as Exhibit A in Appendix A. The new runoff calculations are based on current 2014 City of Fairfax Topographic information 1 ft. contour interval as well as available GIS data showing the existing storm sewer system for the 0.3 square mile drainage area. In addition, runoff depths and associated rainfall intensities from the 2011 Fairfax County Public Facilities Manual that were verified using available NOAA rainfall in the vicinity of the site were used to generate flows. The flows were developed using NRCS TR-55 model with a Type II 24-hour storm distribution routed through the site using standard methodologies for calculation of time of concentrations and associated soils runoff characteristics. The associated analysis is included in Appendix A of this report and is summarized in Table 2 below. The flows generated for this study fall between the previously developed Woolpert Study and FEMA flows and were used for the hydraulic analysis of the existing and proposed culvert for the outfall along the unnamed tributary of the Tusico Branch of Accotink Creek.

Table 2

Proposed at Cross Section Location Current Study Flows

Interval	2 Yr.	10 Yr.	25 Yr.	50 yr.	100 yr.	500 yr.
Location	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
XSEC 3159	89	222	330	438	548	897
XSEC 3069	89	222	330	438	548	897
XSEC 3009	89	222	330	438	548	897
XSEC 2824	92	229	341	445	565	923
XSEC 2523	92	229	341	445	565	923
XSEC 2443.764	143	336	489	630	794	1278
XSEC 1905	143	336	489	630	794	1278

Hydraulic Analysis

The FEMA provided HECRAS Model for the Accotink Creek, Tusico Branch Unnamed Tributary was used as the basis for the model that was developed for this analysis. The model downstream of Keith Avenue was removed and starting water surfaces at FEMA Section 1905.580 were used as boundary conditions for the model. Existing FEMA cross sections in the stream were verified by survey for this model.

Table 3

Starting WSEL from FEMA Model XSEC 1905.580

Storm Interval	W.S. Elev (ft.)
2 Yr.	369.64
10 Yr.	369.91
25 Yr.	370.14
50 yr.	370.46
100 yr.	370.22
500 yr.	370.46

The stream was modeled using Army Corps of Engineers HECRAS River Analysis System Version 5.0.1. The model was extended above existing FEMA Section 2443.764 at Panther Place and the existing 78”x48” CMP culvert data was added to simulate the existing condition along the stream. Open sections were added at existing drop inlet locations simulating the connections while allowing water to overtop the inlets and flow overland across the surface above. Surveyed topographic information was used to develop cross sections and surface information for the overland flow that was modeled as a bridge deck. Appropriate expansion and contraction values were used to simulate the losses associated with turbulence within a drainage structures connecting to pipe culverts along the floodway. Section locations and alignment information for the existing and proposed condition is shown on the working topographic map included as Exhibit A in Appendix B. Information from the Woolpert study and observed field conditions verified that the existing culvert is deteriorated and has several partially blocked sections from the Fairfax Boulevard crossing to the outfall downstream at Panther Place. The FEMA model “n” values were verified and used along the stream and the “n” values for the CMP were increased for the deteriorated condition. The culvert was modeled as partially blocked based on sediment buildup along the bottom of the existing CMP. The existing conditions model included in Appendix B confirms findings from the Woolpert Study showing that the Fairfax Boulevard culvert crossing floods the roadway in the 2 yr. and larger storm events. The existing 100 yr. floodplain limits shown on the working topographic map are based on FEMA limits assuming a 2’ depth of water along the channel top of bank. In addition, the existing 100 yr. and 500 yr. floodplain was modeled and limits developed to provide a base analysis condition to compare the proposed project improvements to meet FEMA requirements for the CLOMR submission. The analysis of the existing conditions including cross sections and water surface profiles are included in Appendix C of the report.

The City currently has a proposed improvement project upstream of the site to replace the existing elliptical 72"x48" CMP with a '8 x 4' concrete box culvert to reduce flooding at the Fairfax Boulevard crossing. The Fairfax Boulevard & Oak St Stormwater Improvements Phase 1 (state project No.0050-151-R74) will construct approximately 78 LF of box culvert and connect to the existing elliptical pipe upstream of the site. The project is scheduled to begin in the spring of 2017. The Woolpert Study proposed the box culvert improvement along with an 8'x4' future downstream improvement to allow the 25 yr. storm event to pass without causing flooding on the existing roadway to meet VDOT and City of Fairfax Standards for the roadway. The HECRAS model was run with the updated flow information using the proposed 8' x 4 'box and the proposed 10'x 4' box culvert beneath Panther Place. The HECRAS model verified the Woolpert SWM model providing similar relative water surface elevations along the modeled floodway including the 2' freeboard for the 25 yr. event at the Fairfax Boulevard crossing. The calibrated HECRAS model was used to evaluate the existing and proposed conditions within the floodplain on the Paul VI Redevelopment site.

In order to remove the 100 yr. floodplain limits from the site and contain the storm event within the proposed culvert multiple pipe and box culvert options were modeled and reviewed for conformance with site requirements. The proposed culvert would need to minimize on site impacts, be constructible, not require extensive downstream outfall grading and provide the required hydraulic elements to minimize water on the existing and adjacent sites. A 10' x 5' box culvert was chosen to meet the requirements for the site downstream of the proposed City project to the existing outfall at the Tusico Branch and the unnamed tributary to Accotink Creek. The analysis of the proposed 10' x 5' box culvert included in Appendix D is illustrated in plan view in Exhibits B and C with the proposed 100yr and 500yr. floodplain limits depicted on the working topographic map of the site. The model shows that storms up to the 100 yr. event are contained within the box culvert on the site and that there is less than 0.01' of water on the Fairfax Boulevard roadway during that 100 yr. event. A plan and profile of the proposed improvements along with a profile showing proposed WSEL's for the 2yr. -500 yr. events are included as Exhibits D and E in Appendix D.

Summary

The model shows that the proposed City 8' x 4' improvement combined with the proposed 10' x 5' box-culvert from Fairfax Boulevard to the outfall at Tusico Branch and the unnamed tributary of Accotink Creek will contain the 100 yr. storm event on the site and provide improved conditions for the Fairfax Boulevard crossing and adjacent properties. The 100 yr. event WSEL at the Fairfax Boulevard crossing is less than 0.1' depth and the modeled WSEL at Panther place shows 0.2' of depth at the downstream end of the crossing with the 100 yr. floodplain tying into the existing limits just upstream of the Keith Avenue Crossing. The 50 yr. modeled event WSEL at Fairfax Boulevard does not impact the roadway and provides an improved condition for motorists traveling the corridor above the condition provided by the proposed City improvement project using the 8' x 4' box culvert downstream.

Existing and proposed 100 yr. and 500 yr. floodplain limits are included in Appendix B in Exhibits A and B. A sample of the proposed revision to the FEMA FIRM map is included in Appendix D as Exhibit F. Table 4, comparing water surface elevations for existing and proposed model conditions, is shown below to summarize the proposed Paul VI improvements on the existing Fairfax Boulevard crossing. The table shows lowered water surface elevations on the proposed Paul VI redevelopment site, the adjacent land

and upstream properties along the Tusico Branch, and the unnamed tributary to Accotink Creek. WSEL's downstream in the existing channel are not changed based on the proposed modeled condition. Proposed water surface elevations for the 2,10,25,50,100 and 500 yr. events are shown in profile along the Tusico Branch of the unnamed tributary to Accotinnk Creek in Appendix D Exhibit E. The proposed revision to the FEMA map panel is shown in Appendix D Exhibit F.

Table 4
HECRAS Modeled Existing vs Proposed WSEL Comparison Table
Tusico Branch Unnamed Tributary to Accotink Creek

Reach	River Sta	Profile	Q Total (cfs)	Exist W.S. Elev (ft.)	Prop (10x5) W.S. Elev (ft.)	Difference (Prop-Exist) W.S. Elev (ft.)
1	3159	2 yr.	89	384.12	384.25	0.13
1	3159	10 yr.	222	386.87	387.05	0.18
1	3159	25 yr.	330	387.36	387.12	-0.24
1	3159	50 yr.	438	387.51	387.39	-0.12
1	3159	100 yr.	548	387.22	383.23	-3.99
1	3159	500 yr.	897	388.78	384.24	-4.54
1	3115		Culvert			
1	3069	2 yr.	89	383.59	379.89	-3.7
1	3069	10 yr.	222	384.84	381.87	-2.97
1	3069	25 yr.	330	384.93	383.68	-1.25
1	3069	50 yr.	438	384.97	383.96	-1.01
1	3069	100 yr.	548	384.59	383.65	-0.94
1	3069	500 yr.	897	383.73	383.82	0.09
1	3039		Culvert			
1	3009	2 yr.	89	382.11	375.63	-6.48
1	3009	10 yr.	222	384.62	378.99	-5.63
1	3009	25 yr.	330	384.71	380.19	-4.52
1	3009	50 yr.	438	384.68	380.44	-4.24
1	3009	100 yr.	548	384.06	382.29	-1.77
1	3009	500 yr.	897	385.43	383.03	-2.4
1	2916		Culvert			
1	2824	2 yr.	92	379.09	373.34	-5.75

Reach	River Sta	Profile	Q Total (cfs)	Exist W.S. Elev (ft.)	Prop (10x5) W.S. Elev (ft.)	Difference (Prop-Exist) W.S. Elev (ft.)
1	2824	50 yr.	445	381.59	378.08	-3.51
1	2824	100 yr.	565	381.35	375.63	-5.72
1	2824	500 yr.	923	383.32	378.92	-4.4
1	2523	2 yr.	92	374.7	371.11	-3.59
1	2523	10 yr.	229	376.35	372.34	-4.01
1	2523	25 yr.	341	375.9	370.61	-5.29
1	2523	50 yr.	445	375.48	371.07	-4.41
1	2523	100 yr.	565	377.39	375.41	-1.98
1	2523	500 yr.	923	377.78	374.92	-2.86
1	2483		Culvert			
1	2443.764	2 yr.	143	371.08	371.08	0
1	2443.764	10 yr.	336	372.33	372.33	0
1	2443.764	25 yr.	489	372.67	372.67	0
1	2443.764	50 yr.	630	372.87	372.87	0
1	2443.764	100 yr.	794	373.12	373.12	0
1	2443.764	500 yr.	1278	373.56	373.56	0
1	2160.924	2 yr.	143	369.98	369.98	0
1	2160.924	10 yr.	336	370.56	370.56	0
1	2160.924	25 yr.	489	370.79	370.79	0
1	2160.924	50 yr.	630	371	371	0
1	2160.924	100 yr.	794	371.04	371.04	0
1	2160.924	500 yr.	1278	371.36	371.36	0
1	1905.58	2 yr.	143	369.64	369.64	0
1	1905.58	10 yr.	336	369.91	369.91	0
1	1905.58	25 yr.	489	370.14	370.14	0
1	1905.58	50 yr.	630	370.46	370.46	0
1	1905.58	100 yr.	794	370.22	370.22	0
1	1905.58	500 yr.	1278	370.46	370.46	0

The following table is provided to meet item 1 checklist requirements for the City of Fairfax Floodplain Permit Application. A site plan is included in Appendix B for item 2 and the calculations included with this report meet the requirements for a Hydraulic Report listed as item 3 on the report application.

Table 5

Paul VI Redevelopment Plan Checklist
Data Table for 100 Yr. Floodplain Permit Application

	Existing	**Proposed**
Impervious surface in floodplain	2.47 Acres	**0 Acres ***
Area of floodplain vegetation disturbed	2.86 Acres	**0.15 Acres***
Area of floodplain land graded	2.86 Acres	**0.15 Acres ***
Max depth of cut or fill on floodplain land	N/A	1.2 ft. fill
Pre and Post development stream velocities	7.39 ft/s us 6.61 ft/s ds	8.94 ft/s us 5.61 ft/s ds
Base elevation of lowest level (ft.)	381.5	386.0 ff Res 376.0 ff Parking
Market value of existing struct and prop work	$5,345,800	$ 0 *

*** 100 Yr. floodplain contained within 10'x5' box culvert below ground on site**

APPENDIX A

DRAINAGE AREA MAP AND
HYDROLIGIC CALCULATIONS

	Summary Table Storm Event					
Node	2-YR	10-YR	25-YR	50-YR	100-YR	500-YR
1	89	222	330	431	548	897
2	91	228	337	438	557	913
3	92	229	341	445	565	923
4	137	324	471	607	764	1232
5	143	336	489	630	794	1278

All flows are in CFS

PLAN LEGEND

- 20 / 22 : EX. MAJOR / MINOR CONTOUR
- : EX. ROAD CENTERLINE
- : EX. ROW
- : PROPERTY LINE
- : EX. EDGE OF PAVEMENT
- : EX. FENCE (ALL TYPES)
- : APPROX. FLOW PATHS
- : DRAINAGE DIVIDS

JERMANTOWN ROAD
ORCHARD STREET
DRAINAGE BASIN AREA A = 85.69 AC
SHEET FLOW = 150 LF
SHALLOW CONCENTRATED FLOW = 740 LF
CHANNEL FLOW = 4,677 LF
SHEET FLOW = 150 LF
SHALLOW CONCENTRATED FLOW = 570 LF
CHANNEL FLOW = 2,600 LF
DRAINAGE BASIN AREA B = 50.49 AC
WARWICK AVENUE
PROJECT SITE
FAIRFAX BOULEVARD--ROUTE #29 & #50
DRAINAGE BASIN AREA D1 = 2.04 AC
SHEET FLOW = 150 LF
SHALLOW CONCENTRATED FLOW = 256 LF
McLEAN AVENUE
NODE 1
NODE 2
DRAINAGE BASIN AREA D3 = 5.81 AC
SHEET FLOW = 150 LF
SHALLOW CONCENTRATED FLOW = 383 LF
NODE 3
DRAINAGE BASIN AREA D1 = 2.04 AC
CEDAR AVENUE
DRAINAGE BASIN C1 AREA = 11.65 AC
SHEET FLOW = 150 LF
SHALLOW CONCENTRATED FLOW = 920 LF
CHANNEL FLOW = 674 LF
BASIN C2 AREA = 10.35 AC
DRAINAGE BASIN AREA E = 1.38 AC
KEITH AVENUE
OAK STREET
BASIN C3 AREA= 21.00 AC
NODE 4
SHEET FLOW = 150 LF
SHALLOW CONCENTRATED FLOW = 944 LF
NODE 5
SHEET FLOW = 150 LF
SHALLOW CONCENTRATED FLOW = 551 LF
SHEET FLOW = 150 LF
SHALLOW CONCENTRATED FLOW = 555 LF
CHANNEL FLOW = 635 LF
SHEET FLOW = 150 LF
SHALLOW CONCENTRATED FLOW = 1287 LF
SHEET FLOW = 150 LF
SHALLOW CONCENTRATED FLOW = 505 LF
CHANNEL FLOW = 1,1380 LF
BASIN C4 AREA= 4.82 AC

VIRGINIA STATE GRID NORTH
NAD 83

200 100 0 200 400
HORIZONTAL GRAPHIC SCALE
1" = 200'

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EXHIBIT A DRAINAGE AREA MAP

FLOOD PLAIN STUDY
PAUL VI.
FAIRFAX CITY, VIRGINIA

PROJECT NO: 15010.003.00
SCALE:
DATE: 04-14-2017
DESIGN: RH
DRAWN: NM
CHECKED: RH
SHEET No. A 01 OF 6

DWG-107365

TR55 Tc Worksheet

Hyd. No. 1

Northern Basin A

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.17		0.00		0.00		
Land slope (%)	= 0.50		0.00		0.00		
Travel Time (min)	**= 23.71**	**+**	**0.00**	**+**	**0.00**	**=**	**23.71**
Shallow Concentrated Flow							
Flow length (ft)	= 145.00		595.00		0.00		
Watercourse slope (%)	= 1.50		1.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.98		2.03		0.00		
Travel Time (min)	**= 1.22**	**+**	**4.88**	**+**	**0.00**	**=**	**6.10**
Channel Flow							
X sectional flow area (sqft)	= 7.07		20.50		0.00		
Wetted perimeter (ft)	= 9.42		15.70		0.00		
Channel slope (%)	= 1.67		1.25		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=10.59						
			13.28				
					0.00		
Flow length (ft)	({0})3920.0		757.0		0.0		
Travel Time (min)	**= 6.17**	**+**	**0.95**	**+**	**0.00**	**=**	**7.12**

Total Travel Time, Tc ..... 36.90 min

TR55 Tc Worksheet

Hyd. No. 2

DRAINAGE BASISIN AREA B

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.17		0.00		0.00		
Land slope (%)	= 0.50		0.00		0.00		
Travel Time (min)	**= 23.71**	**+**	**0.00**	**+**	**0.00**	**=**	**23.71**
Shallow Concentrated Flow							
Flow length (ft)	= 260.00		310.00		0.00		
Watercourse slope (%)	= 1.00		1.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.61		2.03		0.00		
Travel Time (min)	**= 2.69**	**+**	**2.54**	**+**	**0.00**	**=**	**5.23**
Channel Flow							
X sectional flow area (sqft)	= 3.14		3.14		0.00		
Wetted perimeter (ft)	= 6.28		6.28		0.00		
Channel slope (%)	= 1.39		1.18		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=7.36						
			6.78				
					0.00		
Flow length (ft)	({0})2103.0		497.0		0.0		
Travel Time (min)	**= 4.76**	**+**	**1.22**	**+**	**0.00**	**=**	**5.98**

Total Travel Time, Tc ..... 34.90 min

TR55 Tc Worksheet

Hyd. No. 5

Drianage Basin D1

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.17		0.00		0.00		
Land slope (%)	= 1.16		0.00		0.00		
Travel Time (min)	**= 16.93**	**+**	**0.00**	**+**	**0.00**	**=**	**16.93**
Shallow Concentrated Flow							
Flow length (ft)	= 256.00		0.00		0.00		
Watercourse slope (%)	= 1.31		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.85		0.00		0.00		
Travel Time (min)	**= 2.31**	**+**	**0.00**	**+**	**0.00**	**=**	**2.31**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 19.20 min

TR55 Tc Worksheet

Hyd. No. 8

DRAINAGE BASIN AREA D2

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 75.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.17		0.00		0.00		
Land slope (%)	= 1.35		0.00		0.00		
Travel Time (min)	**= 9.15**	**+**	**0.00**	**+**	**0.00**	**=**	**9.15**
Shallow Concentrated Flow							
Flow length (ft)	= 383.00		0.00		0.00		
Watercourse slope (%)	= 1.49		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	=2.48		0.00		0.00		
Travel Time (min)	**= 2.57**	**+**	**0.00**	**+**	**0.00**	**=**	**2.57**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 11.70 min

TR55 Tc Worksheet

Hyd. No. 11

DRAINAGE BASIN AREA D3

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.17		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 17.97**	**+**	**0.00**	**+**	**0.00**	**=**	**17.97**
Shallow Concentrated Flow							
Flow length (ft)	= 944.00		0.00		0.00		
Watercourse slope (%)	= 1.60		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.04		0.00		0.00		
Travel Time (min)	**= 7.71**	**+**	**0.00**	**+**	**0.00**	**=**	**7.71**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 25.70 min

TR55 Tc Worksheet

Hyd. No. 13

DRAINAGE BASIN AREA C1

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.17		0.00		0.00		
Land slope (%)	= 4.28		0.00		0.00		
Travel Time (min)	**= 10.04**	**+**	**0.00**	**+**	**0.00**	**=**	**10.04**
Shallow Concentrated Flow							
Flow length (ft)	= 920.00		0.00		0.00		
Watercourse slope (%)	= 2.66		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.63		0.00		0.00		
Travel Time (min)	**= 5.83**	**+**	**0.00**	**+**	**0.00**	**=**	**5.83**
Channel Flow							
X sectional flow area (sqft)	= 3.14		0.00		0.00		
Wetted perimeter (ft)	= 6.28		0.00		0.00		
Channel slope (%)	= 1.98		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=8.78						
			0.00				
					0.00		
Flow length (ft)	({0})674.0		0.0		0.0		
Travel Time (min)	**= 1.28**	**+**	**0.00**	**+**	**0.00**	**=**	**1.28**

Total Travel Time, Tc ..... 17.10 min

TR55 Tc Worksheet

Hyd. No. 14

DRAINAGE BASIN AREA C2

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.17		0.00		0.00		
Land slope (%)	= 1.81		0.00		0.00		
Travel Time (min)	**= 14.17**	**+**	**0.00**	**+**	**0.00**	**=**	**14.17**
Shallow Concentrated Flow							
Flow length (ft)	= 555.00		0.00		0.00		
Watercourse slope (%)	= 2.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.28		0.00		0.00		
Travel Time (min)	**= 4.05**	**+**	**0.00**	**+**	**0.00**	**=**	**4.05**
Channel Flow							
X sectional flow area (sqft)	= 3.14		0.00		0.00		
Wetted perimeter (ft)	= 6.28		0.00		0.00		
Channel slope (%)	= 1.98		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=8.78						
			0.00				
					0.00		
Flow length (ft)	({0})635.0		0.0		0.0		
Travel Time (min)	**= 1.20**	**+**	**0.00**	**+**	**0.00**	**=**	**1.20**

Total Travel Time, Tc ..... 19.40 min

TR55 Tc Worksheet

Hyd. No. 16

DRAINAGE BASIN AREA C3

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.17		0.00		0.00		
Land slope (%)	= 1.81		0.00		0.00		
Travel Time (min)	**= 14.17**	**+**	**0.00**	**+**	**0.00**	**=**	**14.17**
Shallow Concentrated Flow							
Flow length (ft)	= 505.00		0.00		0.00		
Watercourse slope (%)	= 2.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.28		0.00		0.00		
Travel Time (min)	**= 3.69**	**+**	**0.00**	**+**	**0.00**	**=**	**3.69**
Channel Flow							
X sectional flow area (sqft)	= 3.14		0.00		0.00		
Wetted perimeter (ft)	= 6.28		0.00		0.00		
Channel slope (%)	= 2.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=8.83						
			0.00				
					0.00		
Flow length (ft)	({0})1138.0		0.0		0.0		
Travel Time (min)	**= 2.15**	**+**	**0.00**	**+**	**0.00**	**=**	**2.15**

Total Travel Time, Tc ..... 20.00 min

TR55 Tc Worksheet

Hyd. No. 19

DRAINAGE BASIN AREA C4

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.17		0.00		0.00		
Land slope (%)	= 1.83		0.00		0.00		
Travel Time (min)	**= 14.11**	**+**	**0.00**	**+**	**0.00**	**=**	**14.11**
Shallow Concentrated Flow							
Flow length (ft)	= 1287.00		0.00		0.00		
Watercourse slope (%)	= 4.20		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=3.31		0.00		0.00		
Travel Time (min)	**= 6.49**	**+**	**0.00**	**+**	**0.00**	**=**	**6.49**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 20.60 min

TR55 Tc Worksheet

Hyd. No. 20

DRAINAGE BASIN AREA E

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.17		0.00		0.00		
Land slope (%)	= 1.25		0.00		0.00		
Travel Time (min)	**= 16.43**	**+**	**0.00**	**+**	**0.00**	**=**	**16.43**
Shallow Concentrated Flow							
Flow length (ft)	= 551.00		0.00		0.00		
Watercourse slope (%)	= 3.17		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.87		0.00		0.00		
Travel Time (min)	**= 3.20**	**+**	**0.00**	**+**	**0.00**	**=**	**3.20**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 19.60 min

Hydrograph Report

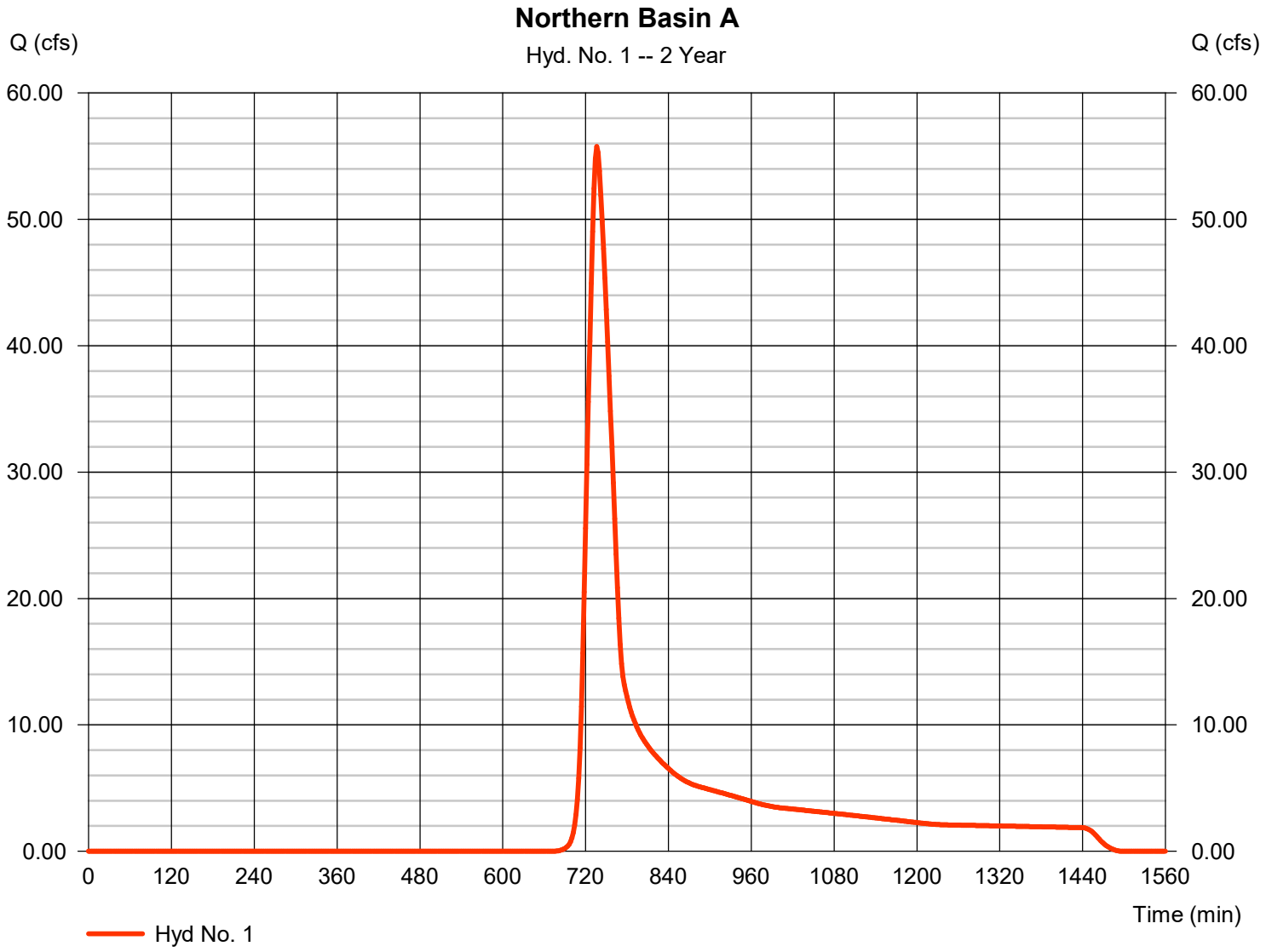
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Thursday, 02 / 2 / 2017

Hyd. No. 1

Northern Basin A

Hydrograph type	= SCS Runoff	Peak discharge	= 55.77 cfs
Storm frequency	= 2 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 280,182 cuft
Drainage area	= 85.690 ac	Curve number	= 72*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 36.90 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(45.470 x 70) + (9.460 x 92) + (30.760 x 70)] / 85.690



Hydrograph Report

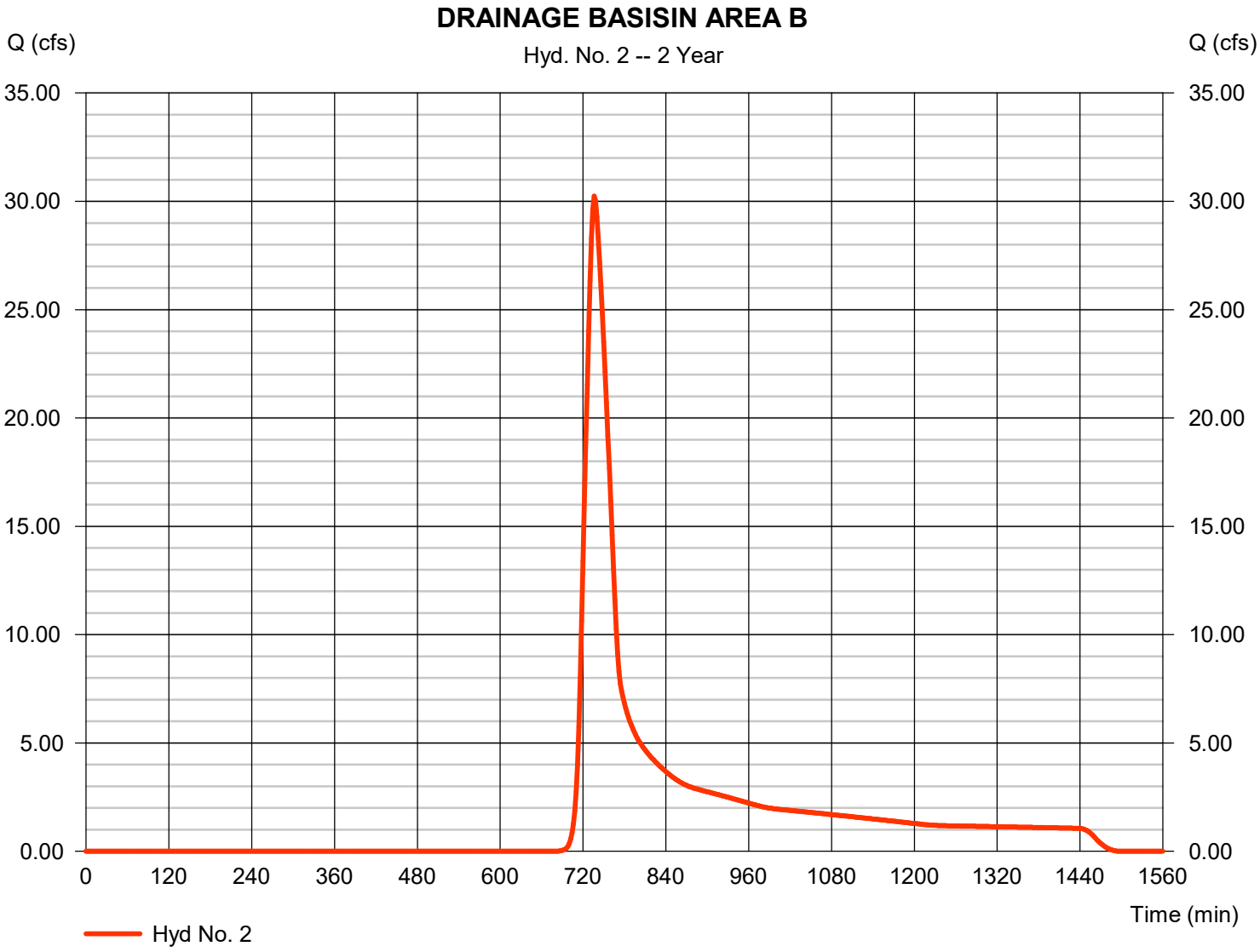
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Thursday, 02 / 2 / 2017

Hyd. No. 2

DRAINAGE BASISIN AREA B

Hydrograph type	= SCS Runoff	Peak discharge	= 30.24 cfs
Storm frequency	= 2 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 154,738 cuft
Drainage area	= 50.130 ac	Curve number	= 71*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 34.90 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(3.260 x 92) + (46.870 x 70)] / 50.130

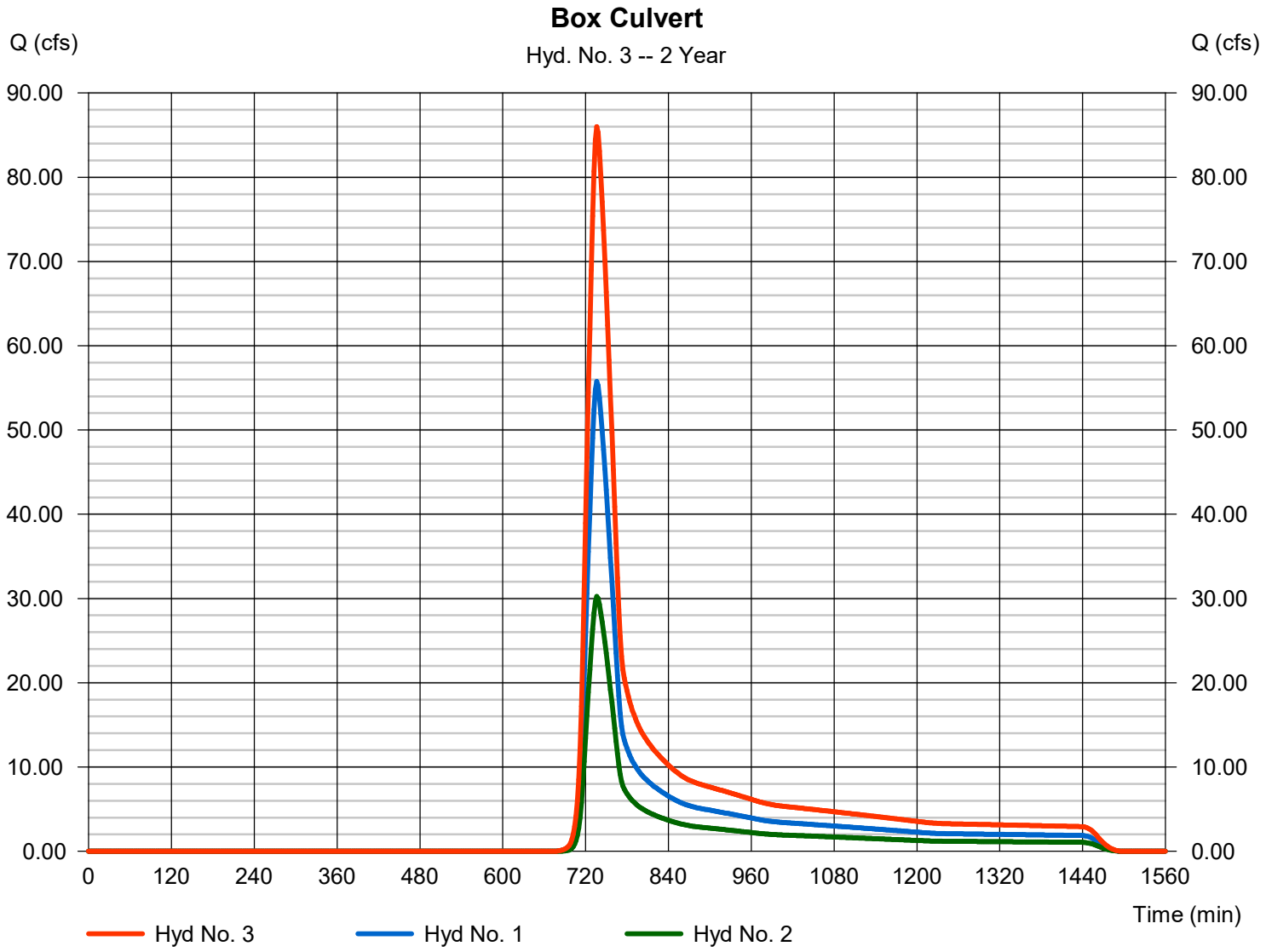


Hydrograph Report

Hyd. No. 3

Box Culvert

Hydrograph type	= Combine	Peak discharge	= 86.01 cfs
Storm frequency	= 2 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 434,920 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 135.820 ac



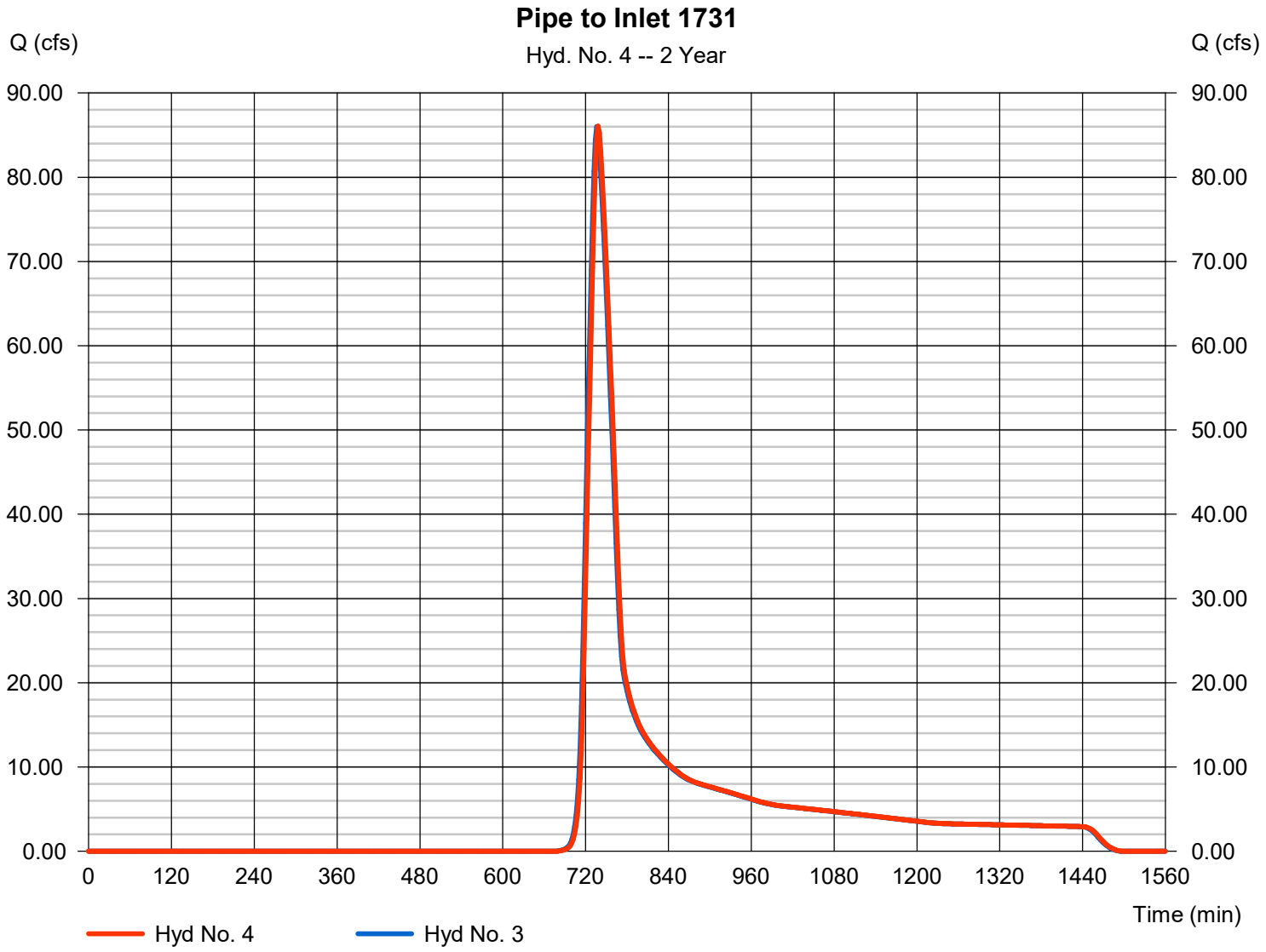
Hydrograph Report

Hyd. No. 4

Pipe to Inlet 1731

Hydrograph type	=	Reach	Peak discharge	=	86.07 cfs
Storm frequency	=	2 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	434,920 cuft
Inflow hyd. No.	=	3 - Box Culvert	Section type	=	Circular
Reach length	=	299.0 ft	Channel slope	=	0.7 %
Manning's n	=	0.013	Bottom width	=	5.0 ft
Side slope	=	0.0:1	Max. depth	=	0.0 ft
Rating curve x	=	6.957	Rating curve m	=	1.250
Ave. velocity	=	0.00 ft/s	Routing coeff.	=	1.0470

Modified Att-Kin routing method used.



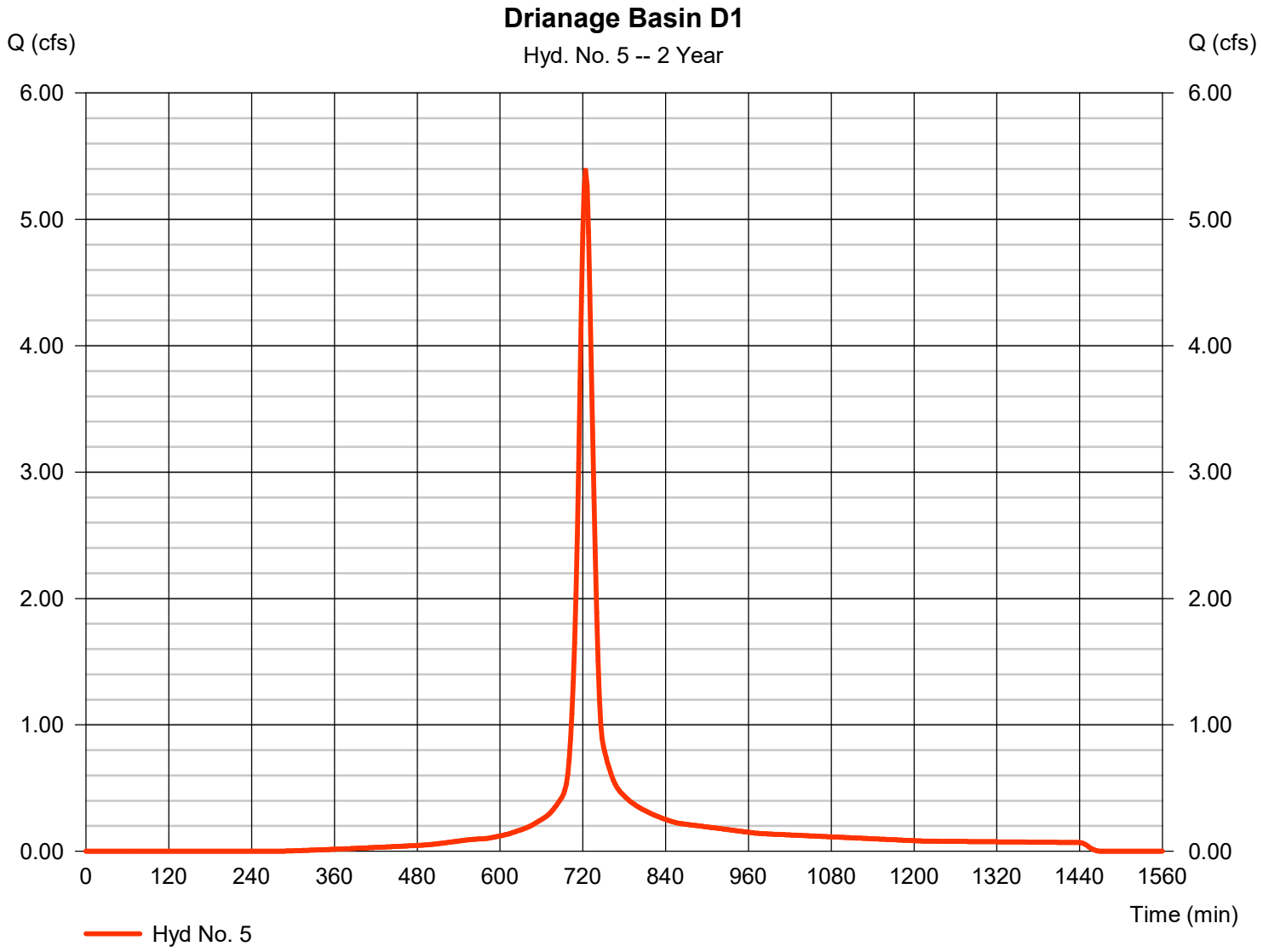
Hydrograph Report

Hyd. No. 5

Drianage Basin D1

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.389 cfs
Storm frequency	=	2 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	17,196 cuft
Drainage area	=	2.040 ac	Curve number	=	92*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	19.20 min
Total precip.	=	3.17 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.040 x 92)] / 2.040

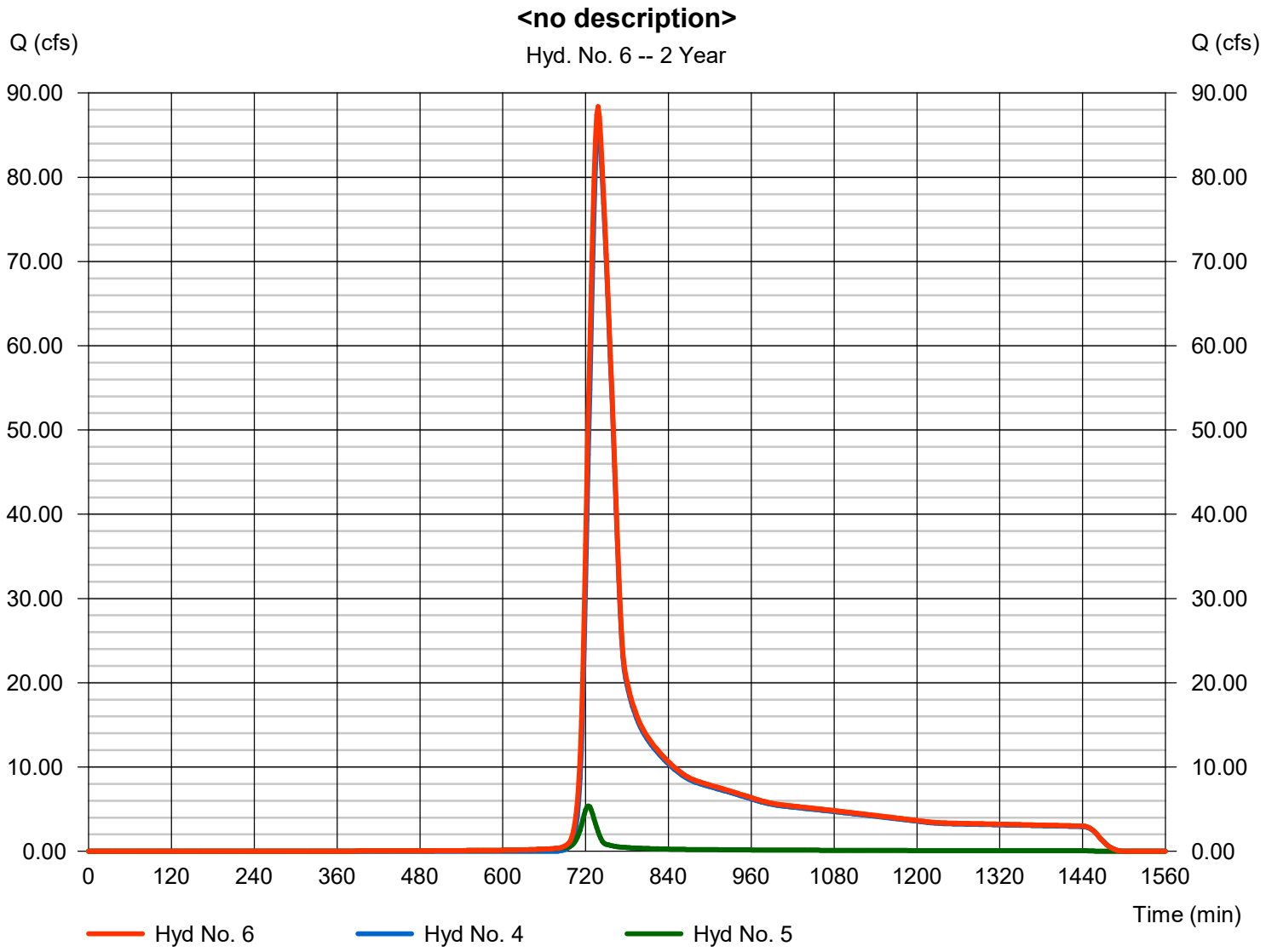


Hydrograph Report

Hyd. No. 6

<no description>

Hydrograph type	= Combine	Peak discharge	= 88.40 cfs
Storm frequency	= 2 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 452,116 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 2.040 ac



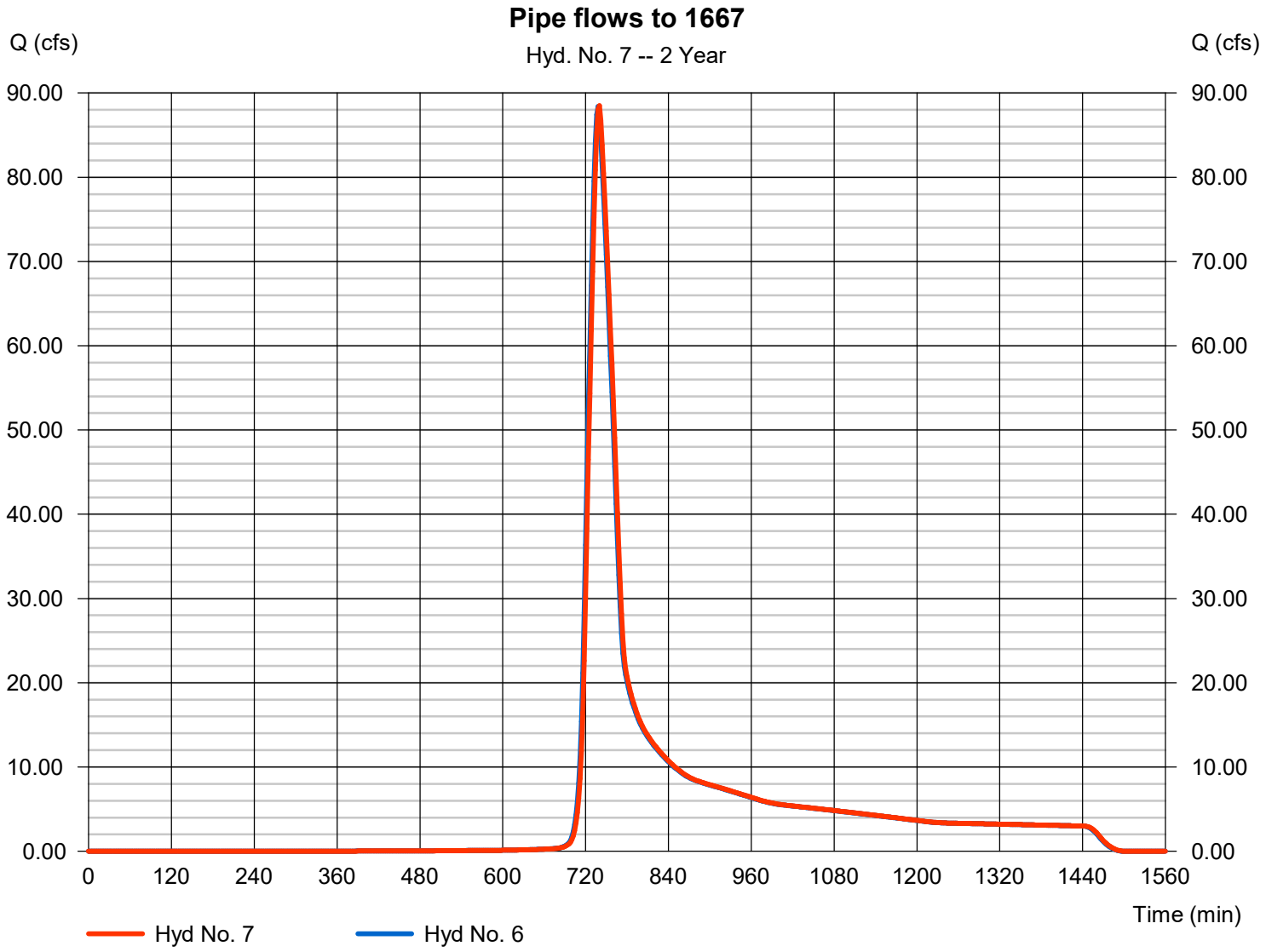
Hydrograph Report

Hyd. No. 7

Pipe flows to 1667

Hydrograph type	= Reach	Peak discharge	= 88.50 cfs
Storm frequency	= 2 yrs	Time to peak	= 740 min
Time interval	= 2 min	Hyd. volume	= 452,115 cuft
Inflow hyd. No.	= 6 - <no description>	Section type	= Circular
Reach length	= 177.0 ft	Channel slope	= 1.5 %
Manning's n	= 0.015	Bottom width	= 5.0 ft
Side slope	= 0.0:1	Max. depth	= 0.0 ft
Rating curve x	= 8.613	Rating curve m	= 1.250
Ave. velocity	= 0.00 ft/s	Routing coeff.	= 1.3122

Modified Att-Kin routing method used.



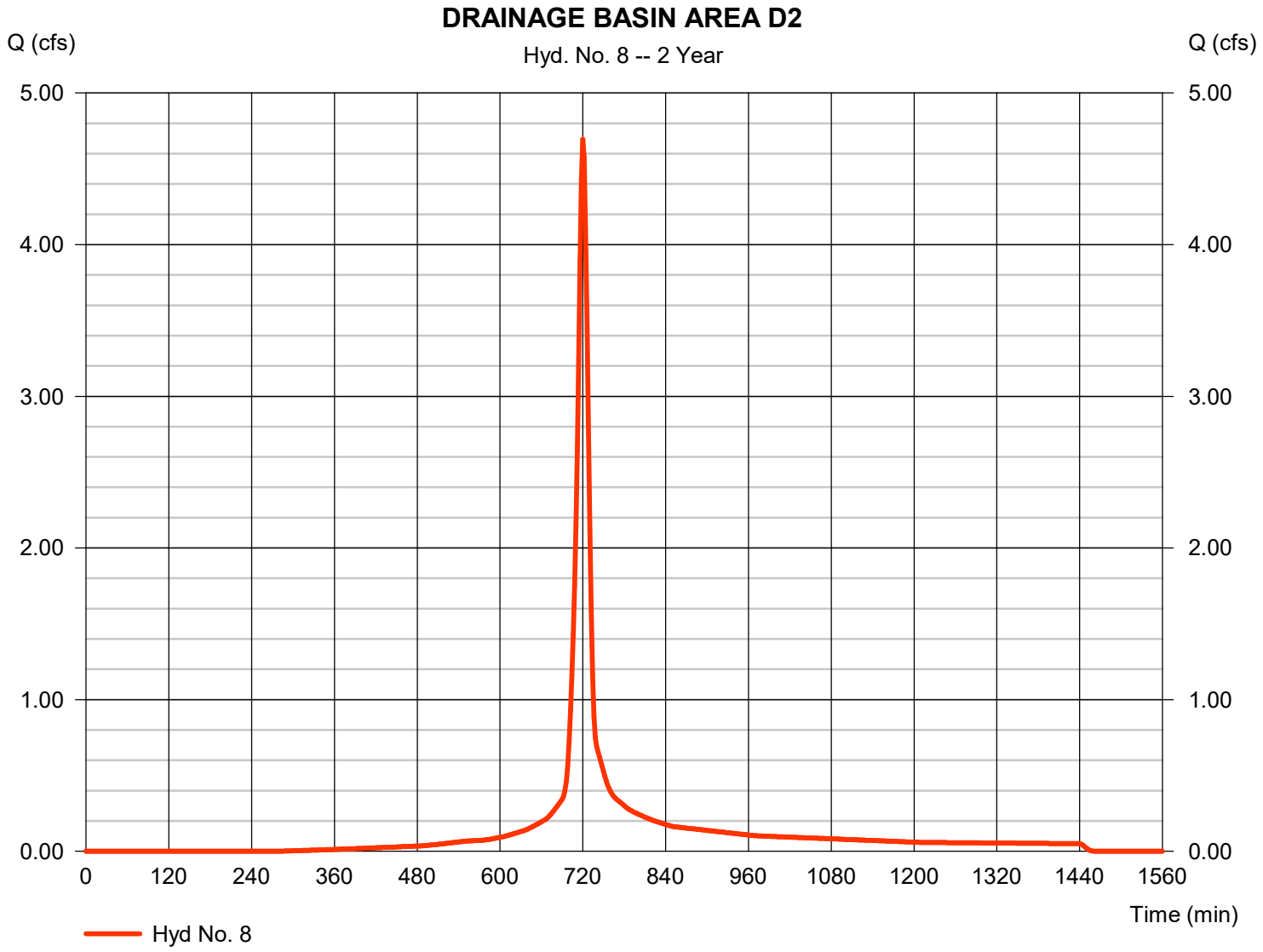
Hydrograph Report

Hyd. No. 8

DRAINAGE BASIN AREA D2

Hydrograph type	= SCS Runoff	Peak discharge	= 4.696 cfs
Storm frequency	= 2 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 12,518 cuft
Drainage area	= 1.440 ac	Curve number	= 92*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 11.70 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.440 x 92)] / 1.440

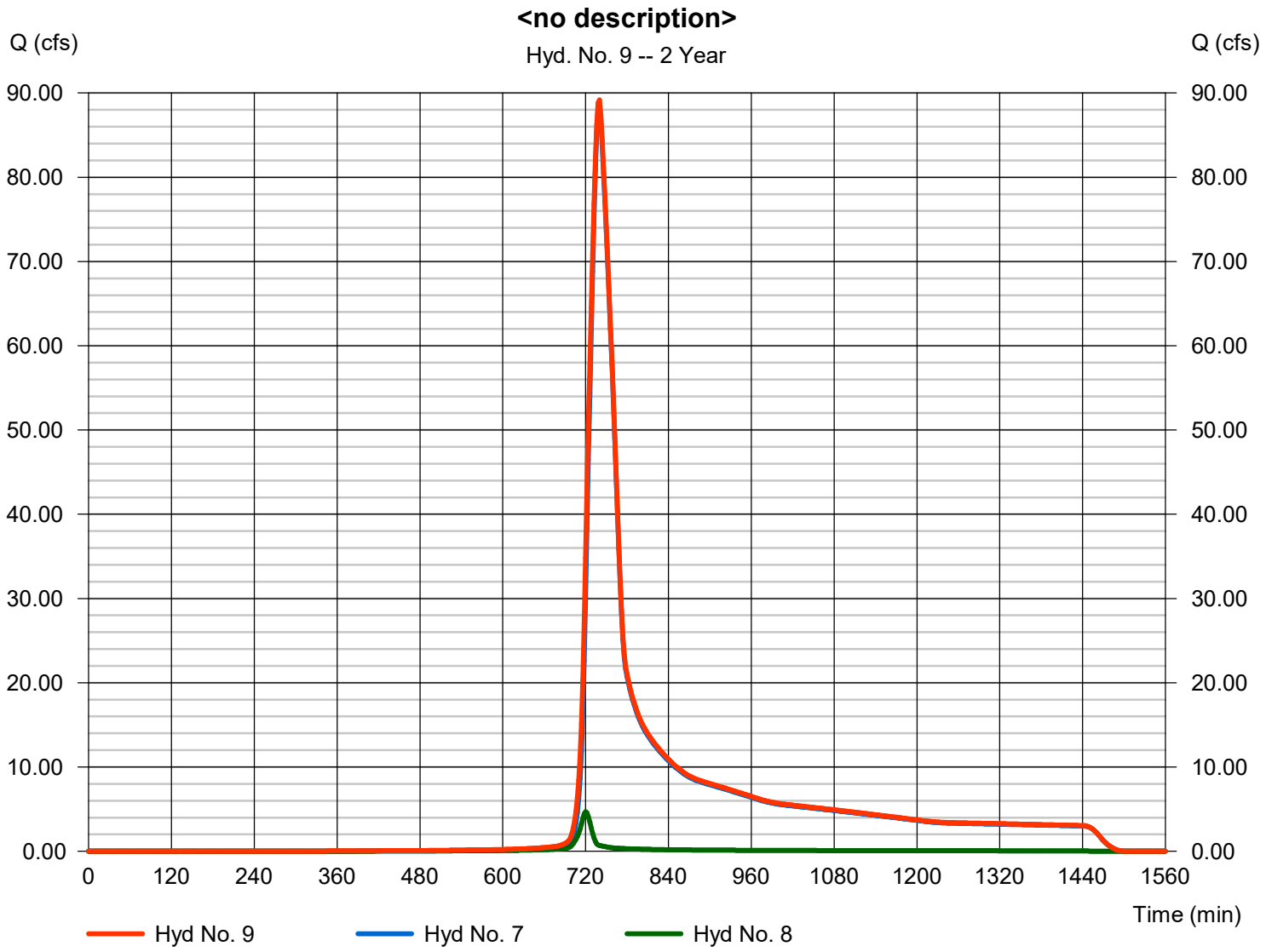


Hydrograph Report

Hyd. No. 9

<no description>

Hydrograph type	= Combine	Peak discharge	= 89.19 cfs
Storm frequency	= 2 yrs	Time to peak	= 740 min
Time interval	= 2 min	Hyd. volume	= 464,633 cuft
Inflow hyds.	= 7, 8	Contrib. drain. area	= 1.440 ac



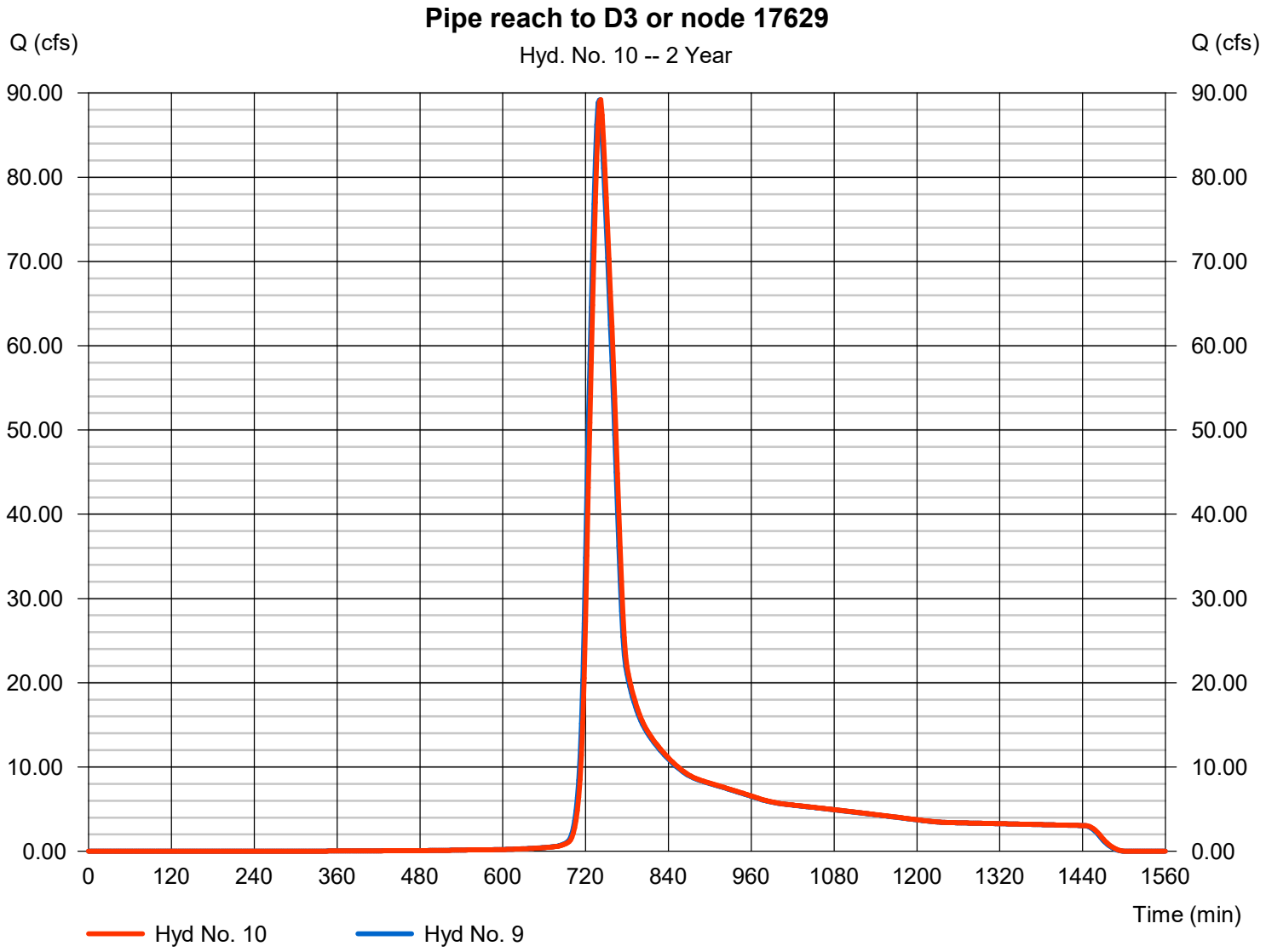
Hydrograph Report

Hyd. No. 10

Pipe reach to D3 or node 17629

Hydrograph type	= Reach	Peak discharge	= 89.20 cfs
Storm frequency	= 2 yrs	Time to peak	= 742 min
Time interval	= 2 min	Hyd. volume	= 464,633 cuft
Inflow hyd. No.	= 9 - <no description>	Section type	= Circular
Reach length	= 317.0 ft	Channel slope	= 1.5 %
Manning's n	= 0.015	Bottom width	= 5.0 ft
Side slope	= 0.0:1	Max. depth	= 0.0 ft
Rating curve x	= 8.613	Rating curve m	= 1.250
Ave. velocity	= 0.00 ft/s	Routing coeff.	= 1.0360

Modified Att-Kin routing method used.



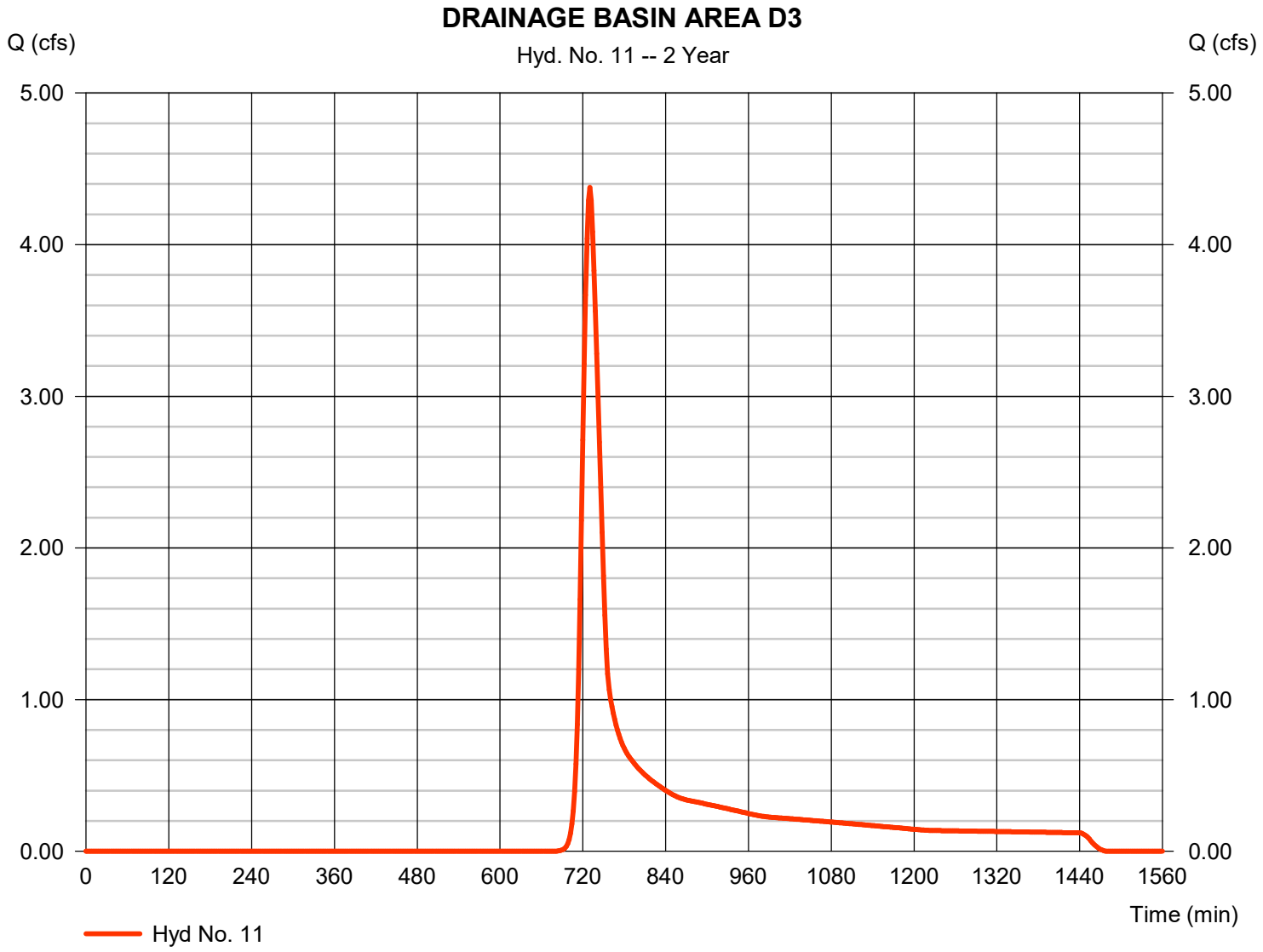
Hydrograph Report

Hyd. No. 11

DRAINAGE BASIN AREA D3

Hydrograph type	= SCS Runoff	Peak discharge	= 4.377 cfs
Storm frequency	= 2 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 17,857 cuft
Drainage area	= 5.810 ac	Curve number	= 71*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 25.70 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.340 x 92) + (5.470 x 70)] / 5.810

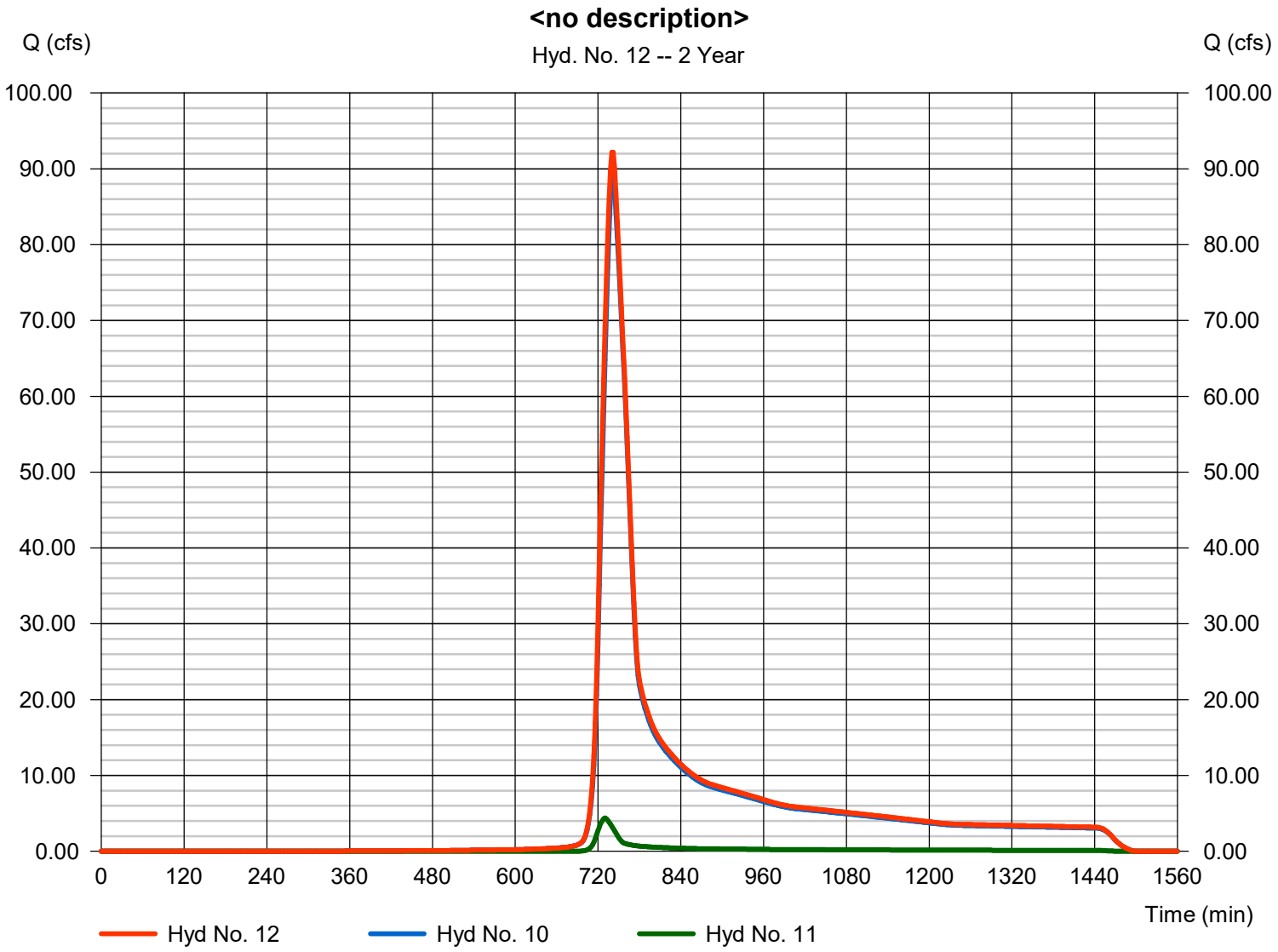


Hydrograph Report

Hyd. No. 12

<no description>

Hydrograph type	= Combine	Peak discharge	= 92.19 cfs
Storm frequency	= 2 yrs	Time to peak	= 740 min
Time interval	= 2 min	Hyd. volume	= 482,489 cuft
Inflow hyds.	= 10, 11	Contrib. drain. area	= 5.810 ac



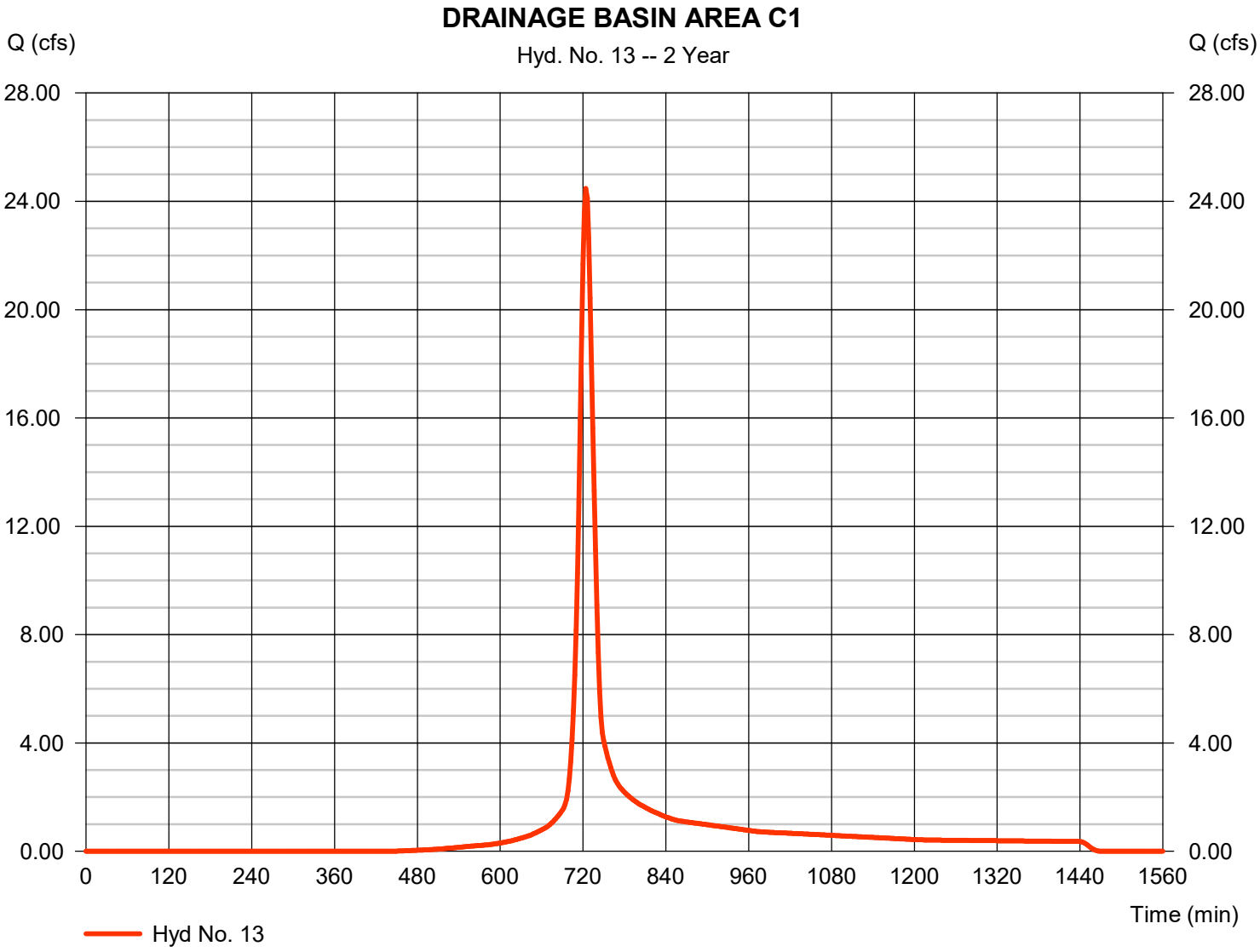
Hydrograph Report

Hyd. No. 13

DRAINAGE BASIN AREA C1

Hydrograph type	= SCS Runoff	Peak discharge	= 24.47 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 76,504 cuft
Drainage area	= 11.650 ac	Curve number	= 86*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.10 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(8.240 x 92) + (3.410 x 70)] / 11.650



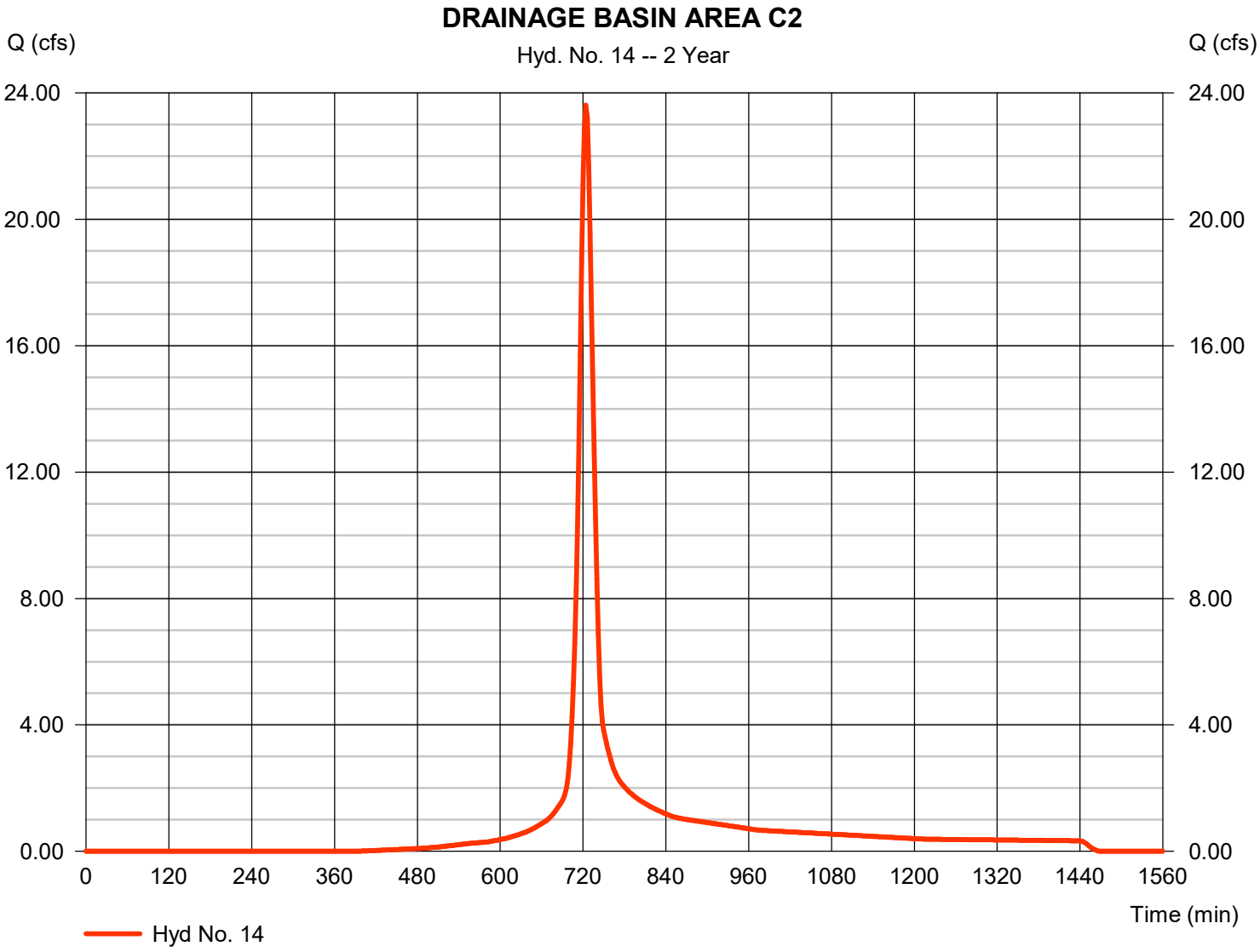
Hydrograph Report

Hyd. No. 14

DRAINAGE BASIN AREA C2

Hydrograph type	= SCS Runoff	Peak discharge	= 23.62 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 74,016 cuft
Drainage area	= 10.350 ac	Curve number	= 88*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 19.40 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(8.270 x 92) + (2.080 x 70)] / 10.350

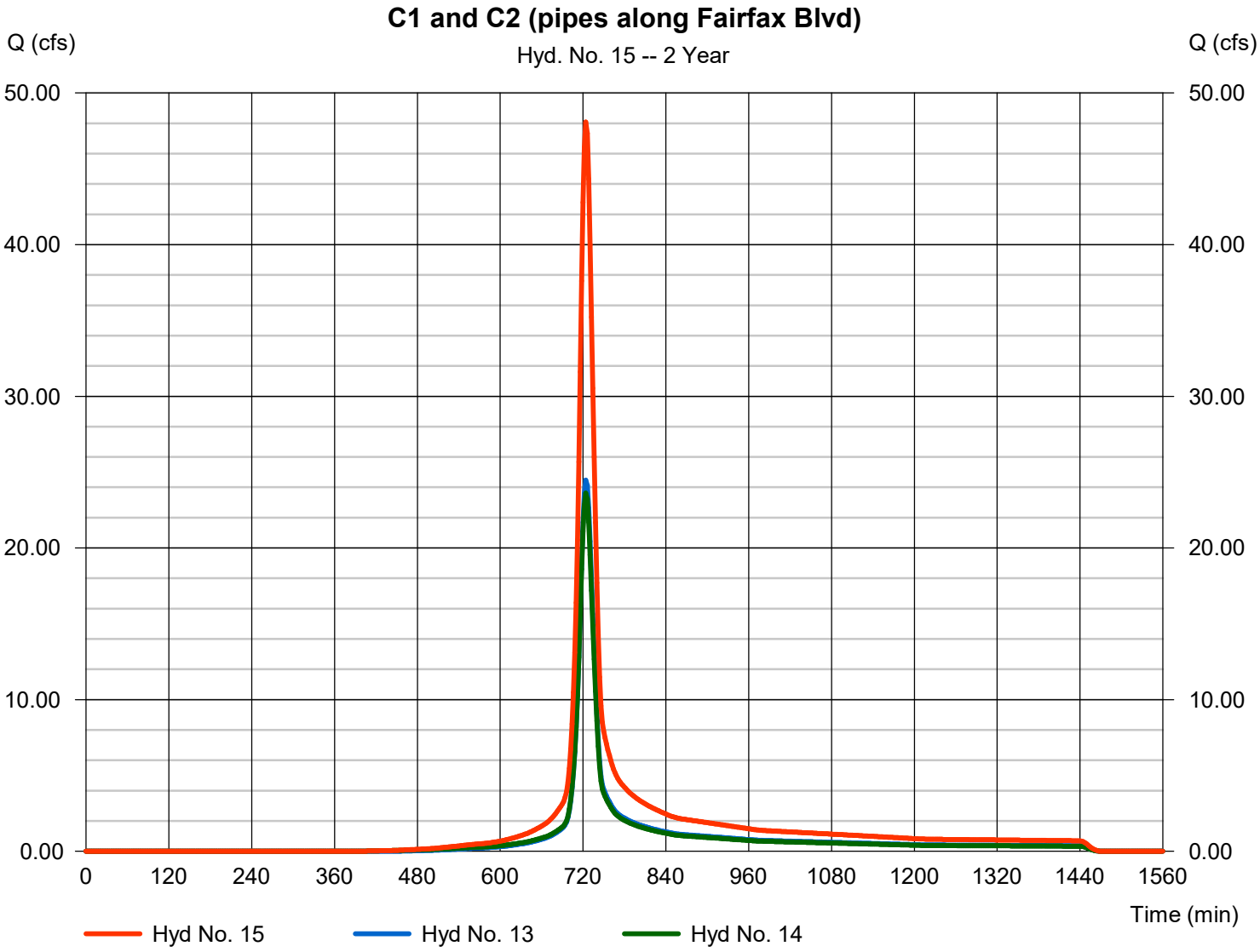


Hydrograph Report

Hyd. No. 15

C1 and C2 (pipes along Fairfax Blvd)

Hydrograph type	= Combine	Peak discharge	= 48.09 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 150,520 cuft
Inflow hyds.	= 13, 14	Contrib. drain. area	= 22.000 ac



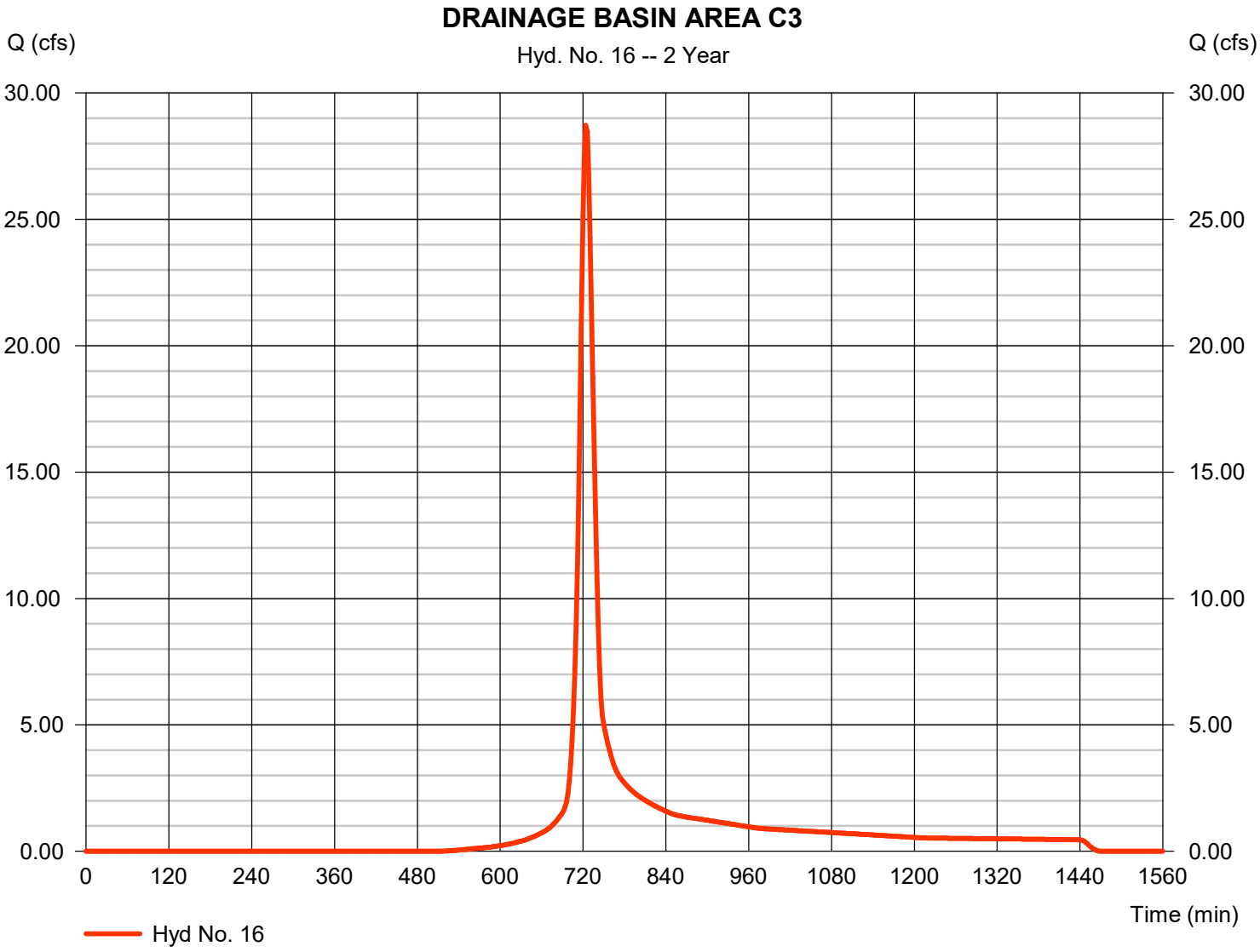
Hydrograph Report

Hyd. No. 16

DRAINAGE BASIN AREA C3

Hydrograph type	=	SCS Runoff	Peak discharge	=	28.72 cfs
Storm frequency	=	2 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	90,077 cuft
Drainage area	=	15.660 ac	Curve number	=	83*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	20.00 min
Total precip.	=	3.17 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(9.340 x 92) + (6.320 x 70)] / 15.660

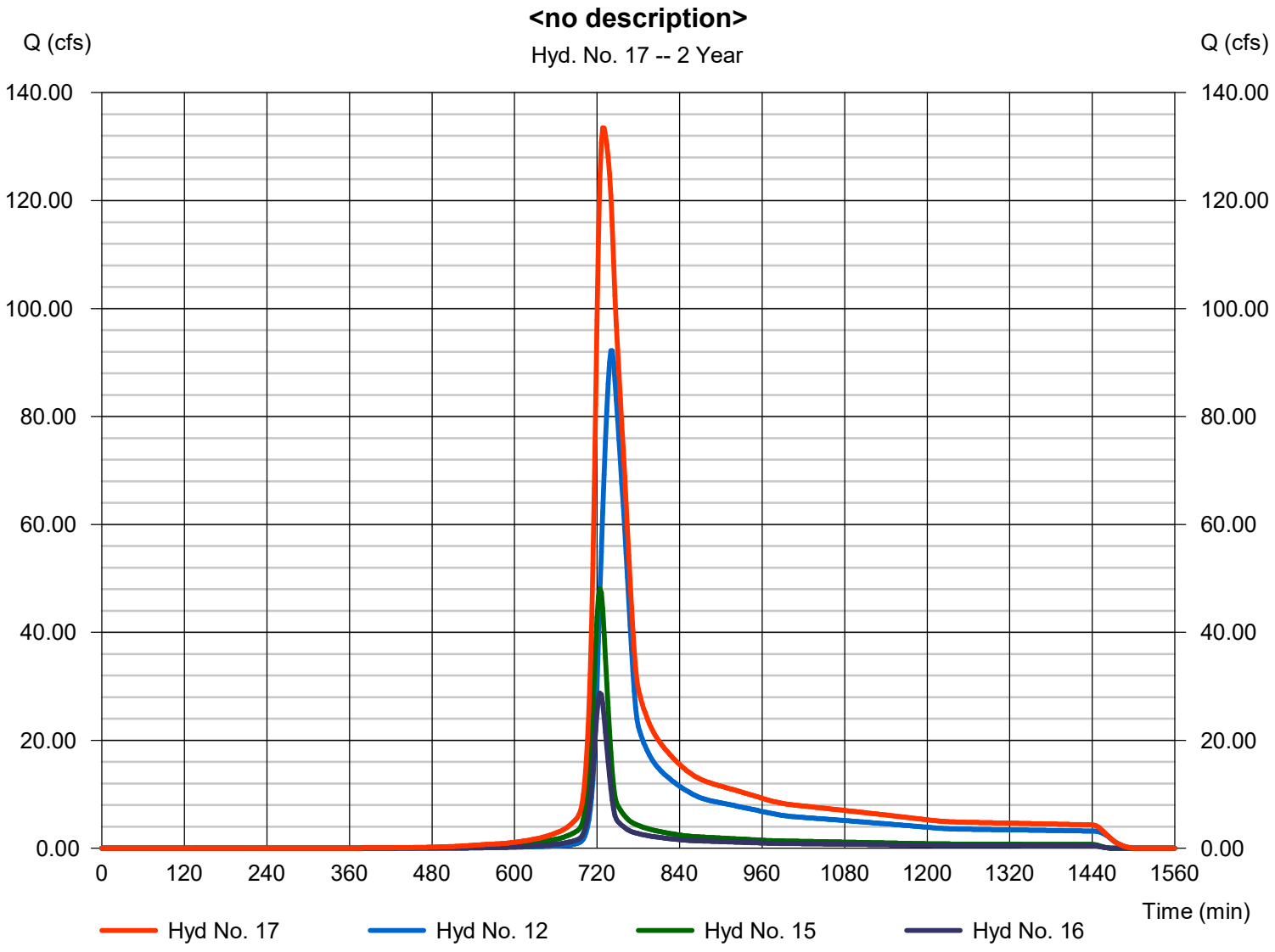


Hydrograph Report

Hyd. No. 17

<no description>

Hydrograph type	=	Combine	Peak discharge	=	133.48 cfs
Storm frequency	=	2 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	723,087 cuft
Inflow hyds.	=	12, 15, 16	Contrib. drain. area	=	15.660 ac



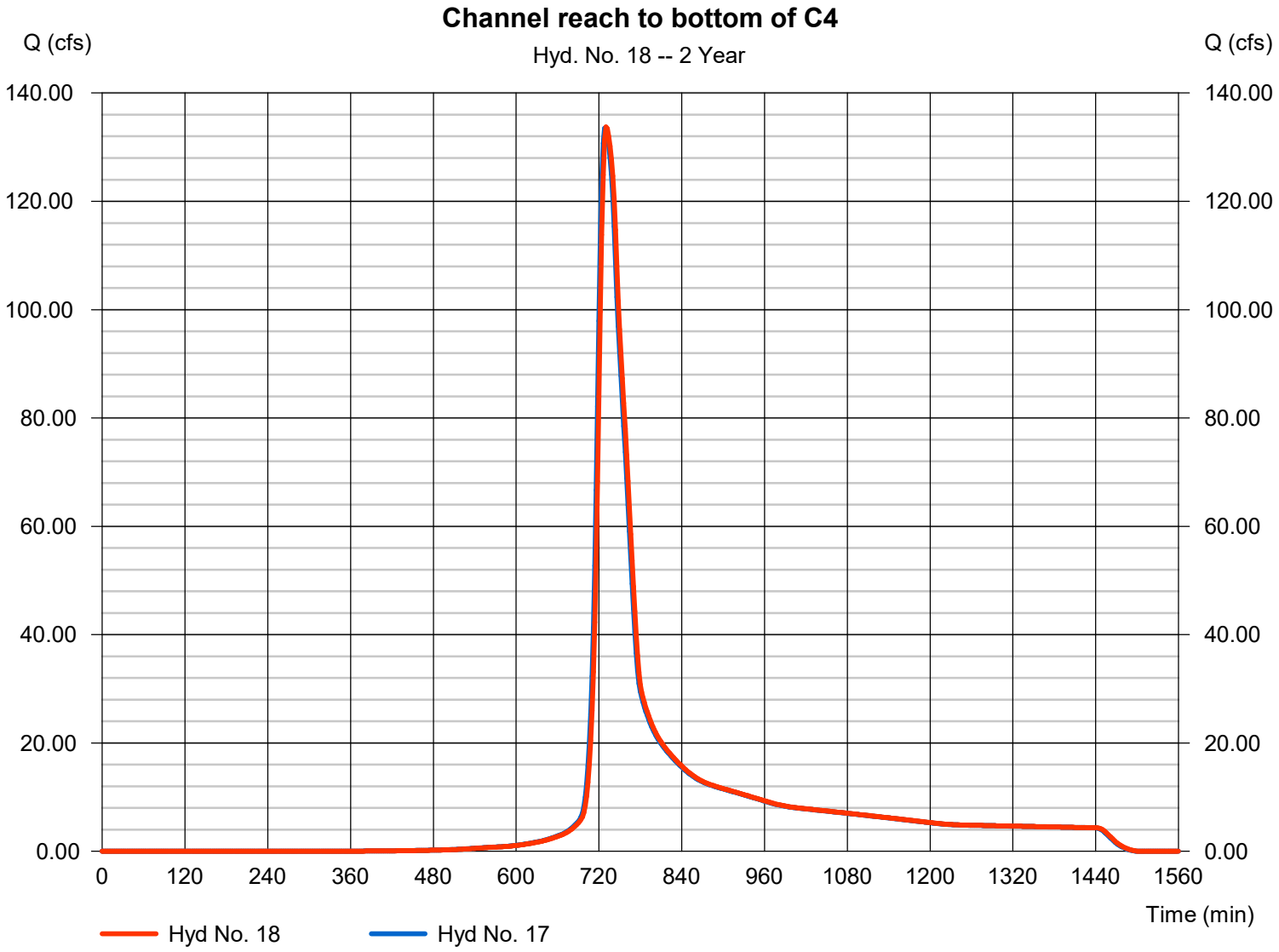
Hydrograph Report

Hyd. No. 18

Channel reach to bottom of C4

Hydrograph type	=	Reach	Peak discharge	=	133.74 cfs
Storm frequency	=	2 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	723,087 cuft
Inflow hyd. No.	=	17 - <no description>	Section type	=	Trapezoidal
Reach length	=	259.0 ft	Channel slope	=	1.8 %
Manning's n	=	0.040	Bottom width	=	14.0 ft
Side slope	=	3.0:1	Max. depth	=	3.0 ft
Rating curve x	=	0.852	Rating curve m	=	1.429
Ave. velocity	=	0.00 ft/s	Routing coeff.	=	1.1260

Modified Att-Kin routing method used.



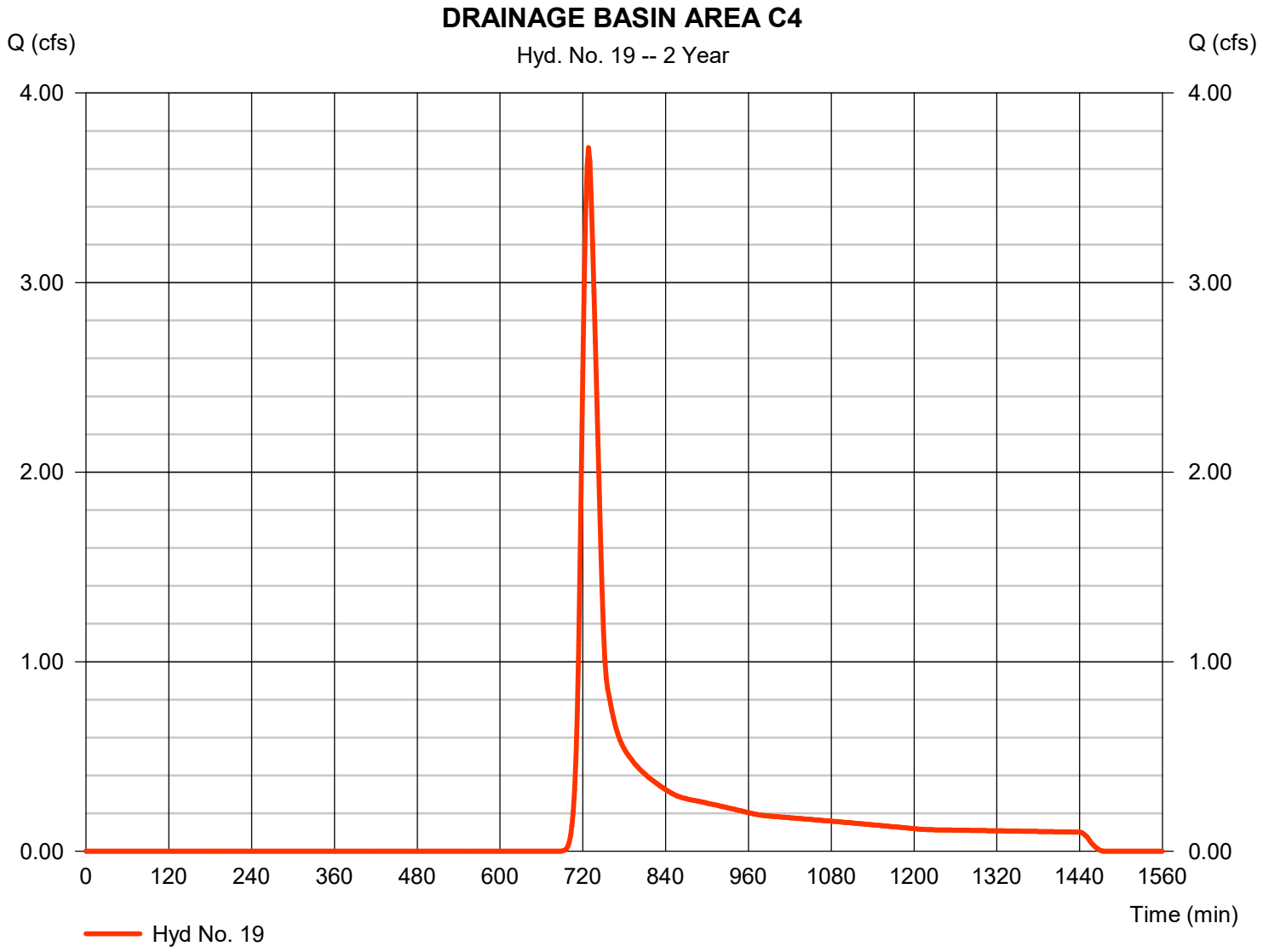
Hydrograph Report

Hyd. No. 19

DRAINAGE BASIN AREA C4

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.712 cfs
Storm frequency	=	2 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	14,437 cuft
Drainage area	=	4.820 ac	Curve number	=	70*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	20.60 min
Total precip.	=	3.17 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.820 x 70)] / 4.820



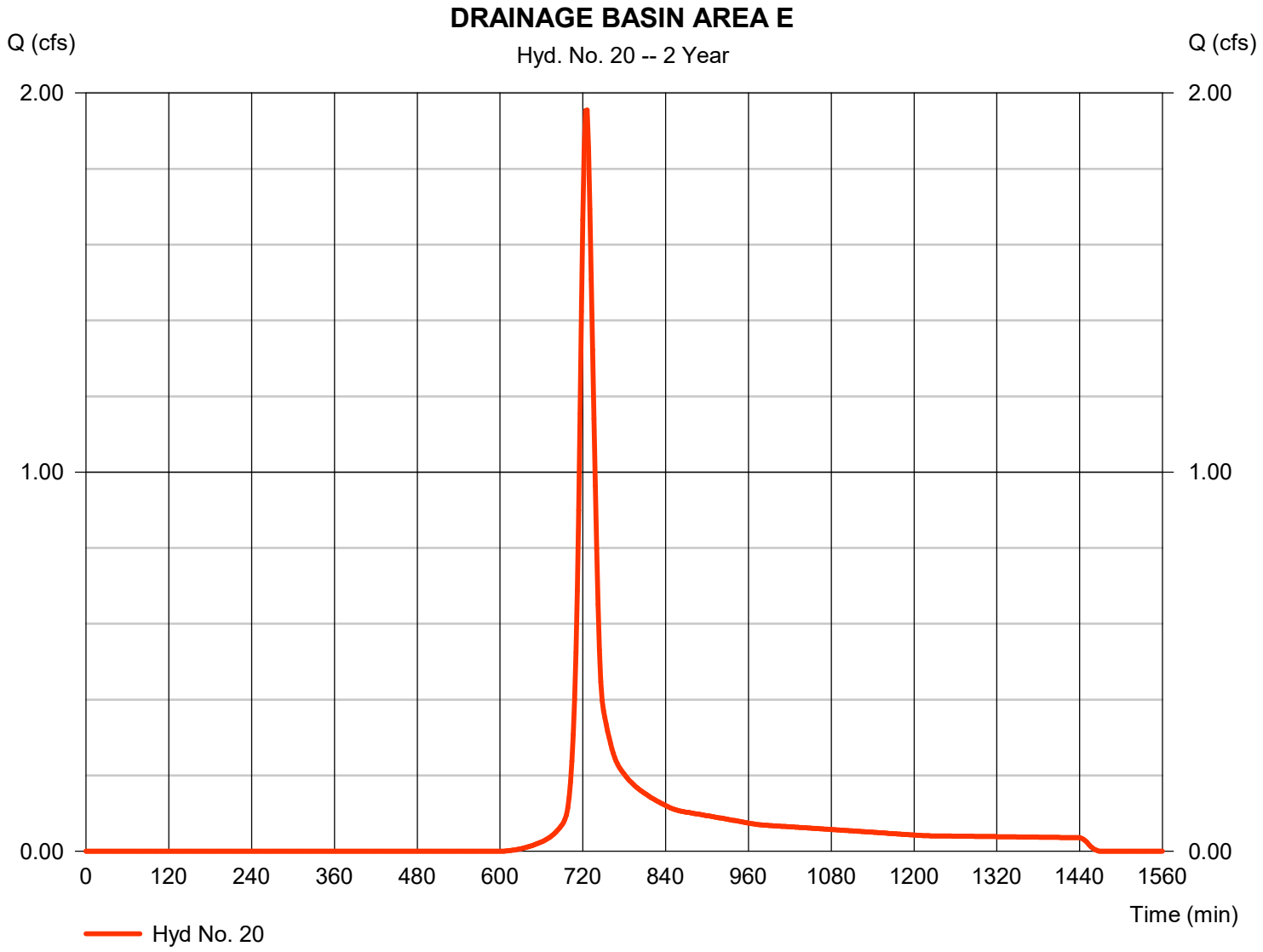
Hydrograph Report

Hyd. No. 20

DRAINAGE BASIN AREA E

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.955 cfs
Storm frequency	=	2 yrs	Time to peak	=	726 min
Time interval	=	2 min	Hyd. volume	=	6,269 cuft
Drainage area	=	1.380 ac	Curve number	=	78*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	19.60 min
Total precip.	=	3.17 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.510 x 92) + (0.870 x 70)] / 1.380

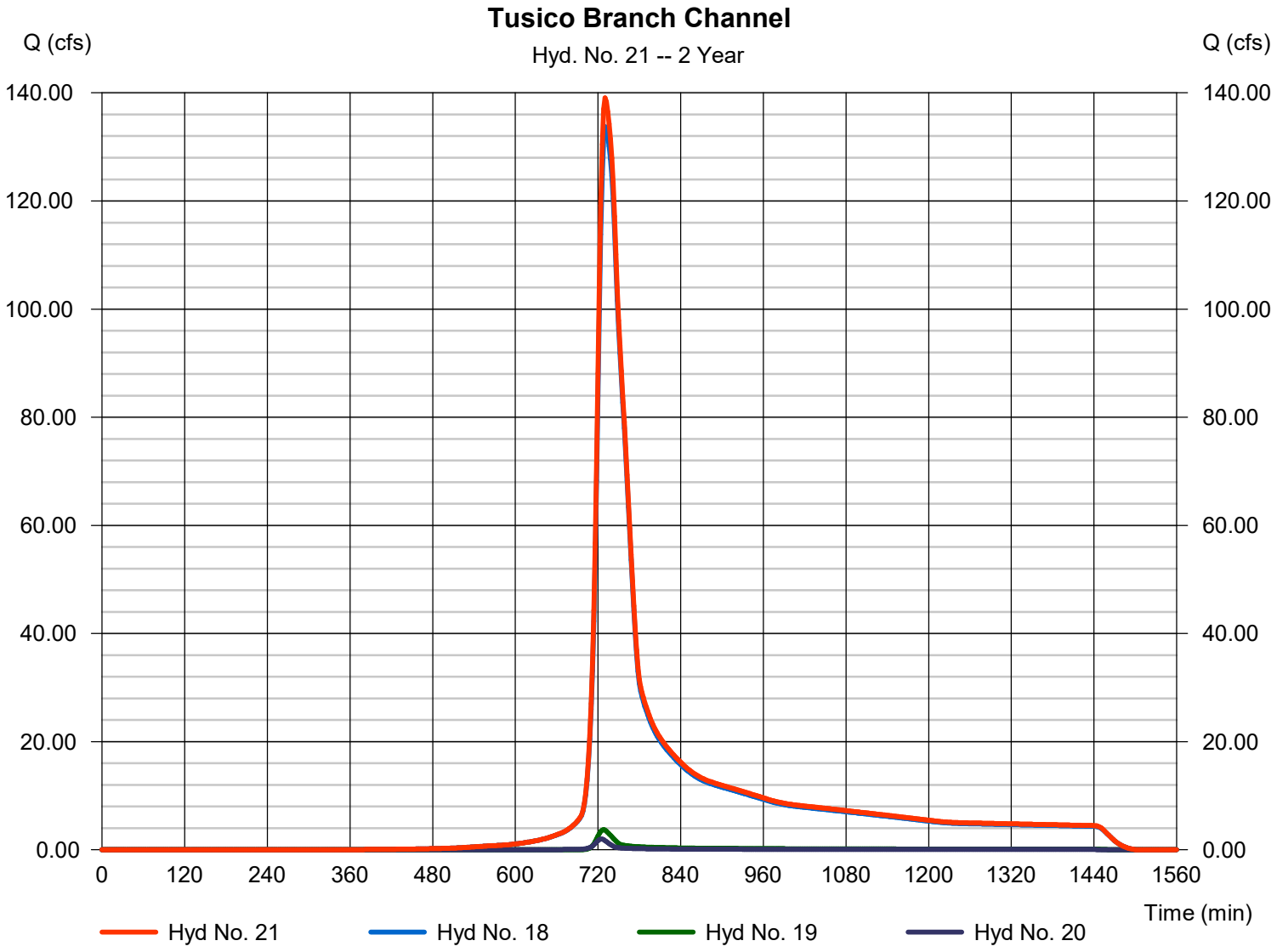


Hydrograph Report

Hyd. No. 21

Tusico Branch Channel

Hydrograph type	= Combine	Peak discharge	= 139.07 cfs
Storm frequency	= 2 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 743,793 cuft
Inflow hyds.	= 18, 19, 20	Contrib. drain. area	= 6.200 ac



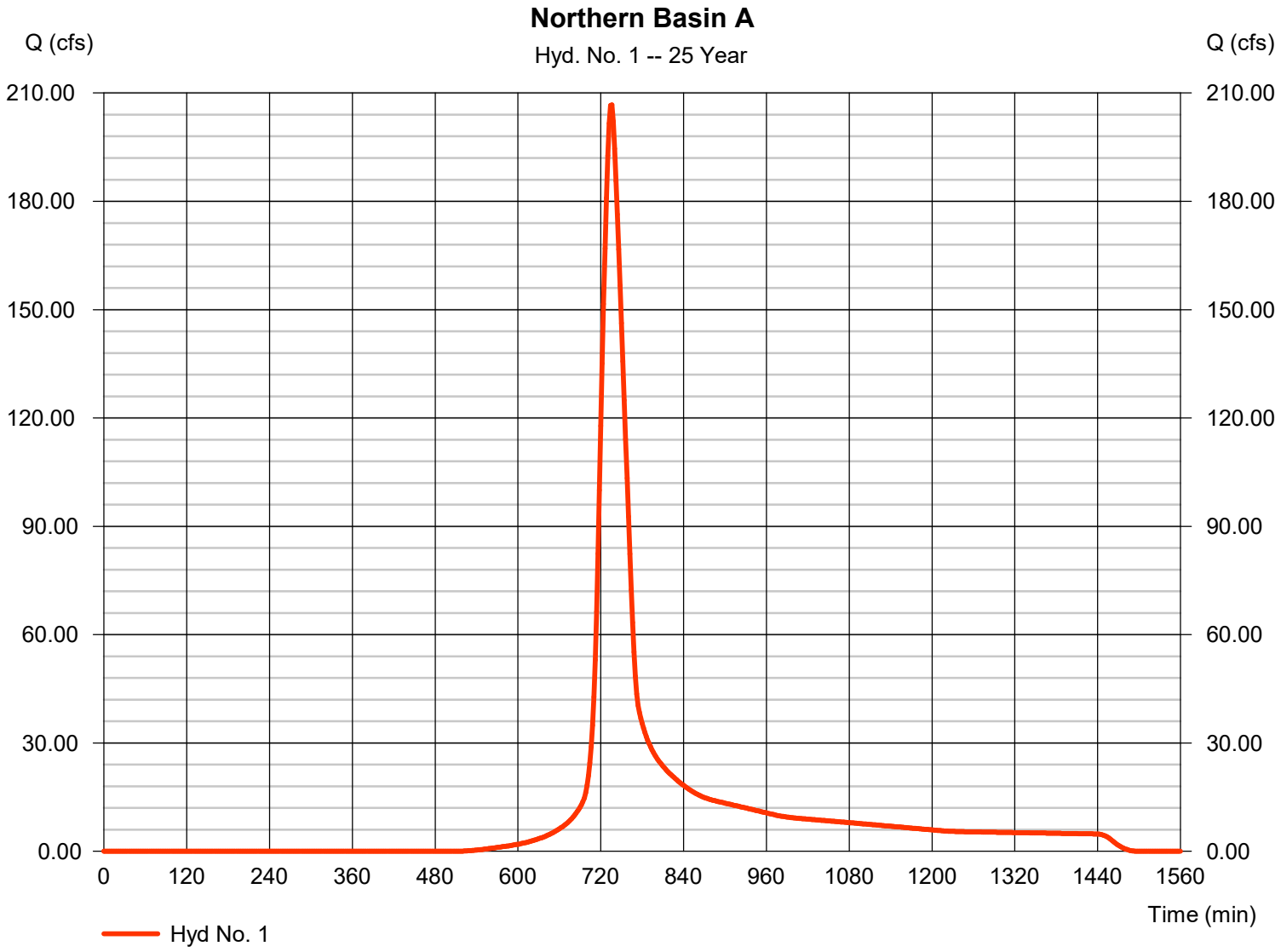
Hydrograph Report

Hyd. No. 1

Northern Basin A

Hydrograph type	=	SCS Runoff	Peak discharge	=	206.72 cfs
Storm frequency	=	25 yrs	Time to peak	=	736 min
Time interval	=	2 min	Hyd. volume	=	943,161 cuft
Drainage area	=	85.690 ac	Curve number	=	72*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	36.90 min
Total precip.	=	6.09 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(45.470 x 70) + (9.460 x 92) + (30.760 x 70)] / 85.690



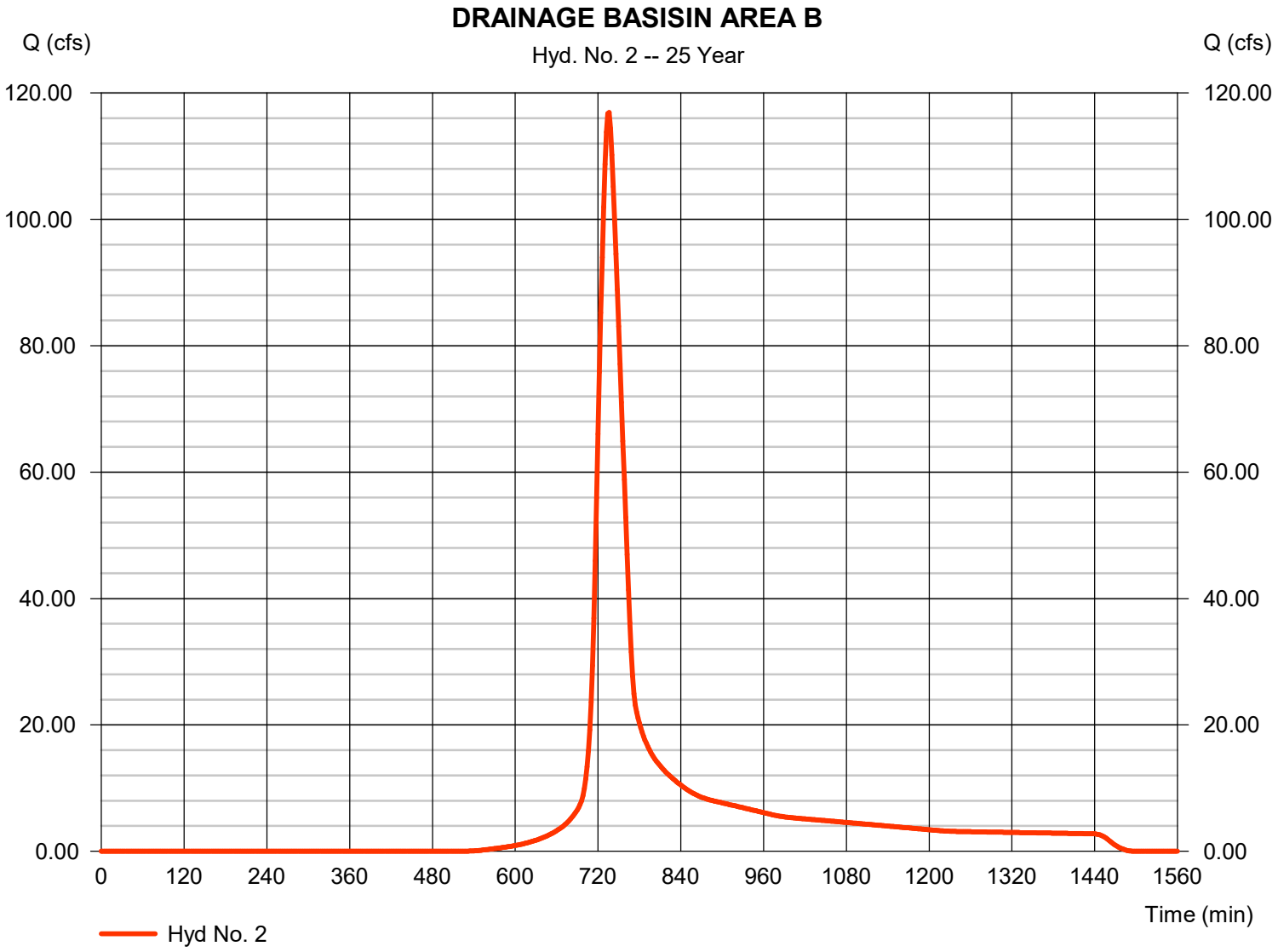
Hydrograph Report

Hyd. No. 2

DRAINAGE BASISIN AREA B

Hydrograph type	=	SCS Runoff	Peak discharge	=	116.92 cfs
Storm frequency	=	25 yrs	Time to peak	=	736 min
Time interval	=	2 min	Hyd. volume	=	534,574 cuft
Drainage area	=	50.130 ac	Curve number	=	71*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	34.90 min
Total precip.	=	6.09 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(3.260 x 92) + (46.870 x 70)] / 50.130

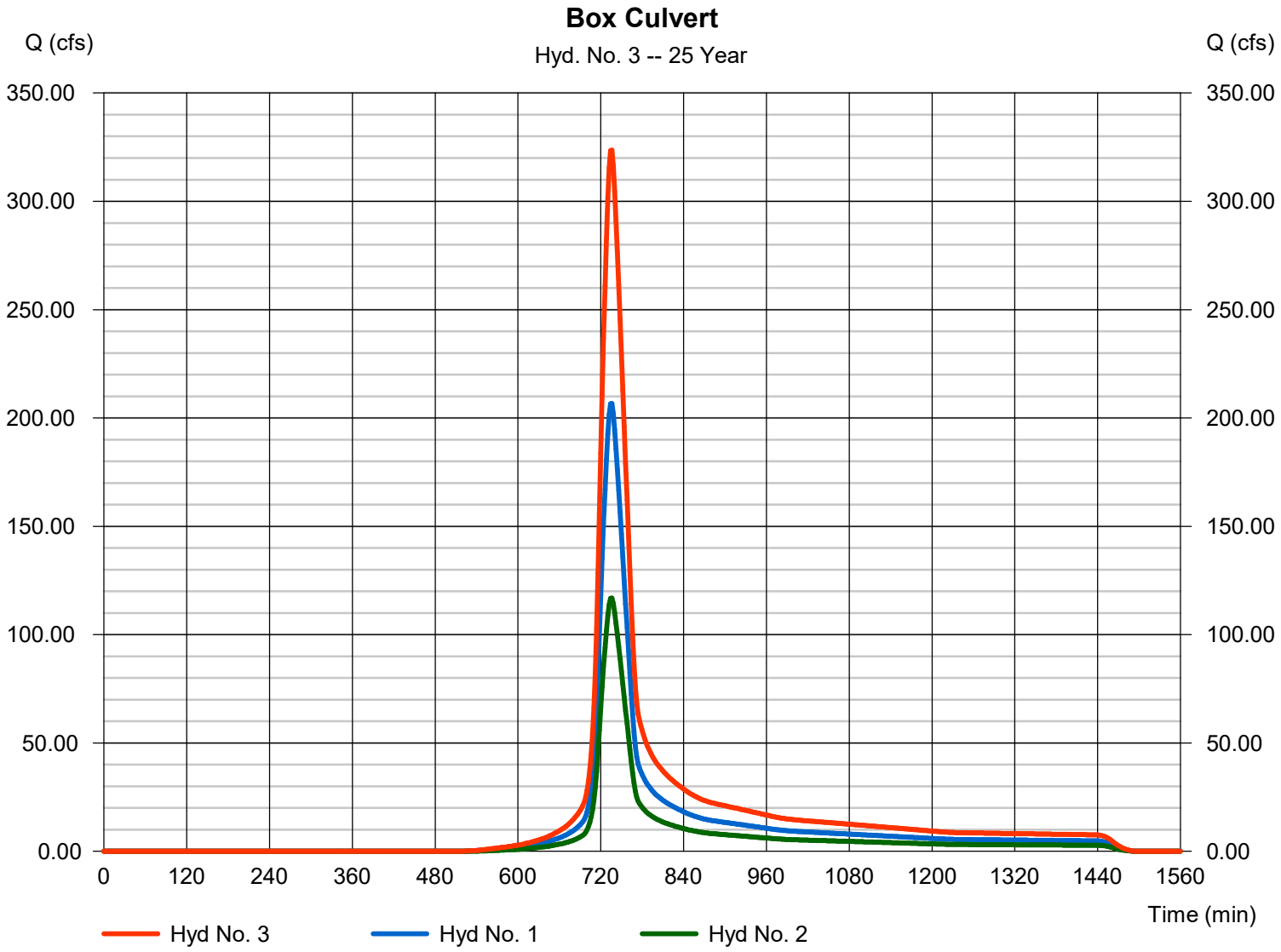


Hydrograph Report

Hyd. No. 3

Box Culvert

Hydrograph type	= Combine	Peak discharge	= 323.64 cfs
Storm frequency	= 25 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 1,477,734 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 135.820 ac



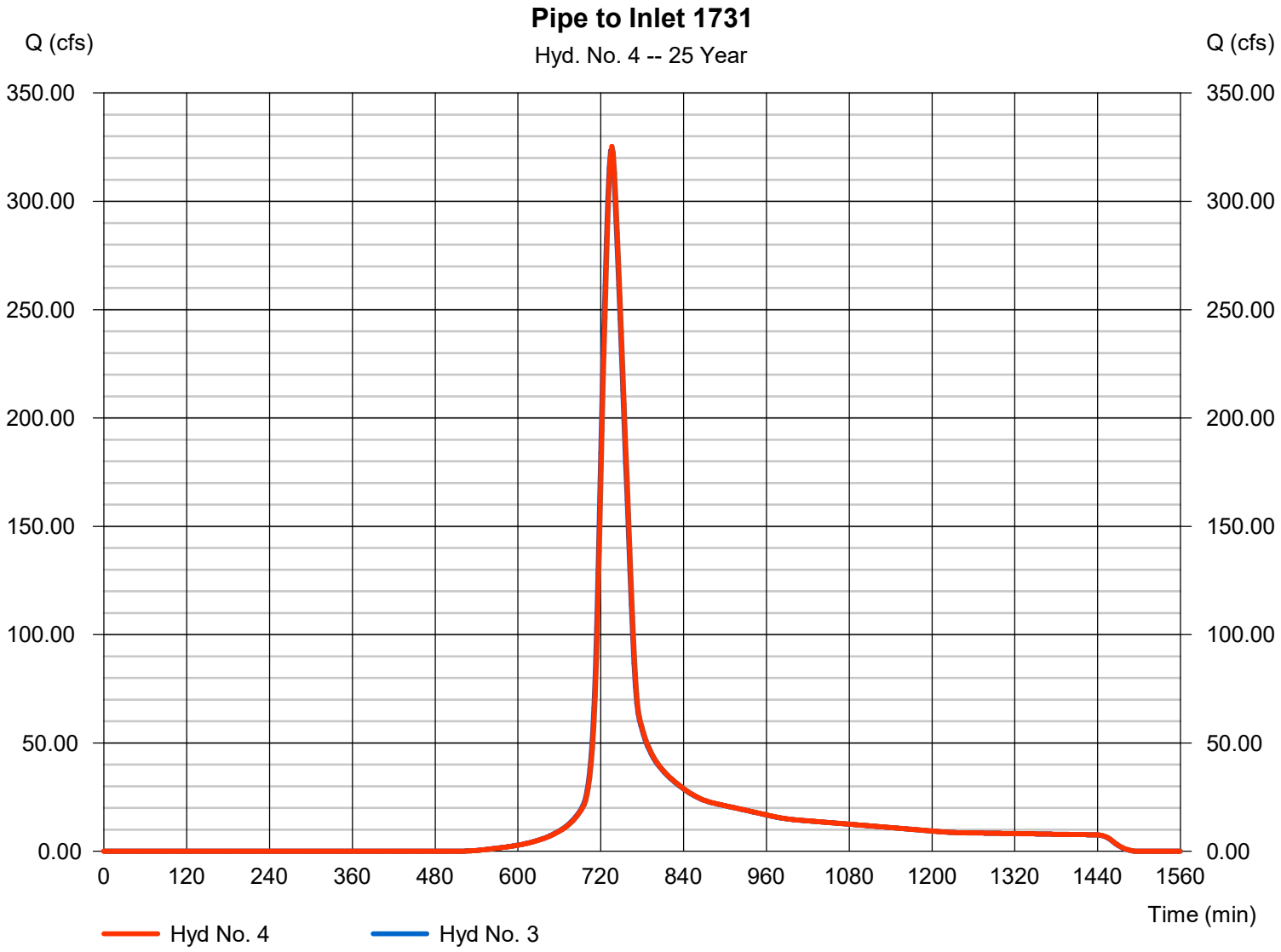
Hydrograph Report

Hyd. No. 4

Pipe to Inlet 1731

Hydrograph type	=	Reach	Peak discharge	=	325.40 cfs
Storm frequency	=	25 yrs	Time to peak	=	736 min
Time interval	=	2 min	Hyd. volume	=	1,477,735 cuft
Inflow hyd. No.	=	3 - Box Culvert	Section type	=	Circular
Reach length	=	299.0 ft	Channel slope	=	0.7 %
Manning's n	=	0.013	Bottom width	=	5.0 ft
Side slope	=	0.0:1	Max. depth	=	0.0 ft
Rating curve x	=	6.957	Rating curve m	=	1.250
Ave. velocity	=	0.00 ft/s	Routing coeff.	=	1.6105

Modified Att-Kin routing method used.



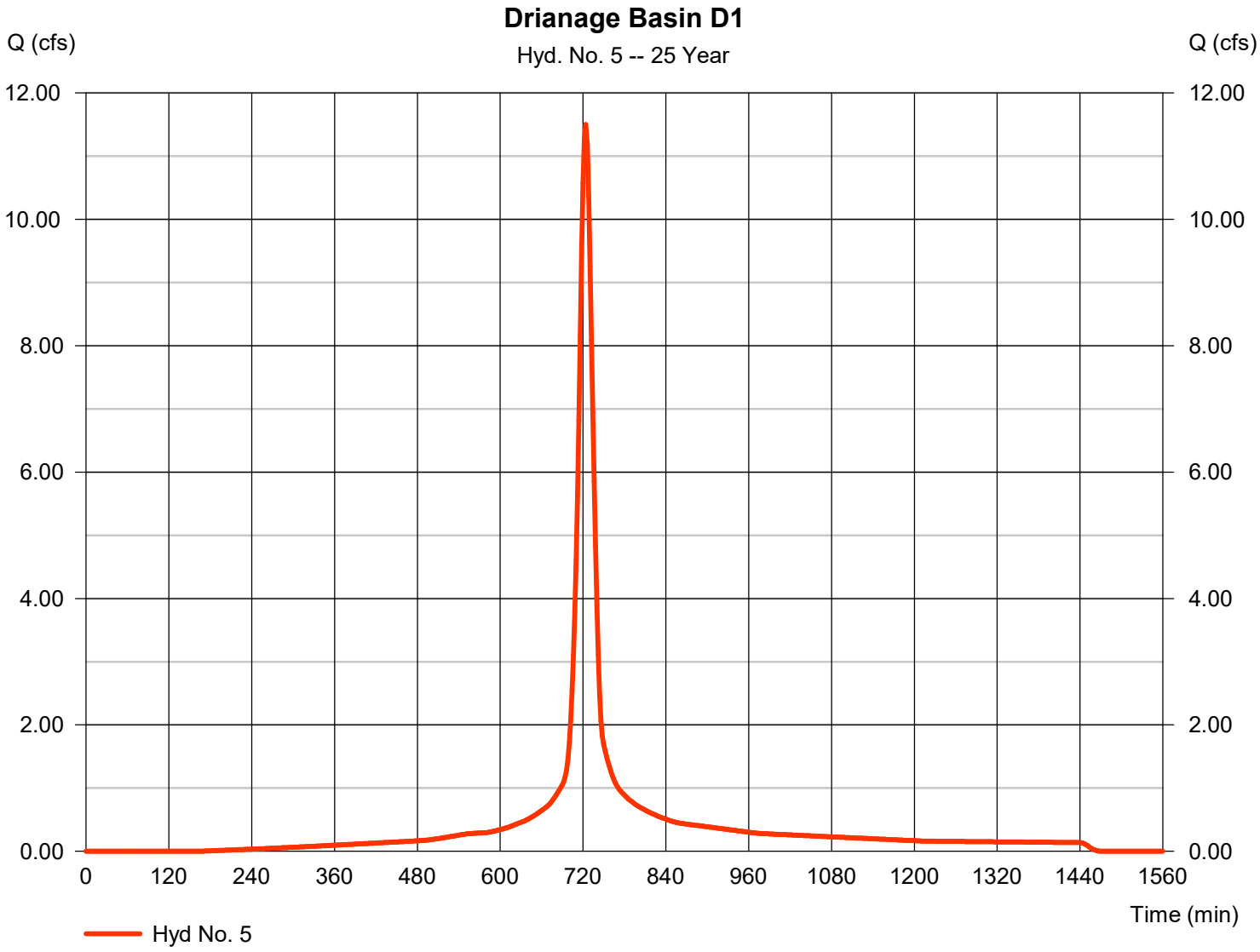
Hydrograph Report

Hyd. No. 5

Drianage Basin D1

Hydrograph type	=	SCS Runoff	Peak discharge	=	11.50 cfs
Storm frequency	=	25 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	38,196 cuft
Drainage area	=	2.040 ac	Curve number	=	92*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	19.20 min
Total precip.	=	6.09 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.040 x 92)] / 2.040

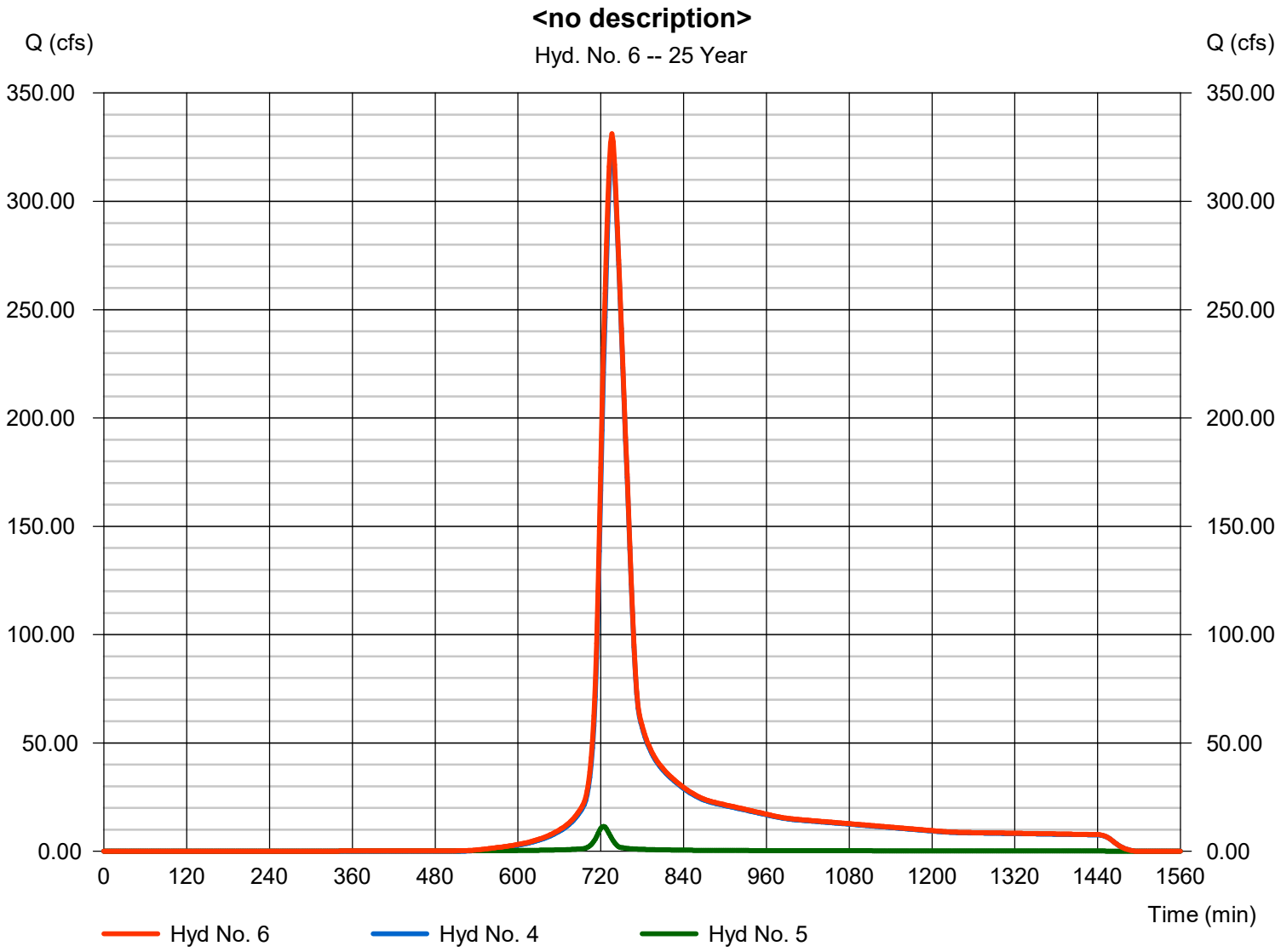


Hydrograph Report

Hyd. No. 6

<no description>

Hydrograph type	= Combine	Peak discharge	= 331.26 cfs
Storm frequency	= 25 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 1,515,931 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 2.040 ac



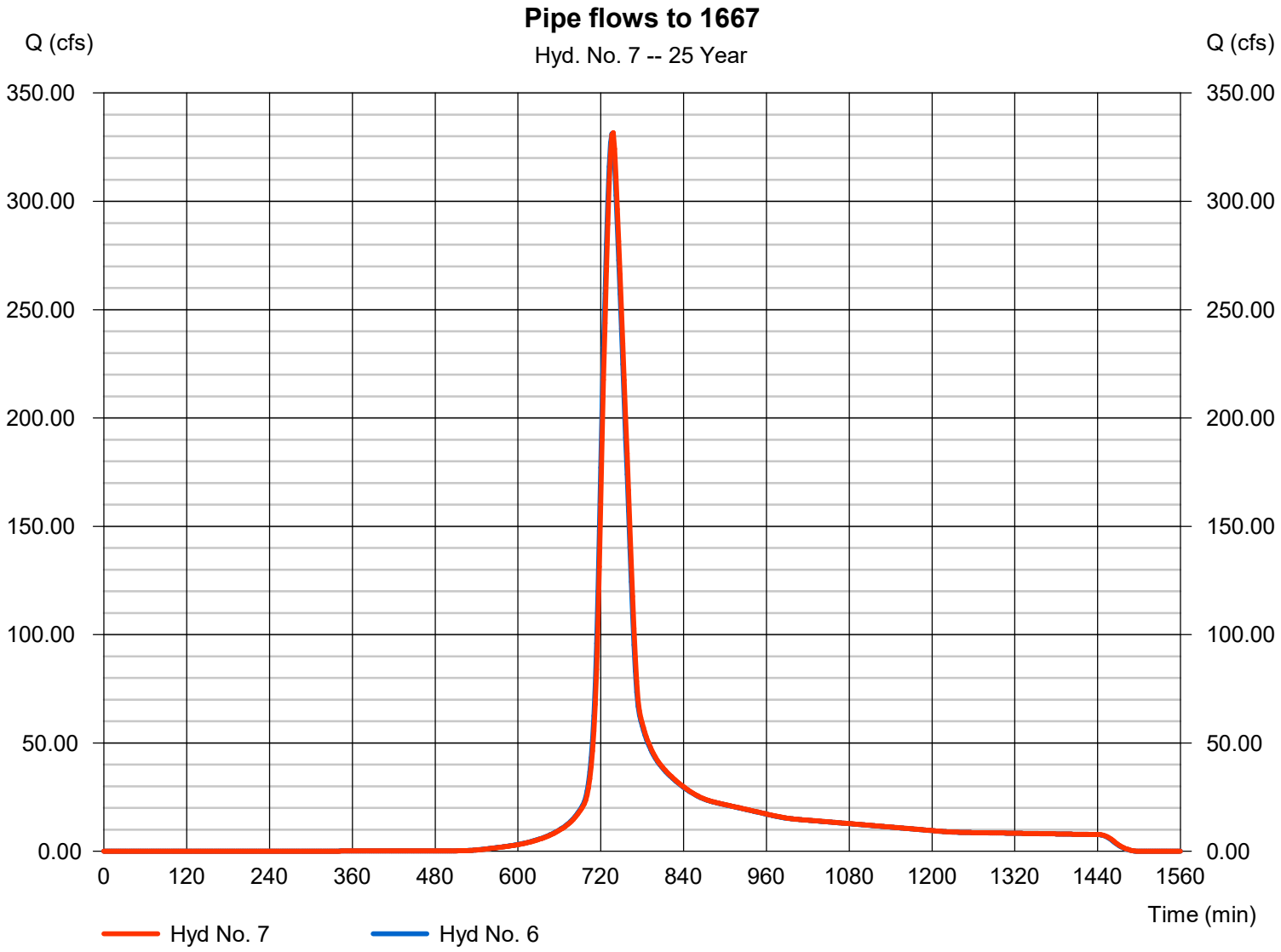
Hydrograph Report

Hyd. No. 7

Pipe flows to 1667

Hydrograph type	= Reach	Peak discharge	= 331.69 cfs
Storm frequency	= 25 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 1,515,931 cuft
Inflow hyd. No.	= 6 - <no description>	Section type	= Circular
Reach length	= 177.0 ft	Channel slope	= 1.5 %
Manning's n	= 0.015	Bottom width	= 5.0 ft
Side slope	= 0.0:1	Max. depth	= 0.0 ft
Rating curve x	= 8.613	Rating curve m	= 1.250
Ave. velocity	= 0.00 ft/s	Routing coeff.	= 1.7546

Modified Att-Kin routing method used.



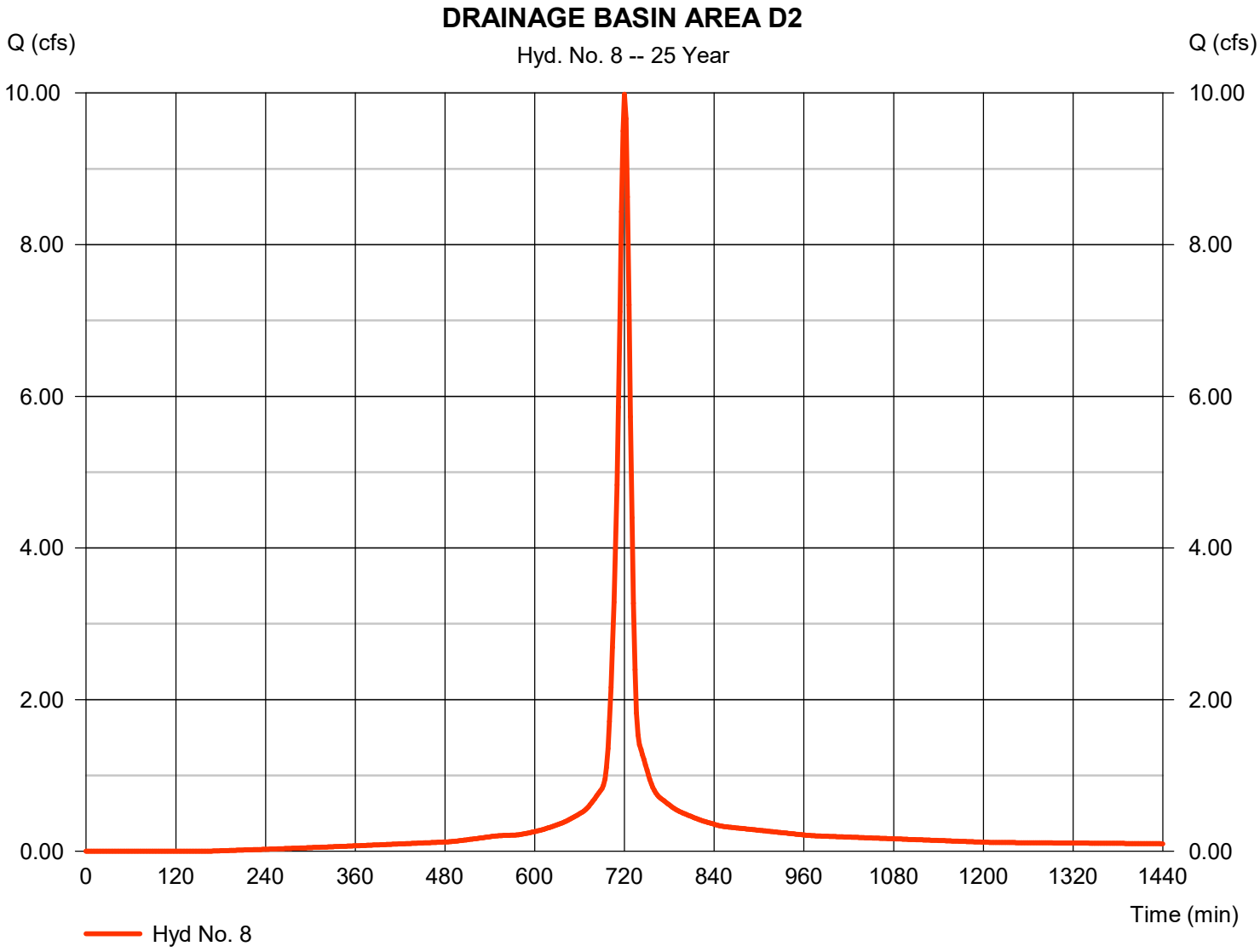
Hydrograph Report

Hyd. No. 8

DRAINAGE BASIN AREA D2

Hydrograph type	=	SCS Runoff	Peak discharge	=	9.983 cfs
Storm frequency	=	25 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	27,804 cuft
Drainage area	=	1.440 ac	Curve number	=	92*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	11.70 min
Total precip.	=	6.09 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.440 x 92)] / 1.440

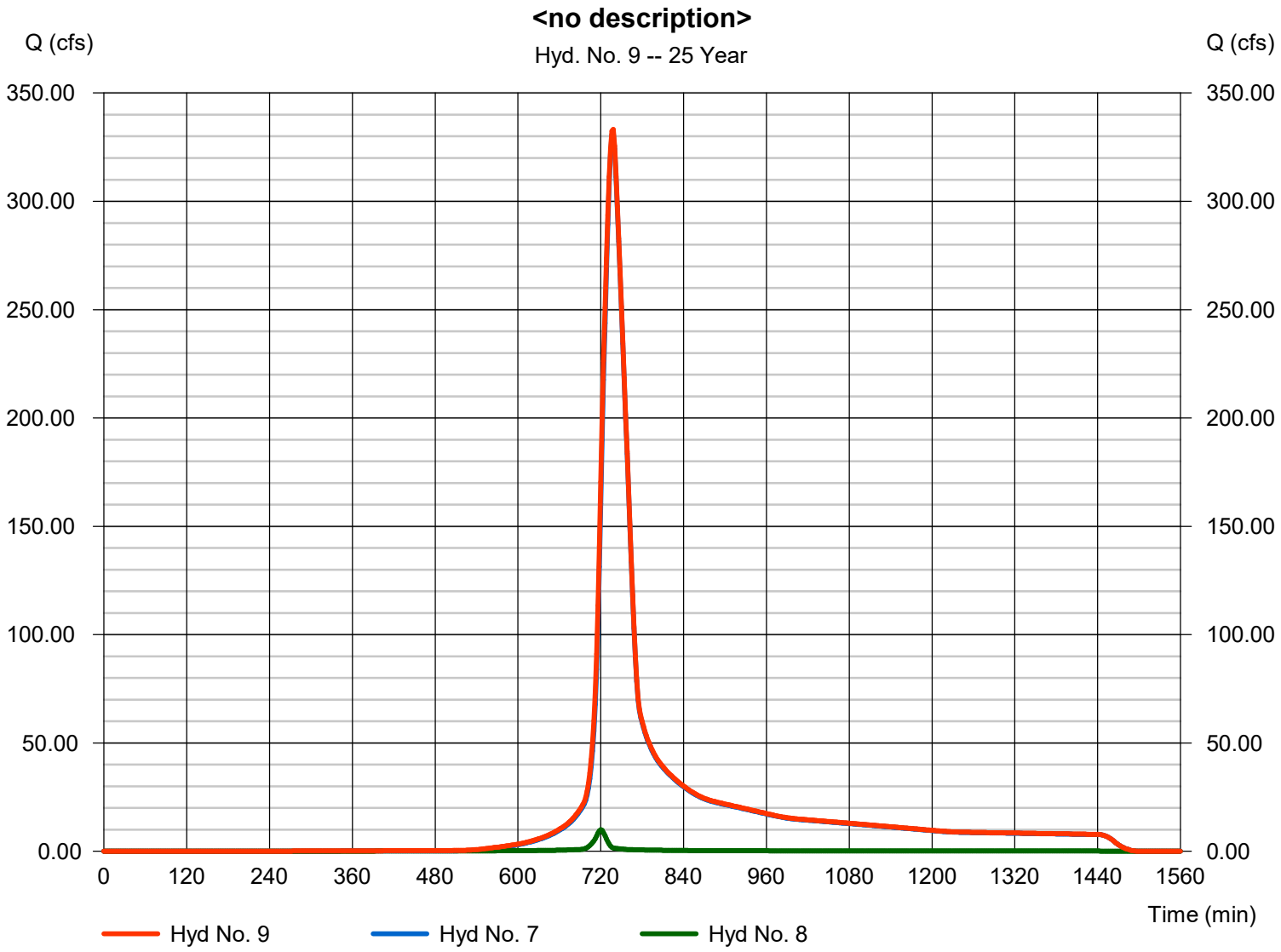


Hydrograph Report

Hyd. No. 9

<no description>

Hydrograph type	= Combine	Peak discharge	= 333.22 cfs
Storm frequency	= 25 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 1,543,736 cuft
Inflow hyds.	= 7, 8	Contrib. drain. area	= 1.440 ac



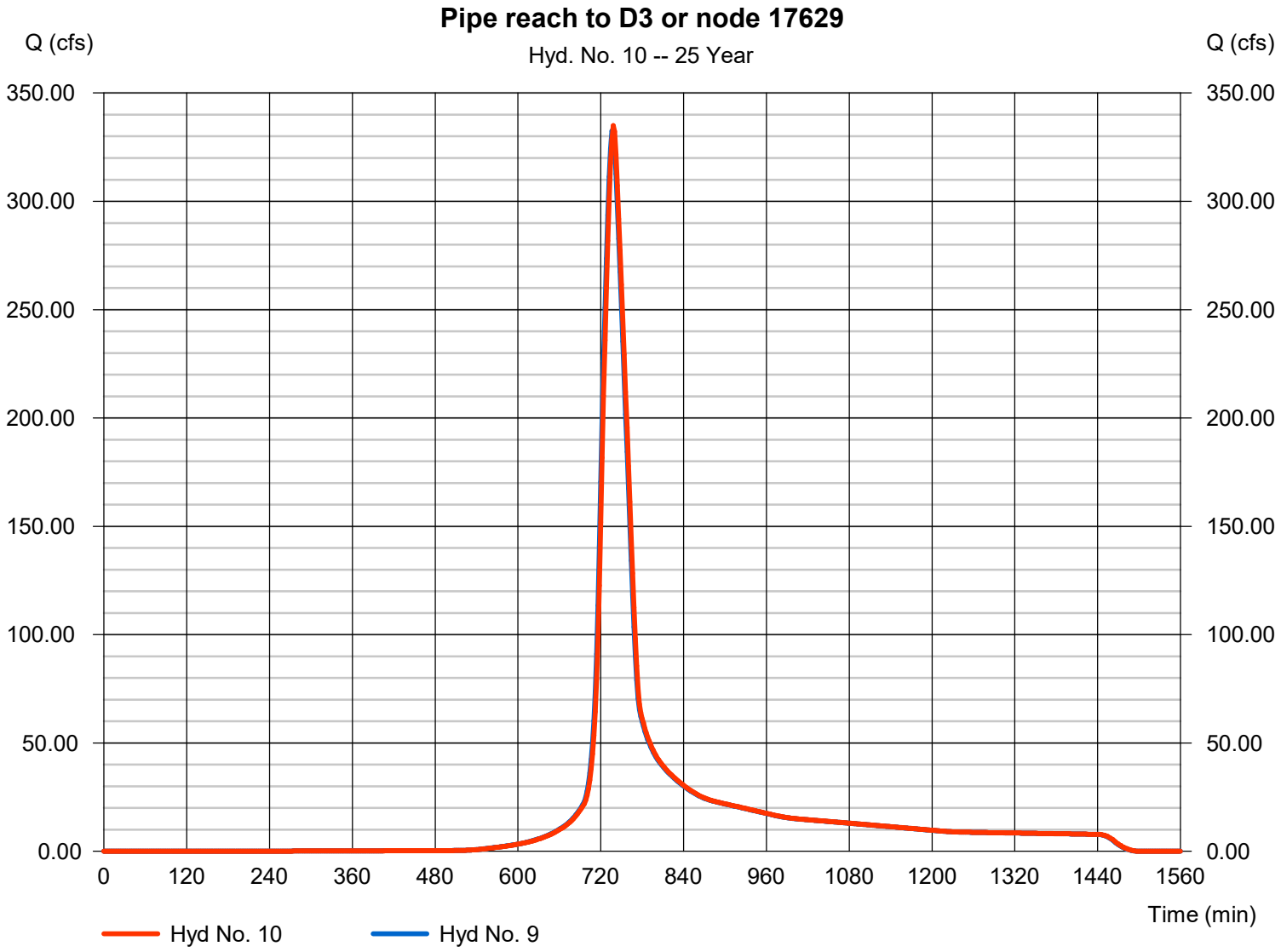
Hydrograph Report

Hyd. No. 10

Pipe reach to D3 or node 17629

Hydrograph type	=	Reach	Peak discharge	=	334.98 cfs
Storm frequency	=	25 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	1,543,736 cuft
Inflow hyd. No.	=	9 - <no description>	Section type	=	Circular
Reach length	=	317.0 ft	Channel slope	=	1.5 %
Manning's n	=	0.015	Bottom width	=	5.0 ft
Side slope	=	0.0:1	Max. depth	=	0.0 ft
Rating curve x	=	8.613	Rating curve m	=	1.250
Ave. velocity	=	0.00 ft/s	Routing coeff.	=	1.6012

Modified Att-Kin routing method used.



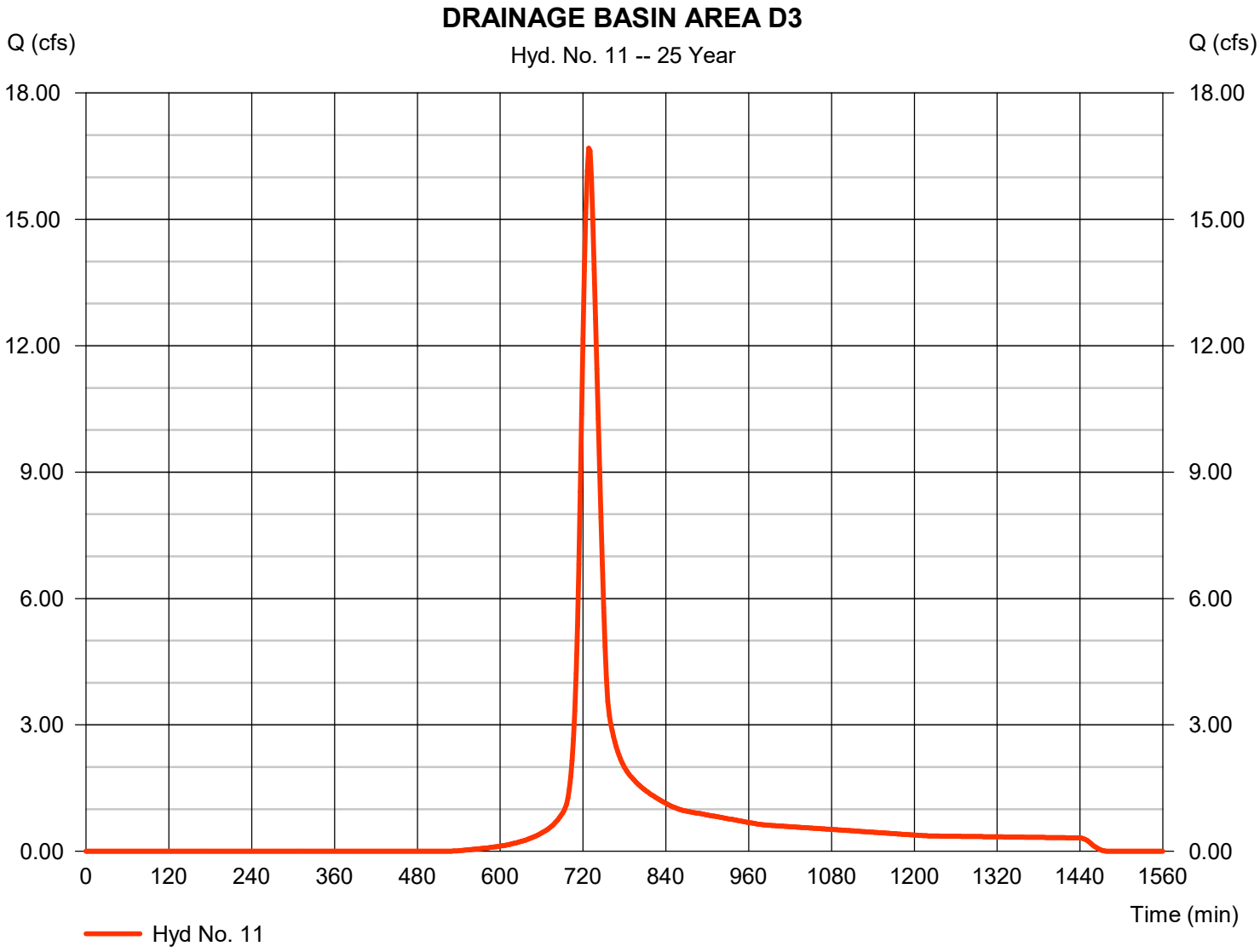
Hydrograph Report

Hyd. No. 11

DRAINAGE BASIN AREA D3

Hydrograph type	=	SCS Runoff	Peak discharge	=	16.69 cfs
Storm frequency	=	25 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	61,689 cuft
Drainage area	=	5.810 ac	Curve number	=	71*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	25.70 min
Total precip.	=	6.09 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.340 x 92) + (5.470 x 70)] / 5.810

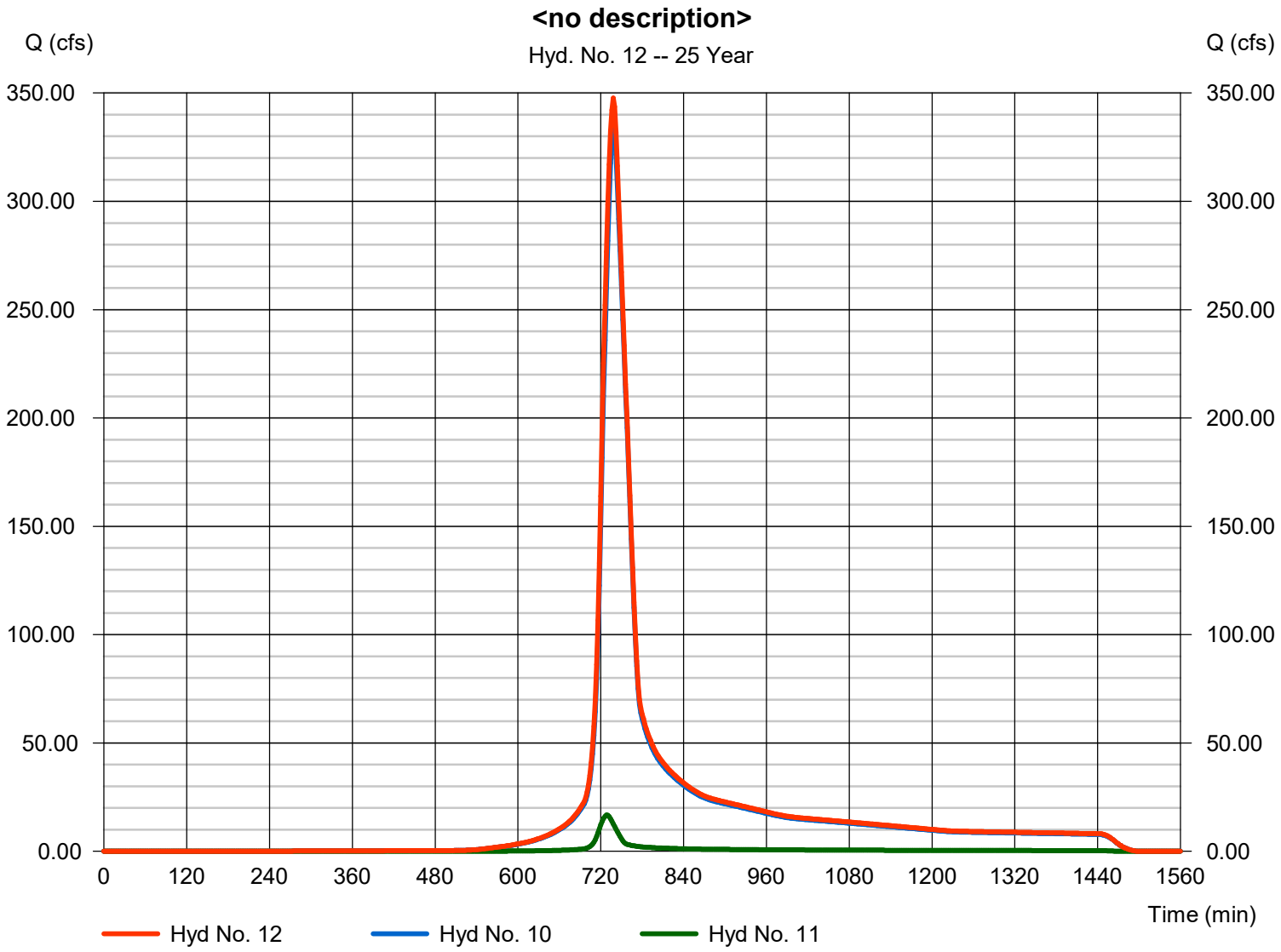


Hydrograph Report

Hyd. No. 12

<no description>

Hydrograph type	=	Combine	Peak discharge	=	347.62 cfs
Storm frequency	=	25 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	1,605,426 cuft
Inflow hyds.	=	10, 11	Contrib. drain. area	=	5.810 ac



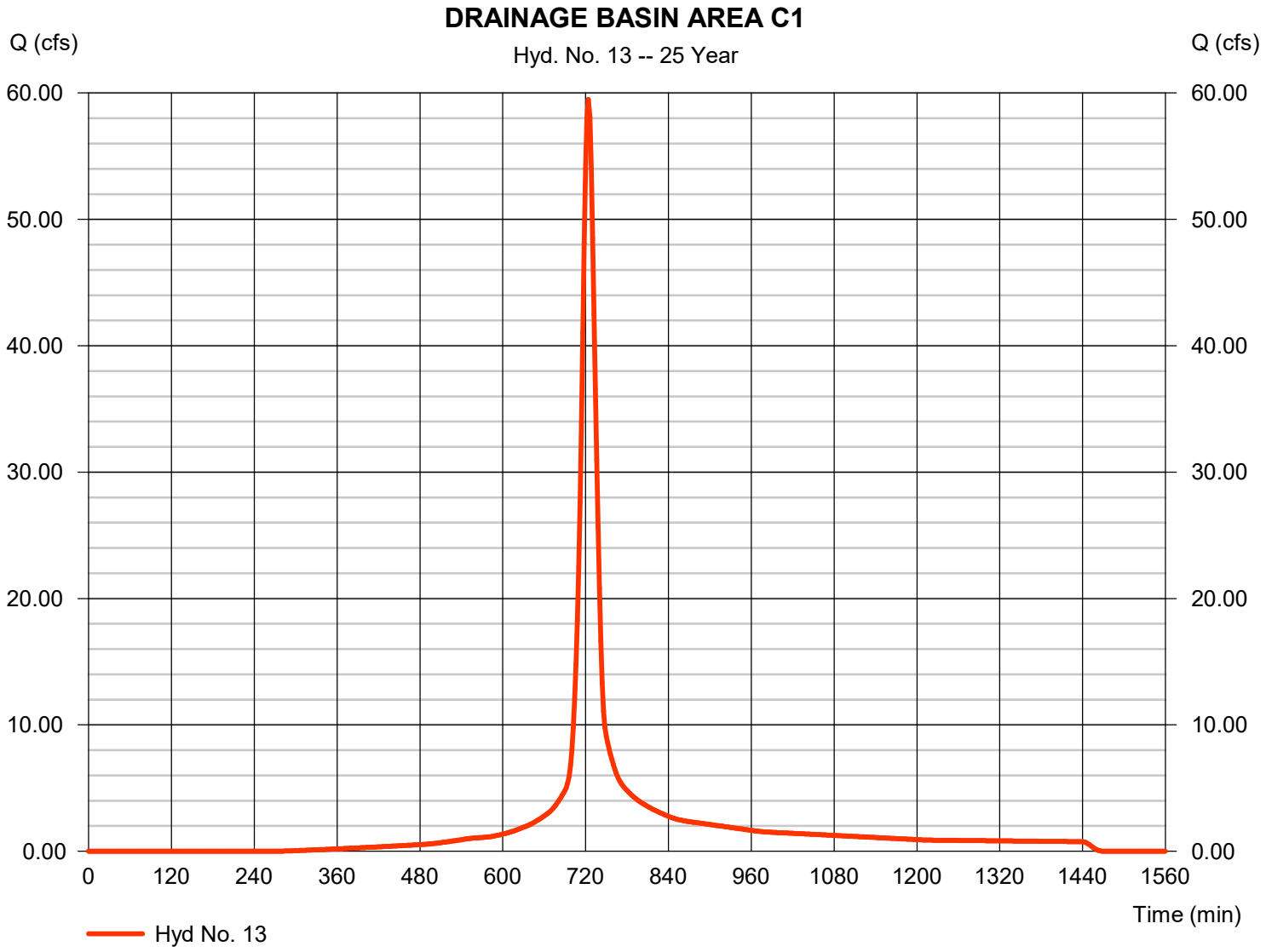
Hydrograph Report

Hyd. No. 13

DRAINAGE BASIN AREA C1

Hydrograph type	=	SCS Runoff	Peak discharge	=	59.49 cfs
Storm frequency	=	25 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	190,092 cuft
Drainage area	=	11.650 ac	Curve number	=	86*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	17.10 min
Total precip.	=	6.09 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(8.240 x 92) + (3.410 x 70)] / 11.650



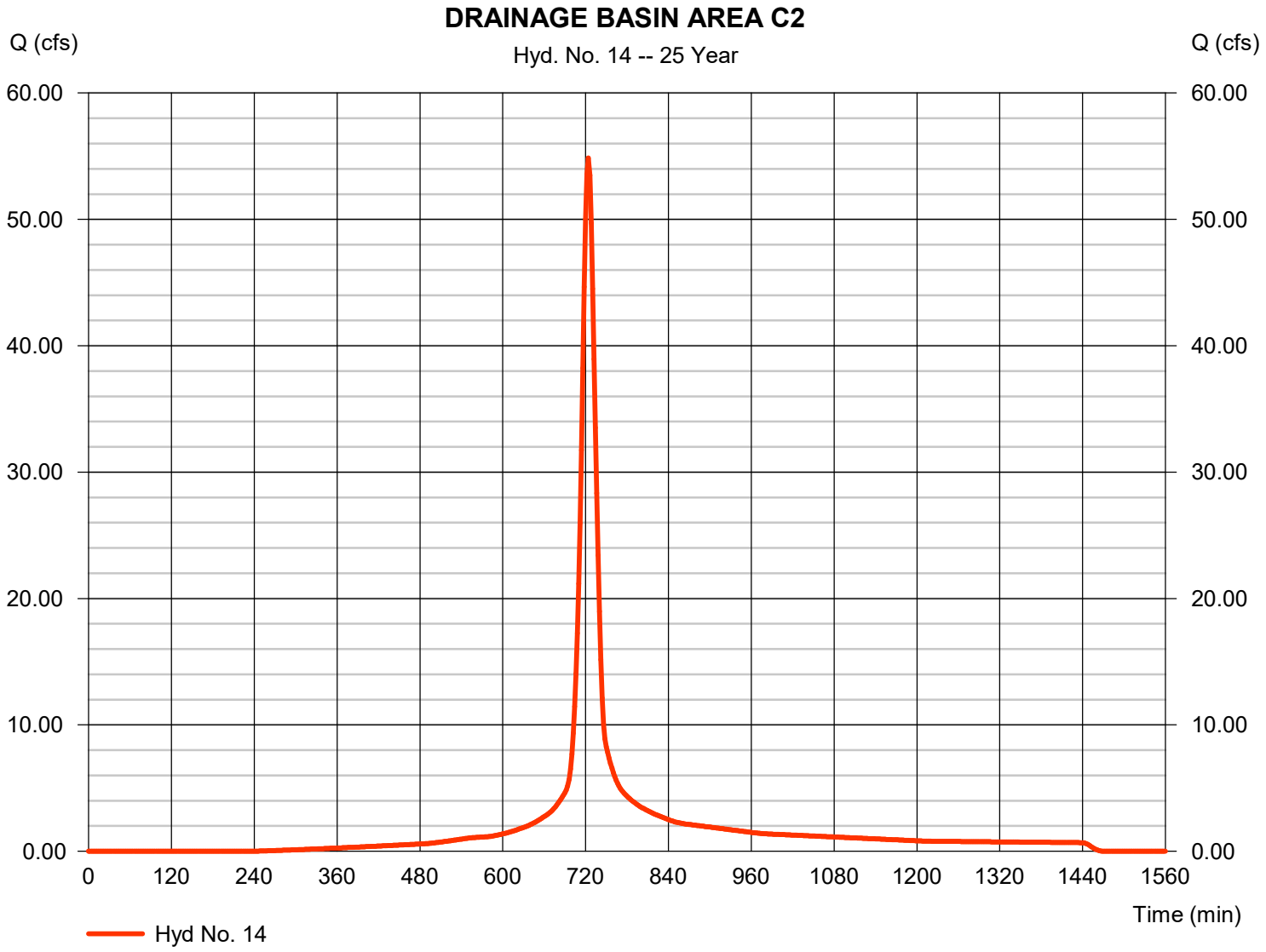
Hydrograph Report

Hyd. No. 14

DRAINAGE BASIN AREA C2

Hydrograph type	=	SCS Runoff	Peak discharge	=	54.85 cfs
Storm frequency	=	25 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	177,054 cuft
Drainage area	=	10.350 ac	Curve number	=	88*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	19.40 min
Total precip.	=	6.09 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(8.270 x 92) + (2.080 x 70)] / 10.350

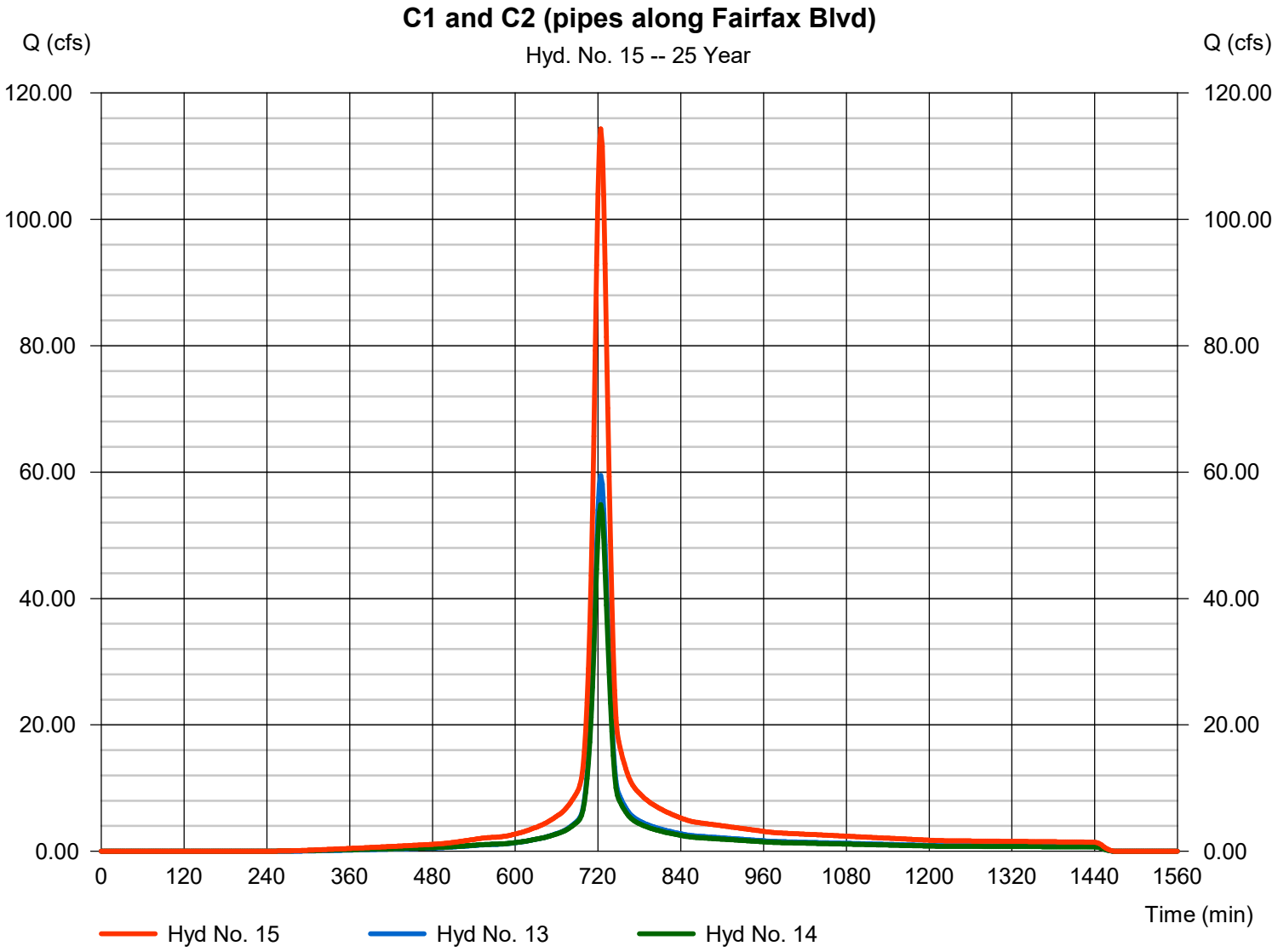


Hydrograph Report

Hyd. No. 15

C1 and C2 (pipes along Fairfax Blvd)

Hydrograph type	= Combine	Peak discharge	= 114.35 cfs
Storm frequency	= 25 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 367,146 cuft
Inflow hyds.	= 13, 14	Contrib. drain. area	= 22.000 ac



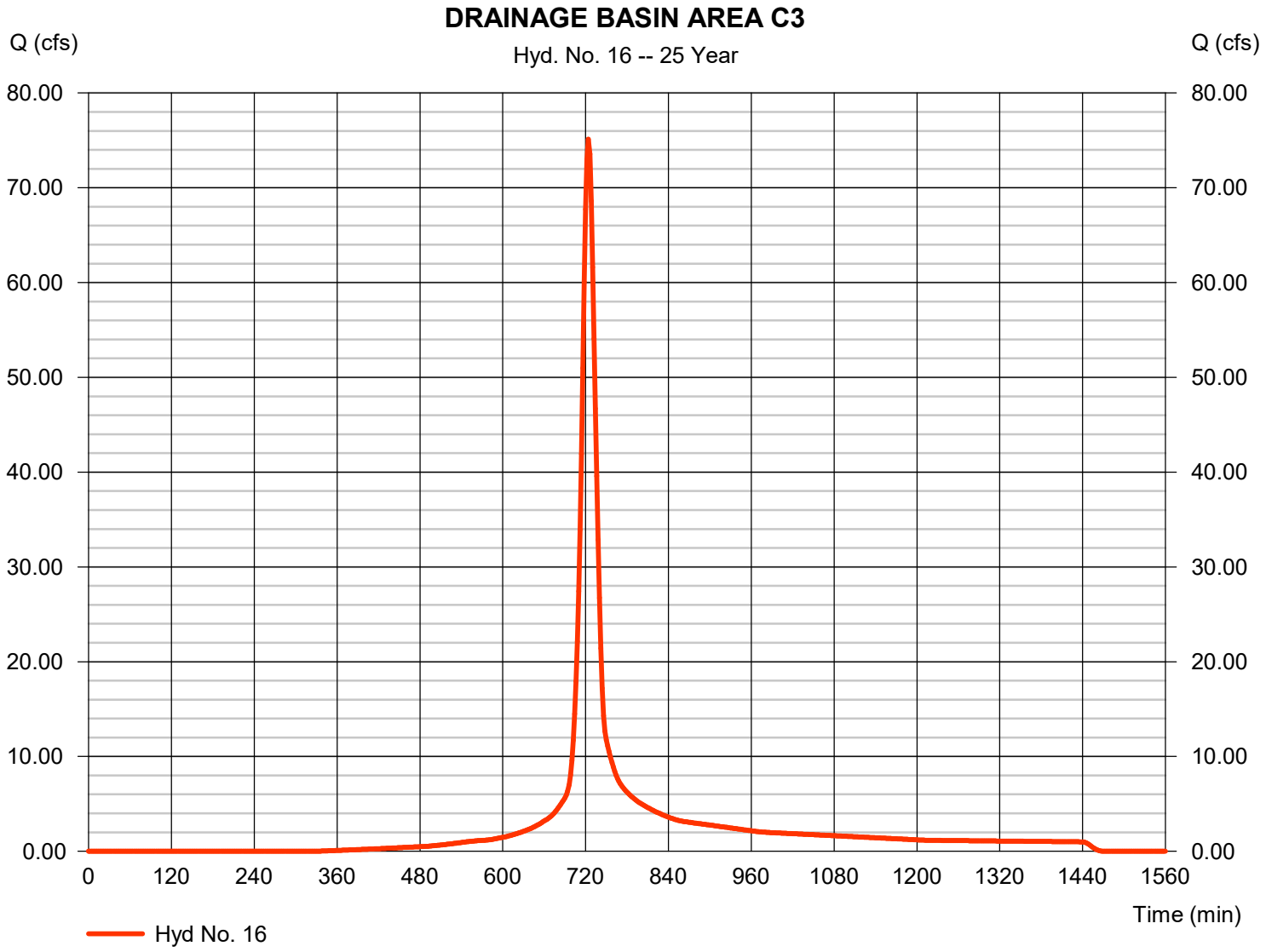
Hydrograph Report

Hyd. No. 16

DRAINAGE BASIN AREA C3

Hydrograph type	=	SCS Runoff	Peak discharge	=	75.12 cfs
Storm frequency	=	25 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	237,330 cuft
Drainage area	=	15.660 ac	Curve number	=	83*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	20.00 min
Total precip.	=	6.09 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(9.340 x 92) + (6.320 x 70)] / 15.660

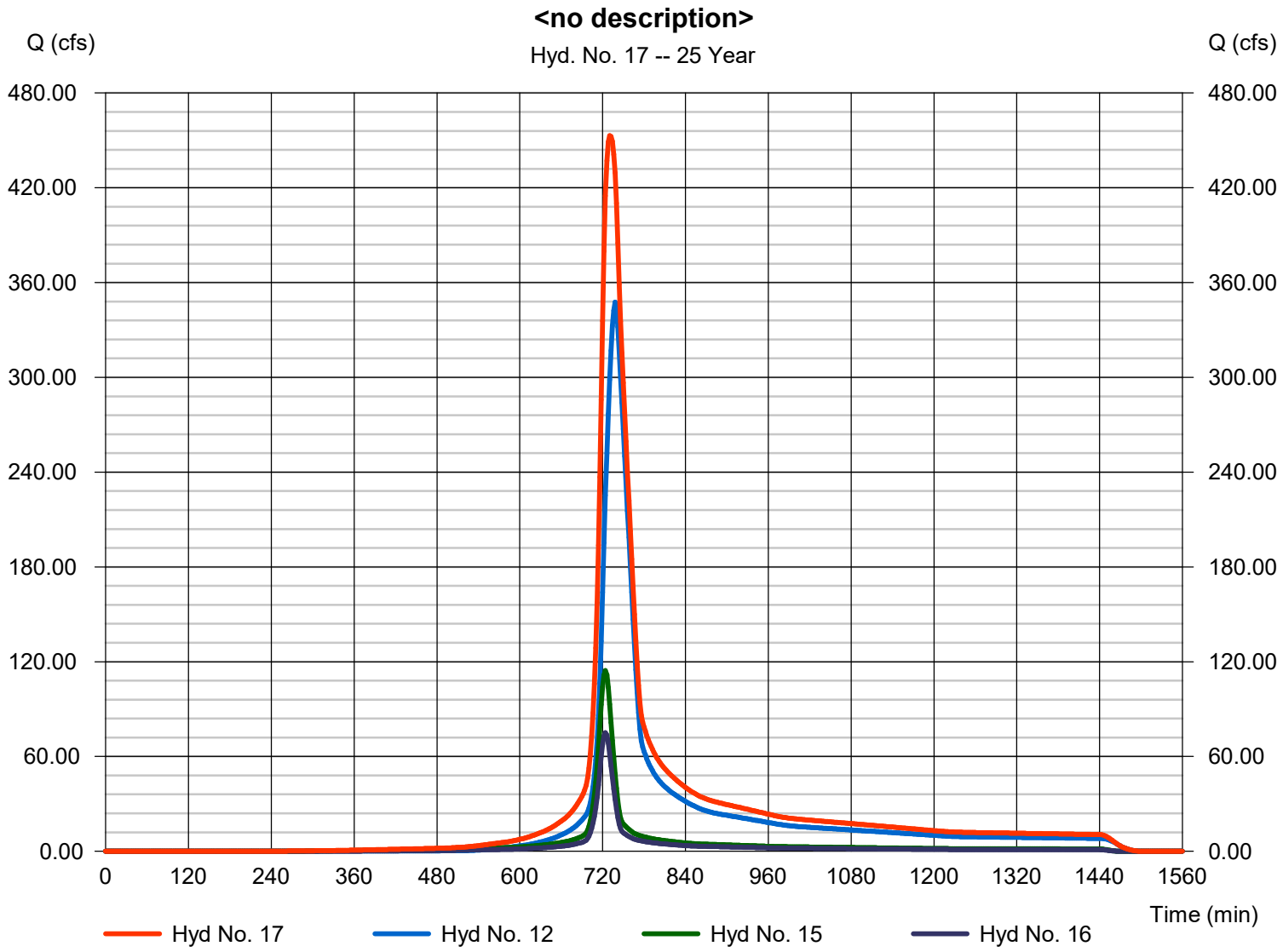


Hydrograph Report

Hyd. No. 17

<no description>

Hydrograph type	= Combine	Peak discharge	= 453.05 cfs
Storm frequency	= 25 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 2,209,901 cuft
Inflow hyds.	= 12, 15, 16	Contrib. drain. area	= 15.660 ac



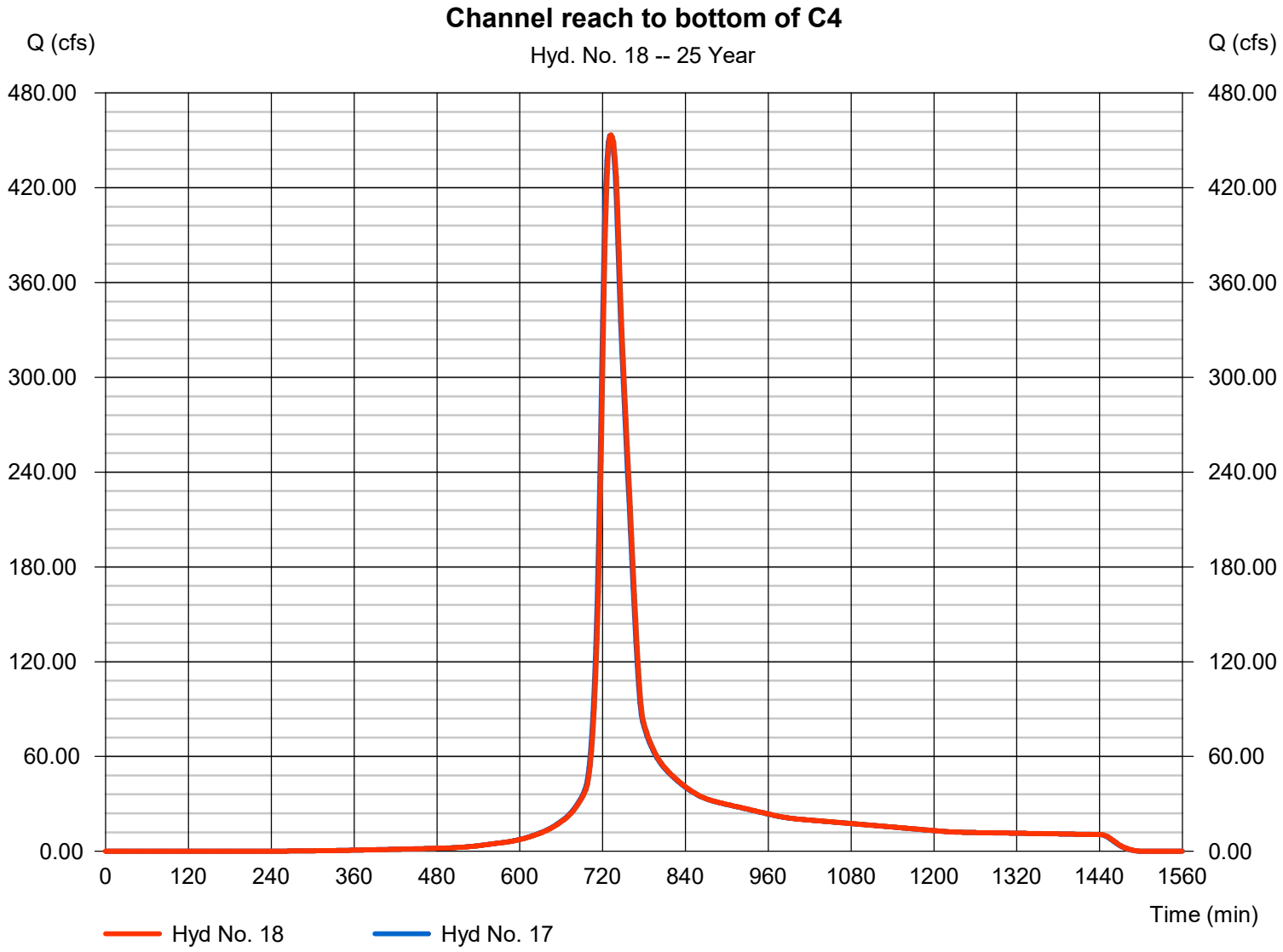
Hydrograph Report

Hyd. No. 18

Channel reach to bottom of C4

Hydrograph type	=	Reach	Peak discharge	=	453.56 cfs
Storm frequency	=	25 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	2,209,902 cuft
Inflow hyd. No.	=	17 - <no description>	Section type	=	Trapezoidal
Reach length	=	259.0 ft	Channel slope	=	1.8 %
Manning's n	=	0.040	Bottom width	=	14.0 ft
Side slope	=	3.0:1	Max. depth	=	3.0 ft
Rating curve x	=	0.852	Rating curve m	=	1.429
Ave. velocity	=	0.00 ft/s	Routing coeff.	=	1.3007

Modified Att-Kin routing method used.



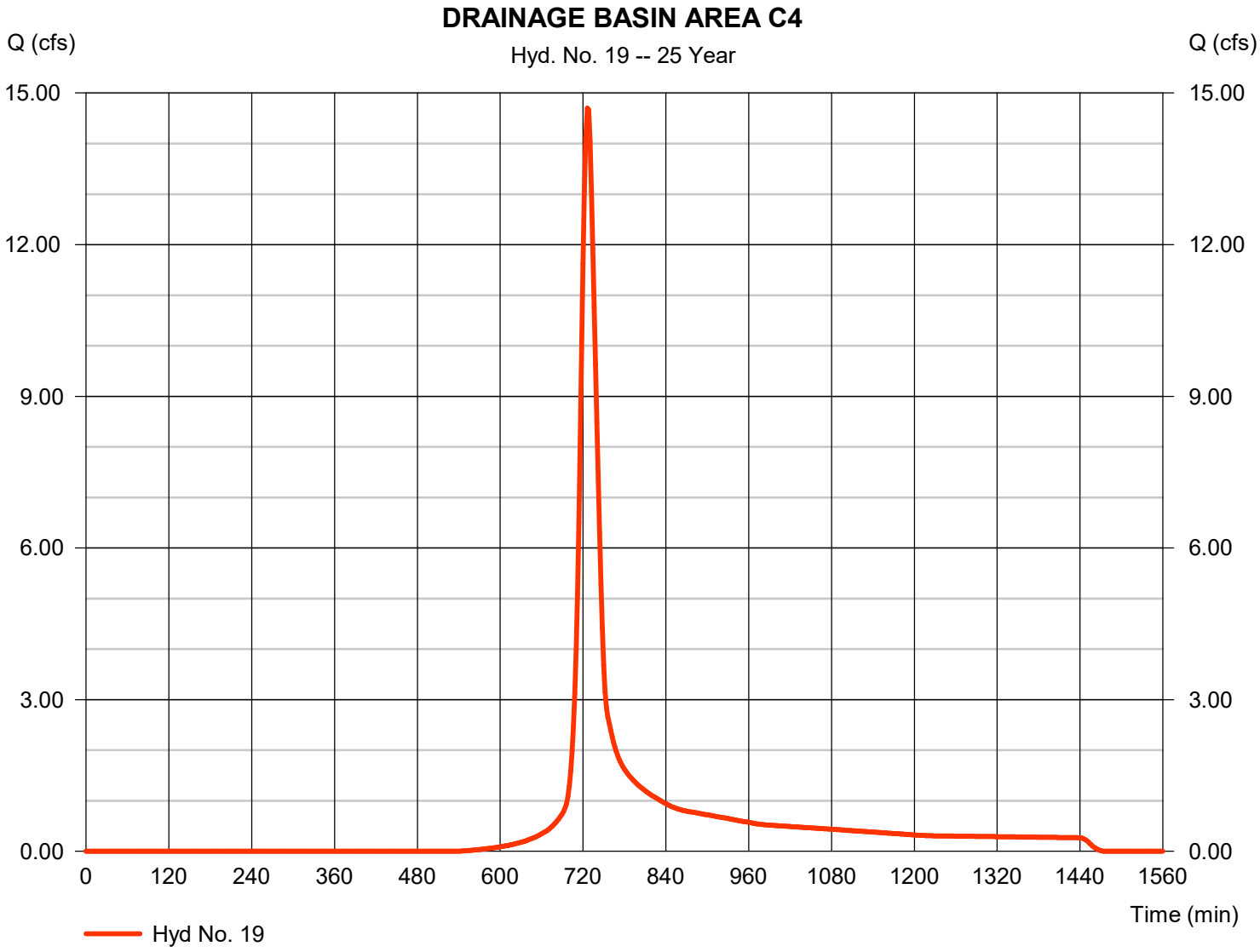
Hydrograph Report

Hyd. No. 19

DRAINAGE BASIN AREA C4

Hydrograph type	= SCS Runoff	Peak discharge	= 14.70 cfs
Storm frequency	= 25 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 51,233 cuft
Drainage area	= 4.820 ac	Curve number	= 70*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 20.60 min
Total precip.	= 6.09 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(4.820 x 70)] / 4.820



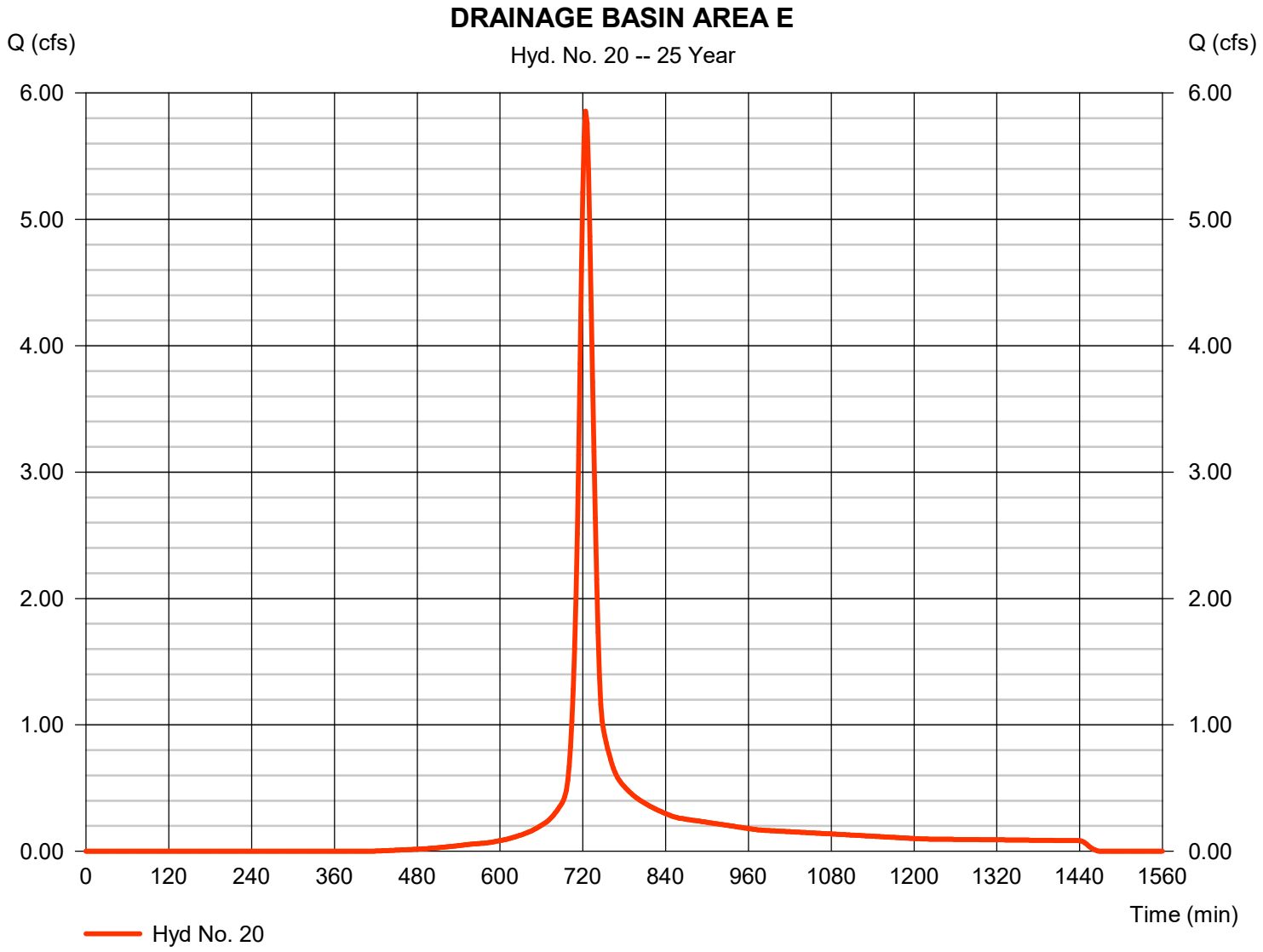
Hydrograph Report

Hyd. No. 20

DRAINAGE BASIN AREA E

Hydrograph type	= SCS Runoff	Peak discharge	= 5.856 cfs
Storm frequency	= 25 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 18,327 cuft
Drainage area	= 1.380 ac	Curve number	= 78*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 19.60 min
Total precip.	= 6.09 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.510 x 92) + (0.870 x 70)] / 1.380

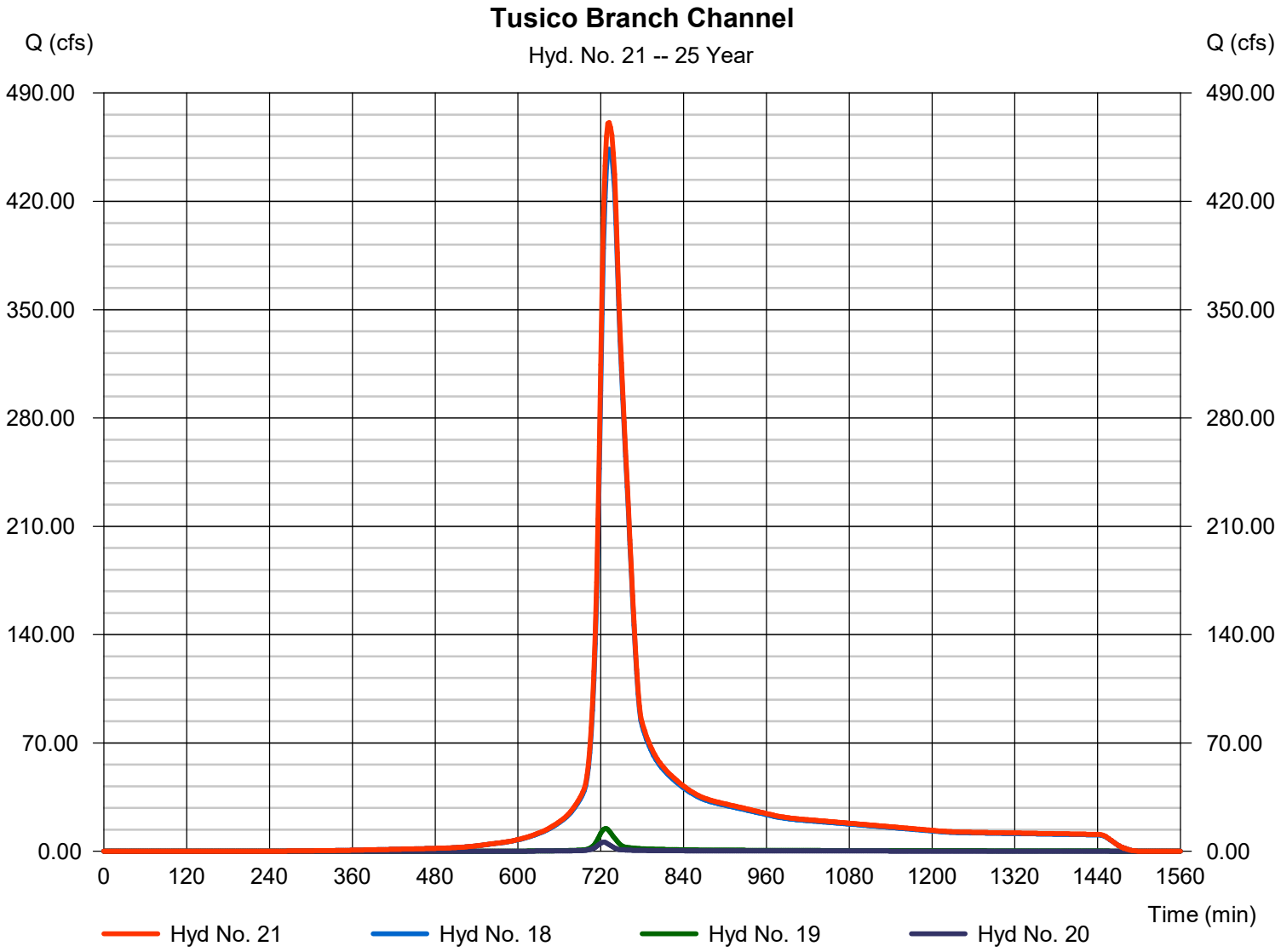


Hydrograph Report

Hyd. No. 21

Tusico Branch Channel

Hydrograph type	= Combine	Peak discharge	= 470.90 cfs
Storm frequency	= 25 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 2,279,462 cuft
Inflow hyds.	= 18, 19, 20	Contrib. drain. area	= 6.200 ac



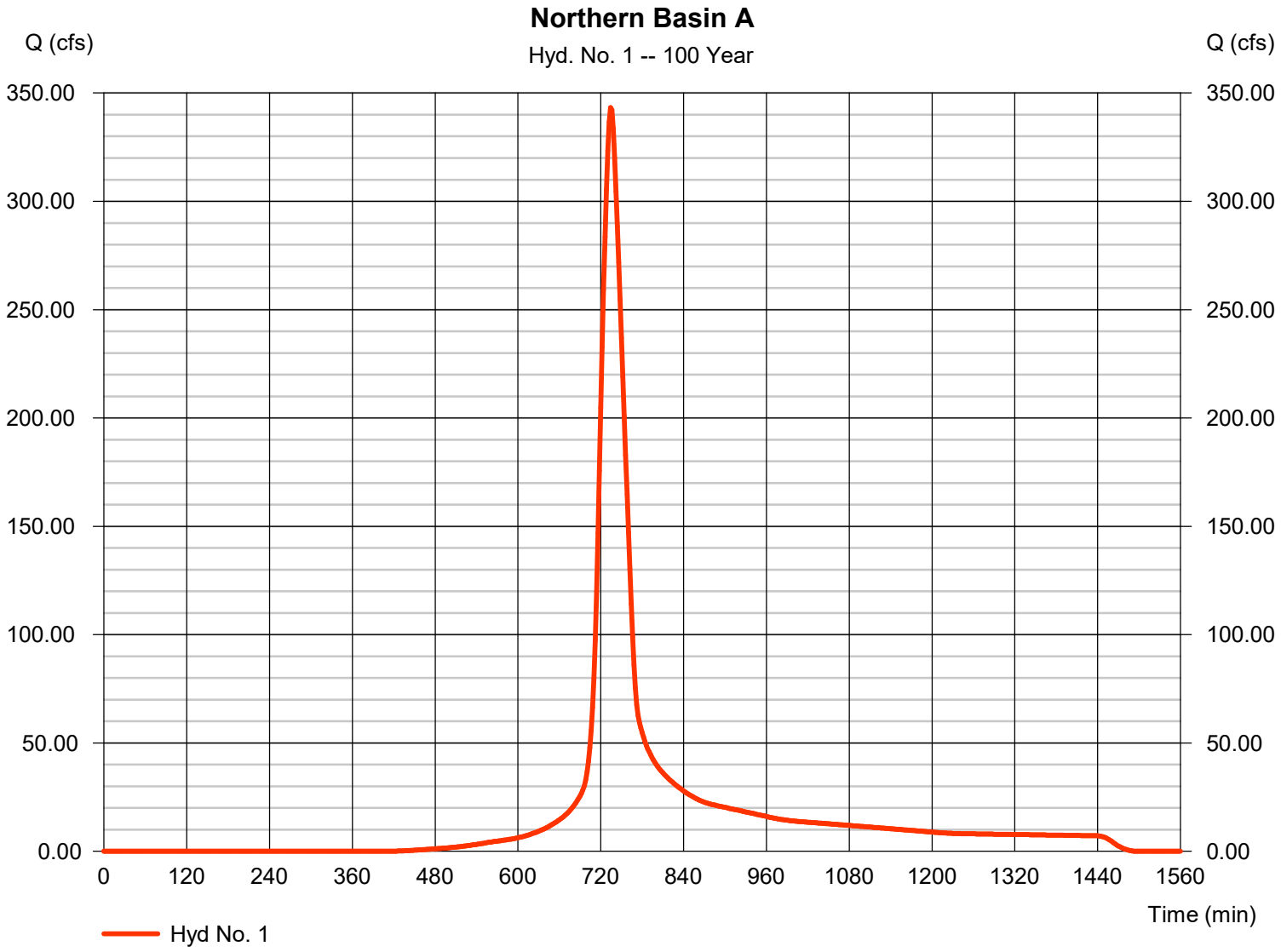
Hydrograph Report

Hyd. No. 1

Northern Basin A

Hydrograph type	=	SCS Runoff	Peak discharge	=	343.32 cfs
Storm frequency	=	100 yrs	Time to peak	=	734 min
Time interval	=	2 min	Hyd. volume	=	1,554,824 cuft
Drainage area	=	85.690 ac	Curve number	=	72*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	36.90 min
Total precip.	=	8.41 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(45.470 x 70) + (9.460 x 92) + (30.760 x 70)] / 85.690



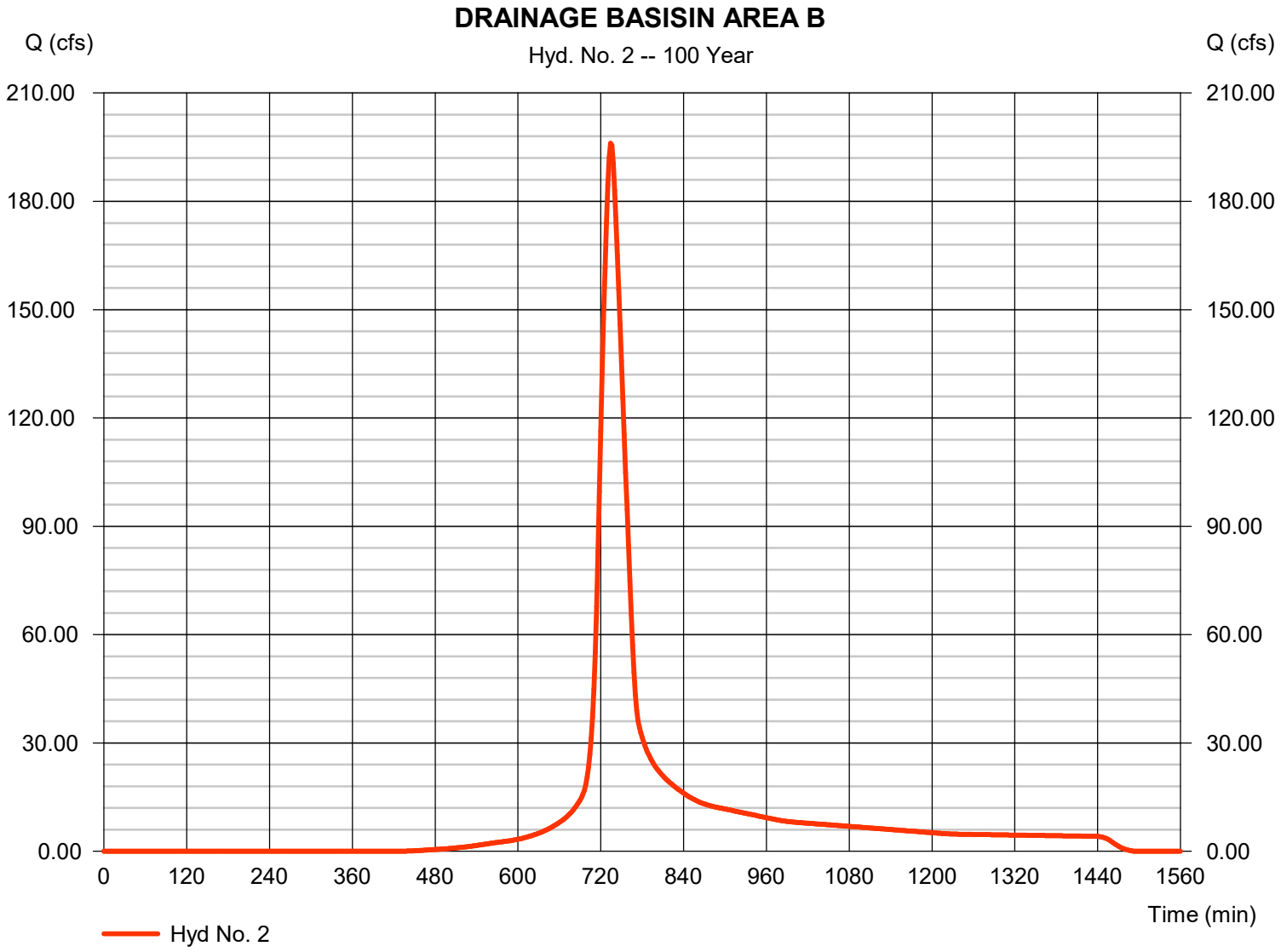
Hydrograph Report

Hyd. No. 2

DRAINAGE BASISIN AREA B

Hydrograph type	=	SCS Runoff	Peak discharge	=	196.08 cfs
Storm frequency	=	100 yrs	Time to peak	=	734 min
Time interval	=	2 min	Hyd. volume	=	888,228 cuft
Drainage area	=	50.130 ac	Curve number	=	71*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	34.90 min
Total precip.	=	8.41 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(3.260 x 92) + (46.870 x 70)] / 50.130

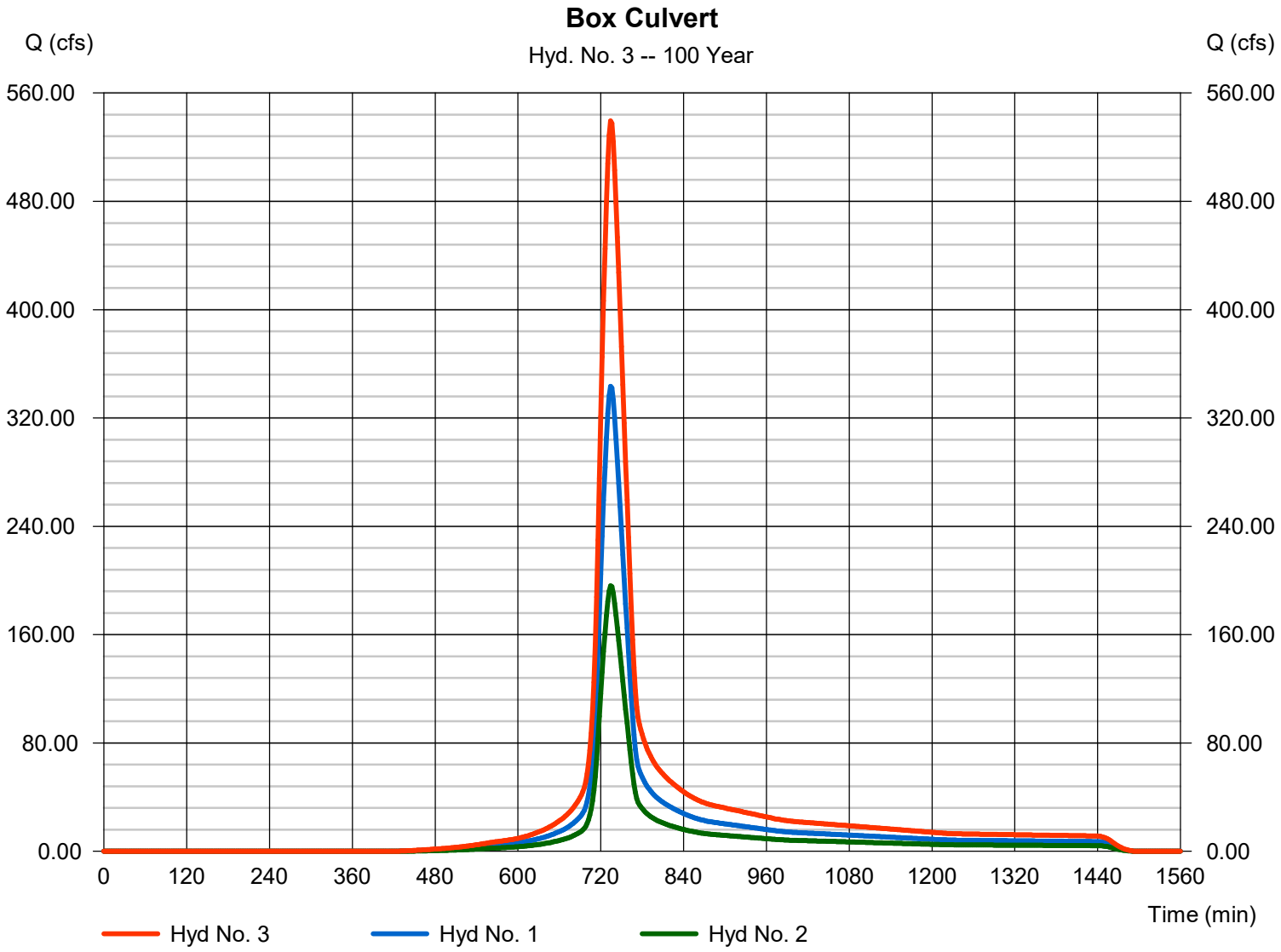


Hydrograph Report

Hyd. No. 3

Box Culvert

Hydrograph type	= Combine	Peak discharge	= 539.41 cfs
Storm frequency	= 100 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 2,443,053 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 135.820 ac



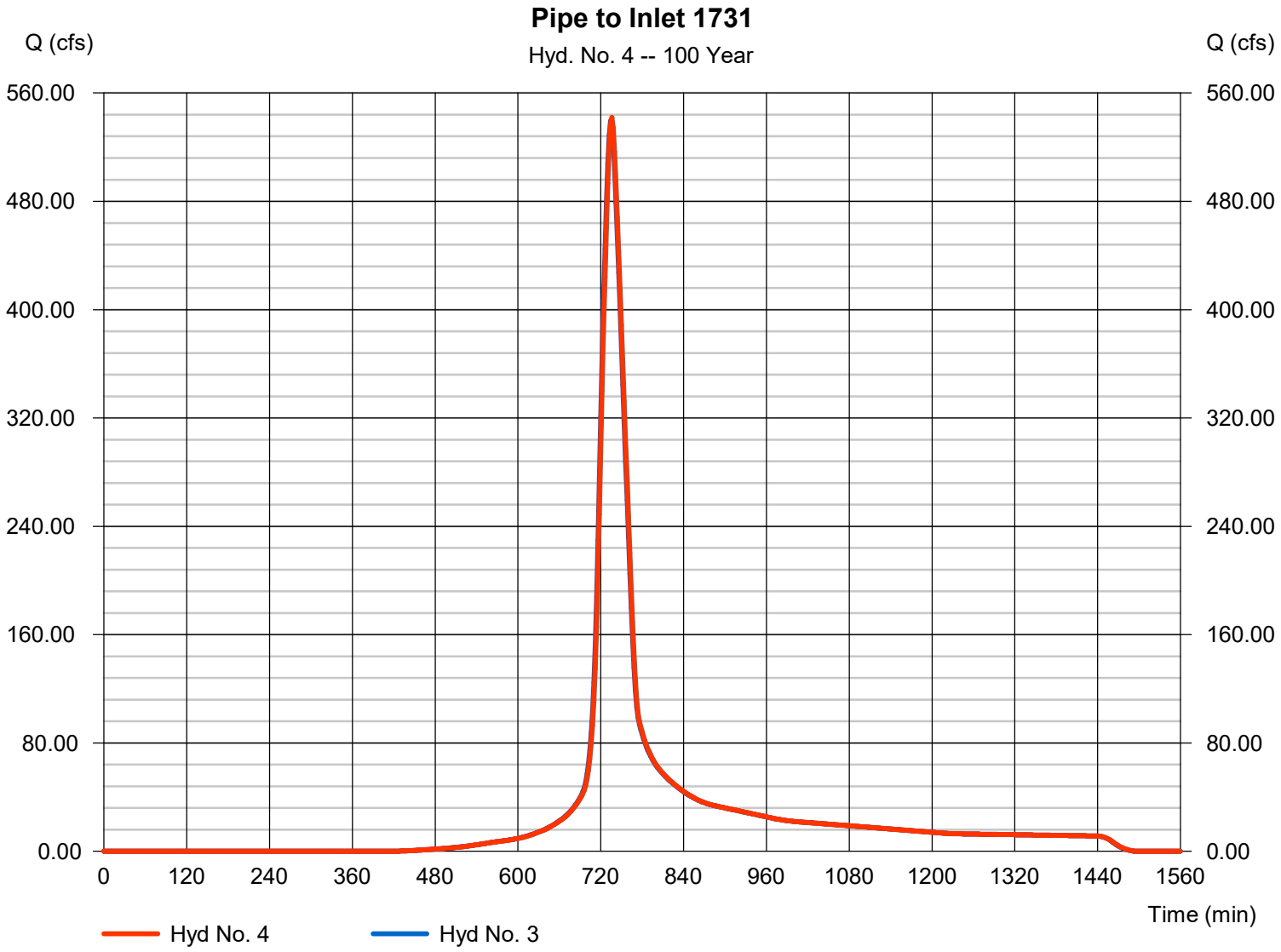
Hydrograph Report

Hyd. No. 4

Pipe to Inlet 1731

Hydrograph type	=	Reach	Peak discharge	=	541.93 cfs
Storm frequency	=	100 yrs	Time to peak	=	736 min
Time interval	=	2 min	Hyd. volume	=	2,443,054 cuft
Inflow hyd. No.	=	3 - Box Culvert	Section type	=	Circular
Reach length	=	299.0 ft	Channel slope	=	0.7 %
Manning's n	=	0.013	Bottom width	=	5.0 ft
Side slope	=	0.0:1	Max. depth	=	0.0 ft
Rating curve x	=	6.957	Rating curve m	=	1.250
Ave. velocity	=	0.00 ft/s	Routing coeff.	=	1.7465

Modified Att-Kin routing method used.



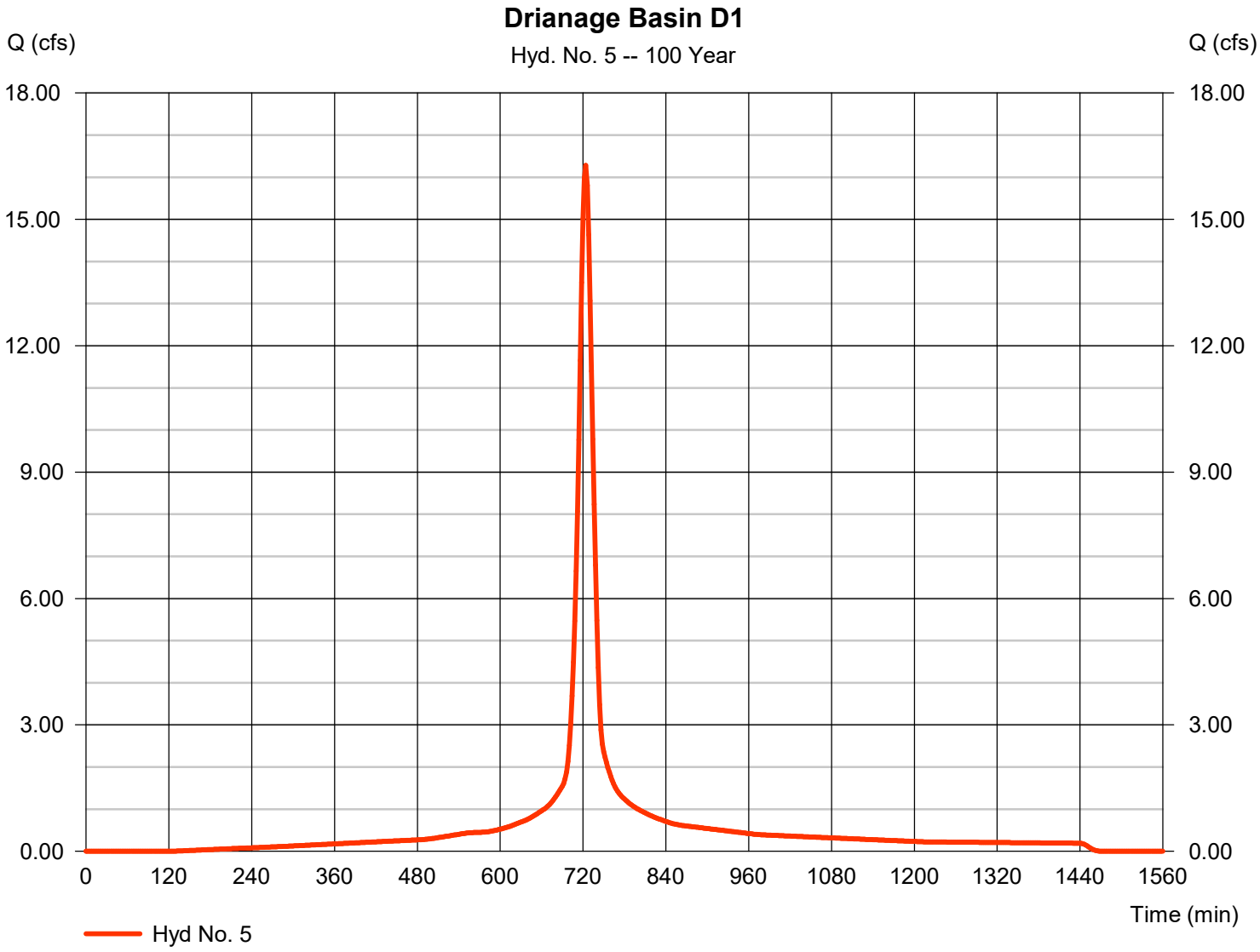
Hydrograph Report

Hyd. No. 5

Drianage Basin D1

Hydrograph type	=	SCS Runoff	Peak discharge	=	16.28 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	55,165 cuft
Drainage area	=	2.040 ac	Curve number	=	92*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	19.20 min
Total precip.	=	8.41 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.040 x 92)] / 2.040

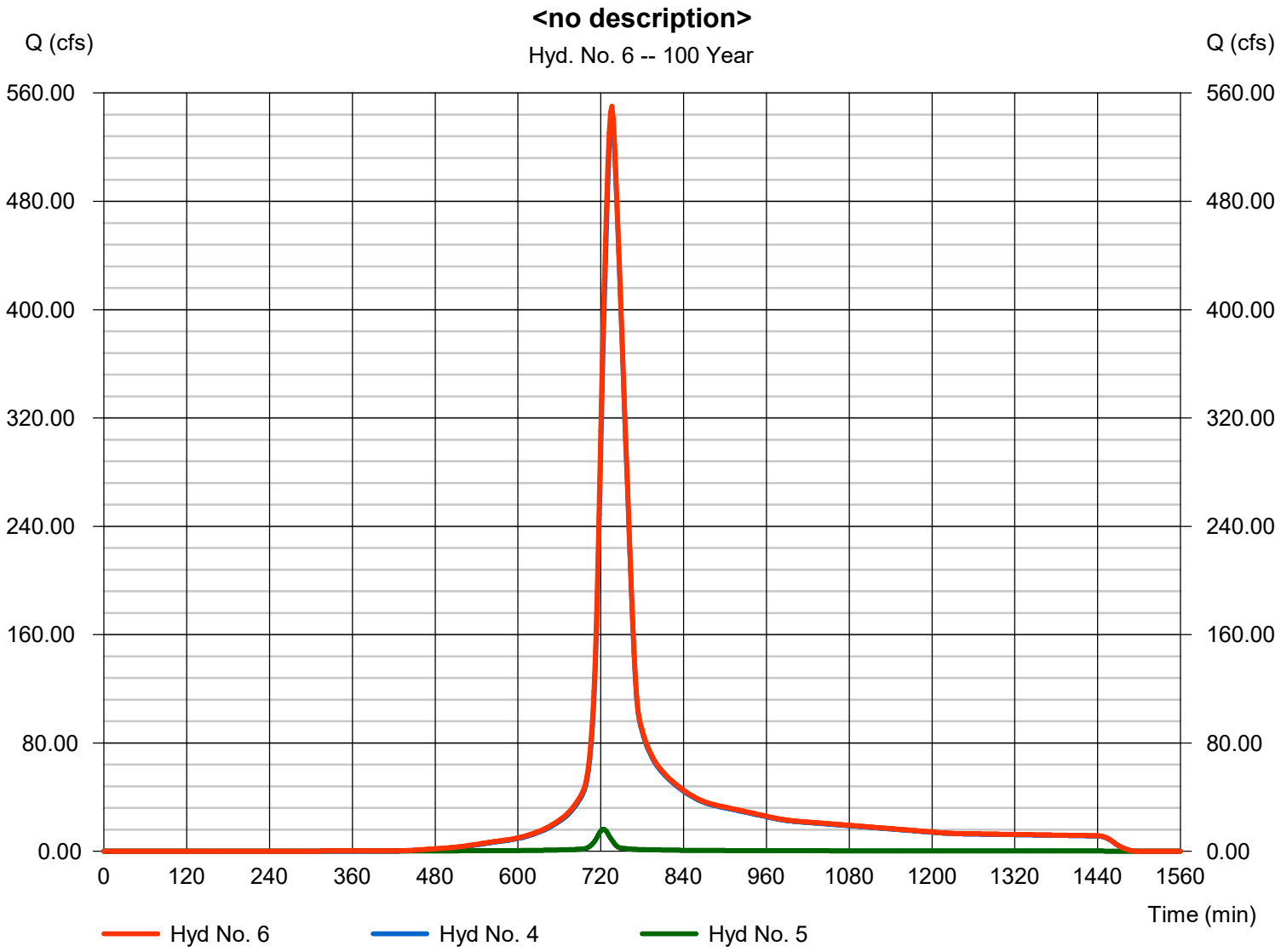


Hydrograph Report

Hyd. No. 6

<no description>

Hydrograph type	= Combine	Peak discharge	= 550.17 cfs
Storm frequency	= 100 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 2,498,218 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 2.040 ac



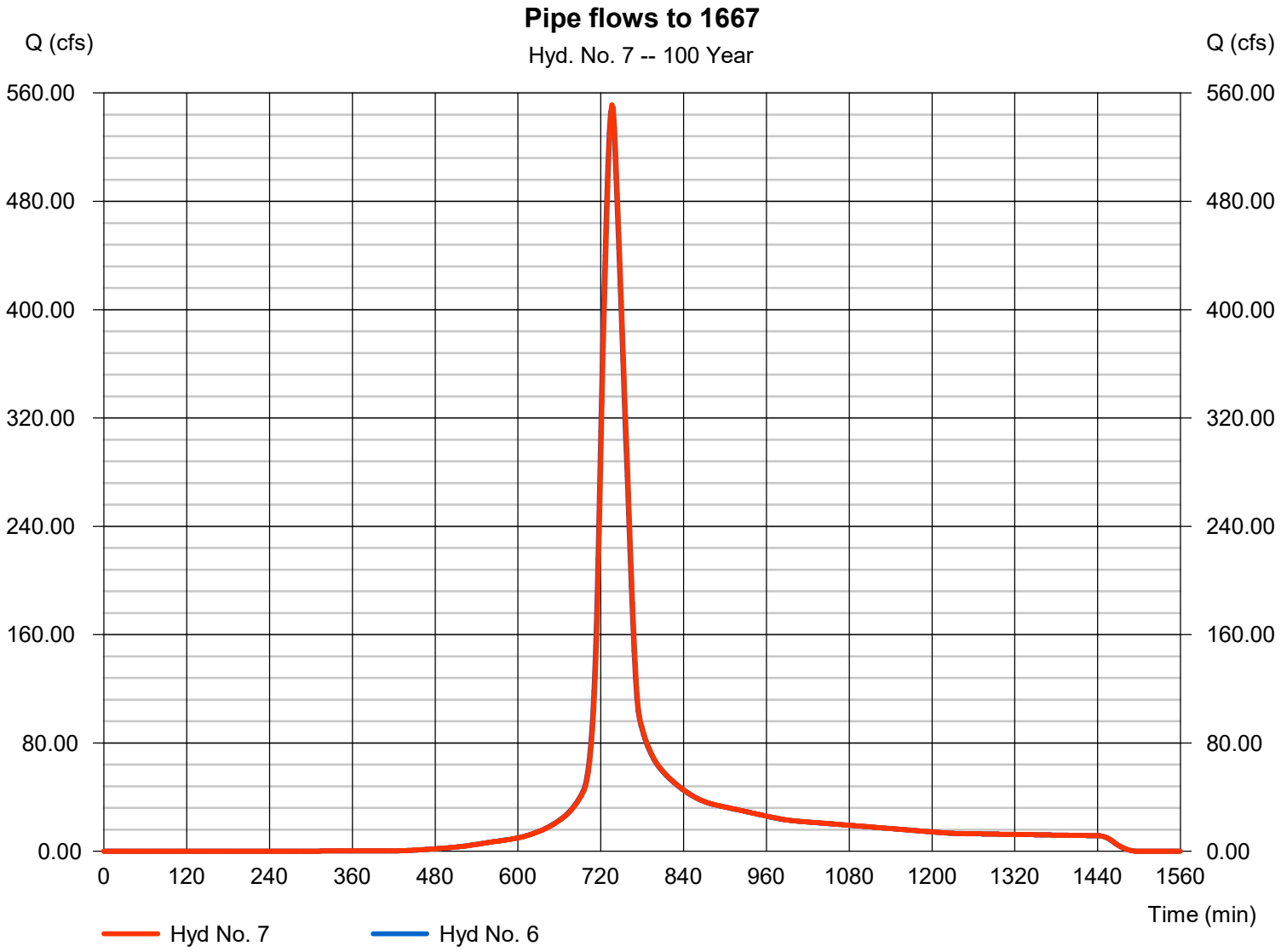
Hydrograph Report

Hyd. No. 7

Pipe flows to 1667

Hydrograph type	= Reach	Peak discharge	= 551.17 cfs
Storm frequency	= 100 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 2,498,219 cuft
Inflow hyd. No.	= 6 - <no description>	Section type	= Circular
Reach length	= 177.0 ft	Channel slope	= 1.5 %
Manning's n	= 0.015	Bottom width	= 5.0 ft
Side slope	= 0.0:1	Max. depth	= 0.0 ft
Rating curve x	= 8.613	Rating curve m	= 1.250
Ave. velocity	= 0.00 ft/s	Routing coeff.	= 1.8446

Modified Att-Kin routing method used.



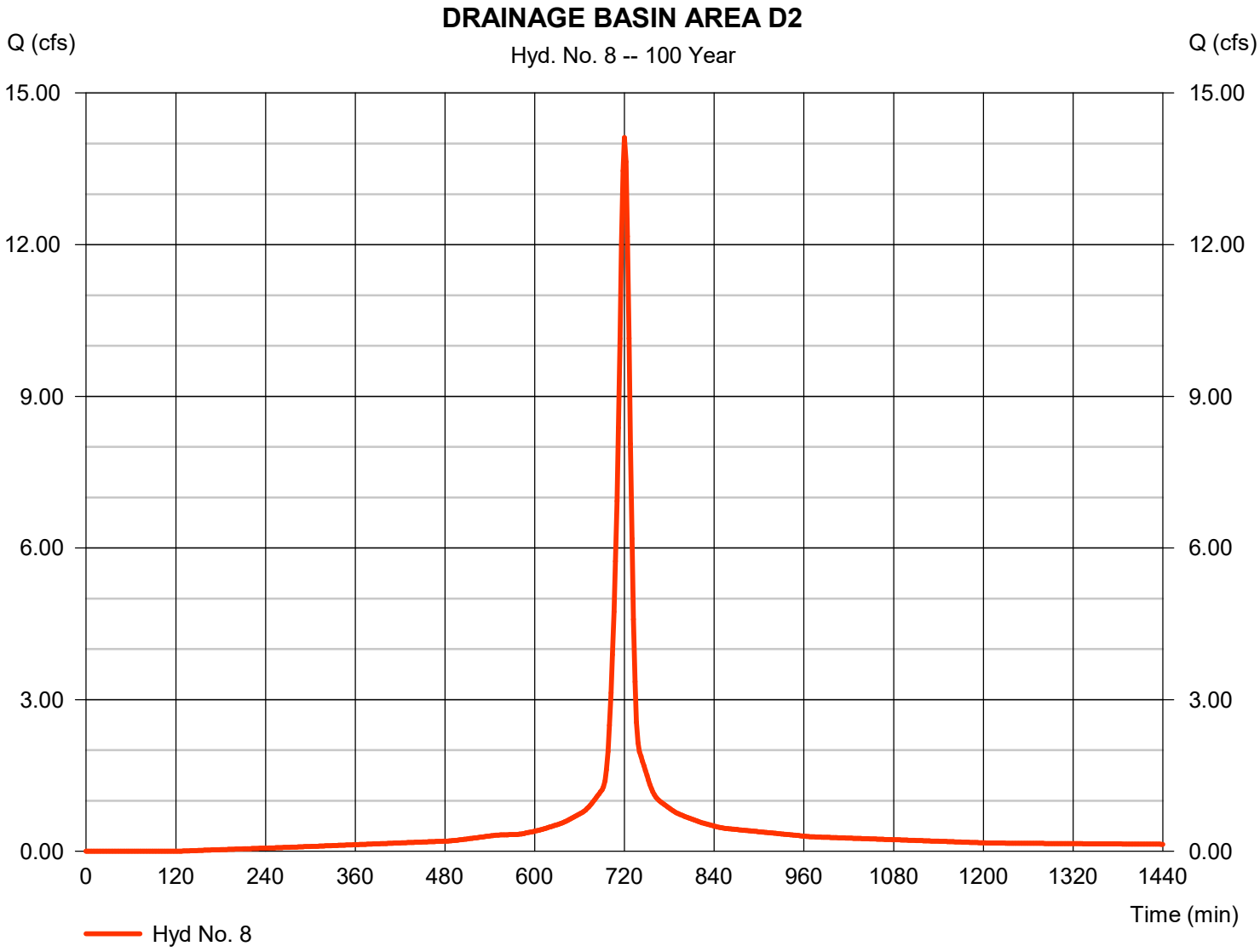
Hydrograph Report

Hyd. No. 8

DRAINAGE BASIN AREA D2

Hydrograph type	= SCS Runoff	Peak discharge	= 14.12 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 40,157 cuft
Drainage area	= 1.440 ac	Curve number	= 92*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 11.70 min
Total precip.	= 8.41 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.440 x 92)] / 1.440

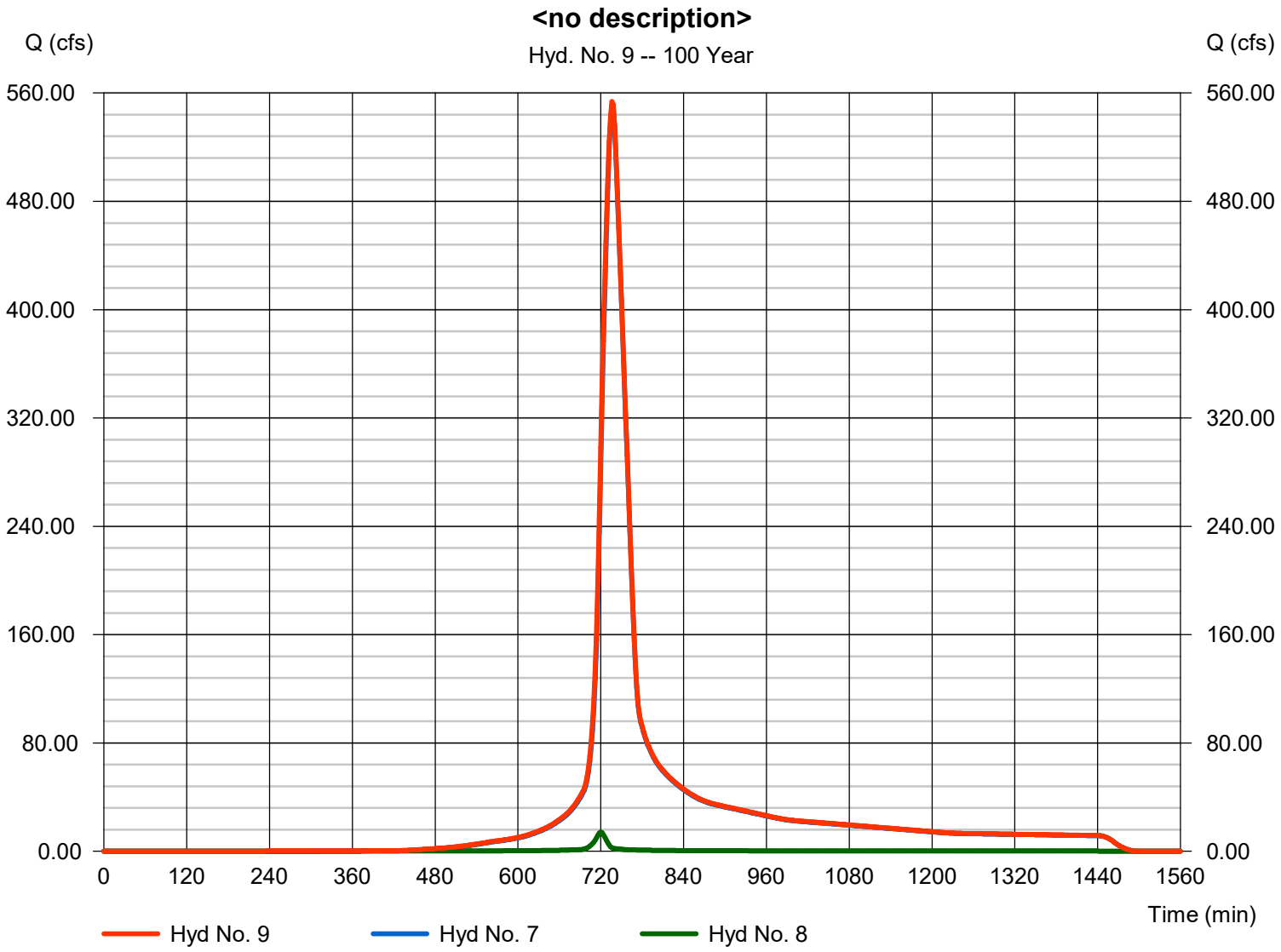


Hydrograph Report

Hyd. No. 9

<no description>

Hydrograph type	= Combine	Peak discharge	= 553.73 cfs
Storm frequency	= 100 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 2,538,375 cuft
Inflow hyds.	= 7, 8	Contrib. drain. area	= 1.440 ac



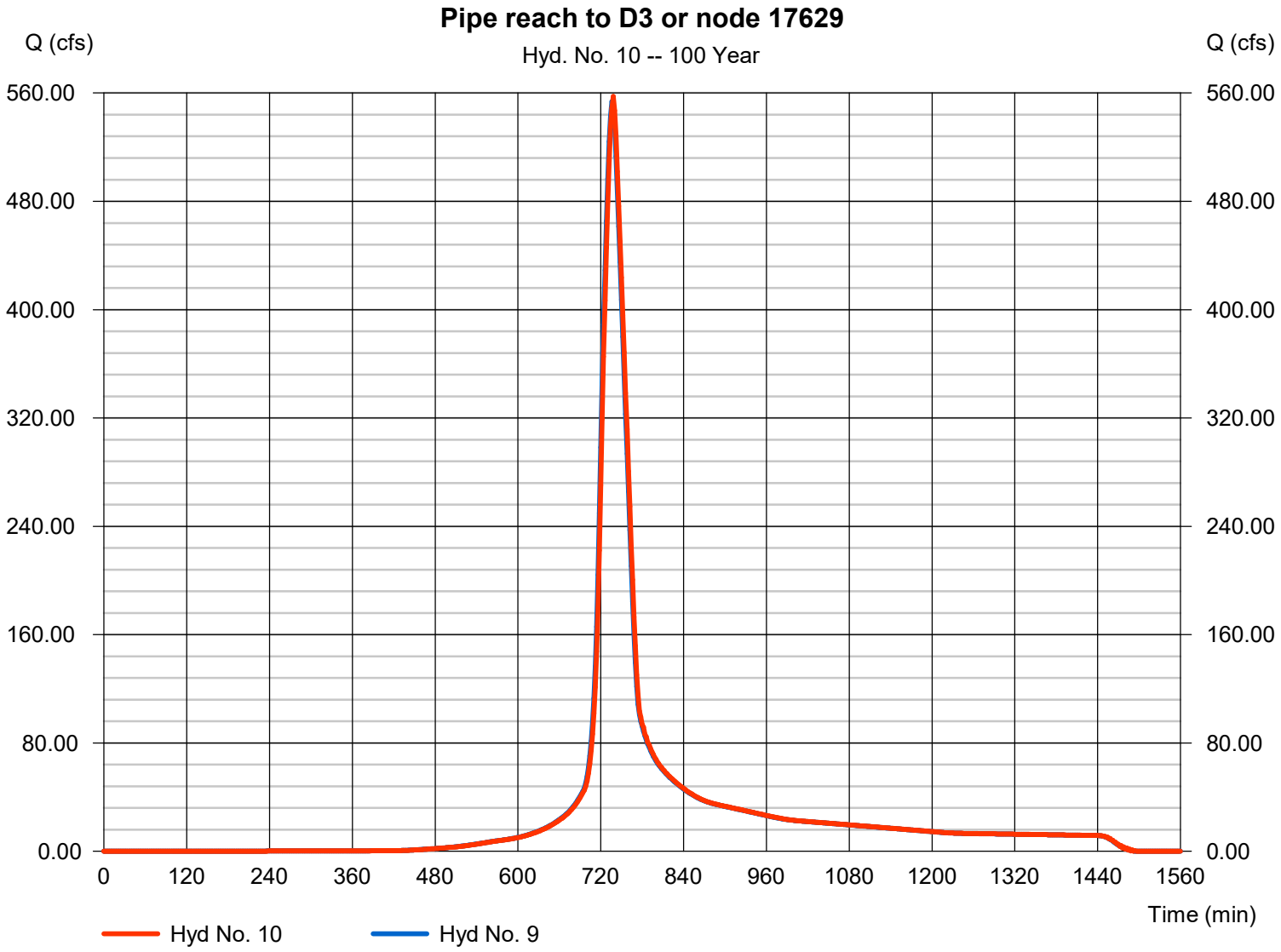
Hydrograph Report

Hyd. No. 10

Pipe reach to D3 or node 17629

Hydrograph type	=	Reach	Peak discharge	=	557.38 cfs
Storm frequency	=	100 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	2,538,402 cuft
Inflow hyd. No.	=	9 - <no description>	Section type	=	Circular
Reach length	=	317.0 ft	Channel slope	=	1.5 %
Manning's n	=	0.015	Bottom width	=	5.0 ft
Side slope	=	0.0:1	Max. depth	=	0.0 ft
Rating curve x	=	8.613	Rating curve m	=	1.250
Ave. velocity	=	0.00 ft/s	Routing coeff.	=	1.7393

Modified Att-Kin routing method used.



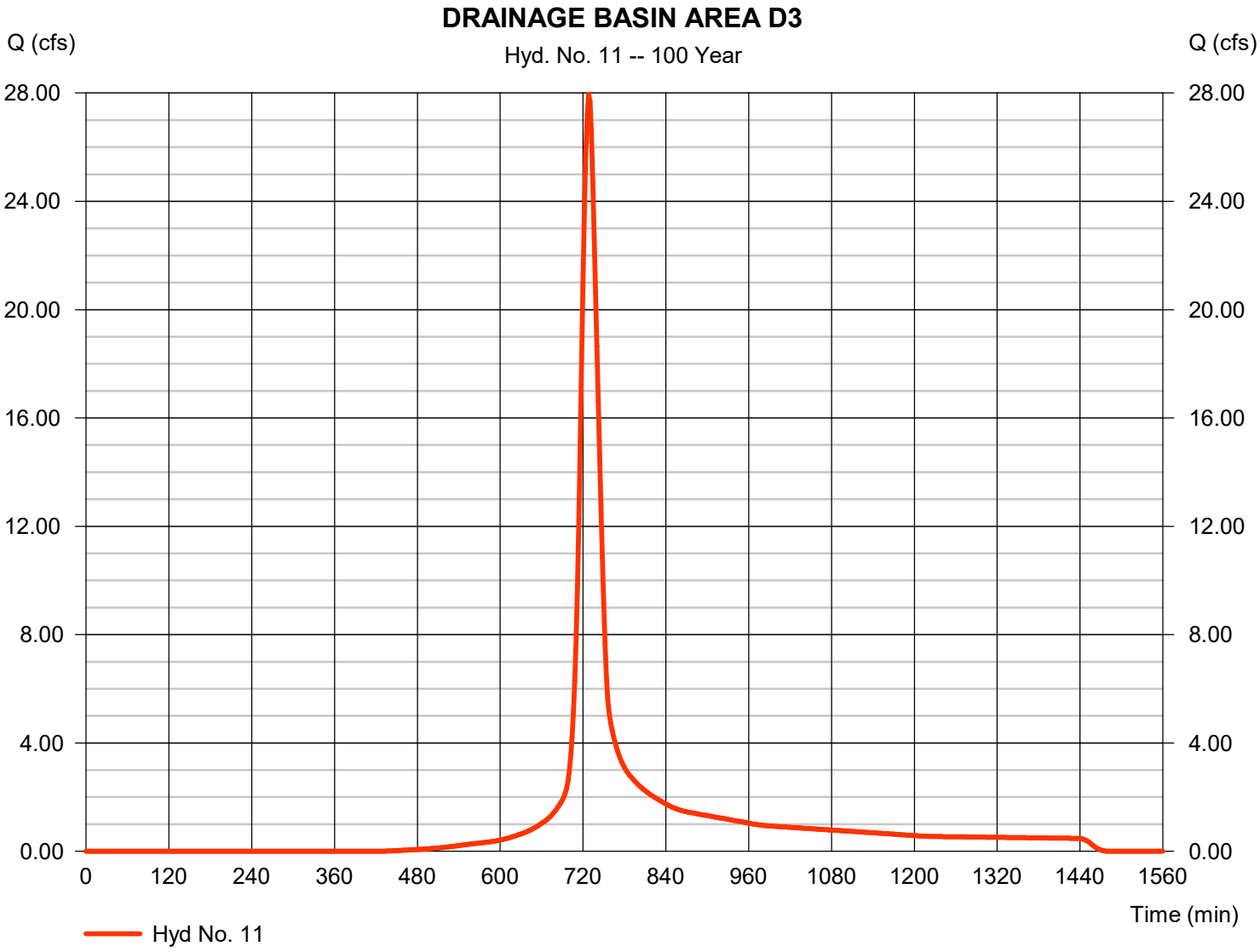
Hydrograph Report

Hyd. No. 11

DRAINAGE BASIN AREA D3

Hydrograph type	= SCS Runoff	Peak discharge	= 27.94 cfs
Storm frequency	= 100 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 102,501 cuft
Drainage area	= 5.810 ac	Curve number	= 71*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 25.70 min
Total precip.	= 8.41 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.340 x 92) + (5.470 x 70)] / 5.810

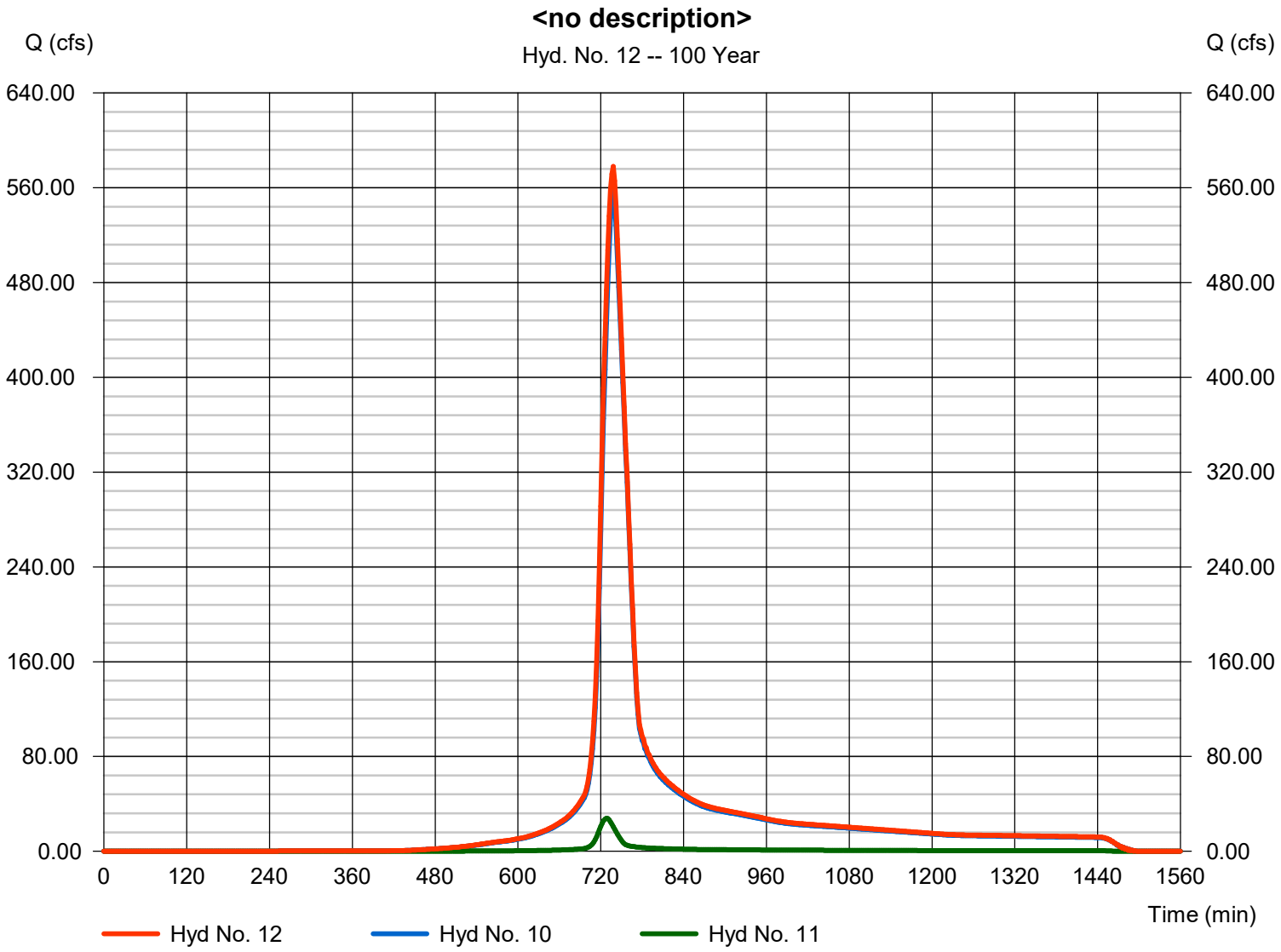


Hydrograph Report

Hyd. No. 12

<no description>

Hydrograph type	= Combine	Peak discharge	= 578.06 cfs
Storm frequency	= 100 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 2,640,901 cuft
Inflow hyds.	= 10, 11	Contrib. drain. area	= 5.810 ac



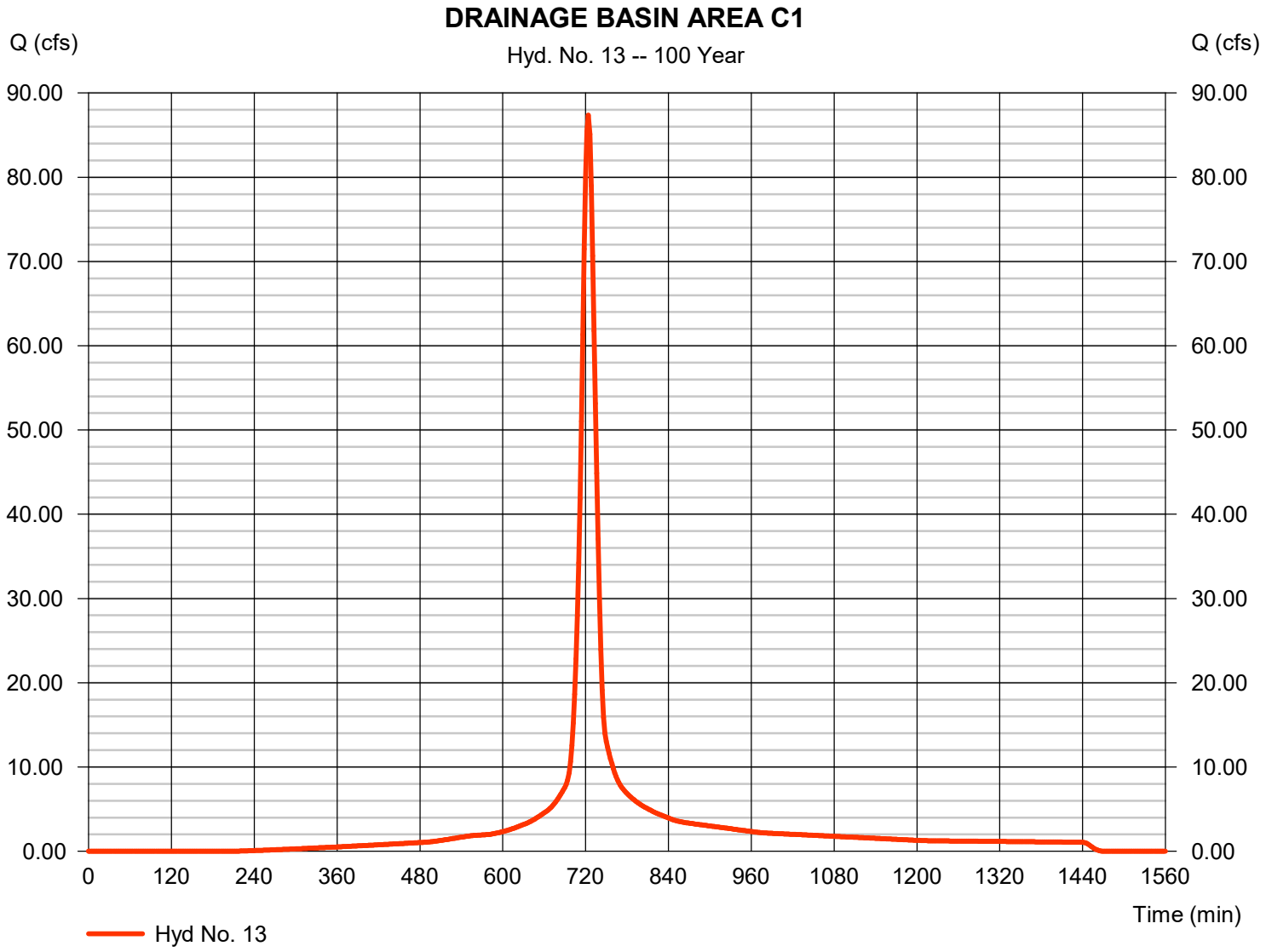
Hydrograph Report

Hyd. No. 13

DRAINAGE BASIN AREA C1

Hydrograph type	=	SCS Runoff	Peak discharge	=	87.38 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	284,582 cuft
Drainage area	=	11.650 ac	Curve number	=	86*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	17.10 min
Total precip.	=	8.41 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(8.240 x 92) + (3.410 x 70)] / 11.650



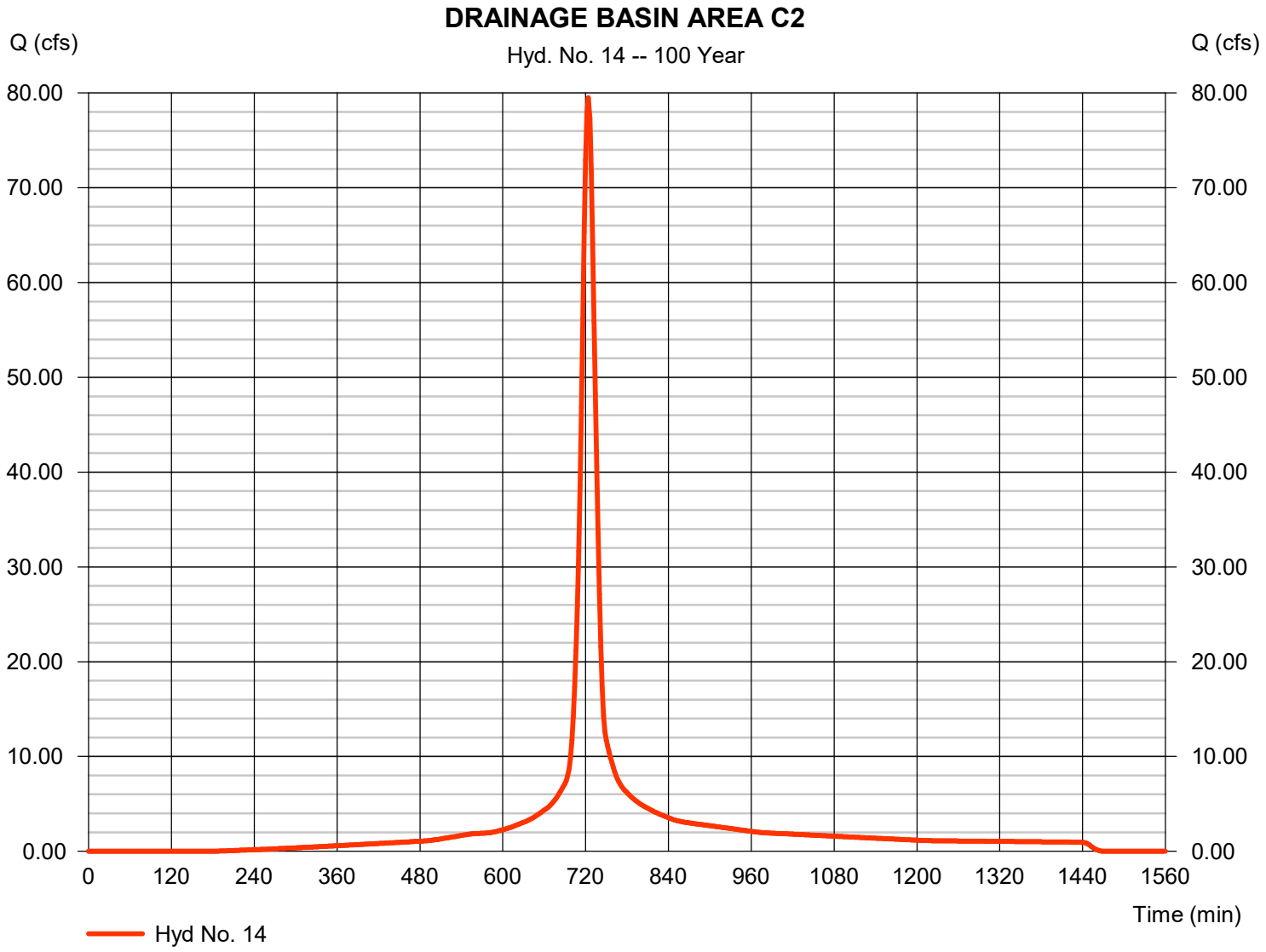
Hydrograph Report

Hyd. No. 14

DRAINAGE BASIN AREA C2

Hydrograph type	=	SCS Runoff	Peak discharge	=	79.49 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	261,842 cuft
Drainage area	=	10.350 ac	Curve number	=	88*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	19.40 min
Total precip.	=	8.41 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(8.270 x 92) + (2.080 x 70)] / 10.350

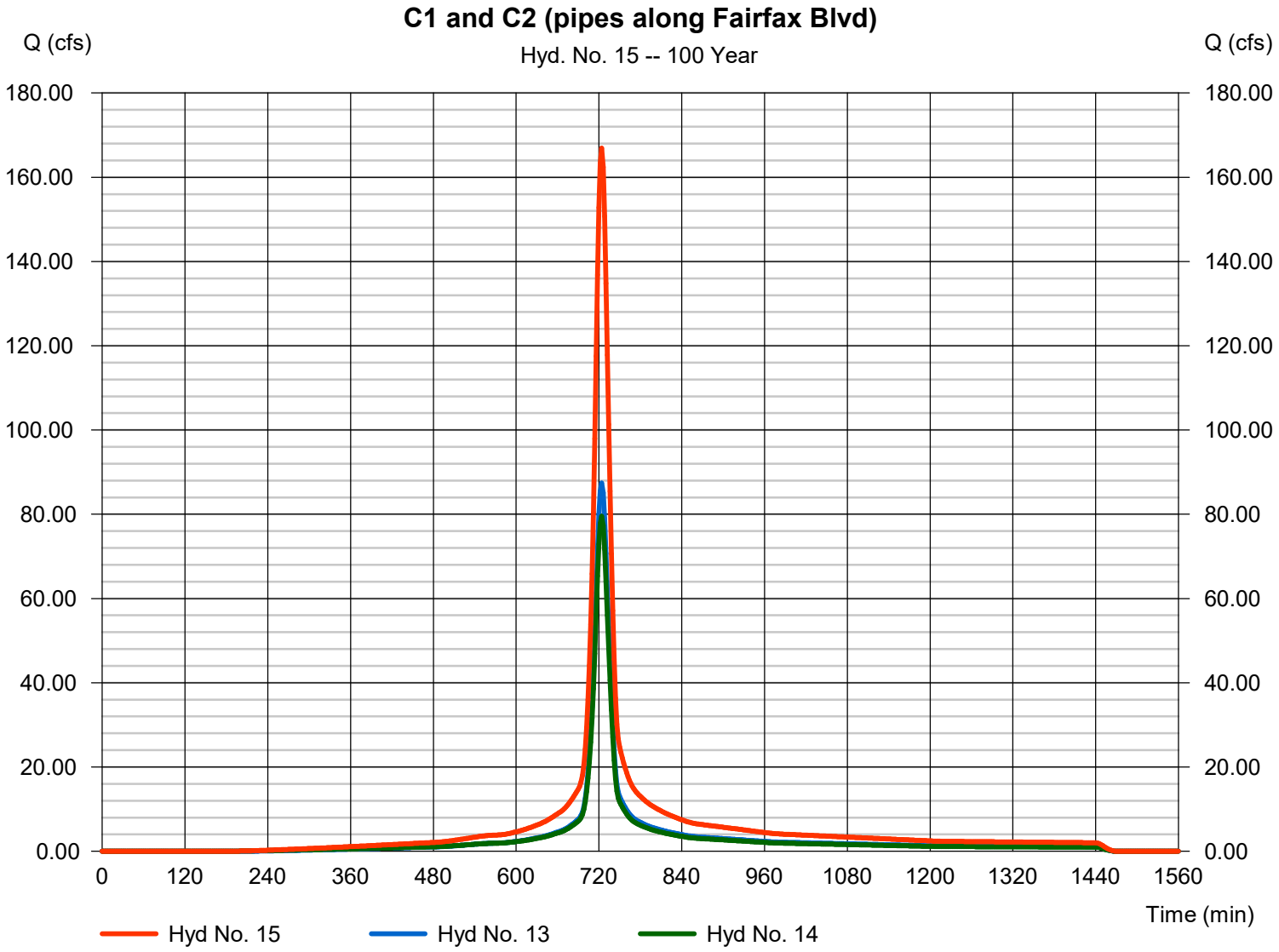


Hydrograph Report

Hyd. No. 15

C1 and C2 (pipes along Fairfax Blvd)

Hydrograph type	= Combine	Peak discharge	= 166.87 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 546,424 cuft
Inflow hyds.	= 13, 14	Contrib. drain. area	= 22.000 ac



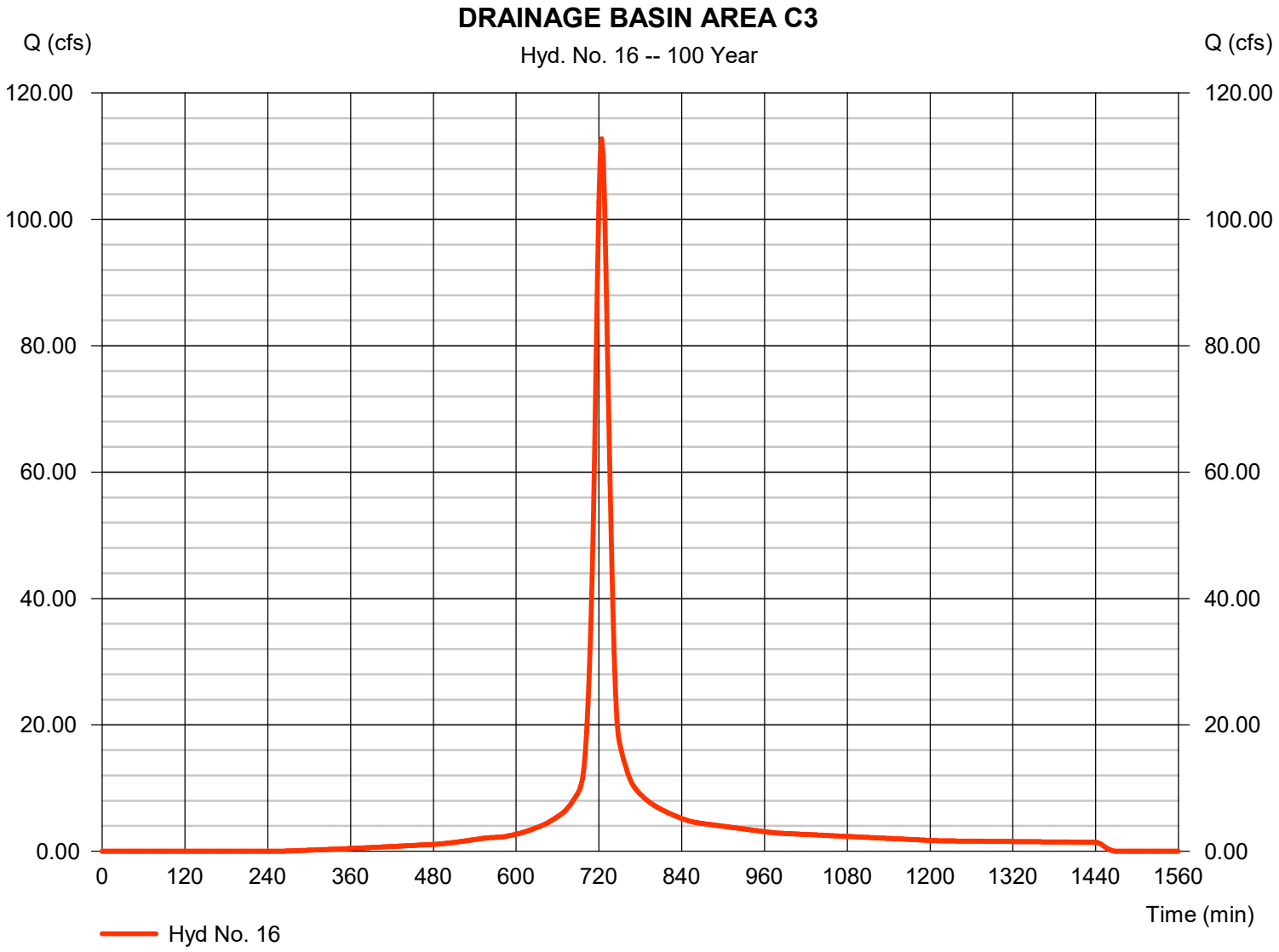
Hydrograph Report

Hyd. No. 16

DRAINAGE BASIN AREA C3

Hydrograph type	=	SCS Runoff	Peak discharge	=	112.74 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	362,088 cuft
Drainage area	=	15.660 ac	Curve number	=	83*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	20.00 min
Total precip.	=	8.41 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(9.340 x 92) + (6.320 x 70)] / 15.660

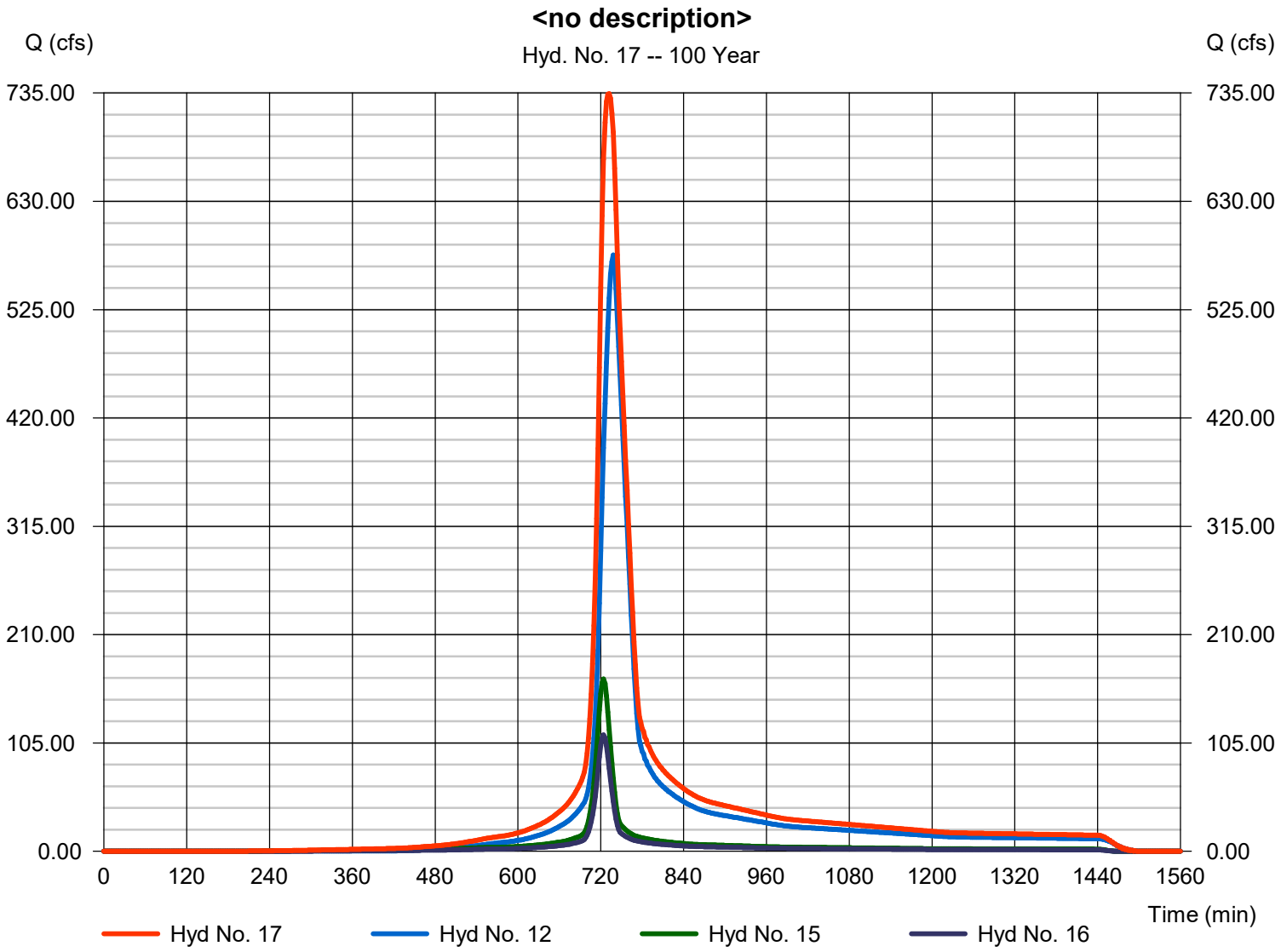


Hydrograph Report

Hyd. No. 17

<no description>

Hydrograph type	= Combine	Peak discharge	= 734.24 cfs
Storm frequency	= 100 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 3,549,415 cuft
Inflow hyds.	= 12, 15, 16	Contrib. drain. area	= 15.660 ac



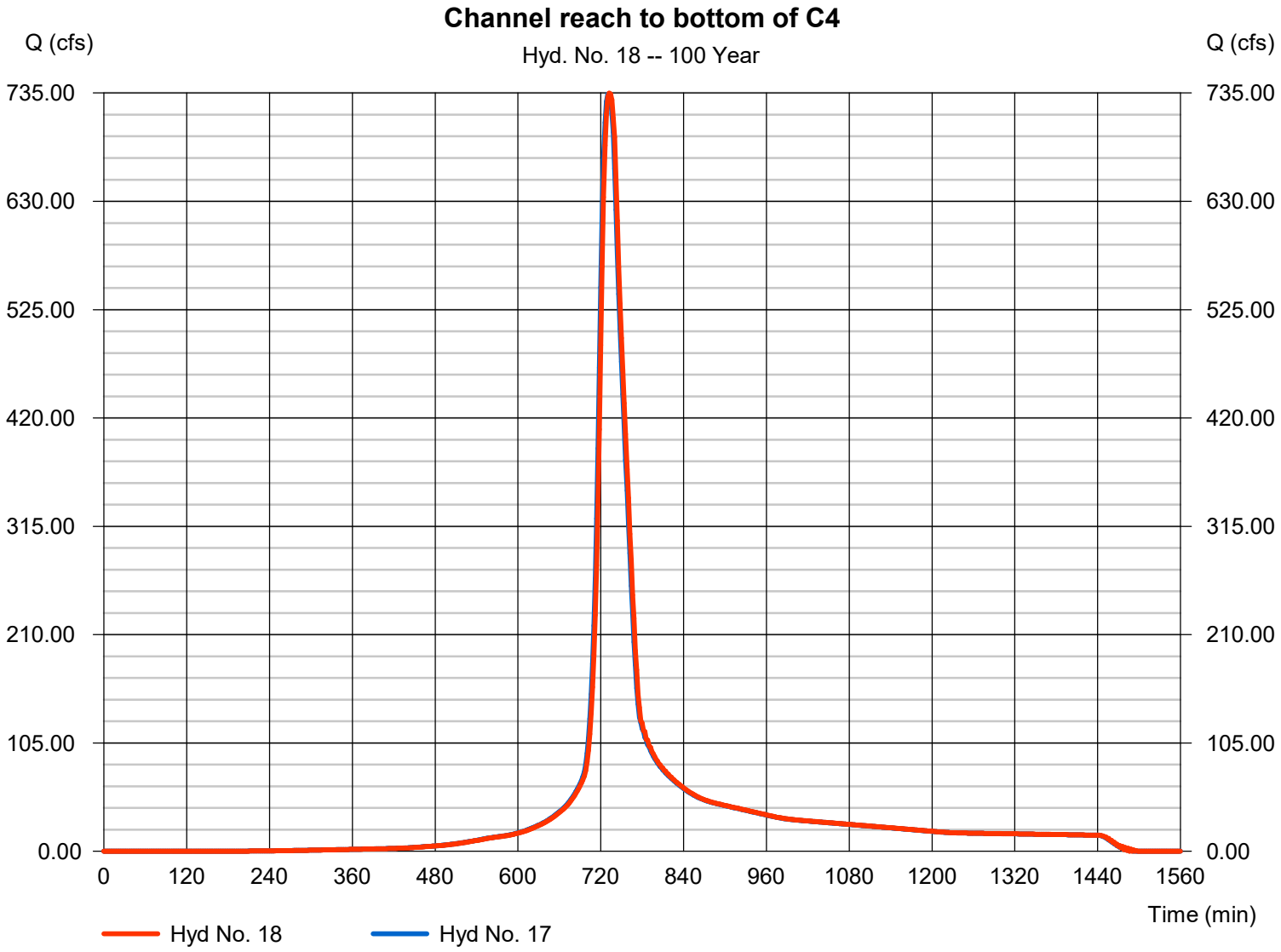
Hydrograph Report

Hyd. No. 18

Channel reach to bottom of C4

Hydrograph type	=	Reach	Peak discharge	=	734.83 cfs
Storm frequency	=	100 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	3,549,518 cuft
Inflow hyd. No.	=	17 - <no description>	Section type	=	Trapezoidal
Reach length	=	259.0 ft	Channel slope	=	1.8 %
Manning's n	=	0.040	Bottom width	=	14.0 ft
Side slope	=	3.0:1	Max. depth	=	3.0 ft
Rating curve x	=	0.852	Rating curve m	=	1.429
Ave. velocity	=	0.00 ft/s	Routing coeff.	=	1.3651

Modified Att-Kin routing method used.



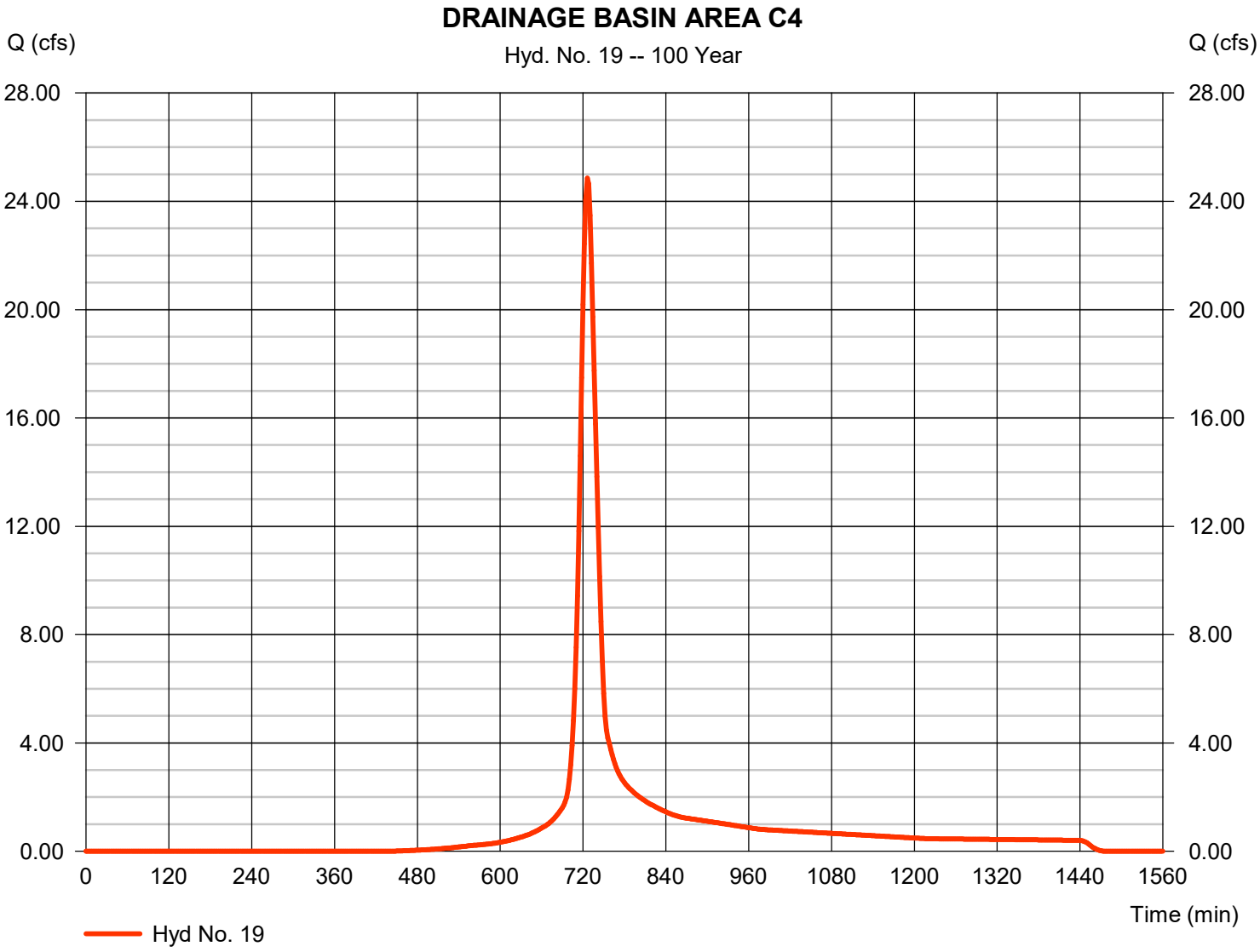
Hydrograph Report

Hyd. No. 19

DRAINAGE BASIN AREA C4

Hydrograph type	= SCS Runoff	Peak discharge	= 24.86 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 85,815 cuft
Drainage area	= 4.820 ac	Curve number	= 70*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 20.60 min
Total precip.	= 8.41 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(4.820 x 70)] / 4.820



Hydrograph Report

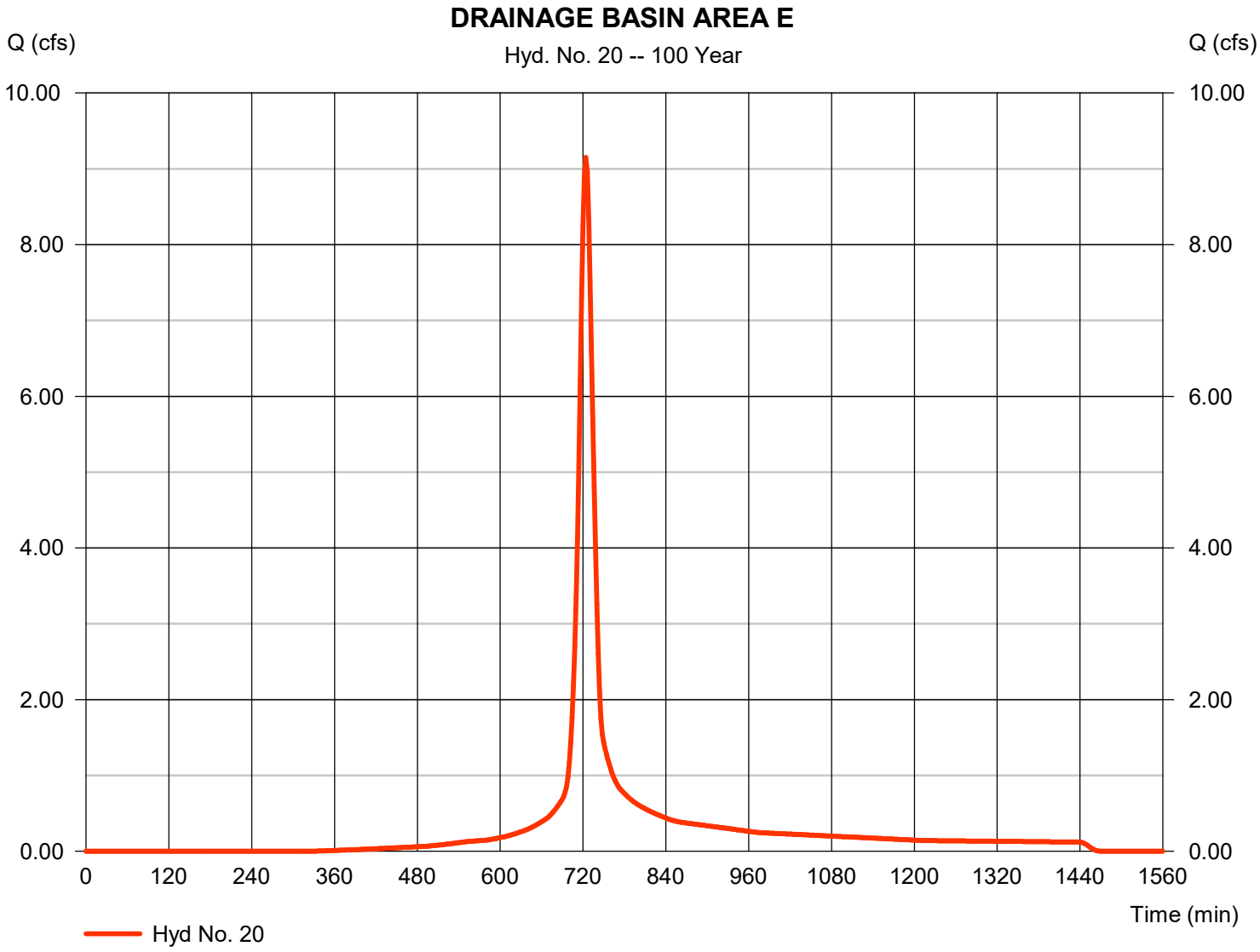
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Thursday, 02 / 2 / 2017

Hyd. No. 20

DRAINAGE BASIN AREA E

Hydrograph type	=	SCS Runoff	Peak discharge	=	9.149 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	28,910 cuft
Drainage area	=	1.380 ac	Curve number	=	78*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	19.60 min
Total precip.	=	8.41 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.510 x 92) + (0.870 x 70)] / 1.380

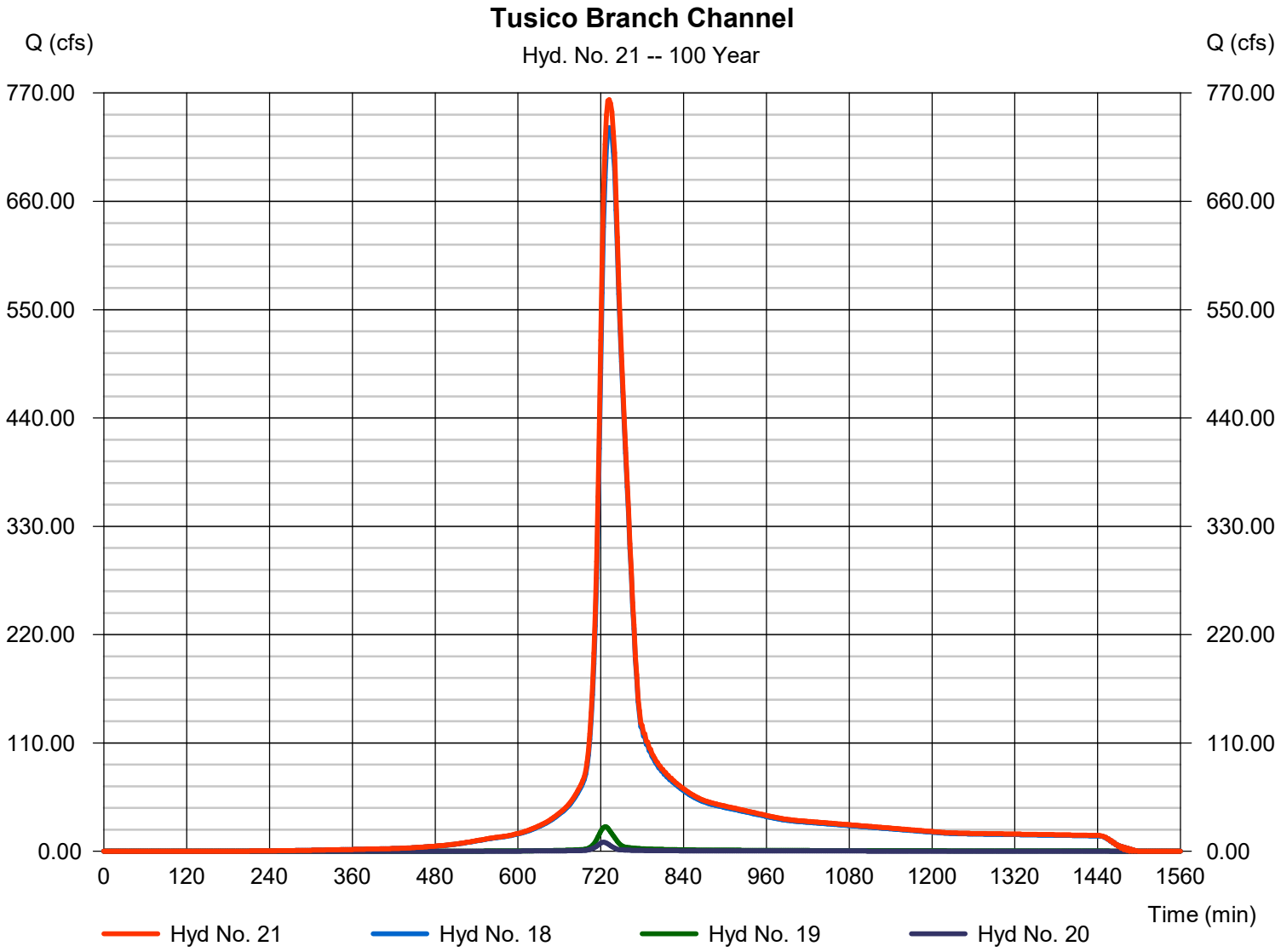


Hydrograph Report

Hyd. No. 21

Tusico Branch Channel

Hydrograph type	= Combine	Peak discharge	= 763.13 cfs
Storm frequency	= 100 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 3,664,243 cuft
Inflow hyds.	= 18, 19, 20	Contrib. drain. area	= 6.200 ac



Hydrograph Report

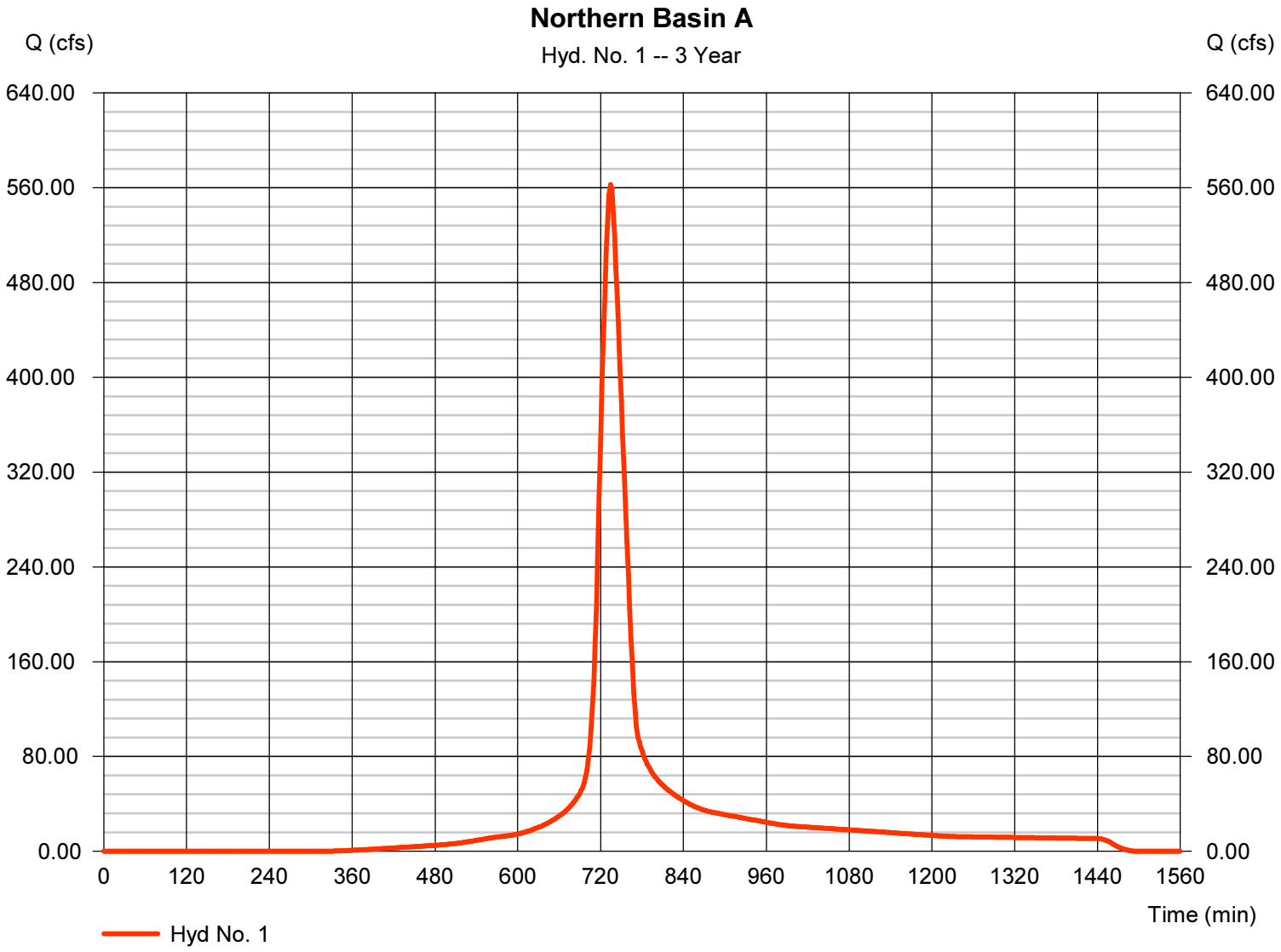
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Monday, 01 / 23 / 2017

Hyd. No. 1

Northern Basin A

Hydrograph type	= SCS Runoff	Peak discharge	= 562.65 cfs
Storm frequency	= 500 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 2,562,917 cuft
Drainage area	= 85.690 ac	Curve number	= 72*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 36.90 min
Total precip.	= 12.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(45.470 x 70) + (9.460 x 92) + (30.760 x 70)] / 85.690



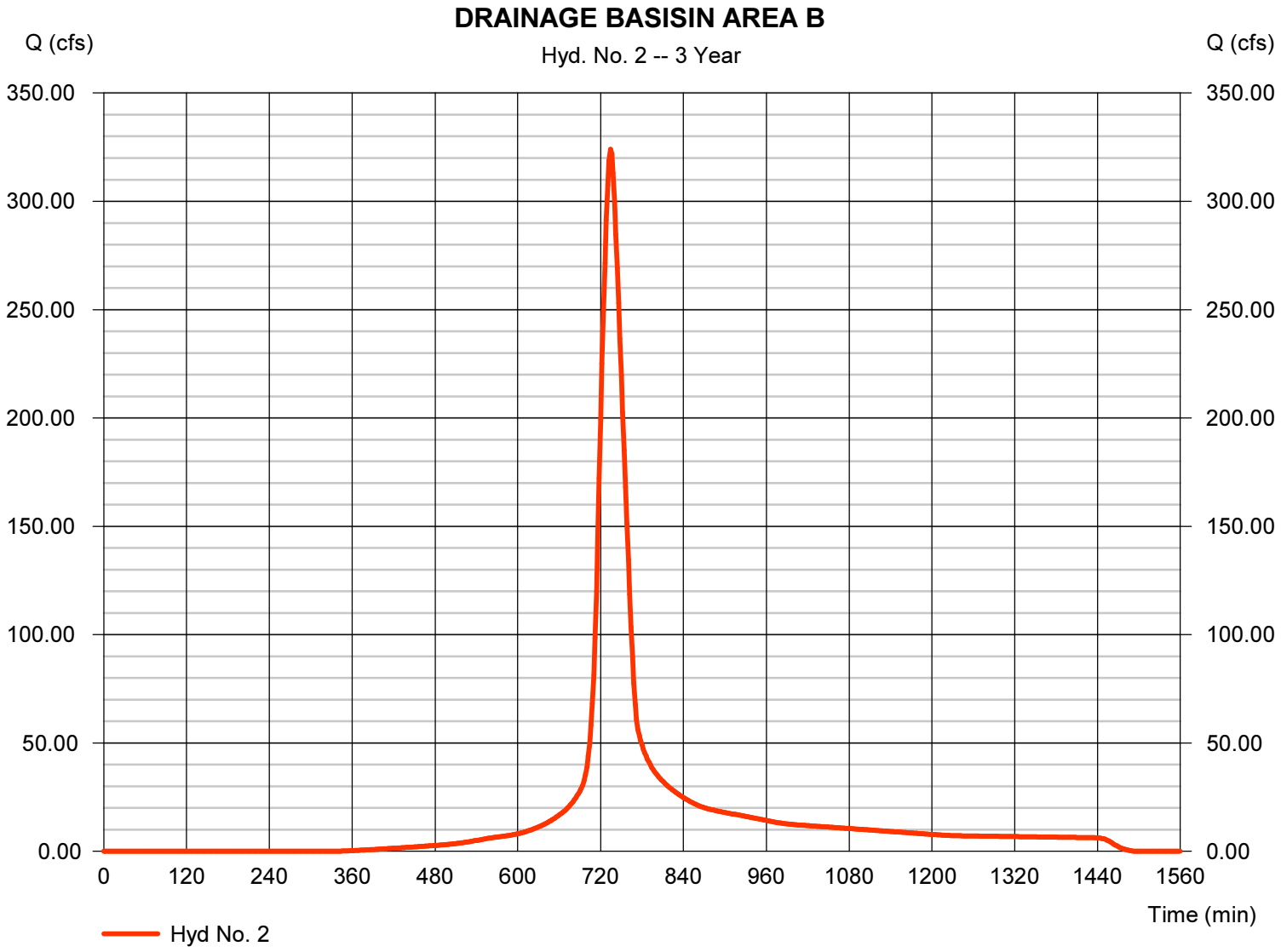
Hydrograph Report

Hyd. No. 2

DRAINAGE BASISIN AREA B

Hydrograph type	= SCS Runoff	Peak discharge	= 323.99 cfs
Storm frequency	= 500 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 1,473,649 cuft
Drainage area	= 50.130 ac	Curve number	= 71*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 34.90 min
Total precip.	= 12.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(3.260 x 92) + (46.870 x 70)] / 50.130

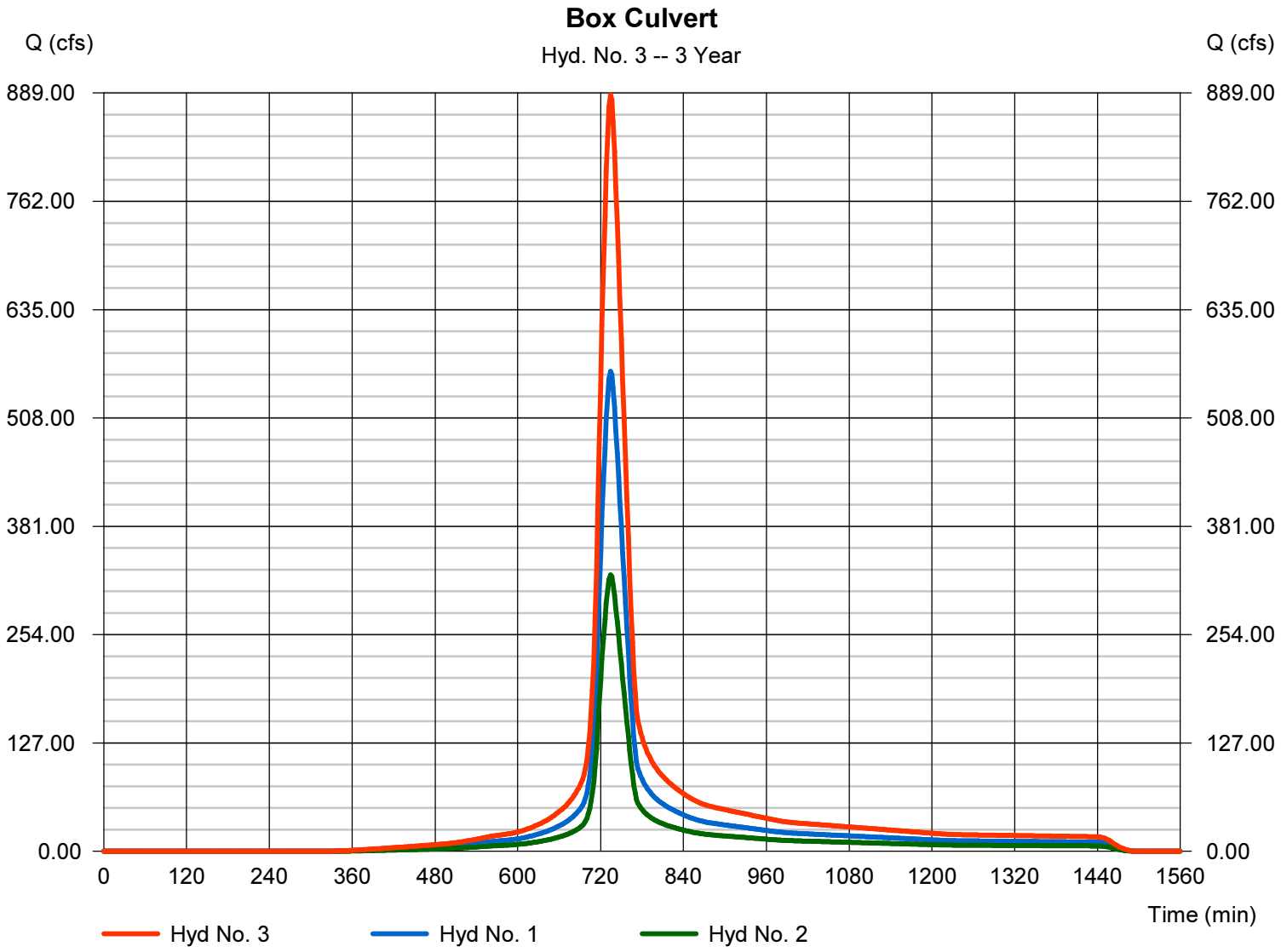


Hydrograph Report

Hyd. No. 3

Box Culvert

Hydrograph type	= Combine	Peak discharge	= 886.64 cfs
Storm frequency	= 500 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 4,036,565 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 135.820 ac



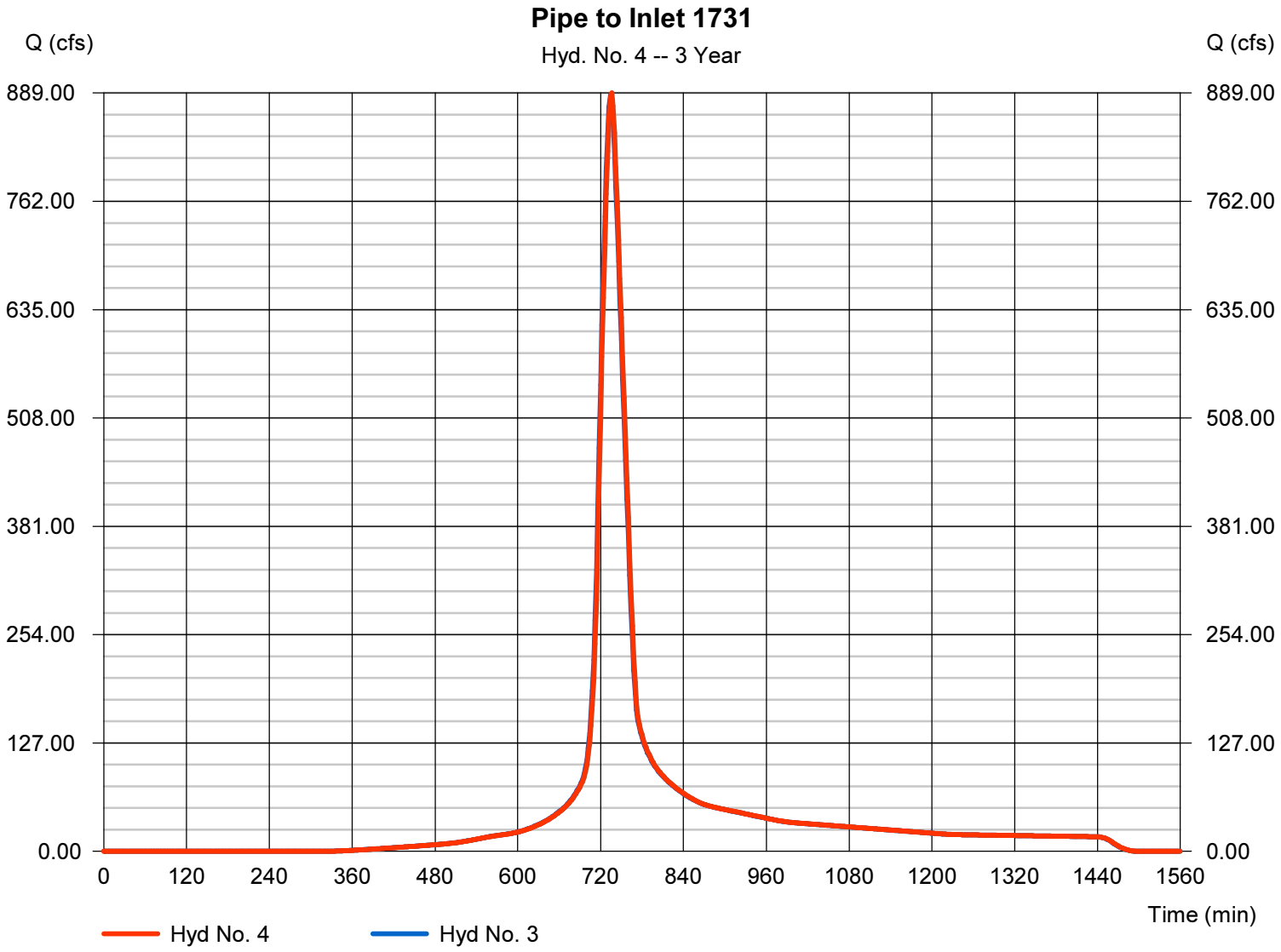
Hydrograph Report

Hyd. No. 4

Pipe to Inlet 1731

Hydrograph type	=	Reach	Peak discharge	=	889.29 cfs
Storm frequency	=	500 yrs	Time to peak	=	736 min
Time interval	=	2 min	Hyd. volume	=	4,036,567 cuft
Inflow hyd. No.	=	3 - Box Culvert	Section type	=	Circular
Reach length	=	299.0 ft	Channel slope	=	0.7 %
Manning's n	=	0.013	Bottom width	=	5.0 ft
Side slope	=	0.0:1	Max. depth	=	0.0 ft
Rating curve x	=	6.957	Rating curve m	=	1.250
Ave. velocity	=	0.00 ft/s	Routing coeff.	=	1.8378

Modified Att-Kin routing method used.



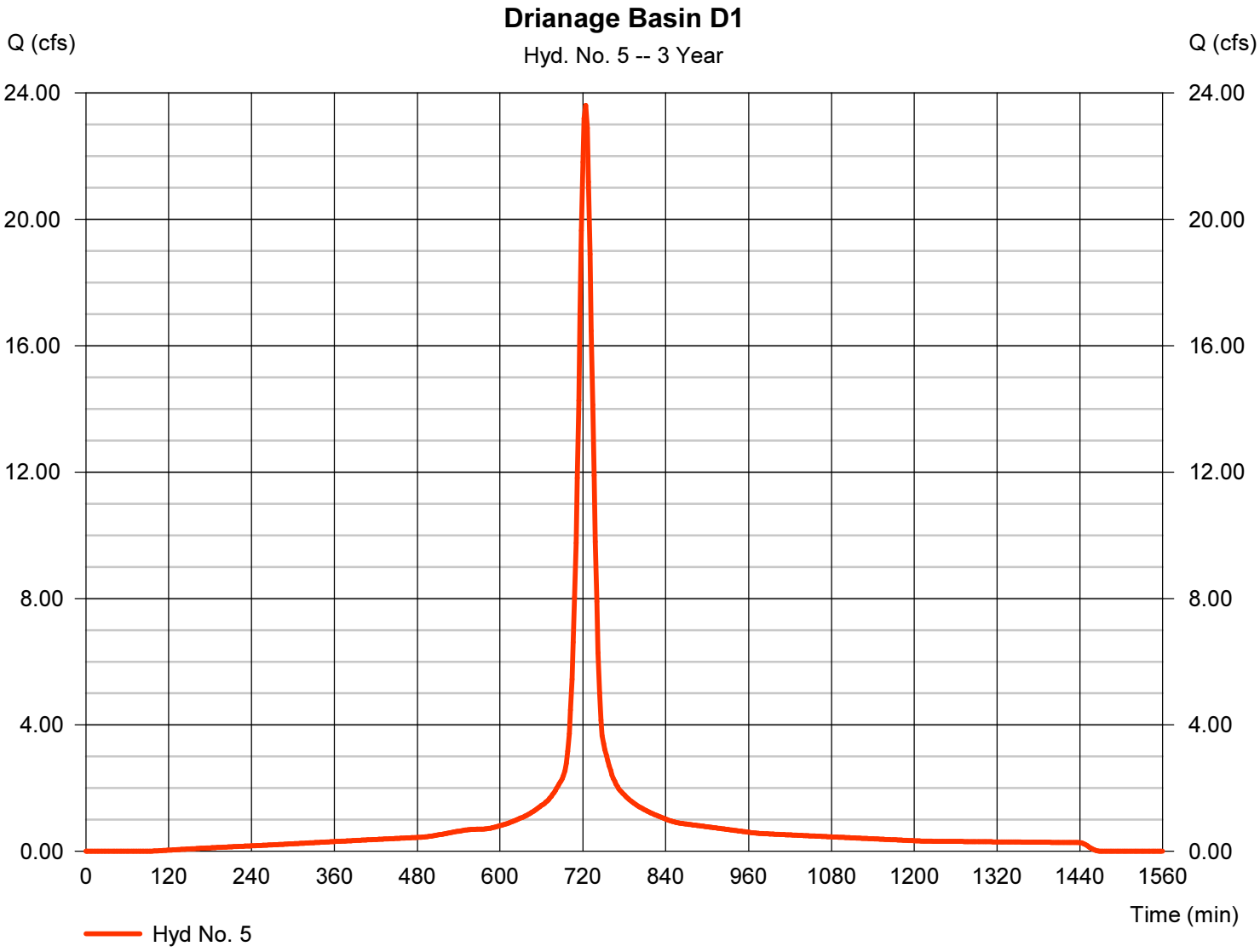
Hydrograph Report

Hyd. No. 5

Drianage Basin D1

Hydrograph type	= SCS Runoff	Peak discharge	= 23.61 cfs
Storm frequency	= 500 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 81,576 cuft
Drainage area	= 2.040 ac	Curve number	= 92*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 19.20 min
Total precip.	= 12.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(2.040 x 92)] / 2.040

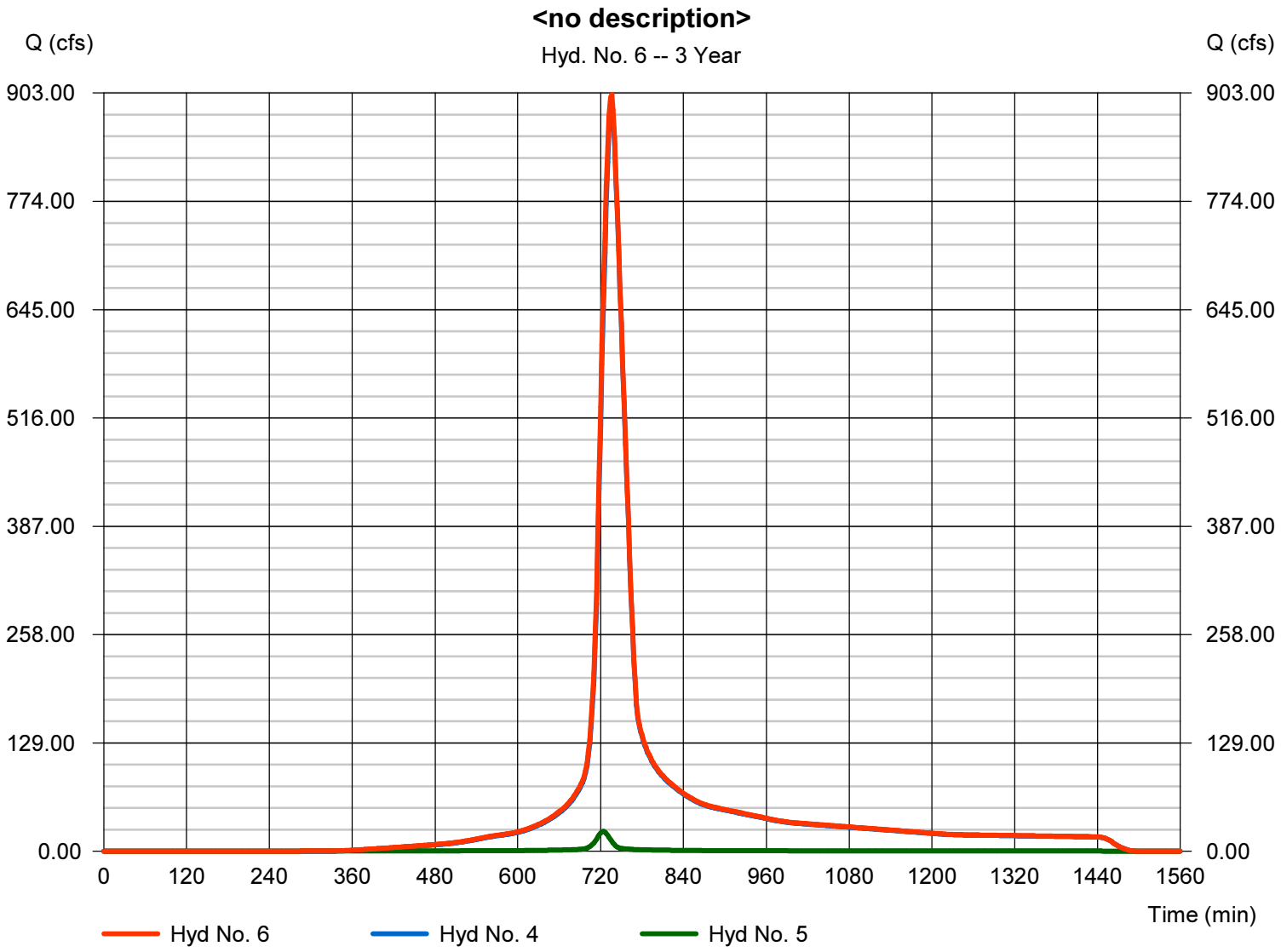


Hydrograph Report

Hyd. No. 6

<no description>

Hydrograph type	= Combine	Peak discharge	= 901.19 cfs
Storm frequency	= 500 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 4,118,143 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 2.040 ac



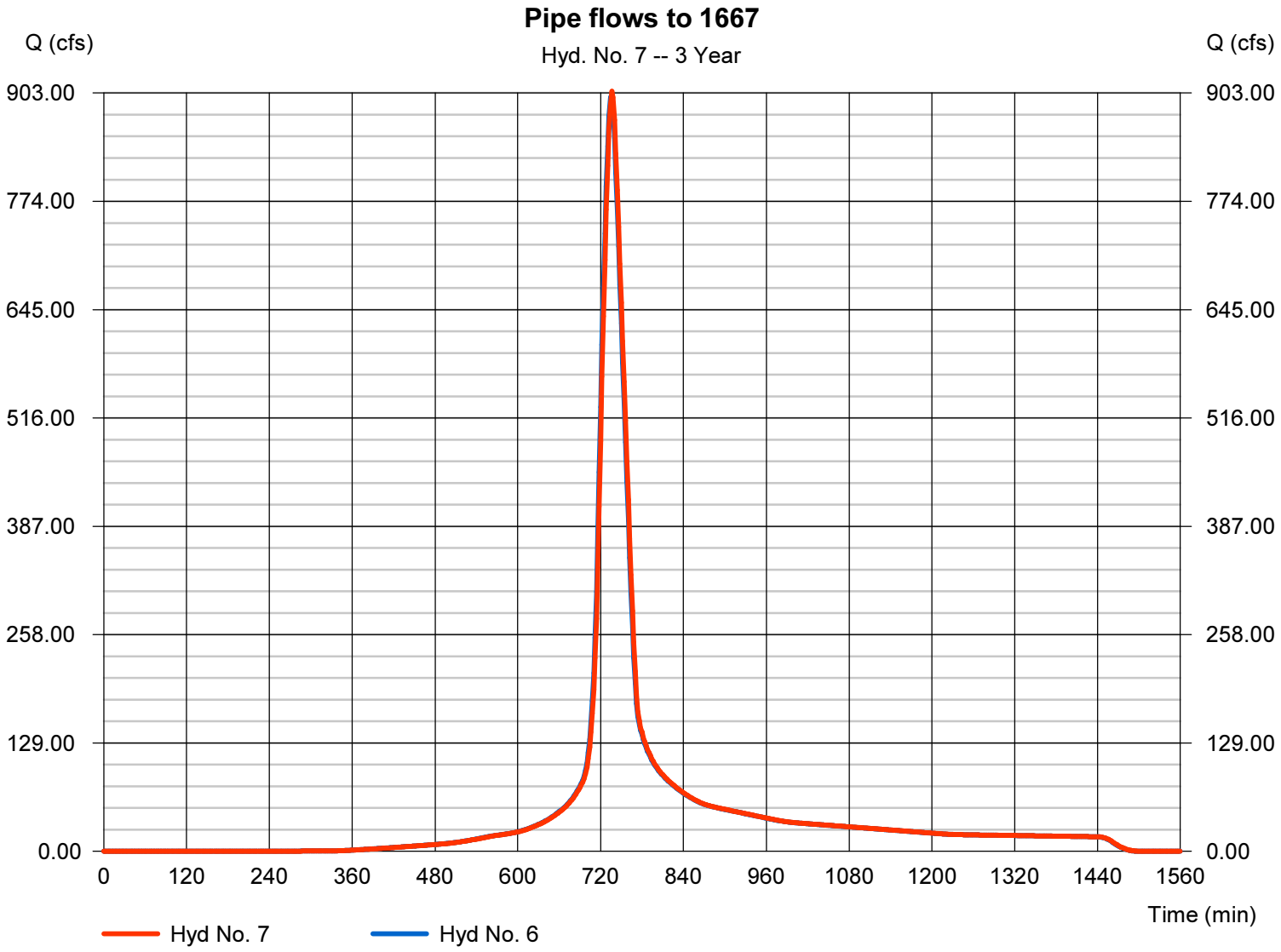
Hydrograph Report

Hyd. No. 7

Pipe flows to 1667

Hydrograph type	= Reach	Peak discharge	= 905.09 cfs
Storm frequency	= 500 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 4,118,155 cuft
Inflow hyd. No.	= 6 - <no description>	Section type	= Circular
Reach length	= 177.0 ft	Channel slope	= 1.5 %
Manning's n	= 0.015	Bottom width	= 5.0 ft
Side slope	= 0.0:1	Max. depth	= 0.0 ft
Rating curve x	= 8.613	Rating curve m	= 1.250
Ave. velocity	= 0.00 ft/s	Routing coeff.	= 1.9022

Modified Att-Kin routing method used.



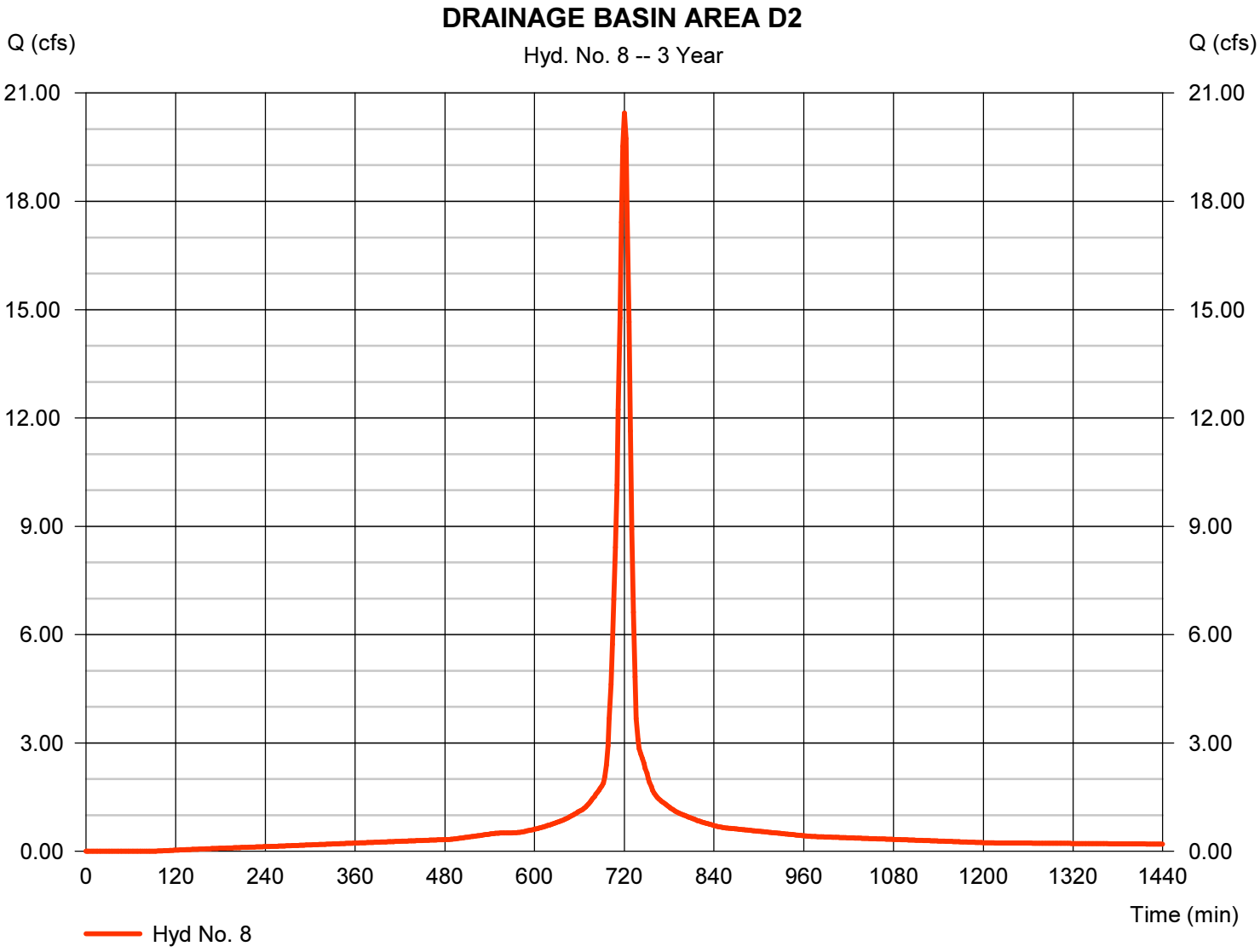
Hydrograph Report

Hyd. No. 8

DRAINAGE BASIN AREA D2

Hydrograph type	= SCS Runoff	Peak discharge	= 20.45 cfs
Storm frequency	= 500 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 59,383 cuft
Drainage area	= 1.440 ac	Curve number	= 92*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 11.70 min
Total precip.	= 12.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.440 x 92)] / 1.440

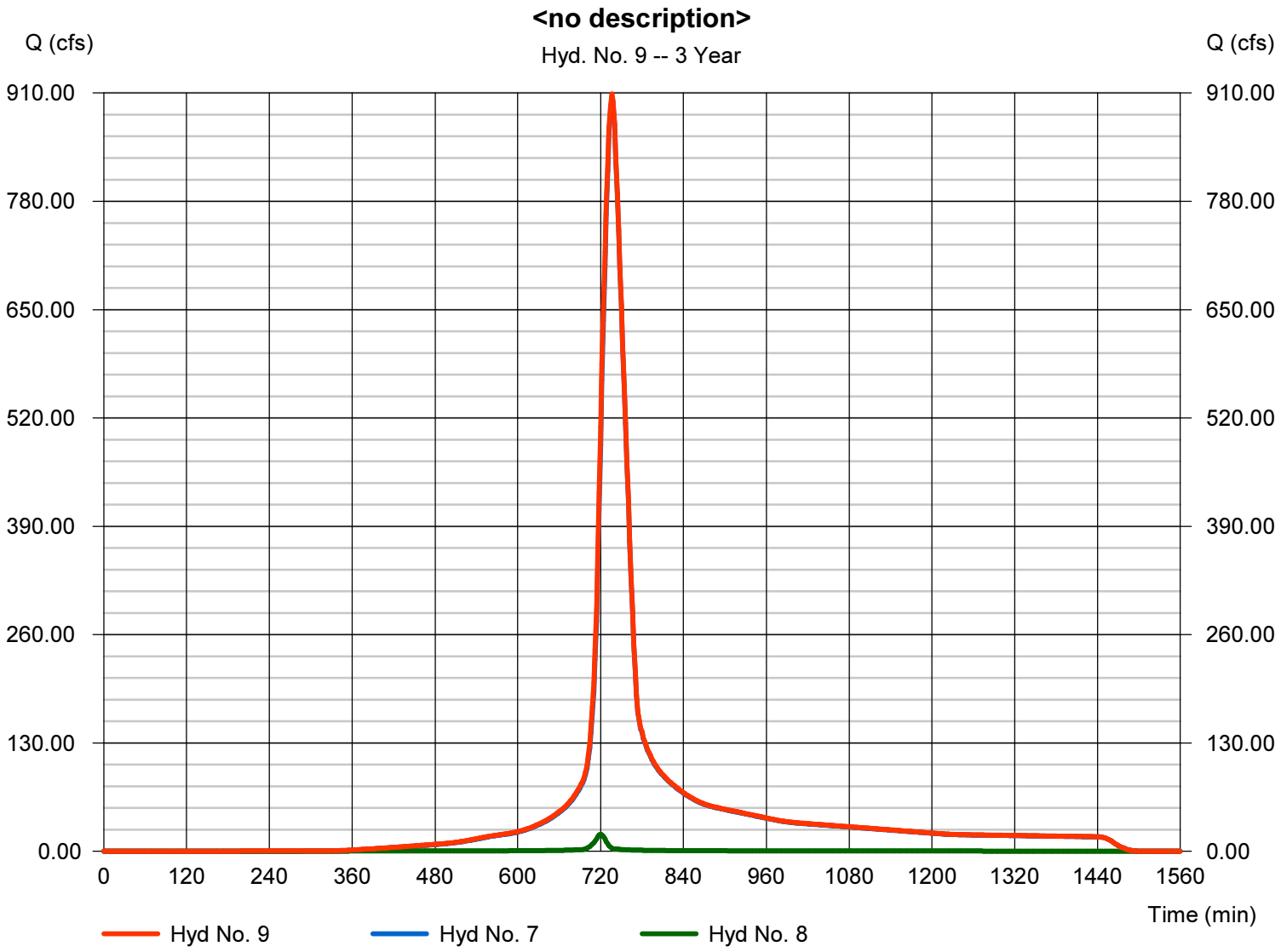


Hydrograph Report

Hyd. No. 9

<no description>

Hydrograph type	= Combine	Peak discharge	= 908.77 cfs
Storm frequency	= 500 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 4,177,539 cuft
Inflow hyds.	= 7, 8	Contrib. drain. area	= 1.440 ac



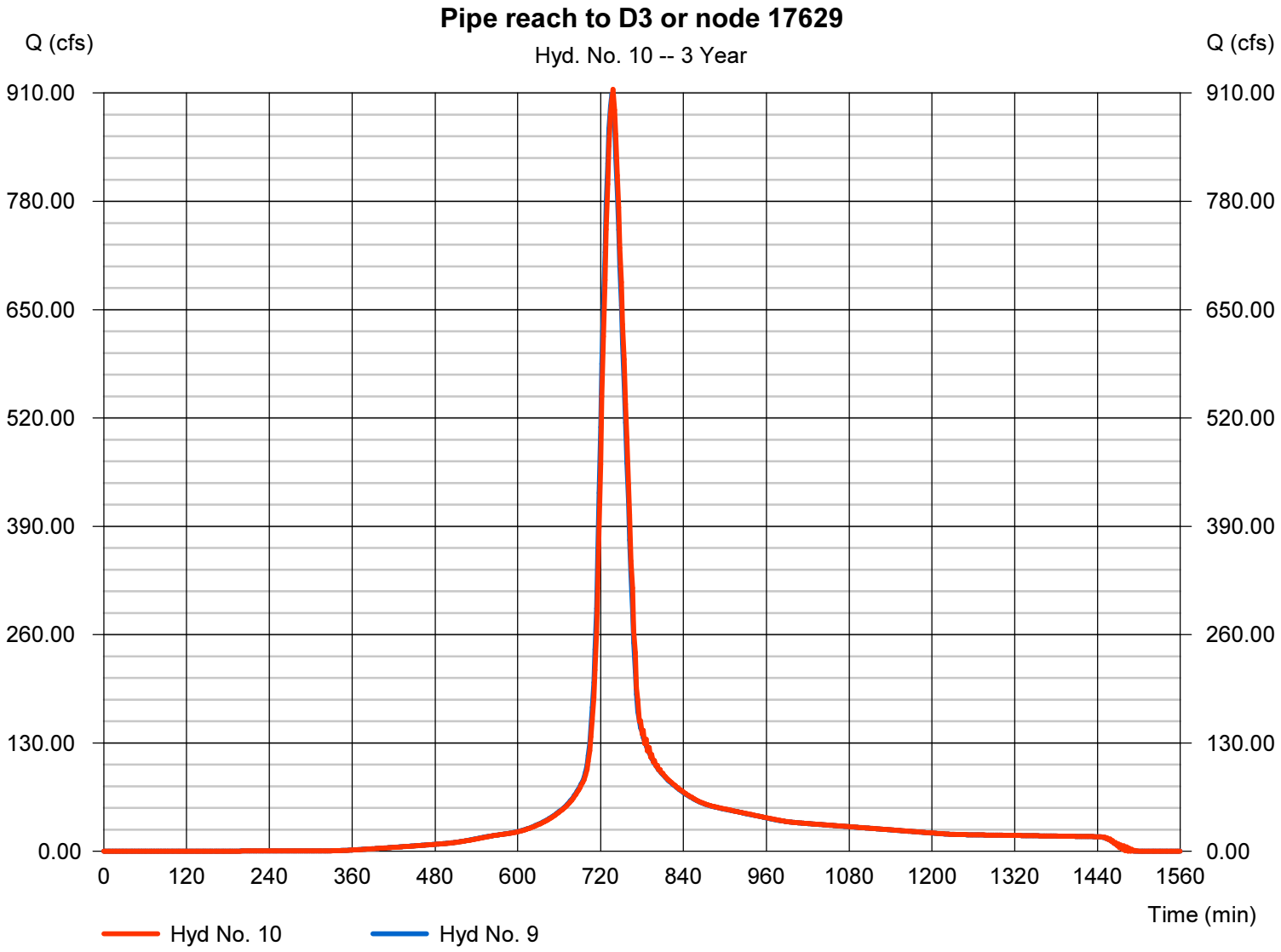
Hydrograph Report

Hyd. No. 10

Pipe reach to D3 or node 17629

Hydrograph type	= Reach	Peak discharge	= 914.28 cfs
Storm frequency	= 500 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 4,177,818 cuft
Inflow hyd. No.	= 9 - <no description>	Section type	= Circular
Reach length	= 317.0 ft	Channel slope	= 1.5 %
Manning's n	= 0.015	Bottom width	= 5.0 ft
Side slope	= 0.0:1	Max. depth	= 0.0 ft
Rating curve x	= 8.613	Rating curve m	= 1.250
Ave. velocity	= 0.00 ft/s	Routing coeff.	= 1.8326

Modified Att-Kin routing method used.



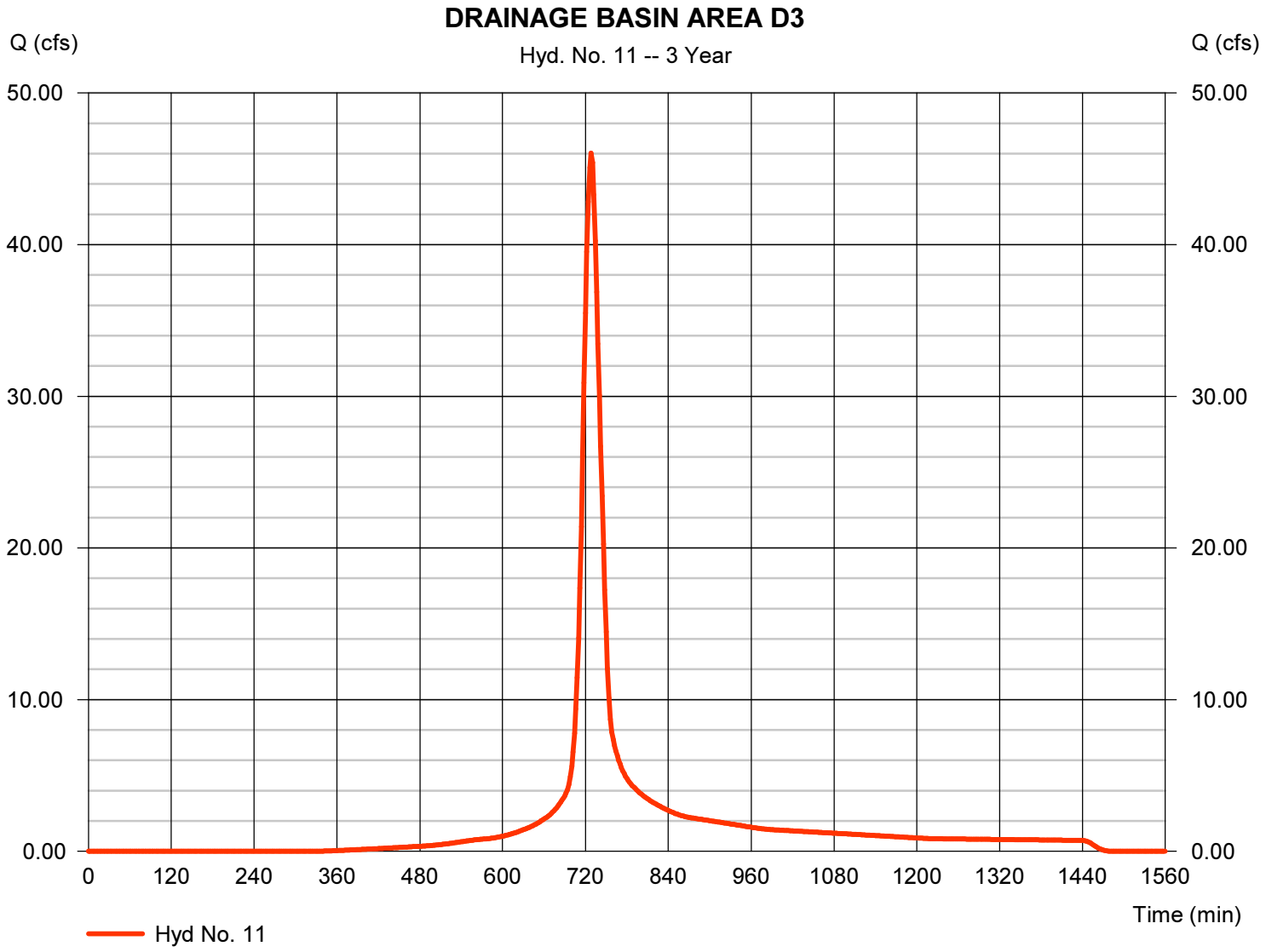
Hydrograph Report

Hyd. No. 11

DRAINAGE BASIN AREA D3

Hydrograph type	= SCS Runoff	Peak discharge	= 46.03 cfs
Storm frequency	= 500 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 170,058 cuft
Drainage area	= 5.810 ac	Curve number	= 71*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 25.70 min
Total precip.	= 12.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.340 x 92) + (5.470 x 70)] / 5.810

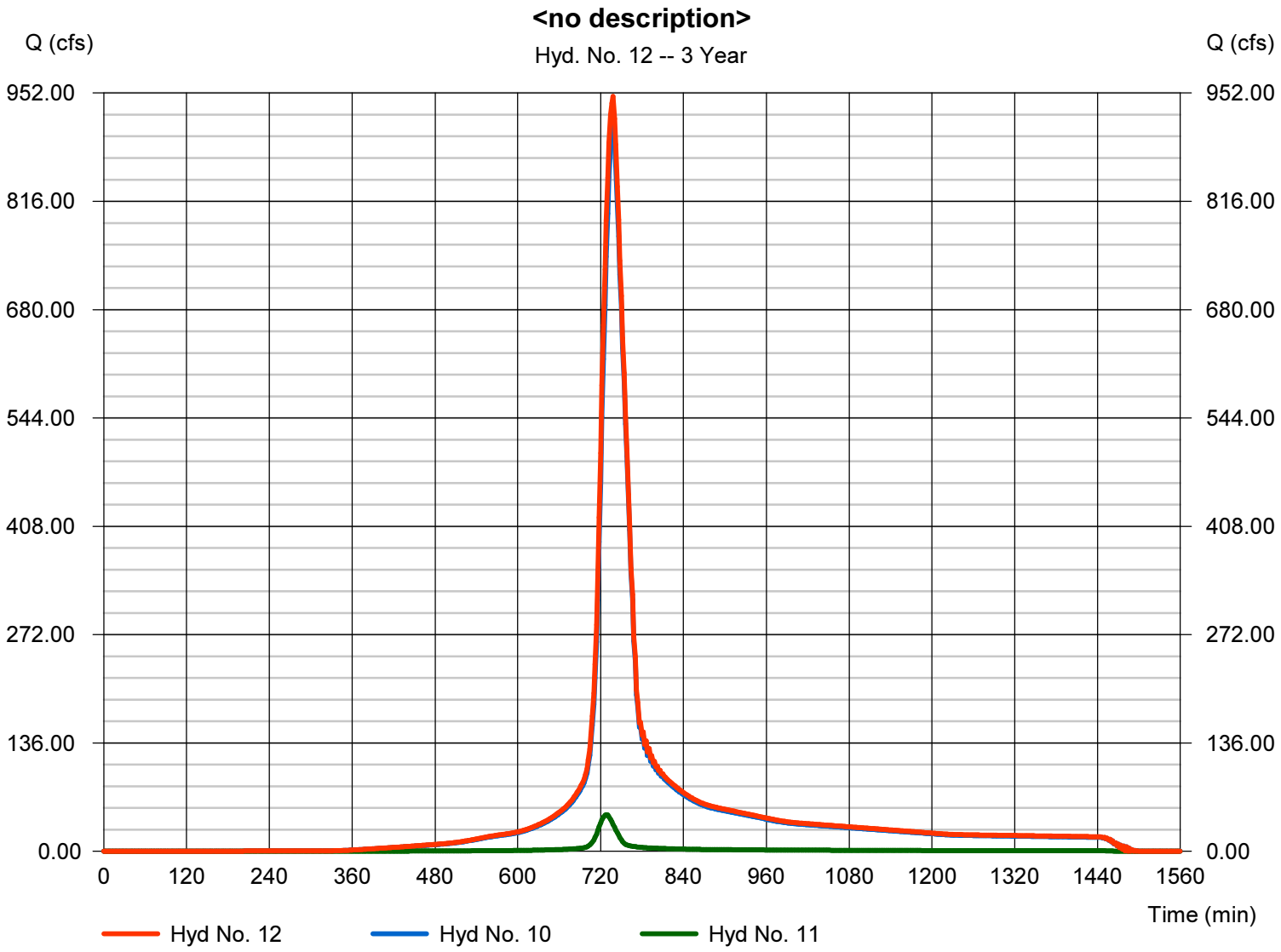


Hydrograph Report

Hyd. No. 12

<no description>

Hydrograph type	= Combine	Peak discharge	= 947.75 cfs
Storm frequency	= 500 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 4,347,875 cuft
Inflow hyds.	= 10, 11	Contrib. drain. area	= 5.810 ac



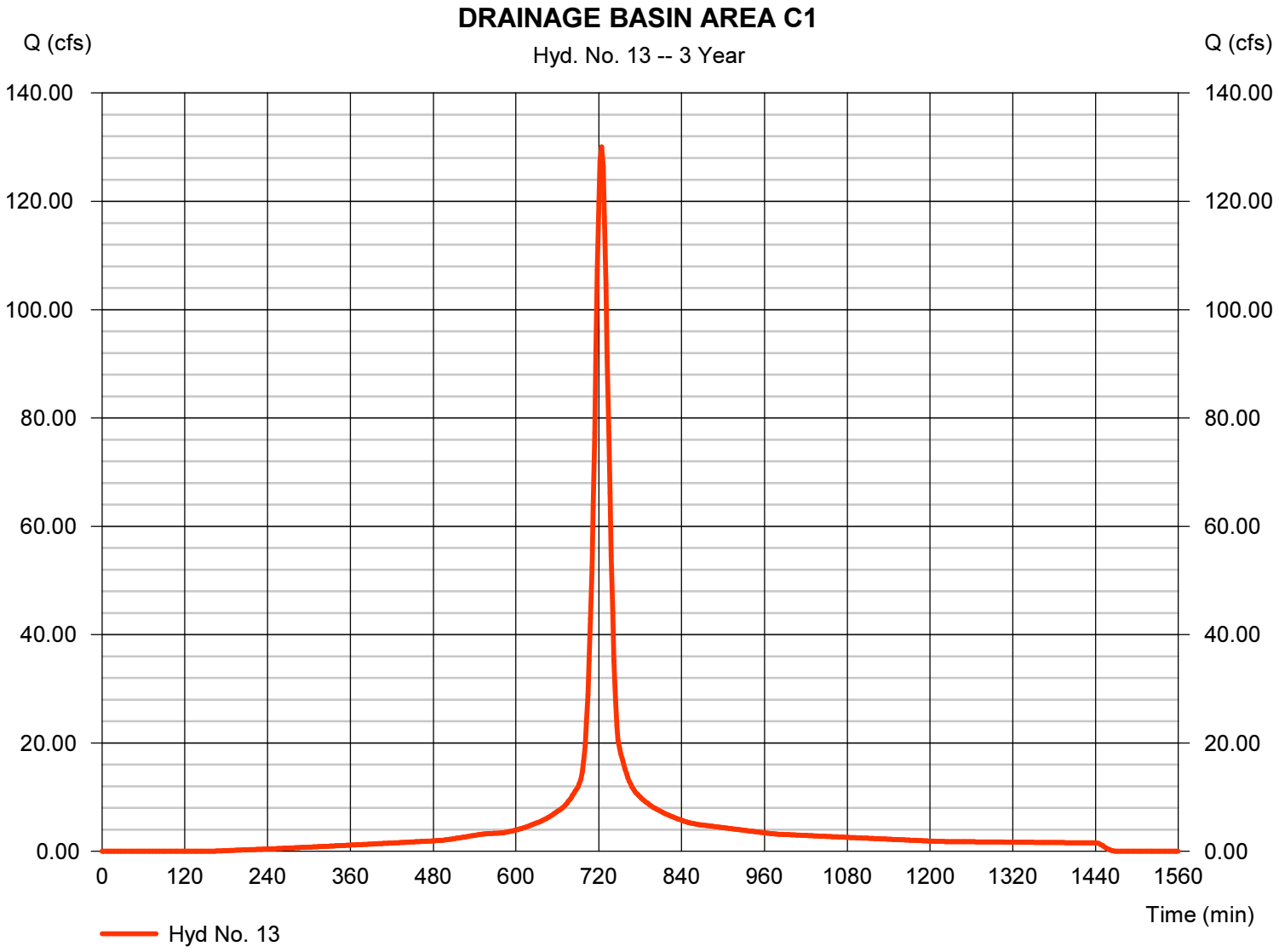
Hydrograph Report

Hyd. No. 13

DRAINAGE BASIN AREA C1

Hydrograph type	= SCS Runoff	Peak discharge	= 130.05 cfs
Storm frequency	= 500 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 433,287 cuft
Drainage area	= 11.650 ac	Curve number	= 86*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.10 min
Total precip.	= 12.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(8.240 x 92) + (3.410 x 70)] / 11.650



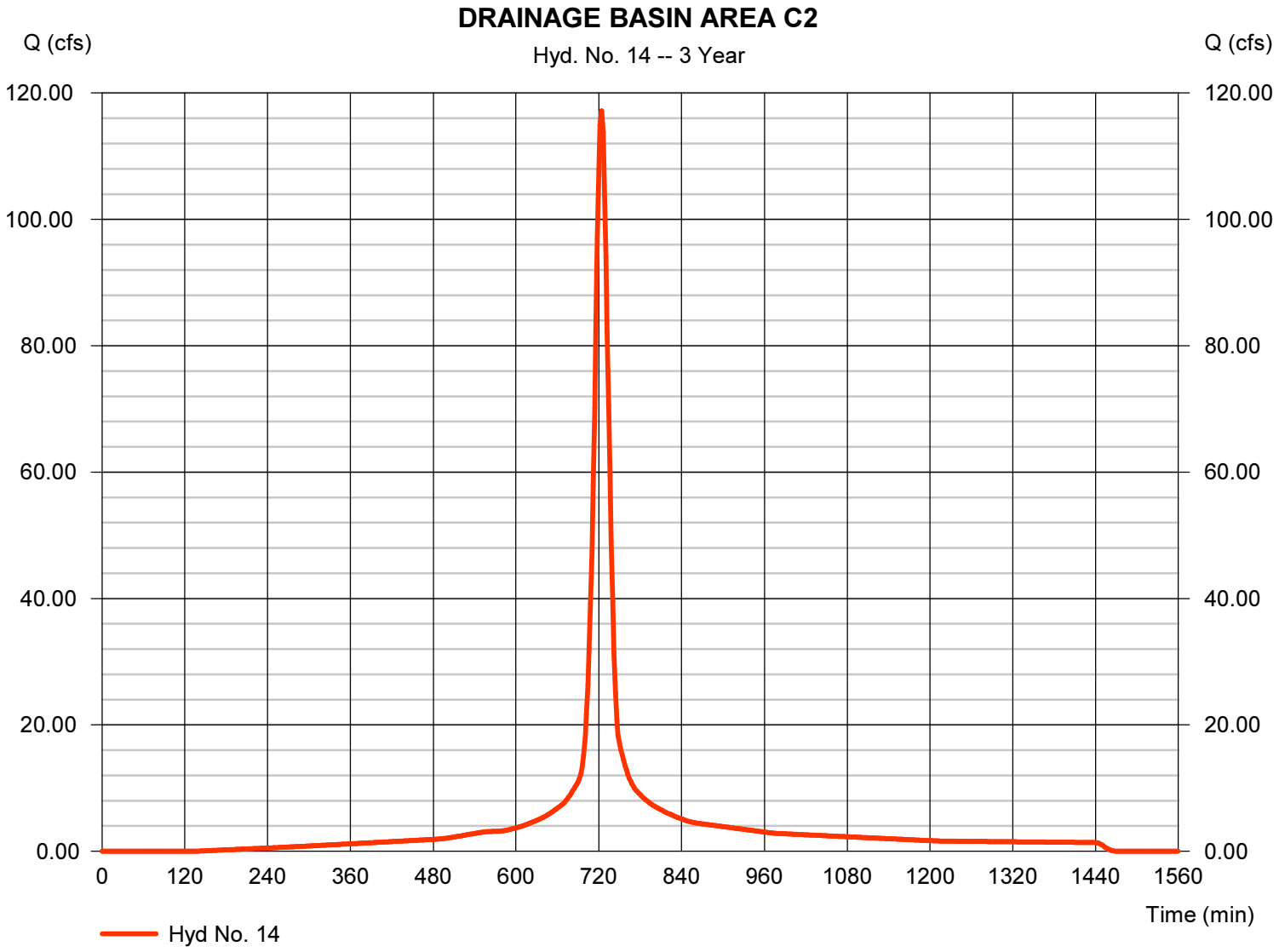
Hydrograph Report

Hyd. No. 14

DRAINAGE BASIN AREA C2

Hydrograph type	= SCS Runoff	Peak discharge	= 117.16 cfs
Storm frequency	= 500 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 394,704 cuft
Drainage area	= 10.350 ac	Curve number	= 88*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 19.40 min
Total precip.	= 12.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(8.270 x 92) + (2.080 x 70)] / 10.350

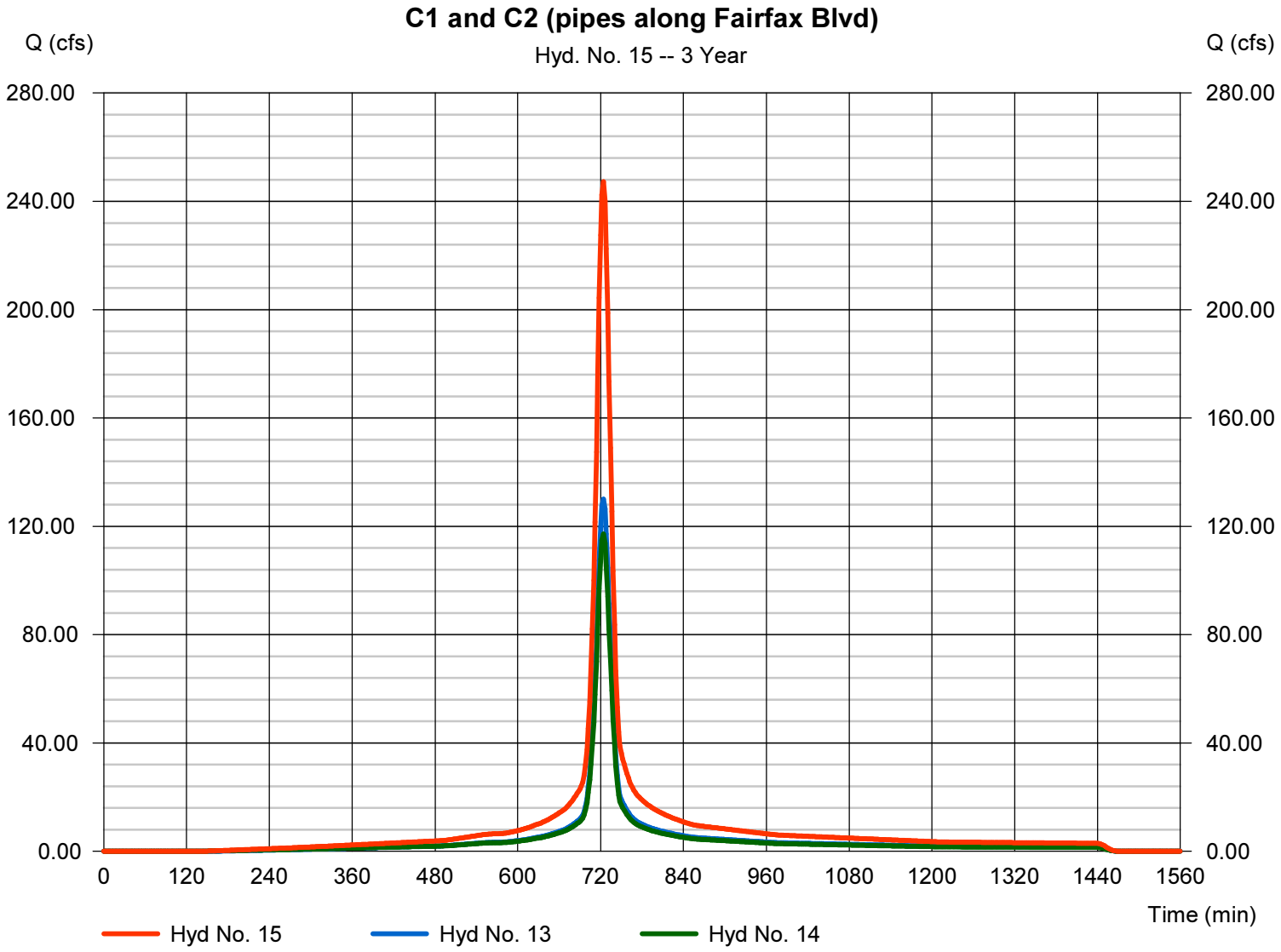


Hydrograph Report

Hyd. No. 15

C1 and C2 (pipes along Fairfax Blvd)

Hydrograph type	= Combine	Peak discharge	= 247.21 cfs
Storm frequency	= 500 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 827,990 cuft
Inflow hyds.	= 13, 14	Contrib. drain. area	= 22.000 ac



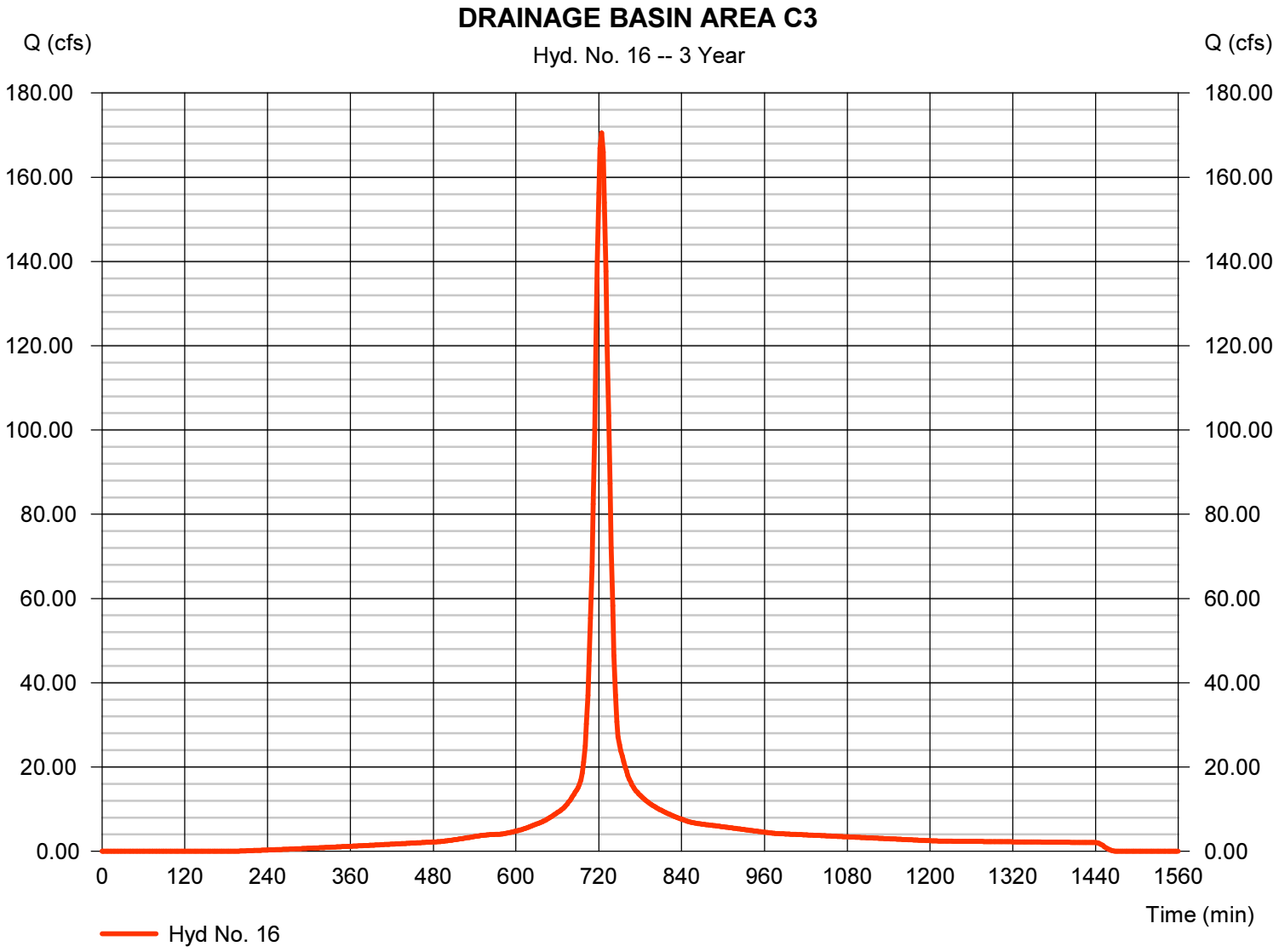
Hydrograph Report

Hyd. No. 16

DRAINAGE BASIN AREA C3

Hydrograph type	= SCS Runoff	Peak discharge	= 170.55 cfs
Storm frequency	= 500 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 559,918 cuft
Drainage area	= 15.660 ac	Curve number	= 83*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 20.00 min
Total precip.	= 12.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(9.340 x 92) + (6.320 x 70)] / 15.660

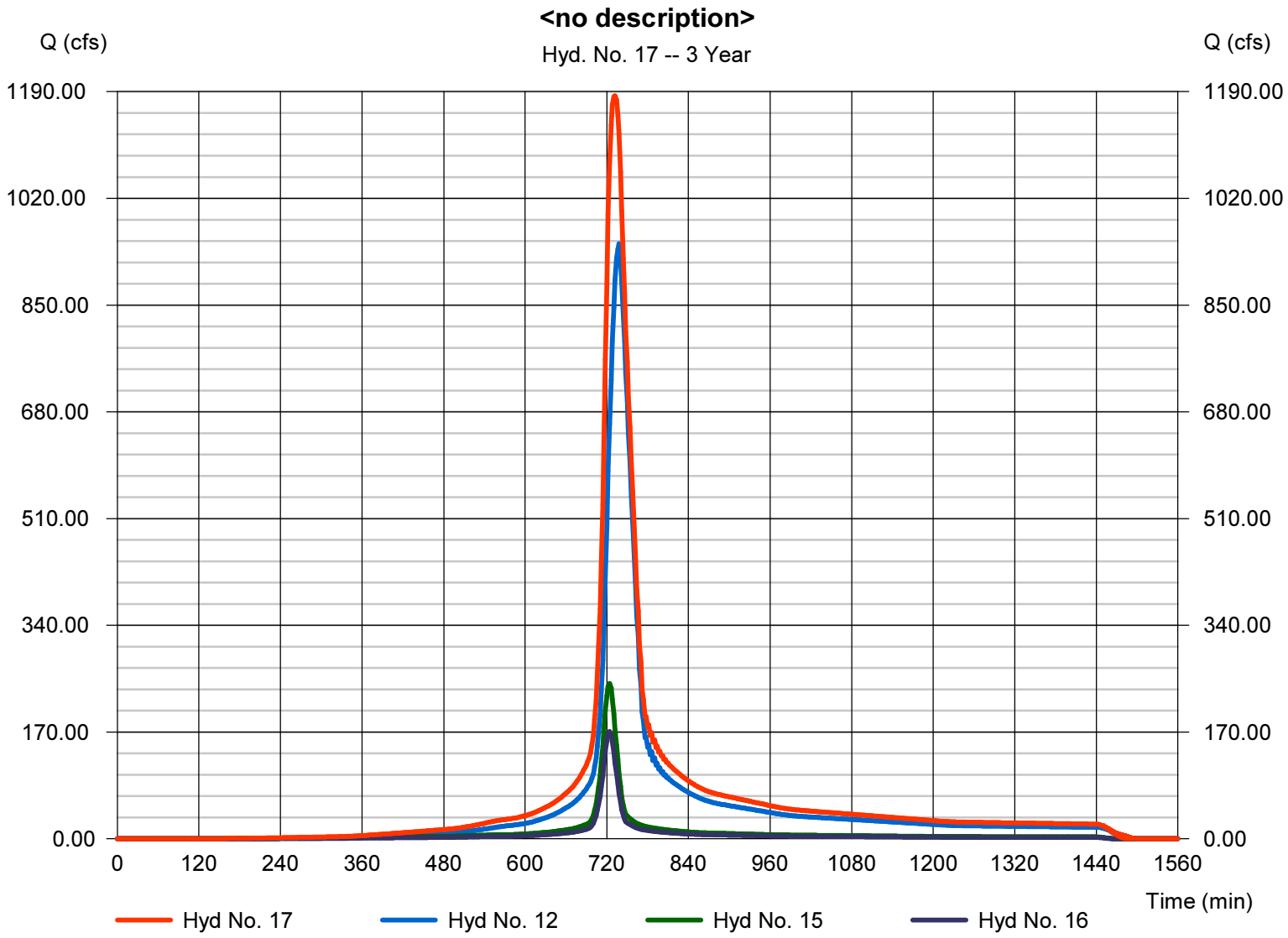


Hydrograph Report

Hyd. No. 17

<no description>

Hydrograph type	= Combine	Peak discharge	= 1183.39 cfs
Storm frequency	= 500 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 5,735,783 cuft
Inflow hyds.	= 12, 15, 16	Contrib. drain. area	= 15.660 ac



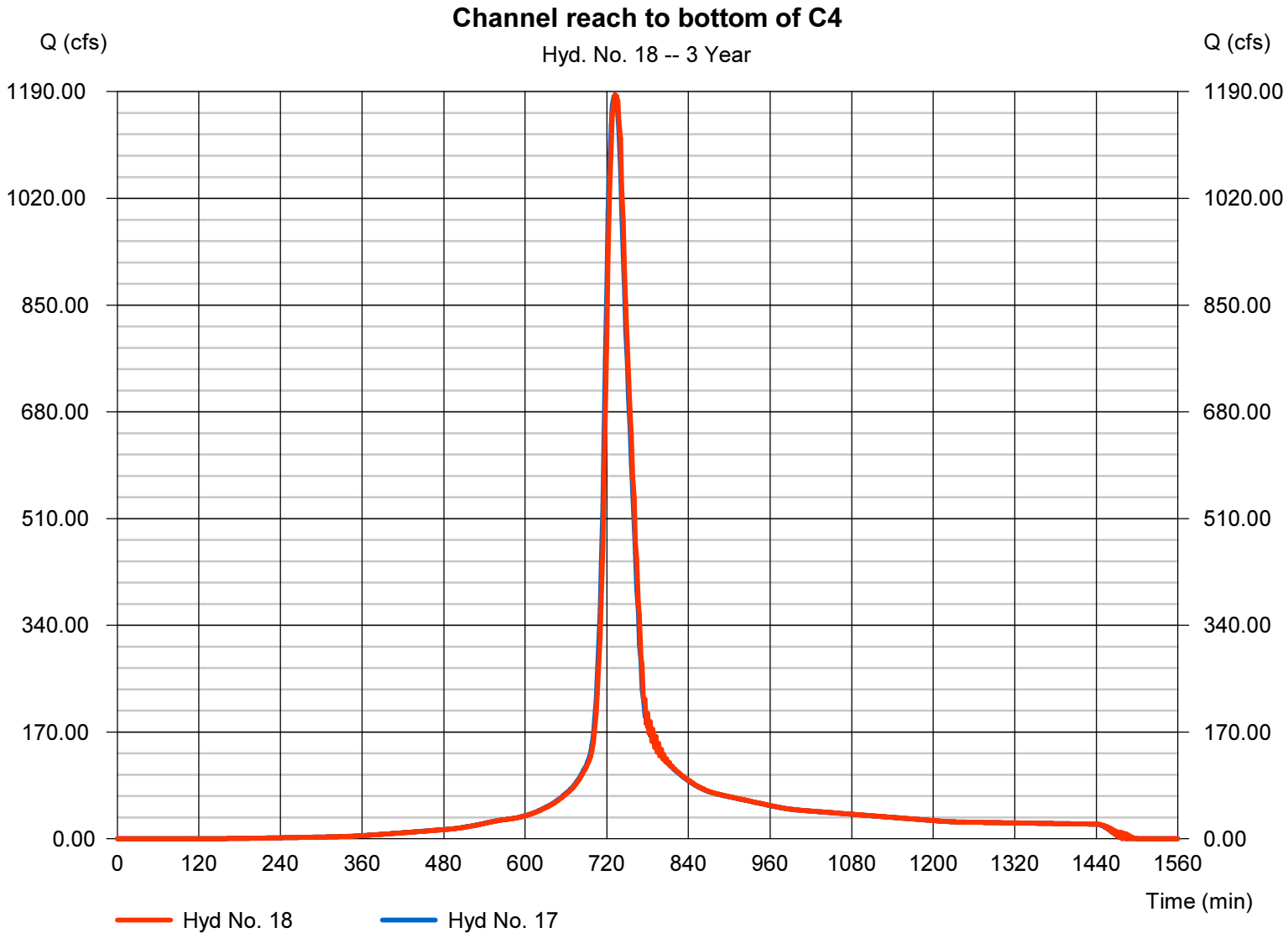
Hydrograph Report

Hyd. No. 18

Channel reach to bottom of C4

Hydrograph type	= Reach	Peak discharge	= 1184.90 cfs
Storm frequency	= 500 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 5,736,800 cuft
Inflow hyd. No.	= 17 - <no description>	Section type	= Trapezoidal
Reach length	= 259.0 ft	Channel slope	= 1.8 %
Manning's n	= 0.040	Bottom width	= 14.0 ft
Side slope	= 3.0:1	Max. depth	= 3.0 ft
Rating curve x	= 0.852	Rating curve m	= 1.429
Ave. velocity	= 0.00 ft/s	Routing coeff.	= 1.4256

Modified Att-Kin routing method used.



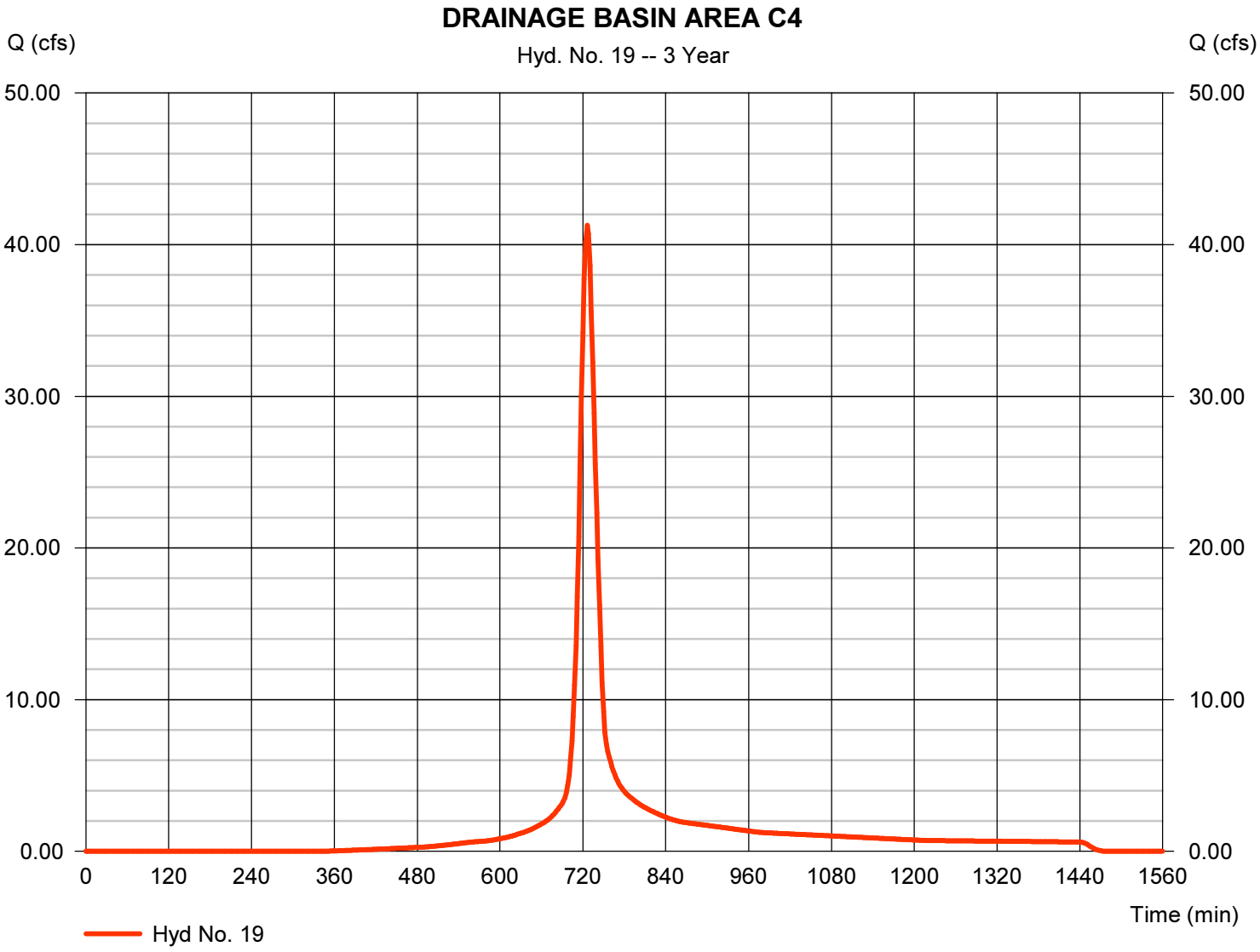
Hydrograph Report

Hyd. No. 19

DRAINAGE BASIN AREA C4

Hydrograph type	= SCS Runoff	Peak discharge	= 41.28 cfs
Storm frequency	= 500 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 143,320 cuft
Drainage area	= 4.820 ac	Curve number	= 70*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 20.60 min
Total precip.	= 12.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(4.820 x 70)] / 4.820



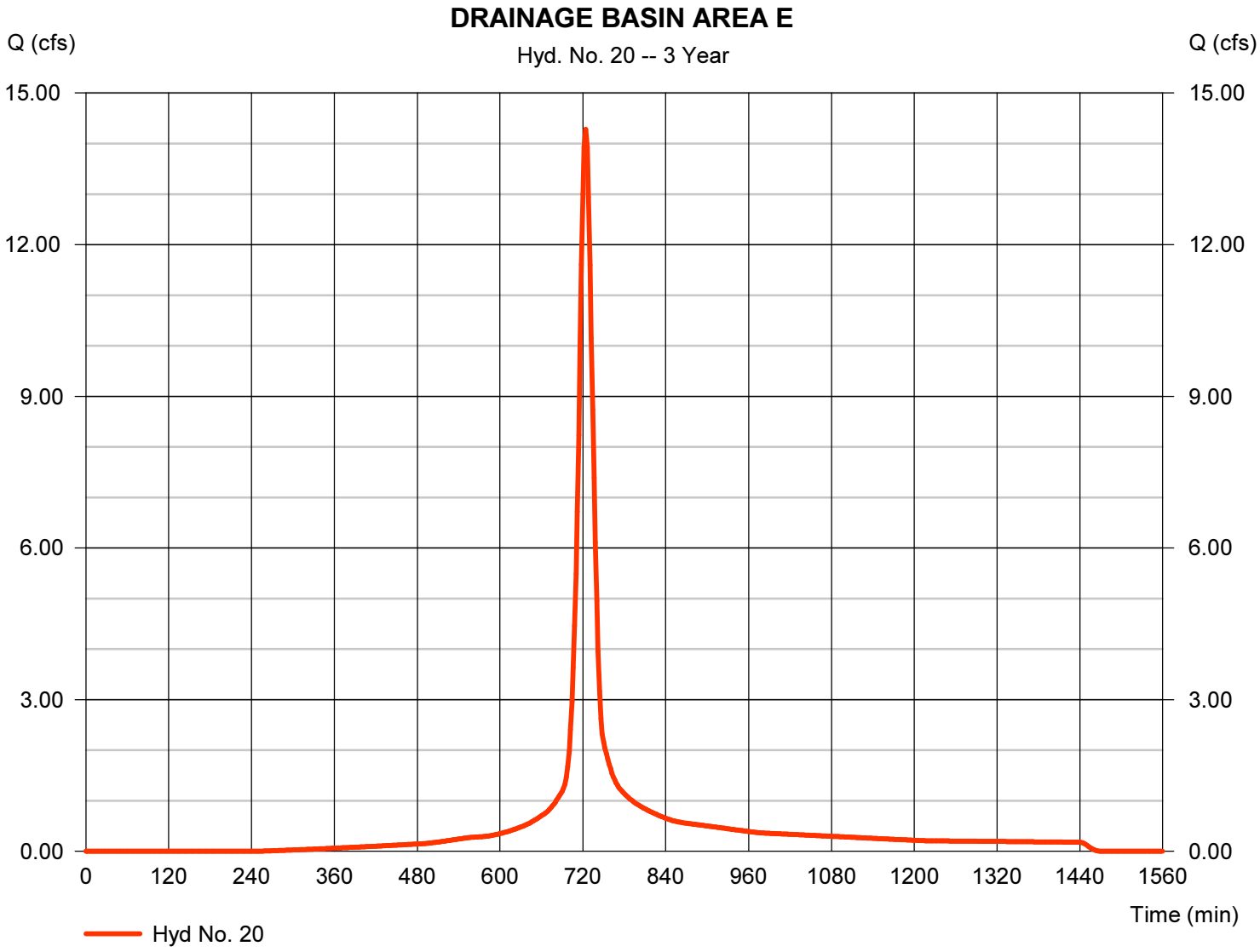
Hydrograph Report

Hyd. No. 20

DRAINAGE BASIN AREA E

Hydrograph type	= SCS Runoff	Peak discharge	= 14.28 cfs
Storm frequency	= 500 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 45,953 cuft
Drainage area	= 1.380 ac	Curve number	= 78*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 19.60 min
Total precip.	= 12.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.510 x 92) + (0.870 x 70)] / 1.380

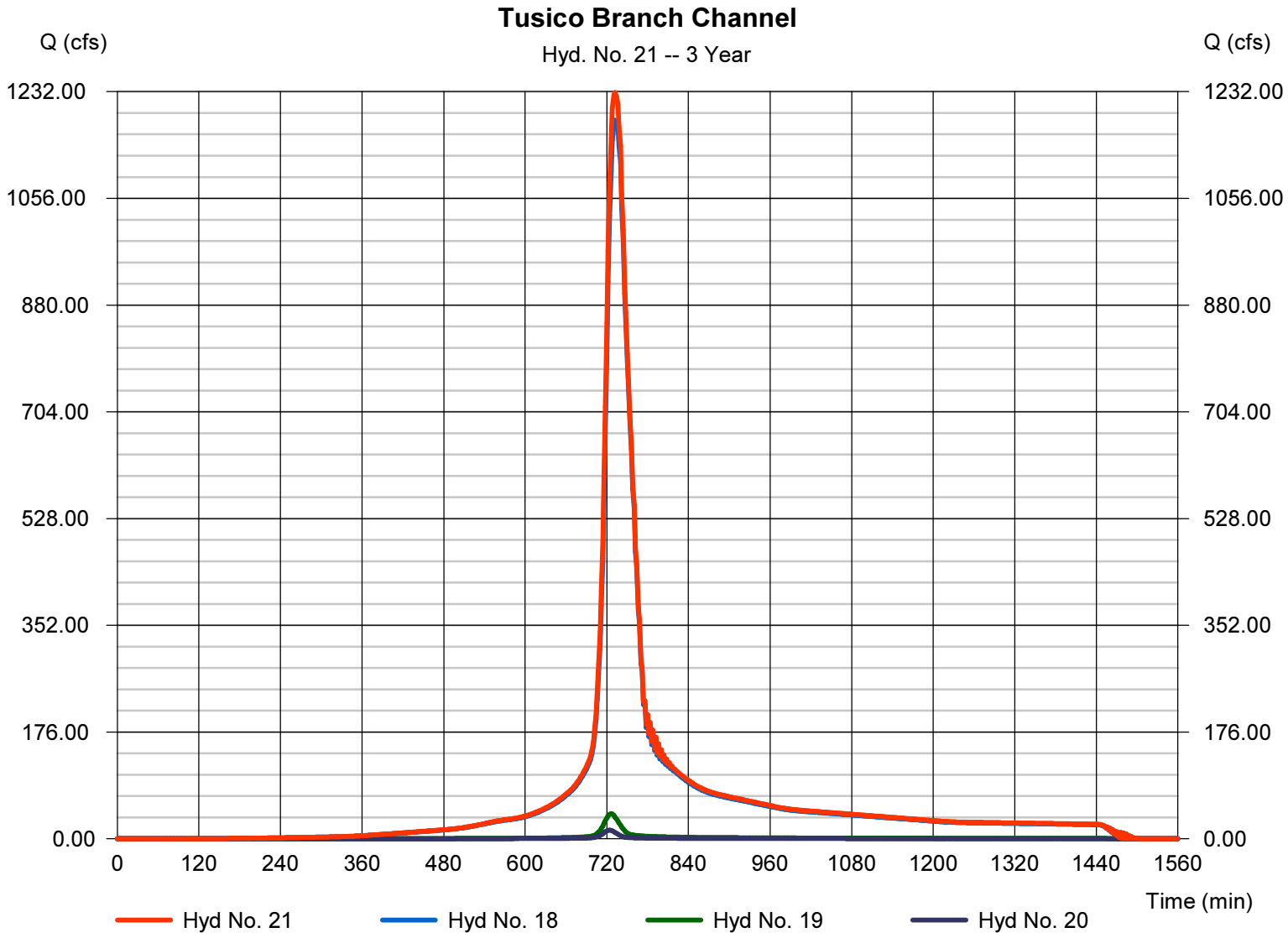


Hydrograph Report

Hyd. No. 21

Tusico Branch Channel

Hydrograph type	= Combine	Peak discharge	= 1230.63 cfs
Storm frequency	= 500 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 5,926,075 cuft
Inflow hyds.	= 18, 19, 20	Contrib. drain. area	= 6.200 ac

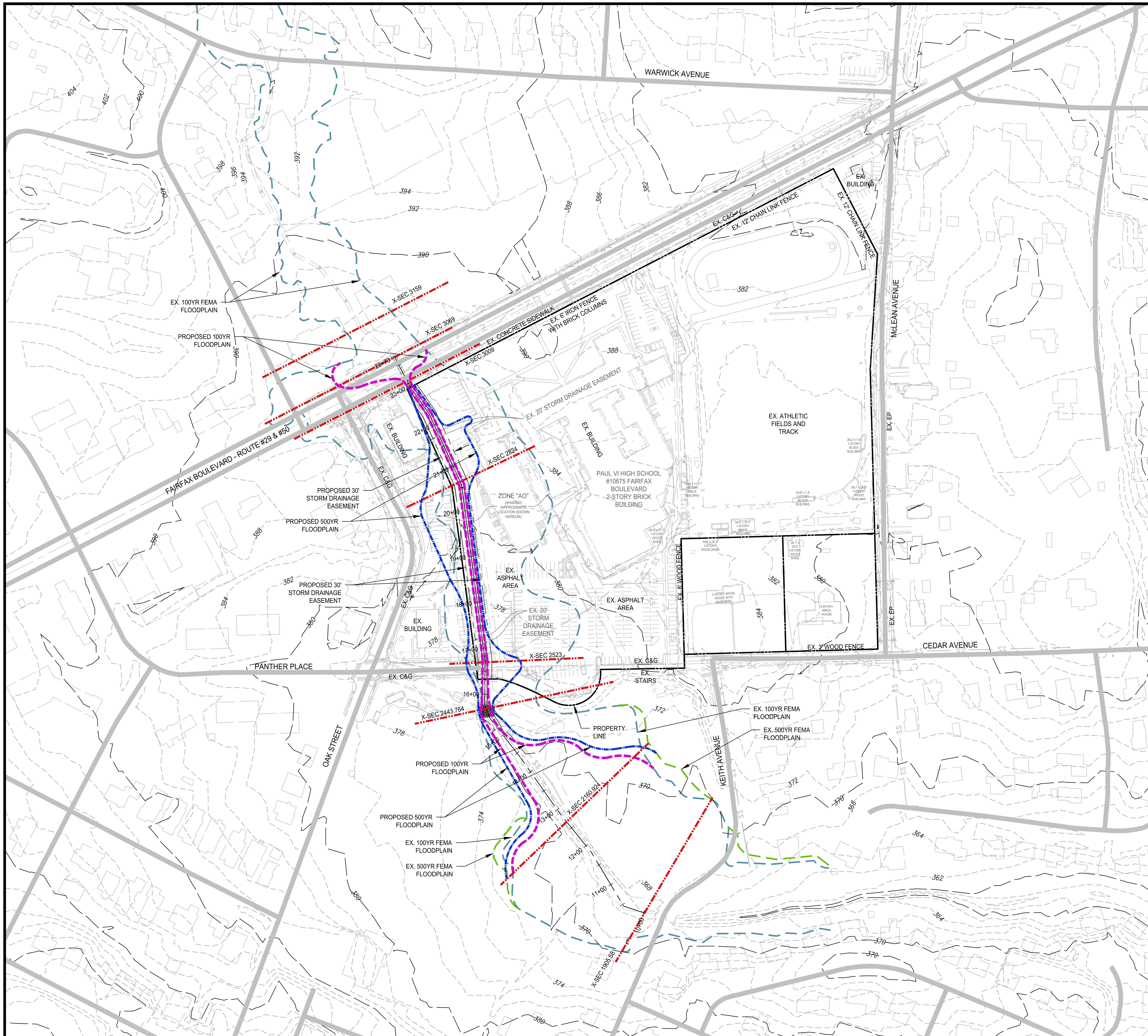


APPENDIX B

FLOODPLAIN MAP AND SITE PLAN

APPENDIX C

HECRAS MODEL EXISTING CONDITIONS
WITH PROFILE AND CROSS SECTIONS



FLOODPLAIN LEGEND

- EX. 100 YR FEMA
- EX. 500 YR FEMA
- PROPOSED 100 YR
- PROPOSED 500 YR
- HECRAS X-SECTION

christopher consultants
9900 main street (suite 400) · fairfax, va 22031
phone 703.273.6820 · fax 703.273.6820

ADVANCE COPY

NOT FOR CONSTRUCTION

EXHIBIT B TOPOGRPHIC MAP WITH 100 AND 500 YR FLOODPLAIN LIMITS

FLOOD PLAIN STUDY

PAUL VI.

FAIRFAX CITY, VIRGINIA

PROJECT NO: 15010.003.00

SCALE:

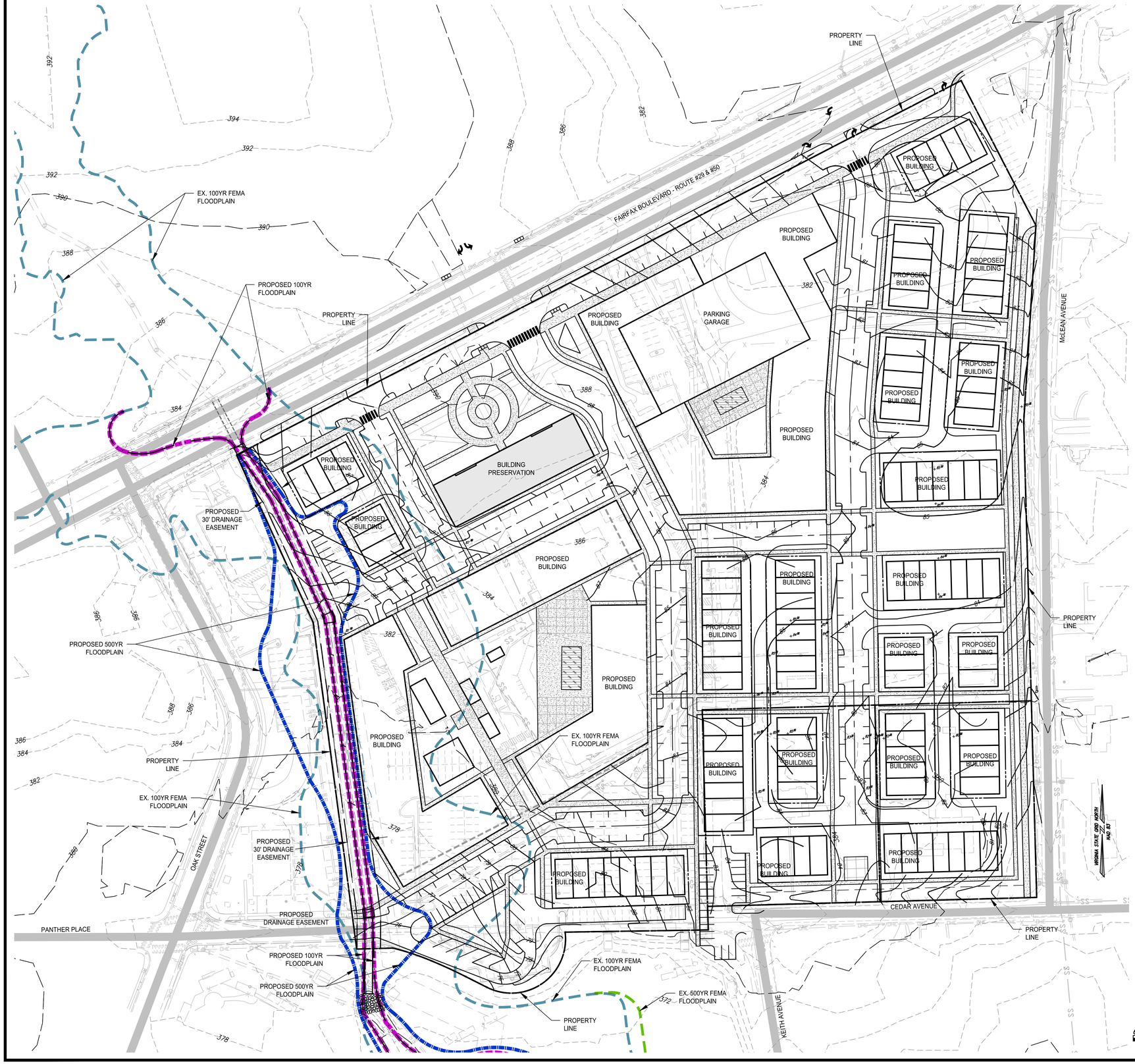
DATE: 04-14-2017

DESIGN: RH
DRAWN: NM
CHECKED: RH

SHEET No. B

1 OF 6

DWG-107365



FLOODPLAIN LEGEND

- EX. 100 YR FEMA
- EX. 500 YR FEMA
- PROPOSED 100 YR
- PROPOSED 500 YR

SCALE: 1" = 60'

60 30 0 60 120

GRAPHIC SCALE

christopher consultants
9900 main street (suite 400) · fairfax, va 22031
phone 703.273.6820 · fax 703.273.6820

ADVANCE COPY

NOT FOR CONSTRUCTION

EXHIBIT C CONCEPT SITE PLAN WITH FLOODPLAIN LIMITS

FLOOD PLAIN STUDY

PAUL VI.

FAIRFAX CITY, VIRGINIA

PROJECT NO:	15010.003.00
SCALE:	1"=60'
DATE:	04-14-2017
DESIGN:	RH
DRAWN:	NM
CHECKED:	RH
SHEET No.	C 01 OF 6

DWG-107365

HEC-RAS HEC-RAS 5.0.1 April 2016
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X   X XXXXXX  XXXX     XXXX    XX    XXXX
X   X X     X   X    X  X   X X   X
X   X X     X       X  X   X   X  X
XXXXXXX XXXX   X    XXX XXXX   XXXXXX   XXXX
X   X X     X       X X   X   X     X
X   X X     X   X    X  X   X   X     X
X   X XXXXXX  XXXX     X   X  X   X  XXXXX
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PROJECT DATA
Project Title: Accotink Creek-revised FEMA 12-29-16
Project File : Tusico.prj
Run Date and Time: 2/7/2017 11:29:33 AM

Project in English units

Project Description:
Project Description:
City of Fairfax Flood Study, prepared by christopher
consultants for review of floodplain along the creek on the
Paul VI
redevelopment site.

The peak discharges for the 2-, 10-, 25-,50-, 100-, and
500-year flood events were
computed in a HEC-HMS model for the Upper Accotink
Creek watershed.

This RAS
model is based on conditions existing in the
City at the time of completion of
the study. However, the hydrologic
analyses, specifically the composite runoff
curve number and
time-of-concentration calculations, reported HEC-HMS model are
based on
ultimate development conditions. However, for the purposes of
hydrologic
modeling, this condition is considered representative of both
existing and
future land use conditions.

****
**
****

* This RAS project
includes
Tusico Branch an unnamed northern tributary of Accotink Creek
existing conditions,
and proposed conditions model.

****
**
****

Model begins upstream of

Keith Avenus Starting WSEL= fixed from FEMA model based on storm events

The model ends one structure north at Fairfax Boulevard.

PLAN DATA

Plan Title: EXISTING CONDITIONS
Plan File : p:\Projects\15010\00300\ENG\HECRAS MODEL\2016-12-29 revised model\Tusico.p19

Geometry Title: Tusico Existing Conditions.geo
Geometry File : p:\Projects\15010\00300\ENG\HECRAS MODEL\2016-12-29 revised model\Tusico.g10

Flow Title : 2-yr through 500-yr Updated flows
Flow File : p:\Projects\15010\00300\ENG\HECRAS MODEL\2016-12-29 revised model\Tusico.f02

Plan Description:
This Plan contains a hydraulic analyses for the 2-, 10-,25, 50-, 100-, and
500-year flood events along Tusico branch and Unnamed Tributary to Accotiink
Creek. The FEMA base model and boundary conditions were used.

The model
evaluates the existing conditions Fairfax Boulevard and the downstream pipe to
the outfall below Panther place and upstream of Keith Ave at exist FEMA section
1905

Plan Summary Information:
Number of: Cross Sections = 8 Multiple Openings = 0
Culverts = 5 Inline Structures = 0
Bridges = 0 Lateral Structures = 0

Computational Information

Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Program Selects Appropriate method
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: 2-yr through 500-yr Updated flows
Flow File : p:\Projects\15010\00300\ENG\HECRAS MODEL\2016-12-29 revised model\Tusico.f02

Flow Data (cfs)

River	Reach	RS	2 yr	10 yr	25 yr	50 yr	100 yr	500 yr
Unnamed Tributar	1	3159	89	222	330	438	548	897
Unnamed Tributar	1	3069	89	222	330	438	548	897
Unnamed Tributar	1	2824	92	229	341	445	565	923
Unnamed Tributar	1	2443.764	143	336	489	630	794	1278

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Unnamed Tributar	1	2 yr	Normal S = 0.02	Known WS = 369.64
Unnamed Tributar	1	10 yr	Normal S = 0.02	Known WS = 369.91
Unnamed Tributar	1	25 yr	Normal S = 0.02	Known WS = 370.14
Unnamed Tributar	1	50 yr	Normal S = 0.02	Known WS = 370.4637
Unnamed Tributar	1	100 yr	Normal S = 0.02	Known WS = 370.22
Unnamed Tributar	1	500 yr	Normal S = 0.02	Known WS = 370.46

GEOMETRY DATA

Geometry Title: Tusico Existing Conditions.geo
Geometry File : p:\Projects\15010\00300\ENG\HECRAS MODEL\2016-12-29 revised model\Tusico.g10

CROSS SECTION

RIVER: Unnamed Tributar
REACH: 1 RS: 3159

INPUT
Description: Drop Inlet Ex 551
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	388.22	20.4	387.72	93.6	388.18	118	386.52	118	380.79
128	380.79	128	386.52	188	388.18	264	388.48		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	118	.015	128	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
118	128	90	94	98	0	0

CROSS SECTION OUTPUT Profile #2 yr

E.G. Elev (ft)	384.23	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.		0.015	
W.S. Elev (ft)	384.12	Reach Len. (ft)	90.00	94.00	98.00
Crit W.S. (ft)	382.13	Flow Area (sq ft)		33.27	
E.G. Slope (ft/ft)	0.000290	Area (sq ft)		33.27	
Q Total (cfs)	89.00	Flow (cfs)		89.00	
Top Width (ft)	10.00	Top Width (ft)		10.00	
Vel Total (ft/s)	2.67	Avg. Vel. (ft/s)		2.67	
Max Chl Dpth (ft)	3.33	Hydr. Depth (ft)		3.33	
Conv. Total (cfs)	5228.4	Conv. (cfs)		5228.4	
Length Wtd. (ft)	94.00	Wetted Per. (ft)		16.65	
Min Ch El (ft)	380.79	Shear (lb/sq ft)		0.04	
Alpha	1.00	Stream Power (lb/ft s)		0.10	
Frctn Loss (ft)		Cum Volume (acre-ft)	0.63	0.83	0.33
C & E Loss (ft)		Cum SA (acres)	0.78	0.36	0.50

CROSS SECTION OUTPUT Profile #10 yr

E.G. Elev (ft)	387.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.20	Wt. n-Val.	0.030	0.015	0.030
W.S. Elev (ft)	386.87	Reach Len. (ft)	90.00	94.00	98.00
Crit W.S. (ft)	383.26	Flow Area (sq ft)	0.92	60.83	2.26
E.G. Slope (ft/ft)	0.000336	Area (sq ft)	0.92	60.83	2.26
Q Total (cfs)	222.00	Flow (cfs)	0.26	221.09	0.64
Top Width (ft)	27.96	Top Width (ft)	5.19	10.00	12.77
Vel Total (ft/s)	3.47	Avg. Vel. (ft/s)	0.29	3.63	0.29
Max Chl Dpth (ft)	6.08	Hydr. Depth (ft)	0.18	6.08	0.18
Conv. Total (cfs)	12119.7	Conv. (cfs)	14.3	12070.2	35.2
Length Wtd. (ft)	94.00	Wetted Per. (ft)	5.21	21.46	12.77
Min Ch El (ft)	380.79	Shear (lb/sq ft)	0.00	0.06	0.00
Alpha	1.09	Stream Power (lb/ft s)	0.00	0.22	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	1.08	1.84	0.73
C & E Loss (ft)		Cum SA (acres)	2.19	0.38	1.82

CROSS SECTION OUTPUT Profile #25 yr

E.G. Elev (ft)	387.71	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.35	Wt. n-Val.	0.030	0.015	0.030
W.S. Elev (ft)	387.36	Reach Len. (ft)	90.00	94.00	98.00
Crit W.S. (ft)	384.01	Flow Area (sq ft)	5.17	65.69	12.72
E.G. Slope (ft/ft)	0.000539	Area (sq ft)	5.17	65.69	12.72
Q Total (cfs)	330.00	Flow (cfs)	3.33	318.48	8.19

Top Width (ft)	52.65	Top Width (ft)	12.33	10.00	30.32
Vel Total (ft/s)	3.95	Avg. Vel. (ft/s)	0.64	4.85	0.64
Max Chl Dpth (ft)	6.57	Hydr. Depth (ft)	0.42	6.57	0.42
Conv. Total (cfs)	14214.3	Conv. (cfs)	143.3	13718.2	352.8
Length Wtd. (ft)	94.00	Wetted Per. (ft)	12.36	21.46	30.33
Min Ch El (ft)	380.79	Shear (lb/sq ft)	0.01	0.10	0.01
Alpha	1.46	Stream Power (lb/ft s)	0.01	0.50	0.01
Frctn Loss (ft)		Cum Volume (acre-ft)	1.56	2.51	0.97
C & E Loss (ft)		Cum SA (acres)	2.33	0.38	2.01

CROSS SECTION OUTPUT Profile #50 yr

E.G. Elev (ft)	388.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.56	Wt. n-Val.	0.030	0.015	0.030
W.S. Elev (ft)	387.51	Reach Len. (ft)	90.00	94.00	98.00
Crit W.S. (ft)	384.68	Flow Area (sq ft)	7.23	67.22	17.78
E.G. Slope (ft/ft)	0.000849	Area (sq ft)	7.23	67.22	17.78
Q Total (cfs)	438.00	Flow (cfs)	6.53	415.39	16.08
Top Width (ft)	60.44	Top Width (ft)	14.58	10.00	35.85
Vel Total (ft/s)	4.75	Avg. Vel. (ft/s)	0.90	6.18	0.90
Max Chl Dpth (ft)	6.72	Hydr. Depth (ft)	0.50	6.72	0.50
Conv. Total (cfs)	15031.2	Conv. (cfs)	224.1	14255.3	551.8
Length Wtd. (ft)	94.00	Wetted Per. (ft)	14.61	21.46	35.87
Min Ch El (ft)	380.79	Shear (lb/sq ft)	0.03	0.17	0.03
Alpha	1.61	Stream Power (lb/ft s)	0.02	1.03	0.02
Frctn Loss (ft)		Cum Volume (acre-ft)	2.12	3.12	1.23
C & E Loss (ft)		Cum SA (acres)	2.48	0.38	2.11

CROSS SECTION OUTPUT Profile #100 yr

E.G. Elev (ft)	388.27	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.05	Wt. n-Val.	0.030	0.015	0.030
W.S. Elev (ft)	387.22	Reach Len. (ft)	90.00	94.00	98.00
Crit W.S. (ft)	385.33	Flow Area (sq ft)	3.62	64.31	8.89
E.G. Slope (ft/ft)	0.001635	Area (sq ft)	3.62	64.31	8.89
Q Total (cfs)	548.00	Flow (cfs)	3.60	535.55	8.85
Top Width (ft)	45.66	Top Width (ft)	10.31	10.00	25.35
Vel Total (ft/s)	7.13	Avg. Vel. (ft/s)	0.99	8.33	1.00
Max Chl Dpth (ft)	6.43	Hydr. Depth (ft)	0.35	6.43	0.35
Conv. Total (cfs)	13550.8	Conv. (cfs)	88.9	13243.0	218.9
Length Wtd. (ft)	94.00	Wetted Per. (ft)	10.33	21.46	25.36
Min Ch El (ft)	380.79	Shear (lb/sq ft)	0.04	0.31	0.04
Alpha	1.33	Stream Power (lb/ft s)	0.04	2.55	0.04
Frctn Loss (ft)		Cum Volume (acre-ft)	2.03	3.70	1.25
C & E Loss (ft)		Cum SA (acres)	3.24	0.38	2.02

CROSS SECTION OUTPUT Profile #500 yr

E.G. Elev (ft)	389.30	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.52	Wt. n-Val.	0.030	0.015	0.030
W.S. Elev (ft)	388.78	Reach Len. (ft)	90.00	94.00	98.00
Crit W.S. (ft)	388.78	Flow Area (sq ft)	111.96	79.88	119.76
E.G. Slope (ft/ft)	0.000907	Area (sq ft)	111.96	79.88	119.76
Q Total (cfs)	897.00	Flow (cfs)	160.70	572.43	163.86

Top Width (ft)	264.00	Top Width (ft)	118.00	10.00	136.00
Vel Total (ft/s)	2.88	Avg. Vel. (ft/s)	1.44	7.17	1.37
Max Chl Dpth (ft)	7.99	Hydr. Depth (ft)	0.95	7.99	0.88
Conv. Total (cfs)	29782.9	Conv. (cfs)	5335.8	19006.4	5440.7
Length Wtd. (ft)	94.00	Wetted Per. (ft)	118.62	21.46	136.32
Min Ch El (ft)	380.79	Shear (lb/sq ft)	0.05	0.21	0.05
Alpha	4.04	Stream Power (lb/ft s)	0.08	1.51	0.07
Frctn Loss (ft)		Cum Volume (acre-ft)	2.78	5.48	1.66
C & E Loss (ft)		Cum SA (acres)	4.19	0.38	3.12

Warning: The cross section had to be extended vertically during the critical depth calculations.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.
Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CULVERT

RIVER: Unnamed Tributar
REACH: 1 RS: 3115

INPUT
Description: Existing eliptical pipe upstream of Fairfax Boulevard
Distance from Upstream XS = 2
Deck/Roadway Width = 88
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 7

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	388.22	20.4	387.72	93.6	388.18
118	386.52	128	386.52	188	388.18
264	388.48				

Upstream Bridge Cross Section Data
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	388.22	20.4	387.72	93.6	388.18	118	386.52	118	380.79
128	380.79	128	386.52	188	388.18	264	388.48		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	118	.015	128	.03

Bank Sta: Left	Right	Coeff Contr.	Expan.
118	128	0	0

Downstream Deck/Roadway Coordinates
num= 8

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	387	42.6	386	87	385
108	384.62	118	384.62	165	384.5
232	384	296	385		

Downstream Bridge Cross Section Data
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

0 387 42.64 386 87 385 108 384.62 108 377.52
118 377.52 118 384.62 165 384.5 232 384 296 385
761 388

Manning's n Values num= 3
Sta n Val Sta n Val Sta n Val
0 .03 108 .015 118 .03

Bank Sta: Left Right Coeff Contr. Expan.
108 118 .1 .3

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name Shape Rise Span
Culvert #1 Ellipse 4 6
FHWA Chart # 29- Horizontal Ellipse; Concrete
FHWA Scale # 1 - Square edge with headwall
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef Exit Loss Coef
2 88 .015 .015 0 .3 .5
Upstream Elevation = 380.79
Centerline Station = 122
Downstream Elevation = 378.14
Centerline Station = 115

CULVERT OUTPUT Profile #2 yr Culv Group: Culvert #1

Q Culv Group (cfs)	89.00	Culv Full Len (ft)	45.78
# Barrels	1	Culv Vel US (ft/s)	7.85
Q Barrel (cfs)	89.00	Culv Vel DS (ft/s)	4.72
E.G. US. (ft)	384.23	Culv Inv El Up (ft)	380.79
W.S. US. (ft)	384.12	Culv Inv El Dn (ft)	378.14
E.G. DS (ft)	383.63	Culv Frctn Ls (ft)	0.08
W.S. DS (ft)	383.59	Culv Exit Loss (ft)	0.16
Delta EG (ft)	0.60	Culv Entr Loss (ft)	0.16
Delta WS (ft)	0.52	Q Weir (cfs)	
E.G. IC (ft)	384.23	Weir Sta Lft (ft)	
E.G. OC (ft)	384.36	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	383.11	Weir Max Depth (ft)	
Culv WS Outlet (ft)	382.14	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	1.37	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	2.32	Min El Weir Flow (ft)	386.53

Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.

CULVERT OUTPUT Profile #10 yr Culv Group: Culvert #1

Q Culv Group (cfs)	199.52	Culv Full Len (ft)	88.00
# Barrels	1	Culv Vel US (ft/s)	10.58
Q Barrel (cfs)	199.52	Culv Vel DS (ft/s)	10.58
E.G. US. (ft)	387.08	Culv Inv El Up (ft)	380.79
W.S. US. (ft)	386.87	Culv Inv El Dn (ft)	378.14
E.G. DS (ft)	384.94	Culv Frctn Ls (ft)	0.80
W.S. DS (ft)	384.84	Culv Exit Loss (ft)	0.82
Delta EG (ft)	2.14	Culv Entr Loss (ft)	0.52
Delta WS (ft)	2.03	Q Weir (cfs)	22.48
E.G. IC (ft)	387.25	Weir Sta Lft (ft)	109.65
E.G. OC (ft)	387.08	Weir Sta Rgt (ft)	148.52
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	384.79	Weir Max Depth (ft)	0.57
Culv WS Outlet (ft)	382.14	Weir Avg Depth (ft)	0.36
Culv Nml Depth (ft)	2.11	Weir Flow Area (sq ft)	13.87
Culv Crt Depth (ft)	3.45	Min El Weir Flow (ft)	386.53

Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations are not valid and the supercritical result has been discarded. The outlet answer will be used.

CULVERT OUTPUT Profile #25 yr Culv Group: Culvert #1

Q Culv Group (cfs)	220.98	Culv Full Len (ft)	88.00
# Barrels	1	Culv Vel US (ft/s)	11.72
Q Barrel (cfs)	220.98	Culv Vel DS (ft/s)	11.72
E.G. US. (ft)	387.71	Culv Inv El Up (ft)	380.79
W.S. US. (ft)	387.36	Culv Inv El Dn (ft)	378.14
E.G. DS (ft)	385.11	Culv Frctn Ls (ft)	0.98
W.S. DS (ft)	384.93	Culv Exit Loss (ft)	0.98
Delta EG (ft)	2.60	Culv Entr Loss (ft)	0.64
Delta WS (ft)	2.43	Q Weir (cfs)	109.02
E.G. IC (ft)	387.85	Weir Sta Lft (ft)	20.17
E.G. OC (ft)	387.71	Weir Sta Rgt (ft)	171.58
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	384.79	Weir Max Depth (ft)	1.21
Culv WS Outlet (ft)	382.14	Weir Avg Depth (ft)	0.68
Culv Nml Depth (ft)	2.23	Weir Flow Area (sq ft)	49.01
Culv Crt Depth (ft)	3.57	Min El Weir Flow (ft)	386.53

Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations are not valid and the supercritical result has been discarded. The outlet answer will be used.

CULVERT OUTPUT Profile #50 yr Culv Group: Culvert #1

Q Culv Group (cfs)	231.61	Culv Full Len (ft)	88.00
# Barrels	1	Culv Vel US (ft/s)	12.29
Q Barrel (cfs)	231.61	Culv Vel DS (ft/s)	12.29
E.G. US. (ft)	388.08	Culv Inv El Up (ft)	380.79
W.S. US. (ft)	387.51	Culv Inv El Dn (ft)	378.14
E.G. DS (ft)	385.27	Culv Frctn Ls (ft)	1.08
W.S. DS (ft)	384.97	Culv Exit Loss (ft)	1.02
Delta EG (ft)	2.80	Culv Entr Loss (ft)	0.70
Delta WS (ft)	2.54	Q Weir (cfs)	206.39

E.G. IC (ft)	388.14	Weir Sta Lft (ft)	5.78
E.G. OC (ft)	388.08	Weir Sta Rgt (ft)	184.33
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	384.79	Weir Max Depth (ft)	1.56
Culv WS Outlet (ft)	382.14	Weir Avg Depth (ft)	0.56
Culv Nml Depth (ft)	2.30	Weir Flow Area (sq ft)	90.16
Culv Crt Depth (ft)	3.63	Min El Weir Flow (ft)	386.53

Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations are not valid and the supercritical result has been discarded. The outlet answer will be used.

CULVERT OUTPUT Profile #100 yr Culv Group: Culvert #1

Q Culv Group (cfs)	244.04	Culv Full Len (ft)	88.00
# Barrels	1	Culv Vel US (ft/s)	12.95
Q Barrel (cfs)	244.04	Culv Vel DS (ft/s)	12.95
E.G. US. (ft)	388.27	Culv Inv El Up (ft)	380.79
W.S. US. (ft)	387.22	Culv Inv El Dn (ft)	378.14
E.G. DS (ft)	385.40	Culv Frctn Ls (ft)	1.20
W.S. DS (ft)	384.59	Culv Exit Loss (ft)	0.90
Delta EG (ft)	2.88	Culv Entr Loss (ft)	0.78
Delta WS (ft)	2.63	Q Weir (cfs)	303.96
E.G. IC (ft)	388.33	Weir Sta Lft (ft)	0.00
E.G. OC (ft)	388.27	Weir Sta Rgt (ft)	213.53
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	384.79	Weir Max Depth (ft)	1.76
Culv WS Outlet (ft)	382.14	Weir Avg Depth (ft)	0.60
Culv Nml Depth (ft)	2.37	Weir Flow Area (sq ft)	128.01
Culv Crt Depth (ft)	3.68	Min El Weir Flow (ft)	386.53

Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations are not valid and the supercritical result has been discarded. The outlet answer will be used.

CULVERT OUTPUT Profile #500 yr Culv Group: Culvert #1

Q Culv Group (cfs)	231.42	Culv Full Len (ft)	88.00
# Barrels	1	Culv Vel US (ft/s)	12.28
Q Barrel (cfs)	231.42	Culv Vel DS (ft/s)	12.28
E.G. US. (ft)	388.75	Culv Inv El Up (ft)	380.79
W.S. US. (ft)	388.78	Culv Inv El Dn (ft)	378.14
E.G. DS (ft)	386.97	Culv Frctn Ls (ft)	1.08
W.S. DS (ft)	383.73	Culv Exit Loss (ft)	0.00
Delta EG (ft)	1.78	Culv Entr Loss (ft)	0.70
Delta WS (ft)	5.05	Q Weir (cfs)	665.58
E.G. IC (ft)	388.74	Weir Sta Lft (ft)	0.00
E.G. OC (ft)	388.75	Weir Sta Rgt (ft)	264.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	384.79	Weir Max Depth (ft)	2.22
Culv WS Outlet (ft)	382.14	Weir Avg Depth (ft)	0.92
Culv Nml Depth (ft)	2.30	Weir Flow Area (sq ft)	243.83
Culv Crt Depth (ft)	3.63	Min El Weir Flow (ft)	386.53

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.
Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations are not valid and the supercritical result has been discarded. The outlet answer will be used.

CROSS SECTION

RIVER: Unnamed Tributar
REACH: 1 RS: 3069

INPUT
Description: Drop Inlet Ex 1778
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	387	42.64	386	87	385	108	384.62	108	377.52
118	377.52	118	384.62	165	384.5	232	384	296	385
761	388								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	108	.015	118	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
108	118	60	60	.1	.3

CROSS SECTION OUTPUT Profile #2 yr

E.G. Elev (ft)	383.63	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.		0.015	
W.S. Elev (ft)	383.59	Reach Len. (ft)	60.00	60.00	60.00
Crit W.S. (ft)	378.87	Flow Area (sq ft)		60.72	
E.G. Slope (ft/ft)	0.000057	Area (sq ft)		60.72	
Q Total (cfs)	89.00	Flow (cfs)		89.00	
Top Width (ft)	10.00	Top Width (ft)		10.00	
Vel Total (ft/s)	1.47	Avg. Vel. (ft/s)		1.47	
Max Chl Dpth (ft)	6.07	Hydr. Depth (ft)		6.07	
Conv. Total (cfs)	11784.9	Conv. (cfs)		11784.9	
Length Wtd. (ft)	60.00	Wetted Per. (ft)		22.14	
Min Ch El (ft)	377.52	Shear (lb/sq ft)		0.01	
Alpha	1.00	Stream Power (lb/ft s)		0.01	
Frctn Loss (ft)		Cum Volume (acre-ft)	0.63	0.80	0.33
C & E Loss (ft)		Cum SA (acres)	0.78	0.34	0.50

CROSS SECTION OUTPUT Profile #10 yr

E.G. Elev (ft)	384.94	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.10	Wt. n-Val.	0.030	0.015	0.030
W.S. Elev (ft)	384.84	Reach Len. (ft)	60.00	60.00	60.00
Crit W.S. (ft)	380.00	Flow Area (sq ft)	1.37	73.23	75.76
E.G. Slope (ft/ft)	0.000163	Area (sq ft)	1.37	73.23	75.76
Q Total (cfs)	222.00	Flow (cfs)	0.20	193.64	28.16
Top Width (ft)	190.26	Top Width (ft)	12.32	10.00	167.95
Vel Total (ft/s)	1.48	Avg. Vel. (ft/s)	0.15	2.64	0.37
Max Chl Dpth (ft)	7.32	Hydr. Depth (ft)	0.11	7.32	0.45
Conv. Total (cfs)	17398.9	Conv. (cfs)	15.7	15176.3	2206.8

Length Wtd. (ft)	60.00	Wetted Per. (ft)	12.32	24.20	167.95
Min Ch El (ft)	377.52	Shear (lb/sq ft)	0.00	0.03	0.00
Alpha	2.81	Stream Power (lb/ft s)	0.00	0.08	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	1.08	1.77	0.73
C & E Loss (ft)		Cum SA (acres)	2.17	0.36	1.61

CROSS SECTION OUTPUT Profile #25 yr

E.G. Elev (ft)	385.11	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.18	Wt. n-Val.	0.030	0.015	0.030
W.S. Elev (ft)	384.93	Reach Len. (ft)	60.00	60.00	60.00
Crit W.S. (ft)	380.74	Flow Area (sq ft)	2.68	74.11	90.83
E.G. Slope (ft/ft)	0.000320	Area (sq ft)	2.68	74.11	90.83
Q Total (cfs)	330.00	Flow (cfs)	0.69	277.05	52.27
Top Width (ft)	200.79	Top Width (ft)	17.20	10.00	173.59
Vel Total (ft/s)	1.97	Avg. Vel. (ft/s)	0.26	3.74	0.58
Max Chl Dpth (ft)	7.41	Hydr. Depth (ft)	0.16	7.41	0.52
Conv. Total (cfs)	18441.7	Conv. (cfs)	38.3	15482.4	2921.0
Length Wtd. (ft)	60.00	Wetted Per. (ft)	17.20	24.20	173.60
Min Ch El (ft)	377.52	Shear (lb/sq ft)	0.00	0.06	0.01
Alpha	3.04	Stream Power (lb/ft s)	0.00	0.23	0.01
Frctn Loss (ft)		Cum Volume (acre-ft)	1.56	2.36	0.97
C & E Loss (ft)		Cum SA (acres)	2.30	0.36	1.78

CROSS SECTION OUTPUT Profile #50 yr

E.G. Elev (ft)	385.27	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.30	Wt. n-Val.	0.030	0.015	0.030
W.S. Elev (ft)	384.97	Reach Len. (ft)	60.00	60.00	60.00
Crit W.S. (ft)	381.43	Flow Area (sq ft)	3.39	74.50	97.68
E.G. Slope (ft/ft)	0.000535	Area (sq ft)	3.39	74.50	97.68
Q Total (cfs)	438.00	Flow (cfs)	1.22	361.24	75.54
Top Width (ft)	205.47	Top Width (ft)	19.36	10.00	176.10
Vel Total (ft/s)	2.49	Avg. Vel. (ft/s)	0.36	4.85	0.77
Max Chl Dpth (ft)	7.45	Hydr. Depth (ft)	0.18	7.45	0.55
Conv. Total (cfs)	18938.0	Conv. (cfs)	52.6	15619.2	3266.2
Length Wtd. (ft)	60.00	Wetted Per. (ft)	19.37	24.20	176.11
Min Ch El (ft)	377.52	Shear (lb/sq ft)	0.01	0.10	0.02
Alpha	3.13	Stream Power (lb/ft s)	0.00	0.50	0.01
Frctn Loss (ft)		Cum Volume (acre-ft)	2.12	2.89	1.23
C & E Loss (ft)		Cum SA (acres)	2.45	0.36	1.87

CROSS SECTION OUTPUT Profile #100 yr

E.G. Elev (ft)	385.40	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.81	Wt. n-Val.		0.015	0.030
W.S. Elev (ft)	384.59	Reach Len. (ft)	60.00	60.00	60.00
Crit W.S. (ft)	382.04	Flow Area (sq ft)		70.71	35.62
E.G. Slope (ft/ft)	0.001327	Area (sq ft)		70.71	35.62
Q Total (cfs)	548.00	Flow (cfs)		522.25	25.75
Top Width (ft)	150.39	Top Width (ft)		10.00	140.39
Vel Total (ft/s)	5.15	Avg. Vel. (ft/s)		7.39	0.72
Max Chl Dpth (ft)	7.07	Hydr. Depth (ft)		7.07	0.25
Conv. Total (cfs)	15045.8	Conv. (cfs)		14338.7	707.1

Length Wtd. (ft)	60.00	Wetted Per. (ft)	24.14	140.39	
Min Ch El (ft)	377.52	Shear (lb/sq ft)	0.24	0.02	
Alpha	1.96	Stream Power (lb/ft s)	1.79	0.02	
Frctn Loss (ft)		Cum Volume (acre-ft)	2.03	3.39	1.25
C & E Loss (ft)		Cum SA (acres)	3.23	0.36	1.84

CROSS SECTION OUTPUT Profile #500 yr

E.G. Elev (ft)	386.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	3.24	Wt. n-Val.		0.015	
W.S. Elev (ft)	383.73	Reach Len. (ft)	60.00	60.00	60.00
Crit W.S. (ft)	383.73	Flow Area (sq ft)		62.09	
E.G. Slope (ft/ft)	0.005468	Area (sq ft)		62.09	
Q Total (cfs)	897.00	Flow (cfs)		897.00	
Top Width (ft)	10.00	Top Width (ft)		10.00	
Vel Total (ft/s)	14.45	Avg. Vel. (ft/s)		14.45	
Max Chl Dpth (ft)	6.21	Hydr. Depth (ft)		6.21	
Conv. Total (cfs)	12130.6	Conv. (cfs)		12130.6	
Length Wtd. (ft)	60.00	Wetted Per. (ft)		22.42	
Min Ch El (ft)	377.52	Shear (lb/sq ft)		0.95	
Alpha	1.00	Stream Power (lb/ft s)		13.66	
Frctn Loss (ft)		Cum Volume (acre-ft)	2.78	4.92	1.66
C & E Loss (ft)		Cum SA (acres)	4.07	0.36	2.96

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CULVERT

RIVER: Unnamed Tributar
REACH: 1 RS: 3039

INPUT
Description: existing pipe under Lee HWY
Distance from Upstream XS = 2
Deck/Roadway Width = 56
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 9

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	387	0 42.64	386	0 87	385 0
108	384.62	0 118	384.62	0 165	384.5 0
232	384	0 296	385	0 761	388 0

Upstream Bridge Cross Section Data
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	387	42.64	386	87	385	108	384.62	108	377.52
118	377.52	118	384.62	165	384.5	232	384	296	385
761	388								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	108	.015	118	.03

Bank Sta: Left Right Coeff Contr. Expan.
108 118 .1 .3

Downstream Deck/Roadway Coordinates
num= 9
Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord
0 387 0 42.64 386 0 87 385 0
108 384.35 0 118 384.35 0 165 384.5 0
232 384 0 296 385 0 761 388 0

Downstream Bridge Cross Section Data
Station Elevation Data num= 11
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
0 387 42.64 386 87 385 108 384.35 108 377.85
118 377.85 118 384.35 165 384.5 232 384 296 385
761 388

Manning's n Values num= 3
Sta n Val Sta n Val Sta n Val
0 .03 108 .015 118 .03

Bank Sta: Left Right Coeff Contr. Expan.
108 118 .1 .3

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name Shape Rise Span
Culvert #1 Ellipse 4 5.83
FHWA Chart # 29- Horizontal Ellipse; Concrete
FHWA Scale # 1 - Square edge with headwall
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef Exit Loss Coef
2 56 .02 .02 1 1 1
Upstream Elevation = 377.32
Centerline Station = 110
Downstream Elevation = 375.85
Centerline Station = 110

CULVERT OUTPUT Profile #2 yr Culv Group: Culvert #1

Q Culv Group (cfs) 89.00 Culv Full Len (ft) 56.00
Barrels 1 Culv Vel US (ft/s) 6.04
Q Barrel (cfs) 89.00 Culv Vel DS (ft/s) 6.04
E.G. US. (ft) 383.63 Culv Inv El Up (ft) 377.32
W.S. US. (ft) 383.59 Culv Inv El Dn (ft) 375.85
E.G. DS (ft) 382.18 Culv Frctn Ls (ft) 0.38
W.S. DS (ft) 382.11 Culv Exit Loss (ft) 0.50
Delta EG (ft) 1.45 Culv Entr Loss (ft) 0.57
Delta WS (ft) 1.48 Q Weir (cfs)

E.G. IC (ft)	381.63	Weir Sta Lft (ft)	
E.G. OC (ft)	383.63	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	381.32	Weir Max Depth (ft)	
Culv WS Outlet (ft)	379.85	Weir Avg Depth (ft)	
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	1.94	Min El Weir Flow (ft)	384.01

CULVERT OUTPUT Profile #10 yr Culv Group: Culvert #1

Q Culv Group (cfs)	39.75	Culv Full Len (ft)	56.00
# Barrels	1	Culv Vel US (ft/s)	2.70
Q Barrel (cfs)	39.75	Culv Vel DS (ft/s)	2.70
E.G. US. (ft)	384.94	Culv Inv El Up (ft)	377.32
W.S. US. (ft)	384.84	Culv Inv El Dn (ft)	375.85
E.G. DS (ft)	384.75	Culv Frctn Ls (ft)	0.08
W.S. DS (ft)	384.62	Culv Exit Loss (ft)	0.00
Delta EG (ft)	0.19	Culv Entr Loss (ft)	0.11
Delta WS (ft)	0.23	Q Weir (cfs)	182.25
E.G. IC (ft)	384.76	Weir Sta Lft (ft)	90.78
E.G. OC (ft)	384.94	Weir Sta Rgt (ft)	291.62
Culvert Control	Outlet	Weir Submerg	0.40
Culv WS Inlet (ft)	381.32	Weir Max Depth (ft)	0.93
Culv WS Outlet (ft)	379.85	Weir Avg Depth (ft)	0.48
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	96.70
Culv Crt Depth (ft)	1.18	Min El Weir Flow (ft)	384.01

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #25 yr Culv Group: Culvert #1

Q Culv Group (cfs)	35.09	Culv Full Len (ft)	56.00
# Barrels	1	Culv Vel US (ft/s)	2.38
Q Barrel (cfs)	35.09	Culv Vel DS (ft/s)	2.38
E.G. US. (ft)	385.12	Culv Inv El Up (ft)	377.32
W.S. US. (ft)	384.93	Culv Inv El Dn (ft)	375.85
E.G. DS (ft)	384.97	Culv Frctn Ls (ft)	0.06
W.S. DS (ft)	384.71	Culv Exit Loss (ft)	0.00
Delta EG (ft)	0.15	Culv Entr Loss (ft)	0.09
Delta WS (ft)	0.22	Q Weir (cfs)	294.91
E.G. IC (ft)	384.97	Weir Sta Lft (ft)	81.57
E.G. OC (ft)	385.12	Weir Sta Rgt (ft)	314.96
Culvert Control	Outlet	Weir Submerg	0.40
Culv WS Inlet (ft)	381.32	Weir Max Depth (ft)	1.12
Culv WS Outlet (ft)	379.85	Weir Avg Depth (ft)	0.59
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	137.78
Culv Crt Depth (ft)	1.08	Min El Weir Flow (ft)	384.01

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #50 yr Culv Group: Culvert #1

Q Culv Group (cfs)	31.19	Culv Full Len (ft)	56.00
# Barrels	1	Culv Vel US (ft/s)	2.12
Q Barrel (cfs)	31.19	Culv Vel DS (ft/s)	2.12
E.G. US. (ft)	385.28	Culv Inv El Up (ft)	377.32
W.S. US. (ft)	384.97	Culv Inv El Dn (ft)	375.85
E.G. DS (ft)	385.16	Culv Frctn Ls (ft)	0.05
W.S. DS (ft)	384.68	Culv Exit Loss (ft)	0.00
Delta EG (ft)	0.12	Culv Entr Loss (ft)	0.07
Delta WS (ft)	0.29	Q Weir (cfs)	406.81
E.G. IC (ft)	385.18	Weir Sta Lft (ft)	74.79
E.G. OC (ft)	385.28	Weir Sta Rgt (ft)	338.68
Culvert Control	Outlet	Weir Submerg	0.29
Culv WS Inlet (ft)	381.32	Weir Max Depth (ft)	1.28
Culv WS Outlet (ft)	379.85	Weir Avg Depth (ft)	0.67
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	175.82
Culv Crt Depth (ft)	1.01	Min El Weir Flow (ft)	384.01

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #100 yr Culv Group: Culvert #1

Q Culv Group (cfs)	32.20	Culv Full Len (ft)	56.00
# Barrels	1	Culv Vel US (ft/s)	2.19
Q Barrel (cfs)	32.20	Culv Vel DS (ft/s)	2.19
E.G. US. (ft)	385.39	Culv Inv El Up (ft)	377.32
W.S. US. (ft)	384.59	Culv Inv El Dn (ft)	375.85
E.G. DS (ft)	385.27	Culv Frctn Ls (ft)	0.05
W.S. DS (ft)	384.06	Culv Exit Loss (ft)	0.00
Delta EG (ft)	0.12	Culv Entr Loss (ft)	0.07
Delta WS (ft)	0.53	Q Weir (cfs)	515.80
E.G. IC (ft)	385.29	Weir Sta Lft (ft)	69.08
E.G. OC (ft)	385.39	Weir Sta Rgt (ft)	358.62
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	381.32	Weir Max Depth (ft)	1.40
Culv WS Outlet (ft)	379.85	Weir Avg Depth (ft)	0.73
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	211.43
Culv Crt Depth (ft)	1.03	Min El Weir Flow (ft)	384.01

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #500 yr Culv Group: Culvert #1

Q Culv Group (cfs)	20.82	Culv Full Len (ft)	56.00
# Barrels	1	Culv Vel US (ft/s)	1.41
Q Barrel (cfs)	20.82	Culv Vel DS (ft/s)	1.41
E.G. US. (ft)	386.07	Culv Inv El Up (ft)	377.32
W.S. US. (ft)	383.73	Culv Inv El Dn (ft)	375.85
E.G. DS (ft)	386.02	Culv Frctn Ls (ft)	0.02
W.S. DS (ft)	385.43	Culv Exit Loss (ft)	0.00
Delta EG (ft)	0.05	Culv Entr Loss (ft)	0.03
Delta WS (ft)	1.70	Q Weir (cfs)	876.18
E.G. IC (ft)	386.03	Weir Sta Lft (ft)	41.32
E.G. OC (ft)	386.07	Weir Sta Rgt (ft)	455.81

Culvert Control	Outlet	Weir Submerg	0.84
Culv WS Inlet (ft)	381.32	Weir Max Depth (ft)	2.03
Culv WS Outlet (ft)	379.85	Weir Avg Depth (ft)	1.04
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	432.16
Culv Crt Depth (ft)	0.78	Min El Weir Flow (ft)	384.01

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CROSS SECTION

RIVER: Unnamed Tributar
REACH: 1 RS: 3009

INPUT
Description: Drop Inlet Ex 1778
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	387	42.64	386	87	385	108	384.35	108	377.85
118	377.85	118	384.35	165	384.5	232	384	296	385
761	388								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	108	.015	118	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
108	118	185	185	.1	.3

CROSS SECTION OUTPUT Profile #2 yr

E.G. Elev (ft)	382.18	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.		0.015	
W.S. Elev (ft)	382.11	Reach Len. (ft)	185.00	185.00	185.00
Crit W.S. (ft)	379.20	Flow Area (sq ft)		42.62	
E.G. Slope (ft/ft)	0.000146	Area (sq ft)		42.62	
Q Total (cfs)	89.00	Flow (cfs)		89.00	
Top Width (ft)	10.00	Top Width (ft)		10.00	
Vel Total (ft/s)	2.09	Avg. Vel. (ft/s)		2.09	
Max Chl Dpth (ft)	4.26	Hydr. Depth (ft)		4.26	
Conv. Total (cfs)	7357.3	Conv. (cfs)		7357.3	
Length Wtd. (ft)	185.00	Wetted Per. (ft)		18.52	
Min Ch El (ft)	377.85	Shear (lb/sq ft)		0.02	
Alpha	1.00	Stream Power (lb/ft s)		0.04	
Frctn Loss (ft)		Cum Volume (acre-ft)	0.63	0.78	0.33
C & E Loss (ft)		Cum SA (acres)	0.78	0.32	0.50

CROSS SECTION OUTPUT Profile #10 yr

E.G. Elev (ft)	384.75	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.	0.030	0.015	0.030
W.S. Elev (ft)	384.62	Reach Len. (ft)	185.00	185.00	185.00
Crit W.S. (ft)	380.33	Flow Area (sq ft)	1.14	67.65	45.52
E.G. Slope (ft/ft)	0.000226	Area (sq ft)	1.14	67.65	45.52
Q Total (cfs)	222.00	Flow (cfs)	0.22	206.71	15.07

Top Width (ft)	171.94	Top Width (ft)	8.57	10.00	153.38
Vel Total (ft/s)	1.94	Avg. Vel. (ft/s)	0.19	3.06	0.33
Max Chl Dpth (ft)	6.77	Hydr. Depth (ft)	0.13	6.77	0.30
Conv. Total (cfs)	14776.0	Conv. (cfs)	14.6	13758.0	1003.3
Length Wtd. (ft)	185.00	Wetted Per. (ft)	8.57	23.00	153.38
Min Ch El (ft)	377.85	Shear (lb/sq ft)	0.00	0.04	0.00
Alpha	2.31	Stream Power (lb/ft s)	0.00	0.13	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	1.08	1.61	0.73
C & E Loss (ft)		Cum SA (acres)	2.16	0.34	1.39

CROSS SECTION OUTPUT Profile #25 yr

E.G. Elev (ft)	384.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.26	Wt. n-Val.	0.030	0.015	0.030
W.S. Elev (ft)	384.71	Reach Len. (ft)	185.00	185.00	185.00
Crit W.S. (ft)	381.08	Flow Area (sq ft)	2.07	68.58	60.09
E.G. Slope (ft/ft)	0.000444	Area (sq ft)	2.07	68.58	60.09
Q Total (cfs)	330.00	Flow (cfs)	0.69	296.58	32.74
Top Width (ft)	180.92	Top Width (ft)	11.58	10.00	159.34
Vel Total (ft/s)	2.52	Avg. Vel. (ft/s)	0.33	4.32	0.54
Max Chl Dpth (ft)	6.86	Hydr. Depth (ft)	0.18	6.86	0.38
Conv. Total (cfs)	15661.5	Conv. (cfs)	32.7	14075.3	1553.6
Length Wtd. (ft)	185.00	Wetted Per. (ft)	11.58	23.00	159.35
Min Ch El (ft)	377.85	Shear (lb/sq ft)	0.00	0.08	0.01
Alpha	2.64	Stream Power (lb/ft s)	0.00	0.36	0.01
Frctn Loss (ft)		Cum Volume (acre-ft)	1.56	2.15	0.97
C & E Loss (ft)		Cum SA (acres)	2.28	0.34	1.55

CROSS SECTION OUTPUT Profile #50 yr

E.G. Elev (ft)	385.16	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.48	Wt. n-Val.	0.030	0.015	0.030
W.S. Elev (ft)	384.68	Reach Len. (ft)	185.00	185.00	185.00
Crit W.S. (ft)	381.74	Flow Area (sq ft)	1.80	68.34	56.23
E.G. Slope (ft/ft)	0.000807	Area (sq ft)	1.80	68.34	56.23
Q Total (cfs)	438.00	Flow (cfs)	0.77	397.46	39.77
Top Width (ft)	178.57	Top Width (ft)	10.79	10.00	157.78
Vel Total (ft/s)	3.47	Avg. Vel. (ft/s)	0.43	5.82	0.71
Max Chl Dpth (ft)	6.83	Hydr. Depth (ft)	0.17	6.83	0.36
Conv. Total (cfs)	15419.1	Conv. (cfs)	27.1	13992.1	1399.9
Length Wtd. (ft)	185.00	Wetted Per. (ft)	10.80	23.00	157.79
Min Ch El (ft)	377.85	Shear (lb/sq ft)	0.01	0.15	0.02
Alpha	2.56	Stream Power (lb/ft s)	0.00	0.87	0.01
Frctn Loss (ft)		Cum Volume (acre-ft)	2.12	2.63	1.23
C & E Loss (ft)		Cum SA (acres)	2.43	0.34	1.64

CROSS SECTION OUTPUT Profile #100 yr

E.G. Elev (ft)	385.27	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.21	Wt. n-Val.		0.015	0.030
W.S. Elev (ft)	384.06	Reach Len. (ft)	185.00	185.00	185.00
Crit W.S. (ft)	382.37	Flow Area (sq ft)		62.08	0.33
E.G. Slope (ft/ft)	0.002041	Area (sq ft)		62.08	0.33
Q Total (cfs)	548.00	Flow (cfs)		547.93	0.07

Top Width (ft)	21.48	Top Width (ft)	10.00	11.48	
Vel Total (ft/s)	8.78	Avg. Vel. (ft/s)	8.83	0.21	
Max Chl Dpth (ft)	6.21	Hydr. Depth (ft)	6.21	0.03	
Conv. Total (cfs)	12129.4	Conv. (cfs)	12127.8	1.6	
Length Wtd. (ft)	185.00	Wetted Per. (ft)	22.42	11.48	
Min Ch El (ft)	377.85	Shear (lb/sq ft)	0.35	0.00	
Alpha	1.01	Stream Power (lb/ft s)	3.11	0.00	
Frctn Loss (ft)		Cum Volume (acre-ft)	2.03	3.08	1.25
C & E Loss (ft)		Cum SA (acres)	3.23	0.34	1.73

CROSS SECTION OUTPUT Profile #500 yr

E.G. Elev (ft)	386.02	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.59	Wt. n-Val.	0.030	0.015	0.030
W.S. Elev (ft)	385.43	Reach Len. (ft)	185.00	185.00	185.00
Crit W.S. (ft)	385.43	Flow Area (sq ft)	20.00	75.81	200.42
E.G. Slope (ft/ft)	0.001196	Area (sq ft)	20.00	75.81	200.42
Q Total (cfs)	897.00	Flow (cfs)	21.53	575.11	300.36
Top Width (ft)	294.95	Top Width (ft)	40.12	10.00	244.82
Vel Total (ft/s)	3.03	Avg. Vel. (ft/s)	1.08	7.59	1.50
Max Chl Dpth (ft)	7.58	Hydr. Depth (ft)	0.50	7.58	0.82
Conv. Total (cfs)	25942.5	Conv. (cfs)	622.7	16633.1	8686.7
Length Wtd. (ft)	185.00	Wetted Per. (ft)	40.14	23.00	244.84
Min Ch El (ft)	377.85	Shear (lb/sq ft)	0.04	0.25	0.06
Alpha	4.11	Stream Power (lb/ft s)	0.04	1.87	0.09
Frctn Loss (ft)		Cum Volume (acre-ft)	2.78	4.33	1.66
C & E Loss (ft)		Cum SA (acres)	4.04	0.34	2.80

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CULVERT

RIVER: Unnamed Tributar
REACH: 1 RS: 2916

INPUT
Description: second exist elipt pipe
Distance from Upstream XS = 2
Deck/Roadway Width = 181
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 9

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	387	0	42	386	0	87	385	0
108	384.35	0	118	384.35	0	165	384.5	0
232	384	0	296	385	0	761	388	0

Upstream Bridge Cross Section Data
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	387	42.64	386	87	385	108	384.35	108	377.85
118	377.85	118	384.35	165	384.5	232	384	296	385
761	388								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	108	.015	118	.03

Bank Sta: Left Right Coeff Contr. Expan.

108	118	.1	.3

Downstream Deck/Roadway Coordinates

num= 6

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	382.5	0	60	381.65	0	64	380.42	0
72	380.42	0	105	383	0	165	385	0

Downstream Bridge Cross Section Data

Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	382.5	60	381.65	64	380.42	64	375.32	72	375.32
72	380.42	105	383	165	385				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	64	.015	72	.03

Bank Sta: Left Right Coeff Contr. Expan.

64	72	.1	.3

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name Shape Rise Span
Culvert #1 Ellipse 4 5.83
FHWA Chart # 29- Horizontal Ellipse; Concrete
FHWA Scale # 1 - Square edge with headwall
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	2	181	.024	.024	1	.3	1

Upstream Elevation = 377.85
Centerline Station = 118
Downstream Elevation = 375.32
Centerline Station = 70

CULVERT OUTPUT Profile #2 yr Culv Group: Culvert #1

Q Culv Group (cfs)	89.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	8.15
Q Barrel (cfs)	89.00	Culv Vel DS (ft/s)	6.22
E.G. US. (ft)	382.18	Culv Inv El Up (ft)	377.85
W.S. US. (ft)	382.11	Culv Inv El Dn (ft)	375.32
E.G. DS (ft)	379.23	Culv Frctn Ls (ft)	0.00
W.S. DS (ft)	379.09	Culv Exit Loss (ft)	0.46

Delta EG (ft)	2.95	Culv Entr Loss (ft)	0.34
Delta WS (ft)	3.03	Q Weir (cfs)	
E.G. IC (ft)	382.18	Weir Sta Lft (ft)	
E.G. OC (ft)	382.15	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	380.80	Weir Max Depth (ft)	
Culv WS Outlet (ft)	379.09	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	1.95	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	1.94	Min El Weir Flow (ft)	384.01

Note: During subcritical analysis, the culvert direct step method, the solution went to normal depth.

CULVERT OUTPUT Profile #10 yr Culv Group: Culvert #1

Q Culv Group (cfs)	99.41	Culv Full Len (ft)	181.00
# Barrels	1	Culv Vel US (ft/s)	6.75
Q Barrel (cfs)	99.41	Culv Vel DS (ft/s)	6.75
E.G. US. (ft)	384.75	Culv Inv El Up (ft)	377.85
W.S. US. (ft)	384.62	Culv Inv El Dn (ft)	375.32
E.G. DS (ft)	381.91	Culv Frctn Ls (ft)	2.21
W.S. DS (ft)	381.62	Culv Exit Loss (ft)	0.42
Delta EG (ft)	2.84	Culv Entr Loss (ft)	0.21
Delta WS (ft)	2.99	Q Weir (cfs)	123.54
E.G. IC (ft)	384.64	Weir Sta Lft (ft)	95.00
E.G. OC (ft)	384.75	Weir Sta Rgt (ft)	280.16
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	381.85	Weir Max Depth (ft)	0.75
Culv WS Outlet (ft)	379.32	Weir Avg Depth (ft)	0.40
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	73.82
Culv Crt Depth (ft)	2.07	Min El Weir Flow (ft)	384.01

CULVERT OUTPUT Profile #25 yr Culv Group: Culvert #1

Q Culv Group (cfs)	100.66	Culv Full Len (ft)	181.00
# Barrels	1	Culv Vel US (ft/s)	6.83
Q Barrel (cfs)	100.66	Culv Vel DS (ft/s)	6.83
E.G. US. (ft)	384.97	Culv Inv El Up (ft)	377.85
W.S. US. (ft)	384.71	Culv Inv El Dn (ft)	375.32
E.G. DS (ft)	382.35	Culv Frctn Ls (ft)	2.26
W.S. DS (ft)	381.76	Culv Exit Loss (ft)	0.14
Delta EG (ft)	2.62	Culv Entr Loss (ft)	0.22
Delta WS (ft)	2.95	Q Weir (cfs)	229.34
E.G. IC (ft)	384.88	Weir Sta Lft (ft)	88.11
E.G. OC (ft)	384.97	Weir Sta Rgt (ft)	293.80
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	381.85	Weir Max Depth (ft)	0.97
Culv WS Outlet (ft)	379.32	Weir Avg Depth (ft)	0.56
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	115.48
Culv Crt Depth (ft)	2.08	Min El Weir Flow (ft)	384.01

CULVERT OUTPUT Profile #50 yr Culv Group: Culvert #1

Q Culv Group (cfs)	100.46	Culv Full Len (ft)	181.00
# Barrels	1	Culv Vel US (ft/s)	6.82

Q Barrel (cfs)	100.46	Culv Vel DS (ft/s)	6.82
E.G. US. (ft)	385.15	Culv Inv El Up (ft)	377.85
W.S. US. (ft)	384.68	Culv Inv El Dn (ft)	375.32
E.G. DS (ft)	382.68	Culv Frctn Ls (ft)	2.26
W.S. DS (ft)	381.59	Culv Exit Loss (ft)	0.00
Delta EG (ft)	2.47	Culv Entr Loss (ft)	0.22
Delta WS (ft)	3.09	Q Weir (cfs)	337.54
E.G. IC (ft)	385.06	Weir Sta Lft (ft)	81.08
E.G. OC (ft)	385.15	Weir Sta Rgt (ft)	316.68
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	381.85	Weir Max Depth (ft)	1.13
Culv WS Outlet (ft)	379.32	Weir Avg Depth (ft)	0.65
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	152.25
Culv Crt Depth (ft)	2.08	Min El Weir Flow (ft)	384.01

CULVERT OUTPUT Profile #100 yr Culv Group: Culvert #1

Q Culv Group (cfs)	88.38	Culv Full Len (ft)	181.00
# Barrels	1	Culv Vel US (ft/s)	6.00
Q Barrel (cfs)	88.38	Culv Vel DS (ft/s)	6.00
E.G. US. (ft)	385.26	Culv Inv El Up (ft)	377.85
W.S. US. (ft)	384.06	Culv Inv El Dn (ft)	375.32
E.G. DS (ft)	383.35	Culv Frctn Ls (ft)	1.75
W.S. DS (ft)	381.35	Culv Exit Loss (ft)	0.00
Delta EG (ft)	1.91	Culv Entr Loss (ft)	0.17
Delta WS (ft)	2.71	Q Weir (cfs)	459.62
E.G. IC (ft)	385.21	Weir Sta Lft (ft)	74.06
E.G. OC (ft)	385.26	Weir Sta Rgt (ft)	341.21
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	381.85	Weir Max Depth (ft)	1.29
Culv WS Outlet (ft)	379.32	Weir Avg Depth (ft)	0.72
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	192.04
Culv Crt Depth (ft)	1.93	Min El Weir Flow (ft)	384.01

CULVERT OUTPUT Profile #500 yr Culv Group: Culvert #1

Q Culv Group (cfs)	76.52	Culv Full Len (ft)	181.00
# Barrels	1	Culv Vel US (ft/s)	5.19
Q Barrel (cfs)	76.52	Culv Vel DS (ft/s)	5.19
E.G. US. (ft)	385.65	Culv Inv El Up (ft)	377.85
W.S. US. (ft)	385.43	Culv Inv El Dn (ft)	375.32
E.G. DS (ft)	384.21	Culv Frctn Ls (ft)	1.31
W.S. DS (ft)	383.32	Culv Exit Loss (ft)	0.00
Delta EG (ft)	1.43	Culv Entr Loss (ft)	0.13
Delta WS (ft)	2.12	Q Weir (cfs)	820.48
E.G. IC (ft)	385.62	Weir Sta Lft (ft)	57.88
E.G. OC (ft)	385.65	Weir Sta Rgt (ft)	397.76
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	381.85	Weir Max Depth (ft)	1.66
Culv WS Outlet (ft)	379.32	Weir Avg Depth (ft)	0.89
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	302.78
Culv Crt Depth (ft)	1.76	Min El Weir Flow (ft)	384.01

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CROSS SECTION

RIVER: Unnamed Tributar
REACH: 1 RS: 2824

INPUT
Description: Drop Inlet Ex 1731
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	382.5	60	381.65	64	380.42	64	375.32	72	375.32
72	380.42	105	383	165	385				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	64	.015	72	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
64	72	304	304	.1	.3

CROSS SECTION OUTPUT Profile #2 yr

E.G. Elev (ft)	379.23	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.		0.015	
W.S. Elev (ft)	379.09	Reach Len. (ft)	304.00	304.00	304.00
Crit W.S. (ft)	376.92	Flow Area (sq ft)		30.13	
E.G. Slope (ft/ft)	0.000393	Area (sq ft)		30.13	
Q Total (cfs)	92.00	Flow (cfs)		92.00	
Top Width (ft)	8.00	Top Width (ft)		8.00	
Vel Total (ft/s)	3.05	Avg. Vel. (ft/s)		3.05	
Max Chl Dpth (ft)	3.77	Hydr. Depth (ft)		3.77	
Conv. Total (cfs)	4642.4	Conv. (cfs)		4642.4	
Length Wtd. (ft)	304.00	Wetted Per. (ft)		15.53	
Min Ch El (ft)	375.32	Shear (lb/sq ft)		0.05	
Alpha	1.00	Stream Power (lb/ft s)		0.15	
Frctn Loss (ft)		Cum Volume (acre-ft)	0.63	0.72	0.33
C & E Loss (ft)		Cum SA (acres)	0.78	0.28	0.50

CROSS SECTION OUTPUT Profile #10 yr

E.G. Elev (ft)	381.91	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.28	Wt. n-Val.	0.030	0.015	0.030
W.S. Elev (ft)	381.62	Reach Len. (ft)	304.00	304.00	304.00
Crit W.S. (ft)	378.25	Flow Area (sq ft)	2.36	50.44	9.28
E.G. Slope (ft/ft)	0.000498	Area (sq ft)	2.36	50.44	9.28
Q Total (cfs)	229.00	Flow (cfs)	1.80	219.90	7.30
Top Width (ft)	27.32	Top Width (ft)	3.92	8.00	15.41
Vel Total (ft/s)	3.69	Avg. Vel. (ft/s)	0.76	4.36	0.79
Max Chl Dpth (ft)	6.30	Hydr. Depth (ft)	0.60	6.30	0.60
Conv. Total (cfs)	10265.2	Conv. (cfs)	80.9	9857.3	327.1
Length Wtd. (ft)	304.00	Wetted Per. (ft)	4.10	18.20	15.45
Min Ch El (ft)	375.32	Shear (lb/sq ft)	0.02	0.09	0.02
Alpha	1.34	Stream Power (lb/ft s)	0.01	0.38	0.01
Frctn Loss (ft)		Cum Volume (acre-ft)	1.08	1.23	0.73
C & E Loss (ft)		Cum SA (acres)	2.13	0.30	1.03

CROSS SECTION OUTPUT Profile #25 yr

E.G. Elev (ft)	382.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.59	Wt. n-Val.	0.030	0.015	0.030
W.S. Elev (ft)	381.76	Reach Len. (ft)	304.00	304.00	304.00
Crit W.S. (ft)	379.15	Flow Area (sq ft)	3.36	51.54	11.53
E.G. Slope (ft/ft)	0.001010	Area (sq ft)	3.36	51.54	11.53
Q Total (cfs)	341.00	Flow (cfs)	2.25	324.87	13.89
Top Width (ft)	37.12	Top Width (ft)	11.95	8.00	17.17
Vel Total (ft/s)	5.13	Avg. Vel. (ft/s)	0.67	6.30	1.20
Max Chl Dpth (ft)	6.44	Hydr. Depth (ft)	0.28	6.44	0.67
Conv. Total (cfs)	10727.3	Conv. (cfs)	70.6	10219.8	436.9
Length Wtd. (ft)	304.00	Wetted Per. (ft)	12.13	18.20	17.23
Min Ch El (ft)	375.32	Shear (lb/sq ft)	0.02	0.18	0.04
Alpha	1.44	Stream Power (lb/ft s)	0.01	1.13	0.05
Frctn Loss (ft)		Cum Volume (acre-ft)	1.56	1.60	0.97
C & E Loss (ft)		Cum SA (acres)	2.23	0.30	1.17

CROSS SECTION OUTPUT Profile #50 yr

E.G. Elev (ft)	382.68	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.09	Wt. n-Val.	0.030	0.015	0.030
W.S. Elev (ft)	381.59	Reach Len. (ft)	304.00	304.00	304.00
Crit W.S. (ft)	379.90	Flow Area (sq ft)	2.22	50.15	8.74
E.G. Slope (ft/ft)	0.001925	Area (sq ft)	2.22	50.15	8.74
Q Total (cfs)	445.00	Flow (cfs)	3.28	428.47	13.25
Top Width (ft)	26.76	Top Width (ft)	3.80	8.00	14.95
Vel Total (ft/s)	7.28	Avg. Vel. (ft/s)	1.47	8.54	1.52
Max Chl Dpth (ft)	6.27	Hydr. Depth (ft)	0.58	6.27	0.58
Conv. Total (cfs)	10141.9	Conv. (cfs)	74.7	9765.1	302.0
Length Wtd. (ft)	304.00	Wetted Per. (ft)	3.98	18.20	15.00
Min Ch El (ft)	375.32	Shear (lb/sq ft)	0.07	0.33	0.07
Alpha	1.33	Stream Power (lb/ft s)	0.10	2.83	0.11
Frctn Loss (ft)		Cum Volume (acre-ft)	2.12	1.92	1.23
C & E Loss (ft)		Cum SA (acres)	2.39	0.30	1.27

CROSS SECTION OUTPUT Profile #100 yr

E.G. Elev (ft)	383.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.00	Wt. n-Val.	0.030	0.015	0.030
W.S. Elev (ft)	381.35	Reach Len. (ft)	304.00	304.00	304.00
Crit W.S. (ft)	381.35	Flow Area (sq ft)	1.40	48.23	5.52
E.G. Slope (ft/ft)	0.003648	Area (sq ft)	1.40	48.23	5.52
Q Total (cfs)	565.00	Flow (cfs)	2.44	552.67	9.88
Top Width (ft)	22.90	Top Width (ft)	3.02	8.00	11.88
Vel Total (ft/s)	10.24	Avg. Vel. (ft/s)	1.74	11.46	1.79
Max Chl Dpth (ft)	6.03	Hydr. Depth (ft)	0.46	6.03	0.46
Conv. Total (cfs)	9353.9	Conv. (cfs)	40.5	9149.9	163.6
Length Wtd. (ft)	304.00	Wetted Per. (ft)	3.16	18.20	11.92
Min Ch El (ft)	375.32	Shear (lb/sq ft)	0.10	0.60	0.11
Alpha	1.22	Stream Power (lb/ft s)	0.18	6.92	0.19
Frctn Loss (ft)		Cum Volume (acre-ft)	2.03	2.21	1.25
C & E Loss (ft)		Cum SA (acres)	3.22	0.30	1.68

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CROSS SECTION OUTPUT Profile #500 yr

E.G. Elev (ft)	384.21	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.90	Wt. n-Val.	0.030	0.015	0.030
W.S. Elev (ft)	383.32	Reach Len. (ft)	304.00	304.00	304.00
Crit W.S. (ft)	383.32	Flow Area (sq ft)	83.58	63.97	54.49
E.G. Slope (ft/ft)	0.001650	Area (sq ft)	83.58	63.97	54.49
Q Total (cfs)	923.00	Flow (cfs)	198.81	594.98	129.21
Top Width (ft)	114.48	Top Width (ft)	64.00	8.00	42.48
Vel Total (ft/s)	4.57	Avg. Vel. (ft/s)	2.38	9.30	2.37
Max Chl Dpth (ft)	8.00	Hydr. Depth (ft)	1.31	8.00	1.28
Conv. Total (cfs)	22723.9	Conv. (cfs)	4894.6	14648.2	3181.2
Length Wtd. (ft)	304.00	Wetted Per. (ft)	65.01	18.20	42.58
Min Ch El (ft)	375.32	Shear (lb/sq ft)	0.13	0.36	0.13
Alpha	2.77	Stream Power (lb/ft s)	0.31	3.37	0.31
Frctn Loss (ft)		Cum Volume (acre-ft)	2.78	2.98	1.66
C & E Loss (ft)		Cum SA (acres)	3.82	0.30	2.19

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CULVERT

RIVER: Unnamed Tributar
REACH: 1 RS: 2633

INPUT
Description: existing eliptical pipe
Distance from Upstream XS = 2
Deck/Roadway Width = 299
Weir Coefficient = 3.1
Upstream Deck/Roadway Coordinates
num= 5

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	382.5		64	380.42		72	380.42	
105	383		165	385				

Upstream Bridge Cross Section Data
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	382.5	60	381.65	64	380.42	64	375.32	72	375.32
72	380.42	105	383	165	385				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	64	.015	72	.03

Bank Sta: Left Right Coeff Contr. Expan.
64 72 .1 .3

Downstream Deck/Roadway Coordinates
num= 6

Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord
0 378 100 377 164 376.5
245 376.21 253 376.21 428 378

Downstream Bridge Cross Section Data
Station Elevation Data num= 9
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
0 378 100 377 164 376.5 245 376.21 245 370.91
253 370.91 253 376.21 293 377 428 378

Manning's n Values num= 3
Sta n Val Sta n Val Sta n Val
0 .03 245 .015 253 .03

Bank Sta: Left Right Coeff Contr. Expan.
245 253 .1 .3

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name Shape Rise Span
Culvert #1 Ellipse 4 5.8
FHWA Chart # 29- Horizontal Ellipse; Concrete
FHWA Scale # 1 - Square edge with headwall
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef Exit Loss Coef
2 299 .024 .024 .5 .3 1
Upstream Elevation = 375.32
Centerline Station = 68
Downstream Elevation = 370.91
Centerline Station = 250

CULVERT OUTPUT Profile #2 yr Culv Group: Culvert #1

Q Culv Group (cfs) 92.00 Culv Full Len (ft)
Barrels 1 Culv Vel US (ft/s) 8.15
Q Barrel (cfs) 92.00 Culv Vel DS (ft/s) 5.56
E.G. US. (ft) 379.23 Culv Inv El Up (ft) 375.32
W.S. US. (ft) 379.09 Culv Inv El Dn (ft) 370.91
E.G. DS (ft) 374.85 Culv Frctn Ls (ft) 0.00
W.S. DS (ft) 374.70 Culv Exit Loss (ft) 0.34
Delta EG (ft) 4.39 Culv Entr Loss (ft) 0.27
Delta WS (ft) 4.38 Q Weir (cfs)
E.G. IC (ft) 379.23 Weir Sta Lft (ft)
E.G. OC (ft) 379.27 Weir Sta Rgt (ft)
Culvert Control Inlet Weir Submerg
Culv WS Inlet (ft) 377.93 Weir Max Depth (ft)
Culv WS Outlet (ft) 374.70 Weir Avg Depth (ft)
Culv Nml Depth (ft) 1.99 Weir Flow Area (sq ft)
Culv Crt Depth (ft) 2.11 Min El Weir Flow (ft) 380.43

Note: During supercritical analysis, the culvert direct step method went to normal depth. The program then assumed normal depth at the outlet.

Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.

CULVERT OUTPUT Profile #10 yr Culv Group: Culvert #1

Q Culv Group (cfs)	133.75	Culv Full Len (ft)	299.00
# Barrels	1	Culv Vel US (ft/s)	7.91
Q Barrel (cfs)	133.75	Culv Vel DS (ft/s)	7.91
E.G. US. (ft)	381.91	Culv Inv El Up (ft)	375.32
W.S. US. (ft)	381.62	Culv Inv El Dn (ft)	370.91
E.G. DS (ft)	376.78	Culv Frctn Ls (ft)	4.29
W.S. DS (ft)	376.35	Culv Exit Loss (ft)	0.55
Delta EG (ft)	5.13	Culv Entr Loss (ft)	0.29
Delta WS (ft)	5.27	Q Weir (cfs)	95.25
E.G. IC (ft)	381.71	Weir Sta Lft (ft)	41.95
E.G. OC (ft)	381.91	Weir Sta Rgt (ft)	91.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	379.32	Weir Max Depth (ft)	1.49
Culv WS Outlet (ft)	374.91	Weir Avg Depth (ft)	0.65
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	31.79
Culv Crt Depth (ft)	2.60	Min El Weir Flow (ft)	380.43

CULVERT OUTPUT Profile #25 yr Culv Group: Culvert #1

Q Culv Group (cfs)	144.02	Culv Full Len (ft)	299.00
# Barrels	1	Culv Vel US (ft/s)	8.52
Q Barrel (cfs)	144.02	Culv Vel DS (ft/s)	8.52
E.G. US. (ft)	382.35	Culv Inv El Up (ft)	375.32
W.S. US. (ft)	381.76	Culv Inv El Dn (ft)	370.91
E.G. DS (ft)	377.03	Culv Frctn Ls (ft)	4.98
W.S. DS (ft)	375.90	Culv Exit Loss (ft)	0.00
Delta EG (ft)	5.32	Culv Entr Loss (ft)	0.34
Delta WS (ft)	5.87	Q Weir (cfs)	196.98
E.G. IC (ft)	382.29	Weir Sta Lft (ft)	8.72
E.G. OC (ft)	382.35	Weir Sta Rgt (ft)	97.02
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	379.32	Weir Max Depth (ft)	1.96
Culv WS Outlet (ft)	374.91	Weir Avg Depth (ft)	0.73
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	64.12
Culv Crt Depth (ft)	2.71	Min El Weir Flow (ft)	380.43

CULVERT OUTPUT Profile #50 yr Culv Group: Culvert #1

Q Culv Group (cfs)	138.28	Culv Full Len (ft)	299.00
# Barrels	1	Culv Vel US (ft/s)	8.18
Q Barrel (cfs)	138.28	Culv Vel DS (ft/s)	8.18
E.G. US. (ft)	382.68	Culv Inv El Up (ft)	375.32
W.S. US. (ft)	381.59	Culv Inv El Dn (ft)	370.91
E.G. DS (ft)	377.78	Culv Frctn Ls (ft)	4.59
W.S. DS (ft)	375.48	Culv Exit Loss (ft)	0.00
Delta EG (ft)	4.90	Culv Entr Loss (ft)	0.31
Delta WS (ft)	6.11	Q Weir (cfs)	307.47

E.G. IC (ft)	382.59	Weir Sta Lft (ft)	0.00
E.G. OC (ft)	382.68	Weir Sta Rgt (ft)	100.96
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	379.32	Weir Max Depth (ft)	2.26
Culv WS Outlet (ft)	374.91	Weir Avg Depth (ft)	0.93
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	94.08
Culv Crt Depth (ft)	2.66	Min El Weir Flow (ft)	380.43

CULVERT OUTPUT Profile #100 yr Culv Group: Culvert #1

Q Culv Group (cfs)	133.78	Culv Full Len (ft)	299.00
# Barrels	1	Culv Vel US (ft/s)	7.91
Q Barrel (cfs)	133.78	Culv Vel DS (ft/s)	7.91
E.G. US. (ft)	382.95	Culv Inv El Up (ft)	375.32
W.S. US. (ft)	381.35	Culv Inv El Dn (ft)	370.91
E.G. DS (ft)	377.82	Culv Frctn Ls (ft)	4.30
W.S. DS (ft)	377.39	Culv Exit Loss (ft)	0.54
Delta EG (ft)	5.13	Culv Entr Loss (ft)	0.29
Delta WS (ft)	3.96	Q Weir (cfs)	431.22
E.G. IC (ft)	382.86	Weir Sta Lft (ft)	0.00
E.G. OC (ft)	382.95	Weir Sta Rgt (ft)	104.45
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	379.32	Weir Max Depth (ft)	2.54
Culv WS Outlet (ft)	374.91	Weir Avg Depth (ft)	1.17
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	122.10
Culv Crt Depth (ft)	2.62	Min El Weir Flow (ft)	380.43

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CULVERT OUTPUT Profile #500 yr Culv Group: Culvert #1

Q Culv Group (cfs)	136.36	Culv Full Len (ft)	299.00
# Barrels	1	Culv Vel US (ft/s)	8.07
Q Barrel (cfs)	136.36	Culv Vel DS (ft/s)	8.07
E.G. US. (ft)	383.56	Culv Inv El Up (ft)	375.32
W.S. US. (ft)	383.32	Culv Inv El Dn (ft)	370.91
E.G. DS (ft)	378.23	Culv Frctn Ls (ft)	4.46
W.S. DS (ft)	377.78	Culv Exit Loss (ft)	0.57
Delta EG (ft)	5.33	Culv Entr Loss (ft)	0.30
Delta WS (ft)	5.53	Q Weir (cfs)	786.64
E.G. IC (ft)	383.49	Weir Sta Lft (ft)	0.00
E.G. OC (ft)	383.56	Weir Sta Rgt (ft)	121.68
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	379.32	Weir Max Depth (ft)	3.14
Culv WS Outlet (ft)	374.91	Weir Avg Depth (ft)	1.56
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	189.57
Culv Crt Depth (ft)	2.63	Min El Weir Flow (ft)	380.43

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CROSS SECTION

RIVER: Unnamed Tributar

REACH: 1 RS: 2523

INPUT
Description: inlet ex 1656 at panther drive
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	378	100	377	164	376.5	245	376.21	245	370.91
253	370.91	253	376.21	293	377	428	378		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	245	.015	253	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
245	253	80	80	.1	.3

CROSS SECTION OUTPUT Profile #2 yr

E.G. Elev (ft)	374.85	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.		0.015	
W.S. Elev (ft)	374.70	Reach Len. (ft)	80.00	80.00	80.00
Crit W.S. (ft)	372.51	Flow Area (sq ft)		30.35	
E.G. Slope (ft/ft)	0.000385	Area (sq ft)		30.35	
Q Total (cfs)	92.00	Flow (cfs)		92.00	
Top Width (ft)	8.00	Top Width (ft)		8.00	
Vel Total (ft/s)	3.03	Avg. Vel. (ft/s)		3.03	
Max Chl Dpth (ft)	3.79	Hydr. Depth (ft)		3.79	
Conv. Total (cfs)	4688.3	Conv. (cfs)		4688.3	
Length Wtd. (ft)	80.00	Wetted Per. (ft)		15.59	
Min Ch El (ft)	370.91	Shear (lb/sq ft)		0.05	
Alpha	1.00	Stream Power (lb/ft s)		0.14	
Frctn Loss (ft)		Cum Volume (acre-ft)	0.63	0.64	0.33
C & E Loss (ft)		Cum SA (acres)	0.78	0.23	0.50

CROSS SECTION OUTPUT Profile #10 yr

E.G. Elev (ft)	376.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.43	Wt. n-Val.	0.030	0.015	0.030
W.S. Elev (ft)	376.35	Reach Len. (ft)	80.00	80.00	80.00
Crit W.S. (ft)	373.84	Flow Area (sq ft)	2.73	43.52	0.50
E.G. Slope (ft/ft)	0.000902	Area (sq ft)	2.73	43.52	0.50
Q Total (cfs)	229.00	Flow (cfs)	0.69	228.18	0.13
Top Width (ft)	54.17	Top Width (ft)	39.08	8.00	7.08
Vel Total (ft/s)	4.90	Avg. Vel. (ft/s)	0.25	5.24	0.25
Max Chl Dpth (ft)	5.44	Hydr. Depth (ft)	0.07	5.44	0.07
Conv. Total (cfs)	7625.2	Conv. (cfs)	23.0	7598.0	4.2
Length Wtd. (ft)	80.00	Wetted Per. (ft)	39.08	18.60	7.09
Min Ch El (ft)	370.91	Shear (lb/sq ft)	0.00	0.13	0.00
Alpha	1.14	Stream Power (lb/ft s)	0.00	0.69	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	1.08	0.89	0.73
C & E Loss (ft)		Cum SA (acres)	1.98	0.25	0.96

CROSS SECTION OUTPUT Profile #25 yr

E.G. Elev (ft)	377.03	Element	Left OB	Channel	Right OB

Vel Head (ft)	1.14	Wt. n-Val.	0.015		
W.S. Elev (ft)	375.90	Reach Len. (ft)	80.00	80.00	80.00
Crit W.S. (ft)	374.74	Flow Area (sq ft)	39.90		
E.G. Slope (ft/ft)	0.002571	Area (sq ft)	39.90		
Q Total (cfs)	341.00	Flow (cfs)	341.00		
Top Width (ft)	8.00	Top Width (ft)	8.00		
Vel Total (ft/s)	8.55	Avg. Vel. (ft/s)	8.55		
Max Chl Dpth (ft)	4.99	Hydr. Depth (ft)	4.99		
Conv. Total (cfs)	6725.1	Conv. (cfs)	6725.1		
Length Wtd. (ft)	80.00	Wetted Per. (ft)	17.97		
Min Ch El (ft)	370.91	Shear (lb/sq ft)	0.36		
Alpha	1.00	Stream Power (lb/ft s)	3.05		
Frctn Loss (ft)		Cum Volume (acre-ft)	1.56	1.04	0.97
C & E Loss (ft)		Cum SA (acres)	2.19	0.25	1.11

CROSS SECTION OUTPUT Profile #50 yr

E.G. Elev (ft)	377.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.31	Wt. n-Val.	0.015		
W.S. Elev (ft)	375.48	Reach Len. (ft)	80.00	80.00	80.00
Crit W.S. (ft)	375.48	Flow Area (sq ft)	36.53		
E.G. Slope (ft/ft)	0.005509	Area (sq ft)	36.53		
Q Total (cfs)	445.00	Flow (cfs)	445.00		
Top Width (ft)	8.00	Top Width (ft)	8.00		
Vel Total (ft/s)	12.18	Avg. Vel. (ft/s)	12.18		
Max Chl Dpth (ft)	4.57	Hydr. Depth (ft)	4.57		
Conv. Total (cfs)	5995.3	Conv. (cfs)	5995.3		
Length Wtd. (ft)	80.00	Wetted Per. (ft)	17.13		
Min Ch El (ft)	370.91	Shear (lb/sq ft)	0.73		
Alpha	1.00	Stream Power (lb/ft s)	8.93		
Frctn Loss (ft)		Cum Volume (acre-ft)	2.12	1.15	1.23
C & E Loss (ft)		Cum SA (acres)	2.38	0.25	1.22

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CROSS SECTION OUTPUT Profile #100 yr

E.G. Elev (ft)	377.82	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.43	Wt. n-Val.	0.030	0.015	0.030
W.S. Elev (ft)	377.39	Reach Len. (ft)	80.00	80.00	80.00
Crit W.S. (ft)	377.39	Flow Area (sq ft)	131.76	51.81	41.35
E.G. Slope (ft/ft)	0.001160	Area (sq ft)	131.76	51.81	41.35
Q Total (cfs)	565.00	Flow (cfs)	178.11	346.03	40.86
Top Width (ft)	283.84	Top Width (ft)	183.65	8.00	92.18
Vel Total (ft/s)	2.51	Avg. Vel. (ft/s)	1.35	6.68	0.99
Max Chl Dpth (ft)	6.48	Hydr. Depth (ft)	0.72	6.48	0.45
Conv. Total (cfs)	16591.5	Conv. (cfs)	5230.3	10161.3	1199.9
Length Wtd. (ft)	80.00	Wetted Per. (ft)	183.66	18.60	92.19
Min Ch El (ft)	370.91	Shear (lb/sq ft)	0.05	0.20	0.03
Alpha	4.43	Stream Power (lb/ft s)	0.07	1.35	0.03
Frctn Loss (ft)		Cum Volume (acre-ft)	2.03	1.25	1.25
C & E Loss (ft)		Cum SA (acres)	2.57	0.25	1.32

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CROSS SECTION OUTPUT Profile #500 yr

E.G. Elev (ft)	378.23	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.44	Wt. n-Val.	0.030	0.015	0.030
W.S. Elev (ft)	377.78	Reach Len. (ft)	80.00	80.00	80.00
Crit W.S. (ft)	377.78	Flow Area (sq ft)	212.36	54.98	88.45
E.G. Slope (ft/ft)	0.001416	Area (sq ft)	212.36	54.98	88.45
Q Total (cfs)	923.00	Flow (cfs)	382.73	422.07	118.20
Top Width (ft)	376.92	Top Width (ft)	223.27	8.00	145.66
Vel Total (ft/s)	2.59	Avg. Vel. (ft/s)	1.80	7.68	1.34
Max Chl Dpth (ft)	6.87	Hydr. Depth (ft)	0.95	6.87	0.61
Conv. Total (cfs)	24532.3	Conv. (cfs)	10172.6	11218.1	3141.6
Length Wtd. (ft)	80.00	Wetted Per. (ft)	223.27	18.60	145.67
Min Ch El (ft)	370.91	Shear (lb/sq ft)	0.08	0.26	0.05
Alpha	4.24	Stream Power (lb/ft s)	0.15	2.01	0.07
Frctn Loss (ft)		Cum Volume (acre-ft)	2.78	1.54	1.66
C & E Loss (ft)		Cum SA (acres)	2.82	0.25	1.53

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CULVERT

RIVER: Unnamed Tributar
REACH: 1 RS: 2483

INPUT
Description: panther drive crossing
Distance from Upstream XS = 2
Deck/Roadway Width = 76
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 7

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	378	100	377	164	376.5
245	376.21	253	376.21	293	377
428	378				

Upstream Bridge Cross Section Data
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	378	100	377	164	376.5	245	376.21	245	370.91
253	370.91	253	376.21	293	377	428	378		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	245	.015	253	.03

Bank Sta: Left	Right	Coeff Contr.	Expan.
245	253	.1	.3

Downstream Deck/Roadway Coordinates
num= 5

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	380	100	378	200	377

417 376 490 378

Downstream Bridge Cross Section Data
Station Elevation Data num= 51

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	381.13	77.36	379.01	111.8	378.85	120.64	378.63	130.93	378.38
181.75	377.61	260.2	376.18	273.62	376.28	292.14	376.41	304.89	376.51
316.95	374.15	324.6	372.83	332.84	372.75	369.85	372.19	383.56	371.96
404.66	372.26	410.13	367.32	412.19	366.96	417.74	367.46	424.54	372.21
434.75	371.2	441.66	371.55	441.78	371.53	443.27	372.01	452.96	375.14
456.41	376.2	457.75	376.26	467.28	376.49	475.29	376.88	556.8	377.13
556.95	377.13	557	377.13	557.05	377.13	557.2	377.13	557.58	377.13
617.56	376.87	647.18	376.94	692.3	377.53	710.02	378.58	729.21	379.2
730.33	379.22	737.58	379.34	742.18	379.42	767.5	379.42	780.78	379.5
787.98	379.55	804.52	379.76	809.62	379.88	816.67	380.18	827.45	380.64
838.08	381.1								

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.015	304.89	.03	404.66	.063	424.54	.1	475.29	.03
692.3	.04	730.33	.015						

Bank Sta: Left Right Coeff Contr. Expan.
404.66 424.54 .1 .3

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name Shape Rise Span
Culvert #1 Ellipse 4 5.83
FHWA Chart # 29- Horizontal Ellipse; Concrete
FHWA Scale # 1 - Square edge with headwall
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	2	76	.024	.024	.5	.3	1

Upstream Elevation = 370.91
Centerline Station = 250
Downstream Elevation = 369.35
Centerline Station = 410

CULVERT OUTPUT Profile #2 yr Culv Group: Culvert #1

Q Culv Group (cfs)	92.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	8.11
Q Barrel (cfs)	92.00	Culv Vel DS (ft/s)	9.73
E.G. US. (ft)	374.85	Culv Inv El Up (ft)	370.91
W.S. US. (ft)	374.70	Culv Inv El Dn (ft)	369.35
E.G. DS (ft)	371.23	Culv Frctn Ls (ft)	0.00
W.S. DS (ft)	371.08	Culv Exit Loss (ft)	1.87
Delta EG (ft)	3.62	Culv Entr Loss (ft)	0.31

Delta WS (ft)	3.62	Q Weir (cfs)	
E.G. IC (ft)	374.80	Weir Sta Lft (ft)	
E.G. OC (ft)	374.85	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	373.52	Weir Max Depth (ft)	
Culv WS Outlet (ft)	371.63	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	1.77	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	2.11	Min El Weir Flow (ft)	376.22

Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #10 yr Culv Group: Culvert #1

Q Culv Group (cfs)	148.87	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	8.76
Q Barrel (cfs)	148.87	Culv Vel DS (ft/s)	11.44
E.G. US. (ft)	376.77	Culv Inv El Up (ft)	370.91
W.S. US. (ft)	376.35	Culv Inv El Dn (ft)	369.35
E.G. DS (ft)	372.61	Culv Frctn Ls (ft)	1.61
W.S. DS (ft)	372.33	Culv Exit Loss (ft)	1.70
Delta EG (ft)	4.16	Culv Entr Loss (ft)	0.36
Delta WS (ft)	4.02	Q Weir (cfs)	80.13
E.G. IC (ft)	376.77	Weir Sta Lft (ft)	129.55
E.G. OC (ft)	376.25	Weir Sta Rgt (ft)	281.31
Culvert Control	Inlet	Weir Submerg	0.00
Culv WS Inlet (ft)	374.91	Weir Max Depth (ft)	0.56
Culv WS Outlet (ft)	372.27	Weir Avg Depth (ft)	0.33
Culv Nml Depth (ft)	2.53	Weir Flow Area (sq ft)	50.57
Culv Crt Depth (ft)	2.75	Min El Weir Flow (ft)	376.22

Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #25 yr Culv Group: Culvert #1

Q Culv Group (cfs)	155.07	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	9.12
Q Barrel (cfs)	155.07	Culv Vel DS (ft/s)	11.63
E.G. US. (ft)	377.03	Culv Inv El Up (ft)	370.91
W.S. US. (ft)	375.90	Culv Inv El Dn (ft)	369.35
E.G. DS (ft)	373.00	Culv Frctn Ls (ft)	0.17
W.S. DS (ft)	372.67	Culv Exit Loss (ft)	1.44
Delta EG (ft)	4.03	Culv Entr Loss (ft)	0.39
Delta WS (ft)	3.22	Q Weir (cfs)	187.24
E.G. IC (ft)	377.03	Weir Sta Lft (ft)	96.72
E.G. OC (ft)	376.41	Weir Sta Rgt (ft)	297.43
Culvert Control	Inlet	Weir Submerg	0.00
Culv WS Inlet (ft)	374.91	Weir Max Depth (ft)	0.82
Culv WS Outlet (ft)	372.33	Weir Avg Depth (ft)	0.48
Culv Nml Depth (ft)	2.63	Weir Flow Area (sq ft)	96.83
Culv Crt Depth (ft)	2.81	Min El Weir Flow (ft)	376.22

Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #50 yr Culv Group: Culvert #1

Q Culv Group (cfs)	158.99	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	9.36
Q Barrel (cfs)	158.99	Culv Vel DS (ft/s)	11.75
E.G. US. (ft)	377.20	Culv Inv El Up (ft)	370.91
W.S. US. (ft)	375.48	Culv Inv El Dn (ft)	369.35
E.G. DS (ft)	373.25	Culv Frctn Ls (ft)	0.55
W.S. DS (ft)	372.87	Culv Exit Loss (ft)	1.27
Delta EG (ft)	3.95	Culv Entr Loss (ft)	0.41
Delta WS (ft)	2.60	Q Weir (cfs)	287.79
E.G. IC (ft)	377.20	Weir Sta Lft (ft)	79.71
E.G. OC (ft)	376.52	Weir Sta Rgt (ft)	320.38
Culvert Control	Inlet	Weir Submerg	0.00
Culv WS Inlet (ft)	374.91	Weir Max Depth (ft)	0.99
Culv WS Outlet (ft)	372.37	Weir Avg Depth (ft)	0.56
Culv Nml Depth (ft)	2.70	Weir Flow Area (sq ft)	134.35
Culv Crt Depth (ft)	2.84	Min El Weir Flow (ft)	376.22

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.
Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #100 yr Culv Group: Culvert #1

Q Culv Group (cfs)	163.26	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	9.61
Q Barrel (cfs)	163.26	Culv Vel DS (ft/s)	9.86
E.G. US. (ft)	377.39	Culv Inv El Up (ft)	370.91
W.S. US. (ft)	377.39	Culv Inv El Dn (ft)	369.35
E.G. DS (ft)	373.50	Culv Frctn Ls (ft)	0.03
W.S. DS (ft)	373.12	Culv Exit Loss (ft)	1.12
Delta EG (ft)	3.89	Culv Entr Loss (ft)	0.43
Delta WS (ft)	4.27	Q Weir (cfs)	401.74
E.G. IC (ft)	377.39	Weir Sta Lft (ft)	64.05
E.G. OC (ft)	377.33	Weir Sta Rgt (ft)	341.53
Culvert Control	Inlet	Weir Submerg	0.00
Culv WS Inlet (ft)	374.91	Weir Max Depth (ft)	1.15
Culv WS Outlet (ft)	373.12	Weir Avg Depth (ft)	0.63
Culv Nml Depth (ft)	2.78	Weir Flow Area (sq ft)	174.94
Culv Crt Depth (ft)	2.88	Min El Weir Flow (ft)	376.22

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.
Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.

CULVERT OUTPUT Profile #500 yr Culv Group: Culvert #1

Q Culv Group (cfs)	177.79	Culv Full Len (ft)	76.00
# Barrels	1	Culv Vel US (ft/s)	10.46
Q Barrel (cfs)	177.79	Culv Vel DS (ft/s)	10.46
E.G. US. (ft)	377.67	Culv Inv El Up (ft)	370.91
W.S. US. (ft)	377.78	Culv Inv El Dn (ft)	369.35
E.G. DS (ft)	374.11	Culv Frctn Ls (ft)	1.90
W.S. DS (ft)	373.56	Culv Exit Loss (ft)	1.15
Delta EG (ft)	3.56	Culv Entr Loss (ft)	0.51
Delta WS (ft)	4.22	Q Weir (cfs)	745.21
E.G. IC (ft)	377.71	Weir Sta Lft (ft)	28.50

E.G. OC (ft)	377.67	Weir Sta Rgt (ft)	389.53
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	374.91	Weir Max Depth (ft)	1.51
Culv WS Outlet (ft)	373.35	Weir Avg Depth (ft)	0.80
Culv Nml Depth (ft)	3.50	Weir Flow Area (sq ft)	288.44
Culv Crt Depth (ft)	2.99	Min El Weir Flow (ft)	376.22

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.
Note: The normal depth exceeds the height of the culvert. The program assumes that the normal depth is equal to the height of the culvert.
Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations are not valid and the supercritical result has been discarded. The outlet answer will be used.

CROSS SECTION

RIVER: Unnamed Tributar
REACH: 1 RS: 2443.764

INPUT
Description: Channel geometry was extracted from the construction plans
entitled "City of Fairfax, Stream Restoration Project, Tributaries
of Accotink Creek." dated February 1995
Station Elevation Data num= 51

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	381.13	77.36	379.01	111.8	378.85	120.64	378.63	130.93	378.38
181.75	377.61	260.2	376.18	273.62	376.28	292.14	376.41	304.89	376.51
316.95	374.15	324.6	372.83	332.84	372.75	369.85	372.19	383.56	371.96
404.66	372.26	410.13	367.32	412.19	366.96	417.74	367.46	424.54	372.21
434.75	371.2	441.66	371.55	441.78	371.53	443.27	372.01	452.96	375.14
456.41	376.2	457.75	376.26	467.28	376.49	475.29	376.88	556.8	377.13
556.95	377.13	557	377.13	557.05	377.13	557.2	377.13	557.58	377.13
617.56	376.87	647.18	376.94	692.3	377.53	710.02	378.58	729.21	379.2
730.33	379.22	737.58	379.34	742.18	379.42	767.5	379.42	780.78	379.5
787.98	379.55	804.52	379.76	809.62	379.88	816.67	380.18	827.45	380.64
838.08	381.1								

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.015	304.89	.03	404.66	.063	424.54	.1	475.29	.03
692.3	.04	730.33	.015						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
404.66	424.54	274	283	291	.1	.3

CROSS SECTION OUTPUT Profile #2 yr

E.G. Elev (ft)	371.23	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.		0.063	
W.S. Elev (ft)	371.08	Reach Len. (ft)	274.00	283.00	291.00
Crit W.S. (ft)		Flow Area (sq ft)		46.82	
E.G. Slope (ft/ft)	0.005251	Area (sq ft)		46.82	
Q Total (cfs)	143.00	Flow (cfs)		143.00	
Top Width (ft)	16.96	Top Width (ft)		16.96	
Vel Total (ft/s)	3.05	Avg. Vel. (ft/s)		3.05	

Max Chl Dpth (ft)	4.12	Hydr. Depth (ft)	2.76		
Conv. Total (cfs)	1973.4	Conv. (cfs)	1973.4		
Length Wtd. (ft)	283.22	Wetted Per. (ft)	19.60		
Min Ch El (ft)	366.96	Shear (lb/sq ft)	0.78		
Alpha	1.00	Stream Power (lb/ft s)	2.39		
Frctn Loss (ft)	1.15	Cum Volume (acre-ft)	0.63	0.62	0.33
C & E Loss (ft)	0.02	Cum SA (acres)	0.78	0.21	0.50

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10 yr

E.G. Elev (ft)	372.61	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.28	Wt. n-Val.	0.030	0.063	0.100
W.S. Elev (ft)	372.33	Reach Len. (ft)	274.00	283.00	291.00
Crit W.S. (ft)		Flow Area (sq ft)	8.88	70.01	14.11
E.G. Slope (ft/ft)	0.008015	Area (sq ft)	8.88	70.01	14.11
Q Total (cfs)	336.00	Flow (cfs)	13.51	307.57	14.92
Top Width (ft)	83.81	Top Width (ft)	44.20	19.88	19.73
Vel Total (ft/s)	3.61	Avg. Vel. (ft/s)	1.52	4.39	1.06
Max Chl Dpth (ft)	5.37	Hydr. Depth (ft)	0.20	3.52	0.72
Conv. Total (cfs)	3753.0	Conv. (cfs)	150.9	3435.5	166.6
Length Wtd. (ft)	283.05	Wetted Per. (ft)	44.21	23.33	19.91
Min Ch El (ft)	366.96	Shear (lb/sq ft)	0.10	1.50	0.35
Alpha	1.36	Stream Power (lb/ft s)	0.15	6.60	0.37
Frctn Loss (ft)	1.87	Cum Volume (acre-ft)	1.08	0.78	0.73
C & E Loss (ft)	0.04	Cum SA (acres)	1.90	0.22	0.93

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #25 yr

E.G. Elev (ft)	373.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.33	Wt. n-Val.	0.030	0.063	0.100
W.S. Elev (ft)	372.67	Reach Len. (ft)	274.00	283.00	291.00
Crit W.S. (ft)	371.33	Flow Area (sq ft)	27.75	76.78	21.00
E.G. Slope (ft/ft)	0.009250	Area (sq ft)	27.75	76.78	21.00
Q Total (cfs)	489.00	Flow (cfs)	73.67	385.33	30.00
Top Width (ft)	107.36	Top Width (ft)	66.70	19.88	20.78
Vel Total (ft/s)	3.90	Avg. Vel. (ft/s)	2.65	5.02	1.43
Max Chl Dpth (ft)	5.71	Hydr. Depth (ft)	0.42	3.86	1.01
Conv. Total (cfs)	5084.4	Conv. (cfs)	766.0	4006.5	311.9
Length Wtd. (ft)	281.95	Wetted Per. (ft)	66.70	23.33	21.02
Min Ch El (ft)	366.96	Shear (lb/sq ft)	0.24	1.90	0.58
Alpha	1.39	Stream Power (lb/ft s)	0.64	9.54	0.82
Frctn Loss (ft)	2.02	Cum Volume (acre-ft)	1.56	0.84	0.97
C & E Loss (ft)	0.06	Cum SA (acres)	2.13	0.22	1.10

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #50 yr

E.G. Elev (ft)	373.25	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.38	Wt. n-Val.	0.030	0.063	0.100
W.S. Elev (ft)	372.87	Reach Len. (ft)	274.00	283.00	291.00
Crit W.S. (ft)	372.64	Flow Area (sq ft)	42.79	80.80	25.27
E.G. Slope (ft/ft)	0.010422	Area (sq ft)	42.79	80.80	25.27
Q Total (cfs)	630.00	Flow (cfs)	142.18	445.36	42.46
Top Width (ft)	121.61	Top Width (ft)	80.32	19.88	21.41
Vel Total (ft/s)	4.23	Avg. Vel. (ft/s)	3.32	5.51	1.68
Max Chl Dpth (ft)	5.91	Hydr. Depth (ft)	0.53	4.06	1.18
Conv. Total (cfs)	6171.0	Conv. (cfs)	1392.7	4362.4	415.9
Length Wtd. (ft)	281.22	Wetted Per. (ft)	80.33	23.33	21.68
Min Ch El (ft)	366.96	Shear (lb/sq ft)	0.35	2.25	0.76
Alpha	1.35	Stream Power (lb/ft s)	1.15	12.42	1.27
Frctn Loss (ft)	2.06	Cum Volume (acre-ft)	2.12	0.89	1.23
C & E Loss (ft)	0.08	Cum SA (acres)	2.31	0.22	1.20

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #100 yr

E.G. Elev (ft)	373.50	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.39	Wt. n-Val.	0.030	0.063	0.100
W.S. Elev (ft)	373.12	Reach Len. (ft)	274.00	283.00	291.00
Crit W.S. (ft)	372.90	Flow Area (sq ft)	62.37	85.60	30.54
E.G. Slope (ft/ft)	0.010002	Area (sq ft)	62.37	85.60	30.54
Q Total (cfs)	794.00	Flow (cfs)	257.95	480.37	55.68
Top Width (ft)	123.76	Top Width (ft)	81.72	19.88	22.16
Vel Total (ft/s)	4.45	Avg. Vel. (ft/s)	4.14	5.61	1.82
Max Chl Dpth (ft)	6.16	Hydr. Depth (ft)	0.76	4.31	1.38
Conv. Total (cfs)	7939.3	Conv. (cfs)	2579.3	4803.3	556.7
Length Wtd. (ft)	280.73	Wetted Per. (ft)	81.75	23.33	22.47
Min Ch El (ft)	366.96	Shear (lb/sq ft)	0.48	2.29	0.85
Alpha	1.26	Stream Power (lb/ft s)	1.97	12.86	1.55
Frctn Loss (ft)	2.24	Cum Volume (acre-ft)	2.03	0.90	1.25
C & E Loss (ft)	0.07	Cum SA (acres)	2.33	0.22	1.22

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #500 yr

E.G. Elev (ft)	374.11	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.55	Wt. n-Val.	0.030	0.063	0.100
W.S. Elev (ft)	373.56	Reach Len. (ft)	274.00	283.00	291.00
Crit W.S. (ft)	373.30	Flow Area (sq ft)	99.01	94.38	40.62
E.G. Slope (ft/ft)	0.011404	Area (sq ft)	99.01	94.38	40.62
Q Total (cfs)	1278.00	Flow (cfs)	582.70	603.52	91.78
Top Width (ft)	127.68	Top Width (ft)	84.28	19.88	23.52
Vel Total (ft/s)	5.46	Avg. Vel. (ft/s)	5.89	6.39	2.26
Max Chl Dpth (ft)	6.60	Hydr. Depth (ft)	1.17	4.75	1.73
Conv. Total (cfs)	11967.7	Conv. (cfs)	5456.7	5651.6	859.4

Length Wtd. (ft)	279.75	Wetted Per. (ft)	84.35	23.33	23.90
Min Ch El (ft)	366.96	Shear (lb/sq ft)	0.84	2.88	1.21
Alpha	1.19	Stream Power (lb/ft s)	4.92	18.42	2.73
Frctn Loss (ft)	2.46	Cum Volume (acre-ft)	2.78	0.98	1.66
C & E Loss (ft)	0.11	Cum SA (acres)	2.54	0.22	1.37

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Unnamed Tributar
REACH: 1 RS: 2160.924

INPUT
Description: Channel geometry was extracted from the construction plans entitled "City of Fairfax, Stream Restoration Project, Tributaries of Accotink Creek." dated February 1995
Station Elevation Data num= 37

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	378.72	7.04	377.3	15.65	375.92	28.58	373.34	97.02	372.1
98.15	372.08	98.89	372.06	100.33	372.05	251.85	370.53	265.31	370.39
290.08	370.47	357.15	370.36	395	370.05	406.63	370.04	411.91	366.53
415.15	364.52	420.54	366.67	428.56	370.58	438.19	369.3	455.44	369.52
508.22	370.21	528.99	370.44	561.35	370.79	601.16	371.36	607.97	371.92
616.5	371.93	625.64	372.26	644.14	373.09	650.36	373.41	684.63	375.61
719.55	375.88	740.69	376.6	763.39	377.05	787.61	377.48	822.28	380.16
836.3	380.66	843.02	380.9						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	406.63	.063	428.56	.1	561.35	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
406.63	428.56	255	255	280	.3	.5

CROSS SECTION OUTPUT Profile #2 yr

E.G. Elev (ft)	370.06	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.	0.063	0.100	
W.S. Elev (ft)	369.98	Reach Len. (ft)	255.00	255.00	280.00
Crit W.S. (ft)		Flow Area (sq ft)	58.34	19.89	
E.G. Slope (ft/ft)	0.002861	Area (sq ft)	58.34	19.89	
Q Total (cfs)	143.00	Flow (cfs)	135.25	7.75	
Top Width (ft)	78.50	Top Width (ft)	20.62	57.88	
Vel Total (ft/s)	1.83	Avg. Vel. (ft/s)	2.32	0.39	
Max Chl Dpth (ft)	5.46	Hydr. Depth (ft)	2.83	0.34	
Conv. Total (cfs)	2673.6	Conv. (cfs)	2528.7	144.9	
Length Wtd. (ft)	258.22	Wetted Per. (ft)	23.42	57.93	
Min Ch El (ft)	364.52	Shear (lb/sq ft)	0.44	0.06	
Alpha	1.52	Stream Power (lb/ft s)	1.03	0.02	
Frctn Loss (ft)	0.38	Cum Volume (acre-ft)	0.63	0.28	0.27
C & E Loss (ft)	0.04	Cum SA (acres)	0.78	0.08	0.31

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10 yr

E.G. Elev (ft)	370.69	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.	0.030	0.063	0.100
W.S. Elev (ft)	370.56	Reach Len. (ft)	255.00	255.00	280.00
Crit W.S. (ft)		Flow Area (sq ft)	33.40	70.56	67.78
E.G. Slope (ft/ft)	0.005220	Area (sq ft)	33.40	70.56	67.78
Q Total (cfs)	336.00	Flow (cfs)	42.49	241.21	52.30
Top Width (ft)	290.57	Top Width (ft)	157.54	21.88	111.14
Vel Total (ft/s)	1.96	Avg. Vel. (ft/s)	1.27	3.42	0.77
Max Chl Dpth (ft)	6.04	Hydr. Depth (ft)	0.21	3.22	0.61
Conv. Total (cfs)	4650.7	Conv. (cfs)	588.1	3338.7	723.9
Length Wtd. (ft)	259.07	Wetted Per. (ft)	157.54	24.83	111.23
Min Ch El (ft)	364.52	Shear (lb/sq ft)	0.07	0.93	0.20
Alpha	2.27	Stream Power (lb/ft s)	0.09	3.17	0.15
Frctn Loss (ft)	0.71	Cum Volume (acre-ft)	0.95	0.32	0.45
C & E Loss (ft)	0.06	Cum SA (acres)	1.27	0.09	0.49

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #25 yr

E.G. Elev (ft)	370.91	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.	0.030	0.063	0.100
W.S. Elev (ft)	370.79	Reach Len. (ft)	255.00	255.00	280.00
Crit W.S. (ft)		Flow Area (sq ft)	72.78	75.66	96.20
E.G. Slope (ft/ft)	0.005075	Area (sq ft)	72.78	75.66	96.20
Q Total (cfs)	489.00	Flow (cfs)	140.04	266.86	82.11
Top Width (ft)	335.51	Top Width (ft)	180.75	21.93	132.83
Vel Total (ft/s)	2.00	Avg. Vel. (ft/s)	1.92	3.53	0.85
Max Chl Dpth (ft)	6.27	Hydr. Depth (ft)	0.40	3.45	0.72
Conv. Total (cfs)	6864.2	Conv. (cfs)	1965.7	3745.9	1152.6
Length Wtd. (ft)	258.97	Wetted Per. (ft)	180.75	24.88	132.92
Min Ch El (ft)	364.52	Shear (lb/sq ft)	0.13	0.96	0.23
Alpha	2.00	Stream Power (lb/ft s)	0.25	3.40	0.20
Frctn Loss (ft)	0.70	Cum Volume (acre-ft)	1.25	0.34	0.58
C & E Loss (ft)	0.05	Cum SA (acres)	1.35	0.09	0.58

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #50 yr

E.G. Elev (ft)	371.11	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.	0.030	0.063	0.100
W.S. Elev (ft)	371.00	Reach Len. (ft)	255.00	255.00	280.00
Crit W.S. (ft)		Flow Area (sq ft)	112.99	80.27	125.67
E.G. Slope (ft/ft)	0.004208	Area (sq ft)	112.99	80.27	125.67
Q Total (cfs)	630.00	Flow (cfs)	246.68	268.17	115.15

Top Width (ft)	371.15	Top Width (ft)	201.71	21.93	147.51
Vel Total (ft/s)	1.98	Avg. Vel. (ft/s)	2.18	3.34	0.92
Max Chl Dpth (ft)	6.48	Hydr. Depth (ft)	0.56	3.66	0.85
Conv. Total (cfs)	9711.9	Conv. (cfs)	3802.7	4134.0	1775.2
Length Wtd. (ft)	259.01	Wetted Per. (ft)	201.71	24.88	147.61
Min Ch El (ft)	364.52	Shear (lb/sq ft)	0.15	0.85	0.22
Alpha	1.74	Stream Power (lb/ft s)	0.32	2.83	0.20
Frctn Loss (ft)	0.58	Cum Volume (acre-ft)	1.63	0.36	0.73
C & E Loss (ft)	0.04	Cum SA (acres)	1.42	0.09	0.64

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #100 yr

E.G. Elev (ft)	371.19	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.15	Wt. n-Val.	0.030	0.063	0.099
W.S. Elev (ft)	371.04	Reach Len. (ft)	255.00	255.00	280.00
Crit W.S. (ft)		Flow Area (sq ft)	120.52	81.08	131.18
E.G. Slope (ft/ft)	0.005957	Area (sq ft)	120.52	81.08	131.18
Q Total (cfs)	794.00	Flow (cfs)	322.90	324.46	146.64
Top Width (ft)	377.42	Top Width (ft)	205.40	21.93	150.10
Vel Total (ft/s)	2.39	Avg. Vel. (ft/s)	2.68	4.00	1.12
Max Chl Dpth (ft)	6.52	Hydr. Depth (ft)	0.59	3.70	0.87
Conv. Total (cfs)	10287.7	Conv. (cfs)	4183.8	4204.0	1900.0
Length Wtd. (ft)	259.14	Wetted Per. (ft)	205.40	24.88	150.19
Min Ch El (ft)	364.52	Shear (lb/sq ft)	0.22	1.21	0.32
Alpha	1.70	Stream Power (lb/ft s)	0.58	4.85	0.36
Frctn Loss (ft)	0.87	Cum Volume (acre-ft)	1.45	0.36	0.71
C & E Loss (ft)	0.06	Cum SA (acres)	1.42	0.09	0.64

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #500 yr

E.G. Elev (ft)	371.54	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.18	Wt. n-Val.	0.030	0.063	0.097
W.S. Elev (ft)	371.36	Reach Len. (ft)	255.00	255.00	280.00
Crit W.S. (ft)		Flow Area (sq ft)	191.96	88.16	183.23
E.G. Slope (ft/ft)	0.006151	Area (sq ft)	191.96	88.16	183.23
Q Total (cfs)	1278.00	Flow (cfs)	646.88	379.02	252.10
Top Width (ft)	432.08	Top Width (ft)	237.55	21.93	172.60
Vel Total (ft/s)	2.76	Avg. Vel. (ft/s)	3.37	4.30	1.38
Max Chl Dpth (ft)	6.84	Hydr. Depth (ft)	0.81	4.02	1.06
Conv. Total (cfs)	16295.4	Conv. (cfs)	8248.2	4832.8	3214.4
Length Wtd. (ft)	259.19	Wetted Per. (ft)	237.56	24.88	172.70
Min Ch El (ft)	364.52	Shear (lb/sq ft)	0.31	1.36	0.41
Alpha	1.53	Stream Power (lb/ft s)	1.05	5.85	0.56
Frctn Loss (ft)	0.95	Cum Volume (acre-ft)	1.86	0.39	0.91
C & E Loss (ft)	0.05	Cum SA (acres)	1.52	0.09	0.72

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Unnamed Tributar
REACH: 1 RS: 1905.580

INPUT
Description: just upstream of Keith Avenue

Channel geometry was extracted
from the construction plans entitled "City of Fairfax, Stream Restoration Project, Tributaries of Accotink Creek." dated February 1995

Station Elevation Data num= 63

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	373.73	4.66	373.56	19.41	372.92	31.95	372.37	42.76	371.9
72.8	370.84	79.87	370.54	85.52	370	99.18	369.59	130.7	369.32
180.53	369.07	205.16	369.04	210.94	368.96	220.27	369.01	234	369.12
248.23	369.25	254.31	369.3	262.89	369.37	277.84	369.5	295.39	368.85
298.93	368.89	303.26	368.84	305.67	368.75	312.89	367.98	318.31	367.37
318.43	367.37	318.5	367.36	332.69	368.12	337.27	367.92	345.67	367.32
354.75	366.73	364.11	366.1	365.28	364.66	367.24	364.67	371.02	364.47
371.99	367.23	375.28	367.09	379.36	367.42	388.64	367.55	393.14	367.72
411.26	369.79	419.79	370.08	426.74	370.89	439.18	371.29	447.88	371.04
458.33	371.4	469.35	371.77	480.67	372.79	493.25	373.19	499.95	372.94
508.59	373.23	513.26	373.95	529.16	374.67	534.9	374.76	550.6	375.48
560.97	376.04	570.02	376.45	578.93	376.86	594.64	378.47	609.16	379.14
612.97	379.33	626.75	379.96	634.21	380.27				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	364.11	.063	371.99	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
364.11	371.99	20429	1904	1727	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	365	369	F
372	634.21	369.6	F

CROSS SECTION OUTPUT Profile #2 yr

E.G. Elev (ft)	369.64	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.030	0.063	0.045
W.S. Elev (ft)	369.64	Reach Len. (ft)			
Crit W.S. (ft)	367.14	Flow Area (sq ft)	216.38	37.58	63.05
E.G. Slope (ft/ft)	0.000100	Area (sq ft)	216.38	37.58	63.05
Q Total (cfs)	143.00	Flow (cfs)	93.18	20.69	29.12
Top Width (ft)	312.43	Top Width (ft)	266.60	7.88	37.96
Vel Total (ft/s)	0.45	Avg. Vel. (ft/s)	0.43	0.55	0.46
Max Chl Dpth (ft)	5.17	Hydr. Depth (ft)	0.81	4.77	1.66
Conv. Total (cfs)	14304.7	Conv. (cfs)	9321.5	2070.1	2913.2
Length Wtd. (ft)		Wetted Per. (ft)	266.78	10.53	38.09
Min Ch El (ft)	364.47	Shear (lb/sq ft)	0.01	0.02	0.01

Alpha	1.02	Stream Power (lb/ft s)	0.00	0.01	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10 yr

E.G. Elev (ft)	369.92	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.030	0.063	0.045
W.S. Elev (ft)	369.91	Reach Len. (ft)			
Crit W.S. (ft)	369.00	Flow Area (sq ft)	289.58	39.70	73.76
E.G. Slope (ft/ft)	0.000267	Area (sq ft)	289.58	39.70	73.76
Q Total (cfs)	336.00	Flow (cfs)	241.92	37.05	57.04
Top Width (ft)	326.27	Top Width (ft)	275.59	7.88	42.80
Vel Total (ft/s)	0.83	Avg. Vel. (ft/s)	0.84	0.93	0.77
Max Chl Dpth (ft)	5.44	Hydr. Depth (ft)	1.05	5.04	1.72
Conv. Total (cfs)	20580.1	Conv. (cfs)	14817.5	2269.1	3493.5
Length Wtd. (ft)		Wetted Per. (ft)	275.78	10.53	42.94
Min Ch El (ft)	364.47	Shear (lb/sq ft)	0.02	0.06	0.03
Alpha	1.01	Stream Power (lb/ft s)	0.01	0.06	0.02
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #25 yr

E.G. Elev (ft)	370.16	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.030	0.063	0.045
W.S. Elev (ft)	370.14	Reach Len. (ft)			
Crit W.S. (ft)	369.00	Flow Area (sq ft)	353.62	41.52	84.35
E.G. Slope (ft/ft)	0.000330	Area (sq ft)	353.62	41.52	84.35
Q Total (cfs)	489.00	Flow (cfs)	371.42	44.39	73.19
Top Width (ft)	336.25	Top Width (ft)	280.05	7.88	48.32
Vel Total (ft/s)	1.02	Avg. Vel. (ft/s)	1.05	1.07	0.87
Max Chl Dpth (ft)	5.67	Hydr. Depth (ft)	1.26	5.27	1.75
Conv. Total (cfs)	26926.8	Conv. (cfs)	20452.5	2444.4	4029.9
Length Wtd. (ft)		Wetted Per. (ft)	280.25	10.53	48.46
Min Ch El (ft)	364.47	Shear (lb/sq ft)	0.03	0.08	0.04
Alpha	1.01	Stream Power (lb/ft s)	0.03	0.09	0.03
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #50 yr

E.G. Elev (ft)	370.48	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.030	0.063	0.045
W.S. Elev (ft)	370.46	Reach Len. (ft)			
Crit W.S. (ft)	369.01	Flow Area (sq ft)	444.83	44.07	100.44
E.G. Slope (ft/ft)	0.000280	Area (sq ft)	444.83	44.07	100.44
Q Total (cfs)	630.00	Flow (cfs)	497.87	45.20	86.94

Top Width (ft)	342.41	Top Width (ft)	283.44	7.88	51.09
Vel Total (ft/s)	1.07	Avg. Vel. (ft/s)	1.12	1.03	0.87
Max Chl Dpth (ft)	5.99	Hydr. Depth (ft)	1.57	5.59	1.97
Conv. Total (cfs)	37632.3	Conv. (cfs)	29739.5	2699.8	5193.1
Length Wtd. (ft)		Wetted Per. (ft)	283.65	10.53	51.26
Min Ch El (ft)	364.47	Shear (lb/sq ft)	0.03	0.07	0.03
Alpha	1.02	Stream Power (lb/ft s)	0.03	0.08	0.03
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #100 yr

E.G. Elev (ft)	370.26	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.030	0.063	0.045
W.S. Elev (ft)	370.22	Reach Len. (ft)			
Crit W.S. (ft)	369.21	Flow Area (sq ft)	376.06	42.15	88.24
E.G. Slope (ft/ft)	0.000728	Area (sq ft)	376.06	42.15	88.24
Q Total (cfs)	794.00	Flow (cfs)	610.23	67.63	116.13
Top Width (ft)	337.77	Top Width (ft)	280.89	7.88	49.00
Vel Total (ft/s)	1.57	Avg. Vel. (ft/s)	1.62	1.60	1.32
Max Chl Dpth (ft)	5.75	Hydr. Depth (ft)	1.34	5.35	1.80
Conv. Total (cfs)	29425.6	Conv. (cfs)	22615.2	2506.5	4303.8
Length Wtd. (ft)		Wetted Per. (ft)	281.09	10.53	49.15
Min Ch El (ft)	364.47	Shear (lb/sq ft)	0.06	0.18	0.08
Alpha	1.02	Stream Power (lb/ft s)	0.10	0.29	0.11
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #500 yr

E.G. Elev (ft)	370.54	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.	0.030	0.063	0.045
W.S. Elev (ft)	370.46	Reach Len. (ft)			
Crit W.S. (ft)	369.49	Flow Area (sq ft)	443.77	44.04	100.25
E.G. Slope (ft/ft)	0.001161	Area (sq ft)	443.77	44.04	100.25
Q Total (cfs)	1278.00	Flow (cfs)	1009.60	91.91	176.49
Top Width (ft)	342.34	Top Width (ft)	283.40	7.88	51.06
Vel Total (ft/s)	2.17	Avg. Vel. (ft/s)	2.28	2.09	1.76
Max Chl Dpth (ft)	5.99	Hydr. Depth (ft)	1.57	5.59	1.96
Conv. Total (cfs)	37500.4	Conv. (cfs)	29624.7	2696.8	5178.9
Length Wtd. (ft)		Wetted Per. (ft)	283.61	10.53	51.23
Min Ch El (ft)	364.47	Shear (lb/sq ft)	0.11	0.30	0.14
Alpha	1.02	Stream Power (lb/ft s)	0.26	0.63	0.25
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

SUMMARY OF MANNING'S N VALUES

River:Unnamed Tributar

Reach	River Sta.	n1	n2	n3	n4	n5	n6	n7
1	3159	.03	.015	.03				
1	3115	Culvert						
1	3069	.03	.015	.03				
1	3039	Culvert						
1	3009	.03	.015	.03				
1	2916	Culvert						
1	2824	.03	.015	.03				
1	2633	Culvert						
1	2523	.03	.015	.03				
1	2483	Culvert						
1	2443.764	.015	.03	.063	.1	.03	.04	.015
1	2160.924	.03	.063	.1	.04			
1	1905.580	.03	.063	.045				

SUMMARY OF REACH LENGTHS

River: Unnamed Tributar

Reach	River Sta.	Left	Channel	Right
1	3159	90	94	98
1	3115	Culvert		
1	3069	60	60	60
1	3039	Culvert		
1	3009	185	185	185
1	2916	Culvert		
1	2824	304	304	304
1	2633	Culvert		
1	2523	80	80	80
1	2483	Culvert		
1	2443.764	274	283	291
1	2160.924	255	255	280
1	1905.580	20429	1904	1727

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Unnamed Tributar

Reach	River Sta.	Contr.	Expan.
1	3159	0	0
1	3115	Culvert	
1	3069	.1	.3
1	3039	Culvert	
1	3009	.1	.3

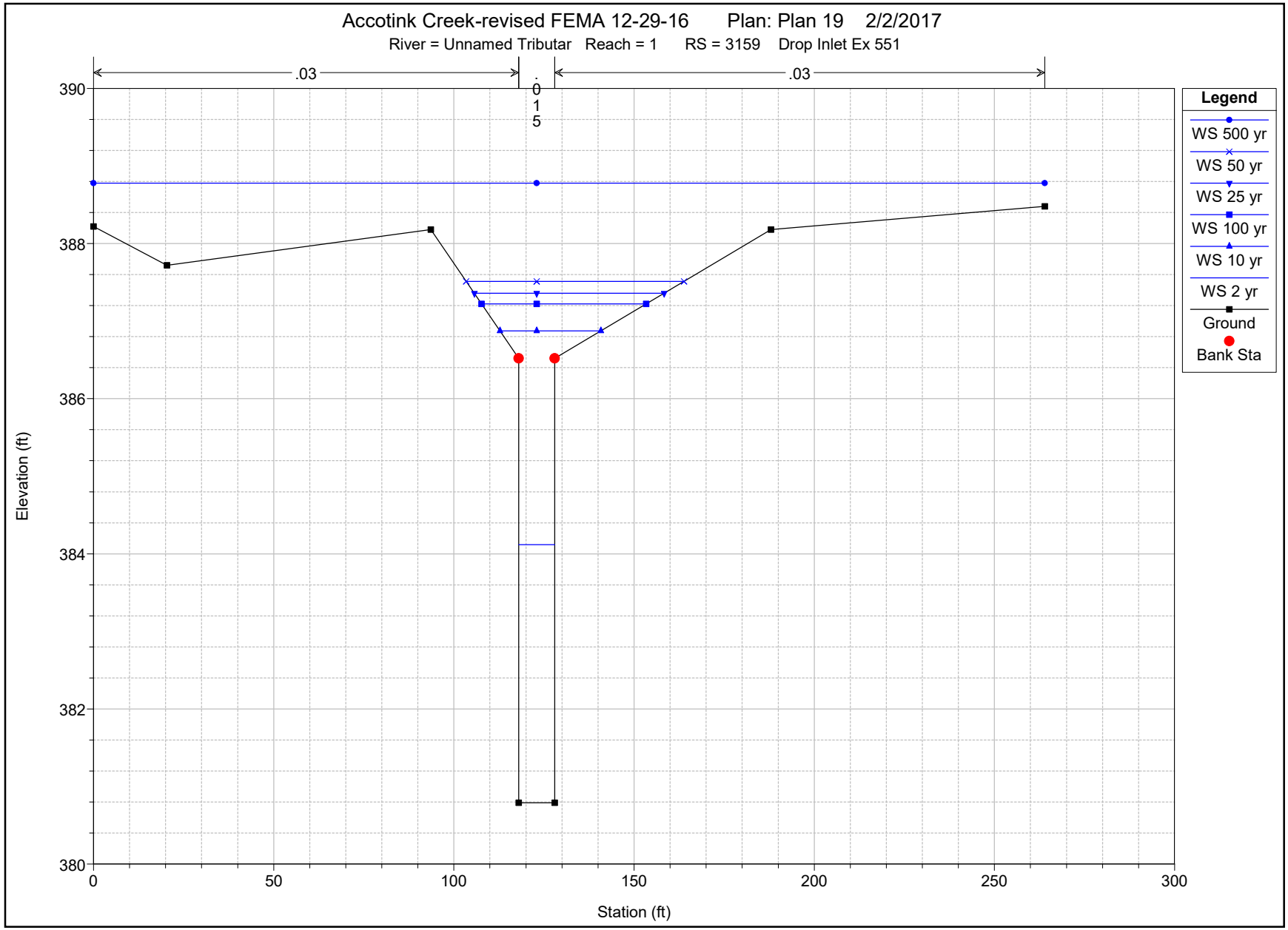
1	2916	Culvert		
1	2824	.1	.3	
1	2633	Culvert		
1	2523	.1	.3	
1	2483	Culvert		
1	2443.764	.1	.3	
1	2160.924	.3	.5	
1	1905.580	.3	.5	

Profile Output Table - Standard Table 1

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft/ft)	E.G. Slope (ft/s)	Vel Chnl (sq ft)	Flow Area (ft)	Top Width	Froude # Chl
1	3159	2 yr	89.00	380.79	384.12	382.13	384.23	0.000290	2.67	33.27	10.00	0.26
1	3159	10 yr	222.00	380.79	386.87	383.26	387.08	0.000336	3.63	64.01	27.96	0.26
1	3159	25 yr	330.00	380.79	387.36	384.01	387.71	0.000539	4.85	83.58	52.65	0.33
1	3159	50 yr	438.00	380.79	387.51	384.68	388.08	0.000849	6.18	92.23	60.44	0.42
1	3159	100 yr	548.00	380.79	387.22	385.33	388.27	0.001635	8.33	76.82	45.66	0.58
1	3159	500 yr	897.00	380.79	388.78	388.78	389.30	0.000907	7.17	311.60	264.00	0.45
1	3115	Culvert										
1	3069	2 yr	89.00	377.52	383.59	378.87	383.63	0.000057	1.47	60.72	10.00	0.10
1	3069	10 yr	222.00	377.52	384.84	380.00	384.94	0.000163	2.64	150.36	190.26	0.17
1	3069	25 yr	330.00	377.52	384.93	380.74	385.11	0.000320	3.74	167.61	200.79	0.24
1	3069	50 yr	438.00	377.52	384.97	381.43	385.27	0.000535	4.85	175.58	205.47	0.31
1	3069	100 yr	548.00	377.52	384.59	382.04	385.40	0.001327	7.39	106.33	150.39	0.49
1	3069	500 yr	897.00	377.52	383.73	383.73	386.97	0.005468	14.45	62.09	10.00	1.02
1	3039	Culvert										
1	3009	2 yr	89.00	377.85	382.11	379.20	382.18	0.000146	2.09	42.62	10.00	0.18
1	3009	10 yr	222.00	377.85	384.62	380.33	384.75	0.000226	3.06	114.31	171.94	0.21
1	3009	25 yr	330.00	377.85	384.71	381.08	384.97	0.000444	4.32	130.75	180.92	0.29
1	3009	50 yr	438.00	377.85	384.68	381.74	385.16	0.000807	5.82	126.37	178.57	0.39
1	3009	100 yr	548.00	377.85	384.06	382.37	385.27	0.002041	8.83	62.41	21.48	0.62
1	3009	500 yr	897.00	377.85	385.43	385.43	386.02	0.001196	7.59	296.23	294.95	0.49
1	2916	Culvert										
1	2824	2 yr	92.00	375.32	379.09	376.92	379.23	0.000393	3.05	30.13	8.00	0.28
1	2824	10 yr	229.00	375.32	381.62	378.25	381.91	0.000498	4.36	62.07	27.32	0.31
1	2824	25 yr	341.00	375.32	381.76	379.15	382.35	0.001010	6.30	66.43	37.12	0.44
1	2824	50 yr	445.00	375.32	381.59	379.90	382.68	0.001925	8.54	61.12	26.76	0.60
1	2824	100 yr	565.00	375.32	381.35	381.35	383.35	0.003648	11.46	55.15	22.90	0.82
1	2824	500 yr	923.00	375.32	383.32	383.32	384.21	0.001650	9.30	202.03	114.48	0.58
1	2633	Culvert										
1	2523	2 yr	92.00	370.91	374.70	372.51	374.85	0.000385	3.03	30.35	8.00	0.27
1	2523	10 yr	229.00	370.91	376.35	373.84	376.78	0.000902	5.24	46.75	54.17	0.40
1	2523	25 yr	341.00	370.91	375.90	374.74	377.03	0.002571	8.55	39.90	8.00	0.67
1	2523	50 yr	445.00	370.91	375.48	375.48	377.78	0.005509	12.18	36.53	8.00	1.00
1	2523	100 yr	565.00	370.91	377.39	377.39	377.82	0.001160	6.68	224.92	283.84	0.46
1	2523	500 yr	923.00	370.91	377.78	377.78	378.23	0.001416	7.68	355.79	376.92	0.52

Tusico existing conditions

1	2483	Culvert									
1	2443.764	2 yr	143.00	366.96	371.08		371.23	0.005251	3.05	46.82	16.96	0.32
1	2443.764	10 yr	336.00	366.96	372.33		372.61	0.008015	4.39	93.00	83.81	0.41
1	2443.764	25 yr	489.00	366.96	372.67	371.33	373.00	0.009250	5.02	125.53	107.36	0.45
1	2443.764	50 yr	630.00	366.96	372.87	372.64	373.25	0.010422	5.51	148.86	121.61	0.48
1	2443.764	100 yr	794.00	366.96	373.12	372.90	373.50	0.010002	5.61	178.51	123.76	0.48
1	2443.764	500 yr	1278.00	366.96	373.56	373.30	374.11	0.011404	6.39	234.00	127.68	0.52
1	2160.924	2 yr	143.00	364.52	369.98		370.06	0.002861	2.32	78.23	78.50	0.24
1	2160.924	10 yr	336.00	364.52	370.56		370.69	0.005220	3.42	171.73	290.57	0.34
1	2160.924	25 yr	489.00	364.52	370.79		370.91	0.005075	3.53	244.65	335.51	0.33
1	2160.924	50 yr	630.00	364.52	371.00		371.11	0.004208	3.34	318.93	371.15	0.31
1	2160.924	100 yr	794.00	364.52	371.04		371.19	0.005957	4.00	332.78	377.42	0.37
1	2160.924	500 yr	1278.00	364.52	371.36		371.54	0.006151	4.30	463.34	432.08	0.38
1	1905.580	2 yr	143.00	364.47	369.64	367.14	369.64	0.000100	0.55	317.01	312.43	0.04
1	1905.580	10 yr	336.00	364.47	369.91	369.00	369.92	0.000267	0.93	403.04	326.27	0.07
1	1905.580	25 yr	489.00	364.47	370.14	369.00	370.16	0.000330	1.07	479.49	336.25	0.08
1	1905.580	50 yr	630.00	364.47	370.46	369.01	370.48	0.000280	1.03	589.33	342.41	0.08
1	1905.580	100 yr	794.00	364.47	370.22	369.21	370.26	0.000728	1.60	506.44	337.77	0.12
1	1905.580	500 yr	1278.00	364.47	370.46	369.49	370.54	0.001161	2.09	588.05	342.34	0.16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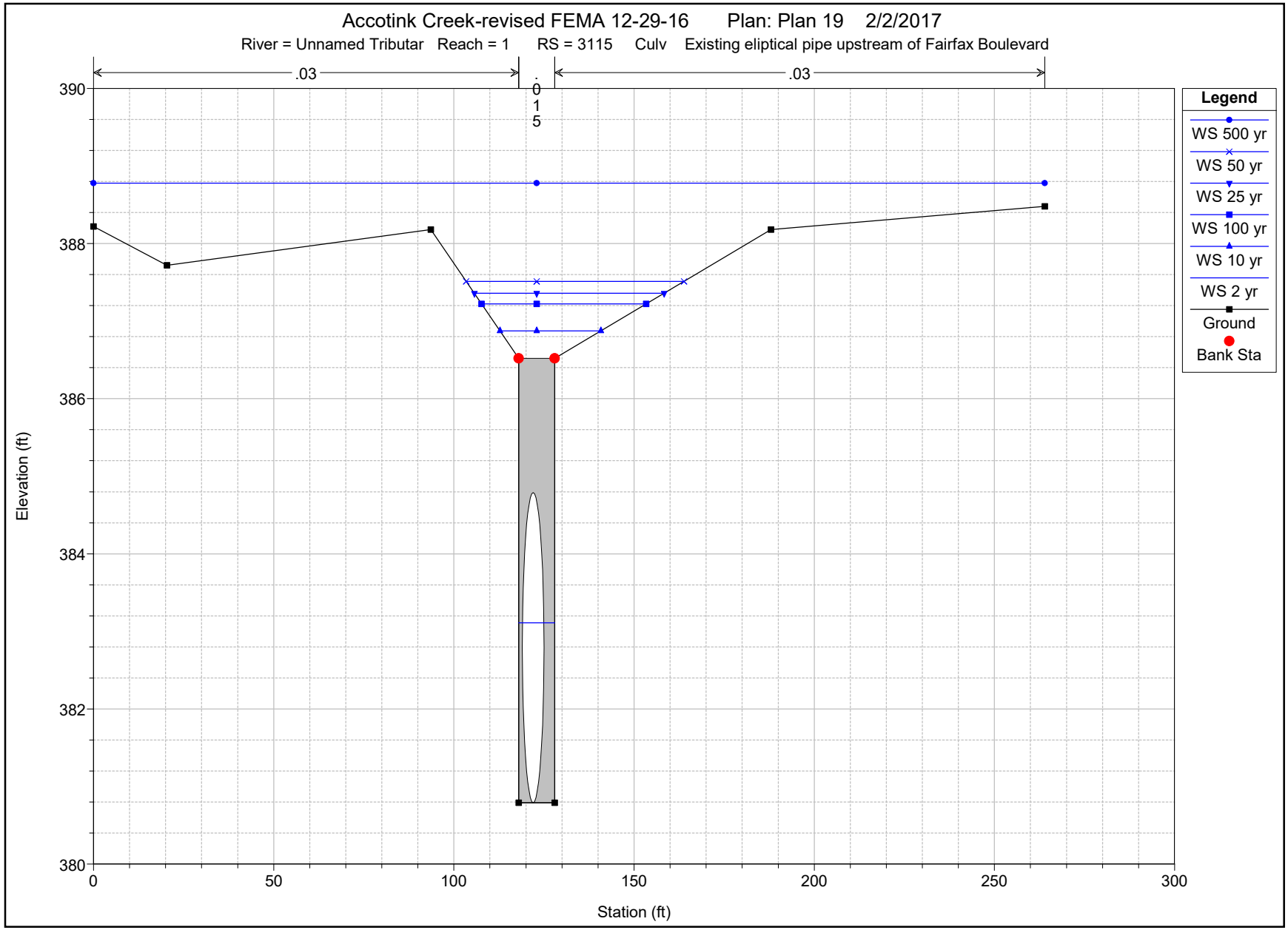
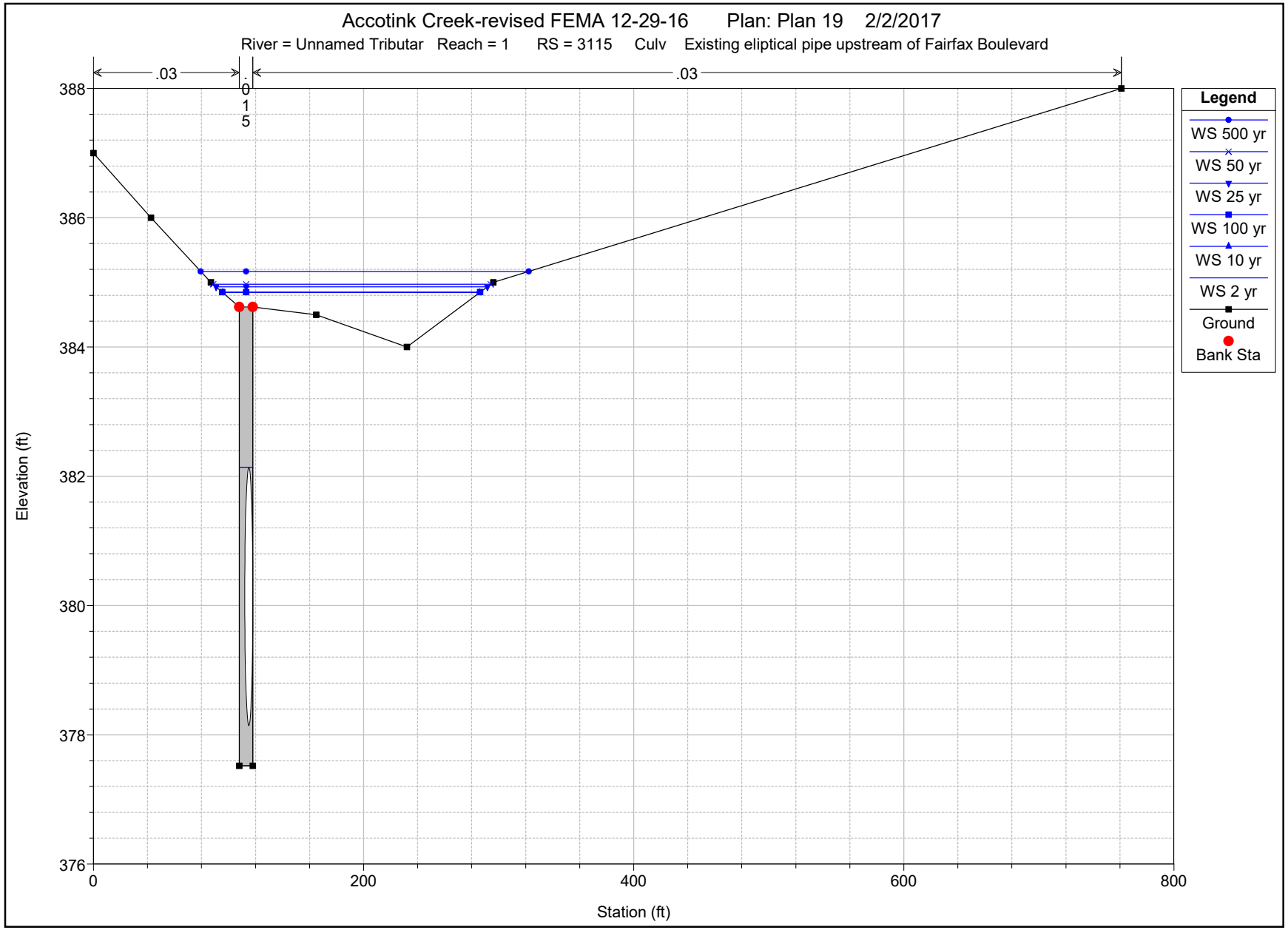
River = Unnamed Tributar Reach = 1 RS = 3159 Drop Inlet Ex 551
.03
.015
.03
Legend
WS 500 yr
WS 50 yr
WS 25 yr
WS 100 yr
WS 10 yr
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
390
388
386
384
382
380
0
50
100
150
200
250
300


Accotink Creek-revised FEMA 12-29-16 Plan: Plan 19 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 3115 Culv Existing eliptical pipe upstream of Fairfax Boulevard
.03
.015
.03
Legend
WS 500 yr
WS 50 yr
WS 25 yr
WS 100 yr
WS 10 yr
WS 2 yr
Ground
Bank Sta
Elevation (ft)
390
388
386
384
382
380
0
50
100
150
200
250
300
Station (ft)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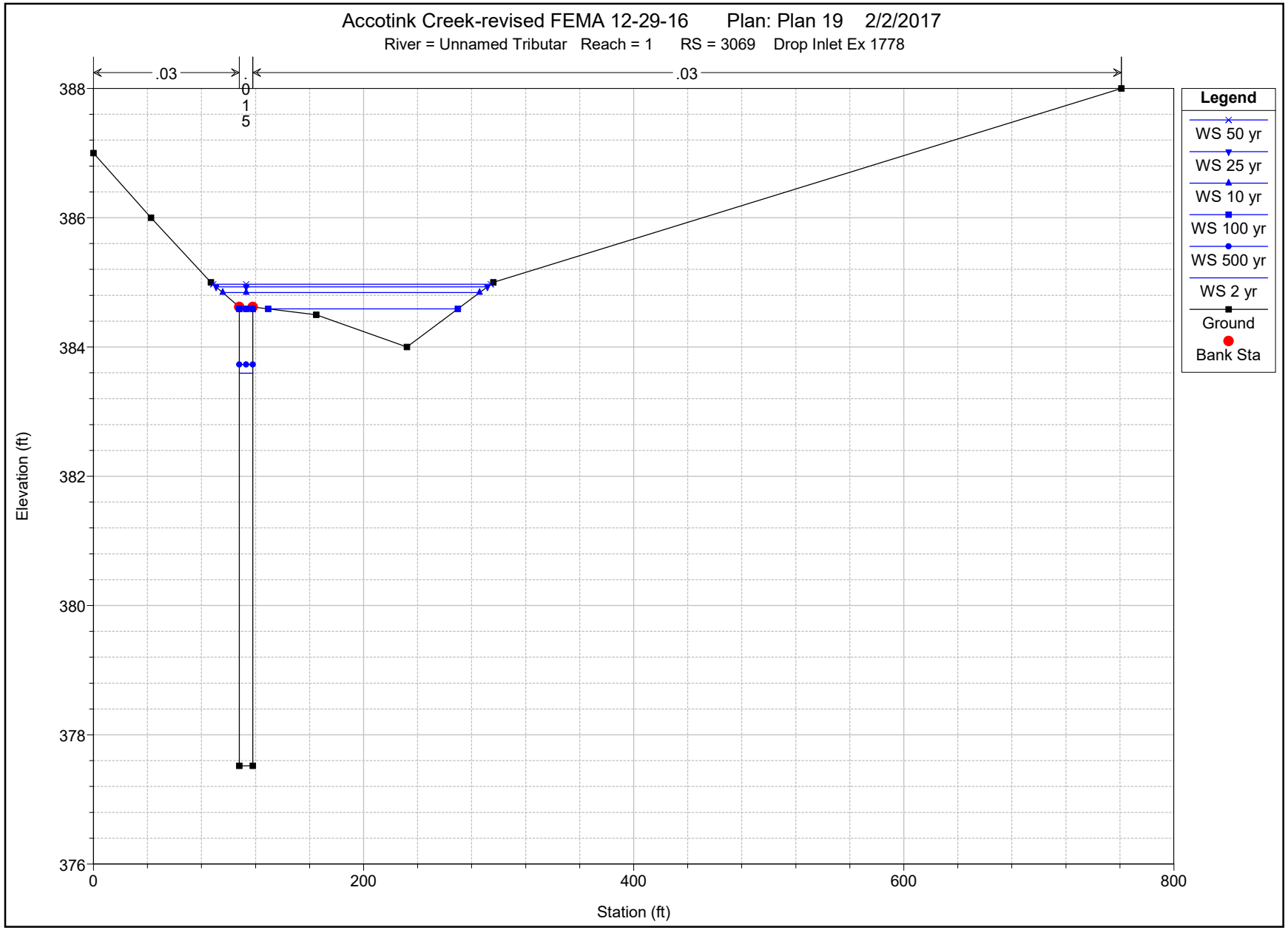
.03
.015
.03
Legend
WS 500 yr
WS 50 yr
WS 25 yr
WS 100 yr
WS 10 yr
WS 2 yr
Ground
Bank Sta
Elevation (ft)
388
386
384
382
380
378
376
0
200
400
600
800
Station (ft)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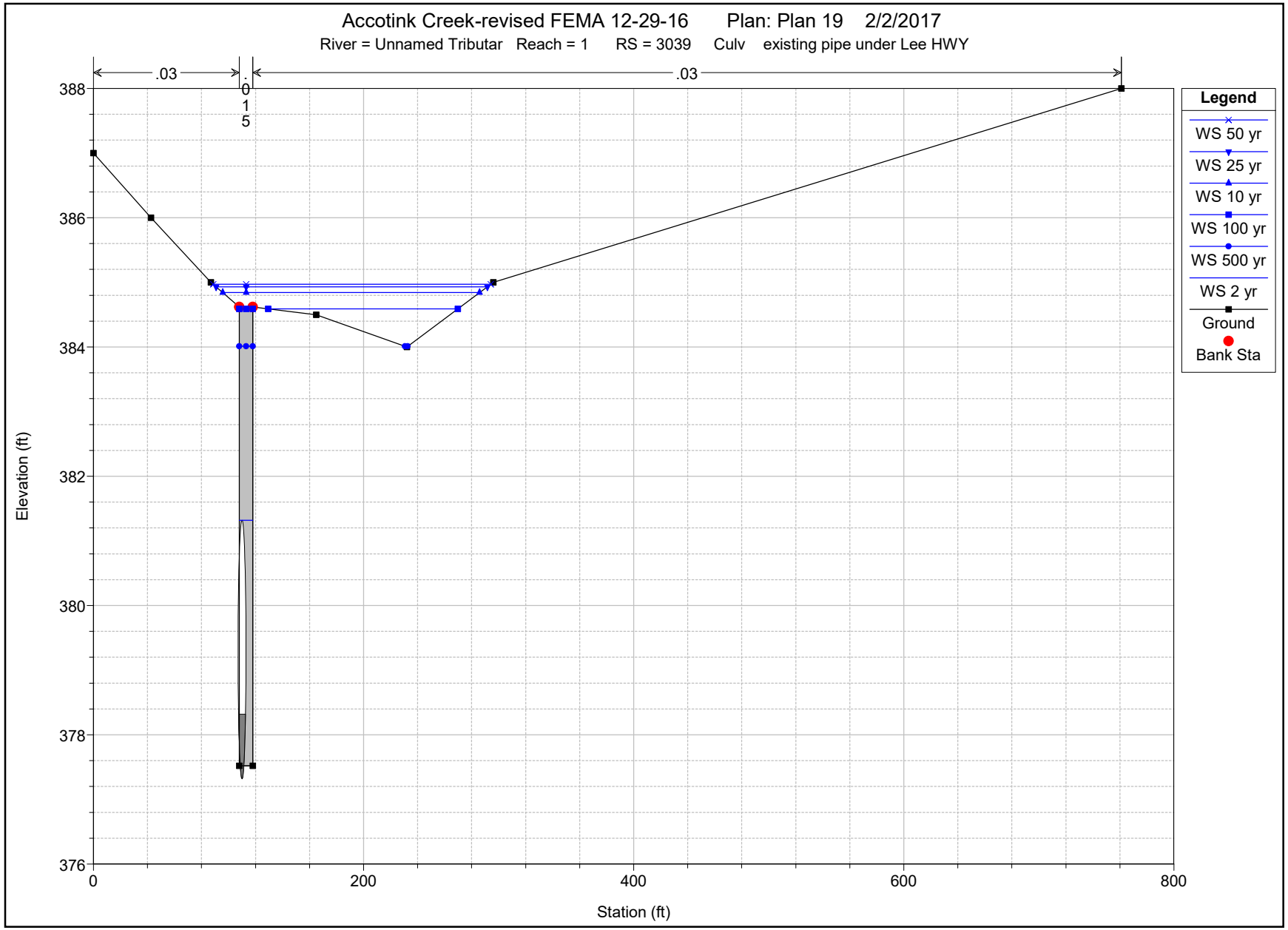
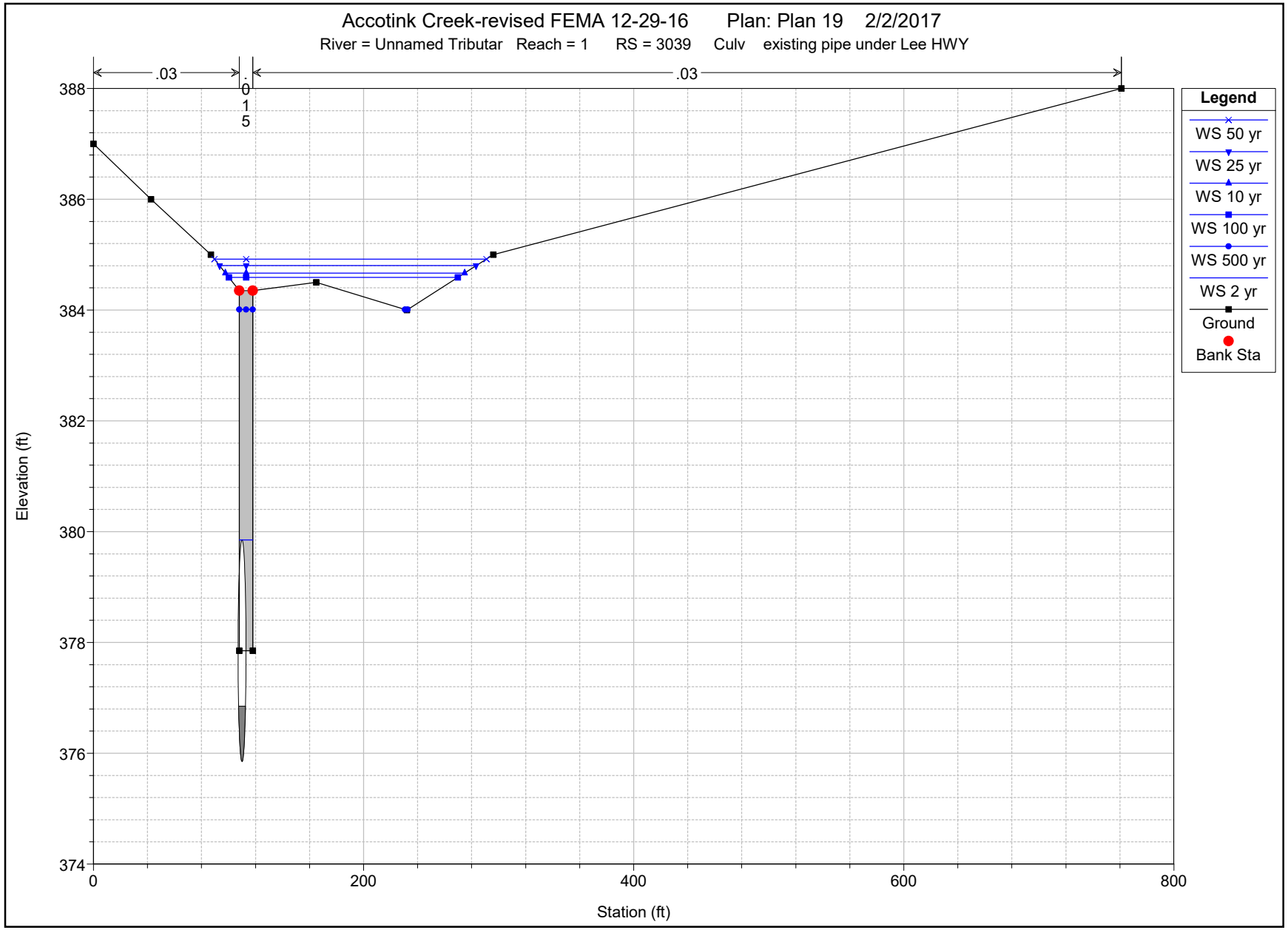
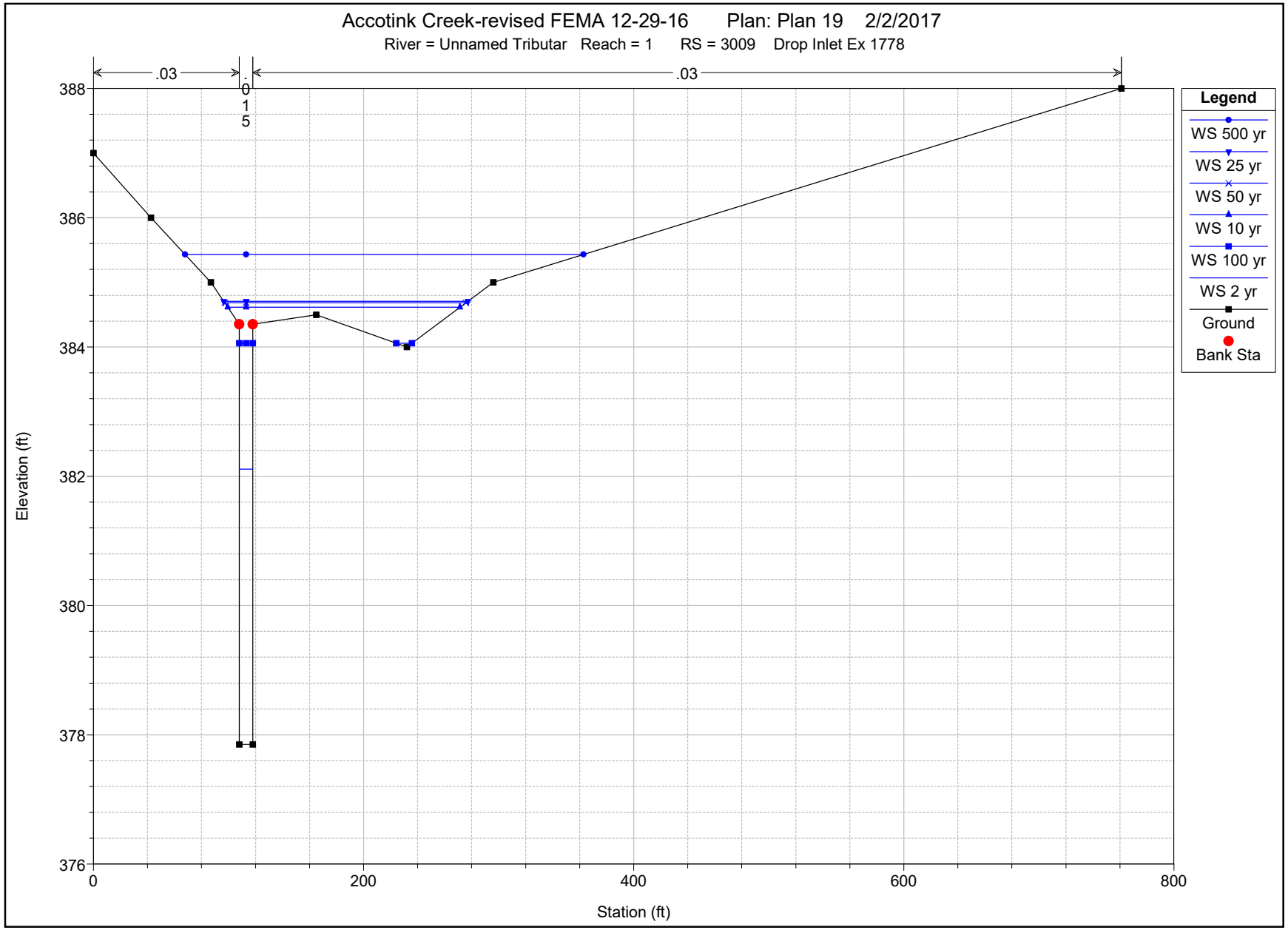
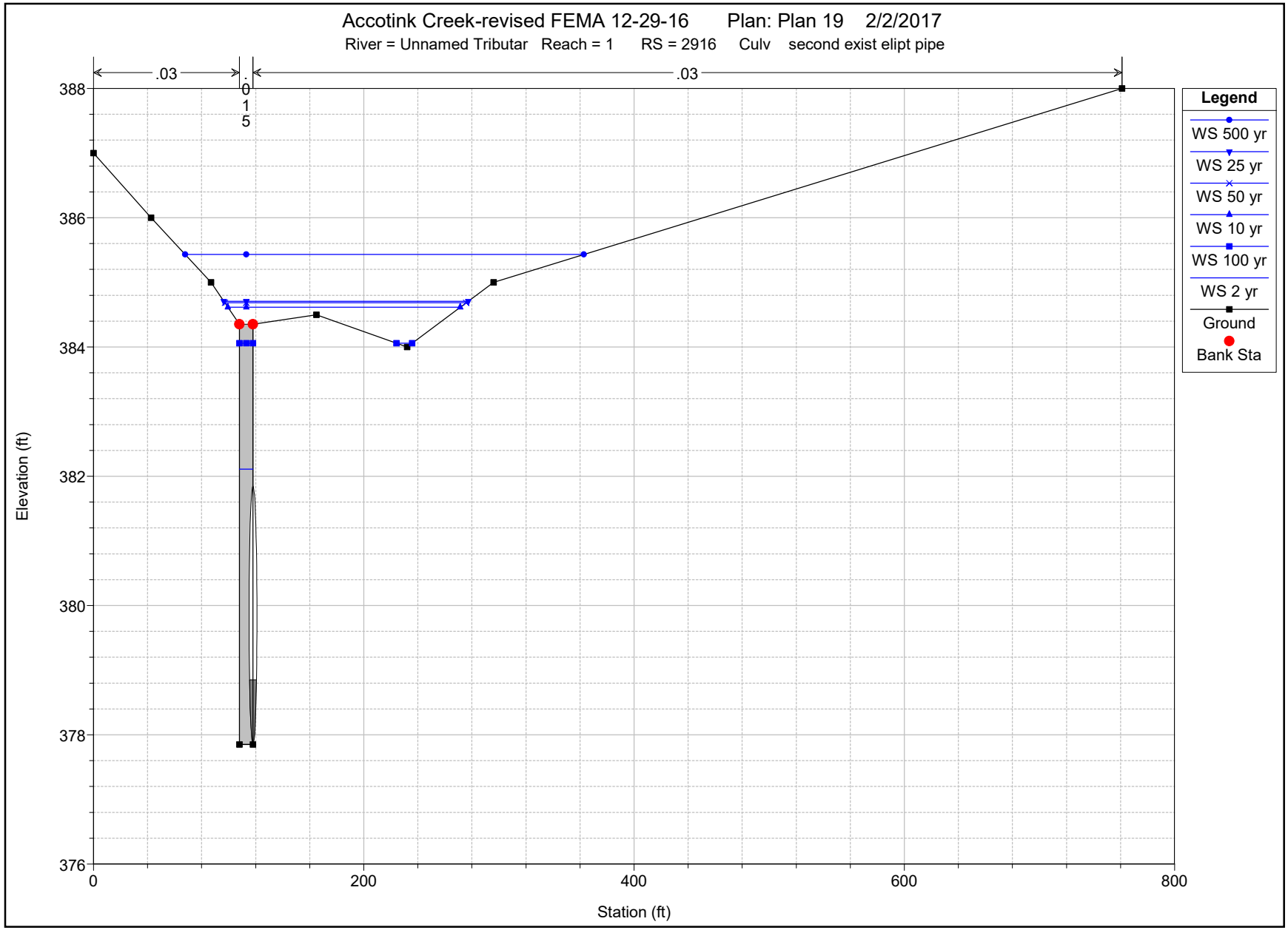
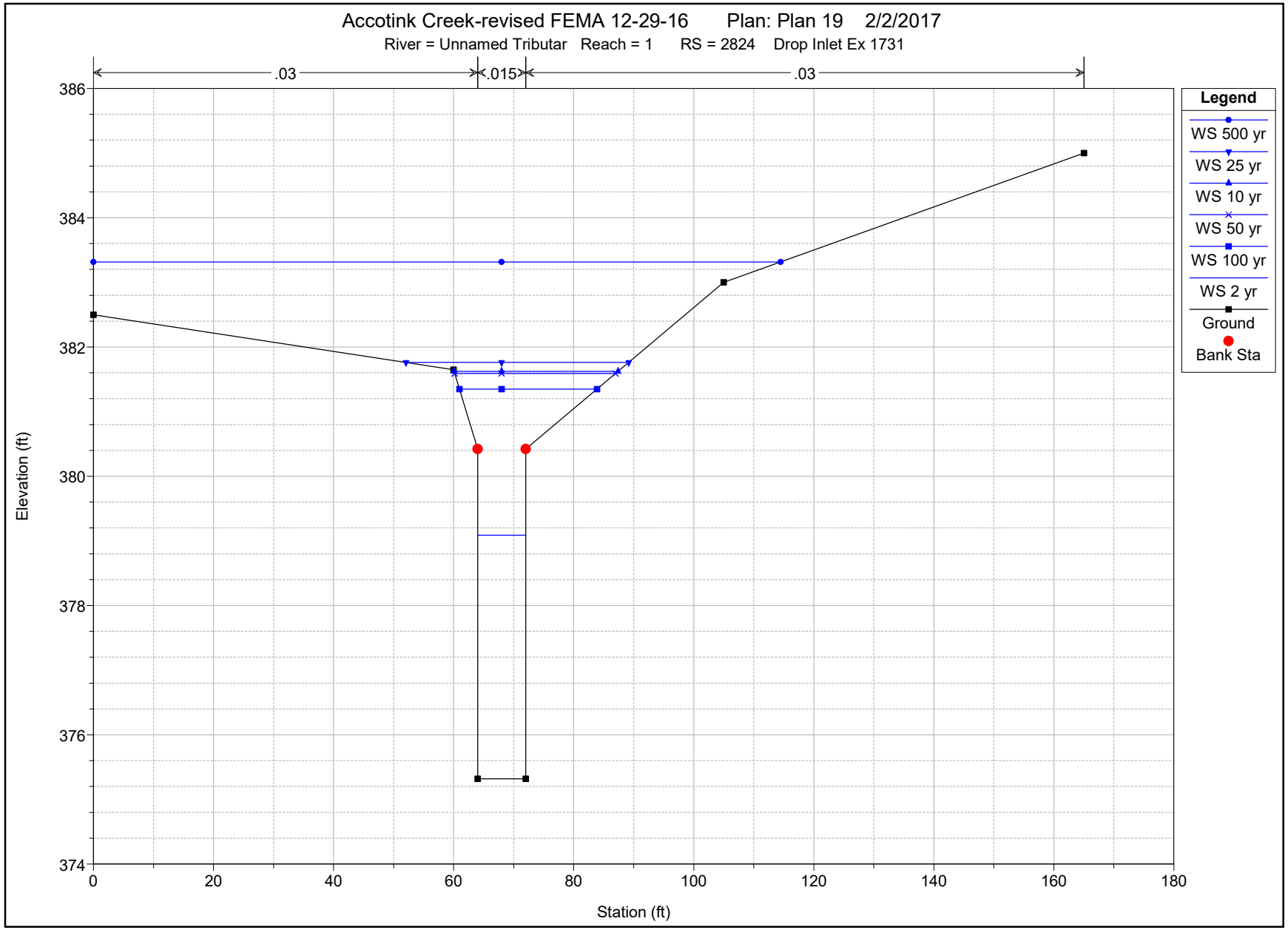
.03
.015
.03
388
386
384
382
380
378
376
Elevation (ft)
0
200
400
600
800
Station (ft)
Legend
WS 50 yr
WS 25 yr
WS 10 yr
WS 100 yr
WS 500 yr
WS 2 yr
Ground
Bank Sta

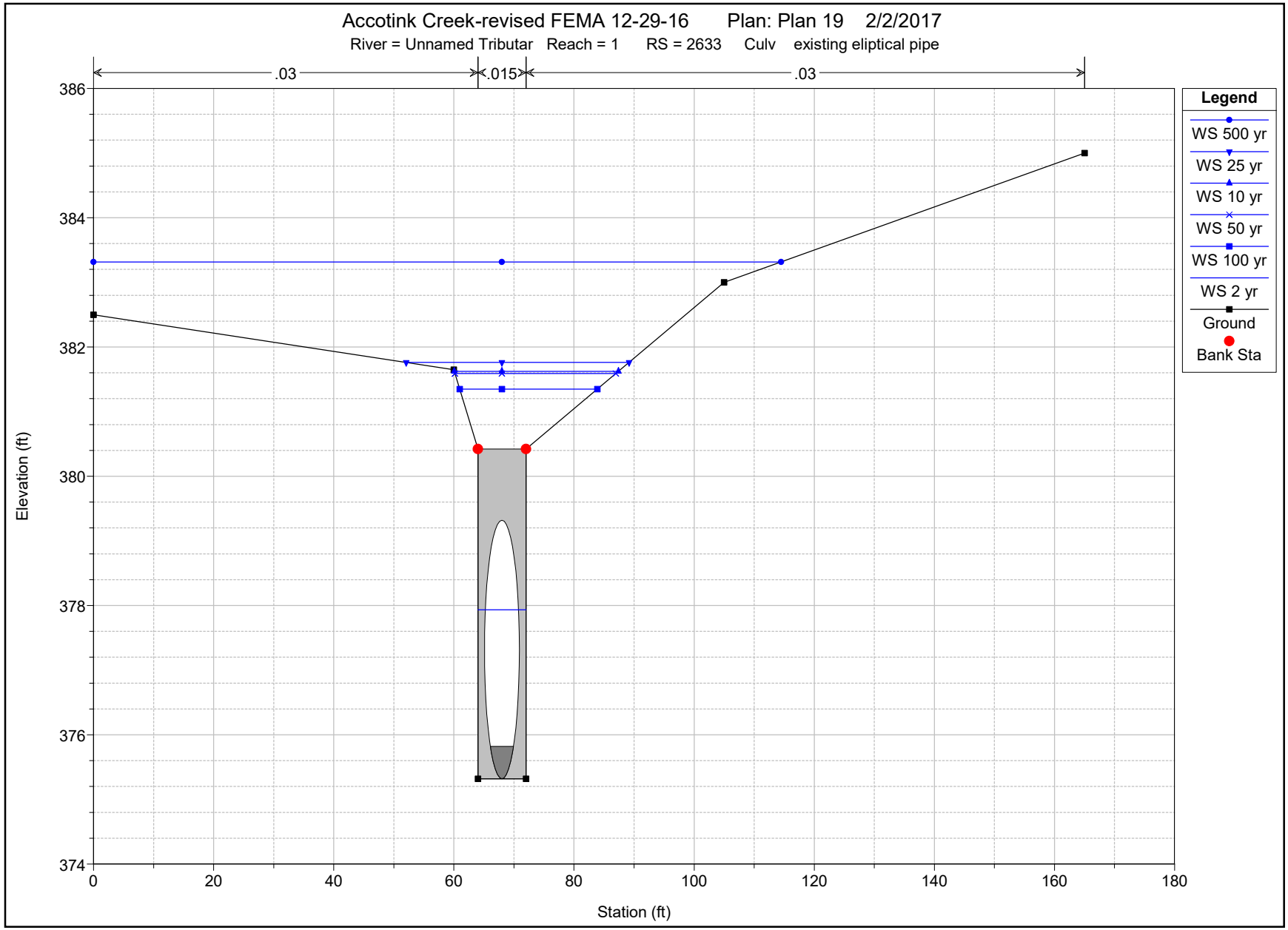

Accotink Creek-revised FEMA 12-29-16 Plan: Plan 19 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 3039 Culv existing pipe under Lee HWY
.03
.03
0
1
5
Legend
WS 50 yr
WS 25 yr
WS 10 yr
WS 100 yr
WS 500 yr
WS 2 yr
Ground
Bank Sta
Elevation (ft)
388
386
384
382
380
378
376
0
200
400
600
800
Station (ft)

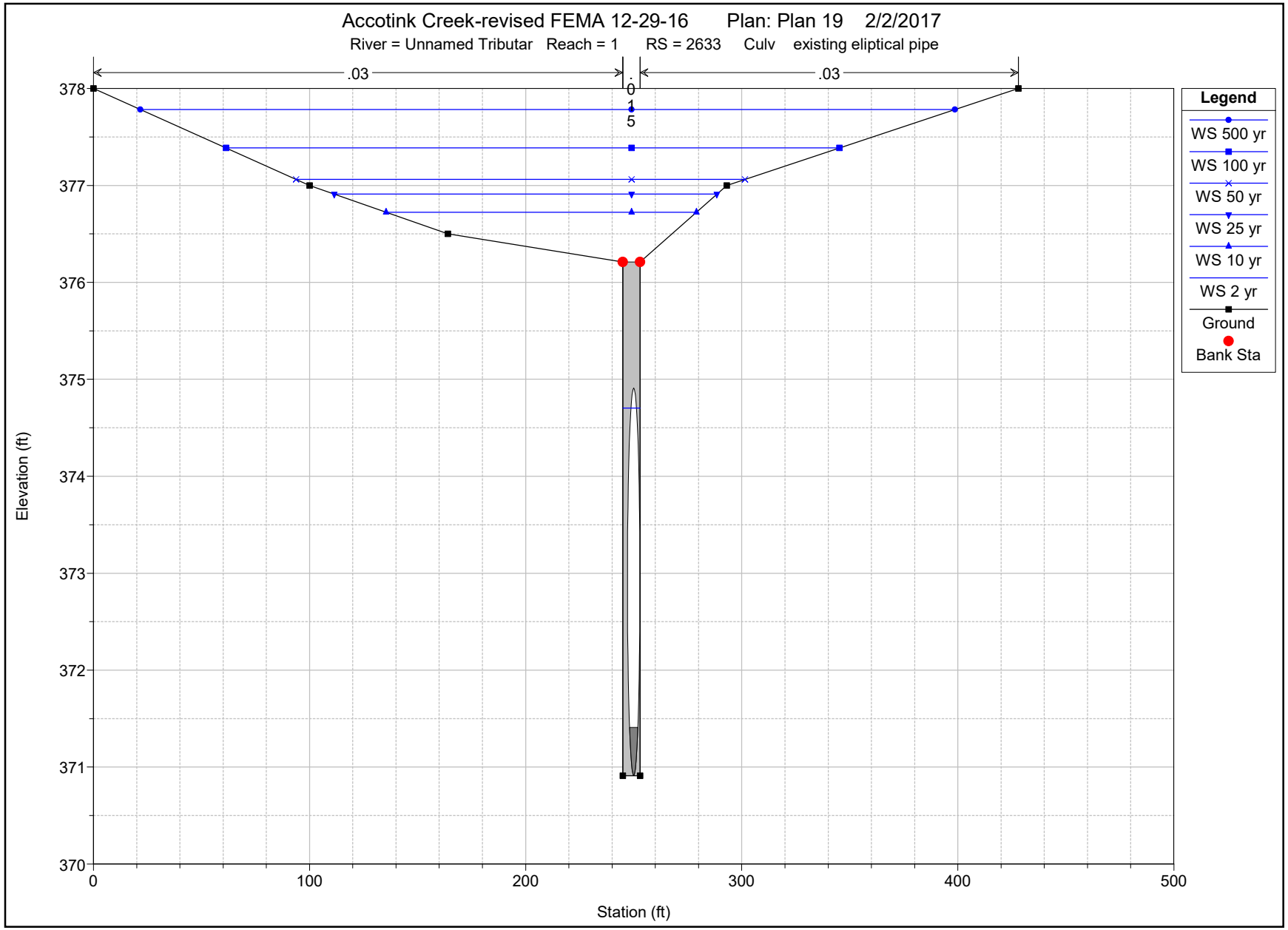

Accotink Creek-revised FEMA 12-29-16 Plan: Plan 19 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 3039 Culv existing pipe under Lee HWY
.03
.015
.03
Legend
WS 50 yr
WS 25 yr
WS 10 yr
WS 100 yr
WS 500 yr
WS 2 yr
Ground
Bank Sta
Elevation (ft)
388
386
384
382
380
378
376
374
0
200
400
600
800
Station (ft)

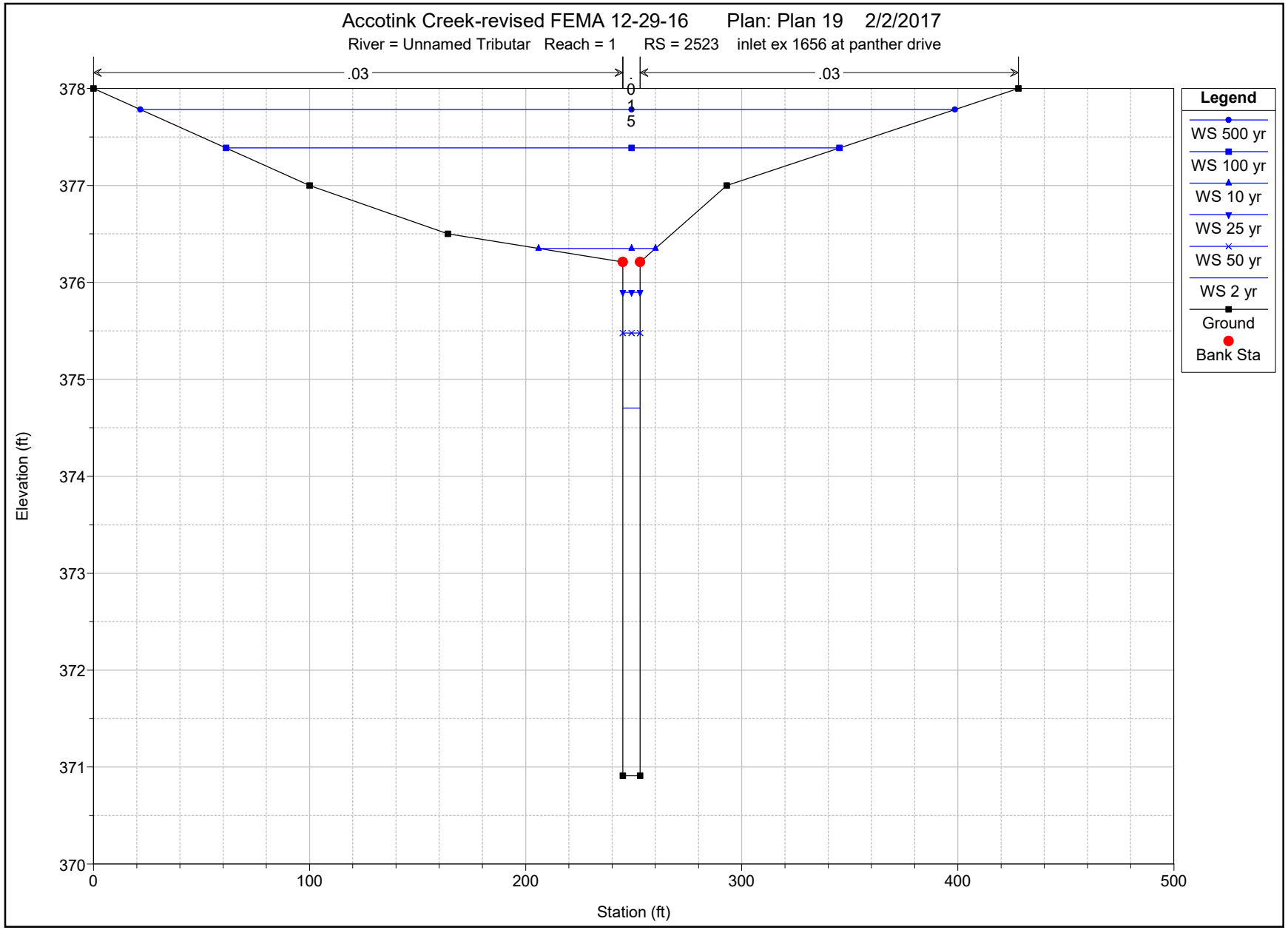

Accotink Creek-revised FEMA 12-29-16 Plan: Plan 19 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 3009 Drop Inlet Ex 1778
.03
.03
0
1
5
Legend
WS 500 yr
WS 25 yr
WS 50 yr
WS 10 yr
WS 100 yr
WS 2 yr
Ground
Bank Sta
Elevation (ft)
388
386
384
382
380
378
376
0
200
400
600
800
Station (ft)

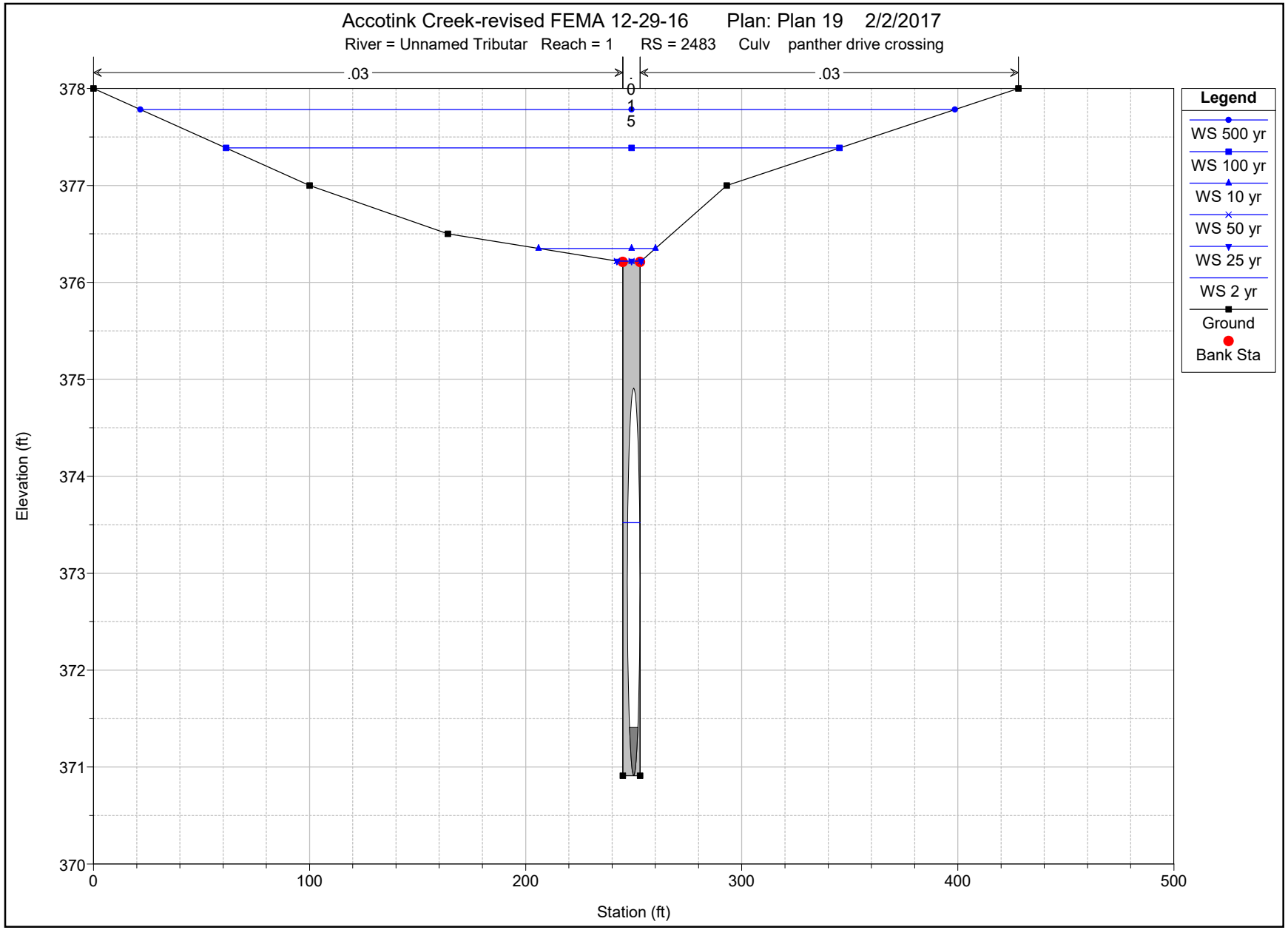

Accotink Creek-revised FEMA 12-29-16 Plan: Plan 19 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 2916 Culv second exist elipt pipe
.03
.015
.03
Legend
WS 500 yr
WS 25 yr
WS 50 yr
WS 10 yr
WS 100 yr
WS 2 yr
Ground
Bank Sta
Elevation (ft)
388
386
384
382
380
378
376
0
200
400
600
800
Station (ft)

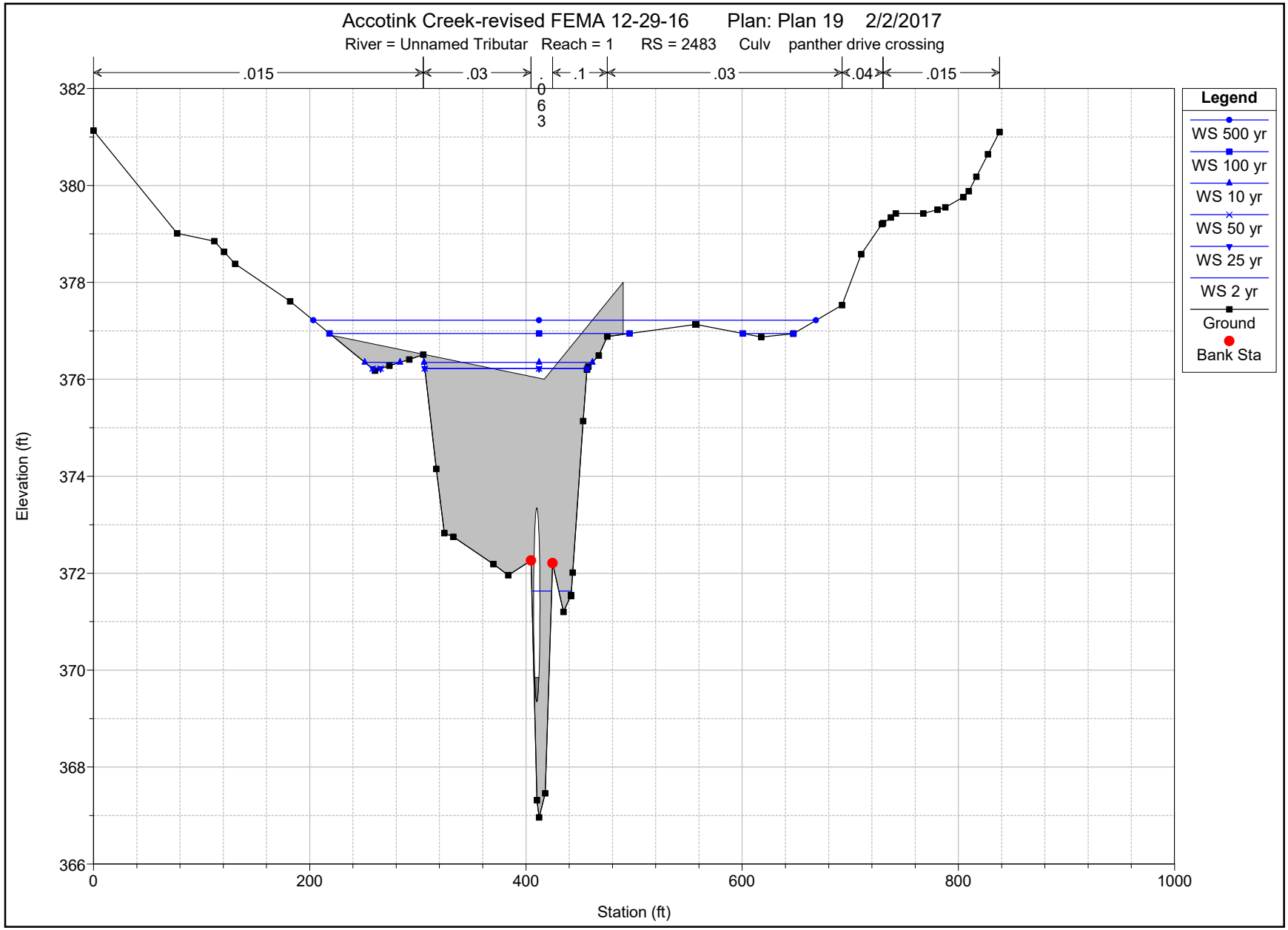

Accotink Creek-revised FEMA 12-29-16 Plan: Plan 19 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 2824 Drop Inlet Ex 1731
.03
.015
.03
Legend
WS 500 yr
WS 25 yr
WS 10 yr
WS 50 yr
WS 100 yr
WS 2 yr
Ground
Bank Sta
Elevation (ft)
386
384
382
380
378
376
374
0
20
40
60
80
100
120
140
160
180
Station (ft)

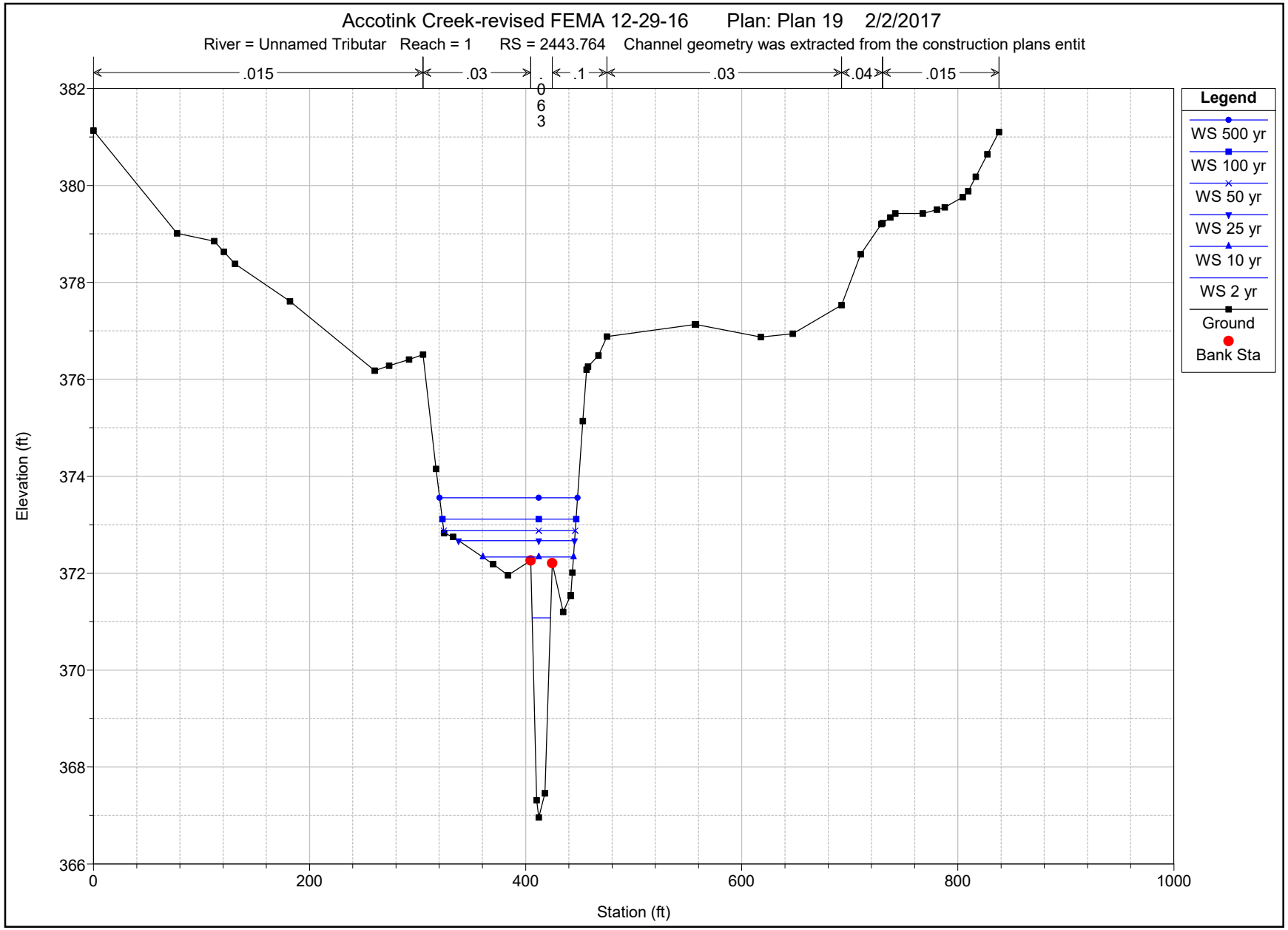

Accotink Creek-revised FEMA 12-29-16 Plan: Plan 19 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 2633 Culv existing eliptical pipe
.03
.015
.03
Legend
WS 500 yr
WS 25 yr
WS 10 yr
WS 50 yr
WS 100 yr
WS 2 yr
Ground
Bank Sta
Elevation (ft)
386
384
382
380
378
376
374
0
20
40
60
80
100
120
140
160
180
Station (ft)

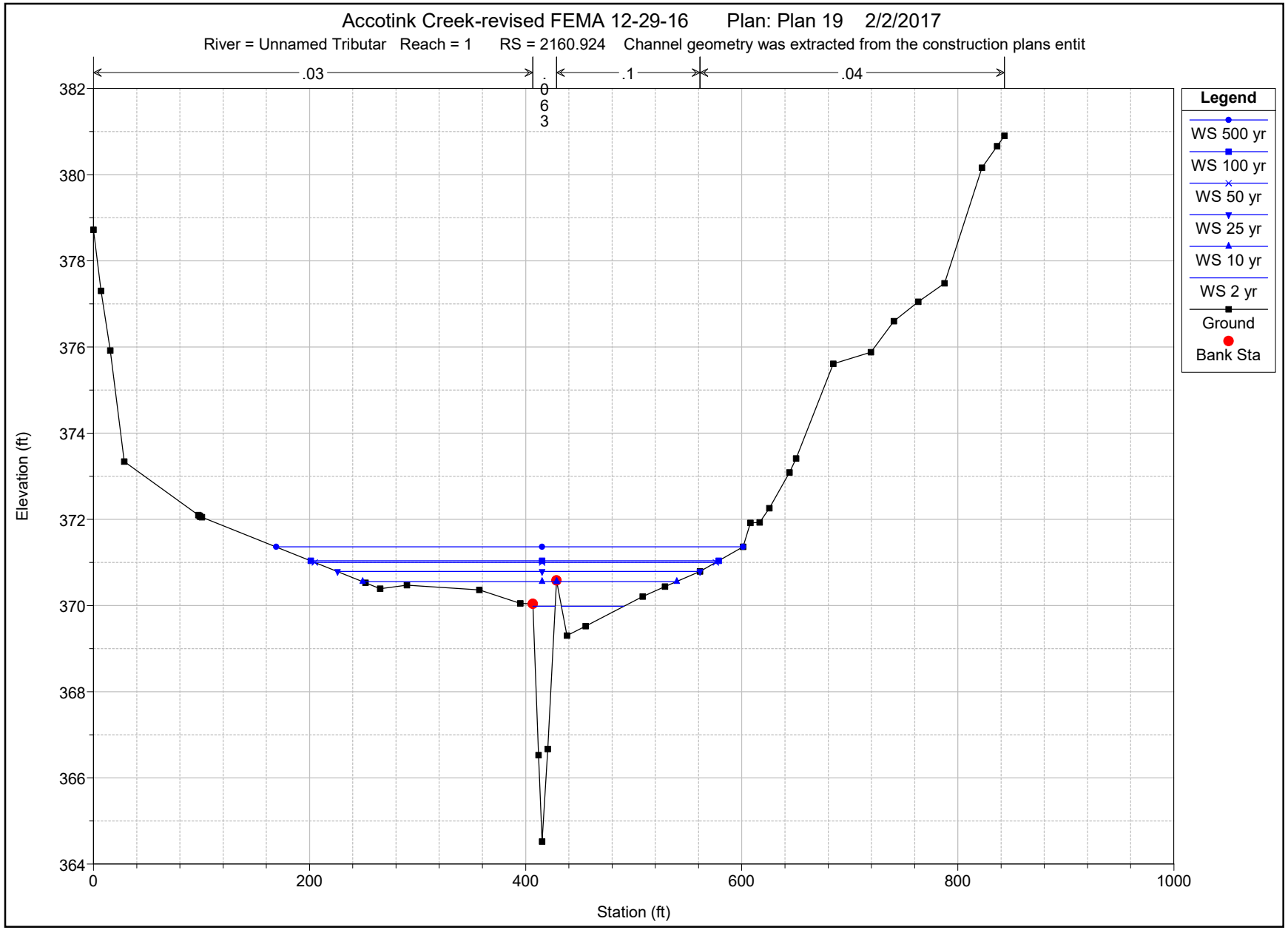

Accotink Creek-revised FEMA 12-29-16 Plan: Plan 19 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 2633 Culv existing eliptical pipe
.03
.03
0.015
Legend
WS 500 yr
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
378
377
376
375
374
373
372
371
370
0
100
200
300
400
500

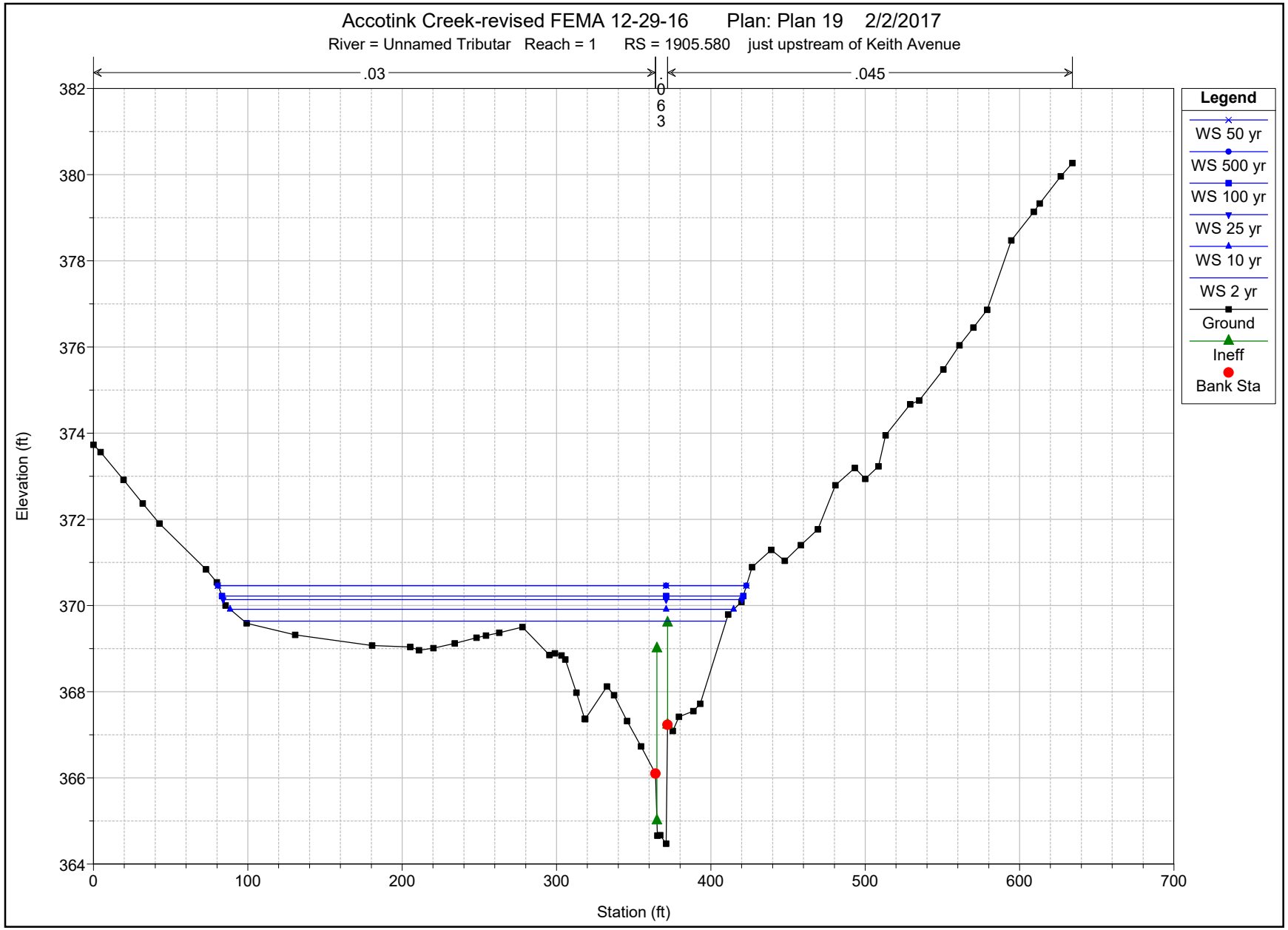

Accotink Creek-revised FEMA 12-29-16 Plan: Plan 19 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 2523 inlet ex 1656 at panther drive
.03
.03
0.15
Legend
WS 500 yr
WS 100 yr
WS 10 yr
WS 25 yr
WS 50 yr
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
378
377
376
375
374
373
372
371
370
0
100
200
300
400
500

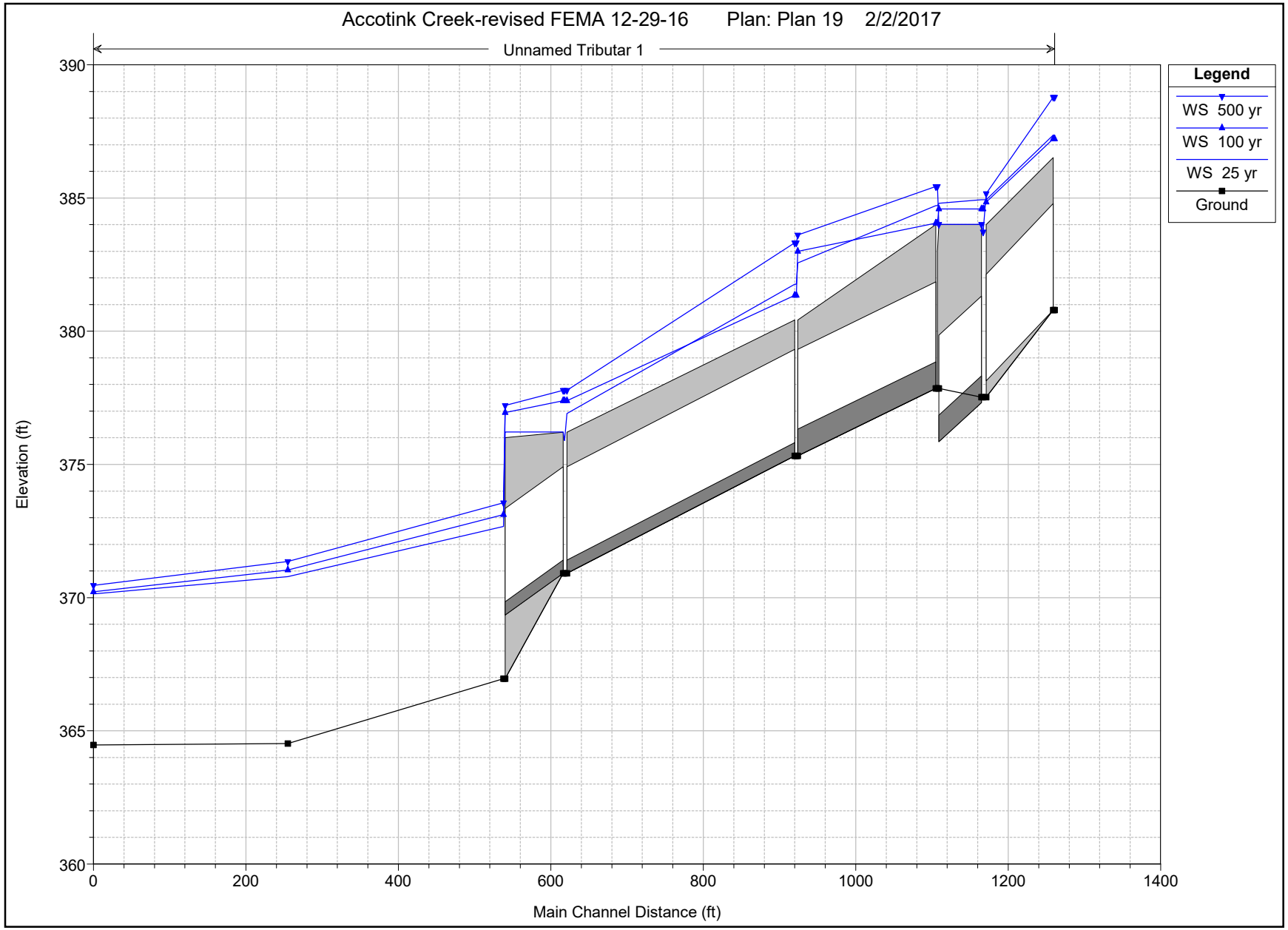

Accotink Creek-revised FEMA 12-29-16 Plan: Plan 19 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 2483 Culv panther drive crossing
.03
.03
.015
Legend
WS 500 yr
WS 100 yr
WS 10 yr
WS 50 yr
WS 25 yr
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
378
377
376
375
374
373
372
371
370
0
100
200
300
400
500


Accotink Creek-revised FEMA 12-29-16 Plan: Plan 19 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 2483 Culv panther drive crossing
.015
.03
.063
.1
.03
.04
.015
Legend
WS 500 yr
WS 100 yr
WS 10 yr
WS 50 yr
WS 25 yr
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
382
380
378
376
374
372
370
368
366
0
200
400
600
800
1000


Accotink Creek-revised FEMA 12-29-16 Plan: Plan 19 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 2443.764 Channel geometry was extracted from the construction plans entit
.015
.03
.063
.1
.03
.04
.015
Legend
WS 500 yr
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
382
380
378
376
374
372
370
368
366
0
200
400
600
800
1000


Accotink Creek-revised FEMA 12-29-16 Plan: Plan 19 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 2160.924 Channel geometry was extracted from the construction plans entit
.03
.063
.1
.04
Legend
WS 500 yr
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 2 yr
Ground
Bank Sta
Elevation (ft)
382
380
378
376
374
372
370
368
366
364
0
200
400
600
800
1000
Station (ft)


Accotink Creek-revised FEMA 12-29-16 Plan: Plan 19 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 1905.580 just upstream of Keith Avenue
.03
.063
.045
Legend
WS 50 yr
WS 500 yr
WS 100 yr
WS 25 yr
WS 10 yr
WS 2 yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
382
380
378
376
374
372
370
368
366
364
0
100
200
300
400
500
600
700


Accotink Creek-revised FEMA 12-29-16 Plan: Plan 19 2/2/2017
Unnamed Tributar 1
Legend
WS 500 yr
WS 100 yr
WS 25 yr
Ground
Elevation (ft)
390
385
380
375
370
365
360
0
200
400
600
800
1000
1200
1400
Main Channel Distance (ft)

APPENDIX D

HECRAS MODEL PROPOSED CONDITIONS
WITH PROFILE AND CROSS SECTIONS

HEC-RAS HEC-RAS 5.0.1 April 2016
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X   X XXXXXX  XXXX     XXXX    XX   XXXX
X   X X     X  X    X  X   X X  X
X   X X     X       X  X   X  X  X
XXXXXXX XXXX   X    XXX XXXX   XXXXXX  XXXX
X   X X     X       X X   X  X    X
X   X X     X  X    X  X  X  X    X
X   X XXXXXX  XXXX    X  X  X  X  XXXXX
```

PROJECT DATA
Project Title: Accotink Creek-revised FEMA 12-29-16
Project File : Tusico.prj
Run Date and Time: 2/7/2017 11:37:41 AM

Project in English units

Project Description:
Project Description:
City of Fairfax Flood Study, prepared by christopher
consultants for review of floodplain along the creek on the
Paul VI
redevelopment site.

The peak discharges for the 2-, 10-, 25-,50-, 100-, and
500-year flood events were
computed in a HEC-HMS model for the Upper Accotink
Creek watershed.

This RAS
model is based on conditions existing in the
City at the time of completion of
the study. However, the hydrologic
analyses, specifically the composite runoff
curve number and
time-of-concentration calculations, reported HEC-HMS model are
based on
ultimate development conditions. However, for the purposes of
hydrologic
modeling, this condition is considered representative of both
existing and
future land use conditions.

****
**
****

* This RAS project
includes
Tusico Branch an unnamed northern tributary of Accotink Creek
existing conditions,
and proposed conditions model.

****
**
****

Model begins upstream of

Keith Avenus Starting WSEL= fixed from FEMA model based on storm events

The model ends one structure north at Fairfax Boulevard.

PLAN DATA

Plan Title: PROPOSED 10X5 BOX
Plan File : p:\Projects\15010\00300\ENG\HECRAS MODEL\2016-12-29 revised model\Tusico.p18

Geometry Title: Tusico 10X5 skew box stm sew prop .geo
Geometry File : p:\Projects\15010\00300\ENG\HECRAS MODEL\2016-12-29 revised model\Tusico.g01

Flow Title : 2-yr through 500-yr Updated flows
Flow File : p:\Projects\15010\00300\ENG\HECRAS MODEL\2016-12-29 revised model\Tusico.f02

Plan Description:
This Plan contains a hydraulic analyses for the 2-, 10-,25, 50-, 100-, and
500-year flood events along Tusico branch and Unnamed Tributary to Accotiink
Creek. The FEMA base model and boundary conditions were used.

The model
evaluates the 8 x 4 box at Fairfax Boulevard and the 10 x 5 box downstream to
the outfall below Panther place and upstream of Keith Ave at exist FEMA section
1905

Plan Summary Information:
Number of: Cross Sections = 8 Multiple Openings = 0
Culverts = 5 Inline Structures = 0
Bridges = 0 Lateral Structures = 0

Computational Information

Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Program Selects Appropriate method
Computational Flow Regime: Mixed Flow

FLOW DATA

Flow Title: 2-yr through 500-yr Updated flows
Flow File : p:\Projects\15010\00300\ENG\HECRAS MODEL\2016-12-29 revised model\Tusico.f02

Flow Data (cfs)

River	Reach	RS	2 yr	10 yr	25 yr	50 yr	100 yr	500 yr
Unnamed Tributar	1	3159	89	222	330	438	548	897
Unnamed Tributar	1	3069	89	222	330	438	548	897
Unnamed Tributar	1	2824	92	229	341	445	565	923
Unnamed Tributar	1	2443.764	143	336	489	630	794	1278

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Unnamed Tributar	1	2 yr	Normal S = 0.02	Known WS = 369.64
Unnamed Tributar	1	10 yr	Normal S = 0.02	Known WS = 369.91
Unnamed Tributar	1	25 yr	Normal S = 0.02	Known WS = 370.14
Unnamed Tributar	1	50 yr	Normal S = 0.02	Known WS = 370.4637
Unnamed Tributar	1	100 yr	Normal S = 0.02	Known WS = 370.22
Unnamed Tributar	1	500 yr	Normal S = 0.02	Known WS = 370.46

GEOMETRY DATA

Geometry Title: Tusico 10X5 skew box stm sew prop .geo
Geometry File : p:\Projects\15010\00300\ENG\HECRAS MODEL\2016-12-29 revised model\Tusico.g01

CROSS SECTION

RIVER: Unnamed Tributar
REACH: 1 RS: 3159

INPUT
Description: Drop Inlet Ex 551
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	388.22	20.4	387.72	93.6	388.18	118	386.52	118	380.79
128	380.79	128	386.52	188	388.18	264	388.48		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	118	.013	128	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
118	128	90	94	98	0	0

CROSS SECTION OUTPUT Profile #2 yr

E.G. Elev (ft)	384.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.10	Wt. n-Val.		0.013	
W.S. Elev (ft)	384.25	Reach Len. (ft)	90.00	94.00	98.00
Crit W.S. (ft)	382.14	Flow Area (sq ft)		34.61	
E.G. Slope (ft/ft)	0.000195	Area (sq ft)		34.61	
Q Total (cfs)	89.00	Flow (cfs)		89.00	
Top Width (ft)	10.00	Top Width (ft)		10.00	
Vel Total (ft/s)	2.57	Avg. Vel. (ft/s)		2.57	
Max Chl Dpth (ft)	3.46	Hydr. Depth (ft)		3.46	
Conv. Total (cfs)	6373.4	Conv. (cfs)		6373.4	
Length Wtd. (ft)	94.00	Wetted Per. (ft)		16.92	
Min Ch El (ft)	380.79	Shear (lb/sq ft)		0.02	
Alpha	1.00	Stream Power (lb/ft s)		0.06	
Frctn Loss (ft)		Cum Volume (acre-ft)	0.63	0.82	0.33
C & E Loss (ft)		Cum SA (acres)	0.78	0.38	0.50

CROSS SECTION OUTPUT Profile #10 yr

E.G. Elev (ft)	387.24	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.19	Wt. n-Val.	0.030	0.013	0.030
W.S. Elev (ft)	387.05	Reach Len. (ft)	90.00	94.00	98.00
Crit W.S. (ft)	383.26	Flow Area (sq ft)	2.09	62.63	5.13
E.G. Slope (ft/ft)	0.000226	Area (sq ft)	2.09	62.63	5.13
Q Total (cfs)	222.00	Flow (cfs)	0.64	219.77	1.58
Top Width (ft)	37.10	Top Width (ft)	7.83	10.00	19.26
Vel Total (ft/s)	3.18	Avg. Vel. (ft/s)	0.31	3.51	0.31
Max Chl Dpth (ft)	6.26	Hydr. Depth (ft)	0.27	6.26	0.27
Conv. Total (cfs)	14767.4	Conv. (cfs)	42.8	14619.4	105.3
Length Wtd. (ft)	94.00	Wetted Per. (ft)	7.85	21.46	19.27
Min Ch El (ft)	380.79	Shear (lb/sq ft)	0.00	0.04	0.00
Alpha	1.21	Stream Power (lb/ft s)	0.00	0.14	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	1.08	1.15	0.73
C & E Loss (ft)		Cum SA (acres)	1.95	0.40	0.97

CROSS SECTION OUTPUT Profile #25 yr

E.G. Elev (ft)	387.52	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.41	Wt. n-Val.	0.030	0.013	0.030
W.S. Elev (ft)	387.12	Reach Len. (ft)	90.00	94.00	98.00
Crit W.S. (ft)	384.01	Flow Area (sq ft)	2.62	63.28	6.45
E.G. Slope (ft/ft)	0.000479	Area (sq ft)	2.62	63.28	6.45
Q Total (cfs)	330.00	Flow (cfs)	1.27	325.60	3.13

Top Width (ft)	40.38	Top Width (ft)	8.78	10.00	21.60
Vel Total (ft/s)	4.56	Avg. Vel. (ft/s)	0.48	5.15	0.48
Max Chl Dpth (ft)	6.33	Hydr. Depth (ft)	0.30	6.33	0.30
Conv. Total (cfs)	15072.6	Conv. (cfs)	58.0	14871.7	142.8
Length Wtd. (ft)	94.00	Wetted Per. (ft)	8.80	21.46	21.61
Min Ch El (ft)	380.79	Shear (lb/sq ft)	0.01	0.09	0.01
Alpha	1.26	Stream Power (lb/ft s)	0.00	0.45	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	1.56	1.31	0.97
C & E Loss (ft)		Cum SA (acres)	2.20	0.40	1.14

CROSS SECTION OUTPUT Profile #50 yr

E.G. Elev (ft)	388.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.62	Wt. n-Val.	0.030	0.013	0.030
W.S. Elev (ft)	387.39	Reach Len. (ft)	90.00	94.00	98.00
Crit W.S. (ft)	384.68	Flow Area (sq ft)	5.50	65.95	13.53
E.G. Slope (ft/ft)	0.000707	Area (sq ft)	5.50	65.95	13.53
Q Total (cfs)	438.00	Flow (cfs)	4.14	423.68	10.19
Top Width (ft)	53.99	Top Width (ft)	12.72	10.00	31.27
Vel Total (ft/s)	5.15	Avg. Vel. (ft/s)	0.75	6.42	0.75
Max Chl Dpth (ft)	6.60	Hydr. Depth (ft)	0.43	6.60	0.43
Conv. Total (cfs)	16473.4	Conv. (cfs)	155.6	15934.6	383.1
Length Wtd. (ft)	94.00	Wetted Per. (ft)	12.75	21.46	31.28
Min Ch El (ft)	380.79	Shear (lb/sq ft)	0.02	0.14	0.02
Alpha	1.50	Stream Power (lb/ft s)	0.01	0.87	0.01
Frctn Loss (ft)		Cum Volume (acre-ft)	2.12	1.60	1.23
C & E Loss (ft)		Cum SA (acres)	2.39	0.40	1.26

CROSS SECTION OUTPUT Profile #100 yr

E.G. Elev (ft)	391.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	7.85	Wt. n-Val.		0.013	
W.S. Elev (ft)	383.23	Reach Len. (ft)	90.00	94.00	98.00
Crit W.S. (ft)	385.31	Flow Area (sq ft)		24.38	
E.G. Slope (ft/ft)	0.020004	Area (sq ft)		24.38	
Q Total (cfs)	548.00	Flow (cfs)		548.00	
Top Width (ft)	10.00	Top Width (ft)		10.00	
Vel Total (ft/s)	22.47	Avg. Vel. (ft/s)		22.47	
Max Chl Dpth (ft)	2.44	Hydr. Depth (ft)		2.44	
Conv. Total (cfs)	3874.6	Conv. (cfs)		3874.6	
Length Wtd. (ft)	94.00	Wetted Per. (ft)		14.88	
Min Ch El (ft)	380.79	Shear (lb/sq ft)		2.05	
Alpha	1.00	Stream Power (lb/ft s)		46.00	
Frctn Loss (ft)		Cum Volume (acre-ft)	2.03	1.93	1.25
C & E Loss (ft)		Cum SA (acres)	2.40	0.40	1.24

CROSS SECTION OUTPUT Profile #500 yr

E.G. Elev (ft)	394.75	Element	Left OB	Channel	Right OB
Vel Head (ft)	10.51	Wt. n-Val.		0.013	
W.S. Elev (ft)	384.24	Reach Len. (ft)	90.00	94.00	98.00
Crit W.S. (ft)	388.82	Flow Area (sq ft)		34.49	
E.G. Slope (ft/ft)	0.020001	Area (sq ft)		34.49	
Q Total (cfs)	897.00	Flow (cfs)		897.00	

Top Width (ft)	10.00	Top Width (ft)	10.00
Vel Total (ft/s)	26.01	Avg. Vel. (ft/s)	26.01
Max Chl Dpth (ft)	3.45	Hydr. Depth (ft)	3.45
Conv. Total (cfs)	6342.6	Conv. (cfs)	6342.6
Length Wtd. (ft)	94.00	Wetted Per. (ft)	16.90
Min Ch El (ft)	380.79	Shear (lb/sq ft)	2.55
Alpha	1.00	Stream Power (lb/ft s)	66.29
Frctn Loss (ft)		Cum Volume (acre-ft)	2.77 3.57 1.66
C & E Loss (ft)		Cum SA (acres)	2.61 0.40 1.39

Warning: The cross section had to be extended vertically during the critical depth calculations.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CULVERT

RIVER: Unnamed Tributar
REACH: 1 RS: 3113

INPUT
Description: exist eliptical pipe
Distance from Upstream XS = 2
Deck/Roadway Width = 88
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 7

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	388.22	20.4	387.72	93.6	388.18
118	386.52	128	386.52	188	388.18
264	388.48				

Upstream Bridge Cross Section Data
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	388.22	20.4	387.72	93.6	388.18	118	386.52	118	380.79
128	380.79	128	386.52	188	388.18	264	388.48		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	118	.013	128	.03

Bank Sta: Left	Right	Coeff Contr.	Expan.
118	128	0	0

Downstream Deck/Roadway Coordinates
num= 9

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	387	42.6	386	87	385
108	384.62	118	384.62	165	384.5
232	384	296	385	761	388

Downstream Bridge Cross Section Data
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	387	42.64	386	87	385	108	384.62	108	377.52

118 377.52 118 384.62 165 384.5 232 384 296 385
761 388

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	108	.013	118	.03

Bank Sta: Left	Right	Coeff Contr.	Expan.
108	118	0	0

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name Shape Rise Span
Culvert #1 Ellipse 4 6
FHWA Chart # 29- Horizontal Ellipse; Concrete
FHWA Scale # 1 - Square edge with headwall
Solution Criteria = Highest U.S. EG

Culvert Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
2	88	.015	.015	0	.3	.5

Upstream Elevation = 380.79
Centerline Station = 122
Downstream Elevation = 378.14
Centerline Station = 115

CULVERT OUTPUT Profile #2 yr Culv Group: Culvert #1

Q Culv Group (cfs)	89.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	7.85
Q Barrel (cfs)	89.00	Culv Vel DS (ft/s)	14.04
E.G. US. (ft)	384.36	Culv Inv El Up (ft)	380.79
W.S. US. (ft)	384.25	Culv Inv El Dn (ft)	378.14
E.G. DS (ft)	380.11	Culv Frctn Ls (ft)	0.00
W.S. DS (ft)	379.89	Culv Exit Loss (ft)	2.58
Delta EG (ft)	4.25	Culv Entr Loss (ft)	0.29
Delta WS (ft)	4.37	Q Weir (cfs)	
E.G. IC (ft)	384.23	Weir Sta Lft (ft)	
E.G. OC (ft)	384.36	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	383.11	Weir Max Depth (ft)	
Culv WS Outlet (ft)	379.62	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	1.37	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	2.32	Min El Weir Flow (ft)	386.53

Note: During the supercritical calculations a hydraulic jump occurred at the outlet of (leaving) the culvert.
Warning: During the supercritical analysis, the program could not converge on a supercritical answer in the downstream cross section. The program used the solution with the least error.
Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #10 yr Culv Group: Culvert #1

Q Culv Group (cfs)	185.07	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	9.82
Q Barrel (cfs)	185.07	Culv Vel DS (ft/s)	17.55
E.G. US. (ft)	387.25	Culv Inv El Up (ft)	380.79
W.S. US. (ft)	387.05	Culv Inv El Dn (ft)	378.14
E.G. DS (ft)	382.27	Culv Frctn Ls (ft)	0.00
W.S. DS (ft)	381.87	Culv Exit Loss (ft)	2.84
Delta EG (ft)	4.97	Culv Entr Loss (ft)	0.45
Delta WS (ft)	5.18	Q Weir (cfs)	36.93
E.G. IC (ft)	387.25	Weir Sta Lft (ft)	107.35
E.G. OC (ft)	386.58	Weir Sta Rgt (ft)	154.19
Culvert Control	Inlet	Weir Submerg	0.00
Culv WS Inlet (ft)	384.79	Weir Max Depth (ft)	0.72
Culv WS Outlet (ft)	380.33	Weir Avg Depth (ft)	0.44
Culv Nml Depth (ft)	2.02	Weir Flow Area (sq ft)	20.59
Culv Crt Depth (ft)	3.34	Min El Weir Flow (ft)	386.53

Warning: The flow through the culvert is supercritical. However, since there is flow over the road (weir flow), the program cannot determine if the downstream cross section should be subcritical or supercritical. The program used the downstream subcritical answer, even though it may not be valid.

Warning: During the supercritical analysis, the program could not converge on a supercritical answer in the downstream cross section. The program used the solution with the least error.

Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #25 yr Culv Group: Culvert #1

Q Culv Group (cfs)	256.57	Culv Full Len (ft)	88.00
# Barrels	1	Culv Vel US (ft/s)	13.61
Q Barrel (cfs)	256.57	Culv Vel DS (ft/s)	13.61
E.G. US. (ft)	387.52	Culv Inv El Up (ft)	380.79
W.S. US. (ft)	387.12	Culv Inv El Dn (ft)	378.14
E.G. DS (ft)	384.12	Culv Frctn Ls (ft)	1.32
W.S. DS (ft)	383.68	Culv Exit Loss (ft)	1.22
Delta EG (ft)	3.40	Culv Entr Loss (ft)	0.86
Delta WS (ft)	3.44	Q Weir (cfs)	73.43
E.G. IC (ft)	390.78	Weir Sta Lft (ft)	103.24
E.G. OC (ft)	387.52	Weir Sta Rgt (ft)	164.31
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	384.79	Weir Max Depth (ft)	1.00
Culv WS Outlet (ft)	382.14	Weir Avg Depth (ft)	0.58
Culv Nml Depth (ft)	2.45	Weir Flow Area (sq ft)	35.69
Culv Crt Depth (ft)	4.00	Min El Weir Flow (ft)	386.53

Note: Culvert critical depth exceeds the height of the culvert.

Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.

Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations are not valid and the supercritical result has been discarded. The outlet answer will be used.

CULVERT OUTPUT Profile #50 yr Culv Group: Culvert #1

Q Culv Group (cfs)	258.84	Culv Full Len (ft)	88.00
# Barrels	1	Culv Vel US (ft/s)	13.73
Q Barrel (cfs)	258.84	Culv Vel DS (ft/s)	13.73

E.G. US. (ft)	388.01	Culv Inv El Up (ft)	380.79
W.S. US. (ft)	387.39	Culv Inv El Dn (ft)	378.14
E.G. DS (ft)	384.68	Culv Frctn Ls (ft)	1.34
W.S. DS (ft)	383.96	Culv Exit Loss (ft)	1.11
Delta EG (ft)	3.33	Culv Entr Loss (ft)	0.88
Delta WS (ft)	3.43	Q Weir (cfs)	179.16
E.G. IC (ft)	390.89	Weir Sta Lft (ft)	8.95
E.G. OC (ft)	388.01	Weir Sta Rgt (ft)	181.51
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	384.79	Weir Max Depth (ft)	1.48
Culv WS Outlet (ft)	382.14	Weir Avg Depth (ft)	0.55
Culv Nml Depth (ft)	2.47	Weir Flow Area (sq ft)	78.40
Culv Crt Depth (ft)	4.00	Min El Weir Flow (ft)	386.53

Note: Culvert critical depth exceeds the height of the culvert.
Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations are not valid and the supercritical result has been discarded. The outlet answer will be used.

CULVERT OUTPUT Profile #100 yr Culv Group: Culvert #1

Q Culv Group (cfs)	269.21	Culv Full Len (ft)	88.00
# Barrels	1	Culv Vel US (ft/s)	14.28
Q Barrel (cfs)	269.21	Culv Vel DS (ft/s)	14.28
E.G. US. (ft)	391.08	Culv Inv El Up (ft)	380.79
W.S. US. (ft)	383.23	Culv Inv El Dn (ft)	378.14
E.G. DS (ft)	384.89	Culv Frctn Ls (ft)	1.45
W.S. DS (ft)	383.65	Culv Exit Loss (ft)	0.96
Delta EG (ft)	6.18	Culv Entr Loss (ft)	0.95
Delta WS (ft)	0.42	Q Weir (cfs)	278.79
E.G. IC (ft)	391.43	Weir Sta Lft (ft)	0.00
E.G. OC (ft)	388.26	Weir Sta Rgt (ft)	202.53
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	384.79	Weir Max Depth (ft)	1.72
Culv WS Outlet (ft)	382.14	Weir Avg Depth (ft)	0.59
Culv Nml Depth (ft)	2.52	Weir Flow Area (sq ft)	118.97
Culv Crt Depth (ft)	4.00	Min El Weir Flow (ft)	386.53

Note: Culvert critical depth exceeds the height of the culvert.
Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note: During the supercritical calculations a hydraulic jump occurred at the inlet of (going into) the culvert.
Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations are not valid and the supercritical result has been discarded. The outlet answer will be used.

CULVERT OUTPUT Profile #500 yr Culv Group: Culvert #1

Q Culv Group (cfs)	230.39	Culv Full Len (ft)	88.00
# Barrels	1	Culv Vel US (ft/s)	12.22
Q Barrel (cfs)	230.39	Culv Vel DS (ft/s)	12.22
E.G. US. (ft)	394.75	Culv Inv El Up (ft)	380.79
W.S. US. (ft)	384.24	Culv Inv El Dn (ft)	378.14
E.G. DS (ft)	386.97	Culv Frctn Ls (ft)	1.07
W.S. DS (ft)	383.82	Culv Exit Loss (ft)	0.00
Delta EG (ft)	7.78	Culv Entr Loss (ft)	0.70
Delta WS (ft)	0.42	Q Weir (cfs)	666.61

E.G. IC (ft)	388.74	Weir Sta Lft (ft)	0.00
E.G. OC (ft)	388.73	Weir Sta Rgt (ft)	264.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	384.79	Weir Max Depth (ft)	2.22
Culv WS Outlet (ft)	382.14	Weir Avg Depth (ft)	0.92
Culv Nml Depth (ft)	2.29	Weir Flow Area (sq ft)	244.11
Culv Crt Depth (ft)	3.62	Min El Weir Flow (ft)	386.53

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.
Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note: During the supercritical calculations a hydraulic jump occurred at the inlet of (going into) the culvert.
Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations are not valid and the supercritical result has been discarded. The outlet answer will be used.

CROSS SECTION

RIVER: Unnamed Tributar
REACH: 1 RS: 3069

INPUT
Description: Drop Inlet Ex 1778
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	387	42.64	386	87	385	108	384.62	108	377.52
118	377.52	118	384.62	165	384.5	232	384	296	385
761	388								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	108	.013	118	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
108	118	60	60	60	0	0

CROSS SECTION OUTPUT Profile #2 yr

E.G. Elev (ft)	380.11	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.22	Wt. n-Val.		0.013	
W.S. Elev (ft)	379.89	Reach Len. (ft)	60.00	60.00	60.00
Crit W.S. (ft)	378.87	Flow Area (sq ft)		23.65	
E.G. Slope (ft/ft)	0.000576	Area (sq ft)		23.65	
Q Total (cfs)	89.00	Flow (cfs)		89.00	
Top Width (ft)	10.00	Top Width (ft)		10.00	
Vel Total (ft/s)	3.76	Avg. Vel. (ft/s)		3.76	
Max Chl Dpth (ft)	2.37	Hydr. Depth (ft)		2.37	
Conv. Total (cfs)	3707.0	Conv. (cfs)		3707.0	
Length Wtd. (ft)	60.00	Wetted Per. (ft)		14.73	
Min Ch El (ft)	377.52	Shear (lb/sq ft)		0.06	
Alpha	1.00	Stream Power (lb/ft s)		0.22	
Frctn Loss (ft)		Cum Volume (acre-ft)	0.63	0.80	0.33
C & E Loss (ft)		Cum SA (acres)	0.78	0.36	0.50

CROSS SECTION OUTPUT Profile #10 yr

E.G. Elev (ft)	382.27	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.40	Wt. n-Val.		0.013	
W.S. Elev (ft)	381.87	Reach Len. (ft)	60.00	60.00	60.00
Crit W.S. (ft)	380.00	Flow Area (sq ft)		43.50	
E.G. Slope (ft/ft)	0.000647	Area (sq ft)		43.50	
Q Total (cfs)	222.00	Flow (cfs)		222.00	
Top Width (ft)	10.00	Top Width (ft)		10.00	
Vel Total (ft/s)	5.10	Avg. Vel. (ft/s)		5.10	
Max Chl Dpth (ft)	4.35	Hydr. Depth (ft)		4.35	
Conv. Total (cfs)	8729.8	Conv. (cfs)		8729.8	
Length Wtd. (ft)	60.00	Wetted Per. (ft)		18.70	
Min Ch El (ft)	377.52	Shear (lb/sq ft)		0.09	
Alpha	1.00	Stream Power (lb/ft s)		0.48	
Frctn Loss (ft)		Cum Volume (acre-ft)	1.08	1.08	0.73
C & E Loss (ft)		Cum SA (acres)	1.94	0.38	0.95

CROSS SECTION OUTPUT Profile #25 yr

E.G. Elev (ft)	384.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.45	Wt. n-Val.		0.013	
W.S. Elev (ft)	383.68	Reach Len. (ft)	60.00	60.00	60.00
Crit W.S. (ft)	380.74	Flow Area (sq ft)		61.56	
E.G. Slope (ft/ft)	0.000568	Area (sq ft)		61.56	
Q Total (cfs)	330.00	Flow (cfs)		330.00	
Top Width (ft)	10.00	Top Width (ft)		10.00	
Vel Total (ft/s)	5.36	Avg. Vel. (ft/s)		5.36	
Max Chl Dpth (ft)	6.16	Hydr. Depth (ft)		6.16	
Conv. Total (cfs)	13840.6	Conv. (cfs)		13840.6	
Length Wtd. (ft)	60.00	Wetted Per. (ft)		22.31	
Min Ch El (ft)	377.52	Shear (lb/sq ft)		0.10	
Alpha	1.00	Stream Power (lb/ft s)		0.52	
Frctn Loss (ft)		Cum Volume (acre-ft)	1.56	1.19	0.97
C & E Loss (ft)		Cum SA (acres)	2.19	0.38	1.11

CROSS SECTION OUTPUT Profile #50 yr

E.G. Elev (ft)	384.68	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.72	Wt. n-Val.		0.013	
W.S. Elev (ft)	383.96	Reach Len. (ft)	60.00	60.00	60.00
Crit W.S. (ft)	381.41	Flow Area (sq ft)		64.37	
E.G. Slope (ft/ft)	0.000892	Area (sq ft)		64.37	
Q Total (cfs)	438.00	Flow (cfs)		438.00	
Top Width (ft)	10.00	Top Width (ft)		10.00	
Vel Total (ft/s)	6.80	Avg. Vel. (ft/s)		6.80	
Max Chl Dpth (ft)	6.44	Hydr. Depth (ft)		6.44	
Conv. Total (cfs)	14665.3	Conv. (cfs)		14665.3	
Length Wtd. (ft)	60.00	Wetted Per. (ft)		22.87	
Min Ch El (ft)	377.52	Shear (lb/sq ft)		0.16	
Alpha	1.00	Stream Power (lb/ft s)		1.07	
Frctn Loss (ft)		Cum Volume (acre-ft)	2.12	1.40	1.23
C & E Loss (ft)		Cum SA (acres)	2.38	0.38	1.22

CROSS SECTION OUTPUT Profile #100 yr

E.G. Elev (ft)	384.89	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.24	Wt. n-Val.		0.013	
W.S. Elev (ft)	383.65	Reach Len. (ft)	60.00	60.00	60.00
Crit W.S. (ft)	382.04	Flow Area (sq ft)		61.31	
E.G. Slope (ft/ft)	0.001584	Area (sq ft)		61.31	
Q Total (cfs)	548.00	Flow (cfs)		548.00	
Top Width (ft)	10.00	Top Width (ft)		10.00	
Vel Total (ft/s)	8.94	Avg. Vel. (ft/s)		8.94	
Max Chl Dpth (ft)	6.13	Hydr. Depth (ft)		6.13	
Conv. Total (cfs)	13769.9	Conv. (cfs)		13769.9	
Length Wtd. (ft)	60.00	Wetted Per. (ft)		22.26	
Min Ch El (ft)	377.52	Shear (lb/sq ft)		0.27	
Alpha	1.00	Stream Power (lb/ft s)		2.43	
Frctn Loss (ft)		Cum Volume (acre-ft)	2.03	1.65	1.25
C & E Loss (ft)		Cum SA (acres)	2.40	0.38	1.24

CROSS SECTION OUTPUT Profile #500 yr

E.G. Elev (ft)	386.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	3.15	Wt. n-Val.		0.013	
W.S. Elev (ft)	383.82	Reach Len. (ft)	60.00	60.00	60.00
Crit W.S. (ft)	383.82	Flow Area (sq ft)		62.98	
E.G. Slope (ft/ft)	0.003958	Area (sq ft)		62.98	
Q Total (cfs)	897.00	Flow (cfs)		897.00	
Top Width (ft)	10.00	Top Width (ft)		10.00	
Vel Total (ft/s)	14.24	Avg. Vel. (ft/s)		14.24	
Max Chl Dpth (ft)	6.30	Hydr. Depth (ft)		6.30	
Conv. Total (cfs)	14257.0	Conv. (cfs)		14257.0	
Length Wtd. (ft)	60.00	Wetted Per. (ft)		22.60	
Min Ch El (ft)	377.52	Shear (lb/sq ft)		0.69	
Alpha	1.00	Stream Power (lb/ft s)		9.81	
Frctn Loss (ft)		Cum Volume (acre-ft)	2.77	3.01	1.66
C & E Loss (ft)		Cum SA (acres)	2.61	0.38	1.39

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CULVERT

RIVER: Unnamed Tributar
REACH: 1 RS: 3039

INPUT
Description: pipe under Lee HWY
Distance from Upstream XS = 2
Deck/Roadway Width = 56
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 9

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	387	0	42.64	386	0	87	385	0
108	384.62	0	118	384.62	0	165	384.5	0
232	384	0	296	385	0	761	388	0

Upstream Bridge Cross Section Data

Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	387	42.64	386	87	385	108	384.62	108	377.52
118	377.52	118	384.62	165	384.5	232	384	296	385
761	388								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	108	.013	118	.03

Bank Sta: Left	Right	Coeff Contr.	Expan.
108	118	0	0

Downstream Deck/Roadway Coordinates
num= 9

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	387	0	42.64	386	0	87	385	0
108	384.35	0	118	384.35	0	165	384.5	0
232	384	0	296	385	0	761	388	0

Downstream Bridge Cross Section Data
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	387	42.64	386	87	385	108	384.35	108	375
118	375	118	384.35	165	384.5	232	384	296	385
761	388								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	108	.013	118	.03

Bank Sta: Left	Right	Coeff Contr.	Expan.
108	118	0	0

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Box	4	8

FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 2 - Inlet edges beveled 1/2 inch at 45 degrees (1:1)
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	2	56	.013	.013	0	.3	.5

Upstream Elevation = 377.52
Centerline Station = 114
Downstream Elevation = 376.27
Centerline Station = 113

CULVERT OUTPUT Profile #2 yr Culv Group: Culvert #1

Q Culv Group (cfs)	89.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	7.10
Q Barrel (cfs)	89.00	Culv Vel DS (ft/s)	11.54
E.G. US. (ft)	380.11	Culv Inv El Up (ft)	377.52
W.S. US. (ft)	379.89	Culv Inv El Dn (ft)	376.27
E.G. DS (ft)	377.43	Culv Frctn Ls (ft)	0.00
W.S. DS (ft)	377.17	Culv Exit Loss (ft)	1.87
Delta EG (ft)	2.68	Culv Entr Loss (ft)	0.24
Delta WS (ft)	2.72	Q Weir (cfs)	
E.G. IC (ft)	379.99	Weir Sta Lft (ft)	
E.G. OC (ft)	380.11	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	379.09	Weir Max Depth (ft)	
Culv WS Outlet (ft)	377.23	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	0.84	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	1.57	Min El Weir Flow (ft)	384.01

Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #10 yr Culv Group: Culvert #1

Q Culv Group (cfs)	222.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	9.63
Q Barrel (cfs)	222.00	Culv Vel DS (ft/s)	14.30
E.G. US. (ft)	382.28	Culv Inv El Up (ft)	377.52
W.S. US. (ft)	381.87	Culv Inv El Dn (ft)	376.27
E.G. DS (ft)	379.47	Culv Frctn Ls (ft)	0.00
W.S. DS (ft)	378.99	Culv Exit Loss (ft)	1.92
Delta EG (ft)	2.81	Culv Entr Loss (ft)	0.43
Delta WS (ft)	2.88	Q Weir (cfs)	
E.G. IC (ft)	382.06	Weir Sta Lft (ft)	
E.G. OC (ft)	382.28	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	380.40	Weir Max Depth (ft)	
Culv WS Outlet (ft)	378.21	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	1.52	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	2.88	Min El Weir Flow (ft)	384.01

Note: During the supercritical calculations a hydraulic jump occurred at the outlet of (leaving) the culvert.
Warning: During the supercritical analysis, the program could not converge on a supercritical answer in the downstream cross section. The program used the solution with the least error.
Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #25 yr Culv Group: Culvert #1

Q Culv Group (cfs)	329.16	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	10.29
Q Barrel (cfs)	329.16	Culv Vel DS (ft/s)	16.68
E.G. US. (ft)	384.12	Culv Inv El Up (ft)	377.52
W.S. US. (ft)	383.68	Culv Inv El Dn (ft)	376.27
E.G. DS (ft)	380.82	Culv Frctn Ls (ft)	0.01
W.S. DS (ft)	380.19	Culv Exit Loss (ft)	2.24
Delta EG (ft)	3.30	Culv Entr Loss (ft)	0.49
Delta WS (ft)	3.48	Q Weir (cfs)	0.84

E.G. IC (ft)	384.12	Weir Sta Lft (ft)	216.40
E.G. OC (ft)	383.70	Weir Sta Rgt (ft)	239.45
Culvert Control	Inlet	Weir Submerg	0.00
Culv WS Inlet (ft)	381.52	Weir Max Depth (ft)	0.12
Culv WS Outlet (ft)	378.74	Weir Avg Depth (ft)	0.06
Culv Nml Depth (ft)	1.99	Weir Flow Area (sq ft)	1.34
Culv Crt Depth (ft)	3.75	Min El Weir Flow (ft)	384.01

Warning: The flow through the culvert is supercritical. However, since there is flow over the road (weir flow), the program cannot determine if the downstream cross section should be subcritical or supercritical. The program used the downstream subcritical answer, even though it may not be valid.

Warning: During the supercritical analysis, the program could not converge on a supercritical answer in the downstream cross section. The program used the solution with the least error.

Warning: During the culvert outlet control computations, the program could not balance the culvert/weir flow. The reported outlet energy grade answer may not be valid.

Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #50 yr Culv Group: Culvert #1

Q Culv Group (cfs)	355.54	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	11.11
Q Barrel (cfs)	355.54	Culv Vel DS (ft/s)	17.30
E.G. US. (ft)	384.68	Culv Inv El Up (ft)	377.52
W.S. US. (ft)	383.96	Culv Inv El Dn (ft)	376.27
E.G. DS (ft)	381.45	Culv Frctn Ls (ft)	0.27
W.S. DS (ft)	380.44	Culv Exit Loss (ft)	2.04
Delta EG (ft)	3.23	Culv Entr Loss (ft)	0.58
Delta WS (ft)	3.52	Q Weir (cfs)	82.46
E.G. IC (ft)	384.68	Weir Sta Lft (ft)	103.79
E.G. OC (ft)	384.03	Weir Sta Rgt (ft)	276.55
Culvert Control	Inlet	Weir Submerg	0.00
Culv WS Inlet (ft)	381.52	Weir Max Depth (ft)	0.70
Culv WS Outlet (ft)	378.84	Weir Avg Depth (ft)	0.31
Culv Nml Depth (ft)	2.10	Weir Flow Area (sq ft)	52.72
Culv Crt Depth (ft)	3.94	Min El Weir Flow (ft)	384.01

Warning: The flow through the culvert is supercritical. However, since there is flow over the road (weir flow), the program cannot determine if the downstream cross section should be subcritical or supercritical. The program used the downstream subcritical answer, even though it may not be valid.

Warning: During the culvert outlet control computations, the program could not balance the culvert/weir flow. The reported outlet energy grade answer may not be valid.

Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #100 yr Culv Group: Culvert #1

Q Culv Group (cfs)	380.40	Culv Full Len (ft)	56.00
# Barrels	1	Culv Vel US (ft/s)	11.89
Q Barrel (cfs)	380.40	Culv Vel DS (ft/s)	11.89
E.G. US. (ft)	384.89	Culv Inv El Up (ft)	377.52
W.S. US. (ft)	383.65	Culv Inv El Dn (ft)	376.27
E.G. DS (ft)	383.17	Culv Frctn Ls (ft)	0.41
W.S. DS (ft)	382.29	Culv Exit Loss (ft)	0.66
Delta EG (ft)	1.72	Culv Entr Loss (ft)	0.66
Delta WS (ft)	1.36	Q Weir (cfs)	167.60
E.G. IC (ft)	384.92	Weir Sta Lft (ft)	92.42

E.G. OC (ft)	384.90	Weir Sta Rgt (ft)	289.72
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	381.52	Weir Max Depth (ft)	0.90
Culv WS Outlet (ft)	380.27	Weir Avg Depth (ft)	0.46
Culv Nml Depth (ft)	2.20	Weir Flow Area (sq ft)	90.79
Culv Crt Depth (ft)	4.00	Min El Weir Flow (ft)	384.01

Note: Culvert critical depth exceeds the height of the culvert.
Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note: During the supercritical calculations a hydraulic jump occurred at the inlet of (going into) the culvert.
Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations are not valid and the supercritical result has been discarded. The outlet answer will be used.

CULVERT OUTPUT Profile #500 yr Culv Group: Culvert #1

Q Culv Group (cfs)	274.59	Culv Full Len (ft)	56.00
# Barrels	1	Culv Vel US (ft/s)	8.58
Q Barrel (cfs)	274.59	Culv Vel DS (ft/s)	8.58
E.G. US. (ft)	386.97	Culv Inv El Up (ft)	377.52
W.S. US. (ft)	383.82	Culv Inv El Dn (ft)	376.27
E.G. DS (ft)	384.97	Culv Frctn Ls (ft)	0.22
W.S. DS (ft)	383.03	Culv Exit Loss (ft)	0.00
Delta EG (ft)	2.00	Culv Entr Loss (ft)	0.34
Delta WS (ft)	0.79	Q Weir (cfs)	622.41
E.G. IC (ft)	385.39	Weir Sta Lft (ft)	64.10
E.G. OC (ft)	385.53	Weir Sta Rgt (ft)	376.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	381.52	Weir Max Depth (ft)	1.52
Culv WS Outlet (ft)	380.27	Weir Avg Depth (ft)	0.79
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	245.15
Culv Crt Depth (ft)	3.32	Min El Weir Flow (ft)	384.01

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.
Note: During the supercritical calculations a hydraulic jump occurred at the inlet of (going into) the culvert.

CROSS SECTION

RIVER: Unnamed Tributar
REACH: 1 RS: 3009

INPUT
Description: Drop Inlet Ex 1778
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	387	42.64	386	87	385	108	384.35	108	375
118	375	118	384.35	165	384.5	232	384	296	385
761	388								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	108	.013	118	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
108	118	185	185	185	0	0

CROSS SECTION OUTPUT Profile #2 yr

E.G. Elev (ft)	378.77	Element	Left OB	Channel	Right OB
Vel Head (ft)	3.14	Wt. n-Val.		0.013	
W.S. Elev (ft)	375.63	Reach Len. (ft)	185.00	185.00	185.00
Crit W.S. (ft)	376.35	Flow Area (sq ft)		6.26	
E.G. Slope (ft/ft)	0.033805	Area (sq ft)		6.26	
Q Total (cfs)	89.00	Flow (cfs)		89.00	
Top Width (ft)	10.00	Top Width (ft)		10.00	
Vel Total (ft/s)	14.22	Avg. Vel. (ft/s)		14.22	
Max Chl Dpth (ft)	0.63	Hydr. Depth (ft)		0.63	
Conv. Total (cfs)	484.1	Conv. (cfs)		484.1	
Length Wtd. (ft)	185.00	Wetted Per. (ft)		11.25	
Min Ch El (ft)	375.00	Shear (lb/sq ft)		1.17	
Alpha	1.00	Stream Power (lb/ft s)		16.69	
Frctn Loss (ft)		Cum Volume (acre-ft)	0.63	0.79	0.33
C & E Loss (ft)		Cum SA (acres)	0.78	0.34	0.50

CROSS SECTION OUTPUT Profile #10 yr

E.G. Elev (ft)	379.47	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.48	Wt. n-Val.		0.013	
W.S. Elev (ft)	378.99	Reach Len. (ft)	185.00	185.00	185.00
Crit W.S. (ft)	377.47	Flow Area (sq ft)		39.88	
E.G. Slope (ft/ft)	0.000819	Area (sq ft)		39.88	
Q Total (cfs)	222.00	Flow (cfs)		222.00	
Top Width (ft)	10.00	Top Width (ft)		10.00	
Vel Total (ft/s)	5.57	Avg. Vel. (ft/s)		5.57	
Max Chl Dpth (ft)	3.99	Hydr. Depth (ft)		3.99	
Conv. Total (cfs)	7755.1	Conv. (cfs)		7755.1	
Length Wtd. (ft)	185.00	Wetted Per. (ft)		17.98	
Min Ch El (ft)	375.00	Shear (lb/sq ft)		0.11	
Alpha	1.00	Stream Power (lb/ft s)		0.63	
Frctn Loss (ft)		Cum Volume (acre-ft)	1.08	1.05	0.73
C & E Loss (ft)		Cum SA (acres)	1.94	0.36	0.95

CROSS SECTION OUTPUT Profile #25 yr

E.G. Elev (ft)	380.82	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.63	Wt. n-Val.		0.013	
W.S. Elev (ft)	380.19	Reach Len. (ft)	185.00	185.00	185.00
Crit W.S. (ft)	378.22	Flow Area (sq ft)		51.95	
E.G. Slope (ft/ft)	0.000888	Area (sq ft)		51.95	
Q Total (cfs)	330.00	Flow (cfs)		330.00	
Top Width (ft)	10.00	Top Width (ft)		10.00	
Vel Total (ft/s)	6.35	Avg. Vel. (ft/s)		6.35	
Max Chl Dpth (ft)	5.19	Hydr. Depth (ft)		5.19	
Conv. Total (cfs)	11076.4	Conv. (cfs)		11076.4	
Length Wtd. (ft)	185.00	Wetted Per. (ft)		20.39	
Min Ch El (ft)	375.00	Shear (lb/sq ft)		0.14	
Alpha	1.00	Stream Power (lb/ft s)		0.90	
Frctn Loss (ft)		Cum Volume (acre-ft)	1.56	1.16	0.97
C & E Loss (ft)		Cum SA (acres)	2.19	0.36	1.11

CROSS SECTION OUTPUT Profile #50 yr

E.G. Elev (ft)	381.45	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.01	Wt. n-Val.		0.013	
W.S. Elev (ft)	380.44	Reach Len. (ft)	185.00	185.00	185.00
Crit W.S. (ft)	378.90	Flow Area (sq ft)		54.38	
E.G. Slope (ft/ft)	0.001385	Area (sq ft)		54.38	
Q Total (cfs)	438.00	Flow (cfs)		438.00	
Top Width (ft)	10.00	Top Width (ft)		10.00	
Vel Total (ft/s)	8.05	Avg. Vel. (ft/s)		8.05	
Max Chl Dpth (ft)	5.44	Hydr. Depth (ft)		5.44	
Conv. Total (cfs)	11768.6	Conv. (cfs)		11768.6	
Length Wtd. (ft)	185.00	Wetted Per. (ft)		20.88	
Min Ch El (ft)	375.00	Shear (lb/sq ft)		0.23	
Alpha	1.00	Stream Power (lb/ft s)		1.81	
Frctn Loss (ft)		Cum Volume (acre-ft)	2.12	1.30	1.23
C & E Loss (ft)		Cum SA (acres)	2.38	0.36	1.22

CROSS SECTION OUTPUT Profile #100 yr

E.G. Elev (ft)	383.17	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.88	Wt. n-Val.		0.013	
W.S. Elev (ft)	382.29	Reach Len. (ft)	185.00	185.00	185.00
Crit W.S. (ft)	379.52	Flow Area (sq ft)		72.92	
E.G. Slope (ft/ft)	0.001014	Area (sq ft)		72.92	
Q Total (cfs)	548.00	Flow (cfs)		548.00	
Top Width (ft)	10.00	Top Width (ft)		10.00	
Vel Total (ft/s)	7.52	Avg. Vel. (ft/s)		7.52	
Max Chl Dpth (ft)	7.29	Hydr. Depth (ft)		7.29	
Conv. Total (cfs)	17205.7	Conv. (cfs)		17205.7	
Length Wtd. (ft)	185.00	Wetted Per. (ft)		24.58	
Min Ch El (ft)	375.00	Shear (lb/sq ft)		0.19	
Alpha	1.00	Stream Power (lb/ft s)		1.41	
Frctn Loss (ft)		Cum Volume (acre-ft)	2.03	1.48	1.25
C & E Loss (ft)		Cum SA (acres)	2.40	0.36	1.24

CROSS SECTION OUTPUT Profile #500 yr

E.G. Elev (ft)	384.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.94	Wt. n-Val.		0.013	
W.S. Elev (ft)	383.03	Reach Len. (ft)	185.00	185.00	185.00
Crit W.S. (ft)	381.28	Flow Area (sq ft)		80.29	
E.G. Slope (ft/ft)	0.002131	Area (sq ft)		80.29	
Q Total (cfs)	897.00	Flow (cfs)		897.00	
Top Width (ft)	10.00	Top Width (ft)		10.00	
Vel Total (ft/s)	11.17	Avg. Vel. (ft/s)		11.17	
Max Chl Dpth (ft)	8.03	Hydr. Depth (ft)		8.03	
Conv. Total (cfs)	19431.7	Conv. (cfs)		19431.7	
Length Wtd. (ft)	185.00	Wetted Per. (ft)		26.06	
Min Ch El (ft)	375.00	Shear (lb/sq ft)		0.41	
Alpha	1.00	Stream Power (lb/ft s)		4.58	
Frctn Loss (ft)		Cum Volume (acre-ft)	2.77	2.64	1.66
C & E Loss (ft)		Cum SA (acres)	2.61	0.36	1.39

CULVERT

RIVER: Unnamed Tributar
REACH: 1 RS: 2916

INPUT
Description: second exist elipt pipe
Distance from Upstream XS = 2
Deck/Roadway Width = 181
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 9

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	387	0	42	386	0	87	385	0
108	384.35	0	118	384.35	0	165	384.5	0
232	384	0	296	385	0	761	388	0

Upstream Bridge Cross Section Data
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	387	42.64	386	87	385	108	384.35	108	375
118	375	118	384.35	165	384.5	232	384	296	385
761	388								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	108	.013	118	.03

Bank Sta: Left Right Coeff Contr. Expan.
108 118 0 0

Downstream Deck/Roadway Coordinates
num= 6

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	382.5	0	60	381.65	0	64	380.42	0
72	380.42	0	105	383	0	165	385	0

Downstream Bridge Cross Section Data
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	382.5	60	381.65	64	380.42	64	372.5	74	372.5
74	380.42	105	383	165	385				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	64	.013	74	.03

Bank Sta: Left Right Coeff Contr. Expan.
64 74 0 0

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins =
Energy head used in spillway design =

Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name Shape Rise Span
Culvert #1 Box 5 10
FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 2 - Inlet edges beveled 1/2 inch at 45 degrees (1:1)
Solution Criteria = Highest U.S. EG

Culvert Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
2	181	.013	.013	0	.6	1

Upstream Elevation = 375
Centerline Station = 115
Downstream Elevation = 372.5
Centerline Station = 67

CULVERT OUTPUT Profile #2 yr Culv Group: Culvert #1

Q Culv Group (cfs)	89.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	6.59
Q Barrel (cfs)	89.00	Culv Vel DS (ft/s)	10.68
E.G. US. (ft)	377.43	Culv Inv El Up (ft)	375.00
W.S. US. (ft)	377.17	Culv Inv El Dn (ft)	372.50
E.G. DS (ft)	374.67	Culv Frctn Ls (ft)	0.00
W.S. DS (ft)	374.23	Culv Exit Loss (ft)	0.44
Delta EG (ft)	2.76	Culv Entr Loss (ft)	0.41
Delta WS (ft)	2.94	Q Weir (cfs)	
E.G. IC (ft)	377.13	Weir Sta Lft (ft)	
E.G. OC (ft)	377.43	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	376.35	Weir Max Depth (ft)	
Culv WS Outlet (ft)	373.33	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	0.83	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	1.35	Min El Weir Flow (ft)	384.01

Note: During supercritical analysis, the culvert direct step method went to normal depth. The program then assumed normal depth at the outlet.
Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #10 yr Culv Group: Culvert #1

Q Culv Group (cfs)	222.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	8.94
Q Barrel (cfs)	222.00	Culv Vel DS (ft/s)	13.96
E.G. US. (ft)	379.47	Culv Inv El Up (ft)	375.00
W.S. US. (ft)	378.99	Culv Inv El Dn (ft)	372.50
E.G. DS (ft)	376.48	Culv Frctn Ls (ft)	0.00
W.S. DS (ft)	375.68	Culv Exit Loss (ft)	0.63
Delta EG (ft)	2.99	Culv Entr Loss (ft)	0.75
Delta WS (ft)	3.31	Q Weir (cfs)	
E.G. IC (ft)	378.91	Weir Sta Lft (ft)	
E.G. OC (ft)	379.47	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	377.48	Weir Max Depth (ft)	
Culv WS Outlet (ft)	374.09	Weir Avg Depth (ft)	

Culv Nml Depth (ft)	1.51	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	2.48	Min El Weir Flow (ft)	384.01

Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #25 yr Culv Group: Culvert #1

Q Culv Group (cfs)	330.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	10.20
Q Barrel (cfs)	330.00	Culv Vel DS (ft/s)	15.50
E.G. US. (ft)	380.82	Culv Inv El Up (ft)	375.00
W.S. US. (ft)	380.19	Culv Inv El Dn (ft)	372.50
E.G. DS (ft)	377.71	Culv Frctn Ls (ft)	0.00
W.S. DS (ft)	376.66	Culv Exit Loss (ft)	0.66
Delta EG (ft)	3.12	Culv Entr Loss (ft)	0.97
Delta WS (ft)	3.53	Q Weir (cfs)	
E.G. IC (ft)	380.09	Weir Sta Lft (ft)	
E.G. OC (ft)	380.82	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	378.23	Weir Max Depth (ft)	
Culv WS Outlet (ft)	374.63	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	1.95	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	3.23	Min El Weir Flow (ft)	384.01

Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #50 yr Culv Group: Culvert #1

Q Culv Group (cfs)	438.00	Culv Full Len (ft)	53.59
# Barrels	1	Culv Vel US (ft/s)	11.21
Q Barrel (cfs)	438.00	Culv Vel DS (ft/s)	8.76
E.G. US. (ft)	381.45	Culv Inv El Up (ft)	375.00
W.S. US. (ft)	380.44	Culv Inv El Dn (ft)	372.50
E.G. DS (ft)	379.07	Culv Frctn Ls (ft)	0.16
W.S. DS (ft)	378.08	Culv Exit Loss (ft)	0.20
Delta EG (ft)	2.38	Culv Entr Loss (ft)	0.59
Delta WS (ft)	2.36	Q Weir (cfs)	
E.G. IC (ft)	381.45	Weir Sta Lft (ft)	
E.G. OC (ft)	382.03	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	378.91	Weir Max Depth (ft)	
Culv WS Outlet (ft)	377.50	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	2.37	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	3.91	Min El Weir Flow (ft)	384.01

Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.

CULVERT OUTPUT Profile #100 yr Culv Group: Culvert #1

Q Culv Group (cfs)	548.00	Culv Full Len (ft)	172.53
# Barrels	1	Culv Vel US (ft/s)	12.30
Q Barrel (cfs)	548.00	Culv Vel DS (ft/s)	17.57
E.G. US. (ft)	383.17	Culv Inv El Up (ft)	375.00
W.S. US. (ft)	382.29	Culv Inv El Dn (ft)	372.50

E.G. DS (ft)	379.31	Culv Frctn Ls (ft)	0.80
W.S. DS (ft)	377.11	Culv Exit Loss (ft)	1.11
Delta EG (ft)	3.86	Culv Entr Loss (ft)	1.36
Delta WS (ft)	5.18	Q Weir (cfs)	
E.G. IC (ft)		Weir Sta Lft (ft)	
E.G. OC (ft)		Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	379.46	Weir Max Depth (ft)	
Culv WS Outlet (ft)	375.62	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	2.77	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	4.54	Min El Weir Flow (ft)	384.01

CULVERT OUTPUT Profile #500 yr Culv Group: Culvert #1

Q Culv Group (cfs)	659.38	Culv Full Len (ft)	181.00
# Barrels	1	Culv Vel US (ft/s)	13.19
Q Barrel (cfs)	659.38	Culv Vel DS (ft/s)	13.19
E.G. US. (ft)	384.97	Culv Inv El Up (ft)	375.00
W.S. US. (ft)	383.03	Culv Inv El Dn (ft)	372.50
E.G. DS (ft)	382.13	Culv Frctn Ls (ft)	1.22
W.S. DS (ft)	378.92	Culv Exit Loss (ft)	0.00
Delta EG (ft)	2.84	Culv Entr Loss (ft)	1.62
Delta WS (ft)	4.11	Q Weir (cfs)	237.62
E.G. IC (ft)	384.94	Weir Sta Lft (ft)	87.64
E.G. OC (ft)	384.97	Weir Sta Rgt (ft)	294.74
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	380.00	Weir Max Depth (ft)	0.98
Culv WS Outlet (ft)	377.50	Weir Avg Depth (ft)	0.57
Culv Nml Depth (ft)	3.16	Weir Flow Area (sq ft)	118.49
Culv Crt Depth (ft)	5.00	Min El Weir Flow (ft)	384.01

Note: Culvert critical depth exceeds the height of the culvert.
Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note: During the supercritical calculations a hydraulic jump occurred at the inlet of (going into) the culvert.
Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations are not valid and the supercritical result has been discarded. The outlet answer will be used.

CROSS SECTION

RIVER: Unnamed Tributar
REACH: 1 RS: 2824

INPUT
Description: Drop Inlet Ex 1731
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	382.5	60	381.65	64	380.42	64	372.5	74	372.5
74	380.42	105	383	165	385				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	64	.013	74	.03

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

64 74 304 304 304 0 0

CROSS SECTION OUTPUT Profile #2 yr

E.G. Elev (ft)	375.10	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.76	Wt. n-Val.		0.013	
W.S. Elev (ft)	373.34	Reach Len. (ft)	304.00	304.00	304.00
Crit W.S. (ft)	373.85	Flow Area (sq ft)		8.36	
E.G. Slope (ft/ft)	0.014450	Area (sq ft)		8.36	
Q Total (cfs)	92.00	Flow (cfs)		89.00	
Top Width (ft)	10.00	Top Width (ft)		10.00	
Vel Total (ft/s)	10.64	Avg. Vel. (ft/s)		10.64	
Max Chl Dpth (ft)	0.84	Hydr. Depth (ft)		0.84	
Conv. Total (cfs)	765.3	Conv. (cfs)		765.3	
Length Wtd. (ft)	304.00	Wetted Per. (ft)		11.67	
Min Ch El (ft)	372.50	Shear (lb/sq ft)		0.65	
Alpha	1.00	Stream Power (lb/ft s)		6.88	
Frctn Loss (ft)		Cum Volume (acre-ft)	0.63	0.75	0.33
C & E Loss (ft)		Cum SA (acres)	0.78	0.30	0.50

CROSS SECTION OUTPUT Profile #10 yr

E.G. Elev (ft)	377.11	Element	Left OB	Channel	Right OB
Vel Head (ft)	3.02	Wt. n-Val.		0.013	
W.S. Elev (ft)	374.09	Reach Len. (ft)	304.00	304.00	304.00
Crit W.S. (ft)	374.98	Flow Area (sq ft)		15.93	
E.G. Slope (ft/ft)	0.012284	Area (sq ft)		15.93	
Q Total (cfs)	229.00	Flow (cfs)		222.00	
Top Width (ft)	10.00	Top Width (ft)		10.00	
Vel Total (ft/s)	13.93	Avg. Vel. (ft/s)		13.93	
Max Chl Dpth (ft)	1.59	Hydr. Depth (ft)		1.59	
Conv. Total (cfs)	2066.1	Conv. (cfs)		2066.1	
Length Wtd. (ft)	304.00	Wetted Per. (ft)		13.19	
Min Ch El (ft)	372.50	Shear (lb/sq ft)		0.93	
Alpha	1.00	Stream Power (lb/ft s)		12.91	
Frctn Loss (ft)		Cum Volume (acre-ft)	1.08	0.98	0.73
C & E Loss (ft)		Cum SA (acres)	1.94	0.32	0.95

CROSS SECTION OUTPUT Profile #25 yr

E.G. Elev (ft)	378.36	Element	Left OB	Channel	Right OB
Vel Head (ft)	3.72	Wt. n-Val.		0.013	
W.S. Elev (ft)	374.63	Reach Len. (ft)	304.00	304.00	304.00
Crit W.S. (ft)	375.73	Flow Area (sq ft)		21.32	
E.G. Slope (ft/ft)	0.011457	Area (sq ft)		21.32	
Q Total (cfs)	341.00	Flow (cfs)		330.00	
Top Width (ft)	10.00	Top Width (ft)		10.00	
Vel Total (ft/s)	15.48	Avg. Vel. (ft/s)		15.48	
Max Chl Dpth (ft)	2.13	Hydr. Depth (ft)		2.13	
Conv. Total (cfs)	3185.9	Conv. (cfs)		3185.9	
Length Wtd. (ft)	304.00	Wetted Per. (ft)		14.26	
Min Ch El (ft)	372.50	Shear (lb/sq ft)		1.07	
Alpha	1.00	Stream Power (lb/ft s)		16.55	
Frctn Loss (ft)		Cum Volume (acre-ft)	1.56	1.06	0.97
C & E Loss (ft)		Cum SA (acres)	2.19	0.32	1.11

CROSS SECTION OUTPUT Profile #50 yr

E.G. Elev (ft)	379.07	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.99	Wt. n-Val.		0.013	
W.S. Elev (ft)	378.08	Reach Len. (ft)	304.00	304.00	304.00
Crit W.S. (ft)	376.44	Flow Area (sq ft)		55.81	
E.G. Slope (ft/ft)	0.001336	Area (sq ft)		55.81	
Q Total (cfs)	445.00	Flow (cfs)		445.00	
Top Width (ft)	10.00	Top Width (ft)		10.00	
Vel Total (ft/s)	7.97	Avg. Vel. (ft/s)		7.97	
Max Chl Dpth (ft)	5.58	Hydr. Depth (ft)		5.58	
Conv. Total (cfs)	12176.3	Conv. (cfs)		12176.3	
Length Wtd. (ft)	304.00	Wetted Per. (ft)		21.16	
Min Ch El (ft)	372.50	Shear (lb/sq ft)		0.22	
Alpha	1.00	Stream Power (lb/ft s)		1.75	
Frctn Loss (ft)		Cum Volume (acre-ft)	2.12	1.15	1.23
C & E Loss (ft)		Cum SA (acres)	2.38	0.32	1.22

CROSS SECTION OUTPUT Profile #100 yr

E.G. Elev (ft)	380.39	Element	Left OB	Channel	Right OB
Vel Head (ft)	4.76	Wt. n-Val.		0.013	
W.S. Elev (ft)	375.63	Reach Len. (ft)	304.00	304.00	304.00
Crit W.S. (ft)	377.02	Flow Area (sq ft)		31.30	
E.G. Slope (ft/ft)	0.010418	Area (sq ft)		31.30	
Q Total (cfs)	565.00	Flow (cfs)		548.00	
Top Width (ft)	10.00	Top Width (ft)		10.00	
Vel Total (ft/s)	17.51	Avg. Vel. (ft/s)		17.51	
Max Chl Dpth (ft)	3.13	Hydr. Depth (ft)		3.13	
Conv. Total (cfs)	5535.5	Conv. (cfs)		5535.5	
Length Wtd. (ft)	304.00	Wetted Per. (ft)		16.26	
Min Ch El (ft)	372.50	Shear (lb/sq ft)		1.25	
Alpha	1.00	Stream Power (lb/ft s)		21.92	
Frctn Loss (ft)		Cum Volume (acre-ft)	2.03	1.33	1.25
C & E Loss (ft)		Cum SA (acres)	2.40	0.32	1.24

CROSS SECTION OUTPUT Profile #500 yr

E.G. Elev (ft)	382.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	3.21	Wt. n-Val.		0.013	
W.S. Elev (ft)	378.92	Reach Len. (ft)	304.00	304.00	304.00
Crit W.S. (ft)	378.92	Flow Area (sq ft)		64.20	
E.G. Slope (ft/ft)	0.003988	Area (sq ft)		64.20	
Q Total (cfs)	923.00	Flow (cfs)		923.00	
Top Width (ft)	10.00	Top Width (ft)		10.00	
Vel Total (ft/s)	14.38	Avg. Vel. (ft/s)		14.38	
Max Chl Dpth (ft)	6.42	Hydr. Depth (ft)		6.42	
Conv. Total (cfs)	14615.5	Conv. (cfs)		14615.5	
Length Wtd. (ft)	304.00	Wetted Per. (ft)		22.84	
Min Ch El (ft)	372.50	Shear (lb/sq ft)		0.70	
Alpha	1.00	Stream Power (lb/ft s)		10.06	
Frctn Loss (ft)		Cum Volume (acre-ft)	2.77	1.93	1.66
C & E Loss (ft)		Cum SA (acres)	2.61	0.32	1.39

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CULVERT

RIVER: Unnamed Tributar
REACH: 1 RS: 2633

INPUT
Description: existing eliptical pipe
Distance from Upstream XS = 2
Deck/Roadway Width = 299
Weir Coefficient = 3.1
Upstream Deck/Roadway Coordinates
num= 5
Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord
0 382.5 64 380.42 72 380.42
105 383 165 385

Upstream Bridge Cross Section Data
Station Elevation Data num= 8
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
0 382.5 60 381.65 64 380.42 64 372.5 74 372.5
74 380.42 105 383 165 385

Manning's n Values num= 3
Sta n Val Sta n Val Sta n Val
0 .03 64 .013 74 .03

Bank Sta: Left Right Coeff Contr. Expan.
64 74 0 0

Downstream Deck/Roadway Coordinates
num= 6
Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord
0 378 100 377 164 376.5
245 376.21 253 376.21 428 378

Downstream Bridge Cross Section Data
Station Elevation Data num= 9
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
0 378 100 377 164 376.5 245 376.21 245 368.5
255 368.5 255 376.21 293 377 428 378

Manning's n Values num= 3
Sta n Val Sta n Val Sta n Val
0 .03 245 .013 255 .03

Bank Sta: Left Right Coeff Contr. Expan.
245 255 0 0

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins =

Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name Shape Rise Span
Culvert #1 Box 5 10
FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 2 - Inlet edges beveled 1/2 inch at 45 degrees (1:1)
Solution Criteria = Highest U.S. EG

Culvert Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
2	299	.013	.013	0	.1	.3

Upstream Elevation = 372.5
Centerline Station = 68
Downstream Elevation = 368.5
Centerline Station = 250

CULVERT OUTPUT Profile #2 yr Culv Group: Culvert #1

Q Culv Group (cfs)	92.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	6.66
Q Barrel (cfs)	92.00	Culv Vel DS (ft/s)	3.52
E.G. US. (ft)	374.67	Culv Inv El Up (ft)	372.50
W.S. US. (ft)	374.23	Culv Inv El Dn (ft)	368.50
E.G. DS (ft)	371.31	Culv Frctn Ls (ft)	0.00
W.S. DS (ft)	371.11	Culv Exit Loss (ft)	0.00
Delta EG (ft)	3.37	Culv Entr Loss (ft)	0.10
Delta WS (ft)	3.11	Q Weir (cfs)	
E.G. IC (ft)	374.67	Weir Sta Lft (ft)	
E.G. OC (ft)	374.64	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	373.88	Weir Max Depth (ft)	
Culv WS Outlet (ft)	371.11	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	0.85	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	1.38	Min El Weir Flow (ft)	380.43

Note: During supercritical analysis, the culvert direct step method went to normal depth. The program then assumed normal depth at the outlet.
Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.

CULVERT OUTPUT Profile #10 yr Culv Group: Culvert #1

Q Culv Group (cfs)	229.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	9.03
Q Barrel (cfs)	229.00	Culv Vel DS (ft/s)	5.96
E.G. US. (ft)	376.49	Culv Inv El Up (ft)	372.50
W.S. US. (ft)	375.68	Culv Inv El Dn (ft)	368.50
E.G. DS (ft)	372.89	Culv Frctn Ls (ft)	0.00
W.S. DS (ft)	372.34	Culv Exit Loss (ft)	0.00
Delta EG (ft)	3.60	Culv Entr Loss (ft)	0.19
Delta WS (ft)	3.33	Q Weir (cfs)	
E.G. IC (ft)	376.49	Weir Sta Lft (ft)	
E.G. OC (ft)	376.43	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	375.04	Weir Max Depth (ft)	

Culv WS Outlet (ft)	372.34	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	1.54	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	2.54	Min El Weir Flow (ft)	380.43

Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.

CULVERT OUTPUT Profile #25 yr Culv Group: Culvert #1

Q Culv Group (cfs)	341.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	10.31
Q Barrel (cfs)	341.00	Culv Vel DS (ft/s)	16.19
E.G. US. (ft)	377.71	Culv Inv El Up (ft)	372.50
W.S. US. (ft)	376.66	Culv Inv El Dn (ft)	368.50
E.G. DS (ft)	373.71	Culv Frctn Ls (ft)	0.00
W.S. DS (ft)	372.66	Culv Exit Loss (ft)	0.97
Delta EG (ft)	4.00	Culv Entr Loss (ft)	0.25
Delta WS (ft)	4.00	Q Weir (cfs)	
E.G. IC (ft)	377.71	Weir Sta Lft (ft)	
E.G. OC (ft)	377.62	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	375.81	Weir Max Depth (ft)	
Culv WS Outlet (ft)	370.61	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	2.02	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	3.31	Min El Weir Flow (ft)	380.43

Warning: During the supercritical analysis, the program could not converge on a supercritical answer in the downstream cross section. The program used the solution with the least error.
Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #50 yr Culv Group: Culvert #1

Q Culv Group (cfs)	445.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	11.27
Q Barrel (cfs)	445.00	Culv Vel DS (ft/s)	17.38
E.G. US. (ft)	379.07	Culv Inv El Up (ft)	372.50
W.S. US. (ft)	378.08	Culv Inv El Dn (ft)	368.50
E.G. DS (ft)	375.07	Culv Frctn Ls (ft)	0.12
W.S. DS (ft)	374.08	Culv Exit Loss (ft)	0.68
Delta EG (ft)	4.00	Culv Entr Loss (ft)	0.65
Delta WS (ft)	4.00	Q Weir (cfs)	
E.G. IC (ft)	379.07	Weir Sta Lft (ft)	
E.G. OC (ft)	378.62	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	376.45	Weir Max Depth (ft)	
Culv WS Outlet (ft)	371.06	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	2.42	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	3.95	Min El Weir Flow (ft)	380.43

Warning: During the supercritical analysis, the program could not converge on a supercritical answer in the downstream cross section. The program used the solution with the least error.
Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #100 yr Culv Group: Culvert #1

Q Culv Group (cfs)	565.00	Culv Full Len (ft)	299.00
# Barrels	1	Culv Vel US (ft/s)	16.02
Q Barrel (cfs)	565.00	Culv Vel DS (ft/s)	11.30
E.G. US. (ft)	380.39	Culv Inv El Up (ft)	372.50
W.S. US. (ft)	375.63	Culv Inv El Dn (ft)	368.50
E.G. DS (ft)	376.45	Culv Frctn Ls (ft)	1.48
W.S. DS (ft)	375.41	Culv Exit Loss (ft)	0.22
Delta EG (ft)	3.94	Culv Entr Loss (ft)	0.38
Delta WS (ft)	0.22	Q Weir (cfs)	
E.G. IC (ft)		Weir Sta Lft (ft)	
E.G. OC (ft)		Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	376.03	Weir Max Depth (ft)	
Culv WS Outlet (ft)	373.50	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	2.86	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	4.63	Min El Weir Flow (ft)	380.43

Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations are not valid and the supercritical result has been discarded. The outlet answer will be used.

CULVERT OUTPUT Profile #500 yr Culv Group: Culvert #1

Q Culv Group (cfs)	799.54	Culv Full Len (ft)	299.00
# Barrels	1	Culv Vel US (ft/s)	15.99
Q Barrel (cfs)	799.54	Culv Vel DS (ft/s)	15.99
E.G. US. (ft)	381.95	Culv Inv El Up (ft)	372.50
W.S. US. (ft)	378.92	Culv Inv El Dn (ft)	368.50
E.G. DS (ft)	378.13	Culv Frctn Ls (ft)	2.96
W.S. DS (ft)	374.92	Culv Exit Loss (ft)	0.23
Delta EG (ft)	3.82	Culv Entr Loss (ft)	0.40
Delta WS (ft)	4.00	Q Weir (cfs)	127.14
E.G. IC (ft)	384.63	Weir Sta Lft (ft)	29.04
E.G. OC (ft)	381.72	Weir Sta Rgt (ft)	93.34
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	377.50	Weir Max Depth (ft)	1.67
Culv WS Outlet (ft)	373.50	Weir Avg Depth (ft)	0.66
Culv Nml Depth (ft)	3.67	Weir Flow Area (sq ft)	42.16
Culv Crt Depth (ft)	5.00	Min El Weir Flow (ft)	380.43

Warning: During subcritical analysis, while trying to calculate culvert and weir flow, the program could not get a balance of energy within the specified tolerance and number of trials. The program used the solution with the minimum error.
Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported inlet energy grade answer may not be valid.
Note: Culvert critical depth exceeds the height of the culvert.
Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note: During the supercritical calculations a hydraulic jump occurred at the inlet of (going into) the culvert.
Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations are not valid and the supercritical result has been discarded. The outlet answer will be used.

CROSS SECTION

RIVER: Unnamed Tributar

REACH: 1 RS: 2523

INPUT
Description: inlet ex 1656 at panther drive
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	378	100	377	164	376.5	245	376.21	245	368.5
255	368.5	255	376.21	293	377	428	378		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	245	.013	255	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
245	255	80	80	80	0	0

CROSS SECTION OUTPUT Profile #2 yr

E.G. Elev (ft)	371.31	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.19	Wt. n-Val.		0.013	
W.S. Elev (ft)	371.11	Reach Len. (ft)	80.00	80.00	80.00
Crit W.S. (ft)	369.88	Flow Area (sq ft)		26.13	
E.G. Slope (ft/ft)	0.000462	Area (sq ft)		26.13	
Q Total (cfs)	92.00	Flow (cfs)		92.00	
Top Width (ft)	10.00	Top Width (ft)		10.00	
Vel Total (ft/s)	3.52	Avg. Vel. (ft/s)		3.52	
Max Chl Dpth (ft)	2.61	Hydr. Depth (ft)		2.61	
Conv. Total (cfs)	4281.4	Conv. (cfs)		4281.4	
Length Wtd. (ft)	80.00	Wetted Per. (ft)		15.23	
Min Ch El (ft)	368.50	Shear (lb/sq ft)		0.05	
Alpha	1.00	Stream Power (lb/ft s)		0.17	
Frctn Loss (ft)		Cum Volume (acre-ft)	0.63	0.67	0.33
C & E Loss (ft)		Cum SA (acres)	0.78	0.23	0.50

CROSS SECTION OUTPUT Profile #10 yr

E.G. Elev (ft)	372.89	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.55	Wt. n-Val.		0.013	
W.S. Elev (ft)	372.34	Reach Len. (ft)	80.00	80.00	80.00
Crit W.S. (ft)	371.03	Flow Area (sq ft)		38.41	
E.G. Slope (ft/ft)	0.000967	Area (sq ft)		38.41	
Q Total (cfs)	229.00	Flow (cfs)		229.00	
Top Width (ft)	10.00	Top Width (ft)		10.00	
Vel Total (ft/s)	5.96	Avg. Vel. (ft/s)		5.96	
Max Chl Dpth (ft)	3.84	Hydr. Depth (ft)		3.84	
Conv. Total (cfs)	7363.5	Conv. (cfs)		7363.5	
Length Wtd. (ft)	80.00	Wetted Per. (ft)		17.68	
Min Ch El (ft)	368.50	Shear (lb/sq ft)		0.13	
Alpha	1.00	Stream Power (lb/ft s)		0.78	
Frctn Loss (ft)		Cum Volume (acre-ft)	1.08	0.85	0.73
C & E Loss (ft)		Cum SA (acres)	1.94	0.25	0.95

CROSS SECTION OUTPUT Profile #25 yr

E.G. Elev (ft)	374.67	Element	Left OB	Channel	Right OB

Vel Head (ft)	4.06	Wt. n-Val.	0.013		
W.S. Elev (ft)	370.61	Reach Len. (ft)	80.00	80.00	80.00
Crit W.S. (ft)	371.80	Flow Area (sq ft)	21.11		
E.G. Slope (ft/ft)	0.011798	Area (sq ft)	21.11		
Q Total (cfs)	341.00	Flow (cfs)	341.00		
Top Width (ft)	10.00	Top Width (ft)	10.00		
Vel Total (ft/s)	16.15	Avg. Vel. (ft/s)	16.15		
Max Chl Dpth (ft)	2.11	Hydr. Depth (ft)	2.11		
Conv. Total (cfs)	3139.4	Conv. (cfs)	3139.4		
Length Wtd. (ft)	80.00	Wetted Per. (ft)	14.22		
Min Ch El (ft)	368.50	Shear (lb/sq ft)	1.09		
Alpha	1.00	Stream Power (lb/ft s)	17.66		
Frctn Loss (ft)		Cum Volume (acre-ft)	1.56	0.89	0.97
C & E Loss (ft)		Cum SA (acres)	2.19	0.25	1.11

CROSS SECTION OUTPUT Profile #50 yr

E.G. Elev (ft)	375.73	Element	Left OB	Channel	Right OB
Vel Head (ft)	4.67	Wt. n-Val.	0.013		
W.S. Elev (ft)	371.07	Reach Len. (ft)	80.00	80.00	80.00
Crit W.S. (ft)	372.44	Flow Area (sq ft)	25.68		
E.G. Slope (ft/ft)	0.011356	Area (sq ft)	25.68		
Q Total (cfs)	445.00	Flow (cfs)	445.00		
Top Width (ft)	10.00	Top Width (ft)	10.00		
Vel Total (ft/s)	17.33	Avg. Vel. (ft/s)	17.33		
Max Chl Dpth (ft)	2.57	Hydr. Depth (ft)	2.57		
Conv. Total (cfs)	4175.9	Conv. (cfs)	4175.9		
Length Wtd. (ft)	80.00	Wetted Per. (ft)	15.14		
Min Ch El (ft)	368.50	Shear (lb/sq ft)	1.20		
Alpha	1.00	Stream Power (lb/ft s)	20.84		
Frctn Loss (ft)		Cum Volume (acre-ft)	2.12	0.95	1.23
C & E Loss (ft)		Cum SA (acres)	2.38	0.25	1.22

CROSS SECTION OUTPUT Profile #100 yr

E.G. Elev (ft)	376.45	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.04	Wt. n-Val.	0.013		
W.S. Elev (ft)	375.41	Reach Len. (ft)	80.00	80.00	80.00
Crit W.S. (ft)	373.11	Flow Area (sq ft)	69.11		
E.G. Slope (ft/ft)	0.001236	Area (sq ft)	69.11		
Q Total (cfs)	565.00	Flow (cfs)	565.00		
Top Width (ft)	10.00	Top Width (ft)	10.00		
Vel Total (ft/s)	8.17	Avg. Vel. (ft/s)	8.17		
Max Chl Dpth (ft)	6.91	Hydr. Depth (ft)	6.91		
Conv. Total (cfs)	16069.4	Conv. (cfs)	16069.4		
Length Wtd. (ft)	80.00	Wetted Per. (ft)	23.82		
Min Ch El (ft)	368.50	Shear (lb/sq ft)	0.22		
Alpha	1.00	Stream Power (lb/ft s)	1.83		
Frctn Loss (ft)		Cum Volume (acre-ft)	2.03	0.99	1.25
C & E Loss (ft)		Cum SA (acres)	2.40	0.25	1.24

CROSS SECTION OUTPUT Profile #500 yr

E.G. Elev (ft)	378.13	Element	Left OB	Channel	Right OB

Vel Head (ft)	3.21	Wt. n-Val.	0.013		
W.S. Elev (ft)	374.92	Reach Len. (ft)	80.00	80.00	80.00
Crit W.S. (ft)	374.92	Flow Area (sq ft)	64.20		
E.G. Slope (ft/ft)	0.003988	Area (sq ft)	64.20		
Q Total (cfs)	923.00	Flow (cfs)	923.00		
Top Width (ft)	10.00	Top Width (ft)	10.00		
Vel Total (ft/s)	14.38	Avg. Vel. (ft/s)	14.38		
Max Chl Dpth (ft)	6.42	Hydr. Depth (ft)	6.42		
Conv. Total (cfs)	14615.3	Conv. (cfs)	14615.3		
Length Wtd. (ft)	80.00	Wetted Per. (ft)	22.84		
Min Ch El (ft)	368.50	Shear (lb/sq ft)	0.70		
Alpha	1.00	Stream Power (lb/ft s)	10.06		
Frctn Loss (ft)		Cum Volume (acre-ft)	2.77	1.29	1.66
C & E Loss (ft)		Cum SA (acres)	2.61	0.25	1.39

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CULVERT

RIVER: Unnamed Tributar
REACH: 1 RS: 2483

INPUT
Description: panther drive crossing
Distance from Upstream XS = 2
Deck/Roadway Width = 76
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 7

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	378	100	377	164	376.5
245	376.21	253	376.21	293	377
428	378				

Upstream Bridge Cross Section Data
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	378	100	377	164	376.5	245	376.21	245	368.5
255	368.5	255	376.21	293	377	428	378		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	245	.013	255	.03

Bank Sta: Left	Right	Coeff Contr.	Expan.
245	255	0	0

Downstream Deck/Roadway Coordinates
num= 5

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	380	100	378	200	377
417	376	490	378		

Downstream Bridge Cross Section Data
Station Elevation Data num= 51

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	381.13	77.36	379.01	111.8	378.85	120.64	378.63	130.93	378.38
181.75	377.61	260.2	376.18	273.62	376.28	292.14	376.41	304.89	376.51
316.95	374.15	324.6	372.83	332.84	372.75	369.85	372.19	383.56	371.96
404.66	372.26	410.13	367.32	412.19	366.96	417.74	367.46	424.54	372.21
434.75	371.2	441.66	371.55	441.78	371.53	443.27	372.01	452.96	375.14
456.41	376.2	457.75	376.26	467.28	376.49	475.29	376.88	556.8	377.13
556.95	377.13	557	377.13	557.05	377.13	557.2	377.13	557.58	377.13
617.56	376.87	647.18	376.94	692.3	377.53	710.02	378.58	729.21	379.2
730.33	379.22	737.58	379.34	742.18	379.42	767.5	379.42	780.78	379.5
787.98	379.55	804.52	379.76	809.62	379.88	816.67	380.18	827.45	380.64
838.08	381.1								

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.015	304.89	.03	404.66	.063	424.54	.1	475.29	.03
692.3	.04	730.33	.015						

Bank Sta: Left	Right	Coeff Contr.	Expan.
404.66	424.54	.1	.3

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Box	5	10

FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 2 - Inlet edges beveled 1/2 inch at 45 degrees (1:1)
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	2	76	.013	.013	0	.3	.1

Upstream Elevation = 368.5
Centerline Station = 250
Downstream Elevation = 368
Centerline Station = 415

CULVERT OUTPUT Profile #2 yr Culv Group: Culvert #1

Q Culv Group (cfs)	92.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	3.60
Q Barrel (cfs)	92.00	Culv Vel DS (ft/s)	2.98
E.G. US. (ft)	371.31	Culv Inv El Up (ft)	368.50
W.S. US. (ft)	371.11	Culv Inv El Dn (ft)	368.00
E.G. DS (ft)	371.23	Culv Frctn Ls (ft)	0.00
W.S. DS (ft)	371.08	Culv Exit Loss (ft)	0.00
Delta EG (ft)	0.09	Culv Entr Loss (ft)	0.06
Delta WS (ft)	0.03	Q Weir (cfs)	
E.G. IC (ft)	370.67	Weir Sta Lft (ft)	
E.G. OC (ft)	371.31	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	

Culv WS Inlet (ft)	371.05	Weir Max Depth (ft)	
Culv WS Outlet (ft)	371.09	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	1.08	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	1.38	Min El Weir Flow (ft)	376.22

CULVERT OUTPUT Profile #10 yr Culv Group: Culvert #1

Q Culv Group (cfs)	229.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	6.44
Q Barrel (cfs)	229.00	Culv Vel DS (ft/s)	5.51
E.G. US. (ft)	372.89	Culv Inv El Up (ft)	368.50
W.S. US. (ft)	372.34	Culv Inv El Dn (ft)	368.00
E.G. DS (ft)	372.61	Culv Frctn Ls (ft)	0.00
W.S. DS (ft)	372.33	Culv Exit Loss (ft)	0.02
Delta EG (ft)	0.29	Culv Entr Loss (ft)	0.19
Delta WS (ft)	0.01	Q Weir (cfs)	
E.G. IC (ft)	372.49	Weir Sta Lft (ft)	
E.G. OC (ft)	372.89	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	372.06	Weir Max Depth (ft)	
Culv WS Outlet (ft)	372.16	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	1.96	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	2.54	Min El Weir Flow (ft)	376.22

CULVERT OUTPUT Profile #25 yr Culv Group: Culvert #1

Q Culv Group (cfs)	341.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	10.31
Q Barrel (cfs)	341.00	Culv Vel DS (ft/s)	8.74
E.G. US. (ft)	373.71	Culv Inv El Up (ft)	368.50
W.S. US. (ft)	372.66	Culv Inv El Dn (ft)	368.00
E.G. DS (ft)	373.00	Culv Frctn Ls (ft)	0.00
W.S. DS (ft)	372.67	Culv Exit Loss (ft)	0.09
Delta EG (ft)	0.71	Culv Entr Loss (ft)	0.25
Delta WS (ft)	0.01	Q Weir (cfs)	
E.G. IC (ft)	373.71	Weir Sta Lft (ft)	
E.G. OC (ft)	373.96	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	371.81	Weir Max Depth (ft)	
Culv WS Outlet (ft)	371.90	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	2.58	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	3.31	Min El Weir Flow (ft)	376.22

Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.

CULVERT OUTPUT Profile #50 yr Culv Group: Culvert #1

Q Culv Group (cfs)	445.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	11.27
Q Barrel (cfs)	445.00	Culv Vel DS (ft/s)	13.15
E.G. US. (ft)	375.07	Culv Inv El Up (ft)	368.50
W.S. US. (ft)	374.08	Culv Inv El Dn (ft)	368.00
E.G. DS (ft)	373.25	Culv Frctn Ls (ft)	1.32
W.S. DS (ft)	372.87	Culv Exit Loss (ft)	0.82

Delta EG (ft)	1.82	Culv Entr Loss (ft)	0.65
Delta WS (ft)	1.21	Q Weir (cfs)	
E.G. IC (ft)	375.07	Weir Sta Lft (ft)	
E.G. OC (ft)	375.01	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	372.45	Weir Max Depth (ft)	
Culv WS Outlet (ft)	371.38	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	3.11	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	3.95	Min El Weir Flow (ft)	376.22

Note: During the supercritical calculations a hydraulic jump occurred at the outlet of (leaving) the culvert.
Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #100 yr Culv Group: Culvert #1

Q Culv Group (cfs)	553.82	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	11.08
Q Barrel (cfs)	553.82	Culv Vel DS (ft/s)	15.65
E.G. US. (ft)	376.45	Culv Inv El Up (ft)	368.50
W.S. US. (ft)	375.41	Culv Inv El Dn (ft)	368.00
E.G. DS (ft)	373.50	Culv Frctn Ls (ft)	0.00
W.S. DS (ft)	373.12	Culv Exit Loss (ft)	1.84
Delta EG (ft)	2.95	Culv Entr Loss (ft)	0.57
Delta WS (ft)	2.29	Q Weir (cfs)	11.18
E.G. IC (ft)	376.45	Weir Sta Lft (ft)	177.49
E.G. OC (ft)	376.04	Weir Sta Rgt (ft)	265.24
Culvert Control	Inlet	Weir Submerg	0.00
Culv WS Inlet (ft)	373.50	Weir Max Depth (ft)	0.24
Culv WS Outlet (ft)	371.54	Weir Avg Depth (ft)	0.13
Culv Nml Depth (ft)	3.64	Weir Flow Area (sq ft)	11.57
Culv Crt Depth (ft)	4.57	Min El Weir Flow (ft)	376.22

Warning: The flow through the culvert is supercritical. However, since there is flow over the road (weir flow), the program cannot determine if the downstream cross section should be subcritical or supercritical. The program used the downstream subcritical answer, even though it may not be valid.
Warning: During the culvert outlet control computations, the program could not balance the culvert/weir flow. The reported outlet energy grade answer may not be valid.
Note: The flow in the culvert is entirely supercritical.
Note: During the supercritical calculations a hydraulic jump occurred at the inlet of (going into) the culvert.

CULVERT OUTPUT Profile #500 yr Culv Group: Culvert #1

Q Culv Group (cfs)	670.87	Culv Full Len (ft)	76.00
# Barrels	1	Culv Vel US (ft/s)	13.42
Q Barrel (cfs)	670.87	Culv Vel DS (ft/s)	13.42
E.G. US. (ft)	378.13	Culv Inv El Up (ft)	368.50
W.S. US. (ft)	374.92	Culv Inv El Dn (ft)	368.00
E.G. DS (ft)	374.11	Culv Frctn Ls (ft)	0.53
W.S. DS (ft)	373.56	Culv Exit Loss (ft)	1.69
Delta EG (ft)	4.02	Culv Entr Loss (ft)	0.84
Delta WS (ft)	1.36	Q Weir (cfs)	252.13
E.G. IC (ft)	377.23	Weir Sta Lft (ft)	85.31
E.G. OC (ft)	377.17	Weir Sta Rgt (ft)	312.82
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	373.50	Weir Max Depth (ft)	0.94

Culv WS Outlet (ft)	373.00	Weir Avg Depth (ft)	0.53
Culv Nml Depth (ft)	4.18	Weir Flow Area (sq ft)	121.24
Culv Crt Depth (ft)	5.00	Min El Weir Flow (ft)	376.22

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.
Note: Culvert critical depth exceeds the height of the culvert.
Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note: During the supercritical calculations a hydraulic jump occurred at the inlet of (going into) the culvert.
Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations are not valid and the supercritical result has been discarded. The outlet answer will be used.

CROSS SECTION

RIVER: Unnamed Tributar
REACH: 1 RS: 2443.764

INPUT
Description: Channel geometry was extracted from the construction plans entitled "City of Fairfax, Stream Restoration Project, Tributaries of Accotink Creek." dated February 1995

Station Elevation Data num= 51

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	381.13	77.36	379.01	111.8	378.85	120.64	378.63	130.93	378.38
181.75	377.61	260.2	376.18	273.62	376.28	292.14	376.41	304.89	376.51
316.95	374.15	324.6	372.83	332.84	372.75	369.85	372.19	383.56	371.96
404.66	372.26	410.13	367.32	412.19	366.96	417.74	367.46	424.54	372.21
434.75	371.2	441.66	371.55	441.78	371.53	443.27	372.01	452.96	375.14
456.41	376.2	457.75	376.26	467.28	376.49	475.29	376.88	556.8	377.13
556.95	377.13	557	377.13	557.05	377.13	557.2	377.13	557.58	377.13
617.56	376.87	647.18	376.94	692.3	377.53	710.02	378.58	729.21	379.2
730.33	379.22	737.58	379.34	742.18	379.42	767.5	379.42	780.78	379.5
787.98	379.55	804.52	379.76	809.62	379.88	816.67	380.18	827.45	380.64
838.08	381.1								

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.015	304.89	.03	404.66	.063	424.54	.1	475.29	.03
692.3	.04	730.33	.015						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
404.66	424.54	274	283	291	.1	.3

CROSS SECTION OUTPUT Profile #2 yr

E.G. Elev (ft)	371.23	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.		0.063	
W.S. Elev (ft)	371.08	Reach Len. (ft)	274.00	283.00	291.00
Crit W.S. (ft)		Flow Area (sq ft)		46.82	
E.G. Slope (ft/ft)	0.005251	Area (sq ft)		46.82	
Q Total (cfs)	143.00	Flow (cfs)		143.00	
Top Width (ft)	16.96	Top Width (ft)		16.96	
Vel Total (ft/s)	3.05	Avg. Vel. (ft/s)		3.05	
Max Chl Dpth (ft)	4.12	Hydr. Depth (ft)		2.76	
Conv. Total (cfs)	1973.4	Conv. (cfs)		1973.4	
Length Wtd. (ft)	283.22	Wetted Per. (ft)		19.60	

Min Ch El (ft)	366.96	Shear (lb/sq ft)	0.78		
Alpha	1.00	Stream Power (lb/ft s)	2.39		
Frctn Loss (ft)	1.15	Cum Volume (acre-ft)	0.63	0.62	0.33
C & E Loss (ft)	0.02	Cum SA (acres)	0.78	0.21	0.50

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10 yr

E.G. Elev (ft)	372.61	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.28	Wt. n-Val.	0.030	0.063	0.100
W.S. Elev (ft)	372.33	Reach Len. (ft)	274.00	283.00	291.00
Crit W.S. (ft)		Flow Area (sq ft)	8.88	70.01	14.11
E.G. Slope (ft/ft)	0.008015	Area (sq ft)	8.88	70.01	14.11
Q Total (cfs)	336.00	Flow (cfs)	13.51	307.57	14.92
Top Width (ft)	83.81	Top Width (ft)	44.20	19.88	19.73
Vel Total (ft/s)	3.61	Avg. Vel. (ft/s)	1.52	4.39	1.06
Max Chl Dpth (ft)	5.37	Hydr. Depth (ft)	0.20	3.52	0.72
Conv. Total (cfs)	3753.0	Conv. (cfs)	150.9	3435.5	166.6
Length Wtd. (ft)	283.05	Wetted Per. (ft)	44.21	23.33	19.91
Min Ch El (ft)	366.96	Shear (lb/sq ft)	0.10	1.50	0.35
Alpha	1.36	Stream Power (lb/ft s)	0.15	6.60	0.37
Frctn Loss (ft)	1.87	Cum Volume (acre-ft)	1.08	0.78	0.73
C & E Loss (ft)	0.04	Cum SA (acres)	1.90	0.22	0.93

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #25 yr

E.G. Elev (ft)	373.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.33	Wt. n-Val.	0.030	0.063	0.100
W.S. Elev (ft)	372.67	Reach Len. (ft)	274.00	283.00	291.00
Crit W.S. (ft)	371.33	Flow Area (sq ft)	27.75	76.78	21.00
E.G. Slope (ft/ft)	0.009250	Area (sq ft)	27.75	76.78	21.00
Q Total (cfs)	489.00	Flow (cfs)	73.67	385.33	30.00
Top Width (ft)	107.36	Top Width (ft)	66.70	19.88	20.78
Vel Total (ft/s)	3.90	Avg. Vel. (ft/s)	2.65	5.02	1.43
Max Chl Dpth (ft)	5.71	Hydr. Depth (ft)	0.42	3.86	1.01
Conv. Total (cfs)	5084.4	Conv. (cfs)	766.0	4006.5	311.9
Length Wtd. (ft)	281.95	Wetted Per. (ft)	66.70	23.33	21.02
Min Ch El (ft)	366.96	Shear (lb/sq ft)	0.24	1.90	0.58
Alpha	1.39	Stream Power (lb/ft s)	0.64	9.54	0.82
Frctn Loss (ft)	2.02	Cum Volume (acre-ft)	1.56	0.84	0.97
C & E Loss (ft)	0.06	Cum SA (acres)	2.13	0.22	1.10

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #50 yr

E.G. Elev (ft)	373.25	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.38	Wt. n-Val.	0.030	0.063	0.100

W.S. Elev (ft)	372.87	Reach Len. (ft)	274.00	283.00	291.00
Crit W.S. (ft)	372.64	Flow Area (sq ft)	42.79	80.80	25.27
E.G. Slope (ft/ft)	0.010422	Area (sq ft)	42.79	80.80	25.27
Q Total (cfs)	630.00	Flow (cfs)	142.18	445.36	42.46
Top Width (ft)	121.61	Top Width (ft)	80.32	19.88	21.41
Vel Total (ft/s)	4.23	Avg. Vel. (ft/s)	3.32	5.51	1.68
Max Chl Dpth (ft)	5.91	Hydr. Depth (ft)	0.53	4.06	1.18
Conv. Total (cfs)	6171.0	Conv. (cfs)	1392.7	4362.4	415.9
Length Wtd. (ft)	281.22	Wetted Per. (ft)	80.33	23.33	21.68
Min Ch El (ft)	366.96	Shear (lb/sq ft)	0.35	2.25	0.76
Alpha	1.35	Stream Power (lb/ft s)	1.15	12.42	1.27
Frctn Loss (ft)	2.06	Cum Volume (acre-ft)	2.12	0.89	1.23
C & E Loss (ft)	0.08	Cum SA (acres)	2.31	0.22	1.20

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #100 yr

E.G. Elev (ft)	373.50	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.39	Wt. n-Val.	0.030	0.063	0.100
W.S. Elev (ft)	373.12	Reach Len. (ft)	274.00	283.00	291.00
Crit W.S. (ft)	372.90	Flow Area (sq ft)	62.37	85.60	30.54
E.G. Slope (ft/ft)	0.010002	Area (sq ft)	62.37	85.60	30.54
Q Total (cfs)	794.00	Flow (cfs)	257.95	480.37	55.68
Top Width (ft)	123.76	Top Width (ft)	81.72	19.88	22.16
Vel Total (ft/s)	4.45	Avg. Vel. (ft/s)	4.14	5.61	1.82
Max Chl Dpth (ft)	6.16	Hydr. Depth (ft)	0.76	4.31	1.38
Conv. Total (cfs)	7939.3	Conv. (cfs)	2579.3	4803.3	556.7
Length Wtd. (ft)	280.73	Wetted Per. (ft)	81.75	23.33	22.47
Min Ch El (ft)	366.96	Shear (lb/sq ft)	0.48	2.29	0.85
Alpha	1.26	Stream Power (lb/ft s)	1.97	12.86	1.55
Frctn Loss (ft)	2.24	Cum Volume (acre-ft)	2.03	0.90	1.25
C & E Loss (ft)	0.07	Cum SA (acres)	2.33	0.22	1.22

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #500 yr

E.G. Elev (ft)	374.11	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.55	Wt. n-Val.	0.030	0.063	0.100
W.S. Elev (ft)	373.56	Reach Len. (ft)	274.00	283.00	291.00
Crit W.S. (ft)	373.30	Flow Area (sq ft)	99.09	94.40	40.64
E.G. Slope (ft/ft)	0.011384	Area (sq ft)	99.09	94.40	40.64
Q Total (cfs)	1278.00	Flow (cfs)	583.00	603.23	91.78
Top Width (ft)	127.69	Top Width (ft)	84.28	19.88	23.52
Vel Total (ft/s)	5.46	Avg. Vel. (ft/s)	5.88	6.39	2.26
Max Chl Dpth (ft)	6.60	Hydr. Depth (ft)	1.18	4.75	1.73
Conv. Total (cfs)	11977.7	Conv. (cfs)	5464.0	5653.6	860.2
Length Wtd. (ft)	279.75	Wetted Per. (ft)	84.36	23.33	23.90
Min Ch El (ft)	366.96	Shear (lb/sq ft)	0.83	2.88	1.21
Alpha	1.19	Stream Power (lb/ft s)	4.91	18.38	2.73

					Tusico
Frctn Loss (ft)	2.46	Cum Volume (acre-ft)	2.77	0.98	1.66
C & E Loss (ft)	0.11	Cum SA (acres)	2.54	0.22	1.37

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Unnamed Tributar
REACH: 1 RS: 2160.924

INPUT
Description: Channel geometry was extracted from the construction plans entitled "City of Fairfax, Stream Restoration Project, Tributaries of Accotink Creek." dated February 1995

Station Elevation Data num= 37

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	378.72	7.04	377.3	15.65	375.92	28.58	373.34	97.02	372.1
98.15	372.08	98.89	372.06	100.33	372.05	251.85	370.53	265.31	370.39
290.08	370.47	357.15	370.36	395	370.05	406.63	370.04	411.91	366.53
415.15	364.52	420.54	366.67	428.56	370.58	438.19	369.3	455.44	369.52
508.22	370.21	528.99	370.44	561.35	370.79	601.16	371.36	607.97	371.92
616.5	371.93	625.64	372.26	644.14	373.09	650.36	373.41	684.63	375.61
719.55	375.88	740.69	376.6	763.39	377.05	787.61	377.48	822.28	380.16
836.3	380.66	843.02	380.9						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	406.63	.063	428.56	.1	561.35	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
406.63	428.56	255	255	280	.3	.5

CROSS SECTION OUTPUT Profile #2 yr

E.G. Elev (ft)	370.06	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.	0.063	0.100	
W.S. Elev (ft)	369.98	Reach Len. (ft)	255.00	255.00	280.00
Crit W.S. (ft)		Flow Area (sq ft)	58.34	19.89	
E.G. Slope (ft/ft)	0.002861	Area (sq ft)	58.34	19.89	
Q Total (cfs)	143.00	Flow (cfs)	135.25	7.75	
Top Width (ft)	78.50	Top Width (ft)	20.62	57.88	
Vel Total (ft/s)	1.83	Avg. Vel. (ft/s)	2.32	0.39	
Max Chl Dpth (ft)	5.46	Hydr. Depth (ft)	2.83	0.34	
Conv. Total (cfs)	2673.6	Conv. (cfs)	2528.7	144.9	
Length Wtd. (ft)	258.22	Wetted Per. (ft)	23.42	57.93	
Min Ch El (ft)	364.52	Shear (lb/sq ft)	0.44	0.06	
Alpha	1.52	Stream Power (lb/ft s)	1.03	0.02	
Frctn Loss (ft)	0.38	Cum Volume (acre-ft)	0.63	0.28	0.27
C & E Loss (ft)	0.04	Cum SA (acres)	0.78	0.08	0.31

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10 yr

E.G. Elev (ft)	370.69	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.	0.030	0.063	0.100
W.S. Elev (ft)	370.56	Reach Len. (ft)	255.00	255.00	280.00
Crit W.S. (ft)		Flow Area (sq ft)	33.40	70.56	67.78
E.G. Slope (ft/ft)	0.005220	Area (sq ft)	33.40	70.56	67.78
Q Total (cfs)	336.00	Flow (cfs)	42.49	241.21	52.30
Top Width (ft)	290.57	Top Width (ft)	157.54	21.88	111.14
Vel Total (ft/s)	1.96	Avg. Vel. (ft/s)	1.27	3.42	0.77
Max Chl Dpth (ft)	6.04	Hydr. Depth (ft)	0.21	3.22	0.61
Conv. Total (cfs)	4650.7	Conv. (cfs)	588.1	3338.7	723.9
Length Wtd. (ft)	259.07	Wetted Per. (ft)	157.54	24.83	111.23
Min Ch El (ft)	364.52	Shear (lb/sq ft)	0.07	0.93	0.20
Alpha	2.27	Stream Power (lb/ft s)	0.09	3.17	0.15
Frctn Loss (ft)	0.71	Cum Volume (acre-ft)	0.95	0.32	0.45
C & E Loss (ft)	0.06	Cum SA (acres)	1.27	0.09	0.49

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #25 yr

E.G. Elev (ft)	370.91	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.	0.030	0.063	0.100
W.S. Elev (ft)	370.79	Reach Len. (ft)	255.00	255.00	280.00
Crit W.S. (ft)		Flow Area (sq ft)	72.78	75.66	96.20
E.G. Slope (ft/ft)	0.005075	Area (sq ft)	72.78	75.66	96.20
Q Total (cfs)	489.00	Flow (cfs)	140.04	266.86	82.11
Top Width (ft)	335.51	Top Width (ft)	180.75	21.93	132.83
Vel Total (ft/s)	2.00	Avg. Vel. (ft/s)	1.92	3.53	0.85
Max Chl Dpth (ft)	6.27	Hydr. Depth (ft)	0.40	3.45	0.72
Conv. Total (cfs)	6864.2	Conv. (cfs)	1965.7	3745.9	1152.6
Length Wtd. (ft)	258.97	Wetted Per. (ft)	180.75	24.88	132.92
Min Ch El (ft)	364.52	Shear (lb/sq ft)	0.13	0.96	0.23
Alpha	2.00	Stream Power (lb/ft s)	0.25	3.40	0.20
Frctn Loss (ft)	0.70	Cum Volume (acre-ft)	1.25	0.34	0.58
C & E Loss (ft)	0.05	Cum SA (acres)	1.35	0.09	0.58

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #50 yr

E.G. Elev (ft)	371.11	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.	0.030	0.063	0.100
W.S. Elev (ft)	371.00	Reach Len. (ft)	255.00	255.00	280.00
Crit W.S. (ft)		Flow Area (sq ft)	112.99	80.27	125.67
E.G. Slope (ft/ft)	0.004208	Area (sq ft)	112.99	80.27	125.67
Q Total (cfs)	630.00	Flow (cfs)	246.68	268.17	115.15
Top Width (ft)	371.15	Top Width (ft)	201.71	21.93	147.51
Vel Total (ft/s)	1.98	Avg. Vel. (ft/s)	2.18	3.34	0.92
Max Chl Dpth (ft)	6.48	Hydr. Depth (ft)	0.56	3.66	0.85

					Tusico
Conv. Total (cfs)	9711.9	Conv. (cfs)	3802.7	4134.0	1775.2
Length Wtd. (ft)	259.01	Wetted Per. (ft)	201.71	24.88	147.61
Min Ch El (ft)	364.52	Shear (lb/sq ft)	0.15	0.85	0.22
Alpha	1.74	Stream Power (lb/ft s)	0.32	2.83	0.20
Frctn Loss (ft)	0.58	Cum Volume (acre-ft)	1.63	0.36	0.73
C & E Loss (ft)	0.04	Cum SA (acres)	1.42	0.09	0.64

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #100 yr

E.G. Elev (ft)	371.19	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.15	Wt. n-Val.	0.030	0.063	0.099
W.S. Elev (ft)	371.04	Reach Len. (ft)	255.00	255.00	280.00
Crit W.S. (ft)	370.82	Flow Area (sq ft)	120.52	81.08	131.18
E.G. Slope (ft/ft)	0.005957	Area (sq ft)	120.52	81.08	131.18
Q Total (cfs)	794.00	Flow (cfs)	322.90	324.46	146.64
Top Width (ft)	377.42	Top Width (ft)	205.40	21.93	150.10
Vel Total (ft/s)	2.39	Avg. Vel. (ft/s)	2.68	4.00	1.12
Max Chl Dpth (ft)	6.52	Hydr. Depth (ft)	0.59	3.70	0.87
Conv. Total (cfs)	10287.7	Conv. (cfs)	4183.8	4204.0	1900.0
Length Wtd. (ft)	259.14	Wetted Per. (ft)	205.40	24.88	150.19
Min Ch El (ft)	364.52	Shear (lb/sq ft)	0.22	1.21	0.32
Alpha	1.70	Stream Power (lb/ft s)	0.58	4.85	0.36
Frctn Loss (ft)	0.87	Cum Volume (acre-ft)	1.45	0.36	0.71
C & E Loss (ft)	0.06	Cum SA (acres)	1.42	0.09	0.64

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Note: Hydraulic jump has occurred between this cross section and the previous upstream section.

CROSS SECTION OUTPUT Profile #500 yr

E.G. Elev (ft)	371.54	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.18	Wt. n-Val.	0.030	0.063	0.097
W.S. Elev (ft)	371.36	Reach Len. (ft)	255.00	255.00	280.00
Crit W.S. (ft)	371.04	Flow Area (sq ft)	191.44	88.11	182.85
E.G. Slope (ft/ft)	0.006186	Area (sq ft)	191.44	88.11	182.85
Q Total (cfs)	1278.00	Flow (cfs)	646.23	379.76	252.00
Top Width (ft)	431.74	Top Width (ft)	237.33	21.93	172.47
Vel Total (ft/s)	2.76	Avg. Vel. (ft/s)	3.38	4.31	1.38
Max Chl Dpth (ft)	6.84	Hydr. Depth (ft)	0.81	4.02	1.06
Conv. Total (cfs)	16248.9	Conv. (cfs)	8216.4	4828.4	3204.1
Length Wtd. (ft)	259.19	Wetted Per. (ft)	237.34	24.88	172.57
Min Ch El (ft)	364.52	Shear (lb/sq ft)	0.31	1.37	0.41
Alpha	1.53	Stream Power (lb/ft s)	1.05	5.90	0.56
Frctn Loss (ft)	0.95	Cum Volume (acre-ft)	1.86	0.39	0.91
C & E Loss (ft)	0.05	Cum SA (acres)	1.52	0.09	0.72

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Note: Hydraulic jump has occurred between this cross section and the previous upstream section.

CROSS SECTION

RIVER: Unnamed Tributar
REACH: 1 RS: 1905.580

INPUT
Description: just upstream of Keith Avenue

Channel geometry was extracted
from the construction plans entitled "City of Fairfax, Stream Restoration Project, Tributaries of Accotink Creek." dated February 1995

Station Elevation Data num= 63

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	373.73	4.66	373.56	19.41	372.92	31.95	372.37	42.76	371.9
72.8	370.84	79.87	370.54	85.52	370	99.18	369.59	130.7	369.32
180.53	369.07	205.16	369.04	210.94	368.96	220.27	369.01	234	369.12
248.23	369.25	254.31	369.3	262.89	369.37	277.84	369.5	295.39	368.85
298.93	368.89	303.26	368.84	305.67	368.75	312.89	367.98	318.31	367.37
318.43	367.37	318.5	367.36	332.69	368.12	337.27	367.92	345.67	367.32
354.75	366.73	364.11	366.1	365.28	364.66	367.24	364.67	371.02	364.47
371.99	367.23	375.28	367.09	379.36	367.42	388.64	367.55	393.14	367.72
411.26	369.79	419.79	370.08	426.74	370.89	439.18	371.29	447.88	371.04
458.33	371.4	469.35	371.77	480.67	372.79	493.25	373.19	499.95	372.94
508.59	373.23	513.26	373.95	529.16	374.67	534.9	374.76	550.6	375.48
560.97	376.04	570.02	376.45	578.93	376.86	594.64	378.47	609.16	379.14
612.97	379.33	626.75	379.96	634.21	380.27				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	364.11	.063	371.99	.045

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
364.11 371.99 20429 1904 1727 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	365	369	F
372	634.21	369.6	F

CROSS SECTION OUTPUT Profile #2 yr

E.G. Elev (ft)	369.64	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.030	0.063	0.045
W.S. Elev (ft)	369.64	Reach Len. (ft)			
Crit W.S. (ft)	367.14	Flow Area (sq ft)	216.38	37.58	63.05
E.G. Slope (ft/ft)	0.000100	Area (sq ft)	216.38	37.58	63.05
Q Total (cfs)	143.00	Flow (cfs)	93.18	20.69	29.12
Top Width (ft)	312.43	Top Width (ft)	266.60	7.88	37.96
Vel Total (ft/s)	0.45	Avg. Vel. (ft/s)	0.43	0.55	0.46
Max Chl Dpth (ft)	5.17	Hydr. Depth (ft)	0.81	4.77	1.66
Conv. Total (cfs)	14304.7	Conv. (cfs)	9321.5	2070.1	2913.2
Length Wtd. (ft)		Wetted Per. (ft)	266.78	10.53	38.09
Min Ch El (ft)	364.47	Shear (lb/sq ft)	0.01	0.02	0.01
Alpha	1.02	Stream Power (lb/ft s)	0.00	0.01	0.00

Frctn Loss (ft)	Cum Volume (acre-ft)
C & E Loss (ft)	Cum SA (acres)

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10 yr

E.G. Elev (ft)	369.92	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.030	0.063	0.045
W.S. Elev (ft)	369.91	Reach Len. (ft)			
Crit W.S. (ft)	369.00	Flow Area (sq ft)	289.58	39.70	73.76
E.G. Slope (ft/ft)	0.000267	Area (sq ft)	289.58	39.70	73.76
Q Total (cfs)	336.00	Flow (cfs)	241.92	37.05	57.04
Top Width (ft)	326.27	Top Width (ft)	275.59	7.88	42.80
Vel Total (ft/s)	0.83	Avg. Vel. (ft/s)	0.84	0.93	0.77
Max Chl Dpth (ft)	5.44	Hydr. Depth (ft)	1.05	5.04	1.72
Conv. Total (cfs)	20580.1	Conv. (cfs)	14817.5	2269.1	3493.5
Length Wtd. (ft)		Wetted Per. (ft)	275.78	10.53	42.94
Min Ch El (ft)	364.47	Shear (lb/sq ft)	0.02	0.06	0.03
Alpha	1.01	Stream Power (lb/ft s)	0.01	0.06	0.02
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #25 yr

E.G. Elev (ft)	370.16	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.030	0.063	0.045
W.S. Elev (ft)	370.14	Reach Len. (ft)			
Crit W.S. (ft)	369.00	Flow Area (sq ft)	353.62	41.52	84.35
E.G. Slope (ft/ft)	0.000330	Area (sq ft)	353.62	41.52	84.35
Q Total (cfs)	489.00	Flow (cfs)	371.42	44.39	73.19
Top Width (ft)	336.25	Top Width (ft)	280.05	7.88	48.32
Vel Total (ft/s)	1.02	Avg. Vel. (ft/s)	1.05	1.07	0.87
Max Chl Dpth (ft)	5.67	Hydr. Depth (ft)	1.26	5.27	1.75
Conv. Total (cfs)	26926.8	Conv. (cfs)	20452.5	2444.4	4029.9
Length Wtd. (ft)		Wetted Per. (ft)	280.25	10.53	48.46
Min Ch El (ft)	364.47	Shear (lb/sq ft)	0.03	0.08	0.04
Alpha	1.01	Stream Power (lb/ft s)	0.03	0.09	0.03
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #50 yr

E.G. Elev (ft)	370.48	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.030	0.063	0.045
W.S. Elev (ft)	370.46	Reach Len. (ft)			
Crit W.S. (ft)	369.01	Flow Area (sq ft)	444.83	44.07	100.44
E.G. Slope (ft/ft)	0.000280	Area (sq ft)	444.83	44.07	100.44
Q Total (cfs)	630.00	Flow (cfs)	497.87	45.20	86.94
Top Width (ft)	342.41	Top Width (ft)	283.44	7.88	51.09

Vel Total (ft/s)	1.07	Avg. Vel. (ft/s)	1.12	1.03	0.87
Max Chl Dpth (ft)	5.99	Hydr. Depth (ft)	1.57	5.59	1.97
Conv. Total (cfs)	37632.3	Conv. (cfs)	29739.5	2699.8	5193.1
Length Wtd. (ft)		Wetted Per. (ft)	283.65	10.53	51.26
Min Ch El (ft)	364.47	Shear (lb/sq ft)	0.03	0.07	0.03
Alpha	1.02	Stream Power (lb/ft s)	0.03	0.08	0.03
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #100 yr

E.G. Elev (ft)	370.26	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.030	0.063	0.045
W.S. Elev (ft)	370.22	Reach Len. (ft)			
Crit W.S. (ft)	369.21	Flow Area (sq ft)	376.06	42.15	88.24
E.G. Slope (ft/ft)	0.000728	Area (sq ft)	376.06	42.15	88.24
Q Total (cfs)	794.00	Flow (cfs)	610.23	67.63	116.13
Top Width (ft)	337.77	Top Width (ft)	280.89	7.88	49.00
Vel Total (ft/s)	1.57	Avg. Vel. (ft/s)	1.62	1.60	1.32
Max Chl Dpth (ft)	5.75	Hydr. Depth (ft)	1.34	5.35	1.80
Conv. Total (cfs)	29425.6	Conv. (cfs)	22615.2	2506.5	4303.8
Length Wtd. (ft)		Wetted Per. (ft)	281.09	10.53	49.15
Min Ch El (ft)	364.47	Shear (lb/sq ft)	0.06	0.18	0.08
Alpha	1.02	Stream Power (lb/ft s)	0.10	0.29	0.11
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #500 yr

E.G. Elev (ft)	370.54	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.	0.030	0.063	0.045
W.S. Elev (ft)	370.46	Reach Len. (ft)			
Crit W.S. (ft)	369.49	Flow Area (sq ft)	443.77	44.04	100.25
E.G. Slope (ft/ft)	0.001161	Area (sq ft)	443.77	44.04	100.25
Q Total (cfs)	1278.00	Flow (cfs)	1009.60	91.91	176.49
Top Width (ft)	342.34	Top Width (ft)	283.40	7.88	51.06
Vel Total (ft/s)	2.17	Avg. Vel. (ft/s)	2.28	2.09	1.76
Max Chl Dpth (ft)	5.99	Hydr. Depth (ft)	1.57	5.59	1.96
Conv. Total (cfs)	37500.4	Conv. (cfs)	29624.7	2696.8	5178.9
Length Wtd. (ft)		Wetted Per. (ft)	283.61	10.53	51.23
Min Ch El (ft)	364.47	Shear (lb/sq ft)	0.11	0.30	0.14
Alpha	1.02	Stream Power (lb/ft s)	0.26	0.63	0.25
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

SUMMARY OF MANNING'S N VALUES

River:Unnamed Tributar

Reach	River Sta.	n1	n2	n3	n4	n5	n6	n7
1	3159	.03	.013	.03				
1	3113	Culvert						
1	3069	.03	.013	.03				
1	3039	Culvert						
1	3009	.03	.013	.03				
1	2916	Culvert						
1	2824	.03	.013	.03				
1	2633	Culvert						
1	2523	.03	.013	.03				
1	2483	Culvert						
1	2443.764	.015	.03	.063	.1	.03	.04	.015
1	2160.924	.03	.063	.1	.04			
1	1905.580	.03	.063	.045				

SUMMARY OF REACH LENGTHS

River: Unnamed Tributar

Reach	River Sta.	Left	Channel	Right
1	3159	90	94	98
1	3113	Culvert		
1	3069	60	60	60
1	3039	Culvert		
1	3009	185	185	185
1	2916	Culvert		
1	2824	304	304	304
1	2633	Culvert		
1	2523	80	80	80
1	2483	Culvert		
1	2443.764	274	283	291
1	2160.924	255	255	280
1	1905.580	20429	1904	1727

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Unnamed Tributar

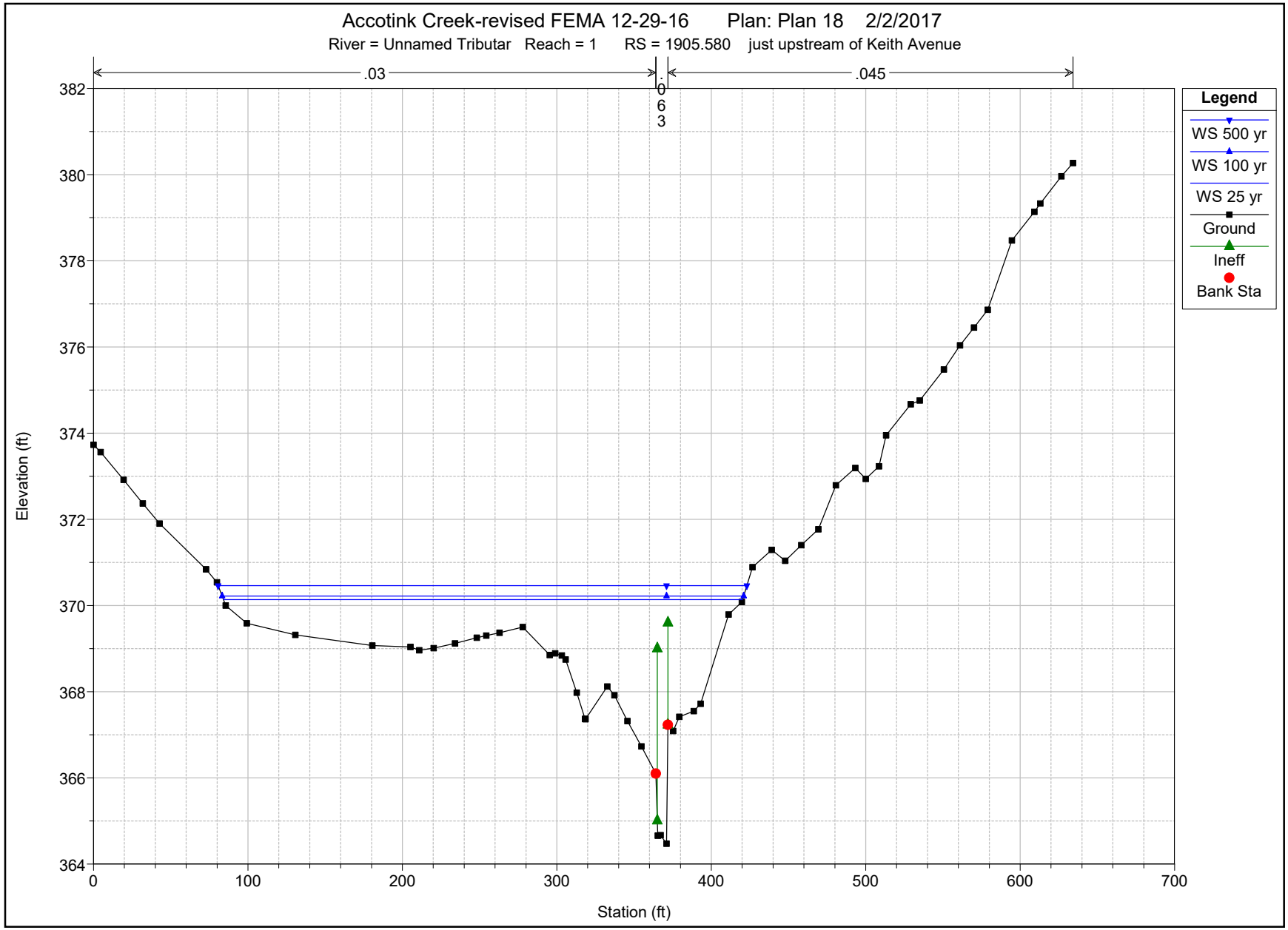
Reach	River Sta.	Contr.	Expan.
1	3159	0	0
1	3113	Culvert	
1	3069	0	0
1	3039	Culvert	
1	3009	0	0
1	2916	Culvert	

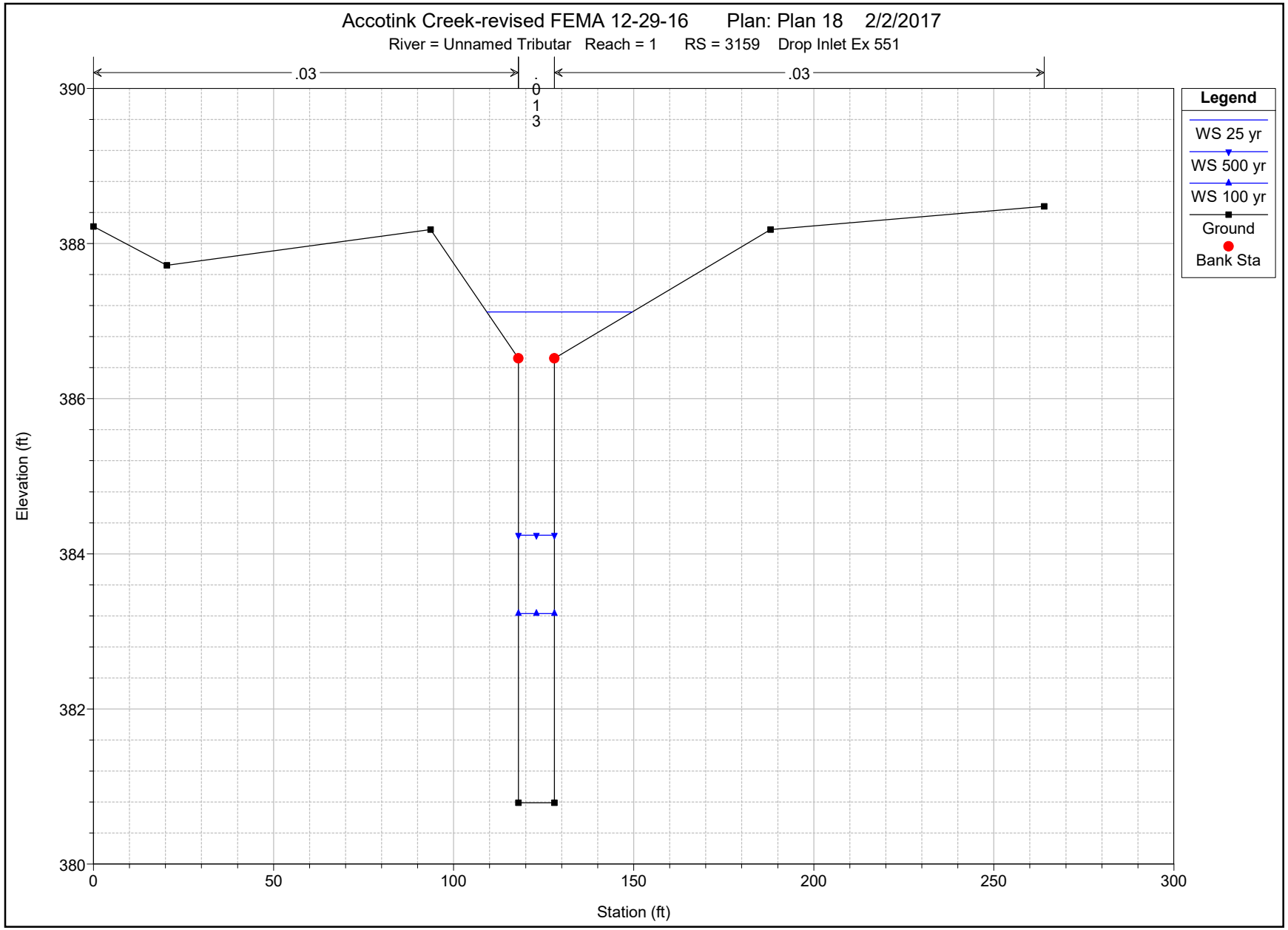
1	2824	0	0
1	2633	Culvert	
1	2523	0	0
1	2483	Culvert	
1	2443.764	.1	.3
1	2160.924	.3	.5
1	1905.580	.3	.5

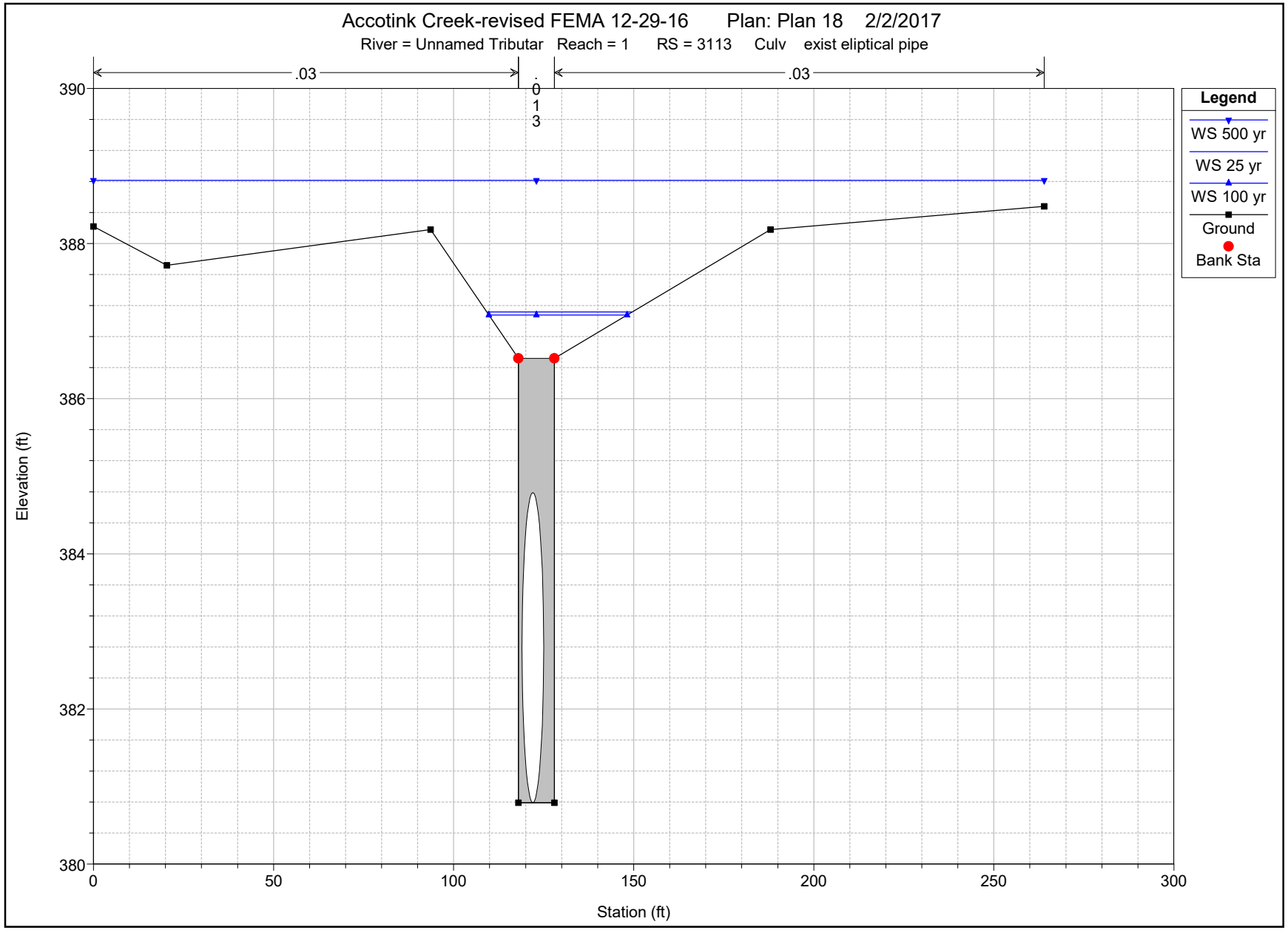
Profile Output Table - Standard Table 1

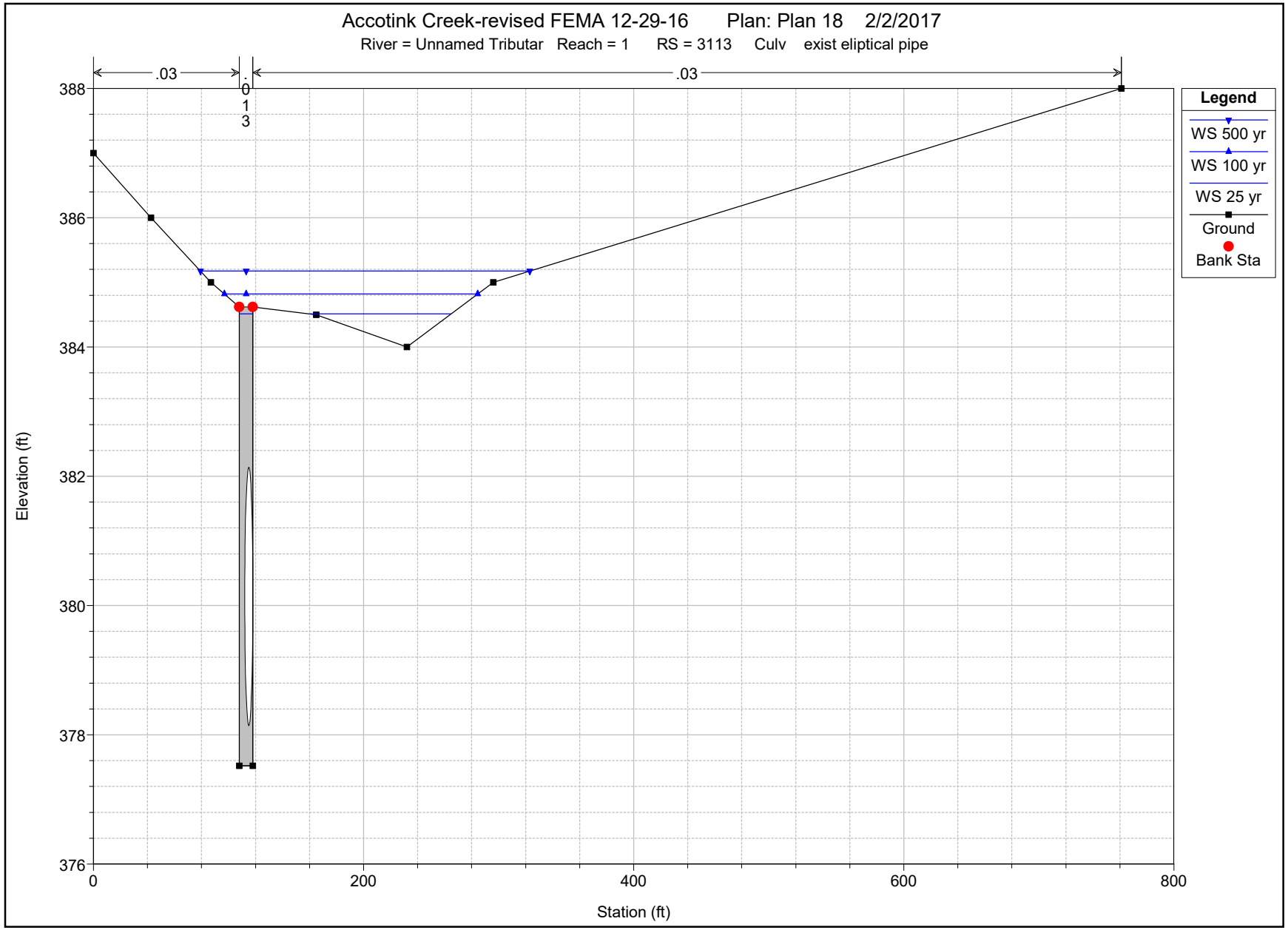
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft/ft)	E.G. Slope (ft/s)	Vel Chnl (sq ft)	Flow Area (ft)	Top Width	Froude # Chl
1	3159	2 yr	89.00	380.79	384.25	382.14	384.35	0.000195	2.57	34.61	10.00	0.24
1	3159	10 yr	222.00	380.79	387.05	383.26	387.24	0.000226	3.51	69.85	37.10	0.25
1	3159	25 yr	330.00	380.79	387.12	384.01	387.52	0.000479	5.15	72.35	40.38	0.36
1	3159	50 yr	438.00	380.79	387.39	384.68	388.01	0.000707	6.42	84.98	53.99	0.44
1	3159	100 yr	548.00	380.79	383.23	385.31	391.08	0.020004	22.47	24.38	10.00	2.54
1	3159	500 yr	897.00	380.79	384.24	388.82	394.75	0.020001	26.01	34.49	10.00	2.47
1	3113	Culvert										
1	3069	2 yr	89.00	377.52	379.89	378.87	380.11	0.000576	3.76	23.65	10.00	0.43
1	3069	10 yr	222.00	377.52	381.87	380.00	382.27	0.000647	5.10	43.50	10.00	0.43
1	3069	25 yr	330.00	377.52	383.68	380.74	384.12	0.000568	5.36	61.56	10.00	0.38
1	3069	50 yr	438.00	377.52	383.96	381.41	384.68	0.000892	6.80	64.37	10.00	0.47
1	3069	100 yr	548.00	377.52	383.65	382.04	384.89	0.001584	8.94	61.31	10.00	0.64
1	3069	500 yr	897.00	377.52	383.82	383.82	386.97	0.003958	14.24	62.98	10.00	1.00
1	3039	Culvert										
1	3009	2 yr	89.00	375.00	375.63	376.35	378.77	0.033805	14.22	6.26	10.00	3.17
1	3009	10 yr	222.00	375.00	378.99	377.47	379.47	0.000819	5.57	39.88	10.00	0.49
1	3009	25 yr	330.00	375.00	380.19	378.22	380.82	0.000888	6.35	51.95	10.00	0.49
1	3009	50 yr	438.00	375.00	380.44	378.90	381.45	0.001385	8.05	54.38	10.00	0.61
1	3009	100 yr	548.00	375.00	382.29	379.52	383.17	0.001014	7.52	72.92	10.00	0.49
1	3009	500 yr	897.00	375.00	383.03	381.28	384.97	0.002131	11.17	80.29	10.00	0.70
1	2916	Culvert										
1	2824	2 yr	92.00	372.50	373.34	373.85	375.10	0.014450	10.64	8.36	10.00	2.05
1	2824	10 yr	229.00	372.50	374.09	374.98	377.11	0.012284	13.93	15.93	10.00	1.95
1	2824	25 yr	341.00	372.50	374.63	375.73	378.36	0.011457	15.48	21.32	10.00	1.87
1	2824	50 yr	445.00	372.50	378.08	376.44	379.07	0.001336	7.97	55.81	10.00	0.60
1	2824	100 yr	565.00	372.50	375.63	377.02	380.39	0.010418	17.51	31.30	10.00	1.74
1	2824	500 yr	923.00	372.50	378.92	378.92	382.13	0.003988	14.38	64.20	10.00	1.00
1	2633	Culvert										
1	2523	2 yr	92.00	368.50	371.11	369.88	371.31	0.000462	3.52	26.13	10.00	0.38
1	2523	10 yr	229.00	368.50	372.34	371.03	372.89	0.000967	5.96	38.41	10.00	0.54
1	2523	25 yr	341.00	368.50	370.61	371.80	374.67	0.011798	16.15	21.11	10.00	1.96
1	2523	50 yr	445.00	368.50	371.07	372.44	375.73	0.011356	17.33	25.68	10.00	1.91
1	2523	100 yr	565.00	368.50	375.41	373.11	376.45	0.001236	8.17	69.11	10.00	0.55
1	2523	500 yr	923.00	368.50	374.92	374.92	378.13	0.003988	14.38	64.20	10.00	1.00

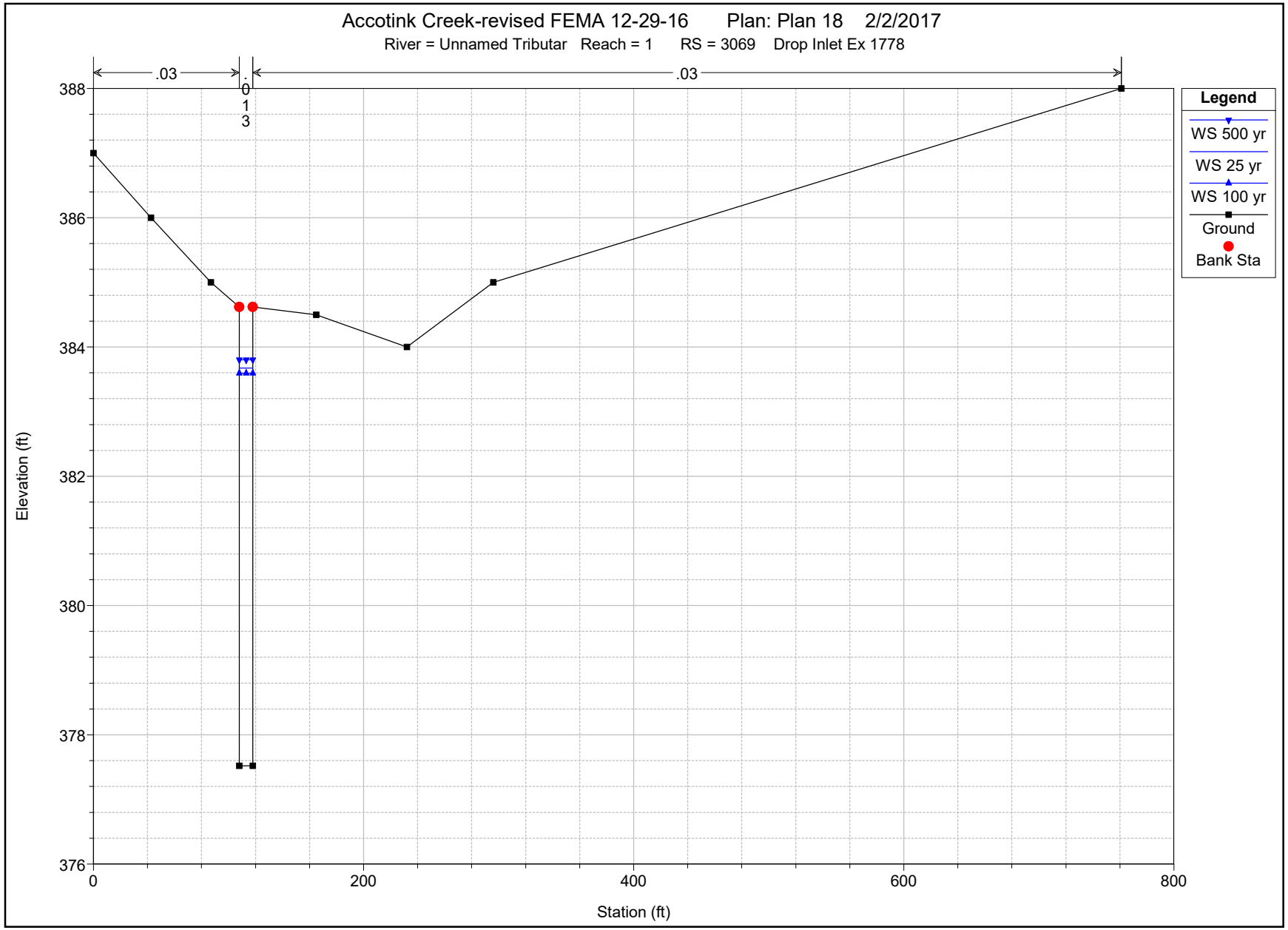
1	2483	Culvert									
1	2443.764	2 yr	143.00	366.96	371.08		371.23	0.005251	3.05	46.82	16.96	0.32
1	2443.764	10 yr	336.00	366.96	372.33		372.61	0.008015	4.39	93.00	83.81	0.41
1	2443.764	25 yr	489.00	366.96	372.67	371.33	373.00	0.009250	5.02	125.53	107.36	0.45
1	2443.764	50 yr	630.00	366.96	372.87	372.64	373.25	0.010422	5.51	148.86	121.61	0.48
1	2443.764	100 yr	794.00	366.96	373.12	372.90	373.50	0.010002	5.61	178.51	123.76	0.48
1	2443.764	500 yr	1278.00	366.96	373.56	373.30	374.11	0.011384	6.39	234.13	127.69	0.52
1	2160.924	2 yr	143.00	364.52	369.98		370.06	0.002861	2.32	78.23	78.50	0.24
1	2160.924	10 yr	336.00	364.52	370.56		370.69	0.005220	3.42	171.73	290.57	0.34
1	2160.924	25 yr	489.00	364.52	370.79		370.91	0.005075	3.53	244.65	335.51	0.33
1	2160.924	50 yr	630.00	364.52	371.00		371.11	0.004208	3.34	318.93	371.15	0.31
1	2160.924	100 yr	794.00	364.52	371.04	370.82	371.19	0.005957	4.00	332.78	377.42	0.37
1	2160.924	500 yr	1278.00	364.52	371.36	371.04	371.54	0.006186	4.31	462.40	431.74	0.38
1	1905.580	2 yr	143.00	364.47	369.64	367.14	369.64	0.000100	0.55	317.01	312.43	0.04
1	1905.580	10 yr	336.00	364.47	369.91	369.00	369.92	0.000267	0.93	403.04	326.27	0.07
1	1905.580	25 yr	489.00	364.47	370.14	369.00	370.16	0.000330	1.07	479.49	336.25	0.08
1	1905.580	50 yr	630.00	364.47	370.46	369.01	370.48	0.000280	1.03	589.33	342.41	0.08
1	1905.580	100 yr	794.00	364.47	370.22	369.21	370.26	0.000728	1.60	506.44	337.77	0.12
1	1905.580	500 yr	1278.00	364.47	370.46	369.49	370.54	0.001161	2.09	588.05	342.34	0.16

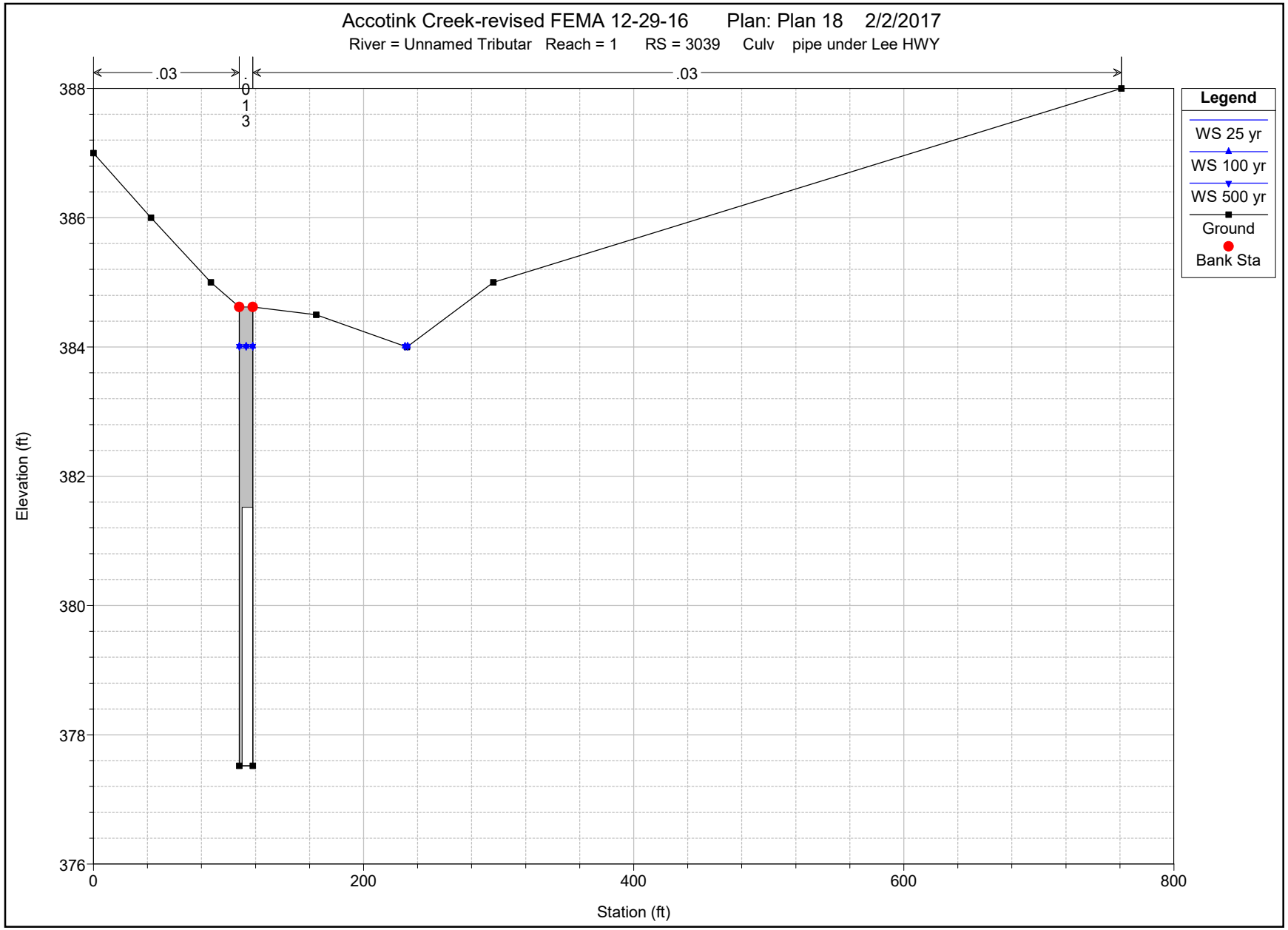

Accotink Creek-revised FEMA 12-29-16 Plan: Plan 18 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 1905.580 just upstream of Keith Avenue
.03
.063
.045
Legend
WS 500 yr
WS 100 yr
WS 25 yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
382
380
378
376
374
372
370
368
366
364
0
100
200
300
400
500
600
700

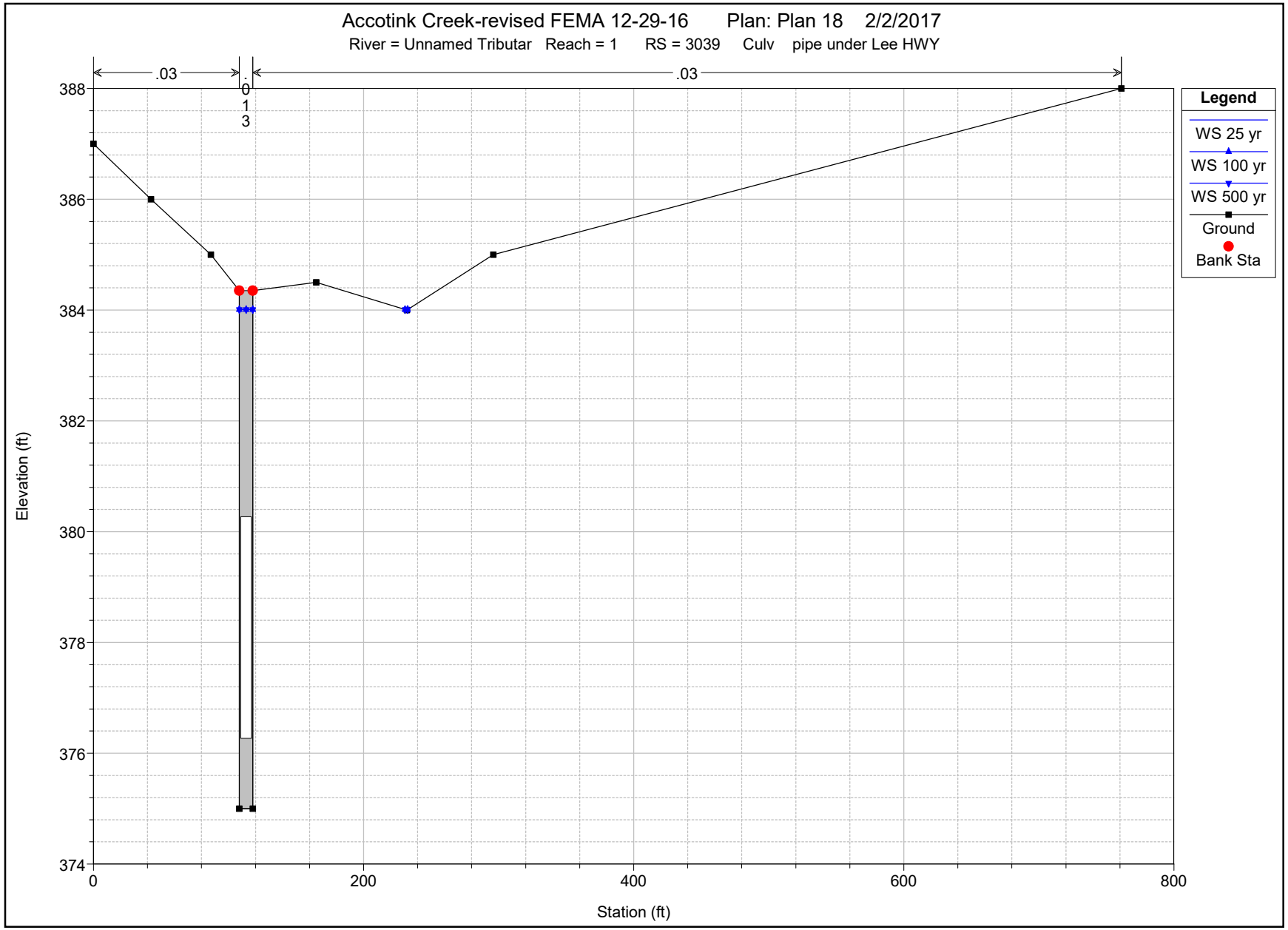

Accotink Creek-revised FEMA 12-29-16 Plan: Plan 18 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 3159 Drop Inlet Ex 551
.03
.013
.03
Legend
WS 25 yr
WS 500 yr
WS 100 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
390
388
386
384
382
380
0
50
100
150
200
250
300

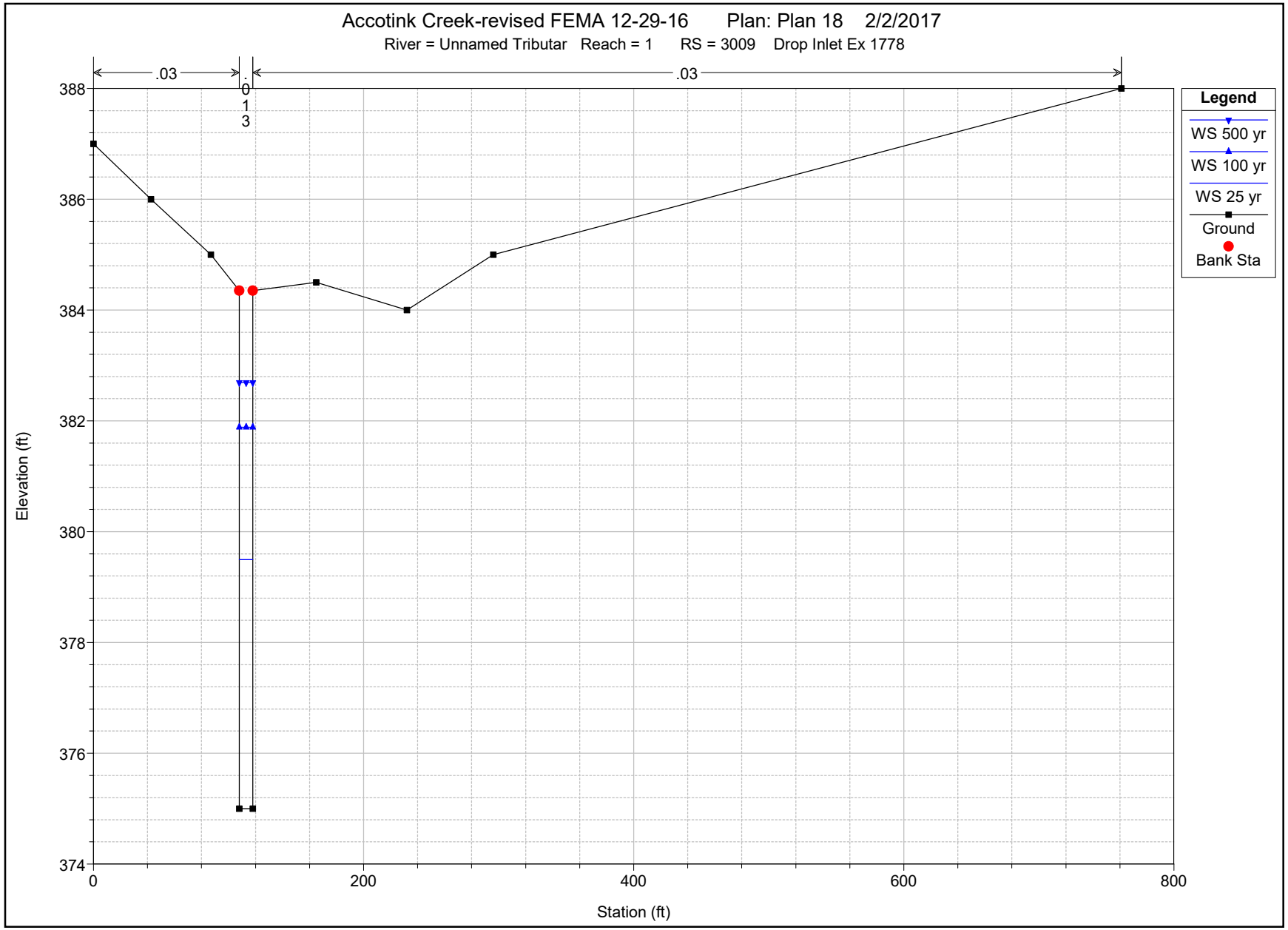

Accotink Creek-revised FEMA 12-29-16 Plan: Plan 18 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 3113 Culv exist eliptical pipe
.03
.013
.03
Legend
WS 500 yr
WS 25 yr
WS 100 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
390
388
386
384
382
380
0
50
100
150
200
250
300

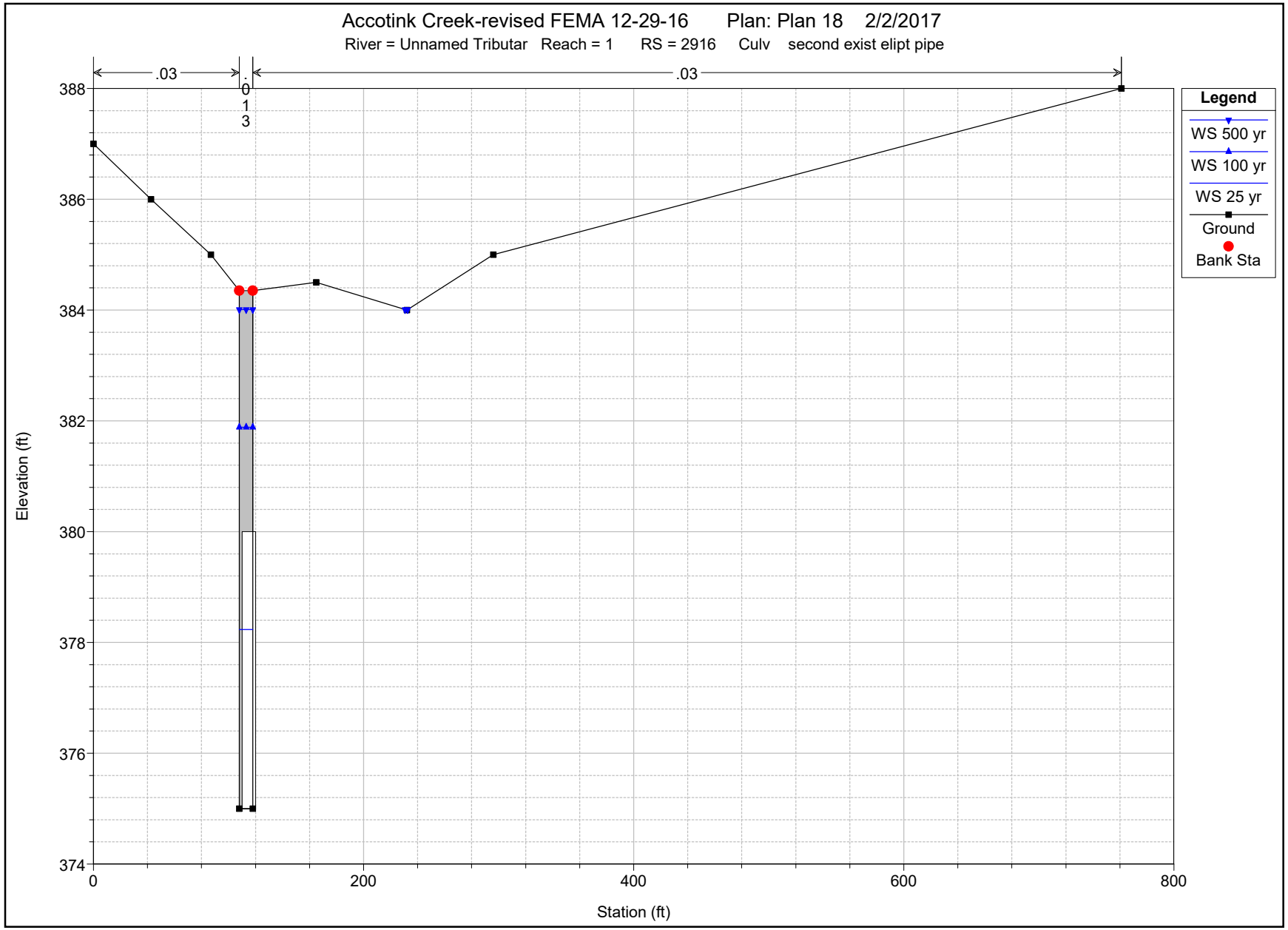

Accotink Creek-revised FEMA 12-29-16 Plan: Plan 18 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 3113 Culv exist eliptical pipe
.03
.013
.03
Legend
WS 500 yr
WS 100 yr
WS 25 yr
Ground
Bank Sta
Elevation (ft)
388
386
384
382
380
378
376
0
200
400
600
800
Station (ft)

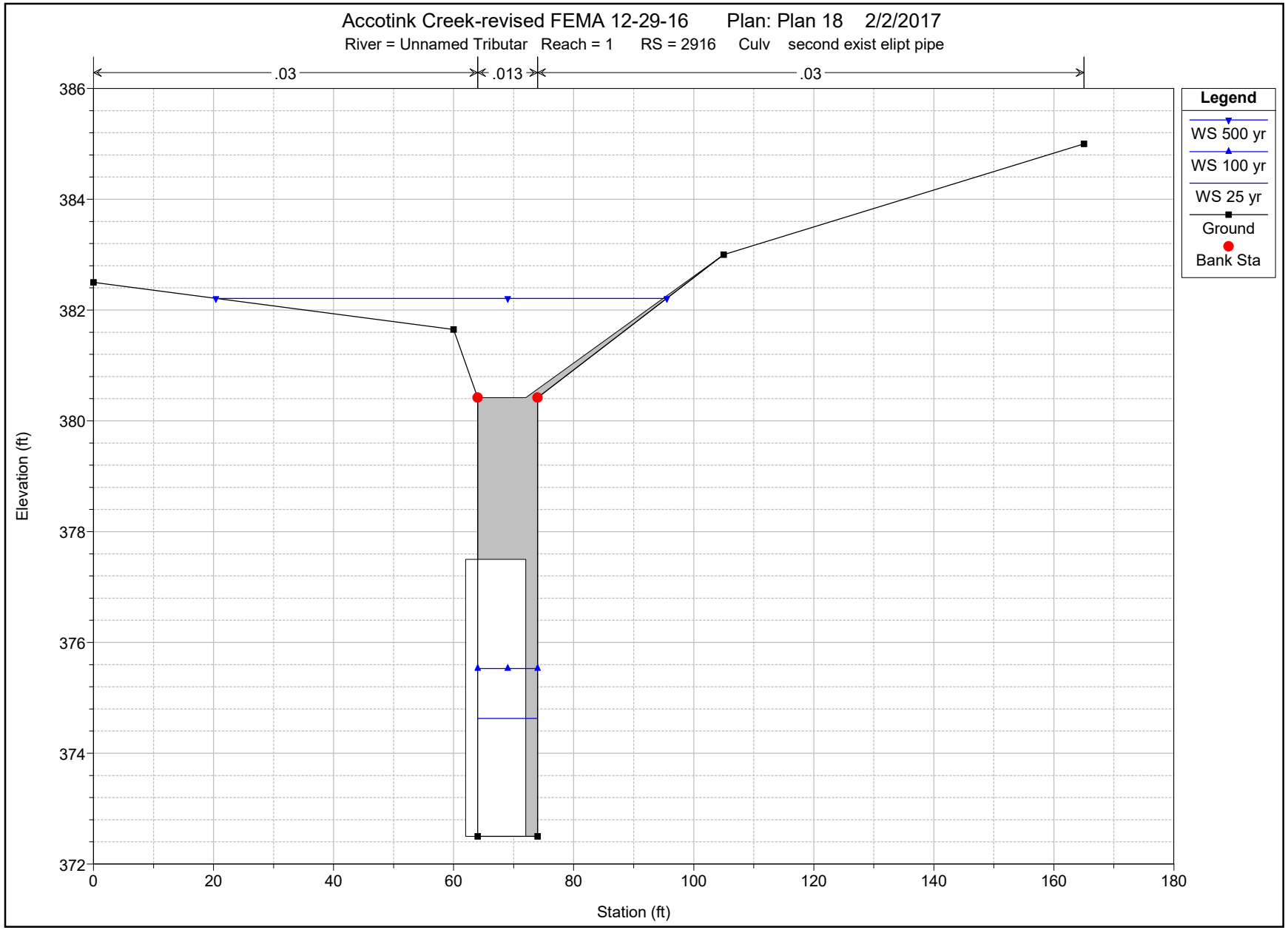

Accotink Creek-revised FEMA 12-29-16 Plan: Plan 18 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 3069 Drop Inlet Ex 1778
.03
.03
0
1
3
Legend
WS 500 yr
WS 25 yr
WS 100 yr
Ground
Bank Sta
Elevation (ft)
388
386
384
382
380
378
376
0
200
400
600
800
Station (ft)

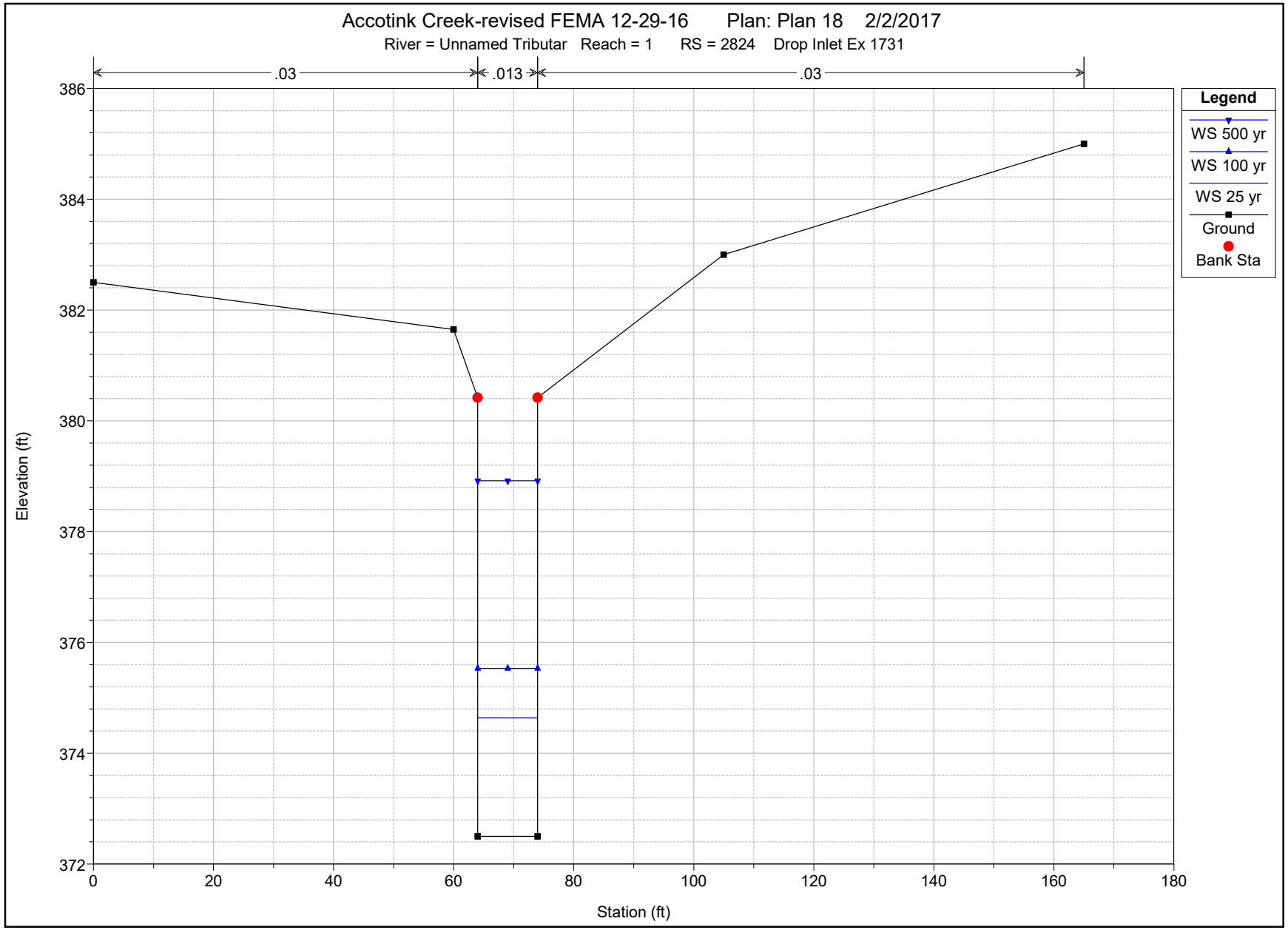

Accotink Creek-revised FEMA 12-29-16 Plan: Plan 18 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 3039 Culv pipe under Lee HWY
.03
.03
0
1
3
Legend
WS 25 yr
WS 100 yr
WS 500 yr
Ground
Bank Sta
Elevation (ft)
388
386
384
382
380
378
376
0
200
400
600
800
Station (ft)

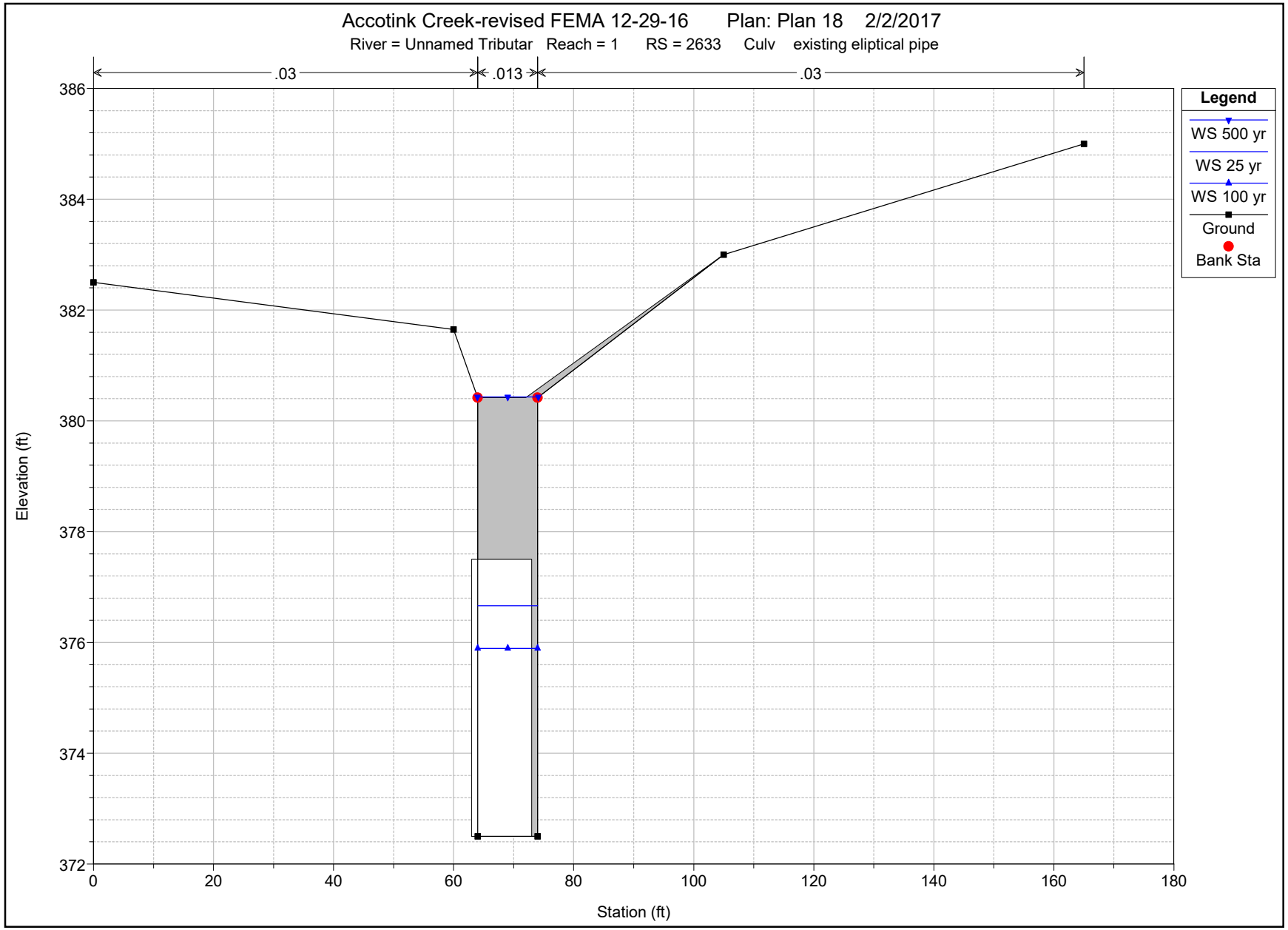

Accotink Creek-revised FEMA 12-29-16 Plan: Plan 18 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 3039 Culv pipe under Lee HWY
.03
.03
0
1
3
Legend
WS 25 yr
WS 100 yr
WS 500 yr
Ground
Bank Sta
Elevation (ft)
388
386
384
382
380
378
376
374
0
200
400
600
800
Station (ft)

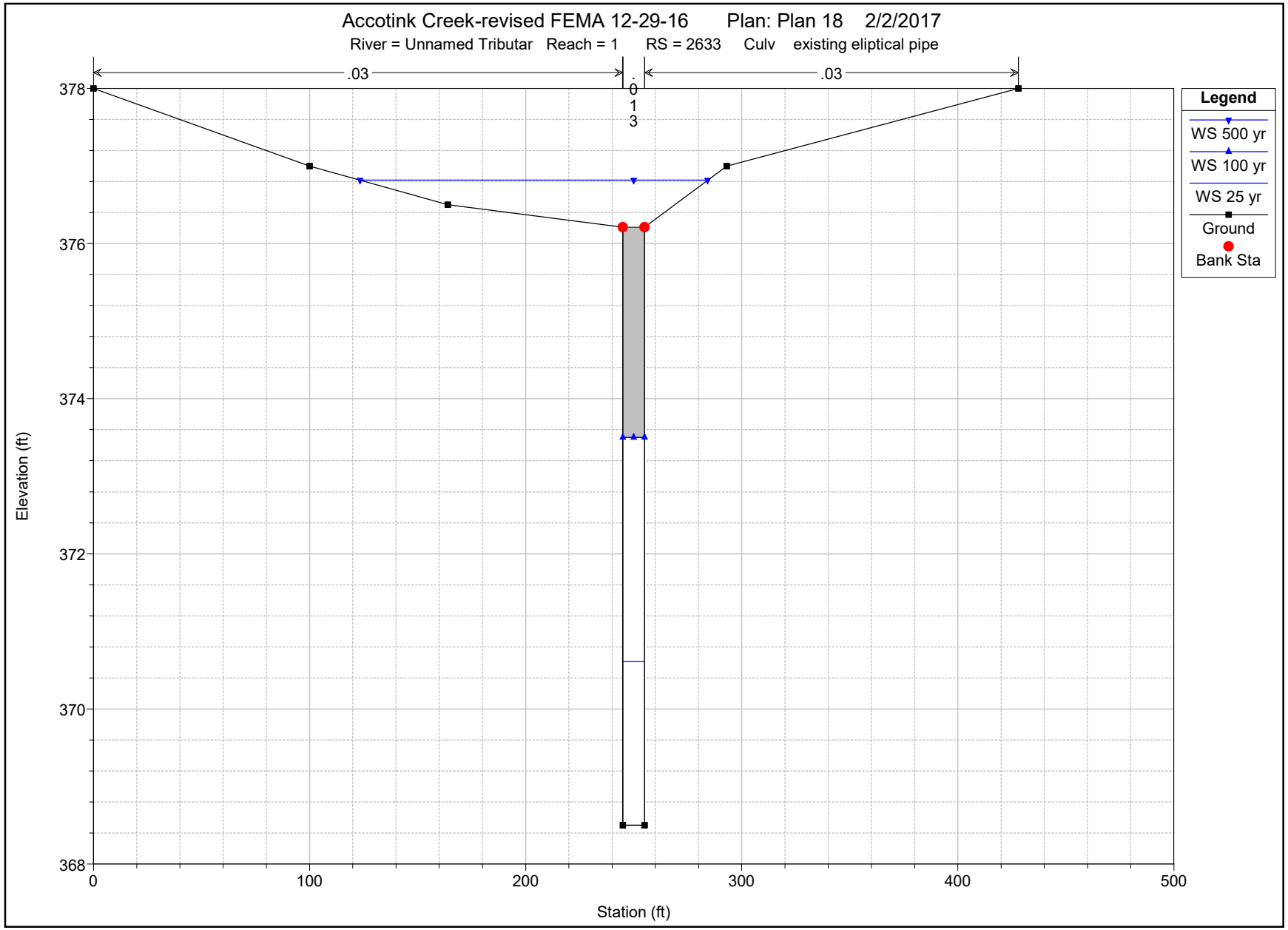

Accotink Creek-revised FEMA 12-29-16 Plan: Plan 18 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 3009 Drop Inlet Ex 1778
.03
.03
0
1
3
Legend
WS 500 yr
WS 100 yr
WS 25 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
388
386
384
382
380
378
376
374
0
200
400
600
800

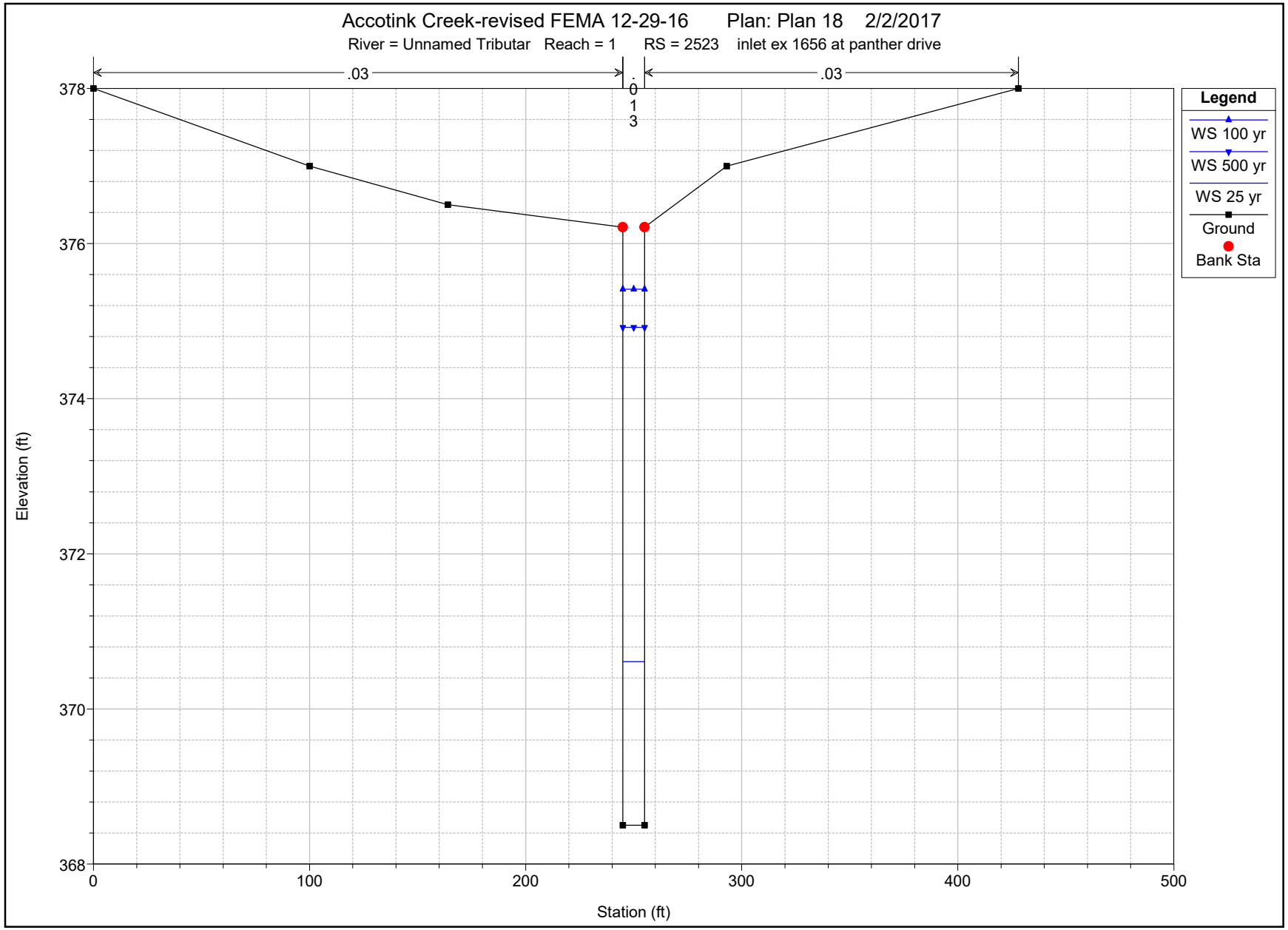

Accotink Creek-revised FEMA 12-29-16 Plan: Plan 18 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 2916 Culv second exist elipt pipe
.03
.03
0
1
3
Legend
WS 500 yr
WS 100 yr
WS 25 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
388
386
384
382
380
378
376
374
0
200
400
600
800

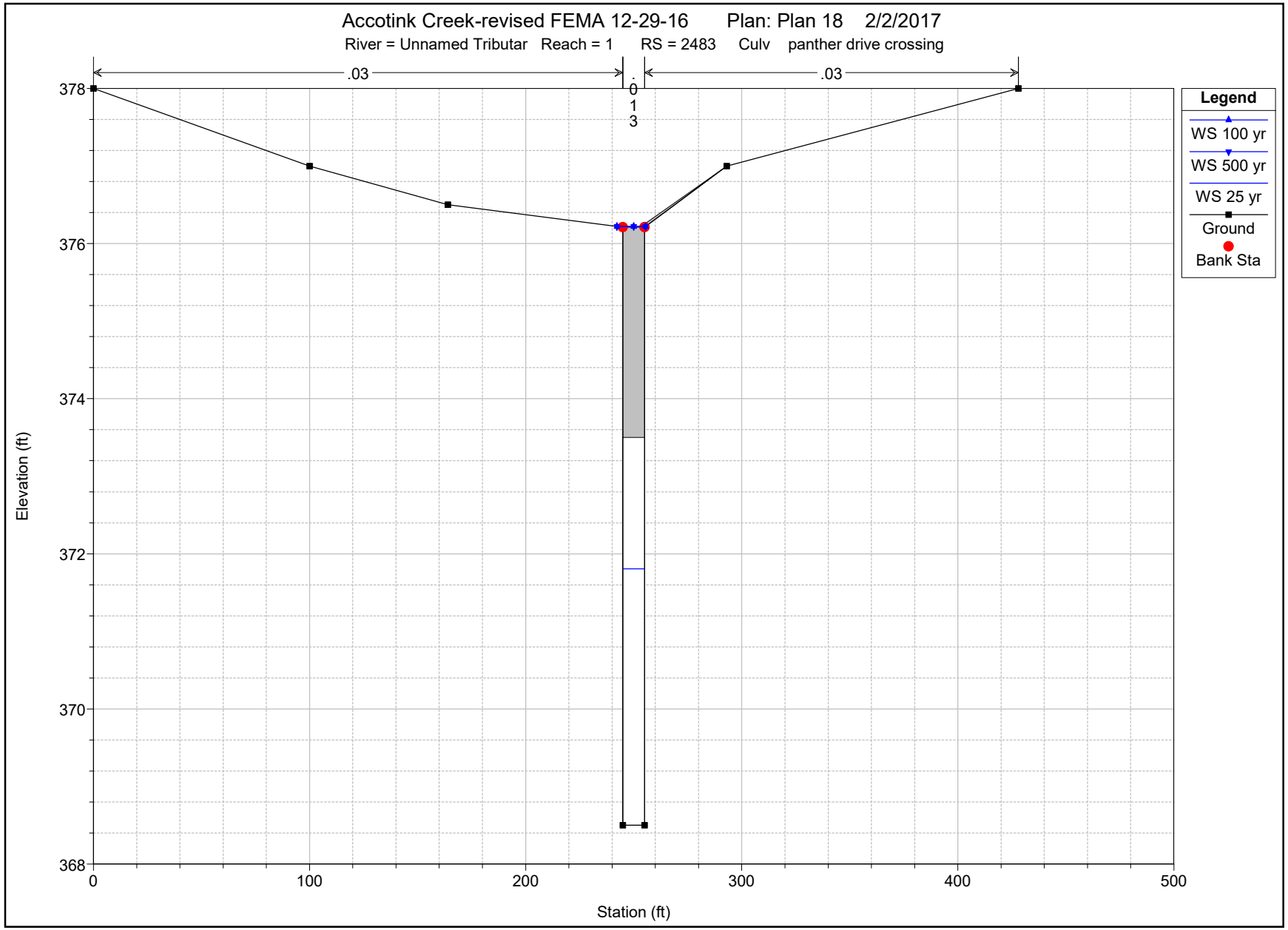

Accotink Creek-revised FEMA 12-29-16 Plan: Plan 18 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 2916 Culv second exist elipt pipe
.03
.013
.03
Legend
WS 500 yr
WS 100 yr
WS 25 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
386
384
382
380
378
376
374
372
0
20
40
60
80
100
120
140
160
180

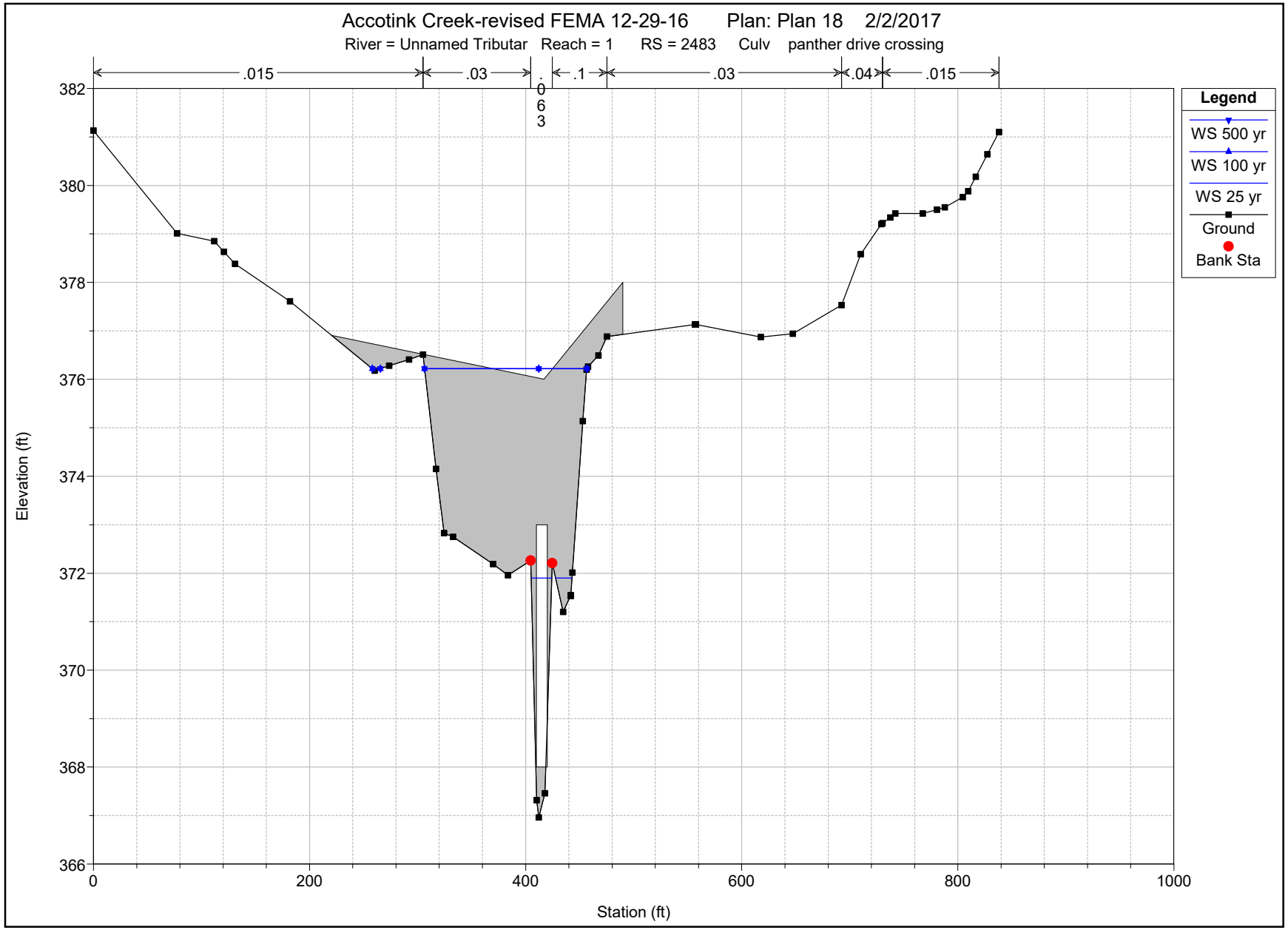

Accotink Creek-revised FEMA 12-29-16 Plan: Plan 18 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 2824 Drop Inlet Ex 1731
.03
.013
.03
Legend
WS 500 yr
WS 100 yr
WS 25 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
386
384
382
380
378
376
374
372
0
20
40
60
80
100
120
140
160
180

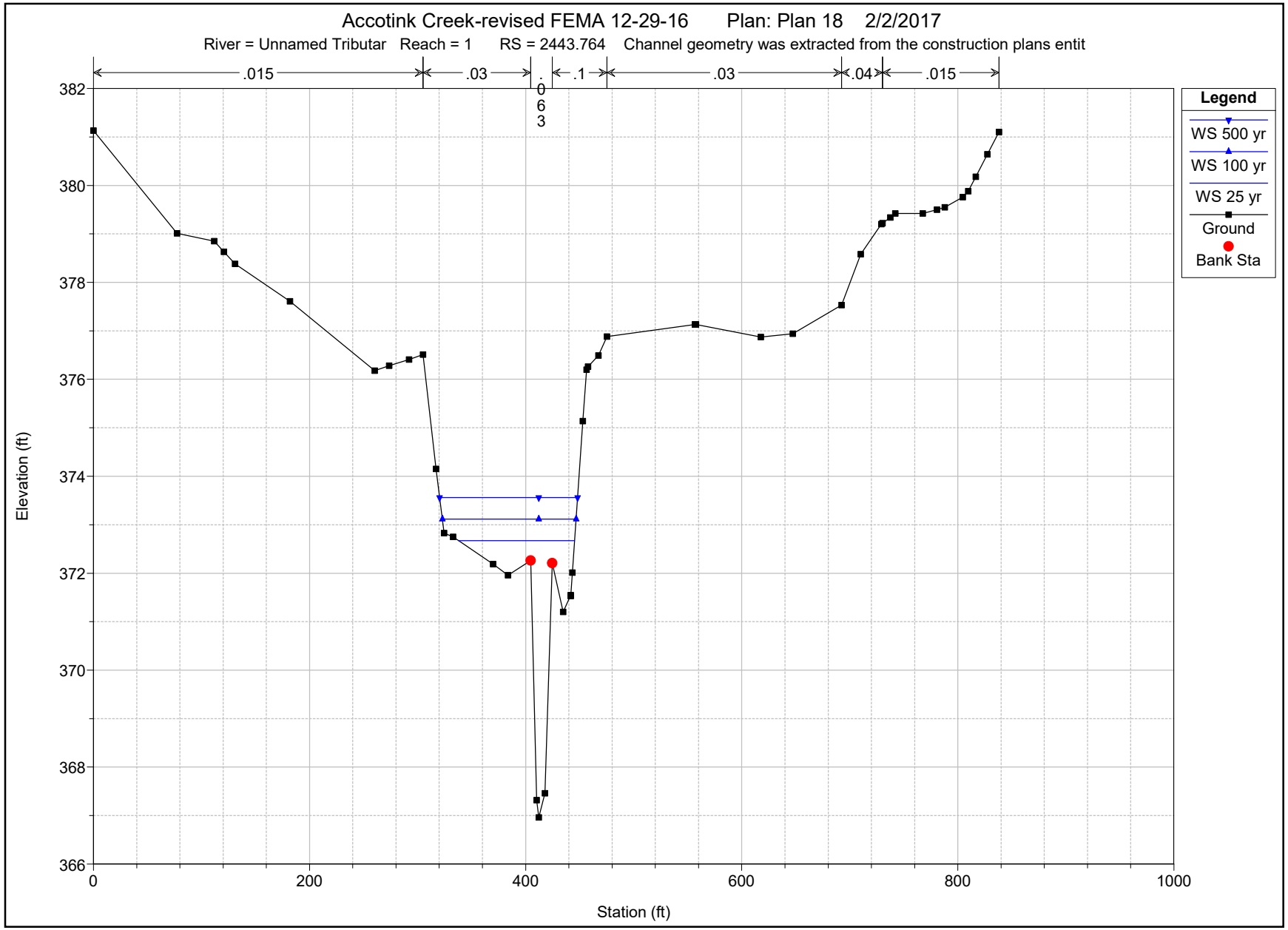

Accotink Creek-revised FEMA 12-29-16 Plan: Plan 18 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 2633 Culv existing eliptical pipe
.03
.013
.03
Legend
WS 500 yr
WS 25 yr
WS 100 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
386
384
382
380
378
376
374
372
0
20
40
60
80
100
120
140
160
180

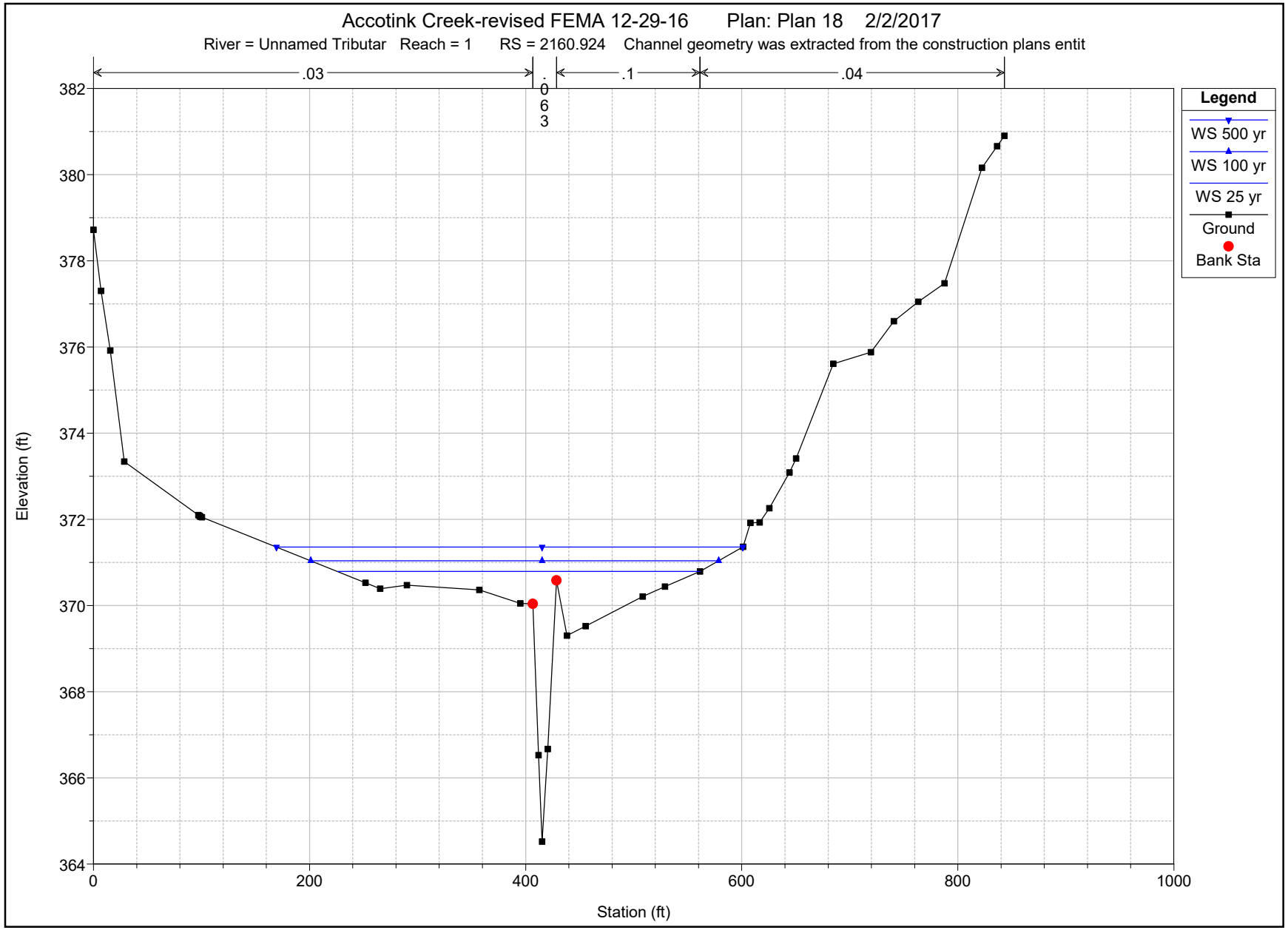

Accotink Creek-revised FEMA 12-29-16 Plan: Plan 18 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 2633 Culv existing eliptical pipe
.03
.013
.03
Legend
WS 500 yr
WS 100 yr
WS 25 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
378
376
374
372
370
368
0
100
200
300
400
500

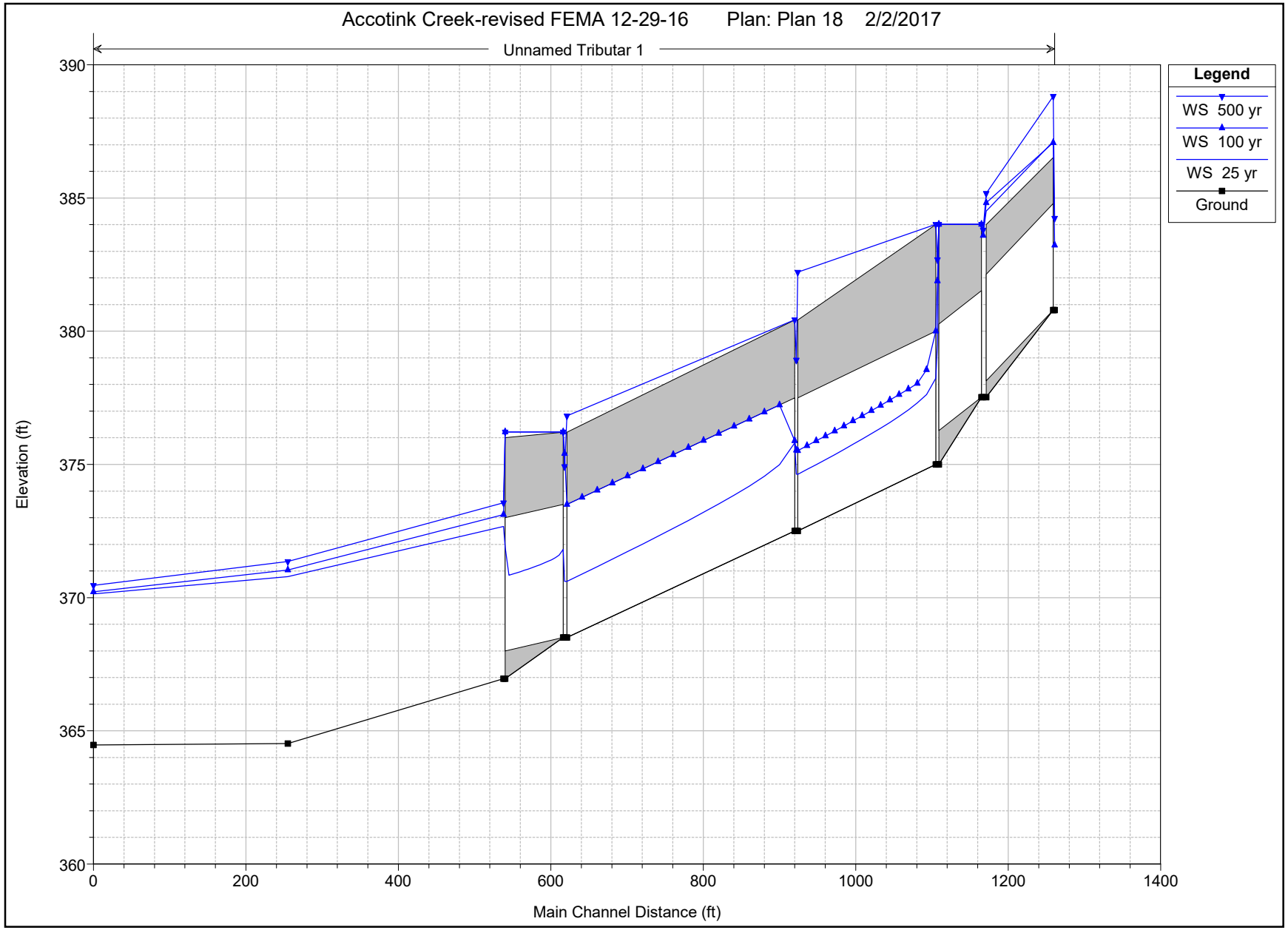

Accotink Creek-revised FEMA 12-29-16 Plan: Plan 18 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 2523 inlet ex 1656 at panther drive
.03
.013
.03
Legend
WS 100 yr
WS 500 yr
WS 25 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
378
376
374
372
370
368
0
100
200
300
400
500


Accotink Creek-revised FEMA 12-29-16 Plan: Plan 18 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 2483 Culv panther drive crossing
.03
.03
.013
Legend
WS 100 yr
WS 500 yr
WS 25 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
378
376
374
372
370
368
0
100
200
300
400
500


Accotink Creek-revised FEMA 12-29-16 Plan: Plan 18 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 2483 Culv panther drive crossing
.015
.03
.063
.1
.03
.04
.015
Legend
WS 500 yr
WS 100 yr
WS 25 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
382
380
378
376
374
372
370
368
366
0
200
400
600
800
1000


Accotink Creek-revised FEMA 12-29-16 Plan: Plan 18 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 2443.764 Channel geometry was extracted from the construction plans entit
.015
.03
.063
.1
.03
.04
.015
Legend
WS 500 yr
WS 100 yr
WS 25 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
382
380
378
376
374
372
370
368
366
0
200
400
600
800
1000


Accotink Creek-revised FEMA 12-29-16 Plan: Plan 18 2/2/2017
River = Unnamed Tributar Reach = 1 RS = 2160.924 Channel geometry was extracted from the construction plans entit
.03
.063
.1
.04
Legend
WS 500 yr
WS 100 yr
WS 25 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
382
380
378
376
374
372
370
368
366
364
0
200
400
600
800
1000


Accotink Creek-revised FEMA 12-29-16 Plan: Plan 18 2/2/2017
Unnamed Tributar 1
Legend
WS 500 yr
WS 100 yr
WS 25 yr
Ground
Elevation (ft)
390
385
380
375
370
365
360
0
200
400
600
800
1000
1200
1400
Main Channel Distance (ft)

VIRGINIA STATE GRID NORTH
NAD 83

HEADWALL
EC-1
CLASS I
25'X30'

15+00
16+00
17+00
18+00
19+00
20+00
21+00
22+00
23+00
23+70

PROP. 30' DRAINAGE EASEMENT

10'x5' BOX CULVERT

EX. DRAINAGE CHANNEL

14'x10' SPECIAL DESIGN JUNCTION BOX CONNECT EX. PIPING AND PROVIDE DROP INLET TOP

PROP. 30' DRAINAGE EASEMENT

10'x5' BOX CULVERT

14'x10' SPECIAL DESIGN JUNCTION BOX CONNECT EX. PIPING AND PROVIDE DROP INLET TOP

8'X4' BOX CULVERT PROPOSED BY OTHERS

30 15 0 30 60
HORIZONTAL GRAPHIC SCALE
1" = 30'

1 2 3 4

390
385
380
375
370
365
360

EX. GROUND
FAIRFAX BLVD.
PANTHER PLACE
EX. CHANNEL
EC-I
CLASS I
STANDARD HW-1
(NO WINGS)

14'x10' SPECIAL DESIGN JUNCTION BOX
14'x10' SPECIAL DESIGN JUNCTION BOX
14'x10' SPECIAL DESIGN JUNCTION BOX

97.82'-10'X5' CONCRETE BOX CULVERT@-0.51%
368.27'-10'X5' CONCRETE BOX CULVERT@-1.09%
162.57'-10'X5' CONCRETE BOX CULVERT@-1.29%
70.02'-10'X5' CONCRETE BOX CULVERT@-1.29%
BY OTHERS
64.35'-8'X4' CONCRETE BOX CULVERT@-1.94%

3 1.5 0 3 6
VERTICAL GRAPHIC SCALE
1" = 3'

30 15 0 30 60
HORIZONTAL GRAPHIC SCALE
1" = 30'

15+74.87 = HEADWALL
CULVERT INV. = 368.00

16+77.81 = JUNCTION BOX
CULVERT INV. = 368.50
RIM = 376.04

20+57.02= JUNCTION BOX
CULVERT INV. = 372.50
RIM = 381.75

20+25.62= BEND IN BOX CULVERT

23+00.67 = JUNCTION BOX
CULVERT INV. IN = 376.27
CULVERT INV. OUT = 375.5
RIM = 384.02

15+00 16+00 17+00 18+00 19+00 20+00 21+00 22+00 23+00 23+70

christopher consultants
9900 main street (suite 400) · fairfax, va 22031
phone 703.273.6820 · fax 703.273.6820

ADVANCE COPY
NOT FOR CONSTRUCTION

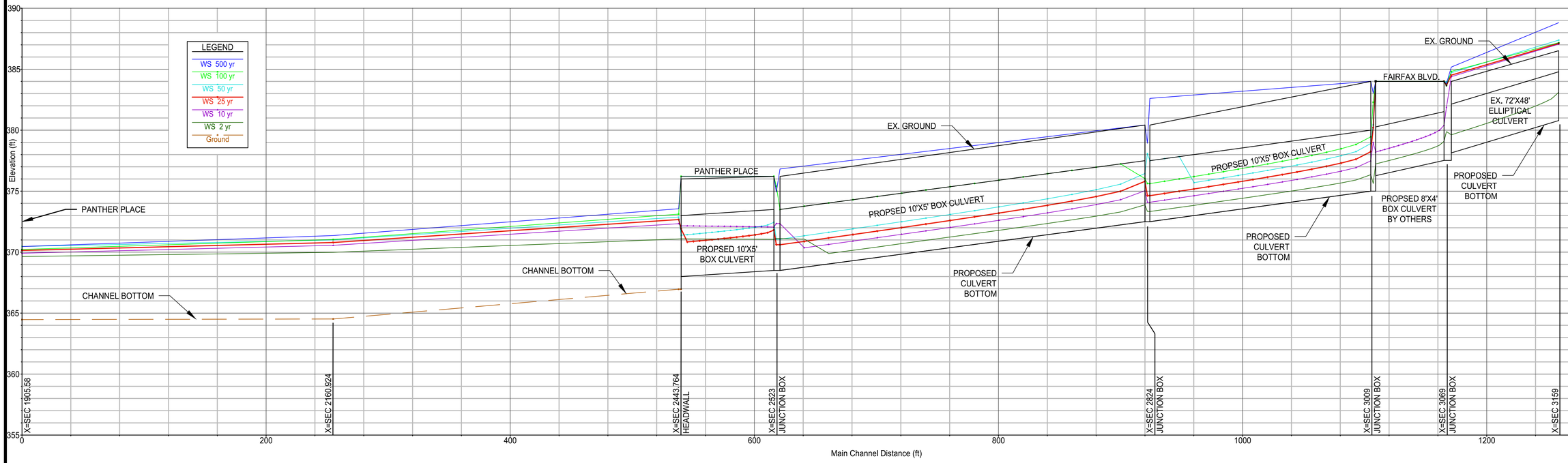
EXHIBIT D PROPOSED BOX CULVERT PLAN AND PROFILE

FLOOD PLAIN STUDY
PAUL VI.
FAIRFAX CITY, VIRGINIA

PROJECT NO: 15010.003.00
SCALE:
DATE: 04-14-2017
DESIGN: RH
DRAWN: NM
CHECKED: RH
SHEET No. D
01 OF 6

DWG-107365

P:\Projects\15010\00300\107365 DWG\D EXHIBIT D PROPOSED BOX CULVERT PLAN AND PROFILE.dwg, 4/11/2017 2:13:53 PM, naomimessier, 1:1, christopher consultants, ltd



4 2 0 4 8
VERTICAL GRAPHIC SCALE
1" = 4'

40 20 0 40 80
HORIZONTAL GRAPHIC SCALE
1" = 40'

christopher consultants
9900 main street (suite 400) · fairfax, va 22031
phone 703.273.6820 · fax 703.273.6820

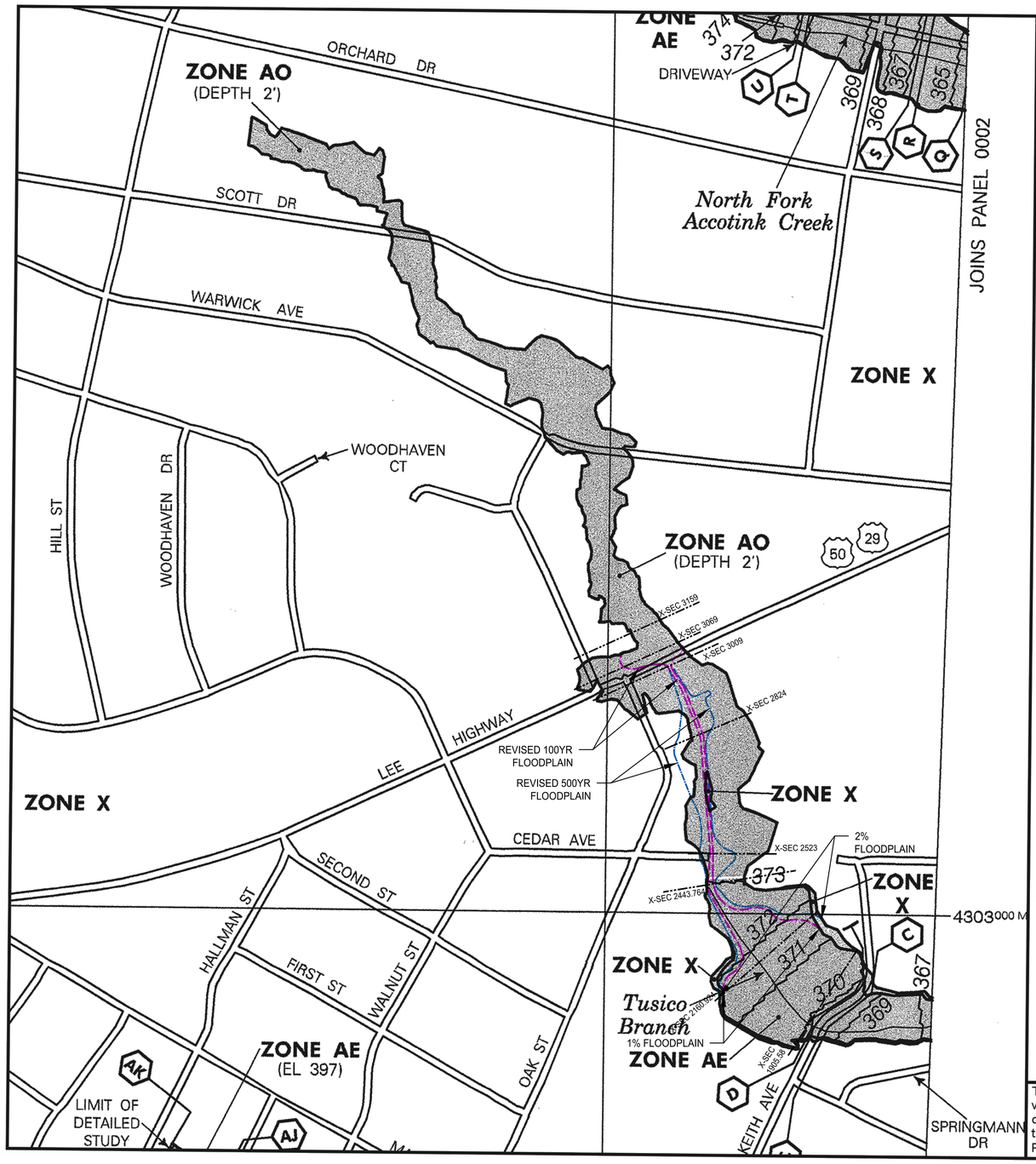
ADVANCE COPY
NOT FOR CONSTRUCTION

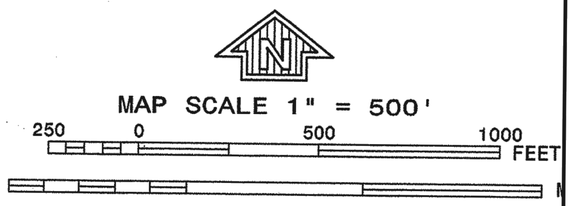
EXHIBIT E PROPOSED
WATER SURFACE
PROFILES TUSICO
BRANCH

FLOOD PLAIN STUDY
PAUL VI.
FAIRFAX CITY, VIRGINIA

PROJECT NO: 15010.003.00
SCALE:
DATE: 04-14-2017
DESIGN: RH
DRAWN: NM
CHECKED: RH
SHEET No.
E
01 OF 6

DWG-107365





NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0001D

FIRM

FLOOD INSURANCE RATE MAP

CITY OF
FAIRFAX,
VIRGINIA
(INDEPENDENT CITY)

PANEL 1 OF 6

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
FAIRFAX, CITY OF	515524	0001	D

REVISED 100YR FLOODPLAIN
REVISED 500YR FLOODPLAIN
HECRAS X-SECTION

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

MAP NUMBER
5155240001D

MAP REVISED
JUNE 2, 2006

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

christopher consultants
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phone 703.273.6820 · fax 703.273.6820

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EXHIBIT F FEMA FLOODPLAIN REVISION MAP

FLOOD PLAIN STUDY
PAUL VI.
FAIRFAX CITY, VIRGINIA

PROJECT NO: 15010.003.00
SCALE:
DATE: 04-14-2017
DESIGN: RH
DRAWN: NM
CHECKED: RH
SHEET No. F
01 OF 6

DWG-107365