Diamond Street Industrial

Technical Appendices

Appendix H

Hydrology/Hydraulics Study

PRELIMINARY HYDROLOGY / HYDRAULICS STUDY

FOR THE:
Tentative Parcel Map for
APNs 223-341-03 Through 14 & 16
City of San Marcos

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DATE PREPARED:
February 25, 2019

REVISION DATE(S):

December 21, 2020

TABLE OF CONTENTS

1.0 PROJECT DESCRIPTION

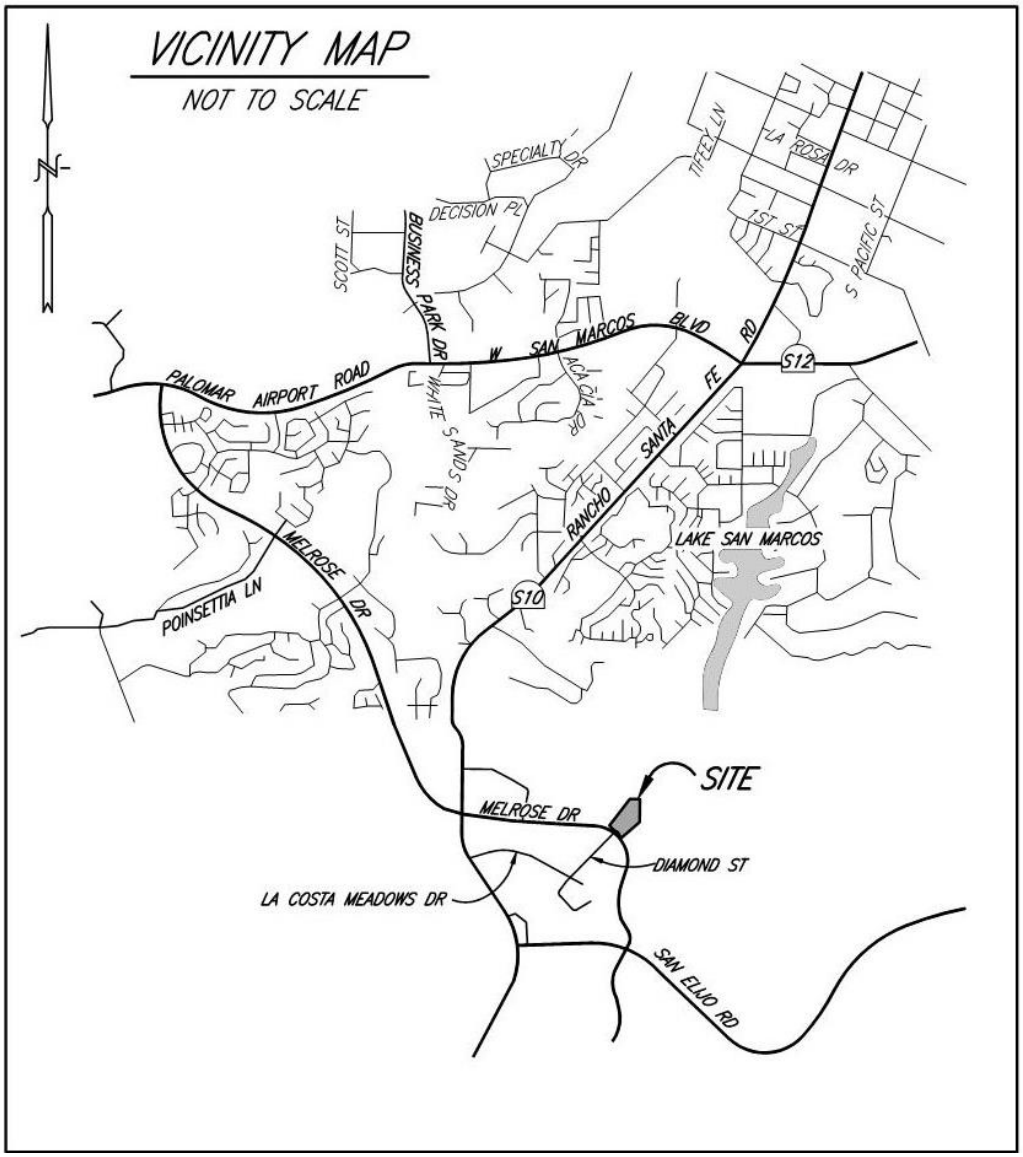
1.1 Purpose of Study

The purpose of this study is to support the design and construction of a large industrial/commercial pad to ensure the new improvements do not adversely impact adjacent or downstream properties.

1.2 Project Description

The project proposes approximately 12-acre pad for future industrial/commercial use. Improvements consists primarily of unpaved driveway which utilizes an existing intersection, retaining walls, drainage infrastructure to allow offsite flows to bypass thru the site and desiltation basins.

2.0 VICINITY MAP



3.0 DESCRIPTION OF WATERSHED

3.1 Pre-Development Topography

The property is currently mostly undeveloped hillsides, except for a portion of residential street atop of the most northerly hillside which all drain south into a natural valley at the bottom of the hills. The valley continues draining south into an existing Type-F inlet where it enters the public storm drain system via a 48" RCP in Melrose Drive. POC-1

There is a small natural ridge that develops in the lower western portion of the property that splits a small portion of the hillside flows west towards an existing access road with adjacent browditches collecting this flow into an existing 30" pipe in the access road. POC-2

Along the Melrose Drive Right of Way there is a 30'- 50' high cut slope that drains into a browditch adjacent to the sidewalk on Melrose Drive. The browditch drains south along Melrose Dr. till it reaches the D-25 where it discharges into Melrose Drive. POC-3

The Pre-Developed Drainage Map can be found as Attachment 2.2 in this report

3.2 Post-Development Topography

The project proposes to fill in a portion of the existing valley to create a large pad that slopes 2.0% towards 2 different desiltation basins while maintaining the natural spilt of the existing ridge. All offsite flows generally remain undisturbed until they reach the northern edge of the pad where they will either enter a 48" pipe or a browditch that drains directly into the existing type-f box. POC-1

The third desiltation basin to the West collects all onsite flows that flow to POC-2 in the pre-development condition and discharges them into the existing browditch along the access road.

A portion of cut slope along Melrose Dr. is now redirected to POC-1, due to the proposed driveway. The remaining undisturbed cut slope drains as it did in the pre-development condition.

The Post-Developed Drainage Map can be found as Attachment 2.3 in this report.

3.3 Hydrologic Unit Contribution

The project is in the Batiquitos Hydrologic Sub Area of the Lower San Marcos Creek Hydrologic Area of the Carlsbad Hydrologic Unit (904.51).

4.0 METHODOLOGY

Peak runoff was determined in accordance with the San Diego County Hydrology Manual, June 2003.

4.1 Drainage system overview

All offsite flows are captured either by a browditch or a 48" pipe that routes the flow to their respective POC. The proposed pad has earthen swales and berms to route the onsite runoff to 1 of the 3 desiltation basins to allow for any collected sediment to drop out of the runoff. Two of the desiltation basins are also being used to attenuate peak flows before draining into the proposed storm drain connecting to the existing Type-F inlet.

4.2 Hydrology Software

The "Rational Hydrology Method, San Diego County Flood Division (1985 Hydrology Manual)" module of the CIVILCADD/CIVIL DESIGN Engineering software version 6.5 is used in this study.

4.3 Hydraulics Software

Hydraflow Storm Sewers 2015 is used in this step. Runoffs calculated from the rational method are entered into this software to design and size the storm drain systems.

5.0 CALCULATIONS

5.1 Determination of Watershed

The watershed is shown as Attachments 1 and 2 of this report.

5.2 Calculate Runoff Coefficient

In accordance with the County's Hydrology Manual, the runoff coefficient "C" was determined from Table 3-1 and USDA Web Soil Survey. From Table 3-1 Undisturbed Natural Terrain was selected. From the Web Soil Survey, soil type D was selected. The runoff coefficient was determined to be 0.35 for both Pre-development and Post-development due to no impervious features being proposed.

5.3 Calculate Manning Roughness Coefficient

The manning's coefficient used for calculations are as follows.
Finished grade (pad): n=0.015
Brow ditch: n=0.016
Overland channel flows: n= 0.040

5.4 Calculate Storm Flows using the Modified Rational Method

Peak runoff for the 6-hour 100-year storm was calculated by the modified rational method using CivilD software in accordance with the County's hydrology manual. Three points of compliance were examined. The results are tabulated below.

POC-1 **SUMMARY: PEAK 100-YEAR RUNOFF Un-mitigated**

	Node #	Tc (min)	Runoff (cfs)
Pre-dev	108	20.97	128.182
Post-dev	110	19.97	135.962
		Increase	7.78

POC-2 **SUMMARY: PEAK 100-YEAR RUNOFF**

	Node #	Tc (min)	Runoff (cfs)
Pre-dev	404	7.70	15.749
Post-dev	407	7.71	13.406
		Reduction	2.343

POC-3 **SUMMARY: PEAK 100-YEAR RUNOFF**

	Node #	Tc (min)	Runoff (cfs)
Pre-dev	503	5.51	1.180
Post-dev	902	5.0	0.281
		Reduction	0.899

POC-1 requires peak flow mitigation, see Section 5.7 for details.
CivilD data and output files can be found in Attachment 3 of this report.

5.5 Design / Analyze Proposed Storm Drain Facilities

Hydraflow Storm Sewer Extension for Autodesk Autocad Civil 3D 2015, version 10.4, (Storm Sewer), is used to size the 48" pipe that routes the offsite flow through the site to the existing Type-F box.
Results of the analysis can be found as Attachment 4.1 of this report.

5.6 Design / Analyze Proposed Desiltation Basins

The Desiltation basins were designed per The California Stormwater BMP Handbook bulletin SE-2 (Sediment Basin) using option 1 for the design basis.

$A_S=1.2Q_{10}/V_S$.

Where:
As= Minimum surface area for trapping soil particles of a certain size

V_S = Settling Velocity of the design particle size chosen= 0.020 mm
The particle size of 0.020mm was chosen based on the soils report sieve analysis for the boring T2-3 (which will be in an area of cut) only had 1.4% of the sample passing a #200 sieve (0.074mm). Also, all import material will be specified to be free of any fines passing a #400 sieve (0.037mm).

$V_S= 2.81d^2 = 2.81*.020^2 = .001124$ ft/sec

Q_{10}= Flow from the area from a 10 year storm

The flow for the 10 year storm was found by utilizing the Rational Method using the P_6 of a 10 year rainfall event per County of San Diego Rainfall Isopluvial maps. (See attachment 2)

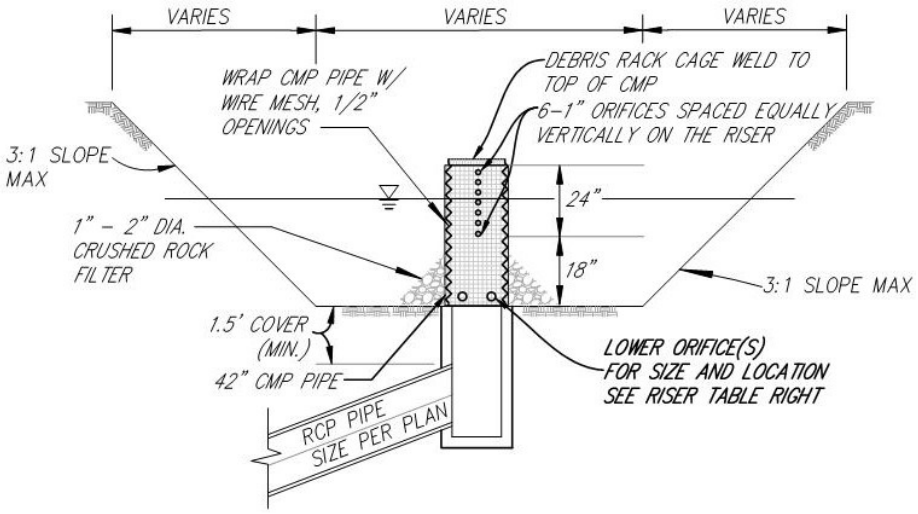
P_6=2.0 inches

The sizing requirements of the 3 onsite basins is summarized in the table below.
Table 5.6-1 Basin Sizing Summary

Basin No.	Flow (cfs)	Required Minimum Area (sf)	Proposed Area (sf)
503	8.94	9,544	9,670
603	1.618	1,727	1,727
406	1.784	1,904	1,986

Table 5.6-1 Basin Sizing Summary

Hydraflow Hydrographs Extension for Autodesk Autocad Civil 3D 2019, Version 2020, was used to size the desiltation basins outlet structure and verify basins will fully drain in less than 96hrs. Basins 503, 603, and 406 use the riser/outlet structure to control outflow.



Basin	Low orifice	
	# of orifices	Diameter
503	2	2 inches
603	1	1.5 inches
406	1	1 inch

See attachment 4.2 for calculations.

5.7 Design / Analyze Proposed Detention Basins

The Desiltation basins were also used as detention basins to control Q_{100} peak flows leaving the site. For POC-1 Q_{100} peak flows were routed through the basins number 503 and 603 as described in Section 5.6. The resulting reduction of Q_{100} at POC is as follows.

SUMMARY: PEAK 100-YEAR RUNOFF

POC-1 **Mitigated**

	Node #	Tc (min)	Runoff (cfs)
Pre-dev	108	20.97	128.182
Post-dev	110	19.97	124.766
		Reduction	3.416

See attachment 4.3 for pond routing calculations and attachment 3.3 for mitigated calculations. The section below explains the use of a modified runoff coefficient in the mitigated calculations.

CALCULATION AFTER THE DETENTION STRUCTURE

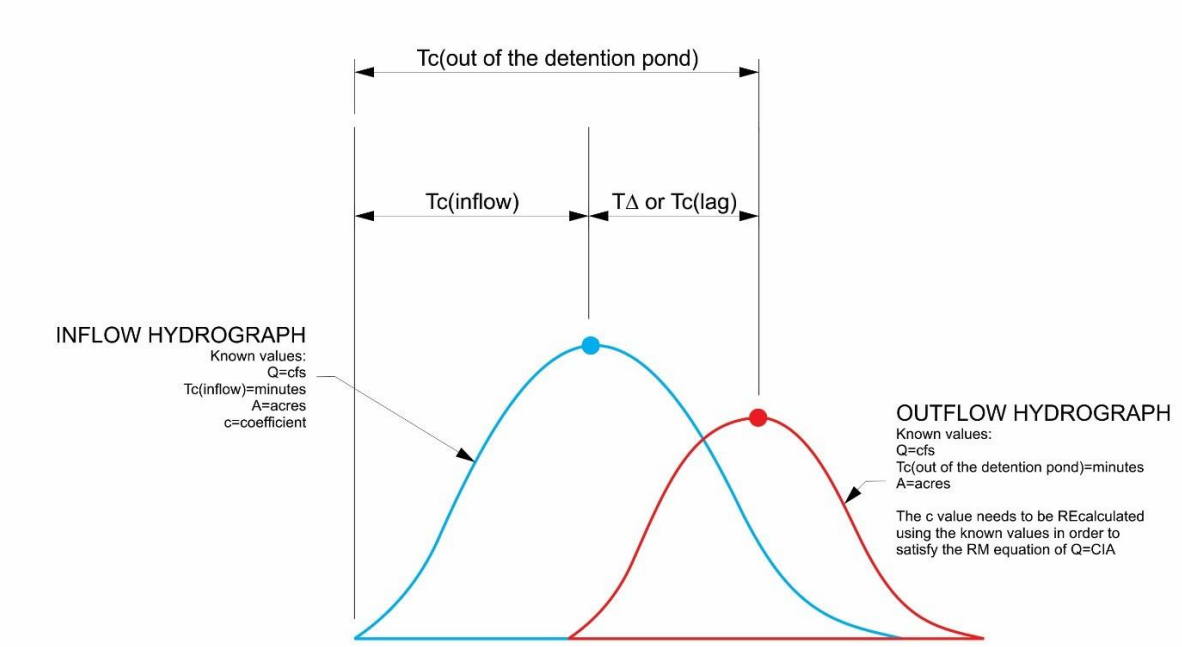
The purpose of the detention structure is to alter the peak flow and or time to peak of a given storm so it will not have a negative impact on the downstream facilities. There are different methods on how to use the resulting values of the outflow hydrograph.

For the purposes of this example there will be an association of the following values:

Q_{in} = Is equal to the inflow value that will enter the basin before storage
Q_{out} = Is equal to the outflow value that will exit the basin after storage
Tc_{in} = Is equal to the Time of Concentration flowing into the basin before detention
Tc_{out} = Is equal to the Time of Concentration exiting the basin after detention
A = Area of the tributary area being examined; (This value does not change)
C_{inflow} = The runoff coefficient going into the basin for detention
C_{out} = The runoff coefficient recalculated considering the water stored in pond for detention

One method is to keep the value of c(inflow) and solve for the I=intensity & Tc(outflow). In this interpretation, we will get a Tc that will not match the value of the Tc(out of the detention structure) of the outflow hydrograph that was calculated using the detention pond. The Tc Using this method shows a disruption on the oneness & continuity of the outflow hydrograph & the formula Q=CIA.

The second method; that is the method we are using is to recalculate the C=coefficient based on the fix values of the outflow hydrograph to achieve a C_{out}. This value uses the C_{inflow} from the flow into the detention basin and then is recalculated by the output of the hydrograph software using Q=CIA; translated as C=Q/IA. This method preserves the formula Q=CIA & does not alter the Tc(out of the detention structure). This method shows that in order to maintain mathematical integrity of the rational equation (Q=CIA), the detention structure alters the runoff coefficient which is the only unknown in the equation. It is noted that the designer feels it is important to hold the value of Tc and the Q values that are calculated from the hydrograph.



GRAPHICAL DIAGRAM OF THE HYDROGRAPH COMING OUT OF THE DETENTION POND

The routing of the runoff through the detention structure gives us the $Q_{(\text{out of the detention structure})}$ and TΔ time lag between $Q_{(\text{inflow})}$ & $Q_{(\text{out of the detention structure})}$.

The known fix values coming out of the detention structure are:

- Q = cfs
- $Tc_{(\text{out of the detention structure})}$ = minutes
- A = acres
- *Please note that c=coefficient is not given directly from the resulting hydrograph coming out of the detention pond.*

In order to satisfy the rational equation of Q=CIA (see Section 3 of the 2003 San Diego County Hydrology Manual) coming out of the detention structure, we will calculate the only unknown value of the equation which is the outlet runoff coefficient, $C_{(\text{outlet})}$. By using the Tc(out of the detention structure) we can solve for the intensity, I. With the intensity (I) value calculated, we can solve for the outlet runoff coefficient, $C_{(\text{outlet})}$.

The following equations are used in this stage: $Q = CIA$ $I = 7.44P_6D^{-0.645}$

Where:

$Q_{(\text{out of the detention structure})}$ = runoff (cfs), known value

$Tc_{(\text{inflow})}$ = detention structure inflow time of concentration (D) (minutes)

$T\Delta$ = time lag between $Q_{(inflow)}$ & $Q_{(out\ of\ the\ detention\ structure)}$ (minutes) $Tc_{(out\ of\ the\ detention\ structure)}$ = $Tc_{(inflow)}$ + $T\Delta$ (minutes)

P_6 = 6 hour precipitation (inches), known value.

I = intensity (inches/hour), calculated based on the value of $Tc_{(out\ of\ the\ detention\ structure)}$

A = tributary area of the detention structure (acres), known value

$C_{(outflow)}$ = runoff coefficient (unitless), value to be solved

CALCULATIONS For Basin 503			
LINE	**ITEM**	**AT THE OUTFLOW OF NODE 503**	**REMARKS**
1	P6 inch	2.9	KNOWN VALUE
2	TC (inflow) mins	11.24	KNOWN VALUE
3	TC (lag) mins	110	FROM THE OUTFLOW HYDROGRAPH
4	TC (ouflow) mins	121.24	LINE 2+3
5	I inches/hour	0.977	FROM THE INTENSITY FORMULA
6	Q(outflow)	0.393	KNOWN VALUE
7	A (inflow=outflow)	8.179	KNOWN VALUE
8	c(inflow)	0.35	KNOWN VALUE FROM THE CONTRIBUTING BASIN(S)
9	c(outflow)	0.049	CALCULATED FROM C=Q/IA

CALCULATIONS For Basin 603			
LINE	**ITEM**	**AT THE OUTFLOW OF NODE 603**	**REMARKS**
1	P6 inch	2.9	KNOWN VALUE
2	TC (inflow) mins	18	KNOWN VALUE
3	TC (lag) mins	72	FROM THE OUTFLOW HYDROGRAPH
4	TC (ouflow) mins	90	LINE 2+3
5	I inches/hour	1.184	FROM THE INTENSITY FORMULA
6	Q(outflow)	0.152	KNOWN VALUE
7	A (inflow=outflow)	2	KNOWN VALUE
8	c(inflow)	0.76	KNOWN VALUE FROM THE CONTRIBUTING BASIN(S)
9	c(outflow)	0.064	CALCULATED FROM C=Q/IA

The preceding highlighted data are then used to continue the calculations downstream of the detention structure.

In summary these are the steps of the calculations presented here:

1. Hydrologic methods of calculation as laid out in the 2003 San Diego Hydrology Manual was used upstream of the detention structure. These includes the methods of determining C, Tc and confluence of a junction. The c values used in the proposed conditions range from "undisturbed natural terrain" to "low & high density residential" whichever is appropriate for the contributing basin.
2. At the outflow of the detention structure, the c value was recalculated using the resulting values of the outflow hydrograph. This method preserves the values of $Tc_{(out\ of\ the\ detention\ structure)}$, A & $Q_{(outflow)}$. Methods and software satisfy the formula Q=CIA & the 2003 San Diego Hydrology Manual. This step shows that in order to maintain mathematical integrity of the rational equation (Q=CIA), the detention structure alters the runoff coefficient which is the only unknown in the equation.
3. The values determined in step 2 were used in the continuation of the calculations using the Hydrologic methods of calculation as laid out in the 2003 San Diego Hydrology Manual downstream of the detention structure. These includes the methods of determining c, Tc and confluence of a junction. The c values used in the proposed conditions range from "undisturbed natural terrain" to "low & high density residential" whichever is appropriate for the contributing basin.

5.0 CONCLUSION

This study and resulting data indicate that the project will not increase 100-year peak runoff downstream of the project. It can therefore be concluded that this project will result in no negative impact on the existing downstream storm drain facilities or adjacent and downstream properties.

Because the project is not located within or discharges to navigable waters, water of the United States, or federal jurisdictional wetlands, as defined by the Clean Water Act, no 401/404 permit is required.

In conclusion, the project has met the City of San Marcos minimum requirements for the peak flow control.

5.0 REFERENCES

County of San Diego Hydrology Manual, June 2003
San Diego County Hydraulic Design Manual, September 2014

7.0 Declaration of Responsible Charge

I hereby declare that I am the engineer of work for this project. That I have exercised responsible charge over the design of the project as defined in section 6703 of the business and professions codes, and that the design is consistent with current design.

I understand that the check of the project drawings and specifications by the City of San Marcos is confined to a review only and does not relieve me, as engineer of work, of my responsibilities for project design.

ENGINEER OF WORK
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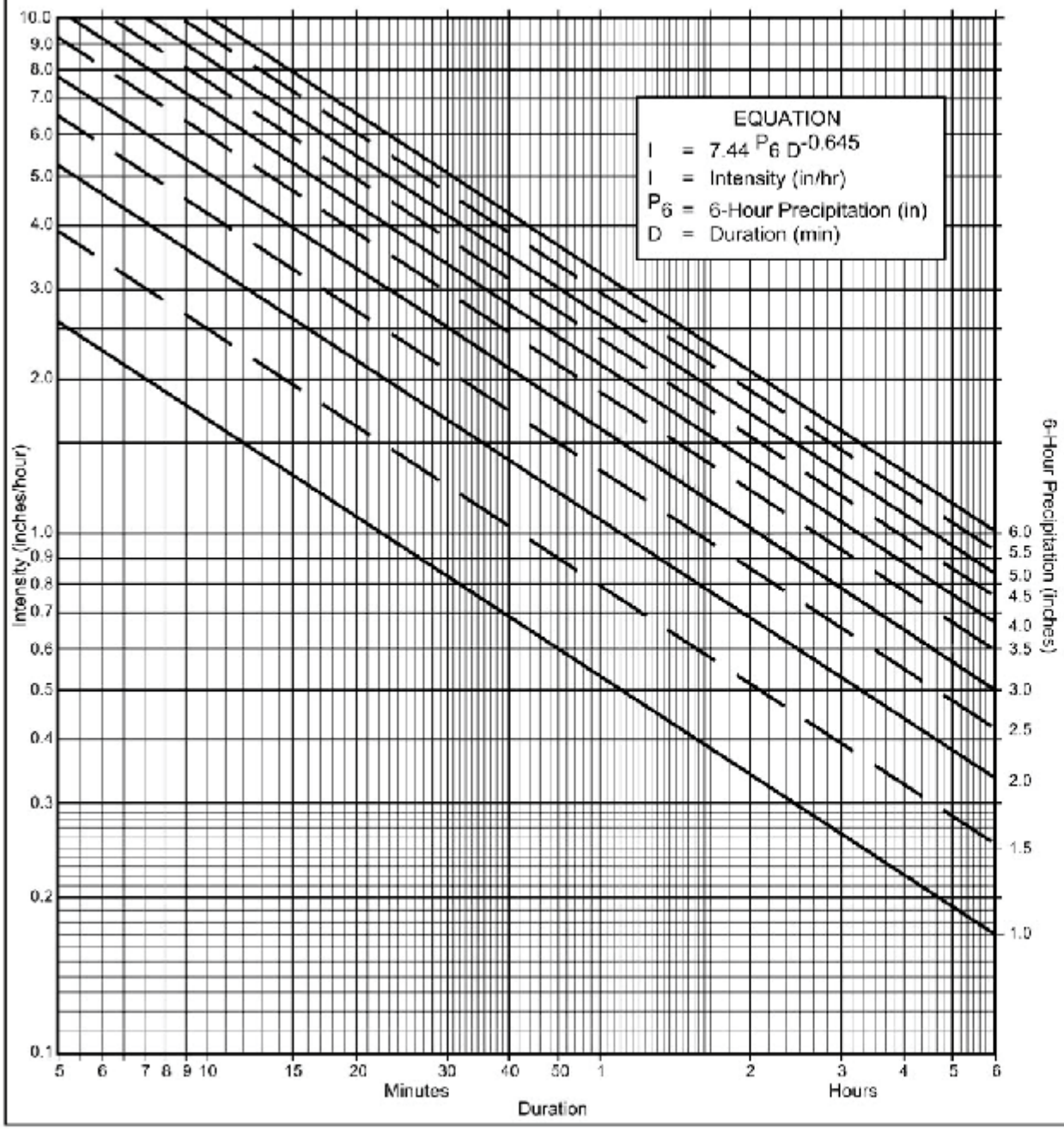
Tel – (760)745-8118
Fax – (760)745-1890

Project Number: 19-089

_____ _____

Robert D. Dentino, RCE 45629 Date
Registration Expire: December 31, 2020

ATTACHMENT 1



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency 100 year

(b) P_6 = 3.1 in., P_{24} = 5.5, $\frac{P_6}{P_{24}}$ = 56.4 %(2)

(c) Adjusted P_6(2) = _____ in.

(d) t_x = _____ min.

(e) I = _____ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

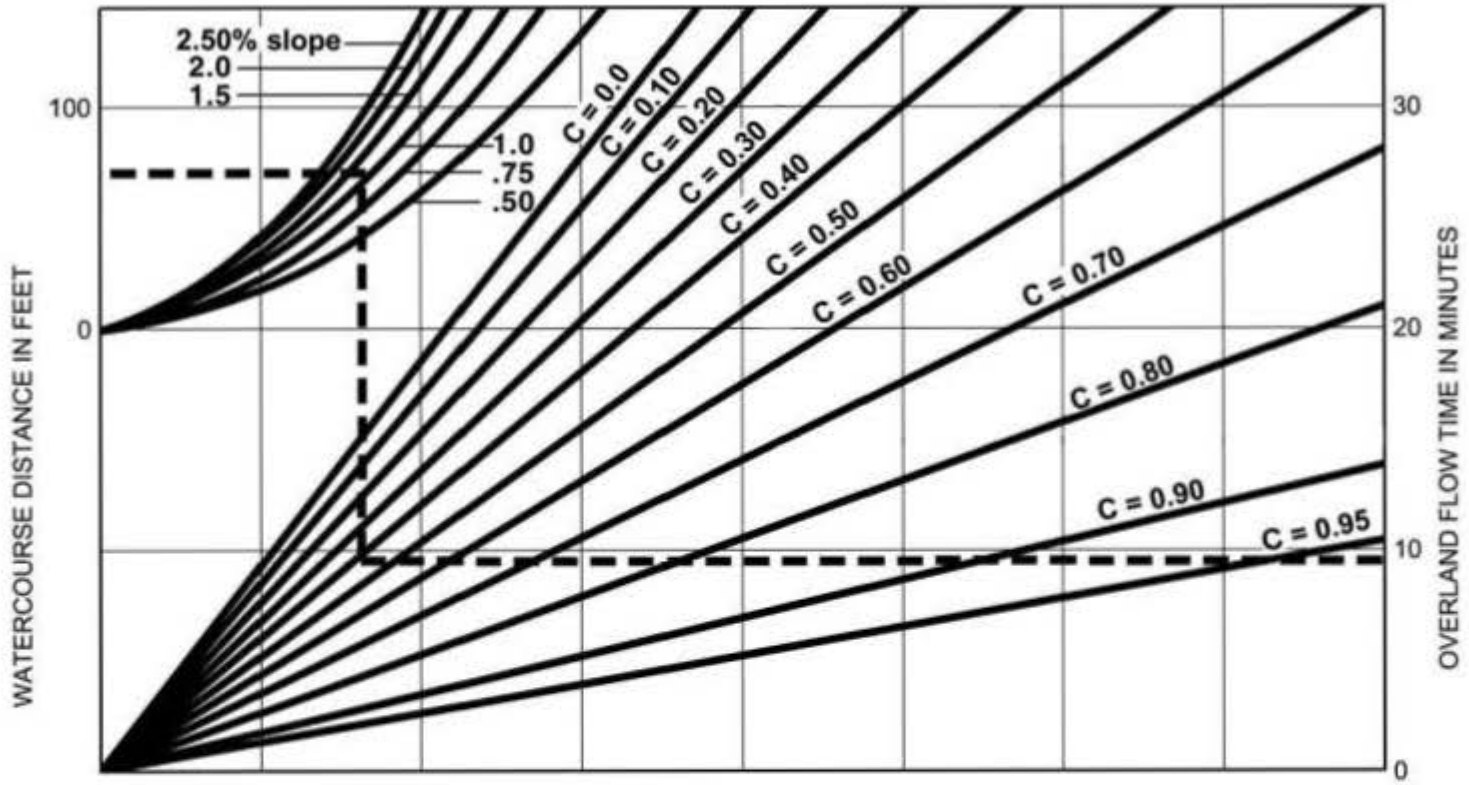
Intensity-Duration Design Chart - Template

FIGURE 3-1

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service



EXAMPLE:
Given: Watercourse Distance (D) = 70 Feet
Slope (s) = 1.3%
Runoff Coefficient (C) = 0.41
Overland Flow Time (T) = 9.5 Minutes

$$T = \frac{1.8\,(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

FIGURE 3-3

Rational Formula - Overland Time of Flow Nomograph

Note that the Initial Time of Concentration should be reflective of the general land-use at the upstream end of a drainage basin. A single lot with an area of two or less acres does not have a significant effect where the drainage basin area is 20 to 600 acres.

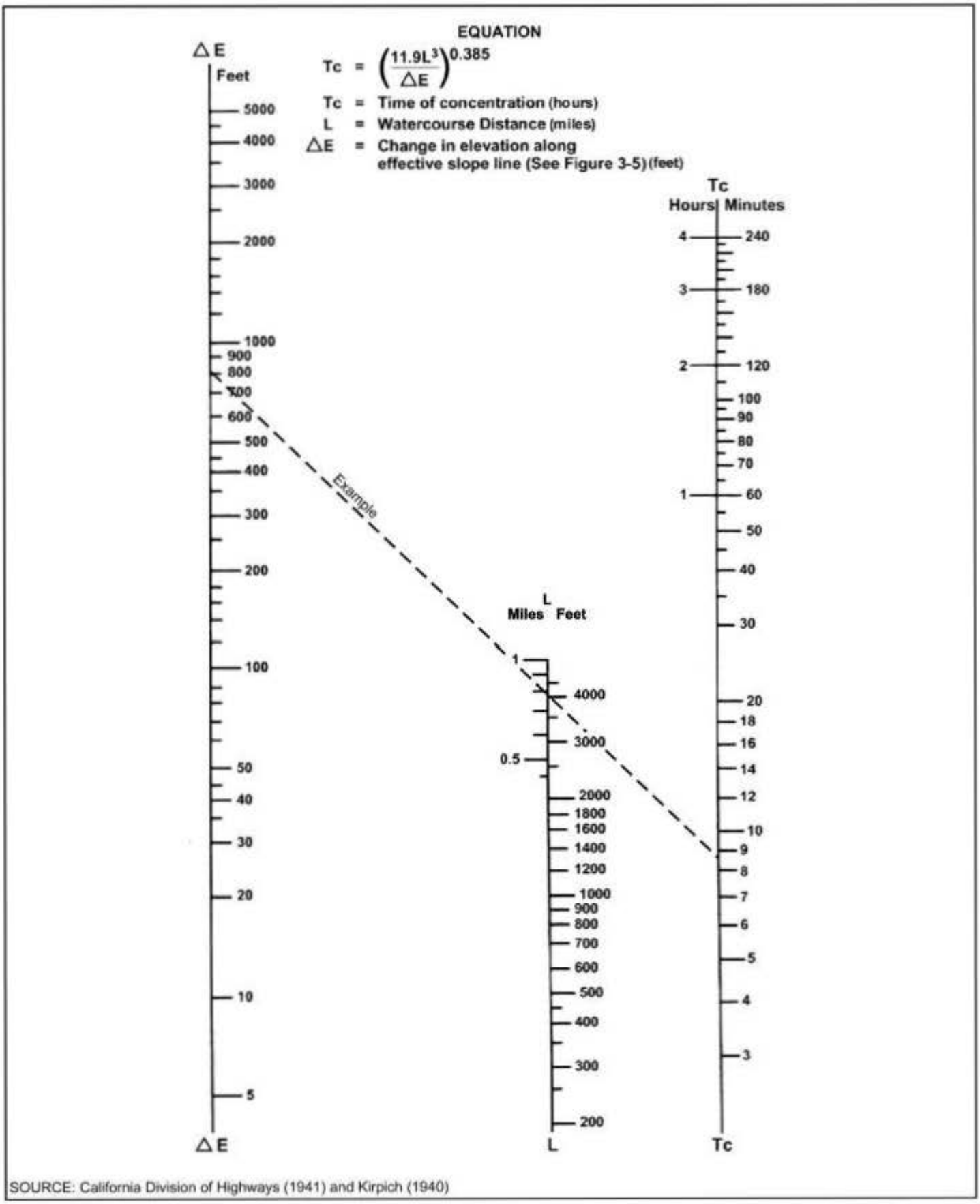
Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved by the "Regulating Agency" when submitted with a detailed study.

Table 3-2

MAXIMUM OVERLAND FLOW LENGTH (L_M) & INITIAL TIME OF CONCENTRATION (T_i)

Element*	DU/ Acre	.5%		1%		2%		3%		5%		10%	
		L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

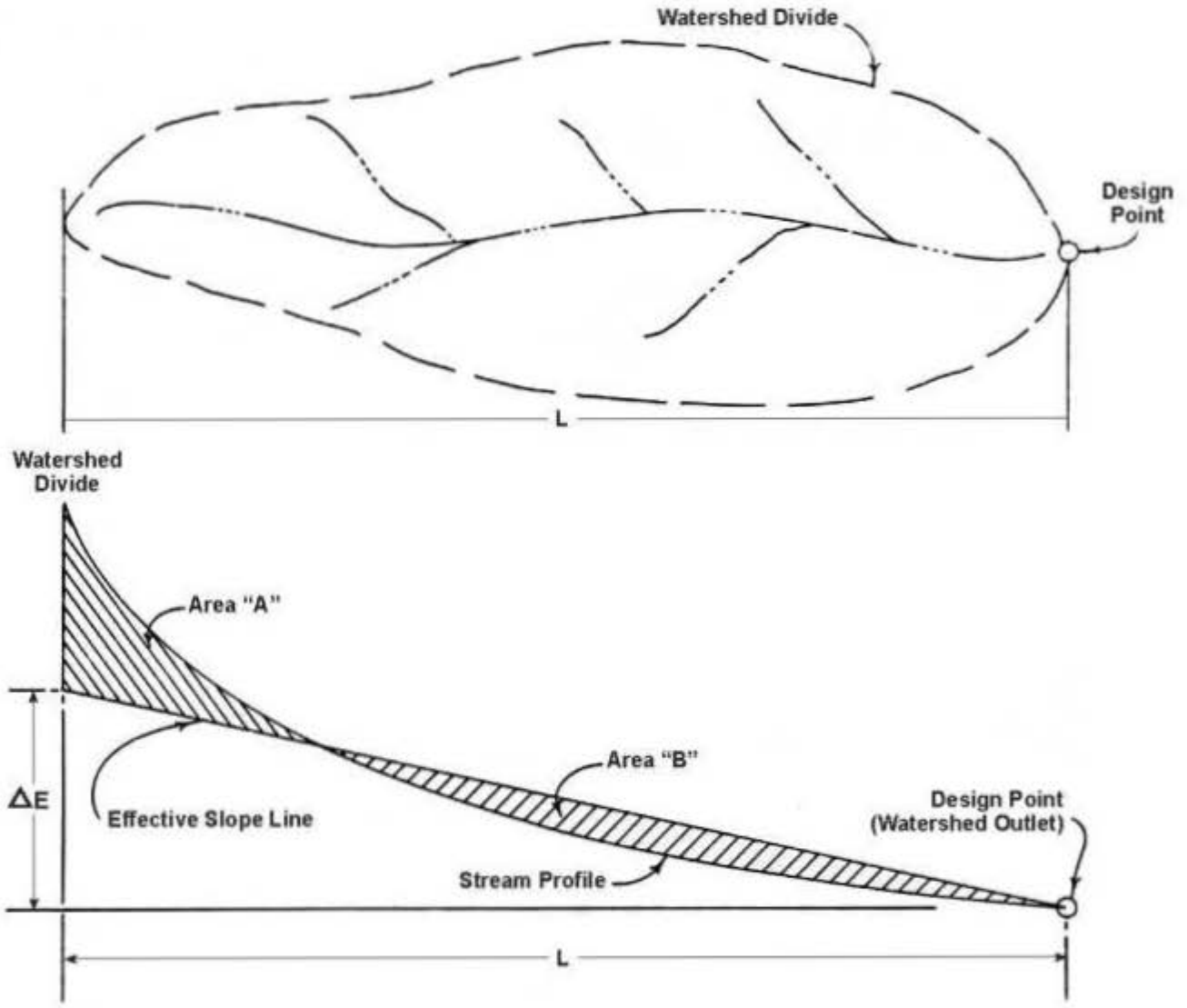
*See Table 3-1 for more detailed description



SOURCE: California Division of Highways (1941) and Kirpich (1940)

FIGURE 3-4

Nomograph for Determination of
Time of Concentration (Tc) or Travel Time (Tt) for Natural Watersheds

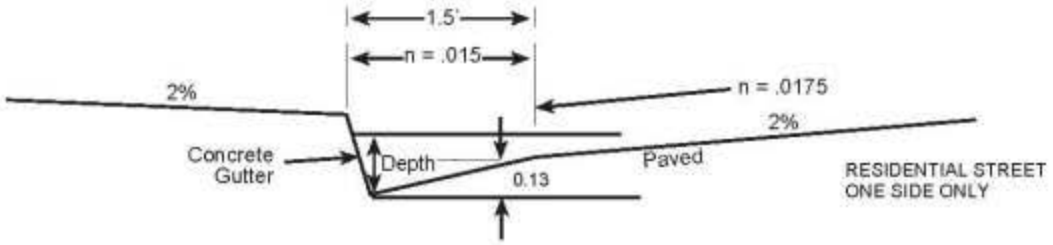


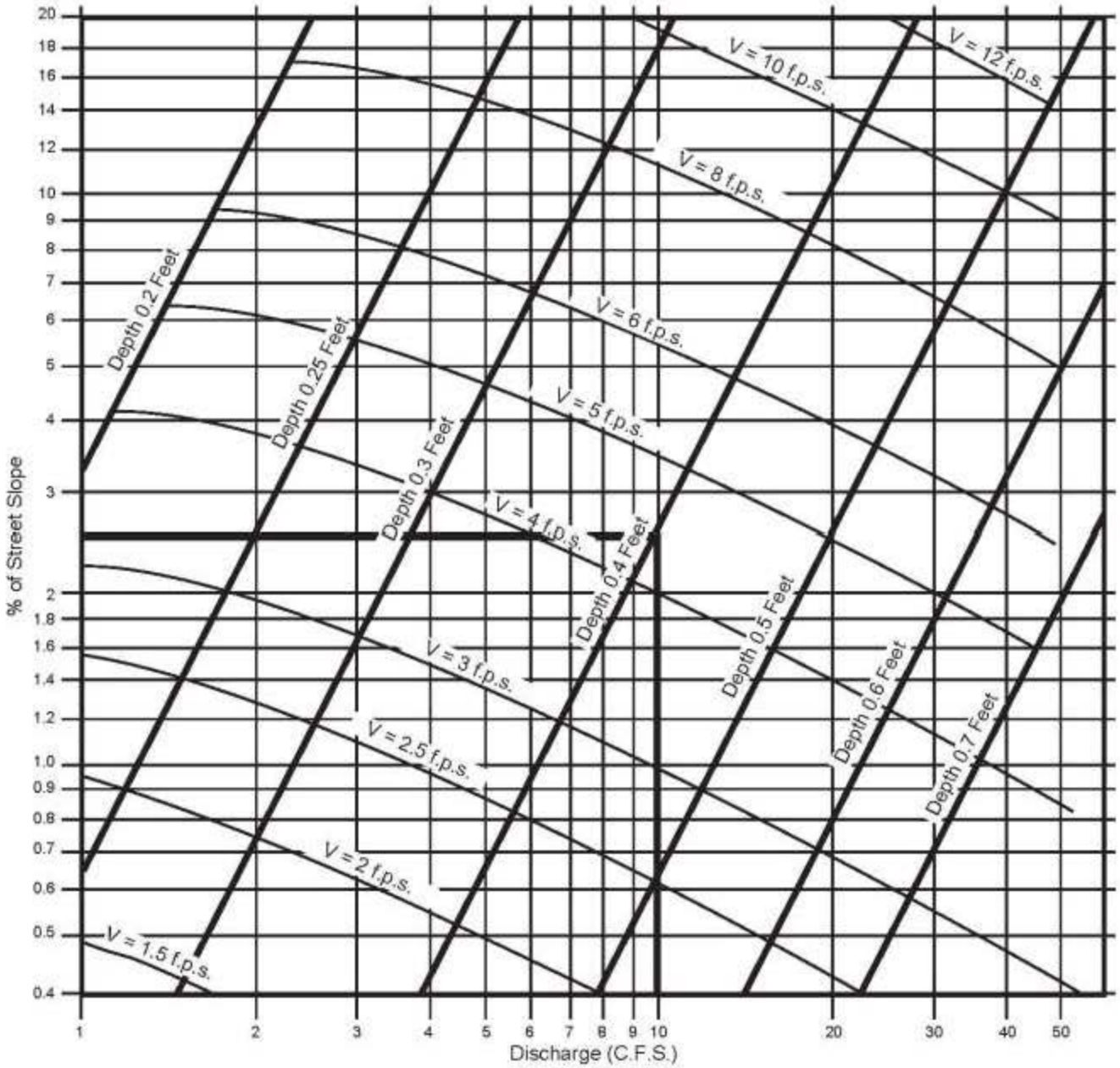
SOURCE: California Division of Highways (1941) and Kirpich (1940)

FIGURE

Computation of Effective Slope for Natural Watersheds

3-5





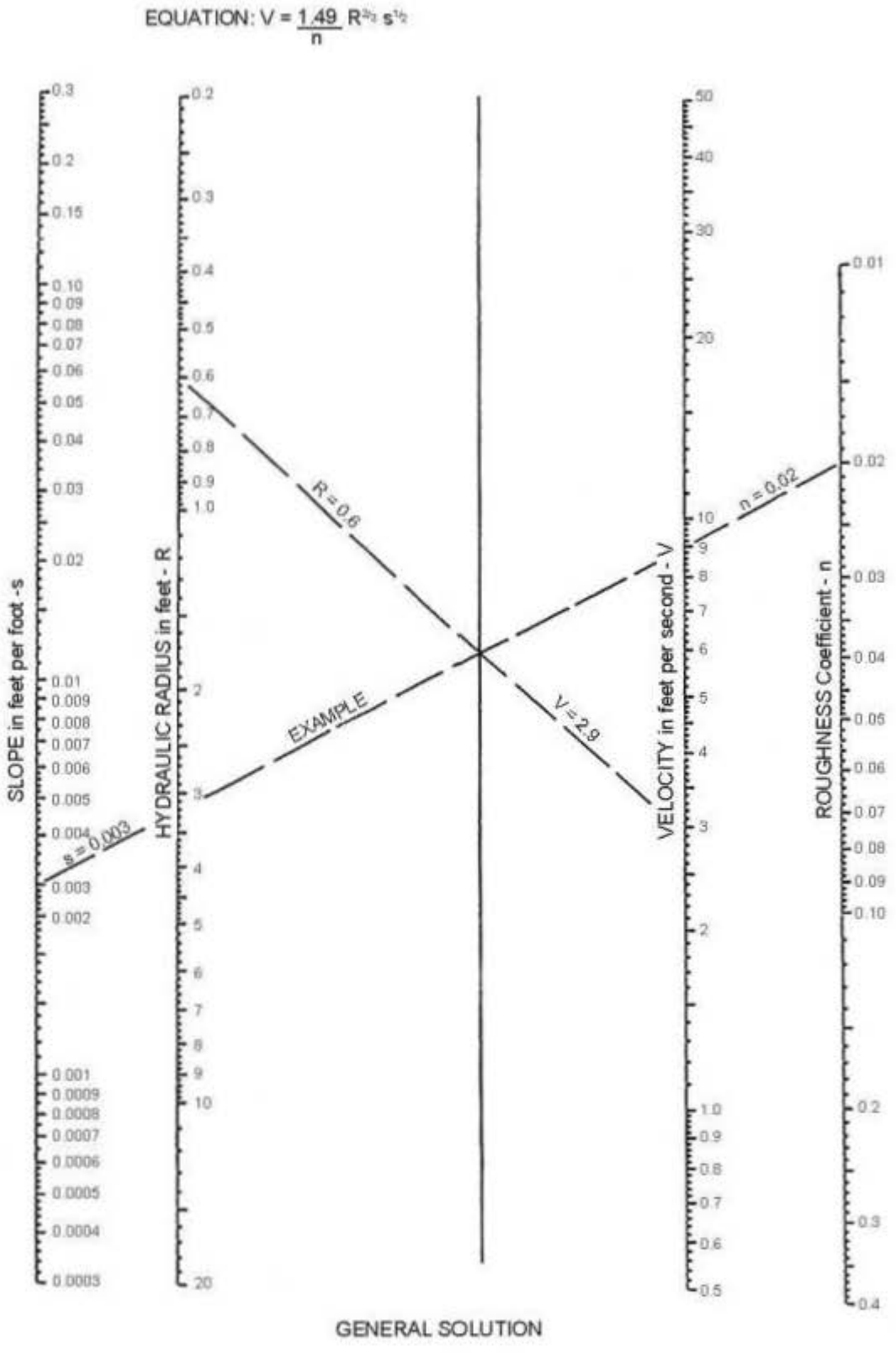
EXAMPLE:
Given: Q = 10 S = 2.5%
Chart gives: Depth = 0.4, Velocity = 4.4 f.p.s.

SOURCE: San Diego County Department of Special District Services Design Manual

FIGURE

Gutter and Roadway Discharge - Velocity Chart

3-6



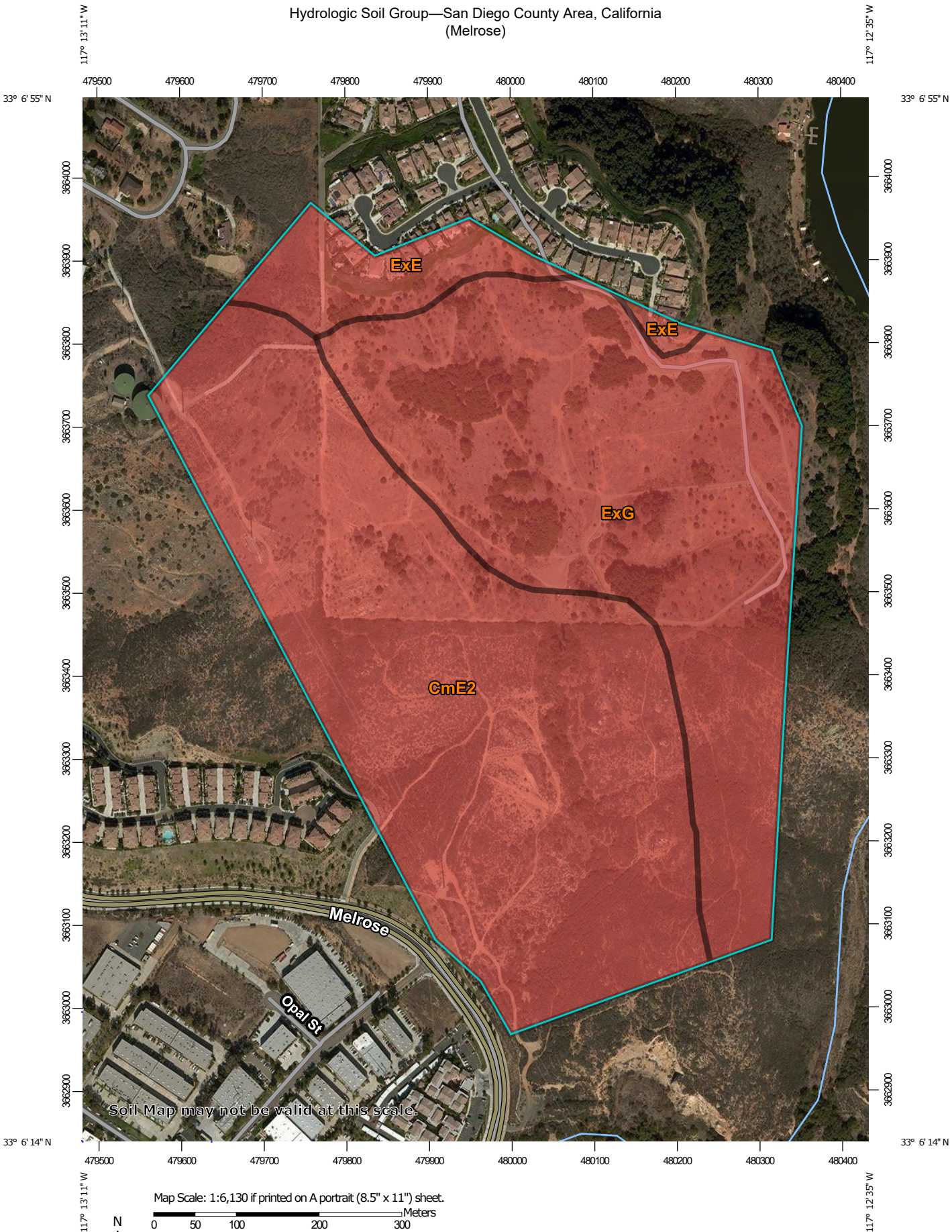
SOURCE: USDOT, FHWA, HDS-3 (1961)

FIGURE

Manning's Equation Nomograph

3-7

Hydrologic Soil Group—San Diego County Area, California
(Melrose)



Map Scale: 1:6,130 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 250 500 1000 1500

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 14, Sep 16, 2019

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

Date(s) aerial images were photographed: Nov 3, 2014—Nov 22, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
CmE2	Cieneba rocky coarse sandy loam, 9 to 30 percent slopes, eroded	D	67.9	52.5%
ExE	Exchequer rocky silt loam, 9 to 30 percent slopes	D	8.2	6.4%
ExG	Exchequer rocky silt loam, 30 to 70 percent slopes	D	53.2	41.2%
Totals for Area of Interest			**129.3**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

ATTACHMENT 2.1

County of San Diego Hydrology Manual

Rainfall Isopluvials

10 Year Rainfall Event - 6 Hours

Isopluvial (inches)

10 yr Storm P6 = 2.0 inches

Orange County

Riverside County

Imperial County

Mexico

Pacific Ocean

OCEANSIDE
VISTA
CARLSBAD
ESCONDIDO
ENCINITAS
SOLANA BEACH
DEL MAR
POWAY
S.D. COUNTY
SANTEE
SAN DIEGO
EL CAJON
LA MESA
LEMON GROVE
CORONADO
CHULA VISTA
IMPERIAL BEACH
SD

117°30' 117°15' 117°00' 116°45' 116°30' 116°15'
33°30' 33°15' 33°00' 32°45' 32°30'

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

N W E S

3 0 3 Miles

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

Orange County

Riverside County

Imperial County

Pacific Ocean

Mexico

100 yr Storm P6 = 2.9 inches

OCEANSIDE
VISTA
CARLSBAD
ESCONDIDO
ENCINITAS
SOLANA BEACH
DEL MAR
POWAY
S.D. COUNTY
SANTEE
SAN DIEGO
EL CAJON
LA MESA
LEMON GROVE
CORONADO
SD
CHULA VISTA
IMPERIAL BEACH

117°30' 117°15' 117°00' 116°45' 116°30' 116°15'
33°30' 33°15' 33°00' 32°45' 32°30'

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

N W E S

3 0 3 Miles

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

Orange County

Riverside County

Imperial County

Pacific Ocean

Mexico

100 yr Storm P24 = 5.25 inches

OCEANSIDE
VISTA
CARLSBAD
ESCONDIDO
ENCINITAS
SOLANA BEACH
POWAY
S.D. COUNTY
DEL MAR
SANTEE
SAN DIEGO
EL CAJON
LA MESA
LEMON GROVE
CORONADO
CHULA VISTA
IMPERIAL BEACH
SD

117°30' 117°15' 117°00' 116°45' 116°30' 116°15'
33°30' 33°15' 33°00' 32°45' 32°30'

N W E S

3 0 3 Miles

ATTACHMENT 2.2

SUB AREA ADD
5.8062 ACRES
104

PIPE L=305 FT

748.00 FS
738.00 IE
103

732.00 IE
105

L=806 FT
6.7959 ACRES

L=1362 FT
9.4782 ACRES

516.00 FS
106

SUB AREA ADD
15.3557 ACRES
203

L=1102 FT
8.5185 ACRES

716.00 FS
L=117 FT
0.0942 ACRES
748.00 FS
204
207

L=227 FT
1.2386 ACRES

505.00 FS
107

776.00 FS
775.50 FS
101
102

L=98 FT
0.2724 ACRES

L=2074 FT
20.8123 ACRES

L=1731 FT
46.1512 ACRES

596.00 FS
401
402

L=82 FT
0.1085 ACRES

L=703 FT
5.9428 ACRES

L=102 FT
0.0711 ACRES
302

808.00 FS
810.00 FS
301

436.00 FS
404

SUB AREA ADD
7.7254 ACRES
403

L=94 FT
0.1339 ACRES
303

L=370 FT
0.3357 ACRES
422.00 FS
304

470.00 FS
108

425.00 FS
417.00 FS
305

POC 1 @ OUTLET OF TYPE-F INLET
AREA = 114.594 ACRES
Q100 = 128.182 CFS
V100 = 7.861 FT/S

POC 3 @ OUTLET OF D-25
AREA = 0.470 ACRES
Q100 = 1.180 CFS
V100 = 3.62 FT/S

POC 2 @ JUNCTION STRUCTURE
AREA = 7.778 ACRES
Q100 = 15.749 CFS
V100 = 6.72 FT/S

TOTAL STUDY AREA
122.8415 ACRES

MELROSE DRIVE

DIAMOND STREET

0 100 200 300 400

LEGEND-ABBREVIATIONS:

- INDICATES TRIBUTARY AREA BOUNDARY
- FLOW LINE
- L = 66 FT — FLOW DISTANCE
- NODE NUMBER (REFERENCED IN COMPUTER PRINT OUT)
- 3.69 ACRES — TOTAL AREA IN SUB TRIBUTARY AREA

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PH (760)745-8118 FX (760)745-1890

PRE-DEVELOPMENT HYDROLOGY MAP FOR: TENTATIVE PARCEL MAP FOR APNs 223-341-03 THROUGH 15 &16

SHEET 1 OF 1

ATTACHMENT 2.3

SUB AREA ADD
5.8062 ACRES
104

PIPE L=305 FT

103
748.00 FS
738.00 IE

105
732.00 IE

SUB AREA ADD
15.3557 ACRES
203

L=806 FT
6.7959 ACRES

L=1102 FT
8.5165 ACRES

L=117 FT
0.0942 ACRES
201

716.00 FS
202
748.00 FS

106
516.00 FS

101
776.00 FS
102
775.50 FS

L=98 FT
0.2724 ACRES

505.00 FS
107

L=2074 FT
20.8123 ACRES

500.00 FS
501
L=912 FT
22.6455 ACRES

L=1131 FT
11.3245 ACRES

L=97 FT
0.1489 ACRES

502
488.00 FS

471.00 FS
465.90 IE
453.00 FS
453.00 IE
108
451.78 IE

48" PIPE LENGTH=245 FT

L=757 FT
8.0301 ACRES

502.00 FS
404
L=94 FT
0.0863 ACRES
405

488.00 FS
688.00 FS
401
586.00 FS
402

L=82 FT
0.1095 ACRES

474.00 FS
701
L=97 FT
0.1147 ACRES
702
469.00 FS

L=703 FT
5.8484 ACRES

486.00 FS
601
L=80 FT
0.1333 ACRES

48" PIPE LENGTH=689 FT

477.60 FS
470.60 IE
602
485.30 FS

L=606 FT
1.8550 ACRES

L=497 FT
1.8680 ACRES

24" PIPE
L=154 FT

L=55 FT
0.1045 ACRES
907

L=672 FT
1.7252 ACRES
110
414.00 FS
407.70 IE
908
438.00 FS
417.00 FS

L=102 FT
0.0711 ACRES
301
808.00 FS
810.00 FS

403
436.00 FS

479.16 FS

POC 3 @ OUTLET OF D-25
AREA = 0.105 ACRES
Q100 = 0.28 CFS

POC 1 @ OUTLET OF RISER
AREA = 114.837 ACRES
Q100 = 124.186 CFS
V100 = 14.78 FT/S

POC 2 @ JUNCTION STRUCTURE
AREA = 7.899 ACRES
Q100 = 13.406 CFS

MELROSE DRIVE

DIAMOND STREET

SCALE: 1"=100'
0 100 200 300 400

LEGEND-ABBREVIATIONS:

- INDICATES TRIBUTARY AREA BOUNDARY
- FLOW LINE
- L = 66 FT — FLOW DISTANCE
- (#) — NODE NUMBER (REFERENCED IN COMPUTER PRINT OUT)
- 3.69 ACRES — TOTAL AREA IN SUB TRIBUTARY AREA

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PH (760)745-8118 FX (760)745-1890

POST-DEVELOPMENT HYDROLOGY MAP FOR: TENTATIVE PARCEL MAP FOR APNs 223-341-03 THROUGH 15 &16

ATTACHMENT 3.1

```
               San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
       Rational Hydrology Study        Date: 02/26/20
--------------------------------------------------------------------------
PRE-DEVELOPMENT
POC-1
100 YR STORM

--------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

--------------------------------------------------------------------------


Program License Serial Number 6332

--------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  2.900
24 hour precipitation(inches) =  5.250
P6/P24 =    55.2%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** INITIAL AREA EVALUATION ****
__________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.520
Initial subarea total flow distance  =   98.000(Ft.)
Highest elevation =  776.000(Ft.)
Lowest elevation =  775.500(Ft.)
Elevation difference =    0.500(Ft.) Slope =  0.510 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 50.00 (Ft)
for the top area slope value of   0.51 %, in a development type of
 4.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   9.24 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5200)*(  50.000^.5)/(   0.510^(1/3)]=   9.24
The initial area total distance of   98.00 (Ft.) entered leaves a
remaining distance of   48.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.17 minutes
for a distance of  48.00 (Ft.) and a slope of  0.51 %
with an elevation difference of   0.24(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.174 Minutes
Tt=[(11.9*0.0091^3)/(  0.24)]^.385=  1.17
Total initial area Ti =   9.24 minutes from Figure 3-3 formula plus
  1.17 minutes from the Figure 3-4 formula =  10.41 minutes
Rainfall intensity (I) =      4.760(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.520
Subarea runoff =      0.673(CFS)
Total initial stream area =        0.272(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      7.957(CFS)
Depth of flow =   0.247(Ft.), Average velocity =   5.183(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2             25.00              0.00
       3             25.10              0.50
       4             30.00              0.51
Manning's 'N' friction factor =   0.013
------------------------------------------------------------------
Sub-Channel flow  =      7.957(CFS)
  '     '       flow top width =     12.415(Ft.)
  '     '    velocity=    5.184(Ft/s)
  '     '       area =      1.535(Sq.Ft)
  '     '       Froude number =     2.598

Upstream point elevation =   775.500(Ft.)
Downstream point elevation =   748.000(Ft.)
Flow length =   806.000(Ft.)
Travel time  =    2.59 min.
Time of concentration =   13.01 min.
Depth of flow =   0.247(Ft.)
Average velocity =   5.183(Ft/s)
Total irregular channel flow =     7.957(CFS)
Irregular channel normal depth above invert elev. =   0.247(Ft.)
Average velocity of channel(s) =   5.183(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      4.124(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.520
Rainfall intensity =      4.124(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.520  CA =      3.675
Subarea runoff =     14.485(CFS) for      6.796(Ac.)
Total runoff =     15.159(CFS)        Total area =       7.068(Ac.)
Depth of flow =   0.315(Ft.), Average velocity =   6.090(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
Rainfall intensity (I) =      4.124(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.520
Time of concentration =    13.01 min.
Rainfall intensity =      4.124(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.520  CA =      6.694
Subarea runoff =     12.452(CFS) for      5.806(Ac.)
Total runoff =     27.611(CFS)        Total area =      12.874(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   738.000(Ft.)
Downstream point/station elevation =   732.000(Ft.)
Pipe length  =   305.00(Ft.) Slope =   0.0197  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    27.611(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    27.611(CFS)
Normal flow depth in pipe =   17.32(In.)
Flow top width inside pipe =   21.51(In.)
Critical Depth =   21.84(In.)
Pipe flow velocity =     11.38(Ft/s)
Travel time through pipe =    0.45 min.
Time of concentration (TC) =    13.45 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      106.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________________
Estimated mean flow rate at midpoint of channel =     31.525(CFS)
Depth of flow =   0.389(Ft.), Average velocity =   7.387(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00             18.00
       2             45.00              0.00
       3             55.00              0.00
       4            100.00             18.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =     31.525(CFS)
  '     '       flow top width =     11.945(Ft.)
  '     '    velocity=    7.387(Ft/s)
  '     '       area =      4.267(Sq.Ft)
  '     '       Froude number =     2.178

Upstream point elevation =   732.000(Ft.)
Downstream point elevation =   516.000(Ft.)
Flow length =  1362.000(Ft.)
Travel time  =    3.07 min.
Time of concentration =   16.53 min.
Depth of flow =   0.389(Ft.)
Average velocity =   7.387(Ft/s)
Total irregular channel flow =    31.525(CFS)
Irregular channel normal depth above invert elev. =   0.389(Ft.)
Average velocity of channel(s) =   7.387(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      3.534(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      3.534(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.448  CA =     10.012
Subarea runoff =      7.771(CFS) for      9.478(Ac.)
Total runoff =     35.382(CFS)        Total area =      22.352(Ac.)
Depth of flow =   0.416(Ft.), Average velocity =   7.699(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.000 to Point/Station      106.000
```

```
**** CONFLUENCE OF MINOR STREAMS ****
____________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     22.352(Ac.)
Runoff from this stream =     35.382(CFS)
Time of concentration =   16.53 min.
Rainfall intensity =     3.534(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** INITIAL AREA EVALUATION ****
____________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =  117.000(Ft.)
Highest elevation =  748.000(Ft.)
Lowest elevation =  716.000(Ft.)
Elevation difference =   32.000(Ft.) Slope = 27.350 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  27.35 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.48 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  27.350^(1/3)]=   4.48
The initial area total distance of  117.00 (Ft.) entered leaves a
remaining distance of   17.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   0.11 minutes
for a distance of  17.00 (Ft.) and a slope of 27.35 %
with an elevation difference of   4.65(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    0.114 Minutes
Tt=[(11.9*0.0032^3)/(  4.65)]^.385=  0.11
Total initial area Ti =   4.48 minutes from Figure 3-3 formula plus
  0.11 minutes from the Figure 3-4 formula =   4.59 minutes
Calculated TC of    4.595 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      7.641(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.251(CFS)
Total initial stream area =        0.094(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      106.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      8.354(CFS)
Depth of flow =   0.170(Ft.), Average velocity =   4.712(Ft/s)
       ******* Irregular Channel Data ***********
----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00             18.00
       2             45.00              0.00
       3             55.00              0.00
       4            100.00             18.00
Manning's 'N' friction factor =   0.040
----------------------------------------------------------------
Sub-Channel flow  =      8.355(CFS)
  '     '       flow top width =     10.850(Ft.)
  '     '    velocity=    4.712(Ft/s)
  '     '       area =      1.773(Sq.Ft)
```

```
  '     '       Froude number =     2.054

Upstream point elevation =   716.000(Ft.)
Downstream point elevation =   516.000(Ft.)
Flow length =  1102.000(Ft.)
Travel time  =    3.90 min.
Time of concentration =    8.49 min.
Depth of flow =   0.170(Ft.)
Average velocity =   4.712(Ft/s)
Total irregular channel flow =     8.354(CFS)
Irregular channel normal depth above invert elev. =   0.170(Ft.)
Average velocity of channel(s) =   4.712(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      5.429(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      5.429(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      3.014
Subarea runoff =     16.113(CFS) for      8.518(Ac.)
Total runoff =     16.364(CFS)        Total area =       8.612(Ac.)
Depth of flow =   0.254(Ft.), Average velocity =   6.067(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      203.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      5.429(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Time of concentration =     8.49 min.
Rainfall intensity =      5.429(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      8.389
Subarea runoff =     29.179(CFS) for     15.356(Ac.)
Total runoff =     45.544(CFS)        Total area =      23.968(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.000 to Point/Station      106.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     23.968(Ac.)
Runoff from this stream =     45.544(CFS)
Time of concentration =    8.49 min.
Rainfall intensity =     5.429(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                  (In/Hr)


1       35.382     16.53               3.534
2       45.544      8.49               5.429
Qmax(1) =
          1.000 *    1.000 *    35.382) +
          0.651 *    1.000 *    45.544) + =      65.028
```

```
Qmax(2) =
          1.000 *    0.514 *    35.382) +
          1.000 *    1.000 *    45.544) + =      63.728

Total of 2 streams to confluence:
Flow rates before confluence point:
      35.382      45.544
Maximum flow rates at confluence using above data:
       65.028       63.728
Area of streams before confluence:
       22.352       23.968
Results of confluence:
Total flow rate =     65.028(CFS)
Time of concentration =    16.525 min.
Effective stream area after confluence =     46.320(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.000 to Point/Station      107.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =     65.078(CFS)
Depth of flow =   0.837(Ft.), Average velocity =   6.432(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00             18.00
       2             45.00              0.00
       3             55.00              0.00
       4            100.00             18.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =     65.078(CFS)
  '     '       flow top width =     14.184(Ft.)
  '     '    velocity=    6.432(Ft/s)
  '     '       area =     10.118(Sq.Ft)
  '     '       Froude number =     1.342

Upstream point elevation =   516.000(Ft.)
Downstream point elevation =   505.000(Ft.)
Flow length =   227.000(Ft.)
Travel time  =    0.59 min.
Time of concentration =   17.11 min.
Depth of flow =   0.837(Ft.)
Average velocity =   6.432(Ft/s)
Total irregular channel flow =    65.078(CFS)
Irregular channel normal depth above invert elev. =   0.837(Ft.)
Average velocity of channel(s) =   6.432(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      3.455(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      3.455(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.396  CA =     18.834
Subarea runoff =      0.048(CFS) for      1.239(Ac.)
Total runoff =     65.075(CFS)        Total area =      47.559(Ac.)
Depth of flow =   0.837(Ft.), Average velocity =   6.432(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      107.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
```

```
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     47.559(Ac.)
Runoff from this stream =     65.075(CFS)
Time of concentration =   17.11 min.
Rainfall intensity =     3.455(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      301.000 to Point/Station      302.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =  102.000(Ft.)
Highest elevation =  810.000(Ft.)
Lowest elevation =  808.000(Ft.)
Elevation difference =    2.000(Ft.) Slope =  1.961 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 85.00 (Ft)
for the top area slope value of   1.96 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   9.94 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*(  85.000^.5)/(   1.961^(1/3)]=   9.94
The initial area total distance of  102.00 (Ft.) entered leaves a
remaining distance of   17.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   0.31 minutes
for a distance of  17.00 (Ft.) and a slope of  1.96 %
with an elevation difference of   0.33(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    0.314 Minutes
Tt=[(11.9*0.0032^3)/(  0.33)]^.385=  0.31
Total initial area Ti =   9.94 minutes from Figure 3-3 formula plus
  0.31 minutes from the Figure 3-4 formula =  10.26 minutes
Rainfall intensity (I) =      4.807(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.119(CFS)
Total initial stream area =        0.071(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      302.000 to Point/Station      107.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =     12.804(CFS)
Depth of flow =   0.234(Ft.), Average velocity =   5.172(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00             18.00
       2             45.00              0.00
       3             55.00              0.00
       4            100.00             18.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =     12.804(CFS)
  '     '       flow top width =     11.169(Ft.)
  '     '    velocity=    5.172(Ft/s)
  '     '       area =      2.475(Sq.Ft)
  '     '       Froude number =     1.936

Upstream point elevation =   808.000(Ft.)
Downstream point elevation =   505.000(Ft.)
```

```
Flow length =  2074.000(Ft.)
Travel time  =    6.68 min.
Time of concentration =   16.94 min.
Depth of flow =   0.234(Ft.)
Average velocity =   5.172(Ft/s)
Total irregular channel flow =    12.804(CFS)
Irregular channel normal depth above invert elev. =   0.234(Ft.)
Average velocity of channel(s) =   5.172(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      3.478(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      3.478(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      7.309
Subarea runoff =     25.300(CFS) for     20.812(Ac.)
Total runoff =     25.419(CFS)        Total area =      20.883(Ac.)
Depth of flow =   0.351(Ft.), Average velocity =   6.658(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      107.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     20.883(Ac.)
Runoff from this stream =     25.419(CFS)
Time of concentration =   16.94 min.
Rainfall intensity =     3.478(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       65.075     17.11               3.455
2       25.419     16.94               3.478
Qmax(1) =
          1.000 *    1.000 *    65.075) +
          0.993 *    1.000 *    25.419) + =      90.329
Qmax(2) =
          1.000 *    0.990 *    65.075) +
          1.000 *    1.000 *    25.419) + =      89.840

Total of 2 streams to confluence:
Flow rates before confluence point:
      65.075      25.419
Maximum flow rates at confluence using above data:
       90.329       89.840
Area of streams before confluence:
       47.559       20.883
Results of confluence:
Total flow rate =     90.329(CFS)
Time of concentration =    17.113 min.
Effective stream area after confluence =     68.442(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      108.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =    109.282(CFS)
Depth of flow =   1.138(Ft.), Average velocity =   7.479(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
```

```
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00             18.00
       2             45.00              0.00
       3             55.00              0.00
       4            100.00             18.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =    109.282(CFS)
  '     '       flow top width =     15.688(Ft.)
  '     '    velocity=    7.479(Ft/s)
  '     '       area =     14.613(Sq.Ft)
  '     '       Froude number =     1.366

Upstream point elevation =   505.000(Ft.)
Downstream point elevation =   425.000(Ft.)
Flow length =  1731.000(Ft.)
Travel time  =    3.86 min.
Time of concentration =   20.97 min.
Depth of flow =   1.138(Ft.)
Average velocity =   7.479(Ft/s)
Total irregular channel flow =   109.282(CFS)
Irregular channel normal depth above invert elev. =   1.138(Ft.)
Average velocity of channel(s) =   7.479(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      3.031(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      3.031(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.369  CA =     42.296
Subarea runoff =     37.852(CFS) for     46.151(Ac.)
Total runoff =    128.182(CFS)        Total area =     114.593(Ac.)
Depth of flow =   1.244(Ft.), Average velocity =   7.861(Ft/s)
End of computations, total study area =         114.593 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 02/26/20

PRE-DEVELOPMENT
POC-2
100 YR STORM

********* Hydrology Study Control Information **********

Program License Serial Number 6332

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.900
24 hour precipitation(inches) = 5.250
P6/P24 = 55.2%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 401.000 to Point/Station 402.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN]
(Permanent Open Space)
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance = 82.000(Ft.)
Highest elevation = 598.000(Ft.)
Lowest elevation = 586.000(Ft.)
Elevation difference = 12.000(Ft.) Slope = 14.634 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 14.63 %, in a development type of
Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration = 5.52 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*(100.000^.5)/(14.634^(1/3)]= 5.52
Rainfall intensity (I) = 7.169(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff = 0.276(CFS)
Total initial stream area = 0.110(Ac.)

++
Process from Point/Station 402.000 to Point/Station 404.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 6.296(CFS)
Depth of flow = 0.202(Ft.), Average velocity = 5.382(Ft/s)
******* Irregular Channel Data ***********

Information entered for subchannel number 1 :

```
Point number      'X' coordinate     'Y' coordinate
       1              0.00              5.00
       2             20.00              0.00
       3             25.00              0.00
       4             45.00              5.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =      6.296(CFS)
  '     '       flow top width =      6.612(Ft.)
  '     '    velocity=    5.382(Ft/s)
  '     '       area =      1.170(Sq.Ft)
  '     '       Froude number =     2.255

Upstream point elevation =   586.000(Ft.)
Downstream point elevation =   436.000(Ft.)
Flow length =   703.000(Ft.)
Travel time  =    2.18 min.
Time of concentration =    7.70 min.
Depth of flow =   0.202(Ft.)
Average velocity =   5.382(Ft/s)
Total irregular channel flow =     6.296(CFS)
Irregular channel normal depth above invert elev. =   0.202(Ft.)
Average velocity of channel(s) =   5.382(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      5.785(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      5.785(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      2.119
Subarea runoff =     11.980(CFS) for      5.943(Ac.)
Total runoff =     12.256(CFS)        Total area =       6.053(Ac.)
Depth of flow =   0.295(Ft.), Average velocity =   6.724(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      403.000 to Point/Station      403.000
**** SUBAREA FLOW ADDITION ****
_________________________________________________________________________
Rainfall intensity (I) =      5.785(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Time of concentration =     7.70 min.
Rainfall intensity =      5.785(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      2.722
Subarea runoff =      3.493(CFS) for      1.725(Ac.)
Total runoff =     15.749(CFS)        Total area =       7.778(Ac.)
End of computations, total study area =           7.778 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 02/26/20

PRE-DEVELOPMENT
POC-3
100 YR STORM

********* Hydrology Study Control Information **********

Program License Serial Number 6332

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.900
24 hour precipitation(inches) = 5.250
P6/P24 = 55.2%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 501.000 to Point/Station 502.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN]
(Permanent Open Space)
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance = 94.000(Ft.)
Highest elevation = 470.000(Ft.)
Lowest elevation = 422.000(Ft.)
Elevation difference = 48.000(Ft.) Slope = 51.064 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 51.06 %, in a development type of
Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration = 3.64 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*(100.000^.5)/(51.064^(1/3)]= 3.64
Calculated TC of 3.639 minutes is less than 5 minutes,
resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) = 7.641(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff = 0.358(CFS)
Total initial stream area = 0.134(Ac.)

++
Process from Point/Station 502.000 to Point/Station 503.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.808(CFS)
Depth of flow = 0.404(Ft.), Average velocity = 3.291(Ft/s)
******* Irregular Channel Data **********

```
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              1.00
       2              1.50              0.00
       3              3.00              1.00
Manning's 'N' friction factor =   0.016
------------------------------------------------------------------
Sub-Channel flow  =      0.808(CFS)
  '     '       flow top width =      1.213(Ft.)
  '     '    velocity=    3.291(Ft/s)
  '     '       area =      0.245(Sq.Ft)
  '     '       Froude number =     1.290

Upstream point elevation =   422.000(Ft.)
Downstream point elevation =   417.000(Ft.)
Flow length =   370.000(Ft.)
Travel time  =    1.87 min.
Time of concentration =    5.51 min.
Depth of flow =   0.404(Ft.)
Average velocity =   3.291(Ft/s)
Total irregular channel flow =     0.808(CFS)
Irregular channel normal depth above invert elev. =   0.404(Ft.)
Average velocity of channel(s) =   3.291(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      7.174(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      7.174(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      0.164
Subarea runoff =      0.822(CFS) for      0.336(Ac.)
Total runoff =      1.180(CFS)        Total area =       0.470(Ac.)
Depth of flow =   0.466(Ft.), Average velocity =   3.618(Ft/s)
End of computations, total study area =           0.470 (Ac.)
```

ATTACHMENT 3.2

```
               San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
       Rational Hydrology Study        Date: 02/25/20
--------------------------------------------------------------------------
POST-DEVELOPMENT
POC-1 UN-MITIGATED
100YR

--------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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Program License Serial Number 6332

--------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  2.900
24 hour precipitation(inches) =  5.250
P6/P24 =    55.2%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** INITIAL AREA EVALUATION ****
__________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.520
Initial subarea total flow distance  =   98.000(Ft.)
Highest elevation =  776.000(Ft.)
Lowest elevation =  775.500(Ft.)
Elevation difference =    0.500(Ft.) Slope =  0.510 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 50.00 (Ft)
for the top area slope value of   0.51 %, in a development type of
 4.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   9.24 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5200)*(  50.000^.5)/(   0.510^(1/3)]=   9.24
The initial area total distance of   98.00 (Ft.) entered leaves a
remaining distance of   48.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.17 minutes
for a distance of  48.00 (Ft.) and a slope of  0.51 %
with an elevation difference of   0.24(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.174 Minutes
Tt=[(11.9*0.0091^3)/(  0.24)]^.385=  1.17
Total initial area Ti =   9.24 minutes from Figure 3-3 formula plus
  1.17 minutes from the Figure 3-4 formula =  10.41 minutes
Rainfall intensity (I) =      4.760(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.520
Subarea runoff =      0.673(CFS)
Total initial stream area =        0.272(Ac.)
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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      7.957(CFS)
Depth of flow =   0.247(Ft.), Average velocity =   5.183(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2             25.00              0.00
       3             25.10              0.50
       4             30.00              0.51
Manning's 'N' friction factor =   0.013
------------------------------------------------------------------
Sub-Channel flow  =      7.957(CFS)
  '     '       flow top width =     12.415(Ft.)
  '     '    velocity=    5.184(Ft/s)
  '     '       area =      1.535(Sq.Ft)
  '     '       Froude number =     2.598

Upstream point elevation =   775.500(Ft.)
Downstream point elevation =   748.000(Ft.)
Flow length =   806.000(Ft.)
Travel time  =    2.59 min.
Time of concentration =   13.01 min.
Depth of flow =   0.247(Ft.)
Average velocity =   5.183(Ft/s)
Total irregular channel flow =     7.957(CFS)
Irregular channel normal depth above invert elev. =   0.247(Ft.)
Average velocity of channel(s) =   5.183(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      4.124(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.520
Rainfall intensity =      4.124(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.520  CA =      3.675
Subarea runoff =     14.485(CFS) for      6.796(Ac.)
Total runoff =     15.159(CFS)        Total area =       7.068(Ac.)
Depth of flow =   0.315(Ft.), Average velocity =   6.090(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
Rainfall intensity (I) =      4.124(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.520
Time of concentration =    13.01 min.
Rainfall intensity =      4.124(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.520  CA =      6.694
Subarea runoff =     12.452(CFS) for      5.806(Ac.)
Total runoff =     27.611(CFS)        Total area =      12.874(Ac.)
```

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Process from Point/Station      104.000 to Point/Station      105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   738.000(Ft.)
Downstream point/station elevation =   732.000(Ft.)
Pipe length  =   305.00(Ft.) Slope =   0.0197  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    27.611(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    27.611(CFS)
Normal flow depth in pipe =   17.32(In.)
Flow top width inside pipe =   21.51(In.)
Critical Depth =   21.84(In.)
Pipe flow velocity =     11.38(Ft/s)
Travel time through pipe =    0.45 min.
Time of concentration (TC) =    13.45 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      106.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________________
Estimated mean flow rate at midpoint of channel =     31.525(CFS)
Depth of flow =   0.389(Ft.), Average velocity =   7.387(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00             18.00
       2             45.00              0.00
       3             55.00              0.00
       4            100.00             18.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =     31.525(CFS)
  '     '       flow top width =     11.945(Ft.)
  '     '    velocity=    7.387(Ft/s)
  '     '       area =      4.267(Sq.Ft)
  '     '       Froude number =     2.178

Upstream point elevation =   732.000(Ft.)
Downstream point elevation =   516.000(Ft.)
Flow length =  1362.000(Ft.)
Travel time  =    3.07 min.
Time of concentration =   16.53 min.
Depth of flow =   0.389(Ft.)
Average velocity =   7.387(Ft/s)
Total irregular channel flow =    31.525(CFS)
Irregular channel normal depth above invert elev. =   0.389(Ft.)
Average velocity of channel(s) =   7.387(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      3.534(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      3.534(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.448  CA =     10.012
Subarea runoff =      7.771(CFS) for      9.478(Ac.)
Total runoff =     35.382(CFS)        Total area =      22.352(Ac.)
Depth of flow =   0.416(Ft.), Average velocity =   7.699(Ft/s)


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Process from Point/Station      106.000 to Point/Station      106.000
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**** CONFLUENCE OF MINOR STREAMS ****
____________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     22.352(Ac.)
Runoff from this stream =     35.382(CFS)
Time of concentration =   16.53 min.
Rainfall intensity =     3.534(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** INITIAL AREA EVALUATION ****
____________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =  117.000(Ft.)
Highest elevation =  748.000(Ft.)
Lowest elevation =  716.000(Ft.)
Elevation difference =   32.000(Ft.) Slope = 27.350 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  27.35 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.48 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  27.350^(1/3)]=   4.48
The initial area total distance of  117.00 (Ft.) entered leaves a
remaining distance of   17.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   0.11 minutes
for a distance of  17.00 (Ft.) and a slope of 27.35 %
with an elevation difference of   4.65(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    0.114 Minutes
Tt=[(11.9*0.0032^3)/(  4.65)]^.385=  0.11
Total initial area Ti =   4.48 minutes from Figure 3-3 formula plus
  0.11 minutes from the Figure 3-4 formula =   4.59 minutes
Calculated TC of    4.595 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      7.641(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.251(CFS)
Total initial stream area =        0.094(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      106.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      8.354(CFS)
Depth of flow =   0.170(Ft.), Average velocity =   4.712(Ft/s)
       ******* Irregular Channel Data ***********
----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00             18.00
       2             45.00              0.00
       3             55.00              0.00
       4            100.00             18.00
Manning's 'N' friction factor =   0.040
----------------------------------------------------------------
Sub-Channel flow  =      8.355(CFS)
  '     '       flow top width =     10.850(Ft.)
  '     '    velocity=    4.712(Ft/s)
  '     '       area =      1.773(Sq.Ft)
```

```
  '     '       Froude number =     2.054

Upstream point elevation =   716.000(Ft.)
Downstream point elevation =   516.000(Ft.)
Flow length =  1102.000(Ft.)
Travel time  =    3.90 min.
Time of concentration =    8.49 min.
Depth of flow =   0.170(Ft.)
Average velocity =   4.712(Ft/s)
Total irregular channel flow =     8.354(CFS)
Irregular channel normal depth above invert elev. =   0.170(Ft.)
Average velocity of channel(s) =   4.712(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      5.429(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      5.429(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      3.014
Subarea runoff =     16.113(CFS) for      8.518(Ac.)
Total runoff =     16.364(CFS)        Total area =       8.612(Ac.)
Depth of flow =   0.254(Ft.), Average velocity =   6.067(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      203.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      5.429(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Time of concentration =     8.49 min.
Rainfall intensity =      5.429(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      8.389
Subarea runoff =     29.179(CFS) for     15.356(Ac.)
Total runoff =     45.544(CFS)        Total area =      23.968(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.000 to Point/Station      106.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     23.968(Ac.)
Runoff from this stream =     45.544(CFS)
Time of concentration =    8.49 min.
Rainfall intensity =     5.429(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                  (In/Hr)


1       35.382     16.53               3.534
2       45.544      8.49               5.429
Qmax(1) =
          1.000 *    1.000 *    35.382) +
          0.651 *    1.000 *    45.544) + =      65.028
```

```
Qmax(2) =
          1.000 *    0.514 *    35.382) +
          1.000 *    1.000 *    45.544) + =      63.728

Total of 2 streams to confluence:
Flow rates before confluence point:
      35.382      45.544
Maximum flow rates at confluence using above data:
       65.028       63.728
Area of streams before confluence:
       22.352       23.968
Results of confluence:
Total flow rate =     65.028(CFS)
Time of concentration =    16.525 min.
Effective stream area after confluence =     46.320(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.000 to Point/Station      107.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =     65.078(CFS)
Depth of flow =   0.837(Ft.), Average velocity =   6.432(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00             18.00
       2             45.00              0.00
       3             55.00              0.00
       4            100.00             18.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =     65.078(CFS)
  '     '       flow top width =     14.184(Ft.)
  '     '    velocity=    6.432(Ft/s)
  '     '       area =     10.118(Sq.Ft)
  '     '       Froude number =     1.342

Upstream point elevation =   516.000(Ft.)
Downstream point elevation =   505.000(Ft.)
Flow length =   227.000(Ft.)
Travel time  =    0.59 min.
Time of concentration =   17.11 min.
Depth of flow =   0.837(Ft.)
Average velocity =   6.432(Ft/s)
Total irregular channel flow =    65.078(CFS)
Irregular channel normal depth above invert elev. =   0.837(Ft.)
Average velocity of channel(s) =   6.432(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      3.455(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      3.455(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.396  CA =     18.834
Subarea runoff =      0.048(CFS) for      1.239(Ac.)
Total runoff =     65.075(CFS)        Total area =      47.559(Ac.)
Depth of flow =   0.837(Ft.), Average velocity =   6.432(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      107.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
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```
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     47.559(Ac.)
Runoff from this stream =     65.075(CFS)
Time of concentration =   17.11 min.
Rainfall intensity =     3.455(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      301.000 to Point/Station      302.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =  102.000(Ft.)
Highest elevation =  810.000(Ft.)
Lowest elevation =  808.000(Ft.)
Elevation difference =    2.000(Ft.) Slope =  1.961 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 85.00 (Ft)
for the top area slope value of   1.96 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   9.94 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*(  85.000^.5)/(   1.961^(1/3)]=   9.94
The initial area total distance of  102.00 (Ft.) entered leaves a
remaining distance of   17.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   0.31 minutes
for a distance of  17.00 (Ft.) and a slope of  1.96 %
with an elevation difference of   0.33(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    0.314 Minutes
Tt=[(11.9*0.0032^3)/(  0.33)]^.385=  0.31
Total initial area Ti =   9.94 minutes from Figure 3-3 formula plus
  0.31 minutes from the Figure 3-4 formula =  10.26 minutes
Rainfall intensity (I) =      4.807(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.119(CFS)
Total initial stream area =        0.071(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      302.000 to Point/Station      107.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =     12.804(CFS)
Depth of flow =   0.234(Ft.), Average velocity =   5.172(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00             18.00
       2             45.00              0.00
       3             55.00              0.00
       4            100.00             18.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =     12.804(CFS)
  '     '       flow top width =     11.169(Ft.)
  '     '    velocity=    5.172(Ft/s)
  '     '       area =      2.475(Sq.Ft)
  '     '       Froude number =     1.936

Upstream point elevation =   808.000(Ft.)
Downstream point elevation =   505.000(Ft.)
```

```
Flow length =  2074.000(Ft.)
Travel time  =    6.68 min.
Time of concentration =   16.94 min.
Depth of flow =   0.234(Ft.)
Average velocity =   5.172(Ft/s)
Total irregular channel flow =    12.804(CFS)
Irregular channel normal depth above invert elev. =   0.234(Ft.)
Average velocity of channel(s) =   5.172(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      3.478(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      3.478(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      7.309
Subarea runoff =     25.300(CFS) for     20.812(Ac.)
Total runoff =     25.419(CFS)        Total area =      20.883(Ac.)
Depth of flow =   0.351(Ft.), Average velocity =   6.658(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      107.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     20.883(Ac.)
Runoff from this stream =     25.419(CFS)
Time of concentration =   16.94 min.
Rainfall intensity =     3.478(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       65.075     17.11               3.455
2       25.419     16.94               3.478
Qmax(1) =
          1.000 *    1.000 *    65.075) +
          0.993 *    1.000 *    25.419) + =      90.329
Qmax(2) =
          1.000 *    0.990 *    65.075) +
          1.000 *    1.000 *    25.419) + =      89.840

Total of 2 streams to confluence:
Flow rates before confluence point:
      65.075      25.419
Maximum flow rates at confluence using above data:
       90.329       89.840
Area of streams before confluence:
       47.559       20.883
Results of confluence:
Total flow rate =     90.329(CFS)
Time of concentration =    17.113 min.
Effective stream area after confluence =     68.442(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      108.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =    100.117(CFS)
Depth of flow =   1.021(Ft.), Average velocity =   7.814(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
```

```
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1             0.00             18.00
       2            45.00              0.00
       3            55.00              0.00
       4           100.00             18.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =    100.117(CFS)
  '     '       flow top width =     15.104(Ft.)
  '     '    velocity=    7.814(Ft/s)
  '     '       area =     12.812(Sq.Ft)
  '     '       Froude number =     1.495

Upstream point elevation =   505.000(Ft.)
Downstream point elevation =   453.000(Ft.)
Flow length =   912.000(Ft.)
Travel time  =    1.95 min.
Time of concentration =   19.06 min.
Depth of flow =   1.021(Ft.)
Average velocity =   7.814(Ft/s)
Total irregular channel flow =   100.117(CFS)
Irregular channel normal depth above invert elev. =   1.021(Ft.)
Average velocity of channel(s) =   7.814(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      3.223(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      3.223(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.374  CA =     34.069
Subarea runoff =     19.488(CFS) for     22.645(Ac.)
Total runoff =    109.818(CFS)        Total area =      91.087(Ac.)
Depth of flow =   1.075(Ft.), Average velocity =   8.048(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      109.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =   453.000(Ft.)
Downstream point/station elevation =   451.780(Ft.)
Pipe length  =   245.00(Ft.) Slope =   0.0050  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   109.818(CFS)
Given pipe size =     48.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     1.990(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      1.432(Ft.)
 Minor friction loss =      1.779(Ft.)       K-factor =   1.50
Pipe flow velocity =      8.74(Ft/s)
Travel time through pipe =    0.47 min.
Time of concentration (TC) =    19.53 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      109.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     91.087(Ac.)
Runoff from this stream =    109.818(CFS)
Time of concentration =   19.53 min.
Rainfall intensity =     3.173(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      501.000 to Point/Station      502.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =   97.000(Ft.)
Highest elevation =  500.000(Ft.)
Lowest elevation =  488.000(Ft.)
Elevation difference =   12.000(Ft.) Slope = 12.371 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  12.37 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.84 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  12.371^(1/3)]=   5.84
Rainfall intensity (I) =      6.915(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.361(CFS)
Total initial stream area =        0.149(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      502.000 to Point/Station      503.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      6.705(CFS)
Depth of flow =   0.237(Ft.), Average velocity =   2.334(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              1.00
       2            100.00              0.00
       3            102.00              1.00
Manning's 'N' friction factor =   0.023
------------------------------------------------------------------
Sub-Channel flow  =      6.705(CFS)
  '     '       flow top width =     24.207(Ft.)
  '     '    velocity=    2.334(Ft/s)
  '     '       area =      2.872(Sq.Ft)
  '     '       Froude number =     1.194

Upstream point elevation =   488.000(Ft.)
Downstream point elevation =   471.000(Ft.)
Flow length =   757.000(Ft.)
Travel time  =    5.40 min.
Time of concentration =   11.24 min.
Depth of flow =   0.237(Ft.)
Average velocity =   2.334(Ft/s)
Total irregular channel flow =     6.705(CFS)
Irregular channel normal depth above invert elev. =   0.237(Ft.)
Average velocity of channel(s) =   2.334(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      4.531(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
```

```
Sub-Area C Value = 0.350
Rainfall intensity =      4.531(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      2.863
Subarea runoff =     12.609(CFS) for      8.030(Ac.)
Total runoff =     12.970(CFS)        Total area =       8.179(Ac.)
Depth of flow =   0.304(Ft.), Average velocity =   2.753(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      109.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      8.179(Ac.)
Runoff from this stream =     12.970(CFS)
Time of concentration =   11.24 min.
Rainfall intensity =     4.531(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1      109.818     19.53               3.173
2       12.970     11.24               4.531
Qmax(1) =
          1.000 *    1.000 *   109.818) +
          0.700 *    1.000 *    12.970) + =     118.902
Qmax(2) =
          1.000 *    0.576 *   109.818) +
          1.000 *    1.000 *    12.970) + =      76.198

Total of 2 streams to confluence:
Flow rates before confluence point:
     109.818      12.970
Maximum flow rates at confluence using above data:
      118.902       76.198
Area of streams before confluence:
       91.087        8.179
Results of confluence:
Total flow rate =    118.902(CFS)
Time of concentration =    19.526 min.
Effective stream area after confluence =     99.266(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      110.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =   451.780(Ft.)
Downstream point/station elevation =   407.700(Ft.)
Pipe length  =   689.00(Ft.) Slope =   0.0640  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   118.902(CFS)
Given pipe size =     48.00(In.)
Calculated individual pipe flow  =   118.902(CFS)
Normal flow depth in pipe =   18.89(In.)
Flow top width inside pipe =   46.90(In.)
Critical Depth =   39.41(In.)
Pipe flow velocity =     25.88(Ft/s)
Travel time through pipe =    0.44 min.
Time of concentration (TC) =    19.97 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      110.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     99.266(Ac.)
Runoff from this stream =    118.902(CFS)
```

```
Time of concentration =   19.97 min.
Rainfall intensity =     3.128(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      601.000 to Point/Station      602.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =   90.000(Ft.)
Highest elevation =  486.000(Ft.)
Lowest elevation =  485.300(Ft.)
Elevation difference =    0.700(Ft.) Slope =  0.778 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 70.00 (Ft)
for the top area slope value of   0.78 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =  12.28 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*(  70.000^.5)/(   0.778^(1/3)]=  12.28
The initial area total distance of   90.00 (Ft.) entered leaves a
remaining distance of   20.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   0.51 minutes
for a distance of  20.00 (Ft.) and a slope of  0.78 %
with an elevation difference of   0.16(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    0.509 Minutes
Tt=[(11.9*0.0038^3)/(  0.16)]^.385=  0.51
Total initial area Ti =  12.28 minutes from Figure 3-3 formula plus
  0.51 minutes from the Figure 3-4 formula =  12.79 minutes
Rainfall intensity (I) =      4.169(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.194(CFS)
Total initial stream area =        0.133(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      602.000 to Point/Station      603.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      1.312(CFS)
Depth of flow =   0.126(Ft.), Average velocity =   1.630(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              1.00
       2            100.00              0.00
       3            102.00              1.00
Manning's 'N' friction factor =   0.023
------------------------------------------------------------------
Sub-Channel flow  =      1.312(CFS)
  '     '       flow top width =     12.816(Ft.)
  '     '    velocity=    1.630(Ft/s)
  '     '       area =      0.805(Sq.Ft)
  '     '       Froude number =     1.146

Upstream point elevation =   485.300(Ft.)
Downstream point elevation =   472.600(Ft.)
Flow length =   497.000(Ft.)
Travel time  =    5.08 min.
Time of concentration =   17.87 min.
Depth of flow =   0.126(Ft.)
```

```
Average velocity =   1.630(Ft/s)
Total irregular channel flow =     1.312(CFS)
Irregular channel normal depth above invert elev. =   0.126(Ft.)
Average velocity of channel(s) =   1.630(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      3.360(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      3.360(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      0.700
Subarea runoff =      2.159(CFS) for      1.868(Ac.)
Total runoff =      2.353(CFS)        Total area =       2.001(Ac.)
Depth of flow =   0.156(Ft.), Average velocity =   1.886(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      603.000 to Point/Station      110.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   470.600(Ft.)
Downstream point/station elevation =   407.700(Ft.)
Pipe length  =   154.00(Ft.) Slope =   0.4084  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.353(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     2.353(CFS)
Normal flow depth in pipe =    2.13(In.)
Flow top width inside pipe =   13.66(In.)
Critical Depth =    6.39(In.)
Pipe flow velocity =     17.12(Ft/s)
Travel time through pipe =    0.15 min.
Time of concentration (TC) =    18.02 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      110.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      2.001(Ac.)
Runoff from this stream =      2.353(CFS)
Time of concentration =   18.02 min.
Rainfall intensity =     3.342(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      701.000 to Point/Station      702.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =   97.000(Ft.)
Highest elevation =  474.000(Ft.)
Lowest elevation =  469.000(Ft.)
Elevation difference =    5.000(Ft.) Slope =  5.155 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   5.16 %, in a development type of
 Permanent Open Space
```

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In Accordance With Figure 3-3
Initial Area Time of Concentration =   7.81 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(   5.155^(1/3)]=   7.81
Rainfall intensity (I) =      5.728(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.231(CFS)
Total initial stream area =        0.115(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      702.000 to Point/Station      110.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      1.662(CFS)
Depth of flow =   0.137(Ft.), Average velocity =   3.522(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2             25.00              0.00
       3             25.10              0.50
       4             30.00              0.51
Manning's 'N' friction factor =   0.020
------------------------------------------------------------------
Sub-Channel flow  =      1.662(CFS)
  '     '       flow top width =      6.883(Ft.)
  '     '    velocity=    3.522(Ft/s)
  '     '       area =      0.472(Sq.Ft)
  '     '       Froude number =     2.370

Upstream point elevation =   469.000(Ft.)
Downstream point elevation =   414.000(Ft.)
Flow length =   672.000(Ft.)
Travel time  =    3.18 min.
Time of concentration =   11.00 min.
Depth of flow =   0.137(Ft.)
Average velocity =   3.522(Ft/s)
Total irregular channel flow =     1.662(CFS)
Irregular channel normal depth above invert elev. =   0.137(Ft.)
Average velocity of channel(s) =   3.522(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      4.596(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      4.596(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      0.661
Subarea runoff =      2.810(CFS) for      1.775(Ac.)
Total runoff =      3.040(CFS)        Total area =       1.890(Ac.)
Depth of flow =   0.172(Ft.), Average velocity =   4.096(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      110.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 3
Stream flow area =      1.890(Ac.)
Runoff from this stream =      3.040(CFS)
Time of concentration =   11.00 min.
Rainfall intensity =     4.596(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      801.000 to Point/Station      802.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =  100.000(Ft.)
Highest elevation =  596.000(Ft.)
Lowest elevation =  576.000(Ft.)
Elevation difference =   20.000(Ft.) Slope = 20.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  20.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.97 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  20.000^(1/3)]=   4.97
Calculated TC of    4.973 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      7.641(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.949(CFS)
Total initial stream area =        0.355(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      802.000 to Point/Station      110.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________________
Estimated mean flow rate at midpoint of channel =     14.207(CFS)
Depth of flow =   0.761(Ft.), Average velocity =  16.335(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              1.00
       2              1.50              0.00
       3              3.00              1.00
Manning's 'N' friction factor =   0.016
------------------------------------------------------------------
Sub-Channel flow  =     14.207(CFS)
  '     '       flow top width =      2.284(Ft.)
  '     '    velocity=   16.335(Ft/s)
  '     '       area =      0.870(Sq.Ft)
  '     '       Froude number =     4.665

Upstream point elevation =   576.000(Ft.)
Downstream point elevation =   414.000(Ft.)
Flow length =  1131.000(Ft.)
Travel time  =    1.15 min.
Time of concentration =    6.13 min.
Depth of flow =   0.761(Ft.)
Average velocity =  16.335(Ft/s)
Total irregular channel flow =    14.207(CFS)
Irregular channel normal depth above invert elev. =   0.761(Ft.)
Average velocity of channel(s) =  16.335(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      6.702(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
```

```
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      6.702(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      4.088
Subarea runoff =     26.447(CFS) for     11.325(Ac.)
Total runoff =     27.396(CFS)        Total area =      11.680(Ac.)
Depth of flow =   0.974(Ft.), Average velocity =  19.249(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      110.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 4
Stream flow area =     11.680(Ac.)
Runoff from this stream =     27.396(CFS)
Time of concentration =    6.13 min.
Rainfall intensity =     6.702(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1      118.902     19.97               3.128
2        2.353     18.02               3.342
3        3.040     11.00               4.596
4       27.396      6.13               6.702
Qmax(1) =
          1.000 *    1.000 *   118.902) +
          0.936 *    1.000 *     2.353) +
          0.681 *    1.000 *     3.040) +
          0.467 *    1.000 *    27.396) + =     135.960
Qmax(2) =
          1.000 *    0.902 *   118.902) +
          1.000 *    1.000 *     2.353) +
          0.727 *    1.000 *     3.040) +
          0.499 *    1.000 *    27.396) + =     125.533
Qmax(3) =
          1.000 *    0.551 *   118.902) +
          1.000 *    0.610 *     2.353) +
          1.000 *    1.000 *     3.040) +
          0.686 *    1.000 *    27.396) + =      88.732
Qmax(4) =
          1.000 *    0.307 *   118.902) +
          1.000 *    0.340 *     2.353) +
          1.000 *    0.557 *     3.040) +
          1.000 *    1.000 *    27.396) + =      66.374

Total of 4 streams to confluence:
Flow rates before confluence point:
     118.902       2.353       3.040      27.396
Maximum flow rates at confluence using above data:
      135.960      125.533       88.732       66.374
Area of streams before confluence:
       99.266        2.001        1.890       11.680
Results of confluence:
Total flow rate =    135.960(CFS)
Time of concentration =    19.970 min.
Effective stream area after confluence =    114.837(Ac.)
End of computations, total study area =         114.837 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 02/25/20

POST-DEVELOPMENT
POC-2 UN-MITIGATED
100YR STORM

********* Hydrology Study Control Information **********

Program License Serial Number 6332

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.900
24 hour precipitation(inches) = 5.250
P6/P24 = 55.2%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 401.000 to Point/Station 402.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN]
(Permanent Open Space)
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance = 82.000(Ft.)
Highest elevation = 598.000(Ft.)
Lowest elevation = 586.000(Ft.)
Elevation difference = 12.000(Ft.) Slope = 14.634 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 14.63 %, in a development type of
Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration = 5.52 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*(100.000^.5)/(14.634^(1/3)]= 5.52
Rainfall intensity (I) = 7.169(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff = 0.276(CFS)
Total initial stream area = 0.110(Ac.)

++
Process from Point/Station 402.000 to Point/Station 403.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 6.194(CFS)
Depth of flow = 0.200(Ft.), Average velocity = 5.351(Ft/s)
******* Irregular Channel Data ***********

Information entered for subchannel number 1 :

```
Point number      'X' coordinate     'Y' coordinate
       1              0.00              5.00
       2             20.00              0.00
       3             25.00              0.00
       4             45.00              5.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =      6.194(CFS)
  '     '       flow top width =      6.597(Ft.)
  '     '    velocity=    5.351(Ft/s)
  '     '       area =      1.157(Sq.Ft)
  '     '       Froude number =     2.252

Upstream point elevation =   586.000(Ft.)
Downstream point elevation =   436.000(Ft.)
Flow length =   703.000(Ft.)
Travel time  =    2.19 min.
Time of concentration =    7.71 min.
Depth of flow =   0.200(Ft.)
Average velocity =   5.351(Ft/s)
Total irregular channel flow =     6.194(CFS)
Irregular channel normal depth above invert elev. =   0.200(Ft.)
Average velocity of channel(s) =   5.351(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      5.779(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      5.779(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      2.085
Subarea runoff =     11.775(CFS) for      5.848(Ac.)
Total runoff =     12.051(CFS)        Total area =       5.958(Ac.)
Depth of flow =   0.292(Ft.), Average velocity =   6.687(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      407.000 to Point/Station      407.000
**** CONFLUENCE OF MINOR STREAMS ****
_________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      5.958(Ac.)
Runoff from this stream =     12.051(CFS)
Time of concentration =    7.71 min.
Rainfall intensity =     5.779(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      404.000 to Point/Station      405.000
**** INITIAL AREA EVALUATION ****
_________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =   94.000(Ft.)
Highest elevation =  502.000(Ft.)
Lowest elevation =  488.000(Ft.)
Elevation difference =   14.000(Ft.) Slope = 14.894 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  14.89 %, in a development type of
```

```
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.49 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  14.894^(1/3)]=   5.49
Rainfall intensity (I) =      7.196(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.217(CFS)
Total initial stream area =        0.086(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      405.000 to Point/Station      406.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      1.566(CFS)
Depth of flow =   0.149(Ft.), Average velocity =   1.380(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              1.00
       2            100.00              0.00
       3            102.00              1.00
Manning's 'N' friction factor =   0.023
------------------------------------------------------------------------
Sub-Channel flow  =      1.566(CFS)
  '     '       flow top width =     15.214(Ft.)
  '     '    velocity=    1.380(Ft/s)
  '     '       area =      1.135(Sq.Ft)
  '     '       Froude number =     0.891

Upstream point elevation =   488.000(Ft.)
Downstream point elevation =   479.160(Ft.)
Flow length =   606.000(Ft.)
Travel time  =    7.32 min.
Time of concentration =   12.80 min.
Depth of flow =   0.149(Ft.)
Average velocity =   1.380(Ft/s)
Total irregular channel flow =     1.566(CFS)
Irregular channel normal depth above invert elev. =   0.149(Ft.)
Average velocity of channel(s) =   1.380(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      4.166(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      4.166(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      0.679
Subarea runoff =      2.614(CFS) for      1.855(Ac.)
Total runoff =      2.830(CFS)        Total area =       1.941(Ac.)
Depth of flow =   0.186(Ft.), Average velocity =   1.600(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      407.000 to Point/Station      407.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.941(Ac.)
Runoff from this stream =      2.830(CFS)
Time of concentration =   12.80 min.
Rainfall intensity =     4.166(In/Hr)
Summary of stream data:
```

```
Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       12.051      7.71               5.779
2        2.830     12.80               4.166
Qmax(1) =
           1.000 *    1.000 *    12.051) +
           1.000 *    0.602 *     2.830) + =      13.755
Qmax(2) =
           0.721 *    1.000 *    12.051) +
           1.000 *    1.000 *     2.830) + =      11.518

Total of 2 streams to confluence:
Flow rates before confluence point:
      12.051       2.830
Maximum flow rates at confluence using above data:
       13.755       11.518
Area of streams before confluence:
        5.958        1.941
Results of confluence:
Total flow rate =     13.755(CFS)
Time of concentration =     7.709 min.
Effective stream area after confluence =      7.899(Ac.)
End of computations, total study area =           7.899 (Ac.)
```

```
               San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
       Rational Hydrology Study        Date: 02/25/20
--------------------------------------------------------------------------
POST-DEVELOPMENT
POC-3 UN-MITIGATED
100YR STORM

--------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

--------------------------------------------------------------------------


Program License Serial Number 6332

--------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  2.900
24 hour precipitation(inches) =  5.250
P6/P24 =    55.2%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      901.000 to Point/Station      902.000
**** INITIAL AREA EVALUATION ****
__________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =   55.000(Ft.)
Highest elevation =  438.000(Ft.)
Lowest elevation =  417.000(Ft.)
Elevation difference =   21.000(Ft.) Slope = 38.182 %
Top of Initial Area Slope adjusted by User to 51.064 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  51.06 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.64 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  51.064^(1/3)]=   3.64
Calculated TC of    3.639 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      7.641(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.281(CFS)
Total initial stream area =        0.105(Ac.)
End of computations, total study area =           0.105 (Ac.)
```

ATTACHMENT 3.3

```
               San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
       Rational Hydrology Study        Date: 02/25/20
--------------------------------------------------------------------------
POST-DEVELOPMENT
POC-1 MITIGATED
100YR STORM

--------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

--------------------------------------------------------------------------


Program License Serial Number 6332

--------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  2.900
24 hour precipitation(inches) =  5.250
P6/P24 =    55.2%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** INITIAL AREA EVALUATION ****
__________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.520
Initial subarea total flow distance  =   98.000(Ft.)
Highest elevation =  776.000(Ft.)
Lowest elevation =  775.500(Ft.)
Elevation difference =    0.500(Ft.) Slope =  0.510 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 50.00 (Ft)
for the top area slope value of   0.51 %, in a development type of
 4.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   9.24 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5200)*(  50.000^.5)/(   0.510^(1/3)]=   9.24
The initial area total distance of   98.00 (Ft.) entered leaves a
remaining distance of   48.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.17 minutes
for a distance of  48.00 (Ft.) and a slope of  0.51 %
with an elevation difference of   0.24(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.174 Minutes
Tt=[(11.9*0.0091^3)/(  0.24)]^.385=  1.17
Total initial area Ti =   9.24 minutes from Figure 3-3 formula plus
  1.17 minutes from the Figure 3-4 formula =  10.41 minutes
Rainfall intensity (I) =      4.760(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.520
Subarea runoff =      0.673(CFS)
Total initial stream area =        0.272(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      7.957(CFS)
Depth of flow =   0.247(Ft.), Average velocity =   5.183(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2             25.00              0.00
       3             25.10              0.50
       4             30.00              0.51
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------------
Sub-Channel flow  =      7.957(CFS)
  '     '       flow top width =     12.415(Ft.)
  '     '    velocity=    5.184(Ft/s)
  '     '       area =      1.535(Sq.Ft)
  '     '       Froude number =     2.598

Upstream point elevation =   775.500(Ft.)
Downstream point elevation =   748.000(Ft.)
Flow length =   806.000(Ft.)
Travel time  =    2.59 min.
Time of concentration =   13.01 min.
Depth of flow =   0.247(Ft.)
Average velocity =   5.183(Ft/s)
Total irregular channel flow =     7.957(CFS)
Irregular channel normal depth above invert elev. =   0.247(Ft.)
Average velocity of channel(s) =   5.183(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      4.124(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.520
Rainfall intensity =      4.124(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.520  CA =      3.675
Subarea runoff =     14.485(CFS) for      6.796(Ac.)
Total runoff =     15.159(CFS)        Total area =       7.068(Ac.)
Depth of flow =   0.315(Ft.), Average velocity =   6.090(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
Rainfall intensity (I) =      4.124(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.520
Time of concentration =    13.01 min.
Rainfall intensity =      4.124(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.520  CA =      6.694
Subarea runoff =     12.452(CFS) for      5.806(Ac.)
Total runoff =     27.611(CFS)        Total area =      12.874(Ac.)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   738.000(Ft.)
Downstream point/station elevation =   732.000(Ft.)
Pipe length  =   305.00(Ft.) Slope =   0.0197  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    27.611(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    27.611(CFS)
Normal flow depth in pipe =   17.32(In.)
Flow top width inside pipe =   21.51(In.)
Critical Depth =   21.84(In.)
Pipe flow velocity =     11.38(Ft/s)
Travel time through pipe =    0.45 min.
Time of concentration (TC) =    13.45 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      106.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________________
Estimated mean flow rate at midpoint of channel =     31.525(CFS)
Depth of flow =   0.389(Ft.), Average velocity =   7.387(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00             18.00
       2             45.00              0.00
       3             55.00              0.00
       4            100.00             18.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =     31.525(CFS)
  '     '       flow top width =     11.945(Ft.)
  '     '    velocity=    7.387(Ft/s)
  '     '       area =      4.267(Sq.Ft)
  '     '       Froude number =     2.178

Upstream point elevation =   732.000(Ft.)
Downstream point elevation =   516.000(Ft.)
Flow length =  1362.000(Ft.)
Travel time  =    3.07 min.
Time of concentration =   16.53 min.
Depth of flow =   0.389(Ft.)
Average velocity =   7.387(Ft/s)
Total irregular channel flow =    31.525(CFS)
Irregular channel normal depth above invert elev. =   0.389(Ft.)
Average velocity of channel(s) =   7.387(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      3.534(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      3.534(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.448  CA =     10.012
Subarea runoff =      7.771(CFS) for      9.478(Ac.)
Total runoff =     35.382(CFS)        Total area =      22.352(Ac.)
Depth of flow =   0.416(Ft.), Average velocity =   7.699(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.000 to Point/Station      106.000
```

```
**** CONFLUENCE OF MINOR STREAMS ****
____________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     22.352(Ac.)
Runoff from this stream =     35.382(CFS)
Time of concentration =   16.53 min.
Rainfall intensity =     3.534(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** INITIAL AREA EVALUATION ****
____________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =  117.000(Ft.)
Highest elevation =  748.000(Ft.)
Lowest elevation =  716.000(Ft.)
Elevation difference =   32.000(Ft.) Slope = 27.350 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  27.35 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.48 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  27.350^(1/3)]=   4.48
The initial area total distance of  117.00 (Ft.) entered leaves a
remaining distance of   17.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   0.11 minutes
for a distance of  17.00 (Ft.) and a slope of 27.35 %
with an elevation difference of   4.65(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    0.114 Minutes
Tt=[(11.9*0.0032^3)/(  4.65)]^.385=  0.11
Total initial area Ti =   4.48 minutes from Figure 3-3 formula plus
  0.11 minutes from the Figure 3-4 formula =   4.59 minutes
Calculated TC of    4.595 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      7.641(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.251(CFS)
Total initial stream area =        0.094(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      106.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      8.354(CFS)
Depth of flow =   0.170(Ft.), Average velocity =   4.712(Ft/s)
       ******* Irregular Channel Data ***********
----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00             18.00
       2             45.00              0.00
       3             55.00              0.00
       4            100.00             18.00
Manning's 'N' friction factor =   0.040
----------------------------------------------------------------
Sub-Channel flow  =      8.355(CFS)
  '     '       flow top width =     10.850(Ft.)
  '     '    velocity=    4.712(Ft/s)
  '     '       area =      1.773(Sq.Ft)
```

```
  '     '       Froude number =     2.054

Upstream point elevation =   716.000(Ft.)
Downstream point elevation =   516.000(Ft.)
Flow length =  1102.000(Ft.)
Travel time  =    3.90 min.
Time of concentration =    8.49 min.
Depth of flow =   0.170(Ft.)
Average velocity =   4.712(Ft/s)
Total irregular channel flow =     8.354(CFS)
Irregular channel normal depth above invert elev. =   0.170(Ft.)
Average velocity of channel(s) =   4.712(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      5.429(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      5.429(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      3.014
Subarea runoff =     16.113(CFS) for      8.518(Ac.)
Total runoff =     16.364(CFS)        Total area =       8.612(Ac.)
Depth of flow =   0.254(Ft.), Average velocity =   6.067(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      203.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      5.429(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Time of concentration =     8.49 min.
Rainfall intensity =      5.429(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      8.389
Subarea runoff =     29.179(CFS) for     15.356(Ac.)
Total runoff =     45.544(CFS)        Total area =      23.968(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.000 to Point/Station      106.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     23.968(Ac.)
Runoff from this stream =     45.544(CFS)
Time of concentration =    8.49 min.
Rainfall intensity =     5.429(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                  (In/Hr)


1       35.382     16.53               3.534
2       45.544      8.49               5.429
Qmax(1) =
          1.000 *    1.000 *    35.382) +
          0.651 *    1.000 *    45.544) + =      65.028
```

```
Qmax(2) =
          1.000 *    0.514 *    35.382) +
          1.000 *    1.000 *    45.544) + =      63.728

Total of 2 streams to confluence:
Flow rates before confluence point:
      35.382      45.544
Maximum flow rates at confluence using above data:
       65.028       63.728
Area of streams before confluence:
       22.352       23.968
Results of confluence:
Total flow rate =     65.028(CFS)
Time of concentration =    16.525 min.
Effective stream area after confluence =     46.320(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.000 to Point/Station      107.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =     65.078(CFS)
Depth of flow =   0.837(Ft.), Average velocity =   6.432(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00             18.00
       2             45.00              0.00
       3             55.00              0.00
       4            100.00             18.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =     65.078(CFS)
  '     '       flow top width =     14.184(Ft.)
  '     '    velocity=    6.432(Ft/s)
  '     '       area =     10.118(Sq.Ft)
  '     '       Froude number =     1.342

Upstream point elevation =   516.000(Ft.)
Downstream point elevation =   505.000(Ft.)
Flow length =   227.000(Ft.)
Travel time  =    0.59 min.
Time of concentration =   17.11 min.
Depth of flow =   0.837(Ft.)
Average velocity =   6.432(Ft/s)
Total irregular channel flow =    65.078(CFS)
Irregular channel normal depth above invert elev. =   0.837(Ft.)
Average velocity of channel(s) =   6.432(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      3.455(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      3.455(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.396  CA =     18.834
Subarea runoff =      0.048(CFS) for      1.239(Ac.)
Total runoff =     65.075(CFS)        Total area =      47.559(Ac.)
Depth of flow =   0.837(Ft.), Average velocity =   6.432(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      107.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
```

```
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     47.559(Ac.)
Runoff from this stream =     65.075(CFS)
Time of concentration =   17.11 min.
Rainfall intensity =     3.455(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      301.000 to Point/Station      302.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =  102.000(Ft.)
Highest elevation =  810.000(Ft.)
Lowest elevation =  808.000(Ft.)
Elevation difference =    2.000(Ft.) Slope =  1.961 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 85.00 (Ft)
for the top area slope value of   1.96 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   9.94 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*(  85.000^.5)/(   1.961^(1/3)]=   9.94
The initial area total distance of  102.00 (Ft.) entered leaves a
remaining distance of   17.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   0.31 minutes
for a distance of  17.00 (Ft.) and a slope of  1.96 %
with an elevation difference of   0.33(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    0.314 Minutes
Tt=[(11.9*0.0032^3)/(  0.33)]^.385=  0.31
Total initial area Ti =   9.94 minutes from Figure 3-3 formula plus
  0.31 minutes from the Figure 3-4 formula =  10.26 minutes
Rainfall intensity (I) =      4.807(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.119(CFS)
Total initial stream area =        0.071(Ac.)


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Process from Point/Station      302.000 to Point/Station      107.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =     12.804(CFS)
Depth of flow =   0.234(Ft.), Average velocity =   5.172(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00             18.00
       2             45.00              0.00
       3             55.00              0.00
       4            100.00             18.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =     12.804(CFS)
  '     '       flow top width =     11.169(Ft.)
  '     '    velocity=    5.172(Ft/s)
  '     '       area =      2.475(Sq.Ft)
  '     '       Froude number =     1.936

Upstream point elevation =   808.000(Ft.)
Downstream point elevation =   505.000(Ft.)
```

```
Flow length =  2074.000(Ft.)
Travel time  =    6.68 min.
Time of concentration =   16.94 min.
Depth of flow =   0.234(Ft.)
Average velocity =   5.172(Ft/s)
Total irregular channel flow =    12.804(CFS)
Irregular channel normal depth above invert elev. =   0.234(Ft.)
Average velocity of channel(s) =   5.172(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      3.478(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      3.478(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      7.309
Subarea runoff =     25.300(CFS) for     20.812(Ac.)
Total runoff =     25.419(CFS)        Total area =      20.883(Ac.)
Depth of flow =   0.351(Ft.), Average velocity =   6.658(Ft/s)


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Process from Point/Station      107.000 to Point/Station      107.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     20.883(Ac.)
Runoff from this stream =     25.419(CFS)
Time of concentration =   16.94 min.
Rainfall intensity =     3.478(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       65.075     17.11               3.455
2       25.419     16.94               3.478
Qmax(1) =
          1.000 *    1.000 *    65.075) +
          0.993 *    1.000 *    25.419) + =      90.329
Qmax(2) =
          1.000 *    0.990 *    65.075) +
          1.000 *    1.000 *    25.419) + =      89.840

Total of 2 streams to confluence:
Flow rates before confluence point:
      65.075      25.419
Maximum flow rates at confluence using above data:
       90.329       89.840
Area of streams before confluence:
       47.559       20.883
Results of confluence:
Total flow rate =     90.329(CFS)
Time of concentration =    17.113 min.
Effective stream area after confluence =     68.442(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      108.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =    100.117(CFS)
Depth of flow =   1.021(Ft.), Average velocity =   7.814(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
```

```
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1             0.00             18.00
       2            45.00              0.00
       3            55.00              0.00
       4           100.00             18.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =    100.117(CFS)
  '     '       flow top width =     15.104(Ft.)
  '     '    velocity=    7.814(Ft/s)
  '     '       area =     12.812(Sq.Ft)
  '     '       Froude number =     1.495

Upstream point elevation =   505.000(Ft.)
Downstream point elevation =   453.000(Ft.)
Flow length =   912.000(Ft.)
Travel time  =    1.95 min.
Time of concentration =   19.06 min.
Depth of flow =   1.021(Ft.)
Average velocity =   7.814(Ft/s)
Total irregular channel flow =   100.117(CFS)
Irregular channel normal depth above invert elev. =   1.021(Ft.)
Average velocity of channel(s) =   7.814(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      3.223(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      3.223(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.374  CA =     34.069
Subarea runoff =     19.488(CFS) for     22.645(Ac.)
Total runoff =    109.818(CFS)        Total area =      91.087(Ac.)
Depth of flow =   1.075(Ft.), Average velocity =   8.048(Ft/s)


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Process from Point/Station      108.000 to Point/Station      109.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =   453.000(Ft.)
Downstream point/station elevation =   451.780(Ft.)
Pipe length  =   245.00(Ft.) Slope =   0.0050  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   109.818(CFS)
Given pipe size =     48.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     1.990(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      1.432(Ft.)
 Minor friction loss =      1.779(Ft.)       K-factor =   1.50
Pipe flow velocity =      8.74(Ft/s)
Travel time through pipe =    0.47 min.
Time of concentration (TC) =    19.53 min.


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Process from Point/Station      109.000 to Point/Station      109.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     91.087(Ac.)
Runoff from this stream =    109.818(CFS)
Time of concentration =   19.53 min.
Rainfall intensity =     3.173(In/Hr)
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Process from Point/Station      503.000 to Point/Station      503.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
______________________________________________________________________________
User specified 'C' value of 0.049 given for subarea
Rainfall intensity (I) =      0.979(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC = 121.00 min.  Rain intensity =       0.98(In/Hr)
Total area =        8.179(Ac.)  Total runoff =     0.393(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      109.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      8.179(Ac.)
Runoff from this stream =      0.393(CFS)
Time of concentration =  121.00 min.
Rainfall intensity =     0.979(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1      109.818     19.53               3.173
2        0.393    121.00               0.979
Qmax(1) =
          1.000 *    1.000 *   109.818) +
          1.000 *    0.161 *     0.393) + =     109.881
Qmax(2) =
          0.308 *    1.000 *   109.818) +
          1.000 *    1.000 *     0.393) + =      34.255

Total of 2 streams to confluence:
Flow rates before confluence point:
     109.818       0.393
Maximum flow rates at confluence using above data:
      109.881       34.255
Area of streams before confluence:
       91.087        8.179
Results of confluence:
Total flow rate =    109.881(CFS)
Time of concentration =    19.526 min.
Effective stream area after confluence =     99.266(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      110.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   451.780(Ft.)
Downstream point/station elevation =   407.700(Ft.)
Pipe length  =   689.00(Ft.) Slope =   0.0640  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   109.881(CFS)
Given pipe size =     48.00(In.)
Calculated individual pipe flow  =   109.881(CFS)
Normal flow depth in pipe =   18.11(In.)
Flow top width inside pipe =   46.53(In.)
Critical Depth =   38.03(In.)
Pipe flow velocity =     25.33(Ft/s)
Travel time through pipe =    0.45 min.
Time of concentration (TC) =    19.98 min.


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Process from Point/Station      110.000 to Point/Station      110.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
```

```
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     99.266(Ac.)
Runoff from this stream =    109.881(CFS)
Time of concentration =   19.98 min.
Rainfall intensity =     3.127(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      603.000 to Point/Station      603.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
______________________________________________________________________________
User specified 'C' value of 0.064 given for subarea
Rainfall intensity (I) =      1.184(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =  90.00 min.  Rain intensity =       1.18(In/Hr)
Total area =        2.001(Ac.)  Total runoff =     0.152(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      603.000 to Point/Station      110.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   470.600(Ft.)
Downstream point/station elevation =   407.700(Ft.)
Pipe length  =   154.00(Ft.) Slope =   0.4084  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.152(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     0.152(CFS)
Normal flow depth in pipe =    0.59(In.)
Flow top width inside pipe =    7.44(In.)
Critical Depth =    1.59(In.)
Pipe flow velocity =      7.43(Ft/s)
Travel time through pipe =    0.35 min.
Time of concentration (TC) =    90.35 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      110.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      2.001(Ac.)
Runoff from this stream =      0.152(CFS)
Time of concentration =   90.35 min.
Rainfall intensity =     1.181(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      701.000 to Point/Station      702.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =   97.000(Ft.)
Highest elevation =  474.000(Ft.)
Lowest elevation =  469.000(Ft.)
Elevation difference =    5.000(Ft.) Slope =  5.155 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   5.16 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   7.81 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(   5.155^(1/3)]=   7.81
```

```
Rainfall intensity (I) =      5.728(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.231(CFS)
Total initial stream area =        0.115(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      702.000 to Point/Station      110.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      1.662(CFS)
Depth of flow =   0.137(Ft.), Average velocity =   3.522(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2             25.00              0.00
       3             25.10              0.50
       4             30.00              0.51
Manning's 'N' friction factor =   0.020
------------------------------------------------------------------
Sub-Channel flow  =      1.662(CFS)
  '     '       flow top width =      6.883(Ft.)
  '     '    velocity=    3.522(Ft/s)
  '     '       area =      0.472(Sq.Ft)
  '     '       Froude number =     2.370

Upstream point elevation =   469.000(Ft.)
Downstream point elevation =   414.000(Ft.)
Flow length =   672.000(Ft.)
Travel time  =    3.18 min.
Time of concentration =   11.00 min.
Depth of flow =   0.137(Ft.)
Average velocity =   3.522(Ft/s)
Total irregular channel flow =     1.662(CFS)
Irregular channel normal depth above invert elev. =   0.137(Ft.)
Average velocity of channel(s) =   3.522(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      4.596(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      4.596(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      0.661
Subarea runoff =      2.810(CFS) for      1.775(Ac.)
Total runoff =      3.040(CFS)        Total area =       1.890(Ac.)
Depth of flow =   0.172(Ft.), Average velocity =   4.096(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      110.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 3
Stream flow area =      1.890(Ac.)
Runoff from this stream =      3.040(CFS)
Time of concentration =   11.00 min.
Rainfall intensity =     4.596(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      801.000 to Point/Station      802.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
```

```
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =  100.000(Ft.)
Highest elevation =  596.000(Ft.)
Lowest elevation =  576.000(Ft.)
Elevation difference =   20.000(Ft.) Slope = 20.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  20.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.97 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  20.000^(1/3)]=   4.97
Calculated TC of    4.973 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      7.641(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.949(CFS)
Total initial stream area =        0.355(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      802.000 to Point/Station      110.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =     14.207(CFS)
Depth of flow =   0.761(Ft.), Average velocity =  16.335(Ft/s)
       ******* Irregular Channel Data ***********
----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              1.00
       2              1.50              0.00
       3              3.00              1.00
Manning's 'N' friction factor =   0.016
----------------------------------------------------------------
Sub-Channel flow  =     14.207(CFS)
  '     '       flow top width =      2.284(Ft.)
  '     '    velocity=   16.335(Ft/s)
  '     '       area =      0.870(Sq.Ft)
  '     '       Froude number =     4.665

Upstream point elevation =   576.000(Ft.)
Downstream point elevation =   414.000(Ft.)
Flow length =  1131.000(Ft.)
Travel time  =    1.15 min.
Time of concentration =    6.13 min.
Depth of flow =   0.761(Ft.)
Average velocity =  16.335(Ft/s)
Total irregular channel flow =    14.207(CFS)
Irregular channel normal depth above invert elev. =   0.761(Ft.)
Average velocity of channel(s) =  16.335(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      6.702(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      6.702(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
```

```
(Q=KCIA) is C = 0.350  CA =      4.088
Subarea runoff =     26.447(CFS) for     11.325(Ac.)
Total runoff =     27.396(CFS)        Total area =      11.680(Ac.)
Depth of flow =   0.974(Ft.), Average velocity =  19.249(Ft/s)


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Process from Point/Station      110.000 to Point/Station      110.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 4
Stream flow area =     11.680(Ac.)
Runoff from this stream =     27.396(CFS)
Time of concentration =    6.13 min.
Rainfall intensity =     6.702(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1      109.881     19.98               3.127
2        0.152     90.35               1.181
3        3.040     11.00               4.596
4       27.396      6.13               6.702
Qmax(1) =
           1.000 *    1.000 *   109.881) +
           1.000 *    0.221 *     0.152) +
           0.680 *    1.000 *     3.040) +
           0.467 *    1.000 *    27.396) + =     124.766
Qmax(2) =
           0.378 *    1.000 *   109.881) +
           1.000 *    1.000 *     0.152) +
           0.257 *    1.000 *     3.040) +
           0.176 *    1.000 *    27.396) + =      47.281
Qmax(3) =
           1.000 *    0.550 *   109.881) +
           1.000 *    0.122 *     0.152) +
           1.000 *    1.000 *     3.040) +
           0.686 *    1.000 *    27.396) + =      82.319
Qmax(4) =
           1.000 *    0.307 *   109.881) +
           1.000 *    0.068 *     0.152) +
           1.000 *    0.557 *     3.040) +
           1.000 *    1.000 *    27.396) + =      62.800

Total of 4 streams to confluence:
Flow rates before confluence point:
     109.881       0.152       3.040      27.396
Maximum flow rates at confluence using above data:
      124.766       47.281       82.319       62.800
Area of streams before confluence:
       99.266        2.001        1.890       11.680
Results of confluence:
Total flow rate =    124.766(CFS)
Time of concentration =    19.979 min.
Effective stream area after confluence =    114.837(Ac.)
End of computations, total study area =         114.837 (Ac.)
```
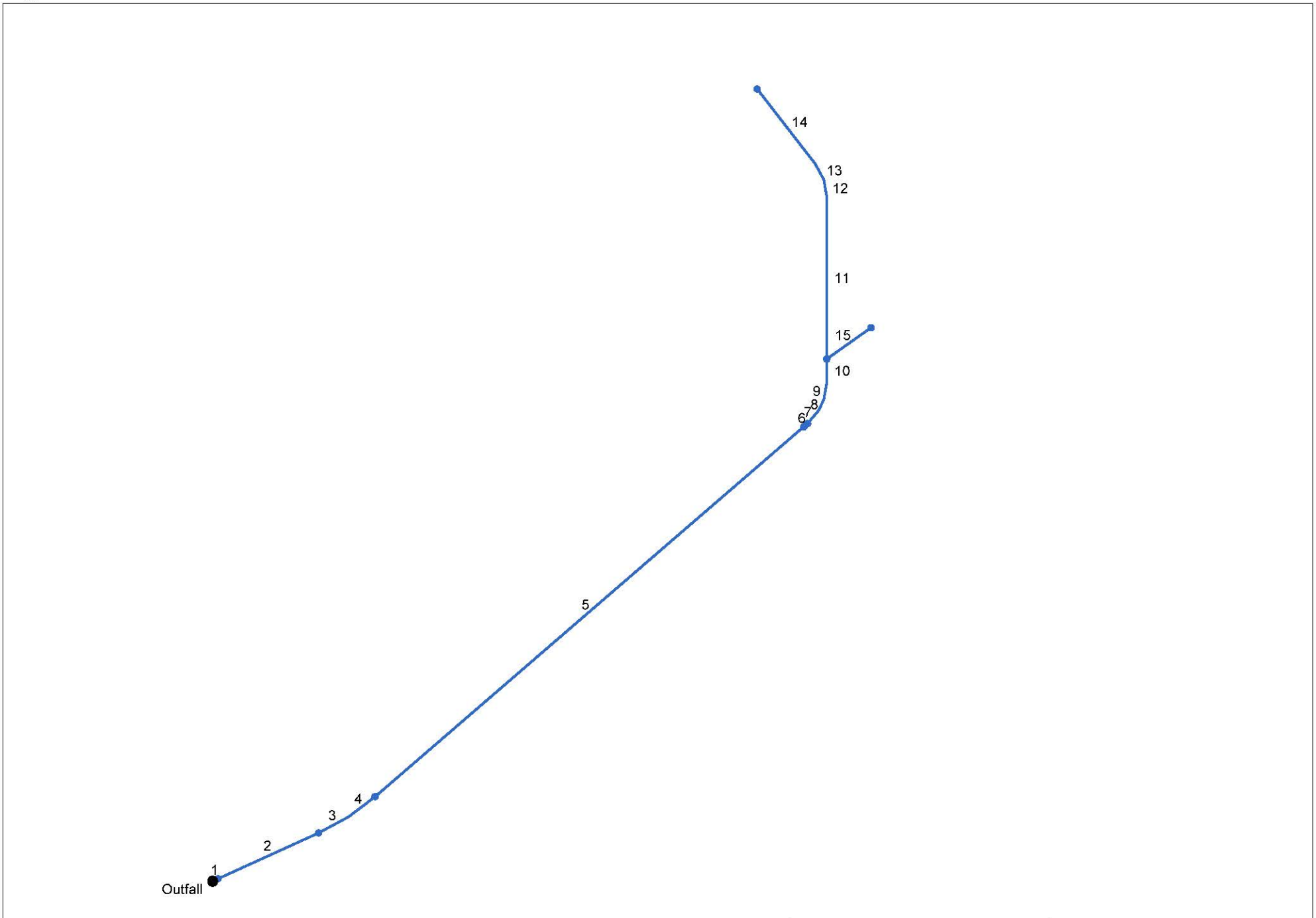

ATTACHMENT 4.1

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



Project File: 48inch_pipe.stm	Number of lines: 15	Date: 2/25/2020

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1		124.8	48	Cir	5.000	407.70	407.77	1.400	410.25	411.12	0.29	411.12	End	Manhole
2		109.9	48	Cir	92.200	407.77	425.48	19.208	411.12	428.65	n/a	428.65	1	Manhole
3		109.9	48	Cir	28.412	425.48	430.97	19.323	428.65	434.14	n/a	434.14	2	None
4		109.9	48	Cir	27.727	430.97	436.46	19.800	434.14	439.63	n/a	439.63	3	Manhole
5		109.9	48	Cir	473.402	436.54	451.40	3.139	439.63	454.57	n/a	454.57	4	Manhole
6		109.9	48	Cir	3.986	451.40	451.48	2.007	454.57	454.65	n/a	454.65	5	Manhole
7		109.9	48	Cir	14.725	451.48	451.56	0.543	454.91	454.99	0.46	455.45	6	None
8		109.9	48	Cir	9.735	451.56	451.61	0.513	455.45	455.50	0.35	455.85	7	None
9		109.9	48	Cir	14.098	451.61	451.68	0.497	455.85*	455.93*	0.25	456.18	8	None
10		109.9	48	Cir	20.000	451.68	451.78	0.500	456.18*	456.30*	1.01	457.31	9	Manhole
11		109.8	48	Cir	135.750	451.78	452.45	0.494	457.31*	458.10*	0.25	458.35	10	None
12		109.8	48	Cir	14.714	452.45	452.53	0.544	458.35*	458.44*	0.44	458.88	11	None
13		109.8	48	Cir	14.765	452.53	452.60	0.474	458.88*	458.96*	0.24	459.20	12	None
14		109.8	48	Cir	79.407	452.60	453.00	0.504	459.20*	459.67*	1.19	460.85	13	Manhole
15		0.39	24	Cir	45.366	451.78	465.90	31.125	457.31	466.11	n/a	466.11 j	10	Manhole

Project File: 48inch_pipe.stm | Number of lines: 15 | Run Date: 2/25/2020

NOTES: Return period = 100 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Hydraulic Grade Line Computations

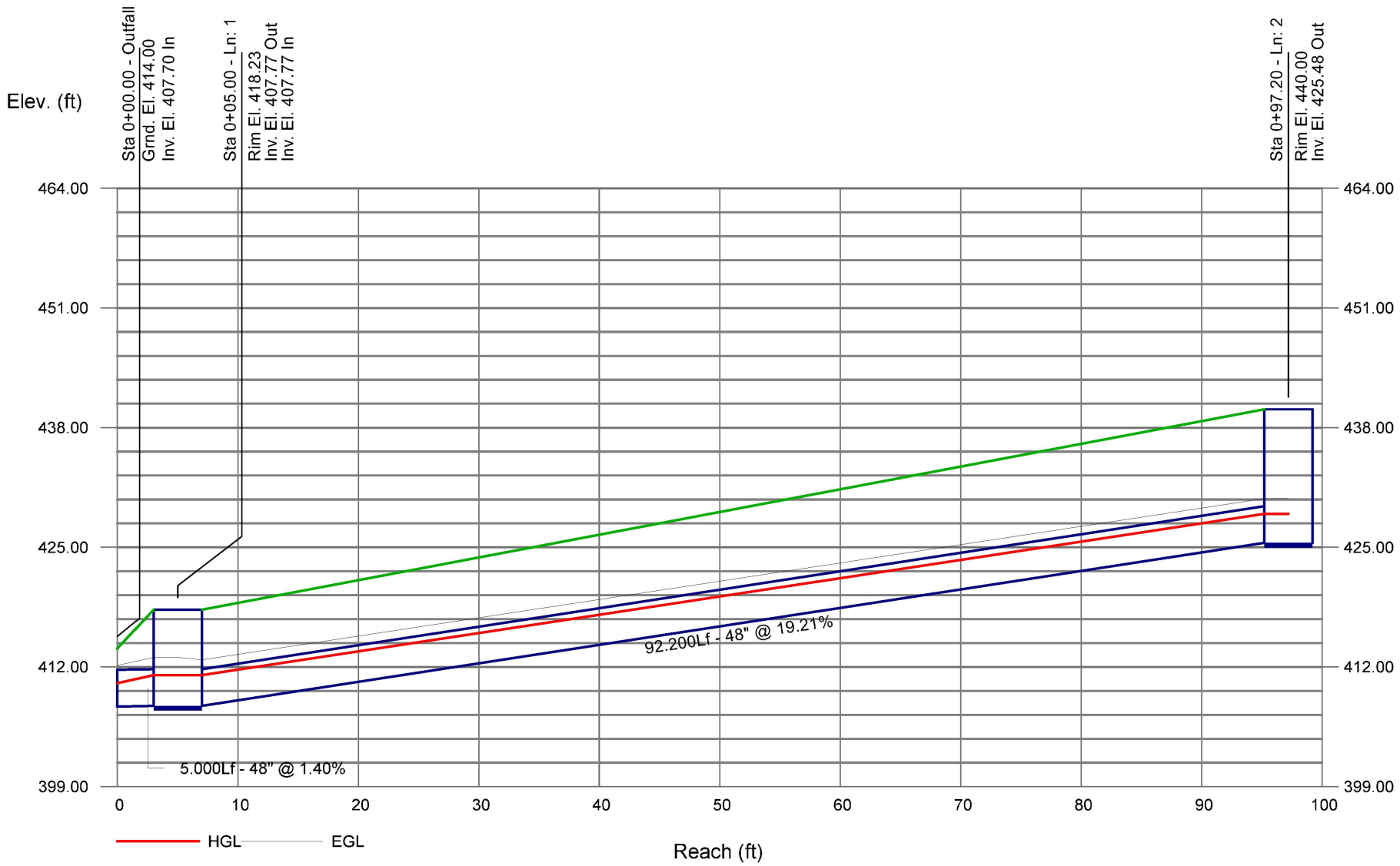
Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(%)	(ft)	(K)	(ft)
1	48	124.8	407.70	410.25	2.55	8.44	14.78	1.92	412.16	0.000	5.000	407.77	411.12	3.35**	11.24	11.10	1.92	413.04	0.000	0.000	n/a	0.15	0.29
2	48	109.9	407.77	411.12	3.35	10.67	9.77	1.65	412.77	0.000	92.200	425.48	428.65	3.17**	10.67	10.30	1.65	430.30	0.000	0.000	n/a	0.15	n/a
3	48	109.9	425.48	428.65	3.17*	10.67	10.30	1.65	430.30	0.000	28.412	430.97	434.14	3.17**	10.67	10.30	1.65	435.79	0.000	0.000	n/a	0.19	n/a
4	48	109.9	430.97	434.14	3.17*	10.67	10.30	1.65	435.79	0.000	27.727	436.46	439.63	3.17**	10.67	10.30	1.65	441.28	0.000	0.000	n/a	0.15	n/a
5	48	109.9	436.54	439.63	3.09	10.40	10.56	1.65	441.28	0.000	473.402	451.40	454.57	3.17**	10.67	10.30	1.65	456.22	0.000	0.000	n/a	0.15	n/a
6	48	109.9	451.40	454.57	3.17*	10.67	10.30	1.65	456.22	0.000	3.986	451.48	454.65	3.17**	10.67	10.30	1.65	456.30	0.000	0.000	n/a	0.18	n/a
7	48	109.9	451.48	454.91	3.43*	11.48	9.57	1.42	456.34	0.543	14.725	451.56	454.99	3.43	11.47	9.58	1.43	456.42	0.544	0.543	0.080	0.32	0.46
8	48	109.9	451.56	455.45	3.89	12.47	8.81	1.21	456.66	0.517	9.735	451.61	455.50	3.89	12.47	8.81	1.21	456.70	0.516	0.516	0.050	0.29	0.35
9	48	109.9	451.61	455.85	4.00	12.56	8.75	1.19	457.04	0.585	14.098	451.68	455.93	4.00	12.57	8.74	1.19	457.12	0.585	0.585	0.083	0.21	0.25
10	48	109.9	451.68	456.18	4.00	12.56	8.75	1.19	457.37	0.585	20.000	451.78	456.30	4.00	12.57	8.74	1.19	457.49	0.585	0.585	0.117	0.85	1.01
11	48	109.8	451.78	457.31	4.00	12.56	8.74	1.19	458.50	0.585	135.750	452.45	458.10	4.00	12.57	8.74	1.19	459.29	0.585	0.585	0.794	0.21	0.25
12	48	109.8	452.45	458.35	4.00	12.56	8.74	1.19	459.54	0.585	14.714	452.53	458.44	4.00	12.57	8.74	1.19	459.62	0.585	0.585	0.086	0.37	0.44
13	48	109.8	452.53	458.88	4.00	12.56	8.74	1.19	460.06	0.585	14.765	452.60	458.96	4.00	12.57	8.74	1.19	460.15	0.585	0.585	0.086	0.20	0.24
14	48	109.8	452.60	459.20	4.00	12.56	8.74	1.19	460.39	0.585	79.407	453.00	459.67	4.00	12.57	8.74	1.19	460.85	0.585	0.585	0.464	1.00	1.19
15	24	0.39	451.78	457.31	2.00	0.18	0.12	0.00	457.31	0.000	45.366	465.90	466.11 j	0.21**	0.18	2.17	0.07	466.19	0.520	0.260	n/a	1.00	n/a

Project File: 48inch_pipe.stm | Number of lines: 15 | Run Date: 2/25/2020

Notes: * Normal depth assumed.; ** Critical depth.; j-Line contains hyd. jump. ; c = cir e = ellip b = box

Storm Sewer Profile

Proj. file: 48inch_pipe.stm



Storm Sewer Profile

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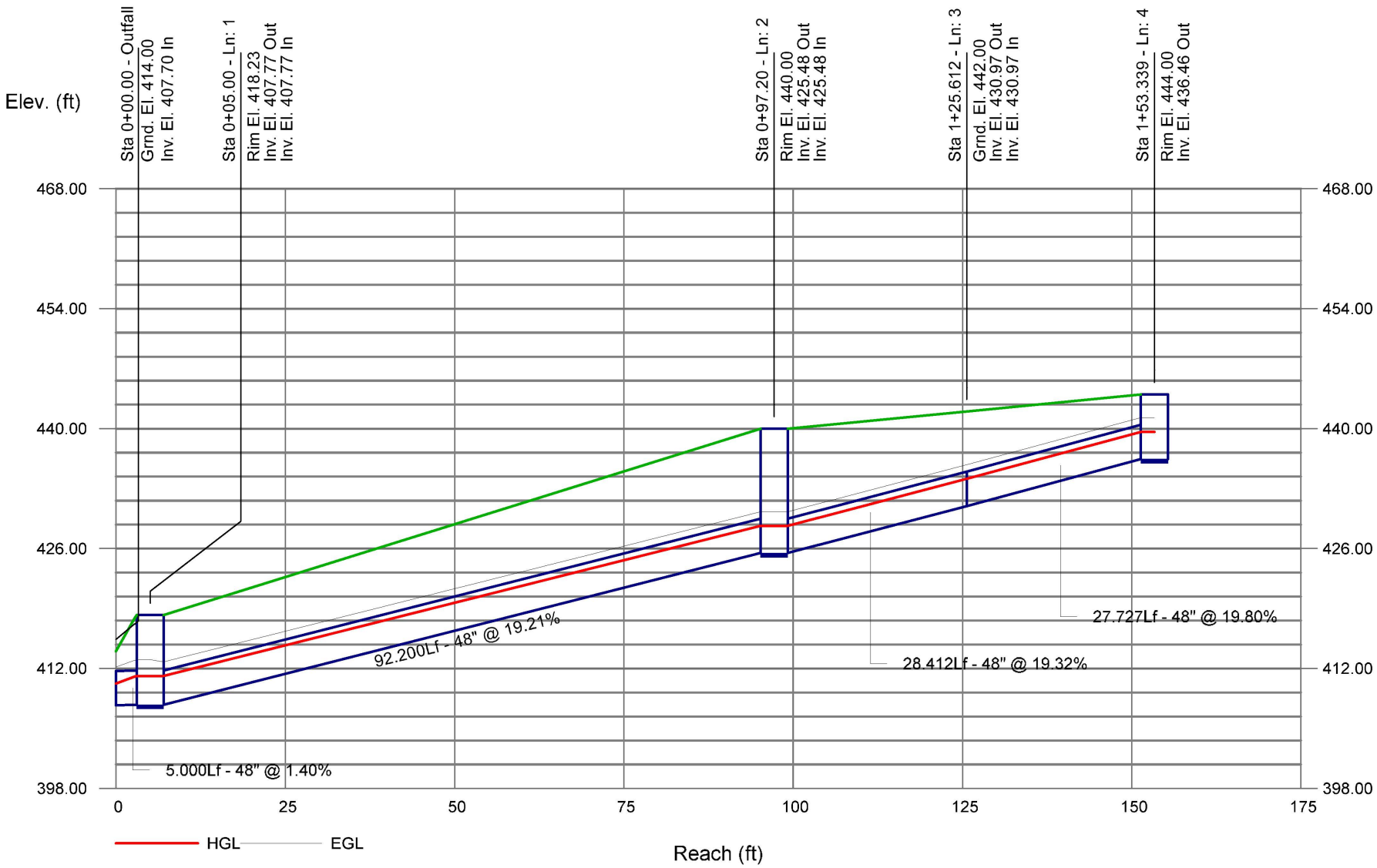
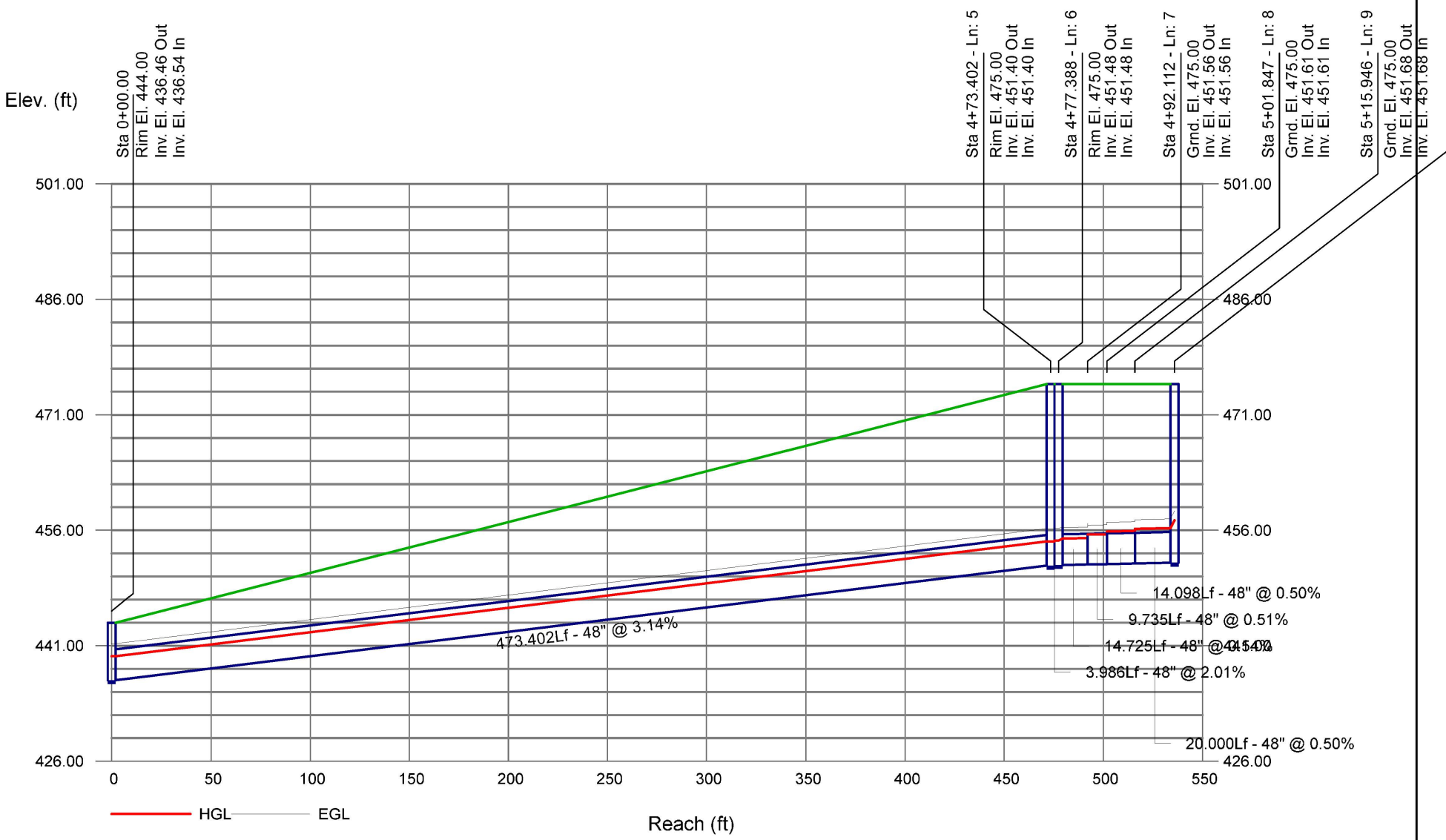


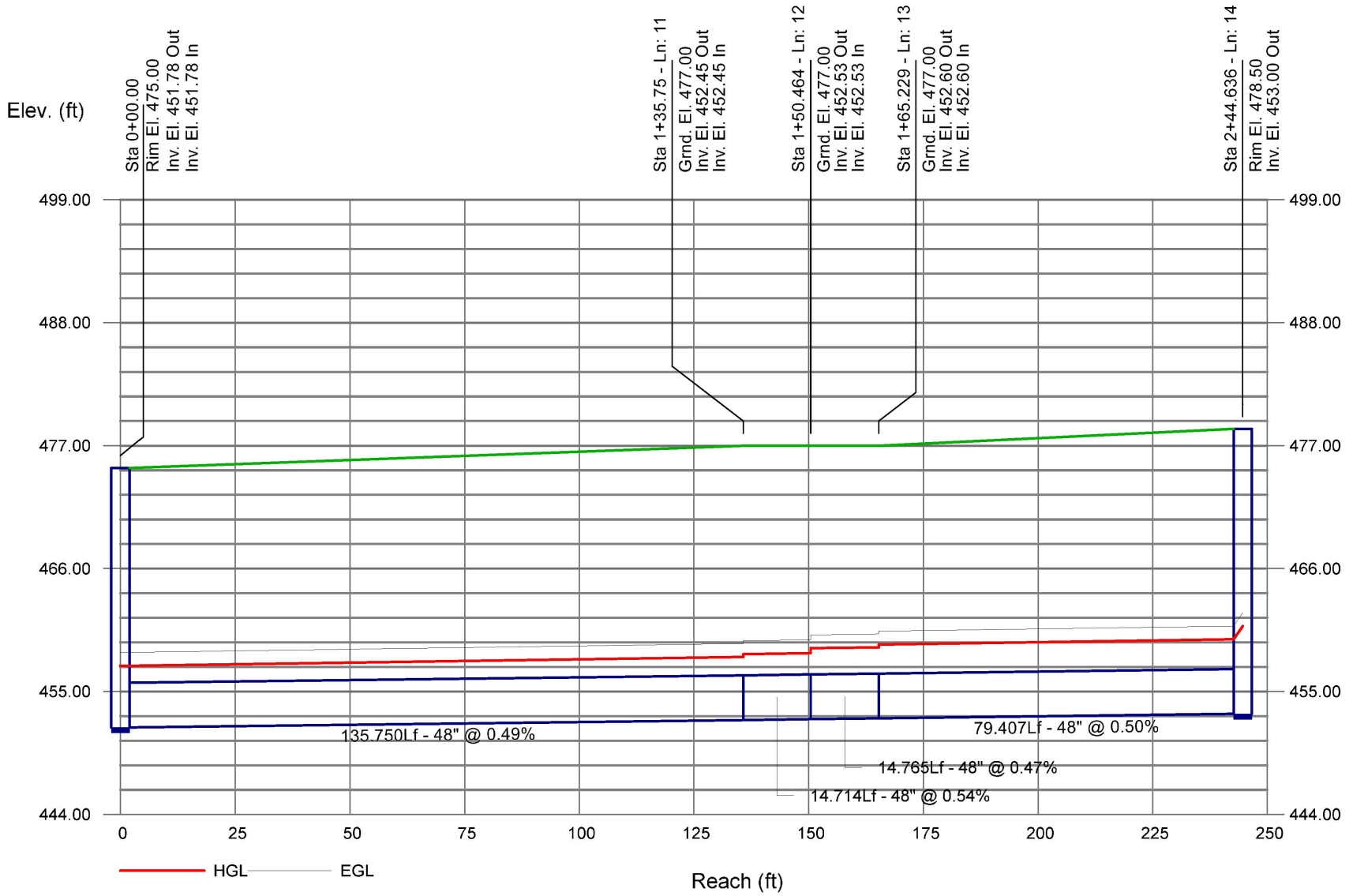
Storm Sewer Profile

Proj. file: 48inch_pipe.stm



Storm Sewer Profile

Proj. file: 48inch_pipe.stm



ATTACHMENT 4.2

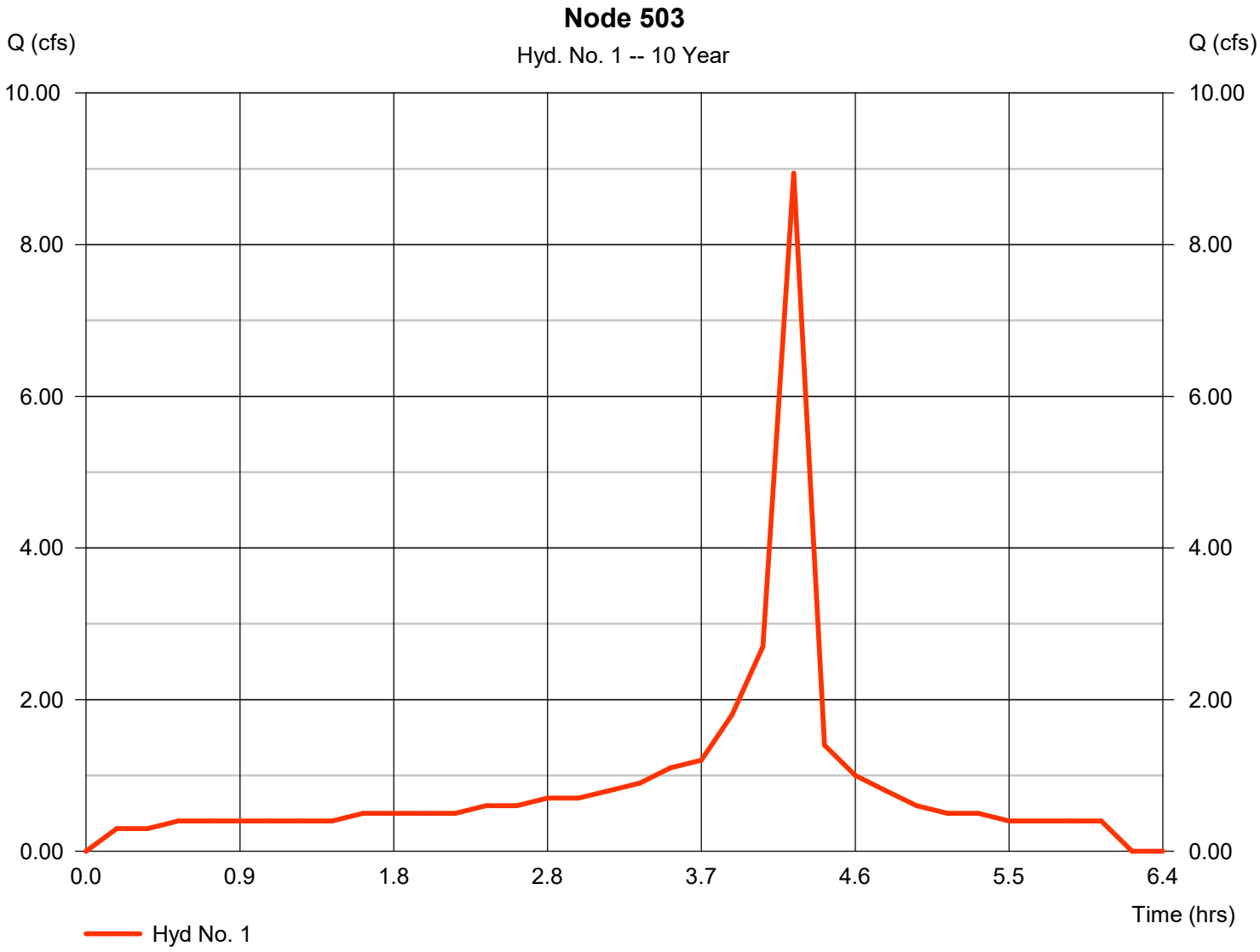
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 02 / 26 / 2020

Hyd. No. 1

Node 503

Hydrograph type	= Manual	Peak discharge	= 8.940 cfs
Storm frequency	= 10 yrs	Time to peak	= 4.22 hrs
Time interval	= 11 min	Hyd. volume	= 20,750 cuft



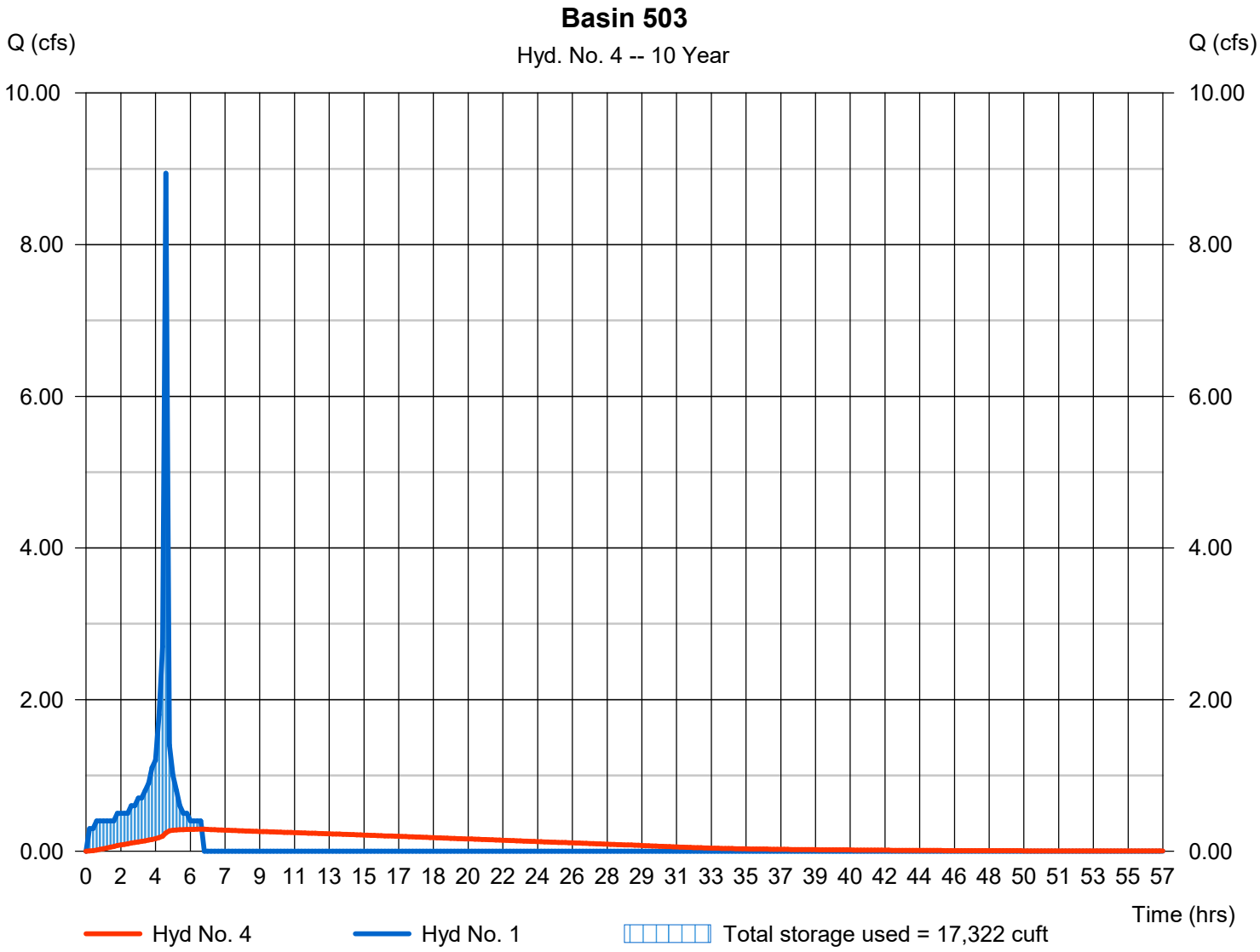
Hydrograph Report

Hyd. No. 4

Basin 503

Hydrograph type	=	Reservoir	Peak discharge	=	0.291 cfs
Storm frequency	=	10 yrs	Time to peak	=	6.05 hrs
Time interval	=	11 min	Hyd. volume	=	20,719 cuft
Inflow hyd. No.	=	1 - Node 503	Max. Elevation	=	471.70 ft
Reservoir name	=	De-silt basin 503	Max. Storage	=	17,322 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - De-silt basin 503

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 470.08 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	470.08	9,670	0	0
1.00	471.08	10,845	10,257	10,257
2.00	472.08	12,076	11,461	21,718
3.00	473.08	13,365	12,721	34,438
4.00	474.08	14,709	14,037	48,475

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	2.00	0.00	1.00
Span (in)	= 24.00	2.00	0.00	1.00
No. Barrels	= 1	2	0	6
Invert El. (ft)	= 465.75	470.08	0.00	471.50
Length (ft)	= 45.00	0.00	0.00	2.00
Slope (%)	= 2.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.66	0.60	0.66
Multi-Stage	= n/a	Yes	No	Yes

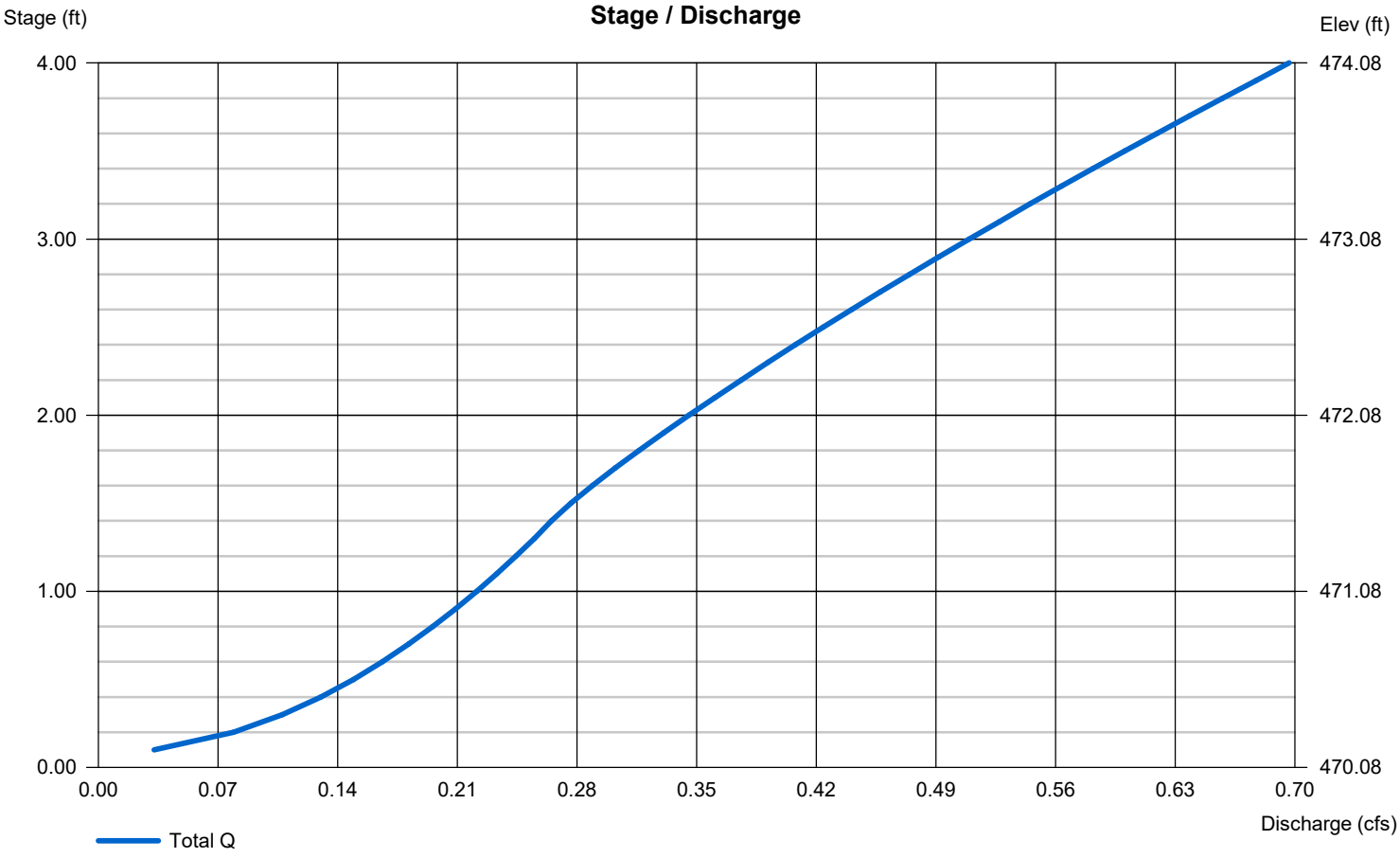
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	Inactive	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No

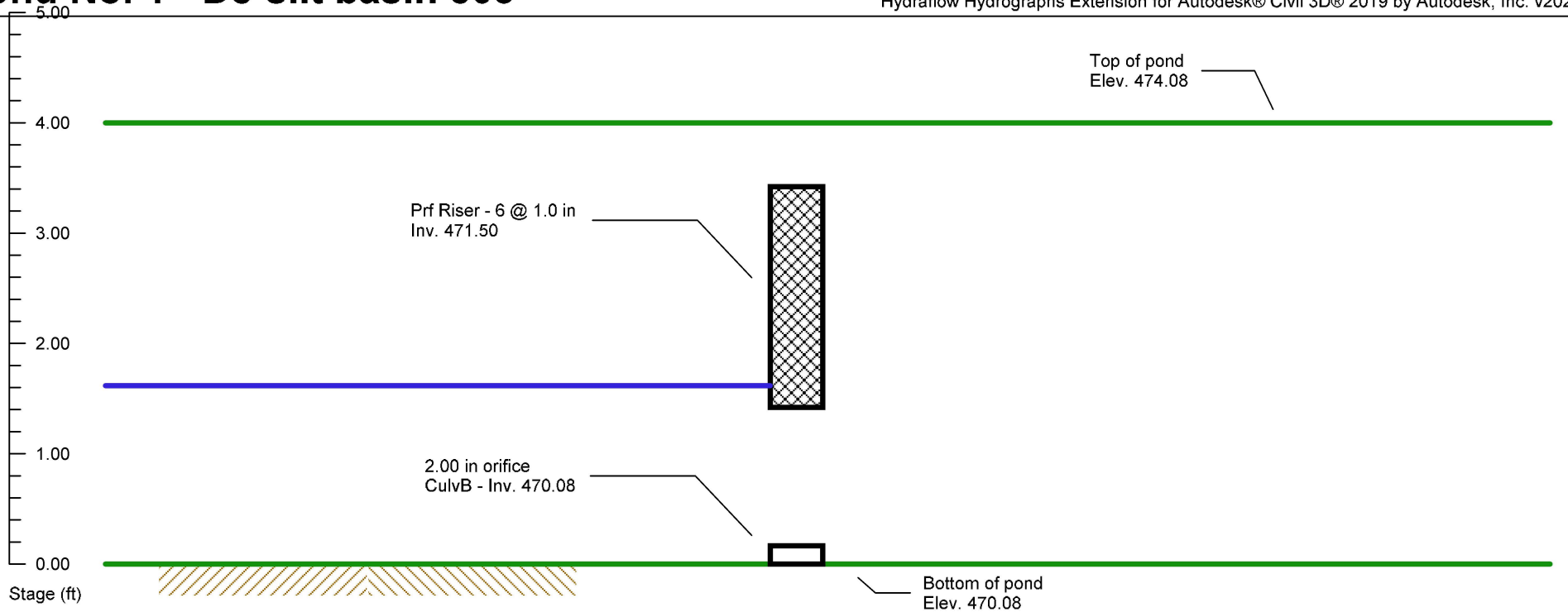
Exfil.(in/hr) = 0.000 (by Contour)

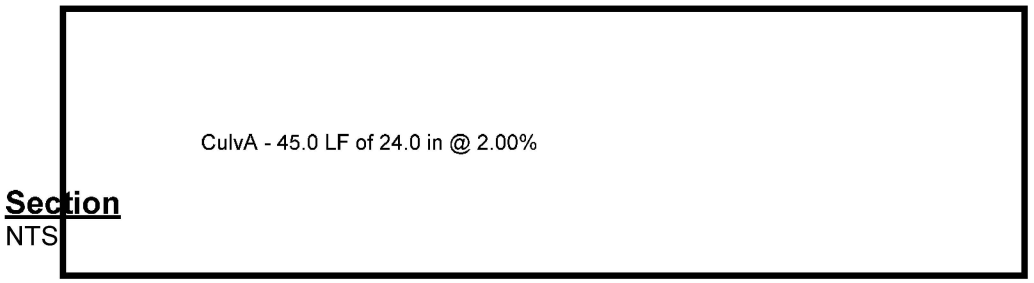
TW Elev. (ft) = 0.00

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



Pond No. 1 - De-silt basin 503





Section
NTS

10-yr

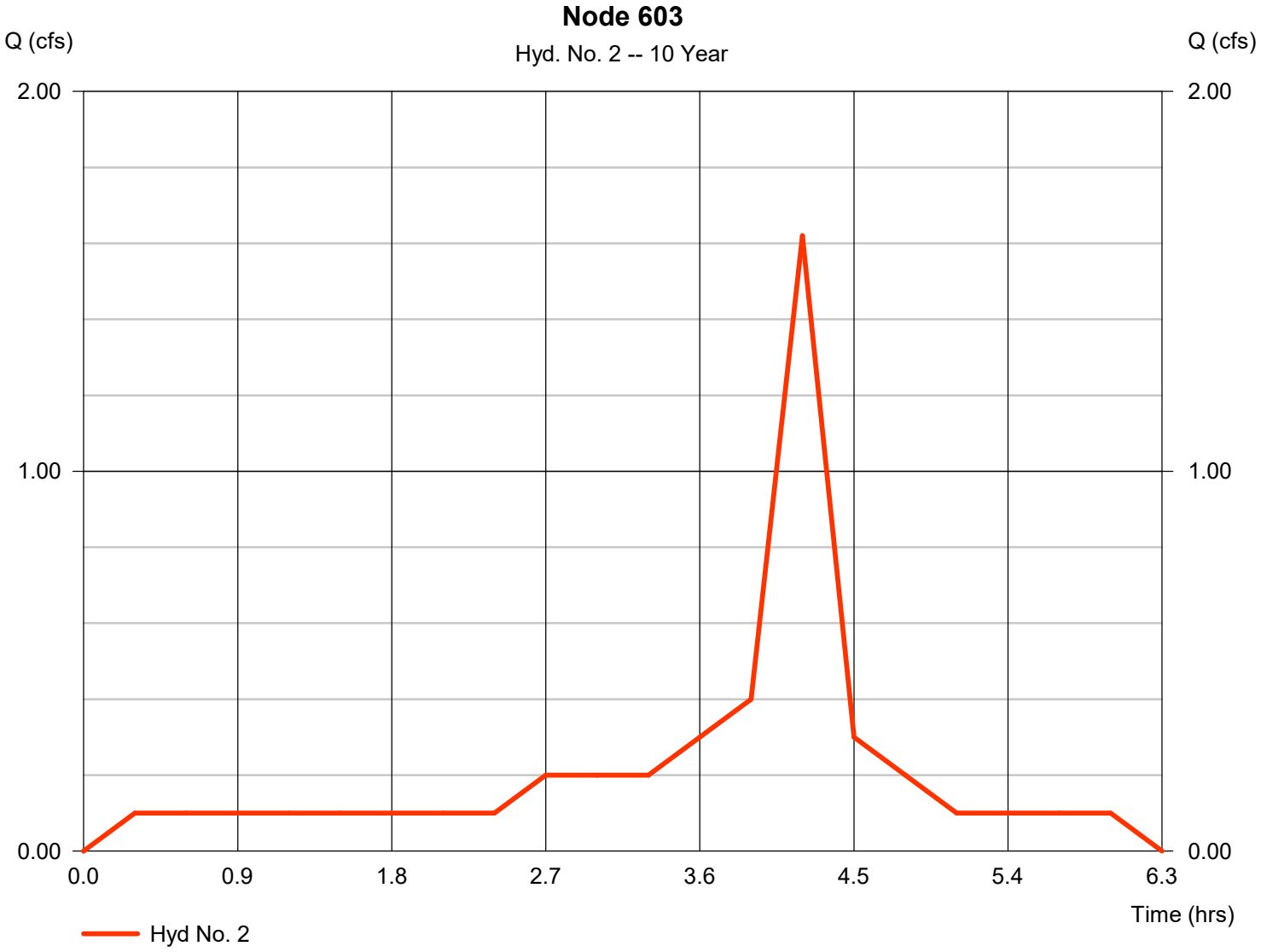
Inflow hydrograph = 1. Manual - Node 503

Hydrograph Report

Hyd. No. 2

Node 603

Hydrograph type	= Manual	Peak discharge	= 1.620 cfs
Storm frequency	= 10 yrs	Time to peak	= 4.20 hrs
Time interval	= 18 min	Hyd. volume	= 4,990 cuft



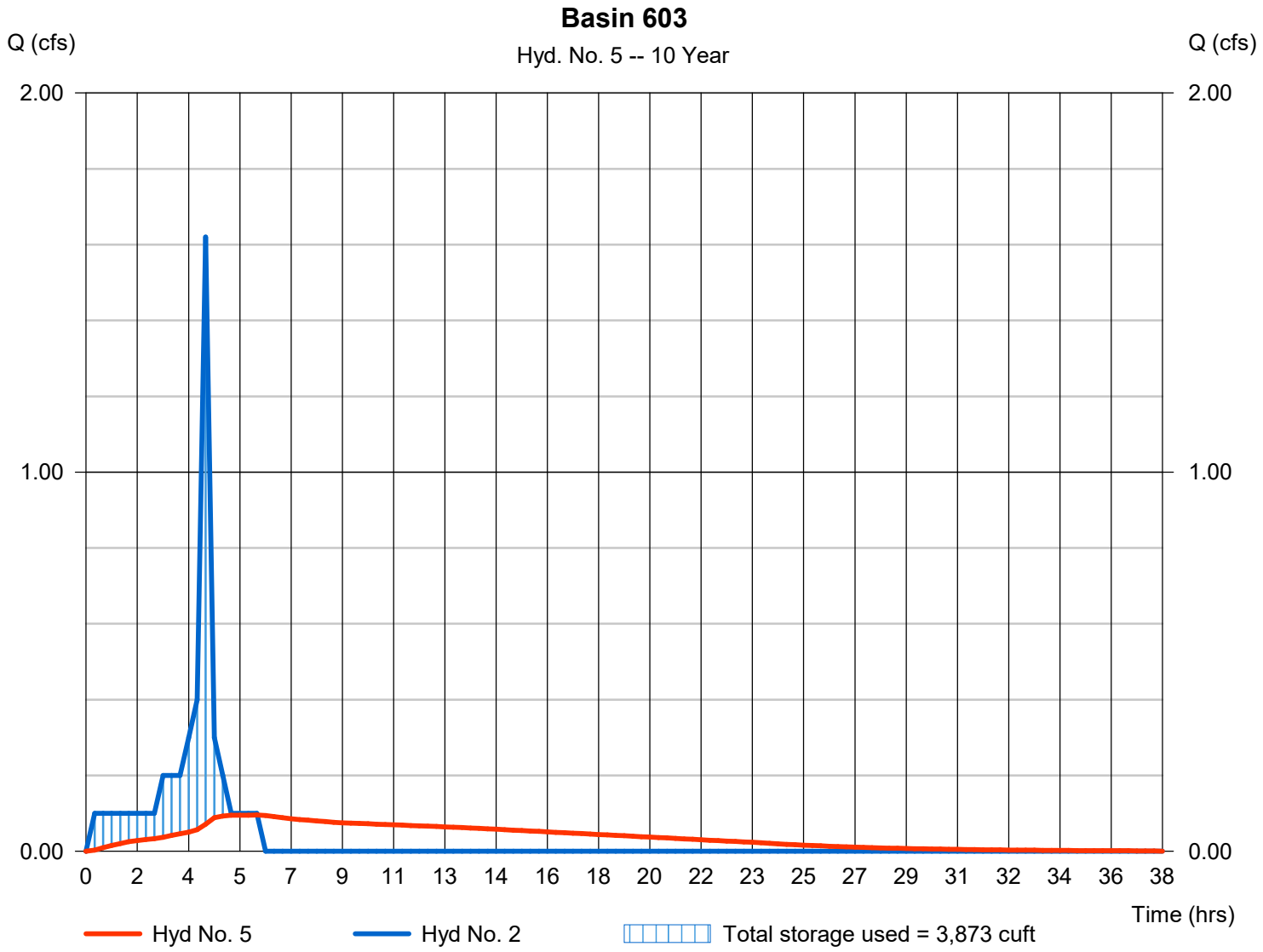
Hydrograph Report

Hyd. No. 5

Basin 603

Hydrograph type	=	Reservoir	Peak discharge	=	0.095 cfs
Storm frequency	=	10 yrs	Time to peak	=	6.00 hrs
Time interval	=	18 min	Hyd. volume	=	4,974 cuft
Inflow hyd. No.	=	2 - Node 603	Max. Elevation	=	474.34 ft
Reservoir name	=	Basin 603	Max. Storage	=	3,873 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - Basin 603

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 472.60 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	472.60	1,727	0	0
1.00	473.60	2,265	1,990	1,990
2.00	474.60	2,860	2,556	4,546
3.00	475.60	3,512	3,180	7,726
4.00	476.60	4,220	3,860	11,587

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	1.50	0.00	1.00
Span (in)	= 12.00	1.50	0.00	1.00
No. Barrels	= 1	1	0	6
Invert El. (ft)	= 470.60	472.60	0.00	474.00
Length (ft)	= 154.00	0.00	0.00	2.00
Slope (%)	= 10.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.66	0.60	0.66
Multi-Stage	= n/a	Yes	No	Yes

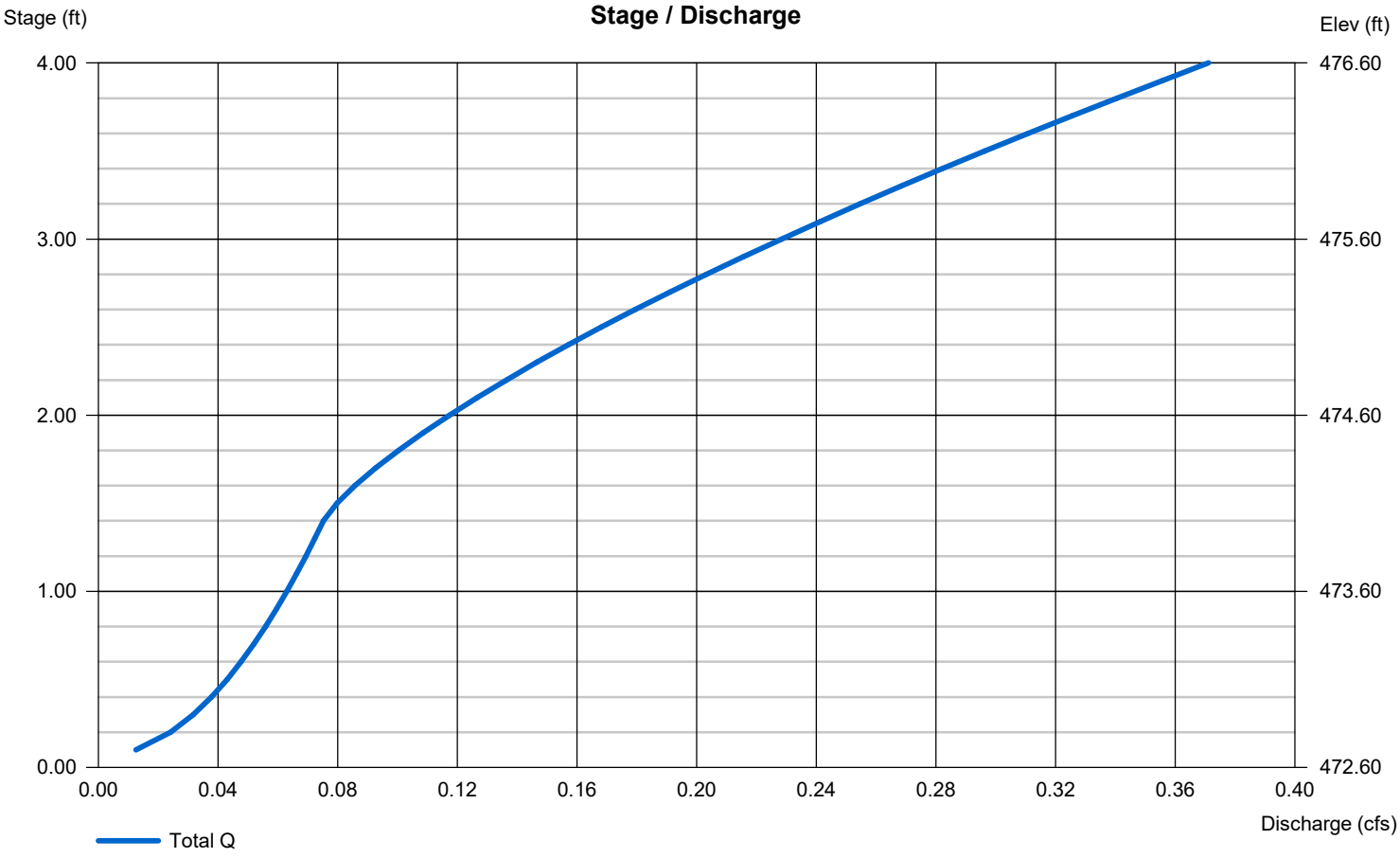
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

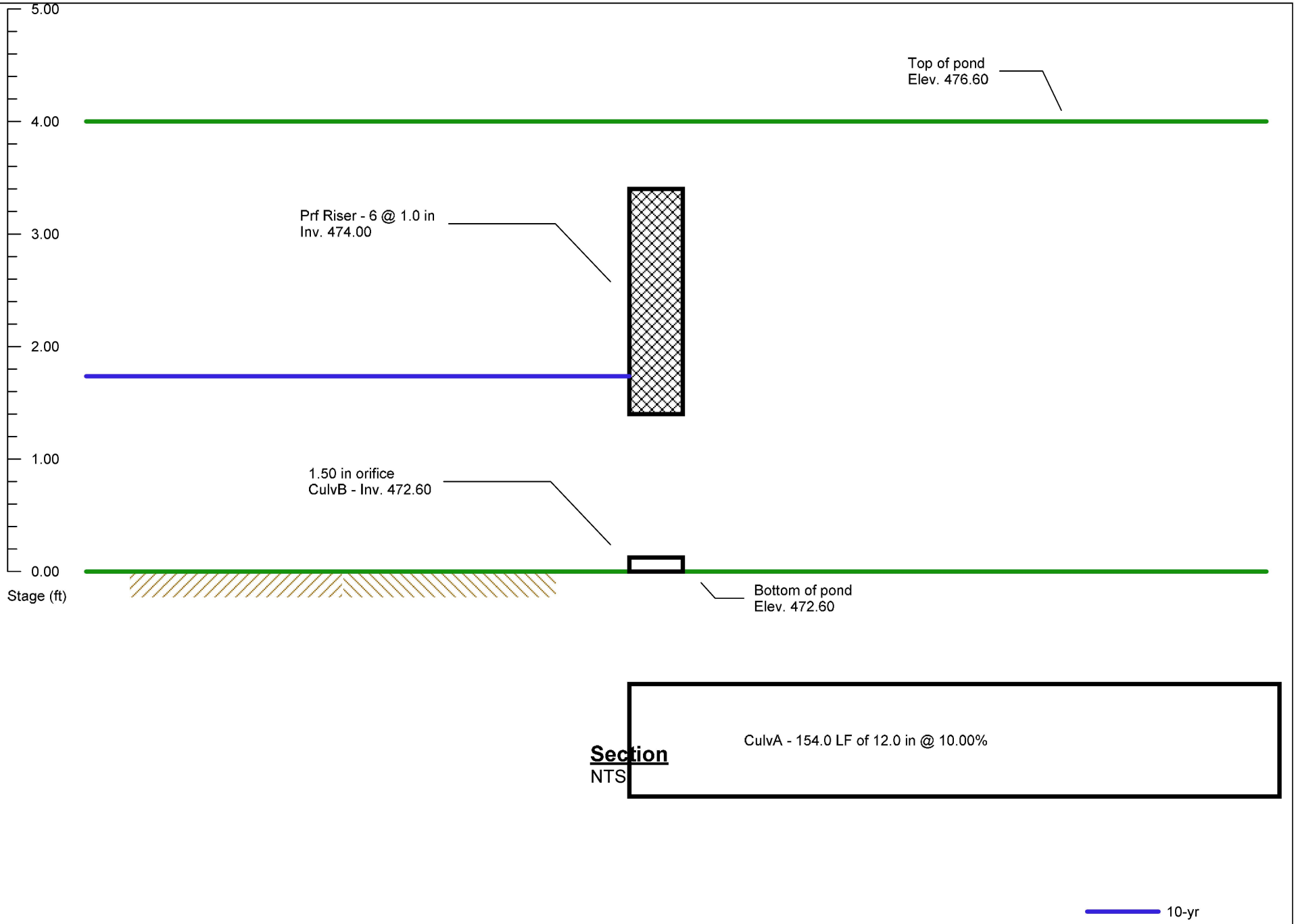
Exfil.(in/hr) = 0.000 (by Contour)

TW Elev. (ft) = 0.00

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



Pond No. 2 - Basin 603



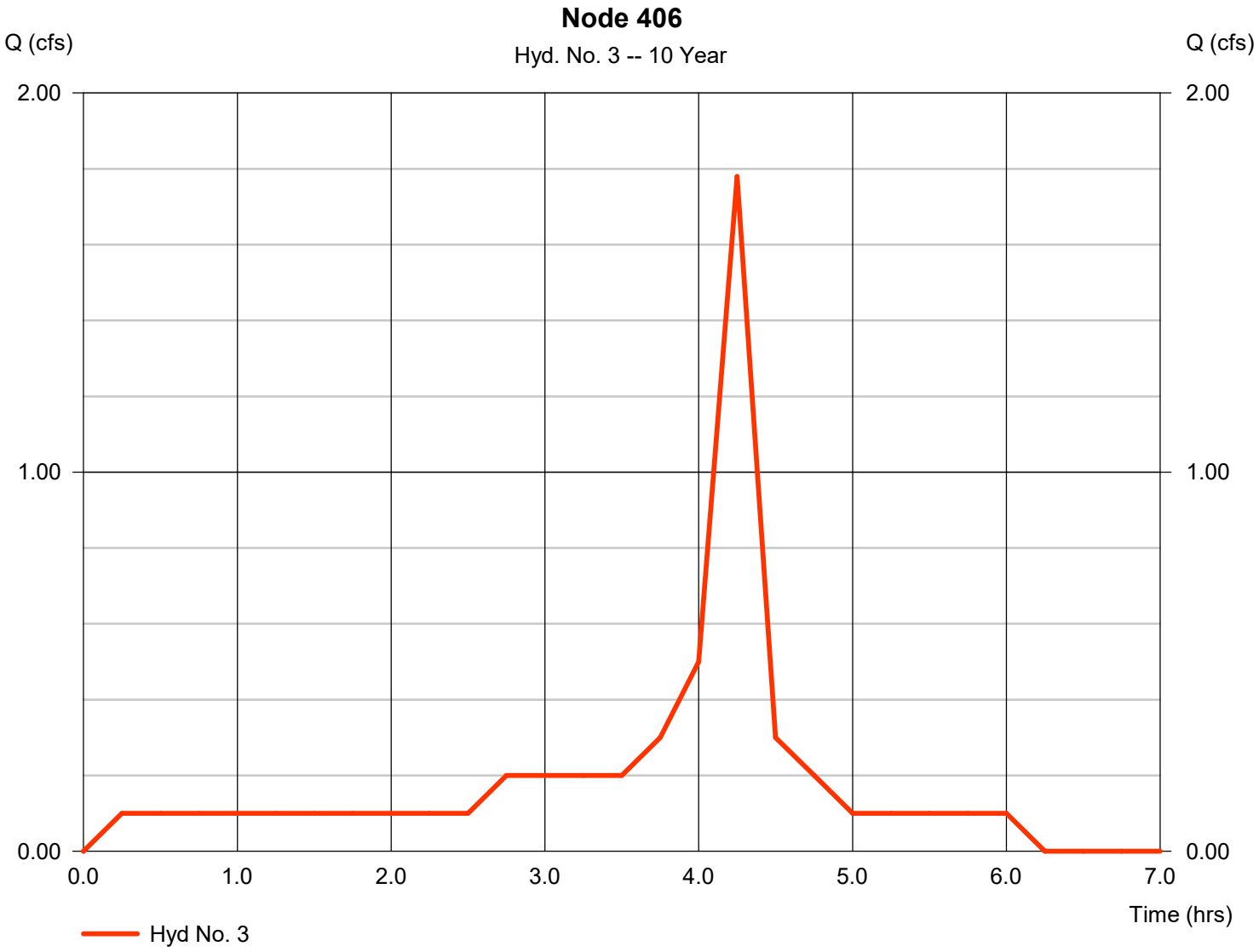
Inflow hydrograph = 2. Manual - Node 603

Hydrograph Report

Hyd. No. 3

Node 406

Hydrograph type	= Manual	Peak discharge	= 1.780 cfs
Storm frequency	= 10 yrs	Time to peak	= 4.25 hrs
Time interval	= 15 min	Hyd. volume	= 4,842 cuft



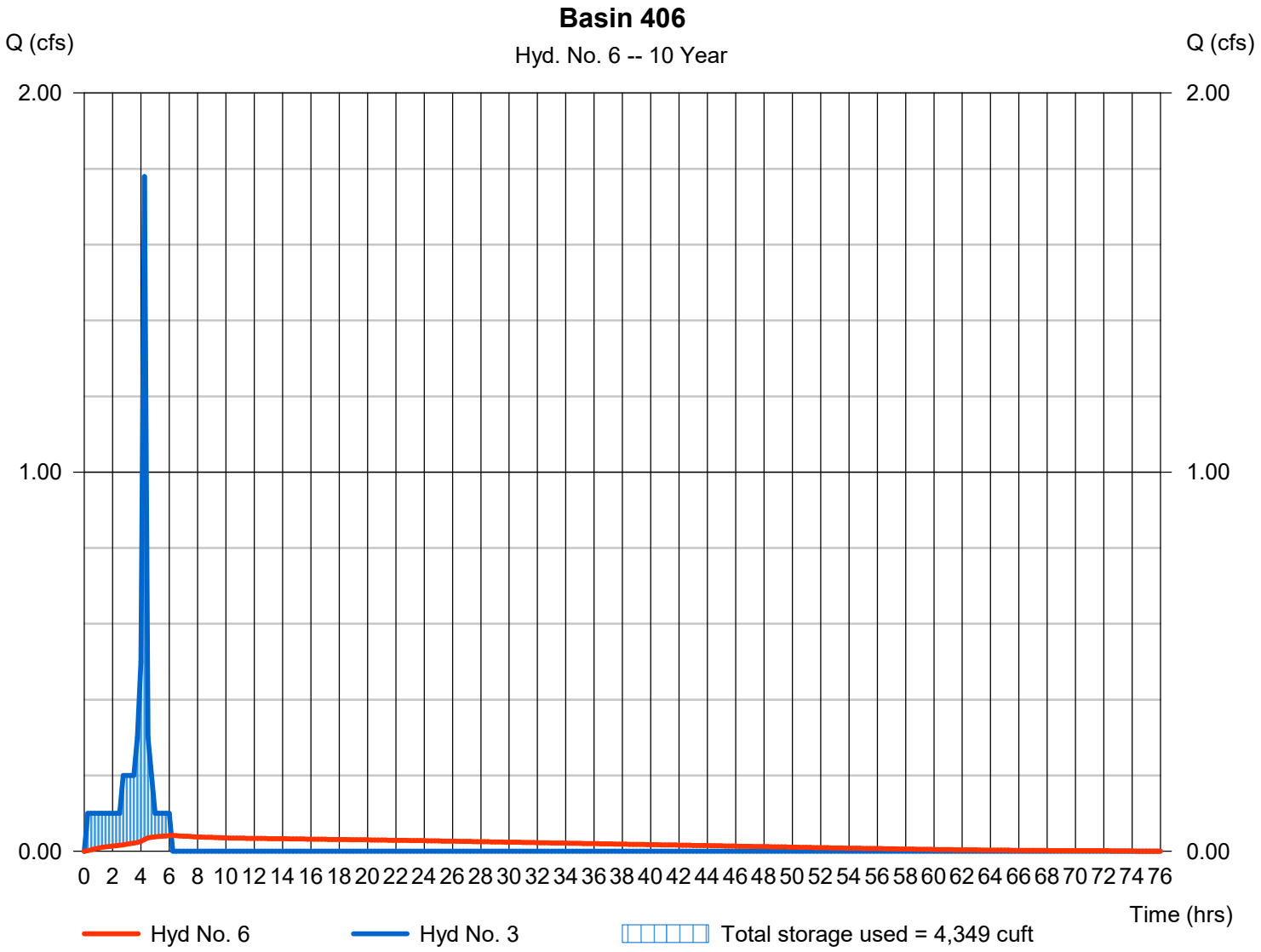
Hydrograph Report

Hyd. No. 6

Basin 406

Hydrograph type	=	Reservoir	Peak discharge	=	0.041 cfs
Storm frequency	=	10 yrs	Time to peak	=	6.25 hrs
Time interval	=	15 min	Hyd. volume	=	4,809 cuft
Inflow hyd. No.	=	3 - Node 406	Max. Elevation	=	480.85 ft
Reservoir name	=	Basin 406	Max. Storage	=	4,349 cuft

Storage Indication method used.



Pond Report

Pond No. 3 - Basin 406

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 479.16 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	479.16	1,986	0	0
1.00	480.16	2,648	2,309	2,309
2.00	481.16	3,366	3,000	5,308
3.00	482.16	4,140	3,746	9,054
4.00	483.16	4,971	4,549	13,603

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	1.00	0.00	1.00
Span (in)	= 12.00	1.00	0.00	1.00
No. Barrels	= 1	1	0	6
Invert El. (ft)	= 474.00	479.16	0.00	480.66
Length (ft)	= 66.00	0.00	0.00	2.00
Slope (%)	= 50.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.66	0.60	0.66
Multi-Stage	= n/a	Yes	No	Yes

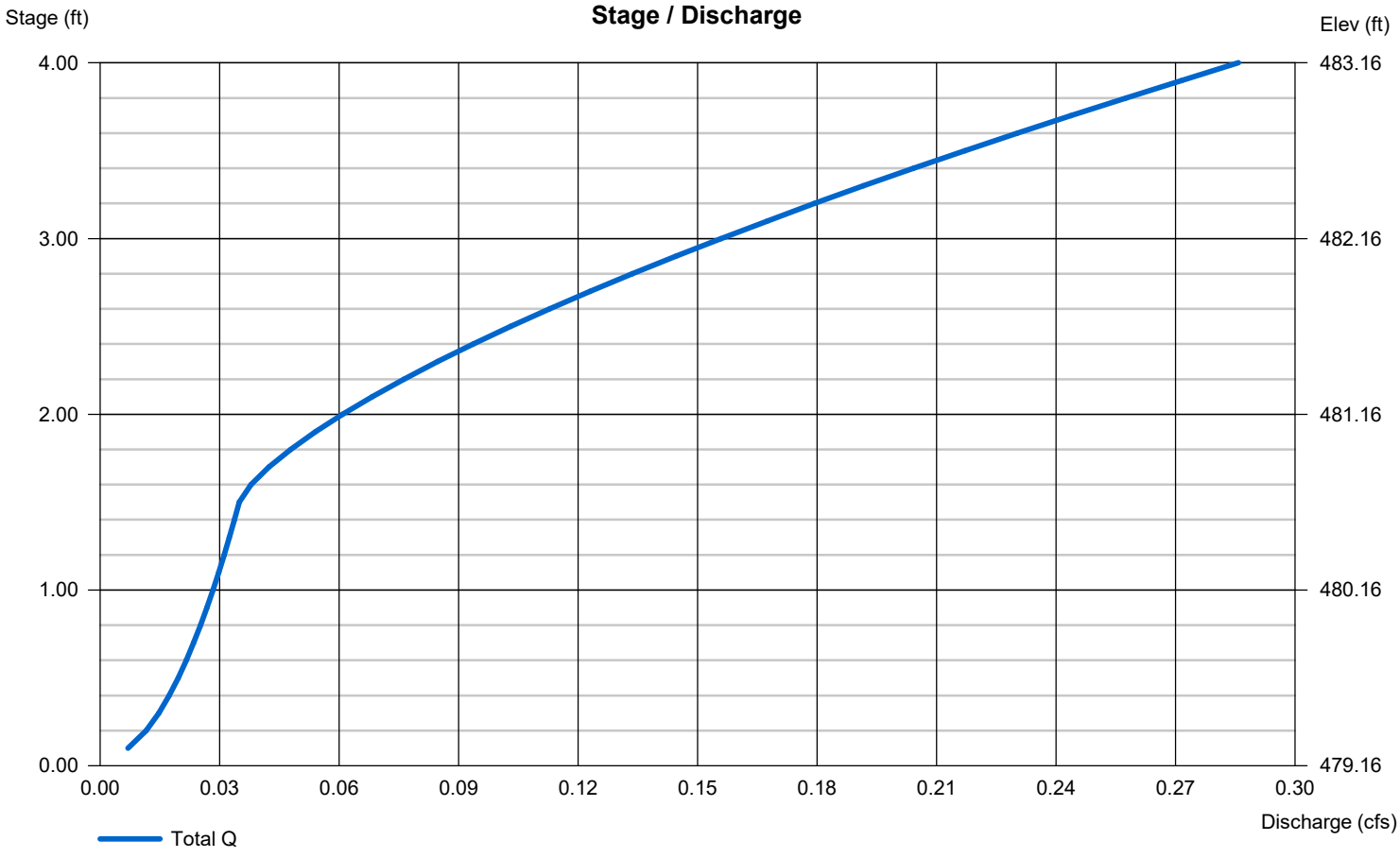
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

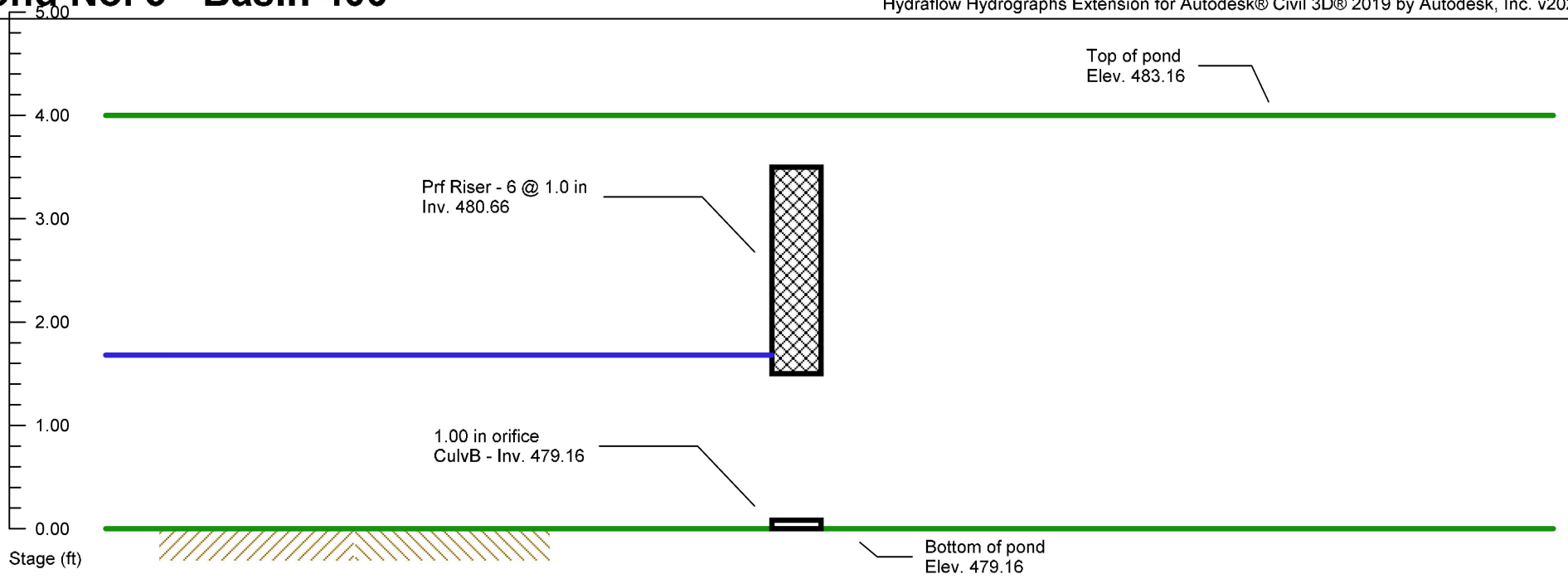
Exfil.(in/hr) = 0.000 (by Contour)

TW Elev. (ft) = 0.00

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



Pond No. 3 - Basin 406



Section
NTS

CulvA - 66.0 LF of 12.0 in @ 50.00%

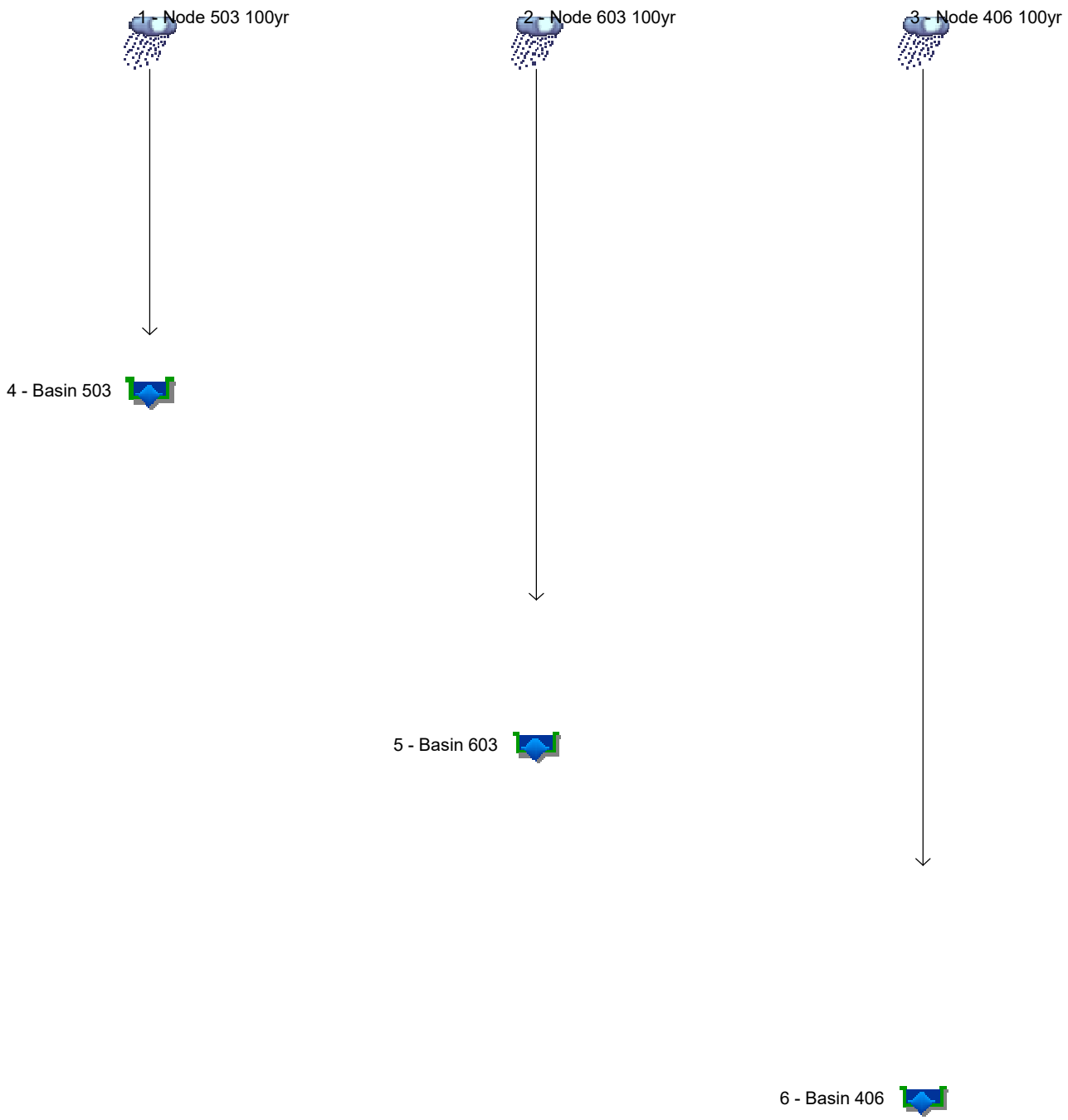
10-yr

Inflow hydrograph = 3. Manual - Node 406

ATTACHMENT 4.3

Watershed Model Schematic

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

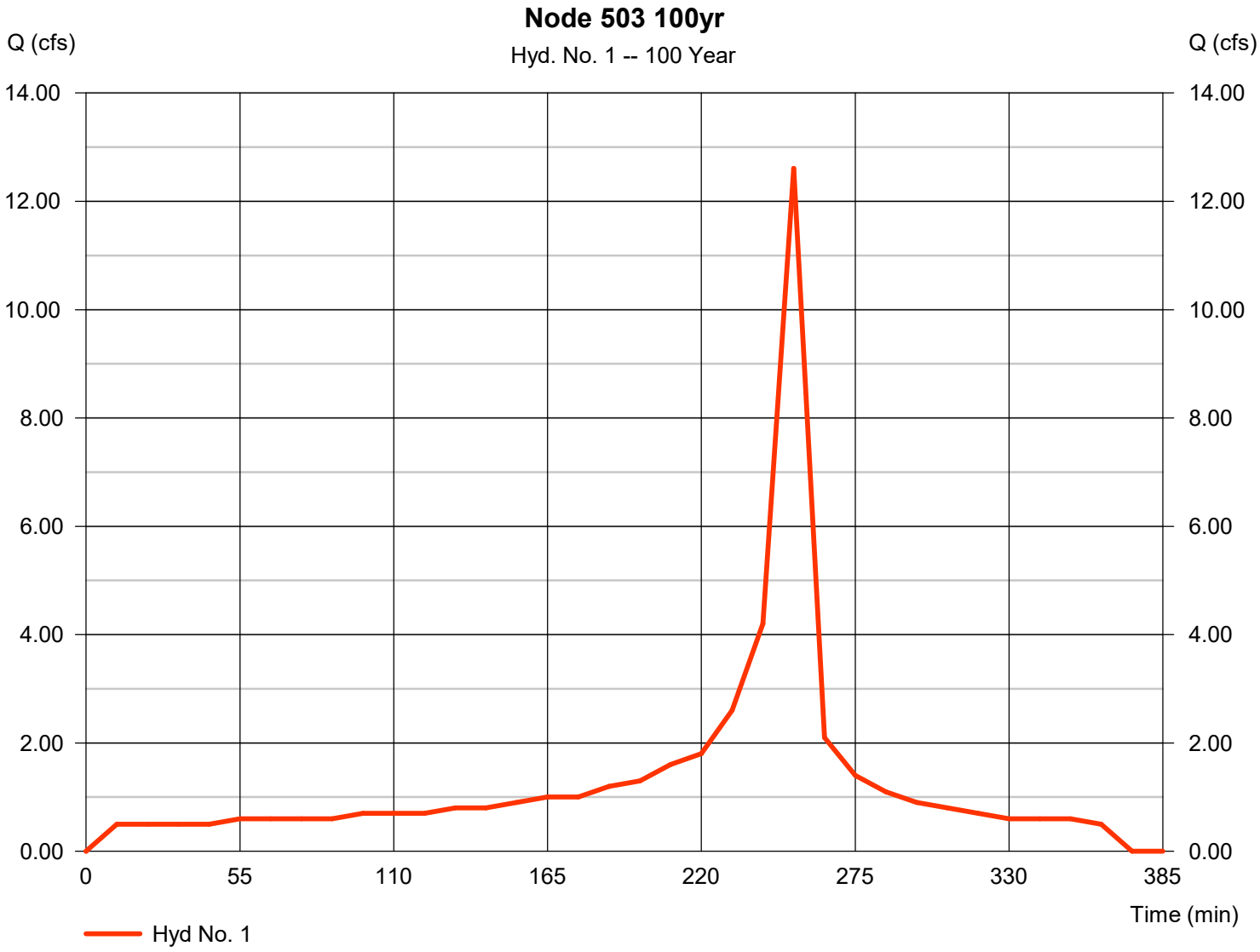


Hydrograph Report

Hyd. No. 1

Node 503 100yr

Hydrograph type	= Manual	Peak discharge	= 12.61 cfs
Storm frequency	= 100 yrs	Time to peak	= 253 min
Time interval	= 11 min	Hyd. volume	= 30,103 cuft



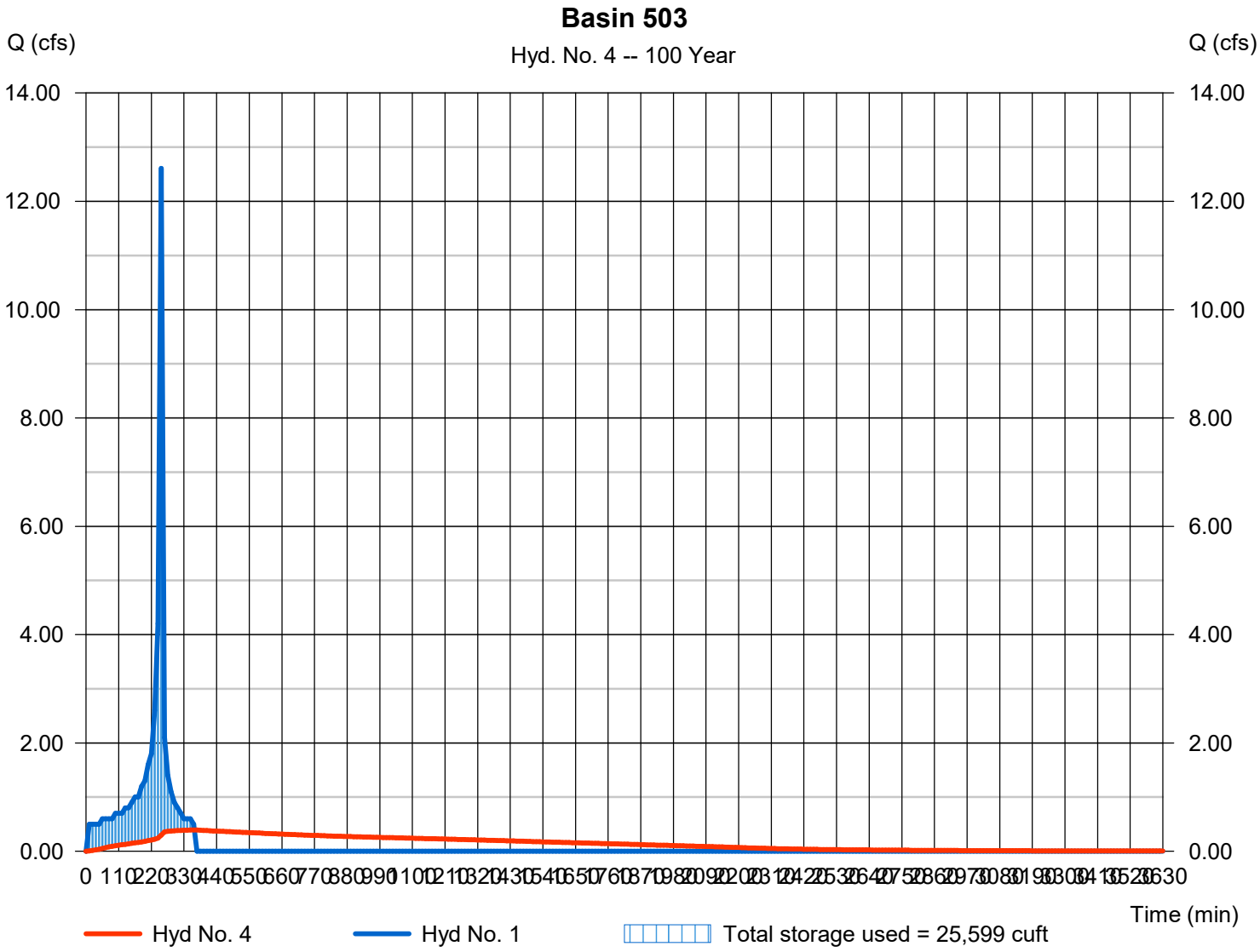
Hydrograph Report

Hyd. No. 4

Basin 503

Hydrograph type	=	Reservoir	Peak discharge	=	0.393 cfs
Storm frequency	=	100 yrs	Time to peak	=	363 min
Time interval	=	11 min	Hyd. volume	=	30,071 cuft
Inflow hyd. No.	=	1 - Node 503 100yr	Max. Elevation	=	472.39 ft
Reservoir name	=	De-silt basin 503	Max. Storage	=	25,599 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - De-silt basin 503

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 470.08 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	470.08	9,670	0	0
1.00	471.08	10,845	10,257	10,257
2.00	472.08	12,076	11,461	21,718
3.00	473.08	13,365	12,721	34,438
4.00	474.08	14,709	14,037	48,475

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	2.00	0.00	1.00
Span (in)	= 24.00	2.00	0.00	1.00
No. Barrels	= 1	2	0	6
Invert El. (ft)	= 465.75	470.08	0.00	471.50
Length (ft)	= 45.00	0.00	0.00	2.00
Slope (%)	= 2.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.66	0.60	0.66
Multi-Stage	= n/a	Yes	No	Yes

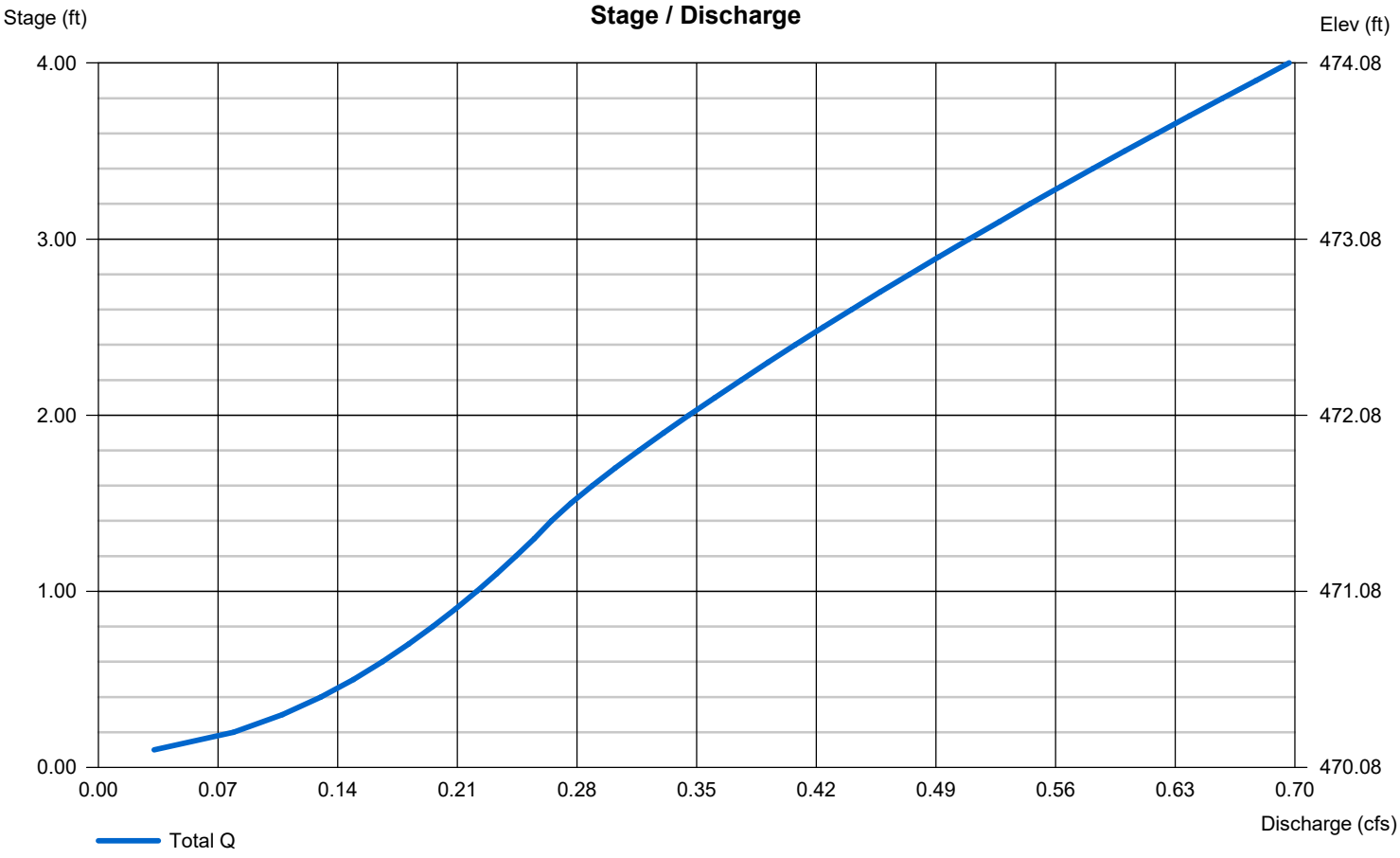
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	Inactive	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No

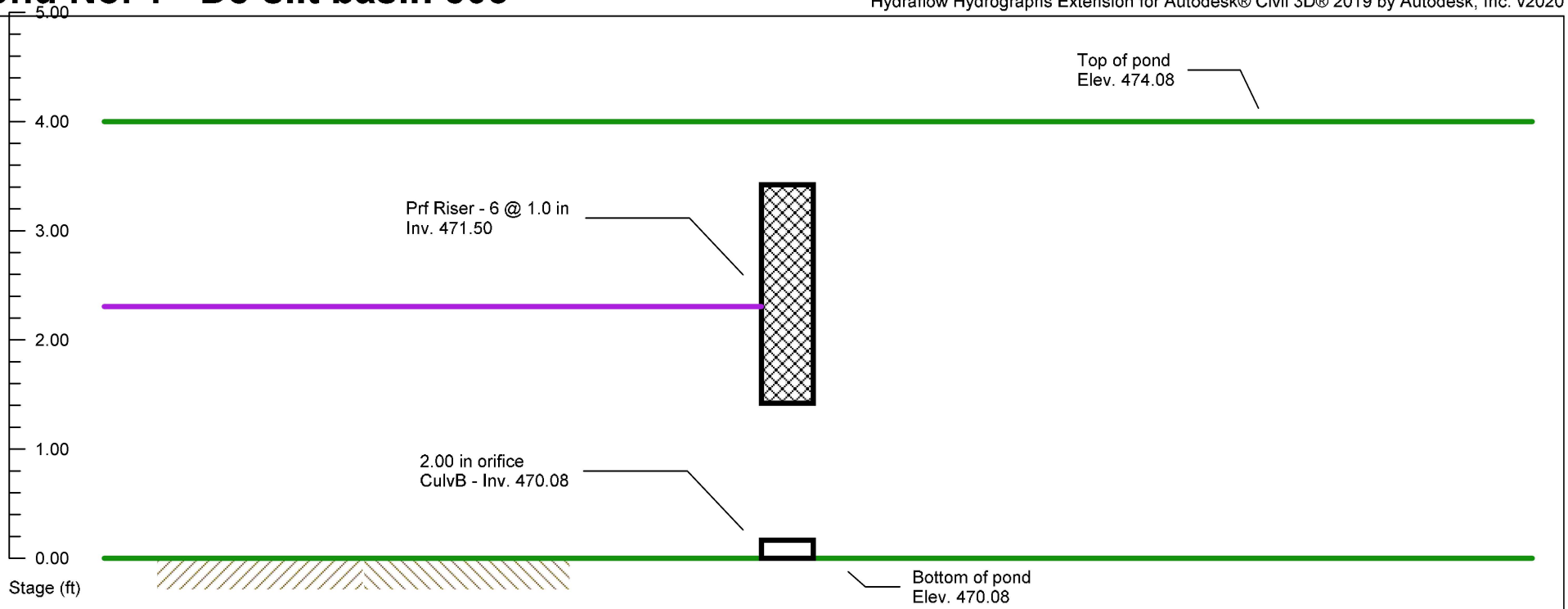
Exfil.(in/hr) = 0.000 (by Contour)

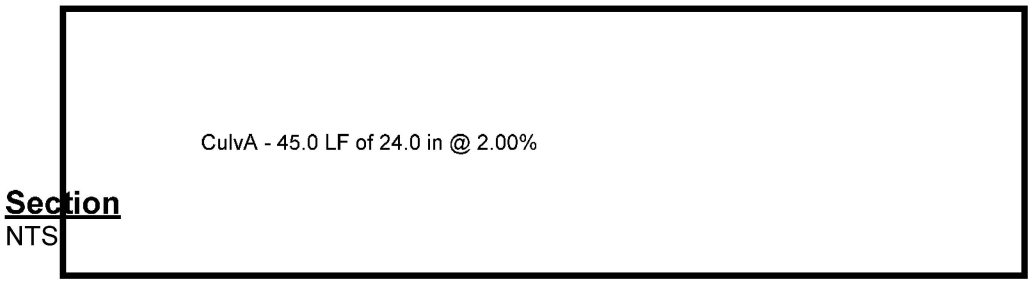
TW Elev. (ft) = 0.00

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



Pond No. 1 - De-silt basin 503





Section
NTS

100-yr

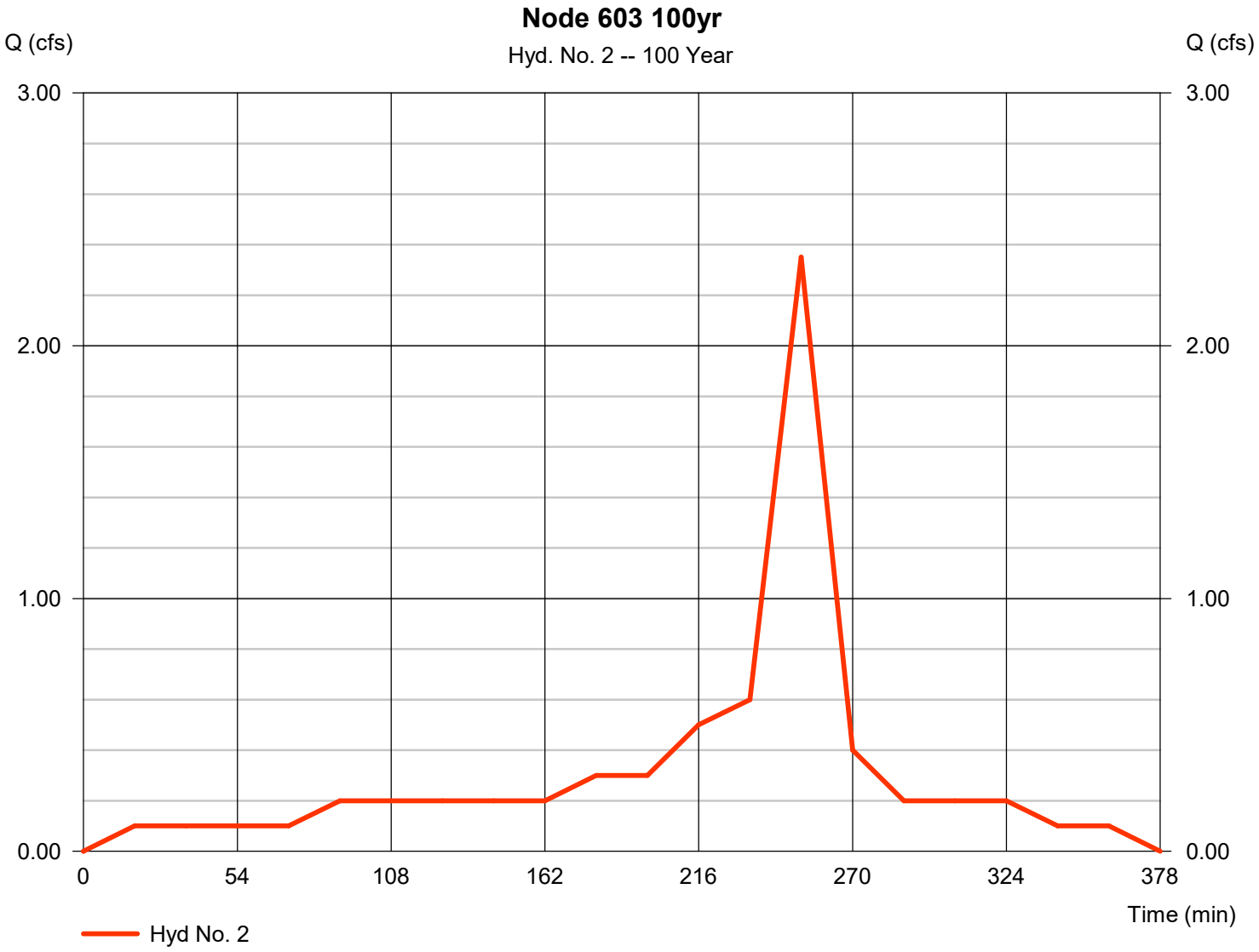
Inflow hydrograph = 1. Manual - Node 503 100yr

Hydrograph Report

Hyd. No. 2

Node 603 100yr

Hydrograph type	= Manual	Peak discharge	= 2.350 cfs
Storm frequency	= 100 yrs	Time to peak	= 252 min
Time interval	= 18 min	Hyd. volume	= 7,182 cuft



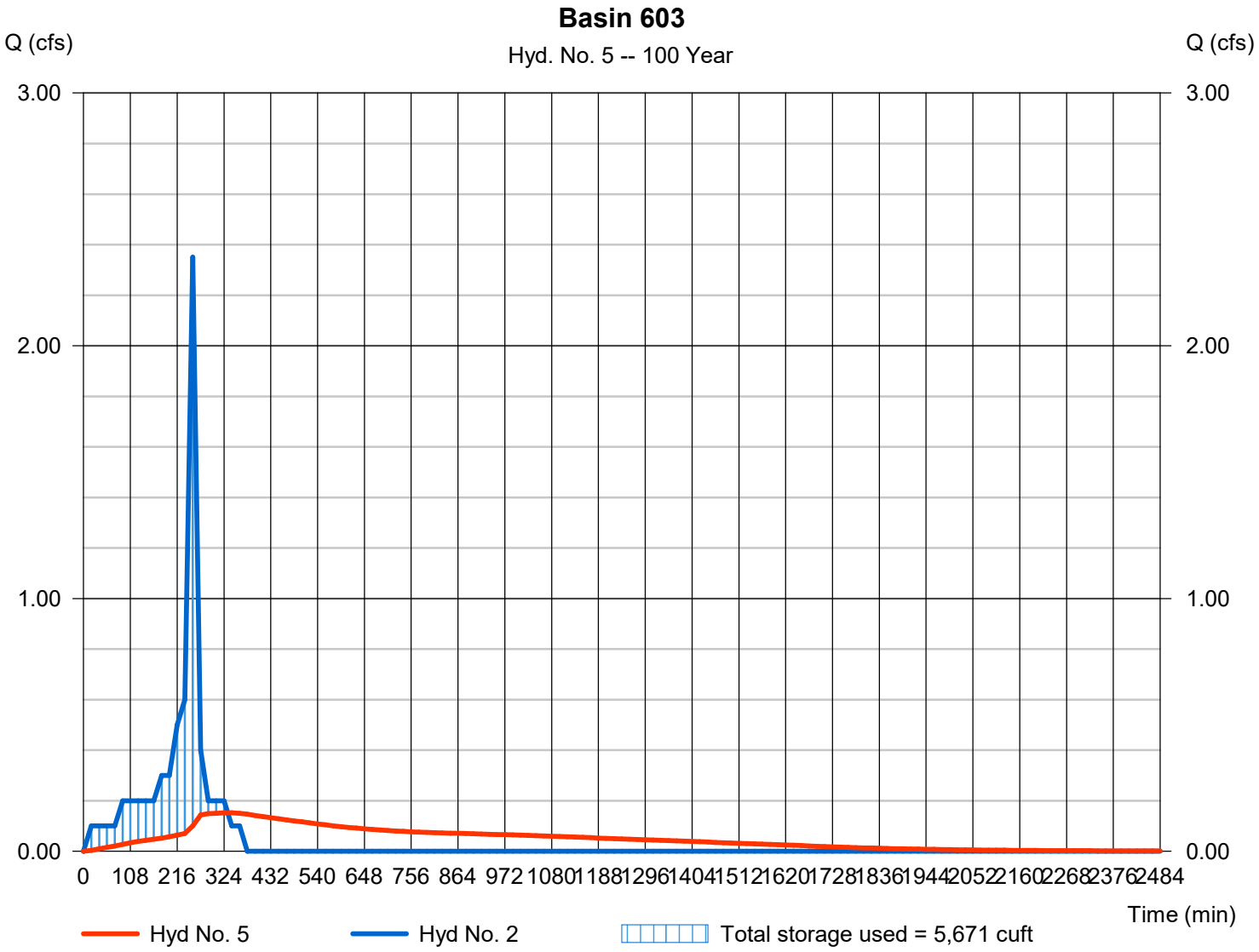
Hydrograph Report

Hyd. No. 5

Basin 603

Hydrograph type	= Reservoir	Peak discharge	= 0.152 cfs
Storm frequency	= 100 yrs	Time to peak	= 324 min
Time interval	= 18 min	Hyd. volume	= 7,166 cuft
Inflow hyd. No.	= 2 - Node 603 100yr	Max. Elevation	= 474.96 ft
Reservoir name	= Basin 603	Max. Storage	= 5,671 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - Basin 603

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 472.60 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	472.60	1,727	0	0
1.00	473.60	2,265	1,990	1,990
2.00	474.60	2,860	2,556	4,546
3.00	475.60	3,512	3,180	7,726
4.00	476.60	4,220	3,860	11,587

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	1.50	0.00	1.00
Span (in)	= 12.00	1.50	0.00	1.00
No. Barrels	= 1	1	0	6
Invert El. (ft)	= 470.60	472.60	0.00	474.00
Length (ft)	= 154.00	0.00	0.00	2.00
Slope (%)	= 10.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.66	0.60	0.66
Multi-Stage	= n/a	Yes	No	Yes

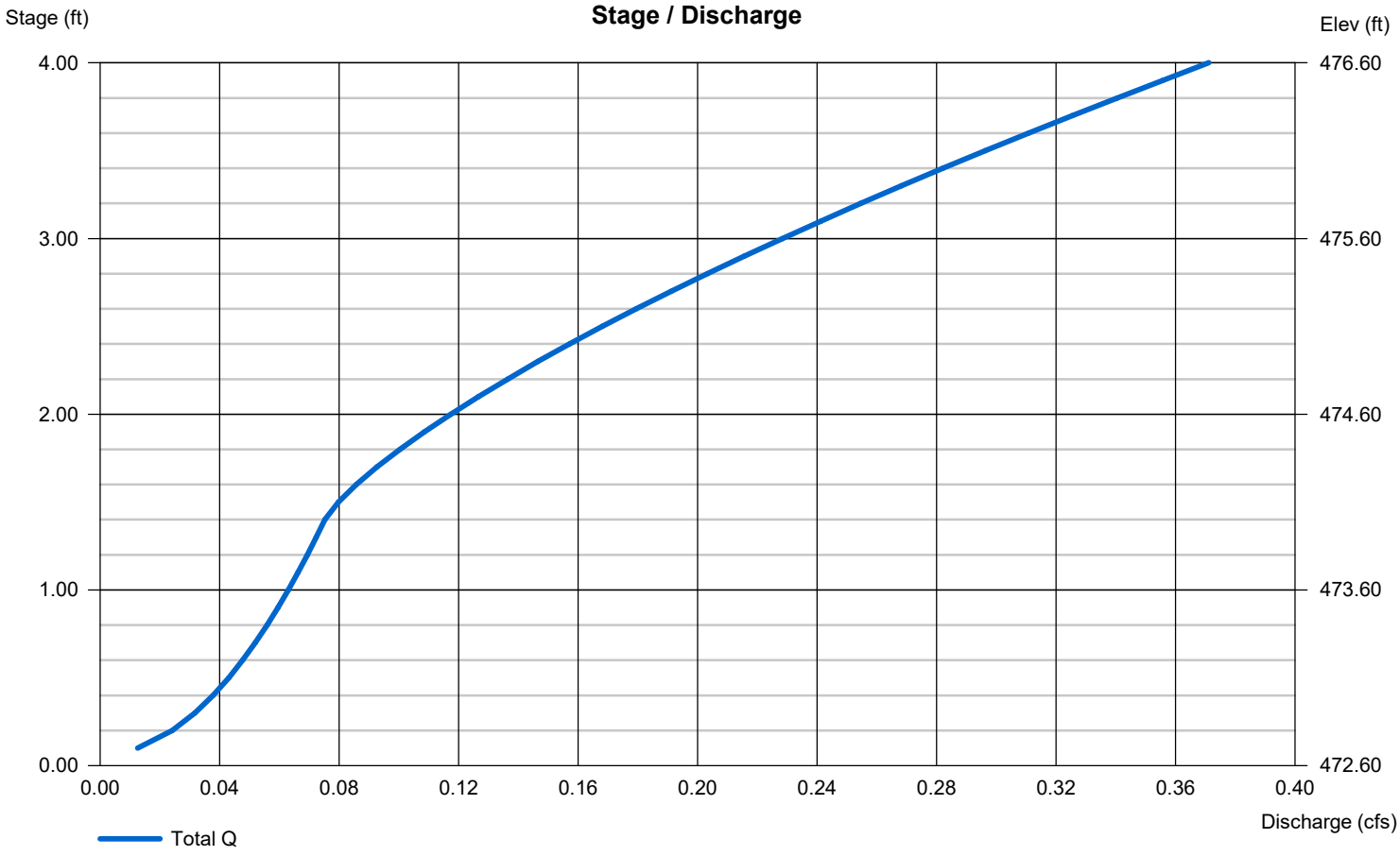
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

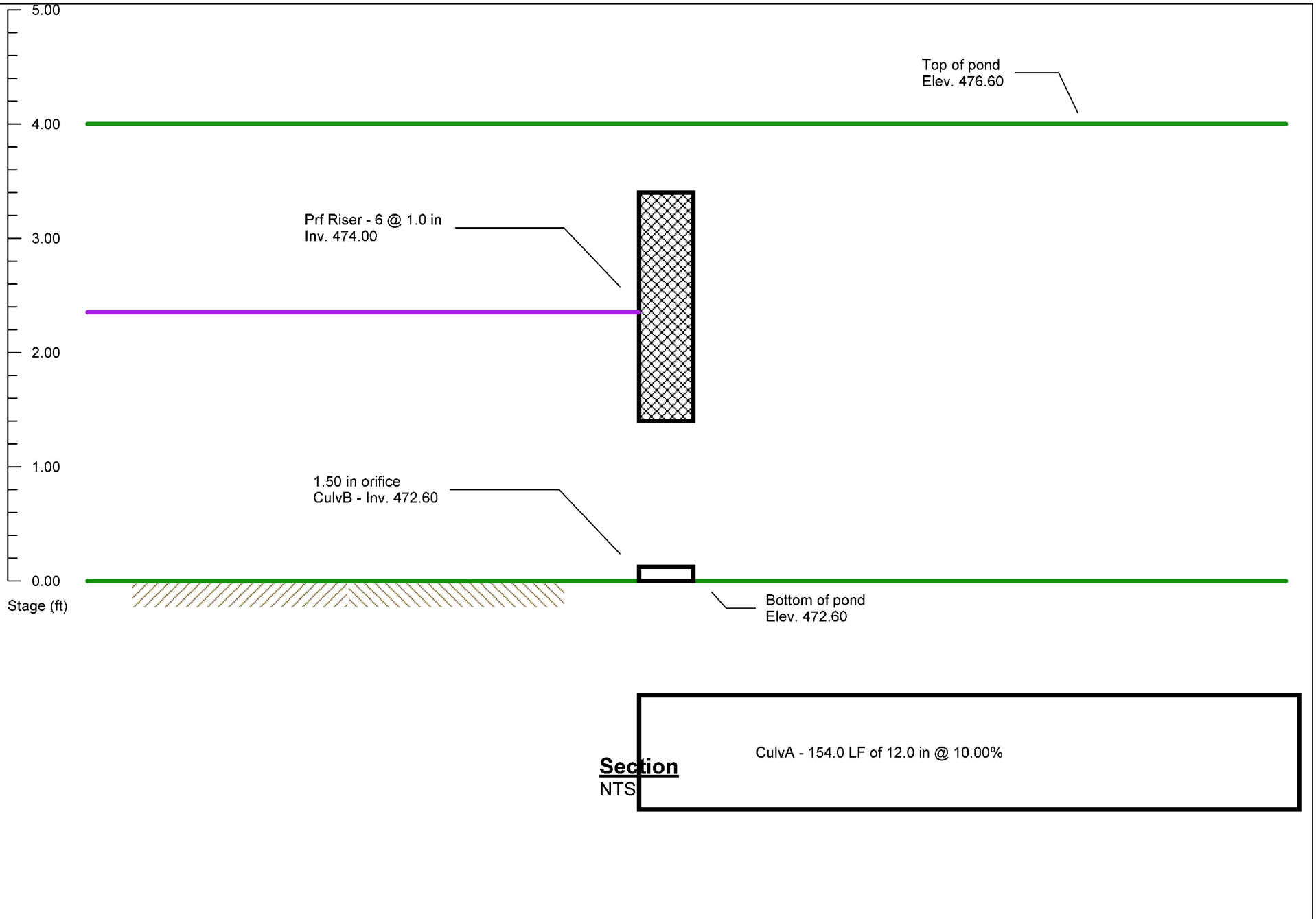
Exfil.(in/hr) = 0.000 (by Contour)

TW Elev. (ft) = 0.00

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



Pond No. 2 - Basin 603

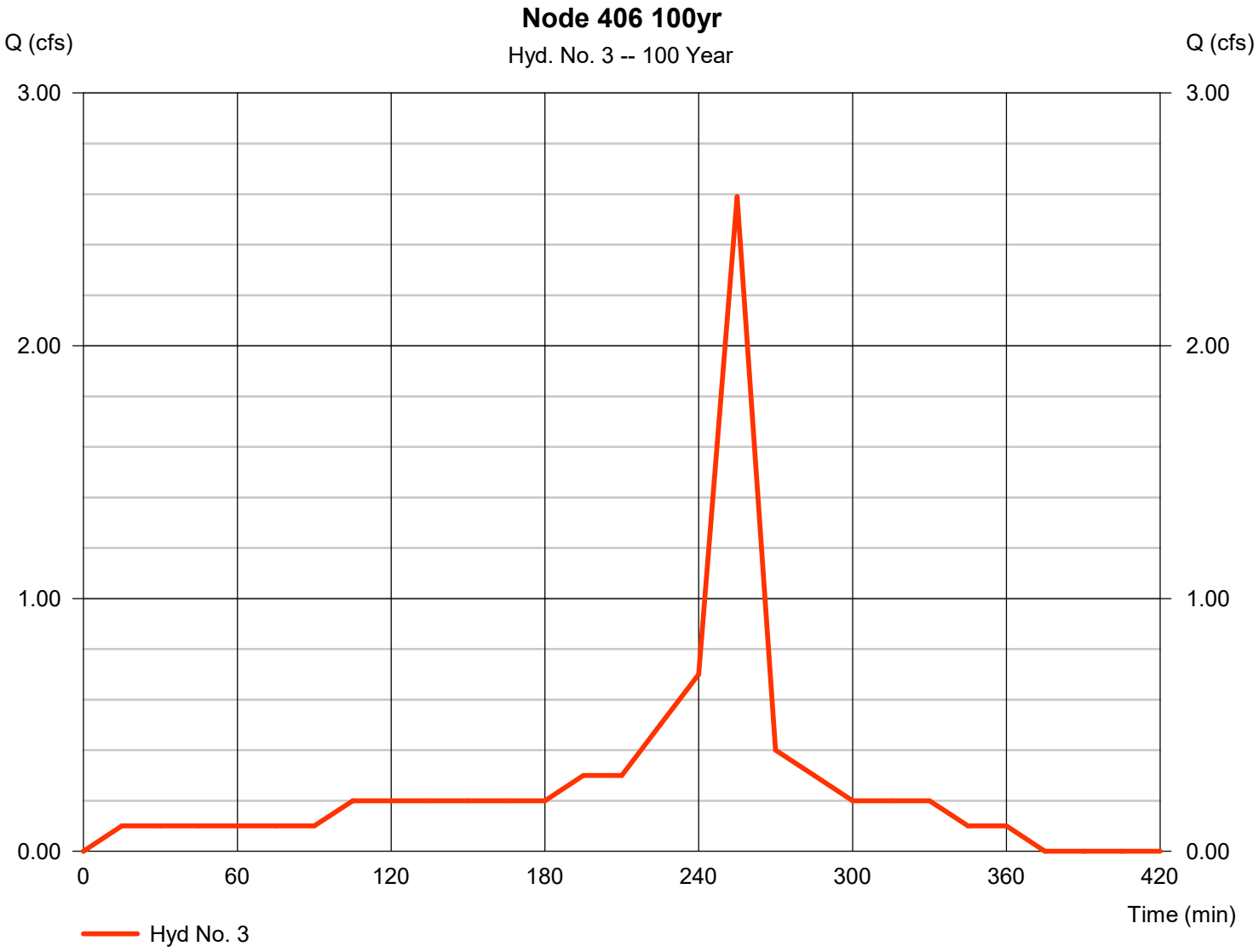


Hydrograph Report

Hyd. No. 3

Node 406 100yr

Hydrograph type	= Manual	Peak discharge	= 2.590 cfs
Storm frequency	= 100 yrs	Time to peak	= 255 min
Time interval	= 15 min	Hyd. volume	= 6,921 cuft



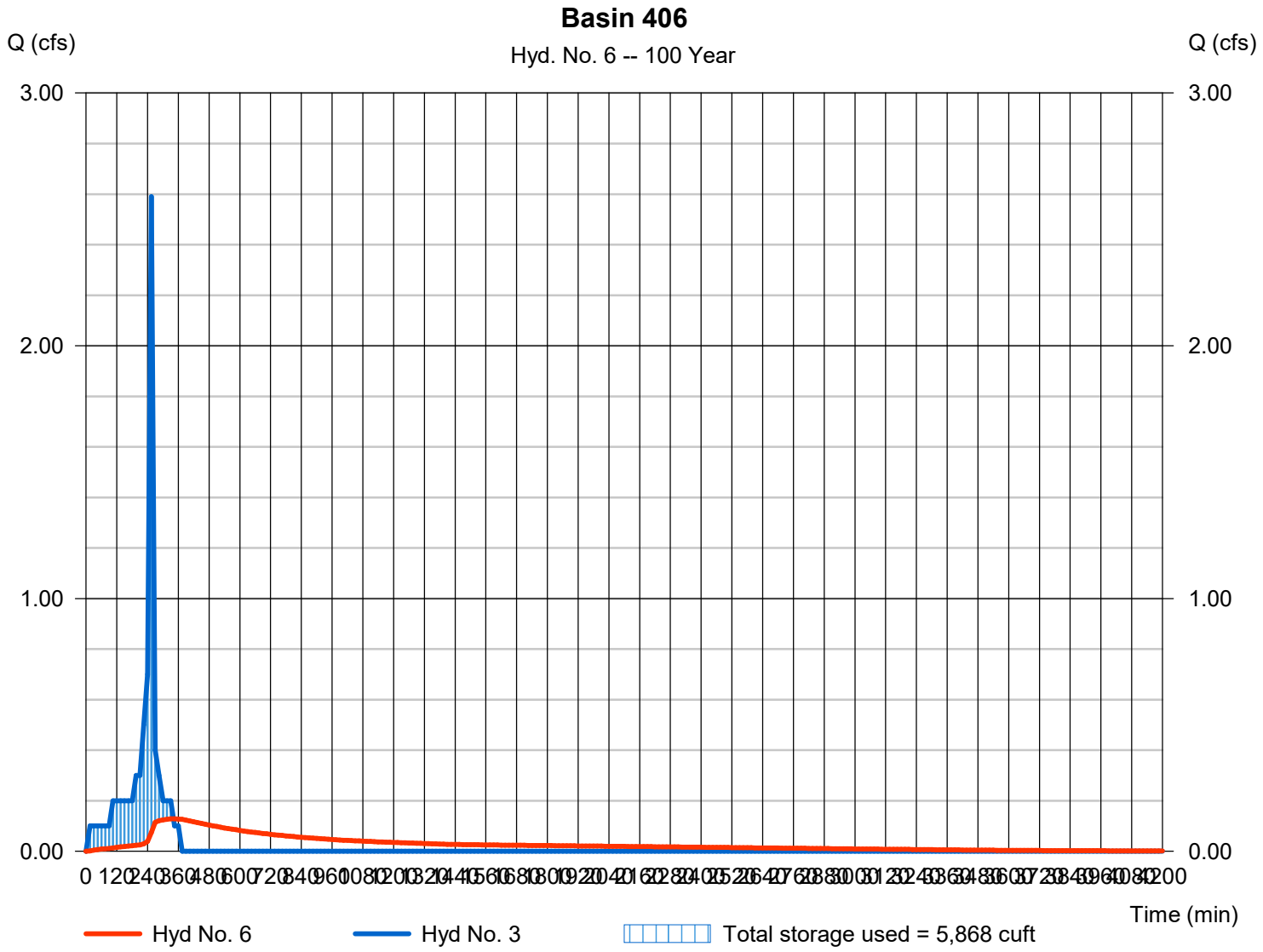
Hydrograph Report

Hyd. No. 6

Basin 406

Hydrograph type	=	Reservoir	Peak discharge	=	0.129 cfs
Storm frequency	=	100 yrs	Time to peak	=	345 min
Time interval	=	15 min	Hyd. volume	=	6,888 cuft
Inflow hyd. No.	=	3 - Node 406 100yr	Max. Elevation	=	481.31 ft
Reservoir name	=	Basin 406	Max. Storage	=	5,868 cuft

Storage Indication method used.



Pond Report

Pond No. 3 - Basin 406

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 479.16 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	479.16	1,986	0	0
1.00	480.16	2,648	2,309	2,309
2.00	481.16	3,366	3,000	5,308
3.00	482.16	4,140	3,746	9,054
4.00	483.16	4,971	4,549	13,603

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	1.00	0.00	1.00
Span (in)	= 12.00	1.00	0.00	1.00
No. Barrels	= 1	1	0	6
Invert El. (ft)	= 474.00	479.16	0.00	480.00
Length (ft)	= 66.00	0.00	0.00	2.00
Slope (%)	= 50.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.66	0.60	0.66
Multi-Stage	= n/a	Yes	No	Yes

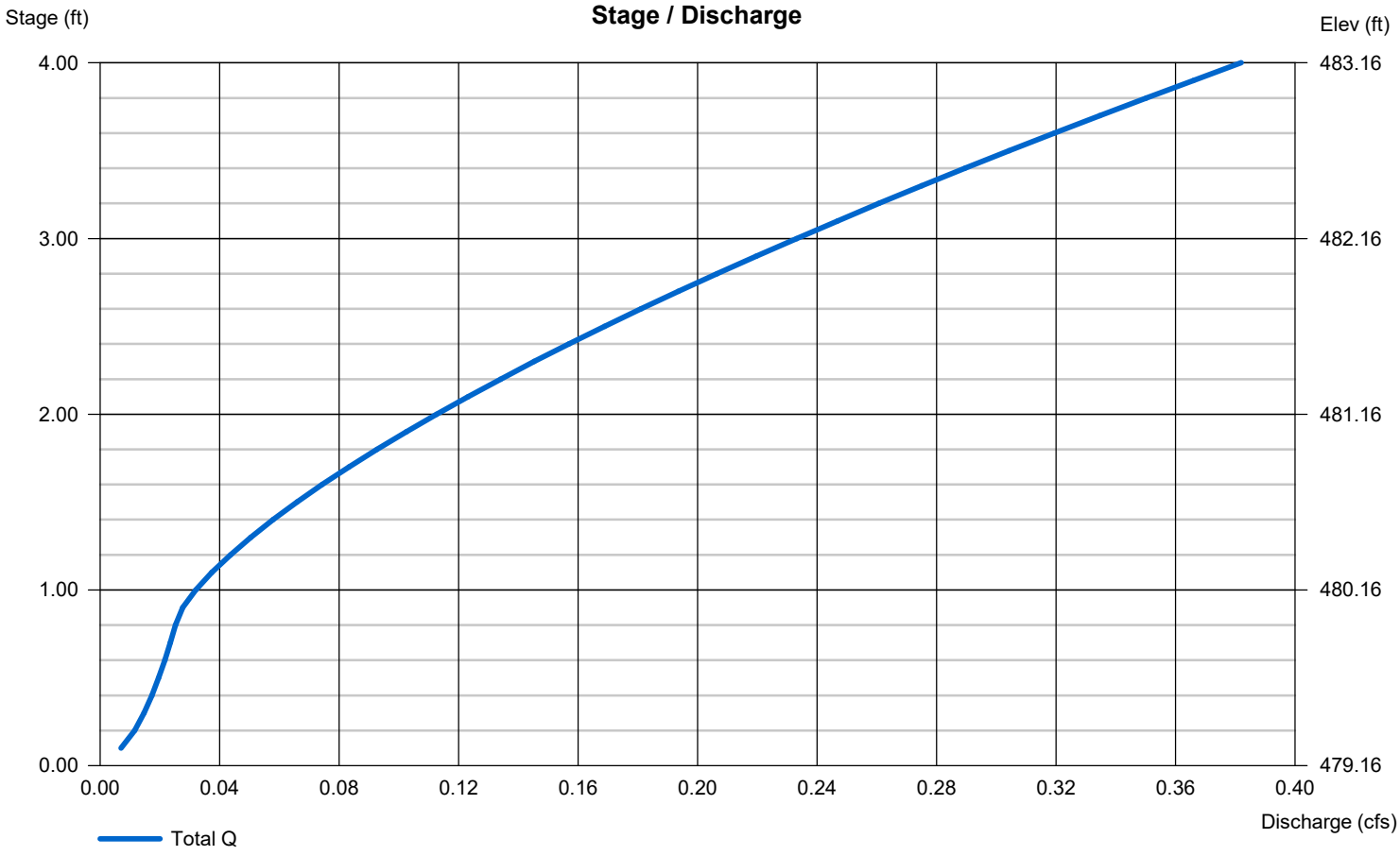
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

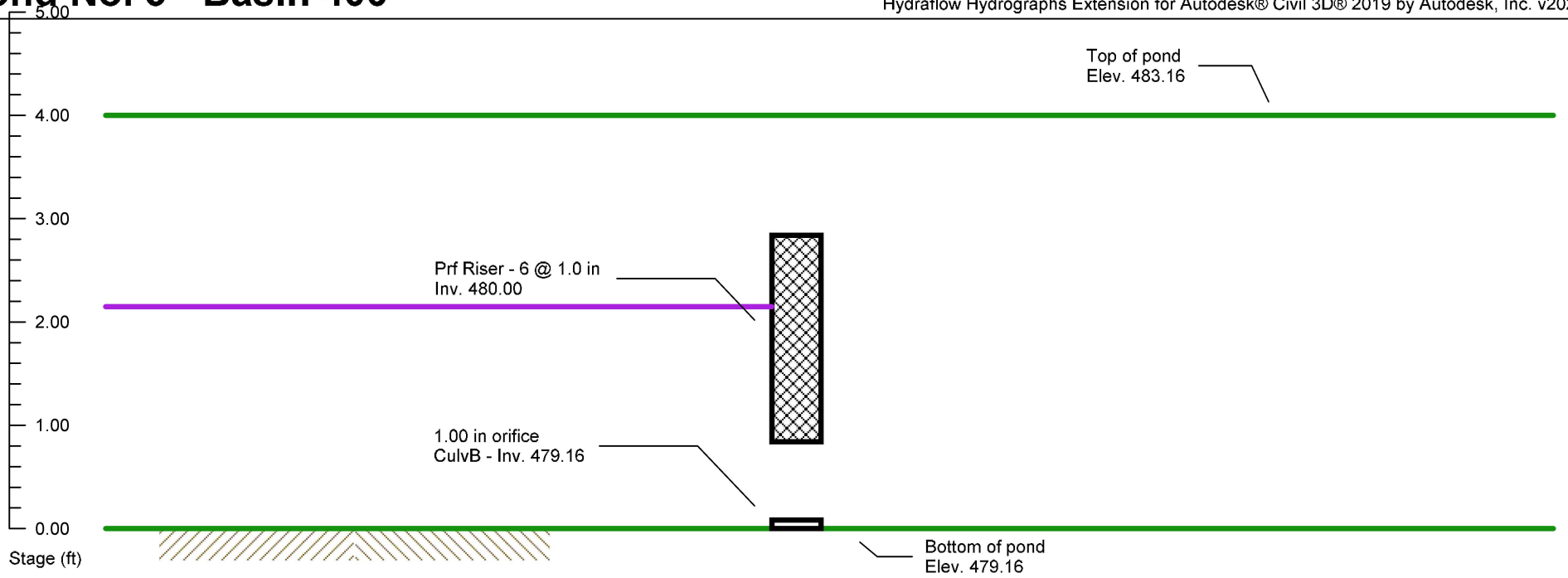
Exfil.(in/hr) = 0.000 (by Contour)

TW Elev. (ft) = 0.00

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



Pond No. 3 - Basin 406



Section
NTS

CulvA - 66.0 LF of 12.0 in @ 50.00%

100-yr

Inflow hydrograph = 3. Manual - Node 406 100yr