

**FINAL ENGINEERING
DRAINAGE STUDY**

FOR

**4110 41st St. Neighborhood House Associates
San Diego, CA 92105**

APN: 454-752-16, 17, 18, 19

OWNER:

City of San Diego - Real Estate Assets
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BY:

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PN: 18235
Date: March 19, 2019
Updated: November 19, 2019

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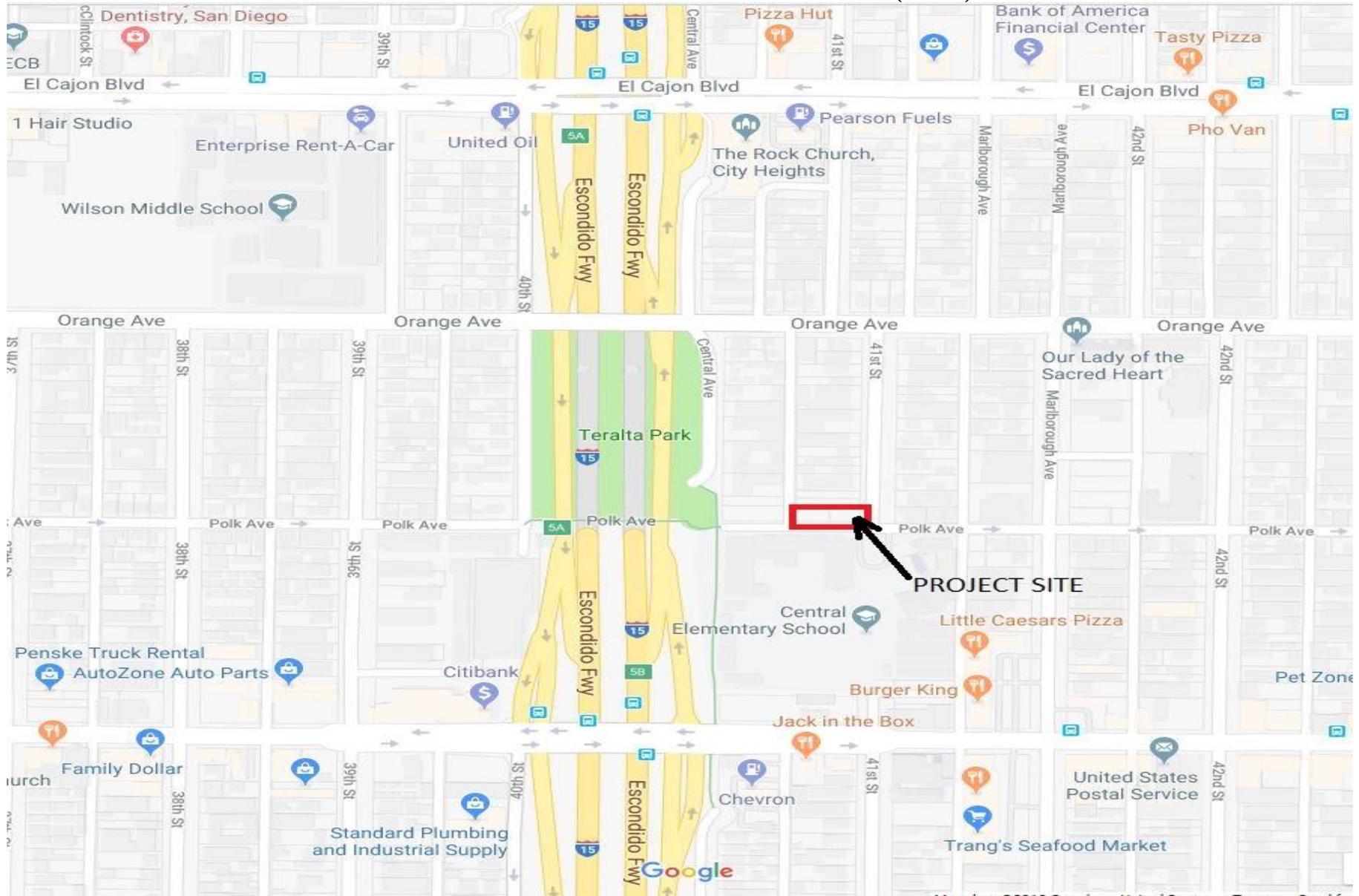
Hydrologic Soil Group Data (will be provided)

EXHIBITS:

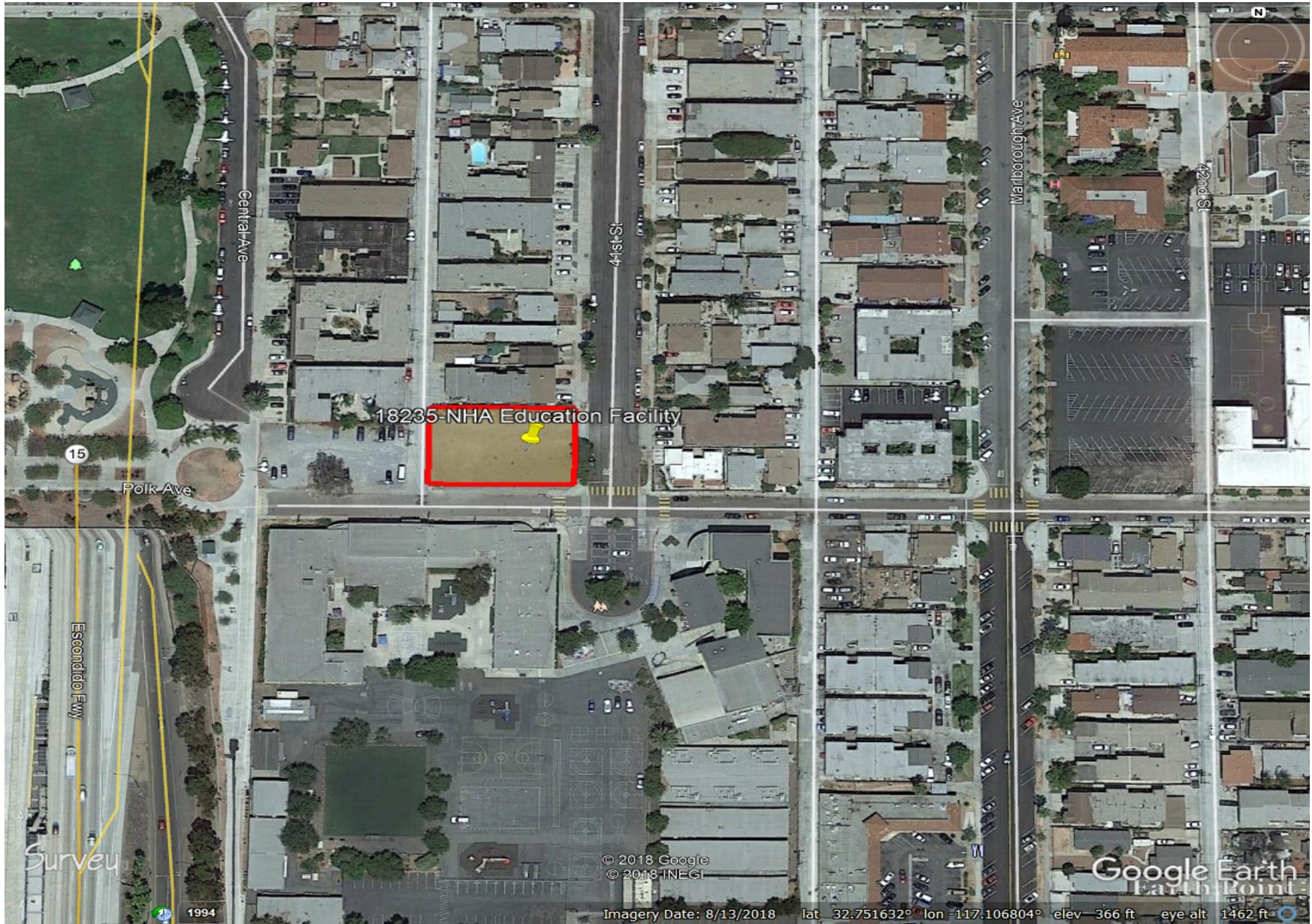
Exhibit A – Pre-Development Hydrology Map

Exhibit B – Post-Development Hydrology Map

VICINITY MAP NEIGHBORHOOD HOUSE ASSOCIATES (NHA)



CURRENT CONDITION



Current Conditions:

The project site currently contains undeveloped 4 tiers of undeveloped land with approximately 0.32 acres located on 41 St. north of Polk Ave. within the City of San Diego, California. The proposed project is a Neighborhood House Association development. The project site is located in Zone RM-1-3 within the City of Height Development District. The property consists of gently sloping that drains southerly into Polk Ave. and ultimately into an existing storm drain system located on Polk Ave. Elevations range from high of approximately 364 feet to low of approximately 362 feet (above the MSL) at the southeast corner. The site is currently undeveloped and covered mainly by dirt. There is no offsite runoff into the site.

See Appendix A for calculations and exhibits.

According to the NRSC Web Soil Survey the soil type is unknown for the areas that this project is located. Geotechnical Investigation will be provided.

METHODOLOGY:

The method used herein to determine discharge quantities is the Rational Method as described in the City of Escondido Drainage Design Standards. A 100 year storm frequently was used due to the location of the site in a local valley and the potential for adverse effect on neighboring properties.

Per the City standards, the following parameters will be used:

Intensity (I) =	2.4 in/hr – Pre Condition (Figure A-1, 100-yr event)
	2.6 in/hr – Post Condition (Figure A-1, 100-yr event)
Time of Concentration (Tc) =	11.8 + 10 = 21.8 min – Pre Condition (Figure A-2)
	18.9 min – Post Condition (Figure A-4) Using formula

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

Runoff coefficients (C):	
Undeveloped Land=	0.45 (Figure 1)
Commercial=	0.85

Pre and post development hydrology maps are located in the back of this report as Exhibit ‘A’ and Exhibit ‘B’ respectively. The included maps outline the sub-basins, flow paths and concentration points for runoff discharging from the site area. All applicable tables and charts referenced from the manual are included herein.

PROPOSED CONDITIONS:

The proposed development project will consist of a Neighborhood House Association, Parking lots and a treatment basin.

The project will have one onsite drainage basin. Basin 1 will sheet flow southeasterly into concrete ditch via curb cut prior to discharging into a proposed treatment basin which ultimately after treatment all the runoff will drain into the existing curb inlet via a proposed storm drain system. The runoff from the

proposed pervious paver area located on the west side of the project site will be conveyed via proposed storm drain system into the biofiltration basin for treatment prior to discharging the site.

See Appendix B for calculations and exhibit.

CONCLUSIONS:

A comparison of the on-site runoff from the existing condition to the proposed conditions shows an increase in runoff because the proposed development adds impervious surfaces.

As previously mentioned, the runoff from the proposed development has been minimized by the use of a water quality treatment facility located before the off-site discharge points which consist of a bio-filtration basin with impermeable liner.

On-site condition

IMP #1	Total Area (ac)	Total Q100 w/o Attenuation (cfs)	Total Q100 w/ Attenuation (cfs)
Pre-Development	0.31	0.34	-
Post-Development	0.31	0.69	0.29

$$\text{Onsite Difference } Q(\text{post}) - Q(\text{pre}) = 0.69 - 0.34 = 0.35$$

The site runoff has an increase of 0.35 cfs which will be reduced by the use of biofiltration basin to 0.29, which is below the existing condition runoff.

**APPENDIX A
EXISTING CONDITIONS CALCULATIONS**

Existing Conditions Hydrology											
BASIN ID	AREA	AREA	C	CA	Change in elevation	Longest Runoff length	Tc	Tc + 10 min	I100	Q100	Cummu-lative Q100
	(ft ²)	(ac.)			ft	ft	(10 min.)	(10 min.)	(in/hr)	(cfs)	(cfs)
BASIN 1	13,533	0.31	0.45	0.14	2.4	900	11.8	21.8	2.40	0.34	-

**APPENDIX B
POST DEVELOPMENT CALCULATIONS**

Post Conditions Hydrology										
BASIN ID	AREA	AREA	C	CA	Slope %	Longest Runoff length	Tc	I100	Q100	Cummu-lative Q100
	(ft ²)	(ac.)			ft	ft	(10 min.)	(in/hr)	(cfs)	(cfs)
BASIN 1	13,533	0.31	0.85	0.26	2.5	3257	18.9	2.60	0.69	-

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

**APPENDIX C
TABLES AND FIGURES FROM CITY OF ESCONDIDO DRAINAGE
STANDARDS**

Table A-1. Runoff Coefficients for Rational Method

Land Use	Runoff Coefficient (C) Soil Type ⁽¹⁾
Residential:	
Single Family	0.55
Multi-Units	0.70
Mobile Homes	0.65
Rural (lots greater than 1/2 acre)	0.45
Commercial ⁽²⁾	
80% Impervious	0.85
Industrial ⁽²⁾	
90% Impervious	0.95

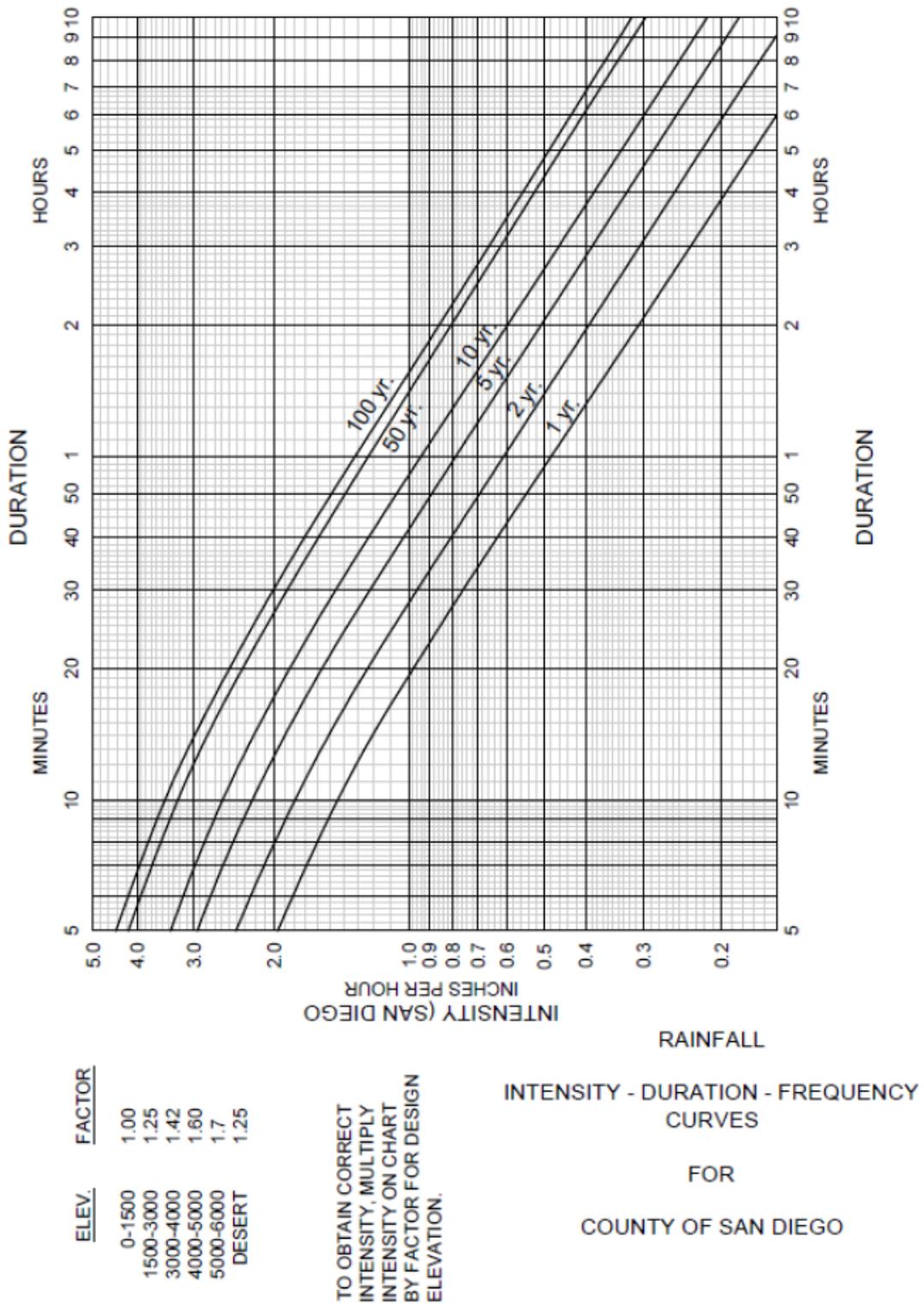


Figure A-1. Intensity-Duration-Frequency Design Chart



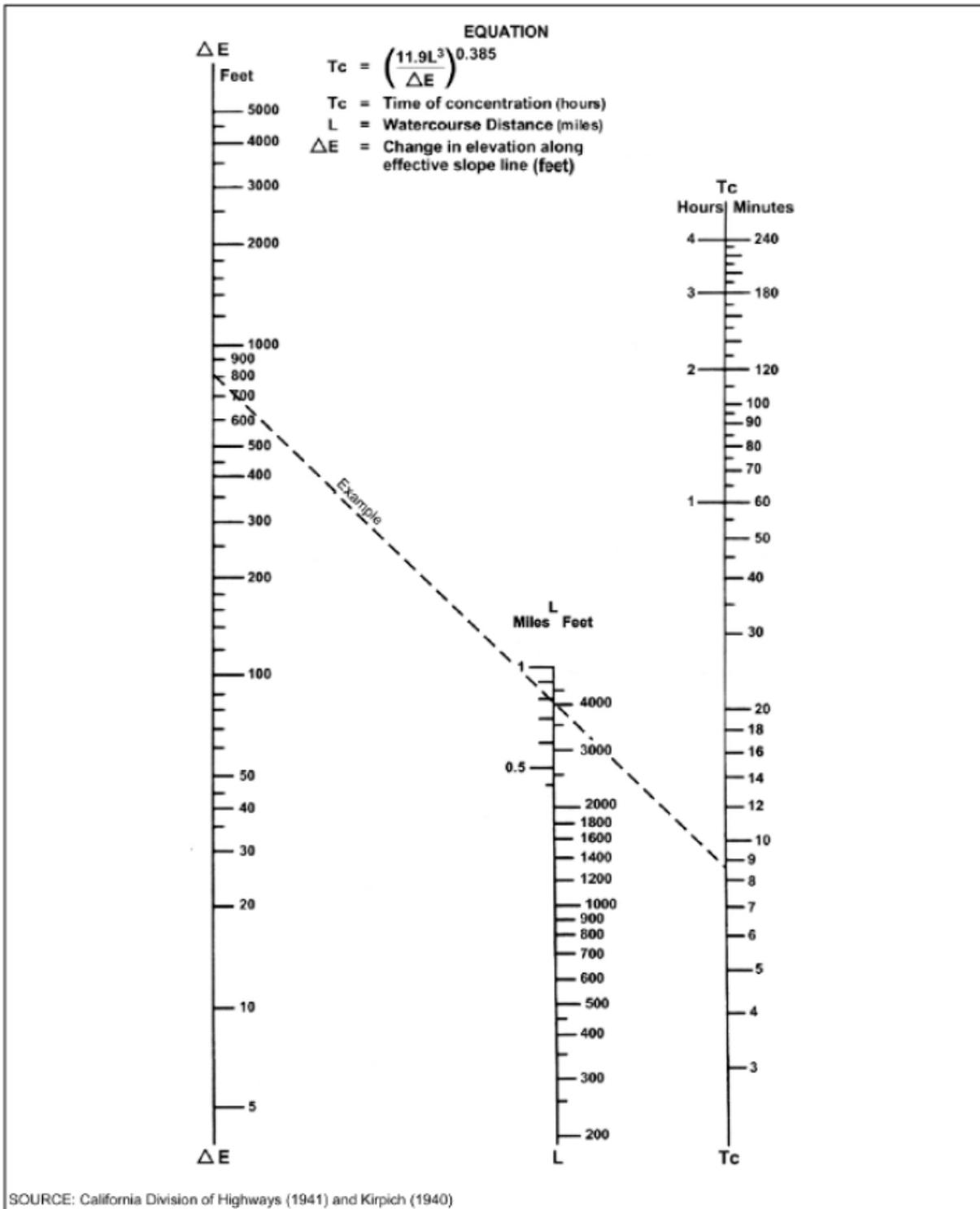


Figure A-2. Nomograph for Determination of T_c for Natural Watersheds

Note: Add ten minutes to the computed time of concentration from Figure A-2.

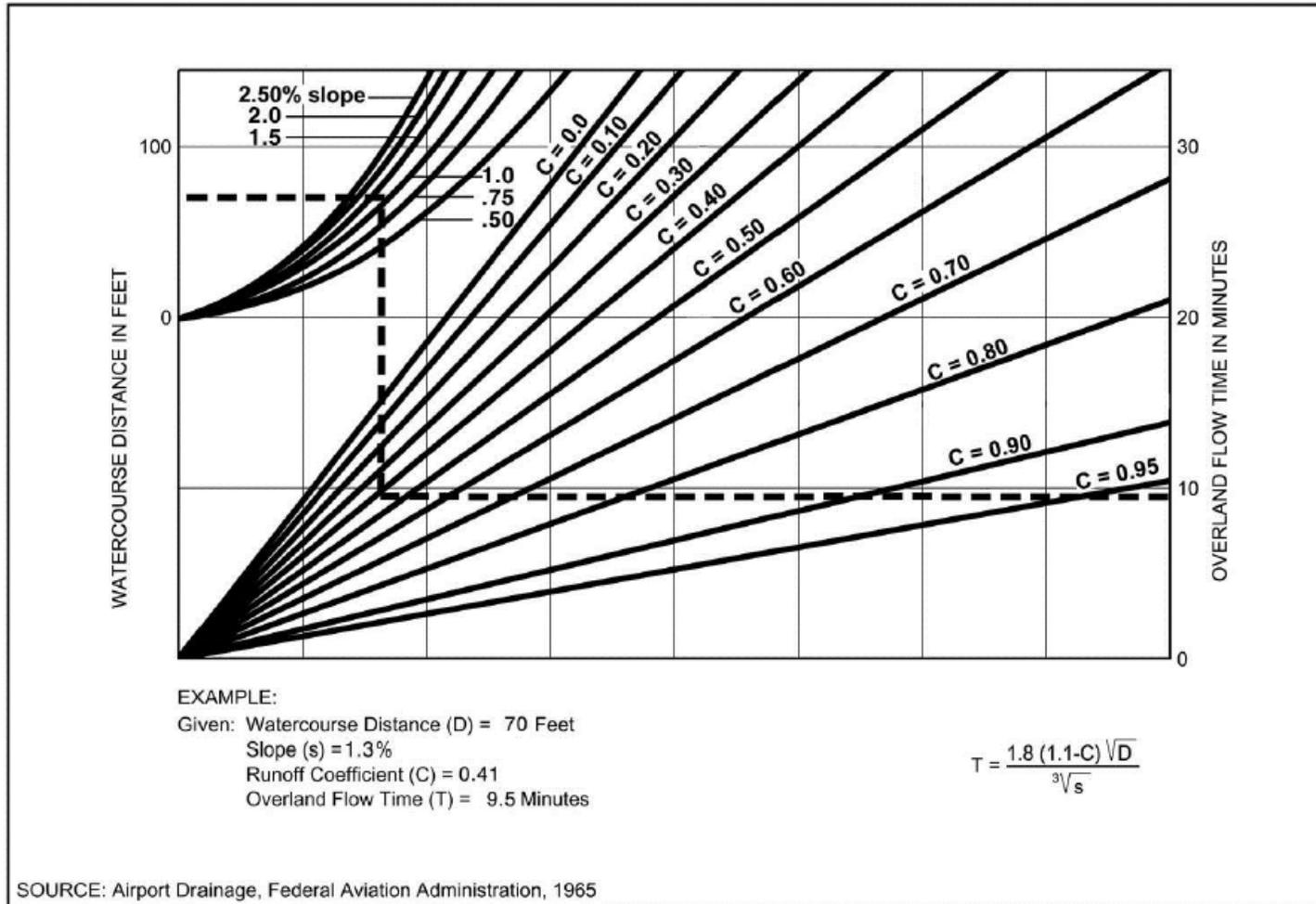


Figure A-4. Rational Formula - Overland Time of Flow Nomograph

Note: Use formula for watercourse distances in excess of 100 feet.

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Basin Model

Hydrology Studio v 3.0.0.13

Project Name: 18235-Peak Attenuation-DMA-1-Revise Limbs

11-19-2019

Predevelopment



Postdevelopment



IMP #1

Hydrograph by Return Period

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Outflow (cfs)							
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
1	Manual	Predevelopment								0.340
2	Manual	Postdevelopment								0.690
3	Pond Route	IMP #1								0.289

Hydrograph 100-yr Summary

Project Name: 18235-Peak Attenuation-DMA-1-Revise Limbs

Hydrology Studio v 3.0.0.13

11-19-2019

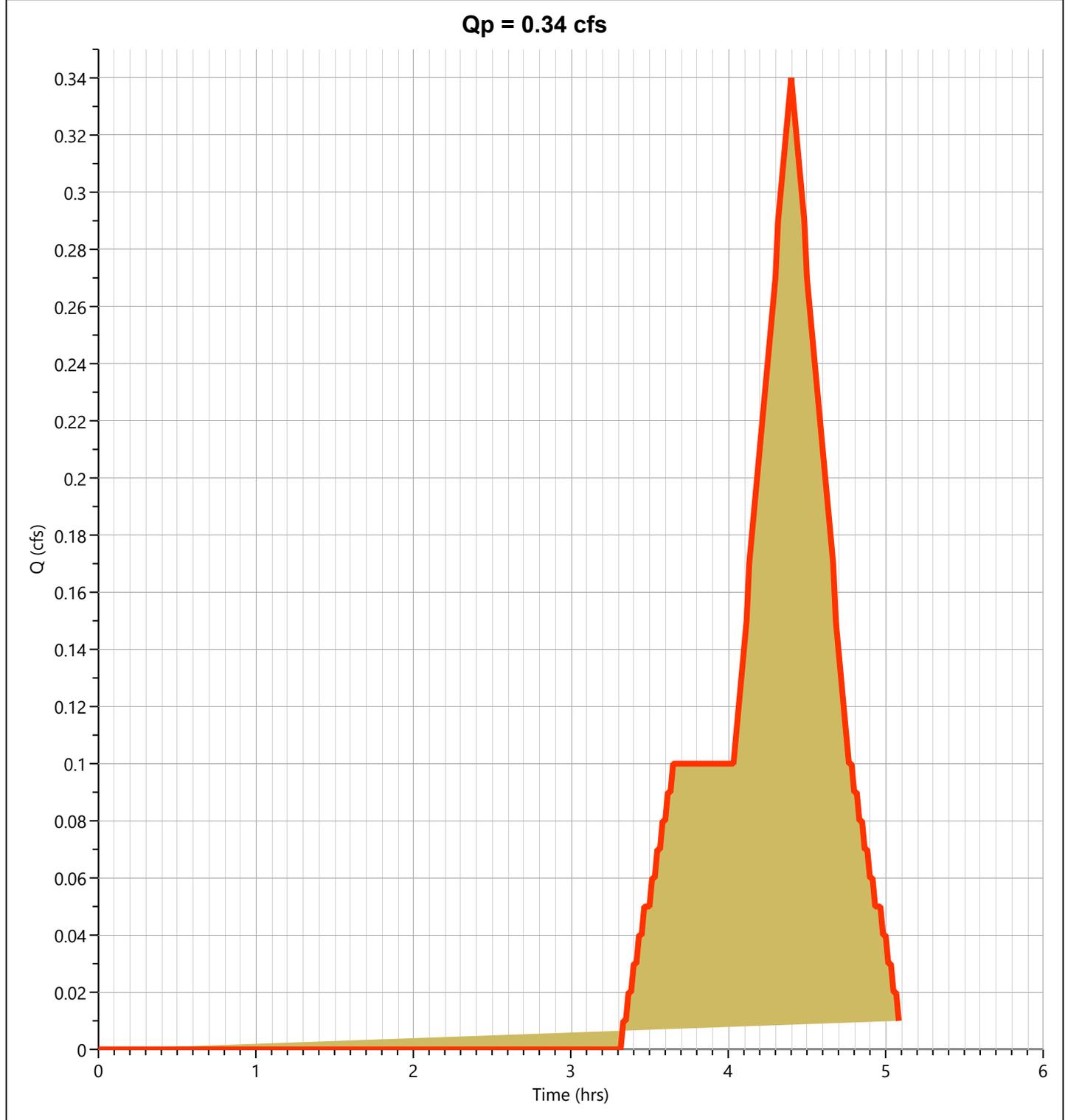
Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	Manual	Predevelopment	0.340	4.40	845	---		
2	Manual	Postdevelopment	0.690	4.43	2,611	---		
3	Pond Route	IMP #1	0.289	4.65	2,273	2	363.13	1,962

Hydrograph Report

Predevelopment

Hyd. No. 1

Hydrograph Type	= Manual	Peak Flow	= 0.340 cfs
Storm Frequency	= 100-yr	Time to Peak	= 4.40 hrs
Time Interval	= 1 min	Hydrograph Volume	= 845 cuft

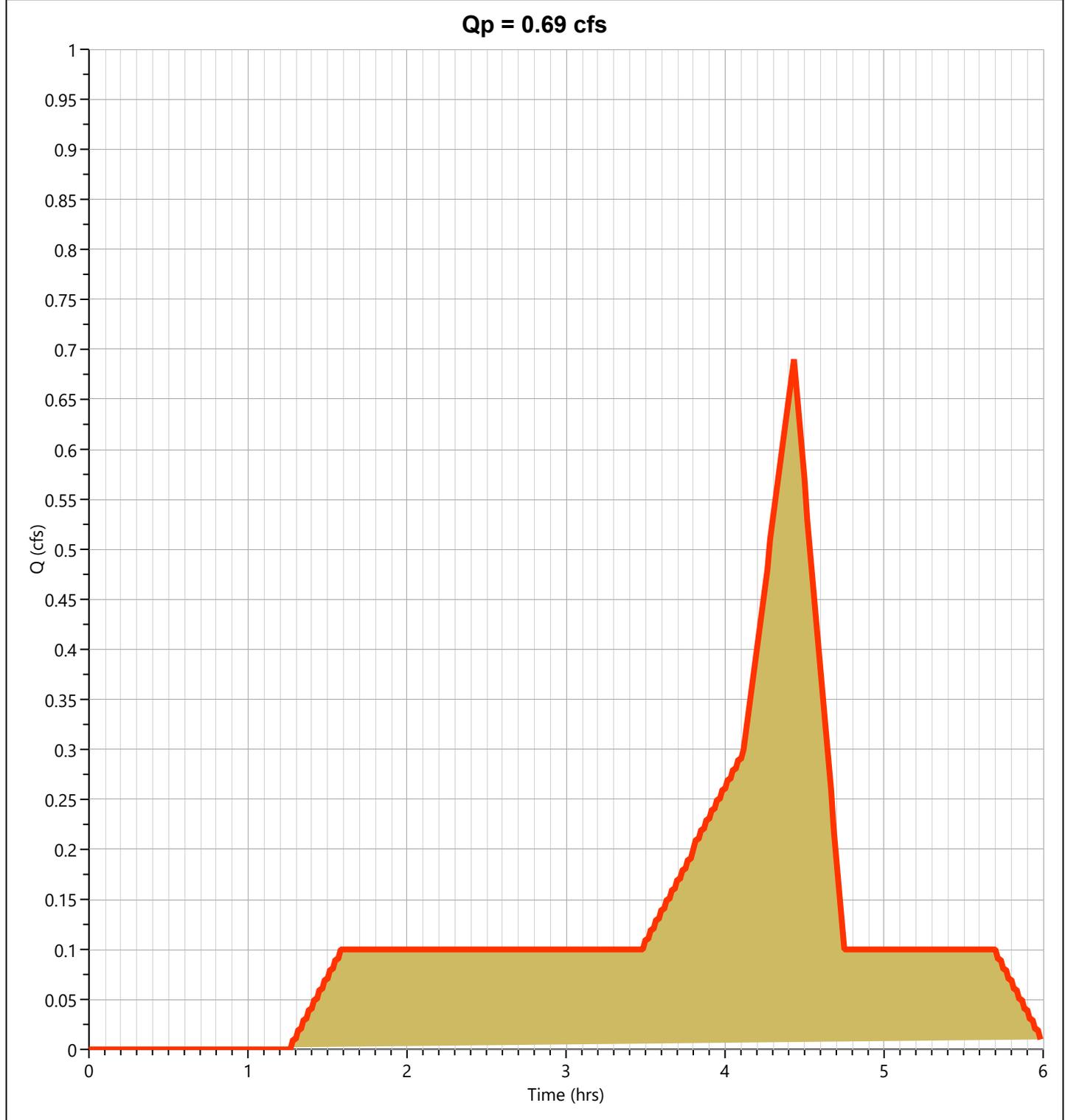


Hydrograph Report

Postdevelopment

Hyd. No. 2

Hydrograph Type	= Manual	Peak Flow	= 0.690 cfs
Storm Frequency	= 100-yr	Time to Peak	= 4.43 hrs
Time Interval	= 1 min	Hydrograph Volume	= 2,611 cuft



Hydrograph Report

IMP #1

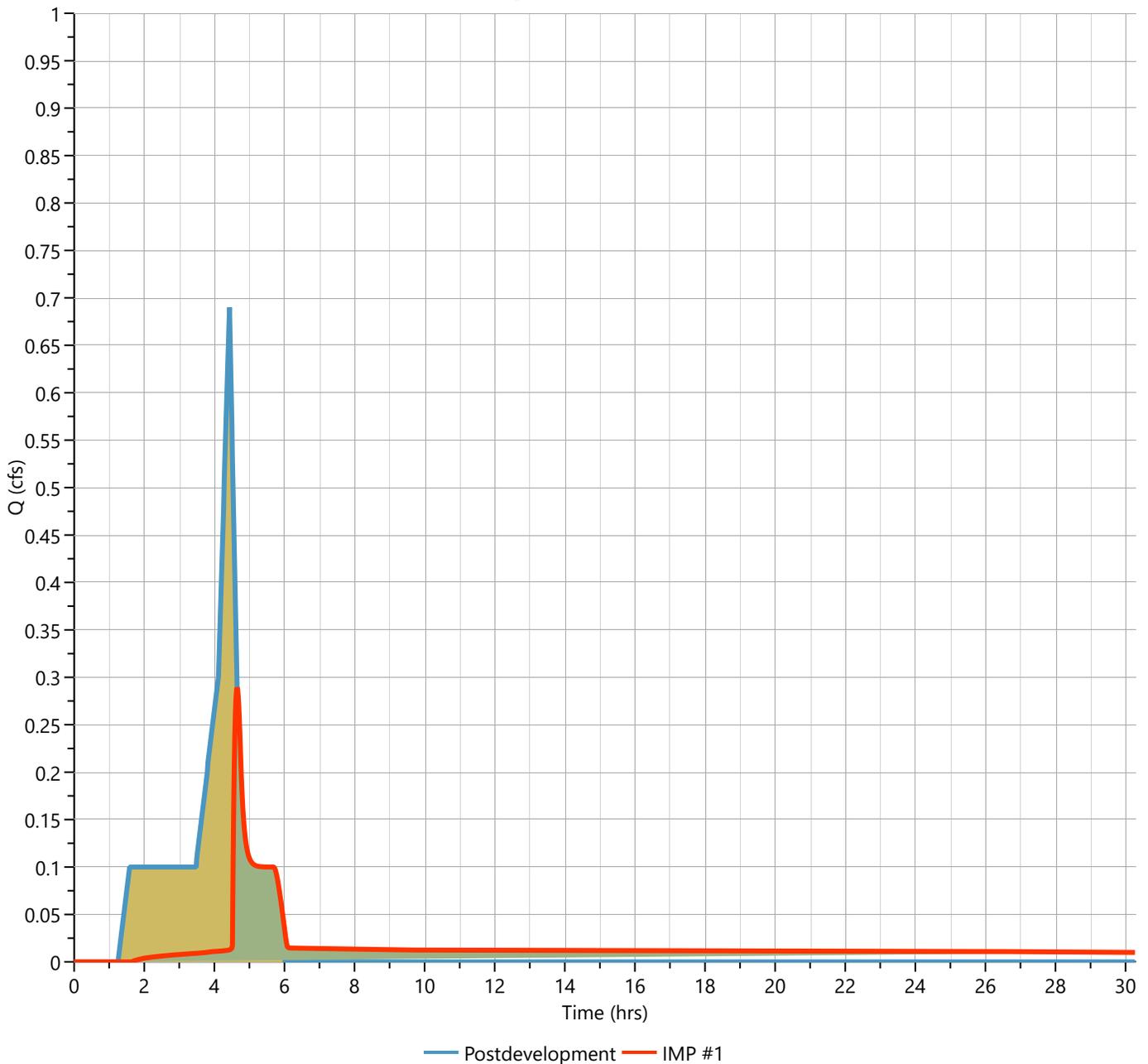
Hyd. No. 3

Hydrograph Type	= Pond Route	Peak Flow	= 0.289 cfs
Storm Frequency	= 100-yr	Time to Peak	= 4.65 hrs
Time Interval	= 1 min	Hydrograph Volume	= 2,273 cuft
Inflow Hydrograph	= 2 - Postdevelopment	Max. Elevation	= 363.13 ft
Pond Name	= IMP-1	Max. Storage	= 1,962 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 14.14 hrs

Qp = 0.29 cfs



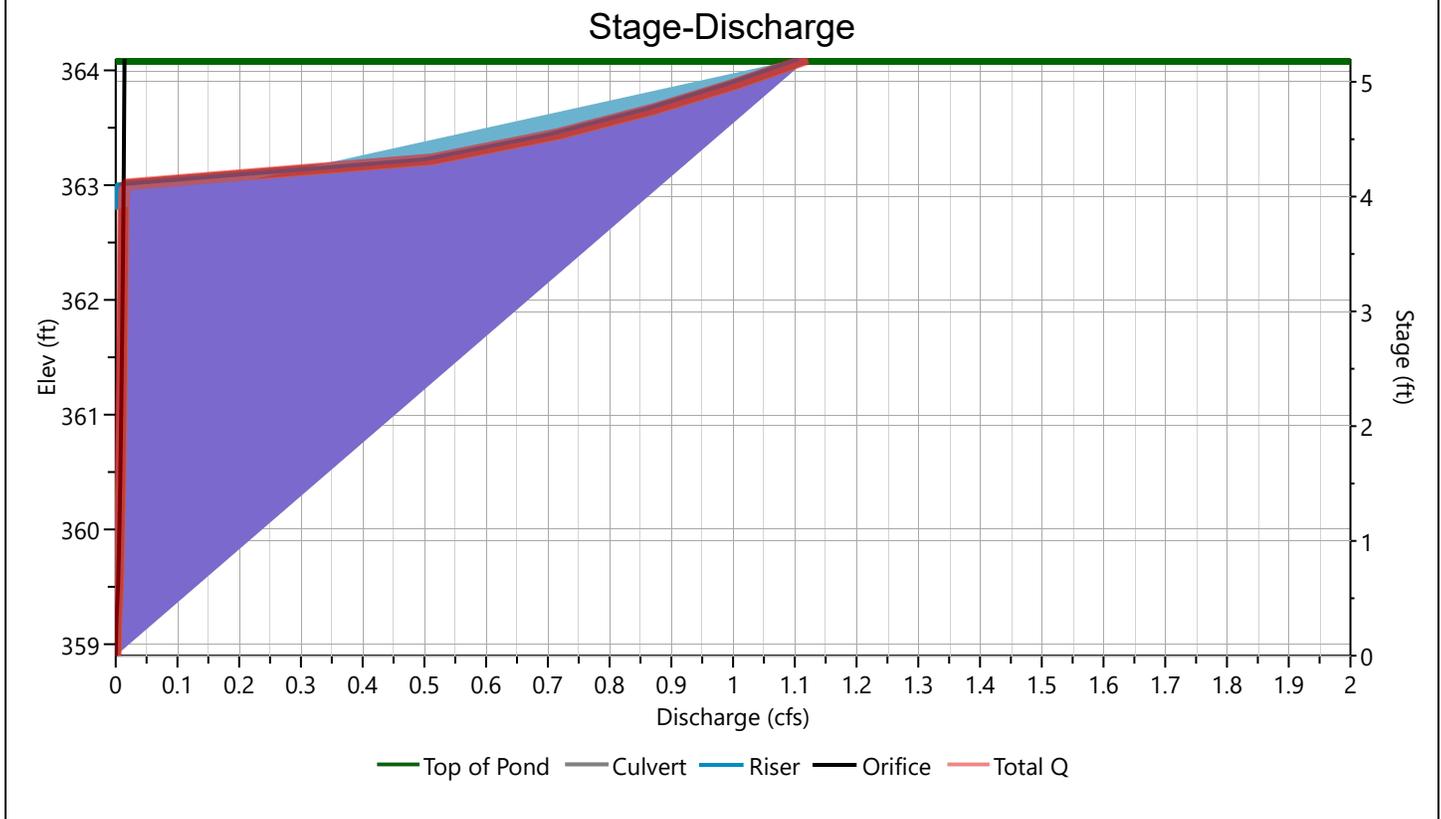
Pond Report

IMP-1

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Orifice Plate
		1*	2	3	
Rise, in	18	.5			Orifice Dia, in
Span, in	18	.5			No. Orifices
No. Barrels	1	1	1		Invert Elevation, ft
Invert Elevation, ft	358.90	359.15			Height, ft
Orifice Coefficient, Co	0.60	0.60	0.60	0.60	Orifice Coefficient, Co
Length, ft	74				
Barrel Slope, %	.5				
N-Value, n	0.013				
Weirs	Riser*	Weirs			Ancillary
		1	2	3	
Shape / Type	Circular				Exfiltration, in/hr
Crest Elevation, ft	363				
Crest Length, ft	1.57				
Angle, deg					
Weir Coefficient, Cw	3.33	3.33	3.33	3.33	

*Routes through Culvert.



Pond Report

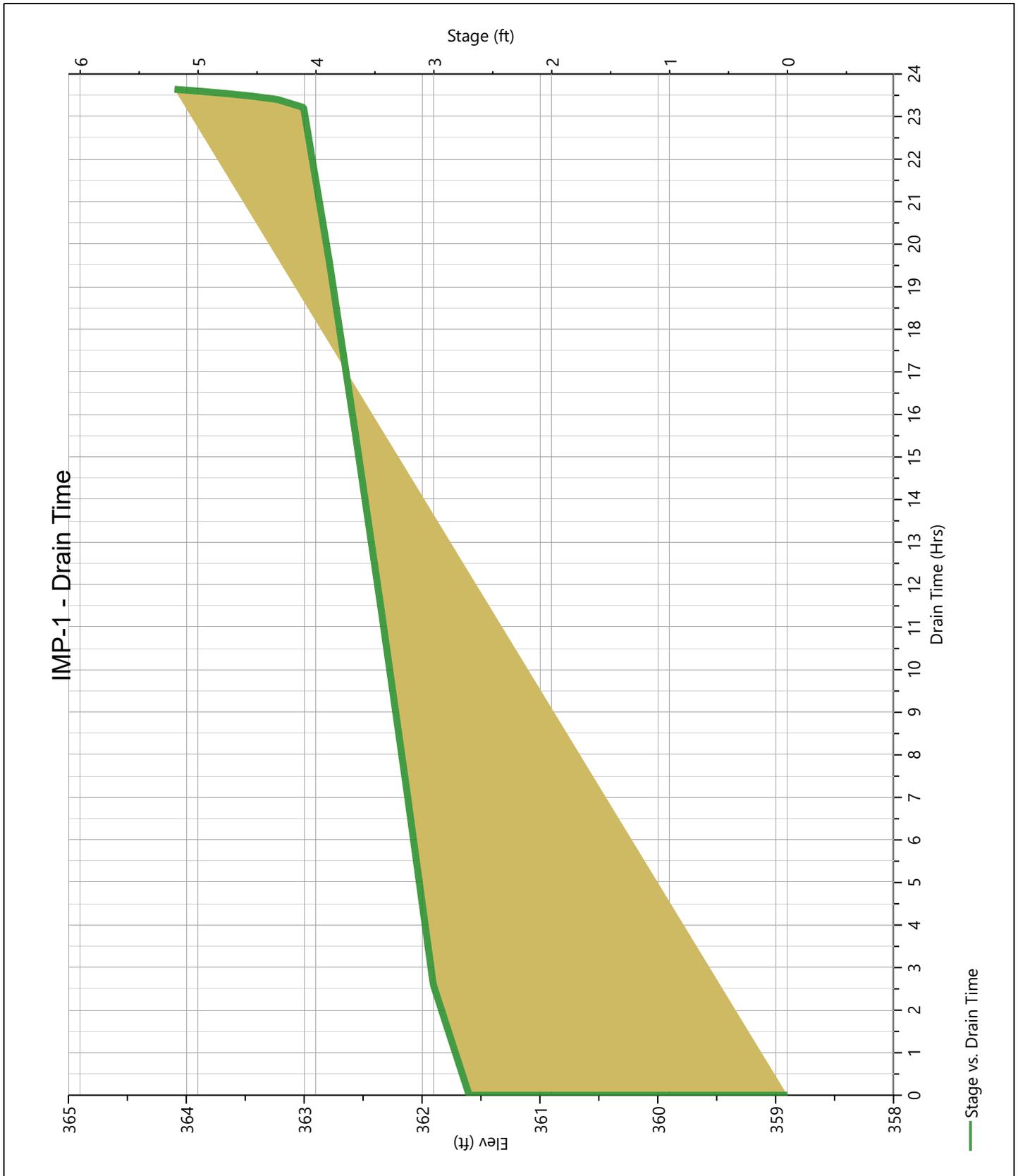
IMP-1

Stage-Storage-Discharge Summary

Stage (ft)	Elev. (ft)	Storage (cuft)	Culvert (cfs)	Orifices, cfs			Riser (cfs)	Weirs, cfs			Pf Riser (cfs)	Exfil (cfs)	User (cfs)	Total (cfs)
				1	2	3		1	2	3				
0.00	358.90	0.000	0.000	0.000			0.000							0.000
3.00	361.90	972	0.011 ic	0.011			0.000							0.011
3.01	361.91	977	0.011 ic	0.011			0.000							0.011
5.20	364.10	2,751	1.120 ic	0.014			1.106 ic							1.120

IMP-1

Pond Drawdown

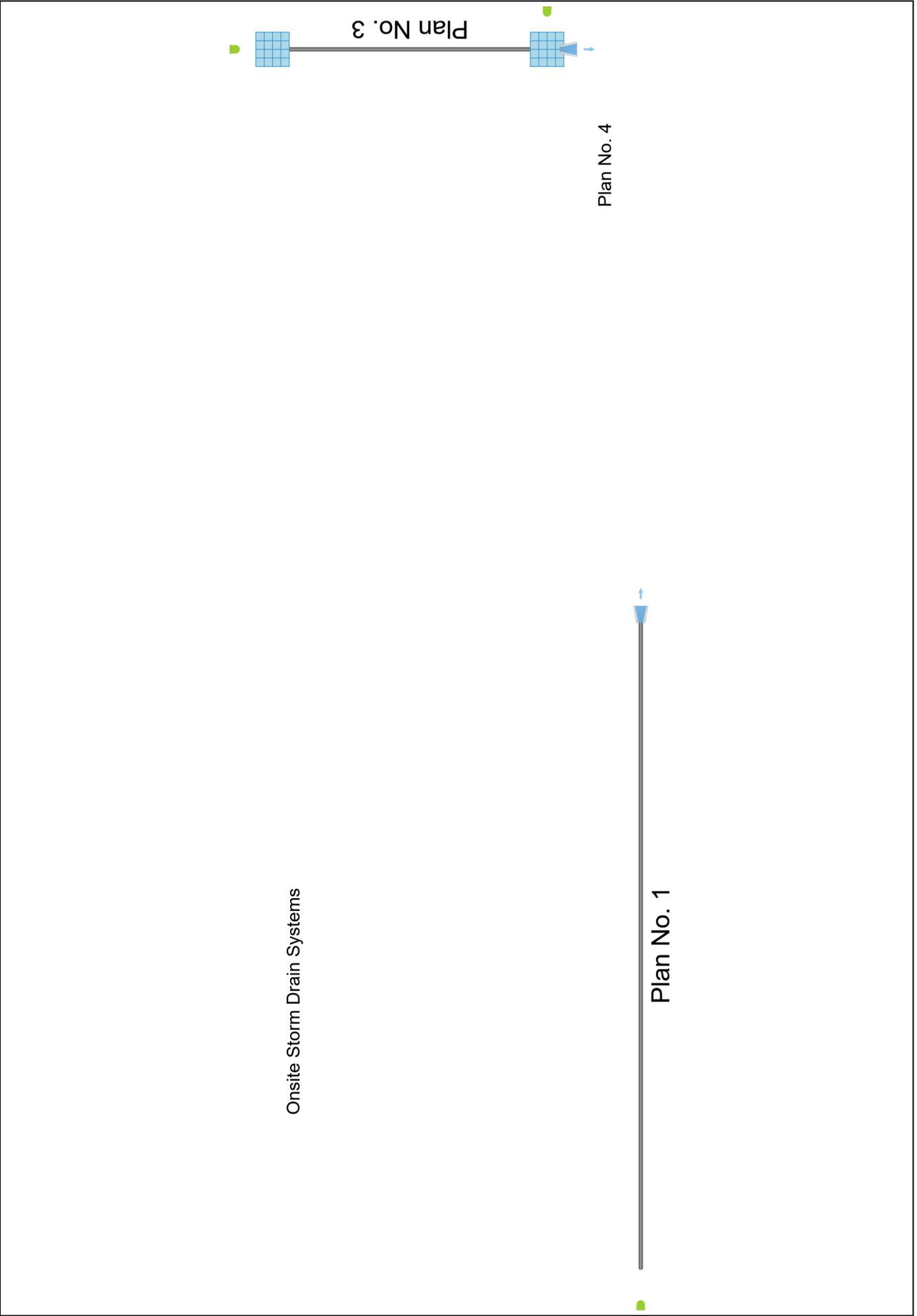


Plan View

Stormwater Studio 2019 v 3.0.0.15

Project Name: Enter Project Name...

11-18-2019

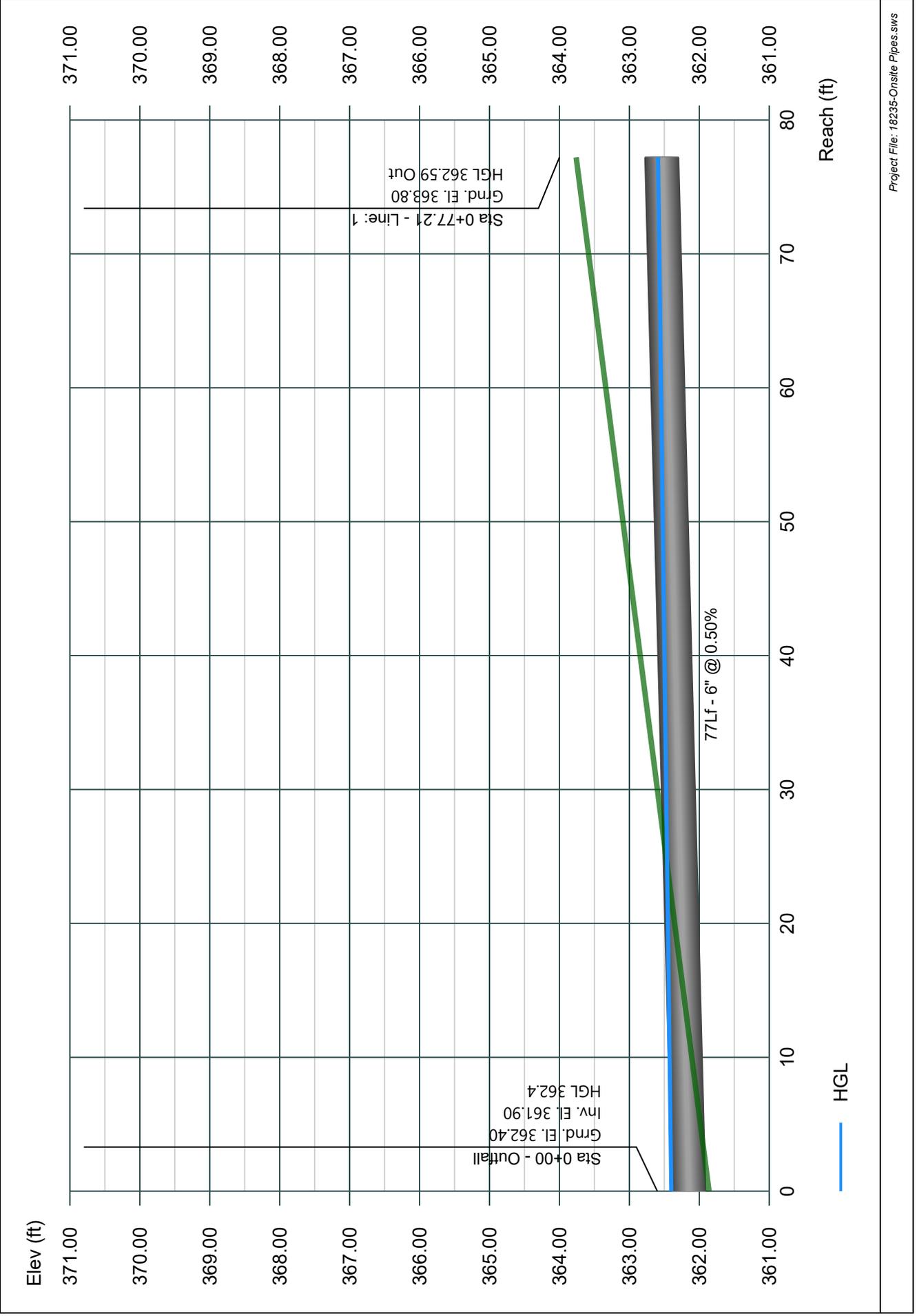


Line 1 - Plan No. 1

Project Name: Enter Project Name...

Stormwater Studio 2019 v 3.0.0.15

11-18-2019

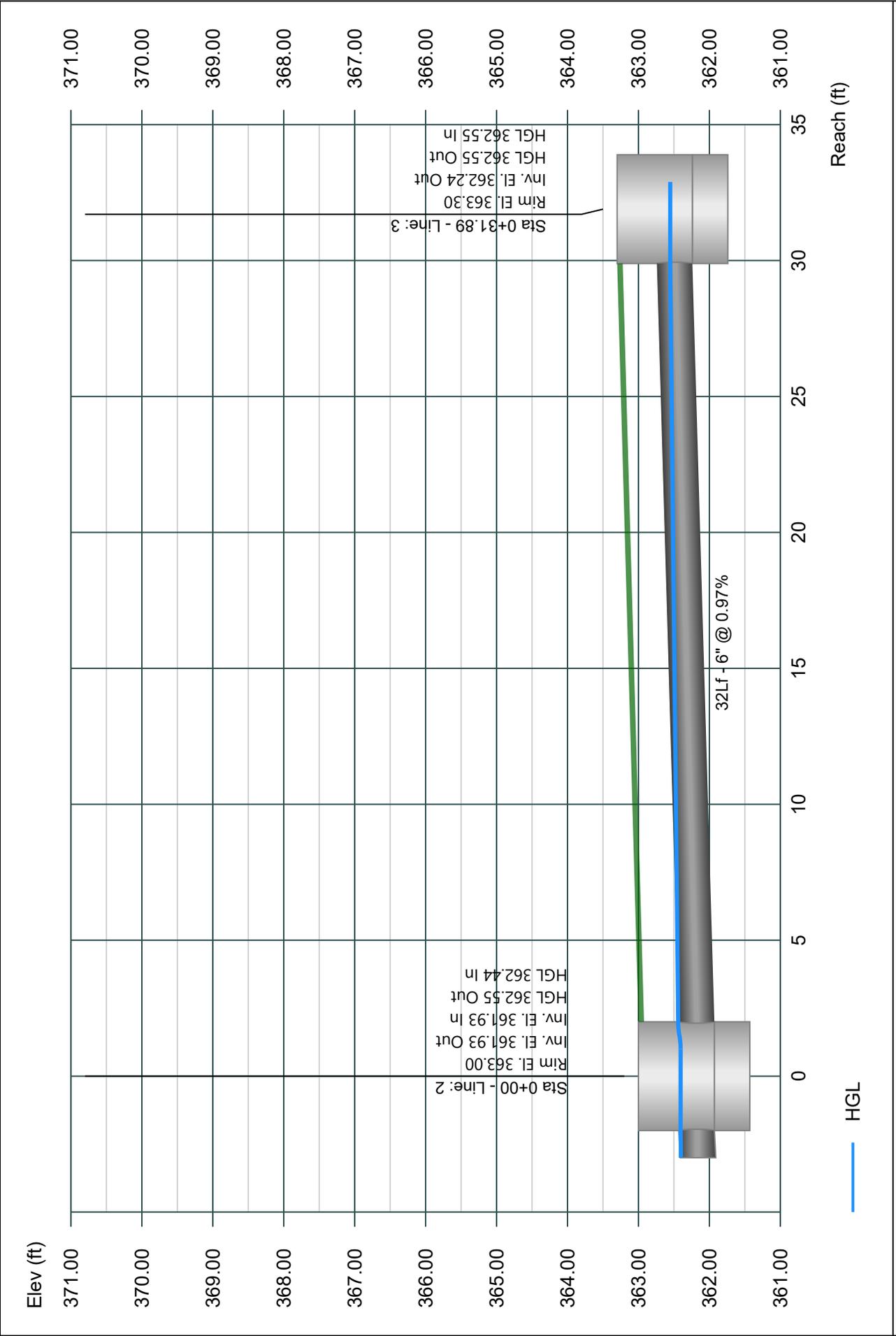


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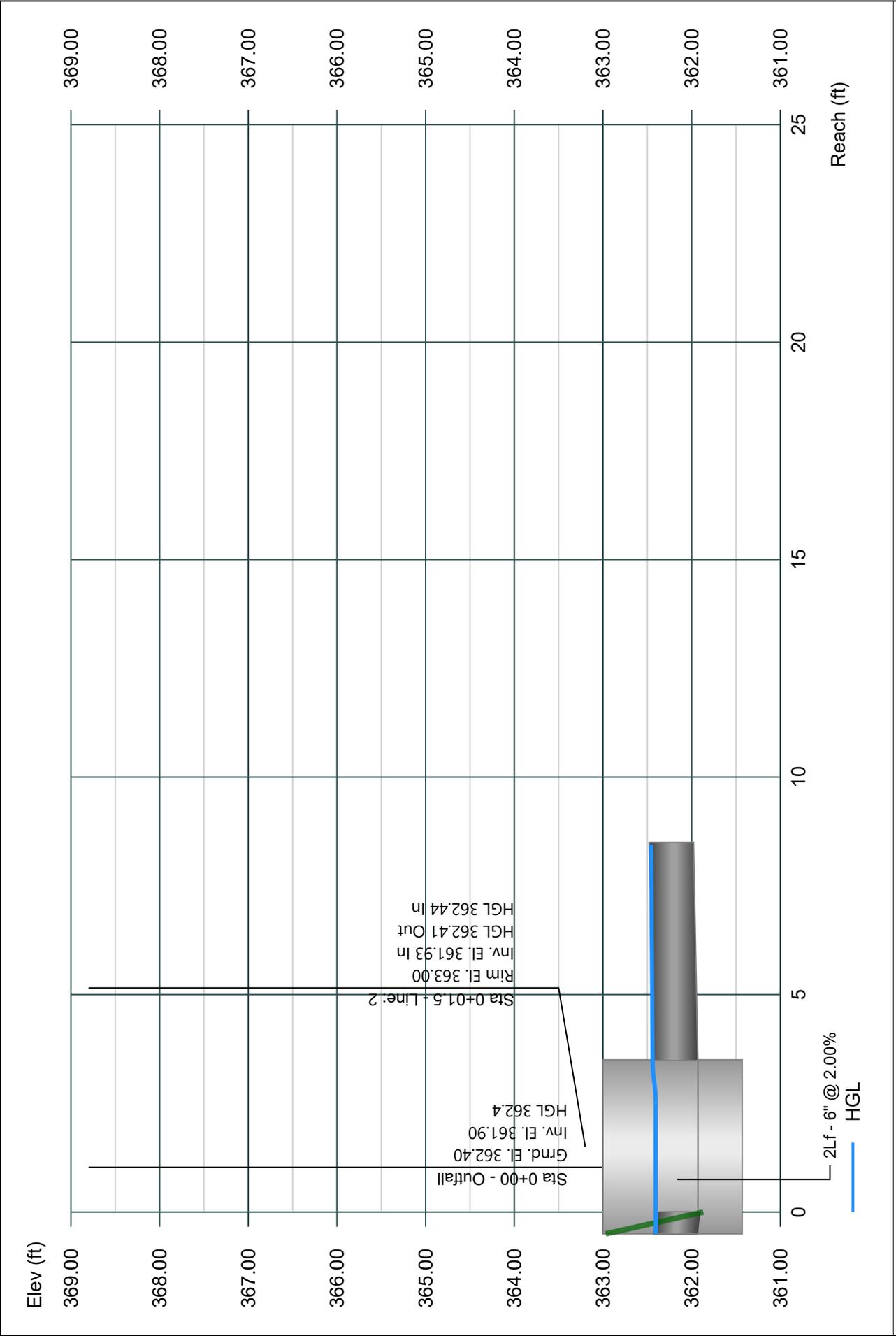


Line 2 - Plan No. 4

Project Name: Enter Project Name...

Stormwater Studio 2019 v 3.0.0.15

11-18-2019



SD Report Report

Stormwater Studio 2019 v 3.0.0.15

Project Name: Enter Project Name...

11-18-2019

Line No.	Line ID	Line Size (in)	Line Length (ft)	Line Slope (ft/ft)	n-value Pipe	Known Q (cfs)	Flow Rate (cfs)	Vel Ave (ft/s)	Minor Loss (ft)	Invert Up (ft)	Invert Dn (ft)	HGL Up (ft)	HGL Dn (ft)	Grnd/Rim Elev Up (ft)	Grnd/Rim Elev Dn (ft)	Junct Type	Line Type
1	Plan No. 1	6	77.21	0.005	0.013	0.24	0.24	1.58	...	362.29	361.90	362.59	362.40	363.80	361.90	None	Cir
2	Plan No. 4	6	1.50	0.02	0.013	0.10	0.44	2.26	0.00	361.93	361.90	362.41	362.40	363.00	361.90	Dp-Grate	Cir
3	Plan No. 3	6	31.89	0.0097	0.013	0.34	0.34	2.19	0.00	362.24	361.93	362.55	362.44	363.30	363.00	Dp-Grate	Cir

Notes: IDF File = 18235-Intensity Data Chart.IDF, Return Period = 2-ys.

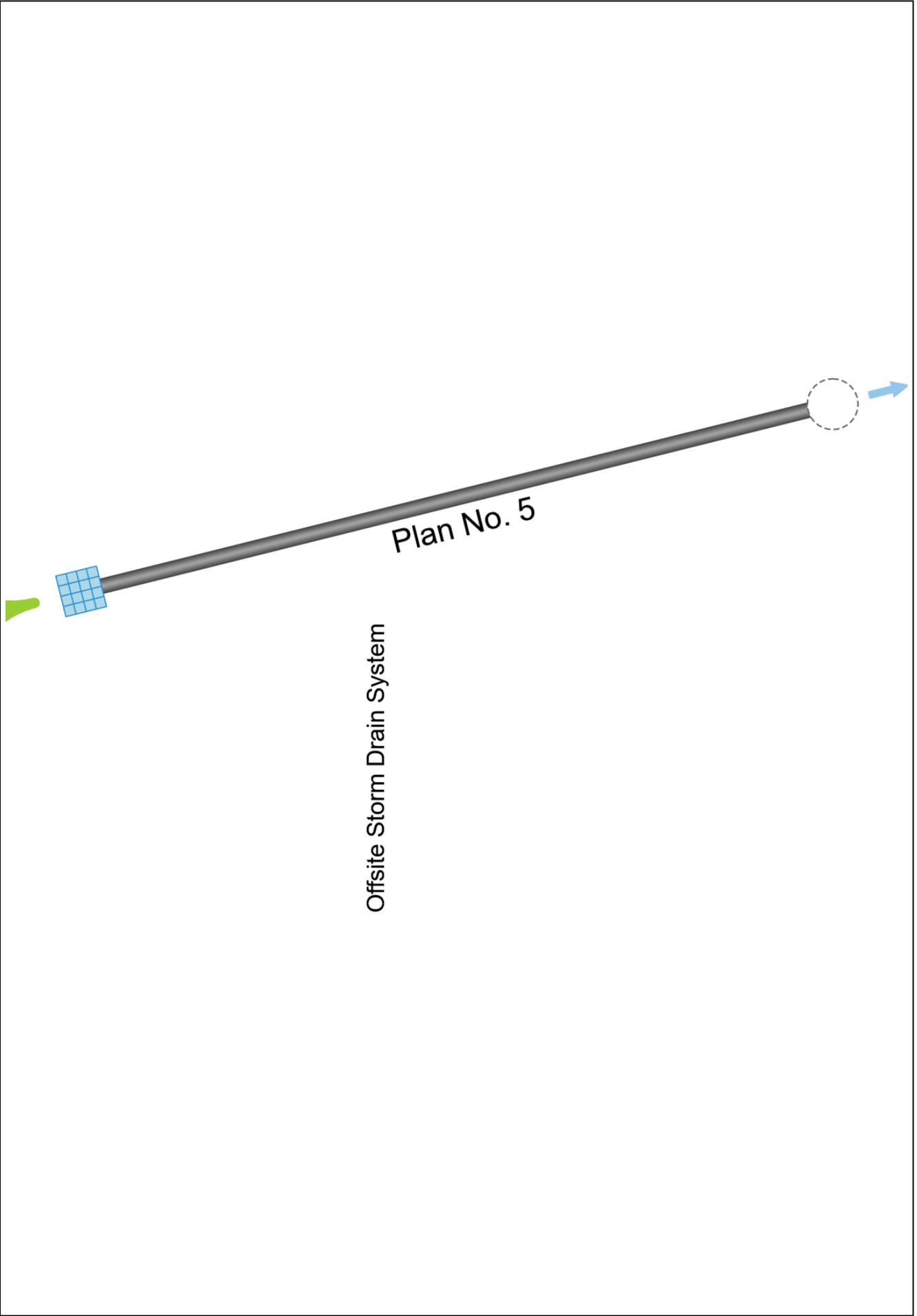
Project File: 18235-Onsite Pipes.sws

Plan View

Stormwater Studio 2019 v 3.0.0.15

Project Name: Enter Project Name...

11-19-2019

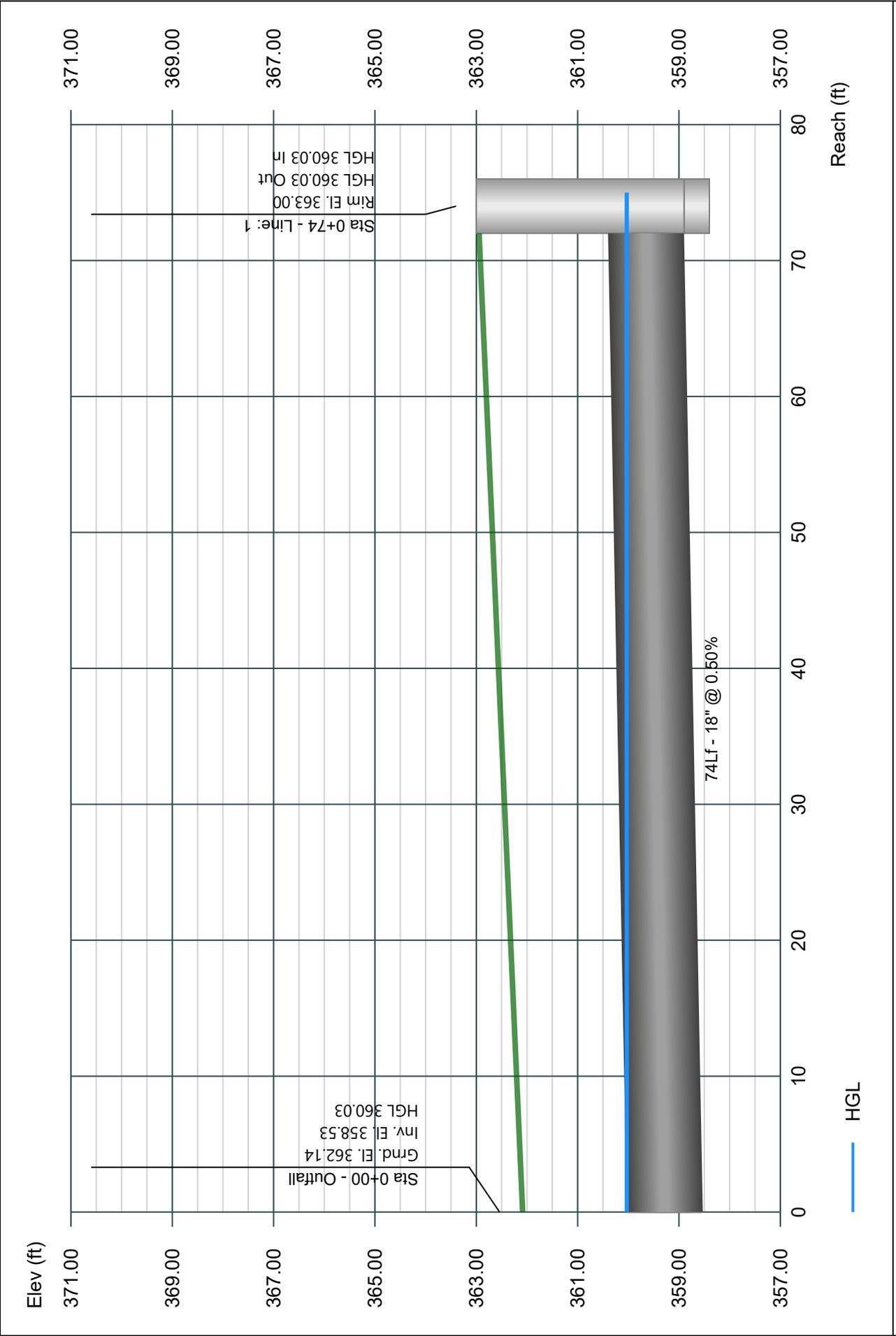


Line 1 - Plan No. 5

Project Name: Enter Project Name...

Stormwater Studio 2019 v 3.0.0.15

11-19-2019



SD Report Report

Stormwater Studio 2019 v 3.0.0.15

Project Name: Enter Project Name...

11-19-2019

Line No.	Line ID	Line Size (in)	Line Length (ft)	Line Slope (ft/ft)	n-value Pipe	Known Q (cfs)	Flow Rate (cfs)	Vel Ave (ft/s)	Minor Loss (ft)	Invert Up (ft)	Invert Dn (ft)	HGL Up (ft)	HGL Dn (ft)	Grnd/Rim Elev Up (ft)	Grnd/Rim Elev Dn (ft)	Junct Type	Line Type
1	Plan No. 5	18	74.00	0.005	0.013	0.29	0.29	0.18	0.00	358.90	358.53	360.03	360.03	363.00	362.14	Dp-Grate	Cir

Notes: IDF File = 18235-Intensity Data Chart.IDF, Return Period = 2-yrs.

Project File: 18235-Offsite Pipes.sws

EXHIBIT A

EXHIBIT B

LEGEND

SYMBOL	DESCRIPTION
---	PROJECT BOUNDRY
█	DRAINAGE BOUNDARY
→	FLOW DIRECTION

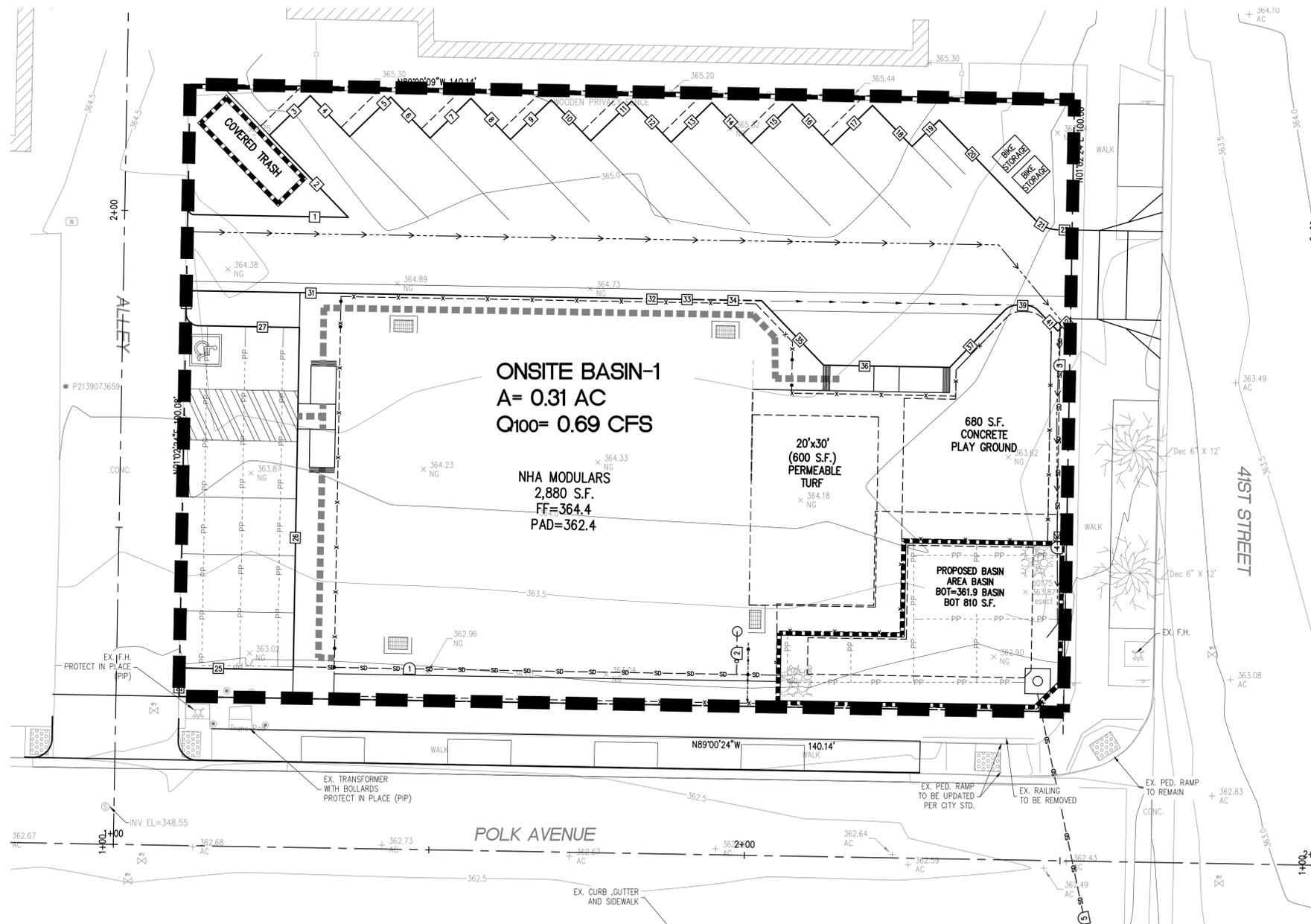
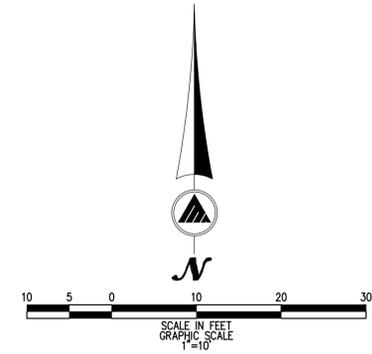


EXHIBIT 'B'
POST DEVELOPMENT MAP FOR
NEIGHBORHOOD HOUSE ASSOCIATES
CITY OF SAN DIEGO, CA


Planning ▲ Engineering △ Surveying
Solved.
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DATE: Nov 19, 2019-10:23am by: rfhigpen FILE: I:\18235\PROD\Reports\Hydrology\Exhibits\18235-Post Drainage.dwg