CEQA PRELIMINARY DRAINAGE REPORT

PERRIN WINERY

RECORD ID: PDS2016-AD-16-023
APN 276-101-04, 276-101-05, 276-101-06
16138 Highland Valley Road
Escondido, CA 92025

Prepared By:

Damon Morelli, P.E. RCE 063621

REGISTERED PROFESSIONAL ENGINEER
DAMON ERIC MORELLI
No. C063621
EXP. 9-30-20
CIVIL
STATE OF CALIFORNIA

EBA Engineering, Inc.
825 Sonoma Avenue, Suite C
Santa Rosa, CA 95404
(EBA Project No. 16-2281)

Prepared for:
Gregory L. Perrin
30318 Longhorn Drive
Canyon Lake, CA 92587
November 8, 2019

C-1

DECLARATION OF RESPONSIBLE CHARGE

DECLARATION OF RESPONDIBLE 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 PROFESSION CODE, AND THAT THE DESIGN IS CONSISTENT WITH THE CURRENT STANDARDS.

I UNDERSTAND THAT THE CHECK OF PROJECT DRAWINGS AND SPECIFICATIONS BY THE CITY OF SAN DIEGO IS CONFINED TO A REVIEW ONLY AND DOES NOT RELIEVE ME, AS ENGINEER OF WORK, OF MY RESPONSIBILITIES FOR PROJECT DESIGN.

ENGINEER OF WORK

____

Damon Morelli, RCE 063621 DATE

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1.0 PROJECT INFORMATION

1.1 INTRODUCTION AND PREDEVELOPMENT SITE CONDITION

This CEQA Preliminary Drainage Study is prepared for the Perrin Winery project located at 16138 Highland Valley Road, Escondido, CA 92025 in Ramona Community Plan area, within unincorporated San Diego County, see the project vicinity map. The site APNs are 276-101-04, 276-101-05, 276-101-06. The proposed improvements of winery facilities and buildings are in APN 276-101-05. The APNs 276-101-04 and 276-101-06 will only involve with access road improvements. The existing site is a single-family residence with over 22 acres of vineyard that would be retained. The site consists of existing concrete/unpaved onsite private road connected to Highland Valley Road at the east entrance and wraps around the project site along the mountain ridge and connected to Highland Valley Road at the west entrance. There is a seasonal creek that flows from east to west crossing both entrances along Highland Valley Road. There are two existing 36-inch culverts at each crossing. The majority site drainage runoff sheet flows in north to south direction towards vineyard area and ultimately flows to the seasonal creek located south of the site that runs along Highland Valley Road in southeast to northwest direction. See Predevelopment Site Discharge Hydrology Map in Appendix A for more detail. The project total disturbed area is 197,069 sf or 4.5 acres and the existing impervious area for this project is 1.22 acres or 27.1% of the site. The site drainage has been divided into 5 systems with subarea to be compared with the post development condition. Systems #1 through #4 drains to seasonal creek on the south side while System #5 drains to the other side of the hill. The runoff is calculated using rational method for each drainage area. Table 1 shows the predevelopment drainage area (A), runoff coefficient (C), time of concentration (Tc), rainfall intensity (I), peak runoff flow rate (Q_{100}) and discharge velocity (V_{100}) at the discharge point during 100-year storm event for each drainage system.

System #1

System #1 includes subarea A and B which drain from the north of the project site through the open area and ultimately discharges at the west entrance of the project site.

System #2

System #2 includes subarea C and D which drain from the north to southeast along the onsite private road and discharge through the open area at the northeast vineyard area that ultimately flows down to the lower seasonal creek.

System #3

System #3 includes subarea E located on the east area of the project site. The includes a partial hillside and along the onsite private road and discharge to sideslope concrete v-ditch which ultimately discharge to the lower seasonal creek.

System #4

System #4 include subarea F located at the north area of east entrance area. The runoff is discharged to the seasonal creek at the east entrance.

System #5

System #5 include a small subarea G on the north side of the site that discharges to the other side of the hill.

1.2 PROJECT VINCINITY MAP

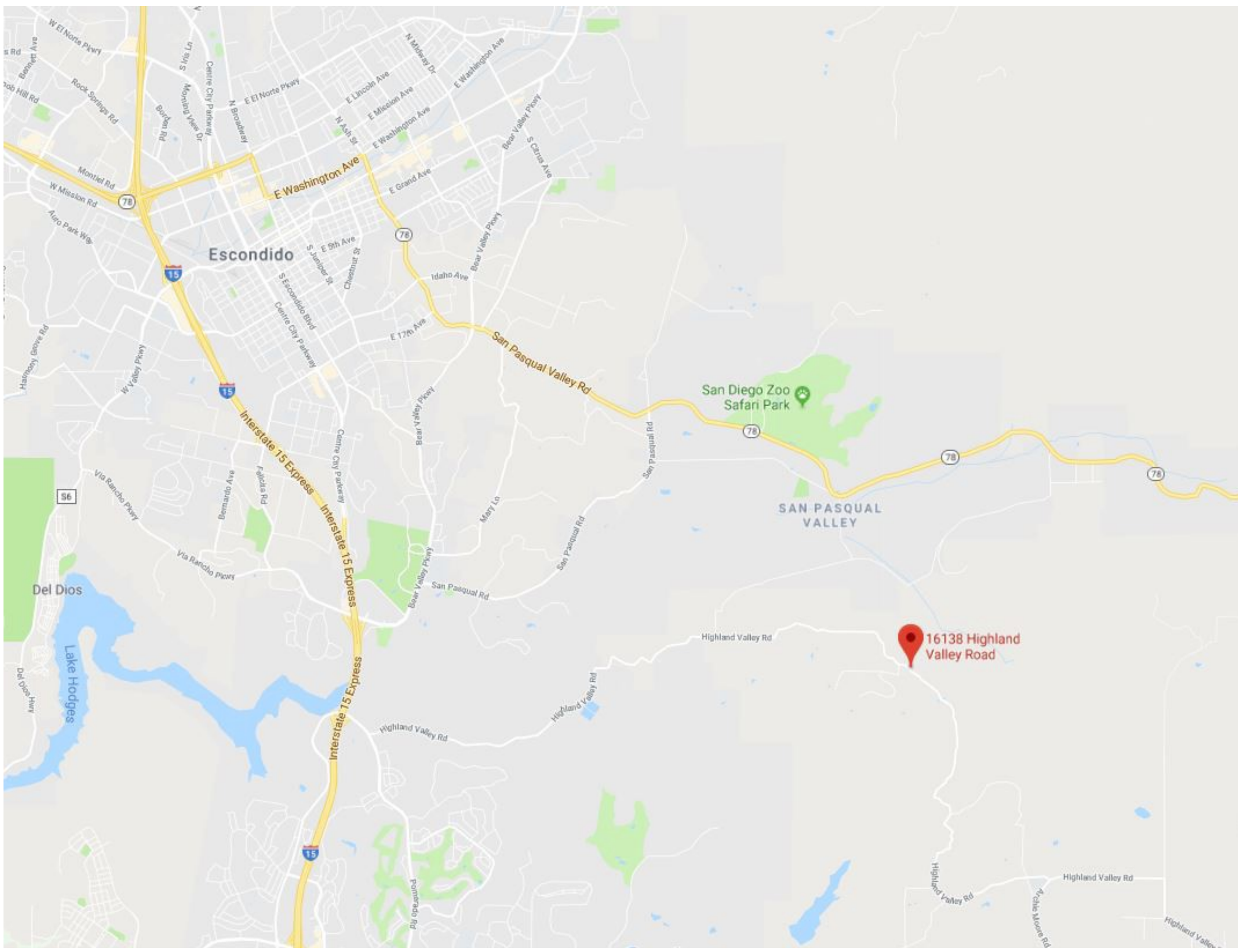


Figure 1 Project vicinity map

1.3 POST DEVELOPMENT CONDITION

The proposed project improvements consist of paved access road, a new winery facility, a crush pad, hospitality building, a climatized storage building, and parking. The proposed impervious area is approximately 2.92 acres or 64.6% of the disturbed area (see Post Development Site Discharge Hydrology Map in Appendix A). The runoff generated by rooftops of the buildings, paved parking lot, paved access road, and other impervious areas will be routed to bioretention areas prior to exiting the site.

The proposed site drainage has been divided into 5 systems with subarea to be compared with the pre-development condition. Systems #1 through #4 drains to seasonal creek on the south side while System #5 drains to the other side of the hill. There is no change in drainage pattern between predevelopment and post development conditions. The summary table in Appendix C.7 shows the post development drainage area (A), runoff coefficient (C), time of concentration (Tc), rainfall intensity (I), peak runoff flow rate (Q_{100}) and discharge velocity (V_{100}) at the discharge point during 100-year storm event for each drainage system.

System #1

System #1 is divided into three subsystems #1A, #1B and #1C. System #1A includes subarea E, F, and A. Subarea E and F drain to each drop inlet then discharge back to drainage area A through the energy dissipator to be discharged at a non-erosive velocity. The runoff from Area A drains to catch basin then the underground piping system and to the bioretention basin #1 located at the west entrance.

System #1B include subarea B that collect the surface runoff from the hill side and along the paved road through the concrete V-ditch and drains to the drop inlet before discharging to the bioretention basin #2 for the subarea B. The drainage from the basin will be discharge to the lower creek.

System #1C includes subarea C which drain from the northwest open area to paved road and to catch basin then drain to bioretention basin #3 and ultimately discharges to the lower creek at the west entrance of the project site.

System #2

System #2 includes subarea G that drains from the north side to the vineyard area located at the northeast area of the project site. The runoff will be treated and capture at Biofiltration #5 with partial retention and will be sheet flow back to the lower which ultimately drains to the lower creek.

System #3

System #3 includes subarea H located on the east area of the project site and along the paved road. The existing sideslope concrete V-ditch that used to intercept the runoff will be abandoned and replaced with bioretention basin #6 at the nearby location. Once the runoff is mitigated the remaining runoff will be discharged to the lower creek.

System #4

System #4 include subarea I located at the south entrance area. The runoff is discharged to the seasonal creek at the east entrance.

System #5

System #5 include a parking lot subarea G on the north side of the site that discharges to the biofiltration #4 with partial retention and ultimately discharges to other side of the hill.

Each drainage system will mitigate the runoff to reduce the post-development peak runoff flow rate less than the pre-development conditions. The bioretention and biofiltration areas will treat and detain the runoff in order to mitigate potential hydromodification impacts. The proposed drainage system is adequate to handle 100-year storm event without flooding the site. The outlet points are located at the same or nearby the existing discharge locations. All outlet will be designed to discharge at a non-erosive velocity.

1.4 OVERALL WATERSHED HYDROLOGY

Predevelopment 100-year hydrology map shows the overall tributary watershed area of 706.5 acres producing runoff through the site entrances (see Figure HYD1 in Appendix B). Based on the hydrology calculation, the site has the peak flow rate (Q_{100}) approximately 845 cubic feet per second (cfs) through the site during the 100-yr storm event assuming all watersheds has hydrologic soil group “C”. The post development hydrology map for the whole watershed area (see Figure HYD2 in Appendix B) calculated by adjusting the post development runoff coefficient (C) shows that the peak flow rate (Q_{100}) has increased to 849.0 cfs. The increase in the post development peak flow rate is considered to be insignificant when considered the overall watershed and assuming that the existing culverts would be able to handle the increased flow. However, the project will mitigate the post development peak runoff flow rate (Q_{100}) to be less or equal the predevelopment conditions at the same discharge point. Existing culverts improvements and/or restoration at both entrances may occur to ensure that the culverts are capable of handling such flow and the runoff will not flood the site.

1.5 100-YR FLOOD HAZARD AREA

The site is located in area of minimal flood hazard (Unshaded Zone X) as listed on FEMA FIRMette Map (see Attachment D). The 100-yr inundation line is defined based on the overall watershed hydrology and is shown on Pre-Development and Post Development Hydrology Map Figures. There will be no structures or buildings that may impede or redirect flood flow.

1.6 PROJECT Q&A

Here is the list of Q&A for project review and approval:
Q: Will the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?

A: No. The drainage patterns will not be altered significantly in the post development condition. There is no alteration to a stream and a river that will increase erosion and siltation on- or off-site.

Q: Will the project substantially alter the existing drainage pattern of the site or area including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?

A: No. The overall drainage patterns will be maintained similar to the existing condition. There is no alteration of the course of a stream or river and the rate or amount of runoff will not significantly increase to cause flooding on- or off-site.

Q: Will the project create or contribute runoff water which will exceed the capacity of existing or planned storm water drainage systems?

A: No. The project will not create or contribute runoff water which will exceed the capacity of existing or planned storm water drainage systems.

Q: Will the project place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map, including County Floodplain Maps?

A: No. The project site is not located within a 100-year flood hazard area. See FEMA Flood Zone Map in Appendix D.

Q: Will the project place within a 100-year flood hazard area structures which would impede or redirect flood flows?

A: No. The project site is not located within a 100-year flood hazard area that will impede or redirect flood flows.

2.0 HYDROLOGY CALCULATIONS AND BASIN SIZING

2.1 HYDROLOGY AND HYDRAULIC CALCULATIONS

The proposed project will increase impervious surface from existing conditions that results in increasing stormwater runoff. The proposed bioretention basins and other stormwater drainage structures are designed to detain the increased runoff and to reduce any impacts on public drainage systems or downstream courses. The project will mitigate the increased runoff by a series of stormwater Best Management Practices (BMPs) as part of Hydro Modification Management Plan (HMP) requirements.

The calculations only compare stormwater runoff between the predevelopment condition and post development condition within the improvement areas. The drainage area outside the impacted areas are not considered. Using "Rational Method" for 6-hour 100-year storm, the

Drainage Summary

	Pre-Development						Post-Development							Mitigated		Mitigation Method
	C_w	T_c	I	A_T	V_{100}	**Q_{100}**	C_w	T_c	I	A_T	V_{100}	**Q_{100}**	ΔQ	V_{100}	**Q_{100}**	
	(unitless)	(minutes)	(inch/hour)	(acre)	(ft/sec)	**(cfs)**	(unitless)	(minutes)	(inch/hour)	(acre)	(ft/sec)	**(cfs)**	(cfs)	(ft/sec)	**(cfs)**	
POC 1	0.39	23.46	3.40	4.16	11.49	**5.59**	0.55	22.26	3.52	4.12	11.49	**8.02**	2.43	10.52	**4.78**	**Bioretention. Please See Attached Basin Routing Worksheets.**
POC 2	0.52	15.03	4.53	1.14	9.13	**2.68**	0.45	17.09	4.17	1.27	8.74	**2.40**	-0.28	n/a	**n/a**	**Post Development Flow is Less Than Pre Development Flows. No Flow Mitigation required.**
POC 3	0.39	18.12	4.02	1.71	8.87	**2.69**	0.42	13.56	4.85	1.66	9.61	**3.41**	0.72	8.87	**2.52**	**Bioretention. Please See Attached Basin Routing Worksheets.**
POC 4	0.64	8.28	6.66	0.13	5.45	**0.53**	0.88	5.38	8.80	0.14	7.12	**1.10**	0.57	4.90	**0.40**	**Bioretention. Please See Attached Basin Routing Worksheets.**
POC 5	0.51	19.73	3.80	0.73	7.36	**1.40**	0.77	10.37	5.76	0.51	8.48	**2.25**	0.85	6.73	**1.04**	**Bioretention. Please See Attached Basin Routing Worksheets.**
POC 6	0.47	14.37	4.67	1.51	9.51	**3.28**	0.49	16.21	4.32	1.52	9.55	**3.20**	-0.08	n/a	**n/a**	**Post Development Flow is Less Than Pre Development Flows. No Flow Mitigation required.**
POC 7	0.61	9.85	5.96	0.26	6.54	**0.95**	0.62	8.78	6.41	0.23	6.59	**0.91**	-0.04	n/a	**n/a**	**Post Development Flow is Less Than Pre Development Flows. No Flow Mitigation required.**

flow rate (Q) is calculated at each control point.

Detail hydrology and hydraulic calculations can be found in Appendix C.

2.2 BASIN SIZING

The pond for each DMA was sized to allow storage for the 100-year storm to mitigate additional runoff due to the development of the site based on the pond storage routing analysis outlined in the San Diego County Hydraulic Design Manual, September 2014, Section 6. The routing calculations and resulting hydrographs can be found in Appendix C.

3.0 CONCLUSION

The proposed project improvements will not significantly alter the existing drainage patterns nor alter the course of the seasonal creek that flows through the site. Hydro Modification Plan (HMP), Best Management Practices (BMPs), and mitigation measures will be implemented to capture and reduce the peak runoff before it is discharged to ensure that there will be no damage to the downstream drainage facilities and drainage channels which could result in substantial erosion or siltation on- or off-site.

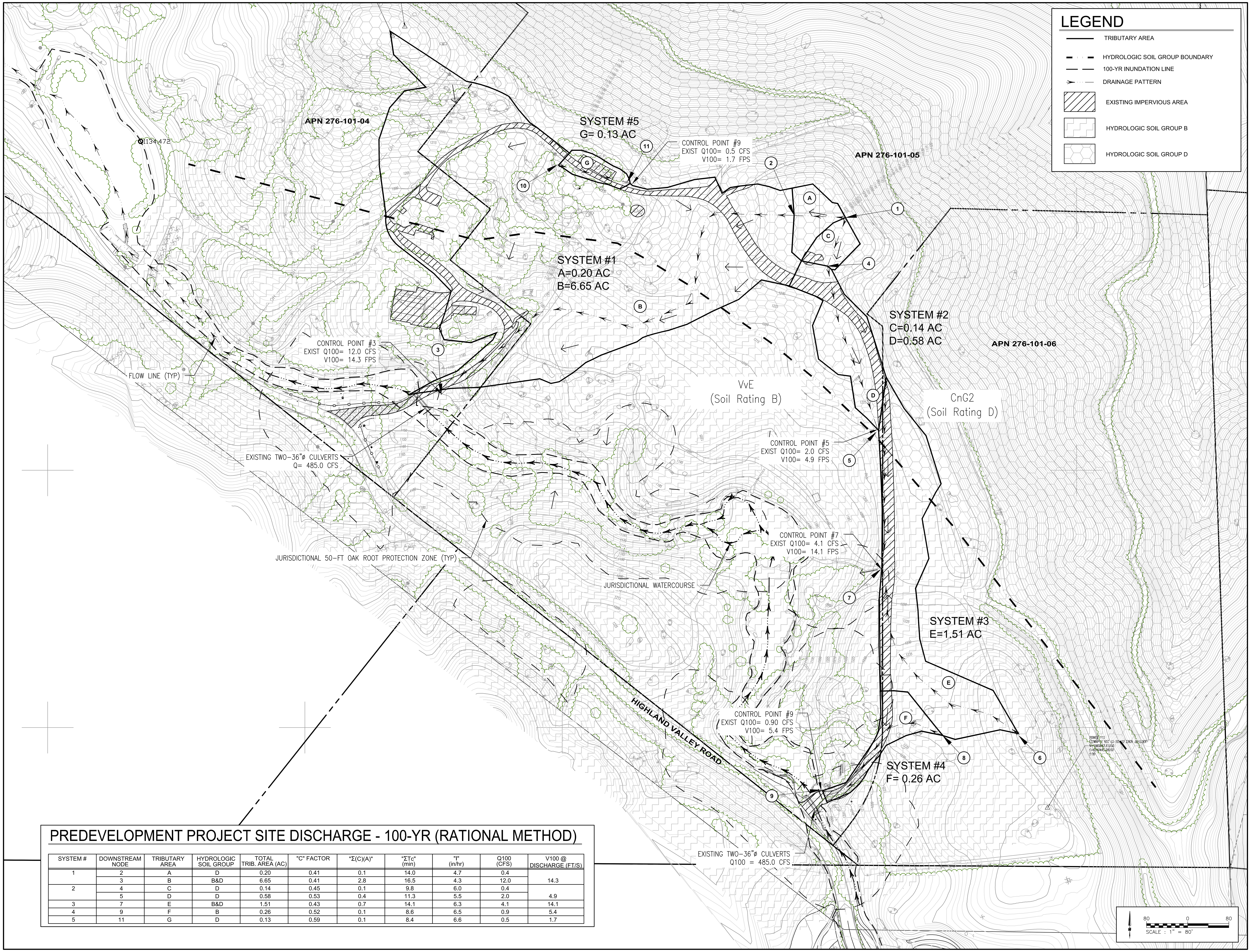
The final design of HMP, BMPs, onsite stormwater facilities will be presented in the final report.

APPENDIX A

SITE DISCHARGE HYDROLOGY MAPS

APPENDIX A.1

PRE-DEVELOPMENT SITE DISCHARGE HYDROLOGY MAP FOR CONDUIT AND CHANNEL ANALYSIS



PREDEVELOPMENT PROJECT SITE DISCHARGE - 100-YR (RATIONAL METHOD)

SYSTEM #	DOWNSTREAM NODE	TRIBUTARY AREA	HYDROLOGIC SOIL GROUP	TOTAL TRIB. AREA (AC)	"C" FACTOR	"Σ(C)(A)"	"ΣTc" (min)	"I" (in/hr)	Q100 (CFS)	V100 @ DISCHARGE (FT/S)
1	2	A	D	0.20	0.41	0.1	14.0	4.7	0.4	
	3	B	B&D	6.65	0.41	2.8	16.5	4.3	12.0	14.3
2	4	C	D	0.14	0.45	0.1	9.8	6.0	0.4	
	5	D	D	0.58	0.53	0.4	11.3	5.5	2.0	4.9
3	7	E	B&D	1.51	0.43	0.7	14.1	6.3	4.1	14.1
4	9	F	B	0.26	0.52	0.1	8.6	6.5	0.9	5.4
5	11	G	D	0.13	0.59	0.1	8.4	6.6	0.5	1.7

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T 707.935.7944
F 707.935.6618
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825 SONOMA AVENUE
SUITE C
SANTA ROSA, CA 95404
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PRE-DEVELOPMENT SITE DISCHARGE HYDROLOGY MAP

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DRAWN BY: WC
SCALE: AS SHOWN
DATE: NOVEMBER 8, 2019

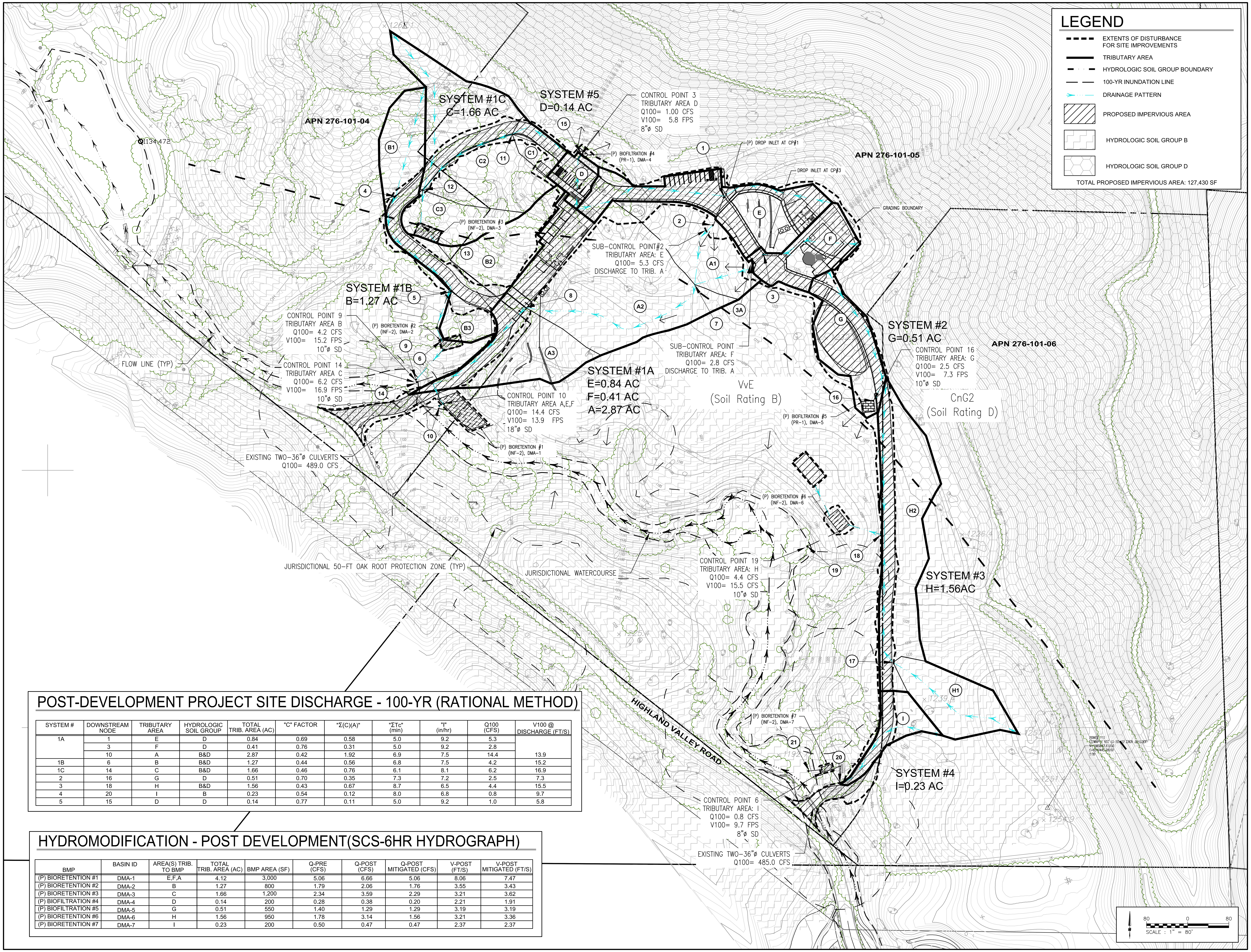
PROJECT NO. 16-2281

1

FIGURE NO.

APPENDIX A.2

POST-DEVELOPMENT SITE DISCHARGE HYDROLOGY MAP FOR CONDUIT AND CHANNEL ANALYSIS



POST-DEVELOPMENT PROJECT SITE DISCHARGE - 100-YR (RATIONAL METHOD)

SYSTEM #	DOWNSTREAM NODE	TRIBUTARY AREA	HYDROLOGIC SOIL GROUP	TOTAL TRIB. AREA (AC)	"C" FACTOR	"Σ(C)(A)"	"ΣTc" (min)	"I" (in/hr)	Q100 (CFS)	V100 @ DISCHARGE (FT/S)
1A	1	E	D	0.84	0.69	0.58	5.0	9.2	5.3	
	3	F	D	0.41	0.76	0.31	5.0	9.2	2.8	
	10	A	B&D	2.87	0.42	1.92	6.9	7.5	14.4	13.9
1B	6	B	B&D	1.27	0.44	0.56	6.8	7.5	4.2	15.2
1C	14	C	B&D	1.66	0.46	0.76	6.1	8.1	6.2	16.9
2	16	G	D	0.51	0.70	0.35	7.3	7.2	2.5	7.3
3	18	H	B&D	1.56	0.43	0.67	8.7	6.5	4.4	15.5
4	20	I	B	0.23	0.54	0.12	8.0	6.8	0.8	9.7
5	15	D	D	0.14	0.77	0.11	5.0	9.2	1.0	5.8

HYDROMODIFICATION - POST DEVELOPMENT(SCS-6HR HYDROGRAPH)

BMP	BASIN ID	AREA(S) TRIB. TO BMP	TOTAL TRIB. AREA (AC)	BMP AREA (SF)	Q-PRE (CFS)	Q-POST (CFS)	Q-POST MITIGATED (CFS)	V-POST (FT/S)	V-POST MITIGATED (FT/S)
(P) BIORETENTION #1	DMA-1	E,F,A	4.12	3,000	5.06	6.66	5.06	8.06	7.47
(P) BIORETENTION #2	DMA-2	B	1.27	800	1.79	2.06	1.76	3.55	3.43
(P) BIORETENTION #3	DMA-3	C	1.66	1,200	2.34	3.59	2.29	3.21	3.62
(P) BIOFILTRATION #4	DMA-4	D	0.14	200	0.28	0.38	0.20	2.21	1.91
(P) BIOFILTRATION #5	DMA-5	G	0.51	550	1.40	1.29	1.29	3.19	3.19
(P) BIORETENTION #6	DMA-6	H	1.56	950	1.78	3.14	1.56	3.21	3.36
(P) BIORETENTION #7	DMA-7	I	0.23	200	0.50	0.47	0.47	2.37	2.37

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POST-DEVELOPMENT SITE DISCHARGE HYDROLOGY MAP

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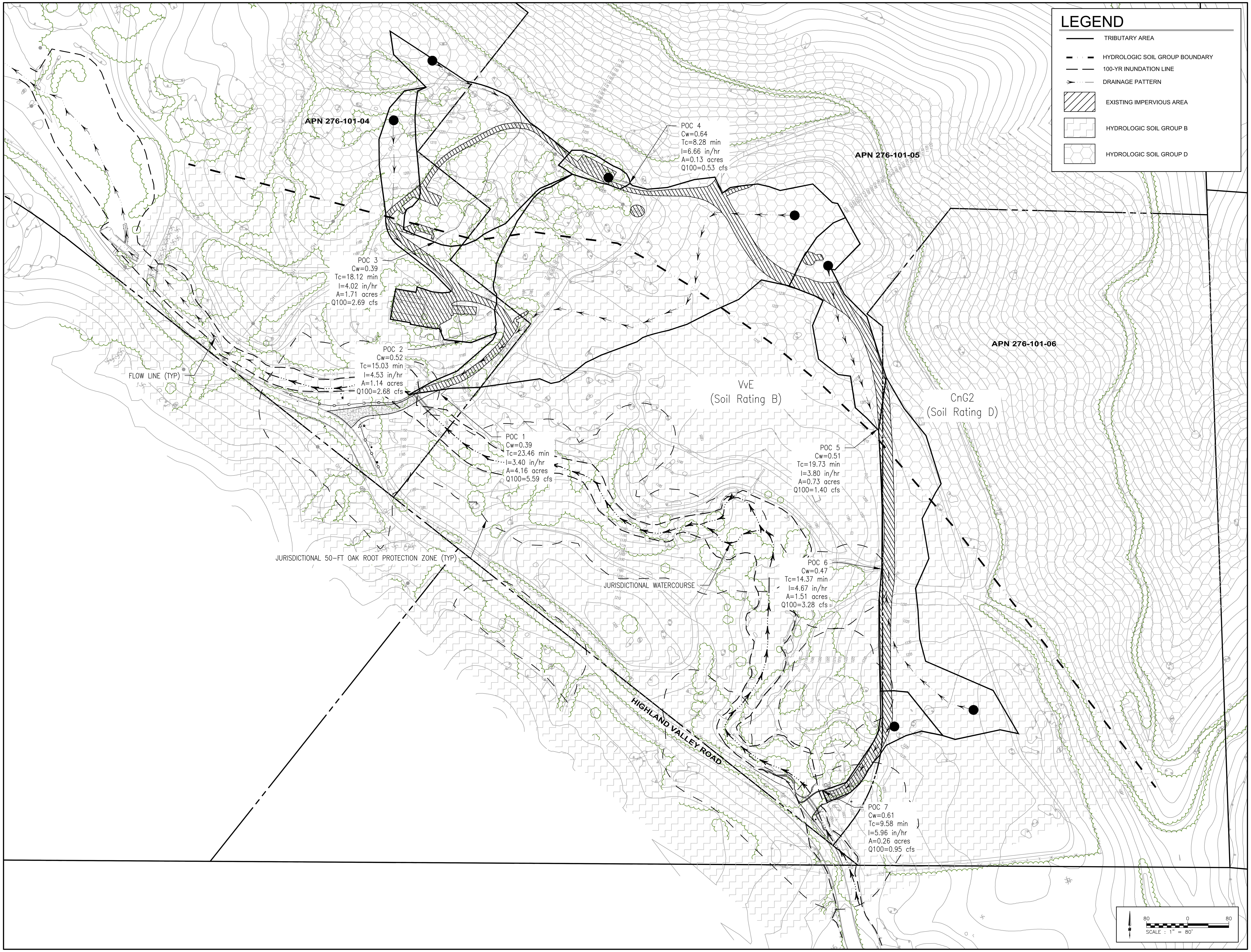
2

FIGURE NO.

APPENDIX A.3

POST-DEVELOPMENT SITE MAP FOR BASIN ROUTING ANALYSIS



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PRE-DEVELOPMENT BASIN ANALYSIS HYDROLOGY MAP

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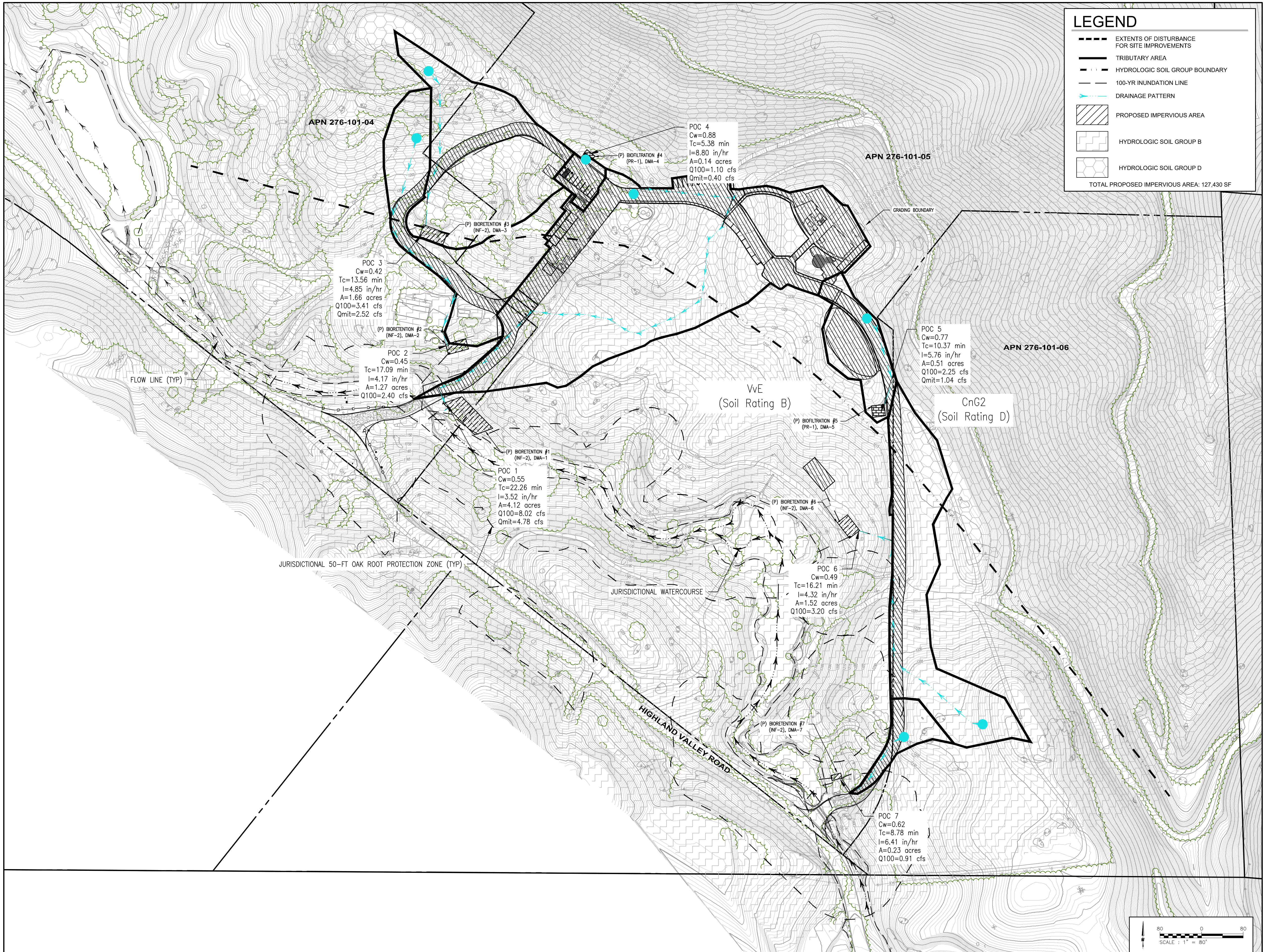
FIGURE NO.

APPENDIX A.4

POST-DEVELOPMENT SITE MAP FOR BASIN ROUTING ANALYSIS



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Sonoma, California 95476
T 707.935.7944
F 707.935.6618
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POST-DEVELOPMENT SITE DISCHARGE HYDROLOGY MAP

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2

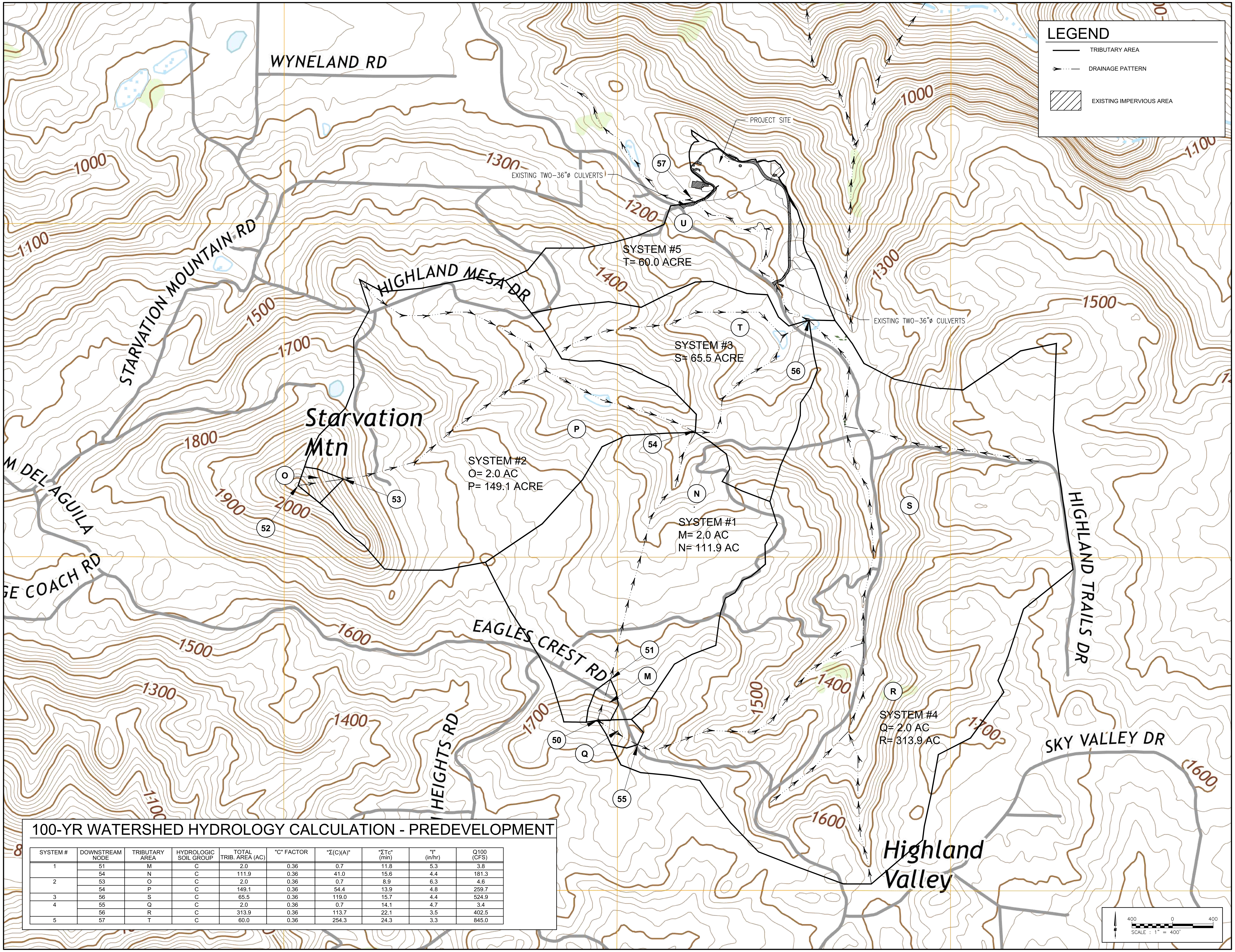
FIGURE NO.

APPENDIX B

100-YR WATERSHED HYDROLOGY MAPS

APPENDIX B.1

PRE-DEVELOPMENT 100-YR WATERSHED HYDROLOGY MAP



100-YR WATERSHED HYDROLOGY CALCULATION - PREDEVELOPMENT

SYSTEM #	DOWNSTREAM NODE	TRIBUTARY AREA	HYDROLOGIC SOIL GROUP	TOTAL TRIB. AREA (AC)	"C" FACTOR	"Σ(C)(A)"	"ΣTc" (min)	"I" (in/hr)	Q100 (CFS)
1	51	M	C	2.0	0.36	0.7	11.8	5.3	3.8
	54	N	C	111.9	0.36	41.0	15.6	4.4	181.3
2	53	O	C	2.0	0.36	0.7	8.9	6.3	4.6
	54	P	C	149.1	0.36	54.4	13.9	4.8	259.7
3	56	S	C	65.5	0.36	119.0	15.7	4.4	524.9
4	55	Q	C	2.0	0.36	0.7	14.1	4.7	3.4
	56	R	C	313.9	0.36	113.7	22.1	3.5	402.5
5	57	T	C	60.0	0.36	254.3	24.3	3.3	845.0

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ARCHITECTURE
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PREDEVELOPMENT 100-YR WATERSHED HYDROLOGY MAP

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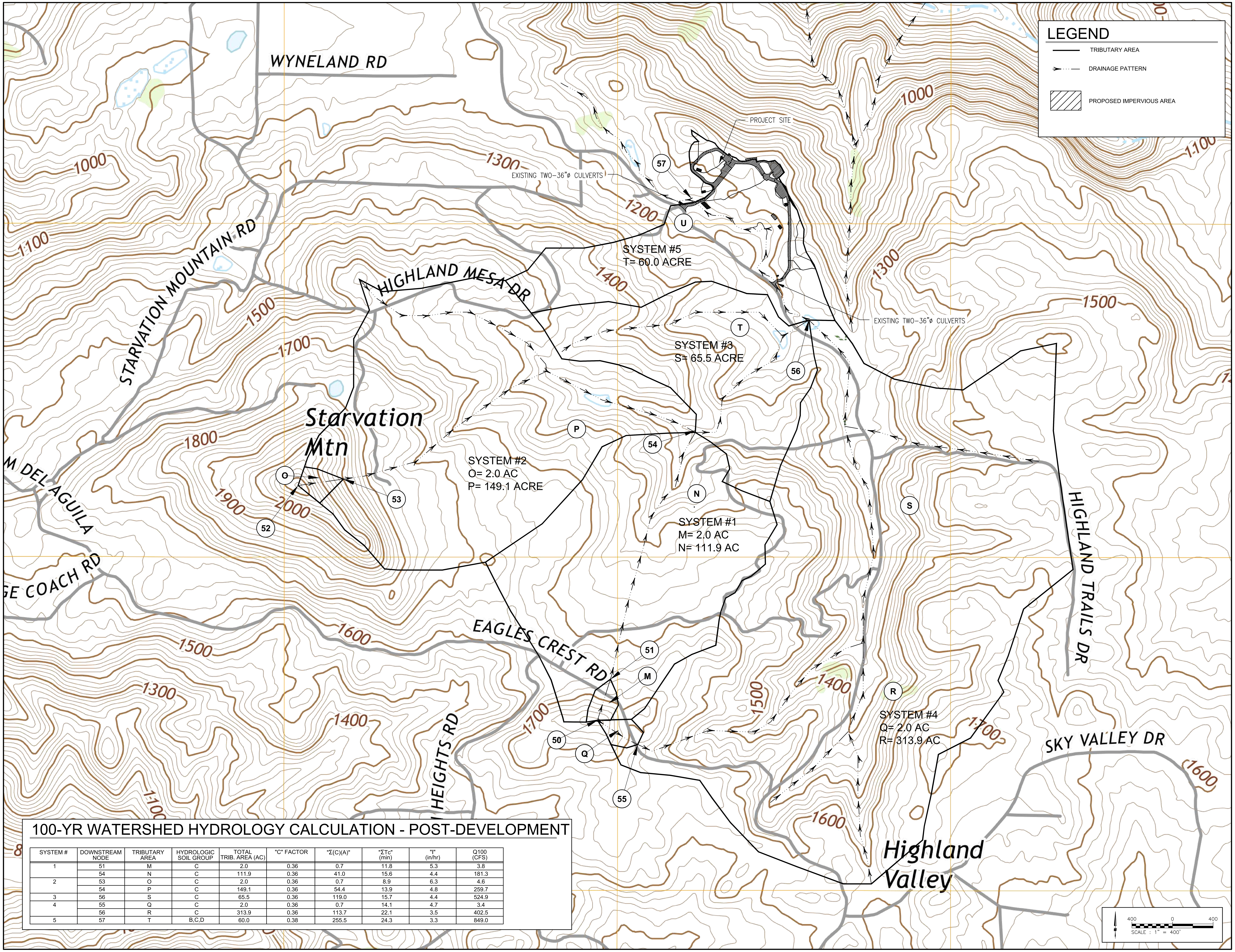
HYD1

FIGURE NO.

APPENDIX B.2

POST-DEVELOPMENT 100-YR WATERSHED HYDROLOGY MAP



100-YR WATERSHED HYDROLOGY CALCULATION - POST-DEVELOPMENT

SYSTEM #	DOWNSTREAM NODE	TRIBUTARY AREA	HYDROLOGIC SOIL GROUP	TOTAL TRIB. AREA (AC)	"C" FACTOR	"Σ(C)(A)"	"ΣTc" (min)	"I" (in/hr)	Q100 (CFS)
1	51	M	C	2.0	0.36	0.7	11.8	5.3	3.8
	54	N	C	111.9	0.36	41.0	15.6	4.4	181.3
2	53	O	C	2.0	0.36	0.7	8.9	6.3	4.6
	54	P	C	149.1	0.36	54.4	13.9	4.8	259.7
3	56	S	C	65.5	0.36	119.0	15.7	4.4	524.9
4	55	Q	C	2.0	0.36	0.7	14.1	4.7	3.4
	56	R	C	313.9	0.36	113.7	22.1	3.5	402.5
5	57	T	B,C,D	60.0	0.38	255.5	24.3	3.3	849.0

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23562 Arnold Drive
Sonoma, California 95476
T 707.935.7944
F 707.935.6618
www.STRATAap.com

CONSULTANTS:

EBA ENGINEERING
825 SONOMA AVENUE
SUITE C
SANTA ROSA, CA 95404
TEL: (707) 544-0784

PROJECT

PROPOSED WINERY PROJECT
16138 HIGHLAND VALLEY ROAD, ESCONDIDO, CA

REVISIONS

SHEET TITLE

POST-DEVELOPMENT 100-YR HYDROLOGY MAP

CHECKED BY: DM

DRAWN BY: WC

SCALE: AS SHOWN

DATE: NOVEMBER 8, 2019

PROJECT NO. 16-2281

HYD2

FIGURE NO.

APPENDIX C

HYDROLOGY/HYDRAULIC CALCULATIONS

APPENDIX C.1

PRE-DEVELOPMENT HYDROLOGY/HYDRAULIC CALCULATIONS FOR CONDUIT AND CHANNEL ANALYSIS

Perrin Winery
16138 Highland Valley Road
Escondido, CA
Hydrology Calculations - Predevelopment Project Site Discharge Area
11/8/2019

Calculate Weighted C-Values (Predevelopment)

Assumptions:

1) Assume "Low Density Residential with 1.0DU/A" for pervious areas and "General Commercial" for impervious areas for runoff coefficients on Table 3-1 from County of San Diego Hydrology Manual (2003).

2) Use a C-value of 0.80 and 0.82 for impervious areas soil group B and D.

3) Use a C-value of 0.32 and 0.41 for pervious areas soil group B and D.

Tributary A: (Hydrologic Soil Group D)

pervious areas=	8628	sf
impervious areas =	0	sf
total area =	8628	sf
$C_{weighted}$=	0.41	

Tributary B: (Hydrologic Soil Group B&D)

pervious areas=	107971	sf	Soil group B
impervious areas =	10779	sf	Soil group B
pervious areas=	156220	sf	Soil group D
impervious areas =	14530	sf	Soil group D
total area =	289500	sf	
$C_{weighted}$=	0.41		

Tributary C: (Hydrologic Soil Group D)

pervious areas=	5669	sf
impervious areas =	577	sf
total area =	6246	sf
$C_{weighted}$=	0.45	

Tributary D: (Hydrologic Soil Group D)

pervious areas=	17771	sf
impervious areas =	7579	sf
total area =	25350	sf
$C_{weighted}$=	0.53	

Tributary E: (Hydrologic Soil Group B)

pervious areas=	42076	sf	Soil group B
impervious areas =	10333	sf	Soil group B
pervious areas=	10289	sf	Soil group D
impervious areas =	3164	sf	Soil group D
total area =	65863	sf	
$C_{weighted}$=	0.43		

Tributary F: (Hydrologic Soil Group B)

pervious areas=	6583	sf
impervious areas =	4882	sf
total area =	11465	sf
$C_{weighted}$=	0.52	

Tributary G: (Hydrologic Soil Group D)

pervious areas=	3013	sf
impervious areas =	2477	sf
total area =	5490	sf
$C_{weighted}$=	0.59	

Perrin Winery
16138 Highland Valley Road
Escondido, CA
Hydrology Calculations - Predevelopment Project Site Discharge Area
11/8/2019

100-Yr Watershed Hydrology - Predevelopment Project Site Discharge Area

Assumptions:

1) Use "Overland Time Flow Nomograph" equation for initial time of concentration:

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

Where Ti= Time of Concentration (Minutes)
C= Runoff Coefficient, Use C-Weighted for the system watershed
S= Slope (%)
D or L = Water Course Distance (Feet)
* Assume sheet flow length is 100 feet

2) Use "Time of Concentration" equation from Figure 3-4 of San Diego County Hydrology Manual

$$Tc = \left(\frac{11.9L^3}{\Delta E}\right)^{0.385}$$

Where Tc= Time of Concentration (Hour)
L= Water Course Distance (Miles)
ΔE= Change in Elevation (Feet)
A= Area (Acre)

3) Use "Rainfall Intensity" equation; $I = 7.44\,(P_{6})\,D^{-0.645}$

Where I= Rainfall Intensitty (in/hr)
P_6= ("3.5"), Rainfall Isopluvials 100-Yr 6-Hr ; See Isopluvial Map
D, (Tc)= Time of Concentration (Minutes)

	Tributary Area	Upstream Node	Downstream Node	A, (ac)	D, (ft)	C	(C)*(A)	Σ(CA)	ΔE, (ft)	S, (%)	Ti, (min)	Tc, (min)	ΣTc	v (ft/s)	I, (in/hr)	Q_{100}
System #1	A	1	2	0.20	100	0.41	0.1	0.1	1	1.0	12.4	1.6	14.0		4.7	0.4
	B	2	3	6.65	900	0.41	2.7	2.8	93	10.3		2.4	16.5	14.3	4.3	12.0
System #2*	C	1	4	0.14	100	0.45	0.1	0.1	3	2.5	8.6	1.1	9.8		6.0	0.4
	D	4	5	0.58	332	0.53	0.3	0.4	15	4.5		1.5	11.3	4.9	5.5	2.0
System #3	E	6	7	1.51	457	0.43	0.7	0.7	45	9.8	6.9	2.1	9.0	14.1	6.3	4.1
System #4*	F	8	9	0.26	300	0.52	0.1	0.1	45	14.8	8.0		8.0	5.4	6.8	0.9
System #5*	G	10	11	0.13	100	0.59	0.1	0.1	2	2.0	7.2	1.2	8.4	1.7	6.6	0.5

*Assume System #2, #4 and #5 sheet flow to natural watershed.

Perrin Winery
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Escondido, CA
Hydrology Calculations - Predevelopment Project Site Discharge Area
11/8/2019

Determine t_c:

System #1
t_c @ Point of Concentration #2 14 min

Determine t_c from Line of Point 2 to 3:

Q @ Point 2=	0.4	cfs	
Estimated Q @ Point 3=	12.3	cfs	** Based on q_{avg} = 1.8 cfs/acre
Average Q in reach=	6.4	cfs	

<u>*Assume Triangular Channel Flow:*</u>

Q=	6.4	cfs	→ SEE CALCS, PG.
n=	0.035		
side slopes=	4:1		
slope=	0.103		
velocity=	6.15	fps	*** Per Channel Report, pg.
flow length=	900	ft	
travel time=	2.4	min	From POC #2 to #3

System #2
t_c @ Point of Concentration #4 9.8 min

Determine t_c from Line of Point 4 to 5:

Q @ Point 4=	0.4	cfs	
Estimated Q @ Point 5=	1.7	cfs	** Based on q_{avg} = 2 .3cfs/acre
Average Q in reach=	1.0	cfs	

<u>*Assume Triangular Channel Flow:*</u>

Q=	1.0	cfs	→ SEE CALCS, PG.
n=	0.035		
side slopes=	4:1		
slope=	0.045		
velocity=	3.62	fps	*** Per Channel Report, pg.
flow length=	332	ft	
travel time=	1.5	min	From POC #4 to #5

System #3

<u>Tributary Area "E"</u> Overland flow to Control Point #7

C weighted=	0.43		
A=	1.51	ac	
L=	457	ft	Use 100 ft Maximum Length for initial
ΔE	45	ft	;1257-1212
S=	9.8	%	
Ti=	6.9	min	from Figure 3-3 of the Hydrology Manual for natural
Tt=	2.1	min	from Figure 3-4 of the Hydrology Manual for natural
Total ΣTc=	9.0	min	
I=	6.3	in/hr	
Q=	**4.1**	cfs	

Perrin Winery
16138 Highland Valley Road
Escondido, CA
Hydrology Calculations
11/8/2019

Pre Development Channel Velocity at Discharge Locations

Control Point 3: 7 ft wide Trapezoidal Channel
Tributary Area: A+B
Assume Trapezoidal Channel

Q_{100}=	12.0	cfs	
Bottom Width=	48	in	
Sideslope=	1:1		
Total Depth=	1.5	ft	
n=	0.014		
slope=	0.1950		
flow depth=	0.20	ft	→ Per calcs, pg.
Velocity=	14.29	fps	

Control Point 5: 3 ft wide V-Ditch Channel
Tributary Area: C+D
Assume V-Ditch Channel

Q_{100}=	2.0	cfs	
Bottom Width=	N/A	in	
Sideslope=	2:1		
Total Depth=	1.5	ft	
n=	0.014		
slope=	0.0200		
flow depth=	0.45	ft	→ Per calcs, pg.
Velocity=	4.9	fps	

Control Point 7: 5 ft wide Trapezoidal Channel

Tributary Area: E

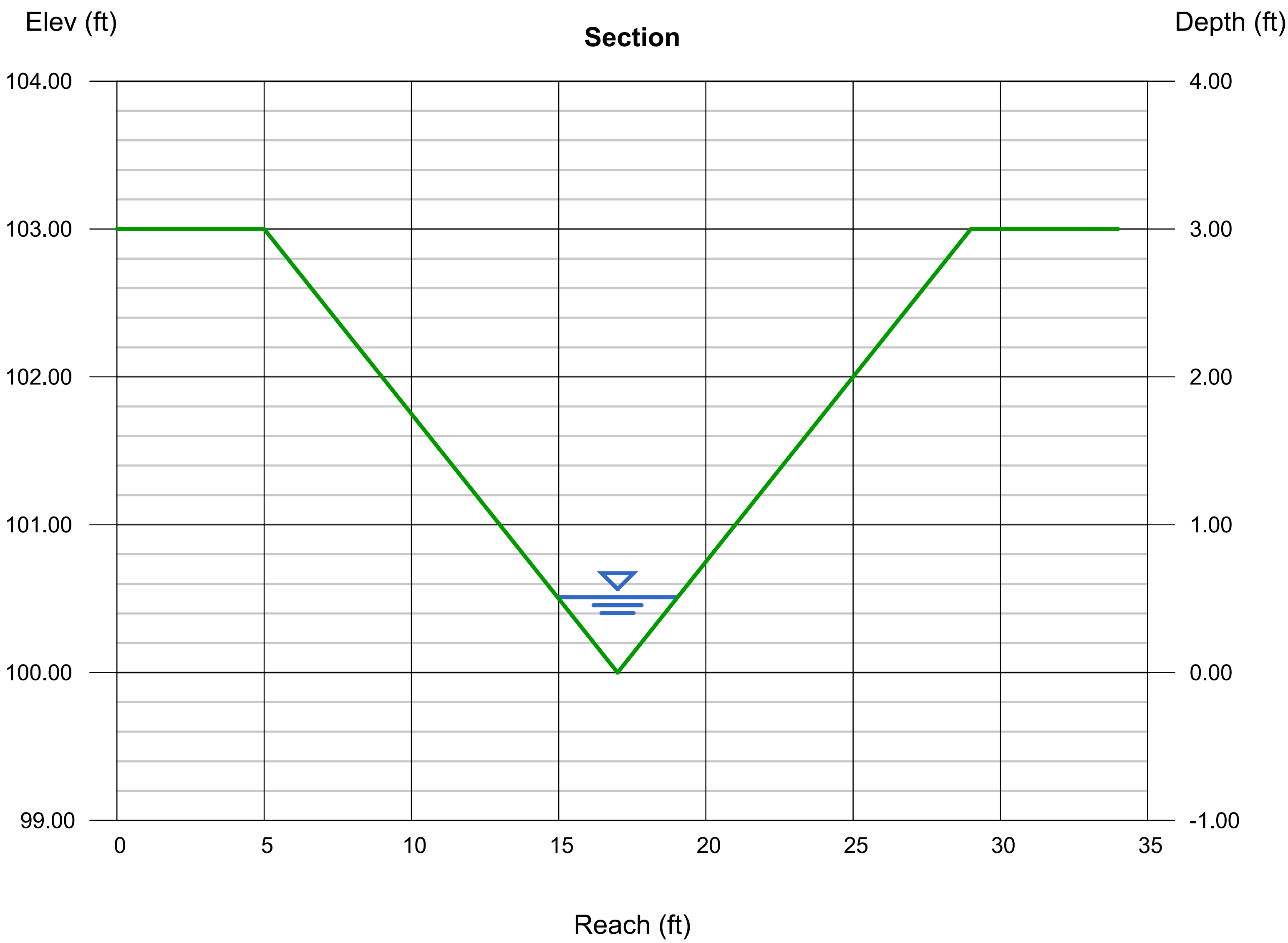
Assume 2:1 V-Ditch Channel

Q_{100}=	4.1	cfs
Bottom Width=	0	in
Sideslope=	1:1	
Total Depth=	1.5	ft
n=	0.014	
slope=	0.1640	
flow depth=	0.54	ft → Per calcs, pg.
Velocity=	14.1	fps

Channel Report

Q @ System #1 POC #2 to #3

Triangular		**Highlighted**	
Side Slopes (z:1)	= 4.00, 4.00	Depth (ft)	= 0.51
Total Depth (ft)	= 3.00	Q (cfs)	= 6.400
		Area (sqft)	= 1.04
Invert Elev (ft)	= 100.00	Velocity (ft/s)	= 6.15
Slope (%)	= 10.30	Wetted Perim (ft)	= 4.21
N-Value	= 0.030	Crit Depth, Yc (ft)	= 0.70
		Top Width (ft)	= 4.08
Calculations		EGL (ft)	= 1.10
Compute by:	Known Q		
Known Q (cfs)	= 6.40		



Channel Report

Q @ System #2 POC #4 to #5

Triangular

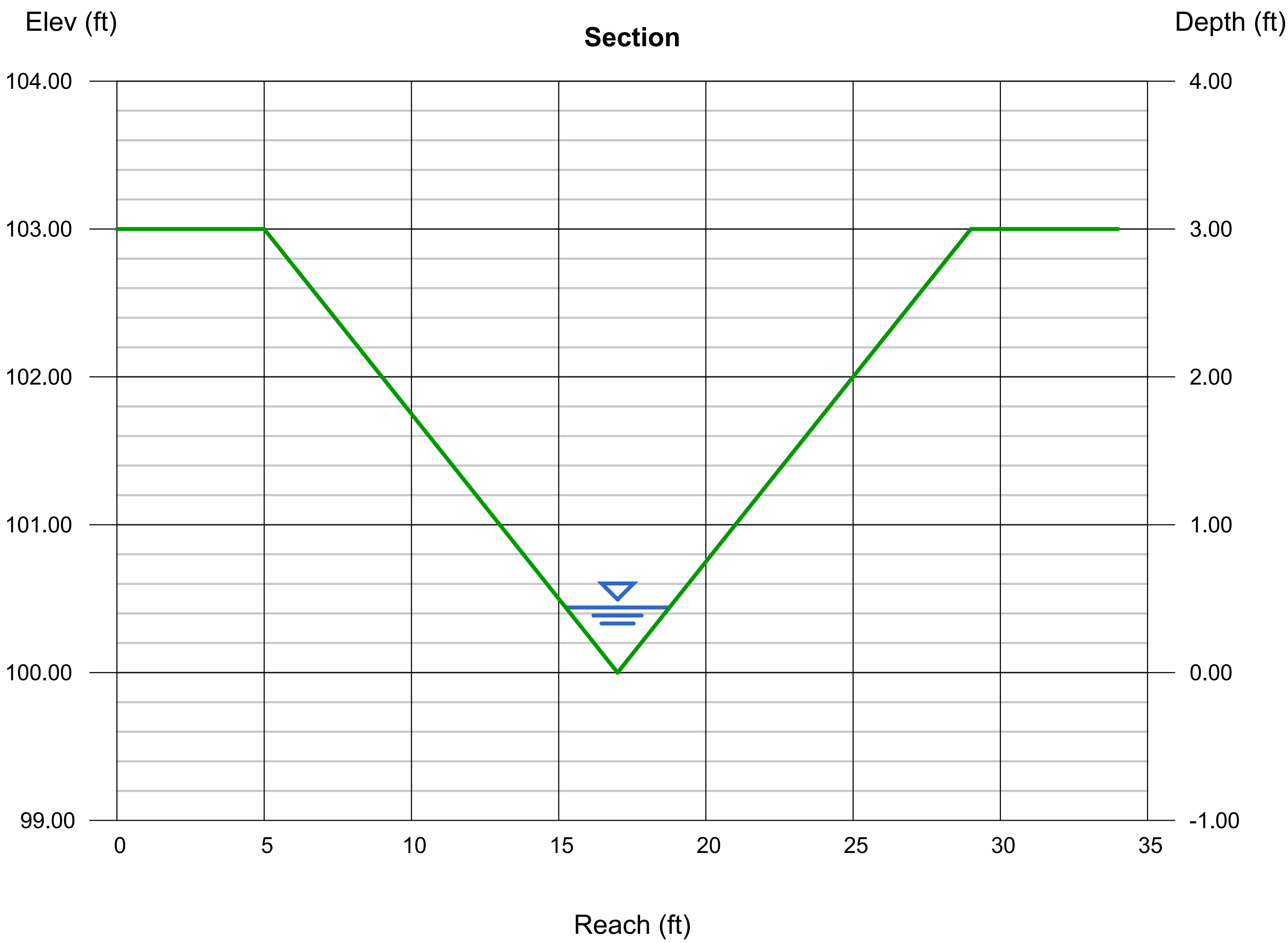
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 100.00
Slope (%)	= 4.50
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.80

Highlighted

Depth (ft)	= 0.44
Q (cfs)	= 2.800
Area (sqft)	= 0.77
Velocity (ft/s)	= 3.62
Wetted Perim (ft)	= 3.63
Crit Depth, Yc (ft)	= 0.50
Top Width (ft)	= 3.52
EGL (ft)	= 0.64



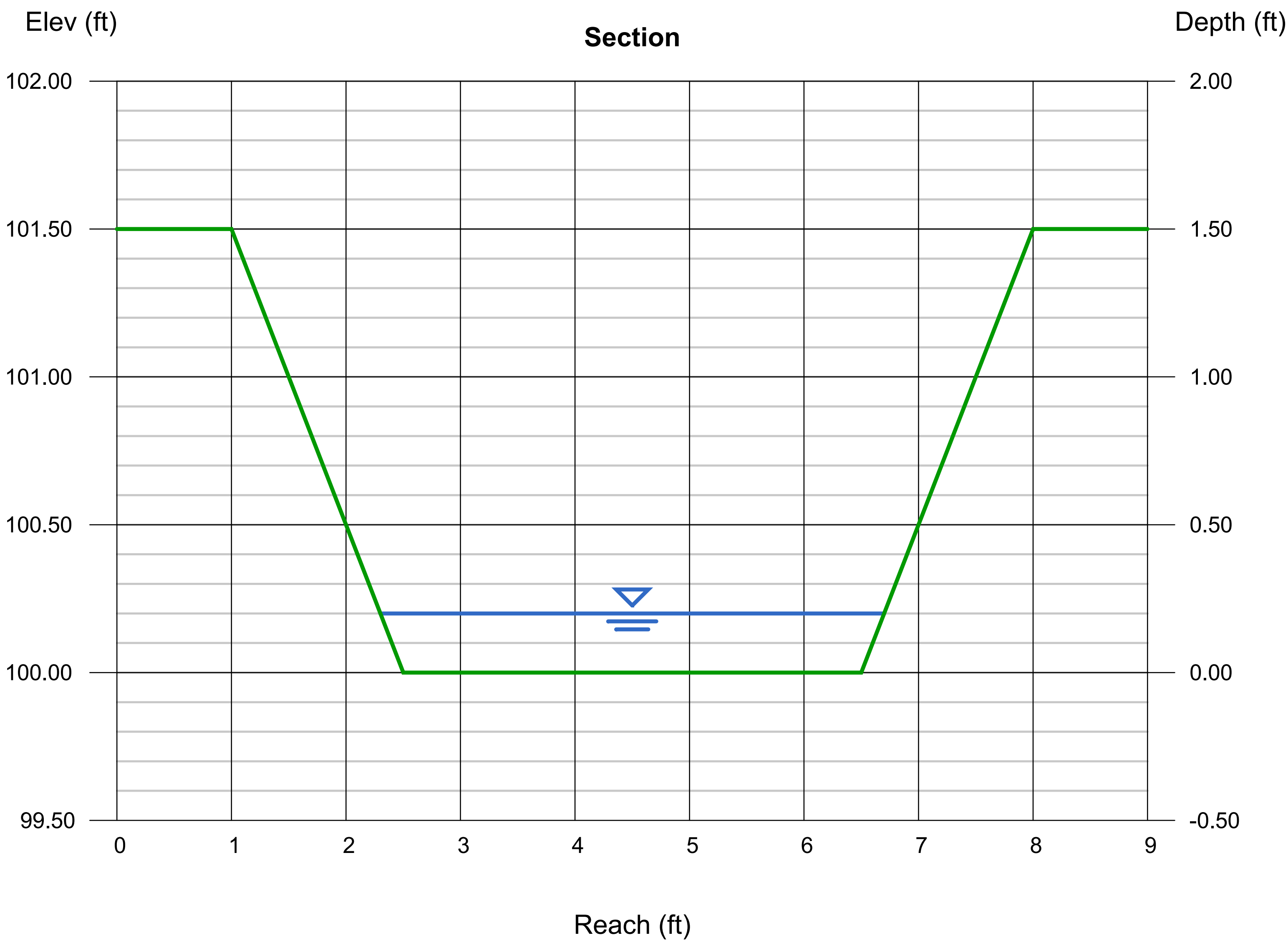
Channel Report

Exist Control Point 3

Trapezoidal	
Bottom Width (ft)	= 4.00
Side Slopes (z:1)	= 1.00, 1.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 100.00
Slope (%)	= 19.50
N-Value	= 0.014

Calculations	
Compute by:	Known Q
Known Q (cfs)	= 12.00

Highlighted	
Depth (ft)	= 0.20
Q (cfs)	= 12.00
Area (sqft)	= 0.84
Velocity (ft/s)	= 14.29
Wetted Perim (ft)	= 4.57
Crit Depth, Yc (ft)	= 0.62
Top Width (ft)	= 4.40
EGL (ft)	= 3.37



Channel Report

Exist Control Point 5

Triangular

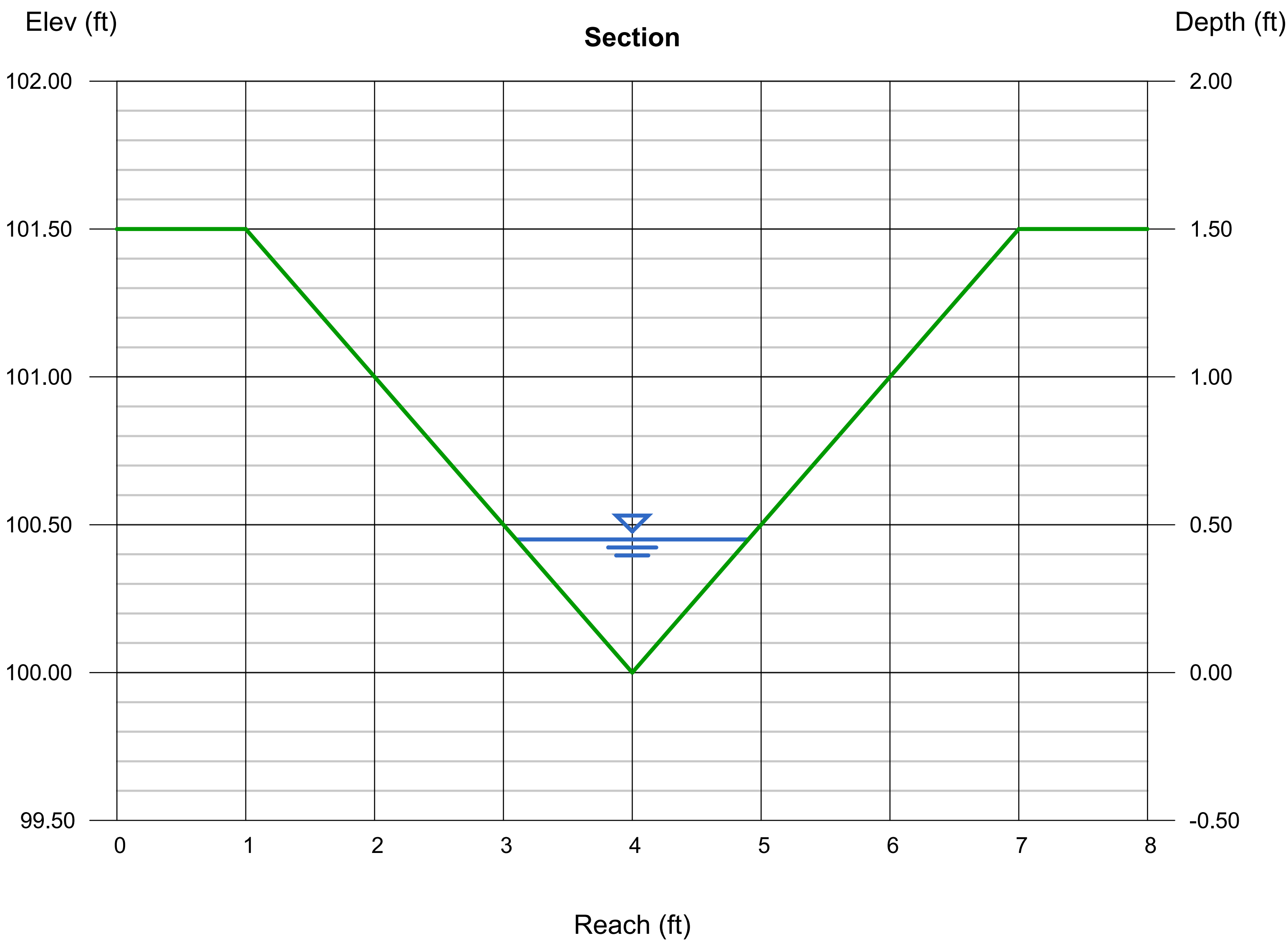
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 100.00
Slope (%)	= 2.00
N-Value	= 0.014

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.00

Highlighted

Depth (ft)	= 0.45
Q (cfs)	= 2.000
Area (sqft)	= 0.40
Velocity (ft/s)	= 4.94
Wetted Perim (ft)	= 2.01
Crit Depth, Yc (ft)	= 0.58
Top Width (ft)	= 1.80
EGL (ft)	= 0.83

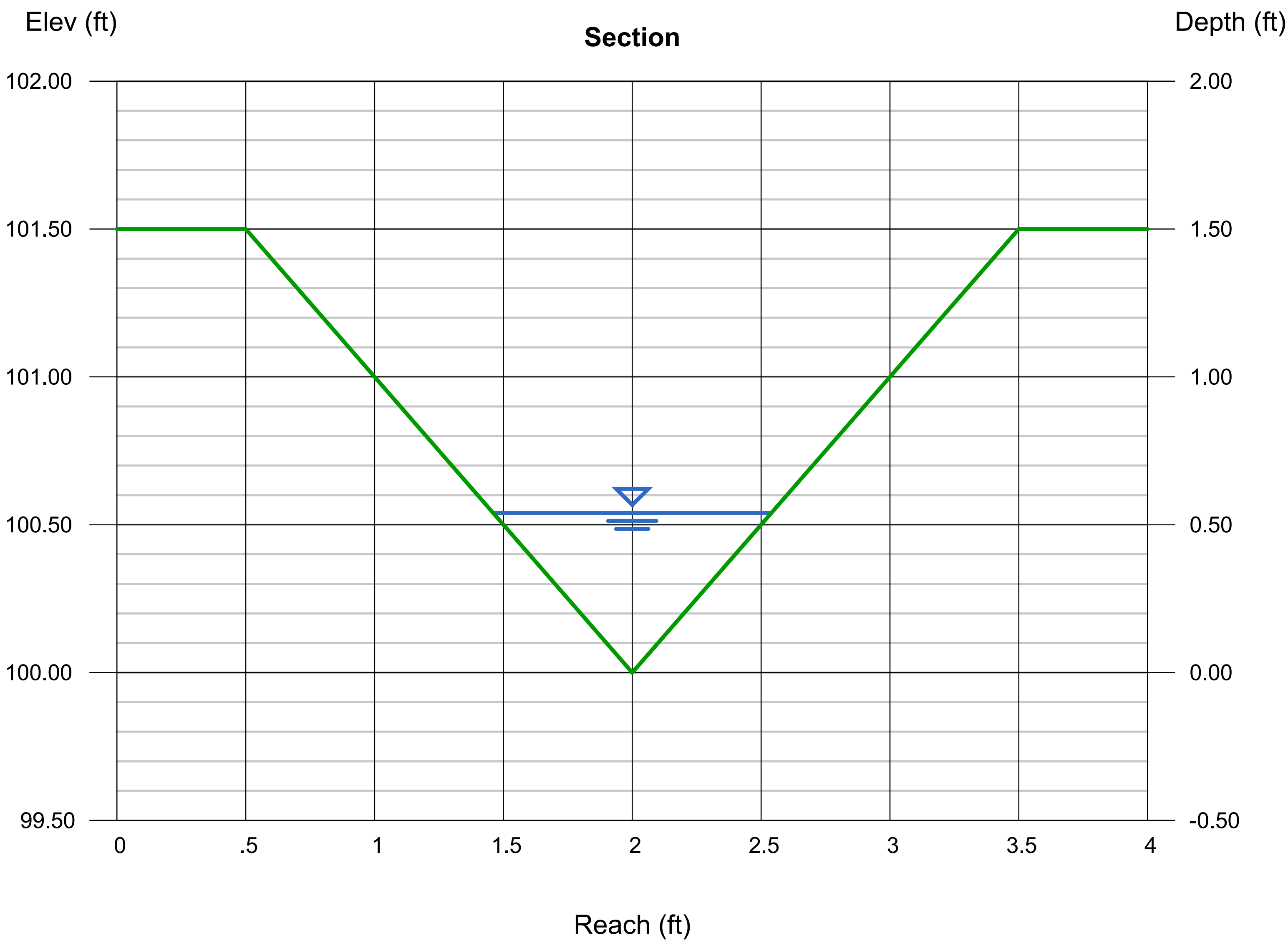


Channel Report

Exist Control Point 7

Triangular	
Side Slopes (z:1)	= 1.00, 1.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 100.00
Slope (%)	= 16.40
N-Value	= 0.014
Calculations	
Compute by:	Known Q
Known Q (cfs)	= 4.10

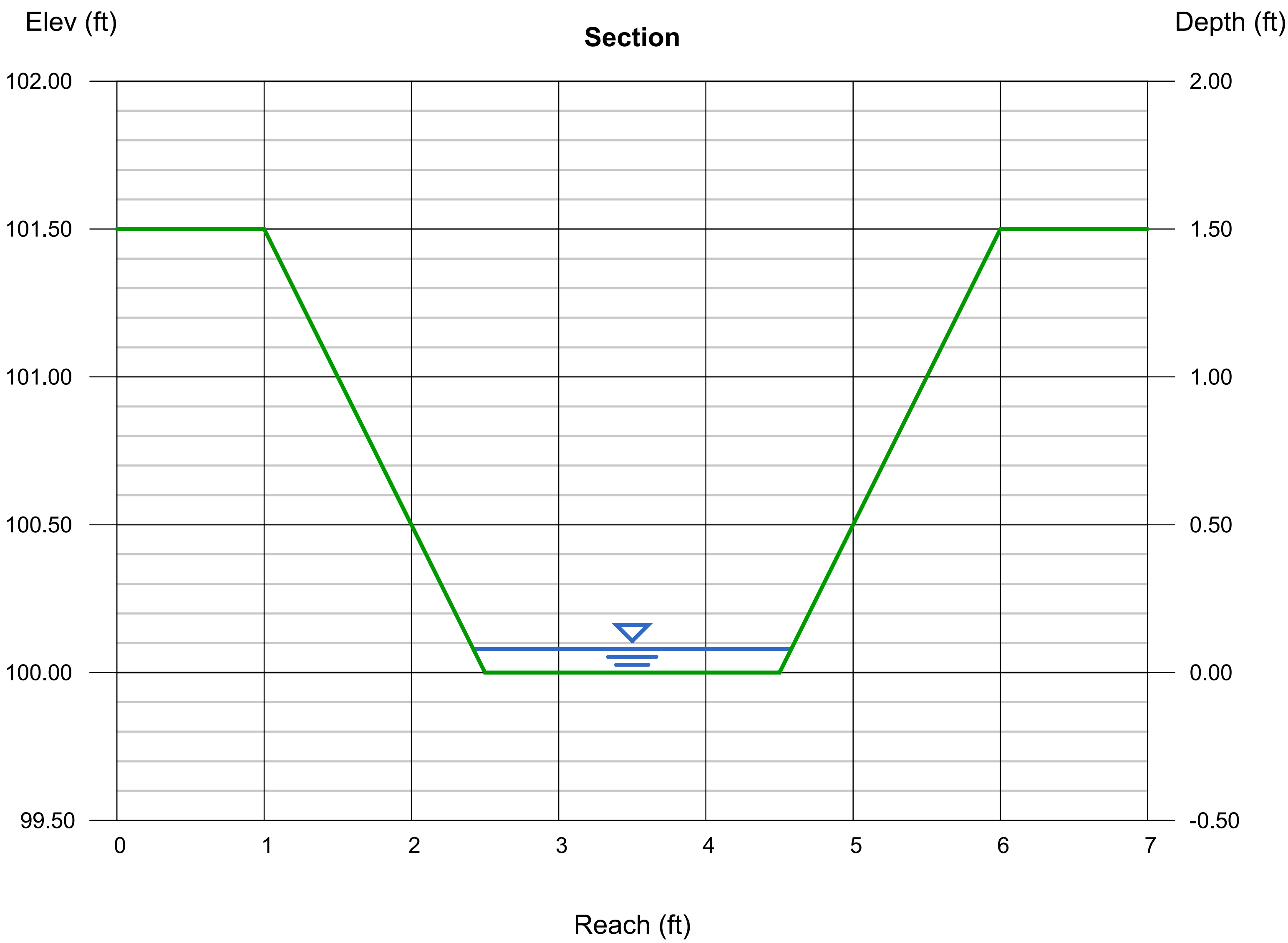
Highlighted	
Depth (ft)	= 0.54
Q (cfs)	= 4.100
Area (sqft)	= 0.29
Velocity (ft/s)	= 14.06
Wetted Perim (ft)	= 1.53
Crit Depth, Yc (ft)	= 1.01
Top Width (ft)	= 1.08
EGL (ft)	= 3.61



Channel Report

Exist Control Point 9

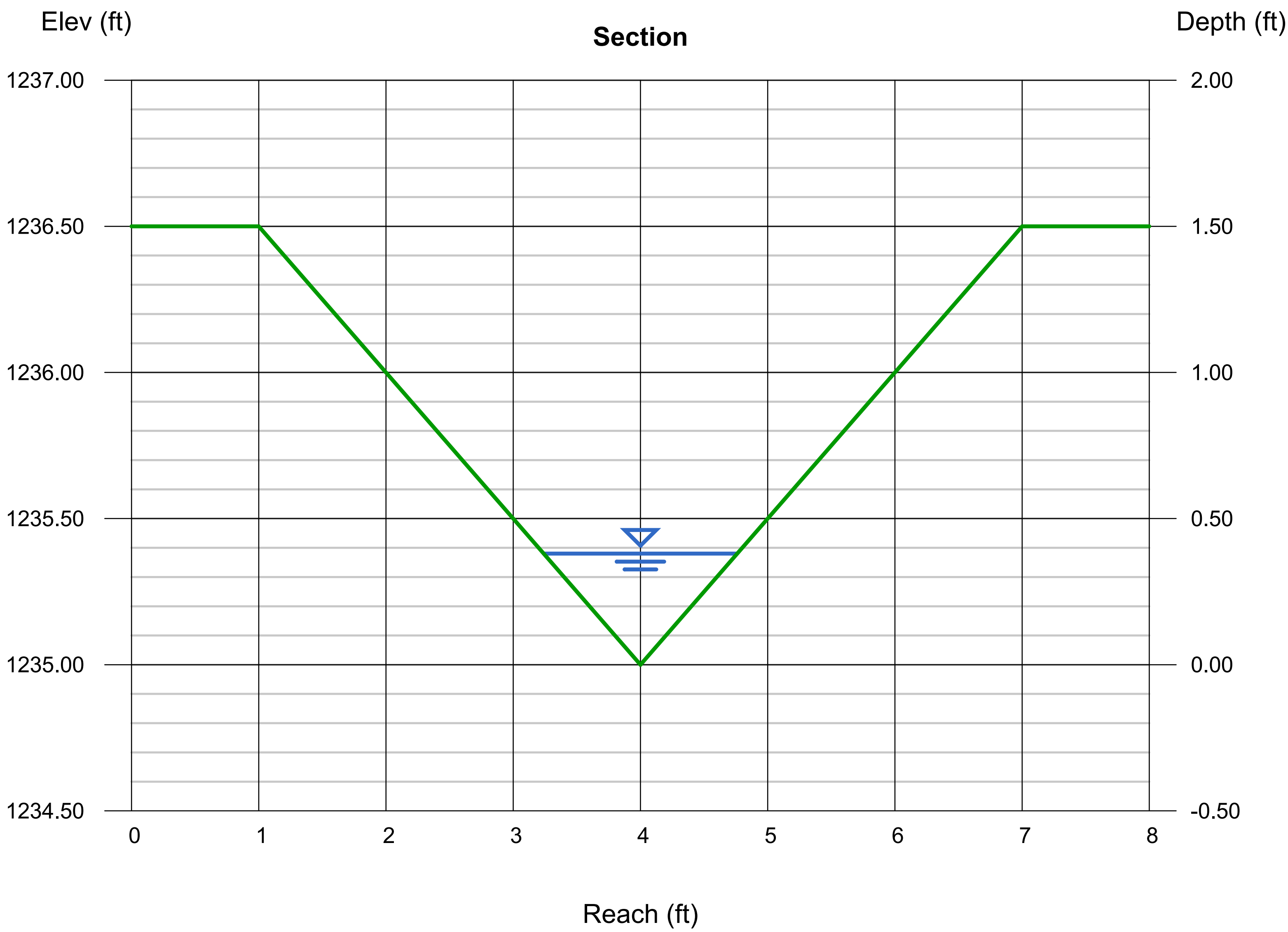
Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 2.00	Depth (ft)	= 0.08
Side Slopes (z:1)	= 1.00, 1.00	Q (cfs)	= 0.900
Total Depth (ft)	= 1.50	Area (sqft)	= 0.17
Invert Elev (ft)	= 100.00	Velocity (ft/s)	= 5.41
Slope (%)	= 10.00	Wetted Perim (ft)	= 2.23
N-Value	= 0.014	Crit Depth, Yc (ft)	= 0.18
		Top Width (ft)	= 2.16
Calculations		EGL (ft)	= 0.53
Compute by:	Known Q		
Known Q (cfs)	= 0.90		



Channel Report

Ex Control Point #11

Triangular		**Highlighted**	
Side Slopes (z:1)	= 2.00, 2.00	Depth (ft)	= 0.38
Total Depth (ft)	= 1.50	Q (cfs)	= 0.500
		Area (sqft)	= 0.29
Invert Elev (ft)	= 1235.00	Velocity (ft/s)	= 1.73
Slope (%)	= 2.00	Wetted Perim (ft)	= 1.70
N-Value	= 0.035	Crit Depth, Yc (ft)	= 0.33
		Top Width (ft)	= 1.52
Calculations		EGL (ft)	= 0.43
Compute by:	Known Q		
Known Q (cfs)	= 0.50		



APPENDIX C.2

POST-DEVELOPMENT HYDROLOGY/HYDRAULIC CALCULATIONS FOR CONDUIT AND CHANNEL ANALYSIS

Perrin Winery
16138 Highland Valley Road
Escondido, CA
Hydrology Calculations - Post Development Project Site Discharge Area
11/8/2019

Calculate Weighted C-Values - Post Development

Assumptions:

1) Assume "Low Density Residential with 1.0DU/A" for pervious areas and "General Commercial" for impervious areas for runoff coefficients on Table 3-1 from County of San Diego Hydrology Manual (2003).
2) Use a C-value of 0.80 and 0.82 for impervious areas soil group B and D.
3) Use a C-value of 0.32 and 0.41 for pervious areas soil group B and D.

Tributary A: (Hydrologic Soil Group B&D)

pervious areas=	68000	sf	Soil group B
impervious areas =	15651	sf	Soil group B
pervious areas=	36954	sf	Soil group D
impervious areas =	4500	sf	Soil group D
total area =	125105	sf	

$C_{weighted}$= 0.42

Tributary B: (Hydrologic Soil Group B&D)

pervious areas=	24348	sf	Soil group B
impervious areas =	7330	sf	Soil group B
pervious areas=	21352	sf	Soil group D
impervious areas =	2320	sf	Soil group D
total area =	55350	sf	

$C_{weighted}$= 0.44

Tributary C: (Hydrologic Soil Group D)

pervious areas=	63500	sf
impervious areas =	8830	sf
total area =	72330	sf

$C_{weighted}$= 0.46

Tributary D: (Hydrologic Soil Group D)

pervious areas=	720	sf
impervious areas =	5480	sf
total area =	6200	sf

$C_{weighted}$= 0.77

Tributary E: (Hydrologic Soil Group D)

pervious areas=	11758	sf
impervious areas =	24782	sf
total area =	36540	sf

$C_{weighted}$= 0.69

Tributary F: (Hydrologic Soil Group D)

pervious areas=	2749	sf
impervious areas =	14951	sf
total area =	17700	sf

$C_{weighted}$= 0.76

Tributary G: (Hydrologic Soil Group D)

pervious areas=	6740	sf

Tributary H: (Hydrologic Soil Group B)

pervious areas=	43728	sf	Soil group B

impervious areas =	15410	sf		impervious areas =	11316	sf	Soil group B
total area =	22150	sf		pervious areas=	10338	sf	Soil group D
				impervious areas =	2518	sf	Soil group D
				total area =	67900	sf	
$C_{weighted}$=	0.70			$C_{weighted}$=	0.43		

Tributary I: (Hydrologic Soil Group B)

pervious areas=	5500	sf	
impervious areas =	4500	sf	
total area =	10000	sf	
			Acre
$C_{weighted}$=	0.54		

Overall Project Site Area=	8.7
Overall Cweighted=	0.50

Perrin Winery
16138 Highland Valley Road
Escondido, CA
Hydrology Calculations - Post Development Project Site Discharge Area
11/8/2019

Calculate Time of Concentration and Flow Rate - Post Development

Assumptions:

1) Use "Overland Time Flow Nomograph" equation for initial time of concentration:

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

Where Ti= Time of Concentration (Minutes),
C= Runoff Coefficient, Use C-Weighted for the system watershed
S= Slope (%)
D or L = Water Course Distance (Feet)

2) Use "Time of Concentration" equation from Figure 3-4 of San Diego County Hydrology Manual

$$Tc = \left(\frac{11.9L^3}{\Delta E}\right)^{0.385}$$

Where Tc= Time of Concentration (Hour)
L= Water Course Distance (Miles)
ΔE= Change in Elevation (Feet)
A= Area (Acre)

3) Use "Rainfall Intensity" equation; $I = 7.44\,(P_{6})\,D^{-0.645}$

Where I= Rainfall Intensitty (in/hr)
P_6= ("3.5"), Rainfall Isopluvials 100-Yr 6-Hr ; See Isopluvial Map
D, (Tc)= Time of Concentration (Minutes)

	Tributary Area	Downstream Node	A, (ac)	D, (ft)	C	(C)*(A)	Σ(CA)	ΔE, (ft)	S, (%)	Ti, (min)	Tc, (min)	ΣTc	v (ft/s)	I, (in/hr)	Q_{100}
System #1	E	2	0.84	296	0.69	0.58	0.58	14.5	4.9	5.0		5.0		9.2	5.3
	F	3	0.41	196	0.76	0.31	0.31	5.0	2.6	5.0		5.0		9.2	2.8
	A	10	2.87	783	0.42	1.22	1.92	62.5	8.0		1.9	6.9	13.9	7.5	14.4
System #1B	B	6	1.27	564	0.44	0.56	0.56	81.0	14.4	5.0	1.8	6.8	15.2 at Point #9	7.5	4.2
System #1C	C	14	1.66	402	0.46	0.76	0.76	43.0	10.7	5.4	0.6	6.1	16.9	8.1	6.2
System #2	G	16	0.51	278	0.70	0.35	0.35	11.5	4.1	6.3	1.0	7.3	7.3	7.2	2.5
System #3	H	18	1.56	538	0.43	0.67	0.67	41.5	7.7	6.2	2.4	8.6	15.5 at Point #19	6.5	4.4
System #4	I	20	0.23	254	0.54	0.12	0.12	39.0	15.4	8.0		8.0	9.7 at Point #21	6.8	0.8
System #5	D	15	0.14	106	0.77	0.11	0.11	11.5	10.8	5.0		5.0	5.8	9.2	1.0

Perrin Winery
16138 Highland Valley Road
Escondido, CA
Hydrology Calculations - Post - Development Project Site Discharge Area
11/8/2019

Determine Time of Concentration, T_c and Flow Rate Q_{100}:

System #1A

Tributary Area "E" Overland flow to Drop Inlet at Control Point #1

C weighted=	0.69		
A=	0.84	ac	
L=	296	ft	Use 90 ft Maximum Length
ΔE	14.5	ft	;1236.0-1221.5
S=	4.9	%	
Ti=	4.1	min	Use 5 mins for Ti
I=	9.2	in/hr	
Q_E=	5.3	cfs	

Q100 @ Tributary Area E 5.3 cfs

Tributary Area "F" Overland flow to Drop Inlet at Control Point #3

C weighted=	0.76		
A=	0.41	ac	
L=	196	ft	Use 75 ft Maximum Length
ΔE	5	ft	;1234-1229
S=	2.6	%	
Ti=	3.9	min	Use 5 mins for Ti
I=	9.2	in/hr	
Qf=	2.8	cfs	

Q100 @ Tributary Area F 2.8 cfs

Tributary Area "A" Overland flow received runoff from subarea E&F and to Control Point #8 and ultimately discharges to seasonal creek @ POC#10

C weighted=	0.42		
Overall A=	2.87	ac	
Subarea A1, A=	0.576	ac	to Control Point #7
L=	125.0	ft	
ΔE	7	ft	;1218-1211
S=	5.6	%	

Junction Equation in Subarea A1 @ POC #7

$Q_{A1}= Q_F+(T_F/T_E)*Q_E$

$= 2.8+(5/5)*5.3$

$=$ 8.2 cfs ; Tc and I are identical for each system

Use Tc= 5 mins

v in natural channel= 4.08 ft/s Assume Q_E=5.3, n=0.035, channel sideslope 4:1,

Tc_{A1}= 0.5 min

Total ΣTc=	5.5	min	; Tc_E+Tc_{A1}
I_{A1}=	8.7	in/hr	
Σ(CA)=	0.9		; Subarea E+F+A1
Q_{A1}=	**8.2**	cfs	
Subarea A2, A=	1.65	ac	to Control Point #8
L=	374.0	ft	
ΔE	32	ft	;1211-1179
S=	8.6	%	
Time of Concentration A1 @ POC #7,Tc_{A1}=	**5.5**	min	
Q @ Point #7=	**8.2**	cfs	
Estimate Q @ POC #8, Assume q_{avg} =	2.5	cfs/acre	
$Q_{A2\ avg}$=	10.2	cfs	;Qb1+(3.0*A_{b2}/2)
v=	5.7	ft/s	Assume Q=10.2, n=0.035, channel sideslope 4:1,
Tt_{A2}=	1.1	min	; travel time to POC#8
ΣTc=	6.6	min	;$Tc_{A1}+Tt_{A2}$
I_{A2}=	7.7	in/hr	
Σ(CA)=	1.6		; Subarea E+F+A1+A2
Q_{A2}=	**12.7**	cfs	;Σ(CA)I
Check Qavg=	10.4	cfs	;Qb1+(Qb2-Qb1)/2 **OK**
Subarea A3, A=	0.65	ac	Flow in Pipe and Gutter to Control Point #9
L=	284.0	ft	
ΔE	23.5	ft	;1179-1155.5
S=	8.3	%	
Assume 12-Inch Pipe, v=	18.2	ft/s	;Assume Q=12.7cfs in pipe
Tt_{A3}=	0.3	min	
Total ΣTc=	6.9	min	;$Tc_{A2}+Tt_{A3}$
I_{A3}=	7.5	in/hr	
Σ(CA)=	1.9		
Q_{A3}=	**14.4**	cfs	
Discharge Velocity in Pipe @ POC #10=	13.9	ft/s	; Assume 18-inch pipe with 5% Slope

System #1B

<u>Tributary Area "B"</u> Overland flow across natural subarea to V-ditch and Drop Inlet and discharge to seasonal creek at POC# 9

C weighted=	0.44		
Overall A=	1.27	ac	
Subarea B1, A=	0.34	ac	to Control Point #4
L=	218.0	ft	
ΔE	57.5	ft	;1252.0-1194.5
S=	26.4	%	
Ti=	5.0	min	from Figure 3-3 of the Hydrology Manual
Tc=	0.8	min	from Figure 3-4 of the Hydrology Manual
Total Time of Concentration, Ttb1=	5.8	min	Use 5 mins for time of concentration
I=	9.2	in/hr	

Qb1=	**1.4**	cfs	
Subarea B2, A=	0.77	ac	Concrete V-Ditch to Control Point #5
L=	239.0	ft	
ΔE	13.5	ft	;1194.5-1181
S=	5.6	%	
Assume q_{avg} =	3.0	cfs/acre	
Qb2=	2.5	cfs	;Qb1+(3.0*A_{b2}/2)
v=	4.6	ft/s	from Figure 3-6 of the Hydrology Manual
Ttb2=	0.9	min	
ΣTc=	6.7	min	;Ttb1+Ttb2
Ib2=	7.6	in/hr	
Qb2=	**3.7**	cfs	;Σ(CA)I
Check Qavg=	2.5	cfs	;Qb1+(Qb2-Qb1)/2 **OK**
Subarea B3, A=	0.16	ac	Pipe Flow to Control Point #6
L=	107.0	ft	
ΔE	10	ft	;1181-1171
S=	9.3	%	
Assume 10-Inch Pipe, v=	12.6	ft/s	;Assume Q=4.0cfs in pipe
Tt3=	0.1	min	
Total ΣTc=	6.8	min	
Ib2=	7.5	in/hr	
Σ(CA)=	0.6		
Qb3=	**4.2**	cfs	

Q100 @ Tributary Area B **4.2 cfs**

Discharge Velocity in Pipe @ POC #9= 15.2 ft/s ; Assume 10-inch pipe with 15% Slope

System #1C

Tributary Area "C" Overland flow across natural subarea and road V-ditch and flow through pipes and discharge to the lower creek bypassing culvert

C weighted=	0.46		
Overall A=	1.66	ac	
Subarea C1, A=	0.14	ac	to Control Point #11
L=	126.0	ft	Use 100 ft for Maximum Length
ΔE	12	ft	;1234.0-1222
S=	9.5	%	
Ti=	5.4	min	from Figure 3-3 of the Hydrology Manual
I=	8.7	in/hr	
Qc1=	**0.6**	cfs	
Subarea C2, A=	1.19	ac	;Concrete V-Ditch to Control Point #12
L=	209.0	ft	; Assume Q from V-ditch subarea is added to the pipe
ΔE	22	ft	;1222-1200
S=	10.5	%	
Assume q_{avg} =	3.5	cfs/acre	
$Qavg_{c2}$=	2.6	cfs	;Qc1+($q_{avg}Ac_2$/2)

v=	6.2	ft/s	from Figure 3-6 of the Hydrology Manual
Time of Concentration @ C2,Ttc2=	0.6	min	
ΣTc=	6.0	min	;Ttc1+Ttc2
I_{C2}=	8.2	in/hr	
Qc2=	**5.0**	cfs	;Σ(CA)I
Check Qavg=	2.8	cfs	;Qc1+(Qc2-Qc1)/2 **OK**
Subarea C3, A=	0.33	ac	;Pipe Flow to Control Point #13
L=	67.0	ft	
ΔE	9	ft	;1200-1191
S=	13.4	%	
Assume 12-Inch Pipe, v=	15.4	ft/s	;Assume Q=5.0cfs in pipe
Tt3=	0.1	min	
Total ΣTc=	6.1	min	;Ttc2+Tt3
I_{C3}=	8.1	in/hr	
Σ(CA)=	0.8		
Q_{C3}=	**6.2**	cfs	
Q100 @ Tributary Area C	**6.2**	**cfs**	
V @ Discharge Point #14 to The Creek	**16.9**	**ft/s**	; Assume 10-inch Pipe @ 15% slope

System #2

Tributary Area "G" Overland flow across road to catch basin @ POC #16 and return to sheet flow to natural area

C weighted=	0.70		
Overall A=	0.51	ac	
L=	278.0	ft	Use 90 ft for Maximum Length
ΔE	11.5	ft	;1236.0-1224.5
S=	4.1	%	
Ti=	6.3	min	
v in Gutter=	3.0	ft/s	;Assume Q=3.0 cfs in gutter pan per Figure 3-6 of the Hydrology Manual
Tt_G=	1.0	min	
Tc_G=	7.3	min	
I=	7.2	in/hr	
Q_G=	2.5	cfs	
V @ Discharge Point #16	**7.3**	**ft/s**	; Assume 10-Inch Pipe with 3% Slope

System #3

Tributary Area "H" Sideslope channel @ POC #18

C weighted=	0.43		
Overall A=	1.56	ac	
Subarea H1, A=	0.47	ac	to Control Point #17
L=	288.0	ft	Use 100 ft for Maximum Length
ΔE	21.5	ft	;1257.0--1232.5
S=	7.5	%	

Ti=	6.2	min	from Figure 3-3 of the Hydrology Manual
Tt_{H1}=	1.7	min	Travel Time from Figure 3-4 of the Hydrology Manual
Tc_{H1}=	7.8	min	Total Time of Concentration @ POC #17
I=	6.9	in/hr	
Q_{H1}=	**1.4**	cfs	
Subarea H2, A=	1.09	ac	;Concrete V-Ditch to Control Point #12
L=	250.0	ft	; Assume Q from V-ditch subarea is added to the pipe
ΔE	20	ft	;1232.5-1212.5
S=	8.0	%	
Assume q_{avg} =	2.5	cfs/acre	
$Qavg_{H2}$=	2.8	cfs	;$Q_{H1}+(q_{avg}A_{H2}/2)$
v=	5.5	ft/s	from Figure 3-6 of the Hydrology Manual
Time of Concentration @ H2, Tt_{H2}=	0.8	min	
ΣTc=	8.6	min	;$Tt_{H1}+Tt_{H2}$
I_{H2}=	6.5	in/hr	
Q_{H2}=	**4.4**	cfs	;Σ(CA)I
Check Qavg=	2.9	cfs	;$Q_{H1}+(Q_{H2}-Q_{H1})/2$ **OK**

Q100 @ Tributary Area H 4.4 cfs

V @ Discharge Point #19 15.5 ft/s ; Assume 10-inch Pipe @ 15% slope

System #4

Tributary Area "I" Overland flow across road V-ditch and to catch basin @ POC #20

C weighted=	0.54		
Overall A=	0.23	ac	
L=	254.0	ft	Use 100 ft for Maximum Length @ 5% Slope 1DU/ac
ΔE	39	ft	;1241.0-1202.0
S=	15.4	%	
Ti=	8.0	min	from Figure 3-3 of the Hydrology Manual, Use 5 min for Ti
I=	6.8	in/hr	
Q_I=	0.8	cfs	

V @ Discharge Point #21 9.7 ft/s ; Assume 8-Inch Pipe with 15% Slope

System #5

Tributary Area "D" Overland flow across parking lot and road V-ditch to POC #15

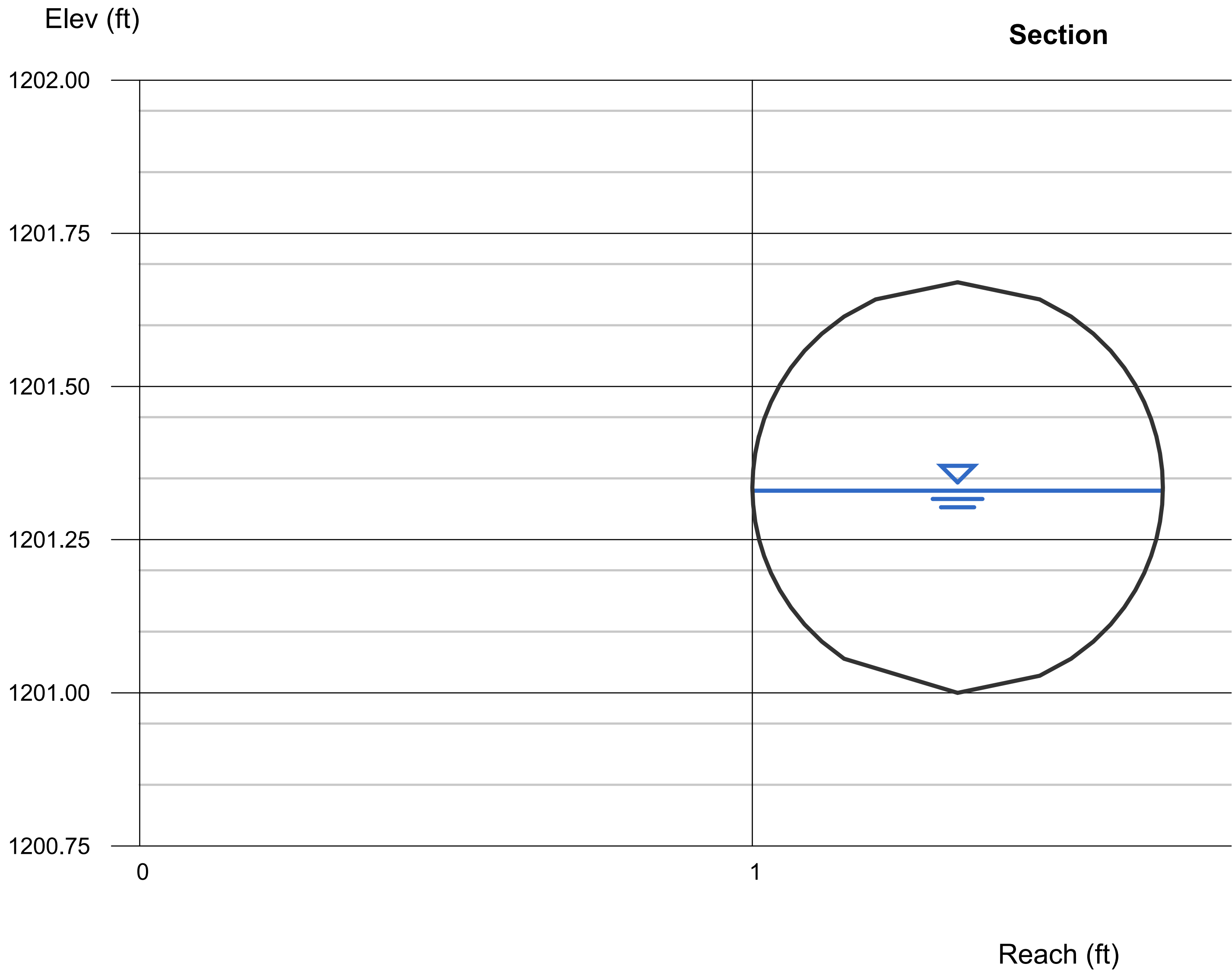
C weighted=	0.77		
Overall A=	0.14	ac	
L=	106.0	ft	Use 60 ft for Maximum Length
ΔE	1	ft	;1236.0-1235
S=	0.9	%	
Ti=	4.1	min	from Table 3-2 of the Hydrology Manual, Use 5 min
I=	9.2	in/hr	
Q_D=	**1.0**	cfs	

V @ Discharge Point #15 **5.8 ft/s** ; Assume 8-Inch Pipe with 3% Slope

Channel Report

Q in Pipe @ Area D POC #15

Circular		**Highlighted**	
Diameter (ft)	= 0.67	Depth (ft)	= 0.33
		Q (cfs)	= 1.000
		Area (sqft)	= 0.17
Invert Elev (ft)	= 1201.00	Velocity (ft/s)	= 5.75
Slope (%)	= 3.00	Wetted Perim (ft)	= 1.05
N-Value	= 0.013	Crit Depth, Yc (ft)	= 0.48
		Top Width (ft)	= 0.67
Calculations		EGL (ft)	= 0.84
Compute by:	Known Q		
Known Q (cfs)	= 1.00		



Channel Report

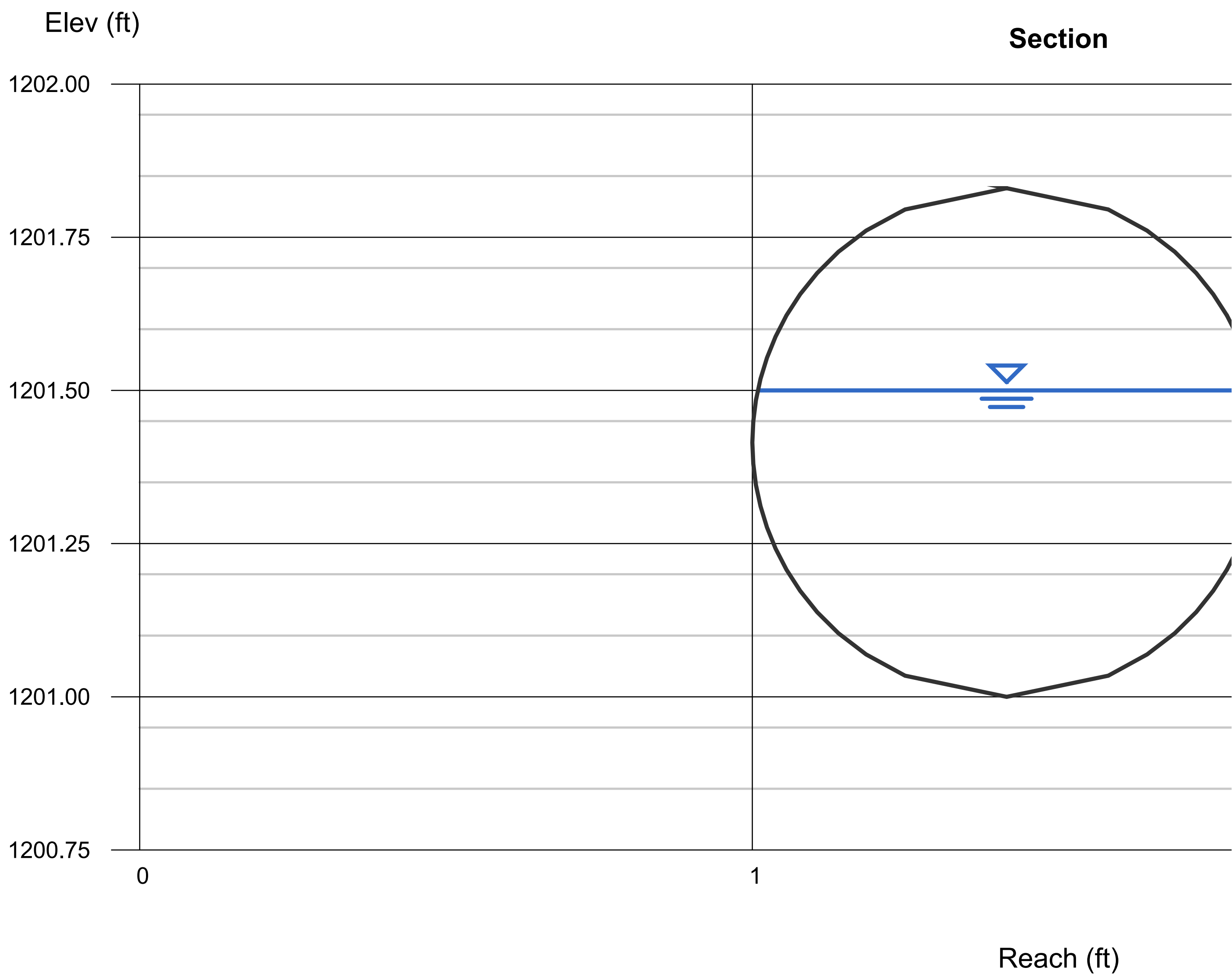
Q in Pipe @ Area G POC #16

Circular
Diameter (ft) = 0.83

Invert Elev (ft) = 1201.00
Slope (%) = 3.00
N-Value = 0.013

Calculations
Compute by: Known Q
Known Q (cfs) = 2.50

Highlighted
Depth (ft) = 0.50
Q (cfs) = 2.500
Area (sqft) = 0.34
Velocity (ft/s) = 7.32
Wetted Perim (ft) = 1.48
Crit Depth, Yc (ft) = 0.71
Top Width (ft) = 0.81
EGL (ft) = 1.33



Channel Report

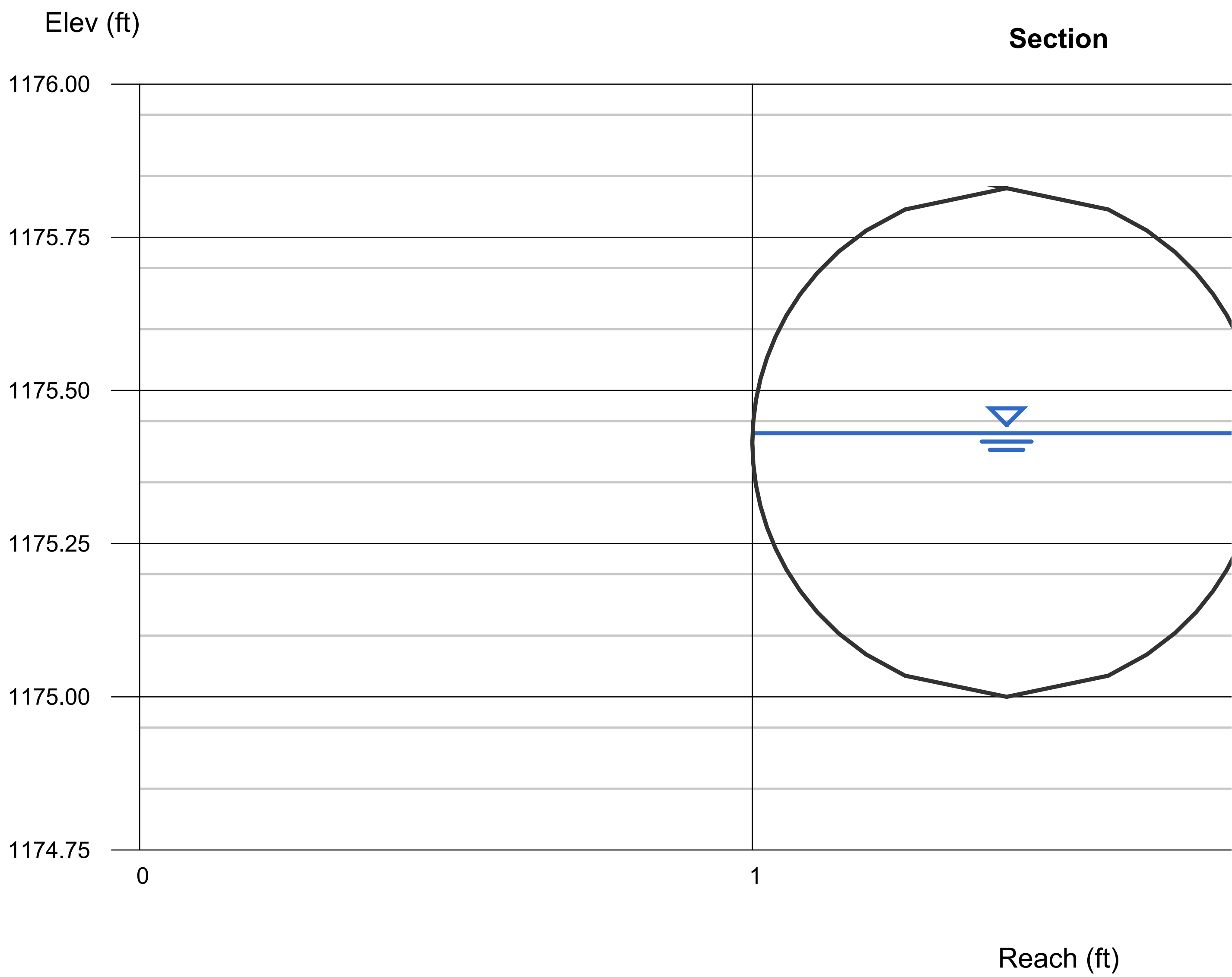
Q in Pipe @ Area H POC #19

Circular
Diameter (ft) = 0.83

Invert Elev (ft) = 1175.00
Slope (%) = 15.00
N-Value = 0.013

Calculations
Compute by: Known Q
Known Q (cfs) = 4.40

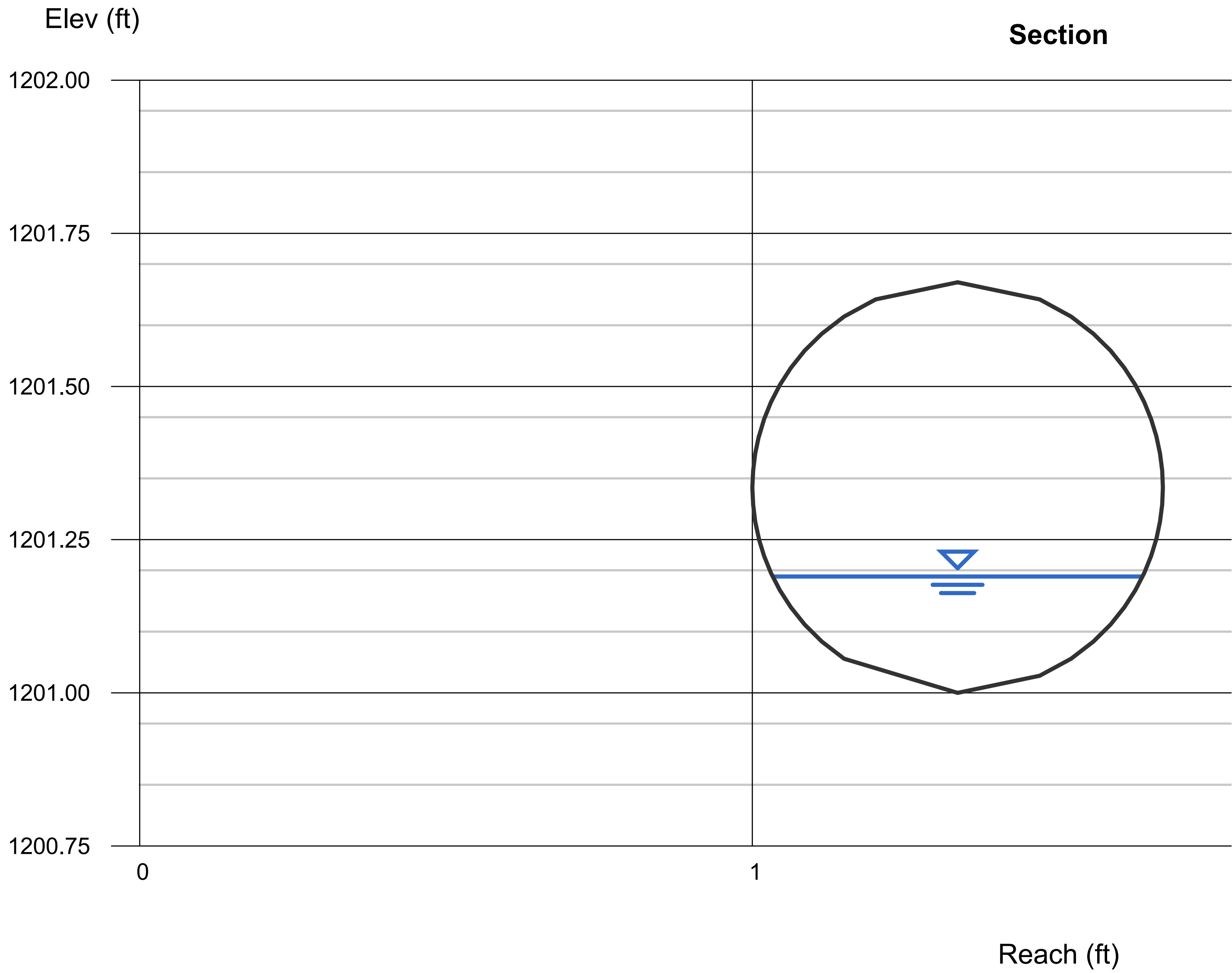
Highlighted
Depth (ft) = 0.43
Q (cfs) = 4.400
Area (sqft) = 0.28
Velocity (ft/s) = 15.49
Wetted Perim (ft) = 1.34
Crit Depth, Yc (ft) = 0.81
Top Width (ft) = 0.83
EGL (ft) = 4.16



Channel Report

Q in Pipe @ Area I POC #21

Circular		**Highlighted**	
Diameter (ft)	= 0.67	Depth (ft)	= 0.19
		Q (cfs)	= 0.800
		Area (sqft)	= 0.08
Invert Elev (ft)	= 1201.00	Velocity (ft/s)	= 9.69
Slope (%)	= 15.00	Wetted Perim (ft)	= 0.75
N-Value	= 0.013	Crit Depth, Yc (ft)	= 0.43
		Top Width (ft)	= 0.60
Calculations		EGL (ft)	= 1.65
Compute by:	Known Q		
Known Q (cfs)	= 0.80		

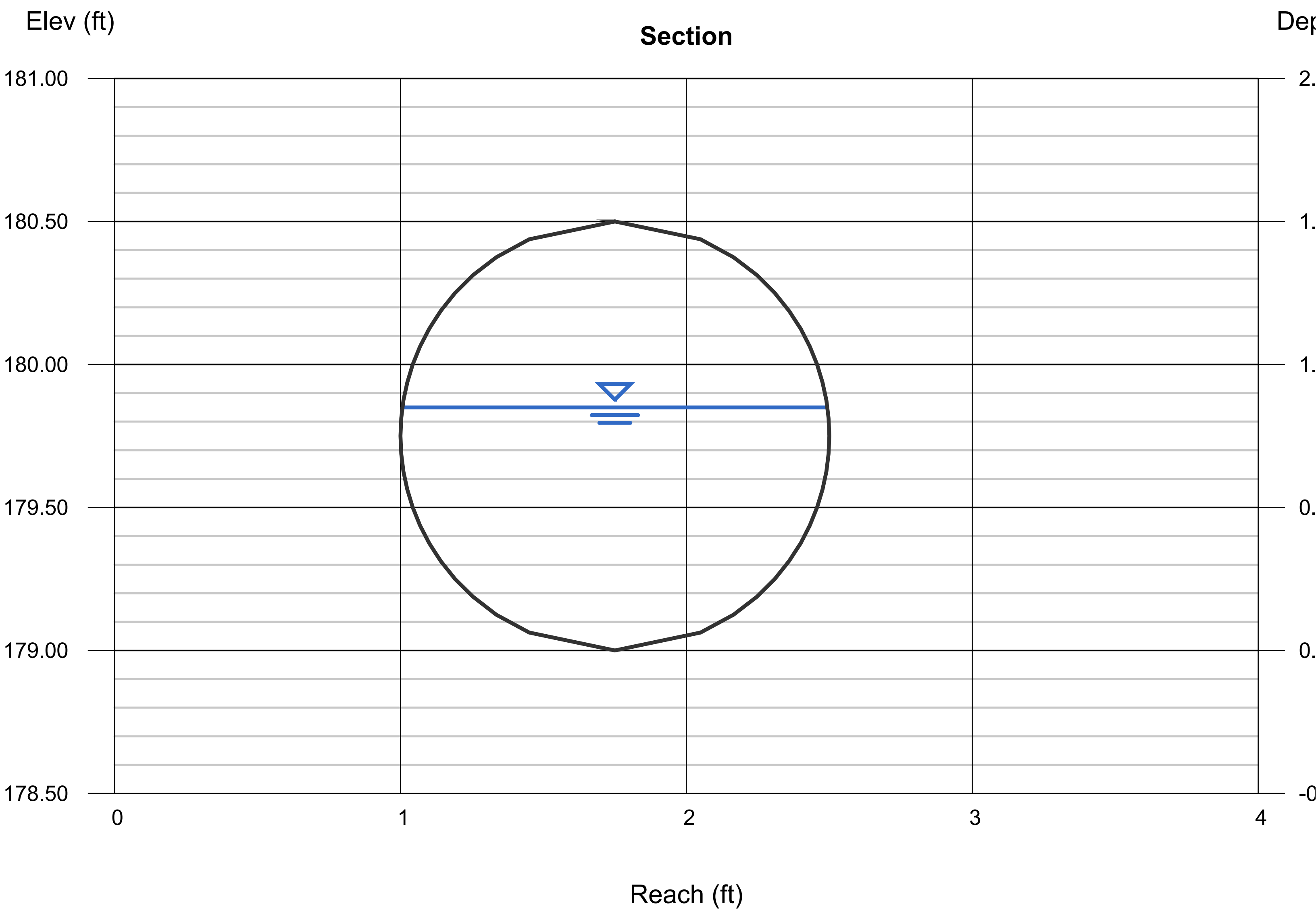


Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. — Monday, Feb 25 2019

Q in Pipe @ Subarea A3 POC #10

Circular		**Highlighted**	
Diameter (ft)	= 1.50	Depth (ft)	= 0.85
		Q (cfs)	= 14.40
		Area (sqft)	= 1.03
Invert Elev (ft)	= 1179.00	Velocity (ft/s)	= 13.93
Slope (%)	= 5.00	Wetted Perim (ft)	= 2.56
N-Value	= 0.013	Crit Depth, Yc (ft)	= 1.40
		Top Width (ft)	= 1.49
Calculations		EGL (ft)	= 3.87
Compute by:	Known Q		
Known Q (cfs)	= 14.40		

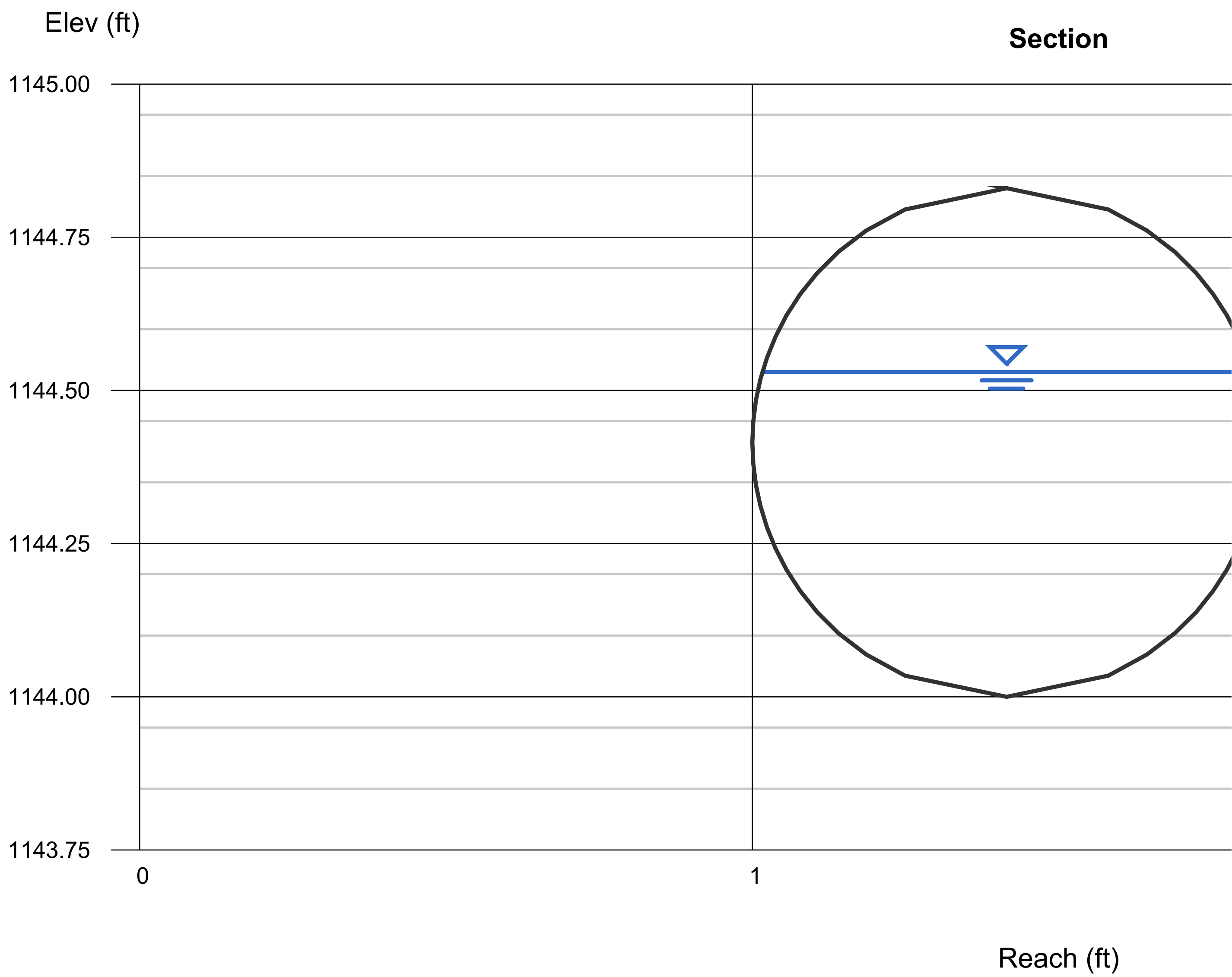


Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Feb 18 2019

Q in Pipe @ Subarea C3 POC #14

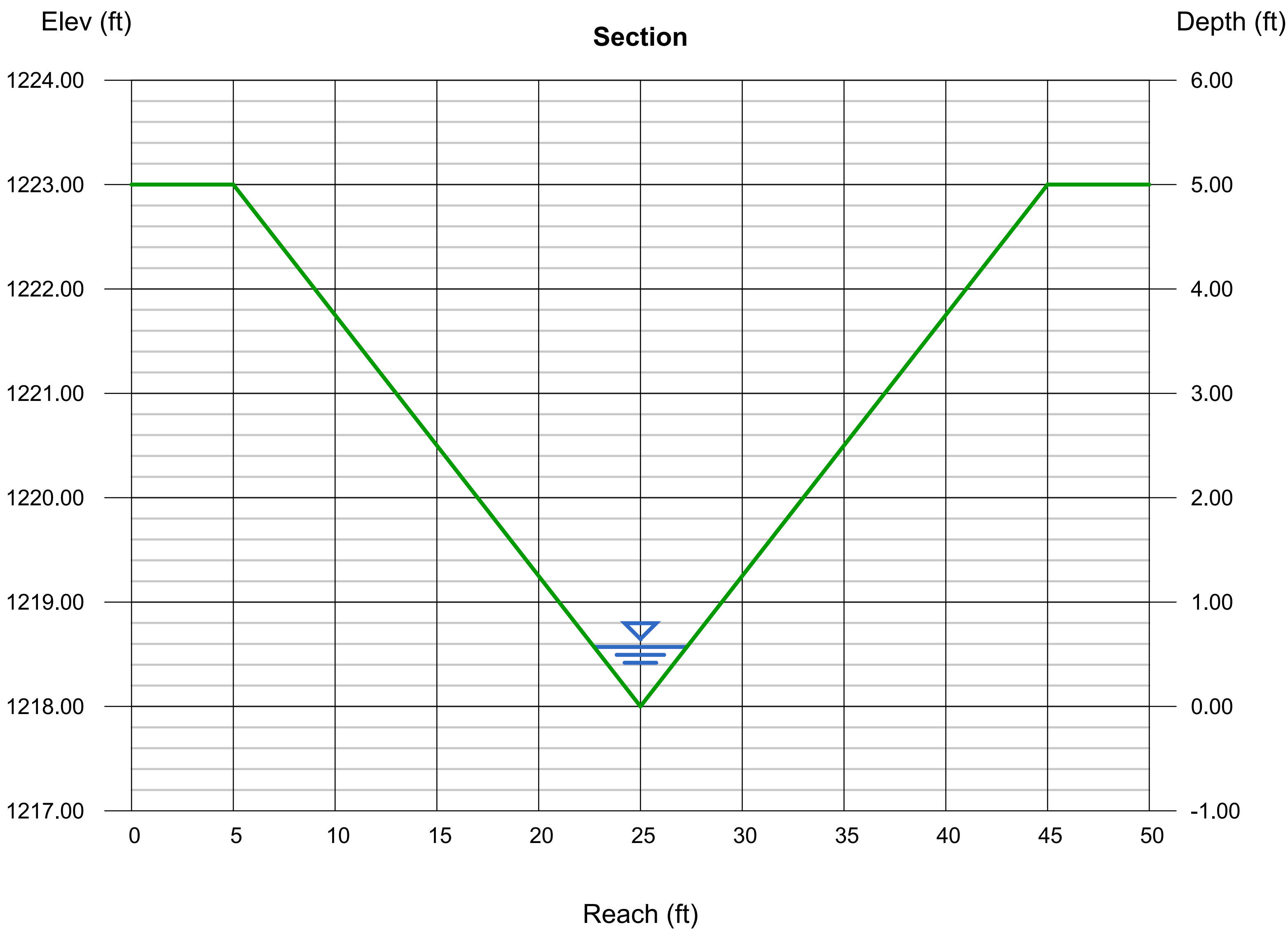
Circular		**Highlighted**	
Diameter (ft)	= 0.83	Depth (ft)	= 0.53
		Q (cfs)	= 6.200
		Area (sqft)	= 0.37
Invert Elev (ft)	= 1144.00	Velocity (ft/s)	= 16.95
Slope (%)	= 15.00	Wetted Perim (ft)	= 1.54
N-Value	= 0.013	Crit Depth, Yc (ft)	= 0.83
		Top Width (ft)	= 0.80
Calculations		EGL (ft)	= 5.00
Compute by:	Known Q		
Known Q (cfs)	= 6.20		



Channel Report

Q @ Subarea A1 to POC #7

Triangular		**Highlighted**	
Side Slopes (z:1)	= 4.00, 4.00	Depth (ft)	= 0.57
Total Depth (ft)	= 5.00	Q (cfs)	= 5.300
		Area (sqft)	= 1.30
Invert Elev (ft)	= 1218.00	Velocity (ft/s)	= 4.08
Slope (%)	= 5.60	Wetted Perim (ft)	= 4.70
N-Value	= 0.035	Crit Depth, Yc (ft)	= 0.65
		Top Width (ft)	= 4.56
Calculations		EGL (ft)	= 0.83
Compute by:	Known Q		
Known Q (cfs)	= 5.30		



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Saturday, Feb 23 2019

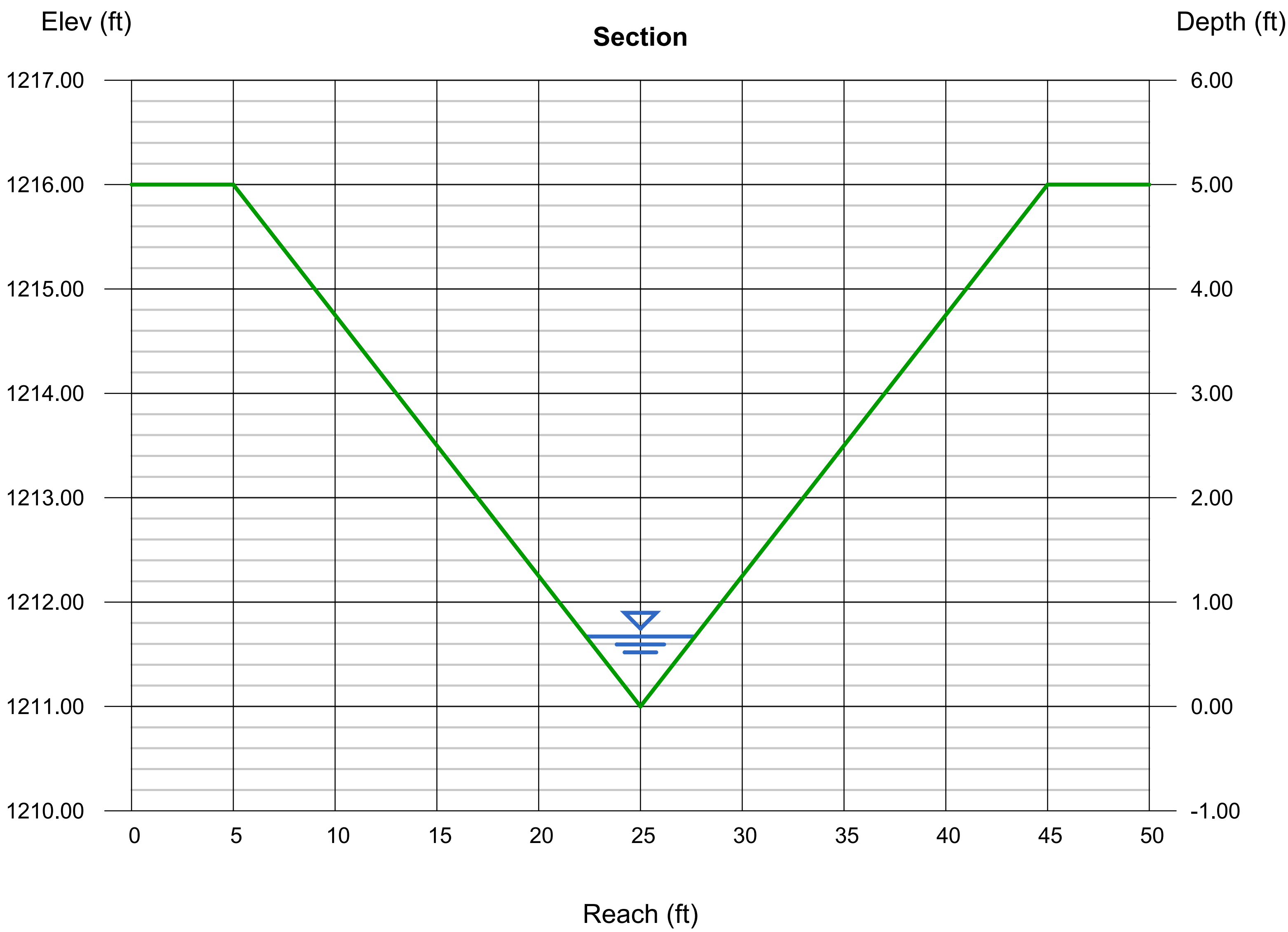
Q @ Subarea A2 to POC #8

Triangular
Side Slopes (z:1) = 4.00, 4.00
Total Depth (ft) = 5.00

Invert Elev (ft) = 1211.00
Slope (%) = 8.60
N-Value = 0.035

Calculations
Compute by: Known Q
Known Q (cfs) = 10.20

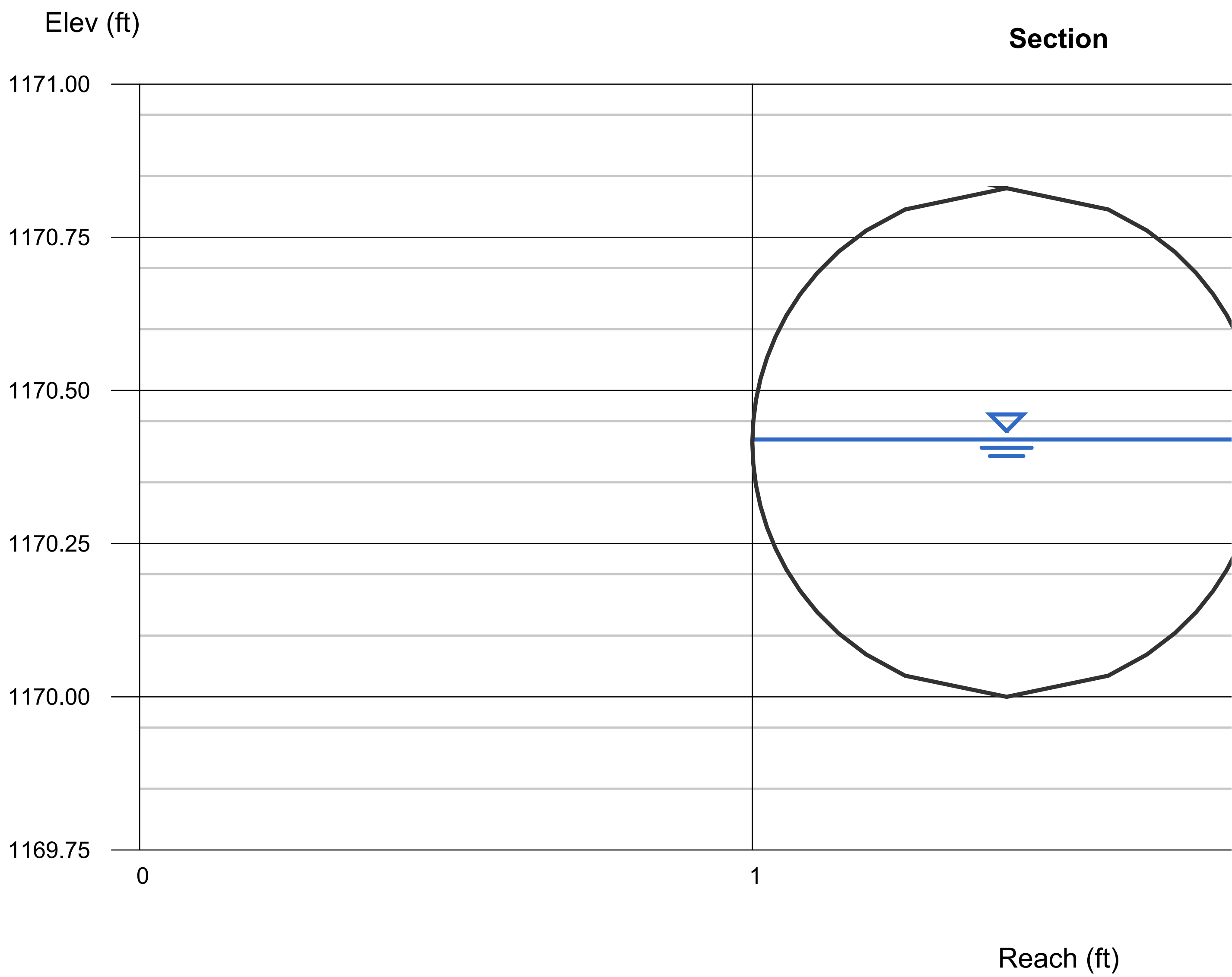
Highlighted
Depth (ft) = 0.67
Q (cfs) = 10.20
Area (sqft) = 1.80
Velocity (ft/s) = 5.68
Wetted Perim (ft) = 5.52
Crit Depth, Yc (ft) = 0.84
Top Width (ft) = 5.36
EGL (ft) = 1.17



Channel Report

Q in Pipe @ Subarea B3 POC #9

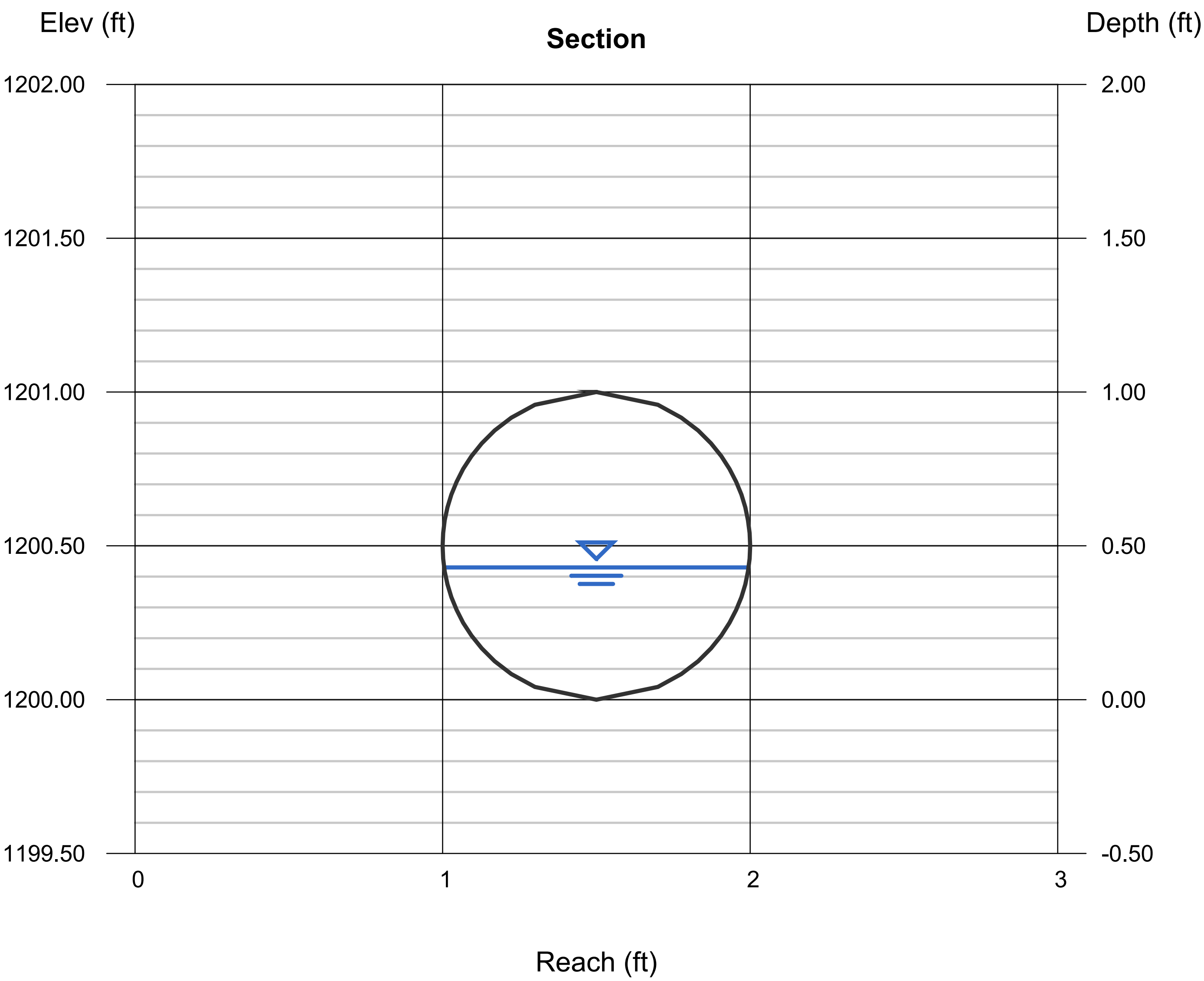
Circular		**Highlighted**	
Diameter (ft)	= 0.83	Depth (ft)	= 0.42
		Q (cfs)	= 4.200
		Area (sqft)	= 0.28
Invert Elev (ft)	= 1170.00	Velocity (ft/s)	= 15.25
Slope (%)	= 15.00	Wetted Perim (ft)	= 1.32
N-Value	= 0.013	Crit Depth, Yc (ft)	= 0.81
		Top Width (ft)	= 0.83
Calculations		EGL (ft)	= 4.04
Compute by:	Known Q		
Known Q (cfs)	= 4.20		



Channel Report

Q in Pipe @ Subarea C3 POC #9

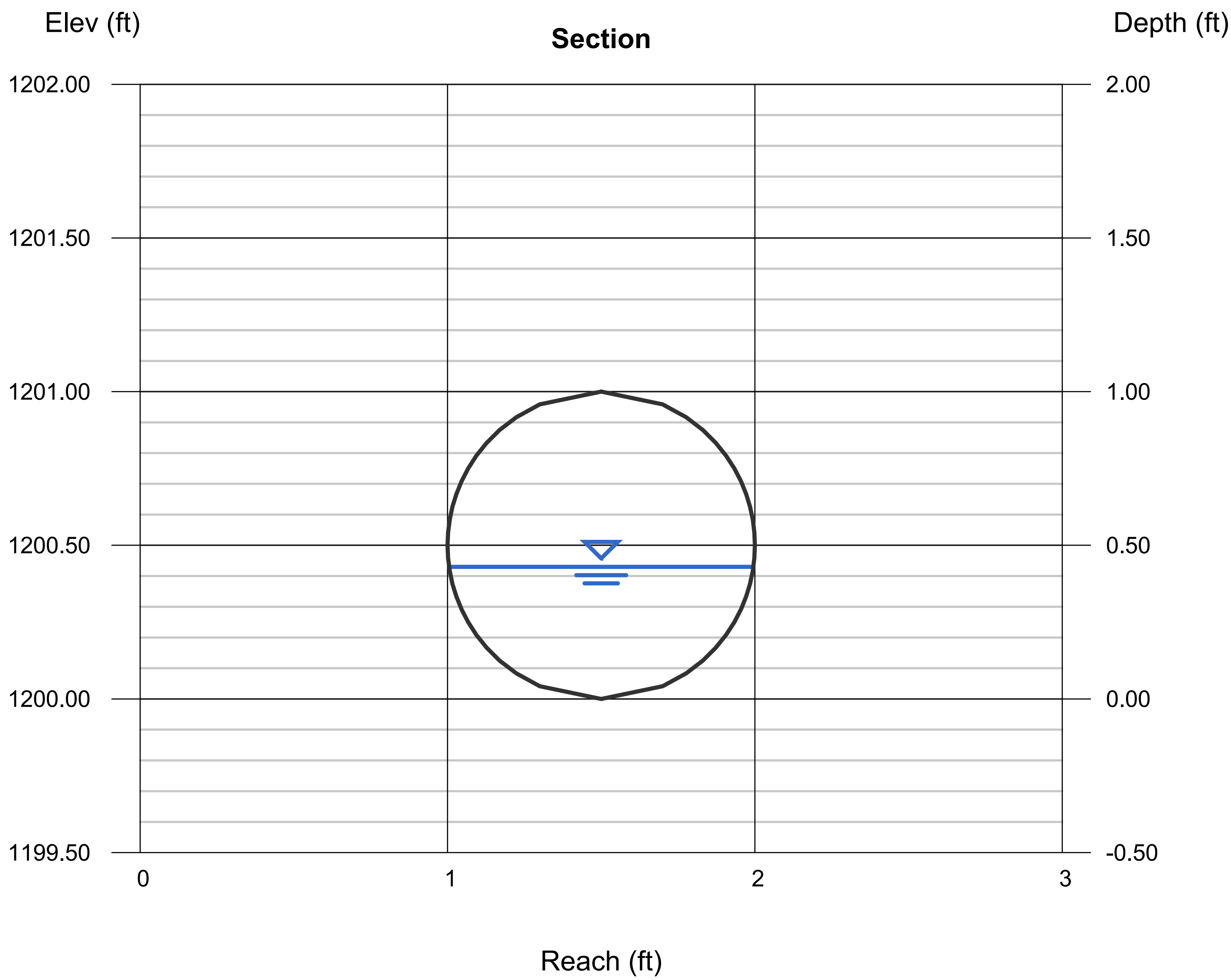
Circular		**Highlighted**	
Diameter (ft)	= 1.00	Depth (ft)	= 0.43
		Q (cfs)	= 5.000
		Area (sqft)	= 0.33
Invert Elev (ft)	= 1200.00	Velocity (ft/s)	= 15.37
Slope (%)	= 13.40	Wetted Perim (ft)	= 1.43
N-Value	= 0.013	Crit Depth, Yc (ft)	= 0.92
		Top Width (ft)	= 0.99
Calculations		EGL (ft)	= 4.10
Compute by:	Known Q		
Known Q (cfs)	= 5.00		



Channel Report

Q in Pipe @ Subarea C3 POC #13

Circular		**Highlighted**	
Diameter (ft)	= 1.00	Depth (ft)	= 0.43
		Q (cfs)	= 5.000
		Area (sqft)	= 0.33
Invert Elev (ft)	= 1200.00	Velocity (ft/s)	= 15.37
Slope (%)	= 13.40	Wetted Perim (ft)	= 1.43
N-Value	= 0.013	Crit Depth, Yc (ft)	= 0.92
		Top Width (ft)	= 0.99
Calculations		EGL (ft)	= 4.10
Compute by:	Known Q		
Known Q (cfs)	= 5.00		



APPENDIX C.3

PRE-DEVELOPMENT 100-YR OVERALL WATERSEHD HYDROLOGY CALCULATIONS

Perrin Winery
16138 Highland Valley Road
Escondido, CA
Hydrology Calculations - 100-Yr Watershed Predevelopment
11/8/2019

100-Yr Watershed Hydrology - Predevelopment

Assumptions:
1) Use "Overland Time Flow Nomograph" equation for initial time of concentration:

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

Where Ti= Time of Concentration (Minutes)
C= Runoff Coefficient,
S= Slope (%)
D or L = Water Course Distance (Feet)

2) Use "Time of Concentration" equation from Figure 3-4 of San Diego County Hydrology Manual

$$Tc = \left(\frac{11.9L^3}{\Delta E}\right)^{0.385}$$

Where Tc= Time of Concentration (Hour)
L= Water Course Distance (Miles)
ΔE= Change in Elevation (Feet)
A= Area (Acre)

3)Assume soil hydrologic group "C" for offsite watershed runoff with low density residential (LDR) with less than 1.0 DU/A (C=0.36 per Table 3-1 on San Diego County Hydrology. Manual)

4) Use "Rainfall Intensity" equation; $I = 7.44\ (P_{6)}\ D^{-0.645}$
Where I= Rainfall Intensitty (in/hr)
P_6= ("3.5"), Rainfall Isopluvials 100-Yr 6-Hr ; See Isopluvial Map
D, (Tc)= Time of Concentration (Minutes)

	Tributary Area	Upstream Node	Downstream Node	A, (ac)	D, (ft)	C	(C)*(A)	Σ(CA)	ΔE, (ft)	S, (%)	Ti, (min)	Tc, (min)	ΣTc	v (ft/s)	I, (in/hr)	Q_{100}
System #1	M	50	51	2.0	423	0.36	0.7	0.7	80	18.9	10.3	1.6	11.8		5.3	3.8
	N	51	54	111.9	2605	0.36	40.3	41.0	305	11.7		3.8	15.6	11.48	4.4	181.3
System #2	O	52	53	2.0	450	0.36	0.7	0.7	215	47.8	7.8	1.1	8.9		6.3	4.6
	P	53	54	149.1	3898	0.36	53.7	54.4	545	14.0		4.9	13.9	13.15	4.8	259.7
System #3	S	54	56	65.5	1739	0.36	23.6	119.0	140	8.1		1.8	15.7	16.01	4.4	524.9
System #4	Q	50	55	2.0	463	0.36	0.7	0.7	60	13.0	12.2	1.9	14.1		4.7	3.4
	R	55	56	313.9	6028	0.36	113.0	113.7	465	7.7		7.9	22.1	12.67	3.5	402.5
System #5	T	56	57	60.0	1943	0.36	21.6	254.3	65	3.3		2.3	24.3	14.26	3.3	845.0

Perrin Winery
16138 Highland Valley Road
Escondido, CA
Hydrology Calculations - Predevelopment Supporting Calculations
11/8/2019

Determine t_c:

System #1

t_c @ Point of Concentration #51 11.8 min

Determine t_c from Line of Point 51 to 54:

Q @ Point 50=	3.8	cfs	
Estimated Q @ Point 2=	113.9	cfs	** Based on q_{avg} = 1 cfs/acre
Average Q in reach=	58.9	cfs	

__Assume Triangular Channel Flow:__

Q=	58.9	cfs	→ SEE CALCS, PG.
n=	0.035		
side slopes=	2:1		
slope=	0.117		
velocity=	11.48	fps	*** Per Channel Report, pg.
flow length=	2,605	ft	
travel time=	3.8	min	From POC #50 to #52

System #2

t_c @ Point of Concentration #53= 8.9 min

Determine t_c from Point 53 to 54:

Q @ Point 51=	4.6	cfs	
Estimated Q @ Point 52=	151.1	cfs	** Based on q_{avg} = 1 cfs/acre
Average Q in reach=	77.8	cfs	

__Assume Triangular Channel Flow:__

Q=	77.8	cfs	
n=	0.035		
side slopes=	2:1		
slope=	0.140		
velocity=	13.15	fps	*** Per Channel Report, pg.
flow length=	3,898	ft	
travel time=	4.9	min	From POC #53 to #54

System #3

Junction Equation @ POC #54

Q_{T1}= Q1+(Tc2/Tc1)*Q2
= 181.2+(13.9/15.6)*259.7
= 411.9 cfs

Q_{T2}= Q2+(I1/I2)*Q1
= 259.7+(4.4/4.8)*181.2
= 427.7 cfs

Use Q2 for larger Q; Use Tc2

t_c @ Point of Concentration #54= 13.9 min

Determine t_c from Point 54 to 56:

Q @ Point 54= 427.7 cfs

Estimated Q @ Point 56= 330.5 cfs ** Based on q_{avg} = 1 cfs/acre

Average Q in reach= 379.1 cfs

Assume Triangular Channel Flow:

Q=	379.1	cfs
n=	0.035	
side slopes=	2:1	
slope=	0.081	
velocity=	16.01	fps
flow length=	1739	ft
travel time=	1.8	min

*** Per Channel Report, pg.

System #4

t_c @ Point of Concentration 55= 1.9 min

Determine t_c from Point 55 to 56:

Q @ Point 55= 3.4 cfs

Estimated Q @ Point 56= 315.9 cfs ** Based on 1 cfs/acre

Average Q in reach= 159.6 cfs

Assume Triangular Channel Flow:

Q=	159.6	cfs
n=	0.035	
side slopes=	2:1	
slope=	0.077	
velocity=	12.67	fps

*** Per Channel Report, pg.

flow length= 6028 ft
travel time= 7.9 min

System #5

Junction Equation @ POC #56

Q_{T3}= Q3+(Tc3/Tc4)*Q4
= 524.9+(15.7/22.1)*402.5
= 810.9 cfs

Q_{T4}= Q4+(I4/I3)*Q3
= 402.5+(3.5/4.4)*524.9
= 823.6 cfs

Use Q4 for larger Q; Use Tc4

t_c @ Point of Concentration #56= 22.1 min

Determine t_c from Point 56 to 57:

Q @ Point 54= 823.6 cfs

Estimated Q @ Point 57= 706.4 cfs ** Based on q_{avg} = 1 cfs/acre

Average Q in reach= 765.0 cfs

Assume Triangular Channel Flow:

Q=	765.0	cfs
n=	0.035	
side slopes=	2:1	
slope=	0.033	
velocity=	14.26	fps *** Per Channel Report, pg.
flow length=	1943	ft
travel time=	2.3	min

Channel Report

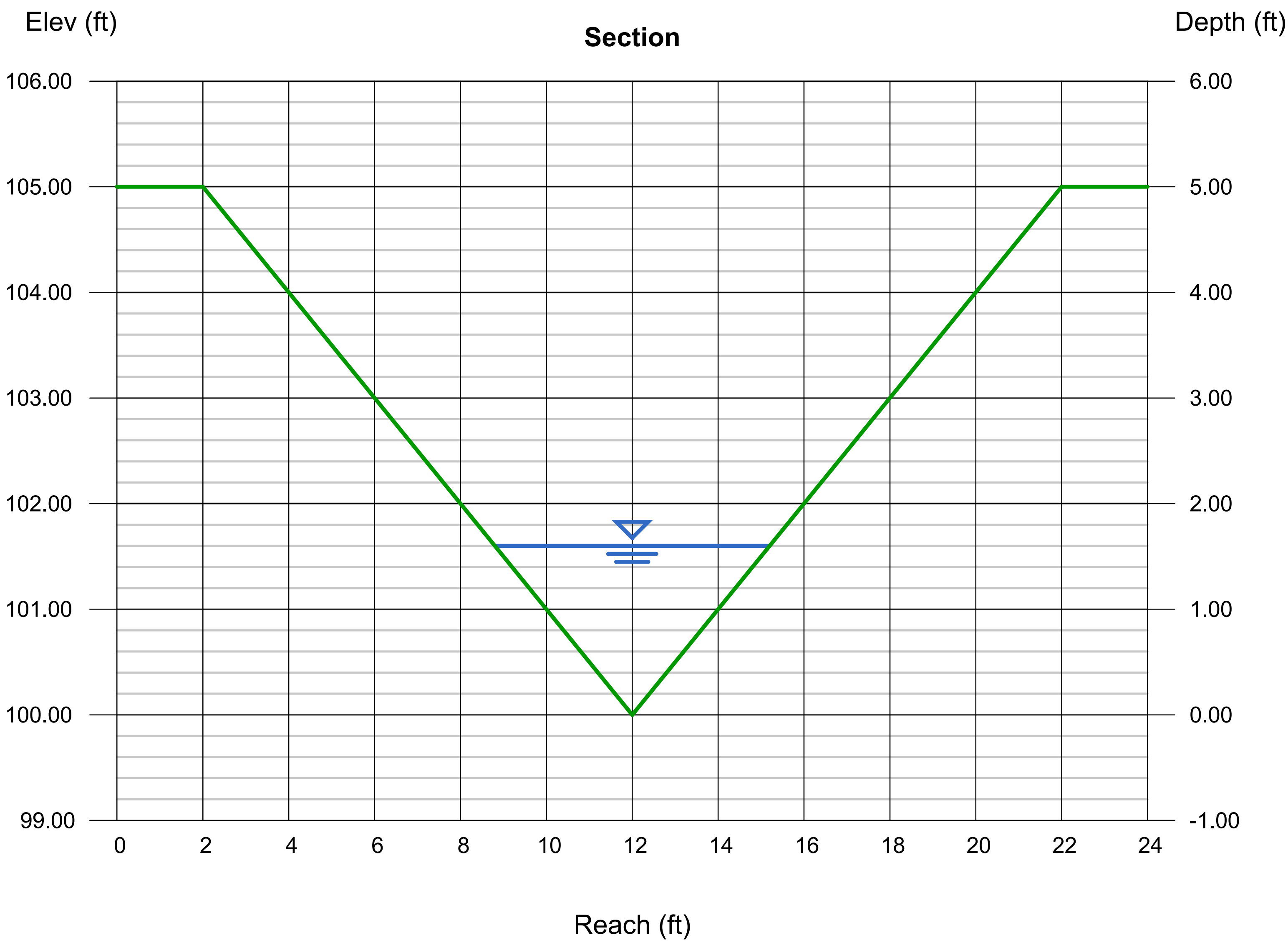
Q @ System #1 POC #51 to #54

Triangular
Side Slopes (z:1) = 2.00, 2.00
Total Depth (ft) = 5.00

Invert Elev (ft) = 100.00
Slope (%) = 11.70
N-Value = 0.035

Calculations
Compute by: Known Q
Known Q (cfs) = 58.80

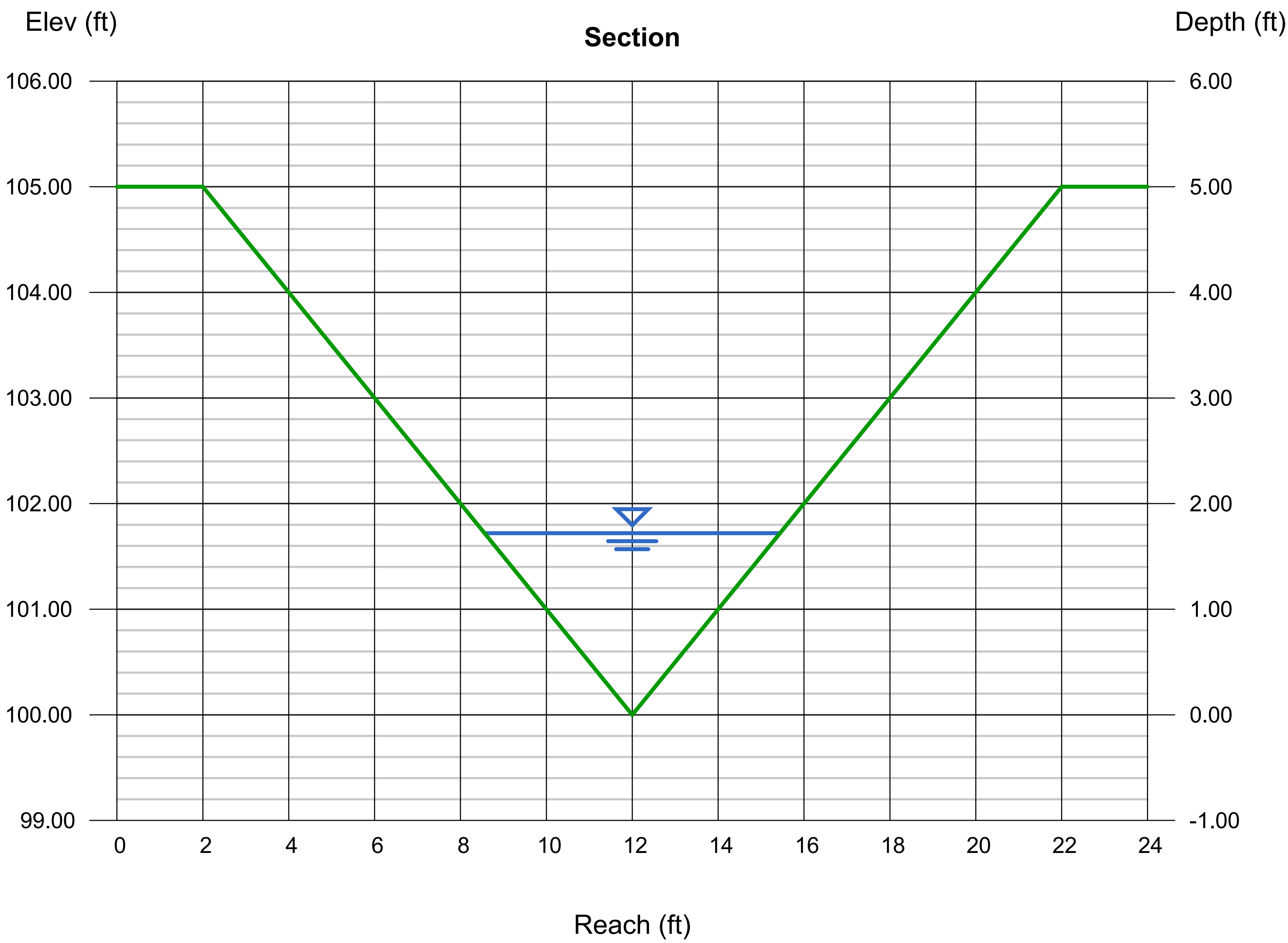
Highlighted
Depth (ft) = 1.60
Q (cfs) = 58.80
Area (sqft) = 5.12
Velocity (ft/s) = 11.48
Wetted Perim (ft) = 7.16
Crit Depth, Yc (ft) = 2.22
Top Width (ft) = 6.40
EGL (ft) = 3.65



Channel Report

Q @ System #2 POC #53 to #54

Triangular		**Highlighted**	
Side Slopes (z:1)	= 2.00, 2.00	Depth (ft)	= 1.72
Total Depth (ft)	= 5.00	Q (cfs)	= 77.80
		Area (sqft)	= 5.92
Invert Elev (ft)	= 100.00	Velocity (ft/s)	= 13.15
Slope (%)	= 14.00	Wetted Perim (ft)	= 7.69
N-Value	= 0.035	Crit Depth, Yc (ft)	= 2.49
		Top Width (ft)	= 6.88
Calculations		EGL (ft)	= 4.41
Compute by:	Known Q		
Known Q (cfs)	= 77.80		



Channel Report

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Q @ System #3 POC #54 to #56

Triangular

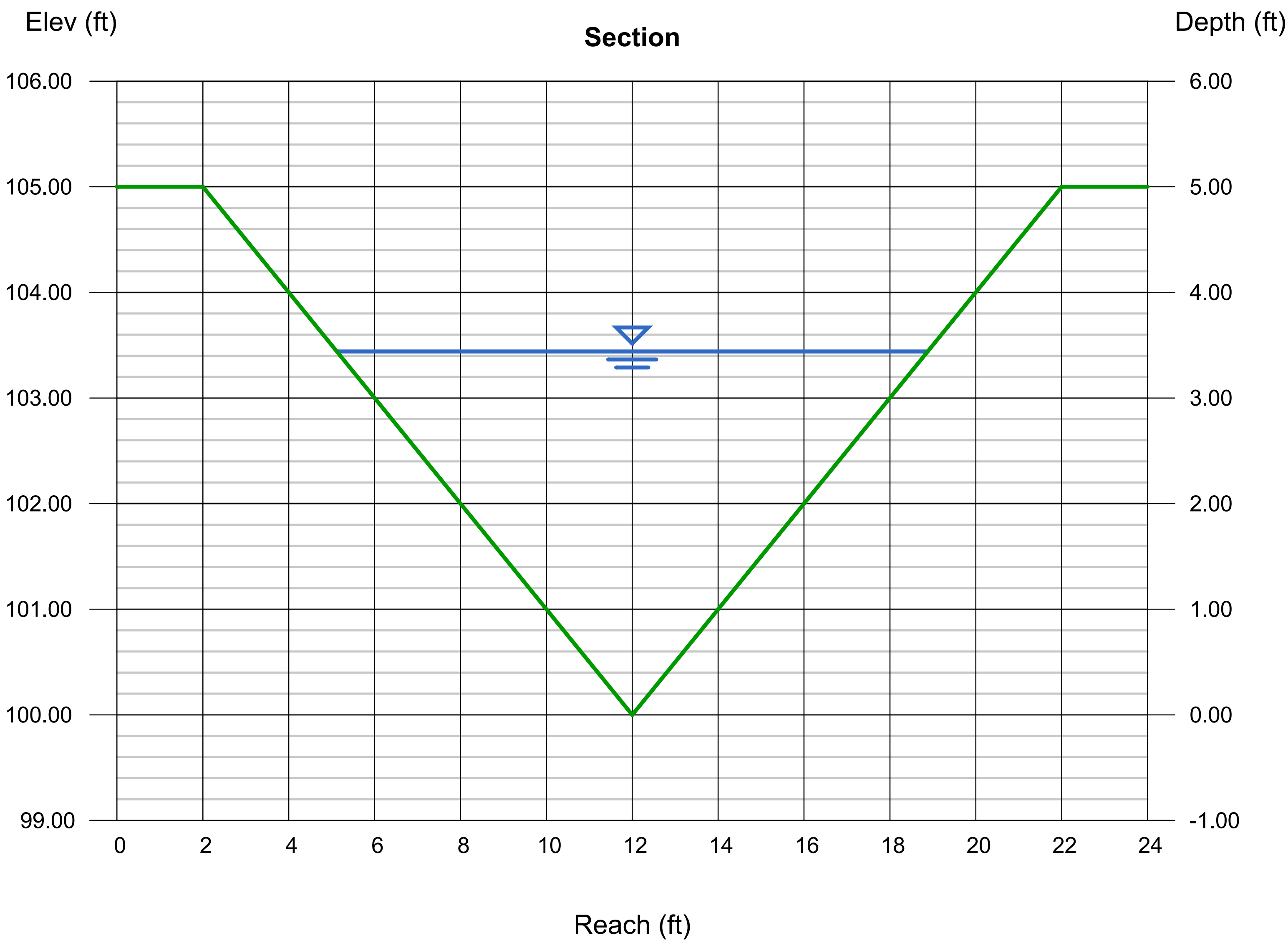
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 5.00
Invert Elev (ft)	= 100.00
Slope (%)	= 8.10
N-Value	= 0.035

Calculations

Compute by:	Known Q
Known Q (cfs)	= 378.90

Highlighted

Depth (ft)	= 3.44
Q (cfs)	= 378.90
Area (sqft)	= 23.67
Velocity (ft/s)	= 16.01
Wetted Perim (ft)	= 15.38
Crit Depth, Yc (ft)	= 4.68
Top Width (ft)	= 13.76
EGL (ft)	= 7.42



Channel Report

Q @ System #4 POC #55 to #56

Triangular

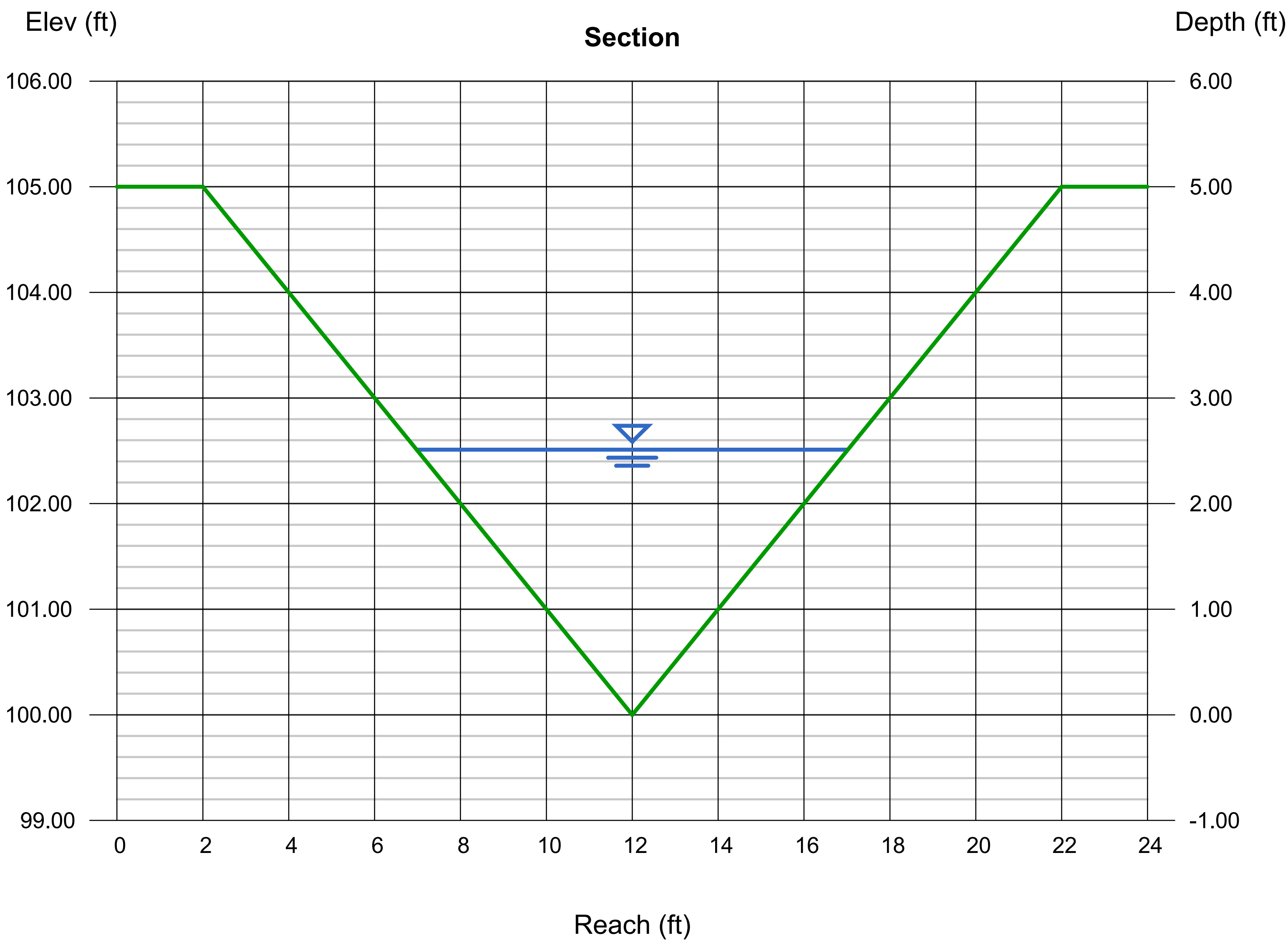
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 5.00
Invert Elev (ft)	= 100.00
Slope (%)	= 7.70
N-Value	= 0.035

Calculations

Compute by:	Known Q
Known Q (cfs)	= 159.60

Highlighted

Depth (ft)	= 2.51
Q (cfs)	= 159.60
Area (sqft)	= 12.60
Velocity (ft/s)	= 12.67
Wetted Perim (ft)	= 11.23
Crit Depth, Yc (ft)	= 3.31
Top Width (ft)	= 10.04
EGL (ft)	= 5.00



Channel Report

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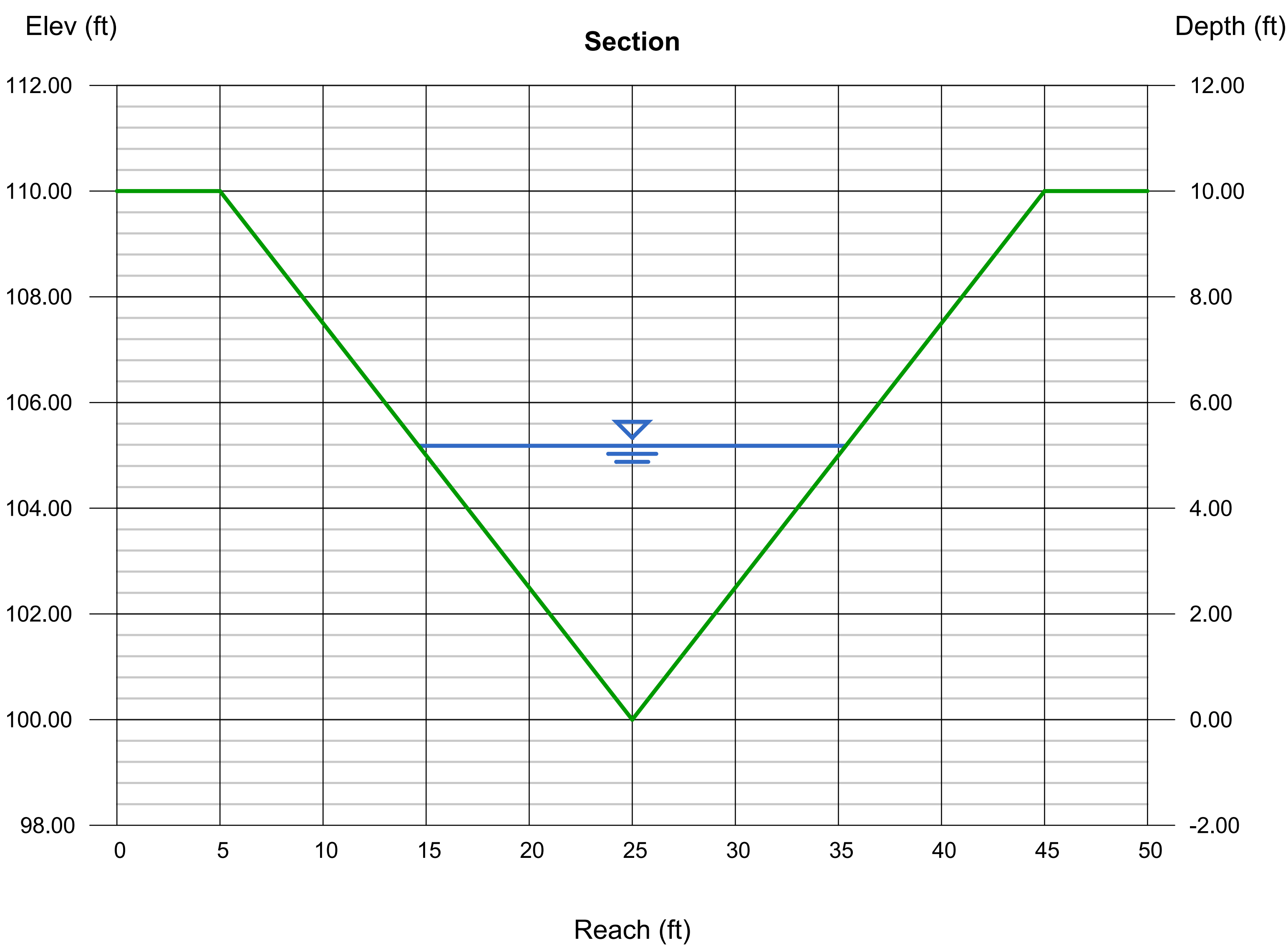
Q @ System #5 POC #56 to #57

Triangular
Side Slopes (z:1) = 2.00, 2.00
Total Depth (ft) = 10.00

Invert Elev (ft) = 100.00
Slope (%) = 3.30
N-Value = 0.033

Calculations
Compute by: Known Q
Known Q (cfs) = 765.00

Highlighted
Depth (ft) = 5.18
Q (cfs) = 765.00
Area (sqft) = 53.67
Velocity (ft/s) = 14.26
Wetted Perim (ft) = 23.17
Crit Depth, Yc (ft) = 6.20
Top Width (ft) = 20.72
EGL (ft) = 8.34



APPENDIX C.4

POST-DEVELOPMENT 100-YR OVERALL WATERSEHD HYDROLOGY CALCULATIONS

Perrin Winery
16138 Highland Valley Road
Escondido, CA
Hydrology Calculations - 100-Yr Watershed Post-Development
11/8/2019

100-Yr Watershed Hydrology - Post-Development

Assumptions:

1) Use "Overland Time Flow Nomograph" equation for initial time of concentration:

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

Where Ti= Time of Concentration (Minutes)
C= Runoff Coefficient,
S= Slope (%)
D or L = Water Course Distance (Feet)

2) Use "Time of Concentration" equation from Figure 3-4 of San Diego County Hydrology Manual

$$Tc = \left(\frac{11.9L^3}{\Delta E}\right)^{0.385}$$

Where Tc= Time of Concentration (Hour)
L= Water Course Distance (Miles)
ΔE= Change in Elevation (Feet)
A= Area (Acre)

3)Assume soil hydrologic group "C" for offsite watershed runoff with low density residential (LDR) with less than 1.0 DU/A (C=0.36 per Table 3-1 on San Diego County Hydrology. Manual)

3A) Assume post-development C-Weighted of 0.48 over 9.5 acres of overall project site area (see post-development of C-weighted calculations on page)

System #5 Post Development
runoff coefficient = (0.36*(60-8.7)+(0.50*8.7))/60
= **0.38**

4) Use "Rainfall Intensity" equation; $I = 7.44\,(P_{6})\,D^{-0.645}$

Where I= Rainfall Intensitty (in/hr)
P_6= ("3.5"), Rainfall Isopluvials 100-Yr 6-Hr ; See Isopluvial Map
D, (Tc)= Time of Concentration (Minutes)

	Tributary Area	Upstream Node	Downstream Node	A, (ac)	D, (ft)	C	(C)*(A)	Σ(CA)	ΔE, (ft)	S, (%)	Ti, (min)	Tc, (min)	ΣTc	v (ft/s)	I, (in/hr)	Q_{100}
System #1	M	50	51	2.0	423	0.36	0.7	0.7	80	18.9	10.3	1.6	11.8		5.3	3.8
	N	51	54	111.9	2605	0.36	40.3	41.0	305	11.7		3.8	15.6	11.48	4.4	181.3
System #2	O	52	53	2.0	450	0.36	0.7	0.7	215	47.8	7.8	1.1	8.9		6.3	4.6
	P	53	54	149.1	3898	0.36	53.7	54.4	545	14.0		4.9	13.9	13.15	4.8	259.7
System #3	S	54	56	65.5	1739	0.36	23.6	119.0	140	8.1		1.8	15.7	16.01	4.4	524.9
System #4	Q	50	55	2.0	463	0.36	0.7	0.7	60	13.0	12.2	1.9	14.1		4.7	3.4
	R	55	56	313.9	6028	0.36	113.0	113.7	465	7.7		7.9	22.1	12.67	3.5	402.5
System #5	T	56	57	60.0	1943	**0.38**	22.8	255.5	65	3.3		2.3	24.3	14.26	3.3	**849.0**

**** The Q_{100} from pre-development to post-development has increased from 845.0 cfs to 849.0 cfs.**

Perrin Winery
16138 Highland Valley Road
Escondido, CA
Hydrology Calculations - Post-Development Supporting Calculations
11/8/2019

Determine t_c:

System #1

t_c @ Point of Concentration #51 11.8 min

Determine t_c from Line of Point 51 to 54:

Q @ Point 50= 3.8 cfs

Estimated Q @ Point 2= 113.9 cfs ** Based on q_{avg} = 1 cfs/acre

Average Q in reach= 58.9 cfs

<u>Assume Triangular Channel Flow:</u>

Q=	58.9	cfs	→ SEE CALCS, PG.
n=	0.035		
side slopes=	2:1		
slope=	0.117		
velocity=	11.48	fps	*** Per Channel Report, pg.
flow length=	2,605	ft	
travel time=	3.8	min	From POC #50 to #52

System #2

t_c @ Point of Concentration #53= 8.9 min

Determine t_c from Point 53 to 54:

Q @ Point 51= 4.6 cfs

Estimated Q @ Point 52= 151.1 cfs ** Based on q_{avg} = 1 cfs/acre

Average Q in reach= 77.8 cfs

<u>Assume Triangular Channel Flow:</u>

Q=	77.8	cfs	
n=	0.035		
side slopes=	2:1		
slope=	0.140		
velocity=	13.15	fps	*** Per Channel Report, pg.
flow length=	3,898	ft	
travel time=	4.9	min	From POC #53 to #54

System #3

Junction Equation @ POC #54

Q_{T1}= Q1+(Tc2/Tc1)*Q2
= 181.2+(13.9/15.6)*259.7
= 411.9 cfs

Q_{T2}= Q2+(I1/I2)*Q1
= 259.7+(4.4/4.8)*181.2
= 427.7 cfs

Use Q2 for larger Q; Use Tc2

t_c @ Point of Concentration #54= 13.9 min

Determine t_c from Point 54 to 56:

Q @ Point 54= 427.7 cfs

Estimated Q @ Point 56= 330.5 cfs ** Based on q_{avg} = 1 cfs/acre

Average Q in reach= 379.1 cfs

Assume Triangular Channel Flow:

Q=	379.1	cfs
n=	0.035	
side slopes=	2:1	
slope=	0.081	
velocity=	16.01	fps
flow length=	1739	ft
travel time=	1.8	min

*** Per Channel Report, pg.

System #4

t_c @ Point of Concentration 55= 1.9 min

Determine t_c from Point 55 to 56:

Q @ Point 55= 3.4 cfs

Estimated Q @ Point 56= 315.9 cfs ** Based on 1 cfs/acre

Average Q in reach= 159.6 cfs

Assume Triangular Channel Flow:

Q=	159.6	cfs
n=	0.035	
side slopes=	2:1	
slope=	0.077	
velocity=	12.67	fps

*** Per Channel Report, pg.

flow length=	6028	ft
travel time=	7.9	min

System #5

Junction Equation @ POC #56

Q_{T3}= Q3+(Tc3/Tc4)*Q4
= 524.9+(15.7/22.1)*402.5
= 810.9 cfs

Q_{T4}= Q4+(I4/I3)*Q3
= 402.5+(3.5/4.4)*524.9
= 823.6 cfs

Use Q4 for larger Q; Use Tc4

t_c @ Point of Concentration #56= 22.1 min

Determine t_c from Point 56 to 57:

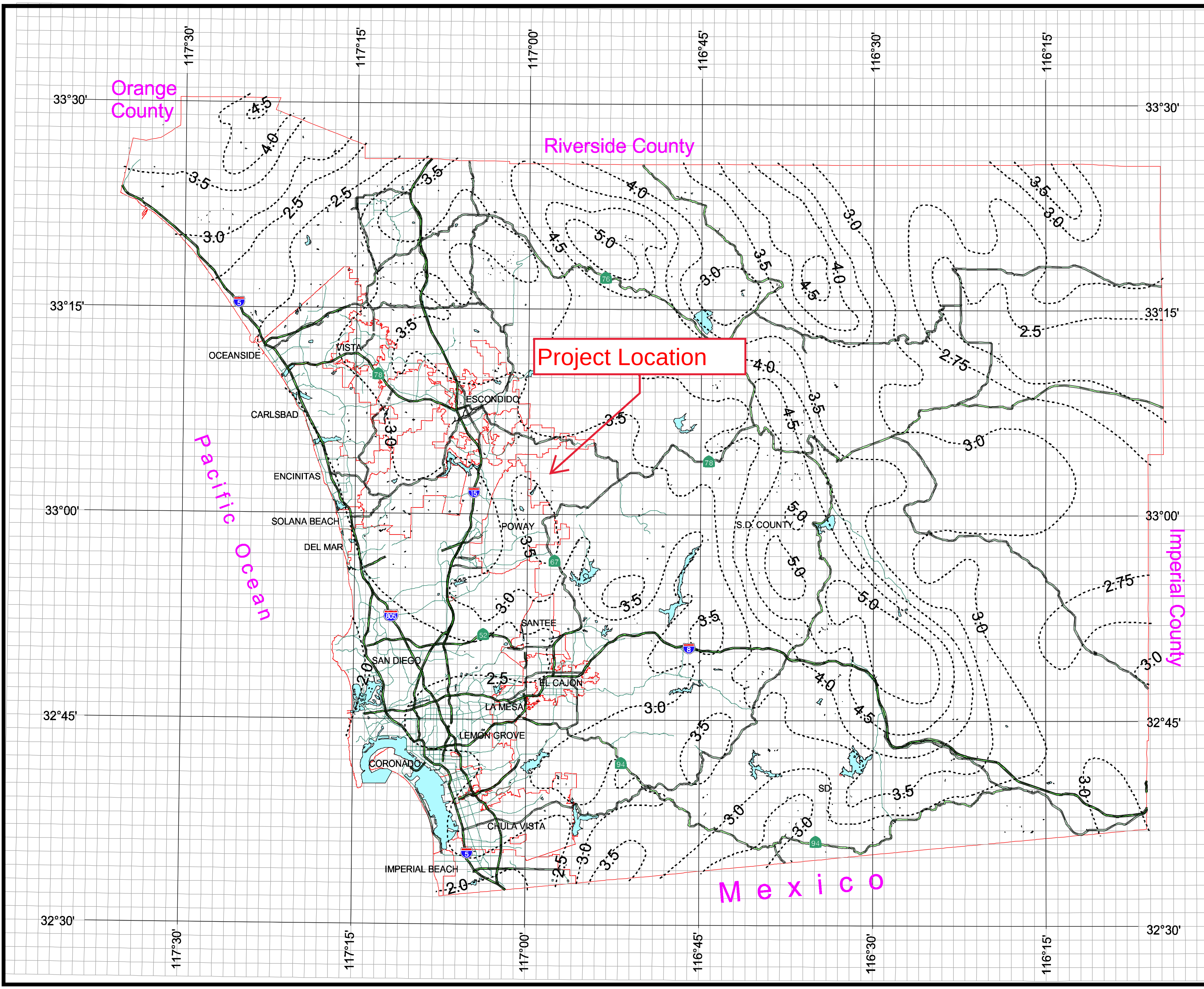
Q @ Point 54=	823.6	cfs	
Estimated Q @ Point 57=	706.4	cfs	** Based on q_{avg} = 1 cfs/acre
Average Q in reach=	765.0	cfs	

<u>Assume Triangular Channel Flow:</u>

Q=	765.0	cfs	
n=	0.035		
side slopes=	2:1		
slope=	0.033		
velocity=	14.26	fps	*** Per Channel Report, pg.
flow length=	1943	ft	
travel time=	2.3	min	

APPENDIX C.5

COUNTY OF SAN DIEGO HYDROLOGIC TABLES AND FIGURES



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

Lat:33o3'
Long: 116o58'
P6 = 3.5

DPW GIS
Department of Public Works
Geographic Information Services

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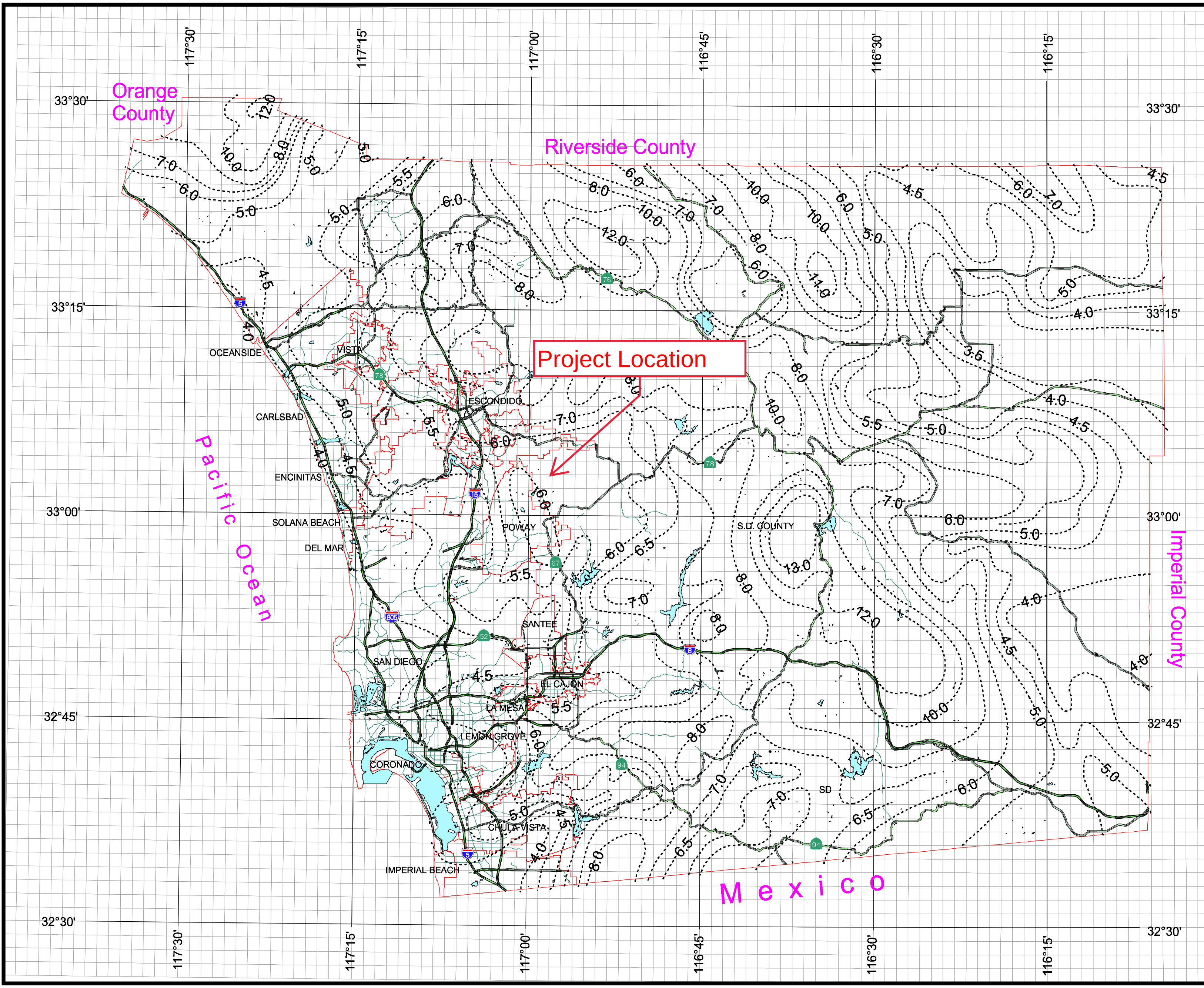

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

Lat:33o3'
Long: 116o58'
P24 = 6.0 in

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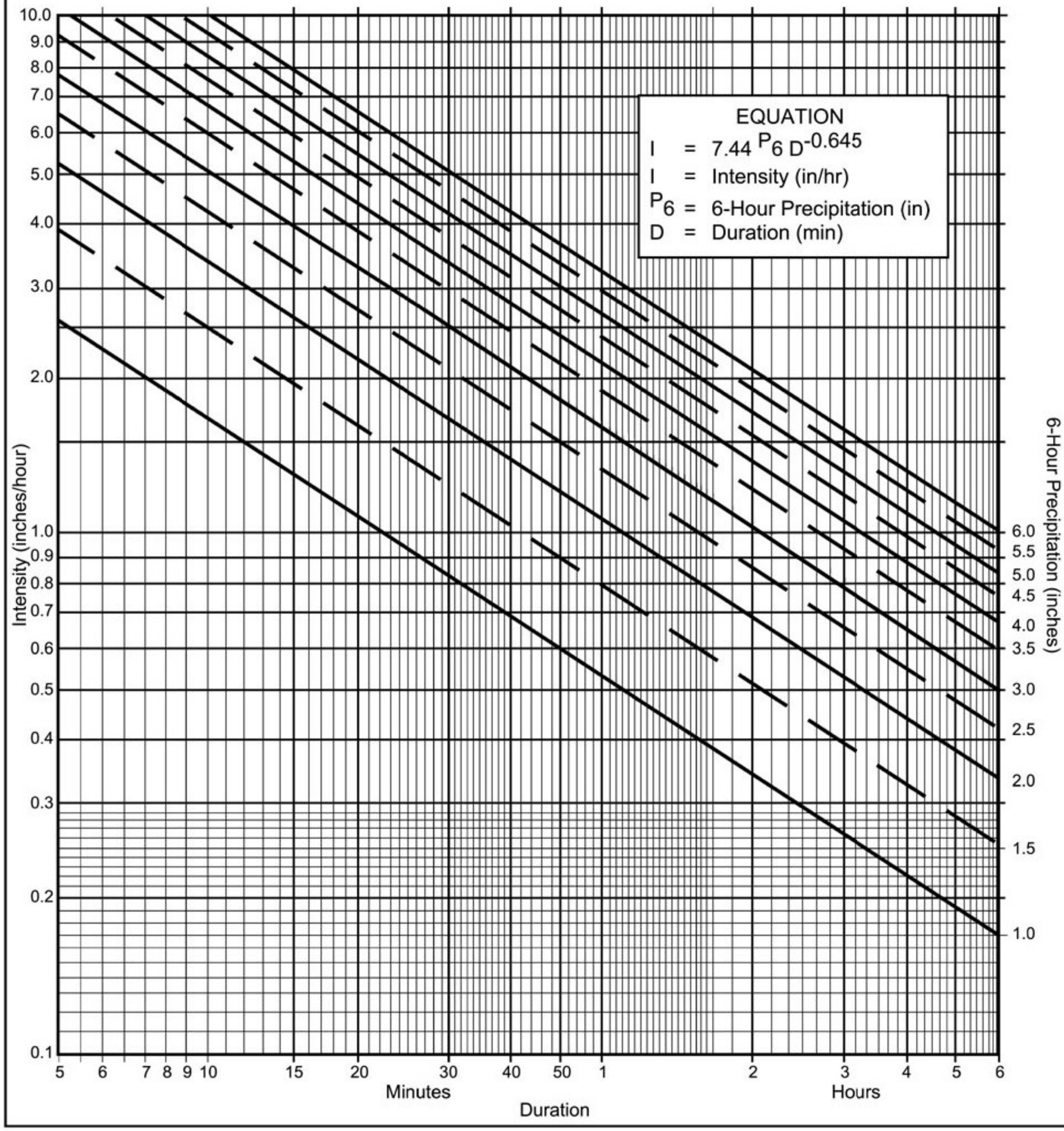


Directions for Application:

(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 applicable 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 = 3.5 in., P_{24} = 6.0 , $\frac{P_6}{P_{24}}$ = 58.3 %(2)

(c) Adjusted $P_6^{(2)}$ = 3.5 in.

(d) t_x = ** min. ** See Calculations Section

(e) I = ** in./hr.

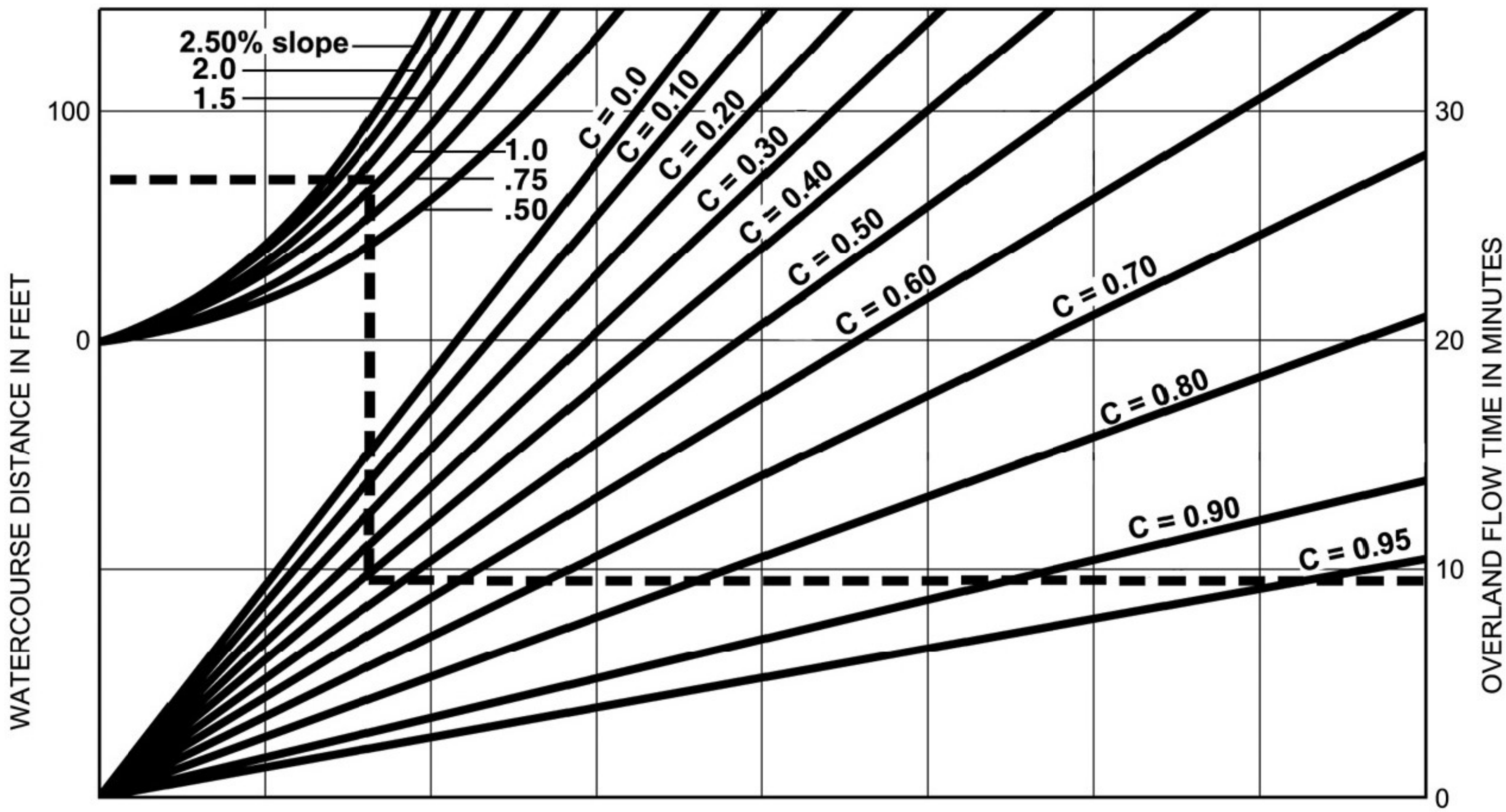
Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6 / Duration	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
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



EXAMPLE:

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

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

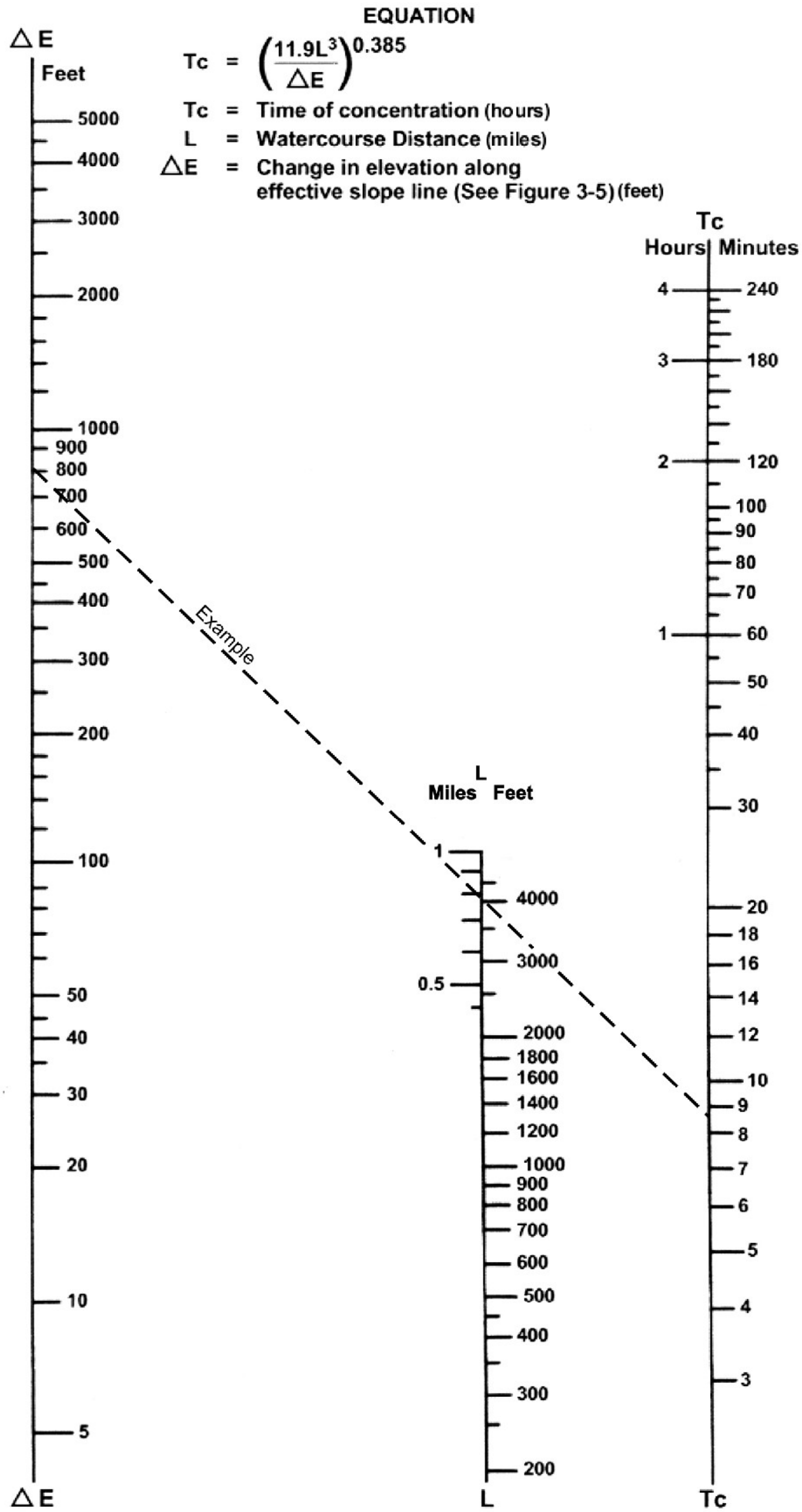
** See Calculations Section

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

FIGURE

3-3

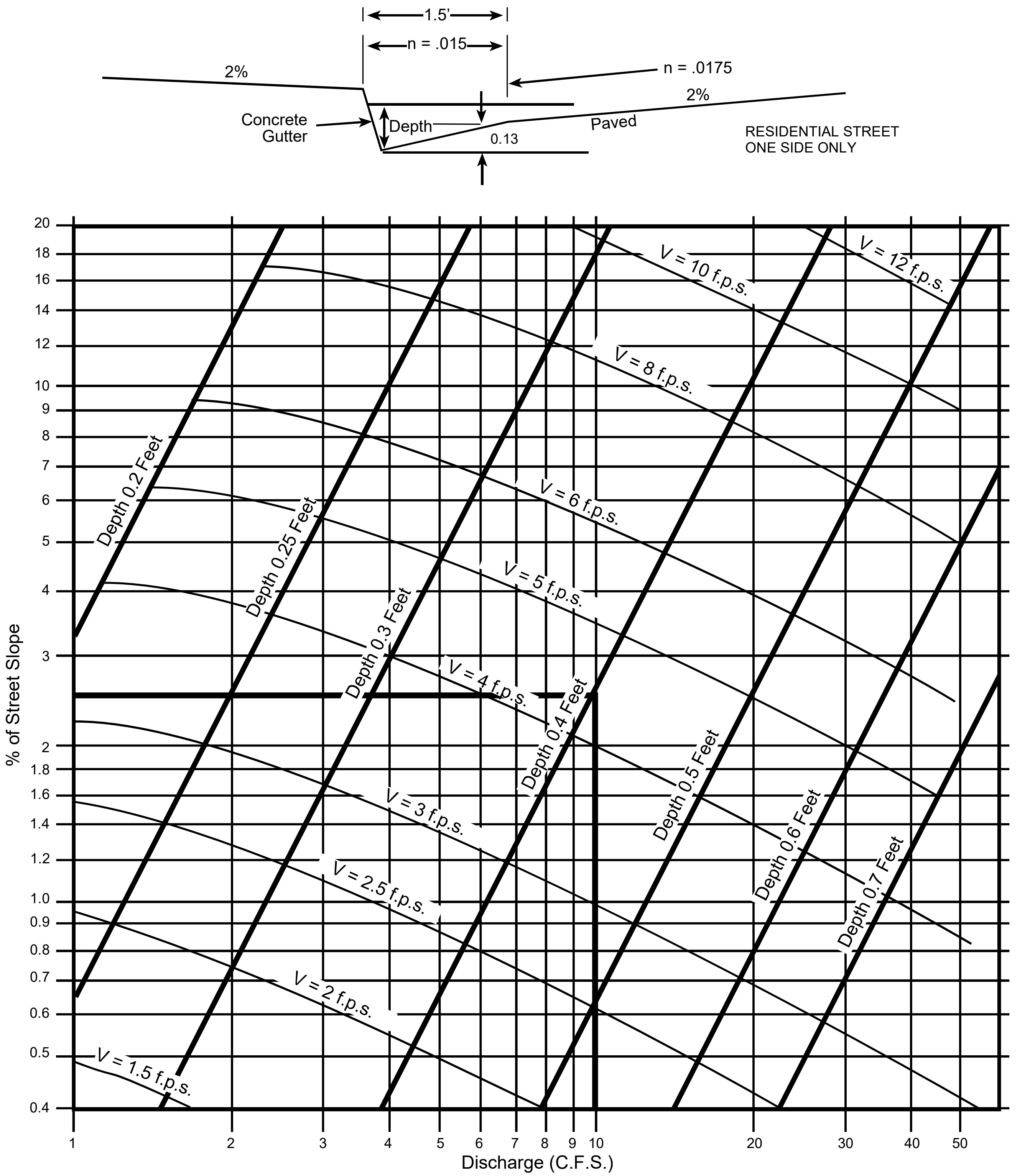
Rational Formula - Overland Time of Flow Nomograph



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



EXAMPLE:

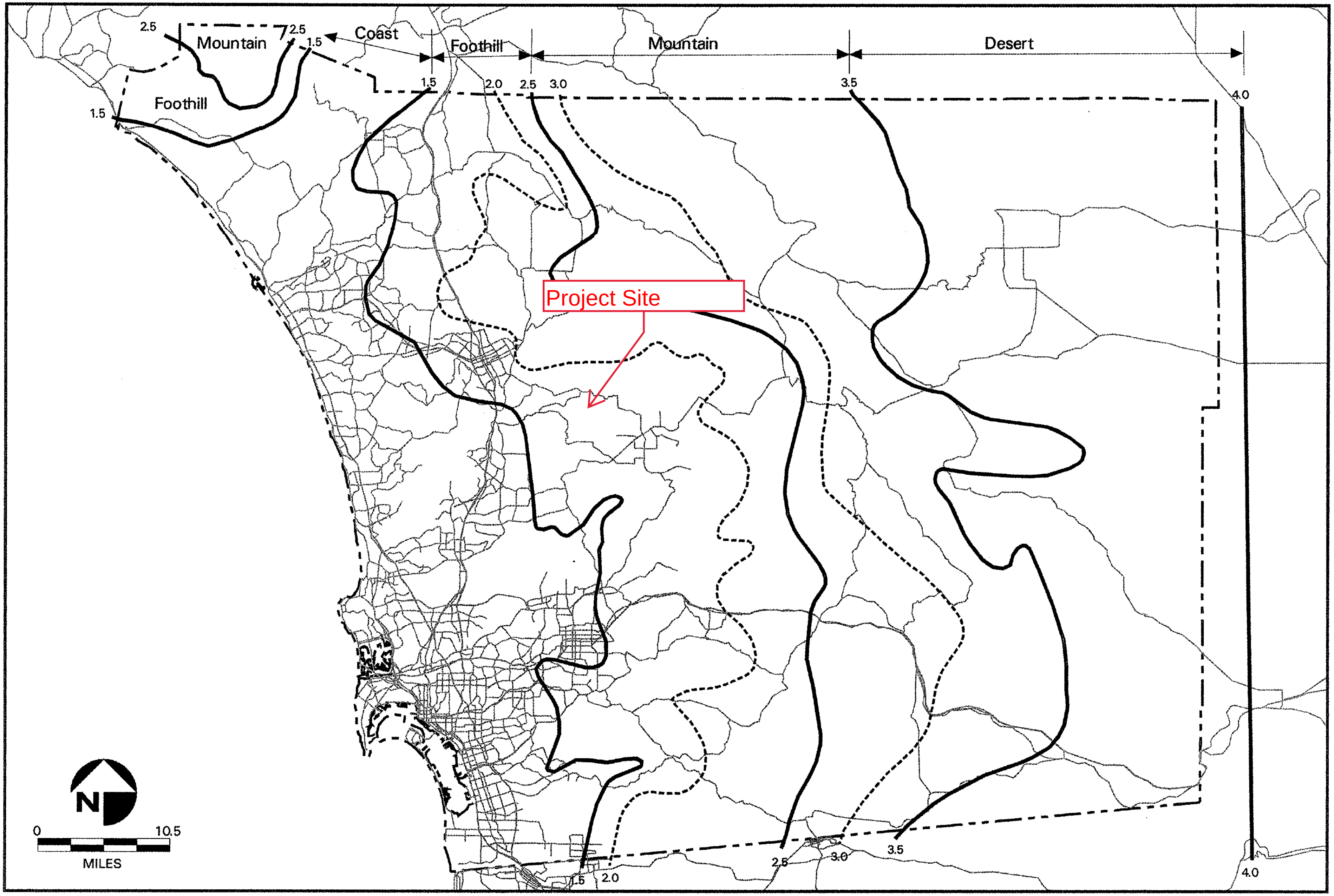
Given: Q = 10 S = 2.5%

Chart gives: Depth = 0.4, Velocity = 4.4 f.p.s.

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

Gutter and Roadway Discharge - Velocity Chart

FIGURE 3-6



County of San Diego Hydrology Manual

Precipitation Zone Numbers (PZN)

FIGURE

C-1

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Table 4-2
RUNOFF CURVE NUMBERS[1] FOR PZN CONDITION = 2.0

Cover Description	Cover Treatment or Practice[2]	Hydrologic Condition[3]	Average Percent Impervious Area[4]	Curve Numbers for Hydrologic Soil Groups: A	B	C	D
Developing urban areas and newly graded areas (pervious areas only, no vegetation)				77	86	91	94
Impervious areas: Paved parking lots, roofs, and driveways (excluding right-of-way)				98	98	98	98
Residential districts by average lot size:[4]							
1/8 acre or less (town houses)			65%	77	85	90	92
1/4 acre			38%	61	75	83	87
1/3 acre			30%	57	72	81	86
1/2 acre			25%	54	70	80	85
1 acre			20%	51	68	79	84
2 acres			12%	46	65	77	82
Streets and roads	Paved; curbs and storm drains (excluding right-of-way)			98	98	98	98
	Paved; open ditches (including right-of-way)			83	89	92	93
	Gravel (including right-of-way)			76	85	89	91
	Hard surface (including right-of-way)			74	84	90	92
	Dirt (including right-of-way)			72	82	87	89
Urban districts[4]	Commercial and business		85%	89	92	94	95
	Industrial		72%	81	88	91	93
Western desert urban areas:							
Natural desert landscaping (pervious areas only)[5]				63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)				96	96	96	96

Table 4-2 (Continued)
RUNOFF CURVE NUMBERS[1] FOR PZN CONDITION = 2.0

Cover Description	Cover Treatment or Practice[2]	Hydrologic Condition[3]	Average Percent Impervious Area[4]	Curve Numbers for Hydrologic Soil Groups: A	B	C	D
Close-seeded legumes or rotated pasture	Straight row	Poor		66	77	85	89
		Good		58	72	81	85
	Contoured	Poor		64	75	83	85
		Good		55	69	78	83
	Contoured and terraced	Poor		63	73	80	83
		Good		51	67	76	80
Cultivated land	Without conservation treatment			72	81	88	91
	With conservation treatment			62	71	78	81
Fallow	Bare soil			77	86	91	94
	Crop residue cover	Poor		76	85	90	92
		Good		74	83	88	90
Farmsteads (buildings, lanes, driveways, and surrounding lots)				59	74	82	86
Irrigated pasture		Poor		58	74	83	87
		Fair		44	65	77	82
		Good		33	58	72	79
Orchards (deciduous)		(see glossary description)					
Orchards (evergreen)		Poor		57	73	82	86
		Fair		44	65	77	82
		Good		33	58	72	79
Row crops	Straight row	Poor		72	81	88	91
		Good		67	78	85	89
	Contoured	Poor		70	79	84	88
		Good		65	75	82	86

Table 4-2 (Continued)
RUNOFF CURVE NUMBERS[1] FOR PZN CONDITION = 2.0

Cover Description	Cover Treatment or Practice[2]	Hydrologic Condition[3]	Average Percent Impervious Area[4]	Curve Numbers for Hydrologic Soil Groups: A	B	C	D
Small grain	Straight row	Poor		65	76	84	88
		Good		63	75	83	87
	Contoured	Poor		63	74	82	85
		Good		61	73	81	84
Vineyards[6]	Disked			76	85	90	92
	Annual grass or legume cover	Poor		65	78	85	89
		Fair		50	69	79	84
		Good		38	61	74	80
Annual grass (Dryland pasture)		Poor		67	78	86	89
		Fair		50	69	79	84
		Good		38	61	74	80
Barren				78	86	91	93
Meadow		Poor		63	77	85	88
		Fair		51	70	80	84
		Good		30	58	72	78
Open space (lawns, parks, golf courses, cemeteries, etc.)[7]	Grass cover <50%	Poor		68	79	86	89
	Grass cover 50% to 75%	Fair		49	69	79	84
	Grass cover >75%	Good		39	61	74	80
Pasture or range land		Poor		68	79	86	89
		Fair		49	69	79	84
		Good		39	61	74	80
Perennial grass		Poor		67	79	86	89
		Fair		50	69	79	84
		Good		38	61	74	80

Table 4-2 (Continued)
RUNOFF CURVE NUMBERS[1] FOR PZN CONDITION = 2.0

Cover Description	Cover Treatment or Practice[2]	Hydrologic Condition[3]	Average Percent Impervious Area[4]	Curve Numbers for Hydrologic Soil Groups: A	B	C	D
Turf[8]		Poor		58	74	83	87
		Fair		44	65	77	82
		Good		33	58	72	79
Water surfaces (during floods)				97	98	99	99
Broadleaf chaparral		Poor		53	70	80	85
		Fair		40	63	75	81
		Good		31	57	71	78
Desert shrub–major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus		Poor		63	77	85	88
		Fair		55	72	81	86
		Good		49	68	79	84
Herbaceous–mixture of grass, weeds, and low-growing brush, with brush the minor element		Poor		[9]	80	87	93
		Fair		[9]	71	81	89
		Good		[9]	62	74	85
Narrowleaf chaparral		Poor		71	82	88	91
		Fair		55	72	81	86
Oak-aspen–mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush		Poor		[9]	66	74	79
		Fair		[9]	48	57	63
		Good		[9]	30	41	48
Open brush		Poor		62	76	84	88
		Fair		46	66	77	83
		Good		41	63	75	81

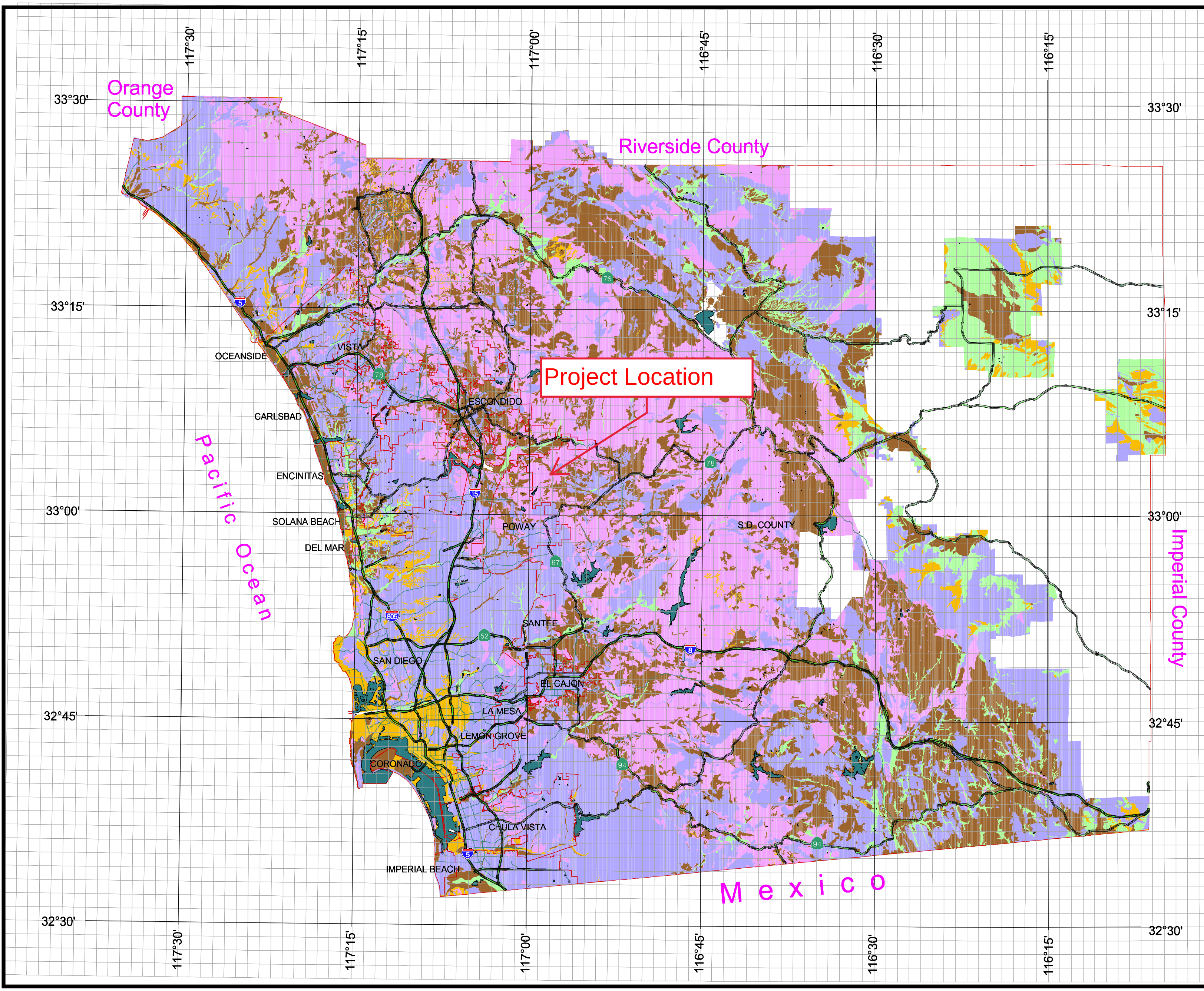
Table 4-2 (Continued)
RUNOFF CURVE NUMBERS[1] FOR PZN CONDITION = 2.0

Cover Description	Cover Treatment or Practice[2]	Hydrologic Condition[3]	Average Percent Impervious Area[4]	Curve Numbers for Hydrologic Soil Groups: A	B	C	D
Pinyon-juniper–pinyon, juniper, or both; grass understory		Poor		[9]	75	85	89
		Fair		[9]	58	73	80
		Good		[9]	41	61	71
Sagebrush with grass understory		Poor		[9]	67	80	85
		Fair		[9]	51	63	70
		Good		[9]	35	47	55
Wood or forest land		Thin stand, poor cover		45	66	77	83
		Good cover		25	55	70	77
Woods (woodland)		Poor		45	66	77	83
		Fair		36	60	73	79
		Good		28	55	70	77
Woodland-grass combination		Poor		57	73	82	86
		Fair		44	65	77	82
		Good		33	58	72	79

1 Average runoff condition, and $I_a = 0.2S$.
2 Hydrologic practices described as "straight row" and "contoured" are defined in the glossary.
3 For definition of hydrologic condition, see Tables 4-3, 4-4, and 4-5.
4 The average percent impervious area shown was used to develop the composite CNs. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. If the impervious area is not directly connected, the NRCS method has an adjustment to reduce the effect.
5 Composite CNs for natural desert landscaping should be computed based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CNs are assumed equivalent to desert shrub in poor hydrologic condition.
6 See glossary.
7 CNs shown are equivalent to those of pasture. Composite CNs may be computed for other combinations of open space cover type.
8 Includes lawns, cemeteries, golf courses and parks with ground cover of mowed and irrigated perennial grass.
9 CNs for Group A have not been developed.

APPENDIX C.6

HYDROLOGIC SOIL GROUP MAP



County of San Diego Hydrology Manual

Soil Hydrologic Groups

Legend

Soil Groups

- Group A
- Group B
- Group C
- Group D
- Undetermined
- Data Unavailable

Lat:33o3'
Long: 116o58'
Soil Group: B & D
*see additional Hydrologic Soil Group Map for more information.

Department of Public Works Geographic Information Services

We Have San Diego Covered!

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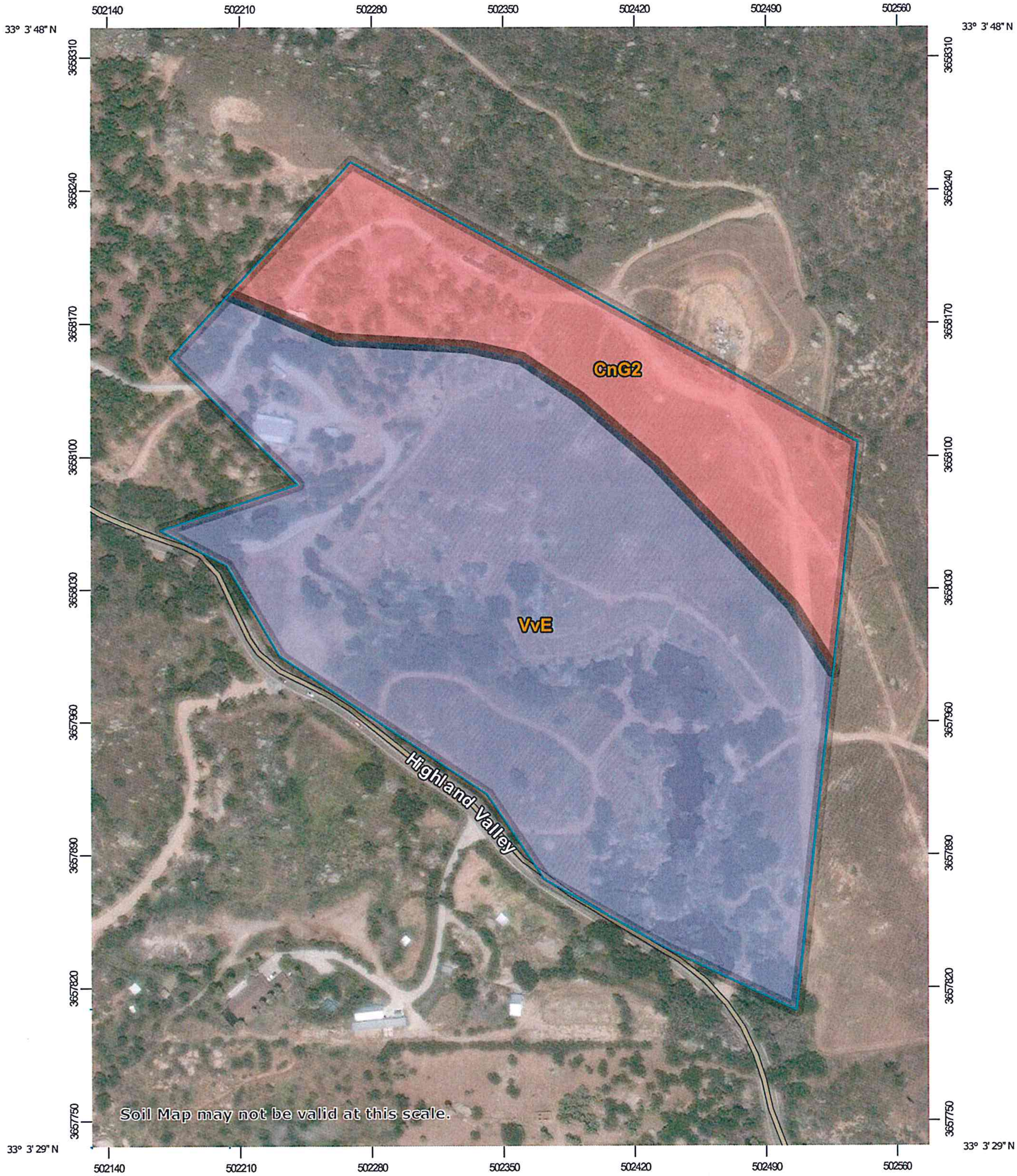
3 0 3 Miles



Map Scale: 1:2,880 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0, 40, 80, 160, 240

Feet: 0, 100, 200, 400, 600

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 12, Sep 13, 2017

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

Date(s) aerial images were photographed: Dec 31, 2009—Mar 11, 2017

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
CnG2	Cieneba-Fallbrook rocky sandy loams, 30 to 65 percent slopes, eroded	D	5.9	25.3%
VvE	Vista rocky coarse sandy loam, 15 to 30 percent slopes	B	17.4	74.7%
Totals for Area of Interest			**23.3**	**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

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie. The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Higher

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

APPENDIX C.7

HYDROGRAPH AND BASIN CALCULATIONS FOR BASIN ROUTING

Drainage Summary																
	Pre-Development						**Post-Development**							**Mitigated**		Mitigation Method
	C_w	T_c	I	A_T	V_{100}	$\mathbf{Q_{100}}$	C_w	T_c	I	A_T	V_{100}	$\mathbf{Q_{100}}$	ΔQ	V_{100}	$\mathbf{Q_{100}}$	
	(unitless)	(minutes)	(inch/hour)	(acre)	(ft/sec)	**(cfs)**	(unitless)	(minutes)	(inch/hour)	(acre)	(ft/sec)	**(cfs)**	(cfs)	(ft/sec)	**(cfs)**	
POC 1	0.39	23.46	3.40	4.16	11.49	**5.59**	0.55	22.26	3.52	4.12	11.49	**8.02**	2.43	10.52	**4.78**	**Bioretention. Please See Attached Basin Routing Worksheets.**
POC 2	0.52	15.03	4.53	1.14	9.13	**2.68**	0.45	17.09	4.17	1.27	8.74	**2.40**	-0.28	n/a	**n/a**	**Post Development Flow is Less Than Pre Development Flows. No Flow Mitigation required.**
POC 3	0.39	18.12	4.02	1.71	8.87	**2.69**	0.42	13.56	4.85	1.66	9.61	**3.41**	0.72	8.87	**2.52**	**Bioretention. Please See Attached Basin Routing Worksheets.**
POC 4	0.64	8.28	6.66	0.13	5.45	**0.53**	0.88	5.38	8.80	0.14	7.12	**1.10**	0.57	4.90	**0.40**	**Bioretention. Please See Attached Basin Routing Worksheets.**
POC 5	0.51	19.73	3.80	0.73	7.36	**1.40**	0.77	10.37	5.76	0.51	8.48	**2.25**	0.85	6.73	**1.04**	**Bioretention. Please See Attached Basin Routing Worksheets.**
POC 6	0.47	14.37	4.67	1.51	9.51	**3.28**	0.49	16.21	4.32	1.52	9.55	**3.20**	-0.08	n/a	**n/a**	**Post Development Flow is Less Than Pre Development Flows. No Flow Mitigation required.**
POC 7	0.61	9.85	5.96	0.26	6.54	**0.95**	0.62	8.78	6.41	0.23	6.59	**0.91**	-0.04	n/a	**n/a**	**Post Development Flow is Less Than Pre Development Flows. No Flow Mitigation required.**

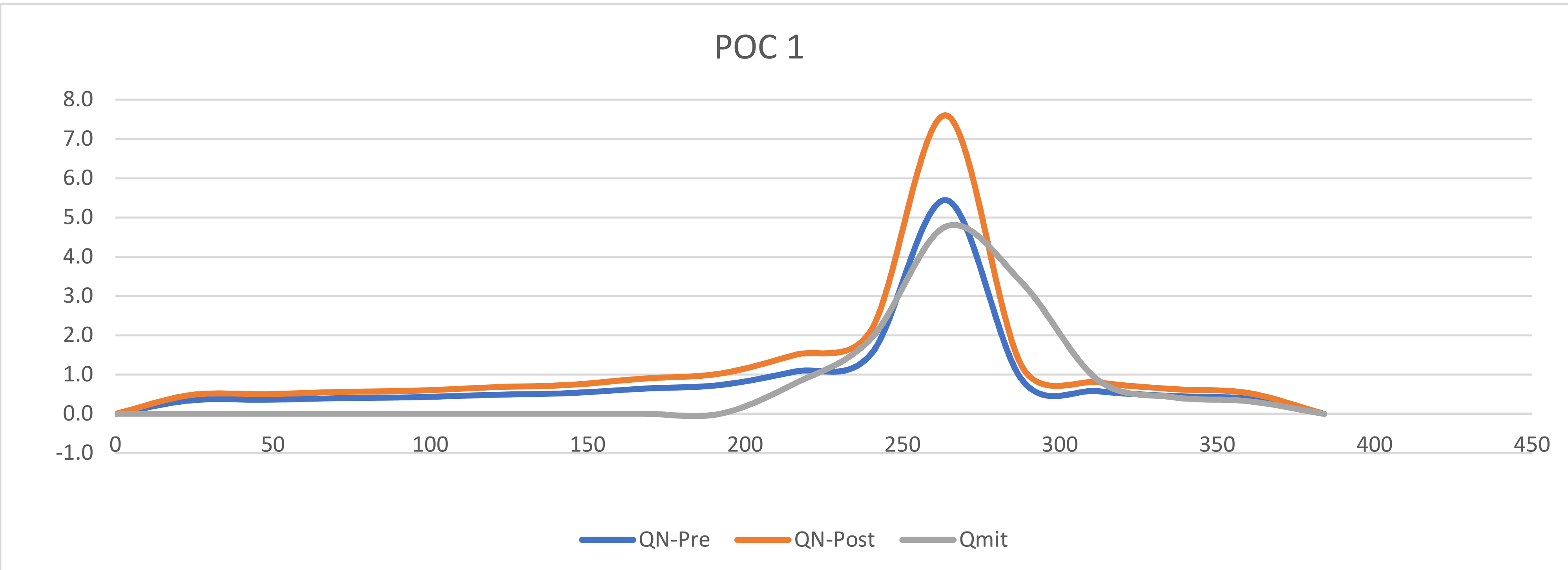
Velocities assume a 12inch pipe falling at 5% slope.

Pre-Development

	Area Impervious	Area Landscaping	Runoff Coefficient Impervious	Runoff Coefficient Landscaping	**Runoff Coefficient Weighted**	Time of Concentration Initial	Elevation at Top of Watercourse	Elevation at Bottom of Watercourse	Elevation Change	Distance of Watercourse	Time of Concentration Travel	Time of Concentration Total	Precipitation 100 year 6 Hour	**Intensity 100 year**	**Area Total**	**Volumetric Flow Pre-Development**
Abbr.	A_I	A_L	C_I	c_L	C_w	T_i	E_T	E_B	ΔE	D	T_T	T_C	P_6	I_{100}	A_T	Q_o
Units	(acres)	(acres)	(unitless)	(unitless)	**(unitless)**	(minutes)	(feet)	(feet)	(feet)	(feet)	(minutes)	(minutes)	(inch)	**(inch/hour)**	**(acres)**	**(cubic feet per second)**
Source	(See Plan)	(See Plan)	(Table 3-1)	(Table 3-1)	$\frac{[(A_I*C_I)+(A_L*C_L)]}{(A_I+A_L)}$	(table 3-2)	(See Plan)	(See Plan)	(E_T-E_B)	(See Plan)	$\frac{(1.8*(1.1-C)*D^{1/2})}{(\Delta E*100/D)^{1/3}}$ (Figure 3-3)	T_i+T_T	(Figure 3-1)	$7.44*P_6*T_C^{-0.645}$ **(Figure 3-1)**	A_I+A_L	$C_w*I_{100}*A_T$
POC 1	0.31	3.84	0.95	0.35	**0.39**	5.8	1,238	1,148	90	899	17.66	23.46	3.5	**3.40**	**4.16**	**5.59**
POC 2	0.32	0.82	0.95	0.35	**0.52**	5.0	1,228	1,169	59	486	10.03	15.03	3.5	**4.53**	**1.14**	**2.68**
POC 3	0.12	1.59	0.95	0.35	**0.39**	5.8	1,256	1,189	67	516	12.32	18.12	3.5	**4.02**	**1.71**	**2.69**
POC 4	0.06	0.07	0.95	0.35	**0.64**	5.0	1,236	1,234	2	43	3.28	8.28	3.5	**6.66**	**0.13**	**0.53**
POC 5	0.19	0.54	0.95	0.35	**0.51**	7.0	1,236	1,224	12	333	12.73	19.73	3.5	**3.80**	**0.73**	**1.40**
POC 6	0.29	1.22	0.95	0.35	**0.47**	5.8	1,248	1,191	57	357	8.57	14.37	3.5	**4.67**	**1.51**	**3.28**
POC 7	0.11	0.15	0.95	0.35	**0.61**	5.0	1,234	1,199	35	200	4.85	9.85	3.5	**5.96**	**0.26**	**0.95**

Post-Development

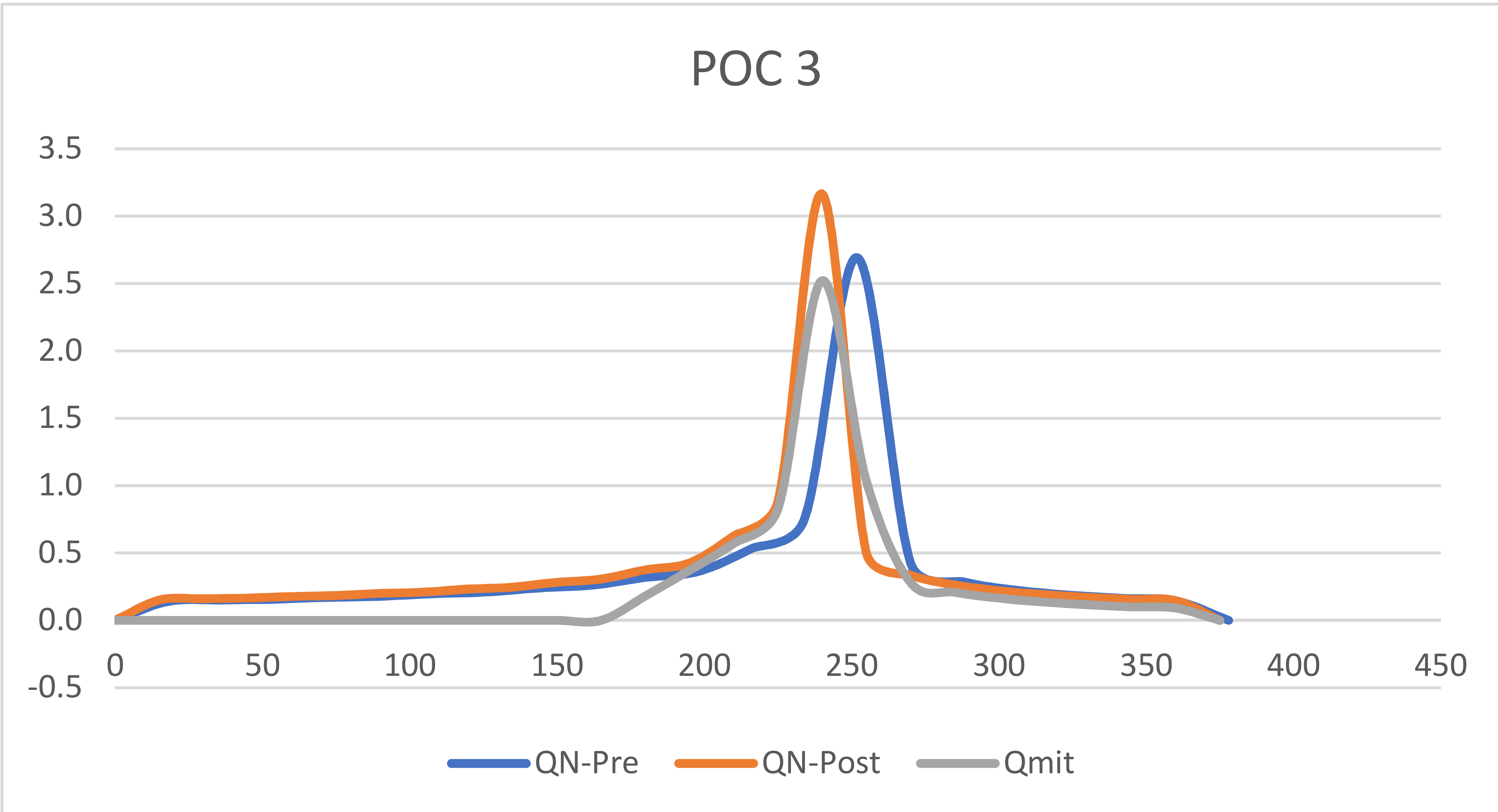
	Area Impervious	Area Landscaping	Runoff Coefficient Impervious	Runoff Coefficient Landscaping	**Runoff Coefficient Weighted**	Time of Concentration Initial	Elevation at Top of Watercourse	Elevation at Bottom of Watercourse	Elevation Change	Distance of Watercourse	Time of Concentration Travel	Time of Concentration Total	Precipitation 100 year 6 Hour	**Intensity 100 year**	**Area Total**	**Volumetric Flow Post-Development**
Abbr.	A_I	A_L	C_I	c_L	C_w	T_i	E_T	E_B	ΔE	D	T_T	T_C	P_6	I_{100}	A_T	Q_P
Units	(acres)	(acres)	(unitless)	(unitless)	**(unitless)**	(minutes)	(feet)	(feet)	(feet)	(feet)	(minutes)	(minutes)	(inch)	**(inch/hour)**	**(acres)**	**(cubic feet per second)**
Source	(See Plan)	(See Plan)	(Table 3-1)	(Table 3-1)	$\frac{[(A_I*C_I)+(A_L*C_L)]}{(A_I+A_L)}$	(table 3-2)	(See Plan)	(See Plan)	(E_T-E_B)	(See Plan)	$\frac{(1.8*(1.1-C)*D^{1/2})}{(\Delta E*100/D)^{1/3}}$ (Figure 3-3)	T_i+T_T	(Figure 3-1)	$7.44*P_6*T_C^{-0.645}$ **(Figure 3-1)**	A_I+A_L	$C_w*I_{100}*A_T$
POC 1	1.39	2.72	0.95	0.35	**0.55**	6.4	1,233	1,148	85	1,048	15.86	22.26	3.5	**3.52**	**4.12**	**8.02**
POC 2	0.22	1.05	0.95	0.35	**0.45**	5.6	1,218	1,169	49	466	11.49	17.09	3.5	**4.17**	**1.27**	**2.40**
POC 3	0.20	1.46	0.95	0.35	**0.42**	5.8	1,254	1,189	65	309	7.76	13.56	3.5	**4.85**	**1.66**	**3.41**
POC 4	0.13	0.02	0.95	0.35	**0.88**	5.0	1,236	1,235	1	6	0.38	5.38	3.5	**8.80**	**0.14**	**1.10**
POC 5	0.35	0.16	0.95	0.35	**0.77**	5.0	1,230	1,224	6	179	5.37	10.37	3.5	**5.76**	**0.51**	**2.25**
POC 6	0.35	1.17	0.95	0.35	**0.49**	5.0	1,247	1,191	56	510	11.21	16.21	3.5	**4.32**	**1.52**	**3.20**
POC 7	0.10	0.13	0.95	0.35	**0.62**	5.0	1,233	1,199	34	152	3.78	8.78	3.5	**6.41**	**0.23**	**0.91**



POC 1
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
0
50
100
150
200
250
300
350
400
450
QN-Pre
QN-Post
Qmit

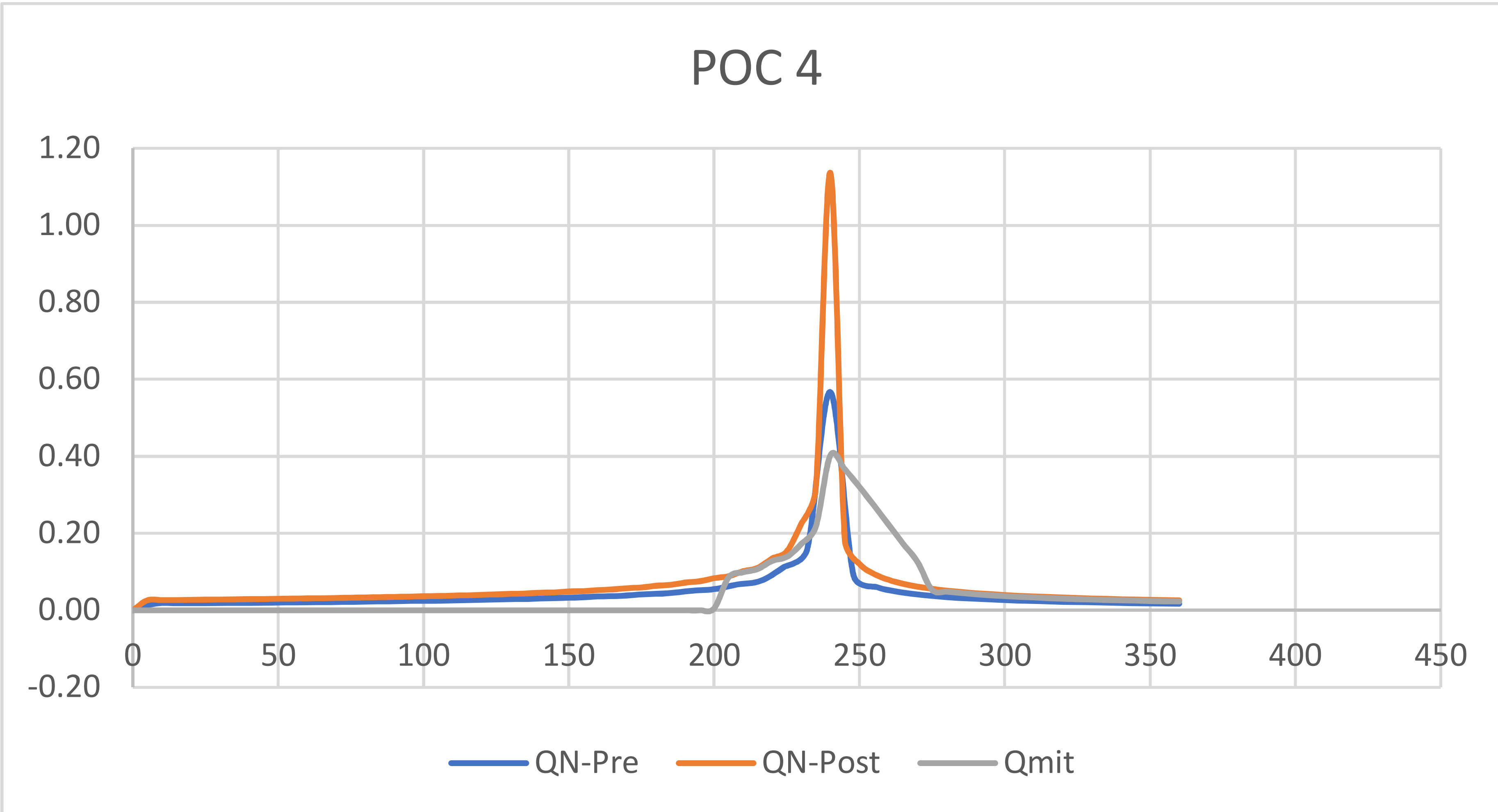
		Pre			Post (Unmitigated)		
Block Number	Time	Total Rainfall For Block N	Rainfall for Block N	Volumetric Flow for Block N	Total Rainfall For Block N	Rainfall for Block N	Volumetric Flow for Block N
N	T	$P_{T(N)}$	P_N	$Q_{N\text{-}Pre}$	$P_{T(N)}$	P_N	$Q_{N\text{-}Post}$
(Unitless)	(Minutes)	(Inches)	(Inches)	(cfs)	(Inches)	(Inches)	(cfs)
-	$N{*}T_c$	$0.124P_6(NT_c)^{0.355}$	$P_{T(N)}-P_{T(N-1)}$	$60C_wA_TP_N/T_c$	$0.124P_6(NT_c)^{0.355}$	$P_{T(N)}-P_{T(N-1)}$	$60C_wA_TP_N/T_c$
0	0	0	0	0	0	0	0
1	24	1.34	1.34	5.4	1.34	1.34	7.6
2	48	1.72	0.37	1.5	1.72	0.37	2.1
3	72	1.98	0.27	1.1	1.98	0.27	1.5
4	96	2.19	0.21	0.9	2.19	0.21	1.2
5	120	2.37	0.18	0.7	2.37	0.18	1.0
6	144	2.53	0.16	0.6	2.53	0.16	0.9
7	168	2.68	0.14	0.6	2.68	0.14	0.8
8	192	2.81	0.13	0.5	2.81	0.13	0.7
9	216	2.93	0.12	0.5	2.93	0.12	0.7
10	240	3.04	0.11	0.5	3.04	0.11	0.6
11	264	3.14	0.10	0.4	3.14	0.10	0.6
12	288	3.24	0.10	0.4	3.24	0.10	0.6
13	312	3.33	0.09	0.4	3.33	0.09	0.5
14	336	3.42	0.09	0.4	3.42	0.09	0.5
15	360	3.51	0.08	0.3	3.51	0.08	0.5

Block Number	Time	Pre-Development Flow (thru)	Post-Development Flow (Inflow)	I_n+I_{n+1}	Infiltration Flow	Riser Out Flow (Mitigated Flow)	Stored Volume	$2S_n/\Delta t-O_n$	$2s_{n+1}/\Delta t+O_{n+1}$	Water Surface Elevation
N	T	Q_{N-Pre}	Q_{N-Post}		Q_{infil}	Q_{mit}	S_n			EL_{WS}
-	(Minutes)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(ft^3)	(cfs)	(cfs)	(ft)
Table 1	-	Table 1	Table 1	$Q_{N-Post}+Q_{(N+1)Post}$	Infiltration Rate x Basin Area	$C_{Oriface}*A_{Riser}(2g*Head_{Riser})^{1/2}$	$S_{n-1}+Q_{N-Post}-Q_{infil}-Q_{out}$	$2S_n/(T_N-T_{n-1})-Q_{infil(n-1)}-Q_{out(n-1)}$	$(2S_n/\Delta t-O_n)+(I_n+I_{n+1})$	Interpolate Basin Matrix for S_n
0	0	0.0	0.0	0.5	0.21	0.00	0.00	0.00	0.48	0.00
15	24	0.3	0.5	1.0	0.21	0.00	392.25	0.34	1.32	0.33
14	48	0.4	0.5	1.1	0.21	0.00	817.18	0.93	1.99	0.68
12	72	0.4	0.6	1.2	0.21	0.00	1321.17	1.63	2.78	1.10
11	96	0.4	0.6	1.3	0.21	0.00	1873.81	2.39	3.66	1.56
9	120	0.5	0.7	1.4	0.21	0.00	2551.15	3.33	4.75	2.13
8	144	0.5	0.7	1.6	0.21	0.00	3310.85	4.39	6.03	2.76
6	168	0.6	0.9	1.9	0.21	0.00	4306.11	5.77	7.70	3.94
5	192	0.7	1.0	2.5	0.21	0.00	5481.43	7.40	9.93	4.75
3	216	1.1	1.5	3.6	0.21	0.78	7347.67	10.00	13.62	5.37
2	240	1.5	2.1	9.7	0.21	1.91	8977.17	11.48	21.20	5.92
1	264	5.4	7.6	8.8	0.21	4.78	16865.25	21.30	30.11	8.55
4	288	0.9	1.2	2.0	0.21	3.34	11425.56	10.88	12.90	6.73
7	312	0.6	0.8	1.4	0.21	0.87	7480.11	6.84	8.28	5.42
10	336	0.5	0.6	1.2	0.21	0.42	6834.57	8.41	9.57	5.20
13	360	0.4	0.5	0.5	0.21	0.32	6686.85	8.66	9.18	5.15
0	384	0.0	0.0	0.0	0.21	0.00	5925.00	7.70	7.70	4.90


POC 3
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
0
50
100
150
200
250
300
350
400
450
QN-Pre
QN-Post
Qmit

Pre					Post (Unmitigated)				
Block Number	Time	Total Rainfall For Block N	Rainfall for Block N	Volumetric Flow for Block N	Block Number	Time	Total Rainfall For Block N	Rainfall for Block N	Volumetric Flow for Block N
N	T	$P_{T(N)}$	P_N	$Q_{N\text{-Pre}}$	N	T	$P_{T(N)}$	P_N	$Q_{N\text{-Post}}$
(Unitless)	(Minutes)	(Inches)	(Inches)	(cfs)	(Unitless)	(Minutes)	(Inches)	(Inches)	(cfs)
-	$N*T_c$	$0.124P_6(NT_c)^{0.355}$	$P_{T(N)}-P_{T(N-1)}$	$60C_wA_TP_N/T_c$	-	$N*T_c$	$0.124P_6(NT_c)^{0.355}$	$P_{T(N)}-P_{T(N-1)}$	$60C_wA_TP_N/T_c$
0	0	0	0	0	0	0	0	0	0
1	18	1.21	1.21	2.7	1	15	1.14	1.14	3.2
2	36	1.55	0.34	0.8	2	30	1.45	0.32	0.9
3	54	1.79	0.24	0.5	3	45	1.68	0.22	0.6
4	72	1.98	0.19	0.4	4	60	1.86	0.18	0.5
5	90	2.14	0.16	0.4	5	75	2.01	0.15	0.4
6	108	2.29	0.14	0.3	6	90	2.14	0.13	0.4
7	126	2.42	0.13	0.3	7	105	2.26	0.12	0.3
8	144	2.53	0.12	0.3	8	120	2.37	0.11	0.3
9	162	2.64	0.11	0.2	9	135	2.48	0.10	0.3
10	180	2.74	0.10	0.2	10	150	2.57	0.09	0.3
11	198	2.84	0.09	0.2	11	165	2.66	0.09	0.2
12	216	2.93	0.09	0.2	12	180	2.74	0.08	0.2
13	234	3.01	0.08	0.2	13	195	2.82	0.08	0.2
14	252	3.09	0.08	0.2	14	210	2.90	0.08	0.2
15	270	3.17	0.08	0.2	15	225	2.97	0.07	0.2
16	288	3.24	0.07	0.2	16	240	3.04	0.07	0.2
17	306	3.31	0.07	0.2	17	255	3.10	0.07	0.2
18	324	3.38	0.07	0.2	18	270	3.17	0.06	0.2
19	342	3.44	0.07	0.1	19	285	3.23	0.06	0.2
20	360	3.51	0.06	0.1	20	300	3.29	0.06	0.2
					21	315	3.34	0.06	0.2
					22	330	3.40	0.06	0.2
					23	345	3.45	0.05	0.2
					24	360	3.51	0.05	0.1

Pre-DevelopBlock Number	Pre-Develop. Time	Pre-Development Flow (thru)	Post-Develop. Block Number	Post-Develop. Time	Post-Development Flow (Inflow)	I_n+I_{n+1}	Infiltration Flow	Riser Out Flow (Mitigated Flow)	Stored Volume	$2S_n/\Delta t-O_n$	$2s_{n+1}/\Delta t+O_{n+1}$	Water Surface Elevation
N	T	$Q_{N\text{-}Pre}$	N	T	$Q_{N\text{-}Post}$		Q_{infil}	Q_{mit}	S_n			EL_{WS}
-	(Minutes)	(cfs)	-	(Minutes)	(cfs)	(cfs)	(cfs)	(cfs)	(ft^3)	(cfs)	(cfs)	(ft)
Table 1	-	Table 1	Table 1	-	Table 1	$Q_{N\text{-}Post}+Q_{(N+1)Post}$	Infiltration Rate x Basin Area	$C_{Oriface}*A_{Riser}(2g*Head_{Riser})^{1/2}$	$S_{n-1}+Q_{N\text{-}Post}-Q_{infil}-Q_{out}$	$2S_n/(T_N-T_{n-1})-Q_{infil(n-1)}-Q_{out(n-1)}$	$(2S_n/\Delta t-O_n)+(I_n+I_{n+1})$	Interpolate Basin Matrix for S_n
0	0	0.0	0	0	0.0	0.2	0.06	0.00	0.00	0.00	0.15	0.00
20	18	0.1	23	15	0.2	0.3	0.06	0.00	85.76	0.14	0.45	0.27
18	36	0.2	21	30	0.2	0.3	0.06	0.00	179.92	0.34	0.67	0.56
17	54	0.2	20	45	0.2	0.3	0.06	0.00	278.81	0.56	0.91	0.87
15	72	0.2	18	60	0.2	0.4	0.06	0.00	388.47	0.81	1.17	1.21
14	90	0.2	17	75	0.2	0.4	0.06	0.00	504.31	1.07	1.45	1.58
12	108	0.2	15	90	0.2	0.4	0.06	0.00	634.57	1.35	1.76	1.98
11	126	0.2	14	105	0.2	0.4	0.06	0.00	773.34	1.66	2.11	2.42
9	144	0.2	12	120	0.2	0.5	0.06	0.00	932.70	2.02	2.50	2.91
8	162	0.3	11	135	0.2	0.5	0.06	0.00	1104.72	2.40	2.93	3.72
6	180	0.3	9	150	0.3	0.6	0.06	0.00	1309.21	2.85	3.44	4.56
5	198	0.4	8	165	0.3	0.7	0.06	0.00	1535.16	3.36	4.04	4.84
3	216	0.5	6	180	0.4	0.8	0.06	0.18	1822.44	3.99	4.80	5.20
2	234	0.8	5	195	0.4	1.1	0.06	0.37	1994.17	4.20	5.25	5.42
1	252	2.7	3	210	0.6	1.5	0.06	0.57	2174.08	4.40	5.91	5.64
4	270	0.4	2	225	0.9	4.0	0.06	0.83	2404.77	4.72	8.77	5.93
7	288	0.3	1	240	3.2	3.7	0.06	2.52	4458.80	9.03	12.69	8.50
10	306	0.2	4	255	0.5	0.8	0.06	1.04	2591.70	3.18	4.02	6.16
13	324	0.2	7	270	0.3	0.6	0.06	0.28	1912.70	3.16	3.76	5.32
16	342	0.2	10	285	0.3	0.5	0.06	0.21	1846.85	3.77	4.25	5.23
19	360	0.1	13	300	0.2	0.4	0.06	0.16	1808.38	3.76	4.17	5.19
0	378	0.0	16	315	0.2	0.4	0.06	0.14	1782.67	3.74	4.10	5.15
			19	330	0.2	0.3	0.06	0.12	1764.04	3.73	4.05	5.13
			22	345	0.2	0.3	0.06	0.10	1749.80	3.72	4.02	5.11
			24	360	0.1	0.1	0.06	0.09	1742.00	3.72	3.86	5.10
			0	375	0.0	0.0	0.06	0.00	1610.00	3.43	3.43	4.94

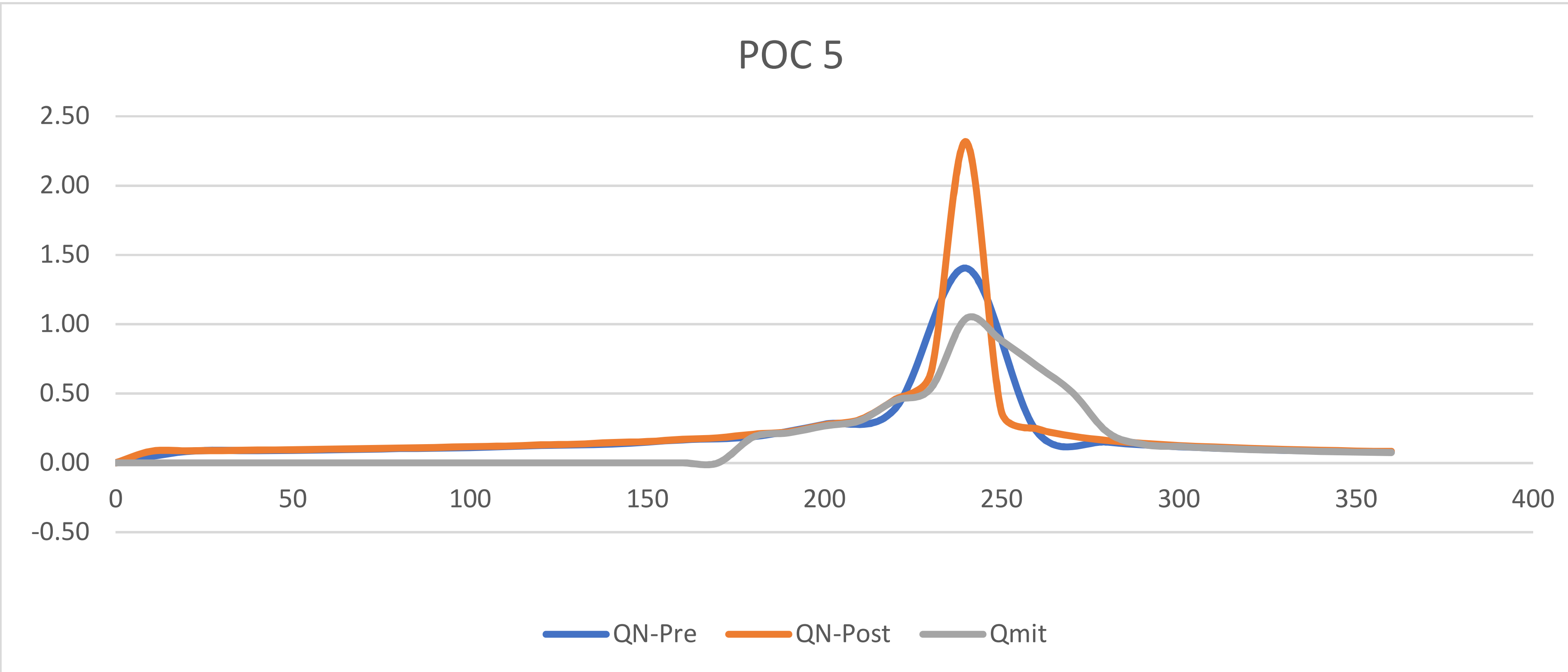

POC 4
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
0
50
100
150
200
250
300
350
400
450
QN-Pre
QN-Post
Qmit

Pre					Post (Unmitigated)				
Block Number	Time	Total Rainfall For Block N	Rainfall for Block N	Volumetric Flow for Block N	Block Number	Time	Total Rainfall For Block N	Rainfall for Block N	Volumetric Flow for Block N
N	T	$P_{T(N)}$	P_N	$Q_{N\text{-}Pre}$	N	T	$P_{T(N)}$	P_N	$Q_{N\text{-}Post}$
(Unitless)	(Minutes)	(Inches)	(Inches)	(cfs)	(Unitless)	(Minutes)	(Inches)	(Inches)	(cfs)
-	$N*T_c$	$0.124P_6(NT_c)^{0.355}$	$P_{T(N)}-P_{T(N-1)}$	$60C_wA_TP_N/T_c$	-	$N*T_c$	$0.124P_6(NT_c)^{0.355}$	$P_{T(N)}-P_{T(N-1)}$	$60C_wA_TP_N/T_c$
0	0	0	0	0.00	0	0	0	0	0.00
1	8	0.91	0.91	0.57	1	5	0.77	0.77	1.14
2	16	1.16	0.25	0.16	2	10	0.98	0.21	0.32
3	24	1.34	0.18	0.11	3	15	1.14	0.15	0.22
4	32	1.49	0.14	0.09	4	20	1.26	0.12	0.18
5	40	1.61	0.12	0.08	5	25	1.36	0.10	0.15
6	48	1.72	0.11	0.07	6	30	1.45	0.09	0.13
7	56	1.81	0.10	0.06	7	35	1.53	0.08	0.12
8	64	1.90	0.09	0.05	8	40	1.61	0.07	0.11
9	72	1.98	0.08	0.05	9	45	1.68	0.07	0.10
10	80	2.06	0.08	0.05	10	50	1.74	0.06	0.09
11	88	2.13	0.07	0.04	11	55	1.80	0.06	0.09
12	96	2.19	0.07	0.04	12	60	1.86	0.06	0.08
13	104	2.26	0.06	0.04	13	65	1.91	0.05	0.08
14	112	2.32	0.06	0.04	14	70	1.96	0.05	0.08
15	120	2.37	0.06	0.04	15	75	2.01	0.05	0.07
16	128	2.43	0.06	0.03	16	80	2.06	0.05	0.07
17	136	2.48	0.05	0.03	17	85	2.10	0.04	0.07
18	144	2.53	0.05	0.03	18	90	2.14	0.04	0.06
19	152	2.58	0.05	0.03	19	95	2.19	0.04	0.06
20	160	2.63	0.05	0.03	20	100	2.23	0.04	0.06
21	168	2.68	0.05	0.03	21	105	2.26	0.04	0.06
22	176	2.72	0.04	0.03	22	110	2.30	0.04	0.06
23	184	2.76	0.04	0.03	23	115	2.34	0.04	0.05
24	192	2.81	0.04	0.03	24	120	2.37	0.04	0.05
25	200	2.85	0.04	0.03	25	125	2.41	0.03	0.05
26	208	2.89	0.04	0.02	26	130	2.44	0.03	0.05
27	216	2.93	0.04	0.02	27	135	2.48	0.03	0.05
28	224	2.96	0.04	0.02	28	140	2.51	0.03	0.05
29	232	3.00	0.04	0.02	29	145	2.54	0.03	0.05
30	240	3.04	0.04	0.02	30	150	2.57	0.03	0.05
31	248	3.07	0.04	0.02	31	155	2.60	0.03	0.04
32	256	3.11	0.03	0.02	32	160	2.63	0.03	0.04
33	264	3.14	0.03	0.02	33	165	2.66	0.03	0.04
34	272	3.18	0.03	0.02	34	170	2.69	0.03	0.04
35	280	3.21	0.03	0.02	35	175	2.71	0.03	0.04
36	288	3.24	0.03	0.02	36	180	2.74	0.03	0.04
37	296	3.27	0.03	0.02	37	185	2.77	0.03	0.04
38	304	3.30	0.03	0.02	38	190	2.80	0.03	0.04
39	312	3.33	0.03	0.02	39	195	2.82	0.03	0.04
40	320	3.36	0.03	0.02	40	200	2.85	0.03	0.04
41	328	3.39	0.03	0.02	41	205	2.87	0.03	0.04
42	336	3.42	0.03	0.02	42	210	2.90	0.02	0.04
43	344	3.45	0.03	0.02	43	215	2.92	0.02	0.04
44	352	3.48	0.03	0.02	44	220	2.94	0.02	0.04
45	360	3.51	0.03	0.02	45	225	2.97	0.02	0.03
					46	230	2.99	0.02	0.03
					47	235	3.01	0.02	0.03
					48	240	3.04	0.02	0.03
					49	245	3.06	0.02	0.03
					50	250	3.08	0.02	0.03
					51	255	3.10	0.02	0.03
					52	260	3.12	0.02	0.03
					53	265	3.15	0.02	0.03
					54	270	3.17	0.02	0.03
					55	275	3.19	0.02	0.03
					56	280	3.21	0.02	0.03
					57	285	3.23	0.02	0.03
					58	290	3.25	0.02	0.03
					59	295	3.27	0.02	0.03
					60	300	3.29	0.02	0.03
					61	305	3.31	0.02	0.03
					62	310	3.33	0.02	0.03
					63	315	3.34	0.02	0.03
					64	320	3.36	0.02	0.03
					65	325	3.38	0.02	0.03
					66	330	3.40	0.02	0.03
					67	335	3.42	0.02	0.03
					68	340	3.44	0.02	0.03
					69	345	3.45	0.02	0.03
					70	350	3.47	0.02	0.03
					71	355	3.49	0.02	0.03
					72	360	3.51	0.02	0.03

Pre-Develop Block Number	Pre-Develop. Time	Pre-Development Flow (thru)	Post-Develop. Block Number	Post-Develop. Time	Post-Development Flow (Inflow)	I_n+I_{n+1}	Infiltration Flow	Riser Out Flow (Mitigated Flow)	Stored Volume	$2S_n/\Delta t-O_n$	$2s_{n+1}/\Delta t+O_{n+1}$	Water Surface Elevation
N	T	Q_{N-Pre}	N	T	Q_{N-Post}		Q_{infil}	Q_{mit}	S_n			EL_{WS}
-	(Minutes)	(cfs)	-	(Minutes)	(cfs)	(cfs)	(cfs)	(cfs)	(ft^3)	(cfs)	(cfs)	(ft)
Table 1	-	Table 1	Table 1	-	Table 1	$Q_{N-Post}+Q_{(N+1)Post}$	Infiltration Rate x Basin Area	$C_{Oriface}*A_{Riser}(2g*Head_{Riser})^{1/2}$	$S_{n-1}+Q_{N-Post}-Q_{infil}-Q_{out}$	$2S_n/(T_N-T_{n-1})-Q_{infil(n-1)}-Q_{out(n-1)}$	$(2S_n/\Delta t-O_n)+(I_n+I_{n+1})$	Interpolate Basin Matrix for S_n
0	0	0.00	0	0	0.00	0.03	0.003	0.00	0.00	0.00	0.03	0.00
44	8	0.02	71	5	0.03	0.05	0.003	0.00	6.94	0.04	0.10	0.09
42	16	0.02	69	10	0.03	0.05	0.003	0.00	14.03	0.09	0.14	0.18
41	24	0.02	68	15	0.03	0.05	0.003	0.00	21.19	0.14	0.19	0.26
39	32	0.02	66	20	0.03	0.05	0.003	0.00	28.51	0.19	0.24	0.36
38	40	0.02	65	25	0.03	0.06	0.003	0.00	35.91	0.24	0.29	0.45
36	48	0.02	63	30	0.03	0.06	0.003	0.00	43.48	0.29	0.34	0.54
35	56	0.02	62	35	0.03	0.06	0.003	0.00	51.14	0.34	0.40	0.64
33	64	0.02	60	40	0.03	0.06	0.003	0.00	58.98	0.39	0.45	0.74
32	72	0.02	59	45	0.03	0.06	0.003	0.00	66.91	0.44	0.50	0.84
30	80	0.02	57	50	0.03	0.06	0.003	0.00	75.05	0.50	0.56	0.94
29	88	0.02	56	55	0.03	0.06	0.003	0.00	83.29	0.55	0.61	1.04
27	96	0.02	54	60	0.03	0.06	0.003	0.00	91.74	0.61	0.67	1.15
26	104	0.02	53	65	0.03	0.06	0.003	0.00	100.31	0.67	0.73	1.25
24	112	0.03	51	70	0.03	0.06	0.003	0.00	109.12	0.72	0.79	1.36
23	120	0.03	50	75	0.03	0.07	0.003	0.00	118.06	0.78	0.85	1.48
21	128	0.03	48	80	0.03	0.07	0.003	0.00	127.25	0.85	0.91	1.59
20	136	0.03	47	85	0.03	0.07	0.003	0.00	136.59	0.91	0.98	1.71
18	144	0.03	45	90	0.03	0.07	0.003	0.00	146.22	0.97	1.04	1.83
17	152	0.03	44	95	0.04	0.07	0.003	0.00	156.00	1.04	1.11	1.95
15	160	0.04	42	100	0.04	0.07	0.003	0.00	166.11	1.10	1.18	2.08
14	168	0.04	41	105	0.04	0.08	0.003	0.00	176.39	1.17	1.25	2.20
12	176	0.04	39	110	0.04	0.08	0.003	0.00	187.04	1.24	1.32	2.34
11	184	0.04	38	115	0.04	0.08	0.003	0.00	197.89	1.32	1.40	2.47
9	192	0.05	36	120	0.04	0.08	0.003	0.00	209.16	1.39	1.47	2.61
8	200	0.05	35	125	0.04	0.08	0.003	0.00	220.66	1.47	1.55	2.76
6	208	0.07	33	130	0.04	0.09	0.003	0.00	232.63	1.55	1.63	2.91
5	216	0.08	32	135	0.04	0.09	0.003	0.00	244.87	1.63	1.72	3.10
3	224	0.11	30	140	0.05	0.09	0.003	0.00	257.68	1.72	1.81	3.35
2	232	0.16	29	145	0.05	0.10	0.003	0.00	270.79	1.80	1.90	3.62
1	240	0.57	27	150	0.05	0.10	0.003	0.00	284.57	1.89	1.99	3.89
4	248	0.09	26	155	0.05	0.10	0.003	0.00	298.72	1.99	2.09	4.17
7	256	0.06	24	160	0.05	0.11	0.003	0.00	313.68	2.09	2.20	4.47
10	264	0.05	23	165	0.05	0.11	0.003	0.00	329.09	2.19	2.30	4.57
13	272	0.04	21	170	0.06	0.12	0.003	0.00	345.50	2.30	2.42	4.65
16	280	0.03	20	175	0.06	0.12	0.003	0.00	362.48	2.41	2.54	4.74
19	288	0.03	18	180	0.06	0.13	0.003	0.00	380.75	2.54	2.67	4.83
22	296	0.03	17	185	0.07	0.14	0.003	0.00	399.76	2.66	2.80	4.92

25	304	0.03
28	312	0.02
31	320	0.02
34	328	0.02
37	336	0.02
40	344	0.02
43	352	0.02
45	360	0.02

15	190	0.07	0.15	0.003	0.00	420.49	2.80	2.95	5.03
14	195	0.08	0.16	0.003	0.00	442.24	2.95	3.10	5.14
12	200	0.08	0.17	0.003	0.00	466.46	3.11	3.28	5.26
11	205	0.09	0.19	0.003	0.09	490.73	3.26	3.45	5.38
9	210	0.10	0.21	0.003	0.10	494.61	3.21	3.42	5.40
8	215	0.11	0.24	0.003	0.11	497.18	3.21	3.46	5.41
6	220	0.13	0.29	0.003	0.13	504.52	3.25	3.54	5.45
5	225	0.15	0.38	0.003	0.14	511.12	3.28	3.65	5.48
3	230	0.22	0.54	0.003	0.17	536.15	3.43	3.97	5.61
2	235	0.32	1.45	0.003	0.22	578.71	3.68	5.14	5.82
1	240	1.14	1.32	0.003	0.40	853.36	5.47	6.78	7.19
4	245	0.18	0.30	0.003	0.37	785.88	4.83	5.13	6.85
7	250	0.12	0.22	0.003	0.32	711.48	4.37	4.59	6.48
10	255	0.09	0.17	0.003	0.27	642.77	3.96	4.14	6.14
13	260	0.08	0.15	0.003	0.22	583.96	3.62	3.77	5.84
16	265	0.07	0.13	0.003	0.17	536.94	3.35	3.48	5.61
19	270	0.06	0.12	0.003	0.13	502.56	3.17	3.29	5.44
22	275	0.06	0.11	0.003	0.05	480.89	3.08	3.18	5.33
25	280	0.05	0.10	0.003	0.05	479.54	3.14	3.24	5.32
28	285	0.05	0.09	0.003	0.04	478.44	3.14	3.23	5.32
31	290	0.04	0.09	0.003	0.04	477.51	3.14	3.22	5.31
34	295	0.04	0.08	0.003	0.04	476.73	3.13	3.22	5.31
37	300	0.04	0.08	0.003	0.04	476.05	3.13	3.21	5.31
40	305	0.04	0.07	0.003	0.03	475.46	3.13	3.20	5.30
43	310	0.04	0.07	0.003	0.03	474.94	3.13	3.20	5.30
46	315	0.03	0.07	0.003	0.03	474.48	3.13	3.19	5.30
49	320	0.03	0.06	0.003	0.03	474.06	3.13	3.19	5.30
52	325	0.03	0.06	0.003	0.03	473.69	3.12	3.19	5.29
55	330	0.03	0.06	0.003	0.03	473.35	3.12	3.18	5.29
58	335	0.03	0.06	0.003	0.03	473.03	3.12	3.18	5.29
61	340	0.03	0.06	0.003	0.03	472.75	3.12	3.18	5.29
64	345	0.03	0.05	0.003	0.02	472.48	3.12	3.18	5.29
67	350	0.03	0.05	0.003	0.02	472.24	3.12	3.17	5.29
70	355	0.03	0.05	0.003	0.02	472.01	3.12	3.17	5.29
72	360	0.03	0.03	0.003	0.02	471.87	3.12	3.15	5.28



POC 5
2.50
2.00
1.50
1.00
0.50
0.00
-0.50
0
50
100
150
200
250
300
350
400
QN-Pre
QN-Post
Qmit

Pre					Post (Unmitigated)				
Block Number	Time	Total Rainfall For Block N	Rainfall for Block N	Volumetric Flow for Block N	Block Number	Time	Total Rainfall For Block N	Rainfall for Block N	Volumetric Flow for Block N
N	T	$P_{T(N)}$	P_N	$Q_{N\text{-}Pre}$	N	T	$P_{T(N)}$	P_N	$Q_{N\text{-}Post}$
-	(Minutes)	(Inches)	(Inches)	(cfs)	-	(Minutes)	(Inches)	(Inches)	(cfs)
-	$N*T_c$	$0.124P_6(NT_c)^{0.355}$	$P_{T(N)}-P_{T(N-1)}$	$60C_wA_TP_N/T_c$	-	$N*T_c$	$0.124P_6(NT_c)^{0.355}$	$P_{T(N)}-P_{T(N-1)}$	$60C_wA_TP_N/T_c$
0	0	0	0	0	0	0	0	0	0
1	20	1.26	1.26	1.4	1	10	0.98	0.98	2.3
2	40	1.61	0.35	0.4	2	20	1.26	0.27	0.6
3	60	1.86	0.25	0.3	3	30	1.45	0.19	0.5
4	80	2.06	0.20	0.2	4	40	1.61	0.16	0.4
5	100	2.23	0.17	0.2	5	50	1.74	0.13	0.3
6	120	2.37	0.15	0.2	6	60	1.86	0.12	0.3
7	140	2.51	0.13	0.1	7	70	1.96	0.10	0.2
8	160	2.63	0.12	0.1	8	80	2.06	0.10	0.2
9	180	2.74	0.11	0.1	9	90	2.14	0.09	0.2
10	200	2.85	0.10	0.1	10	100	2.23	0.08	0.2
11	220	2.94	0.10	0.1	11	110	2.30	0.08	0.2
12	240	3.04	0.09	0.1	12	120	2.37	0.07	0.2
13	260	3.12	0.09	0.1	13	130	2.44	0.07	0.2
14	280	3.21	0.08	0.1	14	140	2.51	0.07	0.2
15	300	3.29	0.08	0.1	15	150	2.57	0.06	0.1
16	320	3.36	0.08	0.1	16	160	2.63	0.06	0.1
17	340	3.44	0.07	0.1	17	170	2.69	0.06	0.1
18	360	3.51	0.07	0.1	18	180	2.74	0.06	0.1
					19	190	2.80	0.05	0.1
					20	200	2.85	0.05	0.1
					21	210	2.90	0.05	0.1
					22	220	2.94	0.05	0.1
					23	230	2.99	0.05	0.1
					24	240	3.04	0.05	0.1
					25	250	3.08	0.04	0.1
					26	260	3.12	0.04	0.1
					27	270	3.17	0.04	0.1
					28	280	3.21	0.04	0.1
					29	290	3.25	0.04	0.1
					30	300	3.29	0.04	0.1
					31	310	3.33	0.04	0.1
					32	320	3.36	0.04	0.1
					33	330	3.40	0.04	0.1
					34	340	3.44	0.04	0.1
					35	350	3.47	0.04	0.1
					36	360	3.51	0.03	0.1

Pre-Develop Block Number	Pre-Develop. Time	Pre-Development Flow (thru)	Post-Develop. Block Number	Post-Develop. Time	Post-Development Flow (Inflow)	I_n+I_{n+1}	Infiltration Flow	Riser Out Flow (Mitigated Flow)	Stored Volume	$2S_n/\Delta t-O_n$	$2s_{n+1}/\Delta t+O_{n+1}$	Water Surface Elevation
N	T	$Q_{N\text{-}Pre}$	N	T	$Q_{N\text{-}Post}$		Q_{infil}	Q_{mit}	S_n			EL_{WS}
-	(Minutes)	(cfs)	-	(Minutes)	(cfs)	(cfs)	(cfs)	(cfs)	(ft^3)	(cfs)	(cfs)	(ft)
Table 1	-	Table 1	Table 1	-	Table 1	$Q_{N\text{-}Post}+Q_{(N+1)Post}$	Infiltration Rate x Basin Area	$C_{Oriface}*A_{Riser}(2g*Head_{Riser})^{1/2}$	$S_{n-1}+Q_{N\text{-}Post}-Q_{infil}-Q_{out}$	$2S_n/(T_N-T_{n-1})-Q_{infil(n-1)}-Q_{out(n-1)}$	$(2S_n/\Delta t-O_n)+(I_n+I_{n+1})$	Interpolate Basin Matrix for S_n
0	0	0.00	0	0	0.00	0.08	0.008	0.00	0.00	0.00	0.08	0.00
17	20	0.08	35	10	0.08	0.17	0.008	0.00	45.67	0.14	0.32	0.21
15	40	0.09	33	20	0.09	0.18	0.008	0.00	93.32	0.30	0.48	0.42
14	60	0.09	32	30	0.09	0.18	0.008	0.00	142.04	0.47	0.65	0.65
12	80	0.10	30	40	0.09	0.19	0.008	0.00	193.05	0.64	0.82	0.88
11	100	0.11	29	50	0.09	0.19	0.008	0.00	245.32	0.81	1.00	1.12
9	120	0.13	27	60	0.10	0.20	0.008	0.00	300.32	0.99	1.19	1.37
8	140	0.14	26	70	0.10	0.21	0.008	0.00	356.81	1.18	1.39	1.62
6	160	0.17	24	80	0.11	0.22	0.008	0.00	416.61	1.38	1.60	1.89
5	180	0.19	23	90	0.11	0.23	0.008	0.00	478.25	1.59	1.81	2.17
3	200	0.28	21	100	0.12	0.24	0.008	0.00	543.98	1.81	2.04	2.47
2	220	0.39	20	110	0.12	0.25	0.008	0.00	612.01	2.03	2.28	2.78
1	240	1.40	18	120	0.13	0.26	0.008	0.00	685.30	2.28	2.54	3.18
4	260	0.22	17	130	0.13	0.28	0.008	0.00	761.61	2.53	2.81	3.74
7	280	0.15	15	140	0.15	0.30	0.008	0.00	844.94	2.81	3.11	4.35
10	300	0.12	14	150	0.15	0.32	0.008	0.00	932.43	3.10	3.42	4.62
13	320	0.10	12	160	0.17	0.35	0.008	0.00	1029.96	3.43	3.78	4.80
16	340	0.09	11	170	0.18	0.39	0.008	0.00	1133.67	3.77	4.16	4.99
18	360	0.08	9	180	0.21	0.43	0.008	0.19	1253.21	4.17	4.60	5.20
			8	190	0.22	0.50	0.008	0.22	1271.26	4.04	4.54	5.24
			6	200	0.27	0.59	0.008	0.27	1301.17	4.11	4.70	5.29
			5	210	0.31	0.77	0.008	0.30	1324.04	4.14	4.91	5.33
			3	220	0.46	1.10	0.008	0.45	1411.79	4.39	5.50	5.49
			2	230	0.65	2.96	0.008	0.54	1524.70	4.62	7.59	5.70
			1	240	2.32	2.68	0.008	1.04	2587.97	8.08	10.77	7.63
			4	250	0.37	0.61	0.008	0.88	2179.32	6.22	6.83	6.89
			7	260	0.25	0.44	0.008	0.70	1793.18	5.09	5.53	6.19
			10	270	0.19	0.35	0.008	0.51	1484.74	4.24	4.60	5.62
			13	280	0.16	0.30	0.008	0.22	1272.51	3.73	4.03	5.24
			16	290	0.14	0.27	0.008	0.13	1220.88	3.84	4.11	5.14
			19	300	0.13	0.24	0.008	0.12	1211.80	3.90	4.14	5.13
			22	310	0.11	0.22	0.008	0.11	1204.85	3.89	4.11	5.12
			25	320	0.10	0.20	0.008	0.10	1199.34	3.88	4.09	5.11
			28	330	0.10	0.19	0.008	0.09	1194.84	3.88	4.07	5.10
			31	340	0.09	0.18	0.008	0.08	1191.08	3.87	4.05	5.09
			34	350	0.09	0.17	0.008	0.08	1187.89	3.87	4.04	5.08
			36	360	0.08	0.08	0.008	0.07	1186.01	3.87	3.95	5.08

APPENDIX D

FEMA FLOOD ZONE MAP

National Flood Hazard Layer FIRMette

FEMA

33°3'56.12"N

116°58'57.54"W

116°58'20.09"W

33°3'25.97"N

Feet 1:6,000

0 250 500 1,000 1,500 2,000

Legend

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

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

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

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

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

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

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

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 7/31/2018 at 1:45:38 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

Comparison of Flood Hazard

Effective & Preliminary Flood Hazards

Effective

Preliminary

Effective	
POI Longitude/Latitude	-116.9757, 33.0616
Effective FIRM Panel	06073C1115G
Effective Date	5/16/2012
Flood Zone	X
Static BFE*	Not Available
Flood Depth	Not Available
Vertical Datum	Not Available

Preliminary	
POI Longitude/Latitude	-116.9757, 33.0616
Preliminary FIRM Panel	06073C1115G
Preliminary Issue Date	1/1/1900
Flood Zone	Not Available
Estimated Static BFE*	Not Available
Estimated Flood Depth	Not Available
Vertical Datum	Not Available

* A **Base Flood Elevation** is the expected elevation of flood water during the 1% annual chance storm event. Structures below the estimated water surface elevation may experience flooding during a base flood event.

Hazard Level	Flood Hazard Zone
High Flood Hazard	**AE, A, AH, AO, VE and V Zones.** Properties in these flood zones have a 1% chance of flooding each year. This represents a 26% chance of flooding over the life of a 30-year mortgage.
Moderate Flood Hazard	**Shaded Zone X.** Properties in the moderate flood risk areas also have a chance of flooding from storm events that have a less than 1% chance of occuring each year. Moderate flood risk indicates an area that may be provided flood risk reduction due to a flood control system or an area that is prone to flooding during a 0.2% annual chance storm event. These areas may have been indicated as areas of shallow flooding by your community.
	Unshaded Zone X. Properties on higher ground and away from local flooding sources have a reduced flood risk when compared to the Moderate and High Flood Risk categories. Structures in these areas may be affected by larger storm events, in excess of the 0.2% annual chance storm event.
Low Flood Hazard	**Insurance Note:** High Risk Areas are called 'Special Flood Hazard Areas' and flood insurance is mandatory for federally backed mortgage holders. Properties in Moderate and Low Flood Risk areas may purchase flood insurance at a lower-cost rate, known as Preferred Risk Policies. See your local insurance agent or visit https://www.fema.gov/national-flood-insurance-program for more information.

Disclaimer: This report is for informational purposes only and is not authorized for official use. The positional accuracy may be compromised in some areas. Please contact your local floodplain administrator for more information or go to msc.fema.gov to view an official copy of the Flood Insurance Rate Maps.

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