CEQA HYDROLOGY/HYDRAULIC STUDY

DATED: 1/12/23

PDS2020-TM-5640; PDS2021-TPM-21293; PDS2020-MUP-20-006
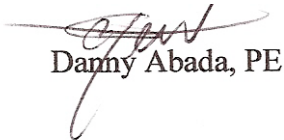For:
Los Coches Plaza

LOCATION: 8445 Los Coches Road, El Cajon, CA 92021
APN: 400-381-02

OWNER:
NLA Acquisitions, LLC. c/o Chad Williams
105 Tallapoosa Street, Suite 307, Montgomery, AL 36104
Phone: 615-815-1465
cwilliams@netlease alliance.com

BY: SPEAR & ASSOCIATES, INC.
CIVIL ENGINEERING AND LAND SURVEYING
475 Production Street
San Marcos, CA 92078
PHONE: (760) 736-2040

Danny Abada, PE

DECLARATION OF RESPONSIBLE CHARGE

I, HEREBY DECLARE THAT I AM THE CIVIL ENGINEER OF WORK FOR THIS PROJECT, THAT I HAVE EXERCISED RESPONSIBLE CHARGE OVER THE DESIGN OF THIS PROJECT AS DEFINED IN SECTION 6703 OF THE BUSINESS AND PROFESSIONAL CODE AND THAT THE DESIGN IS CONSISTENT WITH CURRENT DESIGN STANDARDS.

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

1/12/23

_____   _____

Danny Abada, P.E., Expiration Date 9/30/18   DATE

TABLE OF CONTENTS

I. INTRODUCTION

This hydrology report is prepared for Los Coches Plaza, located at 8445 Los Coches Road, El Cajon, CA 92021. The site encompasses approximately 2.83 acres and is zoned commercial/Industrial. APN: 400-381-02. The pre-developed flat area of the site was previously used as a contractor's storage/truck parking and its surface is covered by 43,815 square feet of impervious surfaces.

The project consists of a commercial development to include a retail shop, drive through restaurant, car wash facility, landscaping and a biofiltration basin for stormwater treatment.

The project will also re-direct an existing 18" CMP per L-5162 within the site, away from proposed building areas. The site slopes mostly northeasterly with elevations ranging approximately from 708 to 660.

A small portion of the site drains west towards Los Coches Road, then north until intercepted by a catch basin and 24" CMP, directing the flow east to an existing 48" stormdrain per L-0278 running north along Sleepy Way. The remaining site area drains easterly and is intercepted to the same 48" stormdrain. The runoff continues north approximately 1 mile until intercepted by Los Coches Creek, then 1.8 miles northwest to the San Diego River then 21.5 miles to the Pacific Ocean

The development will substantially maintain existing drainage patterns and will include new stormdrain improvements and stormwater treatment. We have used the County of San Diego Hydrology Manual for this report to calculate the 100-year flow generated from the site. Based on the soil hydrologic group map in Appendix A of the County Hydrology Manual, 8.3% of the project area consists of type A soil and the remaining area is type B soil. Time of concentration travel times were calculated with the manning equation using average overland flows rates according to section 3.1.4.2(b) of the County Hydrology Manual.

Detention Basins were modeled using Hydrocad and RatHydro. In order to comply with section 6.2.7 of the County Hydraulic Manual all basins were modeled with 1.75' ponding the water quality volume at time = 0; before initiating the 100-year simulation.

II. DISCUSSION/CONCLUSION

This project will substantially maintain existing drainage patterns along the site and will not alter the course of a stream or river and therefore will not contribute to substantial erosion or siltation onsite or offsite.

Post development peak flows, flow volumes and velocities will be maintained lower than from pre-development rates by maximizing pervious surfaces, onsite times of concentration, and use of low impact strategies as shown on the project's Stormwater Management Plan. Therefore, the project will not create or contribute runoff which will exceed the capacity of existing or planned storm water drainage systems.

The project is not located within the 100-year flood zone. The project will not 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. The project will not place structures within a 100-year flood hazard area

which would impede or redirect flood flows. The project will not expose people or structures to a significant risk, injury or death involving flooding as a result of the failure of a levee or dam.

		TC	C	Area (acres)	P_6	I	Q (cfs)	Q (cfs)	V (ft/s)
	100-yr Hydrology Results Summary								
Node 1	Pre-Dev Inlet @ Los Coches O1, O2, A2, O4	7.0	0.89, 0.87, 0.28, 0.4	1.6	2.88	7.59	4.8		
Node 1	Post Dev Inlet @ Los Coches O2, O4	6.6	0.87, 0.74	0.53	2.88	6.34	2.7		
Node 2	Pre-Dev Total @ NE Corner A1, A2, O1, O2, O4	7.9	0.28,0.28, 0.89, 0.87, 0.4	2.82	2.88	7.59	6.0		
Node 2	Post-Dev Total @ NE Corner A, B, O1, O2, O4	10.8	0.7, 0.7, 0.89, 0.87, 0.74	2.82	2.88	4.62	Unmitigated 9.7	Mitigated 5.65	15.4
Node 3	Pre & Post Dev O3	5	0.44	0.19	2.88	7.59	0.6		15.4

ATTACHMENT A

LOS COCHES HIGHWAY

OLD

RD.

8

SITE

VICINITY MAP
NOT TO SCALE

N

4

Project Site

ATTACHMENT B

Developed Conditions 100-yr Event ***Rational Method**

REACH	T_C	C	A	CA	$\sum$CA	P_6	I	**Q cfs**	Reach	V ft/s	L ft	T	$\sum T_C$
Area O1	5	0.89	0.3	0.27	0.27	2.88	7.59	**2.0**	To Exist 24" CMP				
										3.5	395	1.9	6.9
Area O2	5	0.87	0.23	0.20	0.20	2.88	7.59	**1.5**	To Existing Inlet @ los Coches				
										3.5	340	1.6	6.6
Area O3	5	0.44	0.19	0.08	0.08	2.88	7.59	**0.6**					
Area O4	5	0.74	0.3	0.22	0.22	2.88	7.59	**1.7**					
Total Confluence @ Existing Inlet on Los Coches Rd.													
Areas O2 & O4	6.6				0.42	2.88	6.34	**2.7**					
Confluence O1, O2, O4 @ Exist. 24" CMP													
	6.9				0.69	2.88	6.16	**4.2**	To NE Corner	4.3	245	0.95	7.9
Area A	10.8	0.7	1.81	1.27	1.27	2.88	4.62	**5.9**					
Area B	5	0.7	0.18	0.13	0.13	2.88	7.59	**1.0**					

Total @ NE Corner Unmitigated

<u>**Confluence Junction Equation 3.4.2**</u>

(Shortest Tc)

DMA	B		O1, O2, O4		A	
$T_1 =$	5		$T_2 =$	7.90	$T_3 =$	10.80
$I_1 =$	7.59		$I_2 =$	6.16	$I_3 =$	4.62
$Q_1 =$	1.0		$Q_2 =$	4.20	$Q_3 =$	5.90
$Q_{t1} =$	6.4		$Q_{t2} =$	9.3	**$Q_{t3} =$**	**9.7**

Total @ NE Corner Mitigated With Det. Basin A   **Q100=** **5.65**

Pre Development 100-yr Event　　　　　　　　***Rational Method**

REACH	T_C	C	A	CA	$\sum CA$	P_6	I	Q cfs	Reach	V ft/s	L ft	T	$\sum T_C$
Area O1	5	0.89	0.3	0.27	0.27	2.88	7.59	**2.0**	Los Coches	3.5	190	0.9	5.9
Area O2	5	0.87	0.23	0.20	0.20	2.88	7.59	**1.5**					
Confluence O1 & O2	5.9				0.47	2.88	6.82	**3.2**	To Existing Inlet @ los Coches				
										4.1	275	1.1	7
Area O3	5	0.44	0.19	0.08	0.08	2.88	7.59	**0.6**					
Area O4	7.9	0.4	0.18	0.07	0.07	2.88	5.65	**0.4**					
Area A1	10.9	0.28	1.21	0.34	0.34	2.88	4.59	**1.6**					
Area A2	7.6	0.28	0.89	0.25	0.25	2.88	5.79	**1.4**					

Confluence @ Existing Inlet on Los Coches Rd (O1, O2, A2, O4)

Confluence Junction Equation 3.4.2

(Shortest Tc)

DMA O1 & O2　　　　　　　A2　　　　　　　　O4

$T_1 =$	7			$T_2 =$	7.60		$T_3 =$	7.90					
$I_1 =$	7.59			$I_2 =$	5.79		$I_3 =$	5.65					
$\mathbf{Q_1 =}$	3.2			$Q_2 =$	1.40		$Q_3 =$	0.40					
$\mathbf{Q_{t1} =}$	**4.8**			$\mathbf{Q_{t2} =}$	**4.2**		$Q_{t3} =$	4.1	To NE Corner	4.5	240	0.9	7.9

Total Pre-Dev Confluence @ NE Corner

Confluence Junction Equation 3.4.2

DMA A2, O1, O2, O4　　　　　A1

$T_3 =$	7.90		$T_4 =$	10.9	
$I_3 =$	7.59		$I_4 =$	4.59	
$\mathbf{Q_3 =}$	4.80		$Q_4 =$	1.6	
$\mathbf{Q_{t3} =}$	**6.0**		$Q_{t4} =$	4.5	

EQUATION

$I = 7.44 \, P_6 \, D^{-0.645}$

I = Intensity (in/hr)

P_6 = 6-Hour Precipitation (in)

D = Duration (min)
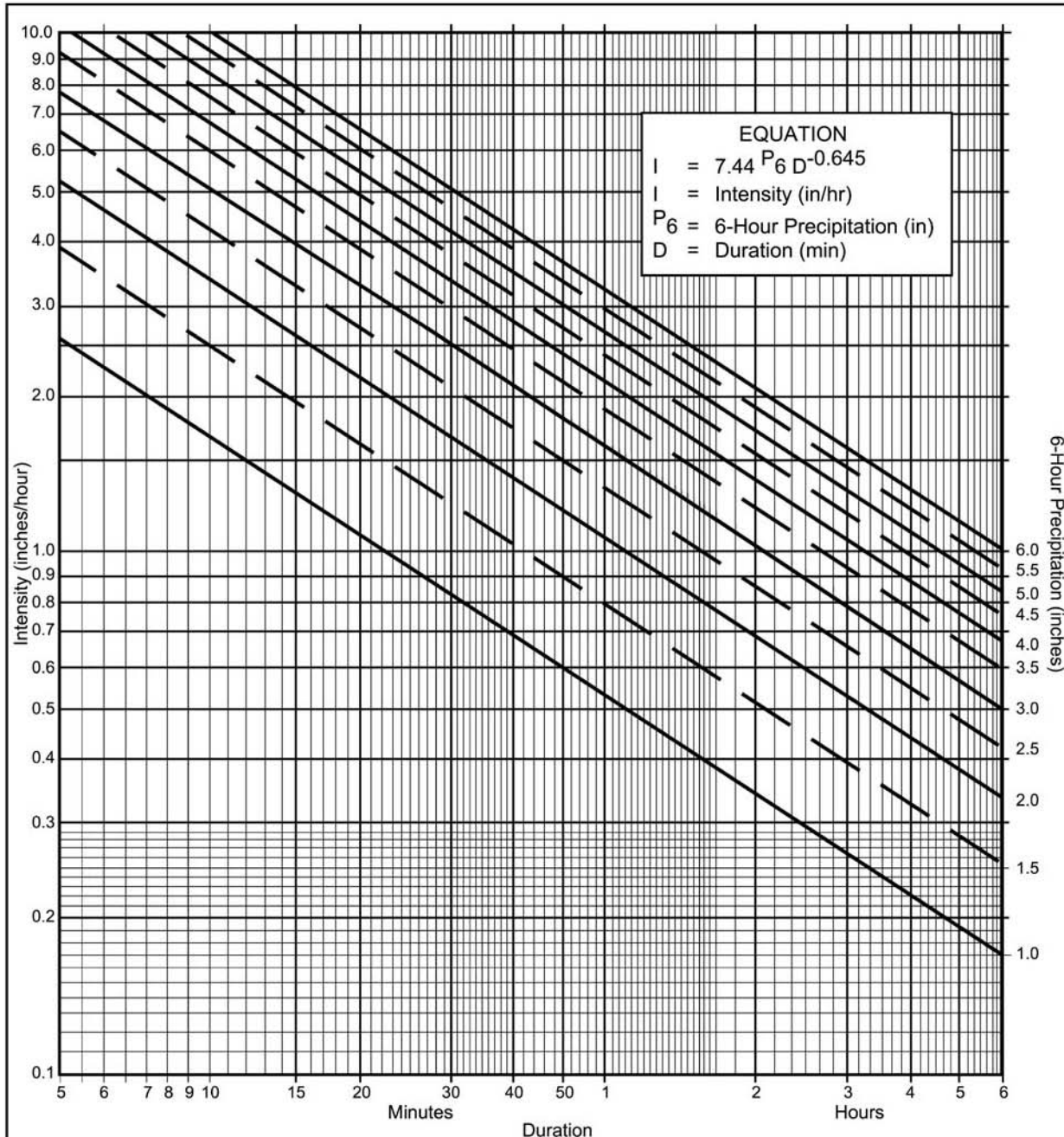
Directions for Application:

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

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

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

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

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

Application Form:

(a) Selected frequency __100__ year

(b) P_6 = __2.88__ in., P_{24} = __5.07__ , $\dfrac{P_6}{P_{24}}$ = __57__ %[2]

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

(d) t_x = _____ min.

(e) I = _____ in./hr.

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

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

Intensity-Duration Design Chart - Template

FIGURE

3-1

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RE: PDS2016-LDGRMN-20115

1 message

Bayona, Joshua <Joshua.Bayona@sdcounty.ca.gov>   Thu, Aug 23, 2018 at 7:52 AM
To: Danny Abada <dannyabada@gmail.com>
Cc: Mark Farrington <mark@farringtonengineering.com>, Josh Zeigler <josh@spearinc.net>

Hi Danny,

I coordinated with County staff about your question regarding the use of the precipitation values from NOAA. The County will be fine with the use of precipitation values directly from NOAA as you had done in the previous review.

Thank you,

Joshua Bayona

Assistant Engineer

County of San Diego

Planning & Development Services (PDS)

Land Development - Engineering Division

5510 Overland Ave, Ste 310

San Diego, CA 92123-1239

O: (858) 495-5454

Joshua.Bayona@sdcounty.ca.gov

Mon-Thurs: 7am-4:30pm

Fri: 7am-11am

http://www.sdcounty.ca.gov/pds/LandDevelopment.html

NOAA Atlas 14, Volume 6, Version 2
Location name: El Cajon, California, USA*
Latitude: 32.8283°, Longitude: -116.9036°
Elevation: m/ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

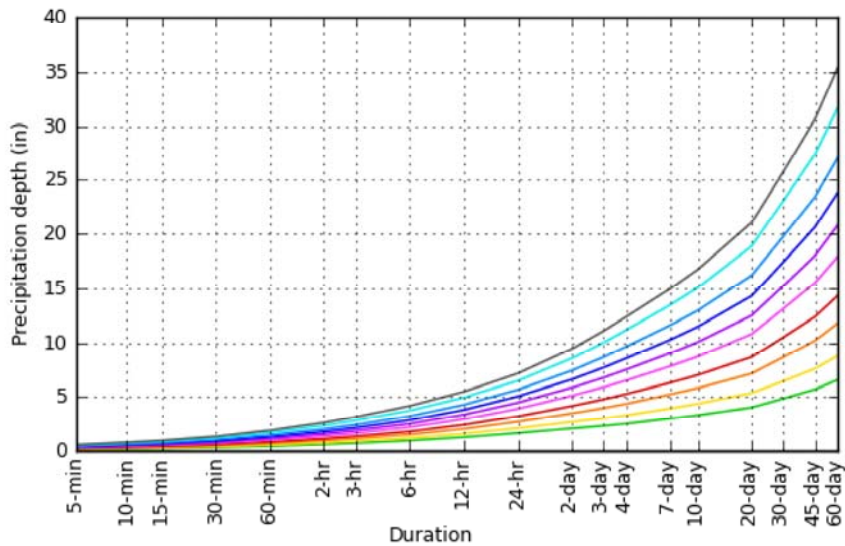| Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.128 (0.107–0.153)	0.160 (0.135–0.193)	0.205 (0.172–0.247)	0.243 (0.201–0.295)	0.296 (0.237–0.373)	0.339 (0.266–0.437)	0.385 (0.294–0.509)	0.433 (0.321–0.590)	0.502 (0.356–0.714)	0.557 (0.381–0.822)
10-min	0.183 (0.154–0.220)	0.230 (0.193–0.276)	0.294 (0.246–0.354)	0.348 (0.289–0.423)	0.425 (0.340–0.535)	0.486 (0.381–0.627)	0.551 (0.421–0.729)	0.621 (0.460–0.846)	0.719 (0.510–1.02)	0.798 (0.546–1.18)
15-min	0.221 (0.186–0.266)	0.278 (0.233–0.334)	0.355 (0.297–0.428)	0.421 (0.349–0.512)	0.513 (0.411–0.647)	0.588 (0.461–0.758)	0.667 (0.509–0.882)	0.751 (0.556–1.02)	0.869 (0.617–1.24)	0.966 (0.661–1.43)
30-min	0.308 (0.259–0.370)	0.387 (0.325–0.465)	0.494 (0.414–0.596)	0.585 (0.486–0.712)	0.715 (0.573–0.901)	0.818 (0.641–1.06)	0.928 (0.708–1.23)	1.05 (0.774–1.42)	1.21 (0.858–1.72)	1.34 (0.919–1.98)
60-min	0.439 (0.369–0.527)	0.551 (0.463–0.662)	0.704 (0.589–0.849)	0.833 (0.692–1.01)	1.02 (0.815–1.28)	1.17 (0.913–1.50)	1.32 (1.01–1.75)	1.49 (1.10–2.03)	1.72 (1.22–2.45)	1.91 (1.31–2.83)
2-hr	0.604 (0.508–0.726)	0.755 (0.634–0.908)	0.963 (0.807–1.16)	1.14 (0.946–1.39)	1.39 (1.12–1.76)	1.60 (1.25–2.06)	1.81 (1.38–2.40)	2.04 (1.52–2.79)	2.38 (1.69–3.38)	2.65 (1.81–3.91)
3-hr	0.724 (0.609–0.869)	0.904 (0.760–1.09)	1.15 (0.965–1.39)	1.36 (1.13–1.66)	1.67 (1.34–2.10)	1.91 (1.50–2.46)	2.17 (1.66–2.87)	2.45 (1.82–3.34)	2.85 (2.02–4.06)	3.18 (2.17–4.69)
6-hr	0.961 (0.809–1.16)	1.20 (1.01–1.45)	1.53 (1.29–1.85)	1.82 (1.51–2.21)	2.22 (1.78–2.79)	2.54 (1.99–3.27)	2.88 (2.20–3.81)	3.25 (2.41–4.43)	3.77 (2.68–5.37)	4.20 (2.87–6.20)
12-hr	1.27 (1.07–1.53)	1.61 (1.35–1.93)	2.06 (1.72–2.48)	2.44 (2.02–2.96)	2.97 (2.38–3.74)	3.39 (2.66–4.37)	3.83 (2.93–5.07)	4.31 (3.19–5.87)	4.97 (3.52–7.07)	5.50 (3.76–8.11)
24-hr	1.67 (1.47–1.93)	2.12 (1.86–2.46)	2.73 (2.39–3.18)	3.24 (2.82–3.80)	3.94 (3.33–4.77)	4.50 (3.72–5.54)	5.07 (4.11–6.39)	5.67 (4.47–7.34)	6.51 (4.94–8.75)	7.17 (5.27–9.96)
2-day	2.10 (1.85–2.44)	2.71 (2.38–3.14)	3.52 (3.09–4.09)	4.19 (3.65–4.92)	5.13 (4.33–6.20)	5.87 (4.86–7.24)	6.64 (5.37–8.37)	7.44 (5.87–9.63)	8.56 (6.49–11.5)	9.44 (6.94–13.1)
3-day	2.34 (2.06–2.72)	3.05 (2.68–3.54)	4.01 (3.51–4.66)	4.80 (4.18–5.63)	5.91 (4.99–7.15)	6.79 (5.62–8.37)	7.71 (6.24–9.72)	8.67 (6.84–11.2)	10.0 (7.60–13.5)	11.1 (8.15–15.4)
4-day	2.54 (2.24–2.95)	3.33 (2.93–3.87)	4.39 (3.85–5.11)	5.28 (4.60–6.20)	6.53 (5.51–7.90)	7.52 (6.23–9.27)	8.55 (6.92–10.8)	9.64 (7.60–12.5)	11.2 (8.47–15.0)	12.4 (9.10–17.2)
7-day	3.02 (2.66–3.50)	3.97 (3.49–4.60)	5.24 (4.60–6.10)	6.31 (5.50–7.40)	7.82 (6.60–9.45)	9.01 (7.46–11.1)	10.3 (8.31–12.9)	11.6 (9.14–15.0)	13.4 (10.2–18.1)	14.9 (11.0–20.7)
10-day	3.34 (2.94–3.87)	4.39 (3.86–5.10)	5.82 (5.11–6.78)	7.02 (6.11–8.24)	8.71 (7.35–10.5)	10.1 (8.32–12.4)	11.5 (9.27–14.4)	12.9 (10.2–16.7)	15.0 (11.4–20.2)	16.7 (12.3–23.2)
20-day	4.06 (3.58–4.71)	5.38 (4.73–6.24)	7.17 (6.28–8.34)	8.68 (7.55–10.2)	10.8 (9.12–13.1)	12.5 (10.4–15.4)	14.3 (11.6–18.0)	16.2 (12.8–20.9)	18.9 (14.3–25.4)	21.0 (15.5–29.2)
30-day	4.88 (4.29–5.65)	6.48 (5.70–7.52)	8.66 (7.60–10.1)	10.5 (9.15–12.3)	13.1 (11.1–15.9)	15.2 (12.6–18.8)	17.4 (14.1–22.0)	19.8 (15.6–25.6)	23.1 (17.5–31.0)	25.8 (18.9–35.8)
45-day	5.71 (5.03–6.62)	7.61 (6.69–8.83)	10.2 (8.94–11.9)	12.4 (10.8–14.5)	15.5 (13.1–18.7)	18.0 (14.9–22.2)	20.6 (16.7–26.0)	23.4 (18.5–30.3)	27.4 (20.8–36.8)	30.6 (22.5–42.5)
60-day	6.59 (5.80–7.64)	8.78 (7.72–10.2)	11.8 (10.3–13.7)	14.3 (12.4–16.8)	17.9 (15.1–21.6)	20.8 (17.2–25.6)	23.8 (19.3–30.0)	27.0 (21.3–35.0)	31.6 (24.0–42.5)	35.3 (26.0–49.1)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

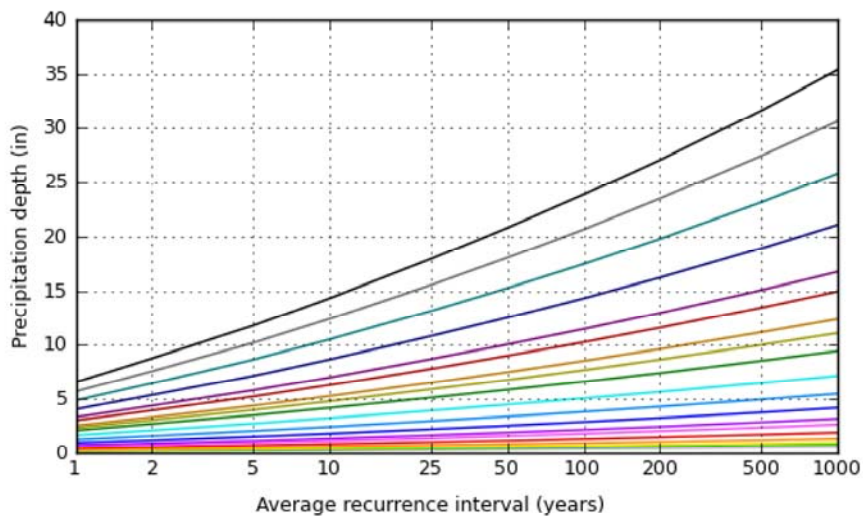Back to Top

PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 32.8283°, Longitude: -116.9036°

NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Mon Aug 26 16:52:48 2019

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Maps & aerials

Small scale terrain
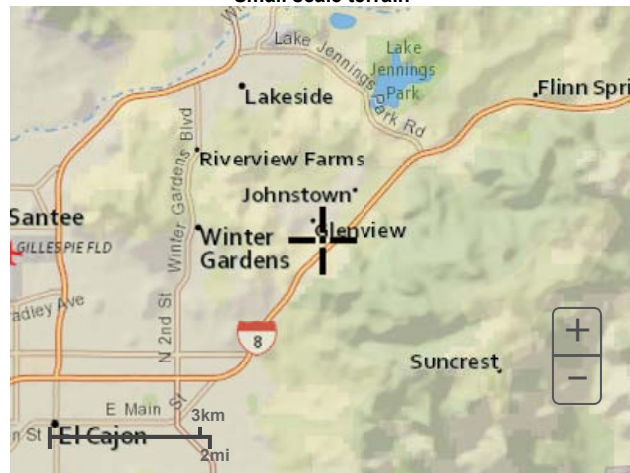
Large scale terrain

Large scale map

13

Large scale aerial

14

Map Scale: 1:1,310 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0   15   30   60   90

Feet
0   50   100   200   300

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

Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

8/23/2019
Page 1 of 4

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 13, Sep 12, 2018

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

Date(s) aerial images were photographed: Dec 7, 2014—Jan 4, 2015

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
VaB	Visalia sandy loam, 2 to 5 percent slopes	A	0.8	11.6%
VsD	Vista coarse sandy loam, 9 to 15 percent slopes, MLRA 20	B	5.8	88.4%
Totals for Area of Interest			**6.6**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

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

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

DU/A = dwelling units per acre
NRCS = National Resources Conservation Service

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<u>Runoff Coefficient Adjustment</u>

Total Onsite Areas A & B 86662
    Type A Soil   15788   18.2%
    Type B Soil   70874   81.8%

    Type A soil Cp =   0.2
    Type B soil Cp =   0.25
    Total Site Composite Cp =   0.24

    Post Development Areas A & B
    Proposed Impervious   60844   70.21%

$C = 0.90 \times (\%\ \text{Impervious}) + Cp \times (1 - \%\ \text{Impervious})$

% impervious =   70.21%
 Cp =   0.24   (Table 3.1, 0% impervious, County Hydrology Manual)
 C =   **0.70**

    Post Development Area O4   **13446** (Soil Type B)
    Proposed Impervious   10136   75.38%

$C = 0.90 \times (\%\ \text{Impervious}) + Cp \times (1 - \%\ \text{Impervious})$

% impervious =   75.38%
 Cp =   0.25   (Table 3.1, 0% impervious, County Hydrology Manual)
 C =   **0.74**

Pre Development Onsite Areas A1 & A2   91515
    Existing Impervious   5737   0.13   6.27%

$C = 0.90 \times (\%\ \text{Impervious}) + Cp \times (1 - \%\ \text{Impervious})$

% impervious =   6.27%
 Cp =   0.24   (Table 3.1, 0% impervious, County Hydrology Manual)
 C =   **0.28**

    Pre & Post Dev. Area O1   **13250** (Soil Type B)
    Proposed Impervious   12983   97.98%

$C = 0.90 \times (\%\ \text{Impervious}) + Cp \times (1 - \%\ \text{Impervious})$

% impervious =   97.98%
 Cp =   0.25   (Table 3.1, 0% impervious, County Hydrology Manual)
 C =   **0.89**

Pre & Post Dev. Area O2　　　　**10033** (Soil Type B)
Proposed Impervious　　9565　　95.34%

C = 0.90 × (% Impervious) + Cp × (1 - % Impervious)

% impervious =　　　95.34%
　Cp =　0.25　　(Table 3.1, 0% impervious, County Hydrology Manual)
　C =　**0.87**

Pre & Post Dev. Area O3　　　　**8362** (Soil Type B)
Proposed Impervious　　2488　　29.75%

C = 0.90 × (% Impervious) + Cp × (1 - % Impervious)

% impervious =　　　29.75%
　Cp =　0.25　　(Table 3.1, 0% impervious, County Hydrology Manual)
　C =　**0.44**

Pre Dev. Area O4　　　　**7980** (Soil Type B)
Proposed Impervious　　1895　　23.75%

C = 0.90 × (% Impervious) + Cp × (1 - % Impervious)

% impervious =　　　23.75%
　Cp =　0.25　　(Table 3.1, 0% impervious, County Hydrology Manual)
　C =　**0.40**

Time of Concentration

Location	Initial Average slope %	Initial L (ft)	Initial Travel Time T (min)	Add'l L (ft)	Average slope %	Notes	Average Q Mannings Eq. V (ft/s)	Additional TC (travel time) T (min)	Total TC T (min)
									(5 minutes min)
Pre Dev.									
Area A1	3.9	100	9.4	260	8	Kirpich Formula		1.5	10.9
Area A2	10	100	6.9	90	6.8	Kirpich Formula		0.7	7.6
Area O4	8	100	6.3	380	5.8		4	1.6	7.9
Area O1	3.3	80	2.3	70	2.2		1.6	0.7	5.0
Area O2	7.5	100	2.1	40	5.7		1.6	0.4	5.0
Area O3	28	40							5.0
Post Dev.									
DMA A	0.6	50	6.0	315	0.6		1.1	4.8	10.8
DMA B	22	100	2.6	163	7.5		6.3	0.4	5.0
Area O4	8	100	3.2	380	5.8		8.9	0.7	5.0

	Initial TC	Pre-Dev Area A1	Pre-Dev Area A2	Pre-Dev Area O4	Offsite O1	Offsite O2	Post-Dev DMA A	DMA B	O4
Initial Travel Time	C =	0.28	0.28	0.4	0.89	0.87	0.7	0.7	0.74
(Figure 3-3)	D ft =	100	100	100	80	100	50	100	100
T min= $\dfrac{1.8(1.1-C)D^{1/2}}{S^{1/3}}$	S % =	3.9	10	8	3.3	7.5	0.6	22	8
	T =	**9.38**	**6.85**	**6.30**	**2.27**	**2.12**	**6.04**	**2.57**	**3.24**

Overland Flow (Pre-Development)
Kirpich Formula

Tc min= $(11.9L^3/\Delta E)^{0.385}$

	Pre-Dev Area A1	Area A2
ΔE ft =	21	6
L Feet =	260	90
L miles =	0.049242	0.017045455
T hours =	0.024813	0.011803349
T min =	1.49	0.71

OVERLAND FLOW TIME IN MINUTES

WATERCOURSE DISTANCE IN FEET

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

EXAMPLE:

Given: Watercourse Distance (D) = 70 Feet
Slope (s) = 1.3%
Runoff Coefficient (C) = 0.41
Overland Flow Time (T) = 9.5 Minutes
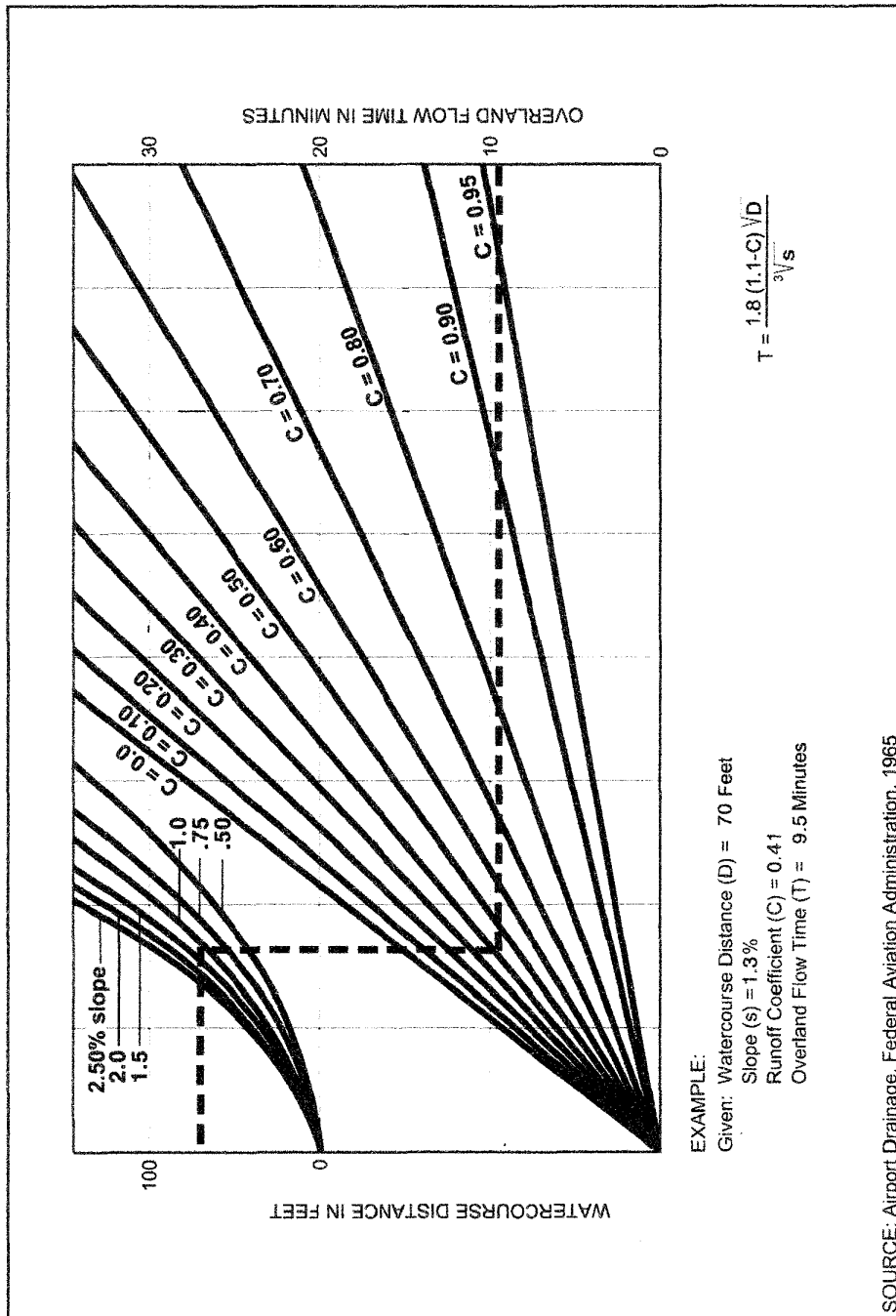
SOURCE: Airport Drainage, Federal Aviation Administration, 1965

FIGURE

3-3

Rational Formula - Overland Time of Flow Nomograph

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EQUATION

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

Tc = Time of concentration (hours)
L = Watercourse Distance (miles)
$\triangle E$ = Change in elevation along effective slope line (See Figure 3-5) (feet)
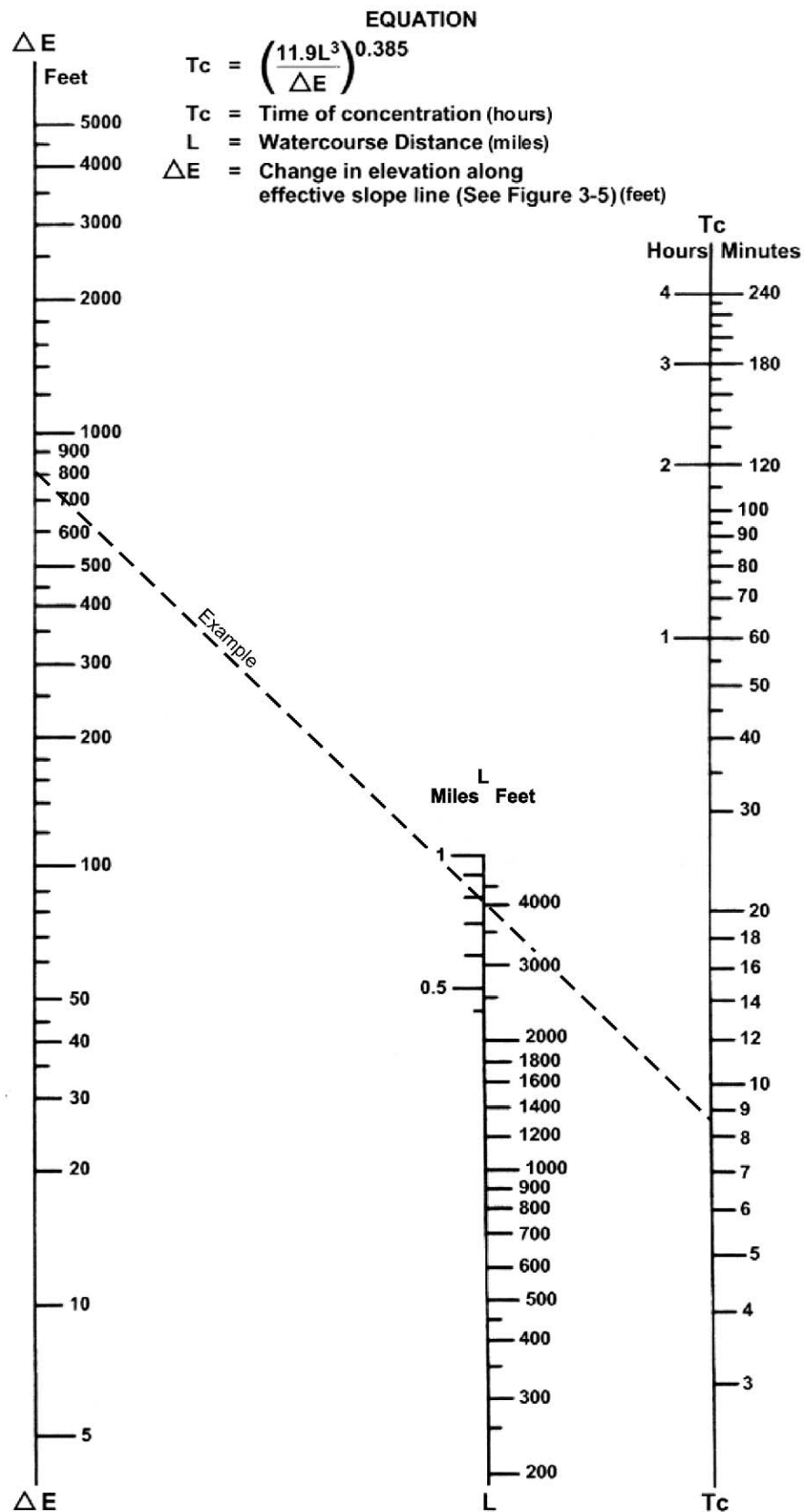
Nomograph for Determination of Time of Concentration (Tc) or Travel Time (Tt) for Natural Watersheds

FIGURE

3-4

Effective Slope Pre-Dev Area A1

Average Slope = 8%

Effective Slope Pre-Dev Area A2
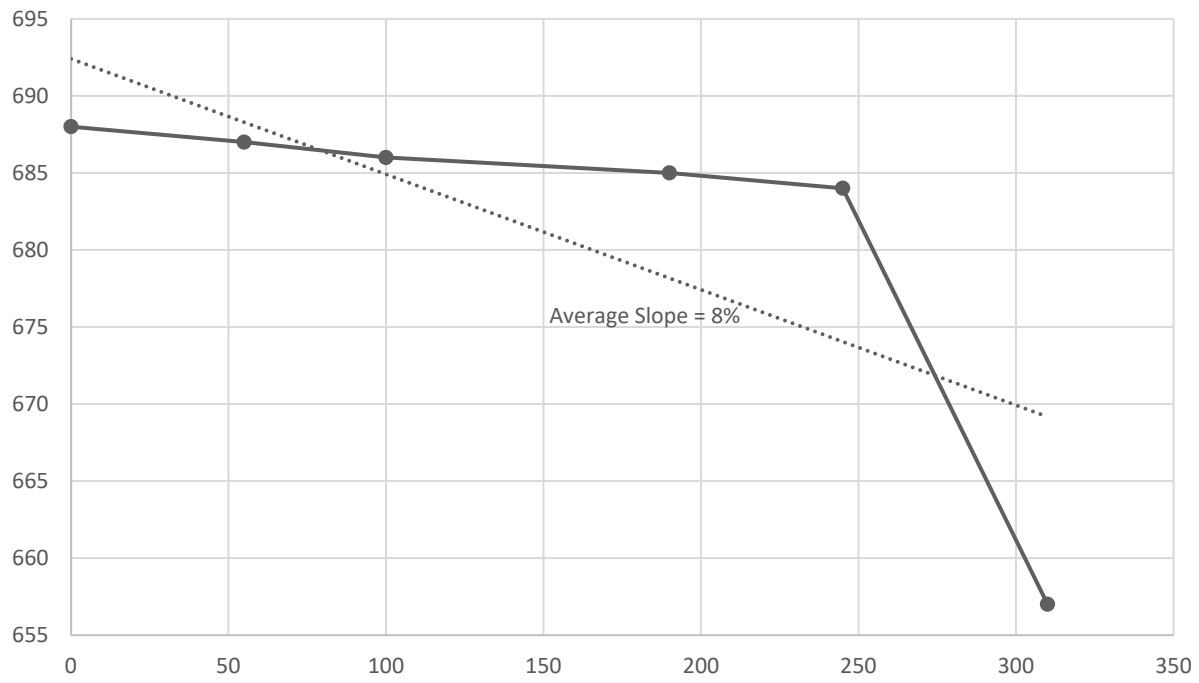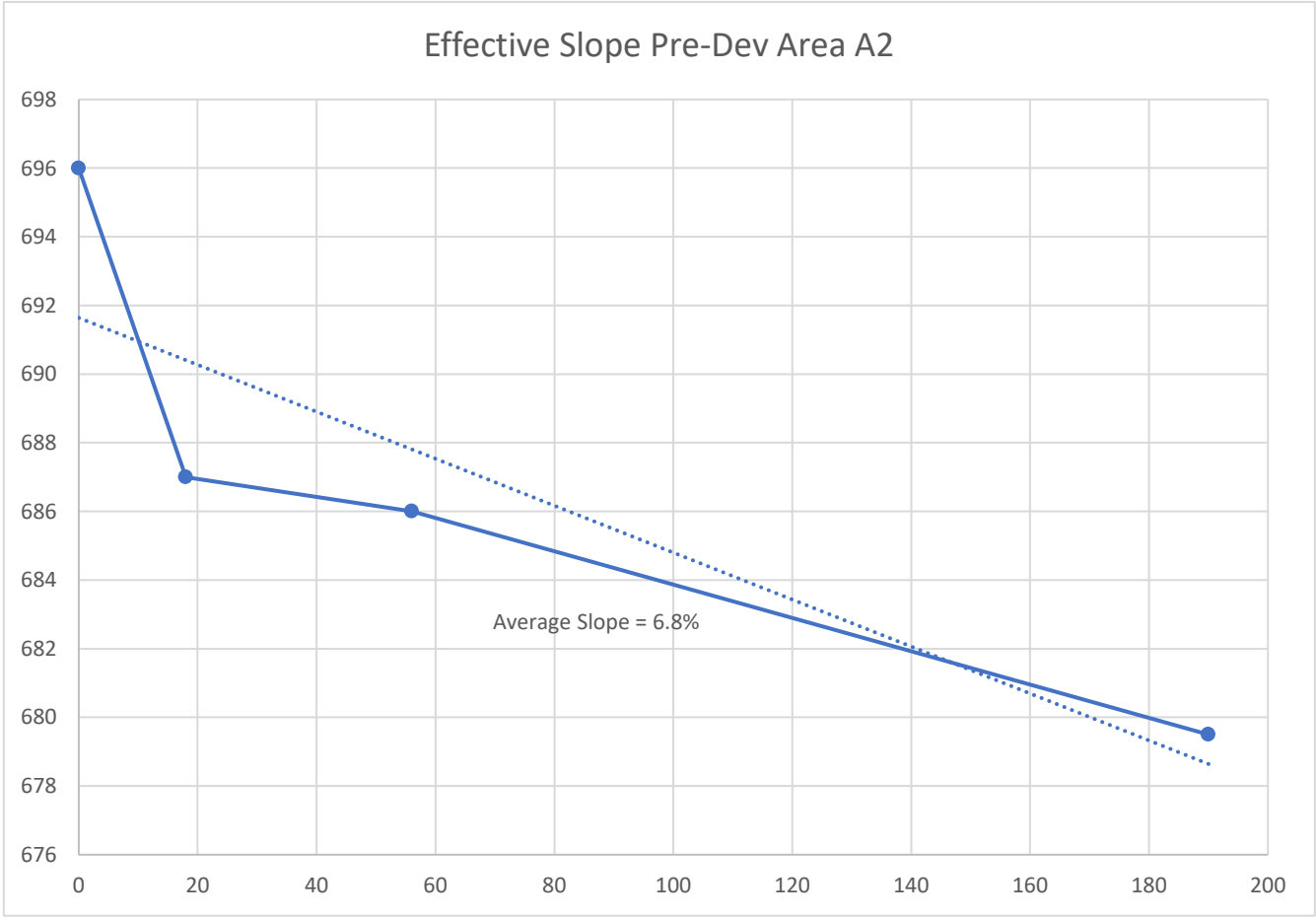
Average Slope = 6.8%

Channel Report

Post Dev Area A TC Flow Path, Average Q

Triangular
Side Slopes (z:1)   = 100.00, 100.00
Total Depth (ft)   = 0.20

Invert Elev (ft)   = 100.00
Slope (%)   = 0.60
N-Value   = 0.016

Calculations
Compute by: Known Q
Known Q (cfs)   = 2.90

Highlighted
Depth (ft)   = 0.16
Q (cfs)   = 2.900
Area (sqft)   = 2.56
Velocity (ft/s)   = 1.13
Wetted Perim (ft)   = 32.00
Crit Depth, Yc (ft) = 0.14
Top Width (ft)   = 32.00
EGL (ft)   = 0.18

Elev (ft)   **Section**   Depth (ft)

Reach (ft)

27

Channel Report

Post-Dev Area B TC Velocity, Average Q

Triangular

Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 0.30
Invert Elev (ft)	= 100.00
Slope (%)	= 7.50
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.50

Highlighted

Depth (ft)	= 0.20
Q (cfs)	= 0.500
Area (sqft)	= 0.08
Velocity (ft/s)	= 6.25
Wetted Perim (ft)	= 0.89
Crit Depth, Yc (ft)	= 0.30
Top Width (ft)	= 0.80
EGL (ft)	= 0.81

28

Channel Report

Post Dev Q100 Area B to Outlet Pipe

Circular

Diameter (ft)	=	1.00

Invert Elev (ft)	=	100.00
Slope (%)	=	1.00
N-Value	=	0.013

Calculations

Compute by:		Known Q
Known Q (cfs)	=	1.00

Highlighted

Depth (ft)	=	0.37
Q (cfs)	=	1.000
Area (sqft)	=	0.27
Velocity (ft/s)	=	3.77
Wetted Perim (ft)	=	1.31
Crit Depth, Yc (ft)	=	0.42
Top Width (ft)	=	0.97
EGL (ft)	=	0.59

Section

Reach (ft)

29

Channel Report

Monday, Dec 19 2022
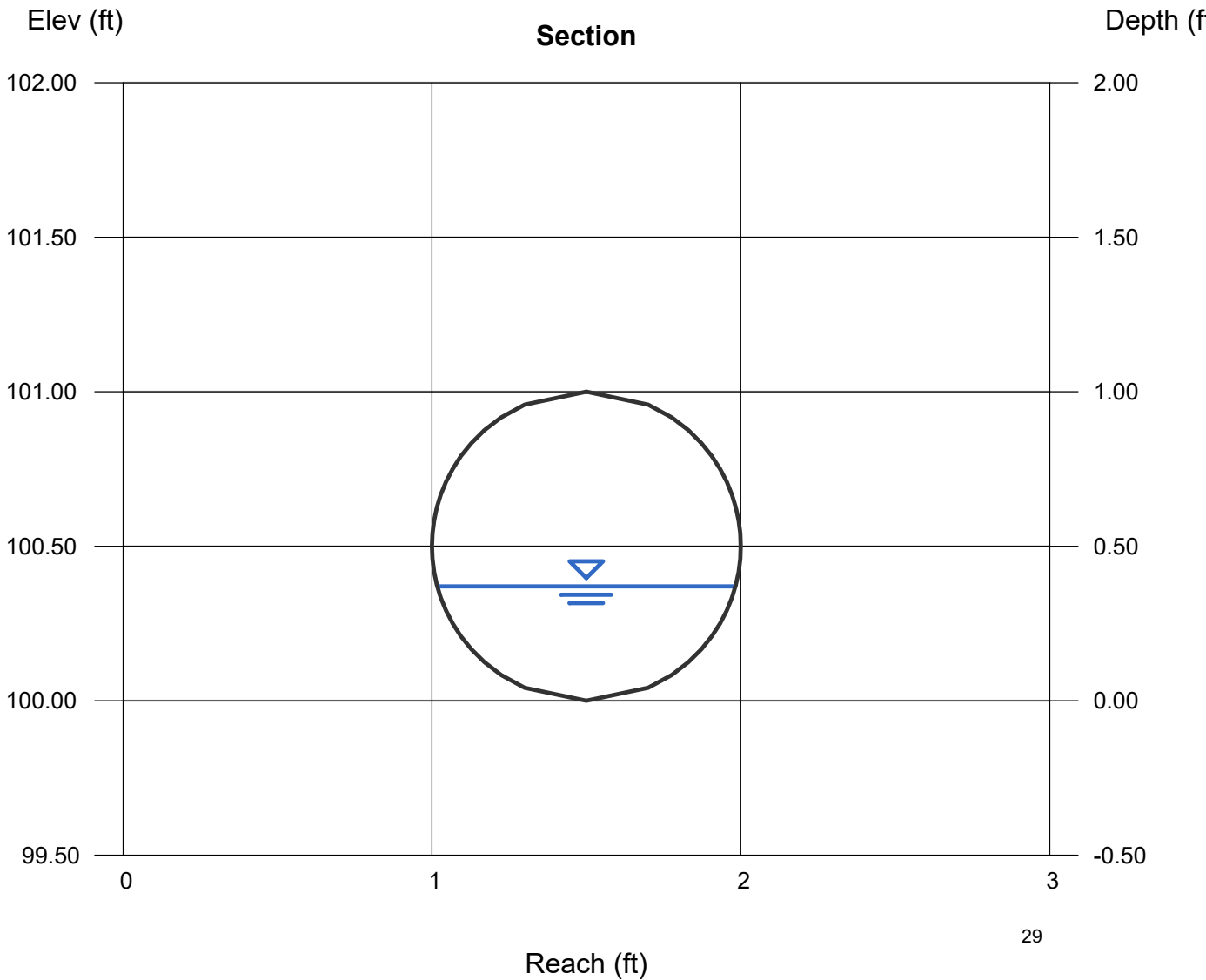
Pre & Post Dev Area O1 TC Flow Path, Average Q

Triangular
Side Slopes (z:1)   = 100.00, 100.00
Total Depth (ft)   = 0.09

Invert Elev (ft)   = 100.00
Slope (%)   = 2.20
N-Value   = 0.016

Calculations
Compute by: Known Q
Known Q (cfs)   = 1.00

Highlighted
Depth (ft)   = 0.08
Q (cfs)   = 1.000
Area (sqft)   = 0.64
Velocity (ft/s)   = 1.56
Wetted Perim (ft)   = 16.00
Crit Depth, Yc (ft)   = 0.09
Top Width (ft)   = 16.00
EGL (ft)   = 0.12

Section

Reach (ft)

30

Channel Report

Tuesday, Dec 27 2022

Pre-Dev Q100 O1 to Los Coches

Triangular
Side Slopes (z:1)	=	5.00, 15.00
Total Depth (ft)	=	0.40
Invert Elev (ft)	=	100.00
Slope (%)	=	4.00
N-Value	=	0.020

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

Highlighted
Depth (ft)	=	0.24
Q (cfs)	=	2.000
Area (sqft)	=	0.58
Velocity (ft/s)	=	3.47
Wetted Perim (ft)	=	4.83
Crit Depth, Yc (ft)	=	0.31
Top Width (ft)	=	4.80
EGL (ft)	=	0.43

31

Reach (ft)

Channel Report

Monday, Dec 19 2022
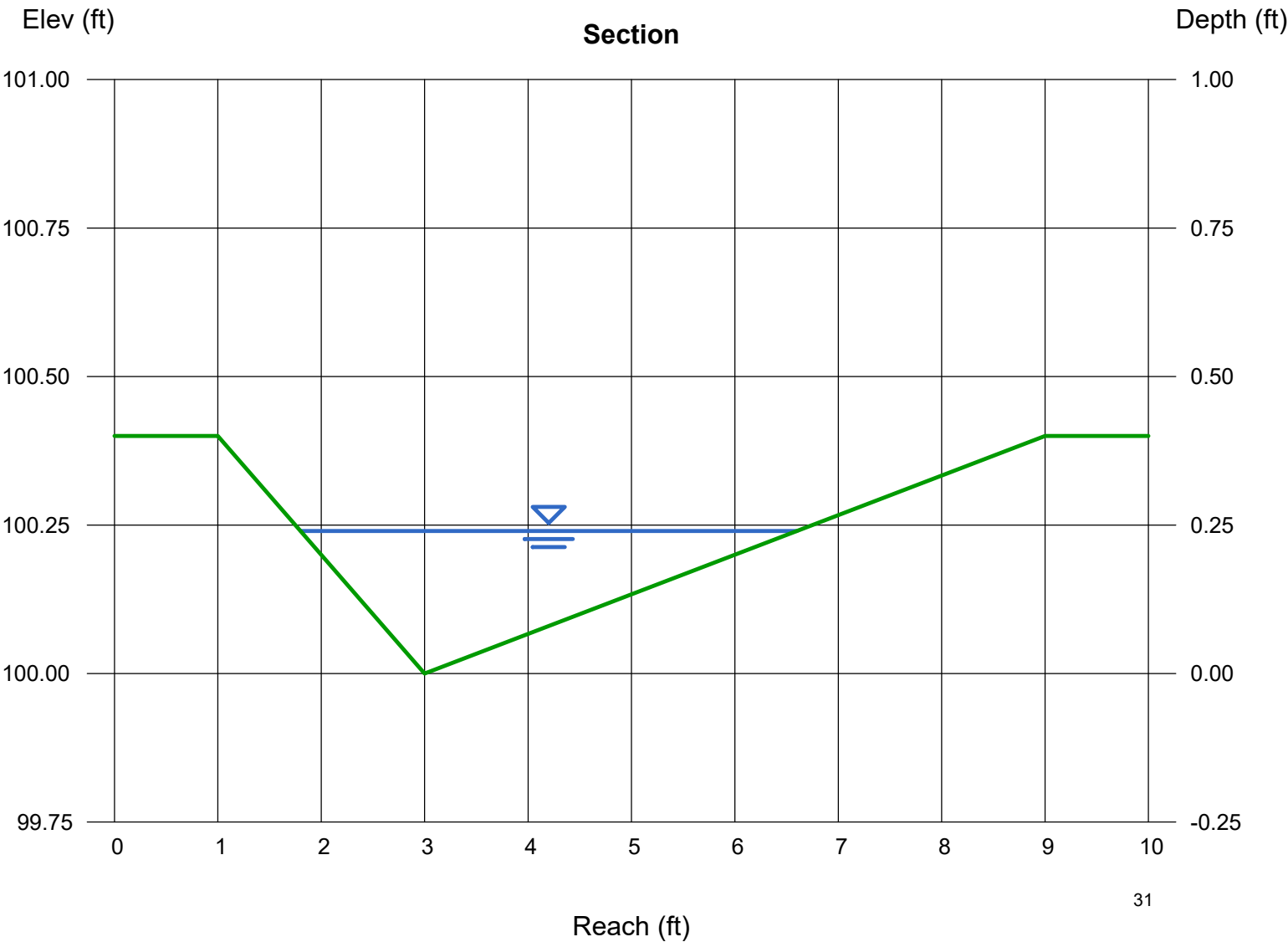
Pre & Post Dev Area O2 TC Flow Path, Average Q

Triangular
Side Slopes (z:1)   = 100.00, 100.00
Total Depth (ft)   = 0.09

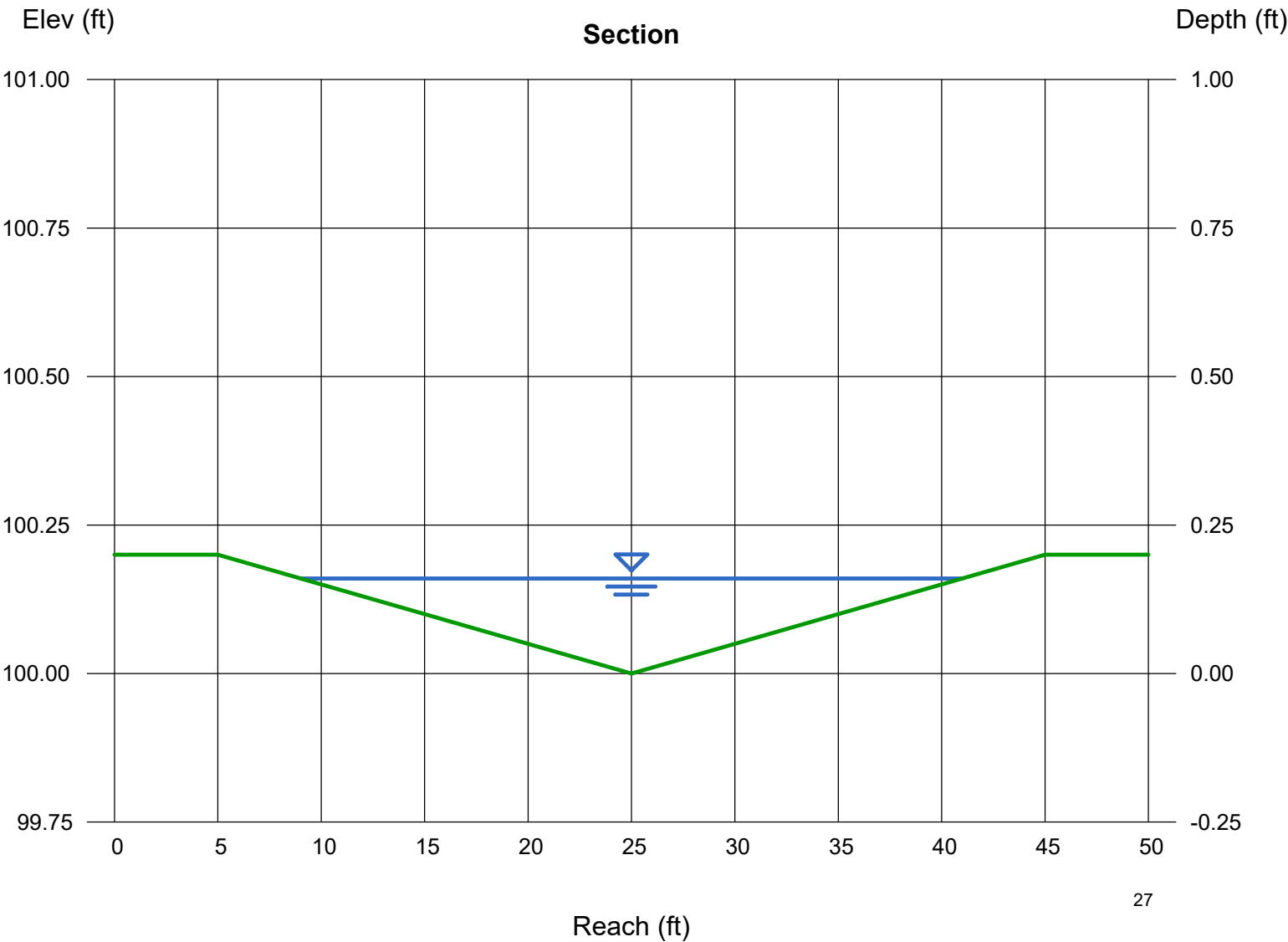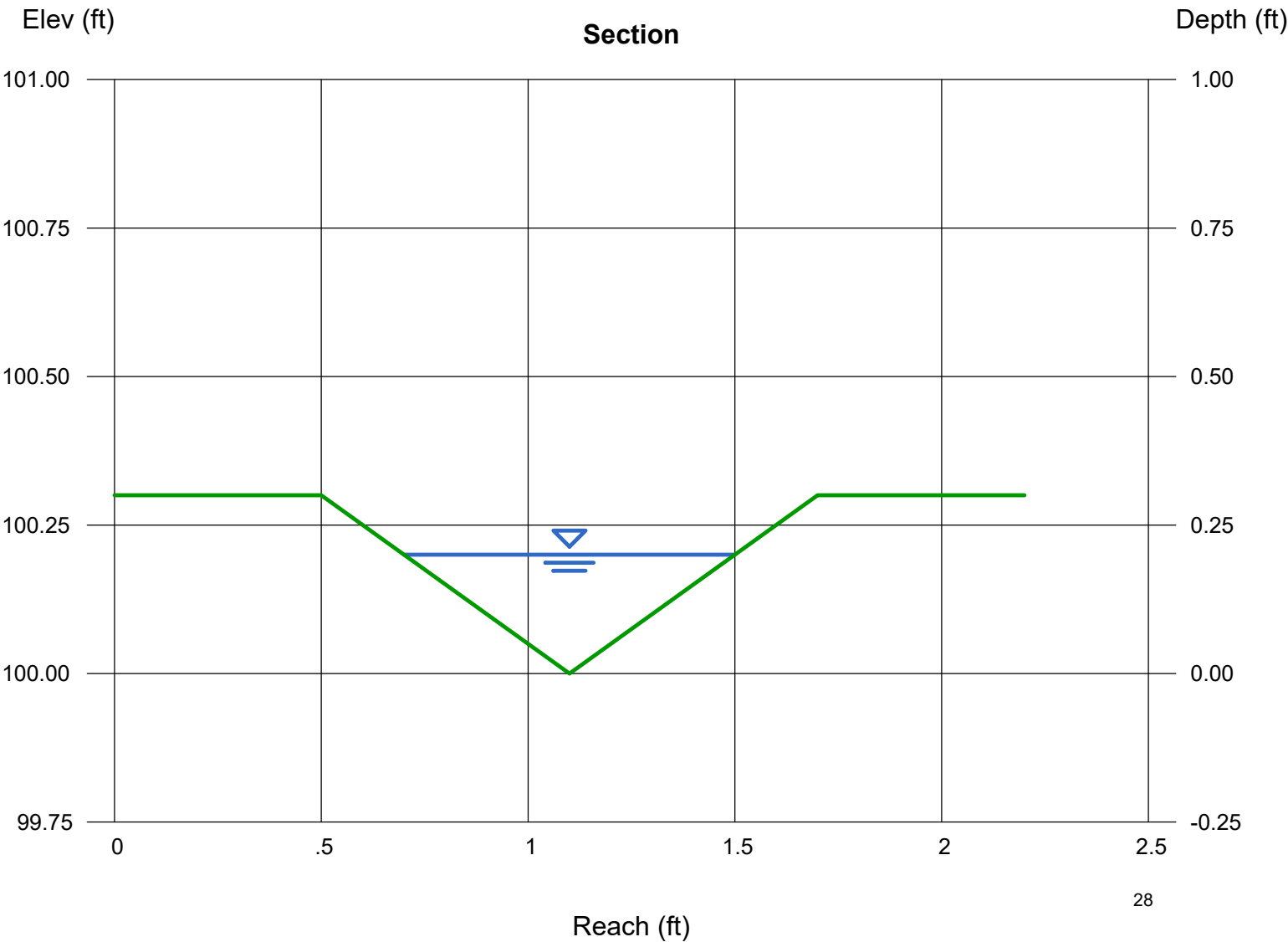Invert Elev (ft)   = 100.00
Slope (%)   = 5.70
N-Value   = 0.016

Calculations
Compute by: Known Q
Known Q (cfs)   = 0.80

Highlighted
Depth (ft)   = 0.07
Q (cfs)   = 0.800
Area (sqft)   = 0.49
Velocity (ft/s)   = 1.63
Wetted Perim (ft)   = 14.00
Crit Depth, Yc (ft) = 0.09
Top Width (ft)   = 14.00
EGL (ft)   = 0.11

Section

Elev (ft) / Depth (ft) vs Reach (ft)

32

Channel Report

Monday, Dec 19 2022
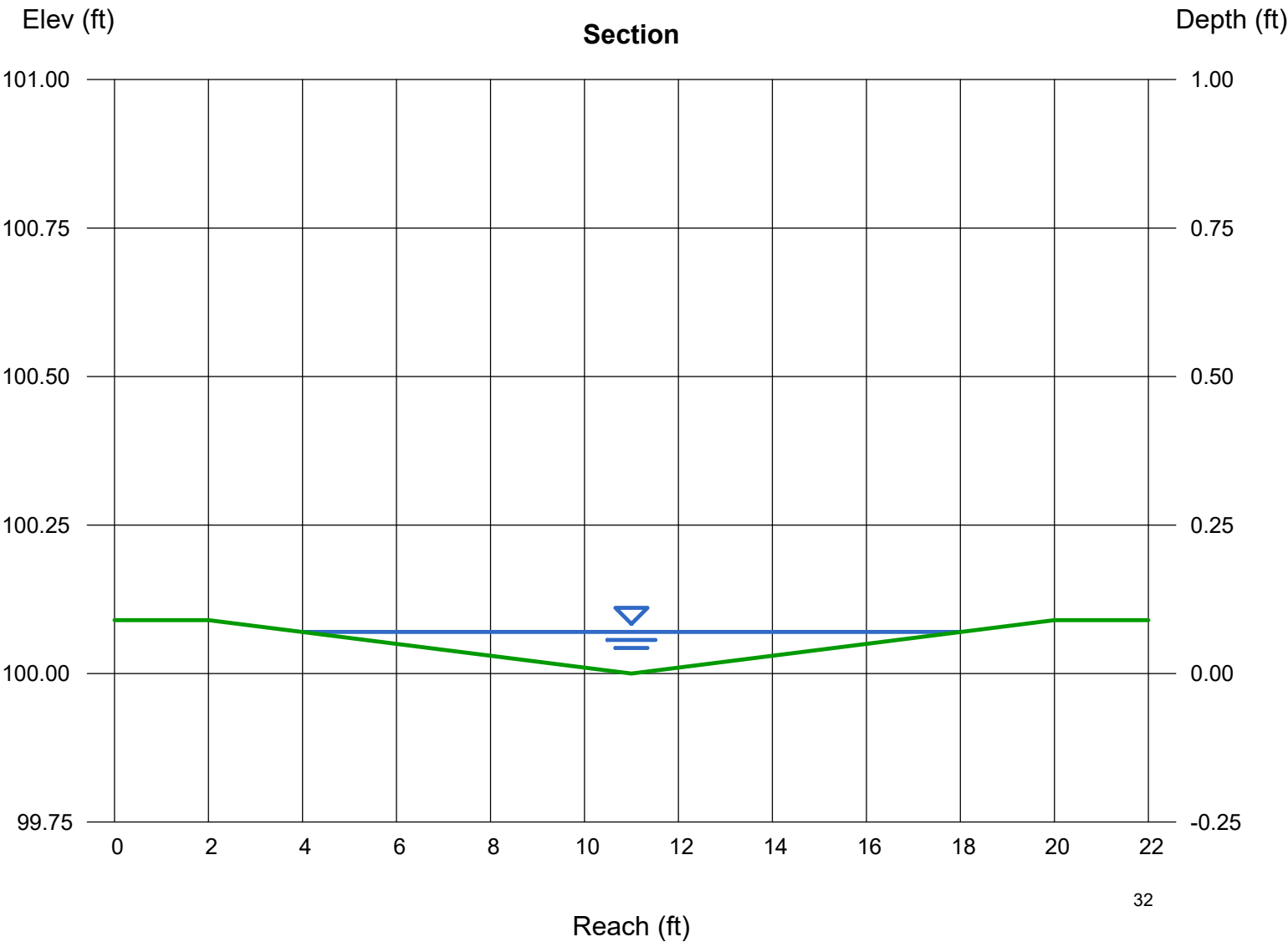
Pre Dev Area O4 TC Flow Path, Average Q

Gutter
Cross Sl, Sx (ft/ft)   = 0.02
Cross Sl, Sw (ft/ft)   = 0.08
Gutter Width (ft)   = 1.50
Invert Elev (ft)   = 100.00
Slope (%)   = 5.80
N-Value   = 0.016

Calculations
Compute by: Known Q
Known Q (cfs)   = 0.20

Highlighted
Depth (ft)   = 0.09
Q (cfs)   = 0.200
Area (sqft)   = 0.05
Velocity (ft/s)   = 3.95
Wetted Perim (ft)   = 0.48
Crit Depth, Yc (ft)   = 0.15
Spread Width (ft)   = 1.13
EGL (ft)   = 0.33

Section

Elev (ft)

Depth (ft)

Reach (ft)

33
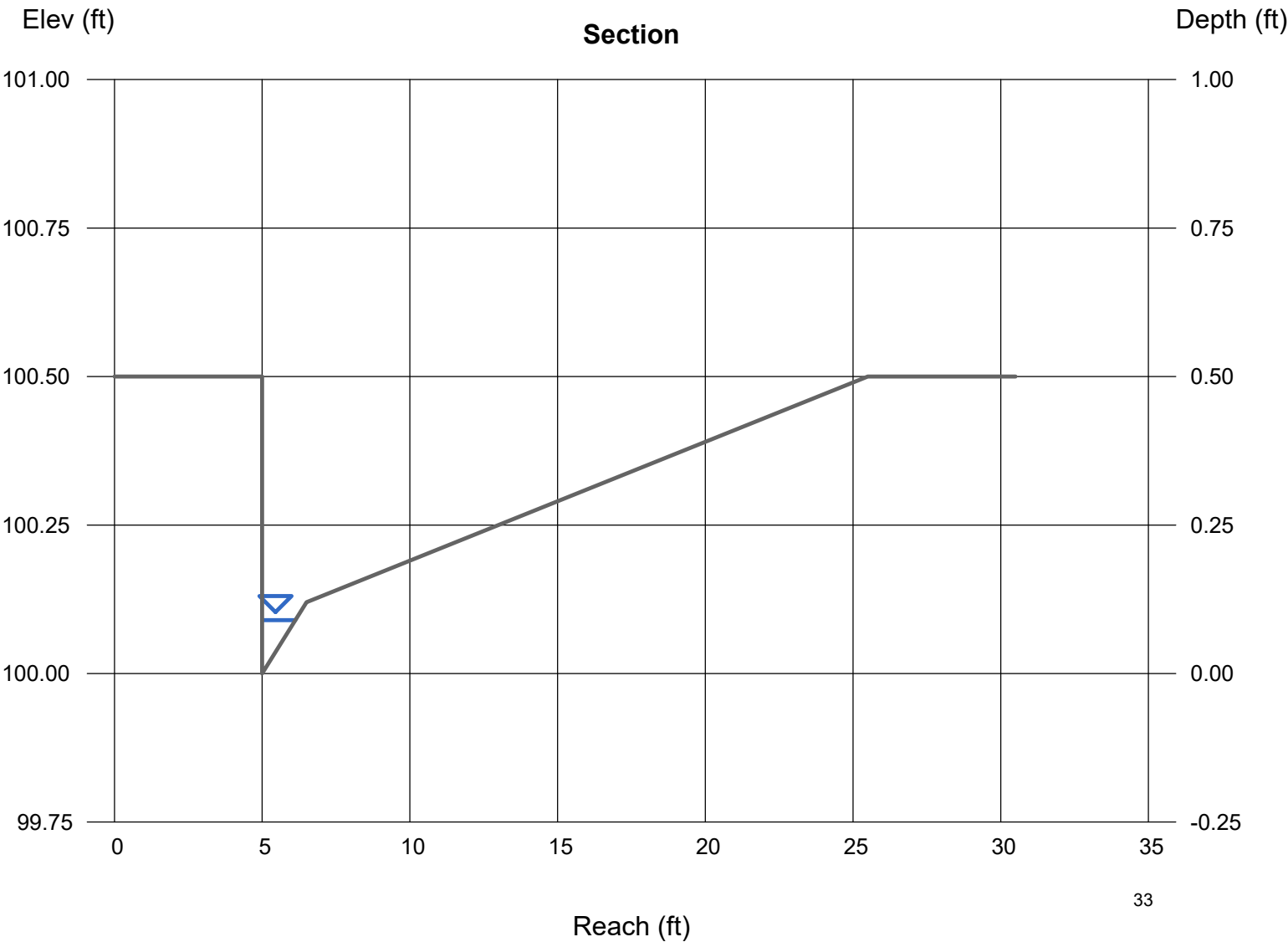
Channel Report

Post Dev Area O4 TC Flow Path, Average Q

Gutter
Cross Sl, Sx (ft/ft)   = 0.02
Cross Sl, Sw (ft/ft)   = 0.08
Gutter Width (ft)   = 1.50
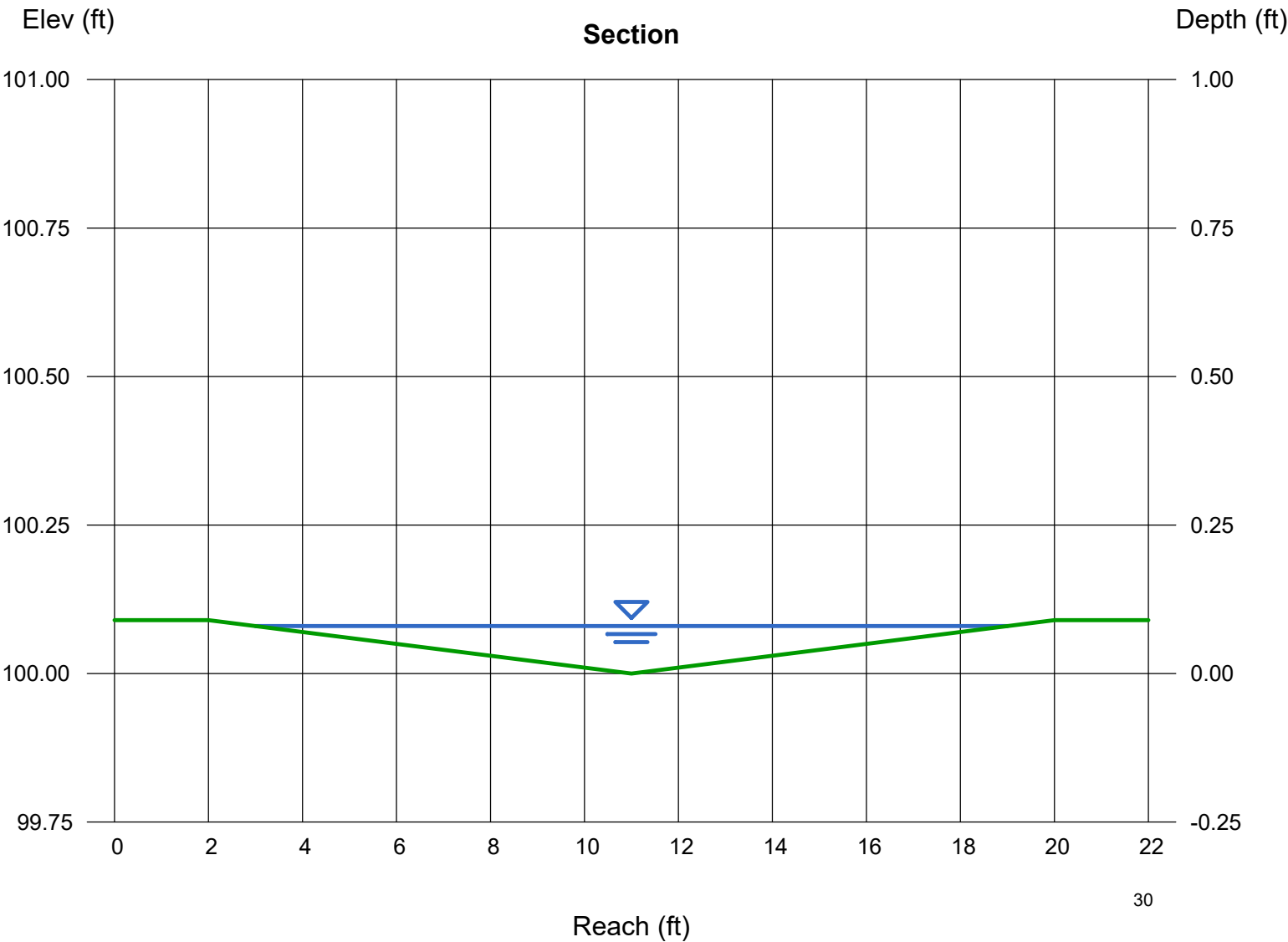Invert Elev (ft)   = 100.00
Slope (%)   = 5.80
N-Value   = 0.016

Calculations
Compute by: Known Q
Known Q (cfs)   = 0.80

Highlighted
Depth (ft)   = 0.12
Q (cfs)   = 0.800
Area (sqft)   = 0.09
Velocity (ft/s)   = 8.89
Wetted Perim (ft)   = 0.24
Crit Depth, Yc (ft)   = 0.23
Spread Width (ft)   = 1.50
EGL (ft)   = 1.35

Elev (ft)   **Section**   Depth (ft)

Reach (ft)

34
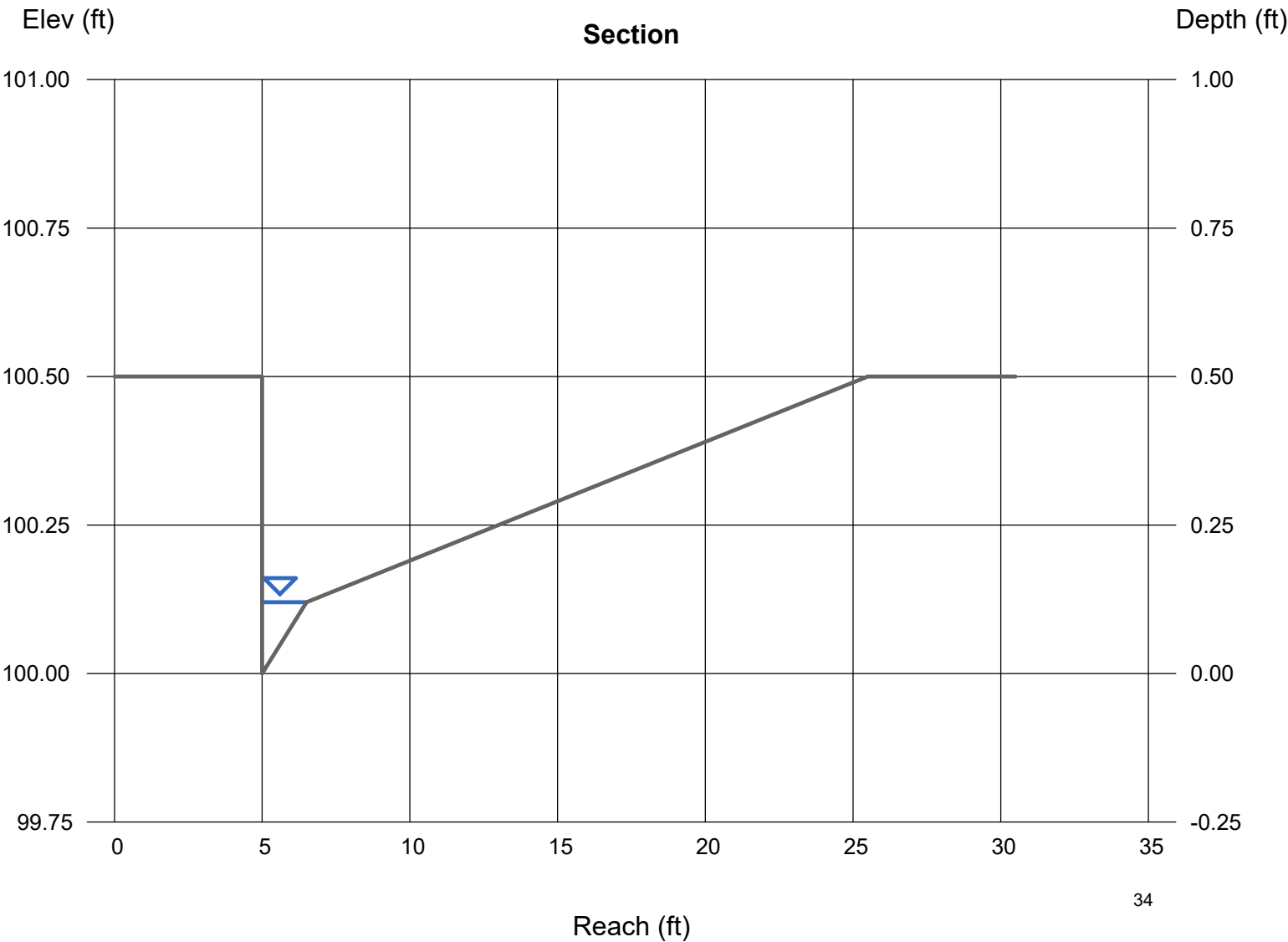
Channel Report

Q100 O1 & O2 to inlet @ Los Coches

Gutter

Cross Sl, Sx (ft/ft)	=	0.02
Cross Sl, Sw (ft/ft)	=	0.08
Gutter Width (ft)	=	1.50
Invert Elev (ft)	=	100.00
Slope (%)	=	5.80
N-Value	=	0.016

Calculations

Compute by:	Known Q	
Known Q (cfs)	=	3.20

Highlighted

Depth (ft)	=	0.26
Q (cfs)	=	3.200
Area (sqft)	=	0.79
Velocity (ft/s)	=	4.05
Wetted Perim (ft)	=	8.77
Crit Depth, Yc (ft)	=	0.34
Spread Width (ft)	=	8.50
EGL (ft)	=	0.52

Section

99.75

Reach (ft)
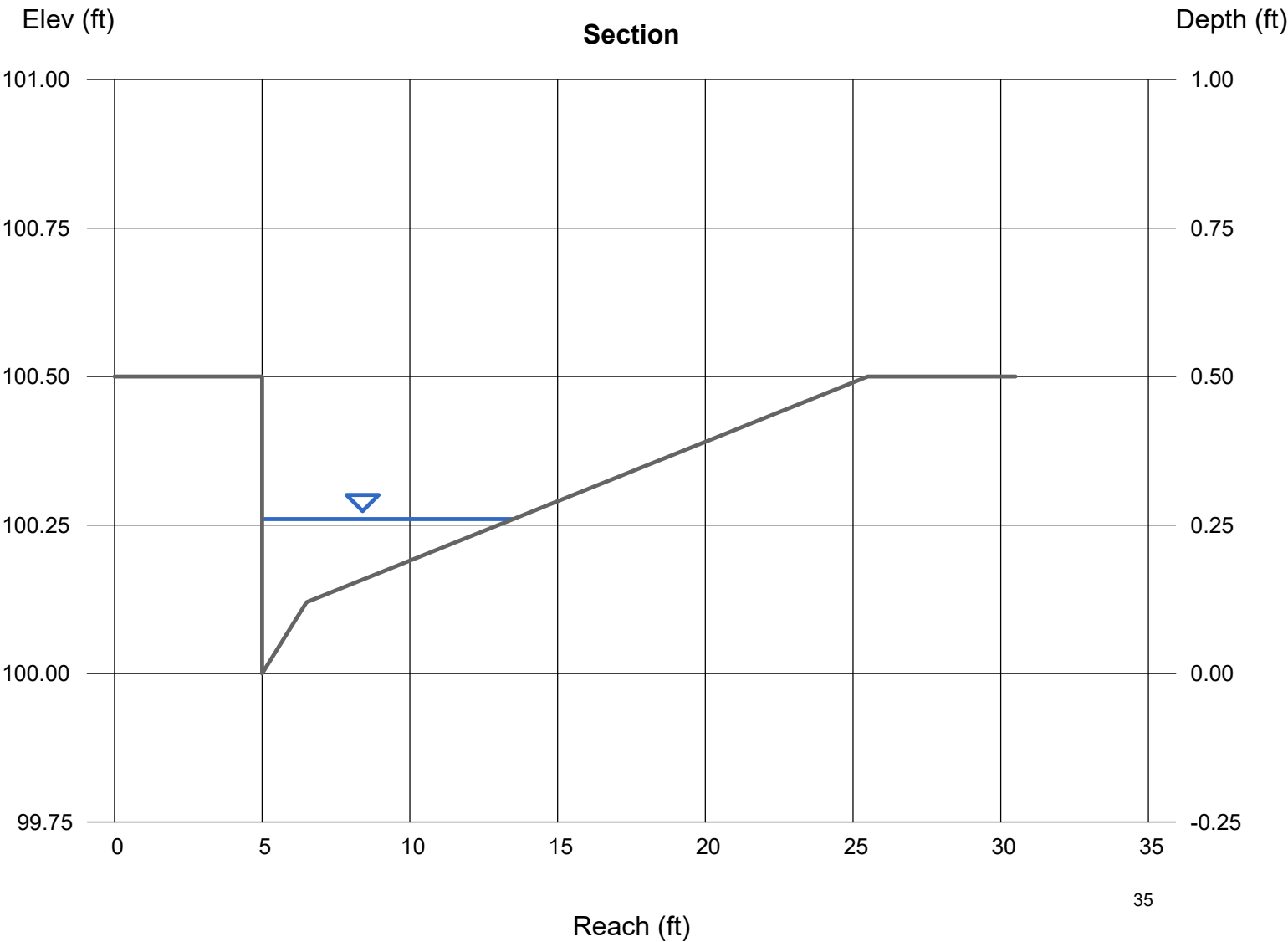
Channel Report

Pre Development Q100 Total

Circular

Diameter (ft)	=	2.00
Invert Elev (ft)	=	100.00
Slope (%)	=	14.30
N-Value	=	0.013

Calculations

Compute by:	Known Q	
Known Q (cfs)	=	6.00

Highlighted

Depth (ft)	=	0.36
Q (cfs)	=	6.000
Area (sqft)	=	0.39
Velocity (ft/s)	=	15.43
Wetted Perim (ft)	=	1.76
Crit Depth, Yc (ft)	=	0.87
Top Width (ft)	=	1.54
EGL (ft)	=	4.06

Section

36
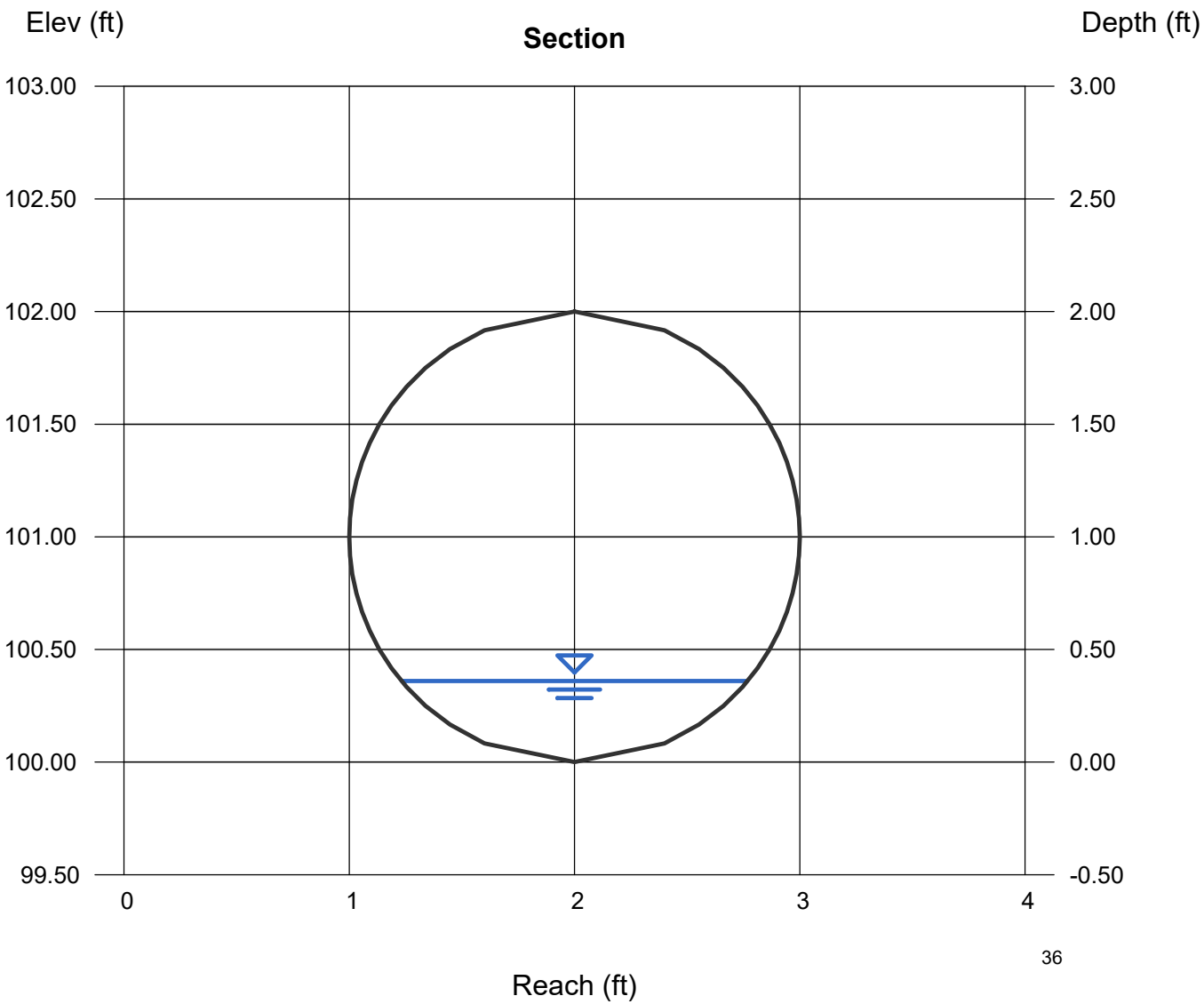
Channel Report

Post Dev Area A Q100 18in to Basin A

Circular

			Highlighted		
Diameter (ft)	=	1.50	Depth (ft)	=	1.01
			Q (cfs)	=	5.900
			Area (sqft)	=	1.27
Invert Elev (ft)	=	100.00	Velocity (ft/s)	=	4.66
Slope (%)	=	0.50	Wetted Perim (ft)	=	2.89
N-Value	=	0.013	Crit Depth, Yc (ft)	=	0.94
			Top Width (ft)	=	1.41
Calculations			EGL (ft)	=	1.35
Compute by:		Known Q			
Known Q (cfs)	=	5.90			

Elev (ft)

Section

Reach (ft)
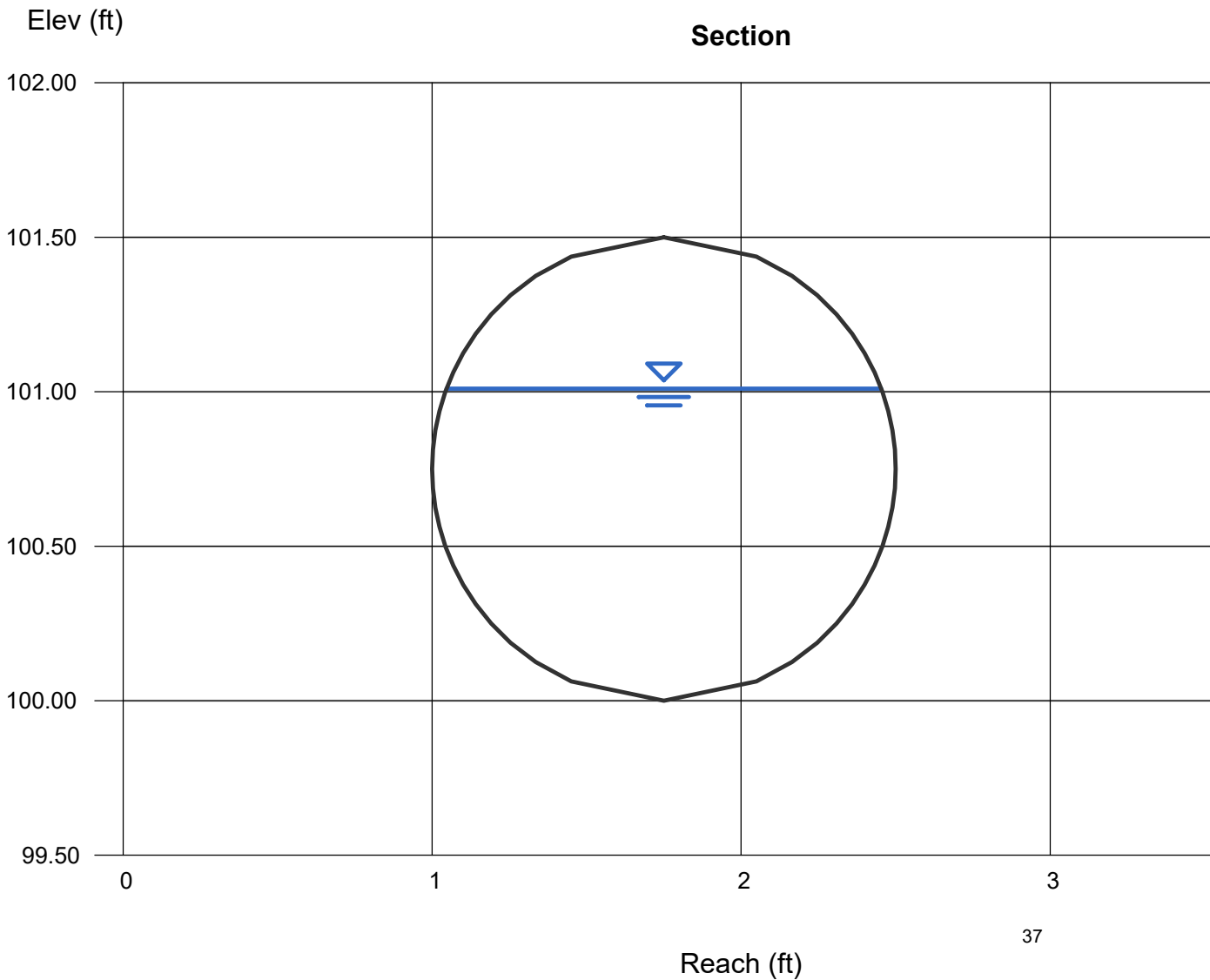
Channel Report

Post Dev Q100 Basin A Outlet

Circular

Diameter (ft)	= 2.00
Invert Elev (ft)	= 100.00
Slope (%)	= 56.60
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.60

Highlighted

Depth (ft)	= 0.14
Q (cfs)	= 1.600
Area (sqft)	= 0.10
Velocity (ft/s)	= 16.16
Wetted Perim (ft)	= 1.08
Crit Depth, Yc (ft)	= 0.44
Top Width (ft)	= 1.03
EGL (ft)	= 4.20

38
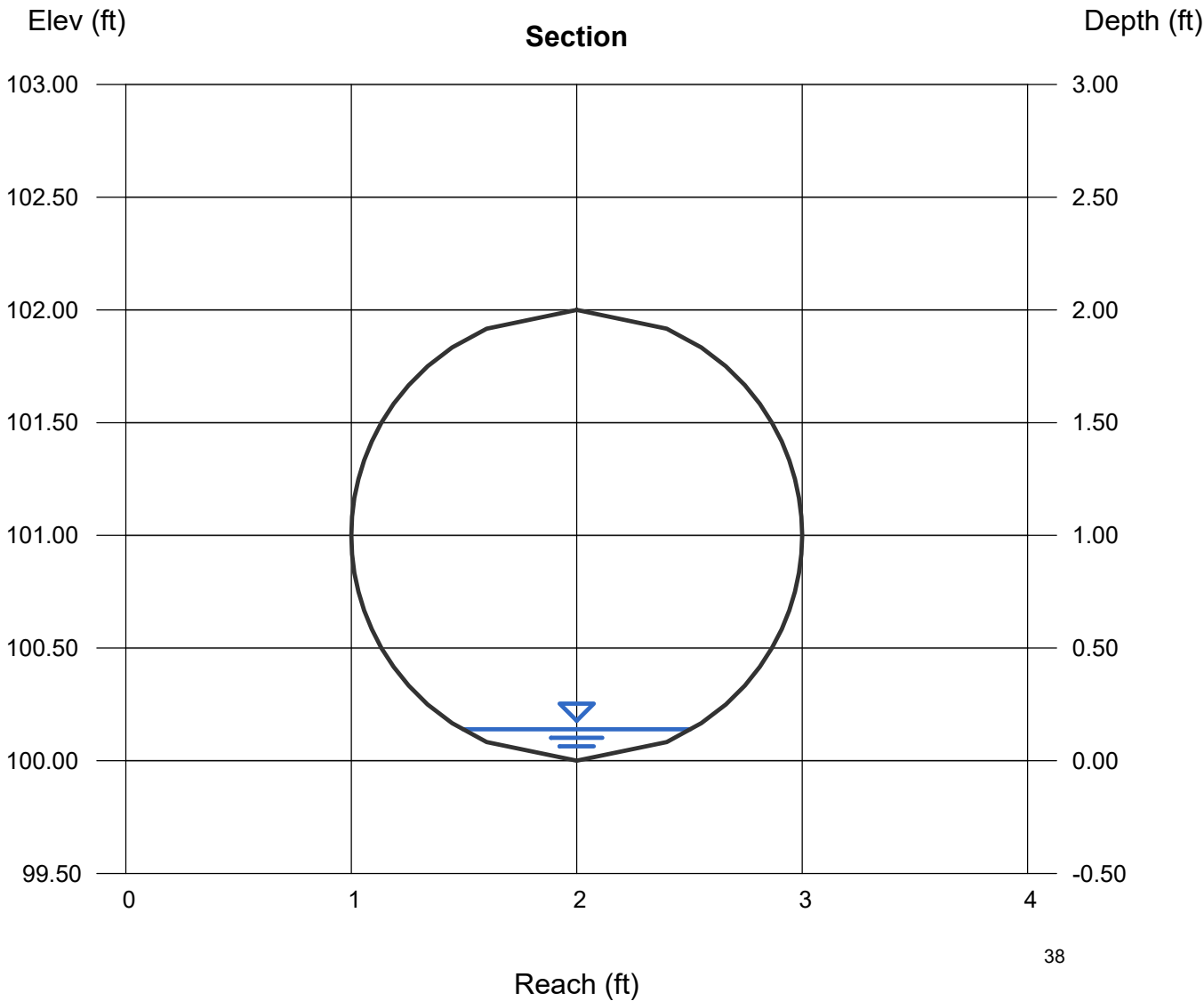
Channel Report

Q100 Post Dev O1 (12in HDPE)

Circular

Diameter (ft)	=	1.00

Invert Elev (ft)	=	100.00
Slope (%)	=	0.50
N-Value	=	0.013

Calculations

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

Highlighted

Depth (ft)	=	0.68
Q (cfs)	=	2.000
Area (sqft)	=	0.57
Velocity (ft/s)	=	3.51
Wetted Perim (ft)	=	1.94
Crit Depth, Yc (ft)	=	0.61
Top Width (ft)	=	0.93
EGL (ft)	=	0.87

Section

39
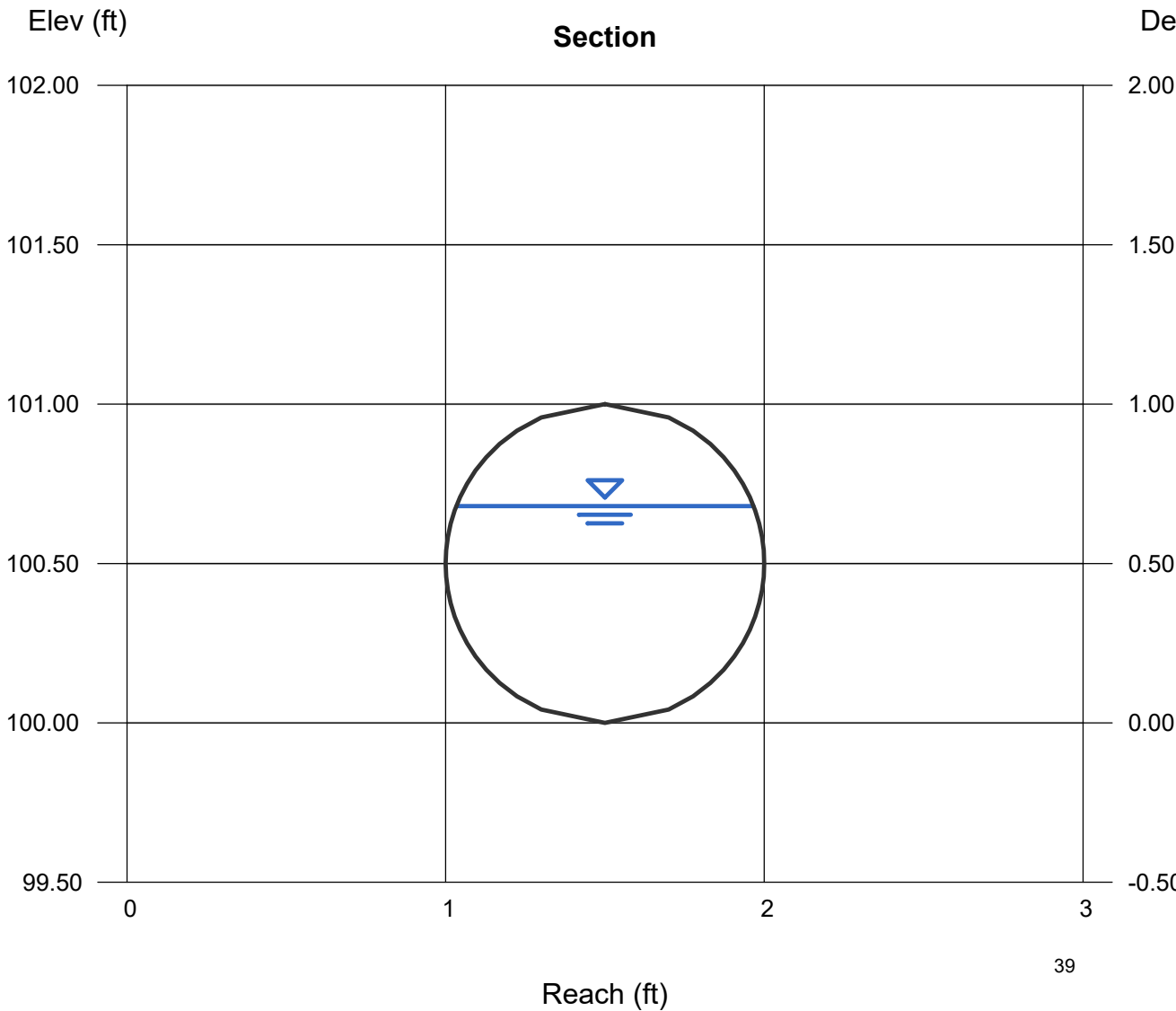
Channel Report

Q100 Post Dev O1 O2, O4 (Exist 24in CMP)

Circular

Diameter (ft)	=	2.00
Invert Elev (ft)	=	100.00
Slope (%)	=	0.50
N-Value	=	0.013

Calculations

Compute by:	Known Q	
Known Q (cfs)	=	4.20

Highlighted

Depth (ft)	=	0.70
Q (cfs)	=	4.200
Area (sqft)	=	0.99
Velocity (ft/s)	=	4.26
Wetted Perim (ft)	=	2.54
Crit Depth, Yc (ft)	=	0.72
Top Width (ft)	=	1.91
EGL (ft)	=	0.98

40

Reach (ft)

ATTACHMENT C

RATIONAL METHOD HYDROGRAPH PROGRAM
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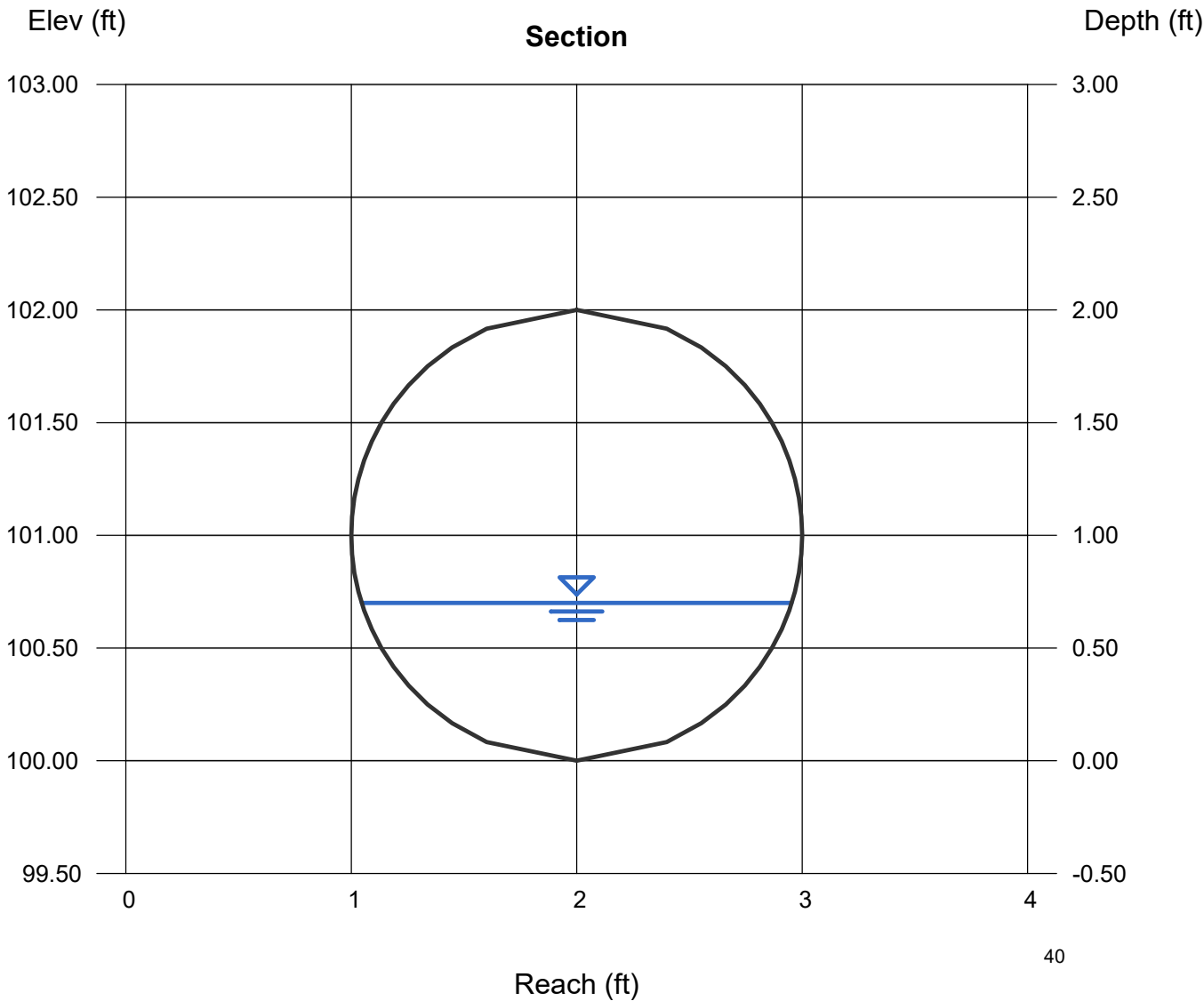
RUN DATE   12/8/2022
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 11 MIN.
6 HOUR RAINFALL 2.88 INCHES
BASIN AREA 1.81 ACRES
RUNOFF COEFFICIENT 0.7   Area A Q100
PEAK DISCHARGE 5.9 CFS

TIME (MIN) = 0   DISCHARGE (CFS) = 0
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TIME (MIN) = 22   DISCHARGE (CFS) = 0.2
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TIME (MIN) = 242   DISCHARGE (CFS) = 1.5
TIME (MIN) = 253   DISCHARGE (CFS) = 5.9
TIME (MIN) = 264   DISCHARGE (CFS) = 0.9
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TIME (MIN) = 308   DISCHARGE (CFS) = 0.4
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TIME (MIN) = 341   DISCHARGE (CFS) = 0.3
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TIME (MIN) = 363   DISCHARGE (CFS) = 0.2
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RUN DATE   12/8/2022
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 5 MIN.
6 HOUR RAINFALL 2.88 INCHES
BASIN AREA 0.18 ACRES
RUNOFF COEFFICIENT 0.7
PEAK DISCHARGE 1 CFS   Area B Q100

```
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TIME (MIN) = 5          DISCHARGE (CFS) =  0
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TIME (MIN) = 20         DISCHARGE (CFS) =  0
TIME (MIN) = 25         DISCHARGE (CFS) =  0
TIME (MIN) = 30         DISCHARGE (CFS) =  0
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TIME (MIN) = 55         DISCHARGE (CFS) =  0
TIME (MIN) = 60         DISCHARGE (CFS) =  0
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TIME (MIN) = 70         DISCHARGE (CFS) =  0
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TIME (MIN) = 135        DISCHARGE (CFS) =  0
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TIME (MIN) = 155        DISCHARGE (CFS) =  0
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TIME (MIN) = 325        DISCHARGE (CFS) =  0
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TIME (MIN) = 345        DISCHARGE (CFS) =  0
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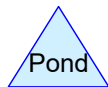
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RUN DATE   12/27/2022
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 7 MIN.
6 HOUR RAINFALL 2.88 INCHES
BASIN AREA 0.83 ACRES
RUNOFF COEFFICIENT 0.82   Areas O1, O2, O4 Q100
PEAK DISCHARGE 4.2 CFS
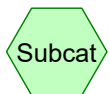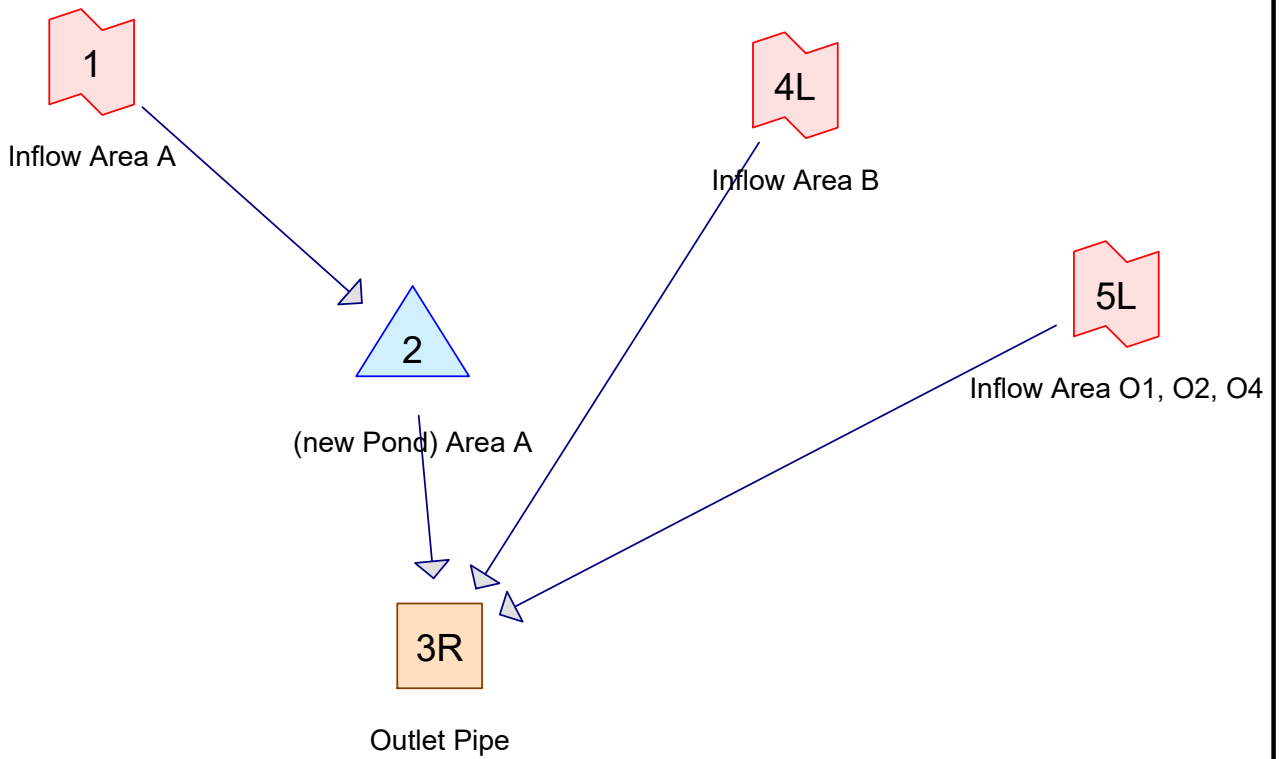
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TIME (MIN) = 308   DISCHARGE (CFS) = 0.2
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TIME (MIN) = 329   DISCHARGE (CFS) = 0.1
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1
Inflow Area A

4L
Inflow Area B

5L
Inflow Area O1, O2, O4

2
(new Pond) Area A

3R
Outlet Pipe

Subcat Reach Pond Link

Summary for Reach 3R: Outlet Pipe

Inflow   =   5.67 cfs @   4.55 hrs, Volume=   0.495 af
Outflow   =   5.65 cfs @   4.55 hrs, Volume=   0.495 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-8.00 hrs, dt= 0.01 hrs
Max. Velocity= 15.42 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 7.32 fps, Avg. Travel Time= 0.0 min

Peak Storage= 7 cf @ 4.55 hrs
Average Depth at Peak Storage= 0.35' , Surface Width= 1.52'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 85.55 cfs

24.0" Round Pipe
n= 0.013
Length= 20.0'   Slope= 0.1430 '/'
Inlet Invert= -4.00', Outlet Invert= -6.86'
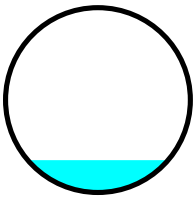
Reach 3R: Outlet Pipe

Hydrograph
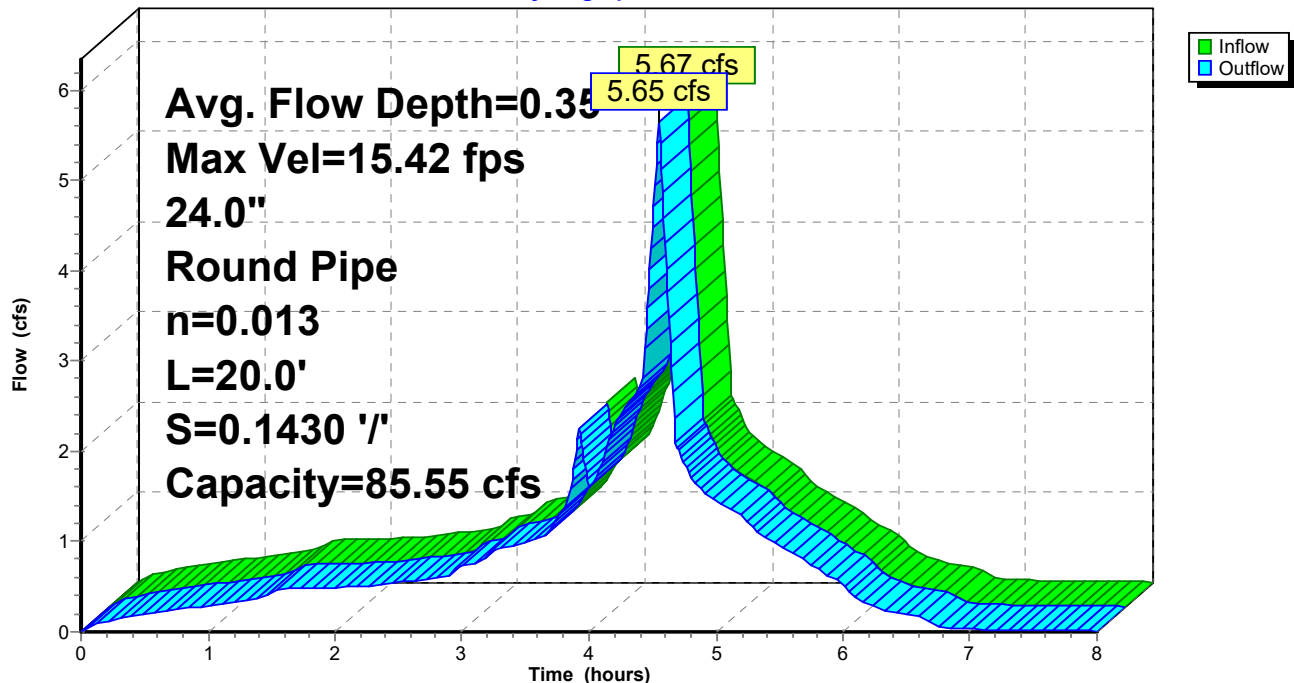
Avg. Flow Depth=0.35
Max Vel=15.42 fps
24.0"
Round Pipe
n=0.013
L=20.0'
S=0.1430 '/'
Capacity=85.55 cfs

5.67 cfs
5.65 cfs

■ Inflow
■ Outflow

Flow (cfs)

Time (hours)

Area A
Prepared by HP
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Rainfall Duration=0 min, Inten=0.00 in/hr
Printed 1/3/2023
Page 3

Reach 3R: Outlet Pipe

Stage-Discharge

Summary for Pond 2: (new Pond) Area A

Inflow	=	5.90 cfs @	4.14 hrs,	Volume=	0.298 af		
Outflow	=	1.61 cfs @	4.29 hrs,	Volume=	0.297 af,	Atten= 73%,	Lag= 9.3 min
Primary	=	1.61 cfs @	4.29 hrs,	Volume=	0.297 af		

    Routed to Reach 3R : Outlet Pipe

Routing by Stor-Ind method, Time Span= 0.00-8.00 hrs, dt= 0.01 hrs
Starting Elev= 1.75' Storage= 2,001 cf
Peak Elev= 3.80' @ 4.29 hrs Storage= 6,310 cf (4,310 cf above start)

Plug-Flow detention time= 73.8 min calculated for 0.251 af (84% of inflow)
Center-of-Mass det. time= 30.5 min (245.8 - 215.3)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	6,814 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
0.00	0
0.50	424
1.00	958
1.50	1,611
2.00	2,390
2.50	3,304
3.00	4,358
3.50	5,535
4.00	6,814

Device	Routing	Invert	Outlet Devices
#1	Primary	1.75'	**7.0" W x 5.0" H Vert. Orifice/Grate** C= 0.600
			Limited to weir flow at low heads
#2	Primary	3.80'	**36.0" x 36.0" Horiz. Orifice/Grate** C= 0.600
			Limited to weir flow at low heads

Primary OutFlow Max=1.59 cfs @ 4.29 hrs HW=3.80' (Free Discharge)
┌**1=Orifice/Grate** (Orifice Controls 1.59 cfs @ 6.54 fps)
└**2=Orifice/Grate** (Weir Controls 0.01 cfs @ 0.17 fps)

Area A
Rainfall Duration=0 min, Inten=0.00 in/hr
Prepared by HP
Printed 1/3/2023
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Page 5

Pond 2: (new Pond) Area A
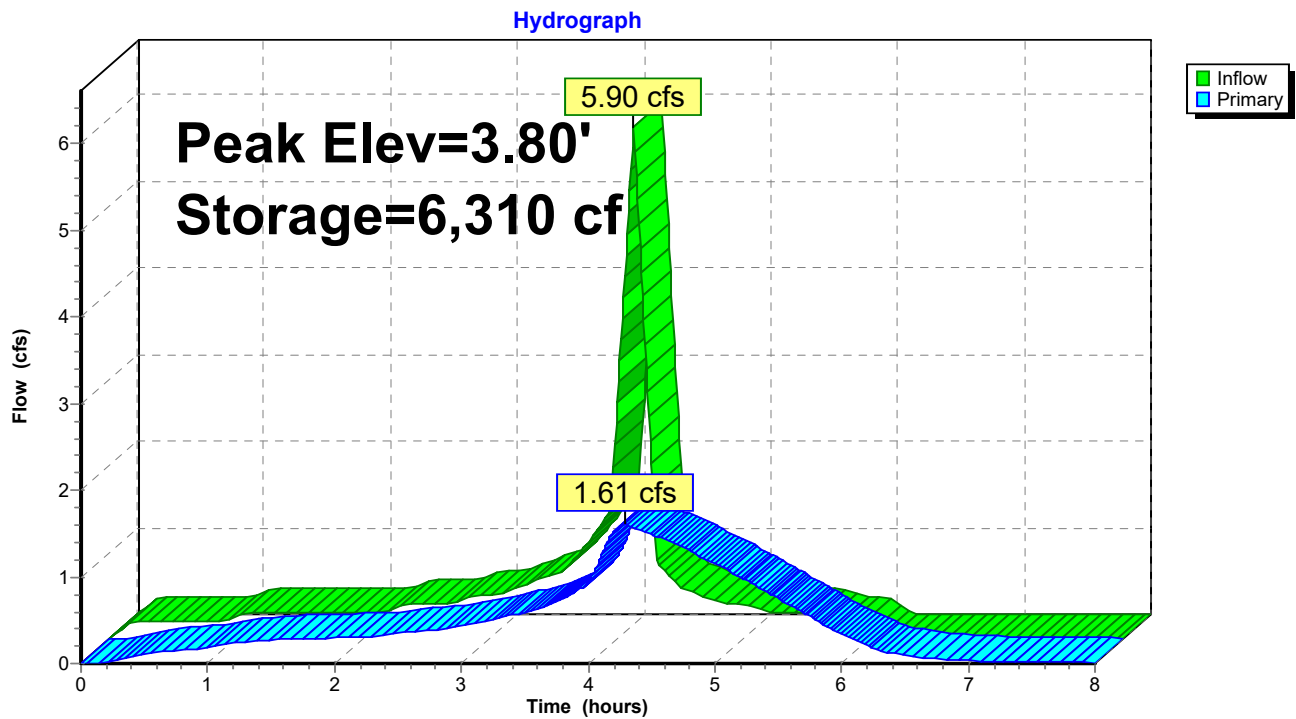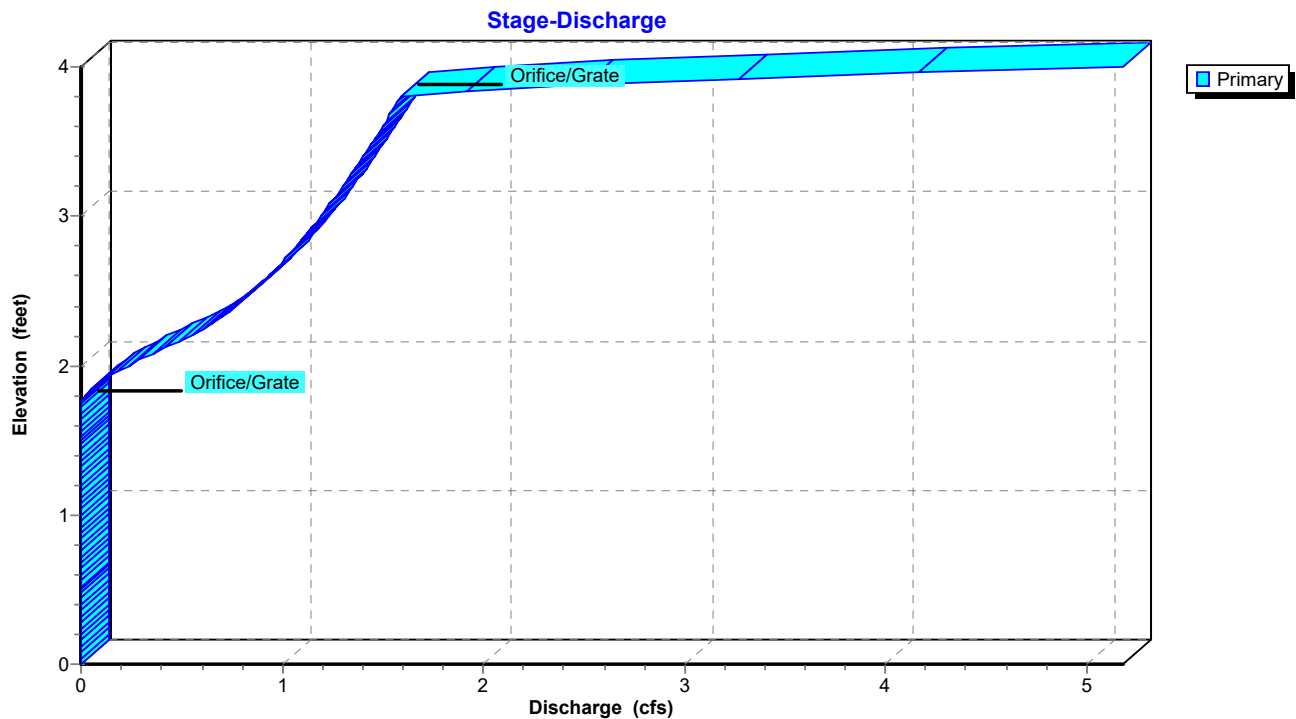
Hydrograph

Peak Elev=3.80'
Storage=6,310 cf

5.90 cfs

1.61 cfs

Inflow
Primary

Pond 2: (new Pond) Area A

Stage-Discharge

Orifice/Grate

Orifice/Grate

Primary

Summary for Link 1: Inflow Area A

Inflow   =   5.90 cfs @   4.14 hrs, Volume=   0.298 af
Primary   =   5.90 cfs @   4.14 hrs, Volume=   0.298 af, Atten= 0%, Lag= 0.0 min
    Routed to Pond 2 : (new Pond) Area A

Primary outflow = Inflow, Time Span= 0.00-8.00 hrs, dt= 0.01 hrs

35 Point manual hydrograph, To= 0.00 hrs, dt= 0.18 hrs, cfs =
    0.00   0.20   0.20   0.20   0.20   0.20   0.30   0.30   0.30   0.30
    0.30   0.30   0.30   0.40   0.40   0.40   0.50   0.50   0.60   0.70
    0.80   1.10   1.50   5.90   0.90   0.60   0.50   0.40   0.40   0.30
    0.30   0.30   0.20   0.20   0.00

Link 1: Inflow Area A
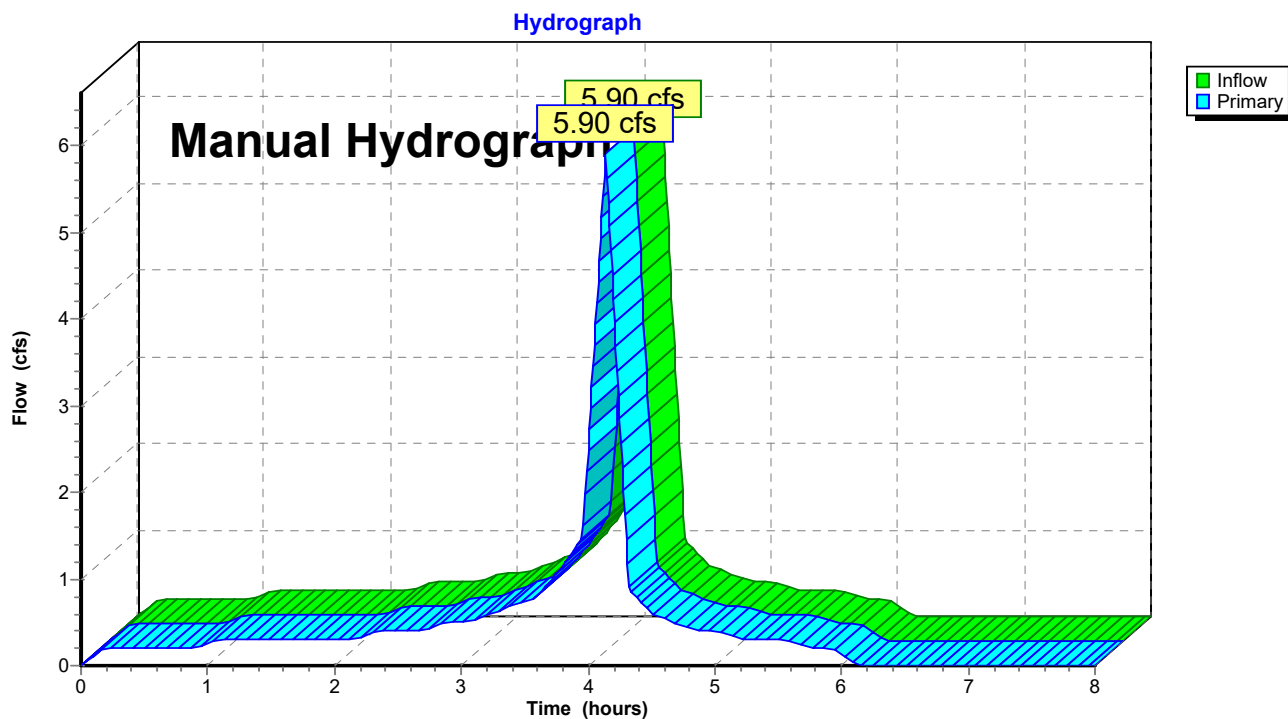
Hydrograph

Area A
Prepared by HP
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Rainfall Duration=0 min, Inten=0.00 in/hr
Printed 1/3/2023
Page 7

Summary for Link 4L: Inflow Area B

Inflow   =   1.00 cfs @   3.92 hrs, Volume=   0.020 af
Primary   =   1.00 cfs @   3.92 hrs, Volume=   0.020 af, Atten= 0%, Lag= 0.0 min
    Routed to Reach 3R : Outlet Pipe

Primary outflow = Inflow, Time Span= 0.00-8.00 hrs, dt= 0.01 hrs

74 Point manual hydrograph, To= 0.00 hrs, dt= 0.08 hrs, cfs =

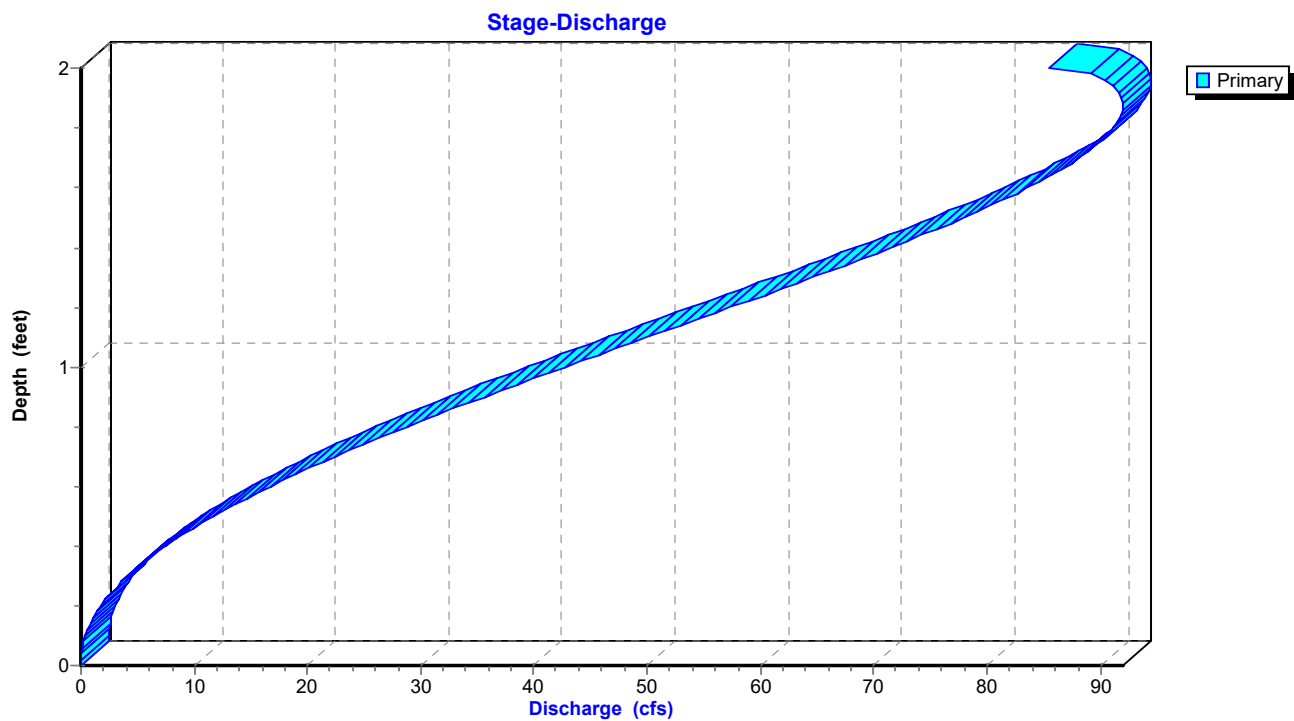|									
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.10
0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.20	0.20	1.00
0.20	0.10	0.10	0.10	0.10	0.10	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00						

Link 4L: Inflow Area B
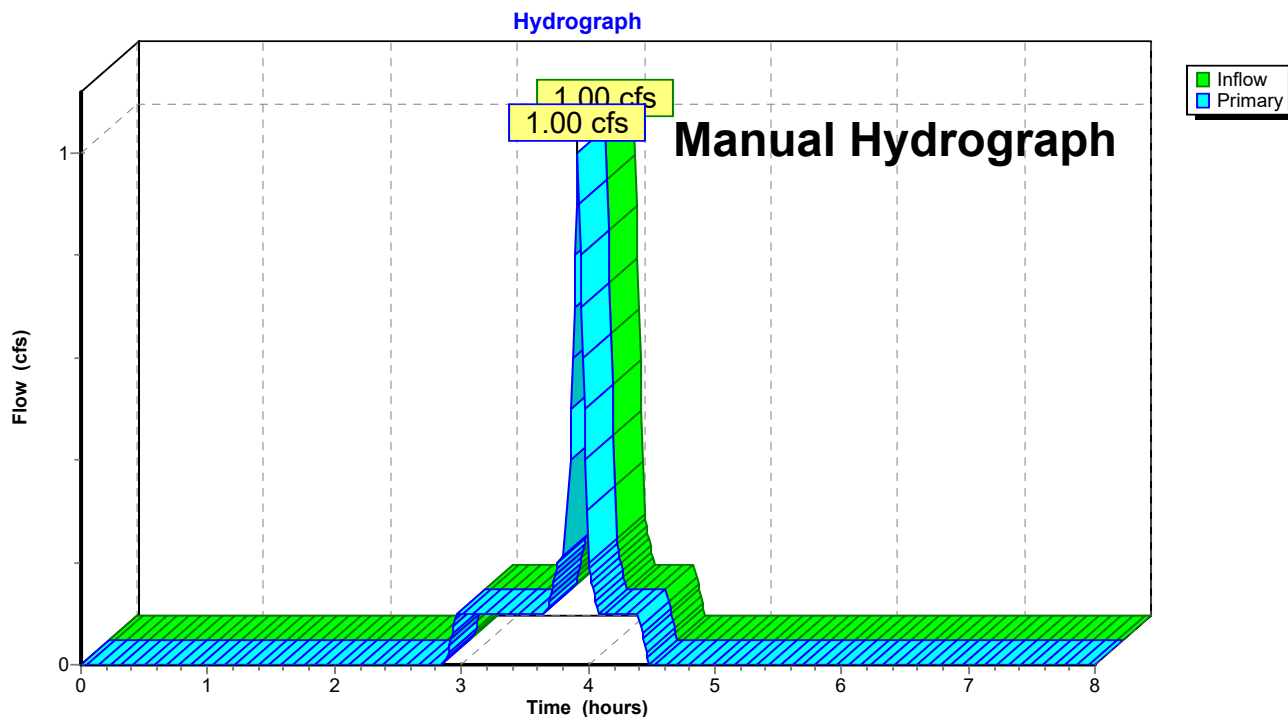
Summary for Link 5L: Inflow Area O1, O2, O4

Inflow   =   4.20 cfs @   4.55 hrs, Volume=   0.178 af
Primary   =   4.20 cfs @   4.55 hrs, Volume=   0.178 af, Atten= 0%, Lag= 0.0 min
    Routed to Reach 3R : Outlet Pipe

Primary outflow = Inflow, Time Span= 0.00-8.00 hrs, dt= 0.01 hrs

53 Point manual hydrograph, To= 0.00 hrs, dt= 0.13 hrs, cfs =

0.00	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
0.10	0.10	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
0.20	0.20	0.20	0.20	0.20	0.30	0.30	0.30	0.30	0.40
0.40	0.50	0.60	0.80	1.10	4.20	0.70	0.40	0.30	0.30
0.30	0.20	0.20	0.20	0.20	0.20	0.20	0.10	0.10	0.10
0.10	0.10	0.00							

Link 5L: Inflow Area O1, O2, O4

ATTACHMENT D

LEGEND OF SYMBOLS

	PROPERTY LINE
	STREET CENTERLINE
	EXISTING CONTOURS
	DIRECTION OF DRAINAGE
	DRAINAGE AREA
(A)	DRAINAGE MANAGEMENT AREA DESIGNATION
	LONGEST FLOW PATH

EXISTING AREAS (PRE-CON):

AREA A1=   0 SF IMPERVIOUS
          52,803 SF PERVIOUS

AREA A2=   5,737 SF IMPERVIOUS
          32,975 SF PERVIOUS

TOTAL AREA A= 91,515 SF, 2.10 ACRES

AREA O1=   12,983 SF IMPERVIOUS
              267 SF PERVIOUS

AREA O2=   9,565 SF IMPERVIOUS
              468 SF PERVIOUS

AREA O3=   2,488 SF IMPERVIOUS
              5,874 SF PERVIOUS

AREA O4=   1,895 SF IMPERVIOUS
              6,085 SF PERVIOUS

TOTAL AREA O= 39,625 SF, 0.91 ACRES

NODE 2
PRE-DEVELOPMENT
Q100= 6.0 cfs
V100= 15.4 fps

SOIL TYPE "B"
SOIL TYPE "A"

TC FLOW PATH L=360'
AVERAGE S=8%

INITIAL FLOW PATH
L=50' S=3.9%

(A1)
1.21 ACRES

SOIL TYPE "A"
SOIL TYPE "B"

NODE 3
PRE-DEVELOPMENT
Q100= 0.9 cfs
V100= SHEET FLOW

(O3)
0.19 ACRES

PRE-DEVELOPMENT
Q100= 1.4 cfs
V100= 1.2 fps

(O1)
0.30 ACRES

TC FLOW PATH= 150'

INITIAL 50'
S=3.3%

(A2)
0.89 ACRES

A2 TC FLOW PATH
L=190'

O1 TO LOS COCHES
TC FLOW PATH L=190'

TC FLOW PATH= 140'

NODE 1
PRE-DEVELOPMENT
Q100= 4.8 cfs
V100= 4.5 fps

(O2)
0.23 ACRES

PRE-DEVELOPMENT
Q100= 1.1 cfs
V100= 1.4 fps

TC FLOW PATH L=480'
AVERAGE S=4.9%

(O4) **0.18 ACRES**

LOS COCHES ROAD

VICINITY MAP
NOT TO SCALE
T.B.M. PG. 1232, D-7

LOS COCHES HIGHWAY
OLD HIGHWAY 8
SITE
8

SCALE: 1" = 20'
20 10 0 20 40 60

N

PRE-DEVELOPMENT DRAINAGE AREA MAP FOR:
8445 LOS COCHES ROAD, EL CAJON

PDS2020-MUP-20-006 AND PDS2022-TPM-21293

PLOT DATE: 1/20/2023 10:53 AM   C:\Users\Abel\spearinc.net\SPEARINC - Documents\PROJECTS\JOBS 2019\19-169 NLA ACQUISITIONS - 8445 LOS COCHES ROAD, EL CAJON\CAD 19-169 Pre DMA.dwg

DRAINAGE MANAGEMENT AREA TABLE

SYMBOL	PROPOSED SURFACE	DMA A1		DMA A2		DMA B1 SELF-MITIGATING		DMA B2 SELF-MITIGATING		DMA O1 EXISTING		DMA O2 EXISTING		DMA O3 EXISTING SELF-MITIGATING		DMA O4A RIGHT-OF-WAY LOS COCHES RD		DMA O4B RIGHT-OF-WAY LOS COCHES RD		DMA O4C RIGHT-OF-WAY LOS COCHES RD	
SOIL TYPE		"A"	"B"	"A"	"B"	"A"	"B"	"A"	"B"	"A"	"B"	"A"	"B"	"A"	"B"	"A"	"B"	"A"	"B"	"A"	"B"
	ROOFTOPS	1,595 SF 0.04 AC	12,576 SF 0.29 AC	0 SF	0 SF	0 SF	0 SF	1,929 SF 0.04 AC	824 SF 0.02 AC	0 SF	0 SF	0 SF	0 SF	0 SF	0 SF						
	PROPOSED NEW PAVEMENT (PARKING LOT AREA)	6,348 SF 0.15 AC	36,681 SF 0.84 AC	0 SF	0 SF	0 SF	0 SF	10,443 SF 0.24 AC	8,698 SF 0.20 AC	0 SF	0 SF	0 SF	0 SF	3,870 SF 0.09 AC	0 SF						
	CONCRETE WALKWAYS, HARDSCAPE, ETC.	550 SF 0.01 AC	3,094 SF 0.07 AC	0 SF	0 SF	0 SF	0 SF	1,584 SF 0.03 AC	3,853 SF 0.09 AC	829 SF 0.02 AC											
	LANDSCAPING	4,454 SF 0.10 AC	13,523 SF 0.31 AC	2,841 SF 0.07 AC	5,000 SF 0.11 AC	879 SF 0.02 AC	511 SF 0.01 AC	8,362 SF 0.19 AC	1,320 SF 0.03 AC	1,894 SF 0.04 AC	96 SF 0.02 AC										

OVERALL DRAINAGE MANAGEMENT AREA TOTAL: 86,662 SF 1.99 AC ... 10,033 SF 0.23 AC ... 8,362 SF 0.19 AC ... 2,904 SF 0.06 AC ... 9,617 SF 0.22 AC ... 925 SF 0.02 AC

TOTAL IMPERVIOUS AREA (DMA A+B+O4+O5) = 66,912 SF, 1.53 AC
DEPTH TO GROUNDWATER = +30 FEET BGS
CCSYA TO PROTECT ONSITE = NONE

TOTAL AREA = 0 31,646 SF 0.72 AC

TOTAL DISTURBED AREA = 100,378 SF, 2.30 AC

VICINITY MAP
NOT TO SCALE
T.B.M. PG. 1232, D-7

SITE

LOS COCHES HIGHWAY 8
OLD RD

SLEEPY WAY

NODE 2
POST-DEVELOPMENT (Σ)
Q100 = 5.65 cfs
V100 = 15.4 fps

POST-DEVELOPMENT (B)
Q100 = 1.0 cfs
V100 = 3.77 fps
POC 1

POST-DEVELOPMENT (A)
Q100 = 1.6 cfs
V100 = 16.2 fps

BIOFILTRATION BASIN A
W/CISTERN
FS=882.00, SF=2,250

SOIL TYPE "B"
SOIL TYPE "A"

B 0.18 ACRES B-2

PARCEL 2
28,354 SQ FT

RETAIL
7,385 SQ FT
FINISHED FLOOR = 687.50

LOADING AND UNLOADING AREA

TC FLOW PATH = 263'
AVERAGE 7.5%

LONGEST TC FLOW PATH = 365'
AVERAGE 0.6%

A-1

A-2

NODE 3
PRE-DEVELOPMENT
Q100 = 0.9 cfs
V100 = SHEET FLOW

O3
0.19 ACRES

PARCEL 1
41,932 SQ FT

CAR WASH BUILDING
FINISHED FLOOR = 683.20

SOIL TYPE "A"
SOIL TYPE "B"

A
1.81 ACRES

O1
0.30 ACRES

TC FLOW PATH = 150'

PARCEL 4
34,952 SQ FT

INITIAL 50'= 22.0%

B-2

INITIAL 50'= 3.3%

INITIAL 50'= 0.6%

PARCEL 3
20,969 SQ FT
DRIVE-THRU FAST FOOD
2,660 SQ FT
FF = 690.90

TC FLOW PATH = 140'

DE-MINIMIS 270 SF

BMP TREE WELL

O2
0.23 ACRES

O4C
0.02 ACRES

NODE 1
POST-DEVELOPMENT
Q100 = 2.7 cfs
V100 = 3.8 fps

O4A
0.06 ACRES

O4A AREA = 1,786 SF
EX. PVMT. MITIGATION

BMP TREE WELL

TC FLOW PATH L=480'
AVERAGE S=4.9%

O4A & O4C AREA = 4,403 SF
PROP. PVMT. MITIGATION

(O4) RAISED MEDIAN = 436 SF

LOS COCHES ROAD

O4B
0.22 ACRES

O4C AREA = 2,617 SF
EX. PVMT. MITIGATION

(O4) RAISED MEDIAN = 436 SF

ORA BELLE LANE

SCALE: 1" = 20'
20 10 0 20 40 60

N

SOURCE CONTROL BMPs IMPLEMENTED:
SC-4.2.1 PREVENTION OF ILLICIT DISCHARGES INTO THE MS4
SC-4.2.2 STORM DRAIN STENCILING OR SIGNAGE
SC-4.2.5 PROTECT TRASH STORAGE AREAS FROM RAINFALL, RUN-ON, RUNOFF, AND WIND DISPERSAL

SITE DESIGN BMPs IMPLEMENTED::
SD-4.3.1 MAINTAIN NATURAL DRAINAGE PATHWAYS AND HYDROLOGIC FEATURES
SD-4.3.3 MINIMIZE IMPERVIOUS AREA
SD-4.3.4 MINIMIZE SOIL COMPACTION
SD-4.3.7 LANDSCAPING WITH NATIVE OR DROUGHT TOLERANT SPECIES

MINIMUM CURB DEPTH IS 12 INCHES; CURBS SHOULD BE VERTICAL ELBOW DOWELED TWO FEET INTO ADJACENT PCC PAVEMENT WITHIN 10 FEET OF THE BIOFILTRATION BASIN.

MAINTENANCE CLEAN-OUT (TO REMAIN CLOSED AT ALL TIMES)
2-3" HARDWOOD MULCH
CATCH BASIN EMERGENCY OVERFLOW
BASIN TOP (MIN.)
RISER TOP
BASIN SURFACE
AMENDED SOIL (K=5 IN/HR) @ 40% POROSITY
3" WASHED SAND (ASTM NO. 33) OVERLYING 3" OF CHOKING STONE (ASTM NO. 8)
GRAVEL TOP
IMPERVIOUS MEMBRANE (PER SOILS ENGINEER) MIN 24-MIL POLYETHYLENE LINER SUCH AS WESTERN ENVIRONMENTAL LINERS AQUA 24 (OR EQUIVALENT) W/ALL SEAMS HEAT WELDED. LINE ENTIRE BASIN WITH LINER (FULLY LINED)
BASIN A = 9.17'
GRAVEL BOTTOM
OUTFALL TO STORM DRAIN SYSTEM
RESTRICTION CAP PER DETAIL HEREON
ASTM NO. 57 STONE LAYER @ 40% POROSITY
6" DIA. PERFORATED PVC UNDERDRAIN (3" OFFSET WITHIN RESTRICTION CAP)

BIOFILTRATION BASIN W/CISTERN
TYPICAL DETAIL & OUTLET CONNECTION
NOT-TO-SCALE

FACE OF PVC CAP
INSTALL 6" PVC THREADED INSERT W/PVC CAP
DRILL ORIFICE INTO MIDDLE OF CAP
BASIN A = 0.91" DIA.
6" DIA. PVC PERFORATED UNDERDRAIN INLET CONNECTION TO OVERFLOW CATCH BASIN

RESTRICTION CAP DETAIL
ATTACH TO THE END OF THE PERFORATED UNDERDRAIN PIPE TO REGULATE FLOW ENTERING THE EMERGENCY OVERFLOW CATCH BASIN

HMP CISTERN VOLUMES:
BASIN A REQUIRED STORAGE VOLUME = 10,917 CU. FT.

PARAMETERS FOR BASIN A:
TOTAL SQ FT = 2,250
TOTAL SURFACE DEPTH = 1.0'
TOTAL AMENDED SOIL DEPTH = 1.50'
TOTAL GRAVEL DEPTH = 9.17'

VOLUME PROVIDED FOR BASIN A:
SURFACE STORAGE (W/3:1 SIDE SLOPES) = 1,980 CU. FT.
AMENDED SOIL STORAGE (@ 40% POROSITY) = 1,350 CU. FT.
GRAVEL STORAGE (@ 40% POROSITY) = 8,253 CU. FT.
TOTAL VOLUME PROVIDED = 11,583 CU. FT.

DMA O4 TREEWELL TREATMENT AREA BREAKDOWN

DMA SUB AREA	DMA O4A	DMA O4B	DMA O4C
DMA SUB AREA DIRECT TREATMENT:			
DIRECT IMPERVIOUS AREA	1,584 SF	3,320 SF	829 SF
DIRECT LANDSCAPE AREA	1,320 SF	1,894 SF	96 SF
DMA SUB AREA TO BE MITIGATED:			
PROPOSED (NEW/REPLACED) IMPERVIOUS AREA TO BE MITIGATED:	0 SF	4,403 SF	0 SF
LOS COCHES EX. IMPERVIOUS TREATMENT MITIGATED AREA FROM O4B:			
EX. IMPERVIOUS AREA (TO REMAIN) TREATMENT	1,786 SF	0 SF	2,617 SF
TOTAL IMPERVIOUS TREATMENT AREA W/MITIGATED INCLUDED:			
PROP. & EX. IMPERVIOUS AREA TREATMENT	3,370 SF	3,320 SF	3,446 SF

LEGEND OF SYMBOLS
—— PROPERTY LINE
—— STREET CENTERLINE
—— EXISTING CONTOURS
→ DIRECTION OF DRAINAGE
→ LONGEST FLOW PATH
—— DRAINAGE AREA
(A) DRAINAGE MANAGEMENT AREA DESIGNATION
PROPOSED STORM DRAIN & CATCH BASIN (PVT)
PROPOSED PVC SOLID STORM DRAIN
PROPOSED PERFORATED PVC UNDERDRAIN W/CO

36"x36" CATCH BASIN TOP OF GRATE
TOP OF MULCH
3" MULCH LAYER
BASIN SURFACE
OUTSIDE OF BOX

BASIN OUTLET STRUCTURE DETAIL
BIOFILTRATION BASIN RISER DETAIL
36" CATCH BASIN'S EAST WALL
NOT-TO-SCALE

PLANS PREPARED BY:
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POST-DEVELOPMENT DMA EXHIBIT FOR:
8445 LOS COCHES ROAD, EL CAJON

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