Appendix F
Hydrology and Hydraulics Report

Palm Avenue Multimodal Corridor Improvements

Preliminary Hydrology and Hydraulics Report

October 2025

Prepared for:

City of Imperial Beach

Prepared by:

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Palm Avenue Multimodal Corridor Improvements
Preliminary Hydrology and Hydraulics Report



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For

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1.0 Introduction

1.1 Project Description

The City of Imperial Beach has received ATP Cycle 6 and SANDAG Transnet funds to construct the Palm Avenue Master Project, between Rainbow Drive and Georgia Street. The Proposed Project includes Class IV bicycle facilities, widened sidewalks, new lighting, median and sidewalk landscape improvements, traffic signal modifications, and storm drain updates, among other components.



Figure 1 - Vicinity Map

1.1.1 Existing Drainage Conditions

Palm Ave is a six-lane arterial roadway lined with landscape medians. Existing drainage includes sheet flow, gutter flow, and several independent storm drain systems, all discharging to Otay River. There is generally a crown along the center of the roadway along Palm Ave. At the western limits of the project near Rainbow Dr, there are open drainage channels paralleling the roadway.

Runoff from the project will discharge to the Otay River near its headwaters discharging to the San Diego Bay. City storm drain systems D, H, K, and P will all receive runoff from the project area, though not all of those systems will be directly affected by the proposed improvements. Where these systems discharge to the Otay River, FEMA floodplain mapping indicates Zone AE, which is considered a Special Flood Hazard Area.

1.1.2 Proposed Drainage Conditions

The intent of the proposed drainage is to closely mimic the existing drainage patterns. The project corridor also includes three open drainage channels paralleling the roadway. There will be no significant diversions of drainage areas.

The project is not expected to adversely impact the floodplain nor require changes to the mapping.

1.2 Objectives

This study is prepared in support of CEQA Environmental Permitting, including addressing the following questions:

Would the Project:

a) Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality?

b) Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?

c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:
   i. result in a substantial erosion or siltation on- or off-site;
   ii. substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or offsite;
   iii. create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or
   iv. impede or redirect flood flows?

d) In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation?

e) Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan

2.0 Methodology

2.1 Rational Method Hydrology

Rational Method peak flow rate calculations have been prepared in accordance with Chapter 3 of the San Diego County Hydrology Manual (County Hydrology Manual). Calculations have been prepared for the 50-year and 100-year events. The Rational Method equation is as follows:

$Q=CIA$

Where: Q = peak discharge (cfs)
C = runoff coefficient (unitless)
I = average rainfall intensity (in/hr)
A = drainage area (ac)

2.1.1 Runoff Coefficient (C)

Runoff coefficients for each of the project areas has been determined based on percent impervious and soil type. Percent impervious has been determined based on aerial imagery and engineering judgement. Soil type has been identified using the NRCS Web Soil Survey. The runoff coefficient is then calculated based on the following equation:

$C=0.90*(\%\ Imp) + C_p*(1-\%\ Imp)$

Where: C_p = Pervious Coefficient for Undisturbed Natural Terrain

2.1.2 Rainfall Intensity (I)

Average rainfall intensity is calculated based on Figure 3-2 of the County Hydrology Manual. The 6-hour precipitation (P_6) is determined based on the isopluvial maps in Appendix B of the County Hydrology Manual. The value for P_6 should be within 45% to 65% of P_{24}. The duration is assumed to be equal to the time of concentration (Tc).

Time of Concentration

The time of concentration consists of an initial time of concentration (Ti) and travel time (Tt). The minimum time of concentration is 5 minutes.

$Tc = Ti + Tt$

Ti is approximated using Figure 3-3 of the County Hydrology Manual and is based on FAA equation for shallow uniform flow on runways. The maximum overland flow length for calculating Ti is specified in Table 3-2 of the County Hydrology Manual based on slope and land use.

Tt is calculated based on flow length and velocity. For significant variations in flow type of velocity, multiple Tt values are calculated and added together for the overall Tt. Street gutter flow is estimated based on Figures 3-6 and 3-7 of the County Hydrology Manual. For other urban concentrated conveyance, velocity is determined based on Manning's Equation or other applicable hydraulic calculations.

2.1.3 Drainage Area (A)

Drainage areas are delineated based upon the best available topographic information. When possible, delineations are field verified for accuracy. Subareas have been delineated as needed based on significant points of interest (i.e. existing or proposed infrastructure, project discharge locations, etc.).

2.2 Hydraulic Design

This preliminary report focuses on the hydraulic capacity specifically of the existing storm drain pipes. Compliance with inlet capacity and street conveyance requirements will be determined during final design.

The general intent of this project is to maintain the existing drainage function and improve the function where feasible. Since this is an urban retrofit project, the drainage design is not expected to meet new development standards.

Pipe capacity calculations were performed based on Manning's open channel flow. Full standard step method hydraulic will be performed during final design. At this stage of design, some pipe sized and slopes are assumed, until additional information is acquired. Some capacity calculations are pending offsite hydrologic calculations not included in the scope of this analysis. Offsite pipes which are not a part of the project have been noted as such.

We have also performed CCTV condition assessment of the existing pipes. The condition will be a factor in prioritizing and determining what systems to upgrade as part of this project.

3.0 Results

3.1 Hydrology

Table 1 is a comparison of existing and proposed results for the 100-year peak flow rate calculations. More detailed calculations are included in Appendix C.

Table 1 – Hydrology Comparison Summary

Location	Ex Area (ac)	Pr Area (ac)	Ex Tc (min)	Pr Tc (min)	Ex Runoff Coefficient	Pr Runoff Coefficient	Ex Q_{100} (cfs)	Pr Q_{100} (cfs)
EX D0.1	0.22	0.22	5.0	5.0	0.90	0.90	1.25	1.25
EX D1.1	0.19	0.22	5.0	5.0	0.90	0.90	1.08	1.25
EX D2.1	0.44	0.40	15.3	15.3	0.41	0.35	0.55	0.43
EX D4.1	6.17	6.17	7.3	7.3	0.82	0.82	25.04	25.04
EX D6.1	3.80	3.80	8.8	8.8	0.87	0.87	14.51	14.51
EX D7.1	0.15	0.15	13.5	13.5	0.35	0.35	0.17	0.17
EX D3.1	3.98	3.98	10.7	10.7	0.85	0.85	13.09	13.09
EX D8.1	0.19	0.19	9.2	9.2	0.52	0.52	0.42	0.42
EX D9.1	2.94	2.94	5.9	5.9	0.85	0.85	14.19	14.19
EX D10.1	0.06	0.06	5.0	5.0	0.90	0.90	0.34	0.34
EX H7.1	1.79	1.79	7.1	7.1	0.85	0.85	7.67	7.67
EX H8.1	0.45	0.45	6.1	6.1	0.87	0.87	2.18	2.18
EX H12.1	0.15	0.15	5.1	5.1	0.87	0.87	0.81	0.81
EX H4.1	0.77	0.48	7.6	5.5	0.85	0.85	3.16	2.43
EX H5.1	0.42	0.71	6.7	6.7	0.87	0.87	1.91	3.24
EX H14.1	0.75	0.75	5.2	5.2	0.87	0.87	4.03	4.03
EX H16.1	19.79	19.79	9.7	9.7	0.87	0.87	70.94	70.94
EX K2.1	18.13	18.13	10.1	10.1	0.87	0.87	63.41	63.41
EX P1.1	0.89	0.89	6.4	6.4	0.87	0.87	4.17	4.17
EX P2.1	6.91	6.91	10.4	10.4	0.85	0.85	23.14	23.14

3.2 Hydraulics

Table 2 includes the results of the pipe hydraulic calculations. See Appendix D for detailed calculations.

Table 2 – Pipe Hydraulics

Pipe Name	Size/Material	Existing Flow (cfs)	Proposed Flow (cfs)	Pipe Capacity (cfs)	Exit Velocity (ft/s)	Capacity Assessment	Condition Assessment
D1	24" RCP	56.3	56.2	39.5	12.57	Moderate exceedance	None reported
D2	24" RCP	55.2	55.1	22.6	-	Moderate exceedance	Moderate deficiencies
D3	18" RCP	13.1	13.1	7.4	-	Minor exceedance	None reported
D5	18" RCP	29.6	29.6	12.5	-	Moderate exceedance	Moderate deficiencies
D7	18" RCP	15.1	15.1	20.3	-	Adequate	Good
D8	18" RCP	15.0	15.0	8.4	-	Moderate exceedance	None reported
D9	18" RCP	14.5	14.5	11.7	-	Minor exceedance	Clogged, moderate deficiencies
D10	18" RCP	0.3	0.3	7.4	-	Adequate	Clogged
H2	36"	86.4	86.4	47.2	-	Major exceedance	None reported
H3	18"	5.1	5.7	7.4	-	Adequate	Major deficiencies
H4	18" RCP	5.1	5.7	7.4	-	Adequate	Major deficiencies
H5	12"X18" CMP	1.9	3.2	7.4	-	Adequate	Minor deficiencies
H6	36"	76.6	76.6	47.2	-	Major exceedance	None reported
H7	18"	9.8	9.8	7.4	-	Adequate	None reported
H8	18" RCP	2.2	2.2	7.4	-	Adequate	Major deficiencies
H9	36" CMP	76.6	76.6	47.2	-	Moderate exceedance	None reported
H10	18" RCP	76.6	76.6	7.4	-	Major exceedance	None reported
H11	24" RCP	76.6	76.6	16.0	-	Major exceedance	None reported
H12	18"	0.8	0.8	7.4	-	Adequate	None reported
H13	18"	75.8	75.8	7.4	-	Major exceedance	Major deficiencies

Pipe Name	Size/Material	Existing Flow (cfs)	Proposed Flow (cfs)	Pipe Capacity (cfs)	Exit Velocity (ft/s)	Capacity Assessment	Condition Assessment
H14	18"	75.8	75.8	7.4	-	Major exceedance	None reported
H15	18"	70.9	70.9	7.4	-	Major exceedance	None reported
H16	15"	70.9	70.9	4.6	-	Major exceedance	Minor deficiencies
K1	15" RCP	63.4	63.4	4.6	3.72	Major exceedance	Moderate deficiencies
K2	15" RCP	63.4	63.4	4.6	-	Major exceedance	None reported
P1	48" RCP	27.3	27.3	101.6	8.08	Uncertain	Minor deficiencies
P2	24"	23.1	23.1	16.0	-	Minor exceedance	None reported

4.0 Conclusions

a) The project will not violate water quality standards or waste discharge requirements. The City is subject to the requirements of the Regional Phase I MS4 Permit (Order No. R9-2013-0001, as amended by Order Nos. R9-2015-001 and R9-2015-0100). The City's BMP Design Manual outlines the requirements and how they impact development projects. The project is implementing Green Street measures as part of the overall compliance approach.

b) The project will not decrease groundwater supplies. The project area is near the Pacific Ocean and has very little runoff infiltrating to the ground. The project will improve conditions by adding landscaping and constructing BMPs.

c) The drainage pattern will not be substantially altered with the project improvements. The proposed drainage pattern will closely mimic existing conditions, as shown in the existing and proposed drainage calculations in Table 1.

i. The exit velocities of the outfall pipe will not significantly change from existing to proposed condition. Analysis shows that most pipes have exit velocities over 5 fps. Currently, outfall pipes have rip rap to provide erosion control and flow dissipation.

ii. There is no substantial increase in runoff being generated in this project. Slight increases in impervious areas may occur due to the construction of wider sidewalks, bus platforms, and curb bulb outs. As the project progresses, landscaping and BMPs will be strategically placed to offset the impact of the additional impervious area that may be added.

iii. Based on preliminary analyses, several pipes are not adequately sized, even in the existing condition. To the extent feasible within the budgetary constraints of the project, pipes that are currently undersized will be upsized as part of the improvements. Additional information from field verification and ground surveying will more accurately determine drainage area delineations and resulting flow captured by the systems. The

capacity of each existing storm drain pipe with current available information was analyzed in Table 2.

iv. The project does not impede or redirect flood flow. The proposed improvements will improve drainage conveyance and capture along this corridor.

d) A very small portion of project at the eastern limit is within the FEMA floodplain Zone AE, which is considered a Special Flood Hazard Area.

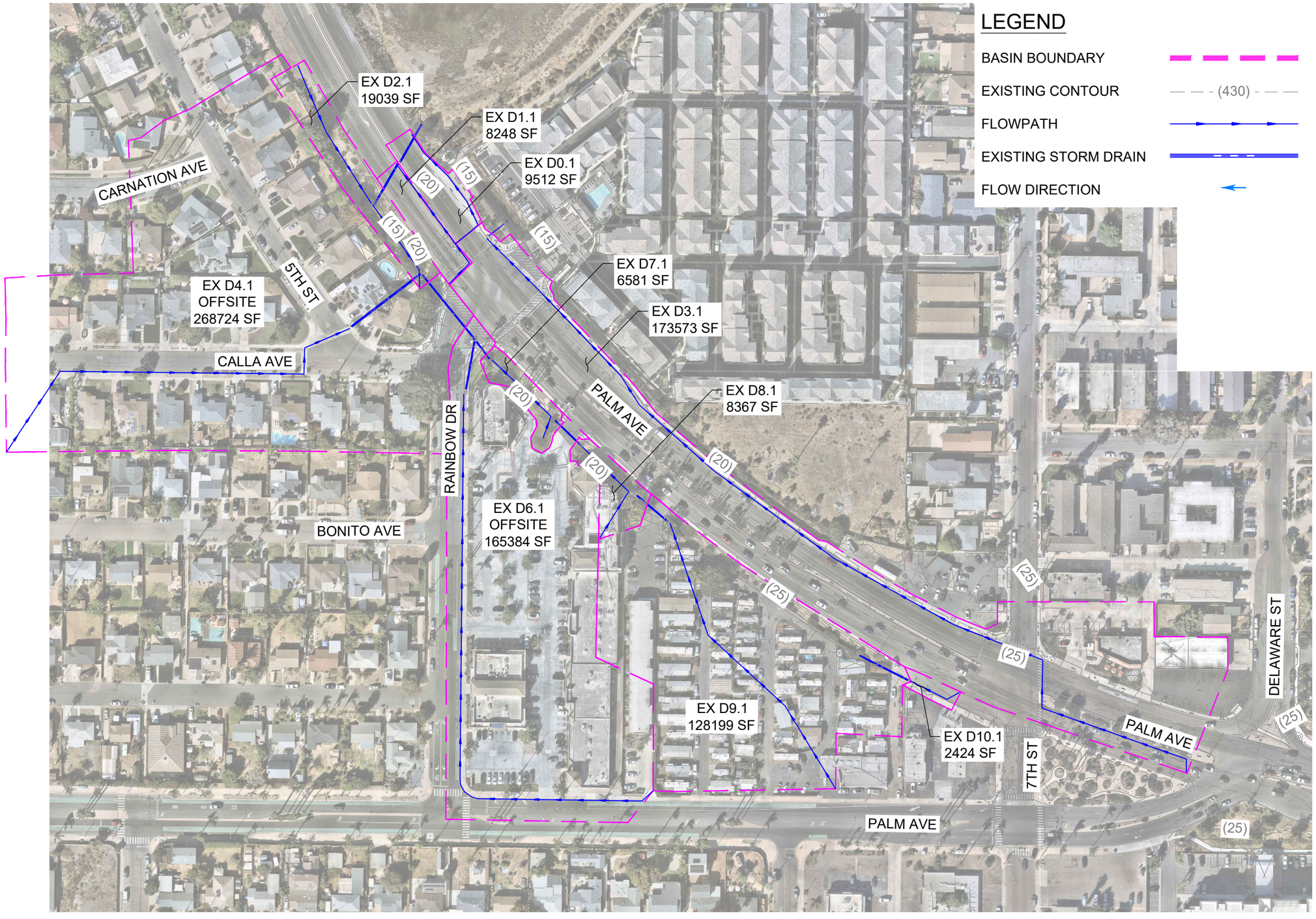
Although the northwestern limits of the project are adjacent to a Tsunami Hazard Area, the roadway itself is not considered a Tsunami Hazard Area, according to the California Department of Conservation

The project is not in a seiche zone.

e) This project will not conflict with or obstruct implementation of a water quality control plan. There is not an existing groundwater management plan within or near the project.

Appendix A - Hydrology Maps

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LEGEND

- BASIN BOUNDARY
- EXISTING CONTOUR — — - (430) - — —
- FLOWPATH
- EXISTING STORM DRAIN
- FLOW DIRECTION

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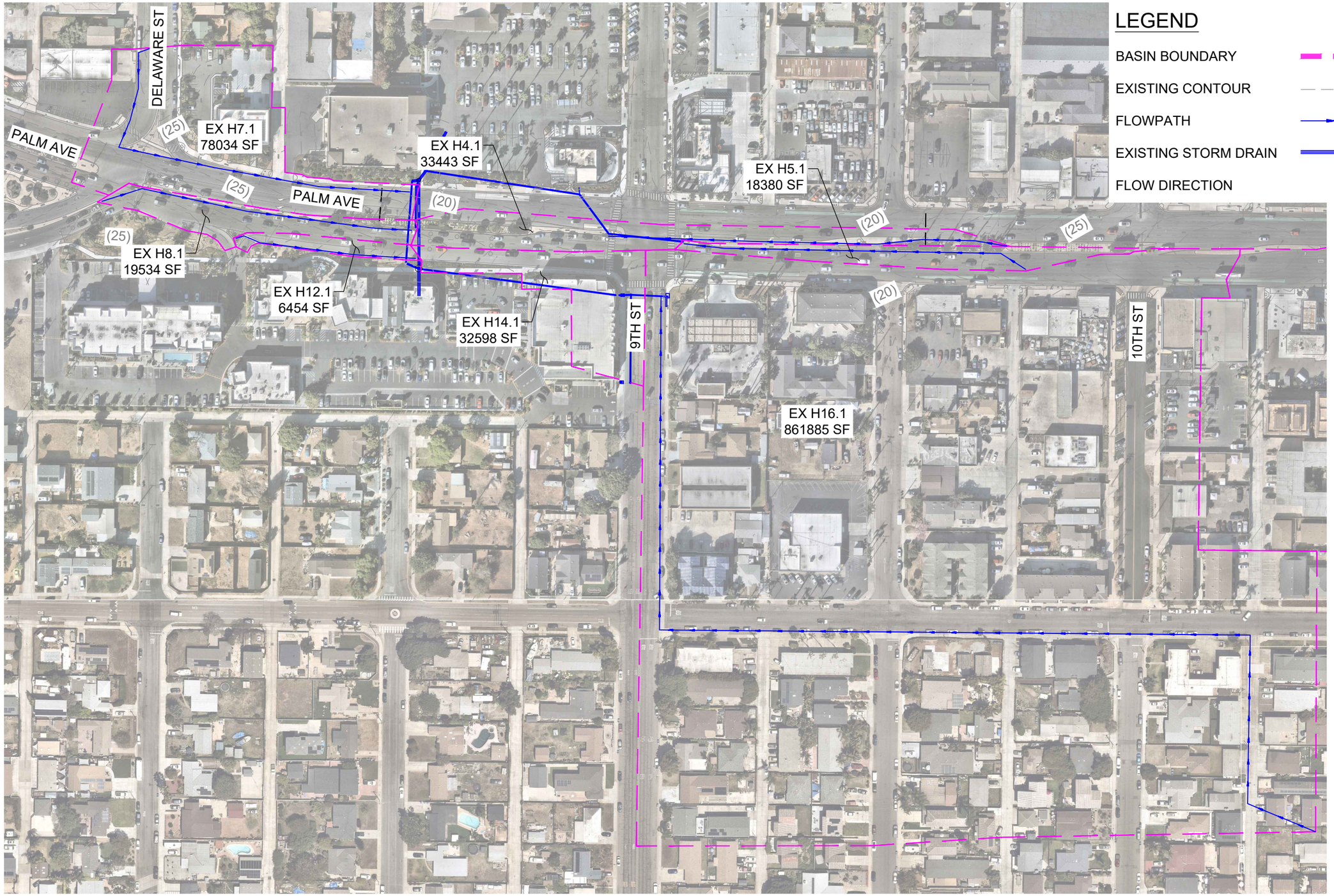
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PALM AVENUE HYDROLOGY - SYSTEM D

EXISTING CONDITIONS

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- EXISTING CONTOUR — — - (430) - — —
- FLOWPATH
- EXISTING STORM DRAIN
- FLOW DIRECTION

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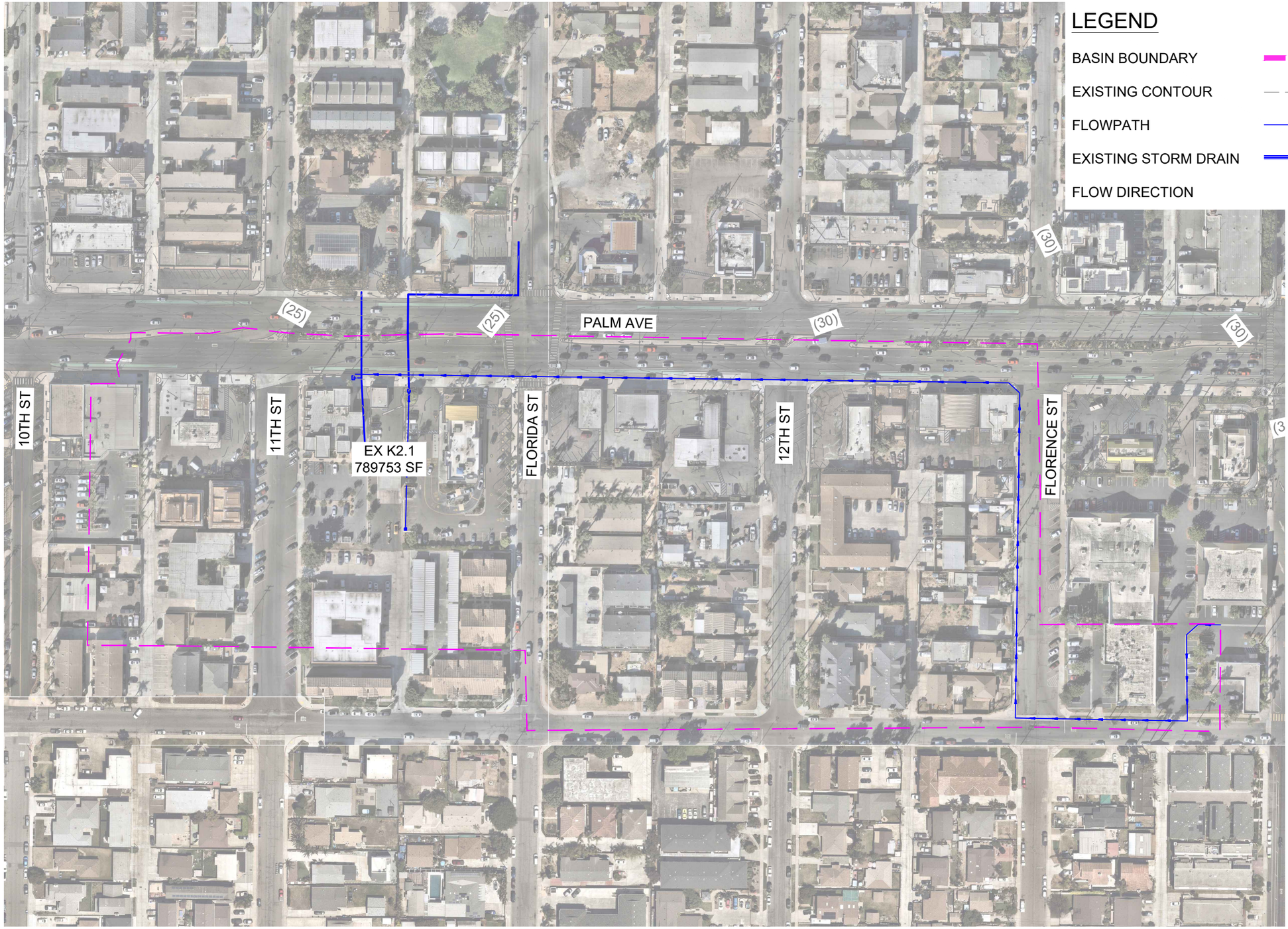
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PALM AVENUE HYDROLOGY - SYSTEM H

EXISTING CONDITIONS

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Sheet 2 of 4

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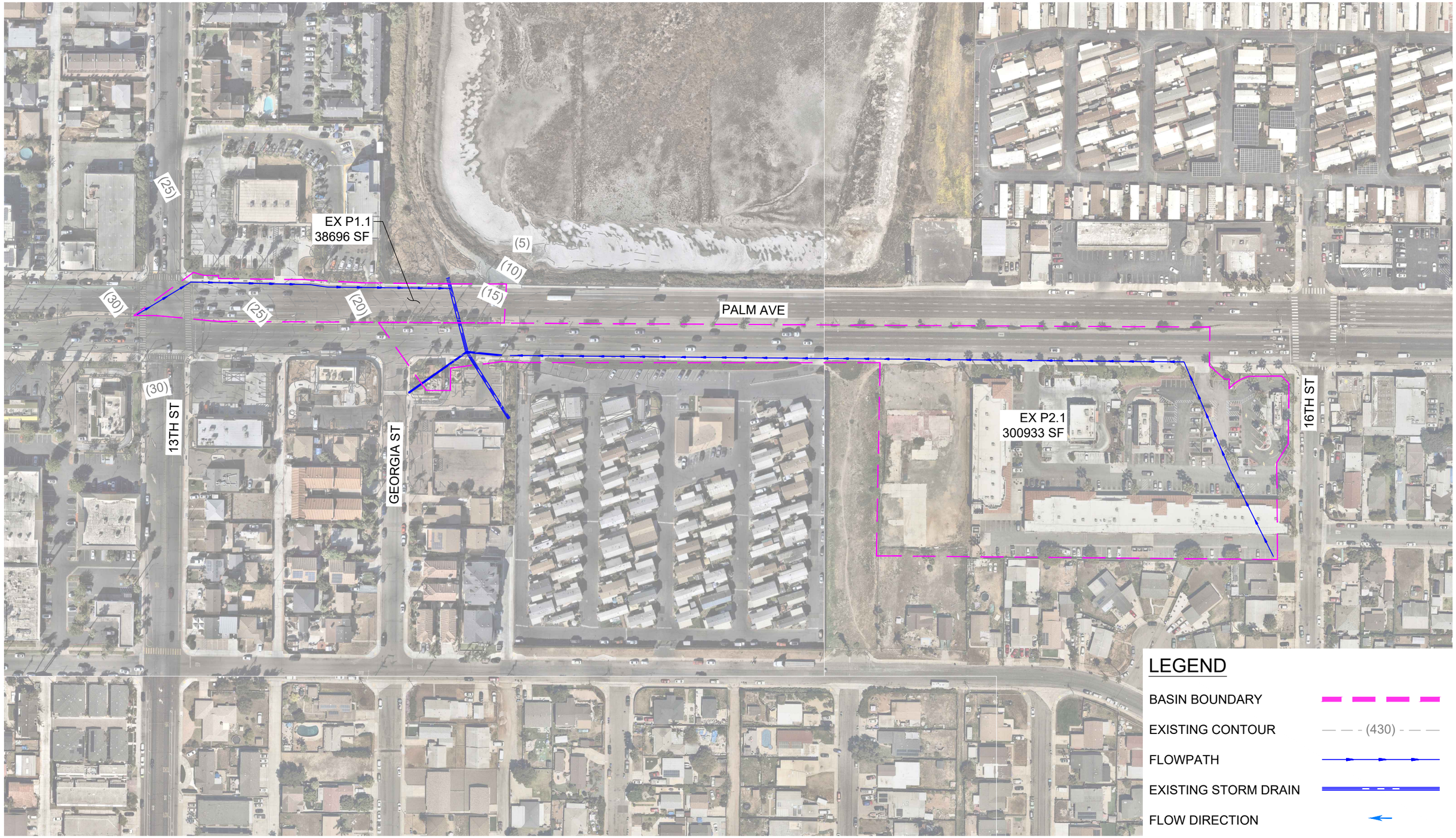
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PALM AVENUE HYDROLOGY- SYSTEM K

EXISTING CONDITIONS

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LEGEND

- BASIN BOUNDARY
- EXISTING CONTOUR (430)
- FLOWPATH
- EXISTING STORM DRAIN
- FLOW DIRECTION

PALM AVENUE HYDROLOGY -SYSTEM P

EXISTING CONDITIONS

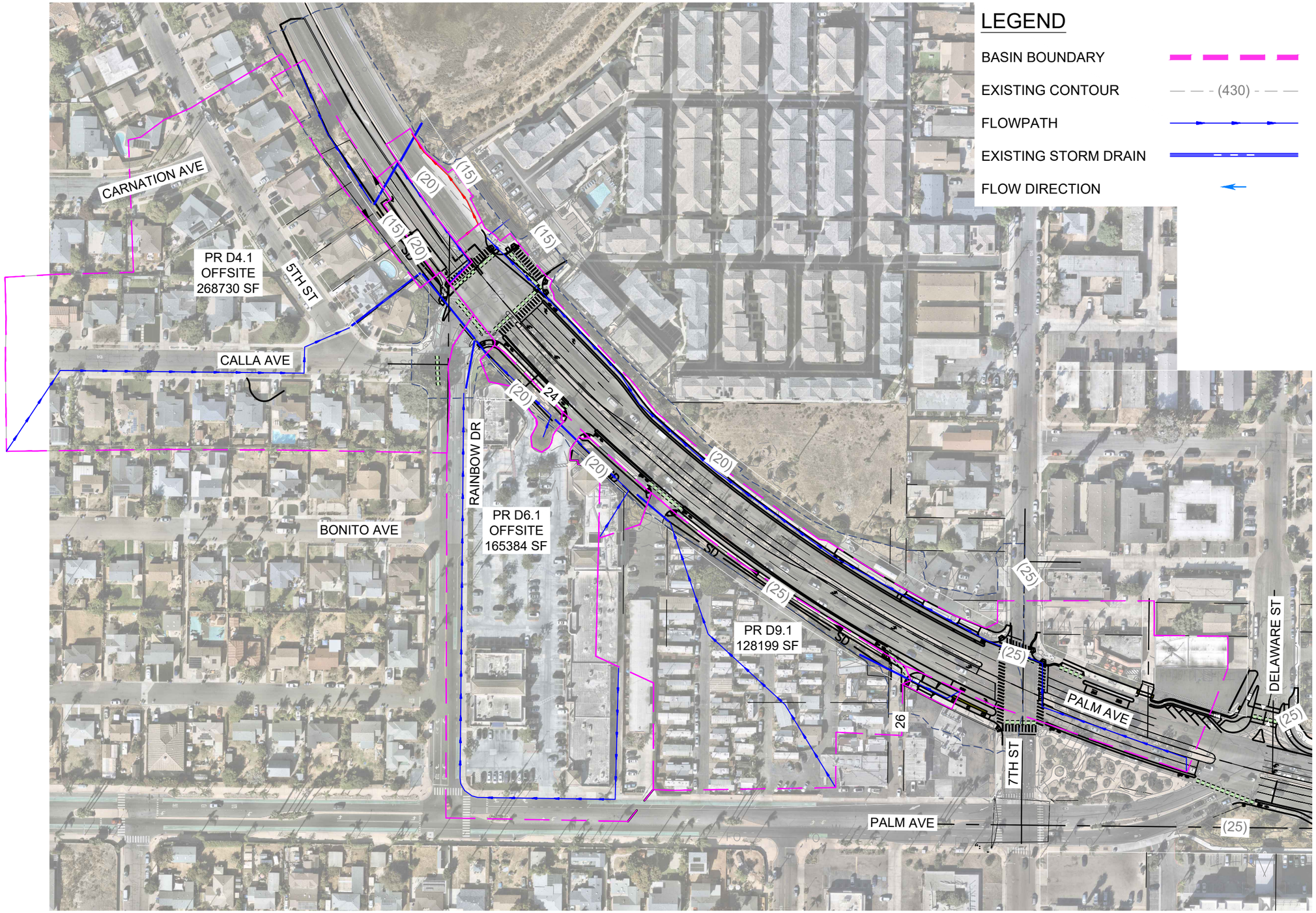
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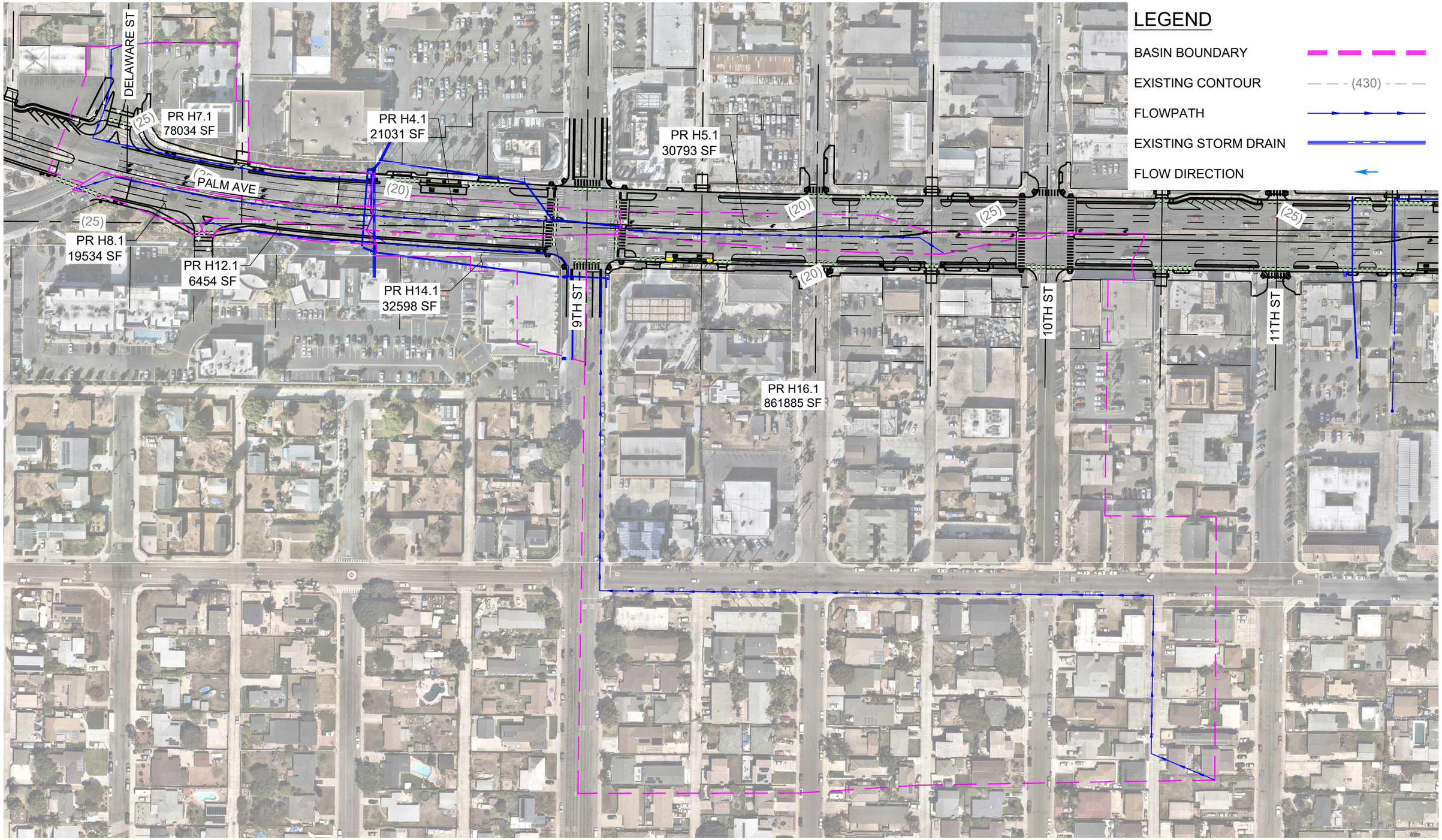
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PALM AVENUE HYDROLOGY - SYSTEM D

PROPOSED CONDITIONS

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PALM AVENUE HYDROLOGY - SYSTEM H

PROPOSED CONDITIONS

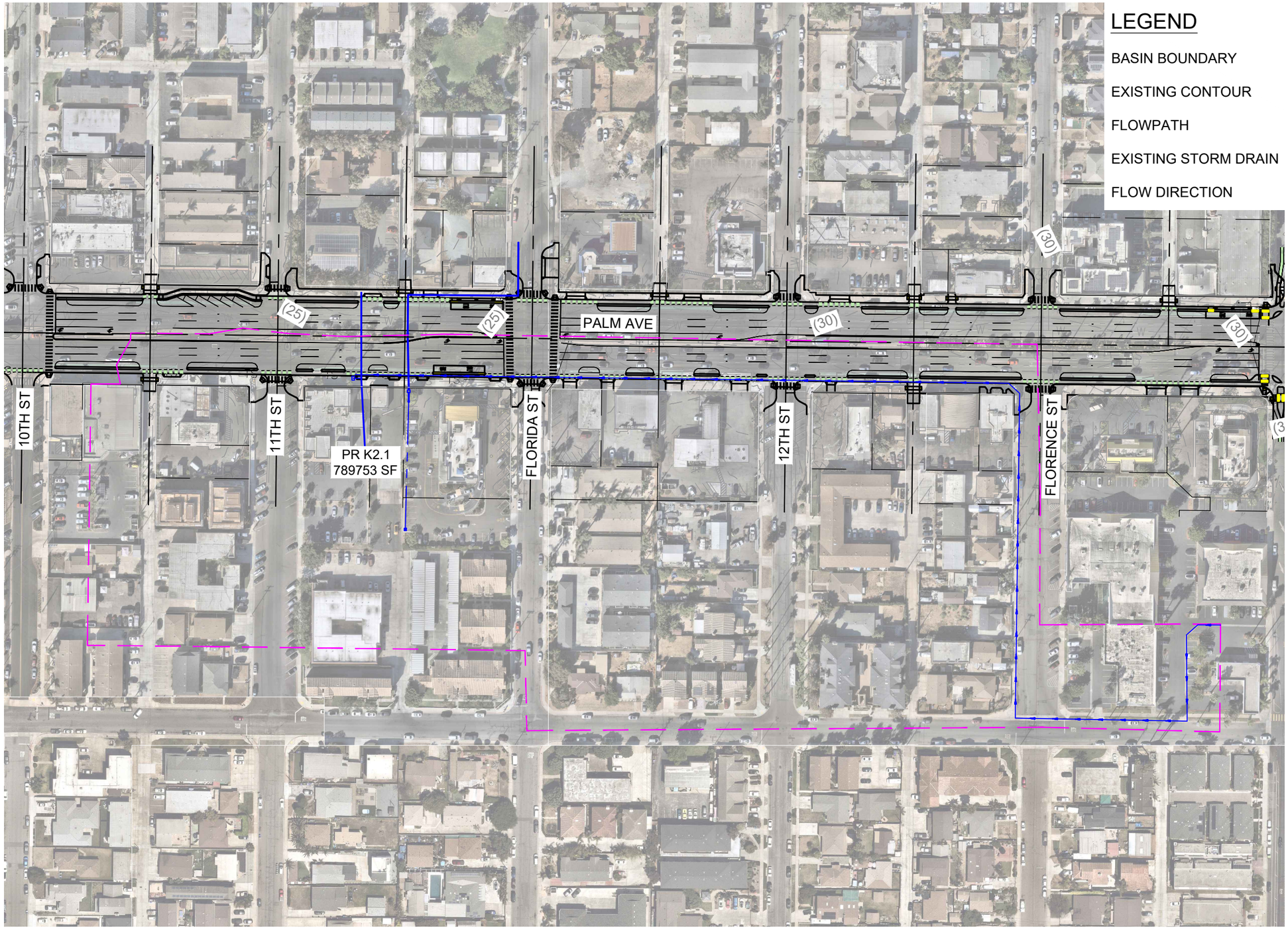
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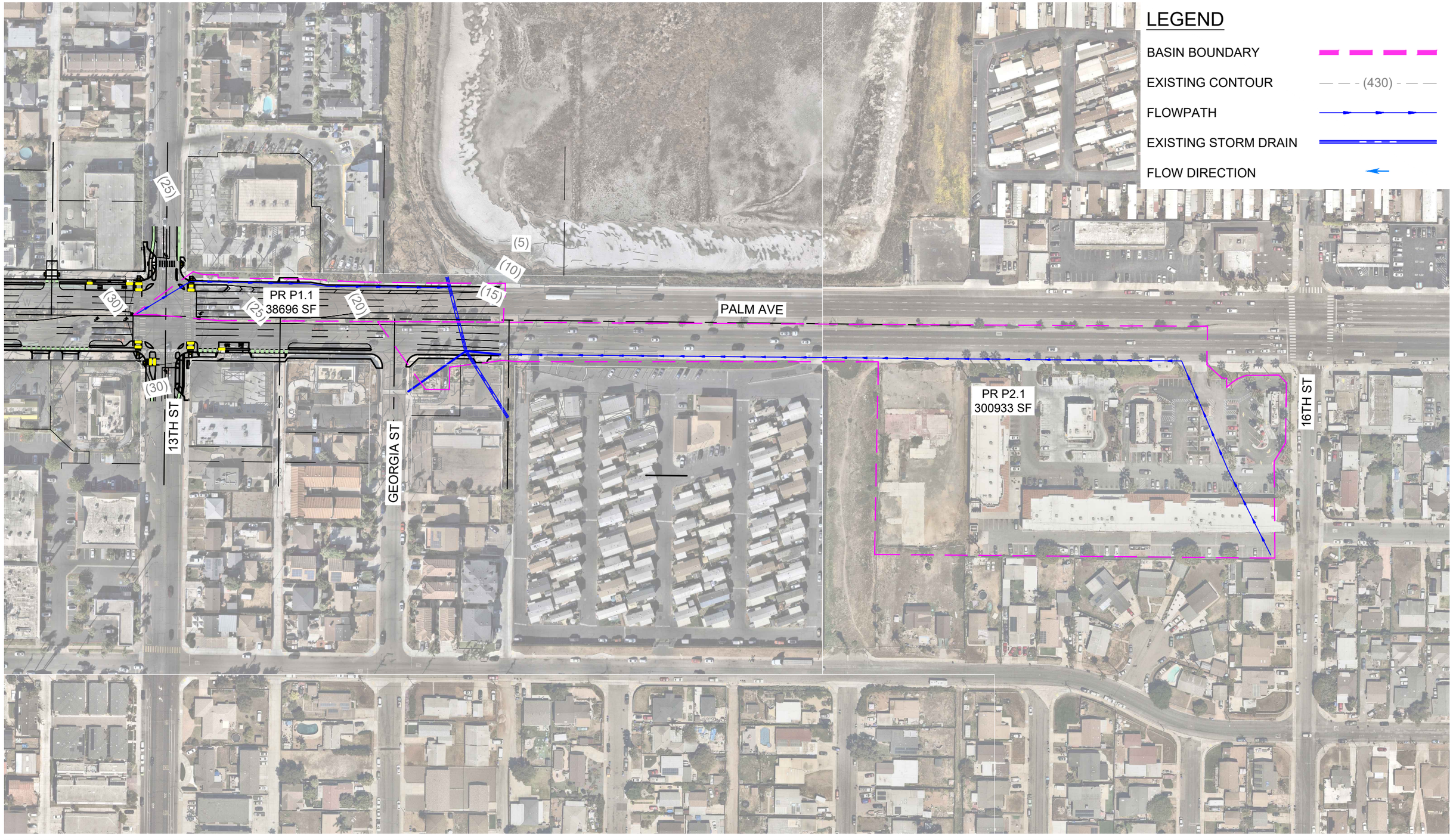
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PALM AVENUE HYDROLOGY - SYSTEM K

PROPOSED CONDITIONS

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Sheet 1 of 1

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PALM AVENUE HYDROLOGY - SYSTEM P

PROPOSED CONDITIONS

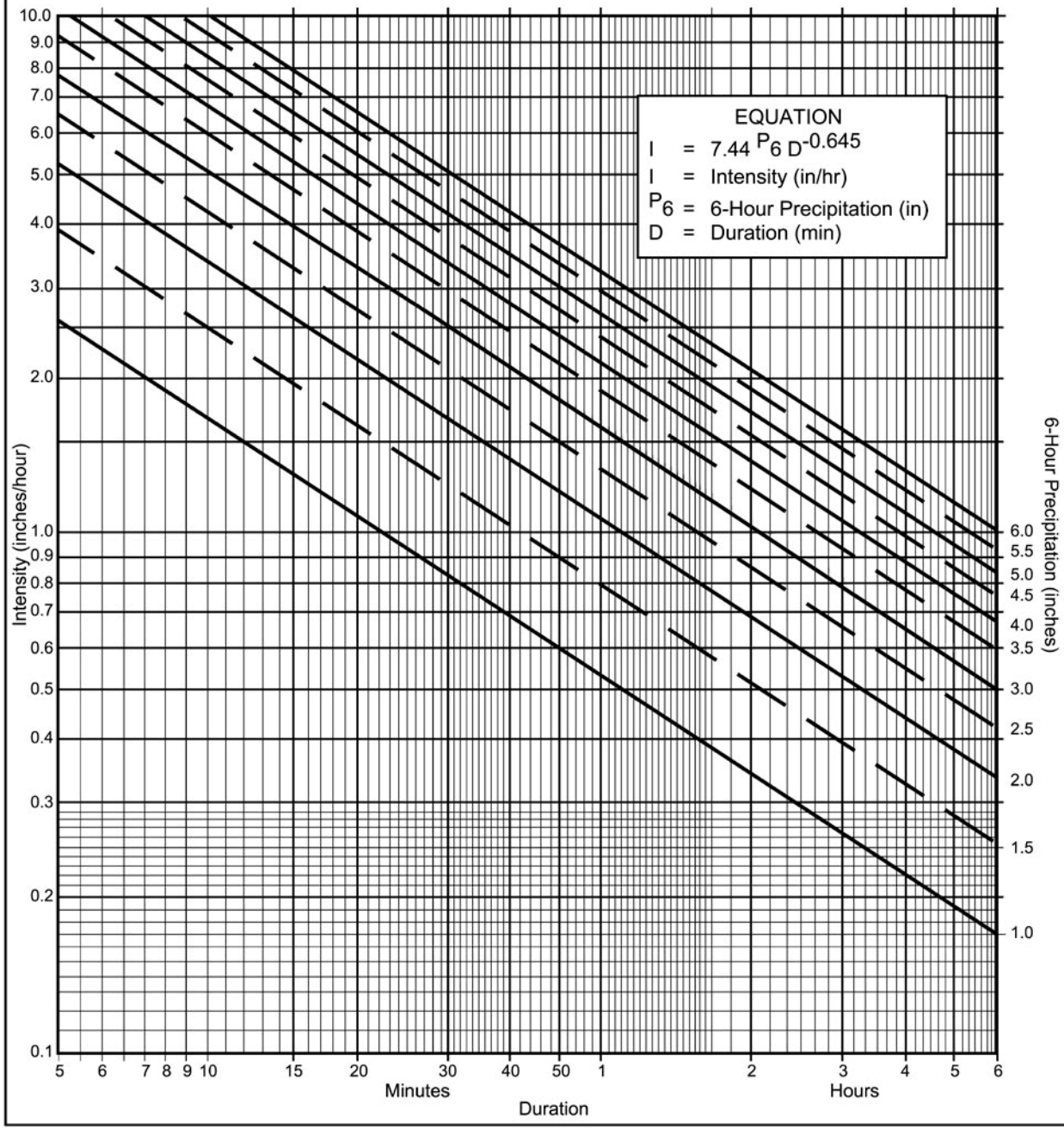
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Sheet 1 of 1

Appendix B - Reference Excerpts

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



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 _____ year

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

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

(d) t_x = _____ min.

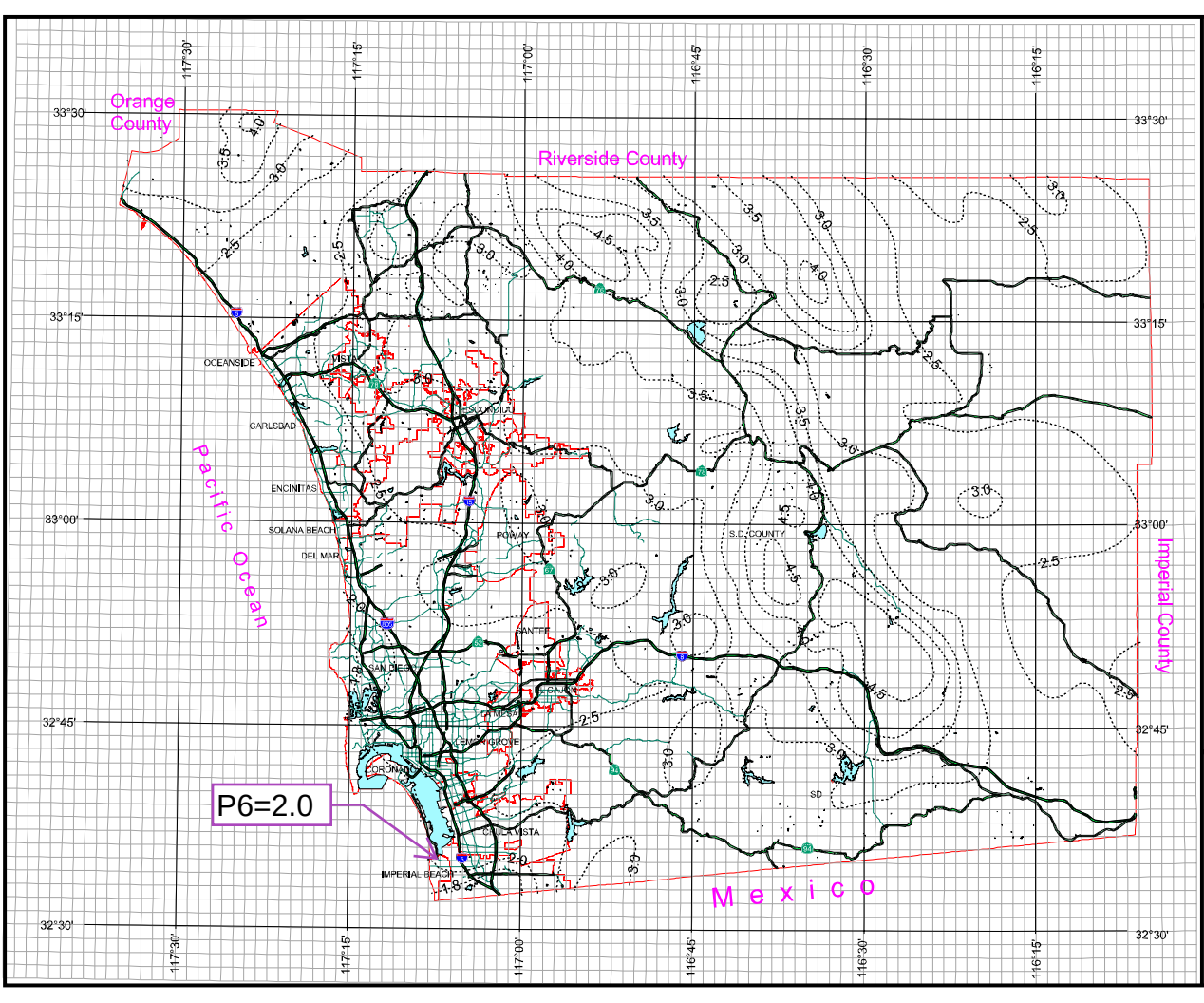
(e) I = _____ in./hr.

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



County of San Diego Hydrology Manual

Rainfall Isopluvials

50 Year Rainfall Event - 6 Hours

Isopluvial (inches)

DPW GIS
Department of Public Works
Geographic Information Services

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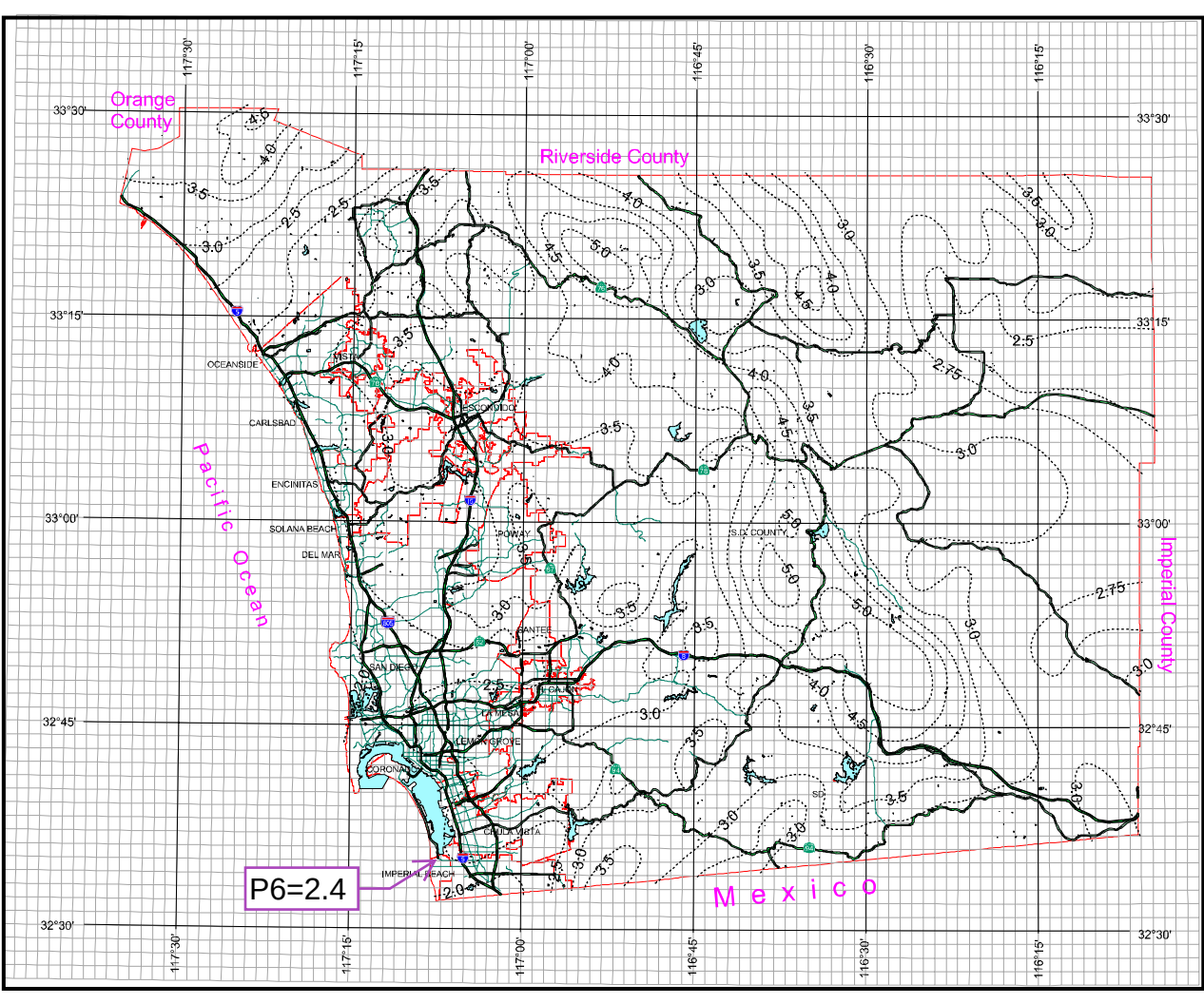
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N W E S

3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

DPW GIS
Department of Public Works
Geographic Information Services

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N W E S

3 0 3 Miles

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

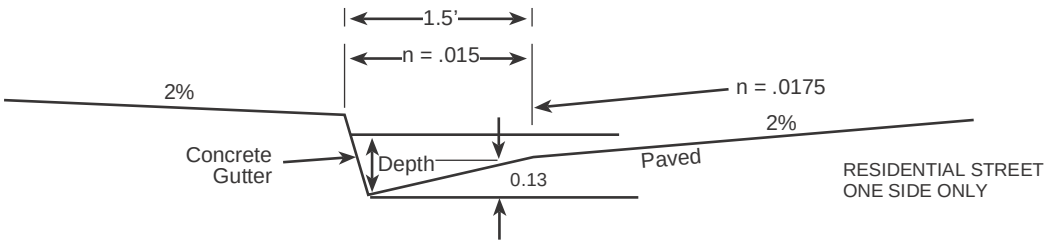
Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved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

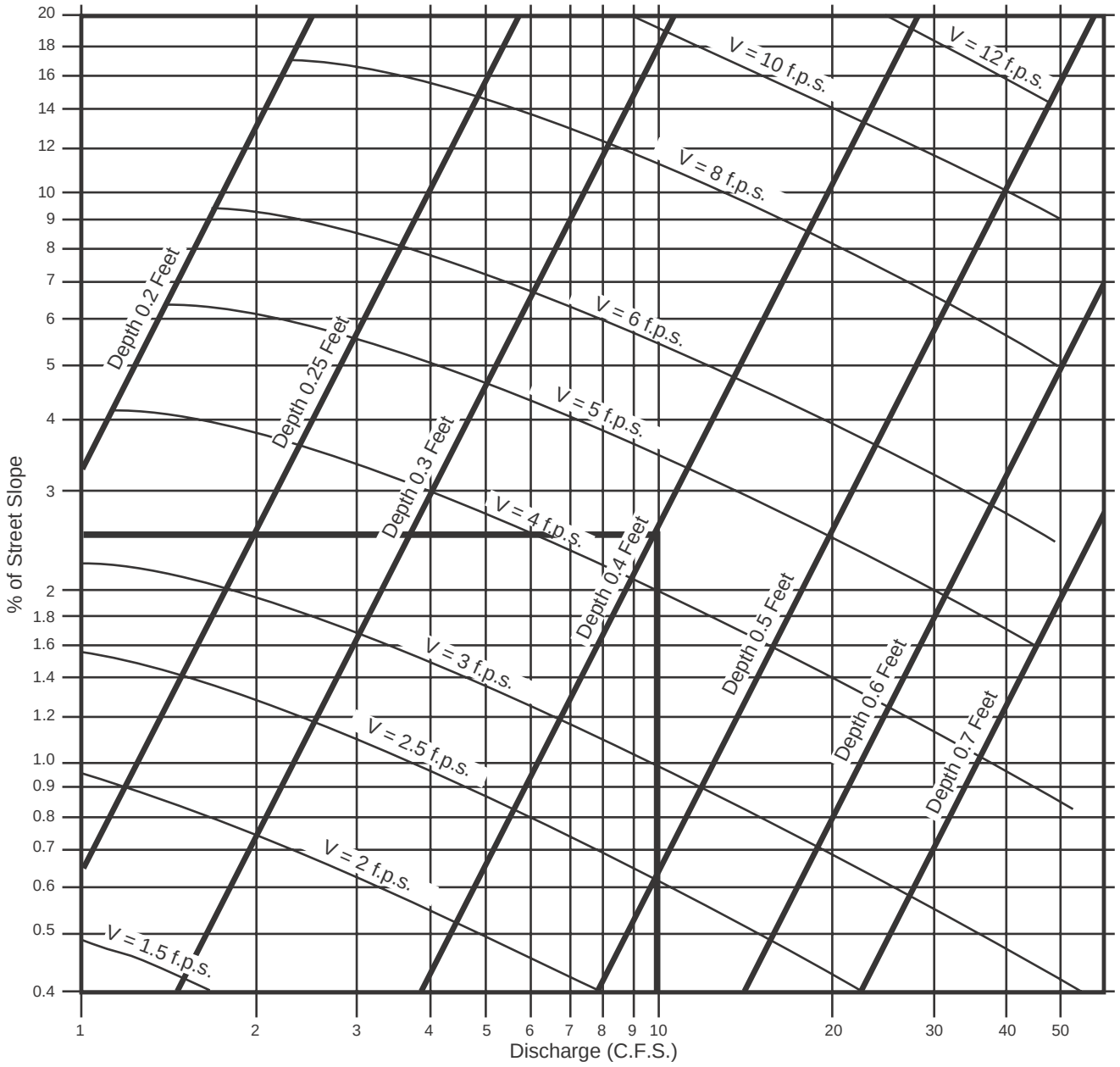
Table 3-2

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

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

*See Table 3-1 for more detailed description





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

F I G U R E

Gutter and Roadway Discharge - Velocity Chart

3-6

San Diego County Area, California

HuC—Huerhuero-Urban land complex, 2 to 9 percent slopes

Map Unit Setting

National map unit symbol: hbcs
Elevation: 1,100 feet
Mean annual precipitation: 12 to 20 inches
Mean annual air temperature: 57 degrees F
Frost-free period: 260 days
Farmland classification: Not prime farmland

Map Unit Composition

Huerhuero and similar soils: 50 percent
Urban land: 30 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Huerhuero

Setting

Landform: Marine terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous alluvium derived from sedimentary rock

Typical profile

H1 - 0 to 12 inches: loam
H2 - 12 to 55 inches: clay
H3 - 55 to 72 inches: stratified sand to sandy loam

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 25.0
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D

Ecological site: R019XG909CA - Terrace
Hydric soil rating: No

Description of Urban Land

Typical profile
H1 - 0 to 6 inches: variable

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

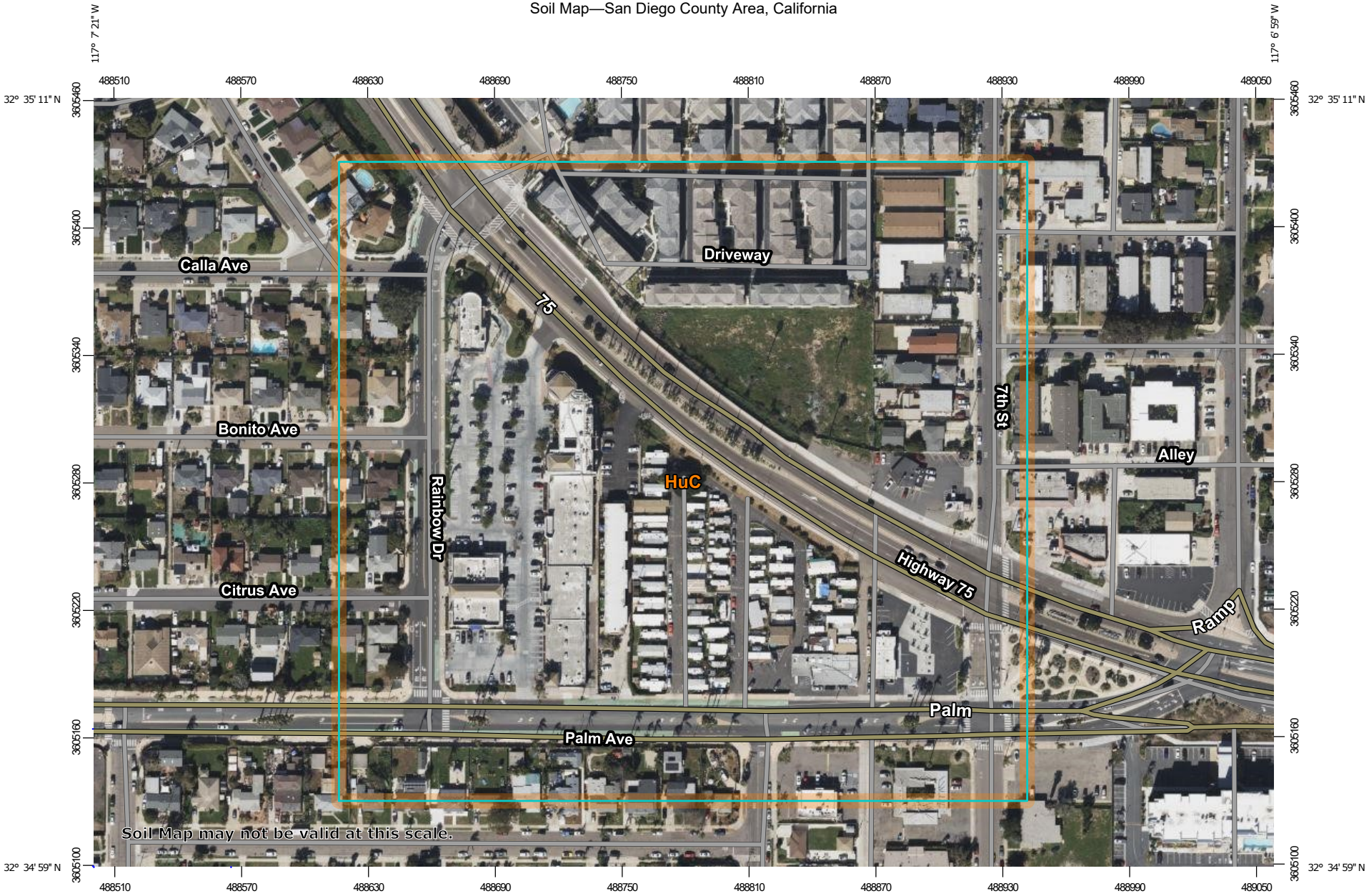
Minor Components

Las flores
Percent of map unit: 10 percent
Hydric soil rating: No

Oliventain
Percent of map unit: 5 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 20, Aug 30, 2024



Map Scale: 1:2,550 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 35 70 140 210

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 Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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 20, Aug 30, 2024

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

Date(s) aerial images were photographed: Mar 1, 2023—Sep 1, 2023

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
HuC	Huerhuero-Urban land complex, 2 to 9 percent slopes	24.3	100.0%
Totals for Area of Interest		**24.3**	**100.0%**

Appendix C - Hydrology Calculations

EXISTING CONDITION

	Area (A)		Runoff Coefficient (C)				Time of Concentration (Tc)										50-Year Event			100-Year Event		
							Initial Travel Time			Shallow Flow Travel Time			Concentrated Flow Travel Time			Total						
Basin Name	Area (sf)	Area (ac)	Imp. Area (sf)	% Imp.	Pervious Coefficient	Runoff Coefficient	Length (ft)	Slope (%)	Ti (min)	Length (ft)	Velocity (fps)	Tt (min)	Length (ft)	Velocity (fps)	Tt (min)	Tc (min)	P_6 (in)	Intensity (I) (in/hr)	Flow Rate (cfs)	P_6 (in)	Intensity (I) (in/hr)	Flow Rate (cfs)
EX D0.1	9,515	0.22	9,515	100.0%	0.35	0.90	60	1.0%	3.2			0.0	157	2.00	1.3	5.0	2.0	5.27	1.04	2.4	6.32	1.25
EX D1.1	8,250	0.19	8,250	100.0%	0.35	0.90	60	1%	3.2			0.0	170	2.00	1.4	5.0	2.0	5.27	0.90	2.4	6.32	1.08
EX D2.1	19,040	0.44	1,904	10.0%	0.35	0.41	50	0.5%	13.2	189	1.5	2.1			0.0	15.3	2.0	2.56	0.46	2.4	3.07	0.55
EX D4.1	268,725	6.17	228,416	85.0%	0.35	0.82	65	1%	4.7			0.0	568	3.70	2.6	7.3	2.0	4.13	20.90	2.4	4.95	25.04
EX D6.1	165,385	3.80	157,116	95.0%	0.35	0.87	60	1%	3.7			0.0	977	3.20	5.1	8.8	2.0	3.66	12.10	2.4	4.39	14.51
EX D7.1	6,585	0.15	0	0.0%	0.35	0.35	70	1%	12.5	88	1.5	1.0			0.0	13.5	2.0	2.78	0.15	2.4	3.33	0.17
EX D3.1	173,575	3.98	156,218	90.0%	0.35	0.85	60	1%	3.7			0.0	1,340	3.20	7.0	10.7	2.0	3.23	10.93	2.4	3.87	13.09
EX D8.1	8,370	0.19	2,511	30.0%	0.35	0.52	80	2%	8.1	100	1.5	1.1			0.0	9.2	2.0	3.56	0.35	2.4	4.27	0.42
EX D9.1	128,200	2.94	115,380	90.0%	0.35	0.85	60	1%	3.7			0.0	425	3.20	2.2	5.9	2.0	4.74	11.85	2.4	5.68	14.19
EX D10.1	2,425	0.06	2,425	100.0%	0.35	0.90	60	1%	3.2			0.0	23	1.00	0.4	5.0	2.0	5.27	0.28	2.4	6.32	0.34
EX H7.1	78,035	1.79	70,232	90.0%	0.35	0.85	60	1%	3.7			0.0	573	2.80	3.4	7.1	2.0	4.20	6.39	2.4	5.04	7.67
EX H8.1	19,535	0.45	18,558	95.0%	0.35	0.87	70	1%	3.2			0.0	419	2.40	2.9	6.1	2.0	4.64	1.82	2.4	5.56	2.18
EX H12.1	6,555	0.15	6,227	95.0%	0.35	0.87	60	1%	3.2			0.0	222	2.00	1.9	5.1	2.0	5.20	0.68	2.4	6.24	0.81
EX H4.1	33,445	0.77	30,101	90.0%	0.35	0.85	60	1%	3.7			0.0	559	2.40	3.9	7.6	2.0	4.02	2.63	2.4	4.83	3.16
EX H5.1	18,385	0.42	17,466	95.0%	0.35	0.87	60	1%	3.2			0.0	477	2.30	3.5	6.7	2.0	4.36	1.59	2.4	5.24	1.91
EX H14.1	32,600	0.75	30,970	95.0%	0.35	0.87	60	1%	3.2			0.0	302	2.50	2.0	5.2	2.0	5.14	3.35	2.4	6.17	4.03
EX H16.1	861,890	19.79	818,796	95.0%	0.35	0.87	60	1%	3.2			0.0	1,747	4.50	6.5	9.7	2.0	3.44	59.23	2.4	4.12	70.94
EX K2.1	789,755	18.13	750,267	95.0%	0.35	0.87	60	1%	3.2			0.0	1,867	4.50	6.9	10.1	2.0	3.35	52.84	2.4	4.02	63.41
EX P1.1	38,700	0.89	36,765	95.0%	0.35	0.87	60	1%	3.2			0.0	475	2.50	3.2	6.4	2.0	4.49	3.48	2.4	5.39	4.17
EX P2.1	300,935	6.91	270,842	90.0%	0.35	0.85	60	1%	3.7			0.0	1,411	3.50	6.7	10.4	2.0	3.29	19.32	2.4	3.94	23.14
Total		68.19	2,731,957																210.29			252.09

PROPOSED CONDITION

	Area (A)		Runoff Coefficient (C)				Time of Concentration (Tc)										50-Year Event			100-Year Event		
							Initial Travel Time			Shallow Flow Travel Time			Concentrated Flow Travel Time			Total						
Basin Name	Area (sf)	Area (ac)	Imp. Area (sf)	% Imp.	Pervious Coefficient	Runoff Coefficient	Length (ft)	Slope (%)	Ti (min)	Length (ft)	Velocity (fps)	Tt (min)	Length (ft)	Velocity (fps)	Tt (min)	Tc (min)	P_6 (in)	Intensity (I) (in/hr)	Flow Rate (cfs)	P_6 (in)	Intensity (I) (in/hr)	Flow Rate (cfs)
PR D0.1	9,515	0.22	9,515	100.0%	0.35	0.90	60	1.0%	3.2			0.0	157	2.00	1.3	5.0	2.0	5.27	1.04	2.4	6.32	1.25
PR D1.1	9,785	0.22	9,785	100.0%	0.35	0.90	60	1%	3.2			0.0	170	2.00	1.4	5.0	2.0	5.27	1.04	2.4	6.32	1.25
PR D2.1	17,545	0.40	0	0.0%	0.35	0.35	50	0.5%	13.2	189	1.5	2.1			0.0	15.3	2.0	2.56	0.36	2.4	3.07	0.43
EX D4.1	268,725	6.17	228,416	85.0%	0.35	0.82	65	1%	4.7			0.0	568	3.70	2.6	7.3	2.0	4.13	20.90	2.4	4.95	25.04
EX D6.1	165,385	3.80	157,116	95.0%	0.35	0.87	60	1%	3.7			0.0	977	3.20	5.1	8.8	2.0	3.66	12.10	2.4	4.39	14.51
PR D7.1	6,585	0.15	0	0.0%	0.35	0.35	70	1%	12.5	88	1.50	1.0			0.0	13.5	2.0	2.78	0.15	2.4	3.33	0.17
PR D3.1	173,575	3.98	156,218	90.0%	0.35	0.85	60	1%	3.7			0.0	1,340	3.20	7.0	10.7	2.0	3.23	10.93	2.4	3.87	13.09
PR D8.1	8,370	0.19	2,511	30.0%	0.35	0.52	80	2%	8.1	100	1.50	1.1			0.0	9.2	2.0	3.56	0.35	2.4	4.27	0.42
PR D9.1	128,200	2.94	115,380	90.0%	0.35	0.85	60	1%	3.7			0.0	425	3.20	2.2	5.9	2.0	4.74	11.85	2.4	5.68	14.19
PR D10.1	2,425	0.06	2,425	100.0%	0.35	0.90	60	1%	3.2			0.0	23	1.00	0.4	5.0	2.0	5.27	0.28	2.4	6.32	0.34
PR H7.1	78,035	1.79	70,232	90.0%	0.35	0.85	60	1%	3.7			0.0	573	2.80	3.4	7.1	2.0	4.20	6.39	2.4	5.04	7.67
PR H8.1	19,535	0.45	18,558	95.0%	0.35	0.87	70	1%	3.2			0.0	419	2.40	2.9	6.1	2.0	4.64	1.82	2.4	5.56	2.18
PR H12.1	6,555	0.15	6,227	95.0%	0.35	0.87	60	1%	3.2			0.0	222	2.00	1.9	5.1	2.0	5.20	0.68	2.4	6.24	0.81
PR H4.1	21,035	0.48	18,932	90.0%	0.35	0.85	60	1%	3.7			0.0	259	2.40	1.8	5.5	2.0	4.96	2.02	2.4	5.95	2.43
PR H5.1	30,795	0.71	29,255	95.0%	0.35	0.87	60	1%	3.2			0.0	477	2.30	3.5	6.7	2.0	4.36	2.69	2.4	5.24	3.24
PR H14.1	32,600	0.75	30,970	95.0%	0.35	0.87	60	1%	3.2			0.0	302	2.50	2.0	5.2	2.0	5.14	3.35	2.4	6.17	4.03
PR H16.1	861,890	19.79	818,796	95.0%	0.35	0.87	60	1%	3.2			0.0	1,747	4.50	6.5	9.7	2.0	3.44	59.23	2.4	4.12	70.94
PR K2.1	789,755	18.13	750,267	95.0%	0.35	0.87	60	1%	3.2			0.0	1,867	4.50	6.9	10.1	2.0	3.35	52.84	2.4	4.02	63.41
PR P1.1	38,700	0.89	36,765	95.0%	0.35	0.87	60	1%	3.2			0.0	475	2.50	3.2	6.4	2.0	4.49	3.48	2.4	5.39	4.17
PR P2.1	300,935	6.91	270,842	90.0%	0.35	0.85	60	1%	3.7			0.0	1,411	3.50	6.7	10.4	2.0	3.29	19.32	2.4	3.94	23.14
Total		68.18	2,732,209																210.82			252.72

Appendix D - Hydraulic Calculations

Pipe Name	Size/Material	Design Storm	Capacity (cfs)	Existing Flow (cfs)	Proposed Flow (cfs)	Capacity Assessment	Condition Assessment	Assumptions
D1	24" RCP	100	39.5	56.3	56.2	Moderate exceedance	None reported	
D2	24" RCP	100	22.6	55.2	55.1	Moderate exceedance	Moderate deficiencies	
D3	18" RCP	100	7.4	13.1	13.1	Minor exceedance	None reported	Pipe slope and size
D5	18" RCP	100	12.5	29.6	29.6	Moderate exceedance	Moderate deficiencies	
D7	18" RCP	100	20.3	15.1	15.1	Adequate	Good	
D8	18" RCP	100	8.4	15.0	15.0	Moderate exceedance	None reported	
D9	18" RCP	100	11.7	14.5	14.5	Minor exceedance	Clogged, moderate deficiencies	
D10	18" RCP	100	7.4	0.3	0.3	Adequate	Clogged	Pipe slope
H2	36"	100	47.2	86.4	86.4	Major exceedance	None reported	Pipe slope
H3	18"	100	7.4	5.1	5.7	Adequate	Major deficiencies	Pipe slope
H4	18" RCP	100	7.4	5.1	5.7	Adequate	Major deficiencies	Pipe slope
H5	12"X18" CMP	100	7.4	1.9	3.2	Adequate	Minor deficiencies	Pipe slope and used 18" diameter
H6	36"	100	47.2	76.6	76.6	Major exceedance	None reported	Pipe slope and size
H7	18"	100	7.4	9.8	9.8	Adequate	None reported	Pipe slope and size
H8	18" RCP	100	7.4	2.2	2.2	Adequate	Major deficiencies	Pipe slope
H9	36" CMP	100	47.2	76.6	76.6	Moderate exceedance	None reported	Pipe slope
H10	18" RCP	100	7.4	76.6	76.6	Major exceedance	None reported	Pipe slope
H11	24" RCP	100	16.0	76.6	76.6	Major exceedance	None reported	Pipe slope
H12	18"	100	7.4	0.8	0.8	Adequate	None reported	Pipe slope and size
H13	18"	100	7.4	75.8	75.8	Major exceedance	Major deficiencies	Pipe slope and size
H14	18"	100	7.4	75.8	75.8	Major exceedance	None reported	Pipe slope and size
H15	18"	100	7.4	70.9	70.9	Major exceedance	None reported	Pipe slope and size
H16	15"	100	4.6	70.9	70.9	Major exceedance	Minor deficiencies	Pipe slope and size
K1	15" RCP	100	4.6	63.4	63.4	Major exceedance	Moderate deficiencies	Pipe slope and size
K2	15" RCP	100	4.6	63.4	63.4	Major exceedance	None reported	Pipe slope and size
P1	48" RCP	100	101.6	27.3	27.3	Uncertain	Minor deficiencies	Pipe slope
P2	24"	100	16.0	23.1	23.1	Minor exceedance	None reported	Pipe slope and size

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Aug 8 2025

EX D1

Circular

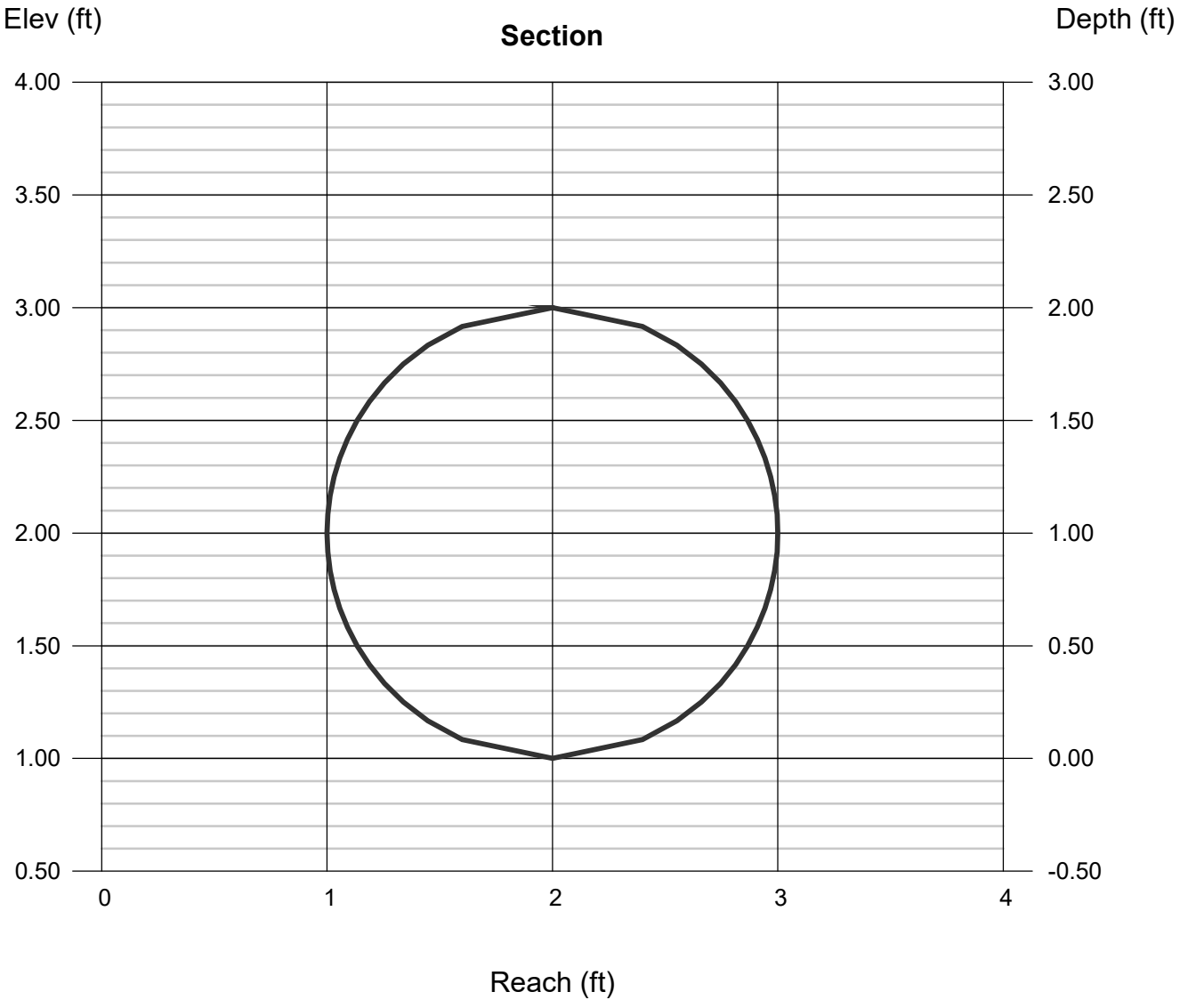
Diameter (ft)	= 2.00
Invert Elev (ft)	= 1.00
Slope (%)	= 3.05
N-Value	= 0.013

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 2.00

Highlighted

Depth (ft)	= 2.00
Q (cfs)	= 39.50
Area (sqft)	= 3.14
Velocity (ft/s)	= 12.57
Wetted Perim (ft)	= 6.28
Crit Depth, Yc (ft)	= 1.95
Top Width (ft)	= 0.00
EGL (ft)	= 4.46



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Aug 8 2025

EX D2

Circular

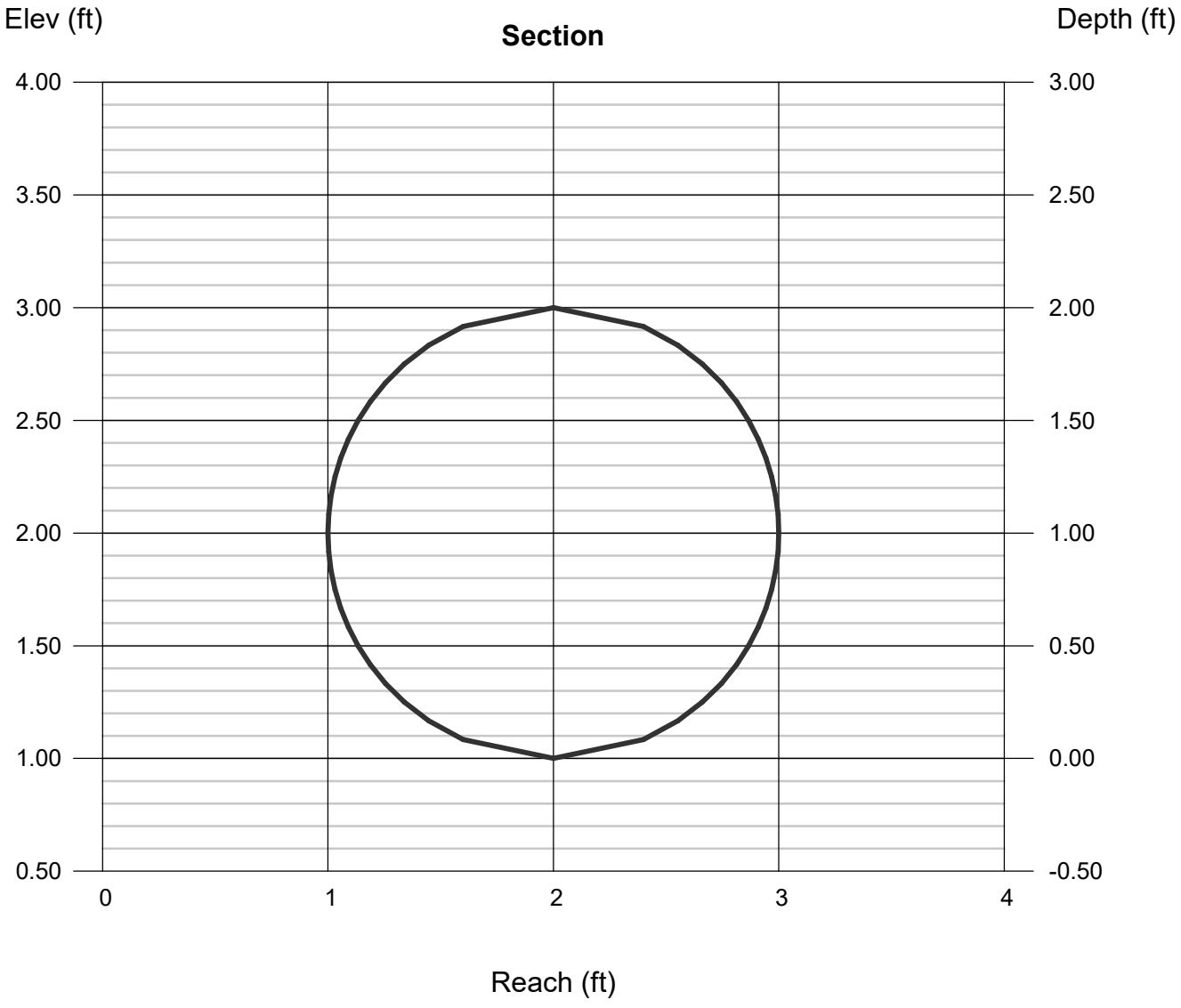
Diameter (ft)	= 2.00
Invert Elev (ft)	= 1.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 2.00

Highlighted

Depth (ft)	= 2.00
Q (cfs)	= 22.62
Area (sqft)	= 3.14
Velocity (ft/s)	= 7.20
Wetted Perim (ft)	= 6.28
Crit Depth, Yc (ft)	= 1.70
Top Width (ft)	= 0.00
EGL (ft)	= 2.81



Channel Report

EX D3

Circular

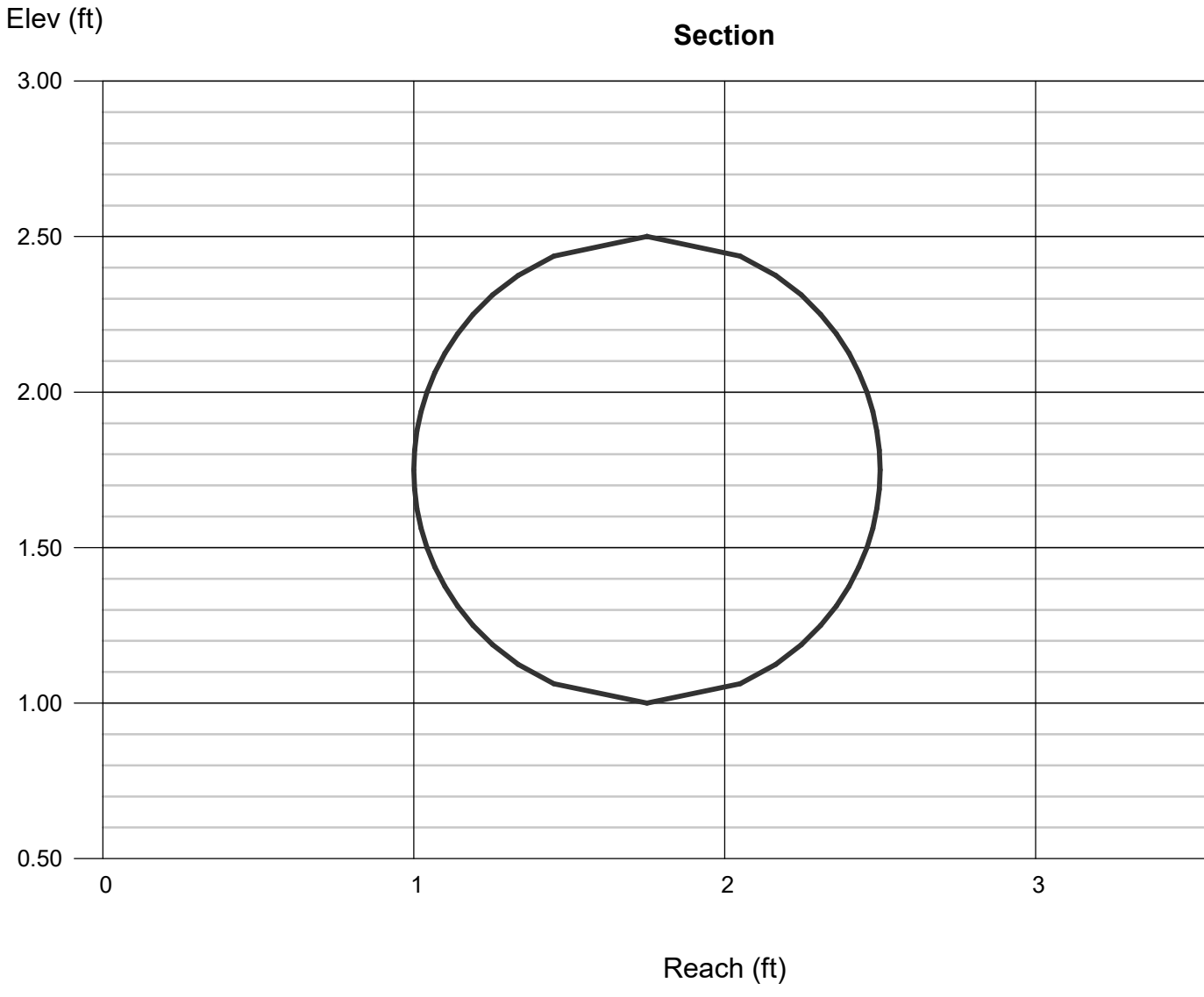
Diameter (ft)	= 1.50
Invert Elev (ft)	= 1.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 1.50

Highlighted

Depth (ft)	= 1.50
Q (cfs)	= 7.425
Area (sqft)	= 1.77
Velocity (ft/s)	= 4.20
Wetted Perim (ft)	= 4.71
Crit Depth, Yc (ft)	= 1.06
Top Width (ft)	= 0.00
EGL (ft)	= 1.77



Channel Report

EX D5

Circular

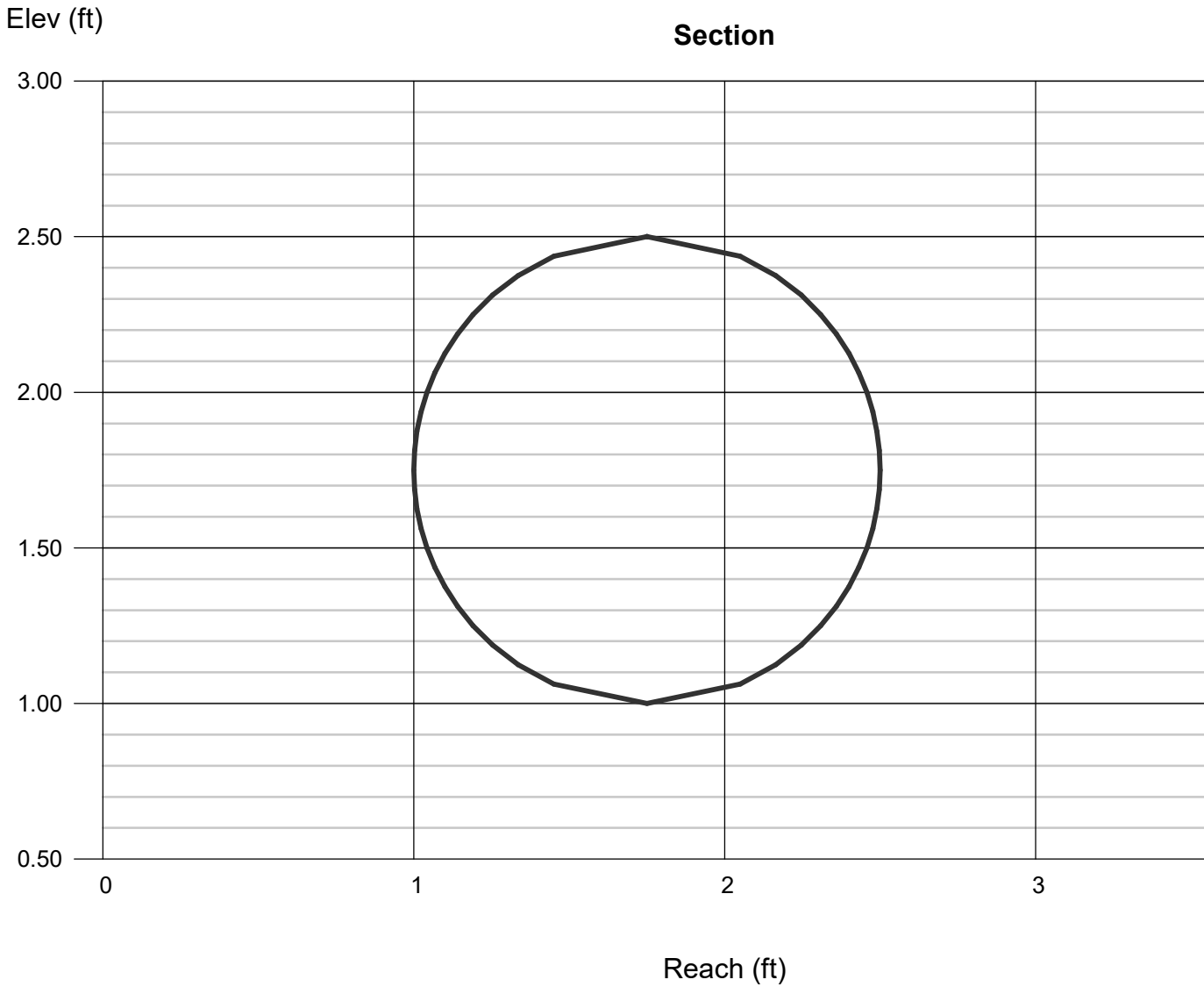
Diameter (ft)	= 1.50
Invert Elev (ft)	= 1.00
Slope (%)	= 1.41
N-Value	= 0.013

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 1.50

Highlighted

Depth (ft)	= 1.50
Q (cfs)	= 12.47
Area (sqft)	= 1.77
Velocity (ft/s)	= 7.06
Wetted Perim (ft)	= 4.71
Crit Depth, Yc (ft)	= 1.34
Top Width (ft)	= 0.00
EGL (ft)	= 2.27



Channel Report

EX D7

Circular

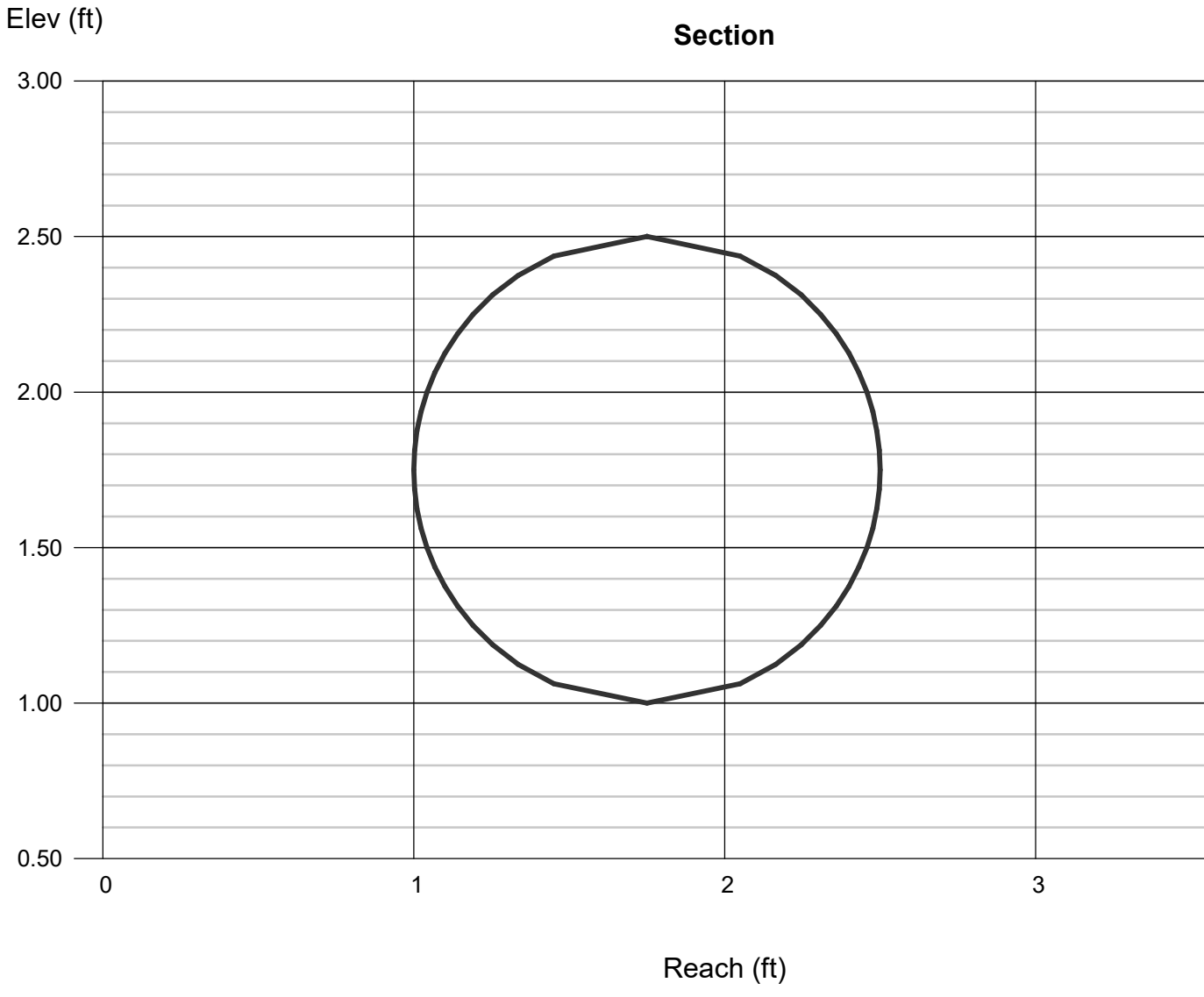
Diameter (ft)	= 1.50
Invert Elev (ft)	= 1.00
Slope (%)	= 3.72
N-Value	= 0.013

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 1.50

Highlighted

Depth (ft)	= 1.50
Q (cfs)	= 20.25
Area (sqft)	= 1.77
Velocity (ft/s)	= 11.46
Wetted Perim (ft)	= 4.71
Crit Depth, Yc (ft)	= 1.47
Top Width (ft)	= 0.00
EGL (ft)	= 3.54



Channel Report

EX D8

Circular

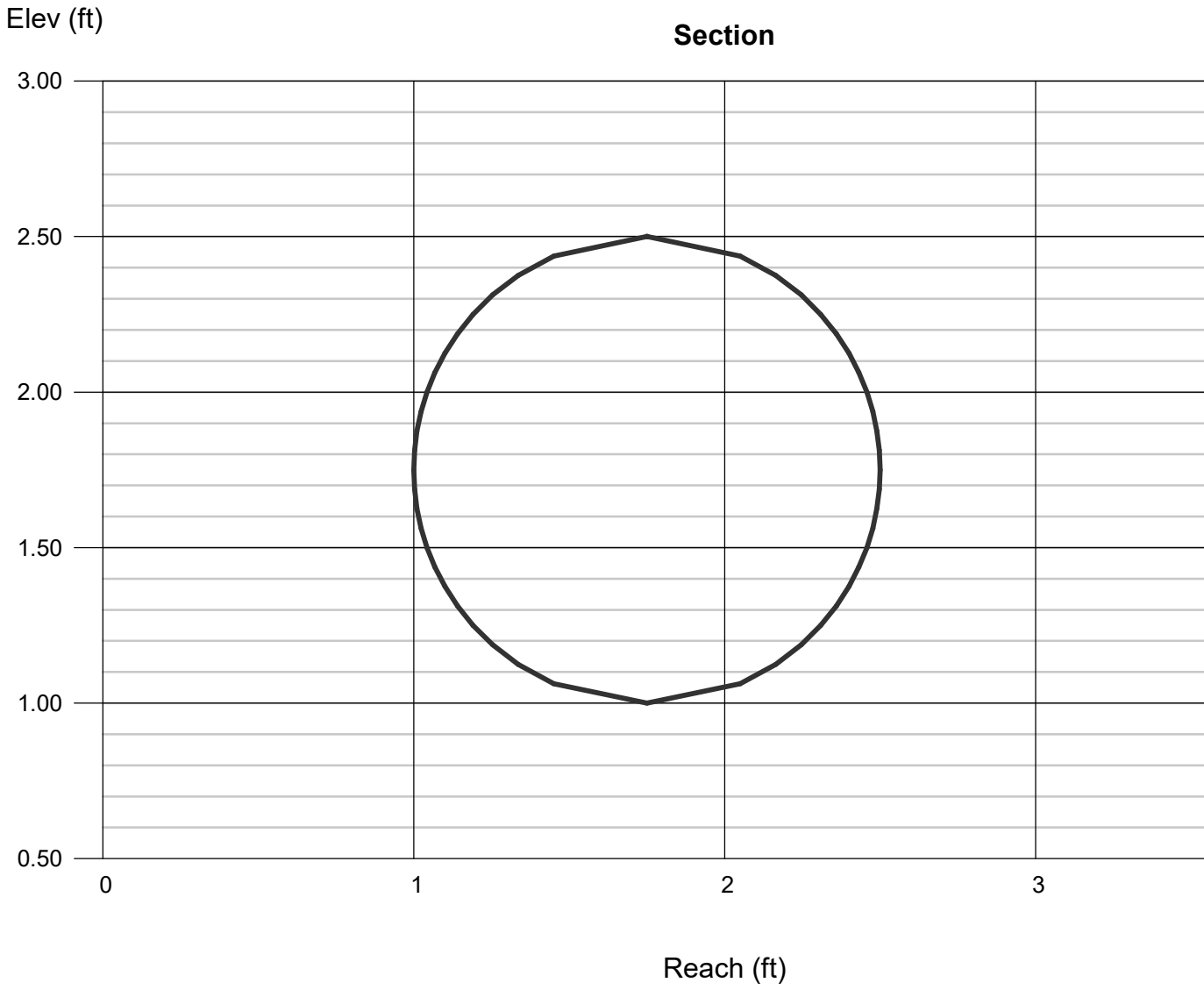
Diameter (ft)	= 1.50
Invert Elev (ft)	= 1.00
Slope (%)	= 0.64
N-Value	= 0.013

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 1.50

Highlighted

Depth (ft)	= 1.50
Q (cfs)	= 8.401
Area (sqft)	= 1.77
Velocity (ft/s)	= 4.75
Wetted Perim (ft)	= 4.71
Crit Depth, Yc (ft)	= 1.13
Top Width (ft)	= 0.00
EGL (ft)	= 1.85



Channel Report

EX D9

Circular

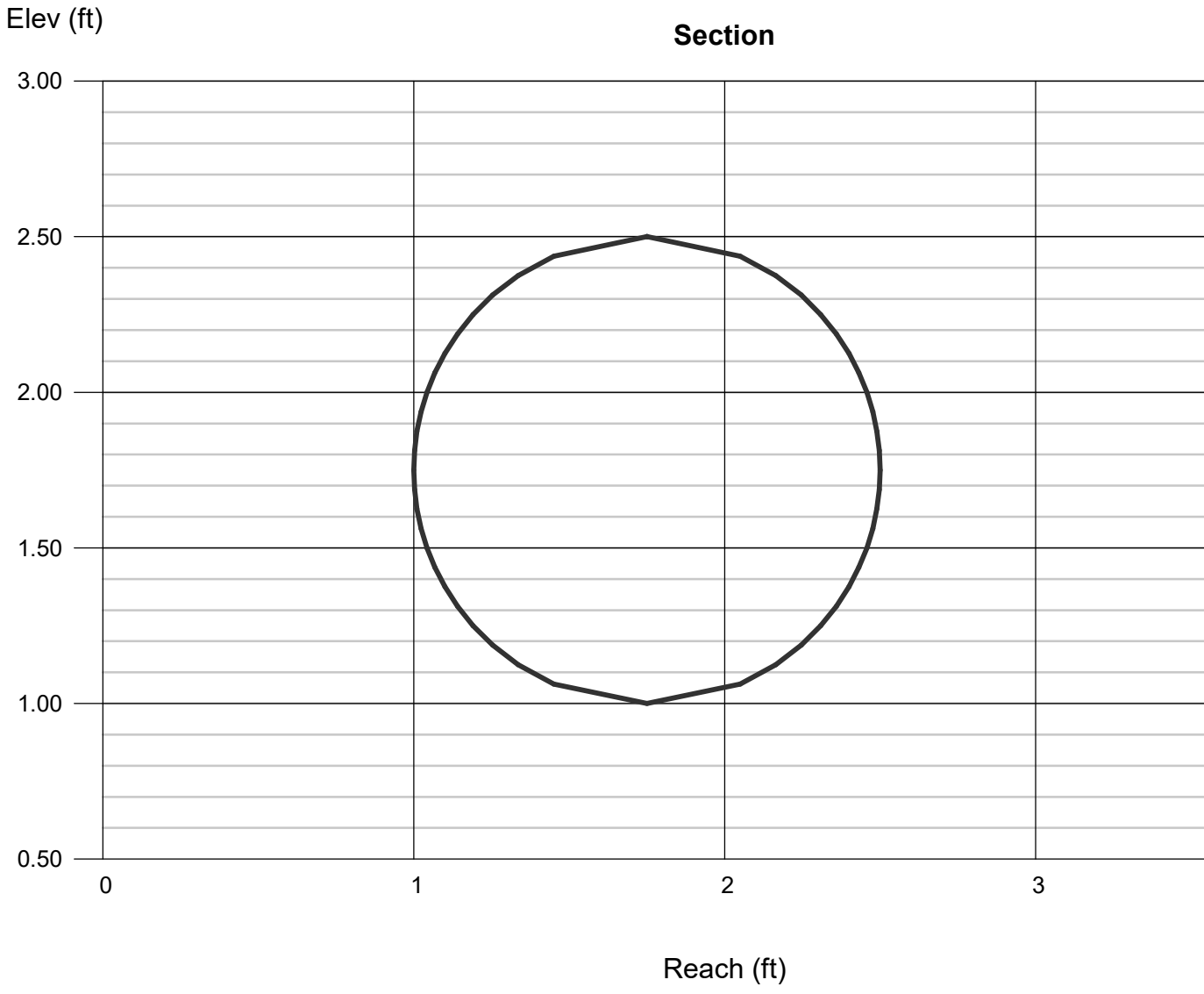
Diameter (ft)	= 1.50
Invert Elev (ft)	= 1.00
Slope (%)	= 1.24
N-Value	= 0.013

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 1.50

Highlighted

Depth (ft)	= 1.50
Q (cfs)	= 11.69
Area (sqft)	= 1.77
Velocity (ft/s)	= 6.62
Wetted Perim (ft)	= 4.71
Crit Depth, Yc (ft)	= 1.31
Top Width (ft)	= 0.00
EGL (ft)	= 2.18



Channel Report

EX D10

Circular

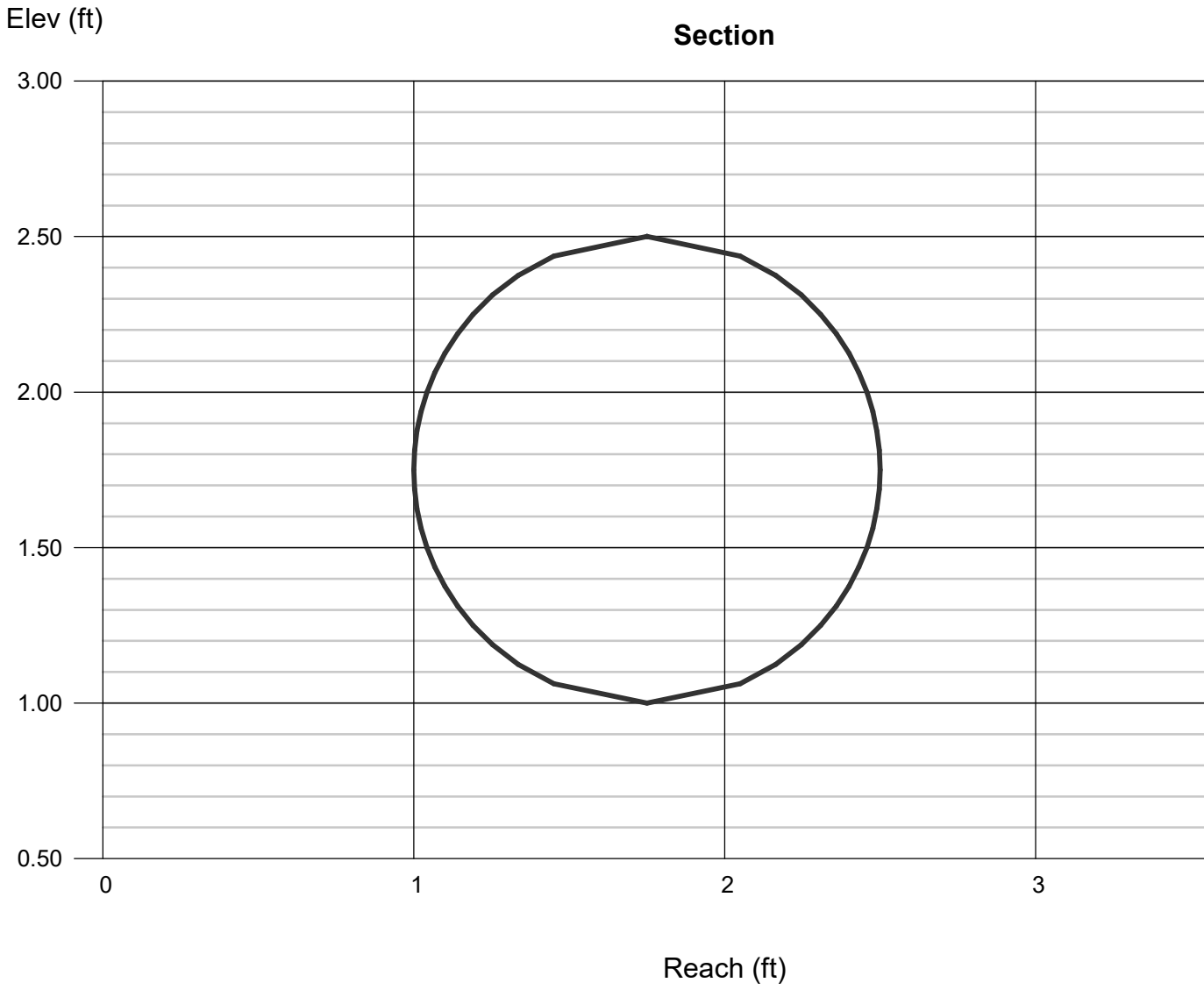
Diameter (ft)	= 1.50
Invert Elev (ft)	= 1.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 1.50

Highlighted

Depth (ft)	= 1.50
Q (cfs)	= 7.425
Area (sqft)	= 1.77
Velocity (ft/s)	= 4.20
Wetted Perim (ft)	= 4.71
Crit Depth, Yc (ft)	= 1.06
Top Width (ft)	= 0.00
EGL (ft)	= 1.77



Channel Report

EX H3

Circular

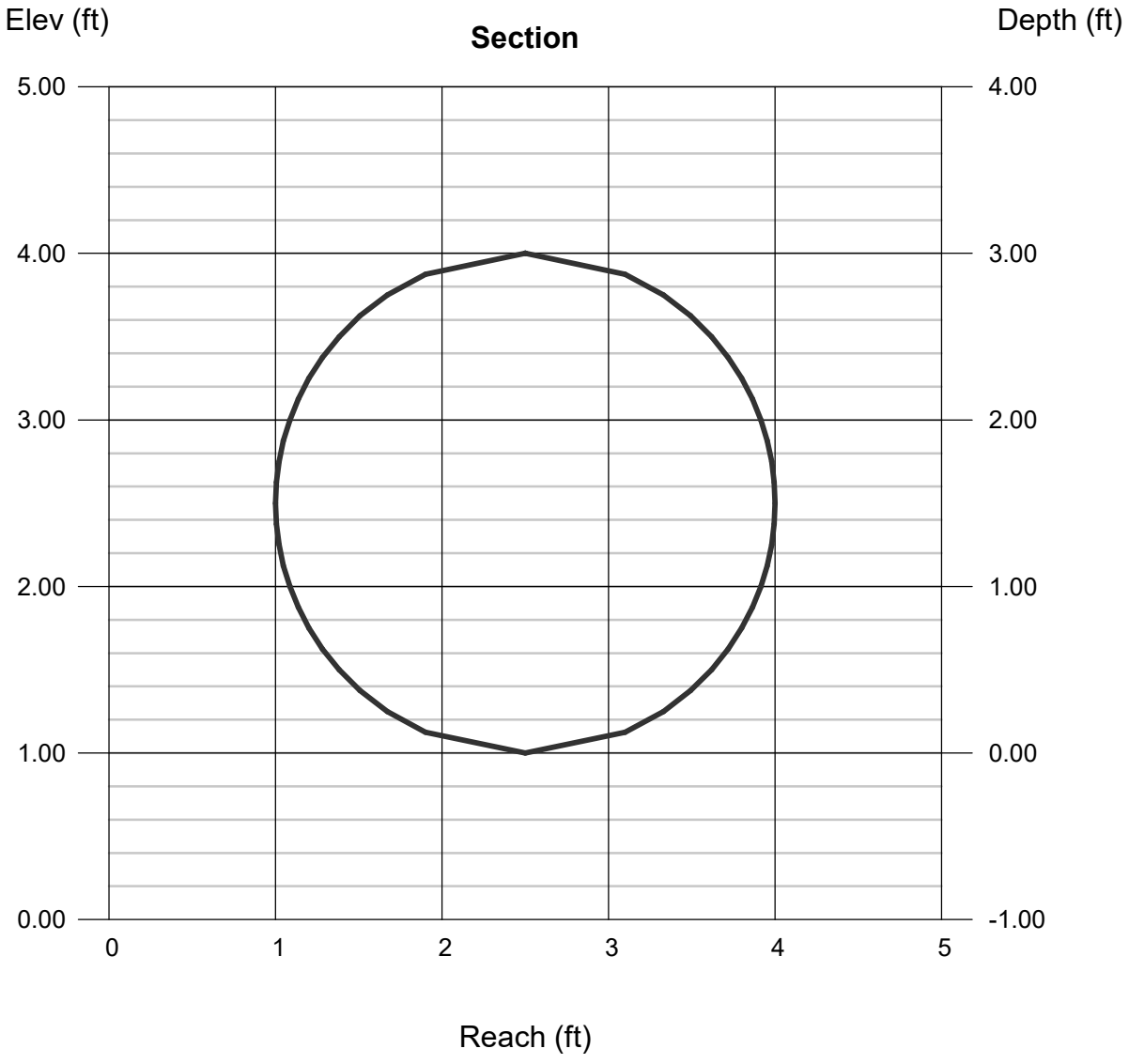
Diameter (ft)	= 3.00
Invert Elev (ft)	= 1.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 3.00

Highlighted

Depth (ft)	= 3.00
Q (cfs)	= 47.16
Area (sqft)	= 7.07
Velocity (ft/s)	= 6.67
Wetted Perim (ft)	= 9.42
Crit Depth, Yc (ft)	= 2.24
Top Width (ft)	= 0.00
EGL (ft)	= 3.69



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Sunday, Aug 17 2025

EX H3

Circular

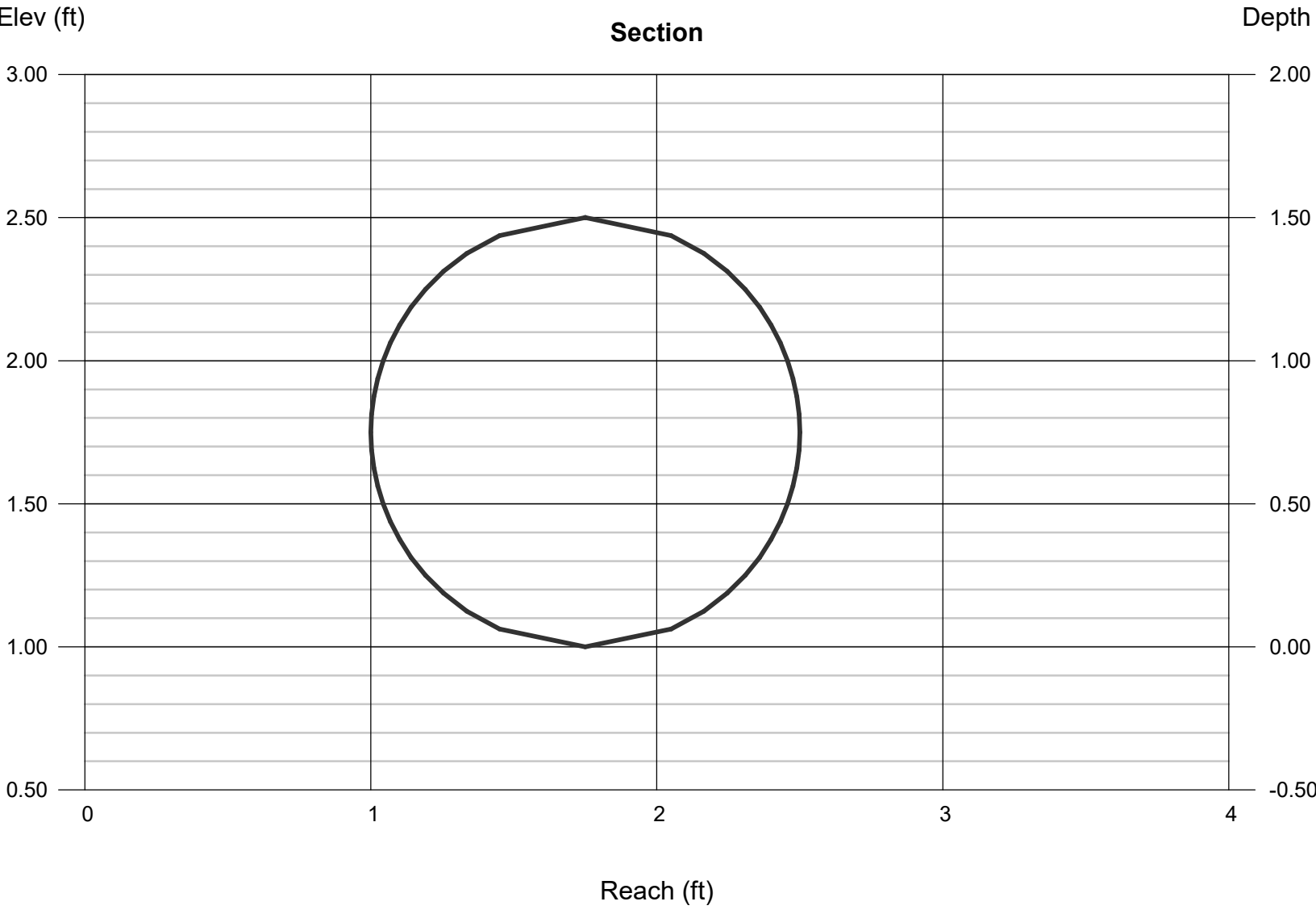
Diameter (ft)	= 1.50
Invert Elev (ft)	= 1.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 1.50

Highlighted

Depth (ft)	= 1.50
Q (cfs)	= 7.425
Area (sqft)	= 1.77
Velocity (ft/s)	= 4.20
Wetted Perim (ft)	= 4.71
Crit Depth, Yc (ft)	= 1.06
Top Width (ft)	= 0.00
EGL (ft)	= 1.77



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Sunday, Aug 17 2025

EX H4

Circular

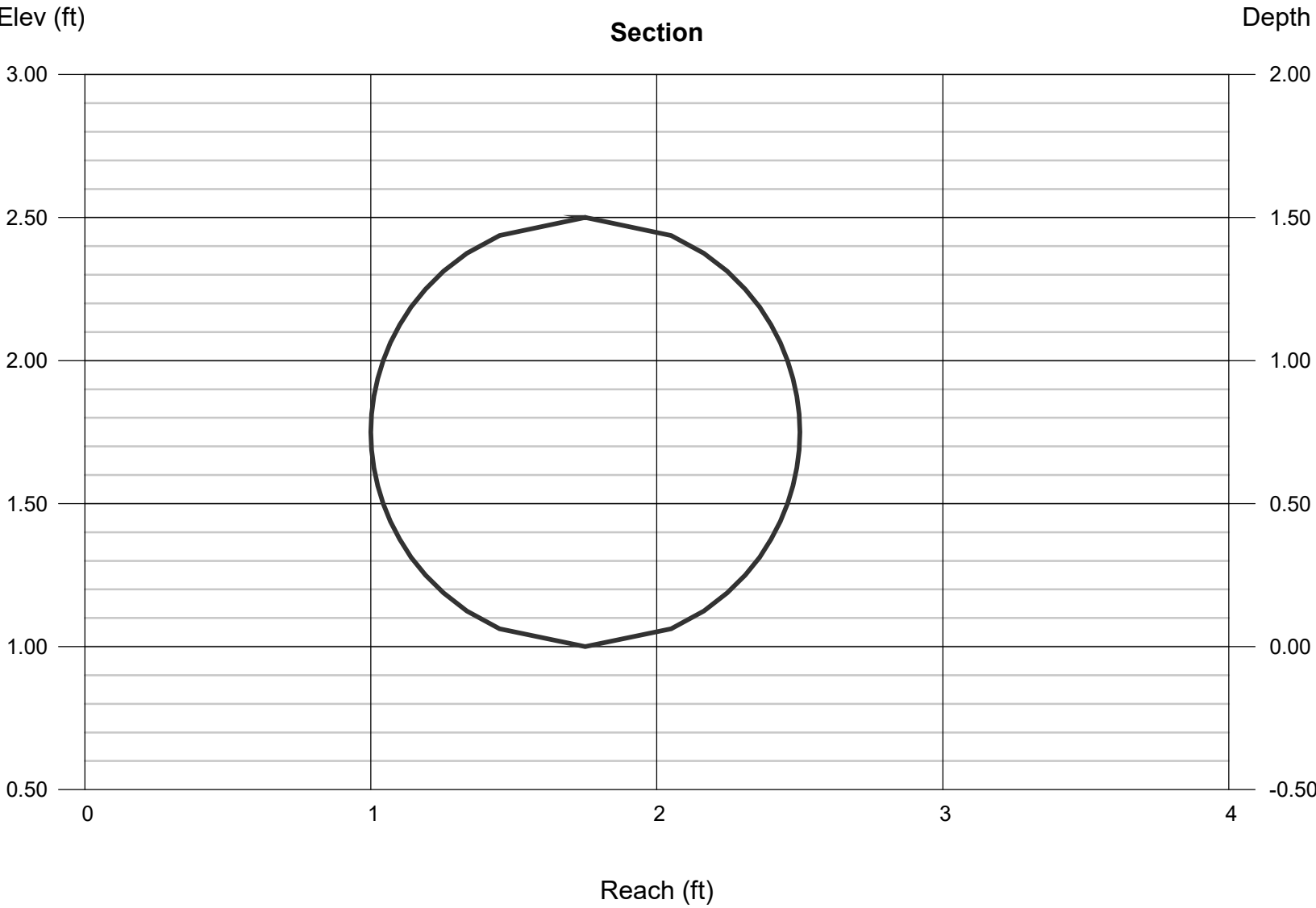
Diameter (ft)	= 1.50
Invert Elev (ft)	= 1.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 1.50

Highlighted

Depth (ft)	= 1.50
Q (cfs)	= 7.425
Area (sqft)	= 1.77
Velocity (ft/s)	= 4.20
Wetted Perim (ft)	= 4.71
Crit Depth, Yc (ft)	= 1.06
Top Width (ft)	= 0.00
EGL (ft)	= 1.77



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Sunday, Aug 17 2025

EX H5

Circular

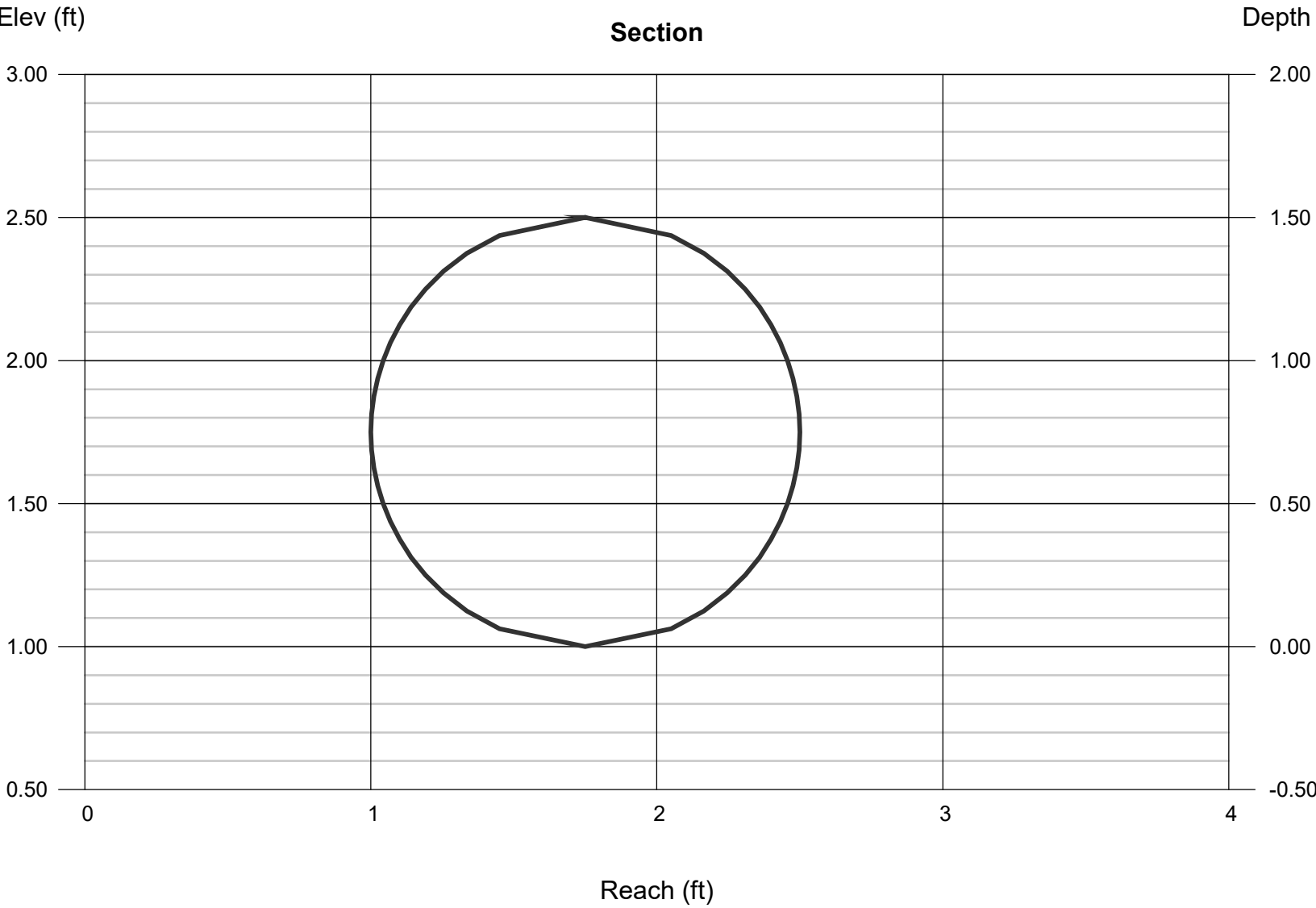
Diameter (ft)	= 1.50
Invert Elev (ft)	= 1.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 1.50

Highlighted

Depth (ft)	= 1.50
Q (cfs)	= 7.425
Area (sqft)	= 1.77
Velocity (ft/s)	= 4.20
Wetted Perim (ft)	= 4.71
Crit Depth, Yc (ft)	= 1.06
Top Width (ft)	= 0.00
EGL (ft)	= 1.77



Channel Report

EX H6

Circular

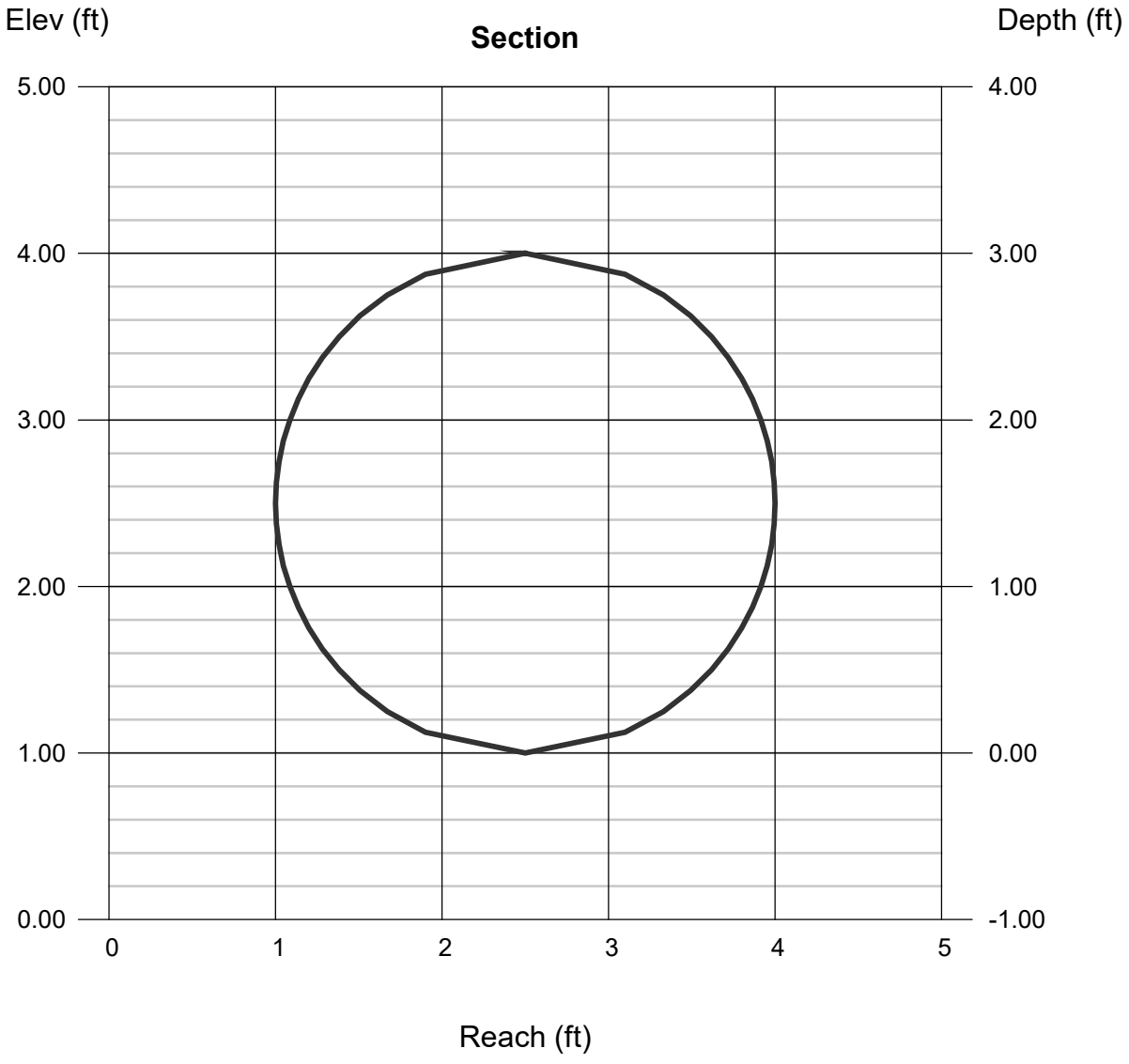
Diameter (ft)	= 3.00
Invert Elev (ft)	= 1.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 3.00

Highlighted

Depth (ft)	= 3.00
Q (cfs)	= 47.16
Area (sqft)	= 7.07
Velocity (ft/s)	= 6.67
Wetted Perim (ft)	= 9.42
Crit Depth, Yc (ft)	= 2.24
Top Width (ft)	= 0.00
EGL (ft)	= 3.69



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Sunday, Aug 17 2025

EX H7

Circular

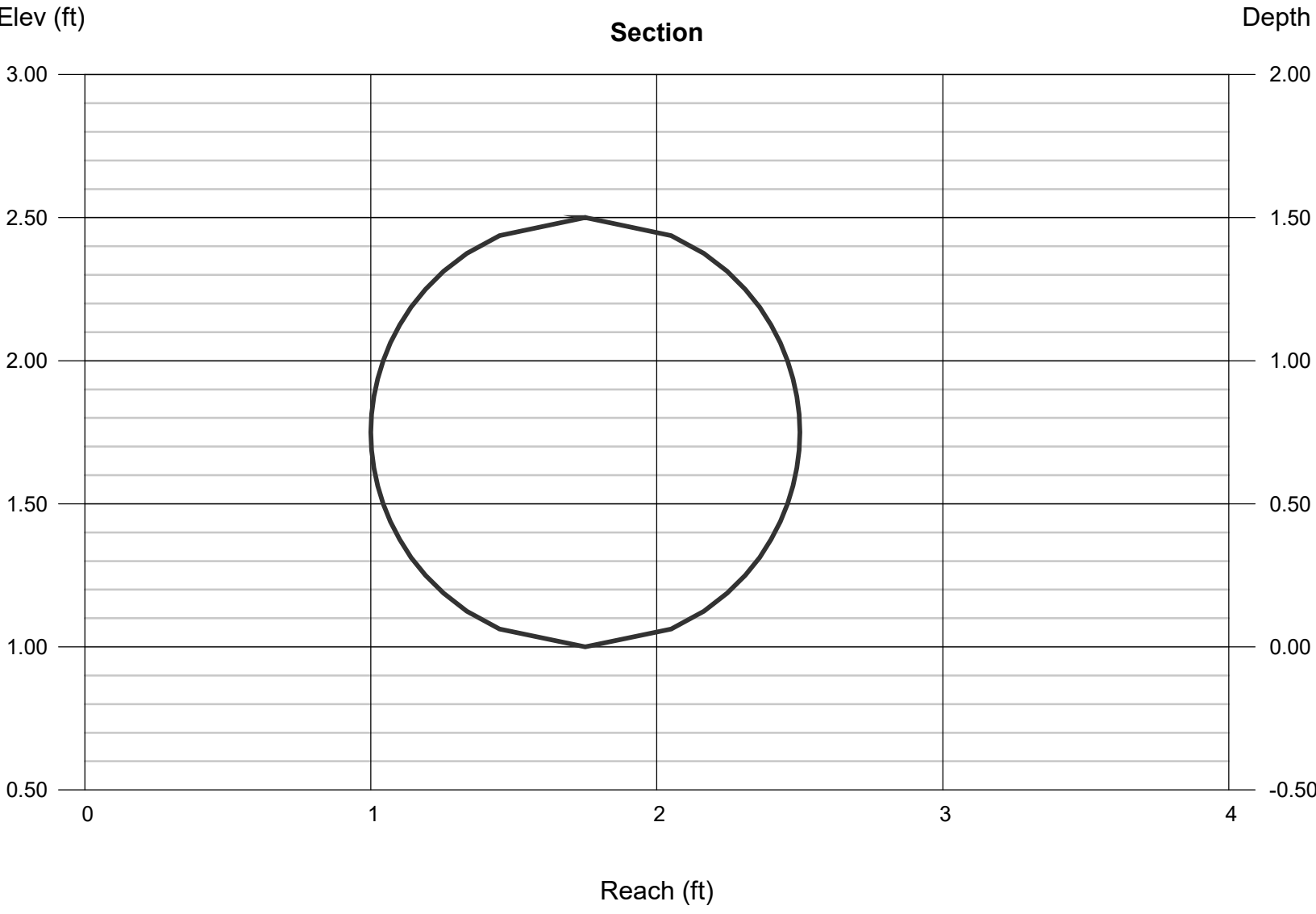
Diameter (ft)	= 1.50
Invert Elev (ft)	= 1.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 1.50

Highlighted

Depth (ft)	= 1.50
Q (cfs)	= 7.425
Area (sqft)	= 1.77
Velocity (ft/s)	= 4.20
Wetted Perim (ft)	= 4.71
Crit Depth, Yc (ft)	= 1.06
Top Width (ft)	= 0.00
EGL (ft)	= 1.77



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Sunday, Aug 17 2025

EX H8

Circular

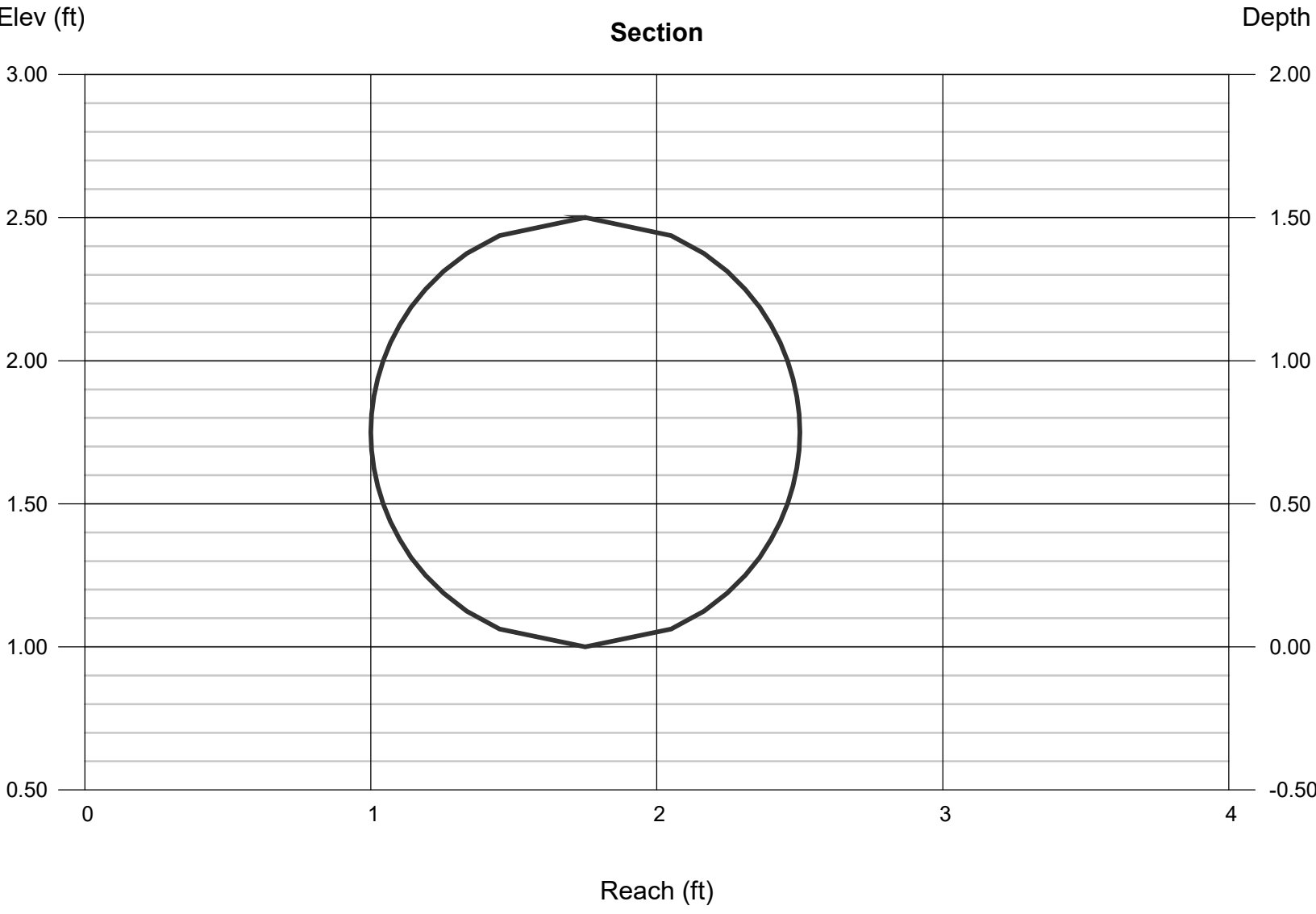
Diameter (ft)	= 1.50
Invert Elev (ft)	= 1.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 1.50

Highlighted

Depth (ft)	= 1.50
Q (cfs)	= 7.425
Area (sqft)	= 1.77
Velocity (ft/s)	= 4.20
Wetted Perim (ft)	= 4.71
Crit Depth, Yc (ft)	= 1.06
Top Width (ft)	= 0.00
EGL (ft)	= 1.77



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Oct 27 2025

EX H9

Circular

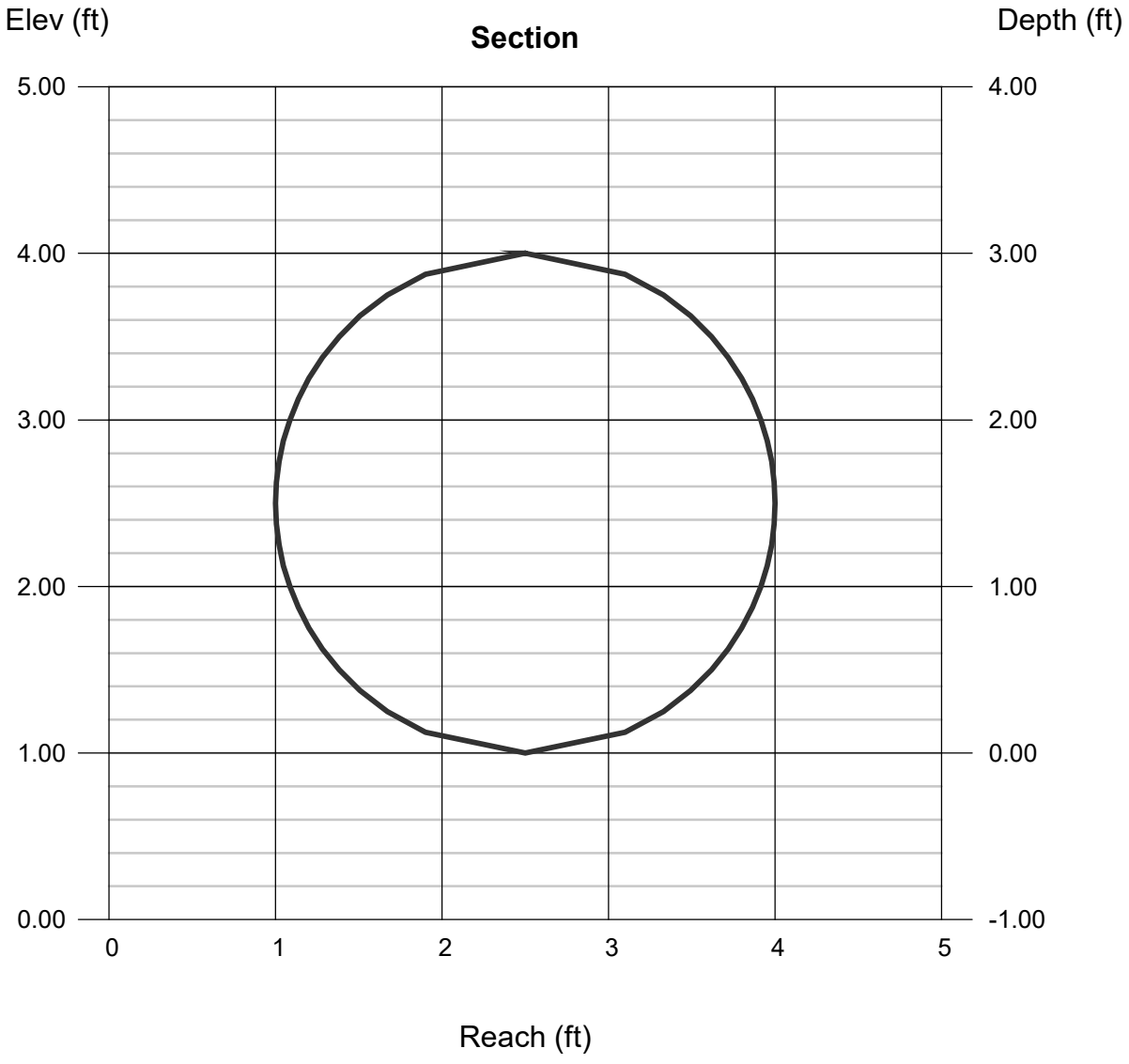
Diameter (ft)	= 3.00
Invert Elev (ft)	= 1.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 3.00

Highlighted

Depth (ft)	= 3.00
Q (cfs)	= 47.16
Area (sqft)	= 7.07
Velocity (ft/s)	= 6.67
Wetted Perim (ft)	= 9.42
Crit Depth, Yc (ft)	= 2.24
Top Width (ft)	= 0.00
EGL (ft)	= 3.69



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Sunday, Aug 17 2025

EX H10

Circular

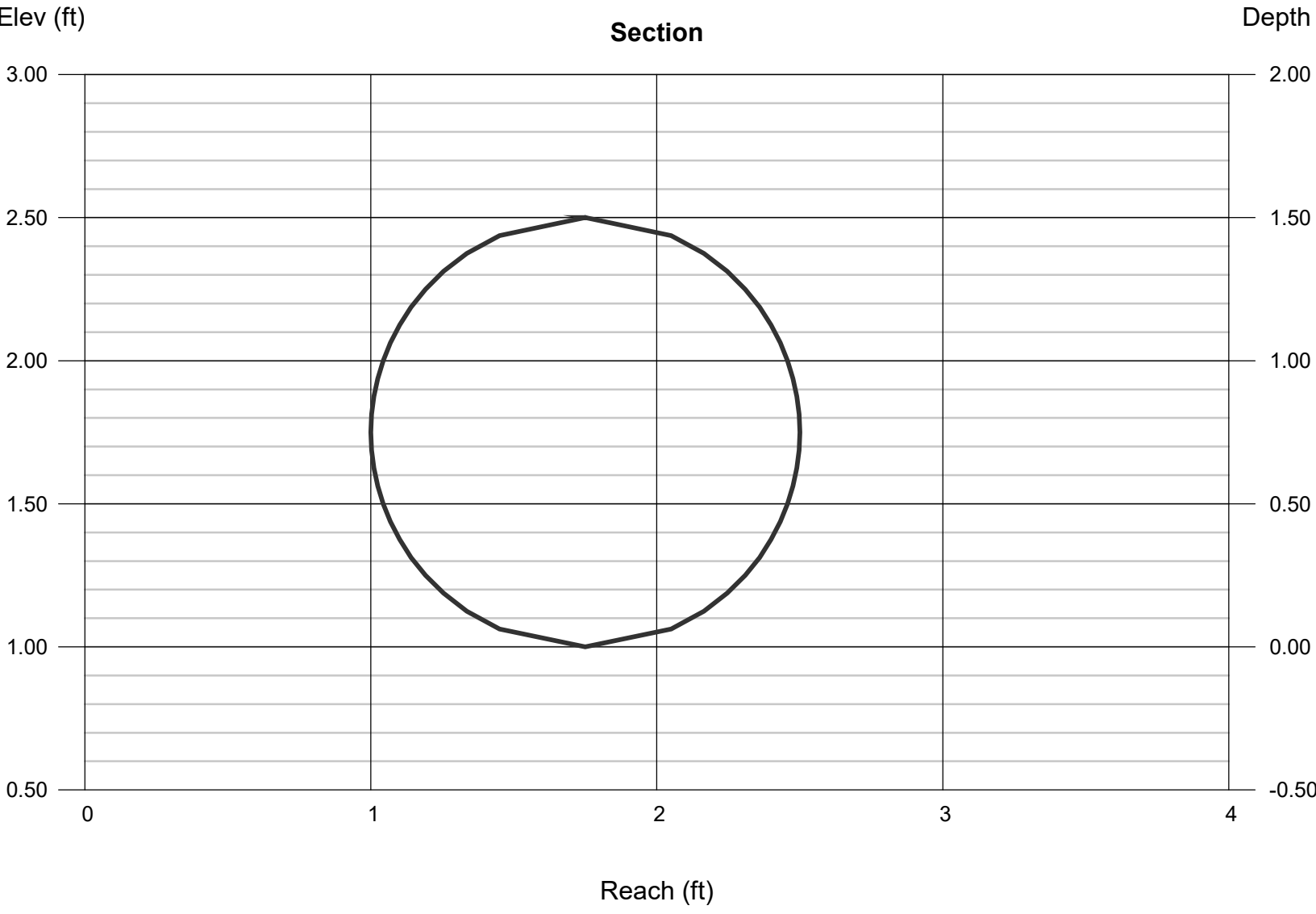
Diameter (ft)	= 1.50
Invert Elev (ft)	= 1.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 1.50

Highlighted

Depth (ft)	= 1.50
Q (cfs)	= 7.425
Area (sqft)	= 1.77
Velocity (ft/s)	= 4.20
Wetted Perim (ft)	= 4.71
Crit Depth, Yc (ft)	= 1.06
Top Width (ft)	= 0.00
EGL (ft)	= 1.77



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Sunday, Aug 17 2025

EX H11

Circular

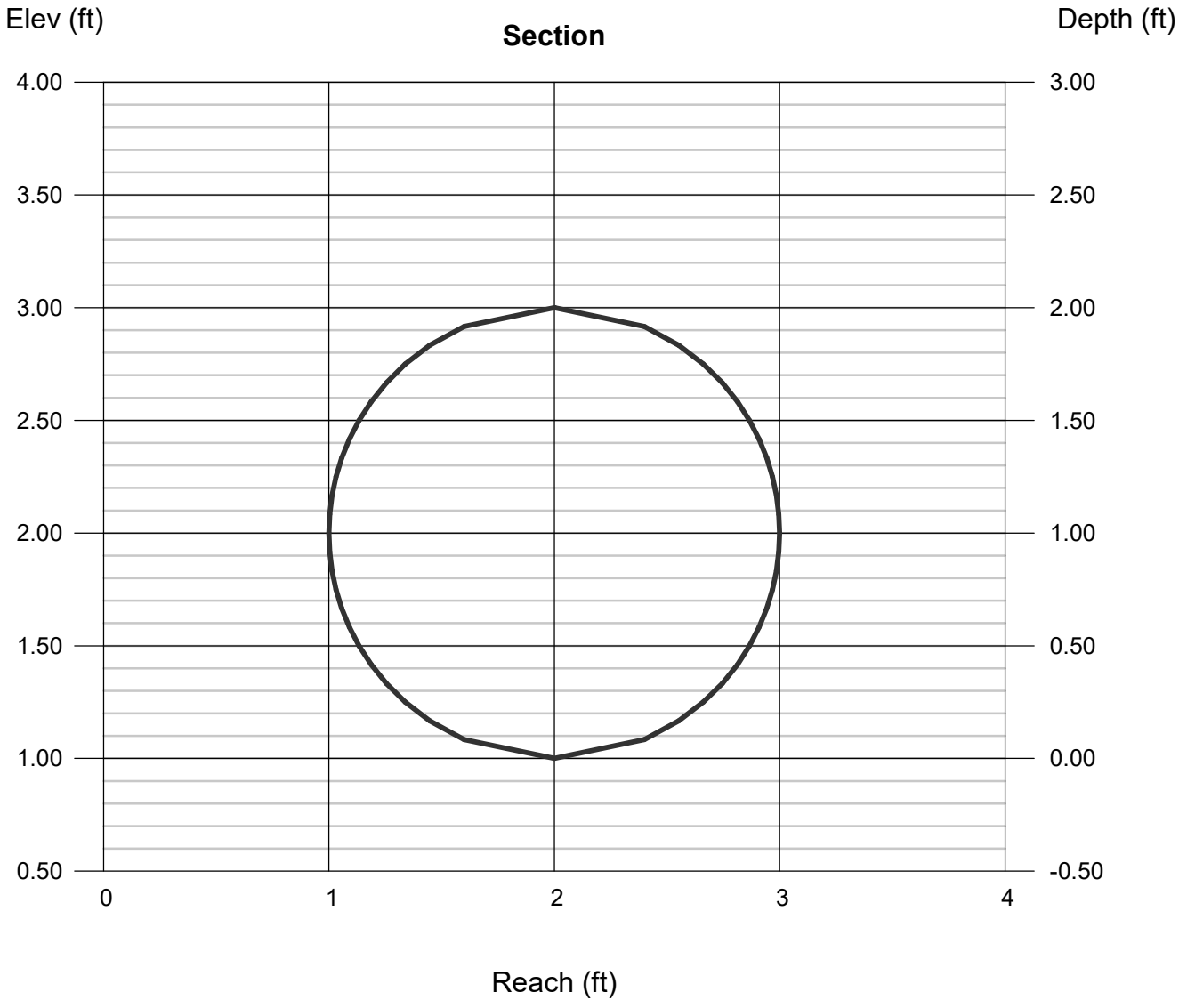
Diameter (ft)	= 2.00
Invert Elev (ft)	= 1.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 2.00

Highlighted

Depth (ft)	= 2.00
Q (cfs)	= 15.99
Area (sqft)	= 3.14
Velocity (ft/s)	= 5.09
Wetted Perim (ft)	= 6.28
Crit Depth, Yc (ft)	= 1.44
Top Width (ft)	= 0.00
EGL (ft)	= 2.40



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Sunday, Aug 17 2025

EX H12

Circular

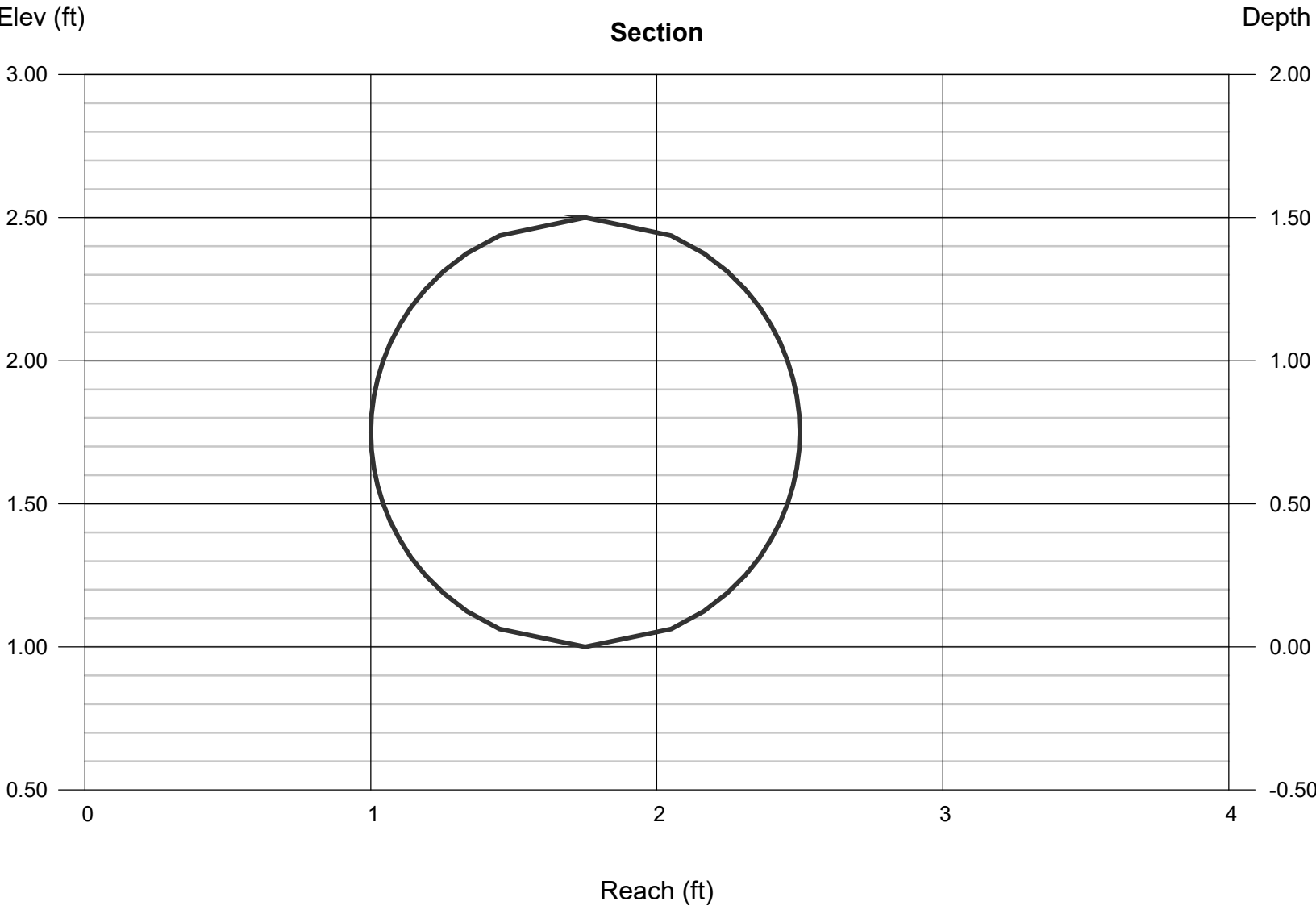
Diameter (ft)	= 1.50
Invert Elev (ft)	= 1.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 1.50

Highlighted

Depth (ft)	= 1.50
Q (cfs)	= 7.425
Area (sqft)	= 1.77
Velocity (ft/s)	= 4.20
Wetted Perim (ft)	= 4.71
Crit Depth, Yc (ft)	= 1.06
Top Width (ft)	= 0.00
EGL (ft)	= 1.77



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Sunday, Aug 17 2025

EX H13

Circular

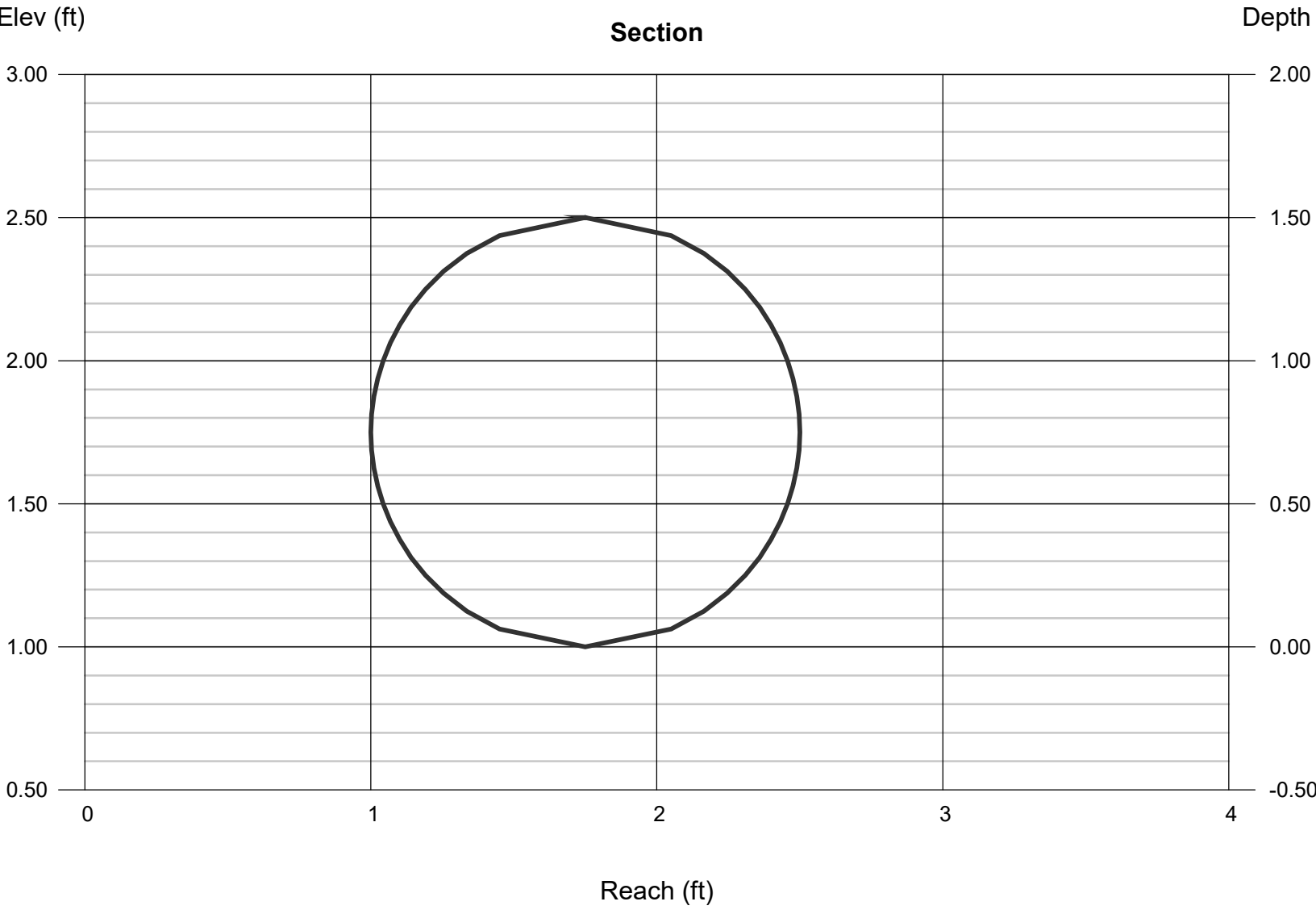
Diameter (ft)	= 1.50
Invert Elev (ft)	= 1.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 1.50

Highlighted

Depth (ft)	= 1.50
Q (cfs)	= 7.425
Area (sqft)	= 1.77
Velocity (ft/s)	= 4.20
Wetted Perim (ft)	= 4.71
Crit Depth, Yc (ft)	= 1.06
Top Width (ft)	= 0.00
EGL (ft)	= 1.77



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Sunday, Aug 17 2025

EX H14

Circular

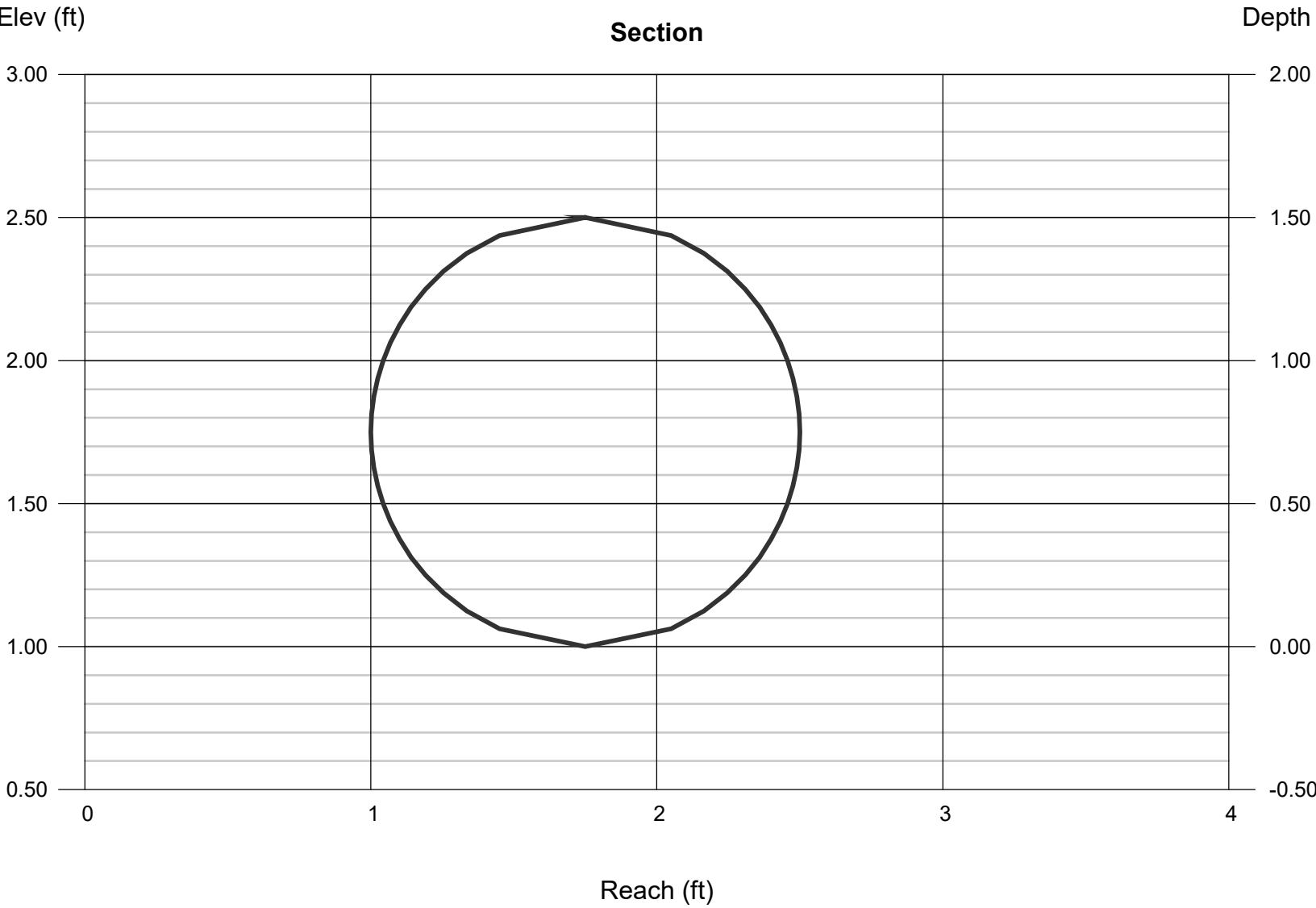
Diameter (ft)	= 1.50
Invert Elev (ft)	= 1.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 1.50

Highlighted

Depth (ft)	= 1.50
Q (cfs)	= 7.425
Area (sqft)	= 1.77
Velocity (ft/s)	= 4.20
Wetted Perim (ft)	= 4.71
Crit Depth, Yc (ft)	= 1.06
Top Width (ft)	= 0.00
EGL (ft)	= 1.77



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Sunday, Aug 17 2025

EX H15

Circular

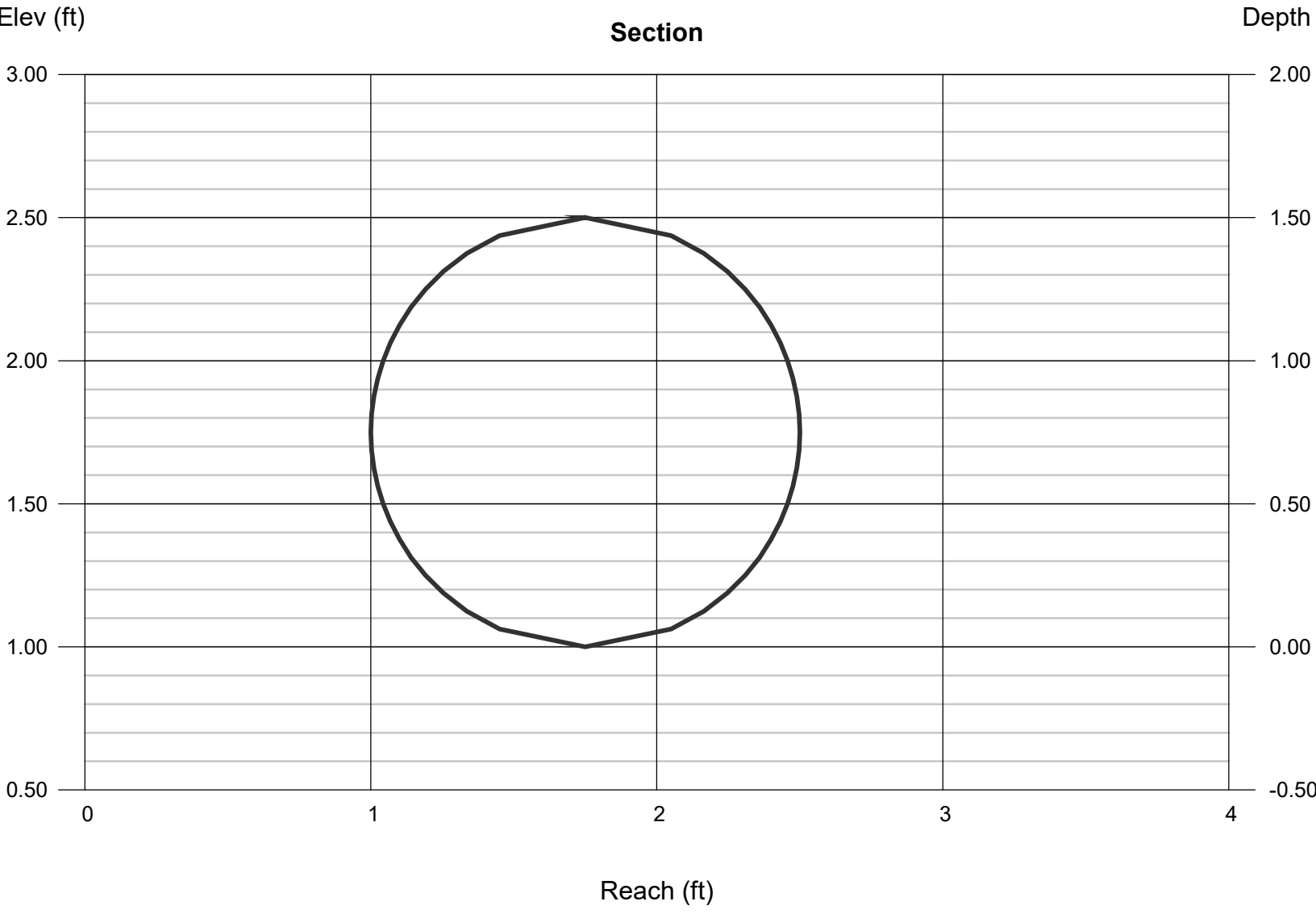
Diameter (ft)	= 1.50
Invert Elev (ft)	= 1.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 1.50

Highlighted

Depth (ft)	= 1.50
Q (cfs)	= 7.425
Area (sqft)	= 1.77
Velocity (ft/s)	= 4.20
Wetted Perim (ft)	= 4.71
Crit Depth, Yc (ft)	= 1.06
Top Width (ft)	= 0.00
EGL (ft)	= 1.77



Channel Report

EX H16

Circular

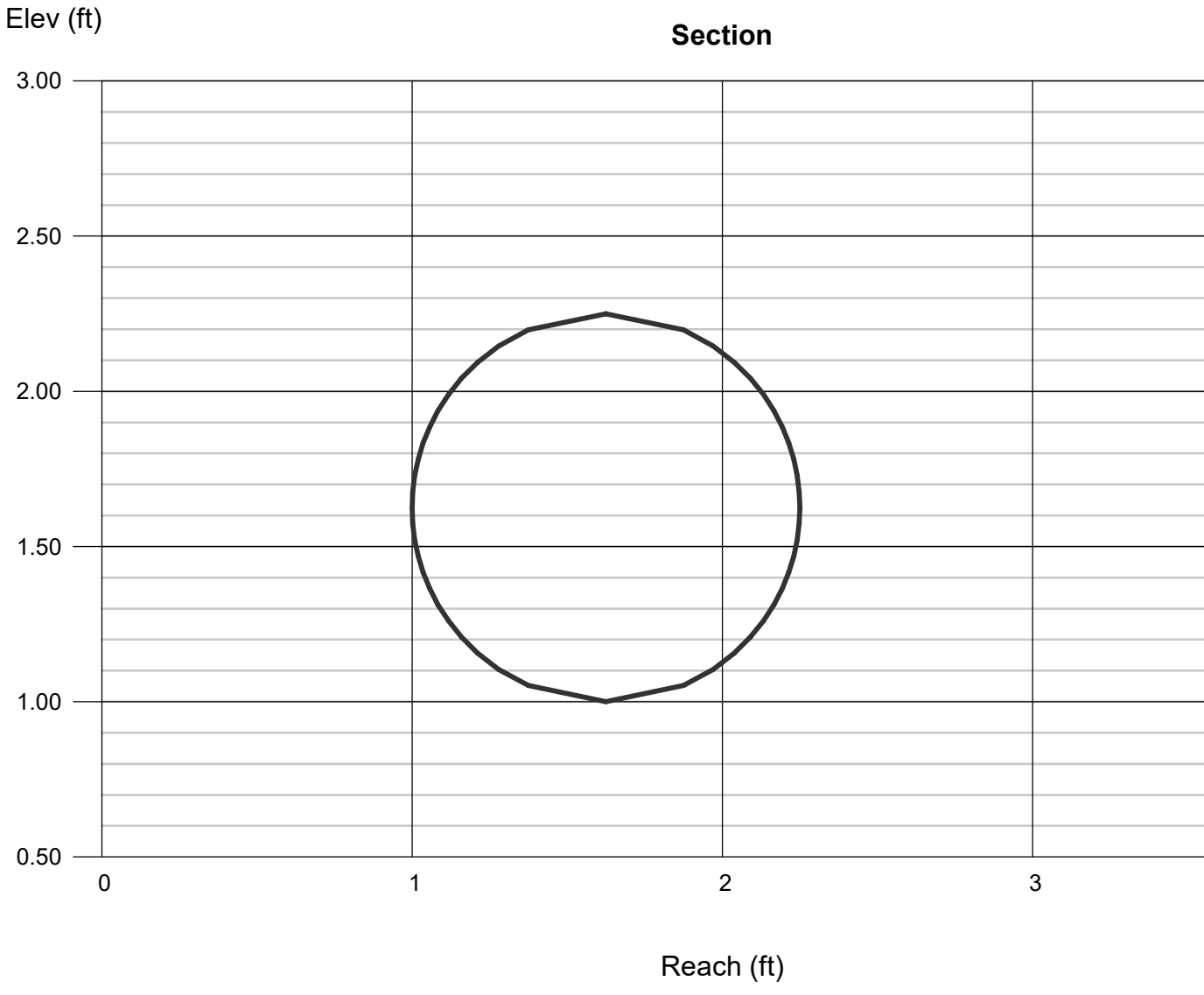
Diameter (ft)	= 1.25
Invert Elev (ft)	= 1.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 1.25

Highlighted

Depth (ft)	= 1.25
Q (cfs)	= 4.566
Area (sqft)	= 1.23
Velocity (ft/s)	= 3.72
Wetted Perim (ft)	= 3.93
Crit Depth, Yc (ft)	= 0.87
Top Width (ft)	= 0.00
EGL (ft)	= 1.47



Channel Report

EX K1

Circular

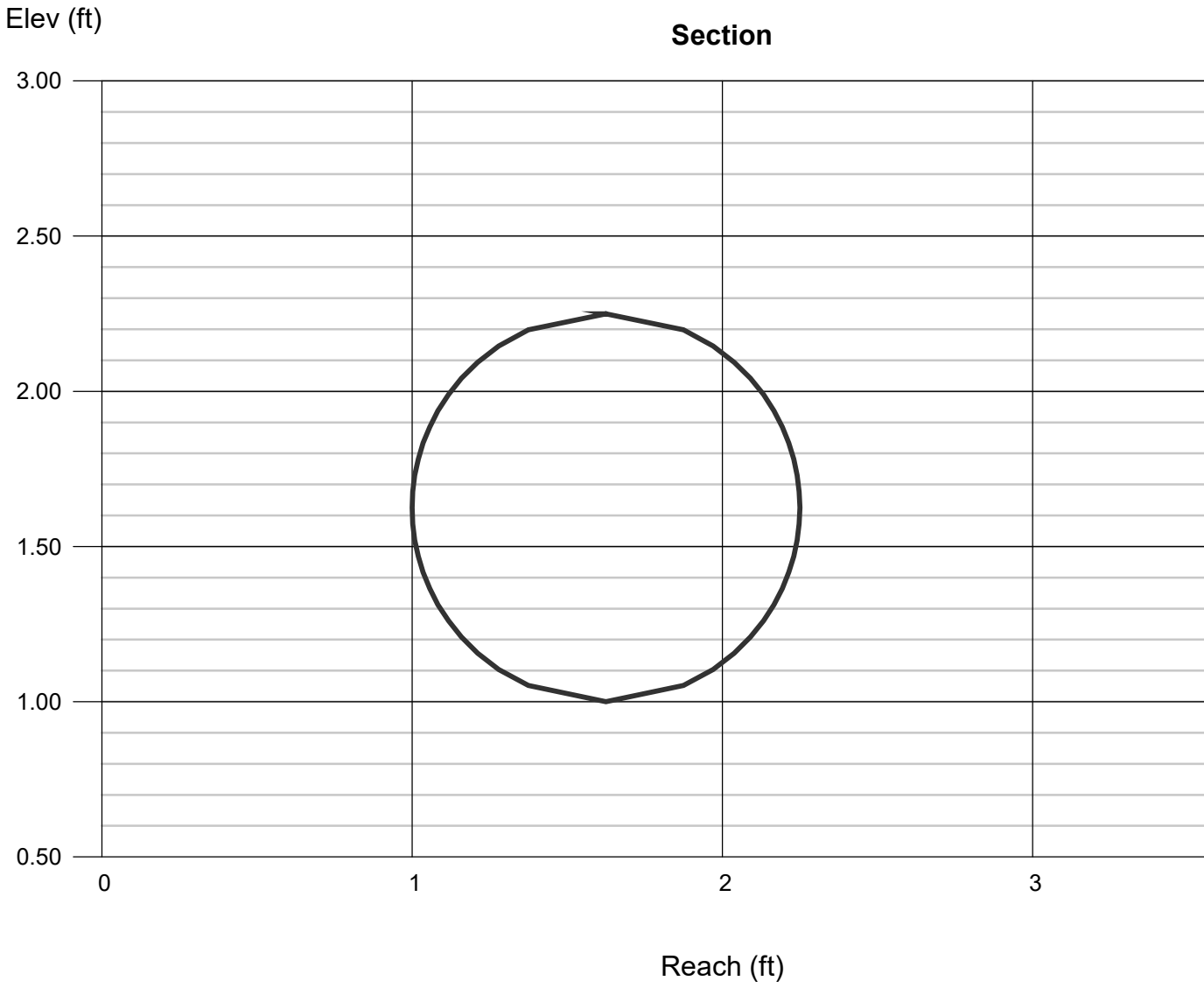
Diameter (ft)	= 1.25
Invert Elev (ft)	= 1.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 1.25

Highlighted

Depth (ft)	= 1.25
Q (cfs)	= 4.566
Area (sqft)	= 1.23
Velocity (ft/s)	= 3.72
Wetted Perim (ft)	= 3.93
Crit Depth, Yc (ft)	= 0.87
Top Width (ft)	= 0.00
EGL (ft)	= 1.47



Channel Report

EX K2

Circular

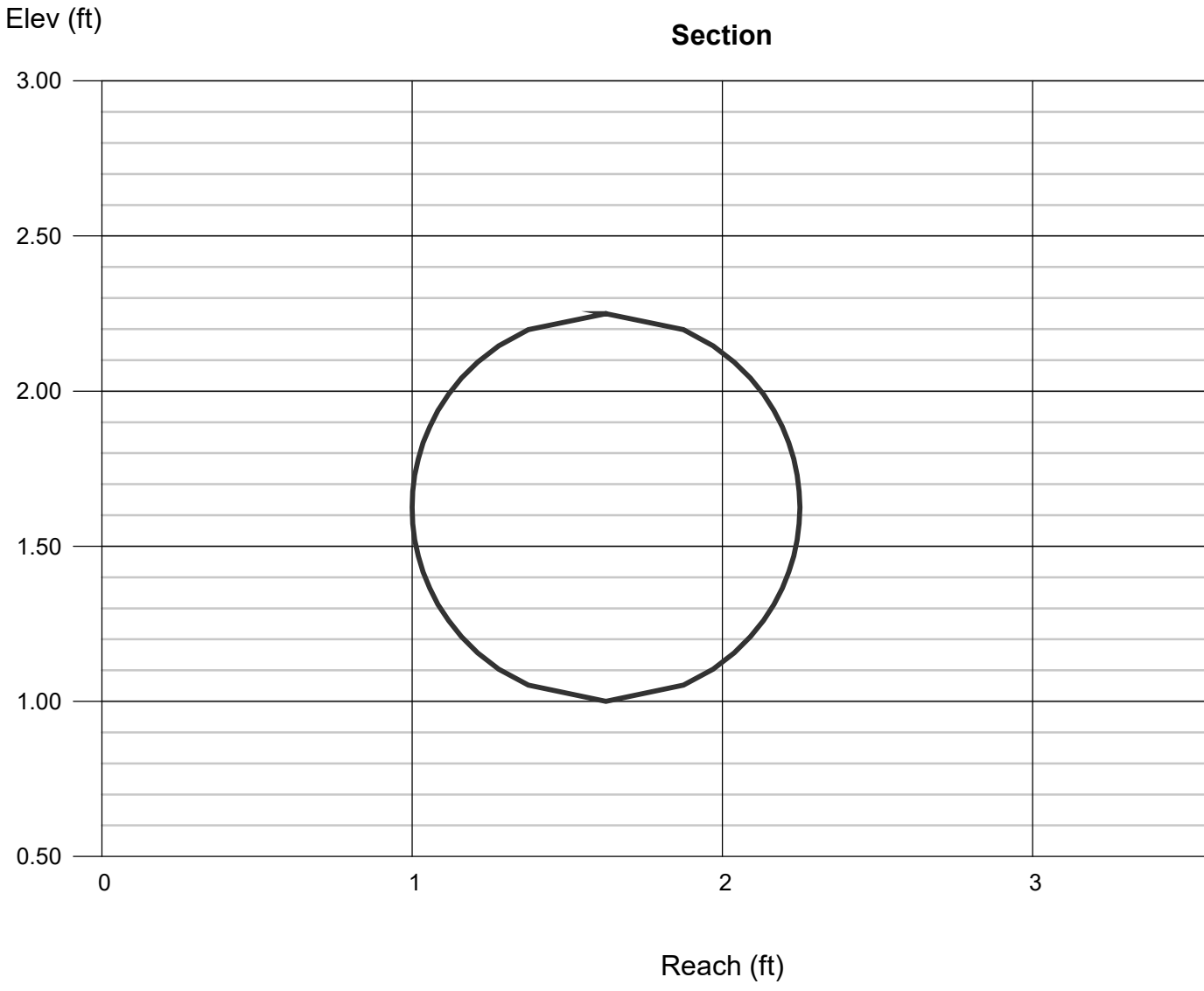
Diameter (ft)	= 1.25
Invert Elev (ft)	= 1.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 1.25

Highlighted

Depth (ft)	= 1.25
Q (cfs)	= 4.566
Area (sqft)	= 1.23
Velocity (ft/s)	= 3.72
Wetted Perim (ft)	= 3.93
Crit Depth, Yc (ft)	= 0.87
Top Width (ft)	= 0.00
EGL (ft)	= 1.47



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Sunday, Aug 17 2025

EX P1

Circular

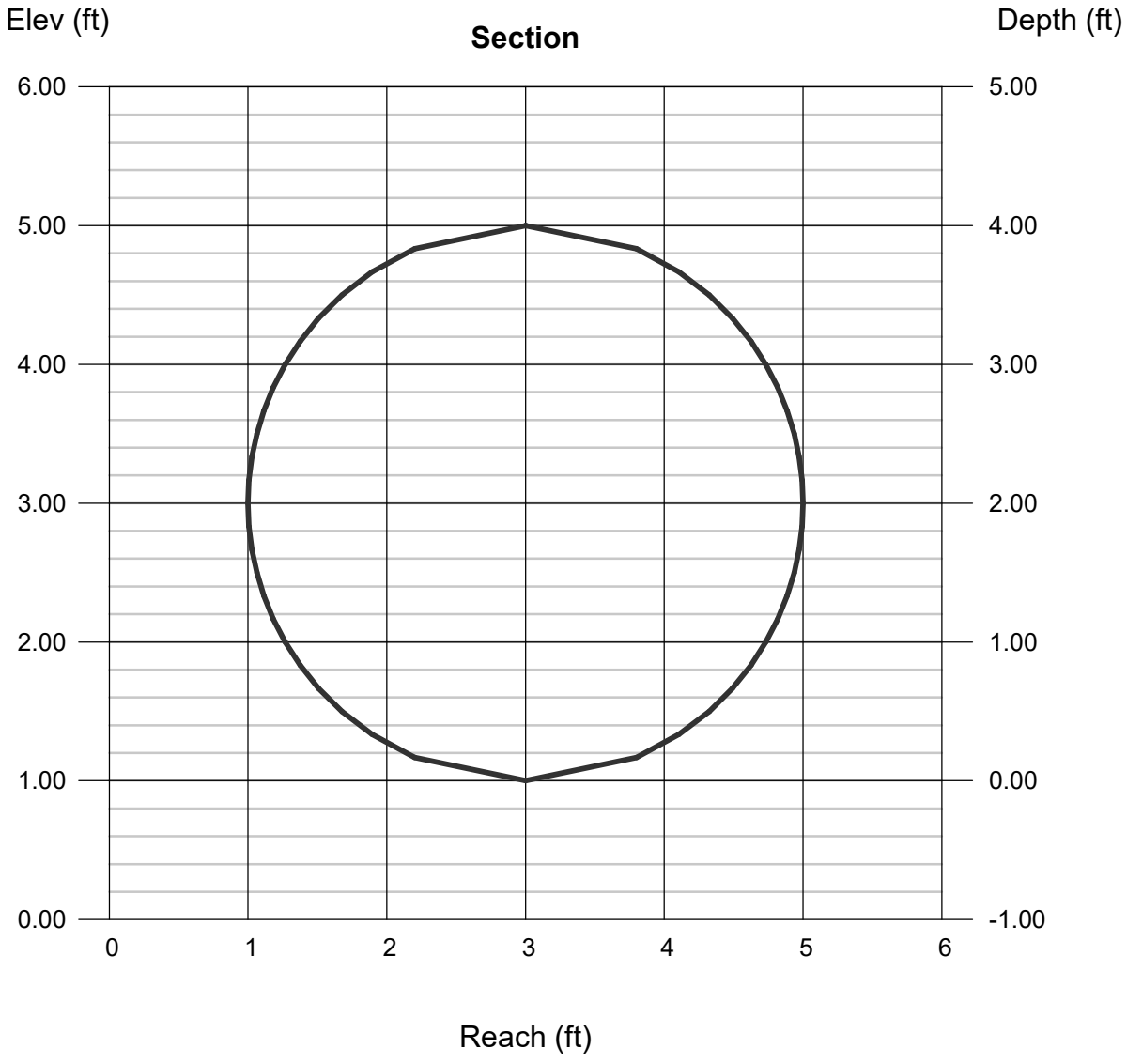
Diameter (ft)	= 4.00
Invert Elev (ft)	= 1.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 4.00

Highlighted

Depth (ft)	= 4.00
Q (cfs)	= 101.57
Area (sqft)	= 12.57
Velocity (ft/s)	= 8.08
Wetted Perim (ft)	= 12.57
Crit Depth, Yc (ft)	= 3.06
Top Width (ft)	= 0.00
EGL (ft)	= 5.02



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Oct 27 2025

EX P2

Circular

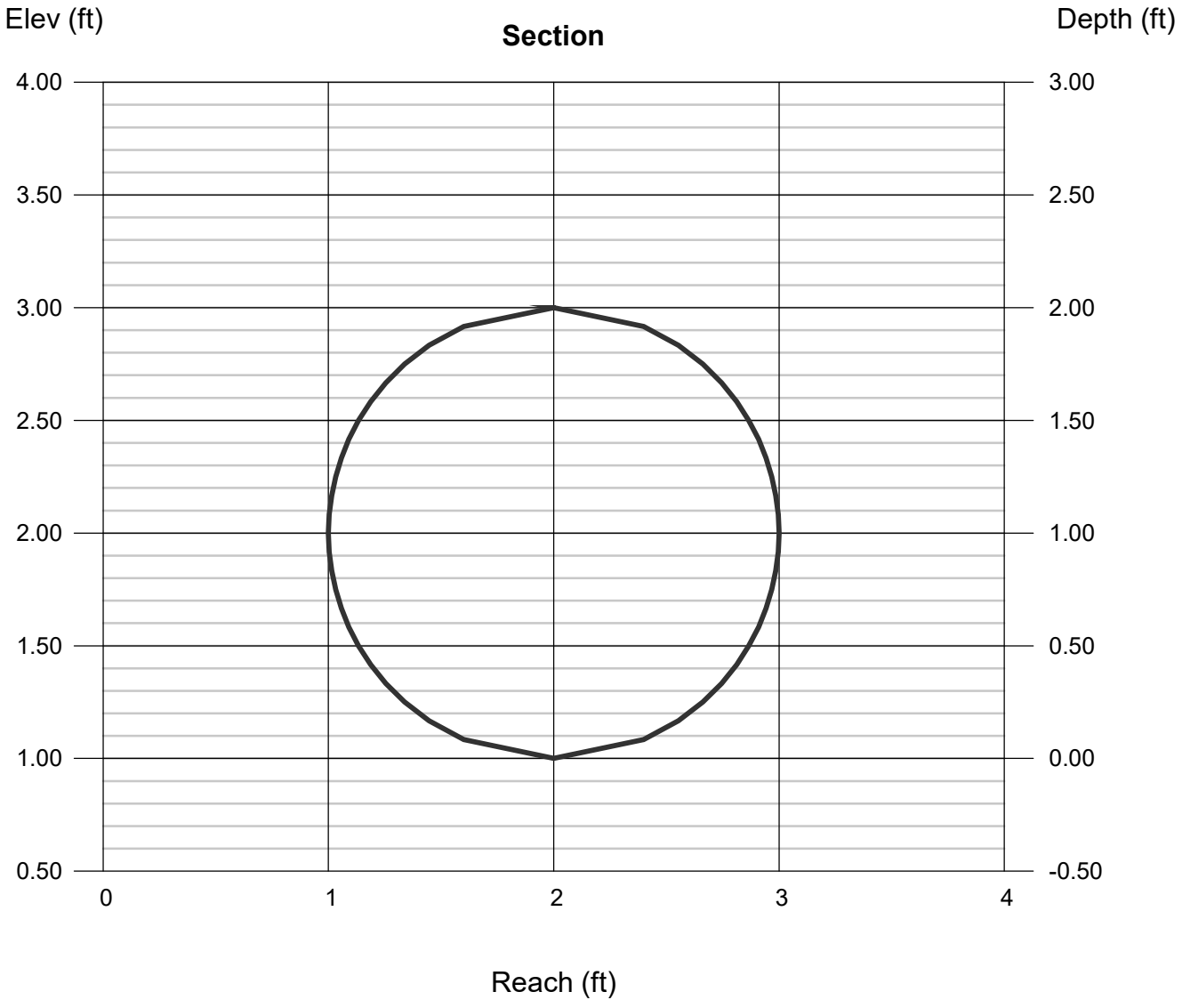
Diameter (ft)	= 2.00
Invert Elev (ft)	= 1.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 2.00

Highlighted

Depth (ft)	= 2.00
Q (cfs)	= 15.99
Area (sqft)	= 3.14
Velocity (ft/s)	= 5.09
Wetted Perim (ft)	= 6.28
Crit Depth, Yc (ft)	= 1.44
Top Width (ft)	= 0.00
EGL (ft)	= 2.40



P:\Projects\2024\856_@ Palm Ave Complete Multimodal Corridor\CAD\Exhibits\856_Storm Drain Exhibit.dwg Plot: Joey Watson Date: 9/18/2025 3:35:38 PM

R/W

R/W

D1

Capacity: Moderate exceedance
Condition: None reported

D3

Capacity: Minor exceedance
Condition: None reported

HWY 75

SEE SHEET 2

Capacity: Moderate exceedance
Condition: Moderate deficiencies

D2

Capacity: Moderate exceedance
Condition: Moderate deficiencies

D5

D4

Not a part of the project.

R/W

D7

Capacity: Adequate
Condition: None reported

D8

Capacity: Moderate exceedance
Condition: Clogged

R/W

D6

Not a part of the project.

RAINBOW DR

0' 20' 40'

SCALE 1" = 20'

N

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PALM AVE COMPLETE MULTIMODAL CORRIDOR
STORM DRAIN SYSTEM D

9/18/2025

P:\Projects\2024\4856_JB Palm Ave Complete Multimodal Corridor\CAD\Exhibits\SDS_Storm Drain Exhibit.dwg Plot: Joey Watson Date: 9/18/2025 3:36:42 PM

SEE SHEET 1

R/W

HWY 75

D10

Capacity: Adequate
Condition: Clogged

D9

Capacity: Minor exceedance
Condition: Clogged, moderate deficiencies

R/W

0' 20' 40'

SCALE 1" = 20'

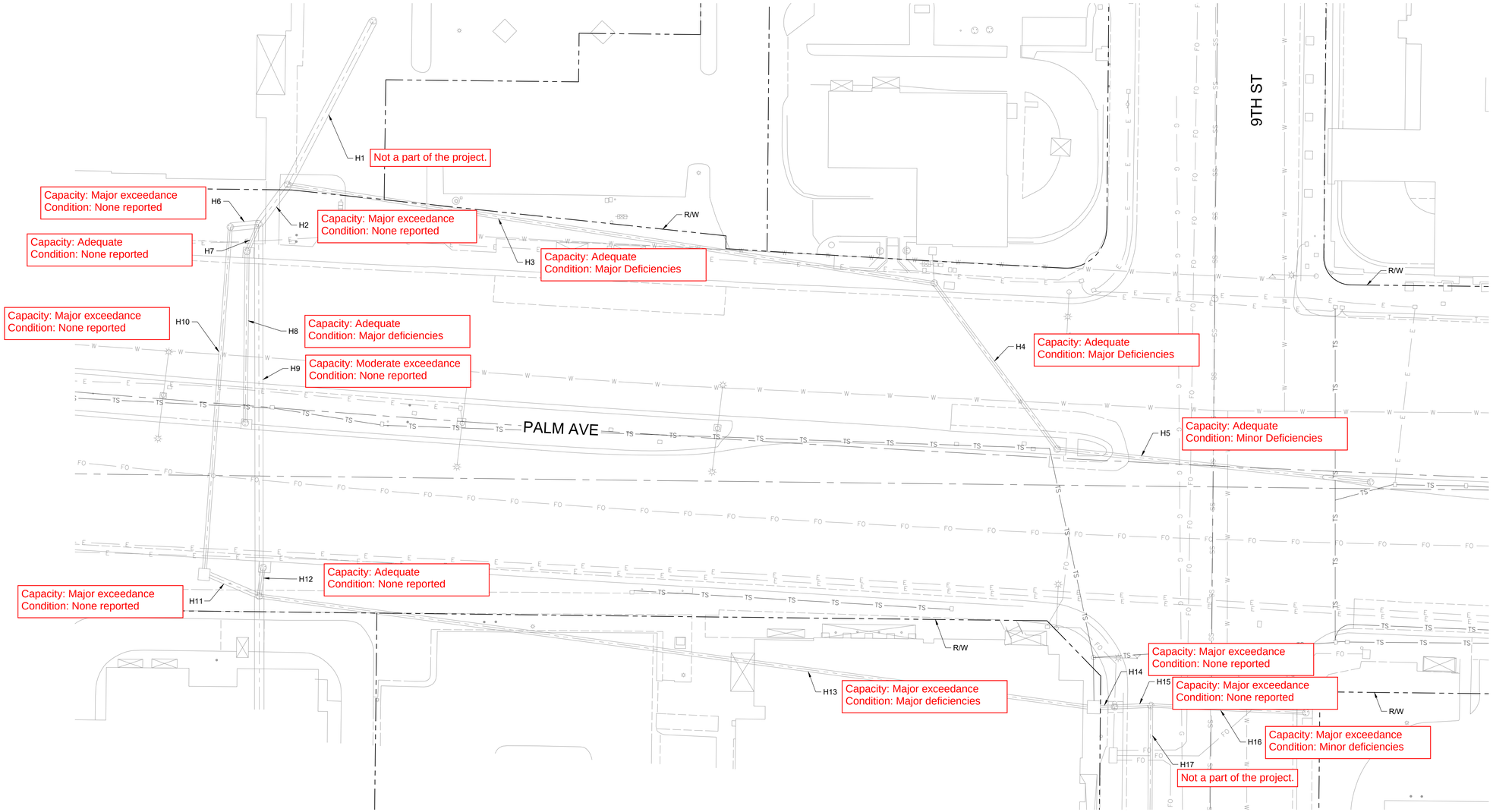
N

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PALM AVE COMPLETE MULTIMODAL CORRIDOR
STORM DRAIN SYSTEM D

9/18/2025

P:\Projects\2024\856_08 Palm Ave Complete Multimodal Corridor\CAD\Exhibits\850_Storm Drain Exhibit.dwg Plot: Joey Watson Date: 9/18/2025 3:26:18 PM



0' 20' 40'
SCALE 1" = 20'

N

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PALM AVE COMPLETE MULTIMODAL CORRIDOR
STORM DRAIN SYSTEM H

9/18/2025

P:\Projects\2024\856_08 Palm Ave Complete Multimodal Corridor\CAD\Exhibits\856_Storm Drain Exhibit.dwg Plot: Joey Watson Date: 9/18/2025 3:36:48 PM

11TH ST

FLORIDA ST

PALM AVE

R/W

Not a part of the project.

K4

K5

Not a part of the project.

K1

Capacity: Major exceedance
Condition: Moderate deficiencies

K6

Not a part of the project.

K7

Not a part of the project.

Capacity: Major exceedance
Condition: None reported

K2

K3

0' 20' 40'

SCALE 1" = 20'

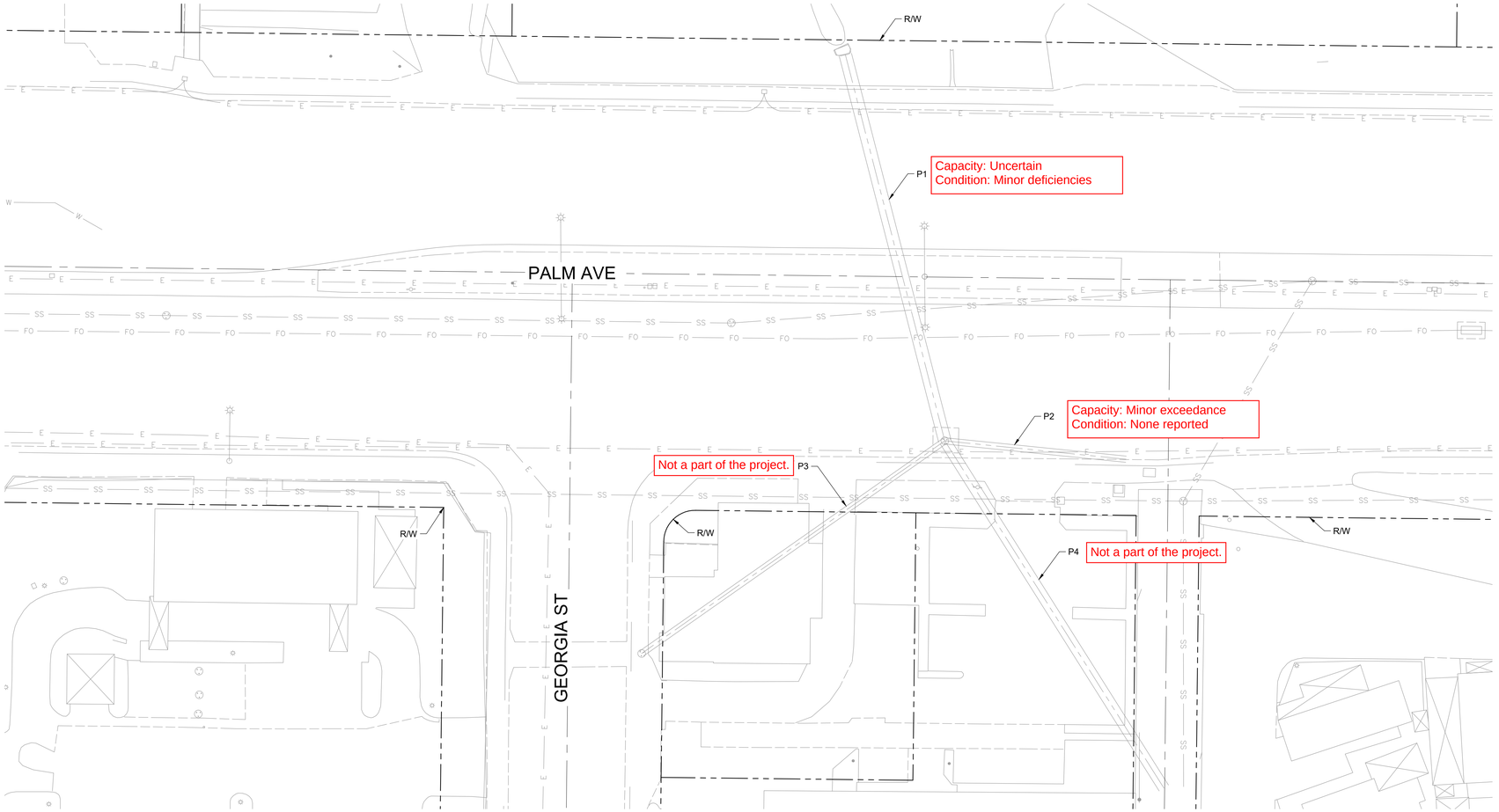
N

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PALM AVE COMPLETE MULTIMODAL CORRIDOR
STORM DRAIN SYSTEM K

9/18/2025

P:\Projects\2024\8766_IB Palm Ave Complete Multimodal Corridor\CAD\Exhibits\SW_Storm Drain Exhibit.dwg Plot: Joey Watson Date: 9/18/2025 3:26:49 PM



0' 20' 40'
SCALE 1" = 20'

N

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PALM AVE COMPLETE MULTIMODAL CORRIDOR
STORM DRAIN SYSTEM P

9/18/2025