U-Stor-It Sorrento Valley Drainage Study

11391 Sorrento Valley Rd.
San Diego, CA 92121

Date Prepared:
September 27, 2021

Prepared for:
Chicago Capitol Funds, LLC
501 W. Broadway STE 2020
San Diego, CA 92101

Prepared By:

ΩMEGA
ENGINEERING CONSULTANTS
4340 Viewridge Ave, Suite B
San Diego, CA 92113
Ph: (858) 634-8620

Declaration of Responsible Charge:
I hereby declare that I am the engineer of work for this project, that I have exercised responsible charge over the design of the project as defined in section 6703 of the business and professions code, and that the design is consistent with current standards. I understand that the check of the project drawings and specifications by the City of San Diego is confined to a review only and does not relieve me, as an engineer of work, of my responsibilities for project design.

Patric de Boer

Patric T. de Boer RCE 83583
Registration Expires 3-31-2023

PATRIC T DEBOER
No.83583
CIVIL

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Appendices

Site & Project Description

This drainage study has been prepared for the proposed commercial development at 11391 Sorrento Valley Rd., San Diego, CA 92121. The project site is currently occupied by a single-story commercial building and asphalt parking lot. The site is located approximately 0.5 miles north from the intersection between Interstate 5 and Interstate 805. See figure No. 1 for a Vicinity Map.

The project will involve the demolition of the existing commercial development and the construction of a self-storage facility along with its corresponding improvements. The self-storage facility will consist of two stories above grade and three subterranean levels. The self-storage facility will occupy the majority of the site. Landscape areas, driveways and a biofiltration facility are part of the proposed site improvements. The total area of analysis is 1.60 acres.

The proposed project will be built with its corresponding private storm drain system. A lined biofiltration basin will be constructed for stormwater treatment purposes. The treatment properties of the facility are detailed in a separate Stormwater Quality Report (SWQMP).

Methodology

The Modified Rational Method was used to determine the peak flowrates generated by the existing and proposed site conditions. The flowrates generated by sub-basins were confluence according to the junction equations as detailed on page 3-24 of the San Diego County Hydrology Manual.

The proposed storm drain pipes and channels were sized using Manning's Equation as specified for circular on page 7-78 & 7-18 of *The Handbook of Hydraulics,* by Brater & King.

The initial time of concentration (Ti) and maximum overland flow length (Lm) were determined using Table 3-2 of the Hydrology Manual included as Appendix 6 on this report.

The 100-yr, 6-hr storm depth (P_6) was determined using the isopluvial map included as Appendix 2 of this report.

The total time of concentration was determined by adding the Ti value to the travel time (Tt). Tt for surface flow on an asphalt swale was determined by modeling the approximate existing grades of the existing parking lot using Hydraflow Express to determine a velocity. Tt for proposed ribbon gutter was also determined modeling the proposed gutter using Hydraflow Express to determine a velocity. See Appendix 7 for Hydraflow Exhibits. Then the length of flow was divided by the flow velocity to determine Tt.

$$\mathbf{Tc = Ti+Tt}$$

The Tc and the P_6 values were entered into the peak intensity formula from page 3-7 of the hydrology manual to determine the intensity of the rainfall during the peak of the 100-year, 6-hr storm.

$$\mathbf{I = 7.44 \times P_6 \times Tc^{-0.645}}$$

The peak discharge rate was determine using the Rational Method Formula.

$$Q = C \times I \times A$$

See the attached calculations for particulars. The following references have been used in preparation of this report:

(1) Handbook of Hydraulics, E.F. Brater & H.W. King, 6th Ed., 1976.
(2) County of San Diego Hydrology Manual, 2003
(3) Modern Sewer Design, American Iron & Steel Institute, 1st Ed., 1980

Existing Conditions

The existing site is currently occupied by a single-story commercial building and asphalt parking lot. The project area is 83% impervious with a general slope between 1% and 5%. The site receives offsite runoff from the southerly development and a portion of landscape along the easterly boundary line.

The offsite runoff generated by the southerly property drains via an asphalt swale into the onsite parking lot where it comingles with onsite flow. The portion of landscape on the easterly boundary line sheet flows to the onsite flow on the onsite parking lot.

The entire site drains from the easterly portion of the site towards the westerly driveway via surface flow. The runoff then drains to the gutter on Sorrento Valley Road. This point is referred to as Discharge Point # 1 in this report.

Proposed Conditions

The project proposes to construct a self-storage facility with two stories above grade and three subterranean levels along with its corresponding improvements. The site was analyzed as two onsite drainage basins that encompass the entire building, landscape and hardscape. The site will modify the drainage system but will keep the same discharge point as the existing conditions.

The runoff generated from the westerly portion of the roof from the self-storage facility will drain towards the west directly to a lined biofiltration basin. The northerly and easterly portions of the site will drain to a series of grated inlets along the gutter on the northerly drive aisle. The collected stormwater will drain via pipe flow to a 36-inch precast box inside the lined biofiltration facility. The southerly portion of the site will drain via gutter flow on the southerly drive aisle into a trench drain that will be connected to the lined biofiltration basin. After treatment, the stormwater discharges to the gutter on Sorrento Valley Rd. via a curb outlet. This point is referred as Discharge Point # 1 in this report.

The offsite flow generated by the southerly property will be bypassed via a brow ditch along the southerly property line and drain on a F-type catch basin, thence to a curb outlet and ultimately on the gutter along Sorrento Valley Rd. The offsite flow travels north approximately 180 feet towards Discharge Point # 1.

Existing Rational Analysis

The existing site is modeled as one onsite and one offsite basin. The existing basins are referred as E-1 and O-1 in this report. The average slope of the basin is 3.0%. The weighted runoff coefficient is 0.82.

Below is a summary of the input data and the resulting flowrates for the 100-year, 6- hour storm.

Existing Rational Calculation Summary

Basin	Impervious %	C	I_{100} (in/hr)	Area (ac)	Q_{100} (cfs)	DP-#
E-1	83%	0.81	6.59	1.50	7.98	DP-1
O-1	73%	0.75	6.59	0.10	0.49	
		Confluence Flow = 8.46 cfs				

The confluence peak runoff flowrate for Discharge Point #1 is 8.46 cfs.

Proposed Rational Analysis

The proposed site was modeled as a two onsite and one offsite basin. The proposed basins are referred to as P-1, P-2 and O-1 in this report. The average slope of the basin is 3.7%. The weighted runoff coefficient is 0.80.

Proposed Rational Calculation Summary

Basin	Impervious %	C	I_{100} (in/hr)	Area (ac)	Q_{100} (cfs)	DP-#
P-1	86%	0.82	6.59	1.45	7.85	DP-1
P-2	0%	0.35	6.59	0.05	0.11	
O-1	73%	0.75	6.59	0.10	0.49	

Below is a summary of the proposed confluence flow calculations.

Proposed Flow Junction Calculation Summary

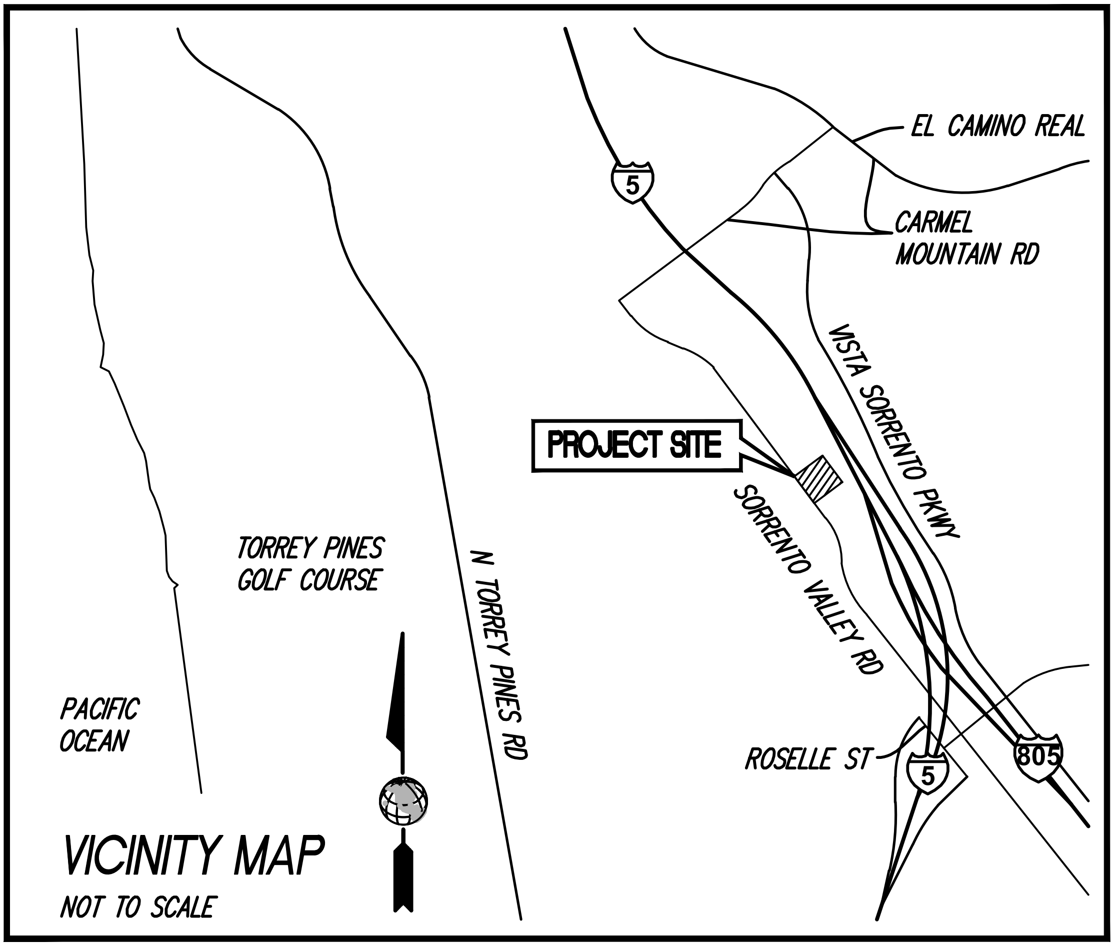
Confluenced Pt.	Tributary Flows	I_{100} (in/hr)	Tc (mins)	Q_{100} (cfs)	Confluenced Flow (cfs)
CP-1	P-2	6.59	5.0	0.11	0.60
	O-1	6.59	5.0	0.49	
DP-1	CP-1	6.59	5.0	0.60	8.45
	P-1	6.59	5.0	7.85	

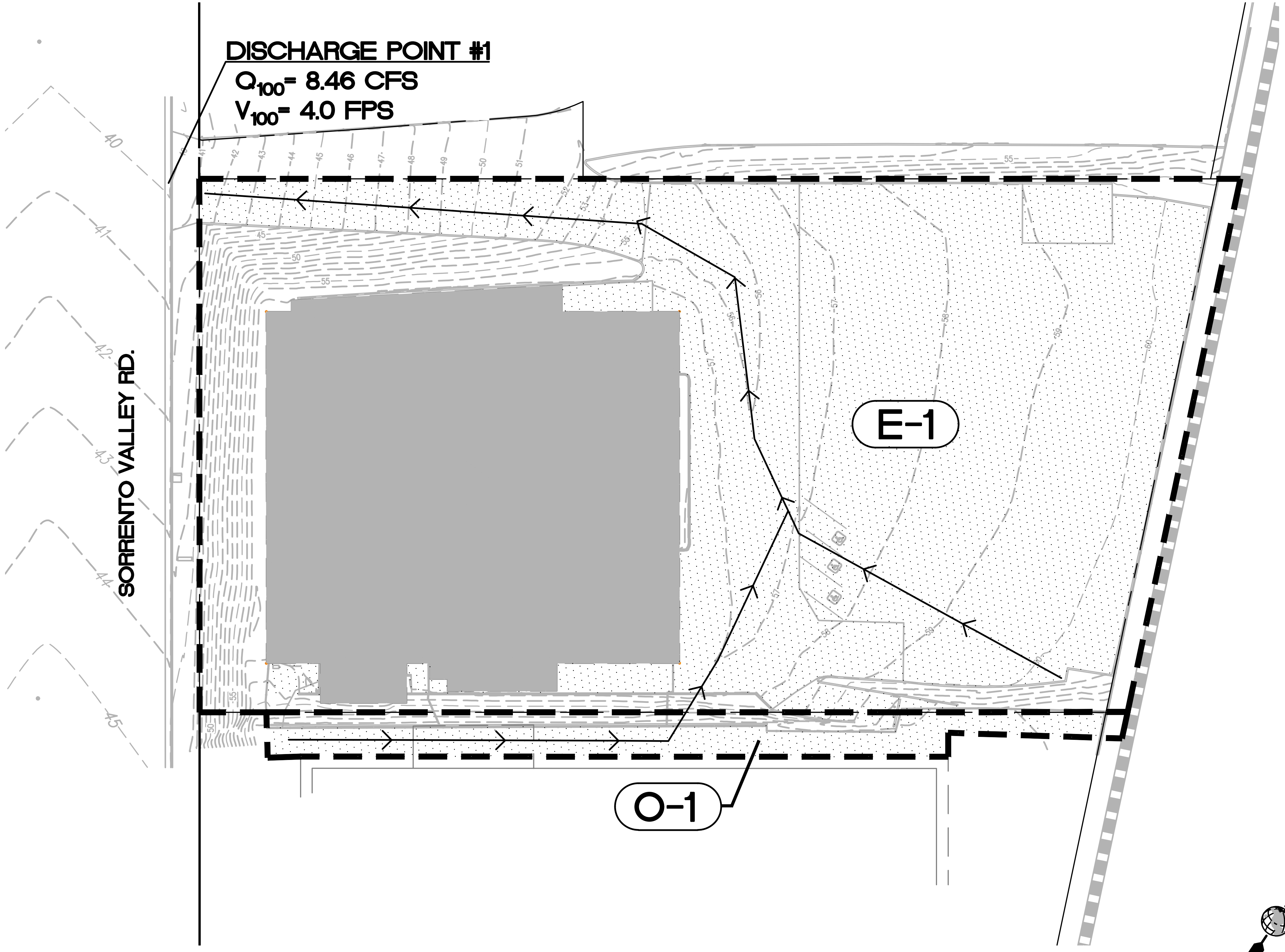
The confluence peak flowrate for Discharge Point #1 is 8.45 cfs for the 100-yr storm event. See the attached calculations for details.

Results and Conclusions

The proposed improvements result in a decrease of generated runoff during the peak of the 100-year, 6-hr storm. The result is a peak storm water flowrate that is less than the existing conditions by 0.01 cfs.

Project does not propose to discharge fill or dredged materials to the Waters of the State, therefore no CWA 401 or 404 permit is required. It is the opinion of Omega Engineering Consultants that the project will not cause adverse effects to the downstream facilities or receiving waters. A separate Storm Water Quality Management Plan has been prepared to discuss the water quality impacts for the proposed development.


EL CAMINO REAL
5
CARMEL
MOUNTAIN RD
VISTA SORRENTO PKWY
PROJECT SITE
SORRENTO VALLEY RD
TORREY PINES
GOLF COURSE
N TORREY PINES RD
PACIFIC
OCEAN
ROSELLE ST
5
805
VICINITY MAP
NOT TO SCALE



LEGEND

BASIN NUMBER	E-#
AREA LIMITS	— — —
DRAINAGE FLOW PATH	→
BUILDING AREA	■
PAVEMENT AREA	▒
PERVIOUS AREA	☐

DRAINAGE BASIN DATA

BASIN #	AREA (AC)	C-VALUE	T_C (MINS)	I_{100} (IN/HR)	Q_{100} (CFS)
E-1	1.50	0.81	5.0	6.59	7.97
O-1	0.10	0.75	5.0	6.59	0.49

AREAS TABLE

BASIN #	IMPERVIOUS AREA (SF)	IMPERVIOUS %	PERVIOUS AREA (SF)	PERVIOUS %
E-1	65,246	83	10,869	17
O-1	4,271	73	1,135	27
			TOTAL AREA (SF)	69,517

U-STOR IT
SORRENTO VALLEY
EXISTING HYDROLOGY
EXHIBIT

GRAPHICAL SCALE: 1" = 40'

0 20 40 80

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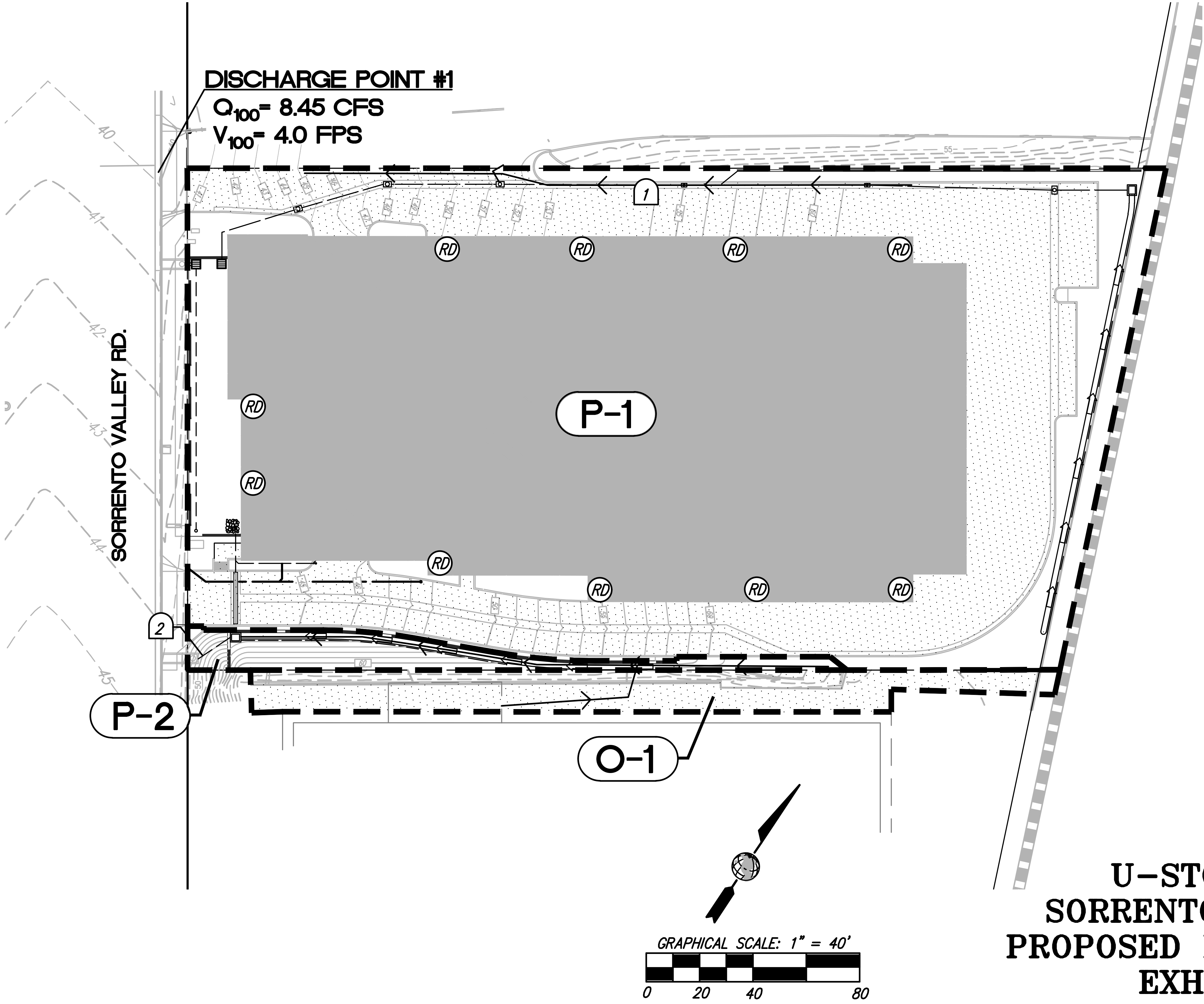
EX. HYDROLOGY EXHIBIT



LEGEND

BASIN NUMBER	P-#
AREA LIMITS	▬ ▬ ▬
DRAINAGE FLOW PATH	→
BUILDING AREA	▩
PAVEMENT AREA	░
PERVIOUS AREA	☐

DRAINAGE BASIN DATA

BASIN #	AREA (AC)	C-VALUE	T_C (MINS)	I_{100} (IN/HR)	Q_{100} (CFS)
P-1	1.45	0.82	5.0	6.59	7.85
P-2	0.05	0.35	5.0	6.59	0.11
O-1	0.10	0.75	5.0	6.59	0.49

ⓧ PIPE DATA

PIPE #	DIAMETER (INCHES)	SLOPE (%)	DEPTH /DIA	V_{100} (FPS)	Q_{100} (CFS)
1	12	4.9	0.47	9.93	3.60
2	8	10	0.26	8.32	0.60

AREAS TABLE

BASIN #	IMPERVIOUS AREA (SF)	IMPERVIOUS %	PERVIOUS AREA (SF)	PERVIOUS %
P-1	63,132	86	8,947	14
P-2	0	0	2,144	100
O-1	4,271	73	1,135	27
			TOTAL AREA (SF)	69,517

U-STOR IT
SORRENTO VALLEY
PROPOSED HYDROLOGY
EXHIBIT

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PROP. HYDROLOGY EXHIBIT

U-STOR-IT SORRENTO VALLEY
HYDROLOGY AND HYDRAULICS CALCS

9/27/2021

BASIN	AREA (SF)	AREA (AC)	% Imp	"C" Value
E-1	65,246	1.50	83%	0.81
O-1	4,271	0.10	73%	0.75
EX. TOTAL	**69,517**	**1.60**		
P-1	63,132	1.45	86%	0.82
P-2	2,114	0.05	0%	0.35
O-1	4,271	0.10	73%	0.75
PROP TOTAL	**69,517**	**1.60**		

Basin Confluence	Symbol
EXISTING	
(E-1 & O-1)	DP-1
PROPOSED	
(P-2 & O-1)	CP-1
(CP-1 & P-1)	DP-2

(A) ECP # - Existing Confluence Point

(B) CP # - Proposed Confluence Point

(C) C value for bare ground is 0.35 (Table 3-1 County Hydrology Manual)
(Type 'D' soil)

C value for impervious surfaces is 0.9

Basins with mixed surface type use a weighted average
of these 2 values. (impervious % x 0.9)+(pervious % x 0.35)

U-STOR-IT SORRENTO VALLEY

HYDROLOGY AND HYDRAULICS CALCS (Table No. 2)

9/27/2021

Sub-Basin	AREA Ac.	"C"	Overland flow length	Concentrated Flow Length, (ft)	S(%) (avg.)	Ti mins	Tt mins	T_c mins	I in/hr	Q cfs	NOTES 85th Percentile
E-1	1.50	0.81	400.0	310.0	5.0%	2.9	1.2	5.0	0.20	0.24	
O-1	0.10	0.75	150.0	90.0	1.0%	4.1	0.0	5.0	0.20	0.01	
								5.0	**0.20**	**0.26**	**Discharge Point-1**
P-1	1.45	0.82	270.0	170.0	7.8%	2.4	1.4	5.0	0.20	0.24	
P-2	0.05	0.35	222.0	147.0	2.3%	3.6	0.89	5.0	0.20	0.003	
O-1	0.10	0.75	60.0	90.0	1.0%	4.1	0.0	5.0	0.20	0.01	No Tt. Portions of the offsite basin sheet flow towards the landscape on P-1.
								5.0	**0.20**	**0.02**	**Confluence Point-1**
								5.0	**0.20**	**0.26**	**Discharge Point # 1**

U-STOR-IT SORRENTO VALLEY

9/27/2021

HYDROLOGY AND HYDRAULICS CALCS (Table No. 2)

Sub-Basin	AREA Ac.	"C"	Overland flow length	Concentrated Flow Length, (ft)	S(%) (avg.)	Ti mins	Tt mins	T_c mins	I in/hr	Q cfs	NOTES 100-year, 6 hr storm
											P(6) 2.5
E-1	1.50	0.81	90.0	310.0	5.0%	2.9	1.2	5.0	6.59	7.98	
O-1	0.10	0.75	60.0	90.0	1.0%	4.1	0.0	5.0	6.59	0.49	
								5.0	**6.59**	**8.46**	**Discharge Point-1**
P-1	1.45	0.82	100.0	170.0	7.8%	2.4	1.4	5.0	6.59	7.85	
P-2	0.05	0.35	75.0	147.0	2.3%	3.6	0.9	5.0	6.59	0.11	
O-1	0.10	0.75	60.0	90.0	1.0%	4.1	0.0	5.0	6.59	0.49	No Tt. Portions of the offsite basin sheet flow towards the landscape on P-1.
								5.0	**6.59**	**0.60**	**Confluence Point-1**
								5.0	**6.59**	**8.45**	**Discharge Point # 1**

CONDUIT SIZING CALCULATIONS

The following chart details the sizing parameters and for conduits that convey runoff on the site.
Flow parameters from *Handbook of Hydraulics, King & Brater* were used, see following page.

K'= Discharge factor = $(Q*n)/(d^{8/3}*s^{1/2})$
n= Mannings coefficient = 0.013 for PVC & HDPE
d=diameter of conduit (ft) = per chart
Q= Discharge = based off portions of basins tributary to outlet
s=Minimum Pipe Slope (ft/ft) = per chart
D=depth of flow = From table 7-4 of the *Handbook of Hydraulics, King & Brater* See right
C_a= Flow factor = From table 7-14 of the *Handbook of Hydraulics, King & Brater* See right
A=Cross sectional area of flow = C_a*d^2
V=Velocity = Q/A

Pipe Flow

Pipe	Tributary Areas	Q (cfs)	S (%)	d (in)	K'	D/d	C_a	A (sf)	V (fps)
1	**Northerly Portion Basin P-1**	3.60	4.9	12	0.2114	0.47	0.363	0.363	9.93
2	**Basins P-2 and O-1**	0.60	10	8	0.0727	0.26	0.162	0.072	8.32

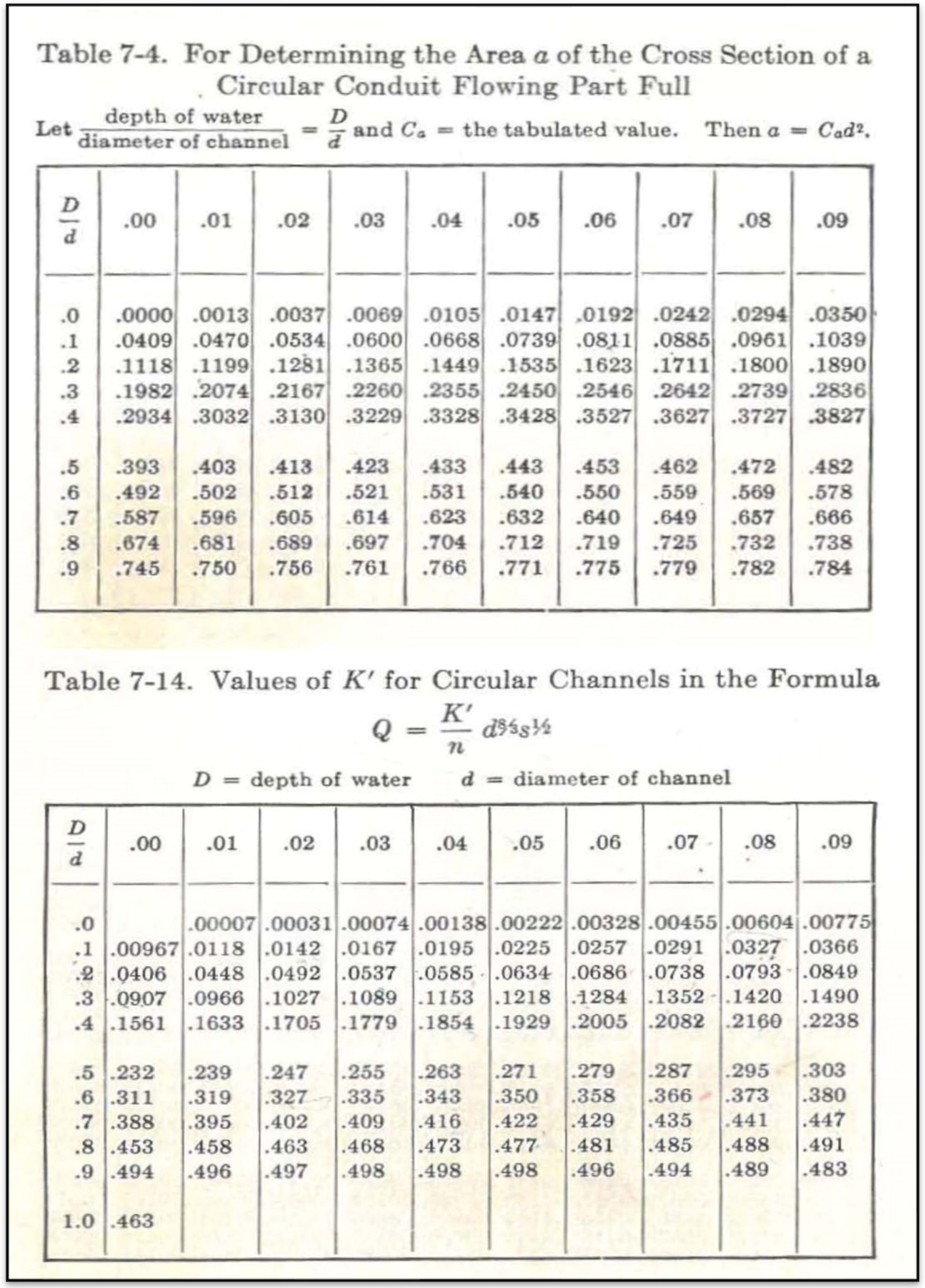


Table 7-4. For Determining the Area *a* of the Cross Section of a Circular Conduit Flowing Part Full

Let $\frac{\text{depth of water}}{\text{diameter of channel}} = \frac{D}{d}$ and C_a = the tabulated value. Then $a = C_a d^2$.

$\frac{D}{d}$	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.0000	.0013	.0037	.0069	.0105	.0147	.0192	.0242	.0294	.0350
.1	.0409	.0470	.0534	.0600	.0668	.0739	.0811	.0885	.0961	.1039
.2	.1118	.1199	.1281	.1365	.1449	.1535	.1623	.1711	.1800	.1890
.3	.1982	.2074	.2167	.2260	.2355	.2450	.2546	.2642	.2739	.2836
.4	.2934	.3032	.3130	.3229	.3328	.3428	.3527	.3627	.3727	.3827
.5	.393	.403	.413	.423	.433	.443	.453	.462	.472	.482
.6	.492	.502	.512	.521	.531	.540	.550	.559	.569	.578
.7	.587	.596	.605	.614	.623	.632	.640	.649	.657	.666
.8	.674	.681	.689	.697	.704	.712	.719	.725	.732	.738
.9	.745	.750	.756	.761	.766	.771	.775	.779	.782	.784

Table 7-14. Values of *K′* for Circular Channels in the Formula

$$Q = \frac{K'}{n} d^{8/3} s^{1/2}$$

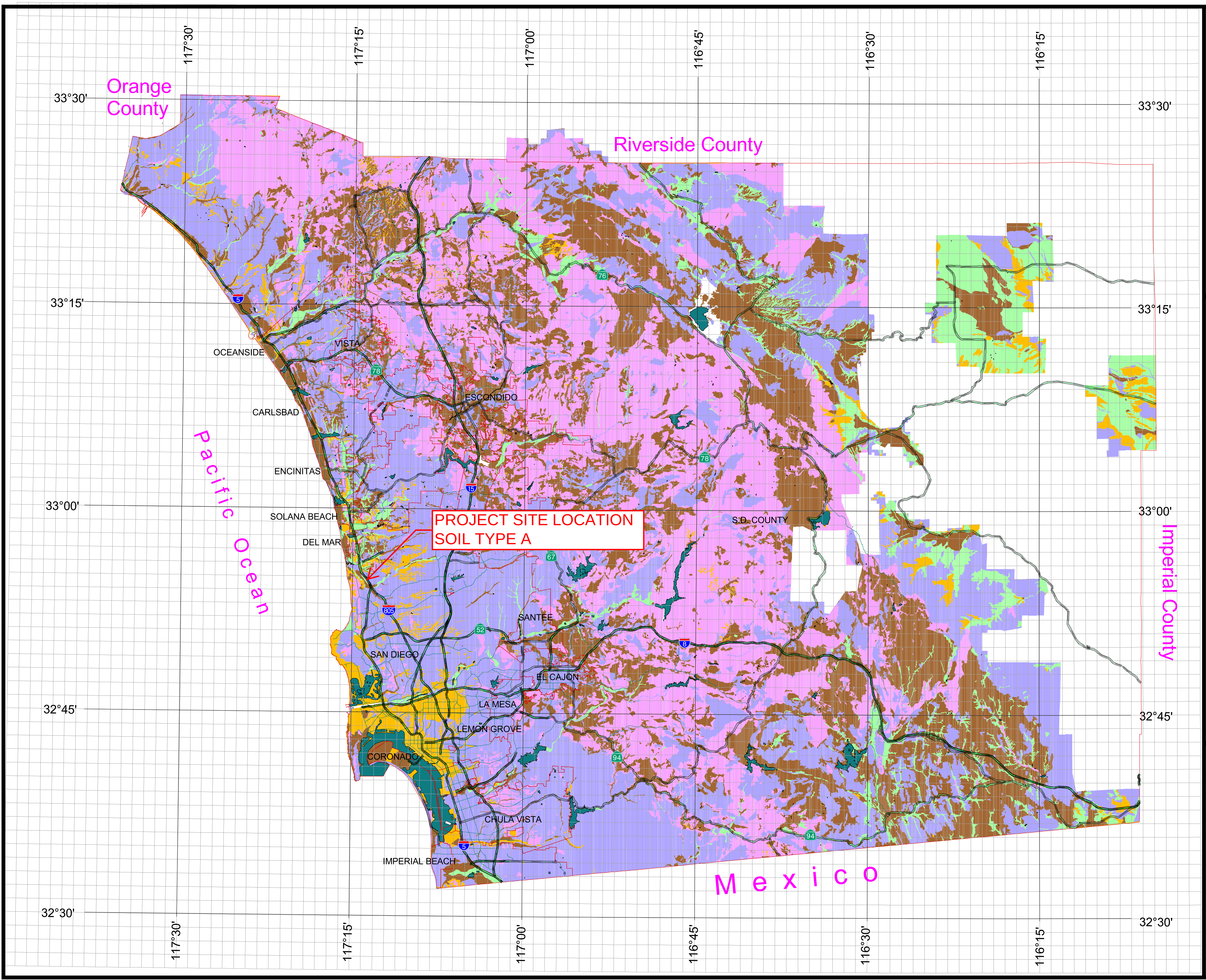
D = depth of water d = diameter of channel

$\frac{D}{d}$	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0		.00007	.00031	.00074	.00138	.00222	.00328	.00455	.00604	.00775
.1	.00967	.0118	.0142	.0167	.0195	.0225	.0257	.0291	.0327	.0366
.2	.0406	.0448	.0492	.0537	.0585	.0634	.0686	.0738	.0793	.0849
.3	.0907	.0966	.1027	.1089	.1153	.1218	.1284	.1352	.1420	.1490
.4	.1561	.1633	.1705	.1779	.1854	.1929	.2005	.2082	.2160	.2238
.5	.232	.239	.247	.255	.263	.271	.279	.287	.295	.303
.6	.311	.319	.327	.335	.343	.350	.358	.366	.373	.380
.7	.388	.395	.402	.409	.416	.422	.429	.435	.441	.447
.8	.453	.458	.463	.468	.473	.477	.481	.485	.488	.491
.9	.494	.496	.497	.498	.498	.498	.496	.494	.489	.483
1.0	.463									

Appendix 1

County of San Diego Hydrology Manual

Soil Hydrologic Groups



PROJECT SITE LOCATION
SOIL TYPE A

Legend

Soil Groups

- 🟩 Group A
- 🟫 Group B
- 🟪 Group C
- 🟦 Group D
- 🟨 Undetermined
- ⬜ Data Unavailable

DPW GIS
Department of Public Works
Geographic Information Services

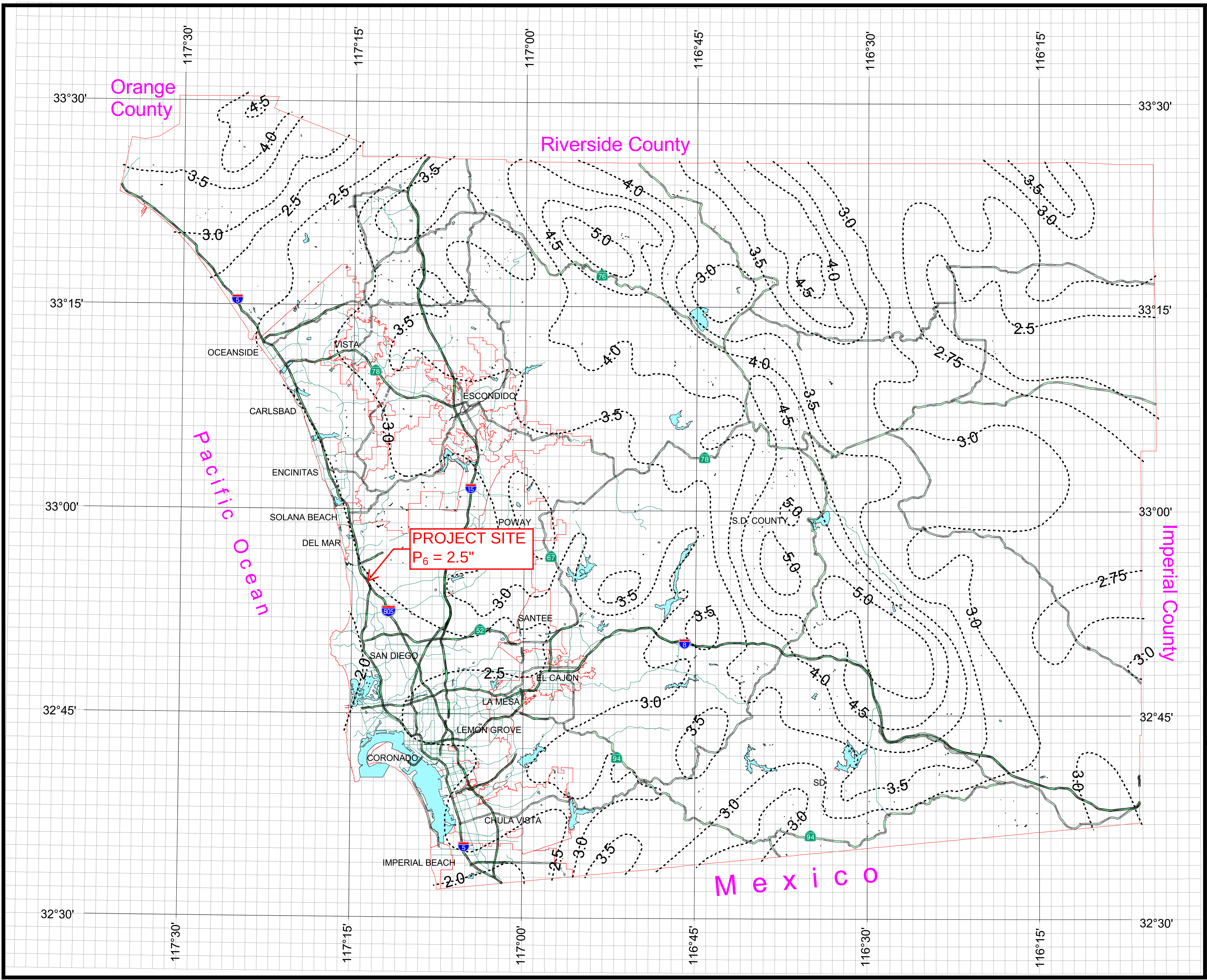
SanGIS
We Have San Diego Covered!

N
W E
S

3 0 3 Miles

APPENDIX 1.0

Appendix 2



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

- - - - - -	Isopluvial (inches)

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W E
S

3 0 3 Miles

APPENDIX 2.0

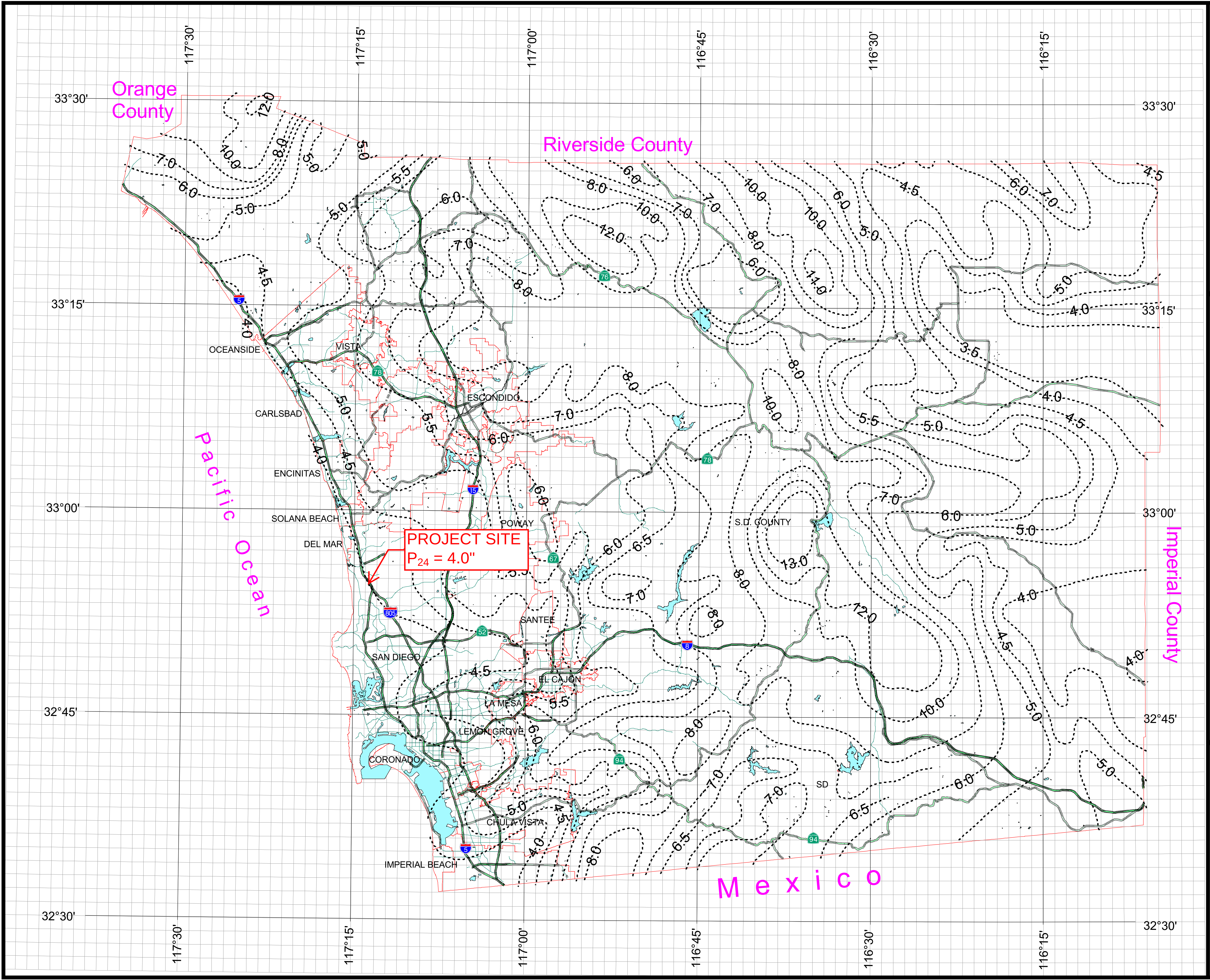
Appendix 3

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

- - - - Isopluvial (inches)



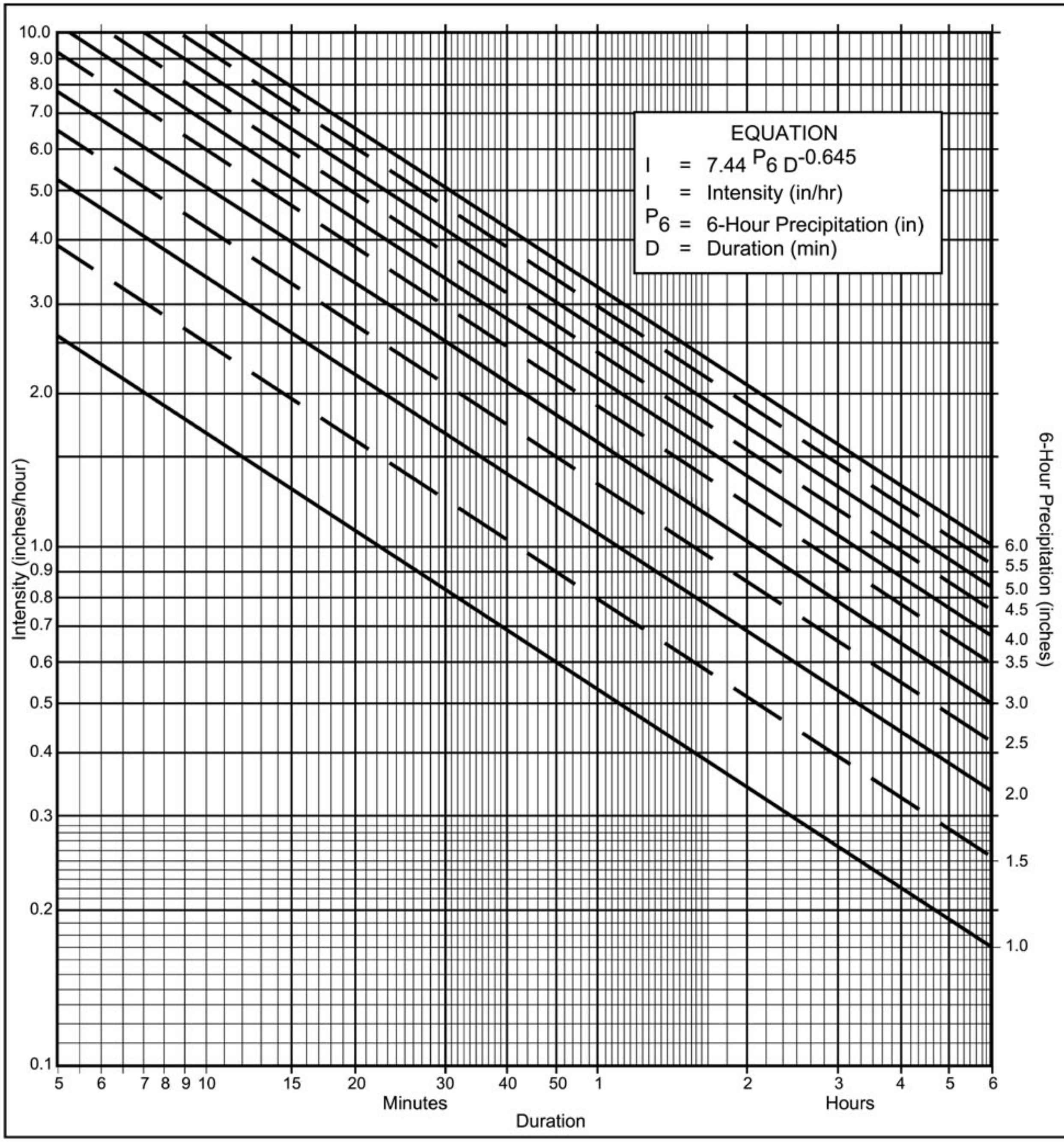
PROJECT SITE
P_{24} = 4.0"

N
W
E
S

3 0 3 Miles

APPENDIX 3.0

Appendix 4



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 applicable to Desert).

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

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

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

Application Form:

(a) Selected frequency 100 year

(b) P_6 = 2.5 in., P_{24} = 4.0 , $\frac{P_6}{P_{24}}$ = 62.5 %$^{(2)}$

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

(d) t_x = ______ min. see calculations for values of each basin

(e) I = ______ in./hr. See methodology to see the equations used for Intensity and time of concentration

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

Appendix 5

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

Appendix 6

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/	.5%		1%		2%		3%		5%		10%	
	Acre	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

O-1
P-2
E-1
P-1

*See Table 3-1 for more detailed description

Appendix 7

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Aug 23 2021

Asphalt Swale - E-1

User-defined

Invert Elev (ft)	= 55.87
Slope (%)	= 5.10
N-Value	= Composite

Calculations

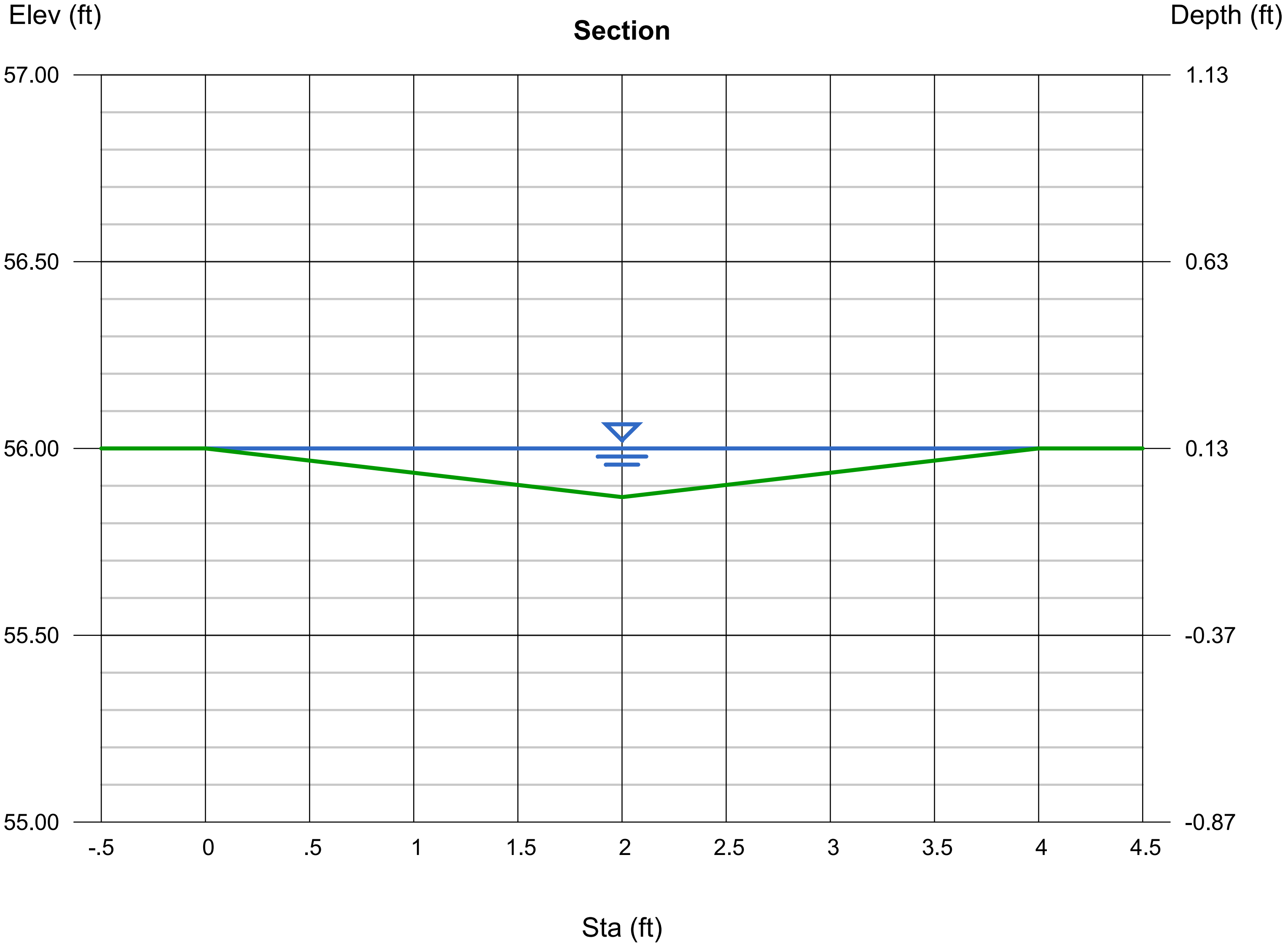
Compute by:	Q vs Depth
No. Increments	= 10

(Sta, El, n)-(Sta, El, n)...

(0.00, 56.00)-(2.00, 55.87, 0.013)-(4.00, 56.00, 0.013)

Highlighted

Depth (ft)	= 0.13
Q (cfs)	= 1.085
Area (sqft)	= 0.26
Velocity (ft/s)	= 4.17
Wetted Perim (ft)	= 4.01
Crit Depth, Yc (ft)	= 0.13
Top Width (ft)	= 4.00
EGL (ft)	= 0.40



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Aug 23 2021

Ribbon Gutter - P-1

User-defined
Invert Elev (ft) = 44.87
Slope (%) = 10.00
N-Value = Composite

Calculations
Compute by: Q vs Depth
No. Increments = 10

(Sta, El, n)-(Sta, El, n)...
(0.00, 45.00)-(1.50, 44.87, 0.013)-(3.00, 45.00, 0.013)

Highlighted
Depth (ft) = 0.13
Q (cfs) = 1.138
Area (sqft) = 0.20
Velocity (ft/s) = 5.84
Wetted Perim (ft) = 3.01
Crit Depth, Yc (ft) = 0.13
Top Width (ft) = 3.00
EGL (ft) = 0.66