



Civil Engineering/Surveying/Planning

# STUART ENGINEERING

**RECORD ID:** PDS2014-GPA-14-005; PDS2014-REZ-14-004;  
PDS2014-TM-5590; PDS2014-STP-14-019; PDS2014-MUP-15-004  
**Environmental Log No.:** PDS2014-ER-14-14013

## PRELIMINARY DRAINAGE STUDY

LAKE JENNINGS MARKETPLACE  
A PROPOSED COMMERCIAL CENTER  
LAKESIDE COMMUNITY PLANNING GROUP  
Project Number PDS2014-TM-5590



*PREPARED BY:*

STUART ENGINEERING  
7525 METROPOLITAN DRIVE, SUITE 308  
SAN DIEGO, CA 92108  
JOB NO. 921-13-05  
STUART PEACE, RCE 27232

*PREPARED FOR:*

South Coast Development, LLC  
P.O. BOX 1053  
SOLANA BEACH, CA 92075

**Revised February 12, 2015**  
Revised November 10, 2014  
July 8, 2014

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1. Exhibit A - Drainage Map – Existing Conditions
2. Exhibit B - Drainage Map – Proposed Conditions
3. Exhibit C - Offsite Drainage Map – Existing Conditions
4. Exhibit D - Federal Emergency Management Agency (FEMA) Map

## **1.0 Declaration of Responsible Charge**

I hereby declare that I am the Engineer of Work for this Drainage Study, that I have exercised responsible charge over the preparation of said study as defined in Section 6703 of the Business and Professions Code, and that the recommendations are consistent with current standards.

I understand that the check of this drainage study by the County of San Diego is confined to a review only does not relieve me, as Engineer of Work, of my responsibilities.



A handwritten signature in cursive script that reads "Stuart Peace".

2-13-15

Stuart Peace, RCE 27232

Date

## **2.0 Introduction**

### **Project Location:**

The project is located in east San Diego County near the community of Lakeside in East San Diego County, south of Old Highway 80, and east of Lake Jennings Park Road (See Vicinity Map Appendix 1). The project site is mapped within the State Responsibility Area.

### **Project Description:**

The proposed project is a commercial shopping center located on an existing vacated site. Work to be done including supporting infrastructure such as sewer, road improvements and utilities, the vacation of an existing paved road, and dedication of a biological open space easement on an approximately 13.10 acre site.

### ***Commercial Shopping Center***

The project proposes to construct a commercial shopping center with 76,100 square feet (sf) of building area. The project would include six structures, all of which will be located on individual lots. The development will include the following:

1. Market Building (Building A – 43,000 sf) located along the east side of the project site.
2. Financial Building with drive through (Building B – 4,500 sf) located on the northeast intersection of Olde Highway 80 and the proposed signalized project entrance on Olde Highway 80.

3. Restaurant with drive through (Building C – 3,500 sf) located on the northwest intersection of Olde Highway 80 and the proposed signalized project entrance on Olde Highway 80.
4. Restaurant-Retail Building (Building D – 9,600 sf) located along the southern boundary of the project's developed area.
5. Gas Station with convenience store and car wash (43,800 sf pad) at the intersection of Olde Highway 80 and Lake Jennings Park Road, and Commercial Building (Building E – 3,000 sf) located directly south of the gas station.
6. Restaurant-Retail Building (Building F – 12,500 sf) located along the southern boundary of the project's developed area. Building F shares a common wall with Building D.

### ***Trail Component***

The project will construct a multi-use trail suitable for pedestrians and equestrian users. The trail will be 10 feet wide and constructed of decomposed granite material. The trail segments adjacent to the two public streets are proposed as standard trail pathways per the Park Lands Dedication Ordinance (PLDO). The trail segment within the open space lot will run along the southern edge of the development area (immediately north of the proposed open space area) within a 20 foot wide trail easement and will include a 10 foot wide treadway.

### ***Access***

The project requires four access points; one from Ridge Hill Road located on the west side of the project, and three others located along Olde Highway 80; a right-in (only) approximately 200 feet east of the intersection of Olde Highway 80 and Lake Jennings Park Road, a full signalized project entry half way along the project frontage, and a second non-signalized project entry (right in – right out only) near the northeast corner of the property.

### ***Walls and Signage***

There will be a comprehensive coordinated sign program designed for the project. It includes a Freeway Pylon Display, Monument Center ID Displays, Monument Signage at the signalized entrance on Olde Highway 80, and a state required Gas Pricing Sign for the gas station, convenience store and car wash Pad.

### ***Parking***

The project proposes 389 parking spaces. The project parking is almost entirely located within the central portion of the site and will largely be out of the casual view of traffic on Lake Jennings Park Road and Olde Highway 80. The County of San Diego Zoning Ordinance requires a total of 389 parking spaces to be provided by the proposed project based on the size and uses proposed in the buildings. Therefore, the project meets the parking requirements of the County of San Diego Zoning Ordinance.

### ***Landscaping Plans***

Landscape plans have been prepared for the project. The landscape plan incorporates a variety of species that are intended to provide a visual buffer from Interstate 8 and be compatible with the riparian zone associated with Los Coches Creek. The plant palette reflects a selection of native plant material which can naturally be found in riparian zones of Southern California.

### **3.0 Calculation Methodology**

Runoff calculations were performed in conformance with the requirements of the *County of San Diego Drainage Design Manual* dated July 2005 and the San Diego County Hydrology Manual dated June 2003 by use of Advanced Engineering Software (AES). The Rational Method Procedure was used for drainage calculations with the following parameters:

Storm Event	100-year, 6-hour event and 24-hour event from Isopluvial Maps (Appendix 2) P <sub>6</sub> = 2.8 inches, P <sub>24</sub> = 6.2 inches 2-year, 6-hour event and 24-hour event from Isopluvial Maps (Appendix 2) P <sub>6</sub> = 1.3 inches
Runoff Coefficient	Estimated actual imperviousness of each sub-basin. See Table 3.1
Soil Type	Type "B" and "C"

The peak flow rate of runoff formula is  $Q = CIA$  where:

Q = peak discharge, in cubic feet per second (cfs)

C = runoff coefficient, proportion of the rainfall that runs off the surface (no units)

I = average rainfall intensity for a duration equal to the time of concentration for the area, in inches per hour (in./hr.)

### **4.0 Existing Drainage Description and Calculations**

#### ***Existing Onsite Drainage Conditions:***

The site currently has sparse vegetation with buildings on the west side of the property. Pecan Park Lane traverses the northeasterly corner of the site. Surface runoff from the area generally sheet flows in a southwesterly direction and discharges to Los Coches Creek without a defined drainage course. The southerly portion of the project is partially located in the Los Coches Creek floodway as shown on the Federal Emergency Management Agency (FEMA) map. The County of San Diego has determined the limits of the floodway through this creek reach.

#### ***Existing Offsite Drainage Conditions Flowing to Onsite Areas:***

A portion of the property located northeasterly of the site and a portion of Old Highway 80, totaling 3.33 acres drain to a headwall and flow to an existing 24" RCP under Olde Highway 80 and outlets to the site.

#### ***Existing Offsite Drainage Conditions Flowing to Existing County Maintained Ridge Hill Road Channel:***

There is approximately 115 acres of offsite area located northerly of Interstate 8 that drains into the existing County of San Diego maintained channel in Ridge Hill Road via a series of pipes and channels. The overall 100-year rate of runoff estimated for this 115-acre area is 201 CFS. The runoff discharges into the existing Ridge Hill Road from an existing channel to the north via pipe flow. The rate of discharge into the Ridge Hill Road channel is limited by the 48" pipe to an estimated flow of Q<sub>100</sub> of 151 cfs. See Appendix 10 for AES 100-year flow calculations.

Runoff from the existing Ridge Hill Road and a portion of the project site drains to the existing channel at a rate of Q100=3.36 cfs. The combined Q100 that drains to the existing Ridge Hill Road channel is 154.36 cfs (151 cfs +3.36 cfs). Runoff from existing Ridge Hill Road channel then outlets to a different channel south of Ridge Hill Road via an existing 48" CMP which flows under pressure during the 100-year storm event. This creates a ponded depth of approximately 2 feet in the existing Ridge Hill Road channel. See Detention Calculations-Offsite in Appendix 7.

The runoff for the existing site was analyzed for a 100-year storm event. See pocket for the Existing Drainage Map which illustrates each drainage management areas and discharge locations. The following table 4-1 summarizes the flow calculations. See Appendix 3 for specific AES calculations.

<b>TABLE 4-1 Summary of Existing Conditions Calculations</b>		
	<b>DESCRIPTION</b>	<b>FLOW</b>
<b>DISCHARGE #1 (Southeasterly to Creek)</b>	<b>DMA 207 (Southeasterly portion of project site) [Node 210]</b>	<b>1.01 cfs</b>
	<b>SUBTOTAL #1</b>	<b>1.01 cfs</b>
<b>DISCHARGE #2 (Southwesterly to Creek)</b>	<b>DMAs 200-203 &amp; 205 (Northeasterly property, Olde Hwy 80 and a portion of project site) [Node 150 - Appendix 3]</b>	<b>13.39 cfs</b>
	<b>DMA 206 (Portion of project site) [Node 310-Appendix 3]</b>	<b>4.59 cfs</b>
	<b>SUBTOTAL #2</b>	<b>17.98 cfs</b>
<b>DISCHARGE #3 (Northeasterly to Rios Canyon Road)</b>	<b>DMA 208 (Easterly Basin) [Node 510 – Appendix 3]</b>	<b>0.64 cfs</b>
	<b>SUBTOTAL #3</b>	<b>0.64 cfs</b>
<b>DISCHARGE #4 (Northwesterly to existing County maintained channel)</b>	<b>DMA 204 (Westerly basin and a portion of project site draining to the existing county maintained channel) [Node 410-Appendix 3]</b>	<b>3.36 cfs</b>
	<b>SUBTOTAL #4</b>	<b>3.36 cfs</b>

<b>TABLE 4-2 Summary of Pre-Development 2-year Storm Flow</b>	
<b>DESCRIPTION</b>	<b>FLOW-Q2</b>
<b>DMA 203</b> <b>[Node 130 – Appendix 5]</b>	<b>2.45 cfs</b>
<b>DMA 204</b> <b>[Node 410 – Appendix 5]</b>	<b>0.94 cfs</b>
<b>DMA 205</b> <b>[Node 150 – Appendix 5]</b>	<b>1.55 cfs</b>
<b>DMA 206</b> <b>[Node 150 – Appendix 5]</b>	<b>2.95 cfs</b>
<b>DMA 207</b> <b>[Node 210 – Appendix 5]</b>	<b>0.52 cfs</b>
<b>Total Pre-Project Q2</b>	<b>8.41 cfs</b>

## **5.0 Proposed Drainage Description and Calculations**

### ***Offsite (Northeasterly Parcel and Old Highway 80)***

Runoff from the off-site property and existing Old Highway 80 northeasterly of this project continue to drain in the same drainage pattern as the existing condition (flow pick up at the existing headwall on the north side of Old Highway 80) however; this project proposes to remove the existing outlet on this project and will construct a public clean-out and public storm drain system in Old Highway 80 to convey the offsite storm water around this project to the west. The public storm drain system in Old Highway 80 will flow from east to west and will accept storm water from new curb inlets constructed on the south side of Old Highway 80. Near the intersection of Old Highway 80 and Lake Jennings Park Road this storm drain system will confluence with the onsite project flow. The 100-year flow rate from only the offsite property and Old Highway 80 is 11.16 cfs.

### ***Onsite***

Runoff from the roofs of the proposed buildings is designed to flow to downspouts and discharge to the surface. Most of the parking lots will drain by means of surface flow to bio-retention basins in the parking medians. The loading dock and southerly buildings will drain to a proprietary higher-rate biofilters (Modular Wetlands System) for treatment. Storm water from these onsite areas will enter the mentioned treatment BMPs before it discharges to the underground storm drain system.

Storm water will primarily flow from all the borders of the project into the central portion of the project. The flow will be directed to the central portion of the project because an underground storage system is proposed in this area.

Storm water from the easterly Grocery building and surface parking lot will flow from east to west by means of surface and underground pipe flow.

Storm water from the southerly retail spaces will flow from south to north by means of surface and underground pipe flow.

Storm water from the northwesterly gas station will flow easterly to the central area by means of surface and underground pipe flow.

Stormwater from the northerly financial and food pads will flow southerly to the central area by means of surface and underground pipe flow.

### ***Storage***

This project proposes an underground storage facility to be constructed under the proposed surface parking lot in the middle portion of the site. This storage facility consisting of an array of oversized storm drain pipes will serve two purposes which are to address Hydromodification flow control and 100-year peak flow. Contained within the Major SWMP are the Hydromodification flow control sizing calculations. Contained within this report are the 100-year peak flow sizing calculations.

Per the Hydromodification Management Plan (HMP Study) located in the Major Storm Water Management Plan (Major SWMP), the underground storage system is proposed to have a capacity of 53,000 cubic feet and will have a metered (orifice controlled) peak discharge of 50-percent of the pre-project 2-year storm. The 2-year peak flow (See Appendix 5 and Summary in Table 4.2 of Section 4 of this report) is 8.41 cfs and 50-percent of that value is 4.2 cfs.

The 100-year storm was estimated to have an overall volume of 21,917 cubic feet (see volume/detention calculations in Appendix 7) and a peak flow rate of 47.32 cfs (see Appendix 4). With the underground storage detention system in place the entire 100-year storm will be stored and the 100-year discharge will be controlled by an orifice and match the pre-development flow rate (50-percent of the 2-year storm).

It is important to note that this will represent a significant drop in peak flow discharge as compared to existing conditions.

### ***Final Discharge***

The final destination of the onsite underground storm drain system carrying the flow from the site is the existing County maintained channel located at the southwest corner of the intersection of Old Highway 80 and Lake Jennings Park Road. Prior to discharging into this channel the onsite flow will converge with the flow from the proposed public storm drain system in Old Highway 80 conveying offsite northeasterly property flow and street flow. The combined 100-year rate of runoff is 22.41 cfs (4.20 cfs-onsite orifice controlled flow, 2.50 cfs-southwesterly onsite area, 11.16 cfs-Old Hwy 80 and northeasterly parcel and 4.55 cfs- Ridge Hill Road). It will discharge by means of headwall and rip rap and will then flow through the existing Ridge Hill Road channel.

Runoff from the project site and offsite flows from the northeasterly property and Old Highway 80 will combine with the runoff from the existing offsite 115-acre area north of Interstate 8 at the existing Ridge Hill Road channel. Runoff from the existing Ridge Hill Road channel flows to an existing 48" corrugated metal pipe under Ridge Hill Road. The existing 48" pipe flows under pressure during the 100-year storm event. This creates a ponded depth of approximately 2.95 feet in the existing Ridge Hill Road channel. The water surface elevation is at elevation 650.91 which is at least 9 feet below the proposed Ridge Hill Road improvements. Therefore, the addition of runoff

from the project site will not have an impact on the adjacent properties and road improvements. See Detention Calculations-Offsite and Onsite in Appendix 8.

Storm water discharges from the existing Ridge Hill Road channel at the south end into the existing 48" corrugated metal pipe under Ridge Hill Road and flows to an existing earthen conveyance south of Ridge Hill Road where it eventually converges with Los Cochés Creek.

Runoff in Los Cochés Creek travels westerly and northerly for approximately 2 miles and becomes a concrete conveyance. Storm water travels northerly in the concrete conveyance for approximately 2 miles and joins San Diego River at the north side of the intersection of Winter Gardens Boulevard and Highway 67.

The runoff for the proposed commercial site was analyzed for a 100-year storm event. As described above, the proposed project will construct an underground storm drain storage system that will decrease the 100-year flow discharge rate. Runoff from the onsite basins that drains to the underground storm drain storage system will outlet at a rate of 0.5Q<sub>2</sub>. See pocket for the Proposed Drainage Map which illustrates each drainage management area and the site storm drain alignment. The following table 5-1 summarizes the flow calculations. See Appendix 4 for Q<sub>100</sub> and Appendix 5 for Q<sub>2</sub> AES calculations.

<b>TABLE 5-1 Summary of Proposed Conditions Calculations</b>		
	<b>DESCRIPTION</b>	<b>FLOW (Q100)</b>
<b>DISCHARGE #1</b> (Southeasterly to Creek)	No Flow in Proposed Conditions	N/A
<b>DISCHARGE #2</b> (Southwesterly to Creek)	No Flow in Proposed Conditions	N/A
<b>DISCHARGE #3</b> (Northeasterly to Rios Canyon Road)	DMA 122 (Easterly Basin) [Node 170-Appendix 4]	2.24 cfs
	<b>SUBTOTAL #3</b>	2.24 cfs
<b>DISCHARGE #4 (OFFSITE)</b> (Northerly to existing county maintained channel)	DMA 120, 121, 116 thru 118 (Northeasterly property and Olde Hwy 80) [Node 135-Appendix 4]	11.16 cfs
	DMA 119 (Ridge Hill Road) [Node 275-Appendix 4]	4.55 cfs
	<b>SUBTOTAL #4 (Offsite)</b>	15.71 cfs
<b>DISCHARGE #4 (ONSITE)</b> (Project site to existing county maintained channel)	DMA 101 thru 111, 113 thru 115 (Project site- routed through underground storage system)	1.70 cfs orifice controlled flow rate
	DMA 112 ( southwest corner of project site not routed to underground storage system) [Node 275- Appendix 4]	2.50 cfs
	<b>SUBTOTAL #4 (Onsite)</b>	4.2 cfs = Pre-development flow rate of 0.5Q2

## **6.0 Existing vs. Proposed Comparative 100-year Peak Flow Analysis**

### ***DISCHARGE #1 Southeasterly to Creek***

As Table 6-1 below identifies, in the post-project condition storm water flow will not be discharged southeasterly to the Creek. Storm water flow will instead be collected in the onsite storm drain system and eventually be discharged to the westerly County Maintained Channel on the west side of Ridge Hill Road.

### ***DISCHARGE #2 Southwesterly to Creek***

As Table 6-1 below identifies, in the post-project condition storm water flow will not be discharged southwesterly to the Creek. Storm water flow will instead be conveyed to the onsite storm drain system and eventually be discharged to the westerly County Maintained Channel on the west side of Ridge Hill Road.

### ***DISCHARGE #3 Northeasterly to Rios Canyon Road***

As Table 6-1 below identifies, in the post-project condition a small increase of storm water to Rios Canyon Road Curb and gutter will occur however; no adverse impacts are anticipated as very little storm water flow currently exists in this location.

### ***DISCHARGE #4 OFFSITE AREA Northeasterly (Old Highway 80 and Ridge Hill Road) to westerly County maintained channel.***

As Table 6-1 below identifies, in the post-project condition will increase the amount of storm water being discharged to the westerly County Maintained Channel on the west side of Ridge Hill Road. As section 7.0 of this report demonstrates, the increase in flow will result in a slightly higher ponded depth but well within the capacity of the channel to not cause adverse conditions.

### ***DISCHARGE #4 ONSITE Project to westerly County maintained channel.***

As Table 6-1 below identifies, in the post-project condition will increase the amount of storm water being discharged to the westerly County Maintained Channel on the west side of Ridge Hill Road as the project currently surface flows south. As section 7.0 of this report demonstrates, the increase in flow will result in a slightly higher ponded depth but well within the capacity of the channel to not cause adverse conditions.

<b>TABLE 6-1 Summary of Existing vs. Proposed Calculations</b>		
	<b>EXISTING CONDITIONS</b>	<b>PROPOSED CONDITIONS</b>
	<b>FLOW (Q100)</b>	<b>FLOW (Q100)</b>
<b>DISCHARGE #1 (Southeasterly to Creek)</b>	<b>1.01 cfs</b>	<b>0</b>
<b>DISCHARGE #2 (Southwesterly to Creek)</b>	<b>17.98 cfs</b>	<b>0</b>
<b>DISCHARGE #3 (Northeasterly to Rios Canyon Road)</b>	<b>0.64 cfs</b>	<b>2.24 cfs</b>
<b>DISCHARGE #4 (OFFSITE) (Northerly to existing county maintained channel)</b>	<b>3.36 cfs</b>	<b>15.71 cfs</b>
<b>DISCHARGE #4 (ONSITE) (Project site to existing county maintained channel)</b>	<b>0</b>	<b>4.20 CFS</b>
<b>TOTAL Q100</b>	<b>22.99 cfs</b>	<b>22.15 cfs</b>

## **7.0 Summary of Flows to Existing County Maintained Channel in Ridge Hill Road**

### ***Final Discharge***

The final destination of the onsite underground storm drain system carrying the flow from the site is the existing County maintained channel located at the southwest corner of the intersection of Old Highway 80 and Lake Jennings Park Road. Most of the onsite flow will go through the onsite detention system which will greatly reduce the peak discharges.

Table 7-1 identifies that at the westerly offsite channel in the proposed project storm water flow will increase however; the slightly higher ponded depth is well within the capacity of the channel to not cause any adverse conditions.

See appendices 7 and 8 for full calculations.

<b>TABLE 7-1 Summary of Flow at Ridge Hill Road Calculations</b>		
	<b>EXISTING CONDITIONS</b>	<b>PROPOSED CONDITIONS</b>
	<b>FLOW (Q100)</b>	<b>FLOW (Q100)</b>
<b>OFFSITE 115 Acres North I-8</b>	<b>151.0 cfs</b>	<b>151.0 cfs</b>
<b>DISCHARGE #4 (OFFSITE) (Northerly to existing county maintained channel)</b>	<b>3.36 cfs</b>	<b>15.71 cfs</b>
<b>DISCHARGE #4 (ONSITE) (Project site to existing county maintained channel)</b>	<b>0</b>	<b>4.20 CFS</b>
<b>TOTAL</b>	<b>154.36 cfs</b>	<b>170.91 cfs</b>
<b>Ponded Depth</b>	<b>1.72' above top of existing 48" pipe in Ridge Hill Road</b>	<b>2.95' above top of existing 48" pipe in Ridge Hill Road.</b>

The discharge through the southerly existing pipe will remain unchanged in the proposed condition as water level in the channel will slightly increase. No adverse impacts are anticipated.

## **8.0 Conclusion**

Local jurisdictional requirements have been identified and addressed in the site planning. With these features/requirements incorporated no adverse impacts are anticipated from the proposed project due to the volume and nature of the runoff.

## **9.0 Environmental Impacts**

This section summarizes the following questions for CEQA purposes:

Would the project:

- 1. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in a substantial erosion or siltation onsite or offsite?**

Response: The proposed commercial project is not substantially altering the drainage pattern of the site that will result in siltation or erosion onsite or offsite.

- 2. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding onsite or offsite?**

Response: An onsite detention basin will be constructed that will control flooding.

- 3. Create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems?**

Response: Proposed onsite and offsite storm drain will be sized to handle the 100-year storm event. The increase in peak flow rate and volume will be stored in onsite storage system. Therefore, there will be no impact on the existing downstream drainage systems.

- 4. Place housing within a 100-year flood hazard as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map, including County Floodplain Maps?**

Response: The proposed project will not place any structure within the 100-year flood hazard area as mapped on a Federal Flood Hazard Boundary or Flood Insurance Rate Map or County Floodplain Maps.

- 5. Place within a 100-year flood hazard area structures which would impede or redirect flood flows?**

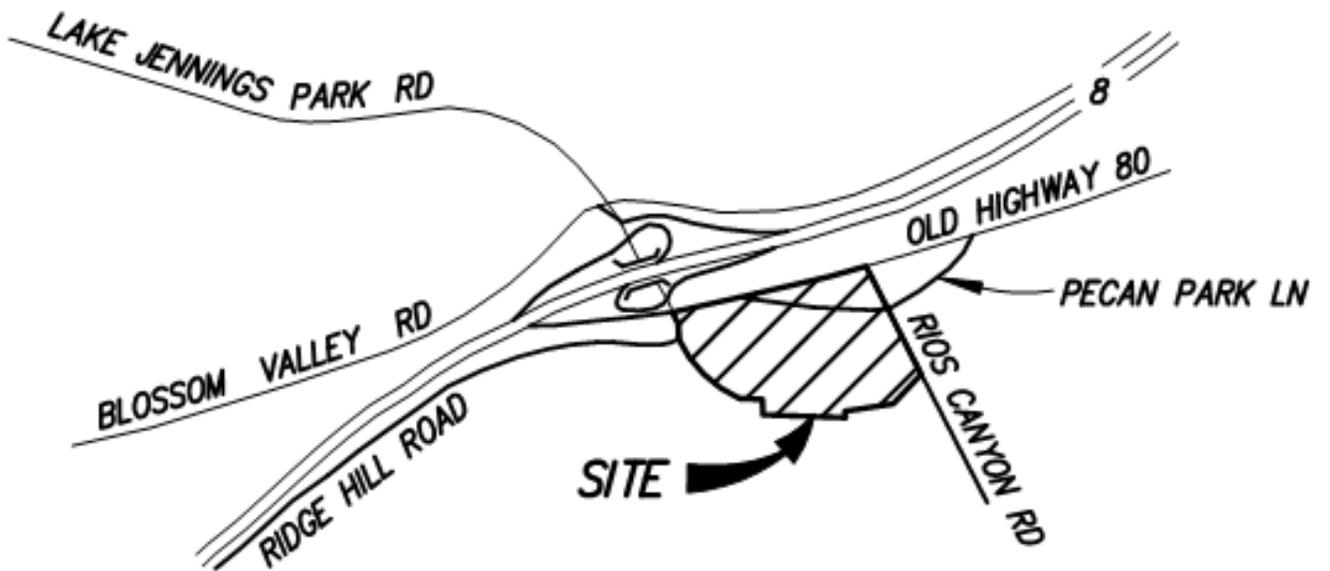
Response: The proposed project will not place any structures including retaining wall within a 100-year flood hazard area which would impede or redirect flood flows.

- 6. Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the result of a levee or dam onsite or offsite?**

Response: There are no dams or levees onsite or near proximity to the project site.

# **APPENDIX 1**

## **VICINITY MAP**



**VICINITY MAP**

NO SCALE

## **APPENDIX 2**

### **COUNTY OF SAN DIEGO MAPS AND TABLES**

**Table 3-1  
RUNOFF COEFFICIENTS FOR URBAN AREAS**

Land Use		Runoff Coefficient "C"				
NRCS Elements	County Elements	% IMPER.	Soil Type			
			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

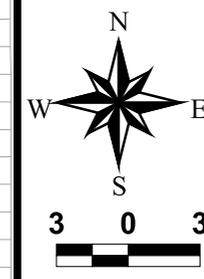
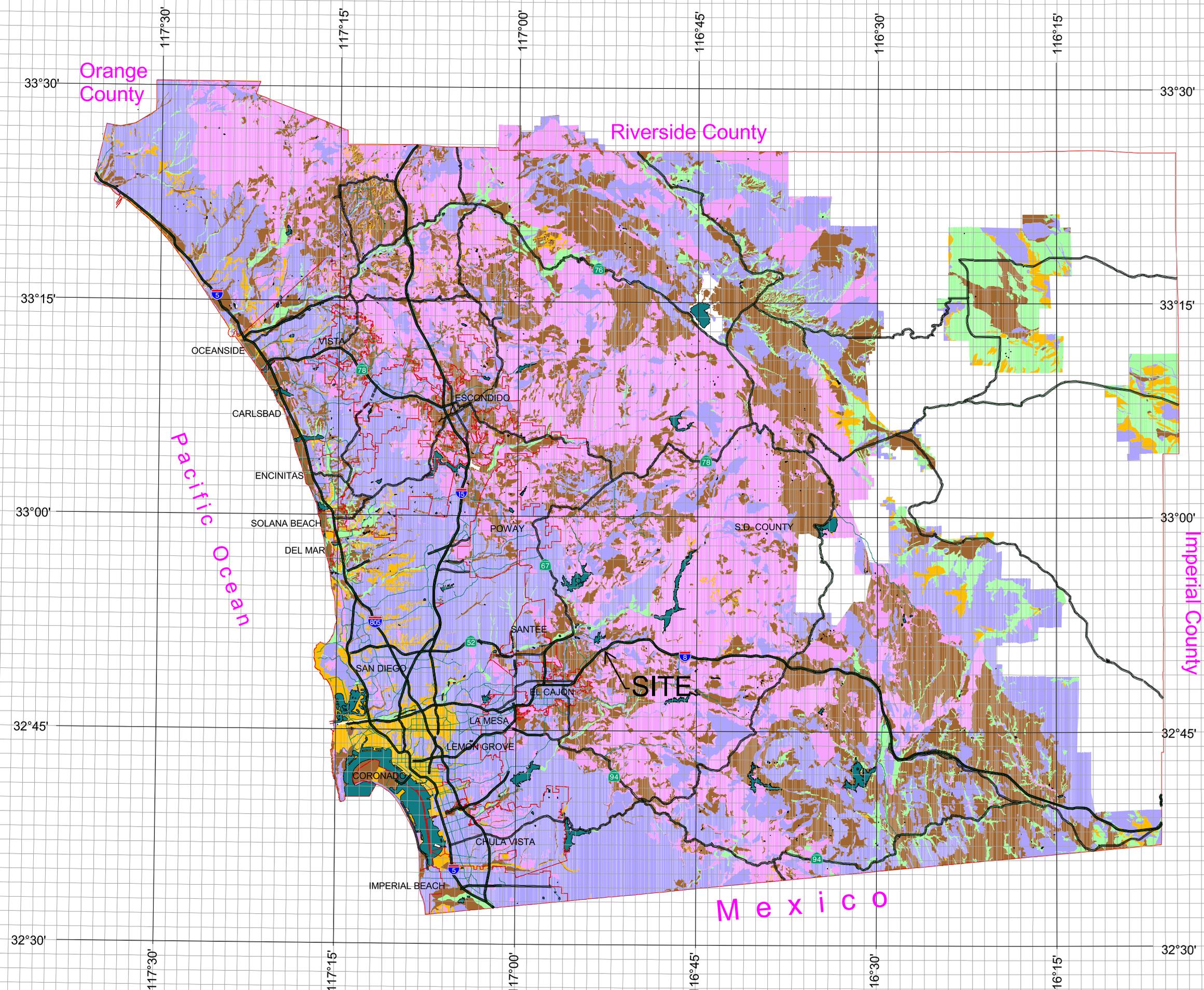
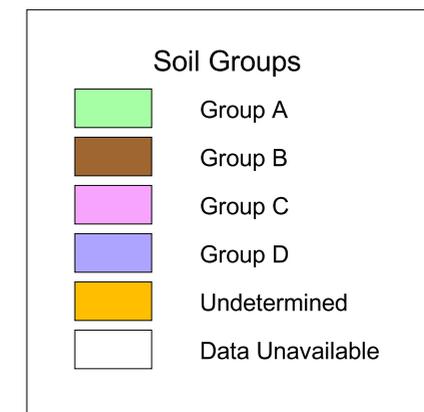
NRCS = National Resources Conservation Service

# County of San Diego Hydrology Manual



## Soil Hydrologic Groups

### Legend



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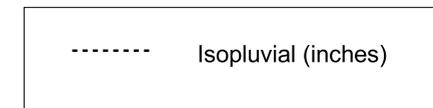
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# County of San Diego Hydrology Manual

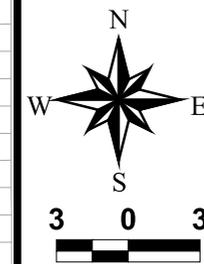
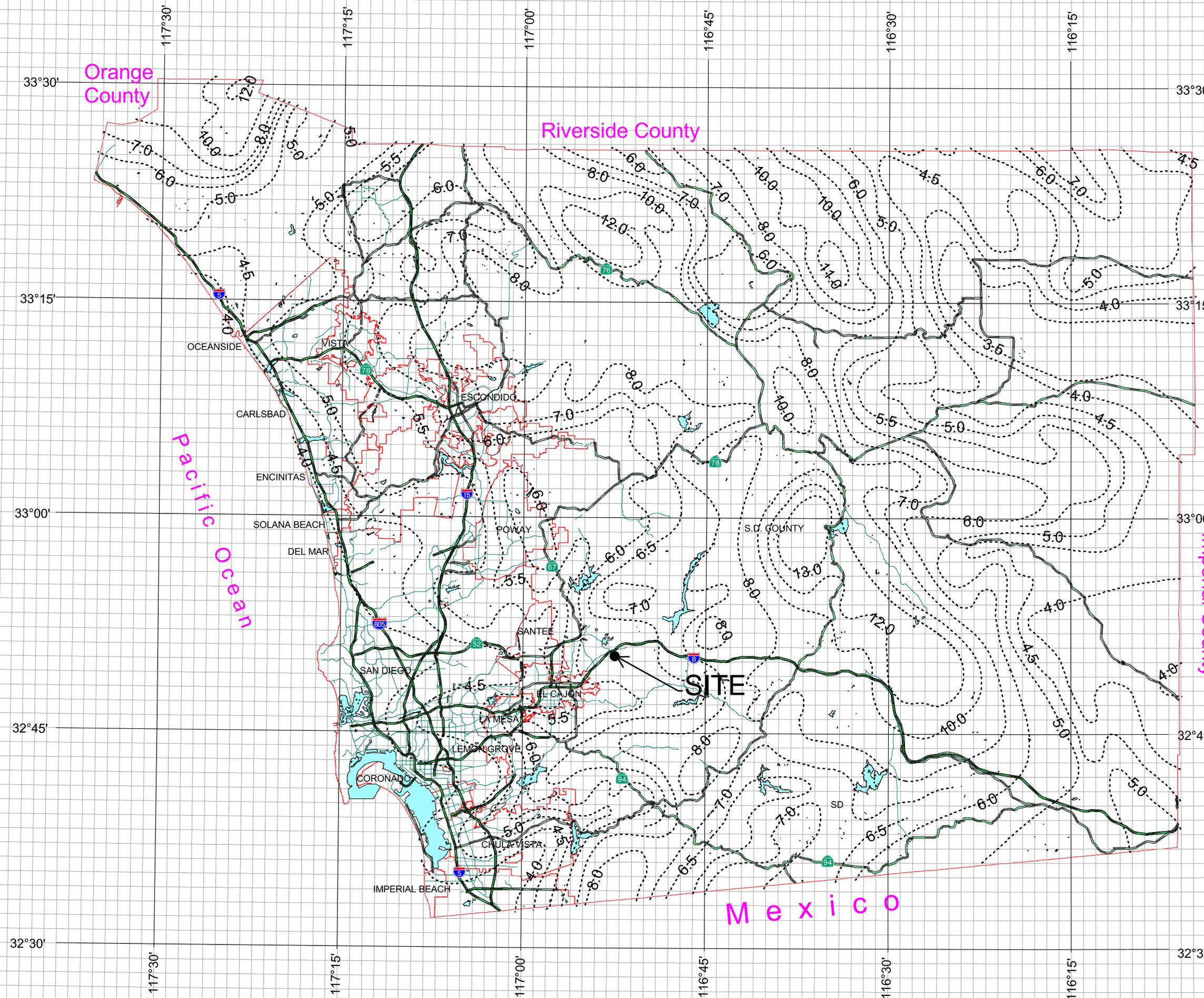


## Rainfall Isopluvials

### 100 Year Rainfall Event - 24 Hours



P<sub>24</sub> = 6.2 inches



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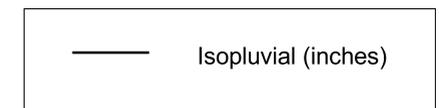
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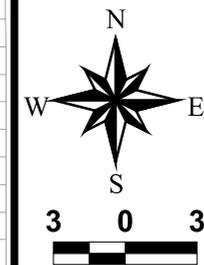
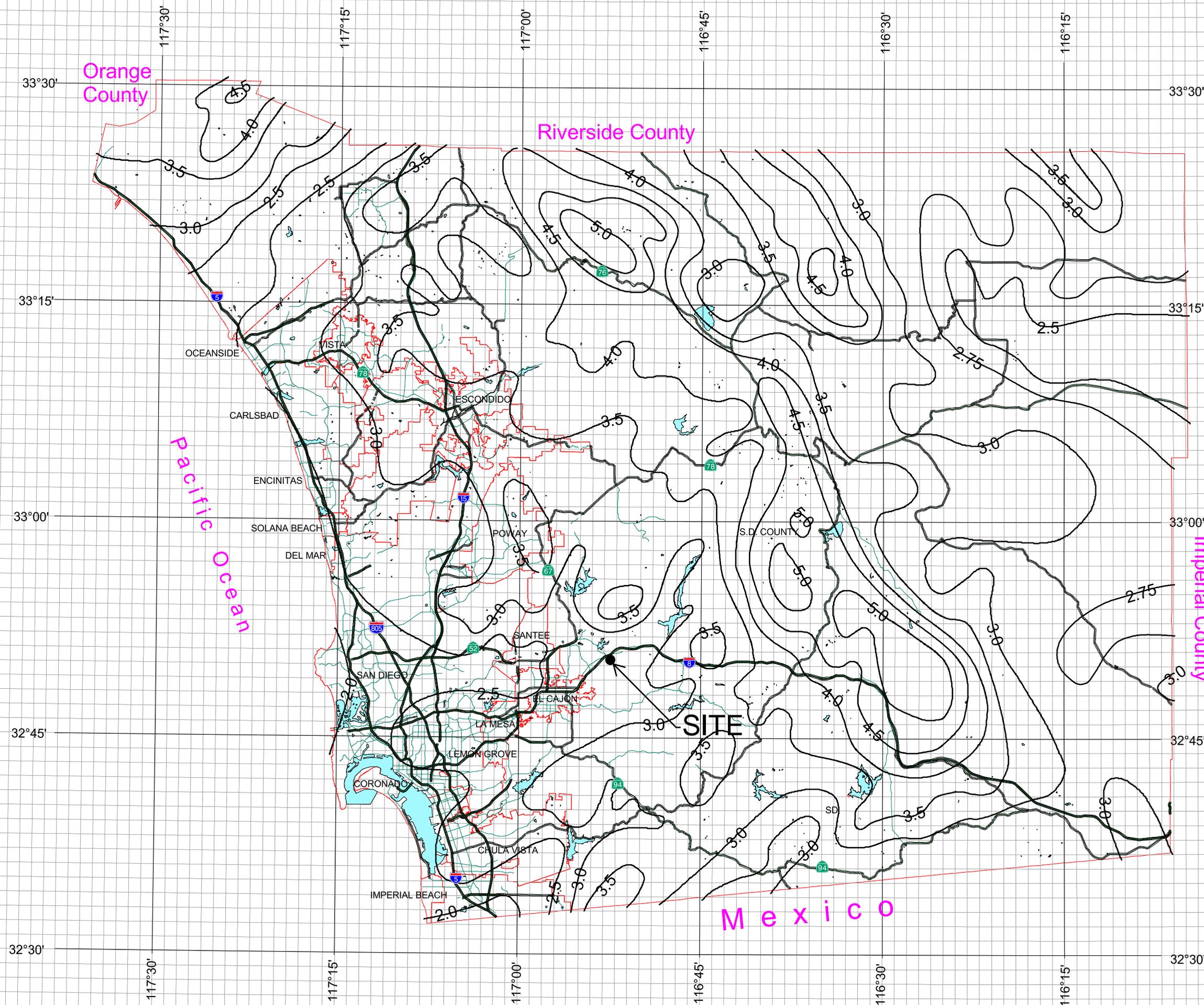


## Rainfall Isopluvials

### 100 Year Rainfall Event - 6 Hours



$P_6 = 2.8$  inches



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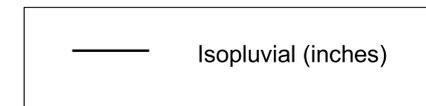
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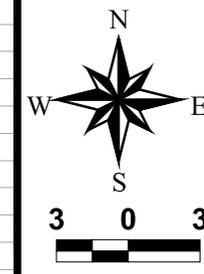
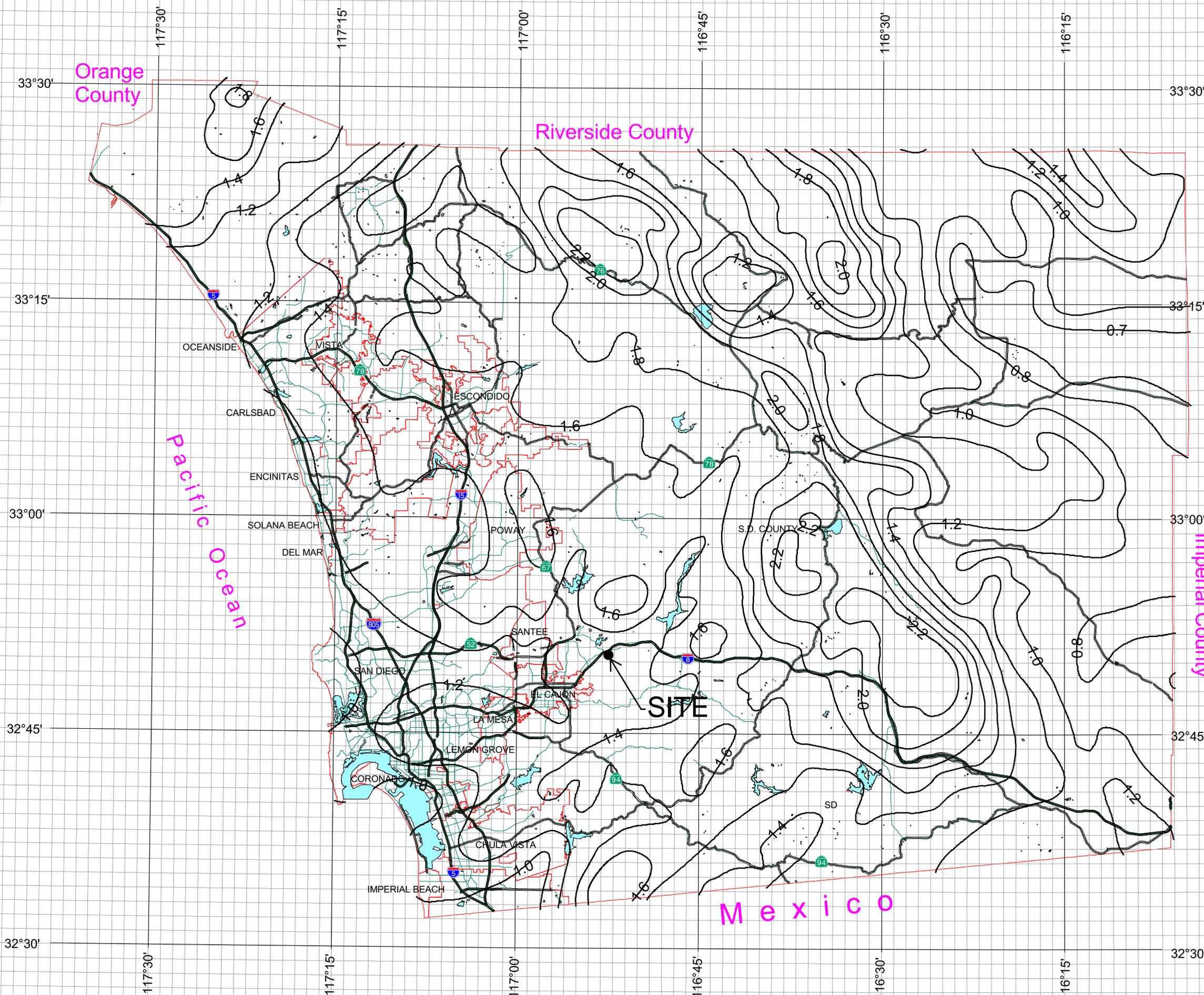


## Rainfall Isopluvials

**2 Year Rainfall Event - 6 Hours**



**P<sub>6</sub> = 1.3 inches**



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