



**DRAINAGE STUDY FOR  
8181 Allison Avenue PROJECT**

**LA MESA, CALIFORNIA**

Intersection of Allison Avenue & Date Avenue  
KPFF Job # 1900264

**April 2021**

Prepared By:

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## Table of Contents

1.	Project Location and Scope .....	3
1.1	Project Location .....	3
1.2	Scope of Report.....	3
2.	Study Objectives .....	4
3.	Project Description .....	4
3.1	Pre-Development Conditions.....	4
3.2	Post Development Conditions .....	4
4.	Methodology .....	4
4.1	Hydrology.....	4
4.2	Hydraulics.....	5
5.	Results and Conclusions.....	5
5.1	Hydrology Results .....	5
5.2	Hydraulic Results.....	5
5.3	Conclusions .....	6

### List of Figures

Figure 1-1 Site Vicinity Map

### List of Tables

Table 5-1 Hydrology Results for Pre-Development (10-Year, 50-Year, and 100-Year)

Table 5-2 Hydrology Results for Post-Development (10-Year, 50-Year, and 100-Year )

### List of Exhibits

Exhibit 1 Existing Site Topography

Exhibit 2 Existing Site Drainage

Exhibit 3 Proposed Site Drainage

Exhibit 4 Rainfall Isopluvials

Exhibit 5 Hydrology Calculations

# 1. Project Location and Scope

## 1.1 Project Location

The proposed development is located in the City of La Mesa, bound by Allison Avenue to the north, Date Avenue to the west and southwest, and a commercial parking lot to the southeast. See Figure 1 for the Site Vicinity Map. See Exhibit 1 for existing site topography.

The total lot development area is 1.27 acres. The development will involve the construction of approximately 147 one- and two-bedroom units and is assumed to be a four-story podium with surface and underground parking.



Figure 1-1: Site Vicinity Map

## 1.2 Scope of Report

This report will focus on identifying the hydrologic and hydraulic effects of the proposed development, by studying the 10-year, 50-year, and 100-year flow rates for the pre and post development conditions.

This report will not discuss water quality measures or best management practices for stormwater mitigation. For information regarding best management practice requirements and implementation, refer to the project Storm Water Quality Management Plan (SWQMP).

## 2. Study Objectives

The specific objectives of this drainage study are:

- Calculate the pre and post development peak flow rates for the 10-year, 50-year, and 100-year storm events.
- Calculate the effects of the post development conditions on the existing hydrology and hydraulics.
- Identify pre and post development areas of concern.

## 3. Project Description

### 3.1 Pre-Development Conditions

The existing site consists of an asphalt parking lot to the west and a vacant site to the east. In the pre-developed condition, the site consists of approximately 55% impervious surface. The pre-development condition is considered 1 drainage management area (DMA) per Exhibit 2.

The overall site area drains from northeast to southwest with an elevation difference of approximately 11.85 feet over a span of 291.62 feet. The underlying soil is type D per the NRCS Hydrologic Soil Group classifications. The existing drainage conveyance is urban. Based on the current topographic survey, the site sheet flow is either routed to a v-ditch gutter that routes the flow to an onsite catch basin located at the southwest corner of the site or directly to the aforementioned catch basin. All flow entering this catch basin is then routed to another catch basin located on Date Avenue. There appears no offsite runoff is conveyed through the site.

### 3.2 Post Development Conditions

The proposed site consists of impervious features including a 4-story housing complex, a central courtyard open to the sky, and an underground parking structure. The pervious features will involve biofiltration landscape planters surrounding the outside perimeter of the housing structure and in the podium deck of the courtyard. In the post-development condition, the site consists of approximately 91% impervious surface. The post-development condition is divided into 10 drainage management areas (DMAs) per proposed grading and site features: DMA #1 through DMA #10 per Exhibit 3.

DMA #1 through DMA #10 consists of roof and podium drains which will be captured and conveyed to the proposed cistern. The captured runoff will then be discharged via sump pump to the proposed proprietary biofiltration system and discharged to the public storm drain system via curb drains. The proposed site will see a change of site topography due to the excavation of soil for the underground parking structure. The overall site development will join to the existing top of the curb.

## 4. Methodology

### 4.1 Hydrology

The hydrology calculations are based on the San Diego County Hydrology Manual (June 2003). The project site is less than one square mile, and therefore the Rational Method was used to calculate the peak flow rate for the 10-year, 50-year, and 100-year storm events. The Rational Method calculates peak flow rate (Q) as a function of runoff coefficient (C), rainfall intensity (I), and drainage area (A):



$$Q = C * I * A$$

#### Runoff Coefficients (C):

Runoff Coefficients for Rational Method in the Hydrology Manual is used to compute the runoff coefficients for the development conditions given the site's imperviousness, soil type, and land use:

$$C = 0.9 * (\% \text{Impervious}) + C_p * (1 - \% \text{Impervious})$$

The site's imperviousness was determined by calculating the impervious area in the pre- and post-development conditions. Per the Hydrology Manual, all sites are assumed to be made up of Type D soil. The project's land use could be considered Commercial; however Industrial land use was assumed as a conservative approach to calculating the site's peak flow rate.

#### Rainfall Intensity (I):

Rainfall intensities were determined from the Intensity-Duration-Frequency Design Chart in the Hydrology Manual. The design chart takes into consideration the time of concentration ( $T_c$ ) and adjusted 6-hour storm rainfall amount ( $P_6$ ), see Exhibit 4, to calculate the rainfall intensity:

$$I = 7.44 * P_6 * D^{-0.645}$$

#### Area (A):

Drainage area was determined by inspecting the existing and proposed conditions and delineating areas according to grading and site features. The Pre-Development Drainage Condition and Post-Development Drainage Condition maps can be found in Exhibit 2 and Exhibit 3.

## **4.2 Hydraulics**

The site is a property line to property line structure, all drainage will be designed per the Plumbing Code by plumbing engineer. Further information will be provided.

# **5. Results and Conclusions**

## **5.1 Hydrology Results**

Table 5-1 and Table 5-2 summarize the hydrology results of the pre- and post- development conditions given the 10-year storm event frequency. The proposed development will decrease the amount of pervious area and thus increase the project site peak flow runoff. As seen in Table 5-1 and Table 5-2, the peak flow runoff rate for the 10-year storm event increased from 3.86 cfs to 5.29 cfs in the pre- and post- development conditions. This represents a roughly 37.05% increase in the peak runoff flow rate. A similar increase in the peak flow runoff rate is experienced in the 50-year and 100-year storm event, which can be seen in Table 5-1 and Table 5-2. In the pre and post development conditions, the peak runoff rate increased from 4.93 cfs and 5.57 cfs to 6.76 cfs and 7.64 cfs, respectively. This represents an overall 37.11% and 37.16% increase in the peak runoff flow rate.

Pre-Development Condition					
Drainage Area No.	Area (acres)	% Impervious	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)
DMA	1.2	55%	3.29	4.20	4.75
Total	<b>1.2</b>	<b>55%</b>	<b>3.86</b>	<b>4.93</b>	<b>5.57</b>

**Table 5-1: Hydrology Results for Pre-Development (10-Year, 50-Year, and 100-Year)**

Post-Development Condition					
Drainage Area No.	Area (acres)	%Impervious	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)
DMA #1	0.3	87%	1.22	1.56	1.76
DMA #2	0.1	89%	0.48	0.62	0.70
DMA #3	0.1	97%	0.49	0.63	0.71
DMA #4	0.0	98%	0.18	0.23	0.26
DMA #5	0.1	95%	0.50	0.64	0.73
DMA #6	0.1	98%	0.30	0.38	0.43
DMA #7	0.1	97%	0.45	0.58	0.65
DMA #8	0.2	89%	0.79	1.02	1.15
DMA #9	0.2	92%	0.69	0.88	1.00
DMA #10	0.0	84%	0.18	0.22	0.25
<b>Total</b>	<b>1.3</b>	<b>92%</b>	<b>5.29</b>	<b>6.76</b>	<b>7.64</b>

**Table 5-2: Hydrology Results for Post-Development (10-Year, 50-Year, and 100-Year)**

## 5.2 Hydraulic Results

The site is a property line to property line structure, all drainage will be designed per the Plumbing Code by plumbing engineer. Further information will be provided.

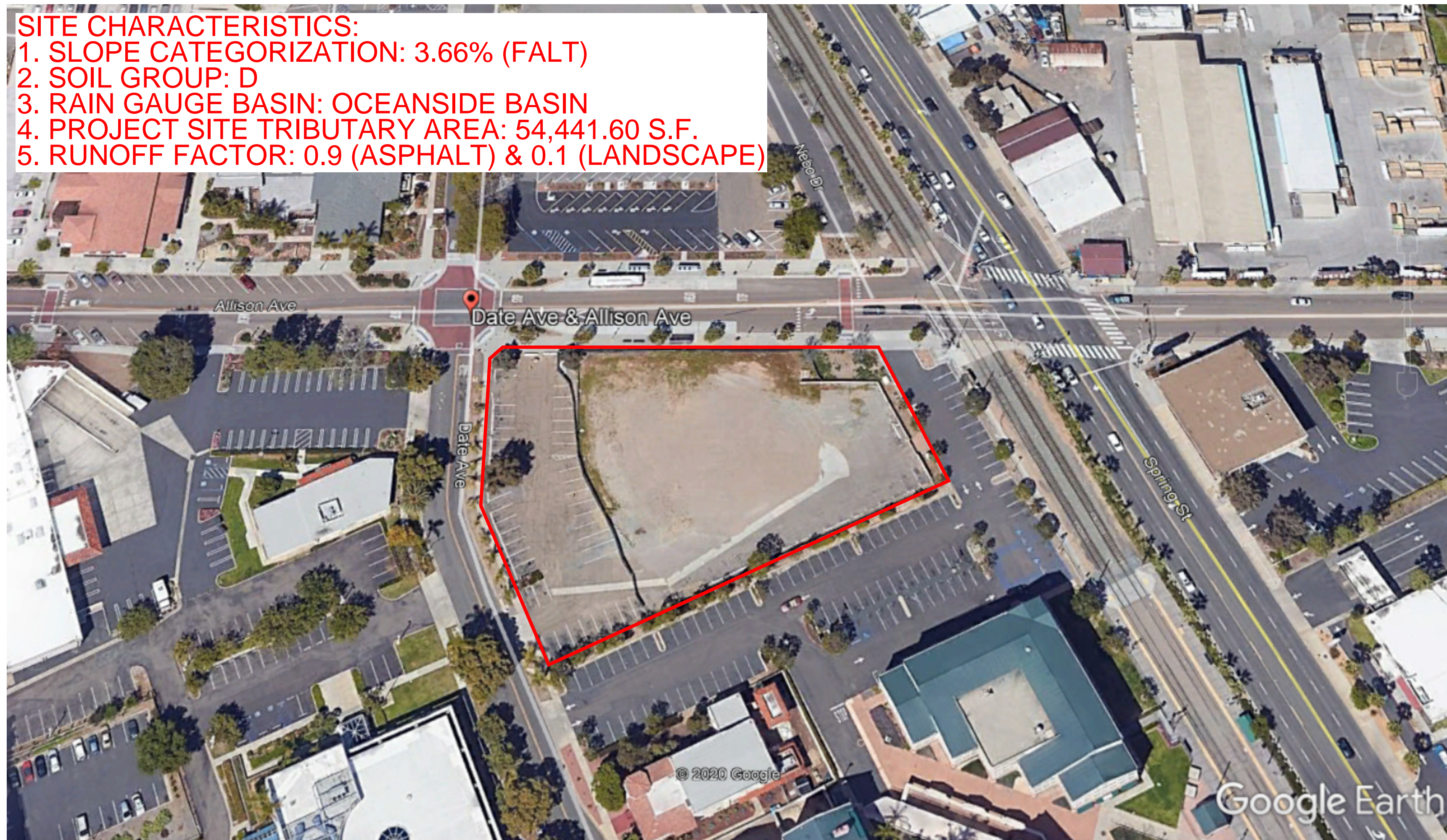
## 5.3 Conclusions

Proposed landscape area and various post construction BMPs identified in the project SWQMP will further alleviate the effects of additional hydrological or hydraulic demands which is typically expected from development.



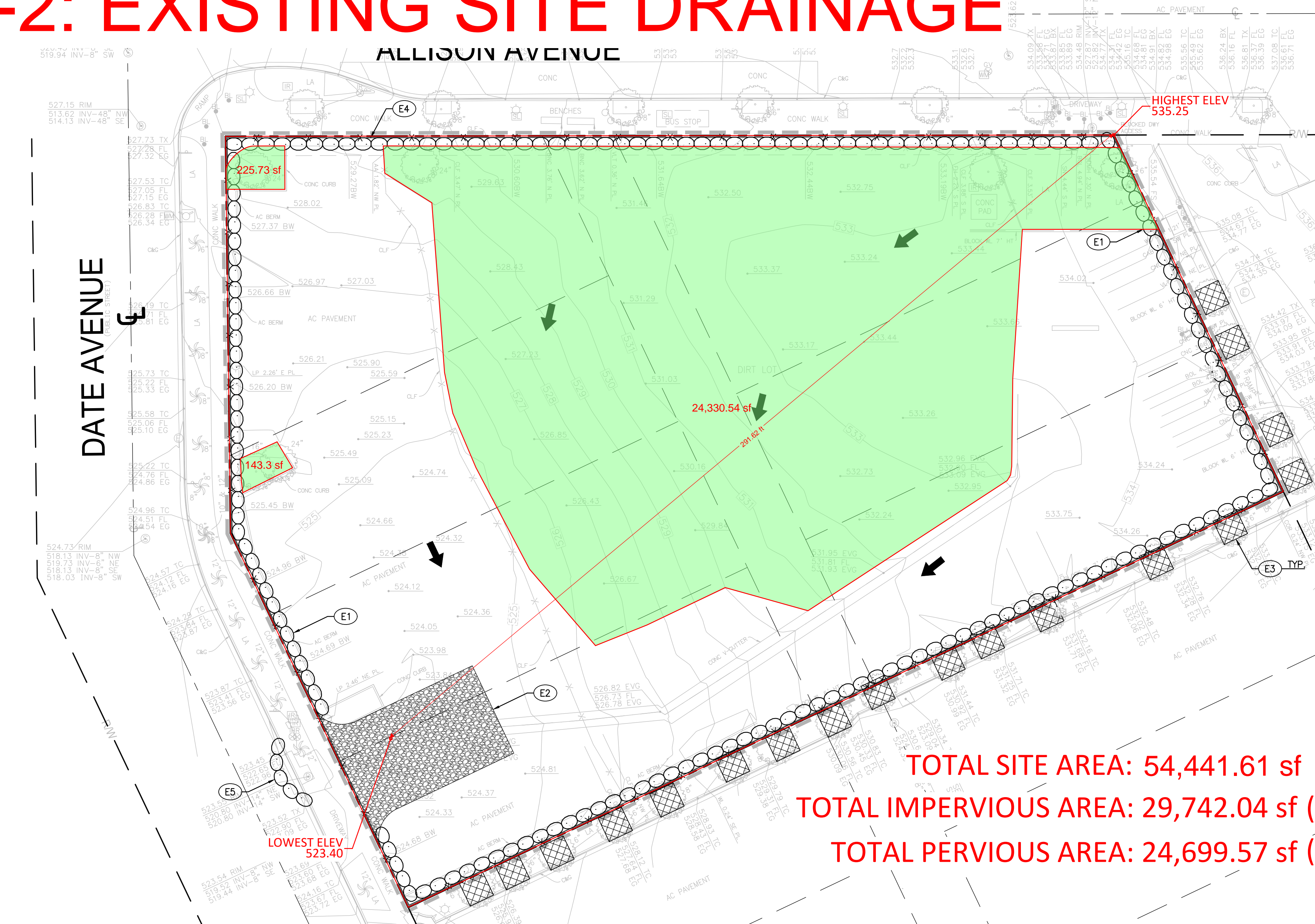
# EX-1: EXISTING SITE TOPOGRAPHY

**SITE CHARACTERISTICS:**  
1. SLOPE CATEGORIZATION: 3.66% (FALT)  
2. SOIL GROUP: D  
3. RAIN GAUGE BASIN: OCEANSIDE BASIN  
4. PROJECT SITE TRIBUTARY AREA: 54,441.60 S.F.  
5. RUNOFF FACTOR: 0.9 (ASPHALT) & 0.1 (LANDSCAPE)





EX-2: EXISTING SITE DRAINAGE



**EROSION CONTROL NOTES:**

- E1 PLACE GRAVEL BAGS TRIPLE ROW PER DETAIL 1, HEREON.
- E2 STABILIZED CONSTRUCTION ENTRANCE PER DETAIL 2, HEREON.
- E3 PROVIDE TREE PROTECTION.
- E4 CONSTRUCTION FENCE. SHOWN FOR REFERENCE ONLY. CONTRACTOR TO COORDINATE LOCATION WITH RESPECT TO STAGING PLAN.
- E5 INLET PROTECTION PER DETAIL 3, HEREON.

**LEGEND**

- LIMIT LINE OF EROSION CONTROL
- PROPERTY LINE
- GRAVEL BAGS
- FIBER ROLL
- DIRECTION OF FLOW
- PROTECT TREE IN PLACE

**BMP NOTES:**

THE FOLLOWING BMPs AS OUTLINED IN, BUT NOT LIMITED TO, THE BEST MANAGEMENT PRACTICE HANDBOOK, CALIFORNIA STORMWATER QUALITY TASK FORCE, SACRAMENTO, CALIFORNIA, JULY 2012, MAY APPLY DURING THE CONSTRUCTION OF THIS PROJECT (ADDITIONAL MEASURES MAY BE REQUIRED IF DEEMED APPROPRIATE BY CITY INSPECTORS):

**EROSION CONTROL**

- EC1-SCHEDULING
- EC2-PRESERVATION OF EXISTING VEGETATION
- EC3-HYDRAULIC MULCH
- EC4-HYDROSEEDING
- EC5-SOIL BINDERS
- EC6-STRAW MULCH
- EC7-GEOTEXTILES AND MATS
- EC8-WOOD MULCHING
- EC9-EARTH DIKES AND DRAINAGE SWALES
- EC10-VELOCITY DISSIPATION DEVICES
- EC11-SLOPE DRAINS
- EC12-STREAMBANK STABILIZATION
- EC13-RESERVED
- EC14-COMPOST BLANKET
- EC15-SOIL PREPARATION/ROUGHENING
- EC16-NON-VEGETATIVE STABILIZATION

**WIND EROSION CONTROL**

- WE1-WIND EROSION CONTROL

**NON-STORMWATER MANAGEMENT**

- NS1-WATER CONSERVATION PRACTICES
- NS2-DEWATERING OPERATIONS
- NS3-PAVING AND GRINDING OPERATIONS
- NS4-TEMPORARY STREAM CROSSING
- NS5-CLEAR WATER DIVERSION
- NS6-ILLICIT CONNECTION/DISCHARGE
- NS7-POTABLE WATER/IRRIGATION
- NS8-VEHICLE AND EQUIPMENT CLEANING
- NS9-VEHICLE AND EQUIPMENT FUELING
- NS10-VEHICLE AND EQUIPMENT MAINTENANCE
- NS11-PILE DRIVING OPERATIONS
- NS12-CONCRETE CURING
- NS13-CONCRETE FINISHING
- NS14-MATERIAL OVER WATER
- NS15-DEMOLITION ADJACENT TO WATER
- NS16-TEMPORARY BATCH PLANTS

**TEMPORARY SEDIMENT CONTROL**

- SE1-SILT FENCE
- SE2-SEDIMENT BASIN
- SE3-SEDIMENT TRAP
- SE4-CHECK DAM
- SE5-FIBER ROLLS
- SE6-GRAVEL BAG BERM
- SE7-STREET SWEEPING AND VACUUMING
- SE8-SANDBAG BARRIER
- SE9-STRAW BALE BARRIER
- SE10-STORM DRAIN INLET PROTECTION
- SE11-ACTIVE TREATMENT SYSTEMS
- SE12-MANUFACTURED LINEAR SEDIMENT CONTROLS
- SE13-COMPOST SOCKS AND BERMS
- SE14-BIOFILTER BAGS

**EQUIPMENT TRACKING CONTROL**

- TC1-STABILIZED CONSTRUCTION ENTRANCE/EXIT
- TC2-STABILIZED CONSTRUCTION ROADWAY
- TC3-ENTRANCE/OUTLET TIRE WASH

**WASTE MANAGEMENT & MATERIALS POLLUTION CONTROL**

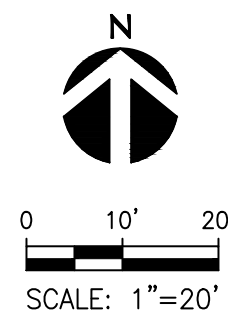
- WM1-MATERIAL DELIVERY AND STORAGE
- WM2-MATERIAL USE
- WM3-STOCKPILE MANAGEMENT
- WM4-SPILL PREVENTION AND CONTROL
- WM5-SOLID WASTE MANAGEMENT
- WM6-HAZARDOUS WASTE MANAGEMENT
- WM7-CONTAMINATED SOIL MANAGEMENT
- WM8-CONCRETE WASTE MANAGEMENT
- WM9-SANITARY/SEPTIC WASTE MANAGEMENT
- WM10-LIQUID WASTE MANAGEMENT

SLOPE INCLINATION	MAXIMUM SHEET FLOW LENGTH (FOR SLOPE INTERRUPTION)
< 4:1 (H:V)	*20'
4:1-2:1 (H:V)	*15'
> 2:1 (H:V)	*10'

\* FIRST ROW NEAR SLOPE TOE

- EROSION CONTROL NOTES:**
- TEMPORARY EROSION CONTROL DEVICES SHOWN ON THE GRADING PLAN WHICH INTERFERE WITH THE WORK SHALL BE RELOCATED OR MODIFIED AS AND WHEN THE INSPECTOR SO DIRECTS AS THE WORK PROGRESSES TO MEET "AS GRADED" CONDITIONS.
  - ALL LOOSE SOIL AND DEBRIS SHALL BE REMOVED FROM THE STREET AREAS UPON STARTING OPERATIONS AND PERIODICALLY THEREAFTER AS DIRECTED BY THE INSPECTOR
  - WHEN THE INSPECTOR SO DIRECTS, A 12-INCH BERM SHALL BE MAINTAINED ALONG THE TOP OF THE SLOPE OF THOSE FILLS ON WHICH GRADING IS NOT IN PROGRESS.
  - STORM AND SEWER DRAIN TRENCHES THAT ARE CUT THROUGH BASIN DIKES OR BASIN INLET DIKES SHALL BE PLUGGED WITH SANDBAGS.
  - EXCEPT WHEN THE INSPECTOR DIRECTS OTHERWISE, ALL DEVICES SHOWN SHALL BE IN PLACE AT THE END OF EACH WORKING DAY WHEN RAIN IS FORECAST, AND SHALL BE MAINTAINED DURING THE RAINY SEASON (OCTOBER 15 TO APRIL 15).
  - SANDBAGS SHALL BE STOCKPILED ON SITE, READY TO BE PLACED IN POSITION WHEN RAIN IS FORECAST, OR WHEN THE INSPECTOR SO DIRECTS.
  - A "STANDBY EMERGENCY CREW" SHALL BE ALERTED BY THE PERMITTEE OR THE CONTRACTOR TO PERFORM EMERGENCY WORK DURING RAINSTORMS. THE PARTY TO BE CONTACTED IS:  
NAME: \_\_\_\_\_ (TO BE FILLED IN BY CONTRACTOR)  
PHONE NUMBER: \_\_\_\_\_

- DUST CONTROL NOTES:**
- DUST SHALL BE CONTROLLED BY WATERING AND/OR APPLYING A DUST PALLIATIVE. THE DUST PALLIATIVE SHALL BE APPLIED IN THE AMOUNT AT THE LOCATIONS AS DIRECTED BY THE ENGINEER.
  - WATER FOR DUST CONTROL SHALL BE APPLIED BY MEANS OF PRESSURE TYPE DISTRIBUTORS OR PIPE LINES EQUIPPED WITH A SPRAY SYSTEM OR HOSES WITH NOZZLES THAT WILL ENSURE A UNIFORM APPLICATION OF WATER.
  - UNLESS WATER IS APPLIED BY MEANS OF PIPE LINES, AT LEAST ONE MOBILE UNIT WITH A MINIMUM CAPACITY OF 100 GALLONS SHALL BE AVAILABLE FOR APPLYING WATER.
  - ALL SOIL MATERIALS OR DEBRIS TRUCKED FROM THE SITE SHALL BE COVERED AND SPRINKLED PRIOR TO ENTERING PUBLIC STREETS.
  - PROVIDE FOR WET SUPPRESSION OR CHEMICAL STABILIZING OF EXPOSED SOILS.
  - PROVIDE FOR RAPID CLEAN-UP OF SEDIMENTS DEPOSITED ON THE PAVED ROADS.
  - LIMIT THE AMOUNT OF AREAS DISTURBED BY CLEARING & EARTH MOVING OPERATIONS BY SCHEDULING THESE ACTIVITIES IN PHASES.



**NOTES:**

- BAG MATERIAL: BAGS SHOULD BE WOVEN POLYPROPYLENE, POLYETHYLENE OR POLYAMIDE FABRIC, MINIMUM UNIT WEIGHT OF 4 OUNCES/YD<sup>2</sup>, MULLEN BURST STRENGTH EXCEEDING 300 LB/IN<sup>2</sup> IN CONFORMANCE WITH THE REQUIREMENTS IN ASTM DESIGNATION D3786, AND ULTRAVIOLET STABILITY EXCEEDING 70% IN CONFORMANCE WITH THE REQUIREMENTS IN ASTM DESIGNATION D4355.
- BAG SIZE: EACH GRAVEL-FILLED BAG SHOULD HAVE A LENGTH OF 18 IN., WIDTH OF 12 IN., THICKNESS OF 3 IN., AND MASS OF APPROXIMATELY 33 LBS. BAG DIMENSIONS ARE NOMINAL, AND MAY VARY BASED ON LOCALLY AVAILABLE MATERIALS.
- FILL MATERIAL: FILL MATERIAL SHALL BE 0.5 TO 1.0 INCH CRUSHED ROCK, CLEAN AND FREE OF CLAY, ORGANIC MATTER, AND OTHER DELETERIOUS MATERIAL, OR OTHER SUITABLE OPEN-GRADED, NON-COHESIVE, POROUS GRAVEL.
- TURN THE ENDS OF GRAVEL BAG BARRIER UP SLOPE TO PREVENT RUNOFF FROM GOING AROUND BARRIER.
- USE PYRAMID APPROACH WHEN STACKING BAGS.

**NOTES:**

- THE CONSTRUCTION ENTRANCE ROADWAYS SHALL BE STABILIZED SO AS TO PREVENT SEDIMENTS FROM BEING DEPOSITED INTO THE PUBLIC ROADS. DEPOSITIONS MUST BE SWEEPED UP IMMEDIATELY AND MAY NOT BE WASHED DOWN BY RAIN OR OTHER MEANS INTO THE STORM DRAIN SYSTEM.
- STABILIZED CONSTRUCTION ENTRANCE SHALL BE LOCATED AT ANY POINT WHERE TRAFFIC WILL BE ENTERING OR LEAVING A CONSTRUCTION SITE OR FROM A PUBLIC RIGHT OF WAY, STREET, ALLEY, AND SIDEWALK OR PARKING AREA.
- IF A WASH RACK IS INCLUDED, A SEDIMENT TRAP OF SOME KIND MUST ALSO BE PROVIDED TO COLLECT WASH WATER RUNOFF.
- ALL VEHICLES ACCESSING THE CONSTRUCTION SITE SHALL UTILIZE THE STABILIZED CONSTRUCTION ENTRANCE.

**STREET MAINTENANCE NOTES**

- REMOVE ALL SEDIMENT DEPOSITED ON PAVED ROADWAYS IMMEDIATELY.
- SWEEP PAVED AREAS THAT RECEIVE CONSTRUCTION TRAFFIC WHENEVER SEDIMENT BECOMES VISIBLE.
- PAVEMENT WASHING WITH WATER IS PROHIBITED IF IT RESULTS IN A DISCHARGE TO THE STORM DRAIN SYSTEM

**NOTES:**

- BAG MATERIAL: BAGS SHOULD BE WOVEN POLYPROPYLENE, POLYETHYLENE OR POLYAMIDE FABRIC, MINIMUM UNIT WEIGHT OF 4 OUNCES/YD<sup>2</sup>, MULLEN BURST STRENGTH EXCEEDING 300 LB/IN<sup>2</sup> IN CONFORMANCE WITH THE REQUIREMENTS IN ASTM DESIGNATION D3786, AND ULTRAVIOLET STABILITY EXCEEDING 70% IN CONFORMANCE WITH THE REQUIREMENTS IN ASTM DESIGNATION D4355.
- BAG SIZE: EACH GRAVEL-FILLED BAG SHOULD HAVE A LENGTH OF 18 IN., WIDTH OF 12 IN., THICKNESS OF 3 IN., AND MASS OF APPROXIMATELY 33 LBS. BAG DIMENSIONS ARE NOMINAL, AND MAY VARY BASED ON LOCALLY AVAILABLE MATERIALS.
- FILL MATERIAL: FILL MATERIAL SHALL BE 0.5 TO 1.0 INCH CRUSHED ROCK, CLEAN AND FREE OF CLAY, ORGANIC MATTER, AND OTHER DELETERIOUS MATERIAL, OR OTHER SUITABLE OPEN-GRADED, NON-COHESIVE, POROUS GRAVEL.
- TURN THE ENDS OF GRAVEL BAG BARRIER UP SLOPE TO PREVENT RUNOFF FROM GOING AROUND BARRIER.
- USE PYRAMID APPROACH WHEN STACKING BAGS.

EROSION CONTROL PLAN

ALLISON AVENUE TOD

USA PROPERTIES

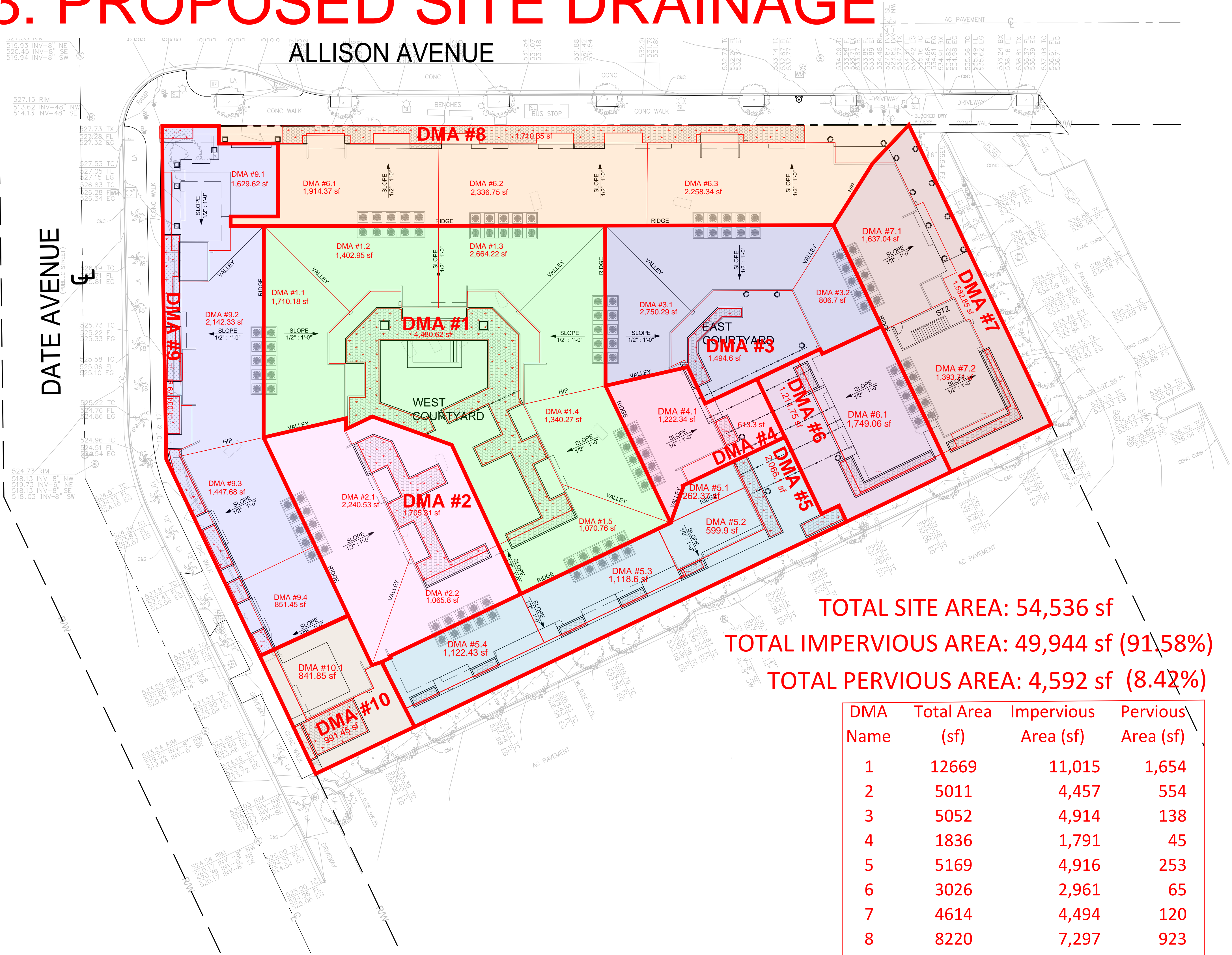


DATE 02-15-2021  
JOB NO. 1236.010  
501 West Broadway  
Suite 1080  
San Diego, CA 92101  
858-350-0544

C1.10



# EX-3: PROPOSED SITE DRAINAGE

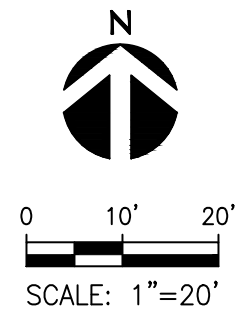


TOTAL SITE AREA: 54,536 sf  
TOTAL IMPERVIOUS AREA: 49,944 sf (91.58%)  
TOTAL PERVIOUS AREA: 4,592 sf (8.42%)

DMA Name	Total Area (sf)	Impervious Area (sf)	Pervious Area (sf)
1	12669	11,015	1,654
2	5011	4,457	554
3	5052	4,914	138
4	1836	1,791	45
5	5169	4,916	253
6	3026	2,961	65
7	4614	4,494	120
8	8220	7,297	923
9	7106	6,563	543
10	1833	1,536	297

- CONSTRUCTION NOTES:
- G01 AREA DRAIN PER DETAIL [SD01], SHEET [\_\_\_].
  - G02 PCC PAVING PER DETAIL [P07], SHEET [\_\_\_].
  - G03 CONTROL JOINT PER DETAIL [P14], SHEET [\_\_\_].
  - G04 ASPHALT PAVING PER DETAIL [P06], SHEET [\_\_\_].
  - G05 PCC CURB AND GUTTER PER DETAIL [P02], SHEET [\_\_\_].
  - G06 PAINT PARKING STRIPING PER DETAIL [ST01], SHEET [\_\_\_].
  - G07 SITE FEATURE WALL PER [\_\_\_\_\_] PLANS.
  - G08 ADA CURB RAMP PER APWA STANDARD PLAN 111-2, CASE TYPE 1.
  - G09 6" CURB PER DETAIL [P01], SHEET [\_\_\_].
  - G10 VALLEY GUTTER PER DETAIL [P04], SHEET [\_\_\_].
  - G11 DRIVE APPROACH PER APWA STANDARD PLAN 110-1, TYPE C.

- LEGEND
- LIMIT OF WORK
  - PROPERTY LINE
  - FLOW LINE
  - GB GRADE BREAK
  - RIDGE LINE
  - EARTHEN SWALE
  - SAWCUT AND JOIN
  - GRADE SLOPE (HORIZONTAL:VERTICAL)
  - LIMITS OF GRADING
  - GRADING BENCH
  - PROPOSED MAJOR CONTOUR
  - PROPOSED MINOR CONTOUR
  - CONCRETE PAVING (REFER TO SHEET [CX.XX] FOR DETAILS)
  - ASPHALT (REFER TO SHEET [CX.XX] FOR DETAILS)
  - GRAVEL (REFER TO ARCHITECTURAL PLANS FOR DETAILS)
  - PLANTER AREA/LANDSCAPE (REFER TO LANDSCAPING PLANS FOR DETAILS)
  - SAND (REFER TO ARCHITECTURAL PLANS FOR DETAILS)
  - PROPOSED BUILDING (REFER TO ARCHITECTURAL PLANS FOR DETAILS)



## GRADING PLAN - PODIUM LEVEL





# EX-3: PROPOSED SITE DRAINAGE (CONT)



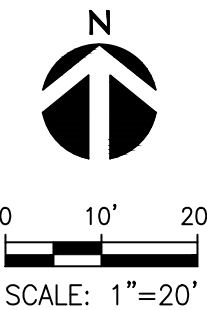
- UTILITY CONSTRUCTION NOTES:**
- STORM DRAIN**
- (SD1) PVC, SCHEDULE 40 STORM DRAIN PIPE.
  - (SD2) POINT OF CONNECTION TO PLUMBING.
  - (SD3) CDS PRETREATMENT UNIT.
  - (SD4) PRECAST CONCRETE MODULE FOR STORM WATER STORAGE. MINIMUM VOLUME = 5,500 CUBIC FEET.
  - (SD5) STORM WATER STORAGE TANK RISER PER MANUFACTURER.
  - (SD6) PUMP.
  - (SD7) PREFABRICATED BIOFILTRATION PLANTER WITH LINEAR FLOW PER MANUFACTURER. MINIMUM TREATMENT FLOW RATE = 0.312 CFS.
  - (SD8) 12" X 12" PRECAST CONCRETE CATCH BASIN.
  - (SD9) OVERFLOW DRAIN.
  - (SD10) CURB DRAIN.

- LEGEND:**
- LIMIT OF WORK
  - - - - - PROPERTY LINE
  - SS SANITARY SEWER
  - W WATER
  - DW DOMESTIC WATER
  - FW FIRE WATER
  - SD STORM DRAIN
  - G GAS
  - E ELECTRIC
  - T TELEPHONE
  - - - - - PERFORATED PIPE
  - ⊕ POINT OF CONNECTION
  - COORDINATION POINT
  - CAP OR PLUG
  - ⊙ UTILITY MANHOLE
  - ⊙ UTILITY CLEANOUT
  - ⊙ STORM DRAIN INLET
  - ⊙ AREA DRAIN/PLANTER DRAIN
  - TRENCH DRAIN
  - ⊙ FIRE HYDRANT
  - △ THRUST BLOCK
  - ⊙ FIRE DEPARTMENT CONNECTION (FDC)
  - ⊙ POST INDICATOR VALVE (PIV)
  - ⊙ WATER VALVE
  - BACKFLOW ASSEMBLY
  - ⊙ UTILITY METER VAULT
  - ⊙ BIOFILTRATION PLANTER

**NOTE:**  
IRRIGATION WATER METER, LINES AND APPURTENANCES BY OTHERS.

**NOTE:**  
ALL BMP'S PROPOSED AS A PART OF THIS PROJECT ARE TO BE INSPECTED BY THE ENGINEER OF RECORD AFTER INSTALLATION AND PRIOR TO OBTAINING A CERTIFICATE OF OCCUPANCY.

**NOTE:**  
PRIOR TO THE INSTALLATION OF ALL STORM DRAIN AND SEWER MAIN LINE CONNECTIONS, THE CONTRACTOR SHALL POTHOLE AND VERIFY THE HORIZONTAL AND VERTICAL LOCATION OF THE MAIN LINE. IF CONDITIONS DIFFER FROM THOSE ON THE PLAN, THE CONTRACTOR SHALL NOTIFY THE ENGINEER AND SHALL NOT BEGIN CONSTRUCTION UNTIL THE CHANGED CONDITION HAS BEEN EVALUATED.



## UTILITY PLAN

8181 ALLISON AVENUE TOD

USA PROPERTIES

**kpff**  
700 South Flower Street  
Suite 2100  
Los Angeles, CA 90017  
O: 213.418.0201  
F: 213.266.5294  
[www.kpff.com](http://www.kpff.com)

**USA**  
PROPERTIES FUND  
Creating Outstanding Communities.

**DAHLIN**

**DATE** 04-15-2021  
**JOB NO.** 1236.010  
501 West Broadway  
Suite 1080  
San Diego, CA 92101  
858-350-0544

C1.40



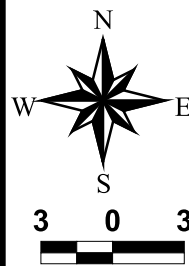
# EX-4: RAINFALL ISOPLUVIALS



Rainfall Isopluvials

10 Year Rainfall Event - 6 Hours

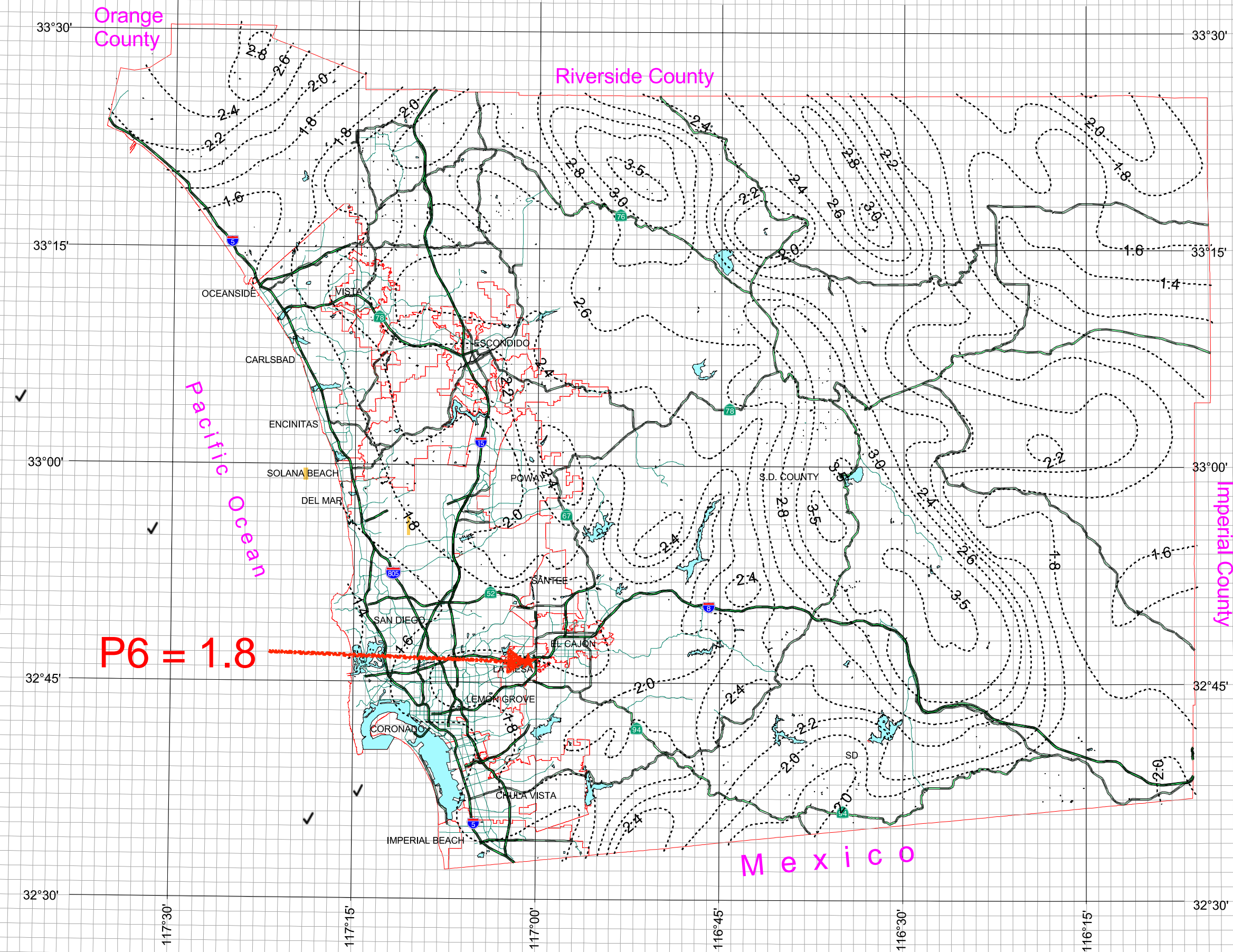
----- Isopluvial (inches)



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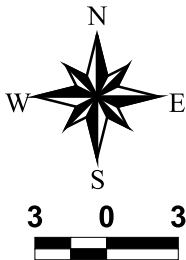
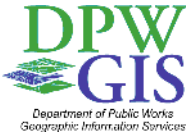
County of San Diego  
Hydrology Manual



Rainfall Isopluvials

10 Year Rainfall Event - 24 Hours

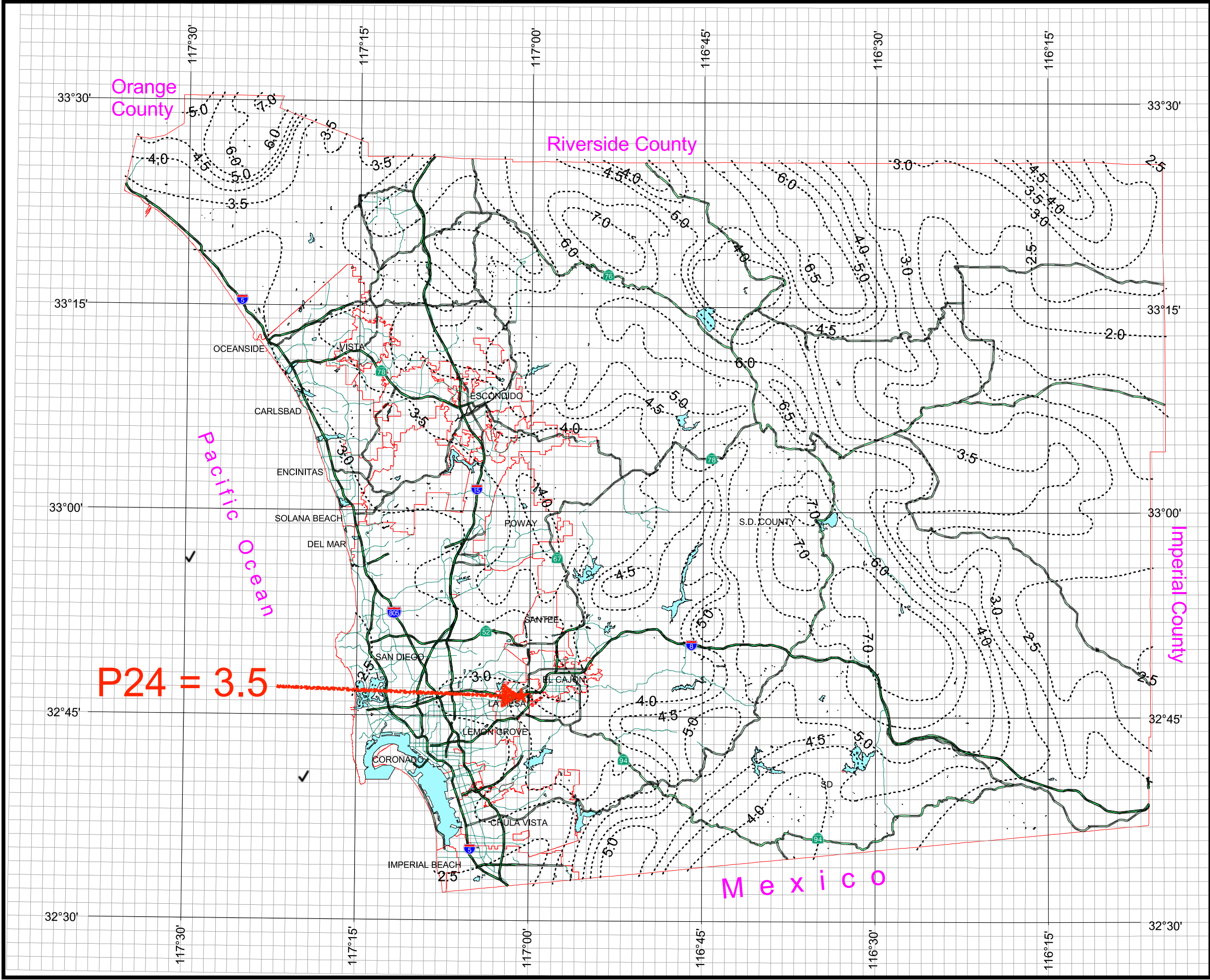
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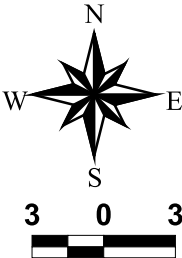
# County of San Diego Hydrology Manual



## Rainfall Isopluvials

### 50 Year Rainfall Event - 6 Hours

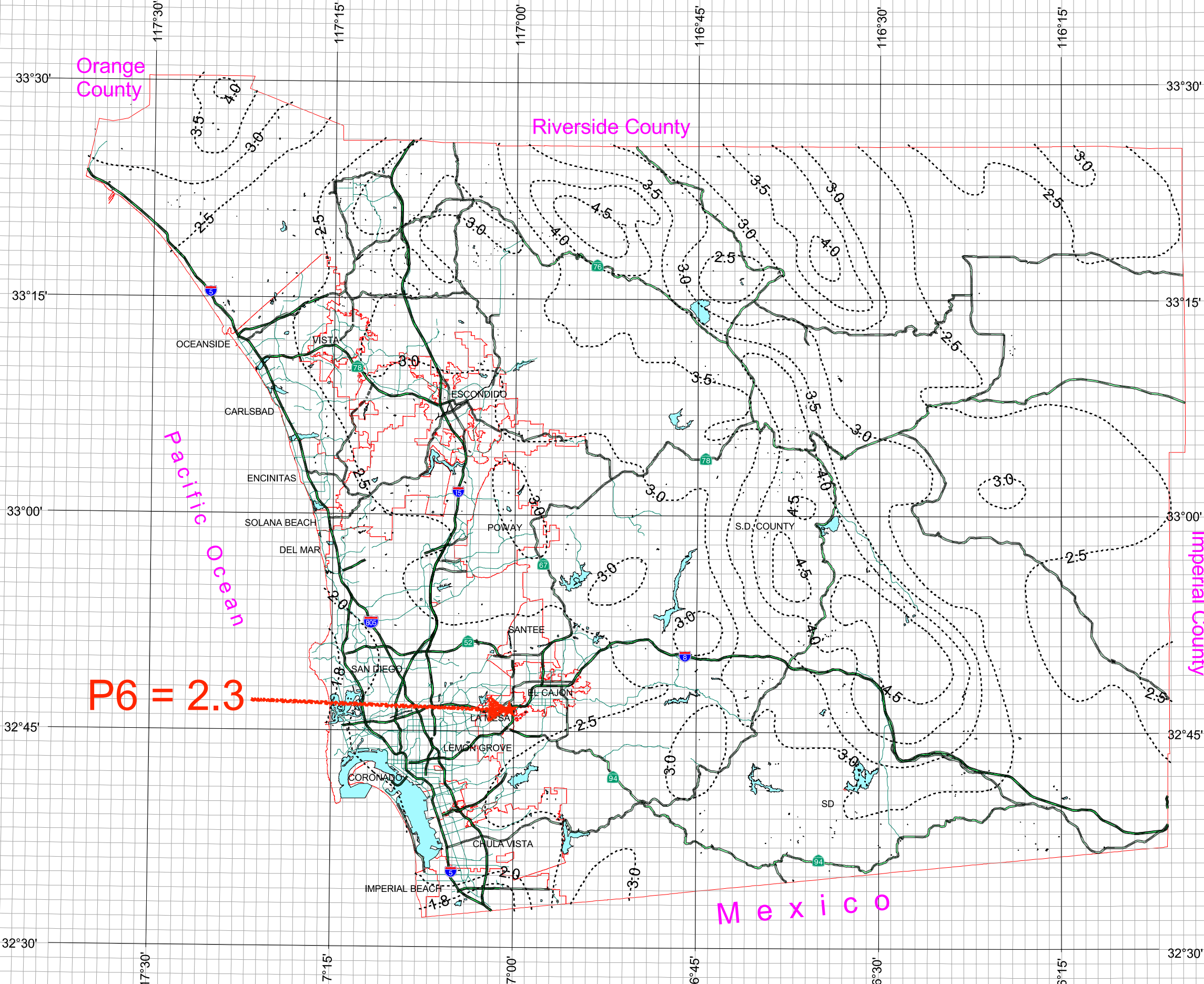
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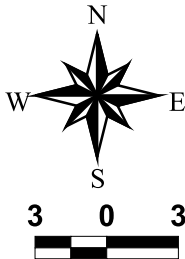
# County of San Diego Hydrology Manual



## Rainfall Isophuvials

### 50 Year Rainfall Event - 24 Hours

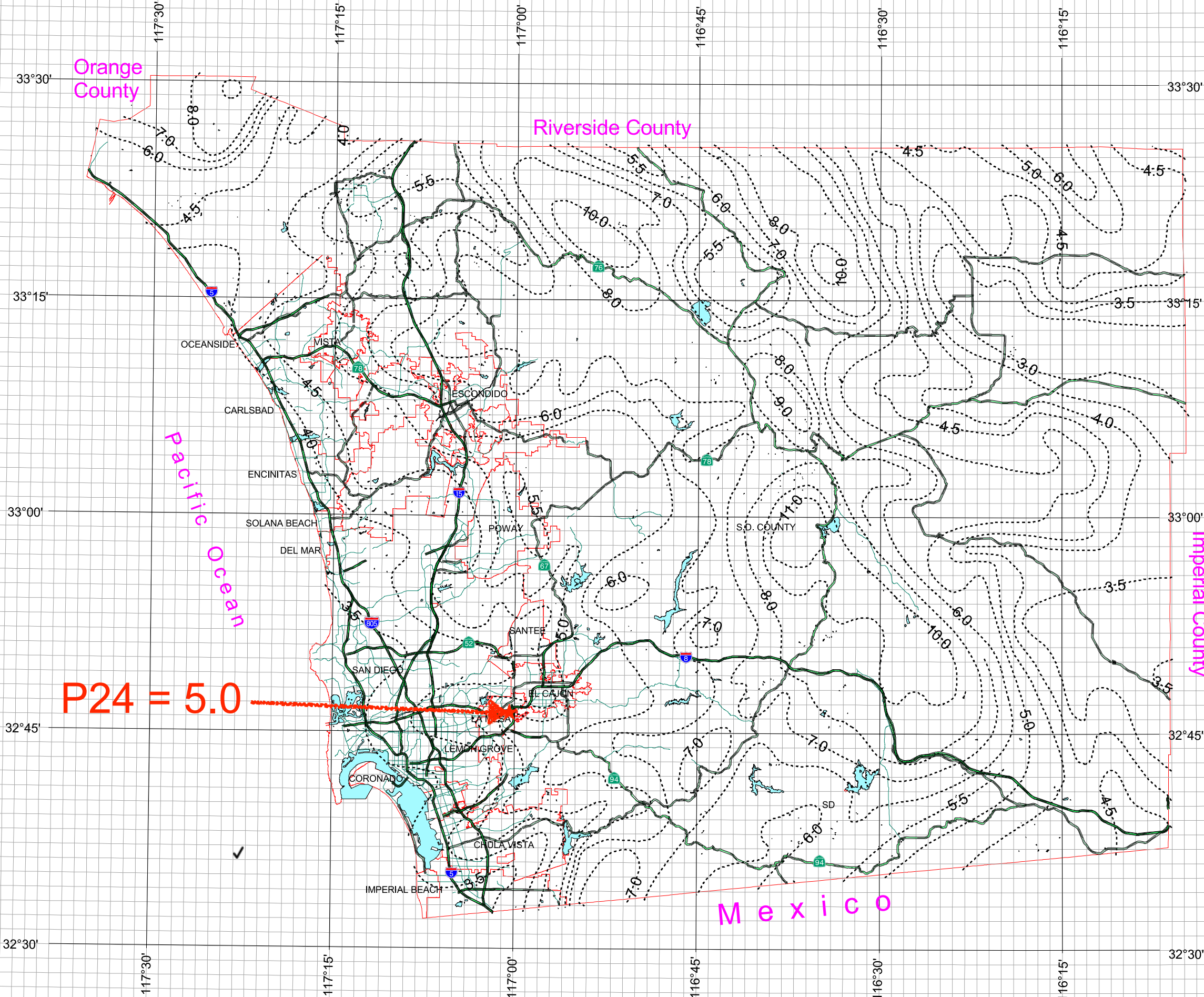
----- Isopluvial (inches)



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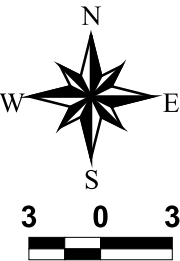
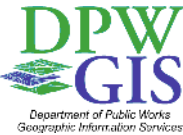
# County of San Diego Hydrology Manual



## Rainfall Isopluvials

### 100 Year Rainfall Event - 6 Hours

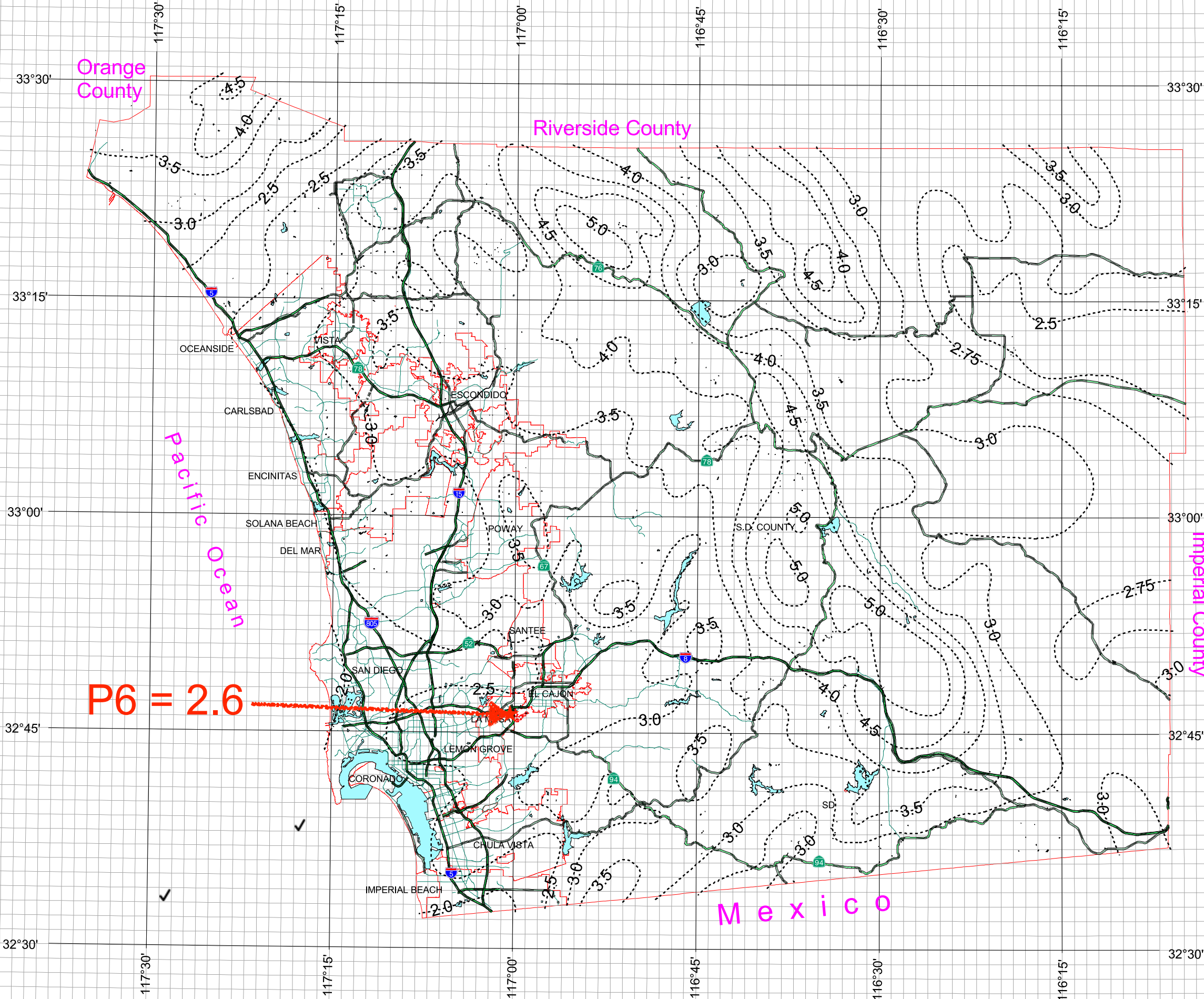
----- Isopluvial (inches)



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# County of San Diego Hydrology Manual

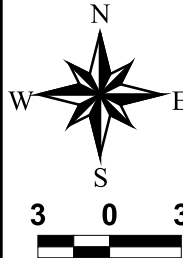


## Rainfall Isopluvials

### 100 Year Rainfall Event - 24 Hours

----- Isopluvial (inches)

P24 = 5.5



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# EX-5: HYDROLOGY CALCULATIONS

Table 1: Equations Used in Hydrology Study

Equations Used	
1.	$C = 0.90 * (\%Impervious) + C_p * (1 - \%Impervious)$
2.	$T_c = \frac{1.8 * (1.1 - C) * sqrt(D)}{(s)^{\frac{1}{3}}}$
3.	$I = 7.44 * P_6 * D^{-0.645}$
4.	$Q = C * I * A$

Table 2: Definition of Variables in Hydrology Study Equations

Definition of Variables	
C	Area- Weighted Runoff Coefficient, proportion of rainfall that runs off the surface
% Impervious	The percentage of project site area that is hardscape
C <sub>p</sub>	Pervious Runoff Coefficient; Value of 0.35 used
P <sub>6</sub> (in)	The adjusted 6-hour storm rainfall amount
D	In Equation 2 of Table 4, D is the watercourse distance in feet In Equation 3 of Table 4, D is the duration in minutes (use t <sub>c</sub> );
s (%)	Slope along watercourse distance
T <sub>c</sub> (min)	Time of concentration (minimum 5 minutes)
I (in/hr)	Average rainfall Intensity for a selected storm frequency
A (acres)	Drainage Area
Q (cfs)	Peak discharge in cubic feet per second

Table 3: Hydrology Calculations for Pre-Development Condition

Pre-Development Condition										
Drainage Area No.	Area (SF)	Area (acres)	% Impervious	C	T <sub>c</sub>	I10	I100	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)
DMA	54,441	1.25	55%	0.65	5.00	4.74	6.85	3.86	4.93	5.57
Total	54,441	1.25	55%	-	-	-	-	3.86	4.93	5.57

Table 4: Hydrology Calculations for Post-Development Condition

Post-Development Condition										
Drainage Area No.	Area (SF)	Area (acres)	%Impervious	C	T <sub>c</sub>	I10	I100	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)
DMA #1	12,669	0.29	87%	0.89	5.00	4.74	6.85	1.22	1.56	1.76
DMA #2	5,011	0.12	89%	0.89	5.00	4.74	6.85	0.48	0.62	0.70
DMA #3	5,052	0.12	97%	0.90	5.00	4.74	6.85	0.49	0.63	0.71
DMA #4	1,836	0.04	98%	0.90	5.00	4.74	6.85	0.18	0.23	0.26
DMA #5	5,169	0.12	95%	0.89	5.00	4.74	6.85	0.50	0.64	0.73
DMA #6	3,026	0.07	98%	0.90	5.00	4.74	6.85	0.30	0.38	0.43
DMA #7	4,614	0.11	97%	0.90	5.00	4.74	6.85	0.45	0.58	0.65
DMA #8	8,220	0.19	89%	0.89	5.00	4.74	6.85	0.79	1.02	1.15
DMA #9	7,106	0.16	92%	0.89	5.00	4.74	6.85	0.69	0.88	1.00
DMA #10	1,833	0.04	84%	0.88	5.00	4.74	6.85	0.18	0.22	0.25
Total	54,536	1.25	92%	-	-	-	-	5.29	6.76	7.64

Table 5: Area-Weighted Runoff Coefficient Calculations

Area-Weighted Runoff Coefficient Calculations		
Drainage Area	% Imp	Equation for C
DMA #1	0.87	0.90 * (0.87) + (0.79 * 0.13) = 0.89
DMA #2	0.89	0.90 * (0.89) + (0.79 * 0.11) = 0.89
DMA #3	0.97	0.90 * (0.97) + (0.79 * 0.03) = 0.90
DMA #4	0.98	0.90 * (0.98) + (0.79 * 0.02) = 0.90
DMA #5	0.95	0.90 * (0.95) + (0.79 * 0.05) = 0.89
DMA #6	0.98	0.90 * (0.98) + (0.79 * 0.02) = 0.90
DMA #7	0.97	0.90 * (0.97) + (0.79 * 0.03) = 0.90
DMA #8	0.89	0.90 * (0.89) + (0.79 * 0.11) = 0.89
DMA #9	0.92	0.90 * (0.92) + (0.79 * 0.08) = 0.89
DMA #10	0.84	0.90 * (0.84) + (0.79 * 0.16) = 0.88

Note: C = 0.90 \* (%Impervious) + C<sub>p</sub> \* (1 - %Impervious)

**Table 5: Adjusted 6-Hour Percipitation**

Adjusted 6-Hour Percipitation				
Years	P6	P24	%	Adjusted P6
10	1.8	3.5	0.51	1.8
50	2.3	5	0.46	2.3
100	2.6	5.5	0.47	2.6