

**SUMMARY OF FINDINGS FOR THE  
ANNUAL DRAINAGE CHANNEL FIELD  
ASSESSMENT AND MAINTENANCE PRIORITIZATION  
PROJECT (PHASE 1)  
FOR  
THE CITY OF SAN DIEGO – MASTER STORM WATER  
SYSTEM MAINTENANCE PROGRAM (MMP) MAP 105:  
EUCLID & CASTANA**

**Job Number 17204-D  
August 4, 2015**

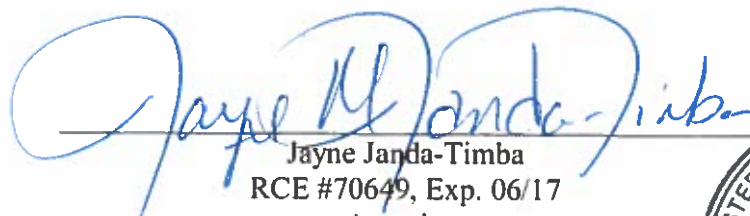
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**SUMMARY OF FINDINGS FOR THE  
ANNUAL DRAINAGE CHANNEL FIELD  
ASSESSMENT AND MAINTENANCE PRIORITIZATION PROJECT (PHASE 1)  
FOR  
THE CITY OF SAN DIEGO – MASTER STORM WATER SYSTEM MAINTENANCE  
PROGRAM (MMP) MAP 105: EUCLID & CASTANA**

Job Number 17204-D

  
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**August 4, 2015**

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## **1.0     Executive Summary**

This report and preliminary analyses concludes that the Channel Prioritization Score for the Euclid & Castana (MMP Map 105) is **50.9 out of 100**. This score is at average and indicates that the channel is recommended for maintenance. If the channel is maintained to reflect the as-built condition, the hydraulic capacity of the channel will increase from the current 1077 cfs (100-year storm event) capacity to a 1616.4 cfs (100-year storm event) capacity. In addition to the hydraulic capacity, the analyses considered other factors including water quality, community input and aesthetics. The analyses concluded that these other factors are generally in good condition and the benefits of maintaining the channel are mainly to reduce the flood risk.

## **2.0     Introduction**

This report summarizes the findings for the Annual Drainage Channel Field Assessment and Maintenance Prioritization Project (Phase 1) for the City of San Diego for Master Storm Water System Maintenance Program (MMP), dated October 2011, Map 105: Euclid & Castana. Refer to Appendix A for the MMP Storm Water Facilities Key Map and Map 105.

### **Purpose**

As part of the Master Storm Water System Maintenance Program (MMP), the City of San Diego performed site visits to drainage channels within the MMP and designated several drainage channels as maintenance priorities. The purpose of Phase 1 of this project is to perform a desktop analysis to evaluate the drainage channels identified by the City of San Diego and rank them in order of significance for the purposes of City of San Diego maintenance activities.

## **3.0     Desktop Channel Maintenance Prioritization Analysis**

The desktop channel maintenance prioritization analysis is based on the following items which were reviewed and evaluated to determine the maintenance priority:

- City of San Diego Operations and Maintenance (O&M) Channel Maintenance Inspection Forms completed for the channel by the City of San Diego (Refer to Appendix B)
- Site photos taken by the City of San Diego (Refer to Appendix B)
- Available as-built plans (Refer to Appendix G)
- Hydraulic Analysis (Refer to Section 5.0 and Appendix D for detailed output)

Section 5.1 of the MMP discusses the Annual Maintenance Needs Determination Process. As part of the determination process, the MMP recommends that certain factors be evaluated including flood risk to life and property, water quality, community input and aesthetics. These four factors were utilized for this channel maintenance prioritization analysis. For the purposes of prioritizing the channel for maintenance activities, each main factor is weighted as shown in Table 1 below:

**Table 1**

<b>Channel Prioritization Assessment Factors and Weighting</b>	
<b>Factor</b>	<b>Percent Weighted (%)</b>
Flood Risk	75
Water Quality	10
Community Input	10
Aesthetics	5

As part of the channel prioritization analysis, each of the main factors has been divided into sub-factors. To determine the Flood Risk factor, a basic hydraulic analysis was performed for the channel. The hydraulic analysis is described in more detail in the Hydraulic Analysis section (Section 5.0) of this report. The remaining factors, Water Quality, Community Input and Aesthetics were assessed based on the site photos and the information provided on the (O&M) Channel Maintenance Inspection Form completed for the channel provided by the City of San Diego. These factors and sub-factors and how they relate to the Channel Prioritization Score are shown in more detail on the Channel Prioritization Assessment Sheet located in Appendix E.

#### **4.0 Hydrologic Summary**

##### Estimated Peak Discharges

A drainage study for the channel was not available at the authorship of this report. The drainage channel is not a Federal Emergency Management Agency (FEMA) defined channel and no detailed hydrologic analysis was available. Therefore, the 100-year storm event peak discharge (Q100) for the channel was estimated based on the size of the watershed tributary to the channel as shown in Table 2 below:

**Table 2**

<b>100-year Peak Discharge (Q100) Estimation Based on Watershed Size</b>				
<b>Watershed Area (square</b>	<b>&lt;1</b>	<b>1</b>	<b>2</b>	<b>&gt;4</b>
<b>cfs per acre</b>	4	2	1.5	1

cfs = cubic feet per second

The 2-, 5-, 10-, 25-, and 50-year storm event flow rates were then approximated by taking the ratio of the unknown storm event 6-hour precipitation and the 100-year storm event 6-hour precipitation, and then multiplying Q100 by the ratio to estimate the flow rate for the unknown storm event. Hydrologic support material is located in Appendix C. A summary of the estimated peak discharges are provided in the table below:

**Table 3**

<b>Summary of Approximate Hydrologic Data</b>						
<b>Drainage Area: 64 acres</b>						
<b>6-hour Precipitation</b>	1.2	1.4	1.6	2.0	2.25	2.5
<b>Frequency</b>	<b>2-Year</b>	<b>5-Year</b>	<b>10-Year</b>	<b>25-Year</b>	<b>50-Year</b>	<b>100-Year</b>
<b>Discharge (cfs)</b>	123	143	164	205	230	256

cfs = cubic feet per second

## **5.0 Hydraulic Analysis**

A basic hydraulic analysis of the channel was performed to assess the Flood Risk factor. The channel assessment limits are shown on Map 105 located in Appendix A. Manning's equation was utilized to calculate the capacity of the channel under two conditions:

1. Post-Maintenance Conditions: based on the material and geometry as observed on a site visit conducted on July 20, 2015 along with City of San Diego's 1999 2-foot topography.
2. Current Conditions: based on the vegetation and sediment levels estimated from the site photos taken by the City of San Diego and information provided on the (O&M) Channel Maintenance Inspection Form prepared by the City of San Diego.

In the absence of As-Built for this channel, a site visit on July 20, 2015 along with City of San Diego 1999 topography was used to obtain the geometry of the channel. This channel is entirely earthen and was measured in the field to have a bottom width of 11 feet. It was measured on the 1999 topography that the channel side slopes are approximately 4:1 and the channel has an approximate overall slope of 0.049. These channel properties were used for hydraulic calculations of the Post-Maintenance Conditions.

Culvert crossings that may exist within the channel reach were not analyzed as part of this hydraulic analysis. Existing culverts may be inefficient or undersized, however the culvert hydraulics were not considered as part of this analysis.

The multiple storm event peak discharges previously calculated in Section 4.0 were evaluated under each condition to assess the capacity of the channel and evaluate the benefit of performing maintenance activities on the channel. See the table below for a summary of the hydraulic results and Appendix D for detailed hydraulic output.

**Table 4**

<b>Summary of Hydraulic Analysis Results</b>			
<b>CURRENT CHANNEL CAPACITY</b>		<b>AS-BUILT CHANNEL CAPACITY</b>	
<b>Current Condition (cfs)</b>	<b>Equivalent Storm Event (year)</b>	<b>As-built Condition (cfs)</b>	<b>Equivalent Storm Event (year)</b>
1077	100	1616.4	100

cfs = cubic feet per second

## **6.0 Other Channel Prioritization Factors**

Sections 4.0 and 5.0 above discuss the determination process for the Flood Risk factor. For more information on the assessment of the Water Quality, Community Input, and Aesthetics factors please refer to the Channel Prioritization Assessment Sheet in Attachment E. The Channel Prioritization Assessment Sheet lists and describes the sub-factors that are considered in the determination of the four main channel assessment factors.

## **7.0 Summary of Findings and Recommendations**

A summary of the Channel Assessment is shown in the table below:

**Table 5**

<b>Channel Prioritization Assessment Scoring Summary</b>		
<b>Factor</b>	<b>Percent Weighted (%)</b>	<b>Weighted Factor Score/Maximum</b>
Flood Risk	75	46.9/75
Water Quality	10	4/10
Community Input	10	0/10
Aesthetics	5	0/5
<b>Overall Channel Score:</b>		<b>50.9/100</b>

Additionally, the following items should be noted:

- The culvert entrance at the downstream end of the channel is protected by a grate. This grate is partially clogged and recommended for maintenance to prevent the grate from fully clogging.

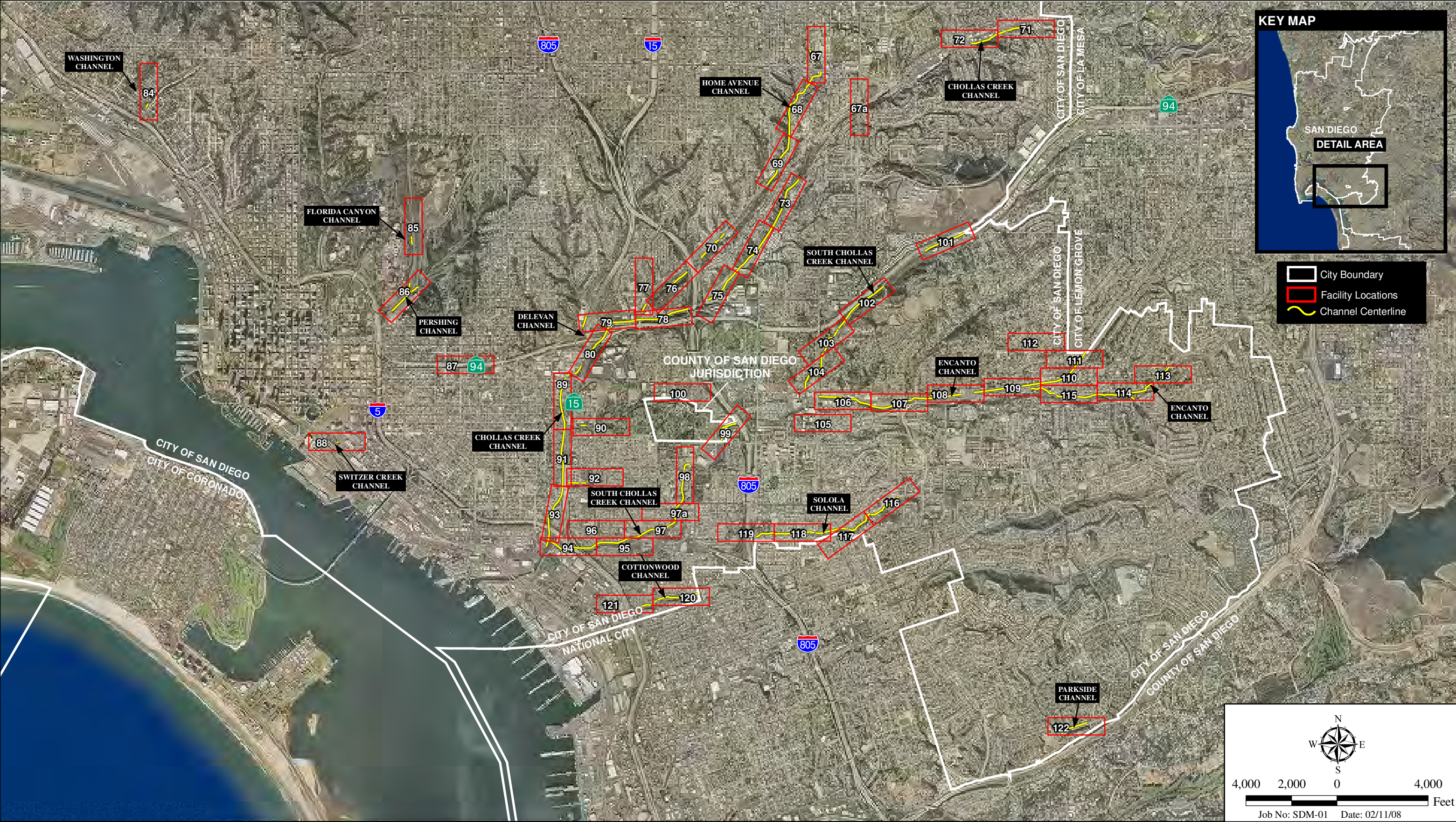
Based on the evaluation of the four weighted channel prioritization factors described in Section 3.0 of this report, the Channel Prioritization Score for MMP Map 105: Euclid & Castana is **50.9**. Refer to the Channel Prioritization Assessment Sheet located in Appendix E for details on the evaluation of the weighted factors and resulting score for this channel.

It is recommended that this drainage channel be maintained to increase the current capacity of the channel from a 1077 cfs (100-year storm event) back to a 1616.4 cfs (100-year storm event) capacity. It is important to note that although maintenance will not reduce the frequency of flooding, it will reduce the overall effect of flooding.

A summary of the channel including an aerial map, channel prioritization score, and other pertinent information is shown on the exhibit titled “Channel Maintenance Prioritization Summary Sheet” located in Appendix F.



**Appendix A**  
**Master Storm Water System Maintenance Program (MMP),**  
**dated October 2011, Storm Water Facilities**  
**Key Map and Map 105: Euclid & Castana**



I:\ArcGIS\SDM-01\Map\ENV\MSSMP\Fig2d\_CentralSD.mxd-NM

# Stormwater Facilites - Central San Diego Area

CITY OF SAN DIEGO MASTER STORMWATER SYSTEM MAINTENANCE PROGRAM

Figure 2d





E:\ArcGIS\SDM-01 StormDrainMaintenance\Map\ENV\MasterPlan\Map105.mxd -RK

## Access and Staging Areas

CITY OF SAN DIEGO MASTER STORMWATER SYSTEM MAINTENANCE PROGRAM

**Appendix B**  
**City of San Diego Operations and Maintenance (O&M)**  
**Channel Maintenance Inspection Forms completed**  
**for the channel and Site photos taken by the City of San Diego**

# Operations and Maintenance

## Channel Maintenance Inspection Form

Date: 5/9/15 Time: 12:45

Channel Map No.: 105

Watershed: Pueblo San Diego  
Euclides Castano

Inspector: Jorge, Jueves

Weather: Good

Initial Inspection

Follow Up Inspection ☒

Item	Condition	Comments
<b>A. Channel Condition</b> 1= Poor Condition/Needs Immediate Attention 2= Moderate Condition 3= Good Condition		
1. Structure Condition	1 2 <u>3</u> N/A	
2. Erosion	1 <u>2</u> 3 N/A	
3. Trash/Debris <u>veg</u>	1 <u>2</u> 3 N/A	Type of trash and source:
4. Water Conveyance/ Volume	1 2 <u>3</u> N/A	
5. Standing Water	Y <u>N</u>	
A. Ponding	Y <u>N</u>	
B. Noticeable odors	Y <u>N</u>	
C. Algae	Y <u>N</u>	
6. Vegetation	1 <u>2</u> 3 N/A	Approx. Coverage/Density of Vegetation: 40%
A. Invasive (Arundo)	1 <u>2</u> 3 N/A	<u>Palms</u>
B. Native	1 <u>2</u> 3 N/A	
7. Sediment	1 <u>2</u> 3 N/A	Approx. Depth/Coverage of Sediment:
8. Transients/ encampments	Y <u>N</u>	

**B. Culverts and Outfalls**

1= Poor Condition/Needs Immediate Attention

2= Moderate Condition

3= Good Condition

Item	Condition	Comments
1. Structure Condition	1 2 <u>3</u> N/A	
2. Trash/ <del>Debris</del> /Sediment <i>Tree</i>	1 <u>2</u> 3 N/A	
3. Clogging	1 2 <u>3</u> N/A	

**C. See Map Attached**

-Identify Key Issues on Map

-Inspect and take photographs from vantage points identified on Map

**Other Comments:****D. To Be Completed by Management****Follow Up Actions**

1.

2.

3.

E. Infrastructure Failure Issues

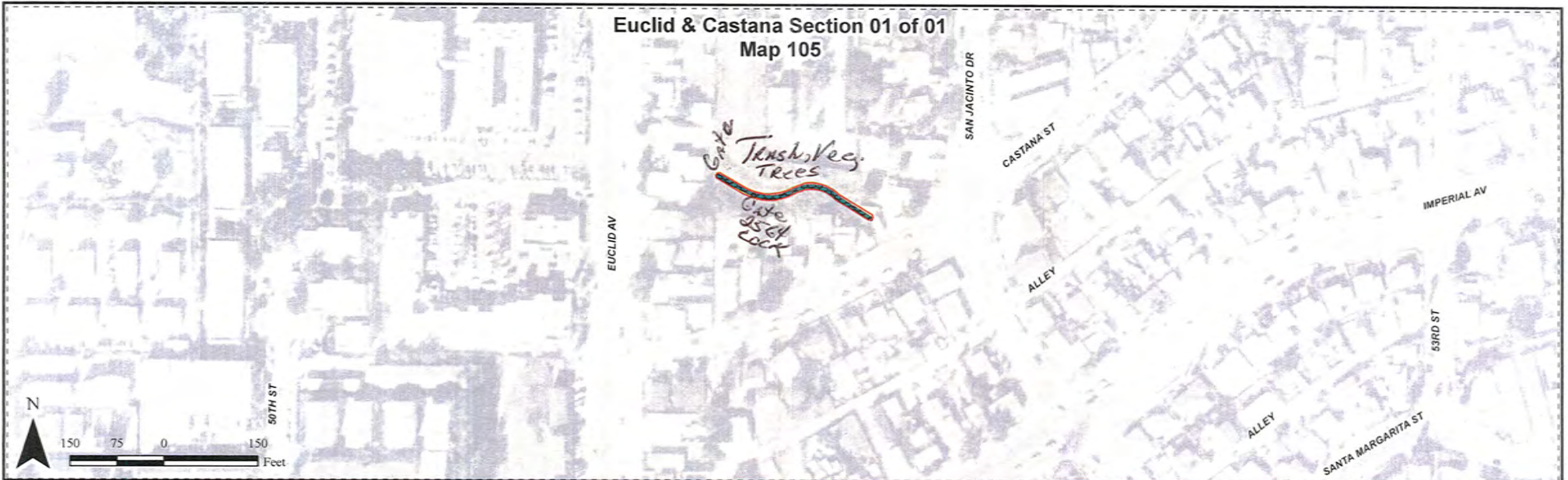
Item	Condition	Comments
1. Broken Concrete/Gunite?	Y N <u>N/A</u>	
2. Broken/Missing Trash Fence?	Y <u>N</u> N/A	
3. Broken/Missing Poles/Supports?	Y <u>N</u> N/A	
4. Exposed Rebar?	Y <u>N</u> N/A	
5. Rock/Debris Accumulation?	Y <u>N</u> N/A	
6. Potential Flooding/Litigation?	Y <u>N</u> N/A	
7. Slope Failure?	Y <u>N</u> N/A	

Other Comments/Observations:

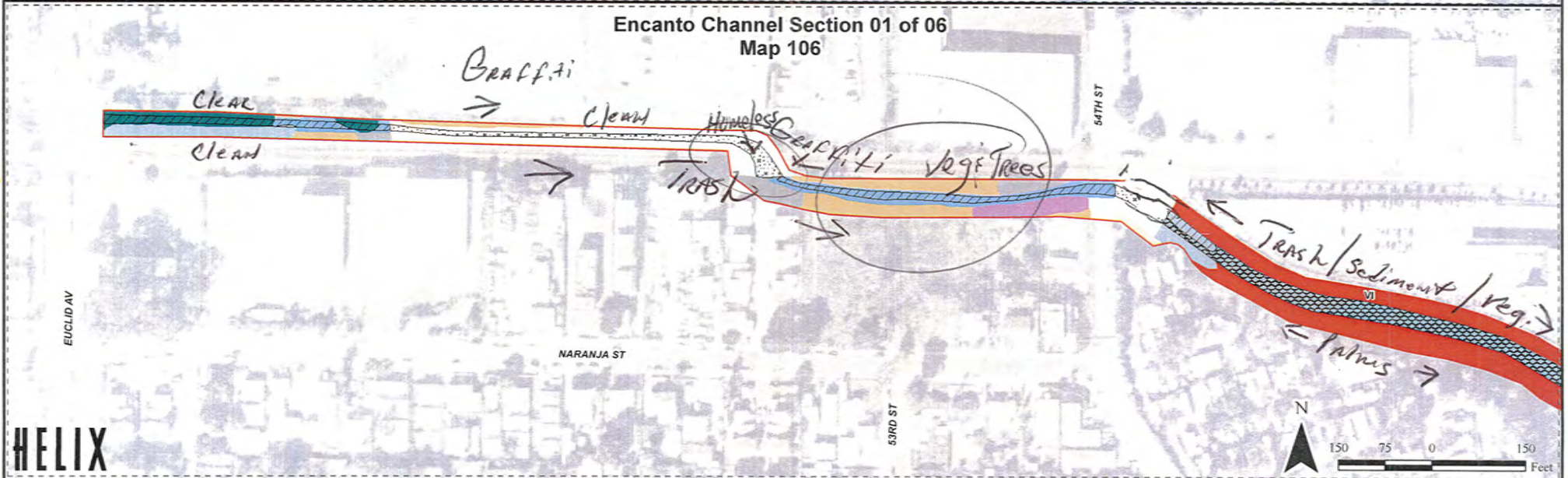
Access to channel has been blocked  
with two buildings !!



Euclid & Castana Section 01 of 01  
Map 105



Encanto Channel Section 01 of 06  
Map 106



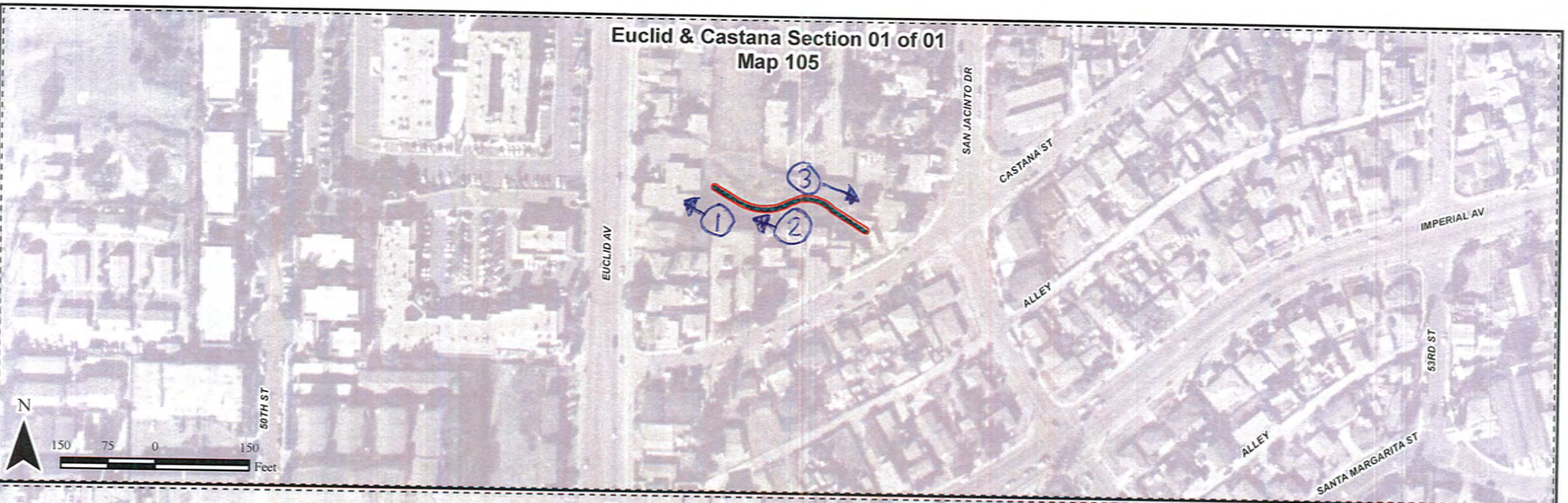
HELIX

Vegetation/Wetland Delineation - Maps 105 & 106

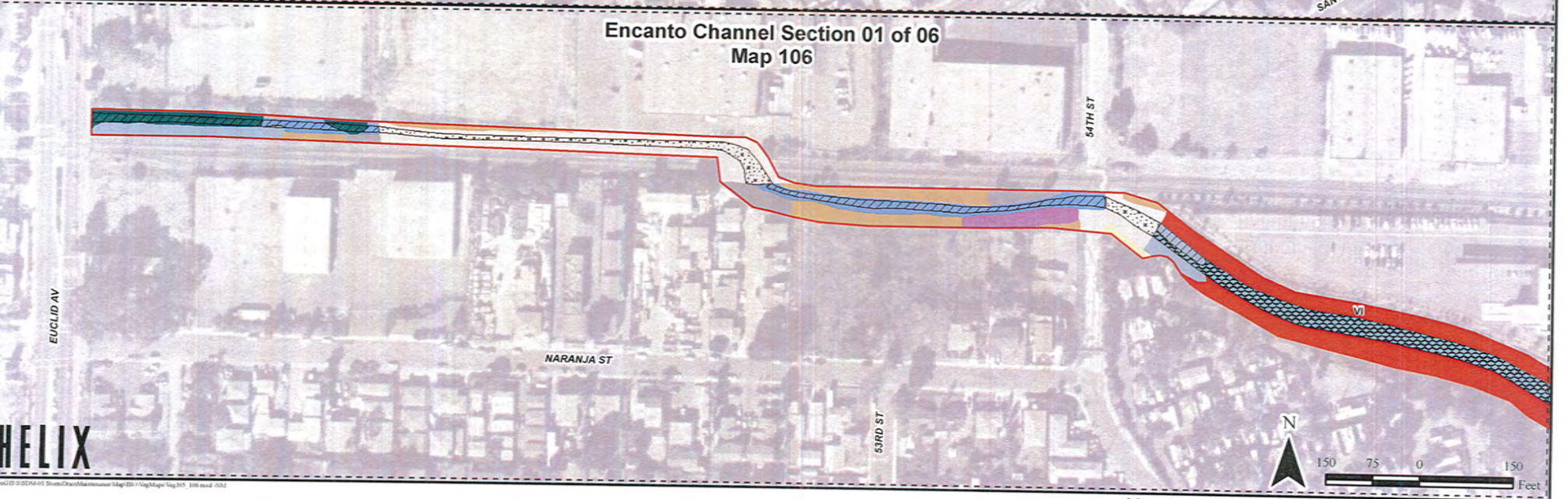
CITY OF SAN DIEGO MASTER STORMWATER SYSTEM MAINTENANCE PROGRAM



Euclid & Castana Section 01 of 01  
Map 105



Encanto Channel Section 01 of 06  
Map 106



Vegetation/Wetland Delineation - Maps 105 & 106

CITY OF SAN DIEGO MASTER STORMWATER SYSTEM MAINTENANCE PROGRAM





Euclid & Castana.1 (5-9-2015)JPG (2).JPG



Euclid & Castana.2 (5-9-2015)JPG (1).JPG



Euclid & Castana.3 (5-9-2015)JPG (3).JPG

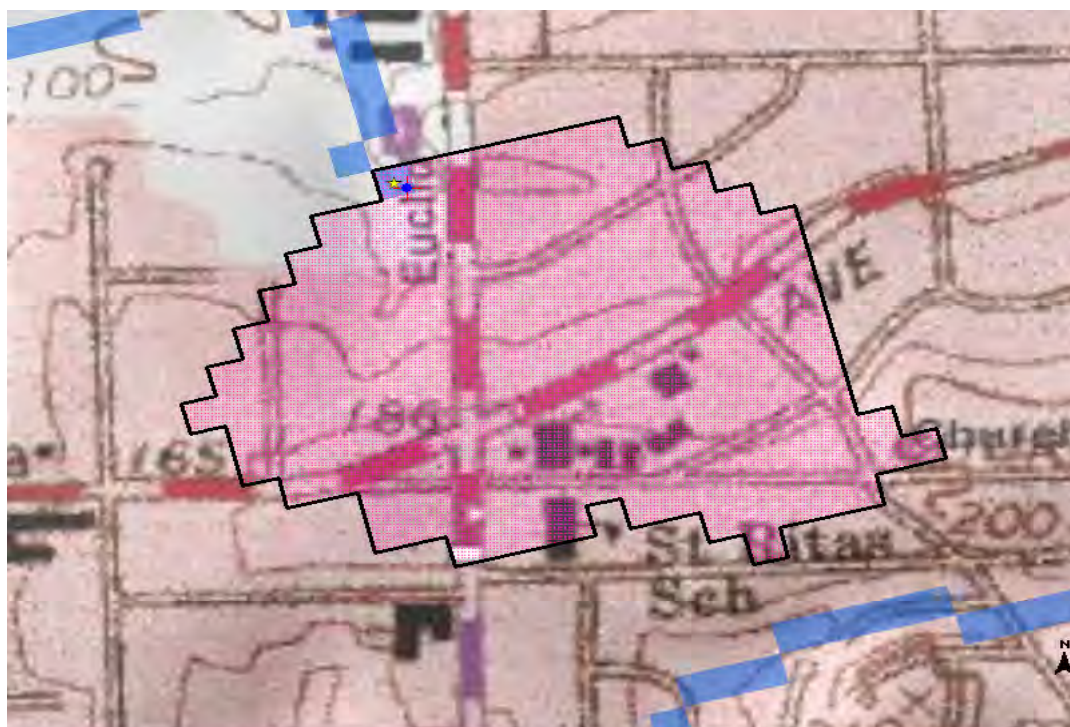


**Appendix C**  
**Hydrologic Support Material**



California StreamStats

## Euclid & Castana Watershed MMP Map 105



0.09 0.045 0 0.09 Miles

### Explanation

★ GlobalWatershedPoint	▲ Gaging Station, Continuous Record	□ hucpoly
⊙ Centroid	▲ Low Flow, Partial Record	— streams
◆ huc_net_Junctions	▲ Peak Flow, Partial Record	⊗ ExcludePoly
▭ GlobalWatershed	▲ Peak and Low Flow, Partial Record	
<b>Synthetic Stream Grid</b>	▲ Stage Only	
■	▲ Low Flow, Partial Record, Stage	
	▲ Miscellaneous Record	
	▲ Unknown	

U.S. Department of the Interior | U.S. Geological Survey

URL: [http://streamstatsags.cr.usgs.gov/ca\\_ss/default.aspx](http://streamstatsags.cr.usgs.gov/ca_ss/default.aspx)

Page Contact Information: [streamstats@usgs.gov](mailto:streamstats@usgs.gov)

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# San Diego County Hydrology Manual

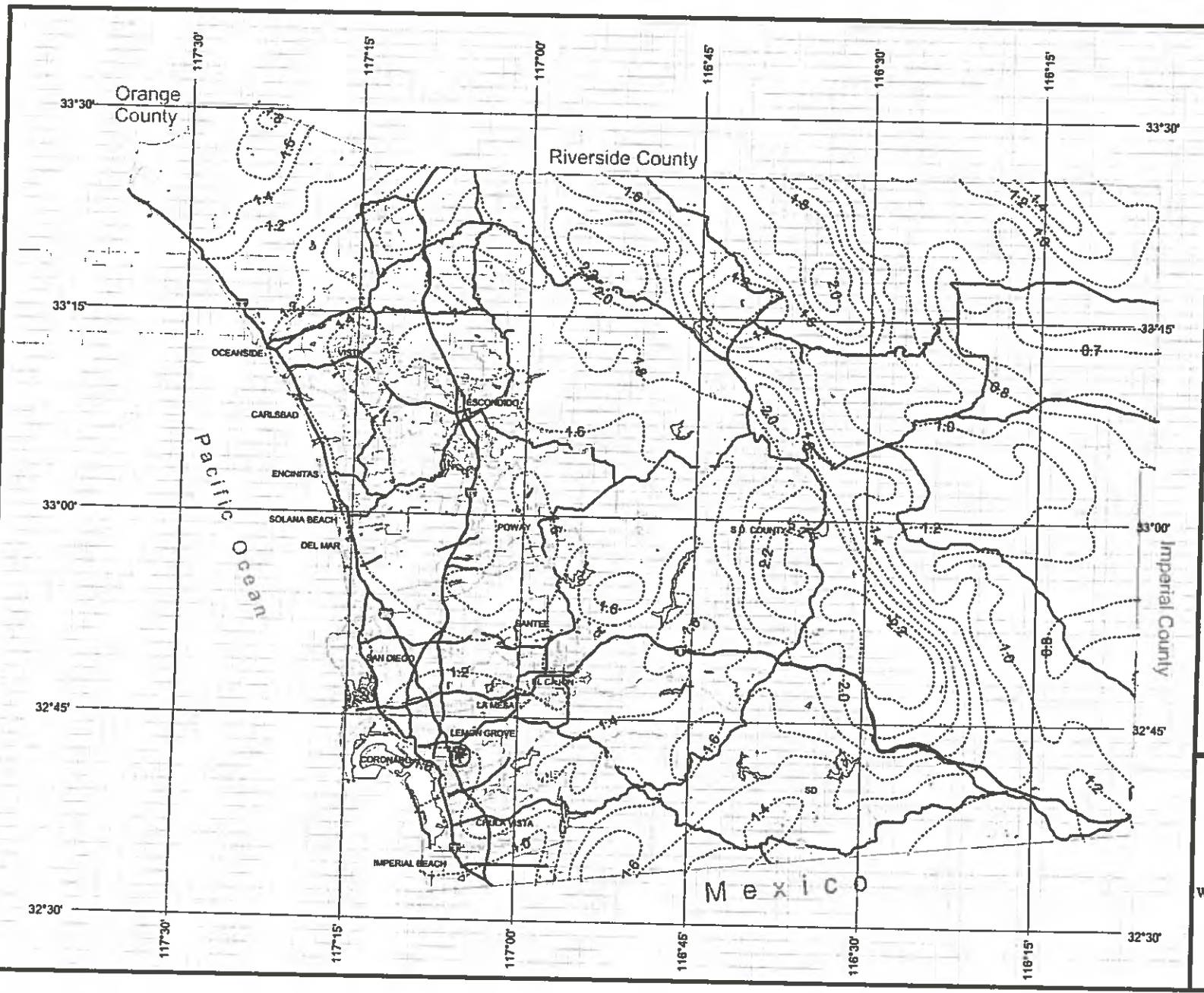


Prepared by the County of San Diego  
Department of Public Works  
Flood Control Section  
June 2003

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E	85 <sup>th</sup> Percentile Precipitation Isopluvial Map	E-1





# County of San Diego Hydrology Manual



## Rainfall Isopluvials

### 5 Year Rainfall Event - 6 Hours

----- Isopluvial (inches)

$\odot P_6 = 1.4$  inches

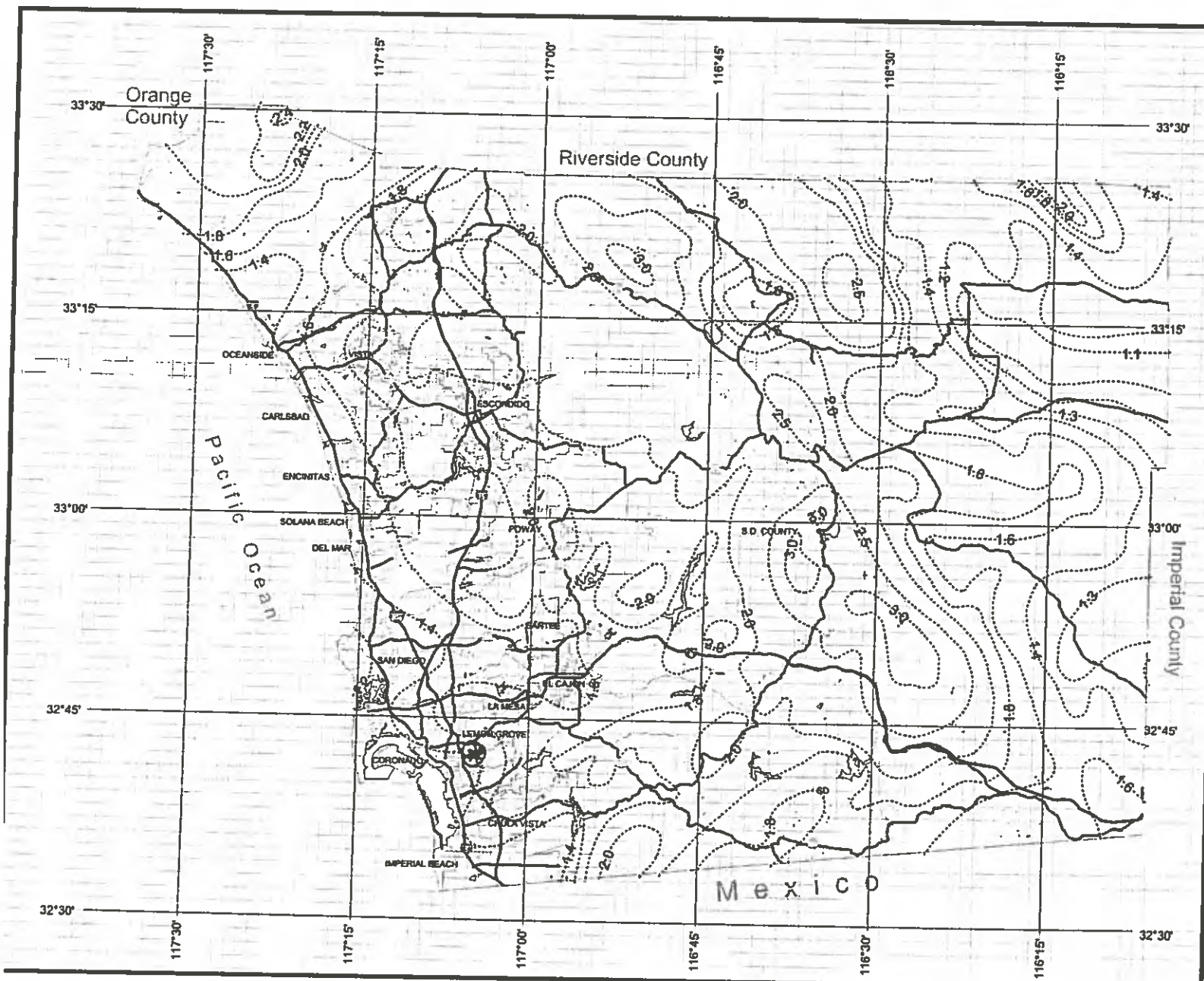
DPW  
GIS  
Department of Public Works  
San Diego, California

GIS  
We Have San Diego Covered



3 0 3 Miles

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# County of San Diego Hydrology Manual



## Rainfall Isopleths

### 10 Year Rainfall Event - 6 Hours

..... Isopleth (Inches)

$P_6 = 1.6$  inches

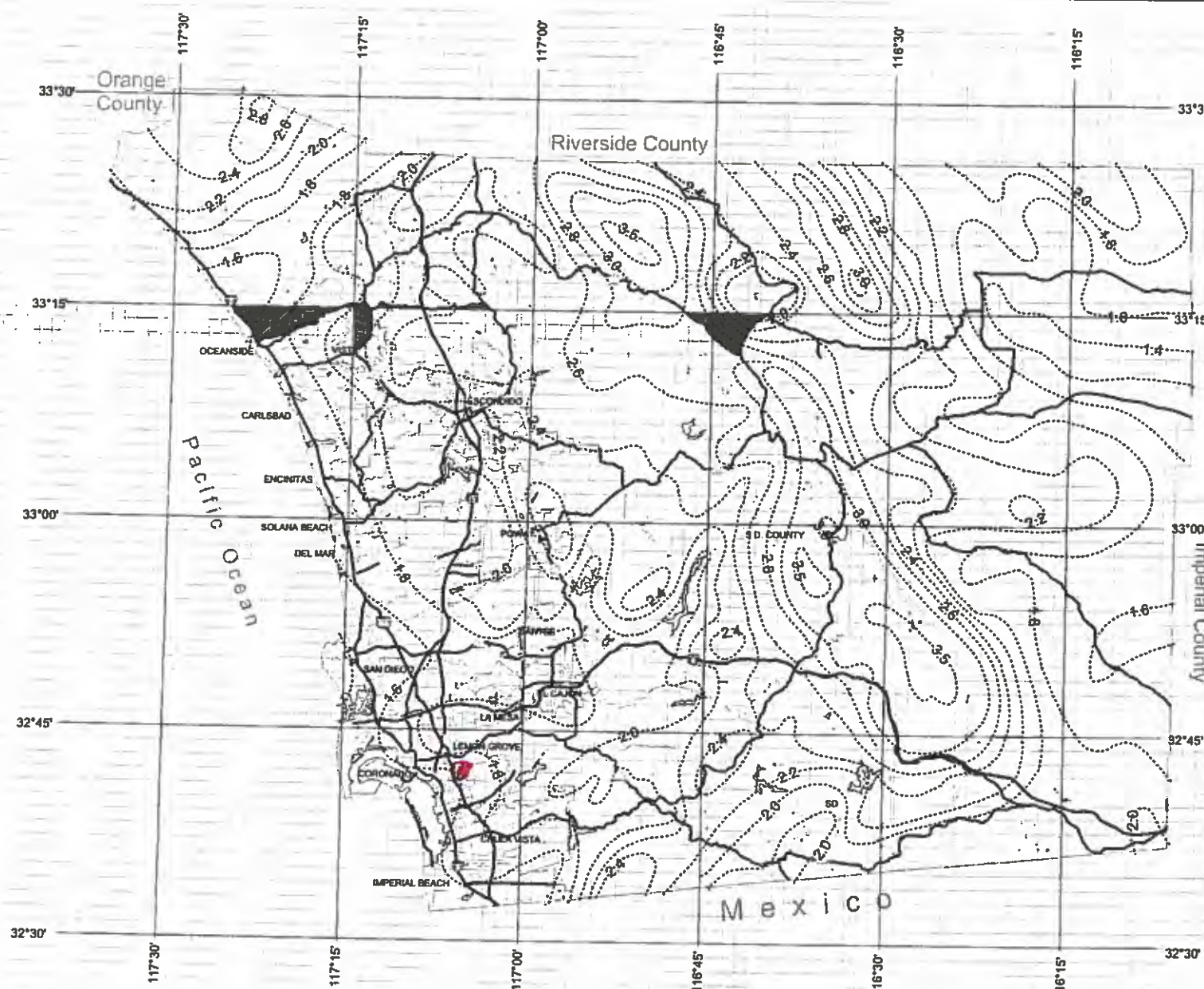
DPW  
GIS

GIS



3 0 3 Miles

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## Rainfall Isopluvials

25 Year Rainfall Event - 6 Hours

----- Isopluvial (inches)

$\otimes P_6 = 2.0$  inches

DPW  
GIS

GIS  
with a focus on Project Coordination

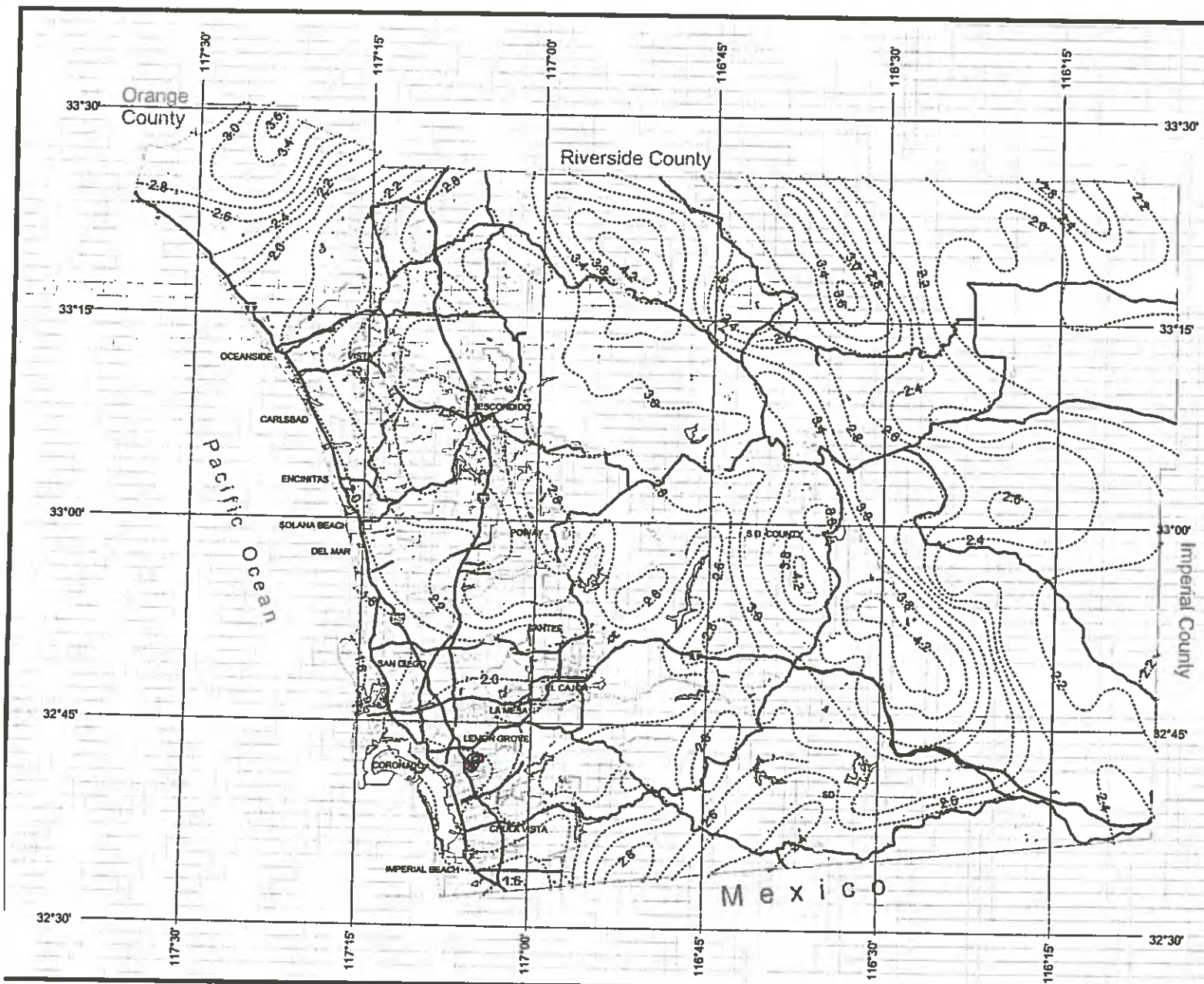


3 0 3 Miles

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# County of San Diego Hydrology Manual



## Rainfall Isopluvials

50 Year Rainfall Event - 6 Hours

..... Isopluvial (inches)

$P_6 = 2.25$  inches

DPW  
GIS

GIS  
We Have San Diego Covered



3 0 3 Miles

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# County of San Diego Hydrology Manual



## Rainfall Isophuvials

### 100 Year Rainfall Event - 6 Hours

----- Isophuvial (inches)

$P_6 = 2.5$  inches

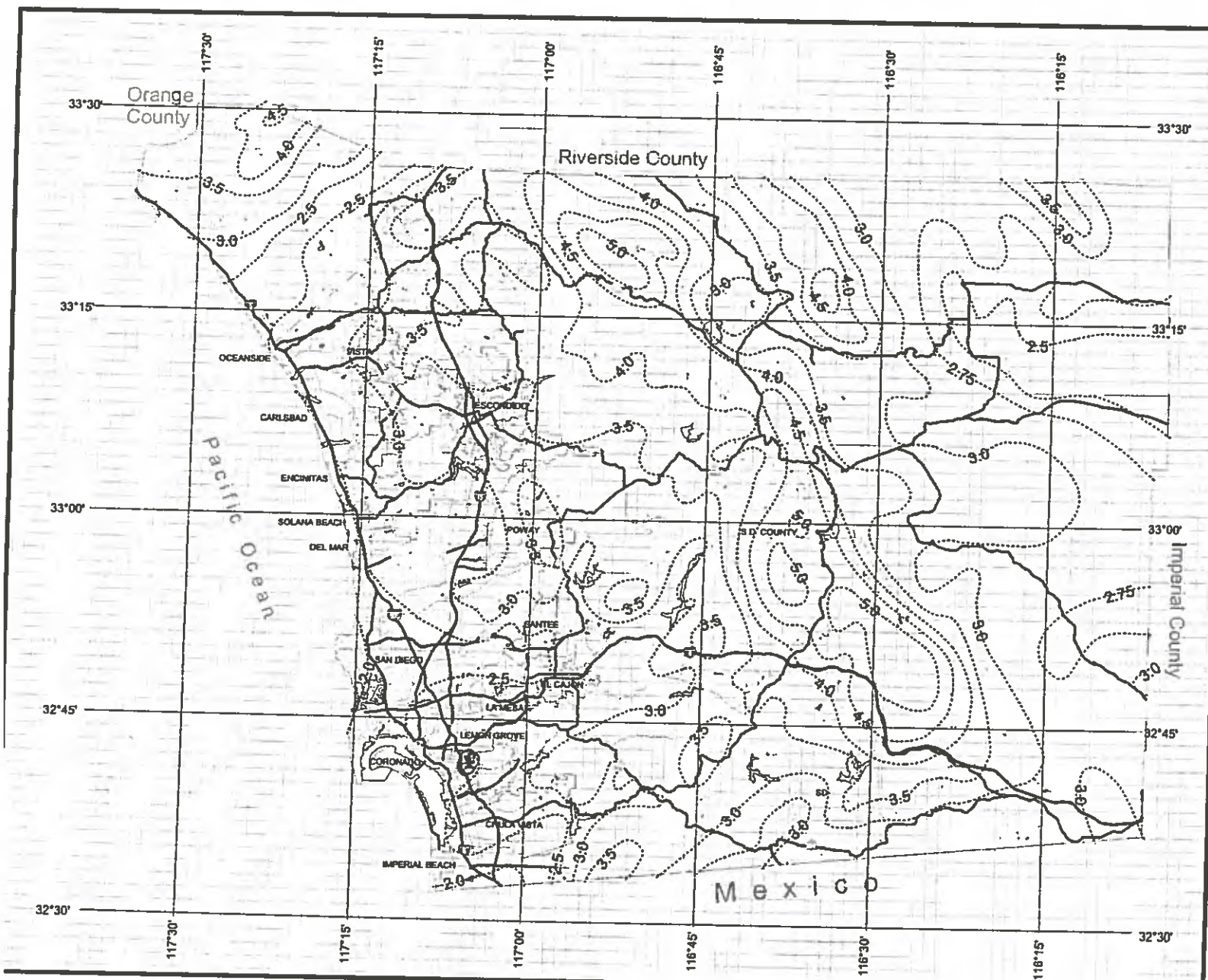
DPW  
GIS  
Department of Public Works  
San Diego, California

GIS  
San Diego County



3 0 3 Miles

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**Appendix D**  
**Hydraulic Analysis Output**

# Hydraulic Analysis Report

## Project Data

Project Title: Project - Euclid and Castana

Designer: Rick Engineering Company

J-17204-D

Project Date: Tuesday, July 21, 2015

Project Units: U.S. Customary Units

## Channel Analysis: As-built\_Euclid&Castana\_100

Notes: In the absence of As-Builts for this channel, a site visit on July 20, 2015 along with City of San Diego 1999 topography was used to obtain the geometry of the channel. This channel is entirely earthen and was measured in the field to have a bottom width of 11 feet. It was measured on the 1999 topography that the channel side slopes are approximately 4:1 and the channel has an approximate overall slope of 0.049. Pursuant to Table 1-104.14A of the City of San Diego Drainage Design Manual, dated April 1984, the roughness coefficient used for the channel side slopes and channel bottom is 0.04. This roughness coefficient is based on some weeds, light brush on banks.

## Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 4.0000 (ft/ft)

Side Slope 2 (Z2): 4.0000 (ft/ft)

Channel Width: 11.0000 (ft)

Longitudinal Slope: 0.0490 (ft/ft)

Manning's n: 0.0400

Depth: 8.0000 (ft)

## Result Parameters

Flow: 7675.5193 (cfs)

Area of Flow: 344.0000 (ft<sup>2</sup>)

Wetted Perimeter: 76.9697 (ft)

Hydraulic Radius: 4.4693 (ft)

Average Velocity: 22.3126 (ft/s)

Top Width: 75.0000 (ft)

Froude Number: 1.8360

Critical Depth: 10.5188 (ft)

Critical Velocity: 13.7482 (ft/s)

Critical Slope: 0.0134 (ft/ft)

Critical Top Width: 95.1507 (ft)

Calculated Max Shear Stress: 24.4608 (lb/ft<sup>2</sup>)

Calculated Avg Shear Stress: 13.6653 (lb/ft<sup>2</sup>)

## **Channel Analysis: Current\_Condition\_Euclid&Castana\_100**

Notes: In the absence of As-Builts for this channel, a site visit on July 20, 2015 along with City of San Diego 1999 topography was used to obtain the geometry of the channel. This channel is entirely earthen and was measured in the field to have a bottom width of 11 feet. It was measured on the 1999 topography that the channel side slopes are approximately 4:1 and the channel has an approximate overall slope of 0.049. Based on the site photos provided to us and a site visit conducted by us, heavy brush is seen on the channel banks. Pursuant to Table 1-104.14A of the City of San Diego Drainage Design Manual, dated April 1984, the roughness coefficient used for the channel side slopes and channel bottom is 0.06. This roughness coefficient is based on some weeds, heavy brush on banks.

### **Input Parameters**

Channel Type: Trapezoidal  
Side Slope 1 (Z1): 4.0000 (ft/ft)  
Side Slope 2 (Z2): 4.0000 (ft/ft)  
Channel Width: 11.0000 (ft)  
Longitudinal Slope: 0.0490 (ft/ft)  
Manning's n: 0.0600  
Depth: 8.0000 (ft)

### **Result Parameters**

Flow: 5117.0129 (cfs)  
Area of Flow: 344.0000 (ft<sup>2</sup>)  
Wetted Perimeter: 76.9697 (ft)  
Hydraulic Radius: 4.4693 (ft)  
Average Velocity: 14.8750 (ft/s)  
Top Width: 75.0000 (ft)  
Froude Number: 1.2240  
Critical Depth: 8.7704 (ft)  
Critical Velocity: 12.6611 (ft/s)  
Critical Slope: 0.0318 (ft/ft)  
Critical Top Width: 81.1630 (ft)  
Calculated Max Shear Stress: 24.4608 (lb/ft<sup>2</sup>)  
Calculated Avg Shear Stress: 13.6653 (lb/ft<sup>2</sup>)



**CITY OF SAN DIEGO**



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# **DRAINAGE DESIGN MANUAL**

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APRIL • 1984



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TABLE 1-104.14A

## DESIGN VALUES FOR MANNINGS ROUGHNESS COEFFICIENT (n)

<u>TYPE OF CHANNEL</u>	<u>N VALUE</u>
Unlined Channels:	
Clay Loam;	0.023
Sand	0.020
Gravel	0.030
Rock	0.040
Lined Channels:	
Portland Cement Concrete	0.015
Air Blown Mortar	0.018
Asphalt Concrete	0.018
Grass Lined Channels: (Shallow depths)	
2 inch length	0.050
4 - 6 inch length	0.060
6 - 12 inch length	0.120
12 - 24 inch + length	0.200
Pavement and Gutters:	
Concrete	0.015
Asphalt Concrete	0.018
Natural Streams: (Less than 100 feet wide at flood stage)	
1. Regular section	
a. Some grass and weeds, little or no brush	0.030
b. Dense growth of weeds, depth of flow substantially greater than weed height	0.040
c. Some weeds, light brush on bank	0.040
d. Some weeds, heavy brush on banks	0.060
e. With trees in channel, branches submerged at flood stage, increase above values by	0.015

TABLE 1-104.14A (Continued)

2.	Irregular section, with pools, slight channel meander increase all values listed in 1. Regular Section, by	0.015
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## Flood Plains: (adjacent to natural streams)

1.	Pasture, no brush	
	a. Short grass	0.030
	b. High grass	0.040
2.	Cultivated areas	
	a. No crop	0.040
	b. Mature row crops	0.040
	c. Mature field crops	0.050
3.	Heavy weeds, scattered brush	0.050
4.	Light brush and trees	0.060
5.	Medium to dense brush	0.090
6.	Dense willows	0.170
7.	Cleared land with tree stumps, 100-150 per acre	0.060
8.	Heavy stand of timer, little undergrowth	
	a. Flood depth below branches	0.110
	b. Flood depth reaches branches	0.140

**Appendix E**  
**Channel Prioritization Assessment Sheet**



**Appendix F**  
**Channel Maintenance Prioritization Summary Sheet**







**Appendix G**  
**Available As-built plans**



**No Available As-built Plans**

**Appendix H**  
**Compact Disc**  
**PDF Version of Full Report**