

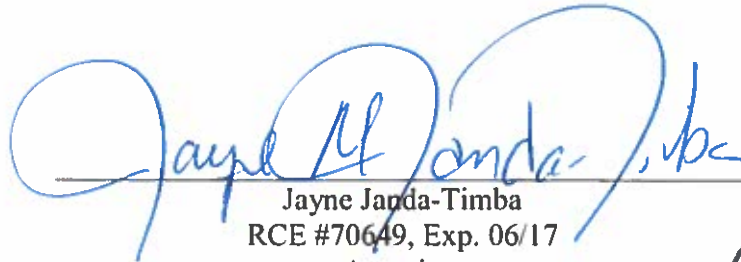
**SUMMARY OF FINDINGS FOR THE
ANNUAL DRAINAGE CHANNEL FIELD
ASSESSMENT AND MAINTENANCE PRIORITIZATION
PROJECT (PHASE 1)
FOR
THE CITY OF SAN DIEGO – MASTER STORM WATER
SYSTEM MAINTENANCE PROGRAM (MMP) MAP 71:
CHOLLAS CREEK CHANNEL**

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

RICK
RICK ENGINEERING COMPANY
ENGINEERING COMPANY
RICK ENGINEERING CO

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ANNUAL DRAINAGE CHANNEL FIELD
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THE CITY OF SAN DIEGO – MASTER STORM WATER SYSTEM MAINTENANCE
PROGRAM (MMP) MAP 71: CHOLLAS CREEK CHANNEL**

Job Number 17204-D



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August 4, 2015

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1.0 Executive Summary

For the purpose of this report and preliminary analyses the Chollas Creek Channel (MMP Map 71) is divided into two reaches:

- Reach 1 - Downstream of Rolando Boulevard
- Reach 2 - Upstream of Rolando Boulevard

This report and preliminary analyses concludes the following Channel Prioritization Score for Chollas Creek Channel (MMP Map 71):

- Reach 1 – **67.8 out of 100**. This score is 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 remain at the current 100-year storm event capacity, however maintenance is recommended to improve other factors, described further in Section 3.0 and Appendix E, such as water quality, community needs and aesthetics.
- Reach 2 – **82.3 out of 100**. This score is above average and indicates that the channel is highly 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 less than 2-year storm event capacity to a 50-year storm event capacity. Other factors considered in the analysis of this reach also included water quality, community needs, and aesthetics related to the channel.

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 71: Chollas Creek Channel. Refer to Appendix A for the MMP Storm Water Facilities Key Map and Map 71.

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

Channel Prioritization Assessment Factors and Weighting	
Factor	Percent Weighted (%)
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

Peak Discharges on As-built Plans

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. The as-built plans for the existing culvert immediately upstream of Aragon Drive, approximately 400 feet upstream of the Chollas Creek Channel Map 71 assessment area, show the peak discharge for the 100-year storm event. Additional flow may enter the system downstream of Aragon Drive, however this is the best hydrologic data available at the authorship of this report and is sufficient for the purposes of this analysis. A copy of the available applicable as-built plans is located in Appendix G. 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 2

Summary of Approximate Hydrologic Data						
Drainage Area: 832 acres						
6-hour Precipitation (in)	1.3	1.65	1.85	2.2	2.3	2.7
Frequency	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Discharge (cfs)¹	577	707	793	943	986	1,157

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 71 located in Appendix A. Manning’s equation was utilized to calculate the capacity of the channel under two conditions:

1. As-built Conditions: based on the material and geometry as shown on the available as-built plans. (Refer to Appendix G)
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.

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.

Reach 1 - Downstream of Rolando Boulevard

The information on the O&M Channel Maintenance Inspection form and the site photos taken by the City of San Diego seemed to focus mainly on Reach 2 - Upstream of Rolando Boulevard. Therefore, Reach 1 was assessed based on aerial (Google Earth imagery, April 2015) and street view imagery (Google Earth imagery, February 2015), which appears to show water in the channel and vegetation that has grown down along the side slopes from the top of the channel banks. Images from Google Earth street view are shown on the exhibit for Reach 1 located in Appendix F. Due to the presence of water in the imagery, the approximate sediment depth was estimated based on the information

provided on the O&M Channel Maintenance Inspection form provided by the City of San Diego. The approximate sediment depth was estimated to be 0.65 feet.

Reach 2 - Upstream of Rolando Boulevard

Based on the approximate vegetation information provided on the O&M Channel Maintenance Inspection form and the site photos taken by the City of San Diego, heavy vegetation exists along the channel bottom and side slopes. Based on the approximate sediment information provided on the O&M Channel Maintenance Inspection form the sediment depth was approximated to be 0.7 feet.

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 3

Summary of Hydraulic Analysis Results				
CHANNEL REACH	CURRENT CHANNEL CAPACITY		AS-BUILT CHANNEL CAPACITY	
	Current Condition (cfs)	Equivalent Storm Event (year)	As-built Condition (cfs)	Equivalent Storm Event (year)
Reach 1 – Downstream of Rolando Boulevard	1,157	100	1,157	100
Reach 2 – Upstream of Rolando Boulevard	372	Less than 2	986	50

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 4

Channel Prioritization Assessment Scoring Summary for Reach 1 – Downstream of Roland		
Factor	Percent Weighted (%)	Weighted Factor Score/Maximum Possible Score
Flood Risk	75	56.3/75
Water Quality	10	4/10
Community Needs	10	5/10
Aesthetics	5	2.5/5
Overall Channel Score:		67.8/100
Channel Prioritization Assessment Scoring Summary for Reach 2 – Upstream of Roland Boulevard		
Factor	Percent Weighted (%)	Weighted Factor Score/Maximum Possible Score
Flood Risk	75	68.8/75
Water Quality	10	6/10
Community Needs	10	5/10
Aesthetics	5	2.5/5
Overall Channel Score:		82.3/100

Additionally, the following items should be noted:

Reach 1 - Downstream of Rolando Boulevard

- Based on aerial (Google Earth imagery, April 2015) and street view imagery (Google Earth imagery, February 2015), it appears that light vegetation exists along the side slopes and water and algae are present in the channel.
- Based on site photos taken by the City of San Diego, heavier vegetation exists for a small segment of the channel immediately downstream of Roland Boulevard. A high risk of vegetation flowing downstream and clogging the culvert exists.

Reach 2 - Upstream of Rolando Boulevard

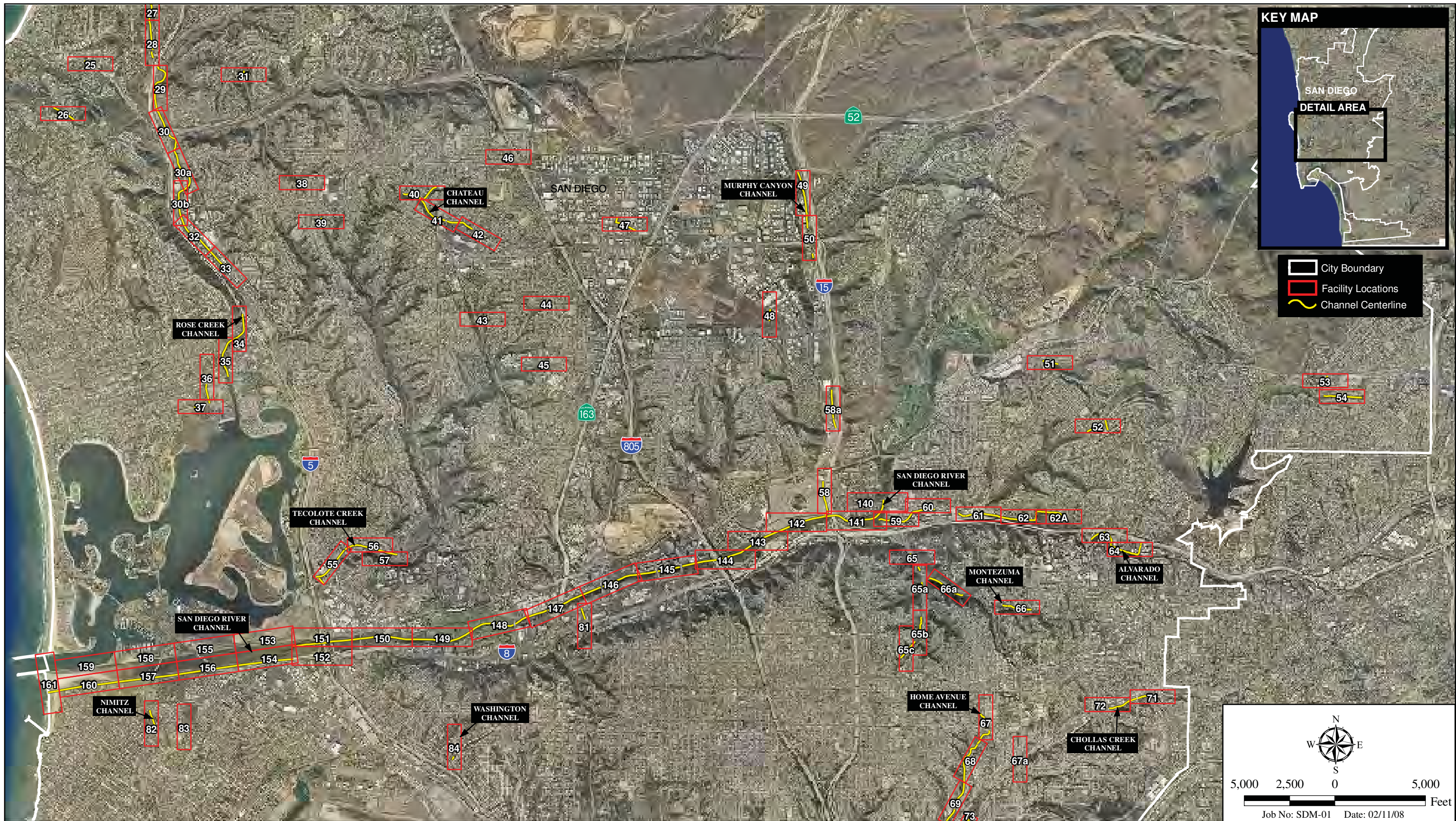
- It was noted on the O&M Channel Maintenance Inspection Form completed for the channel by the City of San Diego that palm trees line the entire length of the channel. A high risk of vegetation flowing downstream and clogging the culvert exists.
- The available as-builts for the channel show that it is rip-rap lined. The O&M Channel Maintenance Inspection Form completed for the channel by the City of San Diego and the site photos taken by the City of San Diego indicate that sediment and ponded water exist in the channel.

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 71: Chollas Creek Channel is **67.8 for Reach 1** and **82.3 for Reach 2**. Refer to the Channel Prioritization Assessment Sheets for each reach located in Appendix E for details on the evaluation of the weighted factors and resulting score for this channel.

It is recommended that Reach 1 be maintained to improve water quality and aesthetics and to prevent large vegetation from flowing downstream and clogging the culvert. It is recommended that Reach 2 be maintained to increase the current capacity of the channel from less than a 2-year storm event back to a 50-year storm event capacity.

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 71: Chollas Creek Channel



I:\ArcGIS\SDM-01\Map\ENV\MSMP\Fig2c_18_Corridor.mxd -NM

Stormwater Facilities - I-8 Corridor

CITY OF SAN DIEGO MASTER STORMWATER SYSTEM MAINTENANCE PROGRAM

Figure 2c





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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

Map # 71

?

Operations and Maintenance

Channel Maintenance Inspection Form

Date: 5-6-2015 Time: 10:40 AM - 11:15 AM

Channel Map No.: # 71

Watershed: Pueblo San Diego

Inspector: E. Rodriguez

Weather: Cloudy

Initial Inspection

Follow Up Inspection

A. Channel Condition		
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. Erosion	1 2 <u>3</u> N/A	NONE
3. Trash/Debris	1 2 <u>3</u> N/A	Type of trash and source: NONE
4. Water Conveyance	1 2 <u>3</u> N/A	85%
4. Standing Water	<u>Y</u> N	
A. Ponding	<u>Y</u> N	
B. Noticeable odors	Y <u>N</u>	
C. Algae	Y <u>N</u>	
5. Vegetation	1 <u>2</u> 3 N/A	Approx. Coverage/Density of Vegetation: 15% Palm
A. Invasive (Arundo)	1 <u>2</u> 3 N/A	Palm Tree's on sides. Tree's
B. Native	1 2 3 N/A	NONE
6. Sediment	1 2 <u>3</u> N/A	Approx. Depth/Coverage of Sediment: 10%
7. Transients/ encampments	Y <u>N</u>	

B. Culverts and Outfalls

1= Good Condition
 2= Moderate Condition
 3= Poor Condition/Needs Immediate Attention

Item	Condition	Comments
1. Structure Condition	① 2 3 N/A	
2. Trash/Debris/Sediment	1 2 ③ N/A	None
3. Clogging	1 ② ③ N/A	None palm tree could plug Culvert Inlet IF Break's & Falls in Channel.

C. See Map Attached

-Identify Key Issues on Map
 -Inspect and take photographs from vantage points identified on Map

Other Comments: palm tree removal down stream of Culvert?

D. To Be Completed by Management

Follow Up Actions

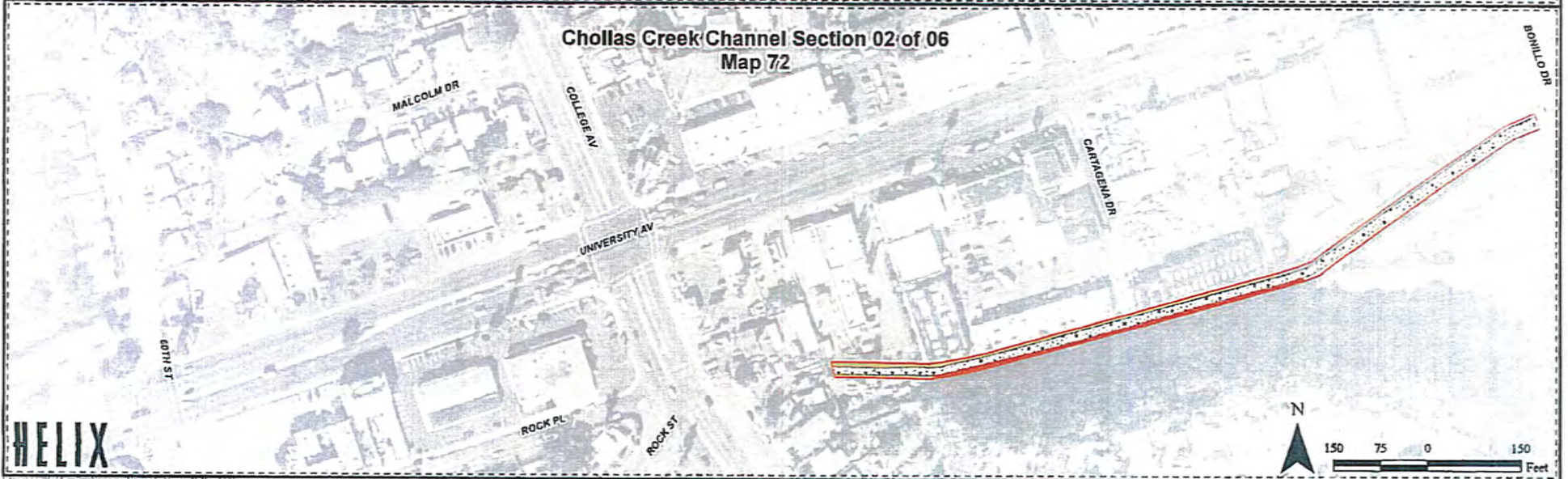
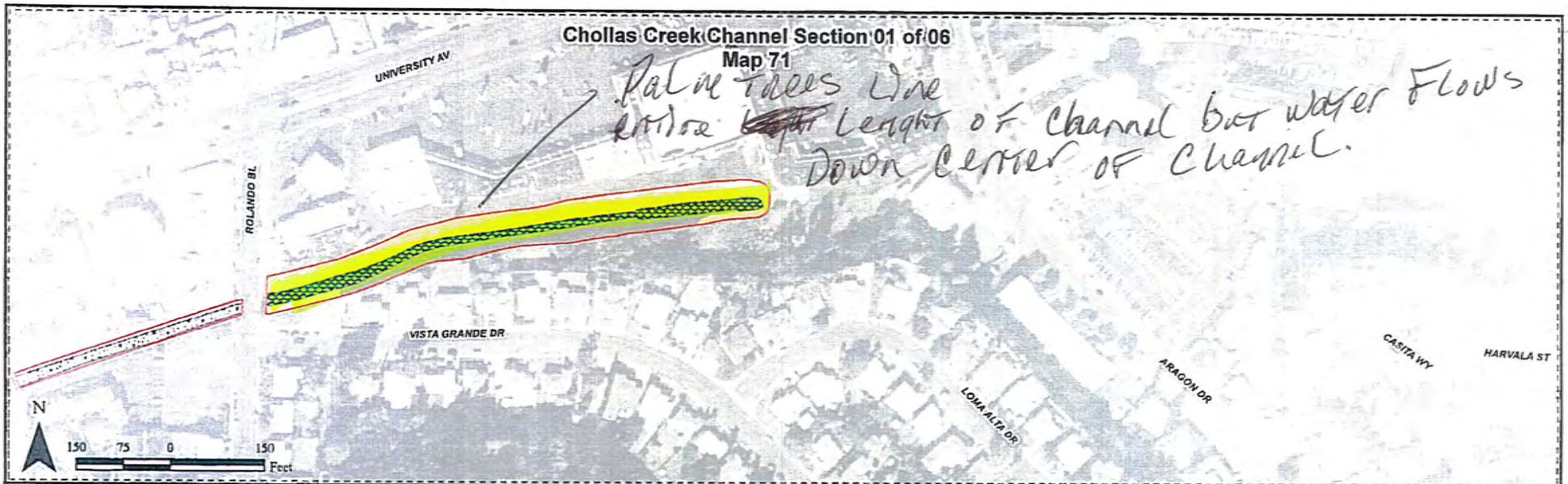
- 1.
- 2.
- 3.

E. Infrastructure Failure Issues

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

Other Comments/Observations:

Completed 5-6-2015
E. Rodriguez

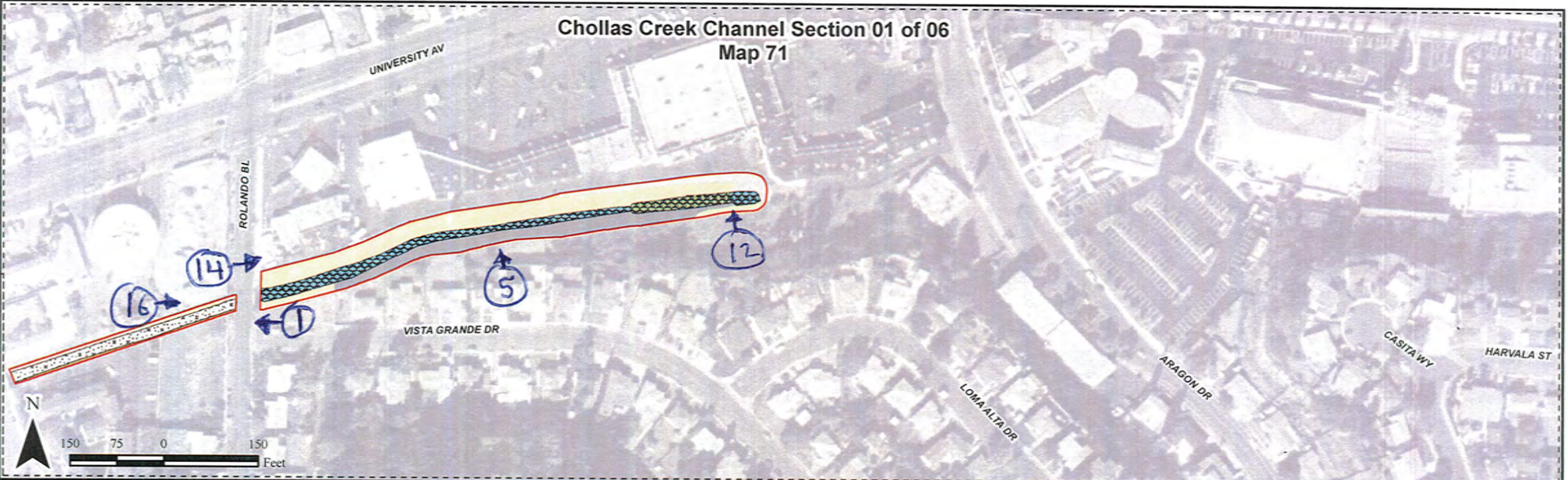


HELIX

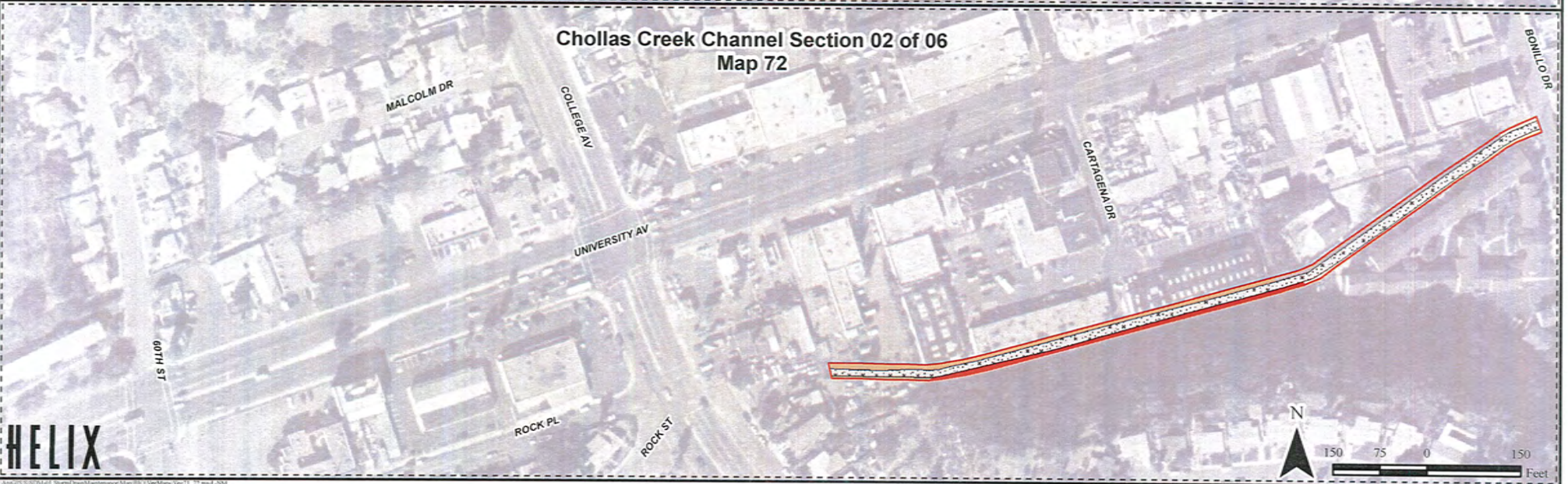
Vegetation/Wetland Delineation - Maps 71 & 72

CITY OF SAN DIEGO MASTER STORMWATER SYSTEM MAINTENANCE PROGRAM

Chollas Creek Channel Section 01 of 06
Map 71



Chollas Creek Channel Section 02 of 06
Map 72



HELIX

Vegetation/Wetland Delineation - Maps 71 & 72

CITY OF SAN DIEGO MASTER STORMWATER SYSTEM MAINTENANCE PROGRAM



Chollas Creek.1 (5-6-2015)



Chollas Creek.5 (5-4-2015)



Chollas Creek.12 (5-4-2015)



Chollas Creek.14 (5-4-2015)

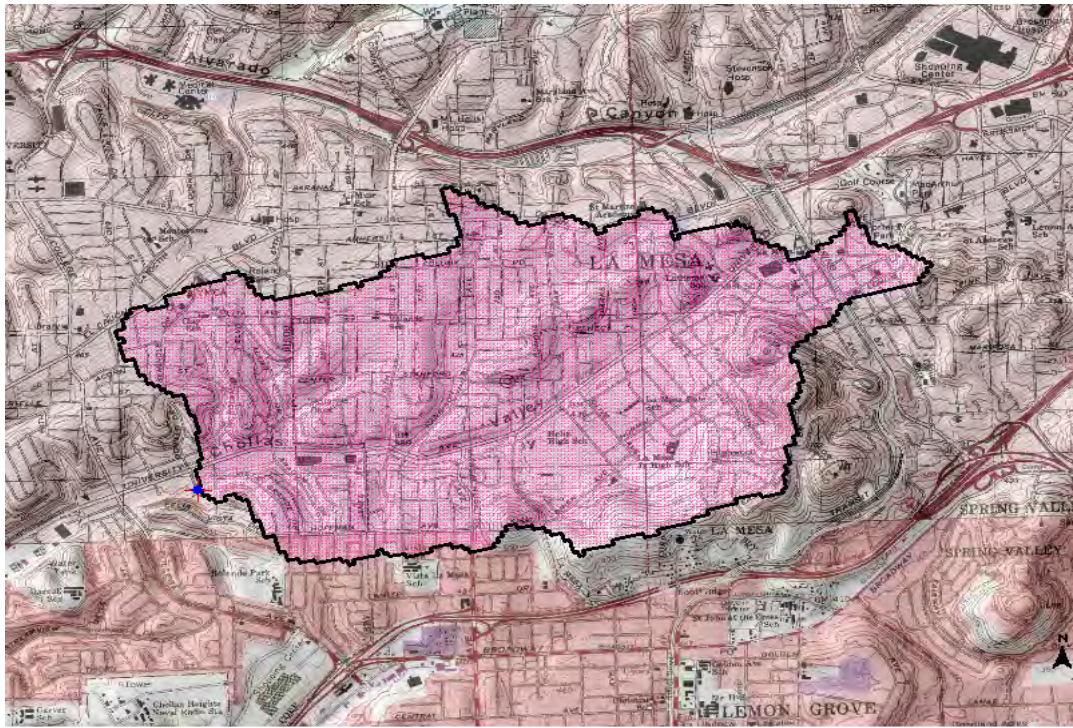


Chollas Creek.16 (5-4-2015)

Appendix C
Hydrologic Support Material



Chollas Creek Channel MMP Map 71 Watershed



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 | |
| Synthetic Stream Grid | ▲ Stage Only | |
| ■ | ▲ Low Flow, Partial Record, Stage | |
| | ▲ Miscellaneous Record | |
| | ▲ Unknown | |



San Diego County Hydrology Manual



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

LIST OF APPENDICES

<u>LETTER</u>	<u>TITLE</u>	
A	Hydrologic Soil Groups Map	A-1
B	Isopluvial Maps	B-1
C	Precipitation Zone Number (PZN) Map	C-1
D	Worksheets for NRCS Hydrologic Method Calculations	D-1
E	85 th Percentile Precipitation Isopluvial Map	E-1

County of San Diego Hydrology Manual



Rainfall Isopleths

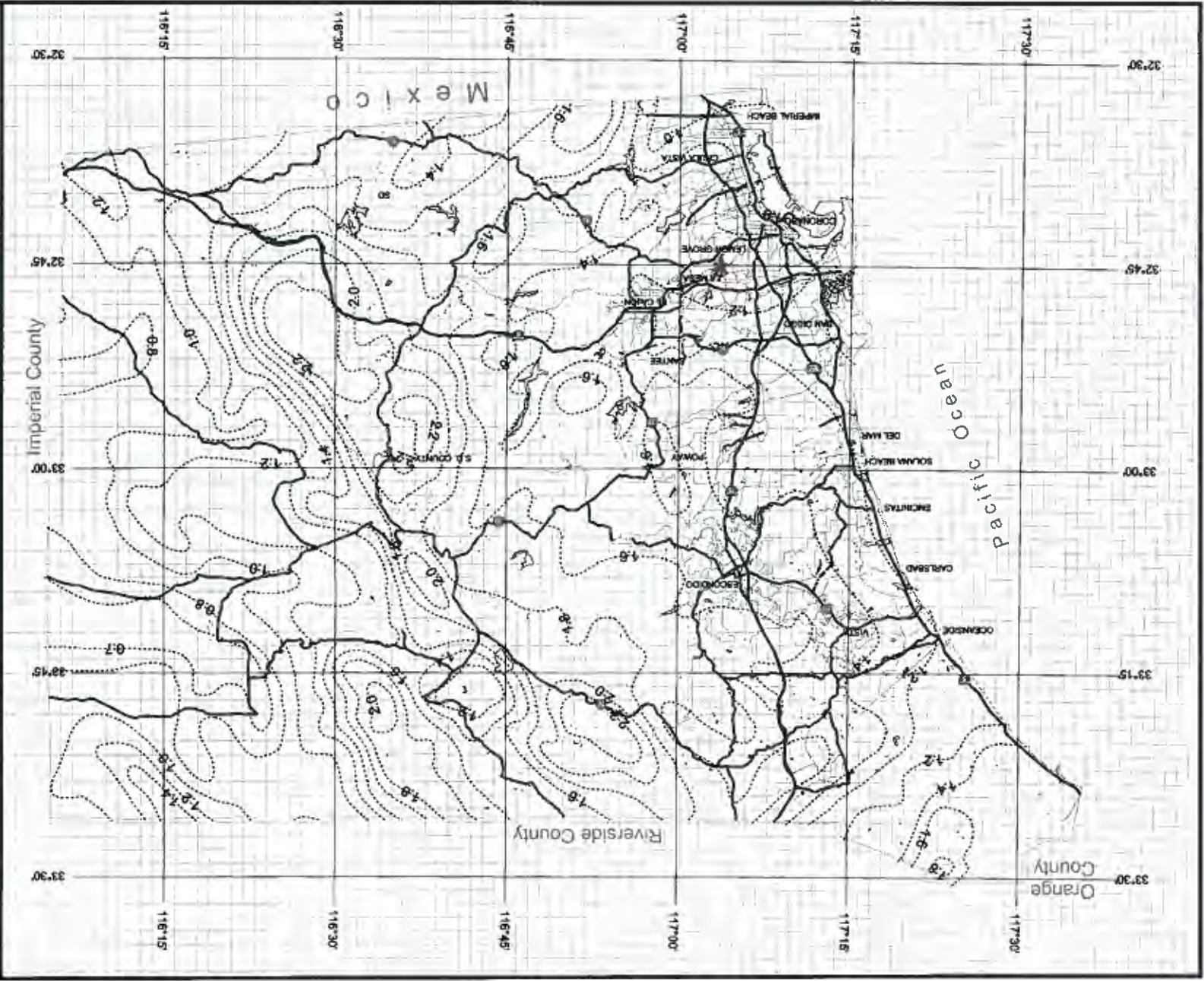
2 Year Rainfall Event - 6 Hours

..... Isopleth (inches)

* $P_v = 1.3$ in



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County of San Diego Hydrology Manual



Rainfall Isopleths

10 Year Rainfall Event - 6 Hours

Isopleth (inches)

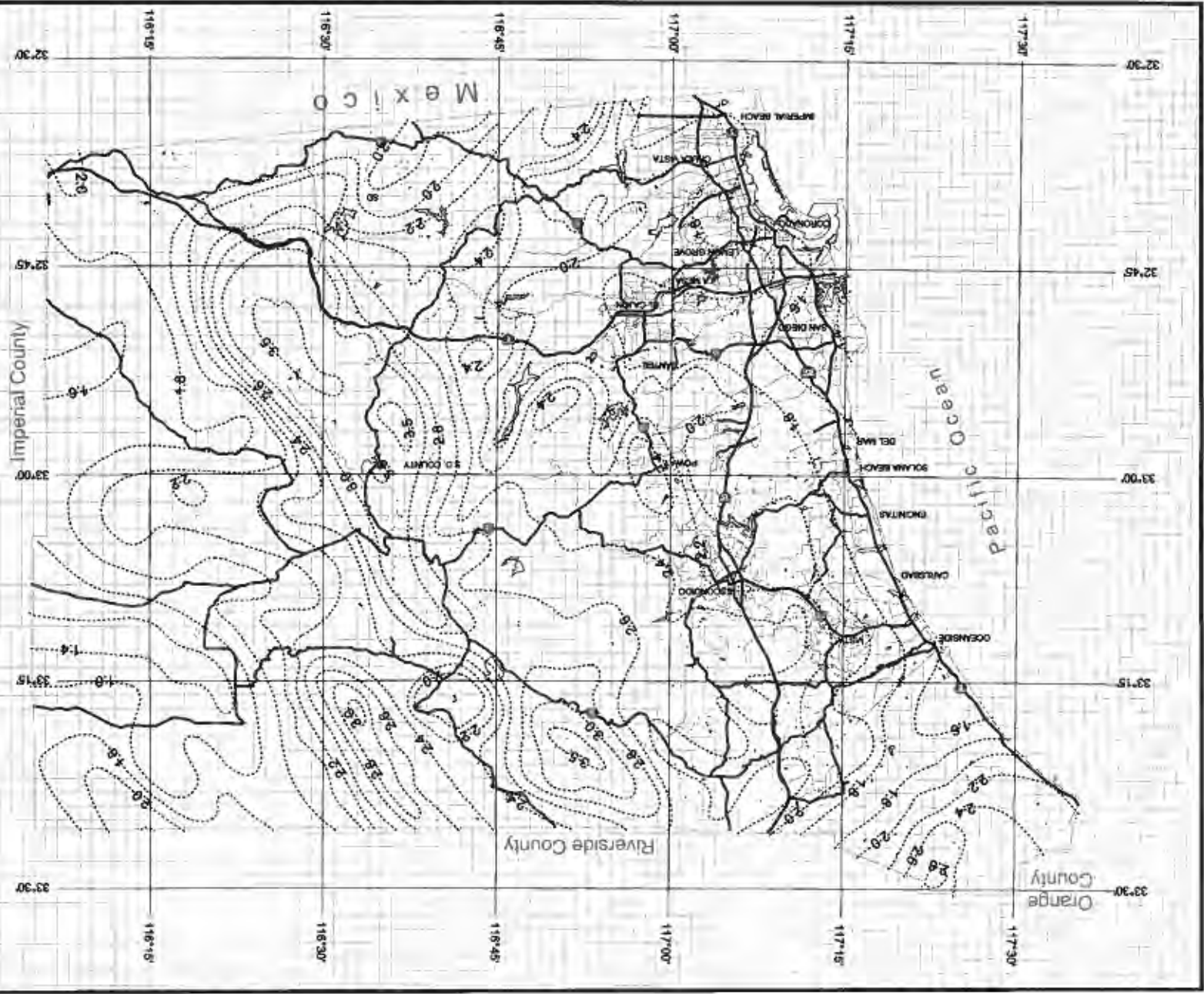
$$\neq P_6 = 1.85 \text{ in.}$$



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Scale: 0 1 2 3 Miles



County of San Diego Hydrology Manual



Rainfall Isopleths

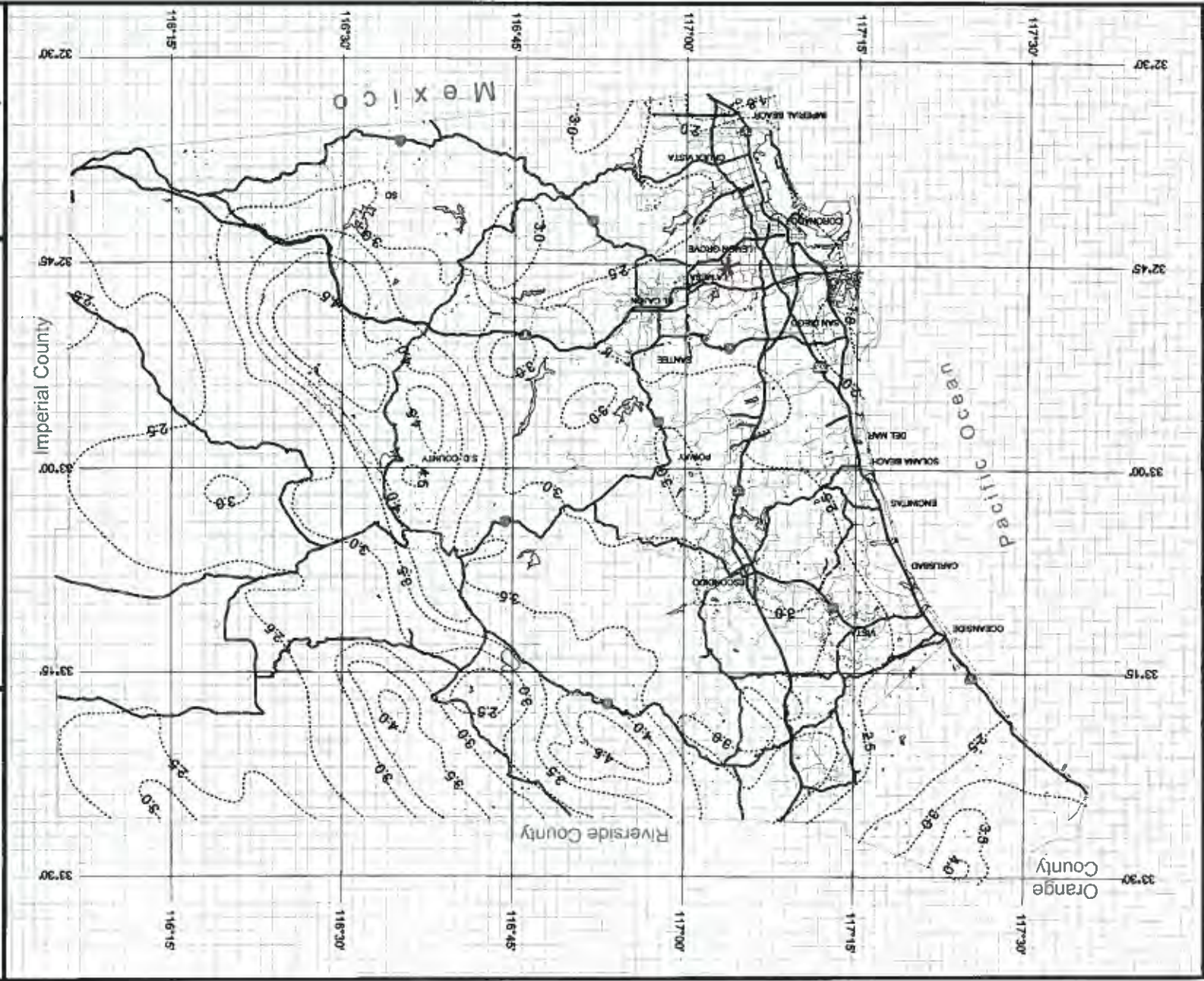
50 Year Rainfall Event - 6 Hours

Isopleth (Inches)

* $P_6 = 2.3$ in



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County of San Diego Hydrology Manual



Rainfall Isopleths

100 Year Rainfall Event - 6 Hours

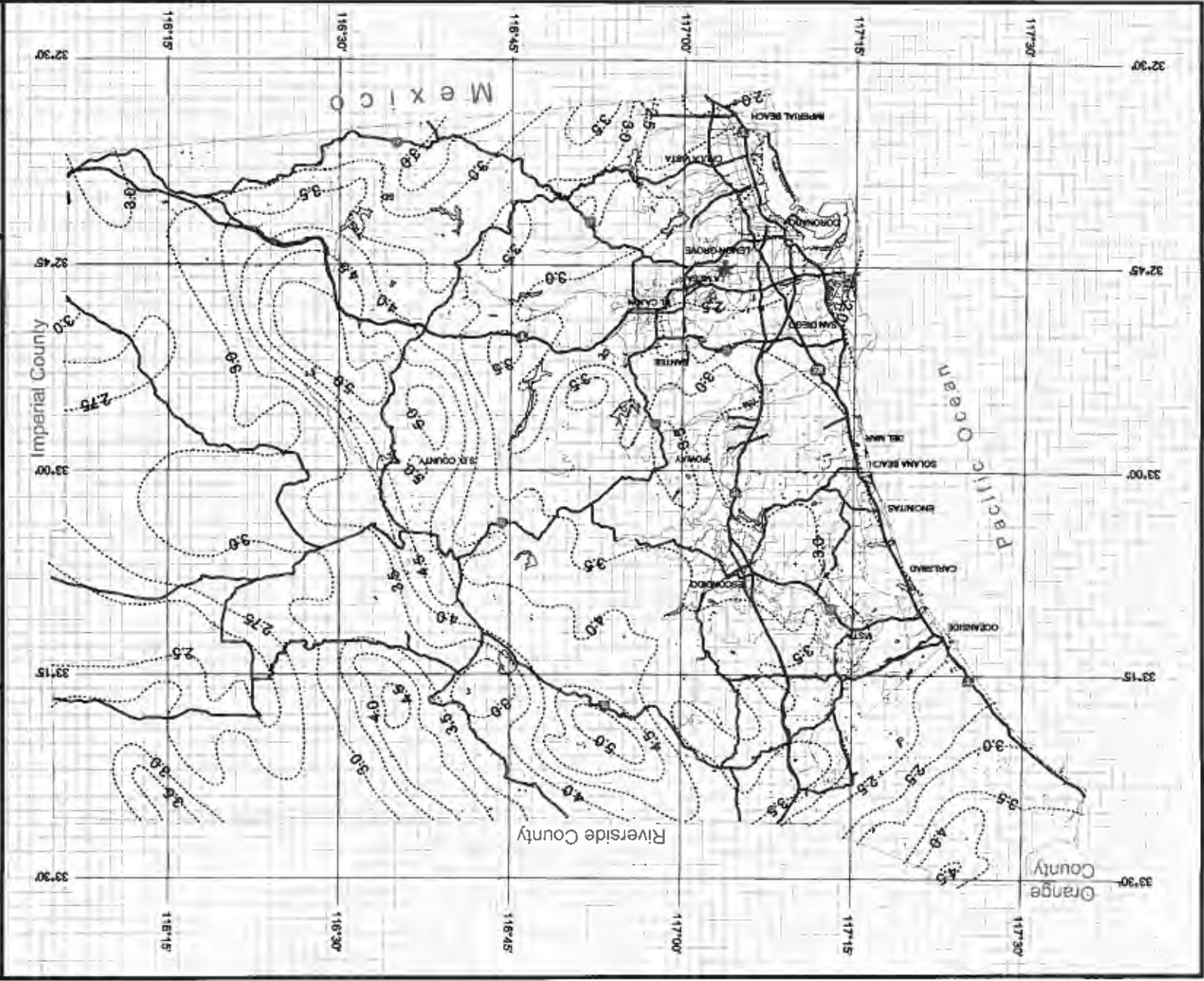
..... Isopleth (inches)

* $P_6 = 2.7$ in



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3 0 3 Miles



Appendix D
Hydraulic Analysis Output

Hydraulic Analysis Report

Project Data

Project Title: ChollasCreek_Map71_DS_Rolando
Designer: Rick Engineering Company J-17204-D
Project Date: Monday, July 13, 2015
Project Units: U.S. Customary Units

Channel Analysis: asbuilt_100

Notes: The cross-section of the channel on the as-built plans show a trapezoidal channel with an 8-foot Portland Cement concrete bottom width, 6.5 feet deep, and 1:1 pneumatically applied mortar side slopes. Pursuant to Table 1-104.14A of the City of San Diego Drainage Design Manual, dated April 1984, the roughness coefficients used for the channel side slopes and channel bottom are 0.018 and 0.015, respectively.

Input Parameters

Channel Type: Custom Cross Section

Cross Section Data

Station (ft)	Elevation (ft)	Manning's n
0.00	6.50	0.0180
6.50	0.00	0.0150
14.50	0.00	0.0180
21.00	6.50	-----

Longitudinal Slope: 0.0130 (ft/ft)

Flow: 1157.0000 (cfs)

Result Parameters

Depth: 4.1102 (ft)

Area of Flow: 49.7749 (ft²)

Wetted Perimeter: 19.6253 (ft)

Hydraulic Radius: 2.5363 (ft)

Average Velocity: 23.2447 (ft/s)

Top Width: 16.2203 (ft)

Froude Number: 2.3384

Critical Depth: 6.5612 (ft)

Critical Velocity: 12.1108 (ft/s)

Critical Slope: 0.0022 (ft/ft)

Critical Top Width: 21.0000 (ft)

Calculated Max Shear Stress: 3.3342 (lb/ft²)

Calculated Avg Shear Stress: 2.0574 (lb/ft²)

Composite Manning's n Equation: Lotter method

Manning's n: 0.0136

Channel Analysis: current_100

Notes: The cross-section of the channel on the as-built plans show a trapezoidal channel with an 8-foot Portland Cement concrete bottom width, 6.5 feet deep, and 1:1 pneumatically applied mortar side slopes. The information on the O&M Channel Maintenance Inspection form and the site photos taken by the City of San Diego seemed to focus mainly on the Reach 2 - Upstream of Rolando Boulevard. Therefore, Reach 1 was assessed based on aerial (Google Earth imagery, April 2015) and street view imagery (Google Earth imagery, February 2015), which appears to show water in the channel and vegetation that has grown down along the side slopes from the top of the channel banks. Due to the presence of water the imagery, the approximate sediment depth was estimated based on the information provided on the O&M Channel Maintenance Inspection form provided by the City of San Diego. The approximate sediment depth was estimated to be 0.65 feet. Pursuant to Table 1-104.14A of the City of San Diego Drainage Design Manual, dated April 1984, the roughness coefficients used for the channel side slopes and channel bottom are 0.04 and 0.03, respectively. The roughness coefficient for the side slopes is based on some weeds, light brush on banks. No large vegetation appears to be protruding above the water, therefore the roughness coefficient for the channel bottom is based on some grass and weeds, little or no brush.

Input Parameters

Channel Type: Custom Cross Section

Cross Section Data

Station (ft)	Elevation (ft)	Manning's n
0.00	6.50	0.0400
5.85	0.65	0.0300
15.15	0.65	0.0400
21.00	6.50	-----

Longitudinal Slope: 0.0130 (ft/ft)

Flow: 1157.0000 (cfs)

Result Parameters

Depth: 5.6530 (ft)

Area of Flow: 84.5299 (ft²)

Wetted Perimeter: 25.2892 (ft)

Hydraulic Radius: 3.3425 (ft)

Average Velocity: 13.6875 (ft/s)

Top Width: 20.6061 (ft)

Froude Number: 1.1909

Critical Depth: 6.1798 (ft)

Critical Velocity: 12.1084 (ft/s)

Critical Slope: 0.0092 (ft/ft)

Critical Top Width: 21.0000 (ft)

Calculated Max Shear Stress: 4.5857 (lb/ft²)

Calculated Avg Shear Stress: 2.7115 (lb/ft²)

Composite Manning's n Equation: Lotter method

Manning's n: 0.0277

Hydraulic Analysis Report – Reach 2

Project Data

Project Title: ChollasCreek_Map71_US_Rolando
Designer: Rick Engineering Company J-17204-D
Project Date: Friday, July 10, 2015
Project Units: U.S. Customary Units

Channel Analysis: asbuilt_50

Notes: The cross-section of the channel on the as-built plans show a trapezoidal riprap lined channel with a 15-foot bottom width, 7 feet deep, and 1.5:1 side slopes. The riprap is specified as light stone. Pursuant to Table 1-104.14A of the City of San Diego Drainage Design Manual, dated April 1984, the roughness coefficients used for the channel side slopes and channel bottom are 0.04.

Input Parameters

Channel Type: Custom Cross Section

Cross Section Data

Station (ft)	Elevation (ft)	Manning's n
0.00	7.00	0.0400
10.50	0.00	0.0400
25.50	0.00	0.0400
36.00	7.00	-----

Longitudinal Slope: 0.0040 (ft/ft)

Flow: 986.0000 (cfs)

Result Parameters

Depth: 6.5148 (ft)

Area of Flow: 161.3876 (ft²)

Wetted Perimeter: 38.4896 (ft)

Hydraulic Radius: 4.1930 (ft)

Average Velocity: 6.1095 (ft/s)

Top Width: 34.5445 (ft)

Froude Number: 0.4981

Critical Depth: 4.3885 (ft)

Critical Velocity: 10.4101 (ft/s)

Critical Slope: 0.0176 (ft/ft)

Critical Top Width: 28.1654 (ft)

Calculated Max Shear Stress: 1.6261 (lb/ft²)

Calculated Avg Shear Stress: 1.0466 (lb/ft²)

Composite Manning's n Equation: Lotter method

Manning's n: 0.0400

Channel Analysis: current_Q

Notes: The cross-section of the channel on the as-built plans show a trapezoidal riprap lined channel with a 15-foot bottom width, 7 feet deep, and 1.5:1 side slopes. Based on the approximate sediment depth provided on the O&M Channel Maintenance Inspection Form completed for the channel by the City of San Diego, the sediment depth was estimated to be approximately 0.7 feet. Based on the site photos and the information provided on the O&M form, there is heavy vegetation along the channel bottom and side slopes. 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 0.11. The roughness coefficient used for the channel bottom is based on medium to dense brush, with trees in the channel, branches submerged at flood stage.

Input Parameters

Channel Type: Custom Cross Section

Cross Section Data

Station (ft)	Elevation (ft)	Manning's n
0.00	7.00	0.1100
9.45	0.70	0.1100
26.55	0.70	0.1100
36.00	7.00	-----

Longitudinal Slope: 0.0040 (ft/ft)

Depth: 6.3000 (ft)

Result Parameters

Flow: 372.0777 (cfs)

Area of Flow: 167.2650 (ft²)

Wetted Perimeter: 39.8150 (ft)

Hydraulic Radius: 4.2011 (ft)

Average Velocity: 2.2245 (ft/s)

Top Width: 36.0000 (ft)

Froude Number: 0.1819

Critical Depth: 2.2836 (ft)

Critical Velocity: 7.9382 (ft/s)

Critical Slope: 0.1520 (ft/ft)

Critical Top Width: 23.9508 (ft)

Calculated Max Shear Stress: 1.8901 (lb/ft²)

Calculated Avg Shear Stress: 1.2555 (lb/ft²)

Composite Manning's n Equation: Lotter method

Manning's n: 0.1100

CITY OF SAN DIEGO



**DRAINAGE DESIGN
MANUAL**

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
----	--	-------

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

Channel Prioritization Assessment Sheet for <u>Chollas Creek Channel MMP Map 71 - Reach 1</u>							Total Channel Score:		67.8 /100		
Flood Hazard (75% of total weight)							Score	factor weight	Weighted Points		
<i>Δ capacity</i>							Sum of sub-factor a-c scores:		0		0
a. Risk of flooding		Current Channel Normal depth capacity ¹ :		1157 cfs	100 -yr. storm event	2-yr.=score of 5; 5-yr.=score of 4; 10-yr.=score of 3; 25-yr.=score of 2; 50-yr.=score of 1; 100-yr.=score of 0		(out of 15)			
b. Increase in storm event capacity		Channel As-Built normal depth capacity ¹ :		1157 cfs	100 -yr. storm event	1 point given for every level increase in -year storm event capacity, post-maintenance					
c. Net percent increase in channel capacity post-maintenance				0%		Less than 100% = score of 0; 100%-199% = score of 1; 200%-299% = score of 2; 300%-399% = score of 3; 400%-500%= score of 4; Over 500% = score of 5				37.5	
<i>Consequence of flooding adjacent areas</i>							0 1 2 3 4		50%		
Surrounding area land use: (area within 100 feet of the channel or area in which more than 10,000 ft ² is impacted from flooding.)				Residential		Residential = score of 4; Commercial = score of 4; Roads = score of 2; Agriculture = score of 1; Other = score of 1					
Is there open space surrounding the channel?				No		If yes, subtract land use score by 1				18.75	
<i>Clogging Potential</i>							0 1 2 3 4		25%		
Are there trees/large debris that have potential to flow D/S and clog culverts/the channel?				Yes						56.3	
Total Weighted Flood Hazard Points											
Water Quality/Channel Condition (10% of total weight)											
<i>Trash/Debris</i>							0 1 2 3 4		20%		0
Type of trash and Source:		None								2	
<i>Standing water</i>							0 1 2 3 4		15%		
Ponding?				Yes							
Noticeable odors?				No						2	
Algae?				Yes							
<i>Sediment</i>							0 1 2 3 4		35%		2
Approx. sediment coverage: (Based on information provided on City of San Diego O&M Channel Maintenance Inspection Form)				10%							
Rock/debris Accumulation?				No						0	
<i>Transients/encampments</i>							0 1 2 3 4		10%		
<i>Culverts and Outfalls</i>							0 1 2 3 4		10%		0
<i>Infrastructure Issues</i>							0 1 2 3 4		10%		0
Culvert structure condition				Good							
Broken concrete/gunite?				No							
Broken or missing trash fence/fence poles/supports?				No						4.0	
Slope failure?				No							
Total Weighted Water Quality Points											
Community Input (10% of total weight)											
<i>Community Complaints Received</i>							YES NO		50%		5
<i>Community Outreach Input</i>							0 1 2 3 4		50%		0
Total Weighted Community Input Points											5.0
Aesthetics (5% of total weight)											
<i>Aesthetics</i>							0 1 2 3 4		100%		2.5
Are the aesthetics of the channel compromised?				Slightly						2.5	
Total Weighted Aesthetics Points											

1. See appendix D for geometry parameters

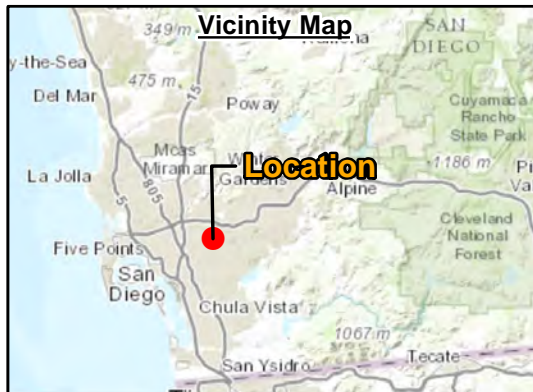
Scoring Legend	
0	Factor is in good condition and does not need attention
1	Factor is in good condition, but will eventually need attention
2	Factor needs attention
3	Factor is in bad condition and needs attention
4	Factor is in severe condition and needs immediate attention

Channel Prioritization Assessment Sheet for <u>Chollas Creek Channel MMP Map 71 - Reach 2</u>							Total Channel Score:		82.3 /100		
Flood Hazard (75% of total weight)							Score	factor weight	Weighted Points		
Δ capacity							Sum of sub-factor a-c scores:	10	25%	12.5	
a. Risk of flooding							Current Channel Normal depth capacity ¹ : 372 cfs <2 -yr. storm event	(out of 15)			
b. Increase in storm event capacity							Channel As-Built normal depth capacity ¹ : 986 cfs 50 -yr. storm event				
c. Net percent increase in channel capacity post-maintenance							165%				
Consequence of flooding adjacent areas							Surrounding area land use: Residential	0 1 2 3 4	50%	37.5	
(area within 100 feet of the channel or area in which more than 10,000 ft ² is impacted from flooding.)							No				
Is there open space surrounding the channel?											
Clogging Potential							Are there trees/large debris that have potential to flow D/S and clog culverts/the channel?	0 1 2 3 4	25%	18.75	
							Yes				
							Total Weighted Flood Hazard Points		68.8		
Water Quality/Channel Condition (10% of total weight)											
Trash/Debris							Type of trash and Source: None based on O&M form, however light transient trash appears in site photo 5	0 1 2 3 4	20%	1	
Standing water							Ponding? Yes	0 1 2 3 4	15%	2	
Noticeable odors? No											
Algae? No											
Sediment							Approx. sediment coverage: (Based on information provided on City of San Diego O&M Channel Maintenance Inspection Form)	0 1 2 3 4	35%	2	
Rock/debris Accumulation?							10%				
							No				
Transients/encampments								0 1 2 3 4	10%	1	
Culverts and Outfalls							Culvert structure condition	0 1 2 3 4	10%	0	
							Good				
Infrastructure Issues							Broken concrete/gunite?	0 1 2 3 4	10%	0	
							No				
							Broken or missing trash fence/fence poles/supports?				
							No				
							Slope failure?				
							No				
							Total Weighted Water Quality Points		6.0		
Community Input (10% of total weight)											
Community Complaints Received							YES NO	50%	5		
Community Outreach Input							0 1 2 3 4	50%	0		
							Total Weighted Community Input Points		5.0		
Aesthetics (5% of total weight)											
Aesthetics							Are the aesthetics of the channel compromised?	0 1 2 3 4	100%	2.5	
							Slightly				
							Total Weighted Aesthetics Points		2.5		

1. See appendix D for geometry parameters

Scoring Legend	
0	Factor is in good condition and does not need attention
1	Factor is in good condition, but will eventually need attention
2	Factor needs attention
3	Factor is in bad condition and needs attention
4	Factor is in severe condition and needs immediate attention

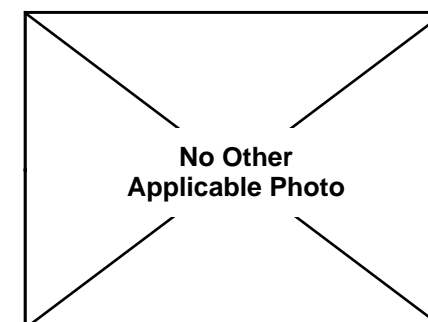
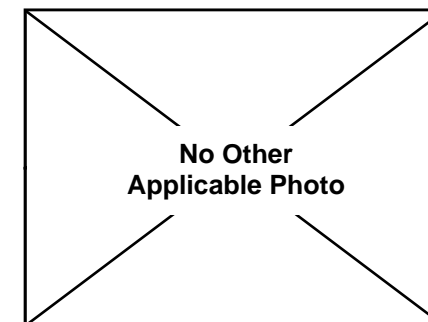
Appendix F
Channel Maintenance Prioritization Summary Sheet



Legend

- Photo Location
- Channel Survey
- City Storm Drain Structure
- City Storm Drain

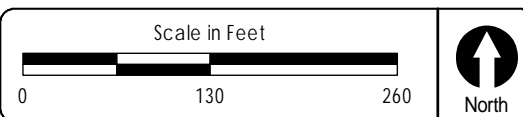
Photos:

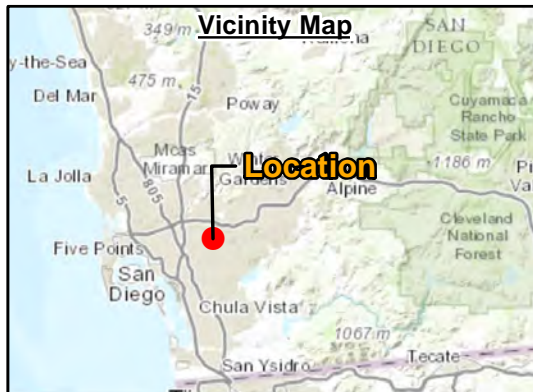


Assessment Results

- **Channel Prioritization Score:**
67.8 out of 100
 - **Flood Hazard Score:**
56.3 out of 75
 - **Water Quality Score:**
4 out of 10
 - **Community Input Score:**
5 out of 10
 - **Aesthetics Score:**
2.5 out of 5
- **Capacity Prior to Maintenance:**
100-year storm event
- **Capacity After Maintenance (As-built Capacity):**
100-year storm event
- **Clogging Potential:** *HIGH*
- **Approximate Vegetation Coverage:** *MEDIUM*
- **Surrounding Area:** *Commercial*
- **Infrastructure Failures:**
None
- **Site Evaluation Date:**
May 6, 2015
- **Notes/Comments:**
Based on site photos taken by the City of San Diego, heavier vegetation exists for a small segment of the channel immediately downstream of Roland Boulevard. A high risk of vegetation flowing downstream and clogging the culvert exists.

W:\17204_D_ChannelRanking\GIS\17204_Channel_Prioritization\MapDocs\Aerial\17204_012015

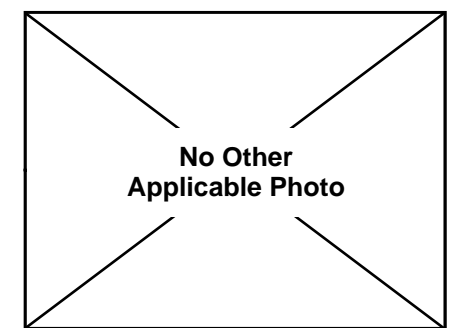




Legend

- Photo Location
- Channel Survey
- City Storm Drain Structure
- City Storm Drain

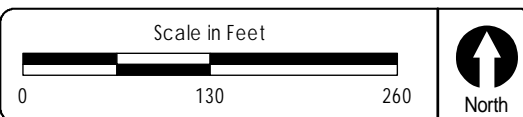
Photos:



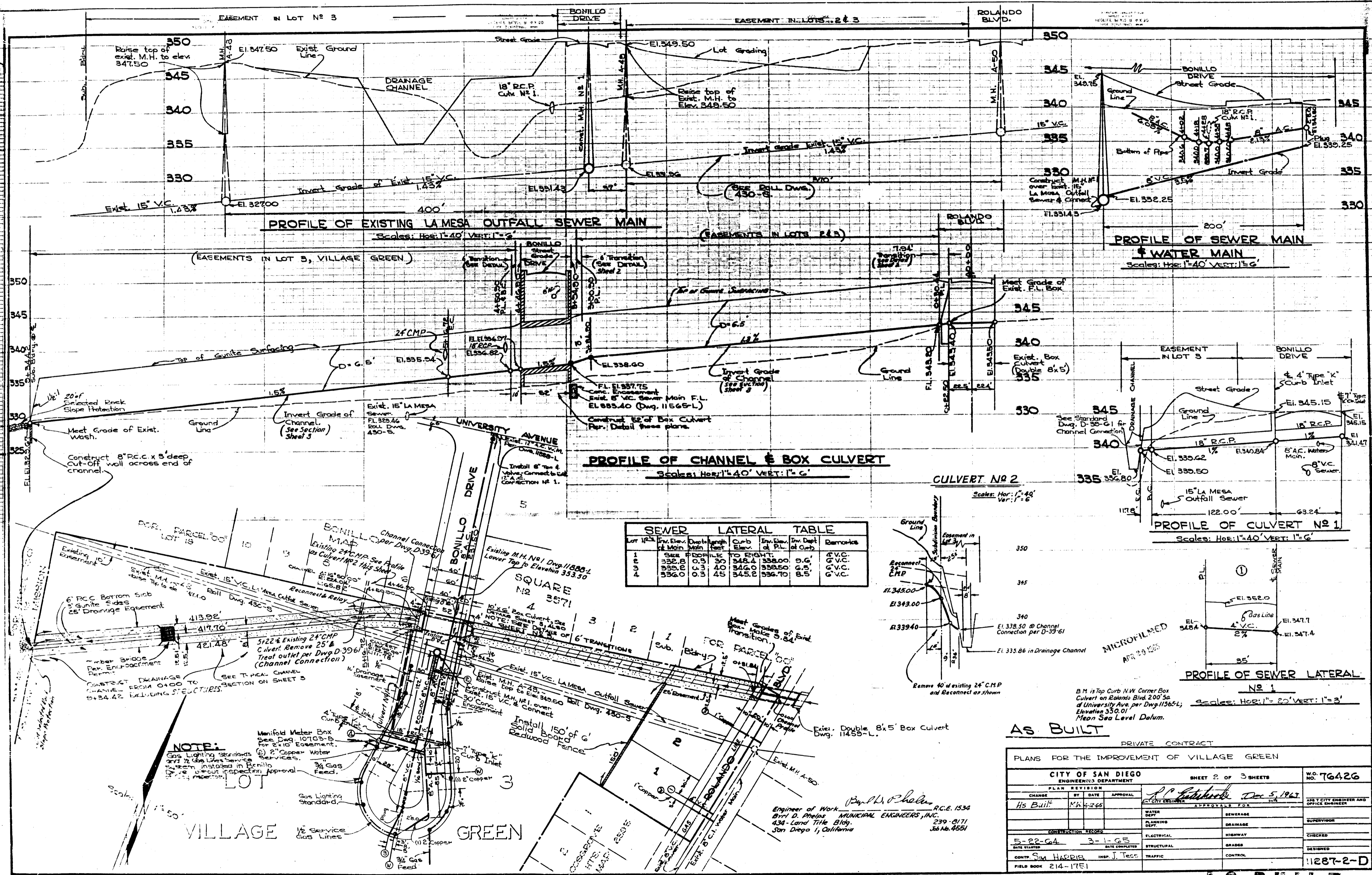
Assessment Results

- **Channel Prioritization Score:**
82.3 out of 100
- **Flood Hazard Score:**
68.8 out of 75
- **Water Quality Score:**
6 out of 10
- **Community Input Score:**
5 out of 10
- **Aesthetics Score:**
2.5 out of 5
- **Capacity Prior to Maintenance:**
Less than 2-year storm event
- **Capacity After Maintenance (As-built Capacity):**
50-year storm event
- **Clogging Potential:** *HIGH*
- **Approximate Vegetation Coverage:** *HIGH*
- **Surrounding Area:** *Residential*
- **Infrastructure Failures:**
None
- **Site Evaluation Date:**
May 6, 2015
- **Notes/Comments:**
Palm trees exist along entire reach.

W:\17204_D_ChannelRanking\GIS\17204_Channel_Prioritization\MapDocs\Aerial\17204_012015



Appendix G
Available As-built plans



Lot No.	Invert Elev. of Main	Dist. from Main	Length	Curb Elev. to Right	Invert Elev. of P.L.	Invert Dept. of Curb	Remarks
1	332.8	0.3	30	348.4	338.00	0.6	6" V.C.
2	333.2	0.3	40	346.0	338.50	0.5	6" V.C.
3	336.0	0.3	45	345.2	336.70	8.5	6" V.C.

CITY OF SAN DIEGO ENGINEERING DEPARTMENT PLAN REVISIONS CHANGED BY DATE APPROVAL As Built M.H. 4-12-65 R.C.E. 1534 239-8171 36 No. 4551		SHEET 2 OF 3 SHEETS W.O. NO. 76426 APPROVAL FOR CONSTRUCTION DATE COMPLETED 3-1-65 DESIGNED 11287-2-D
WATER DEPT. PLANNING DEPT. ELECTRICAL STRUCTURAL TRAFFIC	SEWERAGE DRAINAGE HIGHWAY GRADES CONTROL	SUPERVISOR CHECKED DESIGNED

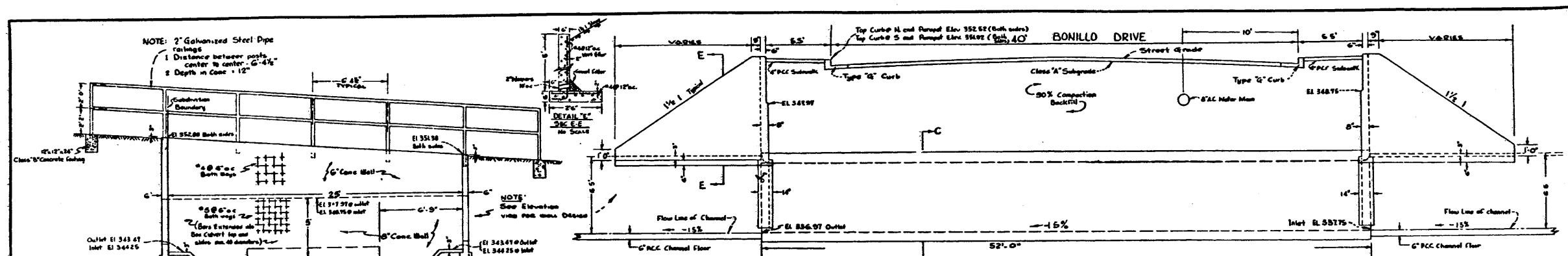
AS BUILT

AS BUILT

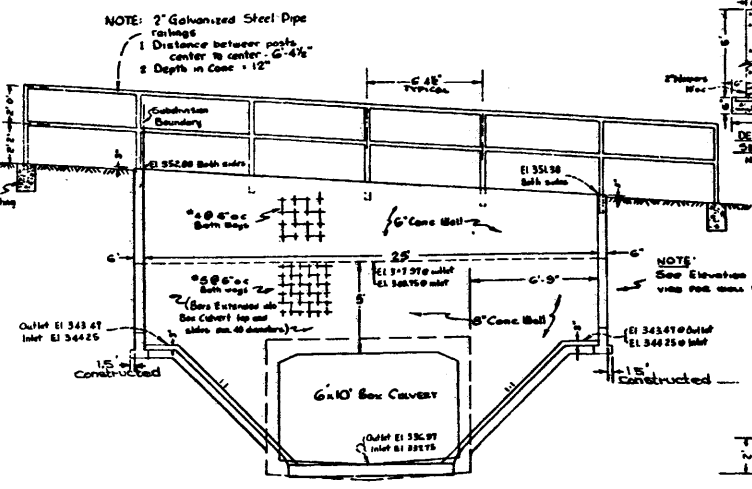
MICROFILMED
APR 29 1968

NOTE:
Gas Lighting Standards
and Gas Lines Service
system installed in Bonillo
Drive without inspection approval
of gas authority.

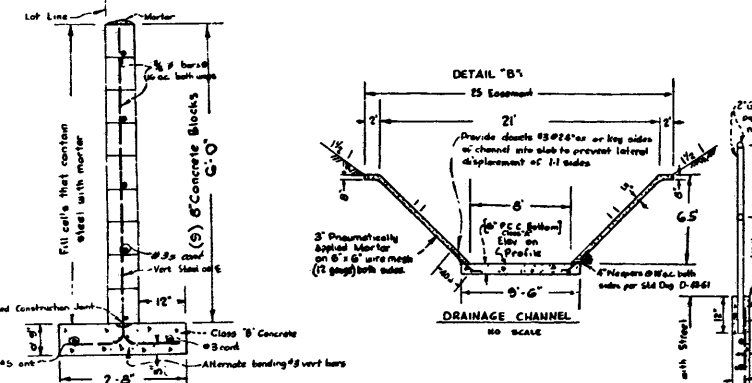
B.M. is Top Curb N.W. Corner Box
Culvert on Bonillo Blvd 200' S of
University Ave per Dwg. 11365-L;
Elevation 350.01
Mean Sea Level Datum.



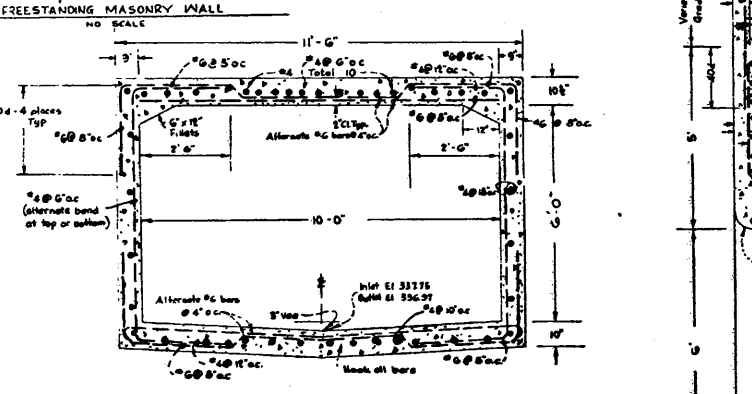
ELEVATION-BOX CULVERT & WALLS
SCALE 1/2" = 1'-0"



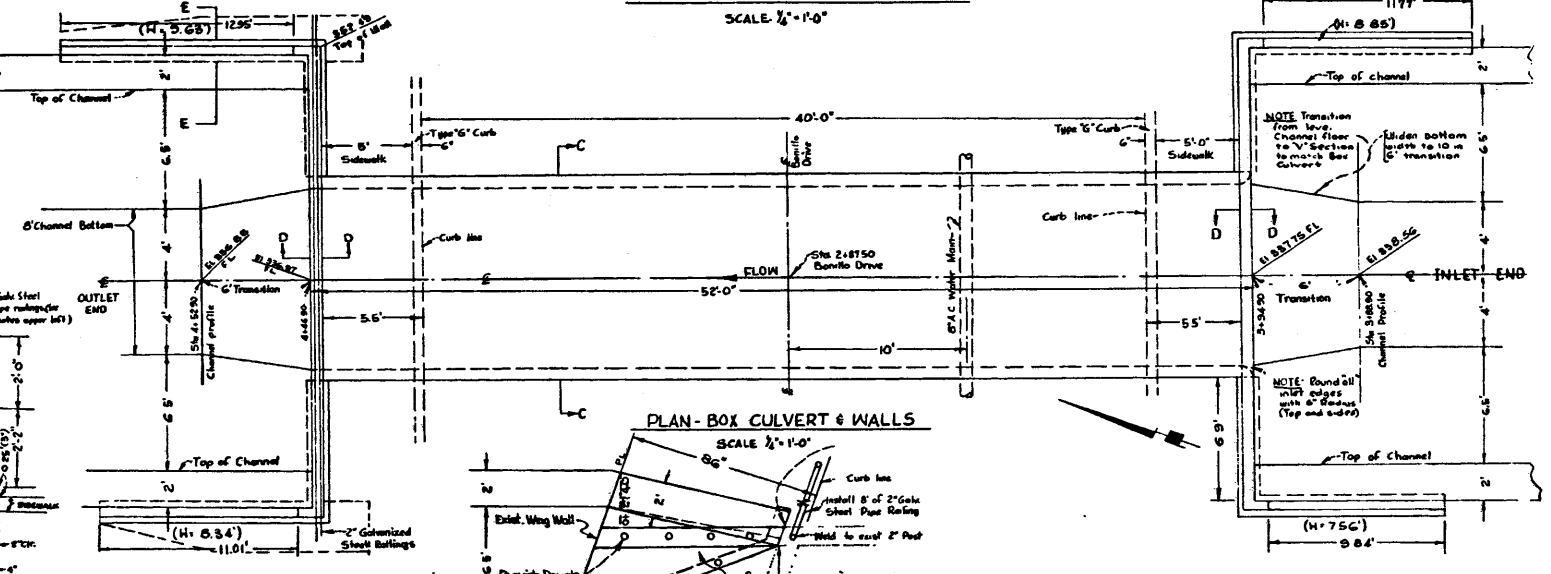
END VIEW AT PARAPETS (TYPICAL)
SCALE 3/4" = 1'-0"



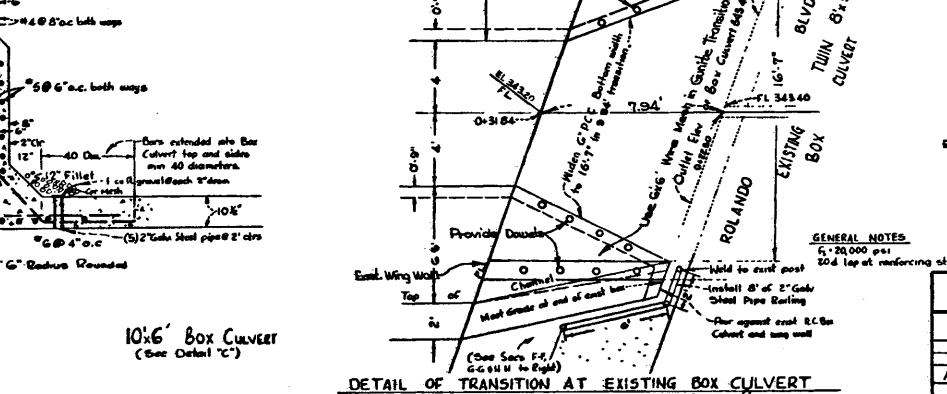
DETAIL "B" - DRAINAGE CHANNEL
NO SCALE



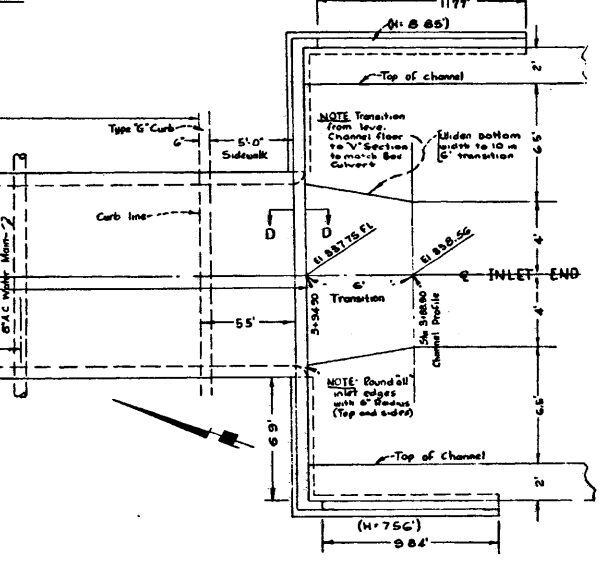
DETAIL "C" - SEC. C-C, BOX CULVERT
SCALE 3/4" = 1'-0"



PLAN-BOX CULVERT & WALLS
SCALE 3/4" = 1'-0"



DETAIL OF TRANSITION AT EXISTING BOX CULVERT
SCALE 3/4" = 1'-0"



X-SECTION @ TRANSITION @ 0+22.5 to 0+30.44
SCALE NO SCALE

AS BUILT PRIVATE CONTRACT

BOX CULVERT, WALLS AND CHANNEL DETAILS
VILLAGE GREEN

CITY OF SAN DIEGO
ENGINEERING DEPARTMENT

SHEET 3 OF 3 SHEETS
NO. 76426

CHANGE	BY	DATE	APPROVAL	REVISIONS
AS BUILT	MVA/HGS			

5-22-64
DATE: SIM HARRIS
FIELD BOOK 214-1761

MARKHAM
RAMSEY
CRULL
112873-D

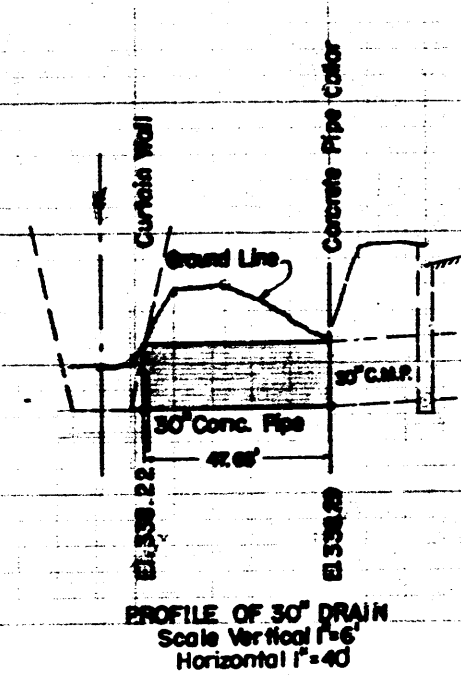
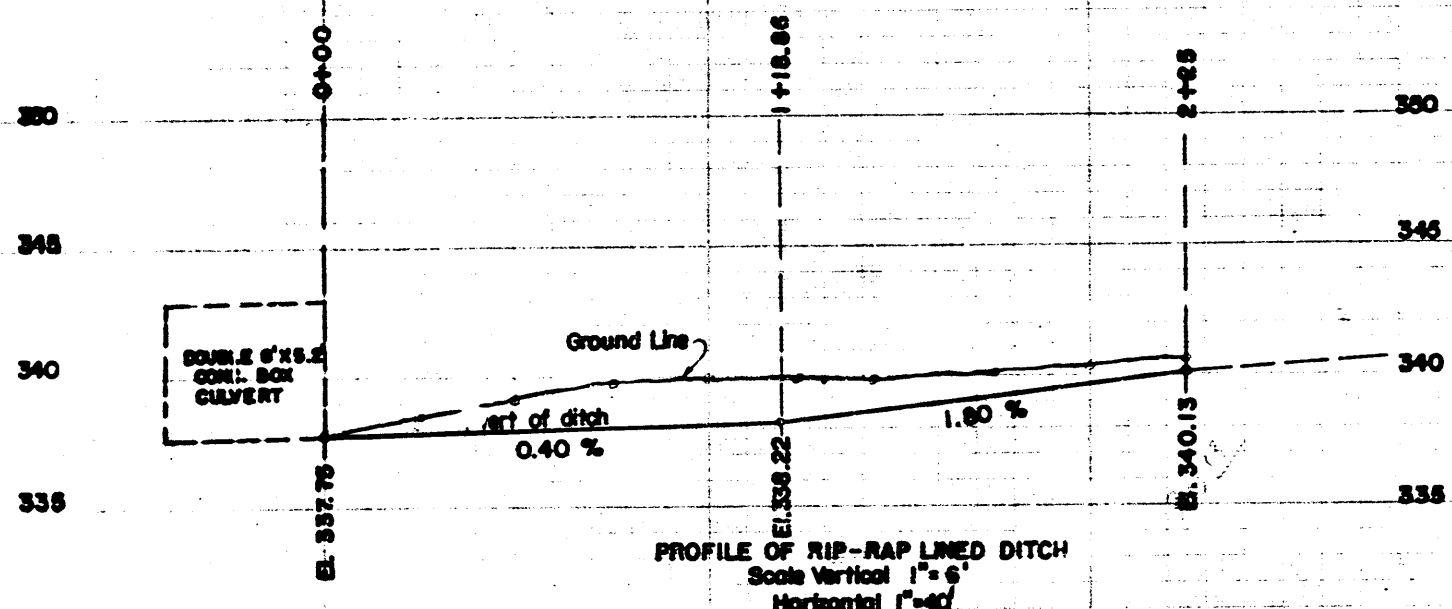
AS BUILT

Engineer of Work
Bryan D. Phillips
434 Land Title Bldg
San Diego, California
Job No. 4581

Principal Engineer
M. J. Phillips
239 - 8171
Job No. 4581

BUZZ-MOUNTED SCALE 1/4"

Bench Mark Elevation 337.75 (see dep. 12378-L)
Invert E. of Box 0+00



WORK TO BE DONE

The construction consists of the following work to be done according to these plans and the specifications hereto attached:

The construction of Concrete Pipe Storm Drain as shown hereon.

The construction of Rip-Rap Lined Ditch as shown on the plans.

The construction of a Curtain Wall as shown thus:

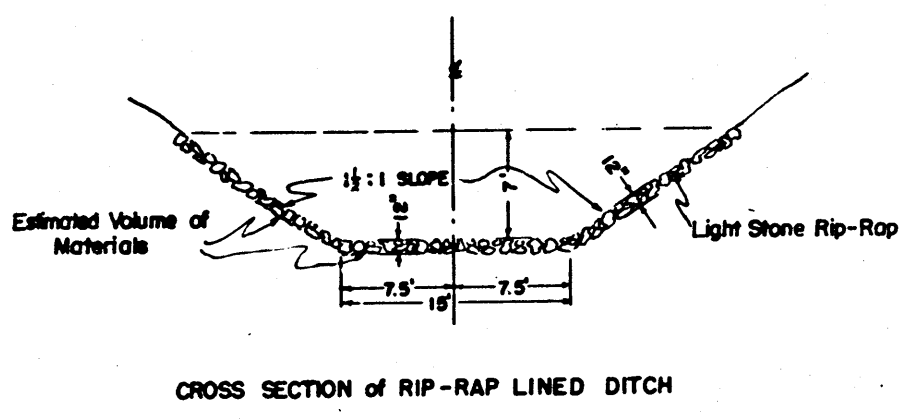
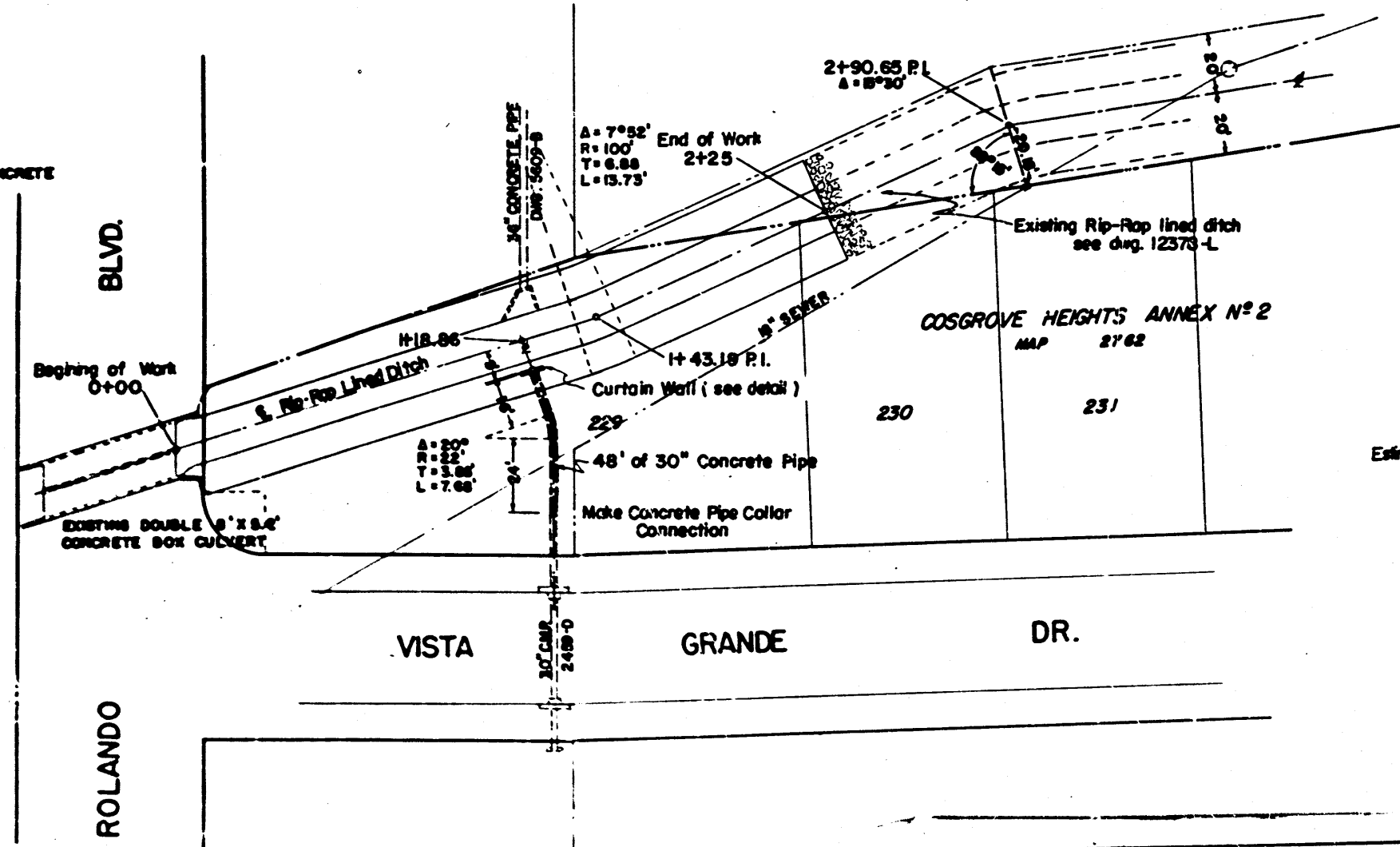
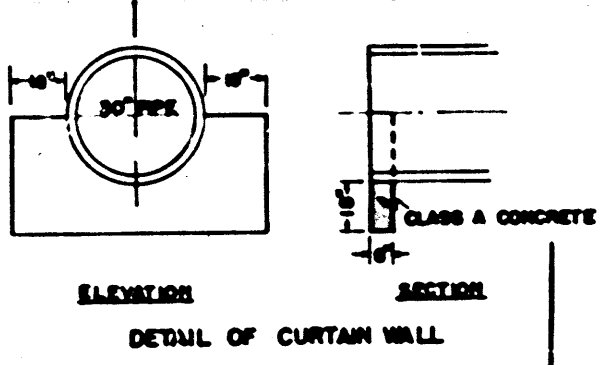
The construction of a Concrete Pipe Collar as shown on the plans.

STANDARD DRAWINGS

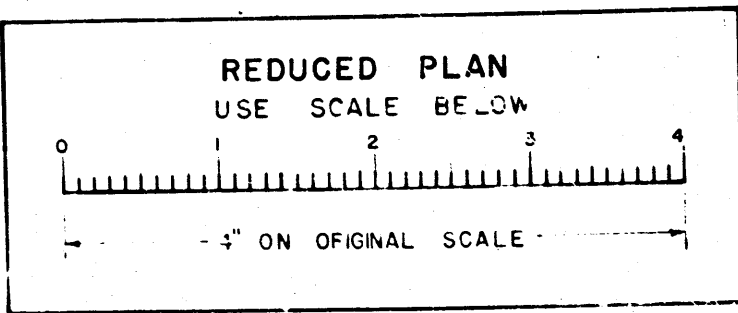
305 - EB
314 - EB

SPECIFICATIONS

Standard Specifications filed July 7, 1954
Special Specifications, N1



CITY DATUM
ADD 3.19 FEET
TO CONVERT TO
MEAN SEA LEVEL



WATER DEPARTMENT	Checked by: [Signature]
SEWER DEPARTMENT	Checked by: [Signature]
DRAINAGE	Checked by: [Signature]
FIELD CHECK	Checked by: [Signature]
OFFICE CHECK	Checked by: [Signature]
PLANNING COMMISSION	Checked by: [Signature]
GRADES	Checked by: [Signature]
SUPERVISOR	Checked by: [Signature]

CITY CONTRACT

CITY OF SAN DIEGO
ENGINEERING DEPARTMENT

Plans for the construction of a Rip-Rap Lined Ditch and a Storm Drain at Rolando Blvd. and Vista Grande Dr.

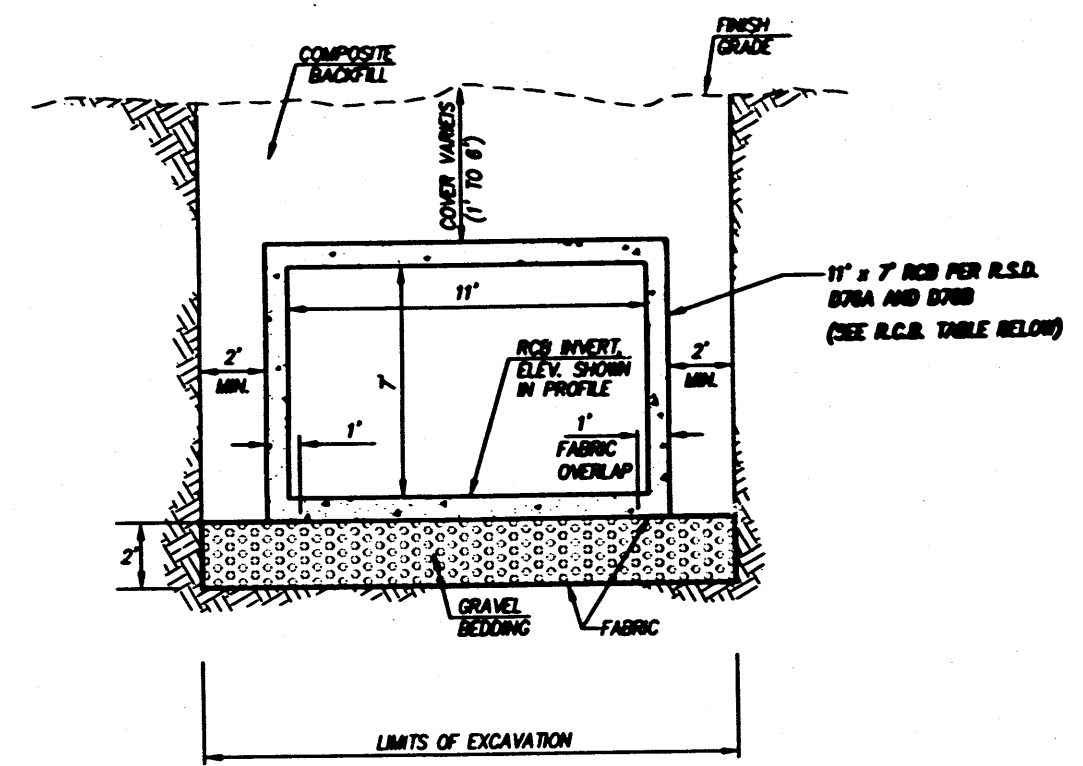
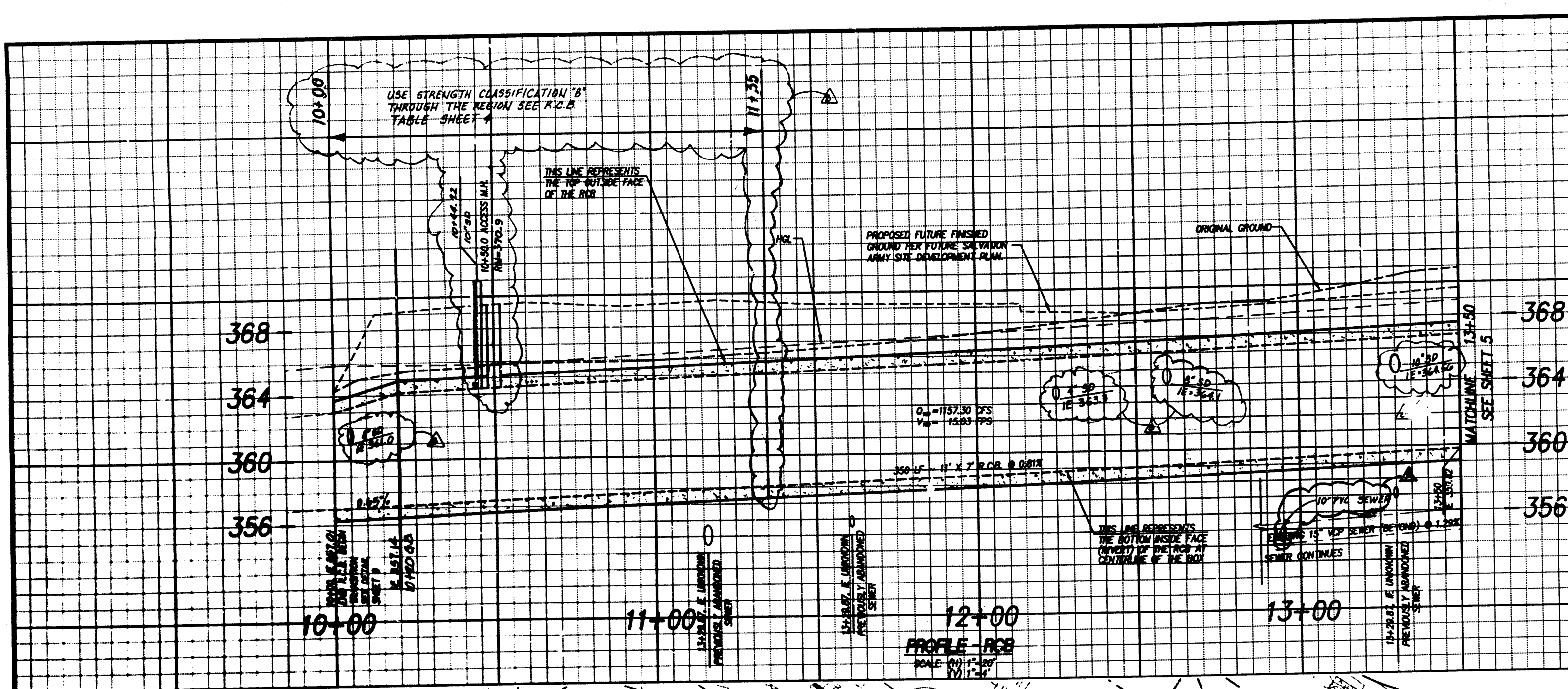
APPROVED: *A.R. Foggy* DATE: 7-2-1955
CITY ENGINEER

SCALE: NOTED

DRAWN BY: LOCKHEAD
TRACED BY: U.W. H-21-75
FIELD WORKS

DRAWING NUMBER: 12701-L

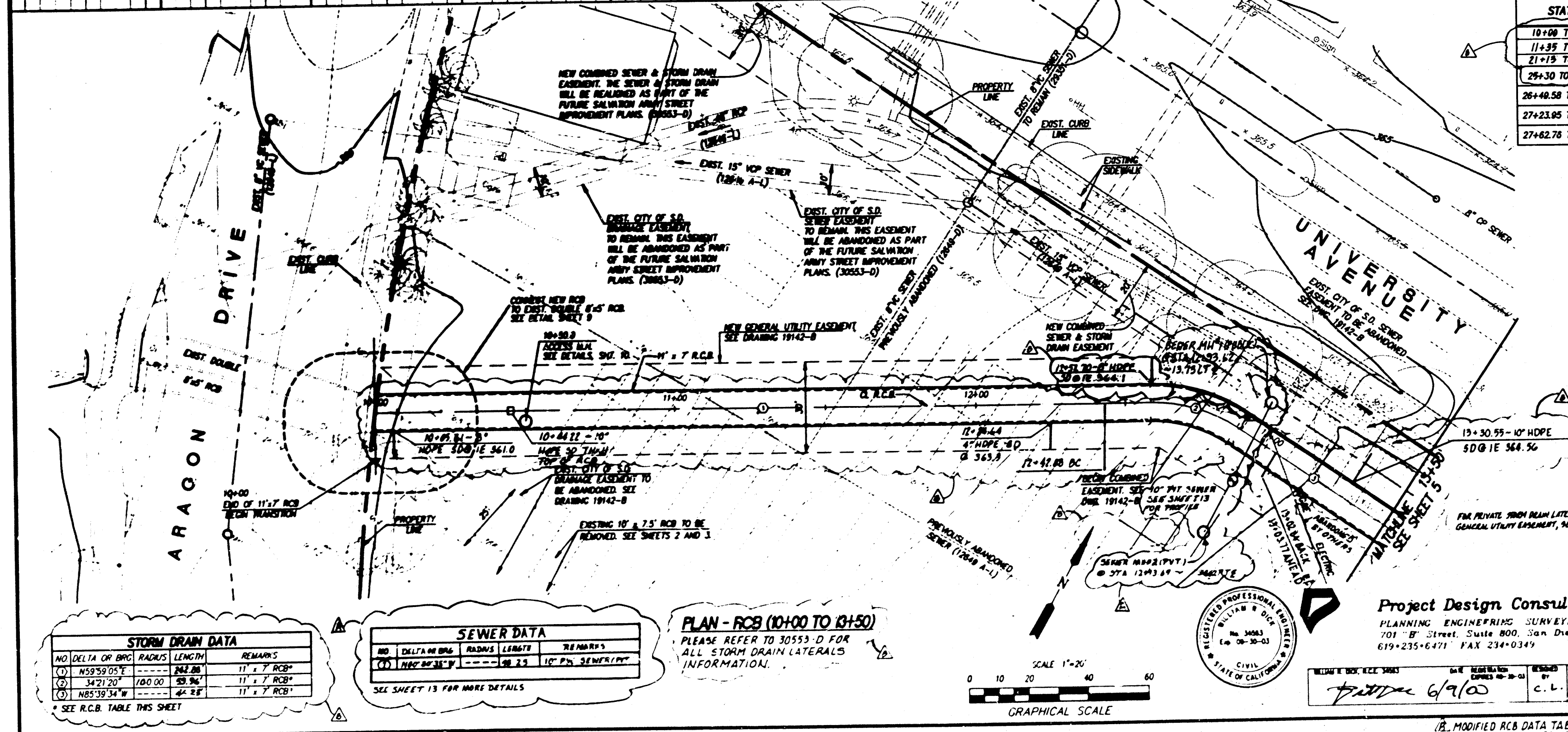
CONSTRUCTION RECORD		NO. 21306
CONTRACTOR: James T. Loob	SUPERVISOR: Birdsell	
DATE STARTED: 4-3-56	DATE STOPPED: None	4-30-56 LB
DATE COMPLETED: 4-26-56		



RCB - TYPICAL SECTION
(10+00 TO 26+40.58)
(NO SCALE)

RCB TABLE

STATION	R.S.D.	STRENGTH CLASSIFICATION	RCB SIZE	USE THIS SIZE FOR TL, TL, TL + REINFORCEMENT
10+00 TO 11+35	D76A, D76B	B	SINGLE 8'x7'	12'x7'
11+35 TO 21+15	D76A, D76B	A	SINGLE 8'x7'	12'x7'
21+15 TO 25+30	D76A, D76B	B	SINGLE 8'x7'	12'x7'
25+30 TO 26+40.58	D76A, D76B	A	SINGLE 11'x7'	12'x7'
26+40.58 TO 27+23.95	D77A, D77B	A	TRANSFORM RCB	8'x7'
27+23.95 TO 27+62.78	EXISTING DEL. 8'x5'	-	EXISTING DEL. 8'x5'	-
27+62.78 TO 29+20.28	D77A, D77B	A	DOUBLE 8'x5'	8'x5'



STORM DRAIN DATA

NO.	DELTA OR BVC	RADIUS	LENGTH	REMARKS
1	N59°59'05"E	---	242.00'	11' x 7' RCB
2	S42°21'20"W	100.00'	59.94'	11' x 7' RCB
3	N85°39'34"W	---	44.28'	11' x 7' RCB

SEE R.C.B. TABLE THIS SHEET

SEWER DATA

NO.	DELTA OR BVC	RADIUS	LENGTH	REMARKS
1	N80°00'35"W	---	10.23'	10" DIA. SEWER/10"

SEE SHEET 13 FOR MORE DETAILS

PLAN - RCB (10+00 TO 13+50)
PLEASE REFER TO 30553-D FOR ALL STORM DRAIN LATERALS INFORMATION.

PRIVATE CONTRACT
IMPROVEMENT PLANS FOR:
**THE SALVATION ARMY
RAY AND JOAN KROC COMMUNITY CENTER
STORM DRAIN IMPROVEMENTS - 10+00 TO 13+50**

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING DEPARTMENT
SHEET 4 OF 12 SHEETS

Project Design Consultants
PLANNING ENGINEERING SURVEYING
701 "B" Street, Suite 800, San Diego, Ca 92111
619-235-6471 FAX 234-0349

30265-4-D

1. MODIFIED RCB DATA TABLE, STORM DRAIN DATA TABLE ADDED STRENGTH CLASSIFICATION FOR RCB IN PROFILE, STORM DRAIN LATERALS IN PLAN & PROFILE AND STORM DRAIN LATERAL NOTE
2. ADDED 10" DIA. SEWER ON PLAN AND PROFILE AND 10" DIA. SEWER DATA TABLE
3. DELETED 10" DIA. FOOTING ON PLAN AND ADDED 10" DIA. FOOTING ON PROFILE

AS BUILT

Appendix H
Compact Disc
PDF Version of Full Report