HYDRAULIC ANALYSIS
TECHNICAL ASSESSMENT REPORT

FOR
ENGINEERED EARTHEN-BOTTOM FLOOD CONTROL CHANNELS LOCATED WITHIN THE SANTA CLARA RIVER WATERSHED & ANTELOPE VALLEY WATERSHED

MAINTAINED AND OPERATED BY THE
LOS ANGELES COUNTY FLOOD CONTROL DISTRICT

IN COMPLIANCE WITH THE

WASTE DISCHARGE REQUIREMENTS
NUMBER R4-2015-0032-A1

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Table of Contents

List of Tables

List of Figures

Appendices

Acronyms and Abbreviations

AB: As-Built Plan

Dwg: Drawing

FEMA: Federal Emergency Management Agency

FMD: Flood Maintenance Division

HEC-RAS: Hydrologic Engineering Center's River Analysis System

LACDPW: Los Angeles County Department of Public Works

LACFCD: Los Angeles County Flood Control District

LiDAR: Light Detection and Ranging

MCI: Maintenance Channel Inlet

MCO: Maintenance Channel Outlet

PD: Private Drain

RDD: Road Drainage Design

SBC: Soft-Bottom Channel

SCR: Santa Clara River

TIN: Triangulated Irregular Network

USACE: United States Army Corps of Engineers

WDR: Waste Discharge Requirements

1 Introduction

The Los Angeles County Flood Control District (LACFCD) operates and maintains numerous engineered soft-bottom flood control channels within the County of Los Angeles. These channels convey storm flows from the canyons and surrounding areas. The LACFCD conducts annual maintenance to provide efficient and effective operation of these facilities to protect life and property from potential flooding, reduce fire hazards, and control vector nuisances.

On February 4, 2010, the Los Angeles Regional Water Quality Control Board (Regional Board) adopted Waste Discharge Requirements (WDR) for the maintenance of soft-bottomed flood control channels, Order No. R4-2010-0021. The adopted WDR required a Feasibility Study to be conducted within six years for all the earth-bottomed channels, authorized in the WDR, in each watershed within Los Angeles County. The Feasibility Study included a hydraulic analysis for the engineered earthen-bottom flood control channels located within the Santa Clara River and Antelope Valley Watersheds. The hydraulic analysis will determine the existing flood control capacity of the soft-bottom channel reaches and whether the potential may exist for native vegetation to remain within the soft-bottom portion of the channel or if additional hydraulic capacity is needed. The WDR was extended on February 12, 2015 (Order No. R4-2015-0032) and amended on February 11, 2016 (Order No. R4-2015-0032-A1).

This report presents the results of a technical assessment of the hydraulic conditions for 51 soft-bottom channel reaches in the Santa Clara River Watershed and one soft-bottom channel reach in the Antelope Valley Watershed included in the WDR. Detailed reach characteristics and hydraulic modeling assumptions are presented in the respective sections for the reaches examined in this report. The report addresses capacity requirements for flood control and analyzes, from a hydraulic perspective, reaches with the potential for restoration or addition of native vegetation or where existing vegetation must be removed. Reaches have been identified where vegetation can remain in the channel and where native vegetation can be reintroduced.

1.1 Study Reaches

Within the Santa Clara River and Antelope Valley Watersheds, there are 52 defined soft-bottom reaches in the Regional Board's WDR. Locations of the 52 soft-bottom channel (SBC) reaches are presented in Figure 1-1. Reach lengths are summarized in Table 1-1.

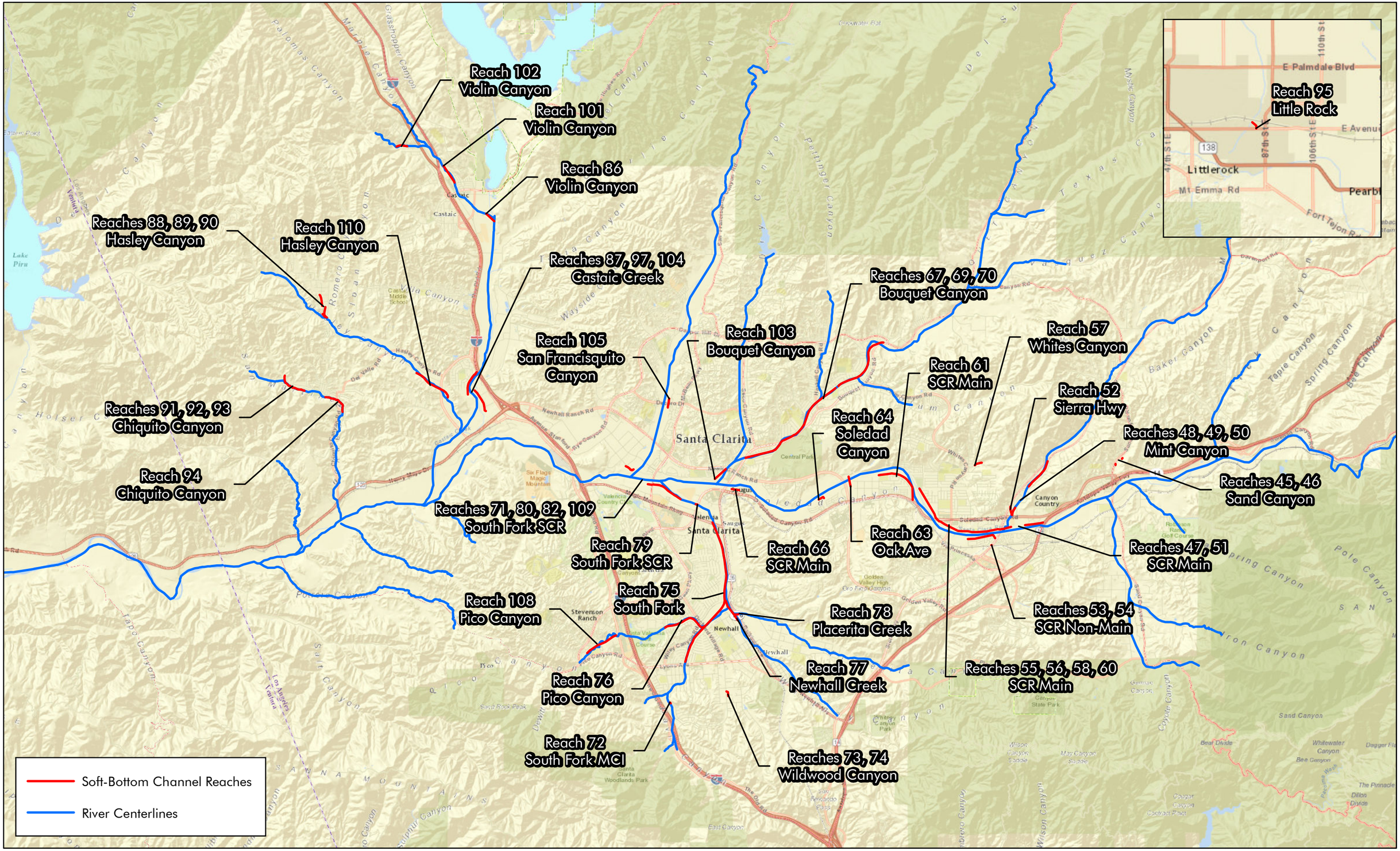
The study reaches include main channels and creeks, as well as their main and secondary tributaries. In the Santa Clara River Watershed, the SBC reaches include portions of the Santa Clara River, South Fork, Hasley Canyon, Violin Canyon, San Martinez Chiquito Canyon, Castaic Creek, Pico Canyon, Bouquet Canyon, Mint Canyon, Sand Canyon, Whites Canyon, Wildwood Canyon, and San Francisquito Canyon. In the Antelope Valley Watershed, the SBC reach includes a portion of Little Rock Wash.

Table 1-1: List of Soft-Bottom Channel Reaches

Report Section	Reach No.	Reach Name	Length (ft)
2	71	Santa Clara River Main Channel	242
	80	South Fork SCR (Main River Channel)	2,686
	82	Santa Clara River Main Channel	849
	109	Santa Clara River (MTD 1510) South Bank West of McBean Pkwy	372
3	76	Pico Canyon	4,116
4	86	Violin Canyon MCO	1,006
	101	Violin Canyon	1,818
	102	Violin Canyon	975

Report Section	Reach No.	Reach Name	Length (ft)
5	88	Hasley Canyon Upper	1,051
	89	Hasley Canyon South Fork	341
	90	Hasley Canyon Lower	1,051
6	97	Castaic Creek (Live Oak)	2,002
	104	Castaic Creek (Handcock)	2,223
7	105	San Francisquito Canyon Channel	833
8	110	Hasley Canyon Channel	3,737
9	47	Santa Clara River Main Channel	1,658
	51	Santa Clara River	931
	55	Santa Clara River Main Channel – Right Bank	3,518
	56	Santa Clara River Main Channel – Left Bank	2,346
	58	Santa Clara River Main Channel	2,644
	60	Santa Clara River Main Channel	3,166
	61	Santa Clara River	4,715
10	63	Oak Ave Road Drainage	914
11	66	Santa Clara River Main Channel	710
12	67	Bouquet Canyon Upper	6,344
	69	Bouquet Canyon Middle	7,326
	70	Bouquet Canyon Lower	3,505
	103	Bouquet Canyon Channel	1,348
13	75	South Fork SCR	14,075
14	79	South Fork SCR (Valencia Blvd Bridge Stabilizer)	168
15	87	Castaic Old Road Drain Outlet	225
16	108	Pico Canyon	3,100
17	45	Sand Canyon Main Channel Inlet	102
	46	Sand Canyon Main Channel Outlet	84
18	48	Mint Canyon Mint Canyon Channel b/w Sierra Hwy & Adon Ave	2,505
	49	Mint Canyon Channel b/w Adon Ave & Scherzinger	385
	50	Mint Canyon Channel b/w Solomint & Soledad	735
	52	Sierra Hwy Road Drainage	722
19	53	Santa Clara River Non/main Channel MCI	35
	54	Santa Clara River Non/main Channel MCO	316
20	57	Whites Canyon MCI	695
21	64	Soledad Canyon Road Drain	574
22	72	South Fork Santa Clara River (Smizer Ranch MCI)	101
23	73	Wildwood Canyon Channel MCI	83
	74	Wildwood Canyon Channel	365
24	77	Newhall Creek Outlet	2,092
25	78	Placerita Creek	376
26	91	San Martinez Chiquito Canyon u/s Kensington Road	599
	92	San Martinez Chiquito Canyon (N. Fork) unnamed	768
	93	San Martinez Chiquito Canyon b/w Kensington/Val Verde Park	1,072
	94	San Martinez Chiquito Canyon b/w Val Verde Park/ d/s of Madison St.	2,446
27 [1]	95	Little Rock Wash	1,823

Notes:
[1] *Reach 95 is the only SBC reach located within the Antelope Valley Watershed.*



PACE Advanced Water Engineering

LACDPW
SANTA CLARA RIVER WATERSHED
SOFT BOTTOM CHANNEL ANALYSIS

TITLE: SOFT-BOTTOM CHANNEL REACH LOCATION MAP

FIGURE: 1-1

1.2 Report Organization

This report is organized into individual sections identifying and describing each SBC reach analyzed for the Santa Clara River and Antelope Valley Watersheds. The sections present the reaches in the same order as listed in Table 1-1. Reaches that are modeled hydraulically as a single reach are summarized together in one section.

Supplementary information is provided in the Appendices A - E regarding notes and photographs from field investigations, existing condition Manning's value assessments, super-elevation calculations and freeboard capacity results.

1.3 Hydrologic Data

Design flow rates were used for the hydraulic analysis of the soft-bottom channel reaches. The flow data used in this study were obtained from various sources. A discussion of the source of the flow data is provided in each reach's section.

1.4 Hydraulic Modeling

Hydraulic models were developed for the 52 SBC reaches using the United States Army Corps of Engineers (USACE) Hydrologic Engineering Center's River Analysis System (HEC-RAS) computer program, Version 5.0.3. Several iterations of the models were conducted for each channel reach.

Initially, a model of the existing conditions was developed. The model of the existing conditions uses design flow rates and vegetation levels in the channel reach representing the typical vegetation levels existing immediately prior to annual maintenance activities (i.e. vegetation levels typical in August-October). A second model was also developed for a "design conditions" (or estimated design conditions) scenario for those cases when existing condition did not have excess capacity or partial excess capacity. The design conditions model uses design flow rates and design roughness conditions in the channel reach.

For the reaches not having excess capacity (to convey the design flow rate) under the existing conditions scenario, the design conditions model was reviewed to determine whether the reach might have excess capacity under a "design conditions" (or estimated design conditions) scenario. If there was excess capacity under the design conditions scenario, development of a model with added native vegetation in a quantity that would not result in the design channel capacity being exceeded was considered. The type and species of the additional vegetation was determined in consultation with BonTerra Psomas, the LACFCD biological consultant.

For reaches that were found to have excess channel capacity under the existing conditions scenario, a model was developed to determine the amount and type of additional vegetation that might be allowed to remain in the channel reach without affecting the design channel capacity. Selection of the vegetation was accomplished with recommendations from BonTerra Psomas.

The hydraulic models follow standard orientation conventions used by the USACE. Cross sections defining channel geometry are described by station and elevation data from left to right, looking in the downstream direction. River stationing begins downstream and increases upstream. Input and output files for the hydraulic models discussed in this report are provided in Appendix E.

1.4.1 *Field Investigations*

Field investigations were conducted for all 52 SBC reaches to verify channel geometry, obstructions, structures, and vegetation. The field investigations were completed by PACE between August and October of 2015. Field notes and photographs were taken of all reaches to document the type, density, and size of vegetation. These items are provided in Appendix A.

1.4.2 *Manning's Roughness Coefficients*

Manning's roughness coefficients were determined from field observations, published values of Manning's roughness coefficients, and engineering judgement. The references used in estimating the Manning's roughness coefficients were "Open-Channel Hydraulics" by Ven T. Chow and "Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains", United States Geological Survey Water-supply Paper 2339.

Six variables were quantified for the observed channel features: (1) river bed material, (2) surface irregularities, (3) variation in channel width, (4) channel obstructions, (5) vegetation, and (6) channel meandering. Each variable has a range of sub-type characterizations that range from smallest to largest roughness contribution. The soft-bottom channel roughness values were estimated using the following formula, developed by Cowan (1956):

$$n = (n_b + n_1 + n_2 + n_3 + n_4)m$$

where:

n_b = a base value of n for a straight, uniform, smooth channel in natural materials

n_1 = a correction factor for the effect of surface irregularities

n_2 = a value for variation in the shape and size of the channel cross section

n_3 = a value for obstructions

n_4 = a value for vegetation and flow conditions

m = a correction factor for meandering of the channel

The Manning's roughness values were estimated on a reach by reach basis. Depending on the native bed material, Figure 1-2 was used to determine the base roughness, n_b.

Bed material	Median size of bed material (in millimeters)	Base *n* value	
		Straight uniform channel[1]	Smooth channel[2]
Sand channels			
Sand[3]	0.2	0.012	—
	.3	.017	—
	.4	.020	—
	.5	.022	—
	.6	.023	—
	.8	.025	—
	1.0	.026	—
Stable channels and flood plains			
Concrete	—	0.012–0.018	0.011
Rock cut	—	—	.025
Firm soil	—	0.025–0.032	.020
Coarse sand	1–2	0.026–0.035	—
Fine gravel	—	—	.024
Gravel	2–64	0.028–0.035	—
Coarse gravel	—	—	.026
Cobble	64–256	0.030–0.050	—
Boulder	>256	0.040–0.070	—

[1] Benson and Dalrymple (1967).
[2] For indicated material; Chow (1959).
[3] Only for upper regime flow where grain roughness is predominant.

Figure 1-2: Base Roughness Value (USGS Water Supply Paper 2339)

The basis for design condition Manning's roughness coefficients comes from values identified in the as-built plans and design reports. For reaches where the roughness coefficient could not be identified, either the n-value was calculated based on hydraulic data from the plans and reports – such as the channel geometry, flow rate, bed slope, and flow depth – or an assumption for the n-value was made based on bare-earth soil conditions.

Each section specifies the existing and design conditions Manning's roughness coefficients for each of the SBC reaches. Appendix B provides the assessment for existing conditions Manning's roughness coefficients for each reach.

1.4.3 *Geometric Data and Cross Sections*

The hydraulic models were developed using 2006 LiDAR topographic point data for each reach, extending both upstream and downstream of the reach of interest to avoid influence of the user defined boundary conditions on the results. The LiDAR data was processed using GIS tools and imported into HEC-RAS to develop the hydraulic models. The vertical datum for all models is NAVD 88.

Cross-sections cut lines were drawn using HEC-GeoRAS and initially placed using cross section locations from the FEMA and USACE models as a guide. For most reaches, additional cross sections were added to the model to incorporate structures, obstructions, bends in the channel, and channel transitions. As-built plans and field measurements were used as necessary to refine channel features such as bridges, culverts, drop structures, and hard surfaces.

1.4.4 *Bridges and Culverts*

Bridges and culverts included in each model use the bridge and culvert data from the FEMA and USACE models. Where structure data was not available from FEMA or USACE models, the structures were modeled based on as-built plans and field measurements.

For low flows through bridges, HEC-RAS can compute the flow through a bridge using three low flow methods: (1) the energy equation method, (2) the momentum balance method, and (3) the Yarnell equation method. Based on the type of bridge pier, a drag coefficient (*Cd*) is selected for the momentum balance equation and a pier shape coefficient (*K*) is selected for the Yarnell equation. The recommended values of *Cd* and *K* are provided in the HEC-RAS 5.0.3 User's Manual. For this analysis, HEC-RAS compared the results for all three methods and selected the method with the greatest energy loss for the solution.

For high flows through bridges, HEC-RAS can calculate high flows through bridges using two methods: (1) the standard step method, and (2) pressure and/or weir flow. The pressure and/or weir flow method is assumed for all bridges and culverts in all models, with the exception of the culvert at Soledad Canyon Road along Mint Canyon (downstream end of Reach 50). For the bridges and culverts using this method, the submerged inlet and outlet coefficient is set to the default value of 0.80.

As flow in the channel approaches the opening of a bridge or culvert, areas develop on either side of the opening where the flow will pond and no longer contribute to the active flow in the channel. Additional areas of ponding occur on either side of the bridge or culvert exit. To model this behavior, ineffective flow markers are applied to cross sections located upstream and downstream of the bridges and culverts. The placement of ineffective flow markers are based on recommendations provided in the HEC-RAS User's Manual. Ineffective flow markers are placed assuming a 1:1 contraction ratio for the upstream side and a 2:1 expansion ratio for the downstream side of the bridge or culvert. The height of the ineffective flow markers are set to the top of deck elevation for the upstream side and to an elevation between the top and the soffit of the deck for the downstream side.

Following USACE Hydrology and Hydraulics Policy Memorandum No. 4, two feet of debris accumulation is applied for debris loading on each side of each bridge pier or interior culvert wall for its entire height that is below the water surface. For piers with sloping extensions, two feet of debris accumulation is applied on each side of each pier for a distance up to six feet below the water surface.

1.4.5 *Contraction and Expansion Coefficients*

The recommended contraction and expansion coefficients of 0.1 and 0.3 from the HEC-RAS User's Manual are used to compute energy losses between cross sections. Since changes in the shape of river cross sections are more abrupt upstream and downstream of bridges, contraction and expansion coefficients were adjusted to 0.3 and 0.5 for the cross sections located immediately upstream and downstream of all bridges, culverts, and weirs.

1.4.6 *Boundary Conditions and Flow Regime*

All HEC-RAS model simulations use steady state conditions with the mixed flow regime option. The mixed flow regime was chosen to allow subcritical and supercritical flow regimes. This option requires boundary conditions at the upstream and downstream ends of the model. Most models use normal depth for the upstream and downstream boundary conditions. Boundary conditions for normal depth are based on the channel bed slope as measured from the HEC-RAS models or as-built plans. For reaches where the water surface elevations were available from as-built plans or previous hydraulic models, the hydraulic grade line was used as the boundary condition. The upstream and downstream limits of the study reach were extended a distance beyond the maintenance limits such that any user-defined boundary condition would not affect the results within the study reach. A discussion of the boundary conditions used is provided in each reach's section.

1.4.7 *Freeboard Requirement*

Freeboard is the vertical distance measured from the design water surface to the top of the channel wall or levee. Freeboard is provided to ensure that the desired degree of protection will not be reduced by unaccounted factors such as embankment settlement, accumulation of silt, trash and debris, and wave action. The freeboard requirement for each SBC reach was determined using the standard in the Los Angeles County Hydraulic Design Manual published in March 1982. The minimum required freeboard is 2.5 feet for trapezoidal channels. The minimum required freeboard increases for reaches where super-elevation may occur. Appendix C identifies the freeboard requirements for each reach, and Appendix D shows the calculation for additional freeboard required due to super-elevation.

1.5 Changes in Streamflow

Condition 21 of the 2015 WDR required that the hydraulic analysis discuss expected changes in stream flow in response to requirements of the Los Angeles County Municipal Separate Storm Sewer (MS4) NPDES Permit, Standard Urban Stormwater Mitigation Plans (SUSMPs), Total Maximum Daily Loads (TMDLs) and other pertinent local plans including, but not limited to the Integrated Regional Water Management Plan (IRWMP) (including implementation of, and plans for, increased stormwater infiltration), the City of Los Angeles' Integrated Resources Plan, the relevant watershed master plan and the LACFCD's Drought Management Plan.

While such infiltration requirements are expected to be effective in reducing stream flows during smaller storm events, which may occur potentially multiple times during a single year, the purpose of such requirements is to improve water quality and conserve water, not to significantly reduce the risk of flooding during major storm events. Flood control channels are typically designed to handle much higher stream flows which occur during large storm events. Such storm events (Flood Control Storms) will produce large volumes of runoff, quickly overwhelming these water quality infiltration facilities and rendering them insignificant in their ability to effectively reduce flow rates during the most intense part of a storm.

1.6 Summary of Results

Of the 52 soft-bottom reaches defined in the Regional Board's WDR, 8 were identified with excess capacity based on analysis of the design conditions, out of which 6 were assumed to have excess capacity since the existing conditions scenario showed excess hydraulic capacity. Under design conditions, 16 reaches had partial excess capacity and under the existing conditions 9 reaches had partial excess capacity. Although these reaches have portions within the channels that have sufficient hydraulic capacity to accommodate vegetation, not all of them are recommended for additional vegetation for one or more of the following reasons: (1) minimal maintenance practices are already being implemented, (2) short and sporadic segments of hydraulic capacity, (3) excess sediment accumulation, (4) a need for removal of most vegetation, (5) a lack of right-of-way or easement for maintenance, (6) additional vegetation would impact structures within the channel reach, and (7) the portion identified with excess capacity is hardscaped. Of the reaches identified with excess or partial excess hydraulic capacity, 7 reaches can accommodate additional vegetation, 3 of which will incorporate new biological recommendations to allow for additional vegetation growth. Detailed modeling results for the individual reaches are presented in each section and in Appendix C. Table 1-2 summarizes the hydraulic modeling results for all of the SBC reaches for the existing and design conditions scenarios.

Table 1-2: Hydraulic Assessment Summary

Reach Number	Reach Name	Hydraulic Modeling Results		
		Existing Condition	Design Condition	Additional Vegetation
71	Santa Clara River Main Channel	No Excess Capacity	No Excess Capacity	No
80	South Fork SCR (Main River Channel)	No Excess Capacity	No Excess Capacity	No
82	Santa Clara River Main Channel	Excess Capacity [1,2]	Excess Capacity [1,2]	Yes
109	Santa Clara River (MTD 1510) South Bank	No Excess Capacity	No Excess Capacity	No
76	Pico Canyon	Partial Excess Capacity [1,3,6]	Partial Excess Capacity [1,3,6]	No
86	Violin Canyon M.C.O	No Excess Capacity	No Excess Capacity	No
101	Violin Canyon	Partial Excess Capacity [1]	Partial Excess Capacity [1]	Yes[12]
102	Violin Canyon	Excess Capacity	Excess Capacity[13]	Yes
88	Hasley Canyon Upper	Partial Excess Capacity	Partial Excess Capacity	Yes
89	Hasley Canyon South Fork	No Excess Capacity	No Excess Capacity	No
90	Hasley Canyon Lower	Partial Excess Capacity [3, 7]	Partial Excess Capacity [3, 7]	No
97	Castaic Creek (Live Oak)	No Excess Capacity [10]	No Excess Capacity [10]	No
104	Castaic Creek (Hancock)	Excess Capacity[1,2]	Excess Capacity [1,2,13]	Yes
105	San Francisquito Canyon Channel	Excess Capacity [1,4]	Excess Capacity [1,4,13]	Yes
110	Hasley Canyon Channel	No Excess Capacity [9]	Excess Capacity [9]	No
47	Santa Clara River Main Channel	No Excess Capacity [1]	Partial Excess Capacity [1]	No
51	Santa Clara River	No Excess Capacity [1]	Partial Excess Capacity [1]	No
55	Santa Clara River Main Channel – Right Bank	No Excess Capacity	No Excess Capacity	No
56	Santa Clara River Main Channel – Left Bank	No Excess Capacity	No Excess Capacity	No
58	Santa Clara River Main Channel	Partial Excess Capacity [7]	Partial Excess Capacity [7]	No
60	Santa Clara River Main Channel	No Excess Capacity	No Excess Capacity	No
61	Santa Clara River	No Excess Capacity	No Excess Capacity	No

Reach Number	Reach Name	Hydraulic Modeling Results		
		Existing Condition	Design Condition	Additional Vegetation
63	Oak Ave Road Drainage	No Excess Capacity [10]	No Excess Capacity [10]	No
66	Santa Clara River Main Channel	No Excess Capacity	No Excess Capacity	No
67	Bouquet Canyon Upper	No Excess Capacity	Partial Excess Capacity [3]	No
69	Bouquet Canyon Middle	No Excess Capacity	Partial Excess Capacity [3]	No
70	Bouquet Canyon Lower	Partial Excess Capacity [3, 8]	Partial Excess Capacity [3, 8]	No
103	Bouquet Canyon Channel	Excess Capacity	Excess Capacity [13]	Yes
75	South Fork SCR	No Excess Capacity	Partial Excess Capacity [3]	No
79	South Fork SCR (Valencia Blvd Bridge Stabilizer)	Partial Excess Capacity [5]	Partial Excess Capacity [5]	No
87	Castaic Old Road Drain Outlet	No Excess Capacity [10]	No Excess Capacity [10]	No
108	Pico Canyon	No Excess Capacity	Excess Capacity [1]	No
45	Sand Canyon M.C.I.	Excess Capacity [10]	Excess Capacity [10, 13]	No
46	Sand Canyon M.C.O.	No Excess Capacity	No Excess Capacity	No
48	Mint Canyon Mint Canyon Channel	No Excess Capacity	No Excess Capacity	No
49	Mint Canyon Channel	No Excess Capacity	No Excess Capacity	No
50	Mint Canyon Channel	No Excess Capacity	No Excess Capacity	No
52	Sierra Hwy Road Drainage[11]	–	–	No
53	Santa Clara River Tributary Channel M.C.I	No Excess Capacity	No Excess Capacity	No
54	Santa Clara River Tributary Channel M.C.O	No Excess Capacity	No Excess Capacity	No
57	Whites Canyon M.C.I	No Excess Capacity	No Excess Capacity	No
64	Soledad Canyon Road Drainage	No Excess Capacity [10]	No Excess Capacity [10]	No
72	South Fork Santa Clara River (Smizer Ranch M.C.I)	No Excess Capacity	No Excess Capacity	No
73	Wildwood Canyon Channel M.C.I.	No Excess Capacity [10]	No Excess Capacity [10]	No
74	Wildwood Canyon Channel	Partial Excess Capacity [6, 10]	Partial Excess Capacity [6, 10]	No

Reach Number	Reach Name	Hydraulic Modeling Results		
		Existing Condition	Design Condition	Additional Vegetation
77	Newhall Creek Outlet	No Excess Capacity [10]	Partial Excess Capacity [3, 8,10]	No
78	Placerita Creek	No Excess Capacity [10]	No Excess Capacity [10]	No
91	San Martinez Chiquito Canyon	No Excess Capacity	No Excess Capacity	No
92	San Martinez Chiquito Canyon	Partial Excess Capacity [1, 7]	Partial Excess Capacity [1, 7]	No
93	San Martinez Chiquito Canyon	No Excess Capacity	Partial Excess Capacity [1, 8]	No
94	San Martinez Chiquito Canyon	No Excess Capacity	No Excess Capacity	No
95	Little Rock Wash	No Excess Capacity	No Excess Capacity	No

Notes:

[1] *Minimal maintenance practice in place (approximately 15' along levee toe), allowing existing vegetation growth to full potential across width of channel in cases where channel width is wider than minimal clearance.*
[2] *Segments identified with capacity have mature existing vegetation in place.*
[3] *Portions identified with excess capacity were predominately segmented and sporadic. No additional vegetation recommendation proposed.*
[4] *Channel design accommodates and allows for mature vegetation.*
[5] *Segment of the channel is in the location of the bridge stabilizer structure where vegetation cannot be planted.*
[6] *Portion identified with excess capacity is hard-bottom (concrete, rip-rap)*
[7] *Limited easement. No additional vegetation recommended within LACFCD right-of-way. Remaining width of channel outside of right-of-way remains natural.*
[8] *Easement does not exist in portions with excess capacity. No additional vegetation recommended.*
[9] *Excess sediment accumulation*
[10] *LACFCD does not have an easement for the reach*
[11] *This reach is part of Reach 50 – Mint Canyon Channel*
[12] *This reach can accommodate additional vegetation then originally designed, however vegetation levels should not exceed existing conditions*
[13] *Design condition scenario not analyzed, assumed to have excess capacity based on results of existing condition analysis*

2 Santa Clara River Reaches 71, 80, 82, and 109

2.1 General Description

The Santa Clara River (SCR) is the mainstem of the Santa Clara River Watershed and includes over 60 different tributaries. SCR originates in the Angeles National Forest and extends approximately 84 miles to the Pacific Ocean. The study reach of SCR is nearly 1.9 miles in length, beginning approximately 1,300 feet downstream of Bouquet Canyon Road and ending approximately 2,500 feet upstream of the Interstate 5. The surrounding land consists mostly of residential and industrial development. There are four soft-bottom channel reaches of interest along this portion of SCR measuring 242 feet (Reach 71), 2,686 feet (Reach 80), 849 feet (Reach 82), and 372 feet (Reach 109) in length. The limits of the SBC reaches are illustrated in Figure 2-1.

Figure 2-1: Reaches 71, 80, 82, & 109 – Santa Clara River

2.2 Structures

Within the study limits, the Santa Clara River is a wide, natural channel with a few segments of engineered slope lining along the left bank for Reaches 71, 80, and 109 and along the right bank for Reach 82. One bridge spans the Santa Clara River within the study limits, as summarized in Table 2-1.

Table 2-1: Reaches 71, 80, 82, & 109 – SCR Structures

Structure Number	HEC-RAS Station	Road Name	Type	Description	Structure Model Data Origin
1	5123	McBean Parkway	Bridge	6 – 1.5-ft wide square nosed pier walls	FEMA model

2.3 Manning's Roughness Coefficient

2.3.1 *Existing Conditions Manning's Roughness Coefficient*

Photographs documenting the existing channel conditions are provided in Appendix A. The existing conditions Manning's roughness coefficients are summarized in Table 2-2 with backup detail provided in Appendix B.

Table 2-2: Reaches 71, 80, 82, & 109 – SCR Existing Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
11651 to 9881	0.036	0.036	0.036
8930 to 8754 [1]	0.054 / 0.045 / 0.036	–	0.065 / 0.051 / 0.054
8267 [1]	0.040 / 0.036 / 0.045	–	0.065 / 0.054 / 0.032
8008	0.015	0.037	0.048
7787	0.035	0.015	0.037
7568 to 7135	0.015	0.037	0.048
6895	0.035	0.015	0.053
6672 to 5913	0.015	0.090	0.084
5513	0.015	0.076	0.033
5390	0.015	0.059	0.033
5229	0.018	0.036	0.018
5016	0.018	0.036	0.018
4785	0.033	0.084	0.053
3071	0.033	0.115	0.015
2627 to 2080	0.074	0.116	0.015
1754	0.066	0.122	0.034
1301 to 400	0.102	0.103	0.036

Notes:

[1] Cross sections 8930 to 8267 capture SCR and South Fork SCR. The Left Bank column provides Manning's n-values for South Fork SCR and the Right Bank column provides Manning's n-values for SCR for this range.

2.3.2 *Design Conditions Manning's Coefficient*

The Manning's roughness values for the design conditions HEC-RAS model are based on information provided in the as-built plans for the engineered channel. The Manning's roughness values used in the design conditions HEC-RAS model are summarized in Table 2-3.

Table 2-3: Reaches 71, 80, & 109 – SCR Design Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
11651 to 400	0.060	0.060	0.060

2.4 Hydrology

Design flow rates were obtained from multiple as-built channel design documents available from the LACFCD website: http://dpw.lacounty.gov. The design documents and discharges are summarized in Table 2-4.

Table 2-4: Reaches 71, 80, 82, & 109 – SCR Design Flow Rates

Design Document No.	Year	Discharge (cfs)	HEC-RAS Station
PD 1946	1986	117,000	8930
MTD 1510	1996	117,900	5016
PD 2278	1990	137,400	3928

2.5 Hydraulic Model

The study reach is modeled with 50 cross sections with the majority of cross sections spaced at roughly 250 foot intervals. The cross sections are cut using 2006 LIDAR topographic data provided by LACDPW. The cross section locations and SBC reach extents are presented in Figure 2-2.

Cross section spacing was chosen to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. Additional cross-sections were incorporated into the model (as needed) at transitional areas and sharp bends to better represent the flow conditions in these portions of the channel. The hydraulic model was run under "mixed flow" conditions so that potential areas of supercritical flow were adequately modeled. HEC-RAS model output data are provided in Appendix E.

2.6 Boundary Conditions

The model consists of three sub-reaches with a junction where South Fork SCR confluences with the Santa Clara River. At the upstream and downstream extents of the model, normal depth is used as the boundary condition. The value of normal depth is estimated as the channel bed slope. Interior boundary conditions (i.e. at the junction) are automatically generated by HEC-RAS from the junction hydraulics. The boundary conditions are summarized in Table 2-5.

Table 2-5: Reaches 71, 80, 82, & 109 – SCR Boundary Conditions

Sub-Reach	Upstream Boundary Condition	Downstream Boundary Condition
SCR – 1	Normal Depth – S = 0.007	Junction
SCR – 2	Junction	Normal Depth – S = 0.007
South Fork – 1	Normal Depth – S = 0.005	Junction

2.7 Results

The water surface elevation from the existing conditions model is used to calculate freeboard at each cross section within the SBC reaches. The existing conditions freeboard is compared to the required freeboard to determine whether there is excess freeboard (hydraulic capacity) at the cross section. Results of the freeboard calculations and capacity determination for each cross section are presented in Table 2-6, and in Figure 2-2. A detailed summary of these results is provided in Appendix C.

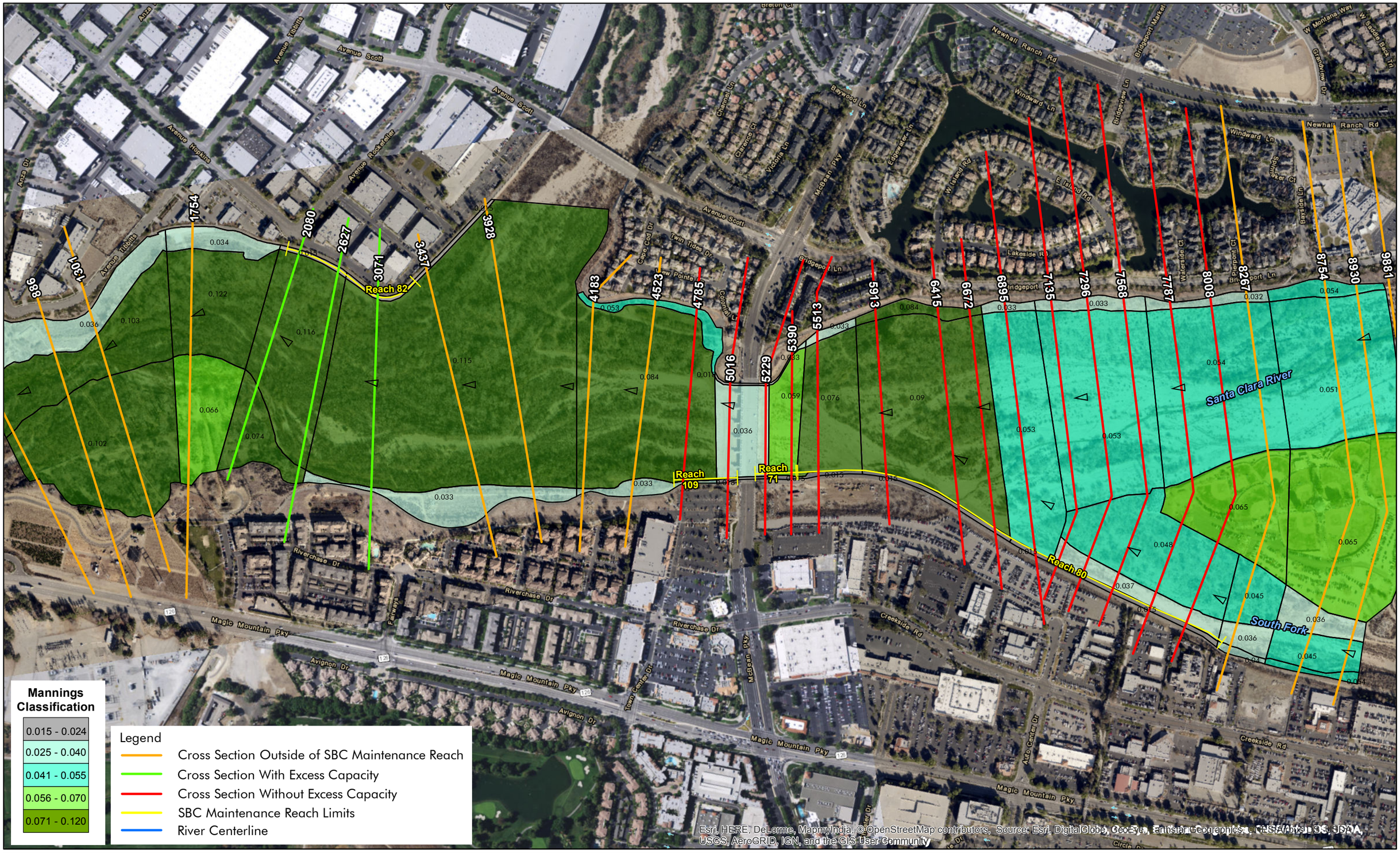
Table 2-6: Reaches 71, 80, 82, & 109 – SCR Excess Capacity Determination

Reach Number	HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
71	5390	2.5	-1.8	0.0	No
	5229	2.5	-1.8	0.0	No
80	8008	2.5	1.6	0.0	No
	7787	2.5	1.3	0.0	No
	7568	2.5	1.2	0.0	No
	7296	2.5	0.5	0.0	No
	7135	2.5	0.2	0.0	No
	6895	2.5	-0.5	0.0	No
	6672	2.5	-1.4	0.0	No
	6415	2.5	-2.0	0.0	No
	5913	2.5	-2.8	0.0	No
	5513	2.5	-2.1	0.0	No
82	3071	2.5	3.0	0.5	Yes
	2627	2.5	3.5	1.0	Yes
	2080	2.5	3.8	1.3	Yes
109	5016	2.5	2.5	0.0	No
	4785	2.5	1.6	0.0	No

2.8 Additional Analysis

Reaches 71, 80, and 109 did not have excess capacity under the existing and design condition scenarios. Therefore, no additional analysis was performed on these reaches.

Reach 82 does have excess freeboard (hydraulic capacity); LACFCD's current maintenance practice only removes vegetation 20 feet from the toe of the levee, leaving the remaining width of the channel vegetated. No additional biological recommendations are proposed; therefore no additional hydraulic analysis was performed.



0 500 1000 Feet

PACE Advanced Water Engineering

LACDPW
SANTA CLARA RIVER WATERSHED
SOFT BOTTOM CHANNEL ANALYSIS

TITLE
SANTA CLARA RIVER 71,80A,82,109
EXISTING CAPACITY RESULTS

FIGURE
2-2

3 Pico Canyon Channel Reach 76

3.1 General Description

Pico Canyon is a tributary to South Fork SCR Channel located in the Santa Clara River Watershed. The channel originates near the crossing of Stevenson Ranch Parkway and Pico Canyon Road, and flows east to its confluence with South Fork SCR. The study reach for Pico Canyon is nearly 4,500 feet in length, beginning approximately 500 feet upstream of Tournament Road and ending at Orchard Village Road. The surrounding land consists of dense residential development, recreational use areas, and bushy open space. The soft-bottom channel reach of interest along Pico Canyon Channel measures 3,912 feet in length. The limits of the SBC reach are illustrated in Figure 3-1.

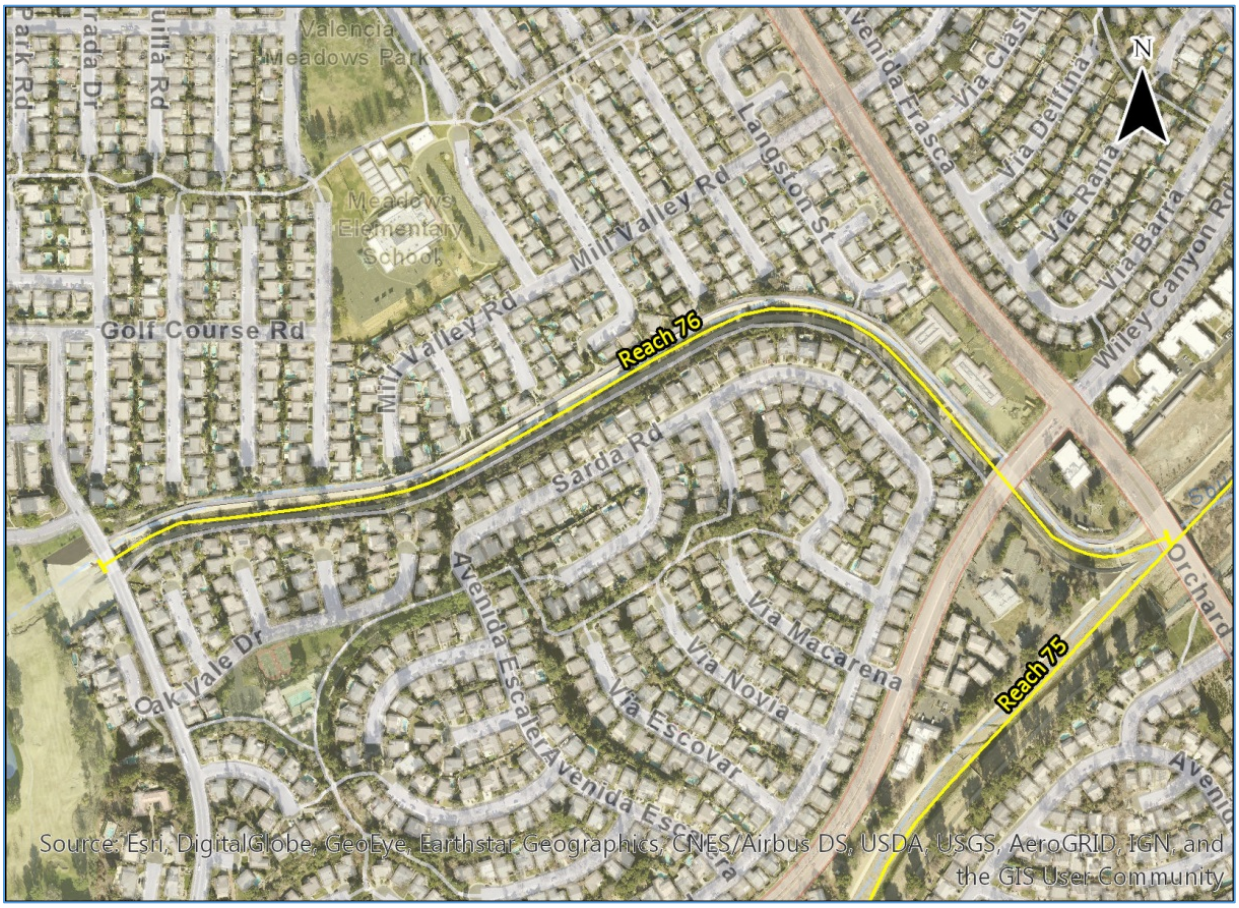


Figure 3-1: Reach 76 – Pico Canyon Channel

3.2 Structures

The reach of interest for Pico Canyon is an engineered, concrete slope-lined channel with an earthen bottom, and seven drop structures. Two bridges span Pico Canyon Channel within the study limits, as summarized in Table 3-1.

Table 3-1: Reach 76 – Pico Canyon Channel Structures

Structure Number	HEC-RAS Station	Road Name	Type	Description	Structure Model Data Origin
1	4124	Tournament Road	Bridge	Clear span bridge (no piers)	FEMA model
2	702	Wiley Canyon Road	Bridge	Clear span bridge (no piers)	FEMA model

3.3 Manning's Roughness Coefficient

3.3.1 *Existing Conditions Manning's Coefficient*

Photographs documenting the existing channel conditions are provided in Appendix A. The existing conditions Manning's roughness coefficients are summarized in Table 3-2 with backup detail provided in Appendix B.

Table 3-2: Reach 76 – Pico Canyon Channel Existing Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
4622 to 4417	0.040	0.040	0.040
4313 to 4080	0.016	0.016	0.016
3982	0.015	0.042	0.015
3849 to 3718	0.015	0.030	0.015
3601	0.015	0.015	0.015
3540 to 3215	0.015	0.030	0.015
3081	0.015	0.015	0.015
3036 to 2723	0.015	0.030	0.015
2609	0.015	0.015	0.015
2546 to 2105	0.015	0.030	0.015
1980	0.015	0.038	0.015
1815	0.015	0.015	0.015
1772 to 1196	0.015	0.030	0.015
1051	0.015	0.015	0.015
998 to 293	0.015	0.032	0.015
214	0.015	0.015	0.015

3.3.2 *Design Conditions Manning's Coefficient*

The Manning's roughness values for the design conditions HEC-RAS model are based on information provided in the as-built plans for the engineered channel. The Manning's roughness values used in the design conditions HEC-RAS model are summarized in Table 3-3.

Table 3-3: Reach 76 – Pico Canyon Channel Design Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
4080 to 214	0.025	0.025	0.025

3.4 Hydrology

Design flow rates were obtained from the PD 813 as-built channel design documents available from the LACFCD website: http://dpw.lacounty.gov. The design document and discharges are summarized in Table 3-4.

Table 3-4: Reach 76 – Pico Canyon Channel Design Flow Rates

Design Document No.	Year	Discharge (cfs)	HEC-RAS Station
PD 813	2002	5,490	4622
PD 813	2002	5,620	3982
PD 813	2002	5,630	3081
PD 813	2002	5,670	1980

3.5 Hydraulic Model

The study reach is modeled with 38 cross sections with the majority of cross sections spaced at roughly 150 foot intervals. The cross sections are cut based on 2006 LIDAR topographic data provided by LACDPW. The cross section locations and soft-bottom reach extents are presented in Figures 3-2 through 3-4.

Cross section spacing was chosen to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. Additional cross-sections were incorporated into the model (as needed) at transitional areas and sharp bends to better represent the flow conditions in these portions of the channel. The hydraulic model was run under “mixed flow” conditions so that potential areas of supercritical flow were adequately modeled. HEC-RAS input and output files are provided in Appendix E.

3.6 Boundary Conditions

The model consists of three sub-reaches with a junction where Pico Canyon confluences with South Fork SCR. At the upstream and downstream extents of the model, normal depth is used as the boundary condition. The value of normal depth is estimated as the channel bed slope. Interior boundary conditions (i.e. at the junction) are automatically generated by HEC-RAS from the junction hydraulics. The boundary conditions are summarized in Table 3-5.

Table 3-5: Reach 76 – Pico Canyon Channel Boundary Conditions

Sub-reach	Upstream Boundary Condition	Downstream Boundary Condition
SForkSantaClara – 1	Normal Depth – S = 0.007	Junction
SForkSantaClara – 2	Junction	Normal Depth – S = 0.004
SFSantaClaraTrib – 1	Normal Depth – S = 0.006	Junction

3.7 Results

The water surface elevation from the existing conditions model is used to calculate freeboard at each cross section within the SBC reach. The existing conditions freeboard is compared to the required freeboard to determine whether there is excess freeboard (hydraulic capacity) at the cross section. Results of the freeboard calculations and capacity determination for each cross section are presented in Table 3-6, and in Figures 3-2 through 3-4. A detailed summary of these results is provided in Appendix C.

Table 3-6: Reach 76 – Pico Canyon Channel Freeboard Capacity Determination

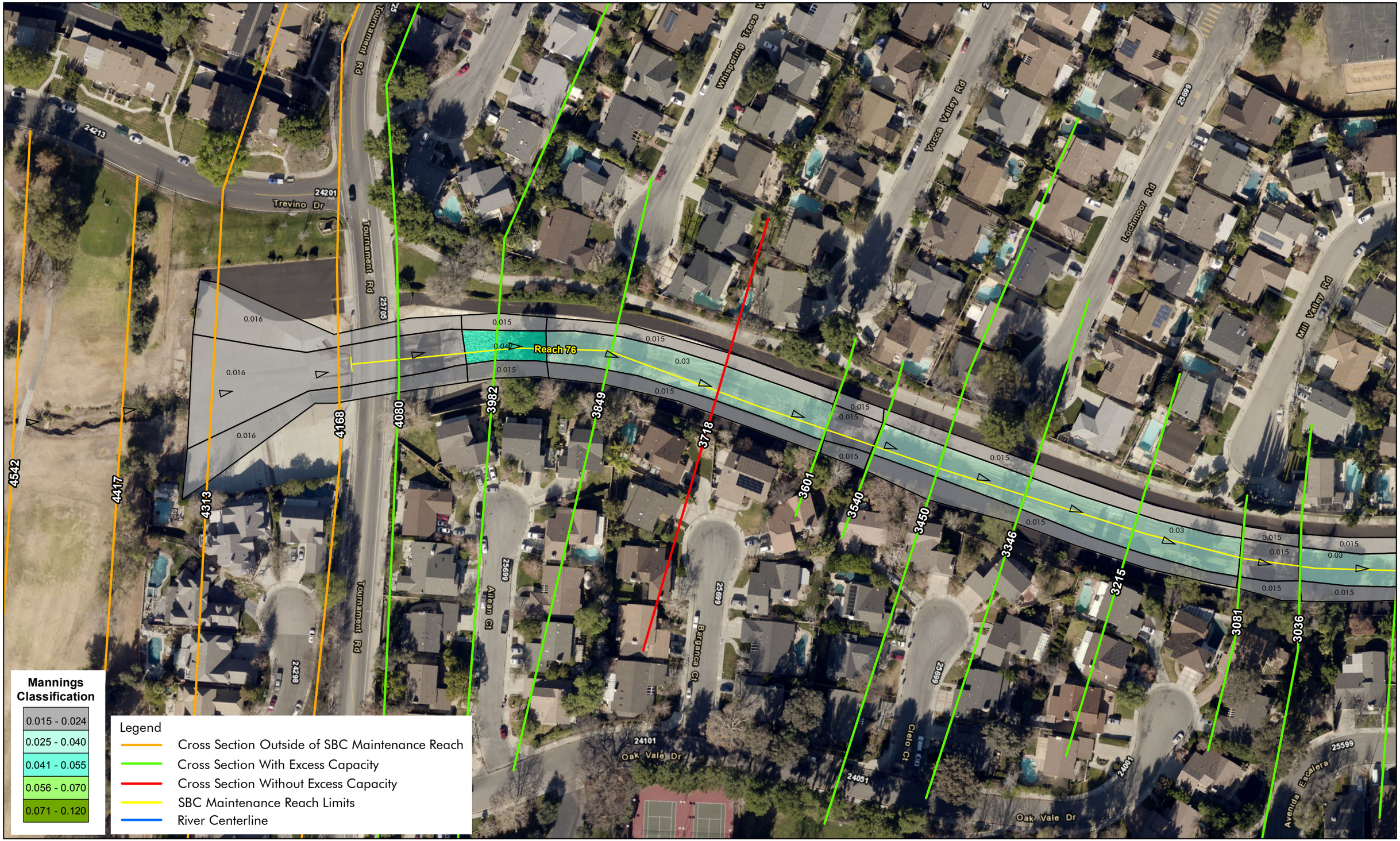
HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
4080*	2.9	11.4	8.5	No*
3982*	2.9	7.5	4.6	No*
3849	2.9	3.5	0.6	Yes
3718	2.9	2.9	0.0	No
3601*	2.5	2.6	0.1	No*
3540	2.7	6.8	4.1	Yes
3450	2.5	5.1	2.6	Yes
3346	2.5	2.9	0.4	Yes
3215	2.5	2.8	0.3	Yes
3081*	2.5	3.4	0.9	No*
3036	2.5	5.5	3.0	Yes
2906	2.5	3.6	1.1	Yes
2723	2.5	2.0	0.0	No
2609	2.5	2.2	0.0	No
2546	2.5	5.6	3.1	Yes
2471	2.5	5.6	3.1	Yes
2303	2.5	2.9	0.4	No
2105	2.5	1.9	0.0	No
1980	3.0	2.9	0.0	No
1815	3.3	2.9	0.0	No
1772	3.3	8.3	5.0	Yes
1571	3.3	3.2	0.0	No
1439	3.3	2.3	0.0	No
1323	3.3	2.4	0.0	No
1196	3.3	2.4	0.0	No
1051	3.3	1.9	0.0	No
998	3.3	6.5	3.2	Yes
933	3.1	2.2	0.0	No
771	2.5	7.1	4.6	Yes
633	2.5	7.8	5.3	Yes
509	3.7	1.3	0.0	No
293	4.2	-0.5	0.0	No
214	4.2	-1.3	0.0	No

Notes:

The cross sections indicated with an asterisk (*) have excess freeboard (hydraulic capacity), but do not have capacity for additional vegetation because they are located in segments of the channel with hard bottom (concrete, rip-rap).

3.8 Additional Analysis

There are segments within Reach 76 that have excess freeboard (hydraulic capacity) under the existing and design condition scenarios; however, they are predominately segmented and sporadic or are hard-bottom. Therefore, no additional analysis was performed on this reach.



0 100 200 Feet

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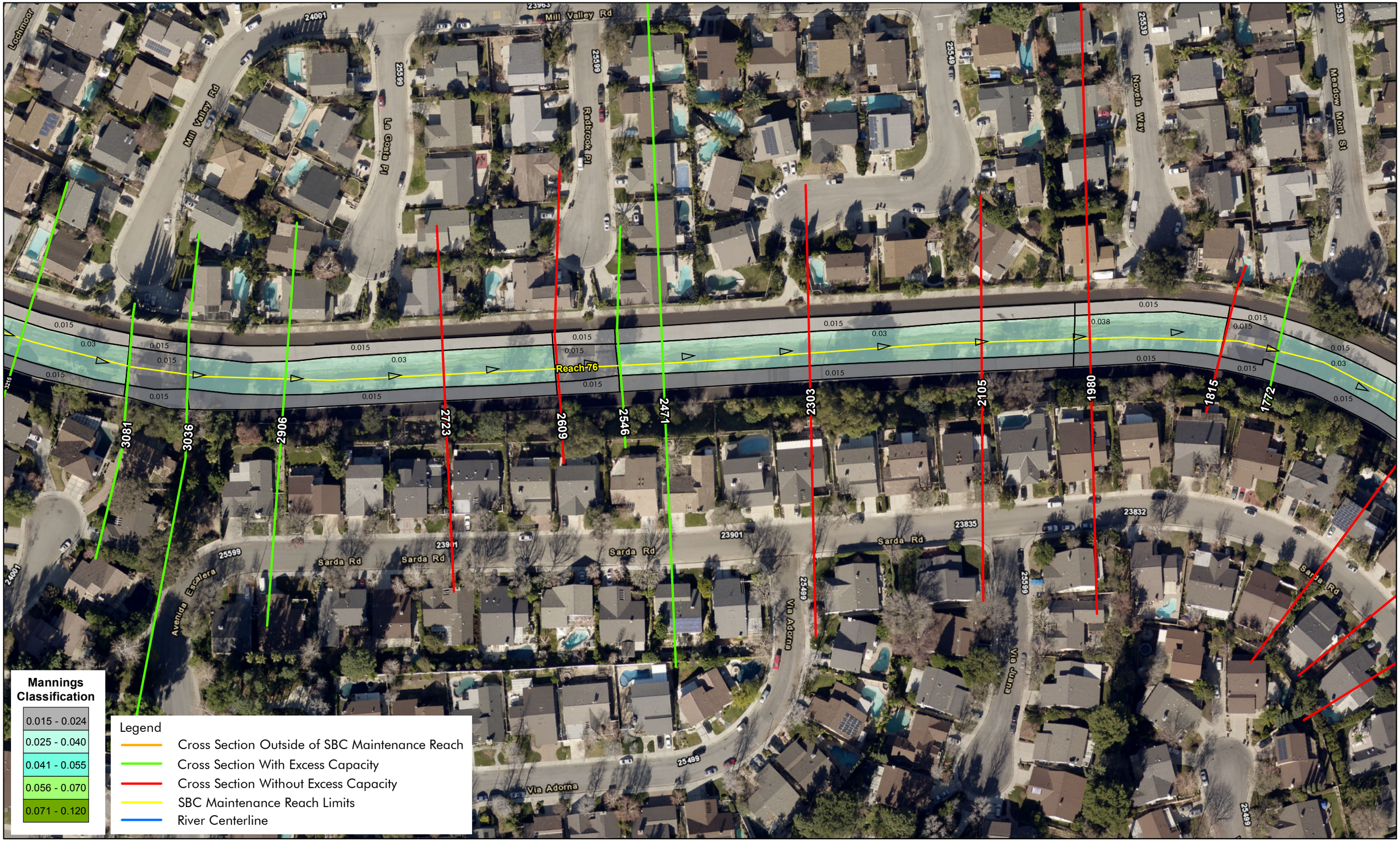
SOFT BOTTOM CHANNEL ANALYSIS

TITLE

PICO CANYON 76
EXISTING CAPACITY RESULTS

FIGURE

3-2



0 100 200 Feet

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TITLE
PICO CANYON 76
EXISTING CAPACITY RESULTS

FIGURE
3-3

Mannings Classification

0.015 - 0.024
0.025 - 0.040
0.041 - 0.055
0.056 - 0.070
0.071 - 0.120

Legend

- Cross Section Outside of SBC Maintenance Reach
- Cross Section With Excess Capacity
- Cross Section Without Excess Capacity
- SBC Maintenance Reach Limits
- River Centerline

0 125 250 Feet

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SOFT BOTTOM CHANNEL ANALYSIS

TITLE
PICO CANYON 76
EXISTING CAPACITY RESULTS

FIGURE
3-4

4 Violin Canyon Reaches 86, 101, and 102

4.1 General Description

Violin Canyon is a tributary to Castaic Creek in the Santa Clara River Watershed. The channel originates in the mountains north of the Santa Clara River and west of Castaic Creek. The study reach is nearly 2.8 miles in length, beginning approximately 3,500 feet upstream of Sierra Oak Trail and ending roughly 650 feet downstream of the confluence with Castaic Creek, south of Castaic Lagoon. The surrounding land consists of commercial and residential areas with brushy open space located at the upstream and downstream boundaries. There are three soft-bottom channel reaches of interest along the Violin Canyon measuring 1,006 feet (Reach 86), 1,818 feet (Reach 101), and 975 feet (Reach 102) in length. The limits of the SBC reaches are illustrated in Figure 4-1.

Figure 4-1: Reaches 86, 101, & 102 – Violin Canyon

4.2 Structures

The reaches of interest for Violin Canyon are engineered earthen bottom channels with concrete slope lining and are separated by engineered, hard surface segments. There are nine structures included in the model for the Violin Canyon Channel: five culverts, three bridges and one lateral structure. The lateral structure is included in the model to simulate channel overflow along the right bank in the area near the I-5 South crossing. The structures included in the model are summarized in Table 4-1.

Table 4-1: Reaches 86, 101, & 102 – Violin Canyon Structures

Structure Number	HEC-RAS Station	Road Name	Type	Description	Structure Model Data Origin
1	10923	Sierra Oak Trail	Culvert	Box culvert with 3 – 23'W x 16'H cells	USACE model
2	10041	The Old Road	Culvert	Box culvert with 2 – 20'W x 8'-10"H cells	USACE model
3	9848	Interstate 5 North	Culvert	Box culvert with 2 – 20'W x 8.5'H cells	USACE model
4	9672	Castaic Road	Culvert	Box culvert with 2 – 20'W x 8'H cells	USACE model
5	7828	Interstate 5 South	Culvert	22'- Diameter CIPP	USACE model
6	4164	Lake Hughes Road	Bridge	Clear span bridge (no piers)	USACE model
7	3047	Fantastic Lane	Bridge	Clear span bridge (no piers)	USACE model
8	1981	Ridge Road	Bridge	Clear span bridge (no piers)	USACE model
9	8222	–	Lateral Structure	Right bank lateral structure	USACE model

4.3 Manning's Roughness Coefficient

4.3.1 *Existing Conditions Manning's Coefficient*

Photographs documenting the existing channel conditions are provided in Appendix A. The existing conditions Manning's roughness coefficients are summarized in Table 4-2 with backup detail provided in Appendix B.

Table 4-2: Reaches 86, 101, & 102 – Violin Canyon Existing Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
14866 to 13241	0.040	0.040	0.040
12808 to 12412	0.041	0.042	0.040
12015 to 11474	0.040	0.046	0.015
11352 to 11185	0.040	0.038	0.015
11112	0.015	0.053	0.015
11047 to 8211	0.015	0.015	0.015
7444 to 7091	0.020	0.020	0.020
6776 to 6518	0.015	0.037	0.055
6258 to 5990	0.015	0.036	0.015
5760 to 5192	0.015	0.040	0.015
5037 to 929	0.015	0.015	0.015

HEC-RAS Station	Left Bank	Main Channel	Right Bank
2095 to 929	0.015	0.015	0.015
762 to 479	0.015	0.048	0.015
330 to 152	0.025	0.025	0.025
878 to 768	0.067	0.025	0.025
634	0.067	0.047	0.025
522 to 315	0.067	0.049	0.082
200 to 28	0.067	0.049	0.032

4.3.2 *Design Conditions Manning's Coefficient*

The Manning's roughness values for the design conditions HEC-RAS model are based on information provided in the as-built plans for the engineered channel. The Manning's roughness values used in the design conditions HEC-RAS model are summarized in Table 4-3.

Table 4-3: Reaches 86 & 101 – Violin Canyon Design Conditions Manning's Roughness

Reach Number	HEC-RAS Station	Left Bank	Main Channel	Right Bank
86	588 to 479	0.015	0.048	0.015
	330 to 152	0.032	0.032	0.032
	878 to 410	0.032	0.032	0.032
101	6776 to 5192	0.032	0.032	0.032

4.4 Hydrology

Design flow rates were obtained from multiple as-built channel design documents available from the LACFCD website: http://dpw.lacounty.gov. A portion of Castaic Creek is modeled with Violin Canyon, and the design flow rate was obtained from the *Castaic Creek Floodway Map No. 335-ML4 dated August 28, 1994 per Ordinance No. 84-0136*. Note that the design storm event is not indicated on the ML Map. The design documents and discharges are summarized in Table 4-4.

Table 4-4: Reaches 86, 101, & 102 – Violin Canyon Design Flow Rates

Design Document No.	Year	Discharge (cfs)	HEC-RAS Station
PD 2275	1997	8,770	14866
PD 2275	1997	8,909	10848
Dwg. No. 39-D8.1-D8.22	1984	11,800	694
335-ML4	1984	23,500	878

4.5 Hydraulic Model

The study reach is modeled with 118 cross-sections with a majority of cross sections spaced at roughly 150 foot intervals. The cross sections are cut based on 2006 LIDAR topographic data provided by LACDPW. The cross section locations and soft-bottom reach extents are presented in Figures 4-2 through 4-4.

Cross section spacing was chosen to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. Additional cross-sections were incorporated

into the model (as needed) at transitional areas and sharp bends to better represent the flow conditions in these portions of the channel. The hydraulic model was run under "mixed flow" conditions so that potential areas of supercritical flow were adequately modeled. HEC-RAS input and output files are provided in Appendix E.

4.6 Boundary Conditions

The model consists of five sub-reaches separated by two junctions. The junctions are located where the Right Overflow reach joins Violin Canyon and where Violin Canyon confluences with Castaic Creek. At the upstream and downstream extents of the model, normal depth is used as the boundary condition. The value of normal depth is estimated as the channel bed slope. Interior boundary conditions (i.e. at the junctions) are automatically generated by HEC-RAS from the junction hydraulics. The boundary conditions are summarized in Table 4-5.

Table 4-5: Reaches 86, 101, & 102 – Violin Canyon Boundary Conditions

Sub-reach	Upstream Boundary Condition	Downstream Boundary Condition
Castaic – 1	Normal Depth – S = 0.005	Junction 4
Castaic – 2	Junction 4	Normal Depth – S = 0.005
Right_OF – 1	Normal Depth – S = 0.020	Junction 2
Violin – 1	Normal Depth – S = 0.030	Junction 2
Violin – 2	Junction 2	Junction 4

4.7 Results

The water surface elevation from the existing conditions model is used to calculate freeboard at each cross section within the SBC reaches. The existing conditions freeboard is compared to the required freeboard to determine whether there is excess freeboard (hydraulic capacity) at the cross section. Results of the freeboard calculations and capacity determination for each cross section are presented in Table 4-6, and in Figures 4-2 through 4-4. A detailed summary of these results is provided in Appendix C.

Table 4-6: Reaches 86, 101, & 102 – Violin Canyon Excess Capacity Determination

Reach Number	HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
86	588	2.5	4.9	2.4	Yes
	479	2.5	-0.2	0.0	No
	330	2.5	-2.7	0.0	No
	253	2.5	-3.6	0.0	No
	152	2.5	-4.8	0.0	No
	878	2.5	-3.0	0.0	No
	768	2.5	-3.4	0.0	No
	634	2.5	-3.7	0.0	No
	522	2.5	-4.1	0.0	No
	410	2.5	-2.4	0.0	No
101	6776	2.5	6.3	3.8	Yes
	6673	2.5	2.3	0.0	No

Reach Number	HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
101	6518	2.5	3.2	0.7	Yes
	6258	2.5	1.8	0.0	No
	5990	2.5	2.9	0.4	Yes
	5760	2.5	2.8	0.3	Yes
	5527	2.5	3.1	0.6	Yes
	5192	4.5	4.8	0.3	Yes
102	12015	2.5	4.2	1.7	Yes
	11722	2.5	8.3	5.8	Yes
	11602	2.5	7.8	5.3	Yes
	11474	2.5	8.8	6.3	Yes
	11352	2.5	7.2	4.7	Yes
	11243	2.5	10.1	7.6	Yes
	11185	2.5	10.5	8.0	Yes
	11112	2.5	6.8	4.3	Yes

4.8 Additional Analysis

Reach 86 did not have capacity under the existing condition scenario. The design conditions scenario was also reviewed; however, this reach does not have excess capacity under design conditions. Therefore, no additional analysis was performed.

Reach 101 can accommodate additional vegetation growth than originally designed. LACFCD's proposed maintenance plan extends 12-ft from the toe of slope and leaves the remaining width of the channel vegetated. The vegetation levels should not exceed existing conditions. No additional biological recommendations are proposed; therefore no additional hydraulic analysis was performed.

For Reach 102, the biological recommendations provided by BonTerra Psomas are as follows:

> *Remove all vegetation within 15 ft of the toe of the levee. At the drainage outlet, mechanically clear woody vegetation at a 45-degree angle towards center of the channel. Within the area of identified capacity, from 15 ft to 41 ft from the toe of the levee, remove all non-native vegetation and remove any newly established native or non-native trees. Allow native shrubs to remain and expand overtime and allow existing mature native trees to remain. All existing vegetation will be subject to maintenance practices allowed under existing permits (e.g. the "lollipopping" of individual trees, and the removal of invasive species).*

Based on engineering judgement, the roughness values for this condition would remain the same as existing condition scenario. Therefore, no additional hydraulic analysis was performed based on the biological recommendations. The hydraulic analysis results remain unchanged and indicate sufficient capacity in the SBC reach to accommodate the BonTerra Psomas recommendations. This recommendation will be a change from the proposed maintenance plan and will need approval from regulatory agencies.

0 100 200 Feet

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TITLE
VIOLIN CANYON 86, 101, & 102
EXISTING CAPACITY RESULTS

FIGURE
4-2

0 200 400 Feet

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SOFT BOTTOM CHANNEL ANALYSIS

TITLE
VIOLIN CANYON 86, 101, & 102
EXISTING CAPACITY RESULTS

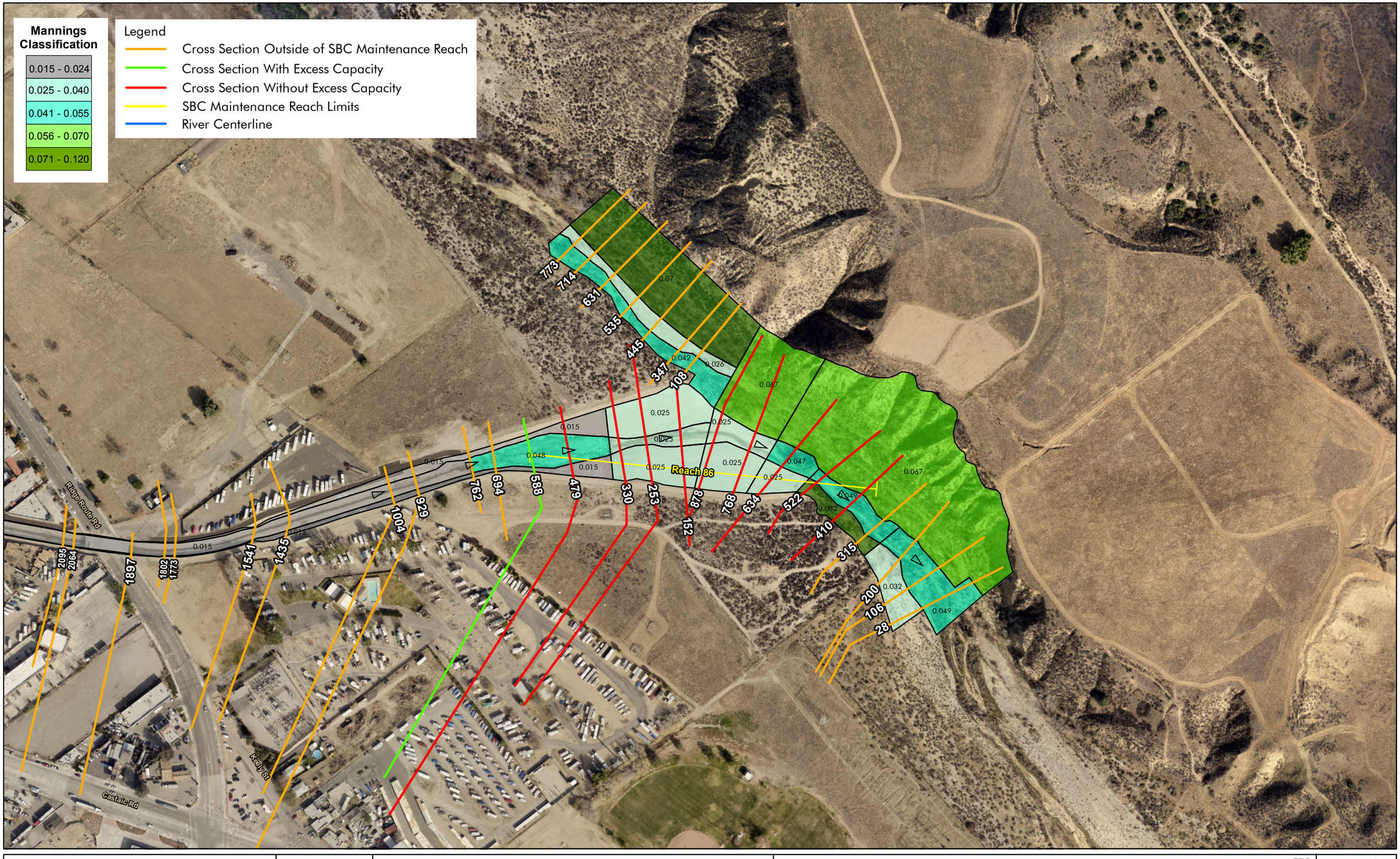
FIGURE
4-3

Mannings Classification

0.015 - 0.024
0.025 - 0.040
0.041 - 0.055
0.056 - 0.070
0.071 - 0.120

Legend

- Cross Section Outside of SBC Maintenance Reach
- Cross Section With Excess Capacity
- Cross Section Without Excess Capacity
- SBC Maintenance Reach Limits
- River Centerline



0 125 250 500 Feet

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TITLE
VIOLIN CANYON 86, 101, & 102
EXISTING CAPACITY RESULTS

FIGURE
4-4

5 Hasley Canyon Reaches 88, 89, and 90

5.1 General Description

Hasley Canyon is a tributary to Castaic Creek located within the Santa Clara River Watershed. Hasley Canyon Channel originates in the mountains north of the Santa Clara River and joins with Castaic Creek at Commerce Center Drive. The study reach is nearly 2,500-feet in length, beginning approximately 800 feet upstream of Sharp Road and ending about 100 feet downstream of Romero Canyon Road. The surrounding land consists mostly of residential development with a few areas of open space. There are three soft-bottom reaches of interest along this portion of Hasley Canyon measuring 1,051 feet (Reach 88), 341 feet (Reach 89), and 1,051 feet (Reach 90) in length. The limits of the SBC reaches are illustrated in Figure 5-1.

Figure 5-1: Reaches 88, 89, & 90 – Hasley Canyon

5.2 Structures

Within the study limits, Hasley Canyon consists of reaches of natural and engineered earthen channel with a few segments of engineered, hardened slope lining. Two bridges cross Hasley Canyon along the study reach, as summarized in Table 5-1.

Table 5-1: Reaches 88, 89, & 90 – Hasley Canyon Structures

Structure Number	HEC-RAS Station	Road Name	Type	Description	Structure Model Data Origin
1	1730	Sharp Road	Culvert	Box culvert with 3 – 10'W x 5'H cells	As-built plans and field measurements
2	92	Romero Canyon Road	Bridge	4 – 1.5-ft wide pier walls with sloping pier nose extensions	USACE model

5.3 Manning's Roughness Coefficients

5.3.1 *Existing Conditions Manning's Roughness Coefficients*

Photographs documenting the existing channel conditions are provided in Appendix A. The existing conditions Manning's roughness coefficients are summarized in Table 5-2 with backup detail provided in Appendix B.

Table 5-2: Reaches 88, 89, & 90 – Hasley Canyon Existing Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
2579 to 2409	0.032	0.034	0.039
2335 to 2239	0.015	0.032	0.066
2137 to 1986	0.015	0.032	0.048
1871 to 1829	0.016	0.033	0.016
1781 to 1767	0.016	0.016	0.016
1697 to 1557	0.040	0.040	0.040
1521	0.037	0.047	0.048
1483 to 1389	0.040	0.034	0.032
1268 to 1180	0.037	0.034	0.054
1151 to 598	0.015	0.043	0.047
555 to 514	0.015	0.044	0.043
452 to 432	0.015	0.053	0.043
318 to 176	0.015	0.015	0.015
79 to 49	0.048	0.052	0.048
19	0.025	0.025	0.025

5.3.2 *Design Conditions Manning's Roughness*

The Manning's roughness values for the design conditions HEC-RAS model are based on information provided in the as-built plans for the engineered channel. The Manning's roughness values used in the Design Conditions HEC-RAS model are summarized in Table 5-3.

Table 5-3: Reaches 88, 89, & 90 – Hasley Canyon Design Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
2579 to 432	0.035	0.035	0.035
318 to 176	0.035	0.015	0.035
73 to 19	0.035	0.035	0.035
265 to 156 (South Fork)	0.035	0.035	0.035

5.4 Hydrology

Design flow rates were obtained from the PD 1496 as-built channel design documents available from the LACFCD website: http://dpw.lacounty.gov. The design document and discharges are summarized in Table 5-4.

Table 5-4: Reaches 88, 89, & 90 – Hasley Canyon Design Flow Rates

Design Document No.	Year	Discharge (cfs)	HEC-RAS Station
PD 1496	1981	1,300	2579
PD 1496	1981	4,620	555

5.5 Hydraulic Model

The study reach is modeled with 57 cross sections with a maximum distance of 110 feet between cross sections and a minimum distance of 10 feet between cross sections. The cross sections are cut based on 2006 LIDAR topographic data provided by LACDPW. The cross section locations and soft-bottom reach extents are presented in Figures 5-2 through 5-3.

Cross section spacing was chosen to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. Additional cross-sections were incorporated into the model at transitional areas and sharp bends to better represent the flow conditions in these portions of the channel. The hydraulic model was run under "mixed flow" conditions so that potential areas of supercritical flow were adequately modeled. HEC-RAS input and output files are provided in Appendix E.

5.6 Boundary Conditions

The model consists of three sub-reaches with a junction where a small tributary (referred to as South Fork) confluences with Hasley Canyon. At the upstream and downstream extents of the model, normal depth is used as the boundary condition. The value of normal depth is estimated as the channel bed slope. Interior boundary conditions (i.e. at the junction) are automatically generated by HEC-RAS from the junction hydraulics. The boundary conditions are summarized in Table 5-5.

Table 5-5: Reaches 88, 89, & 90 – Hasley Canyon Boundary Conditions

Sub-reach	Upstream Boundary Condition	Downstream Boundary Condition
HasleyCanyon – 2	Normal Depth – S = 0.043	Junction
HasleyCanyon – 1	Junction	Normal Depth – S = 0.046
SouthFork – 1	Normal Depth – S = 0.009	Junction

5.7 Results

The water surface elevation from the existing conditions model is used to calculate freeboard at each cross section within the SBC reaches. The existing conditions freeboard is compared to the required freeboard to determine whether there is excess freeboard (hydraulic capacity) at the cross section. Results of the freeboard calculations and excess capacity determination for each cross section are presented in Table 5-6, and in Figures 5-2 through 5-3. A detailed summary of these results is provided in Appendix C.

Table 5-6: Reaches 88, 89, & 90 – Hasley Canyon Excess Capacity Determination

Reach Number	HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
88	2409	2.5	5.6	3.1	Yes
	2335	2.5	5.2	2.7	Yes
	2239	2.5	4.7	2.2	Yes
	2137	2.5	4.9	2.4	Yes
	2059	2.5	3.7	1.2	Yes
	1986	2.5	3.3	0.8	Yes
	1871	2.5	2.7	0.2	Yes
	1829	2.5	0.4	0.0	No
	1781	2.5	-1.6	0.0	No
	1767	2.5	0.7	0.0	No
	1697*	2.5	4.6	2.1	No*
	1678*	2.5	5.3	2.8	No*
	1557*	3.1	5.9	2.8	No*
	1521	3.3	1.3	0.0	No
	1483	3.5	4.2	0.7	Yes
89	156	2.5	-0.6	0.0	No
	555	2.5	3.8	1.3	Yes
	514	2.5	1.8	0.0	No
	452	2.5	1.1	0.0	No
	432	2.5	2.2	0.0	No
	318	2.5	-0.2	0.0	No
	263	2.5	-2.0	0.0	No
90	1151	4.0	7.4	3.4	Yes
	1130	4.0	5.5	1.5	Yes
	1109	4.0	3.9	0.0	No
	1099	4.0	3.7	0.0	No
	1088	4.0	3.2	0.0	No
	1080	4.0	3.1	0.0	No
	1071	4.0	3.2	0.0	No
	1063	4.0	3.3	0.0	No
	1054	4.0	3.5	0.0	No
	1046	4.0	3.1	0.0	No

Reach Number	HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
90	1037	4.0	3.4	0.0	No
	1012	4.0	4.7	0.7	Yes
	955	4.0	4.7	0.7	Yes
	894	4.0	4.0	0.0	No
	823	3.9	5.1	1.2	Yes
	760	3.3	4.3	1.0	Yes
	704	2.5	3.7	1.2	Yes
	640	2.5	4.4	1.9	Yes
	598	2.5	2.3	0.0	No
	555	2.5	3.8	1.3	Yes
	514	2.5	1.8	0.0	No
	452	2.5	1.1	0.0	No
	432	2.5	2.2	0.0	No
	318	2.5	-0.2	0.0	No
	263	2.5	-2.0	0.0	No
	231	2.5	-3.3	0.0	No
	199	2.5	-3.9	0.0	No
	188	2.5	-3.9	0.0	No
	176	2.5	-3.8	0.0	No

Notes:

The cross sections indicated with an asterisk (*) have excess freeboard (hydraulic capacity), but do not have capacity for additional vegetation because they are located in segments of the channel with hard bottom (concrete, rip-rap).

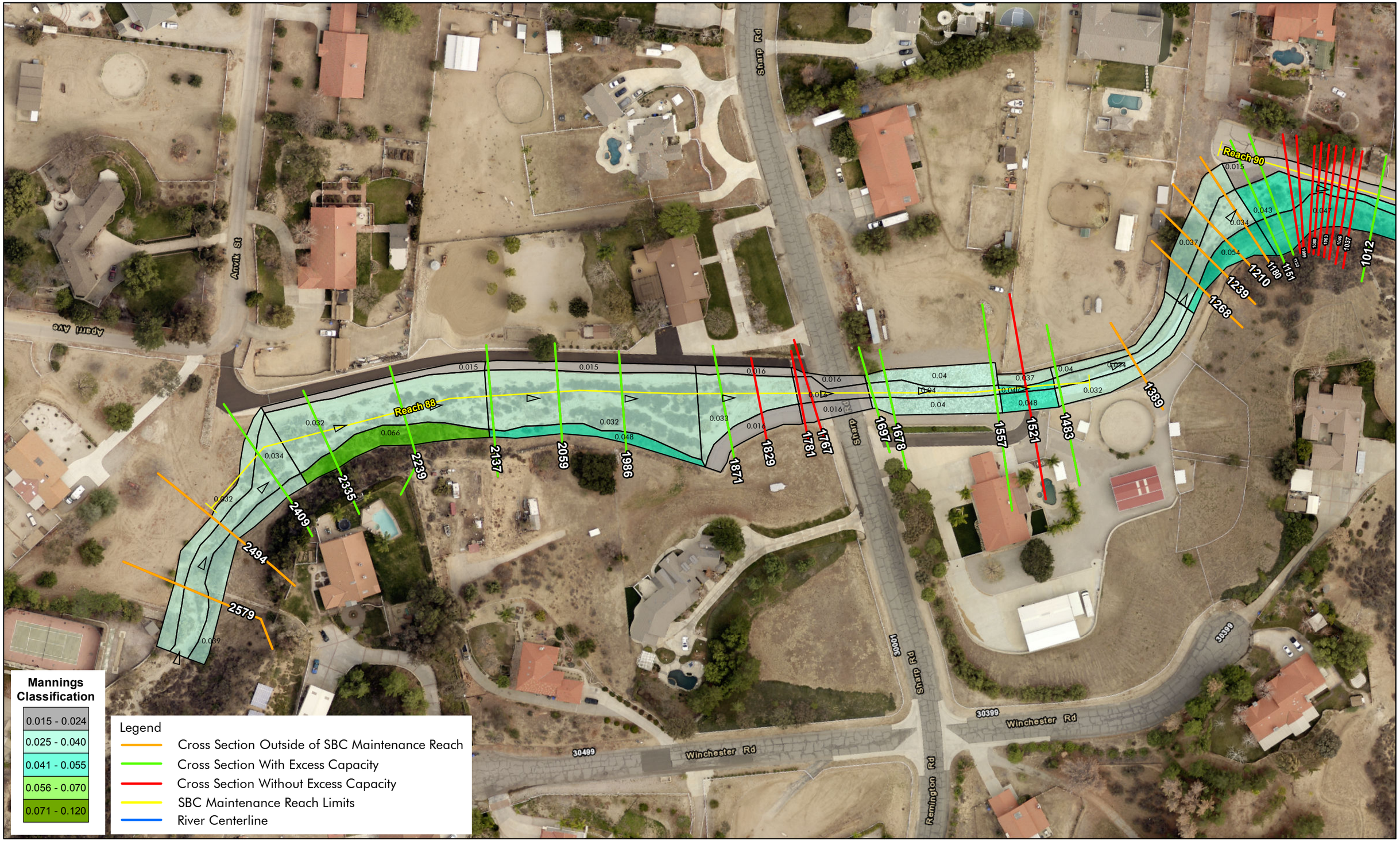
5.8 Additional Analysis

Reaches 89 and 90 do not have excess capacity under existing conditions for a majority of each SBC reach. The design conditions scenario for these reaches was also reviewed; however, these reaches do not have excess capacity under design conditions. Therefore, no additional analysis was performed.

For Reach 88, the biological recommendations provided by BonTerra Psomas are as follows:

> *Remove all vegetation within 15 ft of the toe of the levee. Within the area of identified capacity, from 15 ft to 39 ft from the toe of the levee, remove all non-native vegetation and remove any newly established native or non-native trees. Allow native shrubs to remain and expand overtime and allow existing mature native trees to remain. All existing vegetation will be subject to maintenance practices allowed under existing permits (e.g. the "lollipopping" of individual trees, and the removal of invasive species).*

Based on engineering judgement, the roughness values for this condition would remain the same as existing condition scenario. Therefore, no additional hydraulic analysis was performed based on the biological recommendations. The hydraulic analysis results remain unchanged and indicate sufficient capacity in the SBC reach to accommodate the BonTerra Psomas recommendations. This recommendation will be a change from the current maintenance practice and will need approval from regulatory agencies.



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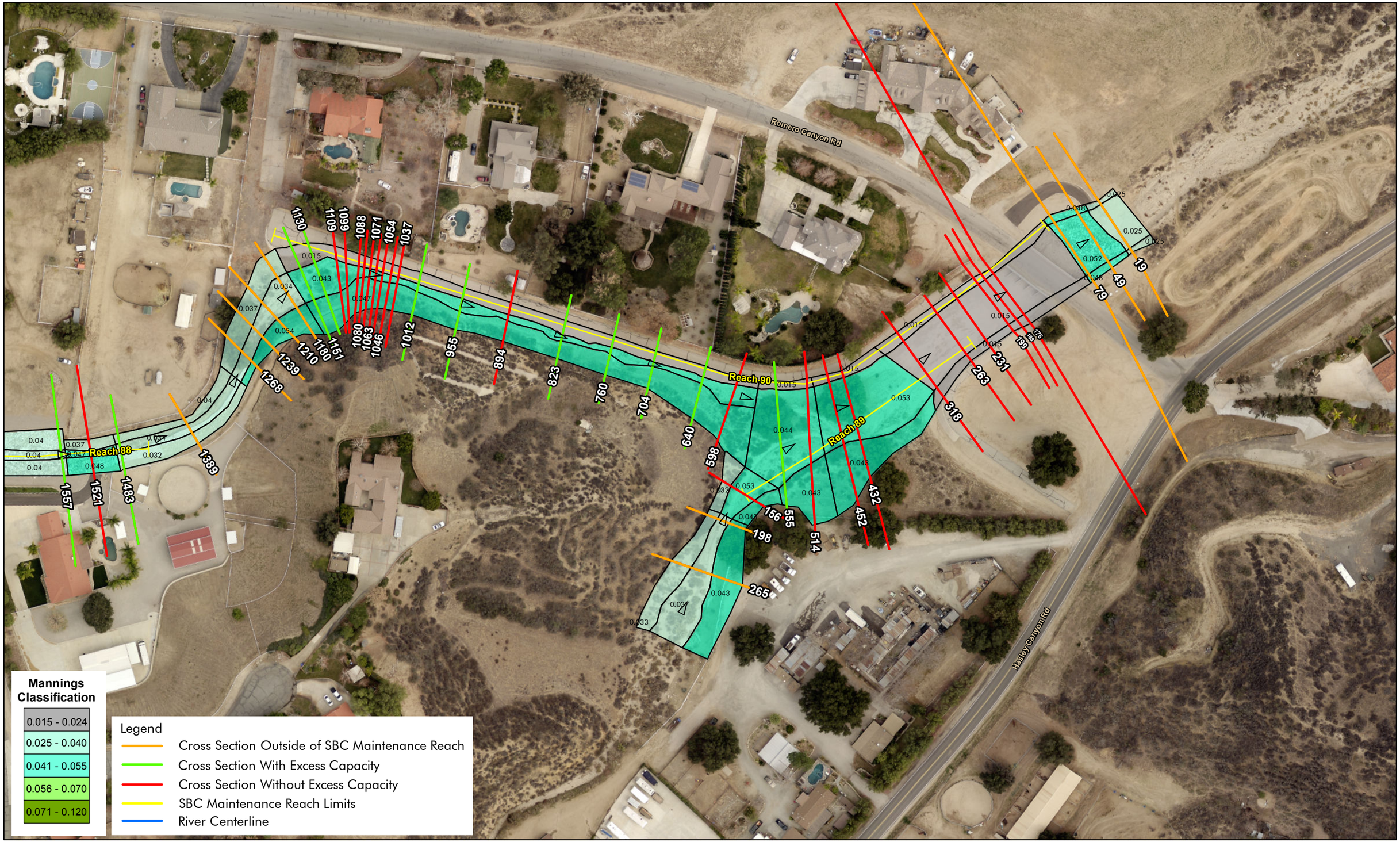
SOFT BOTTOM CHANNEL ANALYSIS

TITLE
HASLEY CANYON 88, 89, & 90
EXISTING CAPACITY RESULTS

FIGURE
5-2



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TITLE

HASLEY CANYON 88, 89, & 90 EXISTING CAPACITY RESULTS

FIGURE

5-3

6 Castaic Creek Reaches 97 and 104

6.1 General Description

Castaic Creek is a major tributary to the Santa Clara River. The stream originates in the Sierra Pelona Mountains and extends south to the confluence with Santa Clara River at Castaic Junction. The study reach begins approximately 60 feet upstream of Interstate 5 and extends south towards Castaic Junction nearly 4,500 feet. The surrounding land consists of residential development, agricultural use areas, and brushy open space. There are two soft-bottom reaches of interest along Castaic Creek measuring 2,002 feet (Reach 97) and 2,223 feet (Reach 104) in length. The limits of the SBC reaches are illustrated in Figure 6-1.

Figure 6-1: Reaches 97 & 104 – Castaic Creek

6.2 Structures

Within the study limits, Castaic Creek is a natural bottom channel with engineered, concrete slope lining along the westerly bank (Reach 97) and engineered, rock slope lining along the easterly bank (Reach 104). Two bridges cross Castaic Creek along the study reach, as summarized in Table 6-1.

Table 6-1: Reaches 97 & 104 – Castaic Creek Structures

Structure Number	HEC-RAS Station	Road Name	Type	Description	Structure Model Data Origin
1	15100	Interstate 5	Bridge	2 – 5.5' wide, square-nosed piers	USACE model
2	14900	The Old Road	Bridge	6 – 1'-4" wide, square-nosed piers	USACE model

6.3 Manning's Roughness Coefficient

6.3.1 *Existing Conditions Manning's Coefficient*

Photographs documenting the existing channel conditions are provided in Appendix A. The existing conditions Manning's roughness coefficients are summarized in Table 6-2 with backup detail provided in Appendix B.

Table 6-2: Reaches 97 & 104 – Castaic Creek Existing Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
15245.39	0.046	0.046	0.046
14892.20 to 14787.25	0.099	0.038	0.047
14720.00 to 14180.60	0.069	0.061	0.015
13713.74	0.061	0.036	0.015
13531.83	0.033	0.033	0.015
13408.48	0.033	0.047	0.015
12733.25	0.033	0.062	0.043
12558.69 to 12271.99	0.040	0.080	0.072
11954.94 to 11106.23	0.040	0.125	0.114
10620.36	0.040	0.082	0.051

6.3.2 *Design Conditions Manning's Coefficient*

The Manning's roughness values for the design conditions HEC-RAS model are based on information provided in the as-built plans for the engineered channel. The Manning's roughness values used in the design conditions HEC-RAS model are summarized in Table 6-3.

Table 6-3: Reach 97 – Castaic Creek Design Conditions Manning's Roughness

Reach Number	HEC-RAS Station	Left Bank	Main Channel	Right Bank
97	14720.00 to 12733.25	0.023	0.023	0.023

Note that the design condition Manning's values for Reach 97 are representative of a bare channel. The design condition Manning's roughness coefficients are applied only to the cross sections within Reach 97. The cross sections located outside of Reach 97 use the existing conditions Manning's roughness coefficients.

6.4 Hydrology

Design flow rates were obtained from multiple as-built channel design documents available from the LACFCD website: http://dpw.lacounty.gov. The design document and discharges are summarized in Table 6-4.

Table 6-4: Reaches 97 & 104 – Castaic Creek Design Flow Rates

HEC-RAS Plan	Design Document No.	Year	Discharge (cfs)	HEC-RAS Station
Reach 97	PD 1982	1986	32,200	15245.39
Reach 104	PD 2441	1998	42,300	15245.39

As discussed in Section 6.3.2, there are two separate plans for Reach 97 and 104 and the design flow rates in both plans are different, in the same way that the design condition Manning's coefficients are different in both plans.

6.5 Hydraulic Model

The study reach is modeled with 20 cross sections with a majority of cross sections spaced at roughly 200 foot intervals. The cross sections are cut using 2006 LIDAR topographic data provided by LACDPW. The cross section locations and SBC reach extents are presented in Figures 6-2 through 6-3.

Cross section spacing was chosen to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. Cross sections spacing near the two bridges were reduced to a minimum of 15 feet to better represent this portion of the channel. The hydraulic model was run under "mixed flow" conditions so that potential areas of supercritical flow were adequately modeled. HEC-RAS input and output files are provided in Appendix E.

6.6 Boundary Conditions

Normal depth is used as the boundary condition for the upstream and downstream extents of the model in both plans for Reach 97 and Reach 104. The value of normal depth is estimated as the channel bed slope. The boundary conditions are summarized in Table 6-5.

Table 6-5: Reaches 97 & 104 – Castaic Creek Boundary Conditions

Sub-reach	Upstream Boundary Condition	Downstream Boundary Condition
Castaic – 1	Normal Depth – S = 0.010	Normal Depth – S = 0.005

6.7 Results

The water surface elevation from the existing conditions model is used to calculate freeboard at each cross section within the SBC reaches. The existing conditions freeboard is compared to the required freeboard to determine whether there is excess freeboard (hydraulic capacity) at the cross section. Results of the freeboard calculations and capacity determination for each cross section are presented in Table 6-6, and in Figures 6-2 through 6-3. Results for Reach 97 are based on the 25-year flow rate, while results for Reach 104 are based on the capital flood flow rate. A detailed summary of these results are provided in Appendix C.

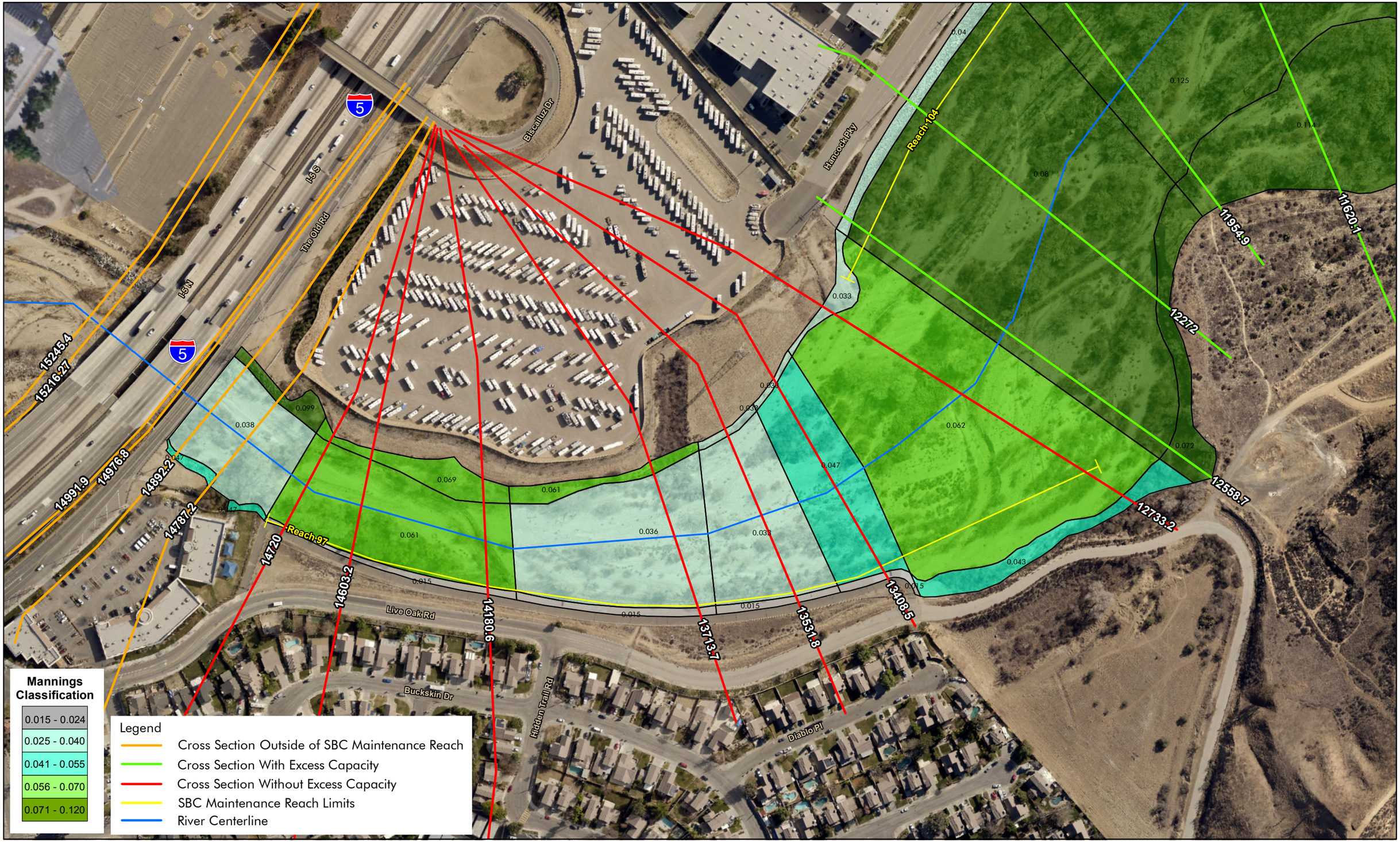
Table 6-6: Reaches 97 & 104 – Castaic Creek Excess Capacity Determination

Reach	HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
97	14720.00	3.2	0.5	0.0	No
	14603.25	3.3	-1.6	0.0	No
	14180.60	3.3	-2.3	0.0	No
	13713.74	3.3	-1.9	0.0	No
	13531.83	3.3	-1.6	0.0	No
	13408.48	3.3	-0.9	0.0	No
	12733.25	2.5	-0.4	0.0	No
104	12558.69	2.5	6.6	4.1	Yes
	12271.99	2.5	6.4	3.9	Yes
	11954.94	2.5	4.3	1.8	Yes
	11621.14	2.5	3.8	1.3	Yes
	11235.55	2.5	7.1	4.6	Yes
	11106.23	2.5	13.8	11.3	Yes

6.8 Additional Analysis

Reach 97 does not have excess hydraulic capacity under the existing conditions scenario. The design conditions scenario was also reviewed; however, this reach does not have excess capacity under design conditions. Therefore, no additional analysis was performed.

Reach 104 does have excess freeboard (hydraulic capacity); LACFCD's proposed maintenance plan only removes vegetation 15 feet from the toe of the levee. Beyond that, LACFCD does not maintain the remainder of the channel and so the reach will remain undisturbed allowing vegetation to grow. No additional biological recommendations are proposed; therefore no additional hydraulic analysis was performed.



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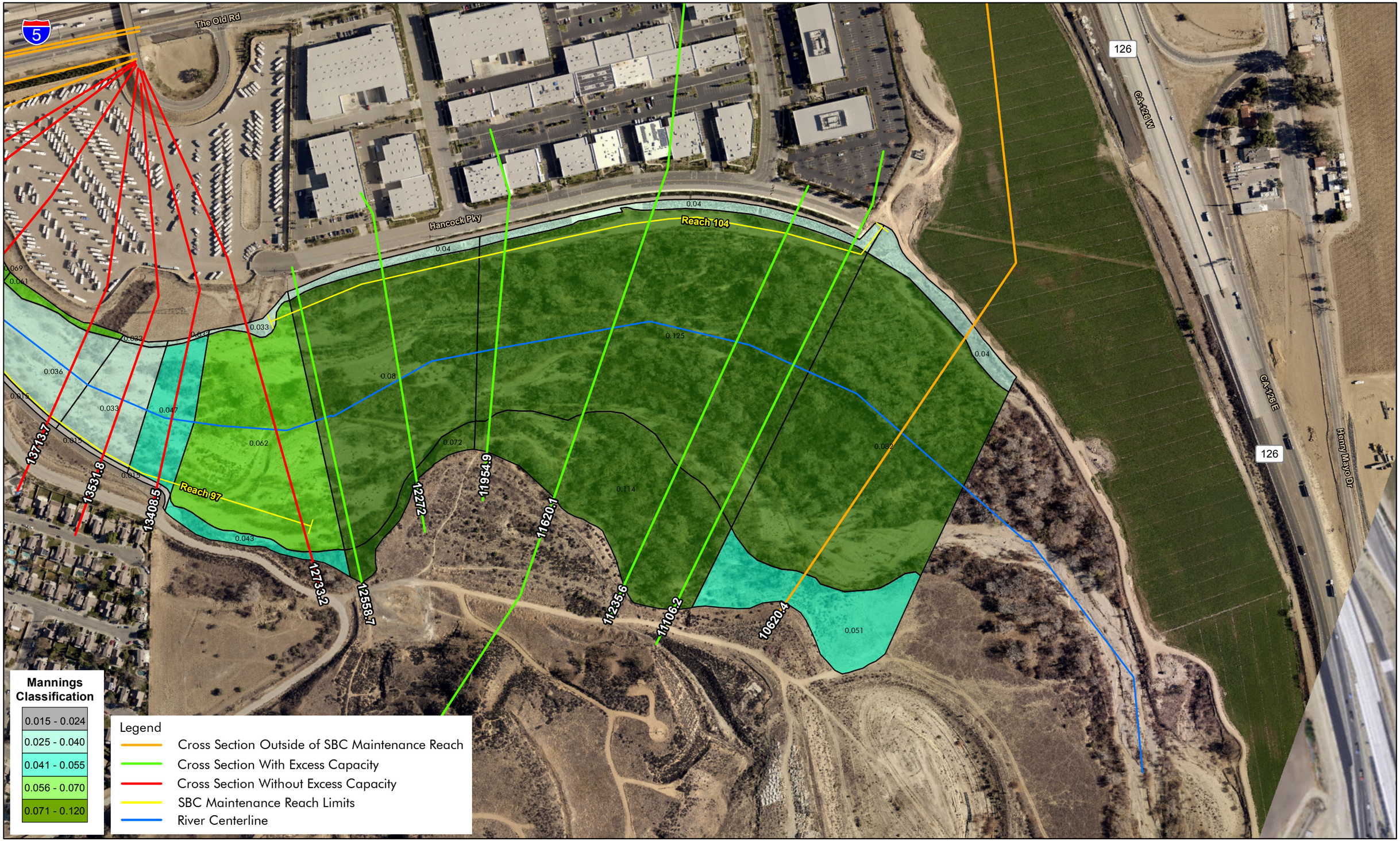
TITLE
CASTAIC CREEK 97 & 104
EXISTING CAPACITY RESULTS

FIGURE
6-2



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CASTAIC CREEK 97 & 104
EXISTING CAPACITY RESULTS

FIGURE
6-3

7 San Francisquito Channel Reach 105

7.1 General Description

San Francisquito Channel is a tributary to SCR. The stream originates from the southern Sierra Pelona Mountains and continues south towards Avenue Scott where it joins with Santa Clara River. The study reach is nearly 2,500 feet in length, extending approximately 1,000 feet upstream and 1,500 feet downstream of Decoro Drive. The surrounding land consists of brushy open space and some residential development. The soft-bottom reach of interest along San Francisquito Channel measures 833 feet in length. The limits of the SBC reach are illustrated in Figure 7-1.

Figure 7-1: Reach 105 – San Francisquito Channel

7.2 Structures

The reach of interest for San Francisquito Channel is an earthen channel with a segment of engineered, hardened slope lining along the east bank. One bridge crosses San Francisquito Channel along the study reach, as summarized in Table 7-1.

Table 7-1: Reach 105 – San Francisquito Channel Structures

Structure Number	HEC-RAS Station	Road Name	Type	Description	Structure Model Data Origin
1	8593	Decoro Drive	Bridge	5 – 2' wide, square-nosed pier walls	FEMA model

7.3 Manning's Roughness Coefficient

7.3.1 *Existing Conditions Manning's Coefficient*

Photographs documenting the existing channel conditions are provided in Appendix A. The existing conditions Manning's roughness coefficients are summarized in Table 7-2 with backup detail provided in Appendix B.

Table 7-2: Reach 105 – San Francisquito Channel Existing Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
9642	0.064	0.036	0.045
9286 to 9078	0.064	0.042	0.045
8732 to 8476	0.041	0.043	0.059
8220	0.066	0.044	0.045
8072 to 7629	0.066	0.044	0.045
7009	0.066	0.038	0.051

7.4 Hydrology

Design flow rates were obtained from the PD 2456 as-built channel design documents available from the LACFCD website: http://dpw.lacounty.gov. The design document and discharges are summarized in Table 7-4.

Table 7-3: Reach 105 – San Francisquito Channel Design Flow Rates

Design Document No.	Year	Discharge (cfs)	HEC-RAS Station
PD 2456	2000	37,400	9642

7.5 Hydraulic Model

The study reach is modeled with 20 cross sections with a majority of cross sections spaced at roughly 200 foot intervals. The cross sections are cut using 2006 LIDAR topographic data provided by LACDPW. The cross section locations and SBC reach extents are presented in Figure 7-2.

Cross section reach lengths were chosen to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. The spacing between cross sections near the bridge was reduced to a minimum of 60 feet to better represent this portion of the channel. The hydraulic model was run under "mixed flow" conditions so that potential areas of supercritical flow were adequately modeled. HEC-RAS input and output files are provided in Appendix E.

7.6 Boundary Conditions

Normal depth is used as the boundary condition for the upstream and downstream extents of the model. The value of normal depth is estimated as the channel bed slope. The boundary conditions are summarized in Table 7-5.

Table 7-4: Reach 105 – San Francisquito Channel Boundary Conditions

Sub-reach	Upstream Boundary Condition	Downstream Boundary Condition
SFC_WM1_WM2	Normal Depth – S = 0.008	Normal Depth – S = 0.007

7.7 Results

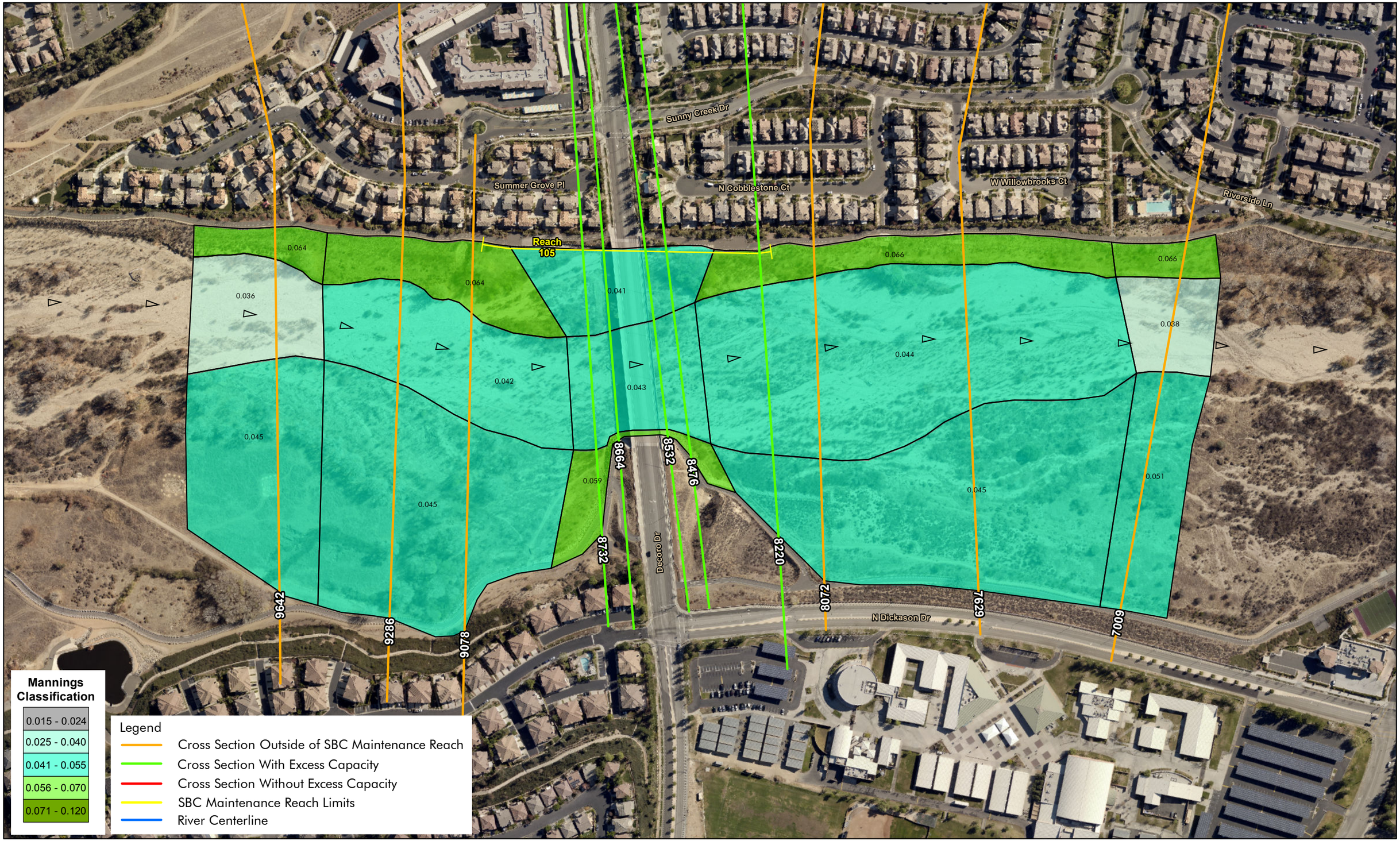
The water surface elevation from the existing conditions model is used to calculate freeboard at each cross section within the SBC reaches. The existing conditions freeboard is compared to the required freeboard to determine whether there is excess freeboard (hydraulic capacity) at the cross section. Results of the freeboard calculations and capacity determination for each cross section are presented in Table 7-6. A detailed summary of these results are provided in Appendix C. A graphical representation of the results for each cross section is presented in Figure 7-2.

Table 7-5: Reach 105 – San Francisquito Channel Excess Capacity Determination

HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
8732	2.5	4.0	1.5	Yes
8664	2.5	5.0	2.5	Yes
8532	2.5	7.1	4.6	Yes
8476	2.5	6.2	3.7	Yes
8220	2.5	5.6	3.1	Yes

7.8 Additional Analysis

LACFCD's proposed maintenance plan only extends 15-ft from the toe of slope for Reach 105. The minimal maintenance practice allows existing vegetation to grow to maximum potential across the majority of the channel. Furthermore, the channel has been designed to accommodate mature vegetation. No additional biological recommendations are proposed; therefore no additional hydraulic analysis was performed.



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SOFT BOTTOM CHANNEL ANALYSIS

TITLE
SAN FRANCISQUITO CANYON 105
EXISTING CAPACITY RESULTS

FIGURE
7-2

8 Hasley Canyon Channel Reach 110

8.1 General Description

Hasley Canyon is a tributary to Castaic Creek located within the Santa Clara River Watershed. Hasley Canyon Channel originates in the mountains north of the Santa Clara River and joins with Castaic Creek at Commerce Center Drive. The study reach is nearly 4,000 feet in length, extending approximately 3,000 feet upstream and 1,000 feet downstream of Commerce Center Drive. The surrounding land consists of mostly commercial property with some brushy open space located at the upstream and downstream boundaries. The soft-bottom reach of interest along Hasley Canyon Channel measures 3,737 feet in length. The limits of the SBC reach are illustrated in Figure 8-1.

Figure 8-1: Reach 110 – Hasley Canyon Channel

8.2 Structures

The reach of interest for Hasley Canyon Channel is an engineered, concrete slope-lined channel with an earthen bottom and 12 drop structures. One bridge crosses Hasley Canyon Channel along the study reach, as summarized in Table 8-1.

Table 8-1: Reach 110 – Hasley Canyon Channel Structures

Structure Number	HEC-RAS Station	Road Name	Type	Description	Structure Model Data Origin
1	4500	Commerce Center Dr.	Bridge	1 – 12" wide square-nosed pier wall	USACE model

8.3 Manning's Roughness Coefficient

8.3.1 *Existing Conditions Manning's Coefficient*

Photographs documenting the existing channel conditions are provided in Appendix A. The existing conditions Manning's roughness coefficients are summarized in Table 8-2 with backup detail provided in Appendix B.

Table 8-2: Reach 110 – Hasley Canyon Channel Existing Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
7672.401	0.025	0.034	0.025
7367.926 to 7321.790	0.025	0.032	0.025
7261.271 to 7054.132	0.015	0.090	0.015
7027.804 to 6754.417	0.015	0.047	0.015
6716.515 to 6433.633	0.015	0.042	0.015
6407.497 to 6033.218	0.015	0.068	0.015
6015.436 to 5739.189	0.015	0.051	0.015
5713.722 to 5141.326	0.015	0.072	0.015
5117.463 to 4926.440	0.015	0.060	0.015
4892.486 to 4678.845	0.015	0.070	0.015
4639.804	0.015	0.052	0.015
4395.956 to 4107.706	0.015	0.121	0.015
4087.444 to 3743.888	0.015	0.095	0.015
3637.300 to 3614.738	0.015	0.085	0.015
3450.237	0.042	0.085	0.042

8.3.2 *Design Conditions Manning's Coefficient*

The Manning's roughness values for the design conditions HEC-RAS model are based on information provided in the as-built plans for the engineered channel. The Manning's roughness values used in the Design Conditions HEC-RAS model are summarized in Table 8-3.

Table 8-3: Reach 110 – Hasley Canyon Channel Design Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
7672.401 to 3450.237	0.030	0.030	0.030

8.4 Hydrology

The design flow rate was obtained from the PD 2262 as-built channel design documents available from the LACFCD website: http://dpw.lacounty.gov. The design document and discharge are summarized in Table 8-4.

Table 8-4: Reach 110 – Hasley Canyon Channel Design Flow Rates

Design Document No.	Year	Discharge (cfs)	HEC-RAS Station
PD 2262	1990	12,300	7672.401

8.5 Hydraulic Model

The study reach is modeled with 55 cross sections with a majority of cross sections spaced at roughly 60 foot intervals. The cross sections are cut using 2006 LIDAR topographic data provided by LACDPW. The cross section locations and SBC reach extents are presented in Figures 8-2 through 8-3.

Cross section spacing was chosen to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. The spacing between cross sections was reduced to approximately 20 foot intervals near drop structures to better represent these portions of the channel. The hydraulic model was run under "mixed flow" conditions so that potential areas of supercritical flow were adequately modeled. HEC-RAS input and output files are provided in Appendix E.

8.6 Boundary Conditions

Normal depth is used as the boundary condition for the upstream and downstream extents of the model. The value of normal depth is estimated as the channel bed slope. The boundary conditions are summarized in Table 8-5.

Table 8-5: Reach 110 – Hasley Canyon Channel Boundary Conditions

Sub-reach	Upstream Boundary Condition	Downstream Boundary Condition
Hasley – 1	Normal Depth – S = 0.022	Normal Depth – S = 0.010

8.7 Results

The water surface elevation from the existing conditions model is used to calculate freeboard at each cross section within the SBC reaches. The existing conditions freeboard is compared to the required freeboard to determine whether there is excess freeboard (hydraulic capacity) at the cross section. Results of the freeboard calculations and capacity determination for each cross section are presented in Table 8-6, and in Figures 8-2 through 8-3. A detailed summary of these results is provided in Appendix C.

Table 8-6: Reach 110 – Hasley Canyon Channel Excess Capacity Determination

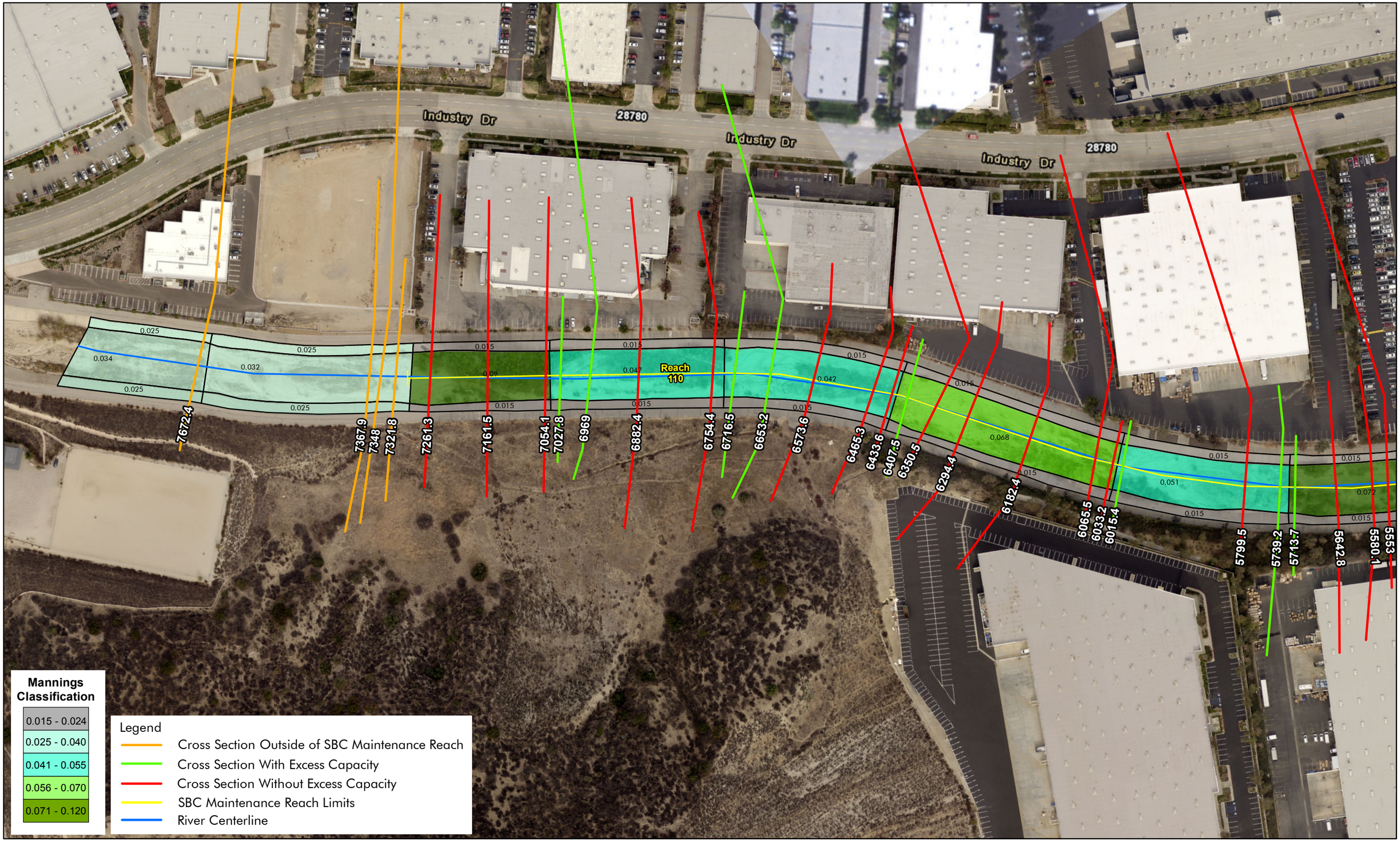
HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
7261.271	2.5	2.2	0.0	No
7161.515	2.5	-1.7	0.0	No
7054.132	2.5	2.3	0.0	No
7027.804	2.6	5.3	2.7	Yes
6969.027	2.7	4.0	1.3	Yes

HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
6882.363	2.9	1.3	0.0	No
6754.417	3.3	2.6	0.0	No
6716.515	3.3	4.8	1.5	Yes
6653.246	3.3	3.7	0.4	Yes
6573.628	3.3	2.0	0.0	No
6465.290	3.3	2.6	0.0	No
6433.633	3.3	3.0	0.0	No
6407.497	3.3	5.7	2.4	Yes
6350.499	3.3	-0.2	0.0	No
6294.441	3.3	0.4	0.0	No
6182.436	3.3	1.3	0.0	No
6065.472	3.3	2.0	0.0	No
6033.218	3.3	3.1	0.0	No
6015.436	3.3	7.4	4.1	Yes
5799.549	3.0	1.9	0.0	No
5739.189	2.8	3.5	0.7	Yes
5713.722	2.6	6.6	4.0	Yes
5642.817	2.6	-1.1	0.0	No
5580.129	2.5	-0.2	0.0	No
5552.958	2.5	-0.2	0.0	No
5439.993	2.6	3.0	0.4	Yes
5401.168	2.6	0.5	0.0	No
5352.139	2.6	-0.6	0.0	No
5295.071	2.6	-0.7	0.0	No
5141.326	2.5	2.3	0.0	No
5117.463	2.5	2.9	0.3	Yes
5097.181	2.5	4.4	1.9	Yes
5006.528	2.5	0.2	0.0	No
4946.520	2.5	1.0	0.0	No
4926.440	2.5	1.7	0.0	No
4892.486	2.5	4.0	1.5	Yes
4763.020	2.5	-2.1	0.0	No
4716.150	2.5	-1.9	0.0	No
4678.845	2.5	-1.9	0.0	No
4639.804	2.5	-5.3	0.0	No
4395.956	3.1	-3.7	0.0	No
4318.117	2.5	-4.0	0.0	No
4155.965	3.3	-1.0	0.0	No
4107.706	3.3	2.0	0.0	No
4087.444	3.3	0.8	0.0	No

HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
3911.677	3.3	-1.8	0.0	No
3829.697	3.3	-1.1	0.0	No
3743.888	3.3	-0.6	0.0	No
3637.300	3.3	3.4	0.1	Yes
3614.738	3.3	6.0	2.7	Yes

8.8 Additional Analysis

The majority of the reach does not have excess hydraulic capacity under the existing conditions scenario. The design conditions scenario was reviewed, and the reach showed excess capacity under design conditions. However, this reach has accumulated excess sediment which may reduce capacity. Therefore, no additional vegetation recommendation is proposed.



0 150 300 Feet

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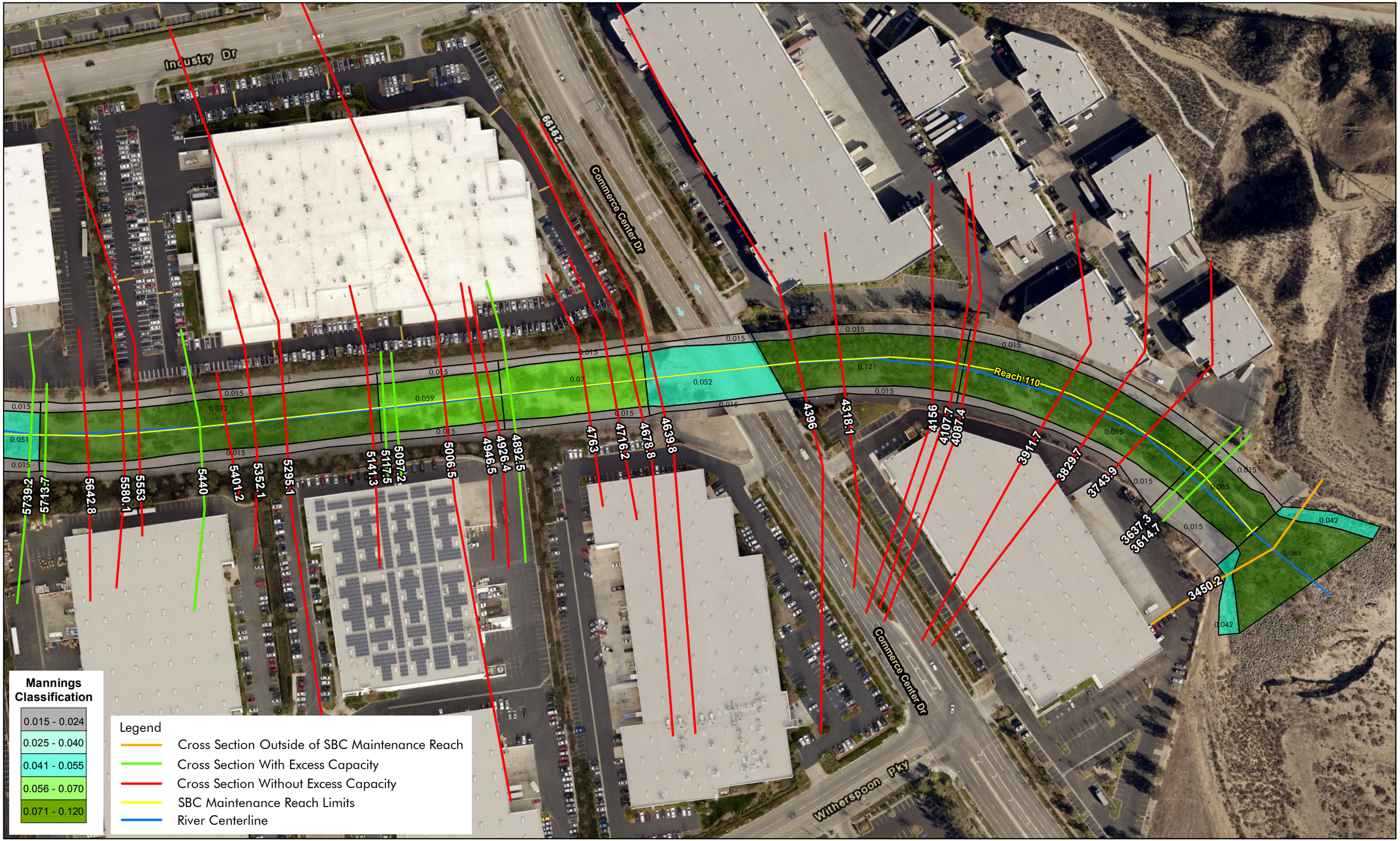
TITLE
HASLEY CANYON 110
EXISTING CAPACITY RESULTS

FIGURE
8-2



0 150 300 Feet

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TITLE

HASLEY CANYON 110
EXISTING CAPACITY RESULTS

FIGURE

8-3

9 Santa Clara River Reaches 47, 51, 55, 56, 58, 60, and 61

9.1 General Description

The reaches of interest along SCR are located between Golden Valley Road and the Antelope Valley Freeway (Highway 14). The study reach of SCR is nearly 4.9 miles in length, beginning approximately 700 feet upstream of Antelope Highway 14 and ending about 3,700 feet downstream of the Golden Valley Road. The surrounding land consists of residential, commercial, and industrial development with areas of brushy open space. There are seven soft-bottom channel reaches of interest along this portion of SCR measuring 1,658 feet (Reach 47), 931 feet (Reach 51), 3,518 feet (Reach 55), 2,346 feet (Reach 56), 2,644 feet (Reach 58), 3,166 feet (Reach 60), and 4,715 feet (Reach 61) in length. The limits of the SBC reaches are illustrated in Figure 9-1.

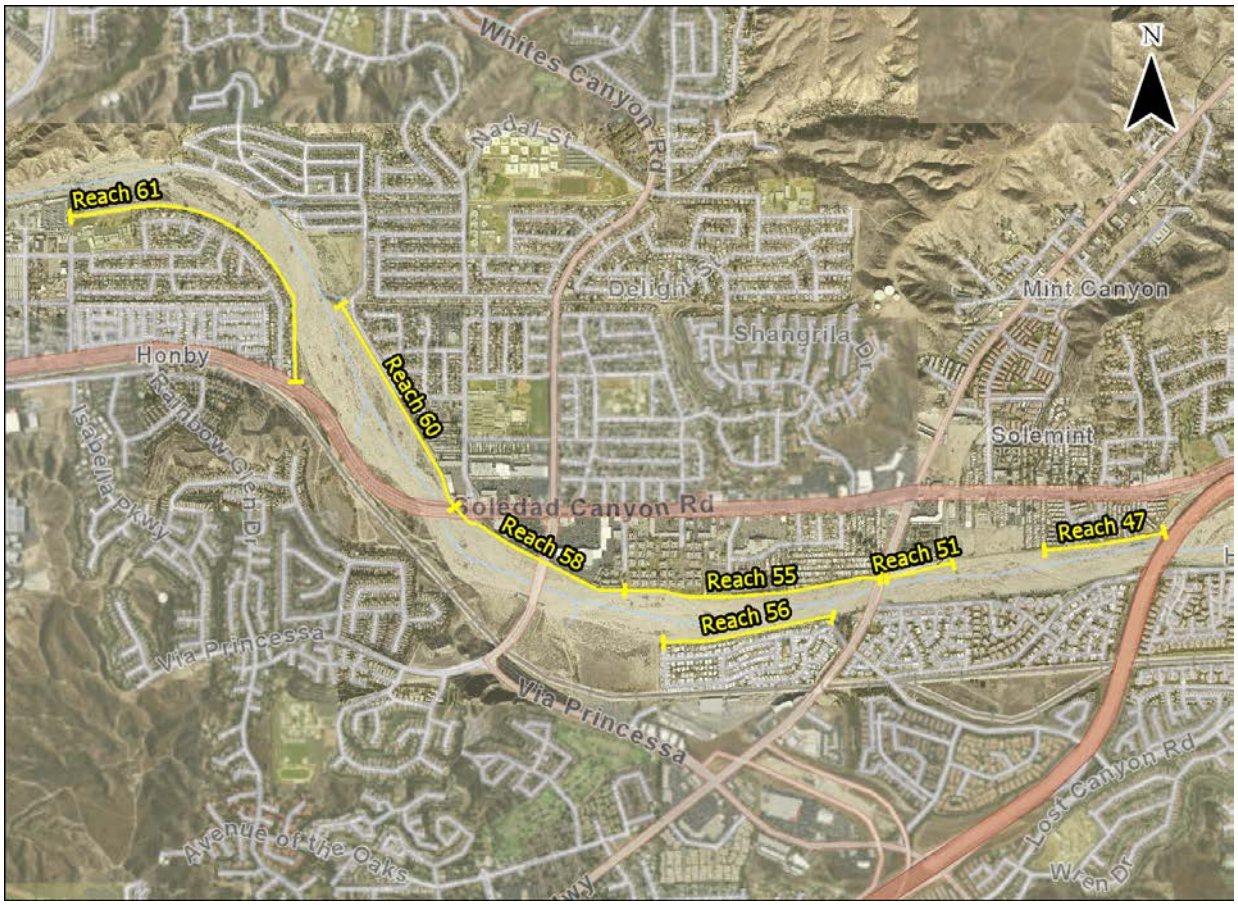


Figure 9-1: Reaches 47, 51, 55, 56, 58, 60, & 61 – Santa Clara River

9.2 Structures

Within the study limits, the Santa Clara River is a wide, natural channel with a few segments of engineered slope lining along the left bank (southerly bank) for Reaches 56 and 61 and along the right bank (northerly bank) for Reaches 47, 51, 56, 58 and 60. Six bridges span the Santa Clara River within the study reach, as summarized in Table 9-1.

Table 9-1: Reaches 47, 51, 55, 56, 58, 60, & 61 – SCR Structures

Structure Number	HEC-RAS Station	Road Name	Type	Description	Structure Model Data Origin
1	297828	Antelope Valley Freeway	Bridge	9 – 4' diameter circular piers	FEMA model
2	293703	Sierra Highway	Bridge	7 – 1.4' wide, square-nosed pier walls	FEMA model
3	288831	Whites Canyon Road	Bridge	7 – 2' wide, square-nosed pier walls	FEMA model
4	286938	Soledad Canyon Road	Bridge	6 – 5'-8" wide, square-nosed pier walls	FEMA model
5	275872	Golden Valley Road	Bridge	8 – 7' diameter circular piers	FEMA model
6	273404	Soledad Canyon Siphon	Pipeline	56 – 5'-4" wide, square-nosed pier walls	FEMA model

9.3 Manning's Roughness Coefficient

9.3.1 *Existing Conditions Manning's Coefficient*

Photographs documenting the existing channel conditions are provided in Appendix A. The existing conditions Manning's roughness coefficients are summarized in Table 9-2 with backup detail provided in Appendix B.

Table 9-2: Reaches 47, 51, 55, 56, 58, 60, & 61 – SCR Existing Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
298780 to 298568	0.015	0.040	0.047
298048	0.042	0.053	0.042
297455	0.015	0.034	0.015
297251 to 296199	0.015	0.036	0.015
296003	0.015	0.048	0.042
295372 to 294815	0.015	0.049	0.042
294737 to 293981	0.015	0.044	0.015
293795	0.015	0.033	0.015
293585	0.043	0.033	0.015
293290 to 292516	0.042	0.036	0.042
292343 to 292016	0.042	0.040	0.015
291582	0.042	0.047	0.042
291145 to 290710	0.042	0.041	0.015
290491 to 289801	0.057	0.048	0.015

HEC-RAS Station	Left Bank	Main Channel	Right Bank
289654	0.071	0.048	0.015
289329 to 289031	0.049	0.035	0.015
288683	0.015	0.039	0.015
288147	0.032	0.033	0.015
287569	0.044	0.042	0.015
287026	0.015	0.037	0.015
286705	0.015	0.039	0.015
286394	0.035	0.036	0.015
285922 to 285295	0.043	0.044	0.015
285000 to 283698	0.038	0.046	0.015
283601 to 283367	0.042	0.036	0.068
283038 to 282815	0.015	0.035	0.048
282457	0.015	0.033	0.015
282020	0.015	0.053	0.015
281600 to 280650	0.015	0.063	0.015
280482	0.015	0.075	0.038
279998 to 279182	0.015	0.053	0.038
279094 to 278916	0.045	0.036	0.038
278514 to 271751	0.036	0.036	0.036

9.3.2 *Design Conditions Manning's Coefficient*

The Manning's roughness values for the design conditions HEC-RAS model are based on information provided in the as-built plans for the engineered channel. The Manning's roughness values used in the design conditions HEC-RAS models are summarized in Table 9-3.

Table 9-3: Reaches 47, 51, 55, 56, 58, 60, & 61 – SCR Design Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
297455 to 293795	0.027	0.027	0.027
293585 to 289992	0.030	0.030	0.030
289801 to 287026	0.025	0.025	0.025
286705 to 279182	0.035	0.035	0.035

9.4 Hydrology

Design flow rates were obtained from multiple as-built channel design documents available from the LACFCD website: http://dpw.lacounty.gov. The design documents and discharges are summarized in Table 9-4.

Table 9-4: Reaches 47, 51, 55, 56, 58, 60, & 61 – SCR Design Flow Rates

Design Document No.	Year	Discharge (cfs)	HEC-RAS Station
PD 1733, Unit I	1983	45,400	298780
PD 2032	1987	52,100	291145
PD 832	1967	2660	2014

9.5 Hydraulic Model

The study reach is modeled with 126 cross sections with the majority of cross sections spaced at roughly 250-foot intervals. The cross sections are cut using 2006 LIDAR topographic data provided by LACDPW. The cross section locations and SBC reach extents are presented in Figures 9-2 through 9-8.

Cross section spacing was chosen to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. Additional cross-sections were incorporated into the model (as needed) at transitional areas and sharp bends to better represent the conditions in these portions of the channel. The hydraulic model was run under “mixed flow” conditions so that potential areas of supercritical flow were adequately modeled. HEC-RAS input and output files are provided in Appendix E.

9.6 Boundary Conditions

The model consists of three sub-reaches with a junction where a small tributary channel (SBC Reaches 53 and 54) confluences with SCR. At the upstream and downstream extents of the model, normal depth is used as the boundary condition. The value of normal depth is estimated as the channel bed slope. Interior boundary conditions (i.e. at the junction) are automatically generated by HEC-RAS from the junction hydraulics. The boundary conditions are summarized in Table 9-5.

Table 9-5: Reaches 47, 51, 55, 56, 58, 60, & 61 – SCR Boundary Conditions

Sub-reach	Upstream Boundary Condition	Downstream Boundary Condition
Santa Clara R – 1	Normal Depth – S = 0.009	Junction
Santa Clara R – 2	Junction	Normal Depth – S = 0.005
SCR Outlet – 1	Normal Depth S = 0.0103	Junction

9.7 Results

The water surface elevation from the existing conditions model is used to calculate freeboard at each cross section within the SBC reaches. The existing conditions freeboard is compared to the required freeboard to determine whether there is excess freeboard (hydraulic capacity) at the cross section. Results of the freeboard calculations and capacity determination for each cross section are presented in Table 9-6, and in Figures 9-2 through 9-8. A detailed summary of these results is provided in Appendix C.

Table 9-6: Reaches 47, 51, 55, 56, 58, 60, & 61 – SCR Excess Capacity Determination

Reach Number	HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
47	297455	2.5	0.9	0.0	No
	297251	2.5	2.0	0.0	No
	296659	2.5	1.5	0.0	No
	296256	2.5	3.0	0.5	Yes
	296199	2.5	2.5	0.0	No
51	294815	2.5	2.0	0.0	No
	294737	2.5	2.8	0.3	Yes
	294646	2.5	3.3	0.8	Yes
	294514	2.5	2.3	0.0	No
	294313	2.5	1.7	0.0	No
	294153	2.5	1.9	0.0	No
	293981	2.5	-0.7	0.0	No
	293795	2.5	2.3	0.0	No
55	293585	2.5	5.3	2.8	Yes
	293290	2.5	1.4	0.0	No
	293168	2.5	1.2	0.0	No
	293108	2.6	-0.7	0.0	No
	293058	2.7	-0.5	0.0	No
	292968	2.8	0.7	0.0	No
	292824	3.1	0.5	0.0	No
	292648	3.3	0.3	0.0	No
	292516	3.5	0.7	0.0	No
	292343	3.7	0.6	0.0	No
	292016	4.2	-0.3	0.0	No
	291582	4.8	-0.7	0.0	No
	291145	5.5	1.6	0.0	No
	290710	6.1	1.4	0.0	No
	290491	2.5	-0.9	0.0	No
	290222	2.5	-0.9	0.0	No
	289992	2.5	-0.8	0.0	No
56	293058	2.7	-0.5	0.0	No
	292968	2.8	0.7	0.0	No
	292824	3.1	0.5	0.0	No
	292648	3.3	0.3	0.0	No
	292516	3.5	0.7	0.0	No
	292343	3.7	0.6	0.0	No
	292016	4.2	-0.3	0.0	No
	291582	4.8	-0.7	0.0	No
	291145	5.5	1.6	0.0	No
	290710	6.1	1.4	0.0	No

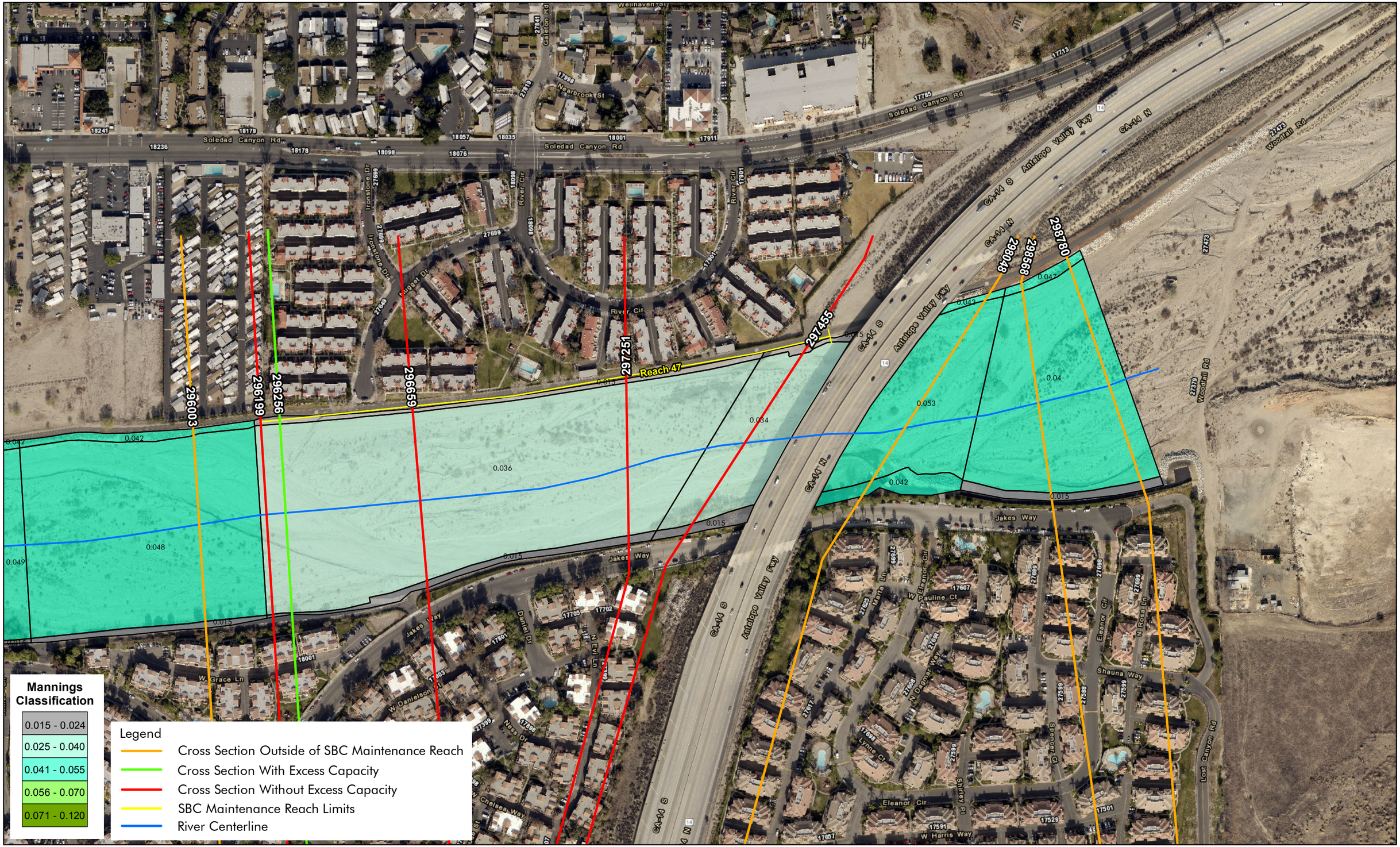
Reach Number	HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
58	289992	2.5	-0.8	0.0	No
	289801	2.5	-0.8	0.0	No
	289654	2.5	1.4	0.0	No
	289329	2.5	-1.8	0.0	No
	289031	2.5	-0.1	0.0	No
	288683	2.5	5.0	2.5	Yes
	288147	2.5	3.4	0.9	Yes
	287569	2.5	3.9	1.4	Yes
	287026	6.1	-5.6	0.0	No
60	286705	2.5	4.0	1.5	Yes
	286394	2.5	0.8	0.0	No
	285922	2.5	0.9	0.0	No
	285521	2.5	1.4	0.0	No
	285295	2.5	0.1	0.0	No
	285000	2.5	0.5	0.0	No
	284751	2.5	0.2	0.0	No
	284503	2.5	-0.5	0.0	No
	284318	3.2	0.1	0.0	No
	284038	6.1	-1.6	0.0	No
	283698	5.7	-0.4	0.0	No
61	284318	3.2	0.1	0.0	No
	284038	6.1	-1.6	0.0	No
	283698	5.7	-0.4	0.0	No
	283601	6.1	0.8	0.0	No
	283494	6.1	1.3	0.0	No
	283367	6.1	3.4	0.0	No
	283038	5.7	2.9	0.0	No
	282815	5.2	1.9	0.0	No
	282457	4.6	0.2	0.0	No
	282020	4.1	-3.2	0.0	No
	281600	3.6	-5.1	0.0	No
	281307	3.2	-3.3	0.0	No
	281011	5.7	0.4	0.0	No
	280650	5.7	-0.2	0.0	No
	280482	5.7	2.3	0.0	No
	279998	2.5	2.4	0.0	No
	279805	2.5	-0.6	0.0	No
	279519	2.5	-3.9	0.0	No
	279242	2.5	-3.5	0.0	No
	279182	2.5	-10.6	0.0	No

9.8 Additional Analysis

Reaches 55, 56, 58, 60 and 61 did not have excess hydraulic capacity under the existing conditions scenario for a majority of the segments. The design conditions scenario for these reaches was also reviewed; however, these reaches do not have excess capacity under design conditions. Therefore, no additional analysis was performed for these reaches.

Reaches 47 and 51 did not have excess hydraulic capacity under the existing conditions scenario. Under the design conditions scenario, these reaches did have partial excess capacity. LACFCD's current maintenance practice extends 20-ft from the toe of slope and leaves the remaining width of the channel vegetated. No additional biological recommendations are proposed; therefore no additional hydraulic analysis was performed.

Reach 58 has partial excess capacity under the existing and design conditions scenarios; however for this reach, LACFCD has limited easement. No additional biological recommendations are proposed; therefore no additional hydraulic analysis was performed.



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SANTA CLARA RIVER 47, 51, 55, 56, 58, 60, & 61
EXISTING CAPACITY RESULTS

FIGURE
9-2

Mannings Classification

0.015 - 0.024
0.025 - 0.040
0.041 - 0.055
0.056 - 0.070
0.071 - 0.120

Legend

- Cross Section Outside of SBC Maintenance Reach
- Cross Section With Excess Capacity
- Cross Section Without Excess Capacity
- SBC Maintenance Reach Limits
- River Centerline

0 150 300 Feet

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SOFT BOTTOM CHANNEL ANALYSIS

TITLE
SANTA CLARA RIVER 47, 51, 55, 56, 58, 60, & 61
EXISTING CAPACITY RESULTS

FIGURE
9-3

Mannings Classification

0.015 - 0.024
0.025 - 0.040
0.041 - 0.055
0.056 - 0.070
0.071 - 0.120

Legend

- Cross Section Outside of SBC Maintenance Reach
- Cross Section With Excess Capacity
- Cross Section Without Excess Capacity
- SBC Maintenance Reach Limits
- River Centerline

0 300 600 Feet

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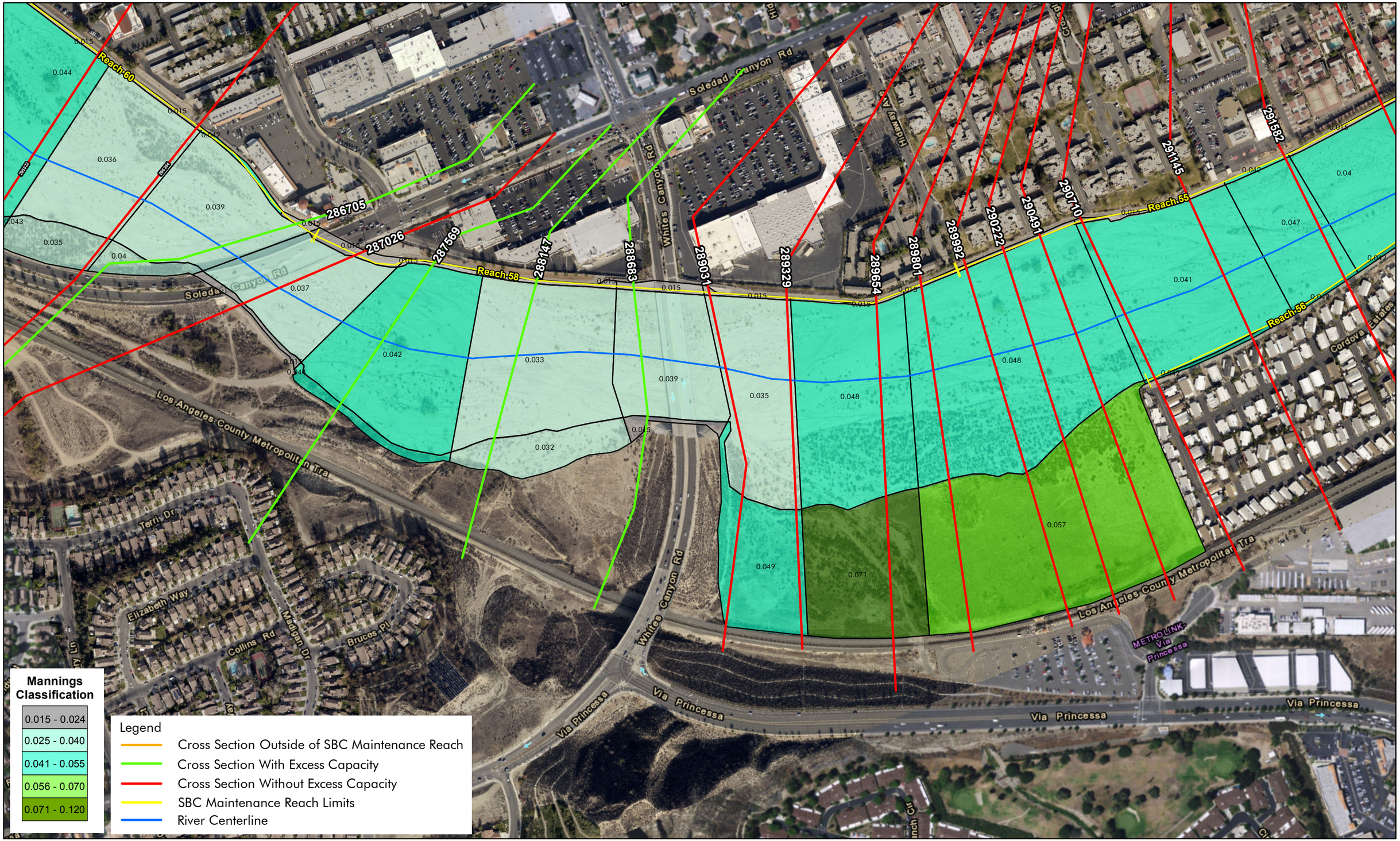
TITLE
SANTA CLARA RIVER 47, 51, 55, 56, 58, 60, & 61
EXISTING CAPACITY RESULTS

FIGURE
9-4



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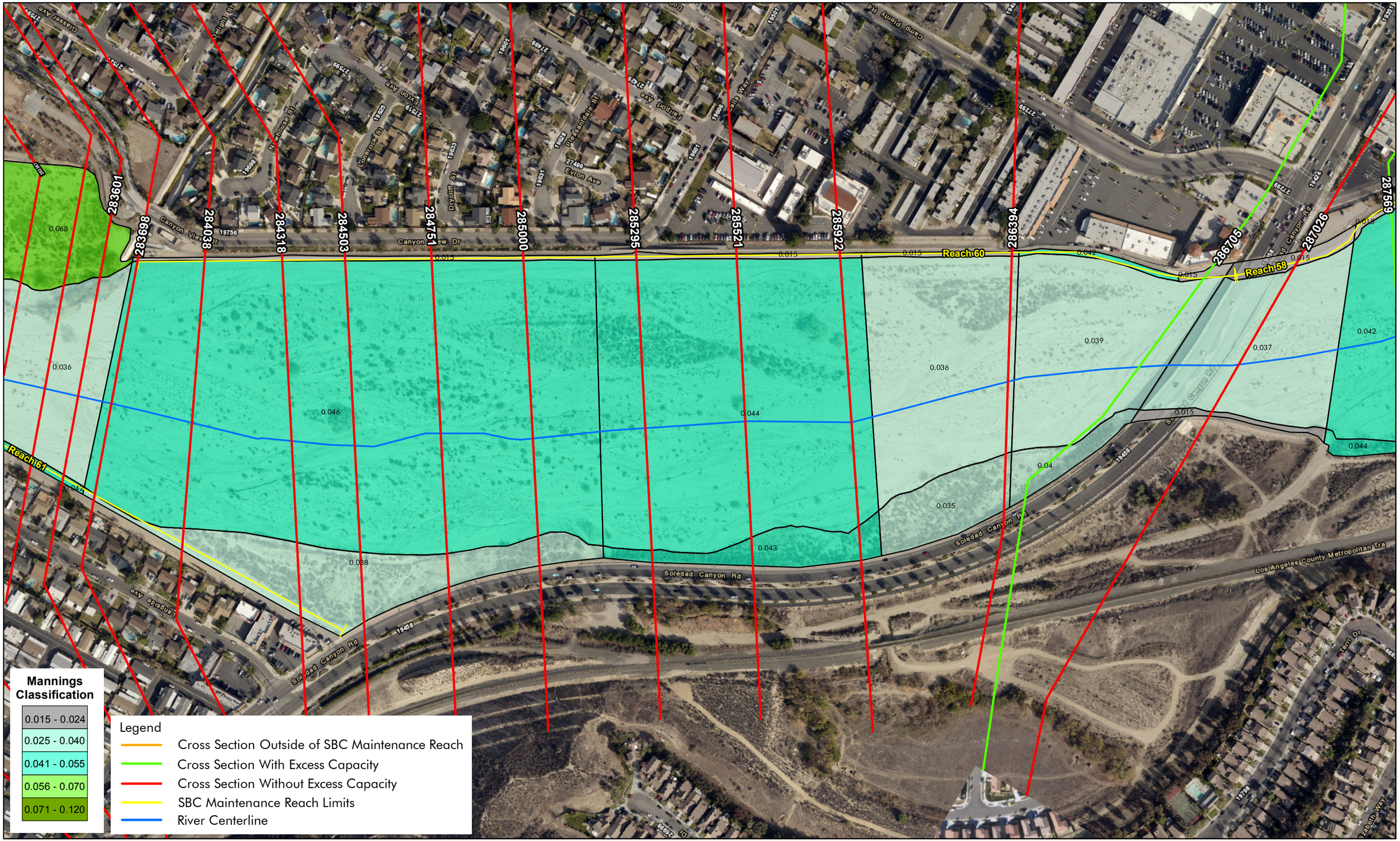
SANTA CLARA RIVER 47, 51, 55, 56, 58, 60, & 61
EXISTING CAPACITY RESULTS

FIGURE
9-5



0 250 500 Feet

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SOFT BOTTOM CHANNEL ANALYSIS

TITLE
SANTA CLARA RIVER 47, 51, 55, 56, 58, 60, & 61
EXISTING CAPACITY RESULTS

FIGURE
9-6

Mannings Classification

0.015 - 0.024
0.025 - 0.040
0.041 - 0.055
0.056 - 0.070
0.071 - 0.120

Legend

- Cross Section Outside of SBC Maintenance Reach
- Cross Section With Excess Capacity
- Cross Section Without Excess Capacity
- SBC Maintenance Reach Limits
- River Centerline

283038 283567 283494 283601 283698 284038 284318 284503 284751 285000

282815 282457 282020 281600 281307 281011

Reach 60 Reach 61

0.048 0.068 0.035 0.036 0.033 0.046 0.053 0.042 0.038 0.063 0.075 0.015

Canyon View Dr Langside Ave Lancebrook Dr Lakemore Dr Edgewater Dr Shadow Island Dr Northcliff Dr Crestview Dr Emerald Green Dr Cottonwood Dr Evron Ave Daylight St Soledad Canyon Rd

0 250 500 Feet

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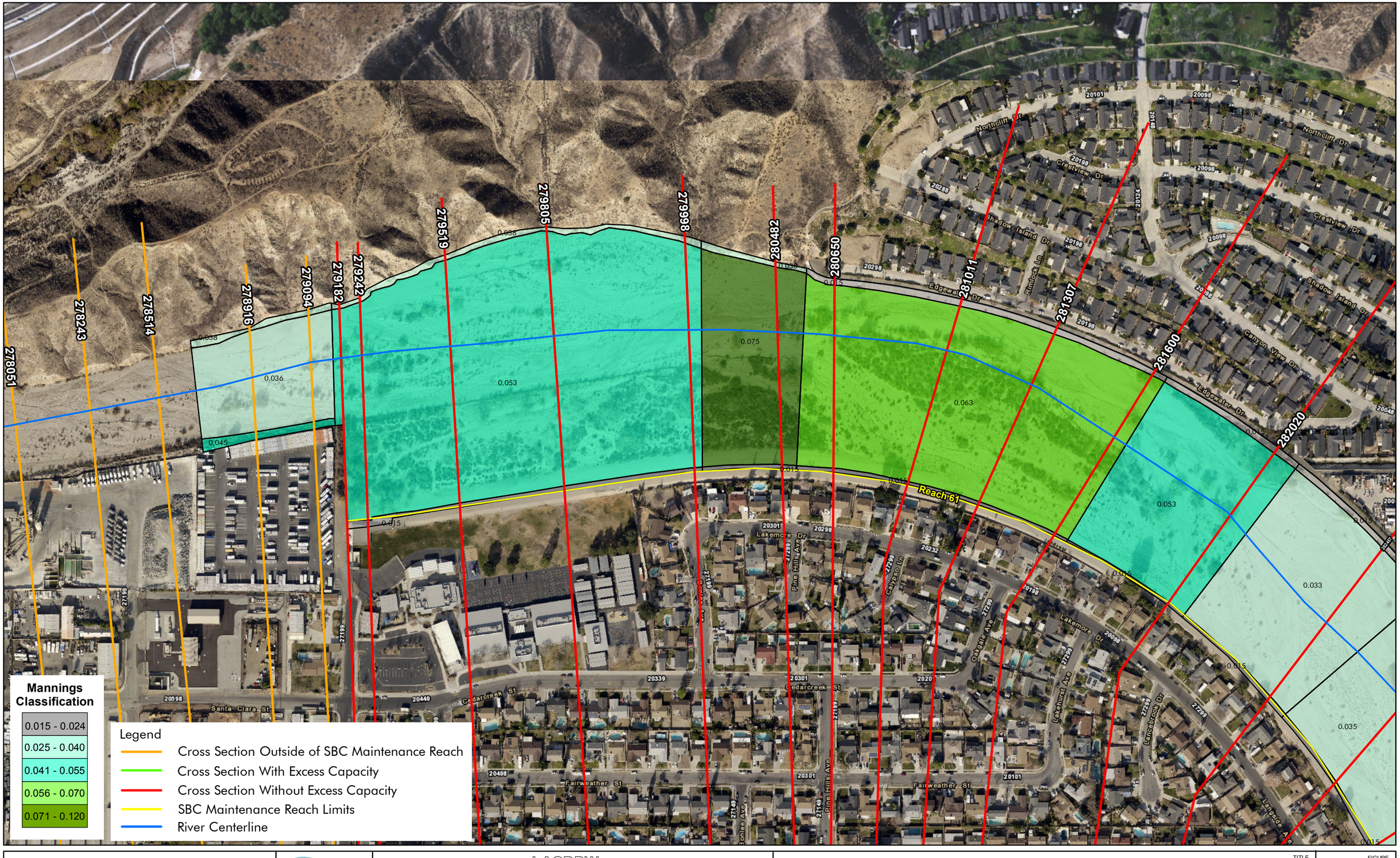
SOFT BOTTOM CHANNEL ANALYSIS

TITLE
SANTA CLARA RIVER 47, 51, 55, 56, 58, 60, & 61
EXISTING CAPACITY RESULTS

FIGURE
9-7



0 250 500 Feet

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SANTA CLARA RIVER WATERSHED
SOFT BOTTOM CHANNEL ANALYSIS

TITLE
SANTA CLARA RIVER 47, 51, 55, 56, 58, 60, & 61
EXISTING CAPACITY RESULTS

FIGURE
9-8

10 Oak Ave. Road Drainage Reach 63

10.1 General Description

Oak Avenue Road Drainage is a minor tributary to the Santa Clara River (SCR). The study reach begins at the outlet of Oak Avenue Road Drainage and extends nearly 2,200 feet to the confluence with SCR. The surrounding land consists of industrial development and areas of brushy open space. The soft-bottom channel reach of interest along Oak Avenue Road Drainage measures 914 feet in length. The limits of the SBC reach are illustrated in Figure 10-1.

Figure 10-1: Reach 63 – Oak Ave. Road Drainage

10.2 Structures

The reach of interest for Oak Avenue Road Drainage is an engineered, earthen channel. There are no additional structures located in this SBC reach.

10.3 Manning's Roughness Coefficient

10.3.1 *Existing Conditions Manning's Coefficient*

Photographs documenting the existing channel conditions are provided in Appendix A. The existing conditions Manning's roughness coefficients are summarized in Table 10-1 with backup detail provided in Appendix B.

Table 10-1: Reach 63 – Oak Ave. Road Drainage Existing Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
2200 to 800	0.015	0.015	0.015
700 to 600	0.027	0.027	0.027
500 to 24	0.027	0.025	0.027

10.3.2 *Design Conditions Manning's Coefficient*

The Manning's roughness values for the design conditions HEC-RAS model are based on information provided in the as-built plans for the engineered channel. The Manning's roughness values used in the design conditions HEC-RAS models are summarized in Table 10-2.

Table 10-2: Reach 63 – Oak Ave. Road Drainage Design Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
2200 to 800	0.015	0.015	0.015
700 to 24	0.028	0.028	0.028

10.4 Hydrology

Design flow rates were obtained from multiple as-built channel design documents available from the LACFCD website: http://dpw.lacounty.gov. The design documents and discharges are summarized in Table 10-3.

Table 10-3: Reach 63 – Oak Ave. Road Drainage Design Flow Rates

Design Document No.	Year	Discharge (cfs)	HEC-RAS Station
RDD 234	1972	637	2200
PD 1679	1983	745	1500

10.5 Hydraulic Model

The study reach is modeled with 23 cross sections with the majority of cross sections spaced at roughly 100-foot intervals. The cross sections are cut using 2006 LIDAR topographic data provided by LACDPW. The cross section locations and SBC reach extents are presented in Figure 10-2.

Cross section spacing was chosen to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. Additional cross-sections were incorporated into the model (as needed) at transitional areas and sharp bends to better represent the conditions in these portions of the channel. The hydraulic model was run under "mixed flow" conditions so that potential areas of supercritical flow were adequately modeled. HEC-RAS input and output files are provided in Appendix E.

10.6 Boundary Conditions

Normal depth is used as the boundary condition for the upstream extent of the model. The value of normal depth is estimated as the channel bed slope. At the downstream extents of the model, a known water surface is used as the boundary condition. The water surface elevation was obtained from the existing conditions HEC-RAS model for SCR Reaches 47, 51, 55, 56, 58, 60, and 61 at cross section 276316. The boundary conditions are summarized in Table 10-4.

Table 10-4: Reach 63 – Oak Ave. Road Drainage Boundary Conditions

Sub-reach	Upstream Boundary Condition	Downstream Boundary Condition
River – 1	Normal Depth – S = 0.005	Known WS – Elev. 1271.14’

10.7 Results

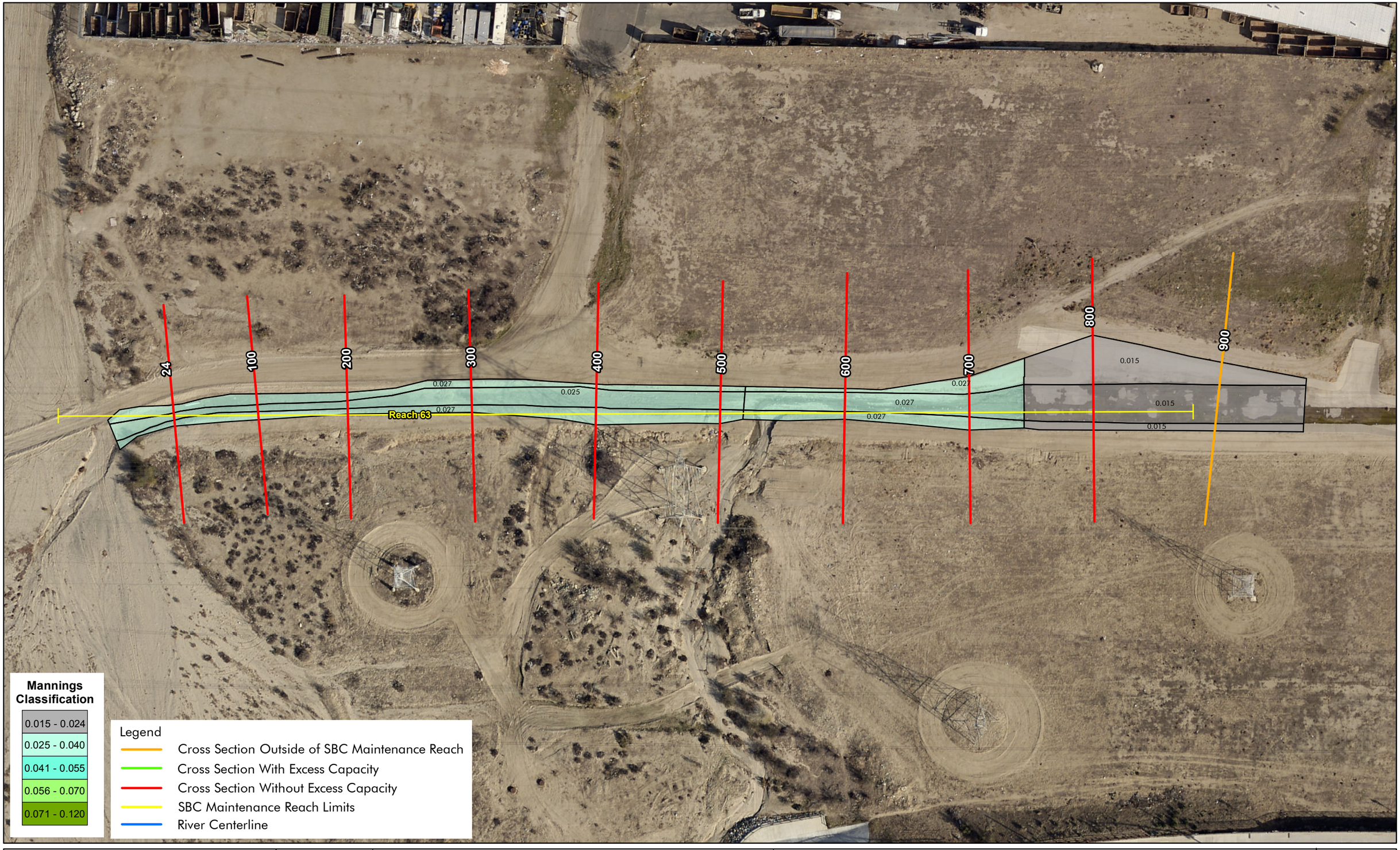
The water surface elevation from the existing conditions model is used to calculate freeboard at each cross section within the SBC reach. The existing conditions freeboard is compared to the required freeboard to determine whether there is excess freeboard (hydraulic capacity) at the cross section. Note that the channel is shallow with a depth varying between 1.5 and 3 feet within the study reach. The channel cannot meet the minimum required freeboard of 2.5 feet due to its shallow depth, so the required freeboard is not applicable for this reach. Results of the freeboard calculations and capacity determination for each cross section are presented in Table 10-5, and in Figure 10-2. A detailed summary of these results is provided in Appendix C.

Table 10-5: Reach 63 – Oak Ave. Road Drainage Excess Capacity Determination

HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
800	N/A	-3.9	0.0	No
700	N/A	-4.2	0.0	No
600	N/A	-4.8	0.0	No
500	N/A	-4.9	0.0	No
400	N/A	-5.9	0.0	No
300	N/A	-5.0	0.0	No
200	N/A	-4.9	0.0	No
100	N/A	-4.7	0.0	No
24	N/A	-4.4	0.0	No

10.8 Additional Analysis

Reach 63 does not have excess hydraulic capacity under the existing conditions scenario. The design conditions scenario for this reach was also reviewed; however, the reach does not have excess capacity under design conditions. Therefore, no additional analysis was performed.



0 70 140 Feet

PACE Advanced Water Engineering

LACDPW
SANTA CLARA RIVER WATERSHED
SOFT BOTTOM CHANNEL ANALYSIS

TITLE
OAK AVE ROAD 63
EXISTING CAPACITY RESULTS

FIGURE
10-2

11 Santa Clara River Reach 66

11.1 General Description

The reach of interest along SCR is located immediately upstream of Bouquet Canyon Road. The study reach is nearly 2,500 feet in length, extending approximately 2,100 feet upstream and approximately 270 feet downstream of Bouquet Canyon Road. The surrounding land consists mostly of residential and industrial development with areas of brushy open space. The soft-bottom channel reach of interest along SCR measures 710 feet in length. The limits of the SBC reach are illustrated in Figure 11-1.

Figure 11-1: Reach 66 – Santa Clara River

11.2 Structures

Within the study limits, the Santa Clara River is a wide, natural channel with segments of engineered slope lining. One bridge spans the Santa Clara River within the study limits, as summarized in Table 11-1.

Table 11-1: Reach 66 – Santa Clara River Structures

Structure Number	River Station	Road Name	Type	Description	Structure Model Data Origin
1	263296	Bouquet Canyon Road	Bridge	5 – 5.5' wide, square-nosed pier walls	FEMA Model

11.3 Manning's Roughness Coefficient

11.3.1 *Existing Conditions Manning's Coefficient*

Photographs documenting the existing channel conditions are provided in Appendix A. The existing conditions Manning's roughness coefficients are summarized in Table 11-2 with backup detail provided in Appendix B.

Table 11-2: Reach 66 – Santa Clara River Existing Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
265467 to 264471	0.038	0.049	0.030
264360 to 263975	0.015	0.043	0.030
263792 to 263493	0.037	0.037	0.030
263391	0.043	0.038	0.031
263095 to 262717	0.015	0.032	0.015

11.3.2 *Design Conditions Manning's Coefficient*

The Manning's roughness values for the design conditions HEC-RAS model are based on information provided in the as-built plans for the engineered channel. The Manning's roughness values used in the design conditions HEC-RAS models are summarized in Table 11-3.

Table 11-3: Reach 66 – Santa Clara River Design Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
264471 to 263792	0.045	0.045	0.045

11.4 Hydrology

Design flow rates were obtained from the PD 1538 as-built channel design documents available from the LACFCD website: http://dpw.lacounty.gov. The design documents and discharges are summarized in Table 11-4.

Table 11-4: Reach 66 – Santa Clara River Design Flow Rates

Design Document No.	Year	Discharge (cfs)	HEC-RAS Station
PD 1538	1979	51,900	265467

11.5 Hydraulic Model

The study reach is modeled with 11 cross sections with the majority of cross sections spaced at roughly 250-foot intervals. The cross sections are cut using 2006 LIDAR topographic data provided by LACDPW. The cross section locations and SBC reach extents are presented in Figure 11-2.

Cross section spacing was chosen to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. Additional cross-sections were incorporated into the model (as needed) at transitional areas and sharp bends to better represent the conditions in these portions of the channel. The hydraulic model was run under "mixed flow" conditions so that potential areas of supercritical flow were adequately modeled. HEC-RAS input and output files are provided in Appendix E.

11.6 Boundary Conditions

Normal depth is used as the boundary condition for the upstream and downstream extents of the model. The value of normal depth is estimated as the channel bed slope. The boundary conditions are summarized in Table 11-5.

Table 11-5: Reach 66 – Santa Clara River Boundary Conditions

Sub-reach	Upstream Boundary Condition	Downstream Boundary Condition
Santa Clara R – Workmap11	Normal Depth – S = 0.010	Normal Depth – S = 0.010

11.7 Results

The water surface elevation from the existing conditions model is used to calculate freeboard at each cross section within the SBC reach. The existing conditions freeboard is compared to the required freeboard to determine whether there is excess freeboard (hydraulic capacity) at the cross section. Results of the freeboard calculations and capacity determination for each cross section are presented in Table 11-6. A graphical representation of the results is presented in Figure 11-2. A detailed summary of these results is provided in Appendix C.

Table 11-6: Reach 66 – Santa Clara River Excess Capacity Determination

HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
264471	2.5	5.6	3.1	Yes
264360	2.5	1.9	0.0	No
263975	2.5	-1.3	0.0	No
263792	2.5	-3.2	0.0	No

11.8 Additional Analysis

Reach 66 does not have excess hydraulic capacity under the existing conditions scenario for a majority of the SBC segments. The design conditions scenario for the reach was also reviewed; however, this reach does not have excess capacity under design conditions. Therefore, no additional analysis was performed.

Newhall Ranch Rd
Brooke Ln
Barnacle Ln
Nautical Ln
Northbrooke Ln
Reach 103
262717
263095
263391
263493
263792
263975
264360
264471
264503
265036
265467
0.03
0.031
0.015
0.043
0.037
0.032
0.038
0.049
Reach 66
Soledad Canyon Rd
Los Angeles County Metropolitan Tra
Heirloom

Mannings Classification

0.015 - 0.024
0.025 - 0.040
0.041 - 0.055
0.056 - 0.070
0.071 - 0.120

Legend

- Cross Section Outside of SBC Maintenance Reach
- Cross Section With Excess Capacity
- Cross Section Without Excess Capacity
- SBC Maintenance Reach Limits
- River Centerline

0 300 600 Feet

PACE Advanced Water Engineering

LACDPW
SANTA CLARA RIVER WATERSHED
SOFT BOTTOM CHANNEL ANALYSIS

TITLE
SANTA CLARA RIVER 66
EXISTING CAPACITY RESULTS

FIGURE
11-2

12 Bouquet Canyon Reaches 67, 69, 70, and 103

12.1 General Description

Bouquet Canyon originates from the Sierra Pelona Mountains near Leona Valley and flows southwesterly to its confluence with SCR. The study reach is nearly four miles in length, beginning immediately downstream of Hob Court and ending approximately 1,500 feet downstream of Newhall Ranch Road. The surrounding land consists of mostly residential and commercial development with a few areas of brushy open space. The soft-bottom channel reaches of interest along Bouquet Canyon measure 6,344 feet (Reach 67), 7,326 feet (Reach 69), 3,505 feet (Reach 70), and 1,348 feet (Reach 103) in length. The limits of the SBC reaches are illustrated in Figure 12-1.

Figure 12-1: Reaches 67, 69, 70, & 103 – Bouquet Canyon

12.2 Structures

The reaches of interest for Bouquet Canyon are engineered, concrete slope-lined channels with earthen bottoms and are separated by concrete channel segments. Eight bridges cross Bouquet Canyon along the study reach, as summarized in Table 12-1.

Table 12-1: Reaches 67, 69, 70, & 103 – Bouquet Canyon Structures

Structure Number	HEC-RAS Station	Road Name	Type	Description	Structure Model Data Origin
1	19686	Benz Road	Bridge	1 – 7' 3-1/4" wide, square-nosed pier wall	USACE model
2	14784	Urbandale Avenue	Bridge	1 – 1'-3" wide, square-nosed pier wall	USACE model
3	12430	Haskell Canyon Road	Bridge	1 – 1.5’ wide, square-nosed pier wall with pier nose extension	USACE model
4	10855	Centurion Way	Bridge	1 – 2’-8” wide, square-nosed pier wall with pier nose extension	USACE model
5	9597	Deadman Canyon Siphon	Pipeline	2 – 2' wide, square-nosed pier walls with pier nose extensions	USACE model
6	7318	Bouquet Canyon Road	Bridge	2 – 1'-3" wide, square-nosed pier walls	USACE model
7	3735	Bouquet Canyon Road	Bridge	1 – 1.5’ wide, square-nosed pier wall	USACE model
8	1692	Newhall Ranch Road	Bridge	1 – 1.5' wide, square-nosed pier wall	USACE model

12.3 Manning’s Roughness Coefficient

12.3.1 *Existing Conditions Manning’s Coefficient*

Photographs documenting the existing channel conditions are provided in Appendix A. The existing conditions Manning’s roughness coefficients are summarized in Table 12-2 with backup detail provided in Appendix B.

Table 12-2: Reaches 67, 69, 70, & 103 – Bouquet Canyon Existing Conditions Manning’s Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
21252 to 20807	0.015	0.032	0.015
20651 to 20533	0.015	0.060	0.015
20381 to 20123	0.015	0.053	0.015
19874 to 19718	0.015	0.032	0.015
19639 to 19502	0.015	0.050	0.015
19357 to 19281	0.015	0.032	0.015

HEC-RAS Station	Left Bank	Main Channel	Right Bank
18953 to 18844	0.015	0.051	0.015
18713 to 18174	0.015	0.050	0.015
17903 to 17627	0.015	0.035	0.015
17544 to 17049	0.015	0.034	0.015
17000	0.015	0.035	0.015
16911	0.015	0.015	0.015
16522 to 16417	0.015	0.058	0.015
16138 to 15822	0.015	0.040	0.015
15639 to 15047	0.015	0.064	0.015
14923 to 14754	0.015	0.015	0.015
14600 to 14126	0.015	0.051	0.015
13982 to 13787	0.015	0.034	0.015
13591 to 13124	0.015	0.032	0.015
12968 to 12685	0.015	0.050	0.015
12495 to 11858	0.015	0.045	0.015
11702 to 11308	0.015	0.035	0.015
11296 to 10913	0.015	0.032	0.015
10801	0.015	0.030	0.015
10679 to 10434	0.015	0.044	0.015
10103	0.015	0.056	0.015
9987 to 9747	0.015	0.030	0.015
9640	0.015	0.015	0.015
9557 to 7619	0.015	0.030	0.015
7430	0.015	0.036	0.015
7215 to 7121	0.028	0.036	0.028
7016	0.036	0.038	0.040
6826 to 6483	0.038	0.032	0.040
6309 to 4096	0.015	0.032	0.015
4038 to 3839	0.015	0.030	0.015
3568 to 1612	0.015	0.015	0.015
1372 to 753	0.015	0.090	0.015
521	0.015	0.047	0.015
167	0.015	0.032	0.045

12.3.2 *Design Conditions Manning's Coefficient*

The Manning's roughness values for the design conditions HEC-RAS model are based on information provided in the as-built plans for the engineered channel. The Manning's roughness values used in the design conditions HEC-RAS model are summarized in Table 12-3.

Table 12-3: Reaches 67, 69, & 70 – Bouquet Canyon Design Conditions Manning's Roughness

Reach Number	HEC-RAS Station	Left Bank	Main Channel	Right Bank
67	21252 to 19281	0.015	0.025	0.015
	18953 to 17000	0.015	0.024	0.015
	16911	0.015	0.015	0.015
	16522 to 15047	0.015	0.024	0.015
69	14600 to 13124	0.015	0.024	0.015
	12968 to 12328	0.015	0.050	0.015
	12134 to 9747	0.015	0.027	0.015
	9640	0.015	0.015	0.015
	9557	0.015	0.027	0.015
	9355 to 7430	0.015	0.028	0.015
70	7215 to 6483	0.028	0.028	0.028
	6309 to 4152	0.015	0.028	0.015
	4096	0.015	0.032	0.015
	4038 to 3963	0.015	0.030	0.015
	3839	0.015	0.028	0.015

12.4 Hydrology

Design flow rates were obtained from multiple as-built channel design documents available from the LACFCD website: http://dpw.lacounty.gov. The design documents and discharges are summarized in Table 12-4.

Table 12-4: Reaches 67, 69, 70, & 103 – Bouquet Canyon Design Flow Rates

Design Document No.	Year	Discharge (cfs)	HEC-RAS Station
PD 1201	1977	19,400	21252
PD 802	1968	19,800	18953
PD 700-B	1966	19,900	17049
PD 625-B	1965	21,845	16911
PD 722	1966	21,480	14355
PD 1201	1977	22,800	12685
PD 1065	1974	31,100	10801
PD 2225	1999	35,300	2808

12.5 Hydraulic Model

The study reach is modeled with 118 cross sections with the majority of cross sections spaced at roughly 150-foot intervals. The cross sections are cut using 2006 LIDAR topographic data provided by LACDPW. The cross section locations and SBC reach extents are presented in Figures 12-2 through 12-11.

Cross section spacing was chosen to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. Additional cross-sections were incorporated into the model (as needed) at transitional areas and sharp bends to better represent the conditions in these portions of the channel. The hydraulic model was run under "mixed flow" conditions so that potential areas of supercritical flow were adequately modeled. HEC-RAS input and output files are provided in Appendix E.

12.6 Boundary Conditions

Normal depth is used as the boundary condition for the upstream extent of the model. The value of normal depth is estimated as the channel bed slope. At the downstream extents of the model, a known water surface is used as the boundary condition. The water surface elevation was obtained from the existing conditions HEC-RAS model for SCR Reaches 71, 80, 82, and 109 at cross section 11651. The boundary conditions are summarized in Table 12-5.

Table 12-5: Reaches 67, 69, 70, & 103 – Bouquet Canyon Boundary Conditions

Sub-reach	Upstream Boundary Condition	Downstream Boundary Condition
BouquetCanyon – BC_WM3_WM4	Normal Depth – S = 0.0125	Known WS – Elev. = 1148.82'

12.7 Results

The water surface elevation from the existing conditions model is used to calculate freeboard at each cross section within the SBC reaches. The existing conditions freeboard is compared to the required freeboard to determine whether there is excess freeboard (hydraulic capacity) at the cross section. Results of the freeboard calculations and capacity determination for each cross section are presented in Table 12-6, and in Figures 12-2 through 12-11. A detailed summary of these results is provided in Appendix C.

Table 12-6: Reaches 67, 69, 70, & 103 – Bouquet Canyon Excess Capacity Determination

Reach Number	HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
67	21252	2.6	-5.0	0.0	No
	21150	4.0	-3.4	0.0	No
	21033	5.6	-2.4	0.0	No
	20929	7.1	-2.4	0.0	No
	20807	8.7	-0.8	0.0	No
	20651	6.2	-2.0	0.0	No
	20533	8.7	-6.9	0.0	No
	20381	8.7	-5.1	0.0	No
	20262	8.7	-9.1	0.0	No
	20123	8.7	-7.8	0.0	No
	19874	7.2	-10.6	0.0	No
	19718	7.2	-13.8	0.0	No
	19639	7.2	-6.7	0.0	No
	19502	7.2	-6.0	0.0	No
	19357	7.2	-5.1	0.0	No
	19281	7.2	-4.1	0.0	No

Reach Number	HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
67	18953	7.2	-8.0	0.0	No
	18844	7.2	-7.2	0.0	No
	18713	7.1	-7.9	0.0	No
	18343	5.4	-5.7	0.0	No
	18260	4.0	-5.1	0.0	No
	18174	2.6	-2.5	0.0	No
	17903	2.5	-1.6	0.0	No
	17704	2.5	-0.9	0.0	No
	17627	2.8	-0.8	0.0	No
	17544	2.8	-2.0	0.0	No
	17271	2.8	-1.3	0.0	No
	17049	2.8	-0.8	0.0	No
	17000	2.8	-0.7	0.0	No
	16911	2.8	0.3	0.0	No
	16522	2.8	1.0	0.0	No
	16417	2.8	-3.1	0.0	No
	16138	2.8	-0.7	0.0	No
	15882	2.6	-2.8	0.0	No
	15822	2.5	-1.8	0.0	No
	15639	2.5	-4.4	0.0	No
	15250	2.5	-4.1	0.0	No
	15047	2.5	-1.7	0.0	No
69	14600	2.5	2.8	0.3	Yes
	14355	2.5	-1.6	0.0	No
	14126	2.5	0.4	0.0	No
	13982	2.5	0.9	0.0	No
	13787	2.5	0.2	0.0	No
	13591	2.5	0.5	0.0	No
	13424	2.5	2.6	0.1	Yes
	13275	2.5	0.7	0.0	No
	13124	2.5	2.3	0.0	No
	12968	2.5	2.1	0.0	No
	12685*	2.5	9.2	6.7	No*
	12495	2.5	0.3	0.0	No
	12328*	2.5	2.7	0.2	No*
	12134	2.5	2.0	0.0	No
	11895	2.5	1.0	0.0	No
	11858	2.5	-0.5	0.0	No
	11702	2.5	-1.4	0.0	No
	11308	2.5	-3.3	0.0	No

Reach Number	HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
69	11296	2.5	-5.0	0.0	No
	10913	2.6	-8.0	0.0	No
	10801	2.5	-1.2	0.0	No
	10679	2.9	-1.6	0.0	No
	10434	2.9	-3.4	0.0	No
	10103	2.9	-6.3	0.0	No
	9987	2.9	-6.5	0.0	No
	9820	2.9	-9.0	0.0	No
	9747	2.9	-9.0	0.0	No
	9640	2.9	-13.6	0.0	No
	9557	2.9	-11.8	0.0	No
	9355	3.3	-3.2	0.0	No
	9135	3.3	-0.3	0.0	No
	8942	2.5	-0.7	0.0	No
	8852	3.3	0.7	0.0	No
	8423	2.5	0.3	0.0	No
	8209	2.5	0.6	0.0	No
	8048	2.5	-0.8	0.0	No
	7866	4.4	1.0	0.0	No
	7731	7.7	2.4	0.0	No
	7681	9.2	2.8	0.0	No
	7619	10.3	9.3	0.0	No
	7430	10.3	1.2	0.0	No
70	7215	10.3	0.5	0.0	No
	7121	10.3	7.1	0.0	No
	7016	10.3	8.2	0.0	No
	6826	4.0	1.0	0.0	No
	6671	5.0	3.4	0.0	No
	6483	5.0	6.2	1.2	Yes
	6309	5.0	-3.7	0.0	No
	6102	5.0	-1.4	0.0	No
	5810	5.0	-3.5	0.0	No
	5675	5.0	-3.1	0.0	No
	5431	3.8	-3.6	0.0	No
	5202	2.7	-4.2	0.0	No
	5070	2.5	-5.0	0.0	No
	4893	2.5	-5.8	0.0	No
	4769	2.5	-6.9	0.0	No
	4526	2.5	-7.4	0.0	No
	4333	2.5	-8.7	0.0	No

Reach Number	HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
70	4152	2.5	-6.9	0.0	No
	4096	2.5	-5.1	0.0	No
	4038	2.5	6.1	3.6	Yes
	3963	2.5	6.7	4.2	Yes
	3839	2.5	5.9	3.4	Yes
103	1372*	2.5	5.6	3.1	No*
	1085	2.5	-1.1	0.0	No
	753	2.5	4.0	1.5	Yes
	521	2.5	8.5	6.0	Yes

Notes:

The cross sections indicated with an asterisk (*) have excess freeboard (hydraulic capacity), but do not have capacity for additional vegetation because they are located in segments of the channel with hard bottom (concrete, rip-rap).

12.8 Additional Analysis

Under the existing conditions scenario, Reaches 67 and 69 do not have excess hydraulic capacity, and Reach 70 has partial excess capacity. Under the design conditions scenario, Reaches 67, 69 and 70 have partial excess hydraulic capacity. However, portions identified with excess capacity were predominately segmented and sporadic. For Reach 70, LACFCD does not have easement for the portion identified with excess capacity. Therefore, no additional analysis was performed for these reaches.

For Reach 103, the biological recommendations provided by BonTerra Psomas are as follows:

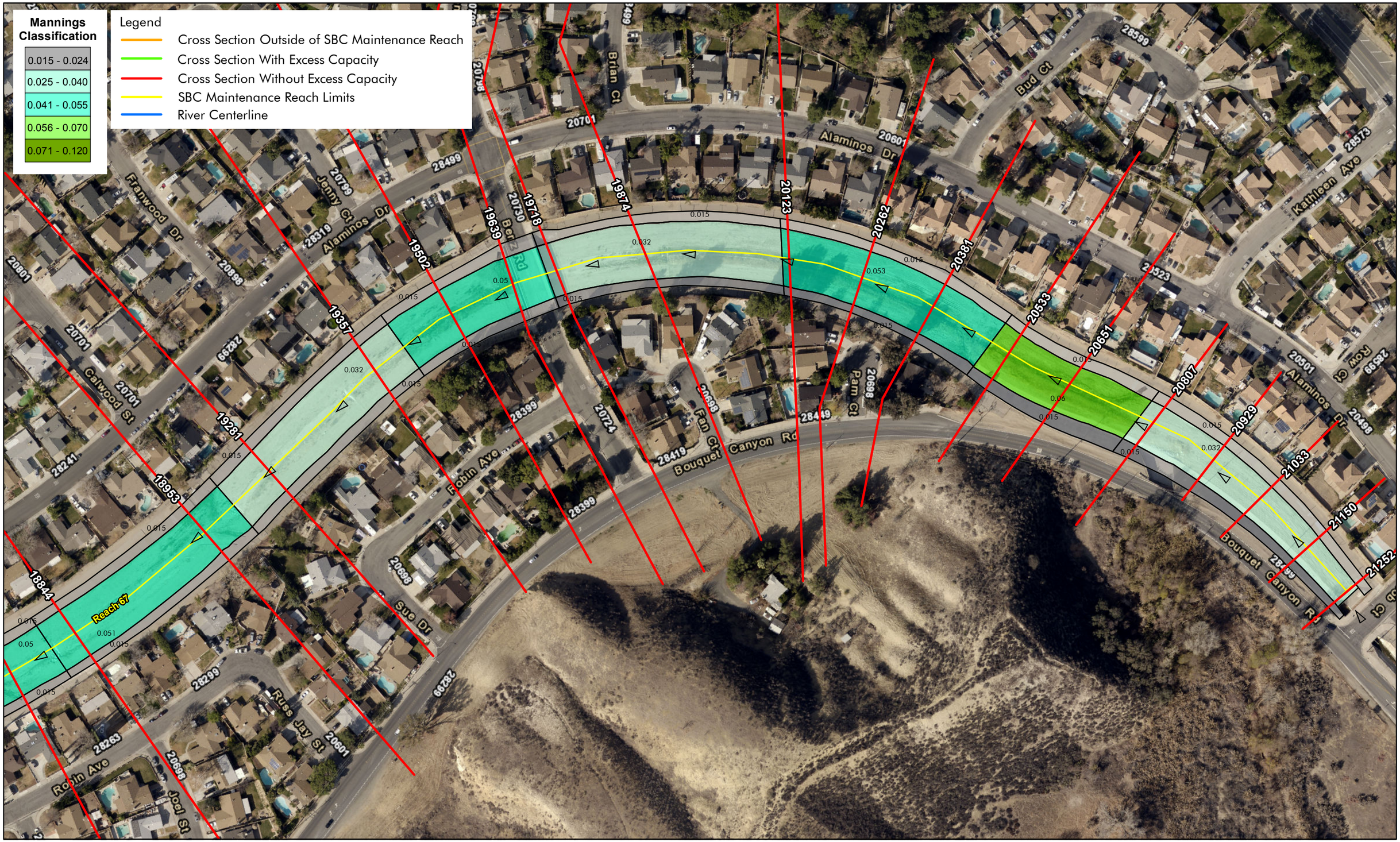
> *Mechanically clear vegetation on a 15-foot wide path along the toe of both levee slopes. At the drainage outlet, mechanically clear woody vegetation from a 10-foot-wide entrainment channel that would extend for 50 feet at a 20-degree angle and involve re-grading roughly 56 cubic yards of sediment. Mechanically clear woody vegetation and re-grade a 20-foot wide low-flow channel through the center of the channel. Mechanically clear all vegetation and remove 3,000 cubic yards of sediment over the grouted riprap (upstream limit to 300 feet downstream). Remove woody vegetation bi-annually and alternately between the grouted riprap and the middle of the length of the channel. Downstream of the grouted riprap, a 20-foot strip of vegetation on both sides of the low-flow channel will remain protected. As vegetation thickens over time in these protected 20-foot strips, the plant removal is allowed in the same footprint in the same manner, but the intensity of removal and regrading of sediment would be lessened. A total of 100 cubic yards of sediment is expected to be re-graded or removed across all activities in the channel annually.*

Based on these recommendations, there will be several zones with varying levels of vegetation throughout the reach. Some zones will be maintained annually, a few areas will be maintained bi-annually and alternately, and the remaining areas will be protected and left undisturbed. A “BonTerra Psomas Recommended” model was created for the recommended conditions by modifying the “Existing Conditions” HEC-RAS model. The revised hydraulic model results show sufficient capacity along the SBC reach to accommodate the BonTerra Psomas recommendations. A summary of excess hydraulic capacity results for existing, design, and recommended conditions is shown in Table 12-7. This recommendation will be a change from the proposed maintenance plan and will need approval from the regulatory agencies.

Table 12-7: Reach 67, 69, 70 & 103 – Additional Analysis Summary

Reach Number	HEC-RAS Station	Required Freeboard (ft)	Excess Freeboard (Hydraulic Capacity)		
			Existing Conditions (ft)	Design Conditions (ft)	BonTerra Recommended (ft)
103	1372	2.5	3.1	3.2	3.2
	1085	2.5	0.0	0.5	0.0
	753	2.5	1.5	4.5	2.0
	521	2.5	6.0	6.8	6.0

Detailed results for the revised hydraulic model, along with backup data for the Manning's n values are provided in Appendix H.


Mannings Classification
0.015 - 0.024
0.025 - 0.040
0.041 - 0.055
0.056 - 0.070
0.071 - 0.120
Legend
Cross Section Outside of SBC Maintenance Reach
Cross Section With Excess Capacity
Cross Section Without Excess Capacity
SBC Maintenance Reach Limits
River Centerline
Brian Ct
Bud Ct
Alaminos Dr
Franwood Dr
Jenny Ct
Kathleen Ave
Calwood St
Pam Ct
Fan Ct
Bouquet Canyon Rd
Robin Ave
Sue Dr
Russ Jay St
Joel St
Reach 67
0.015
0.032
0.05
0.053
0.06
0.051
19639
19718
19874
20123
20262
20381
19502
19357
19281
18953
18844
20533
20651
20807
20929
21033
21150
21252
0 150 300 Feet
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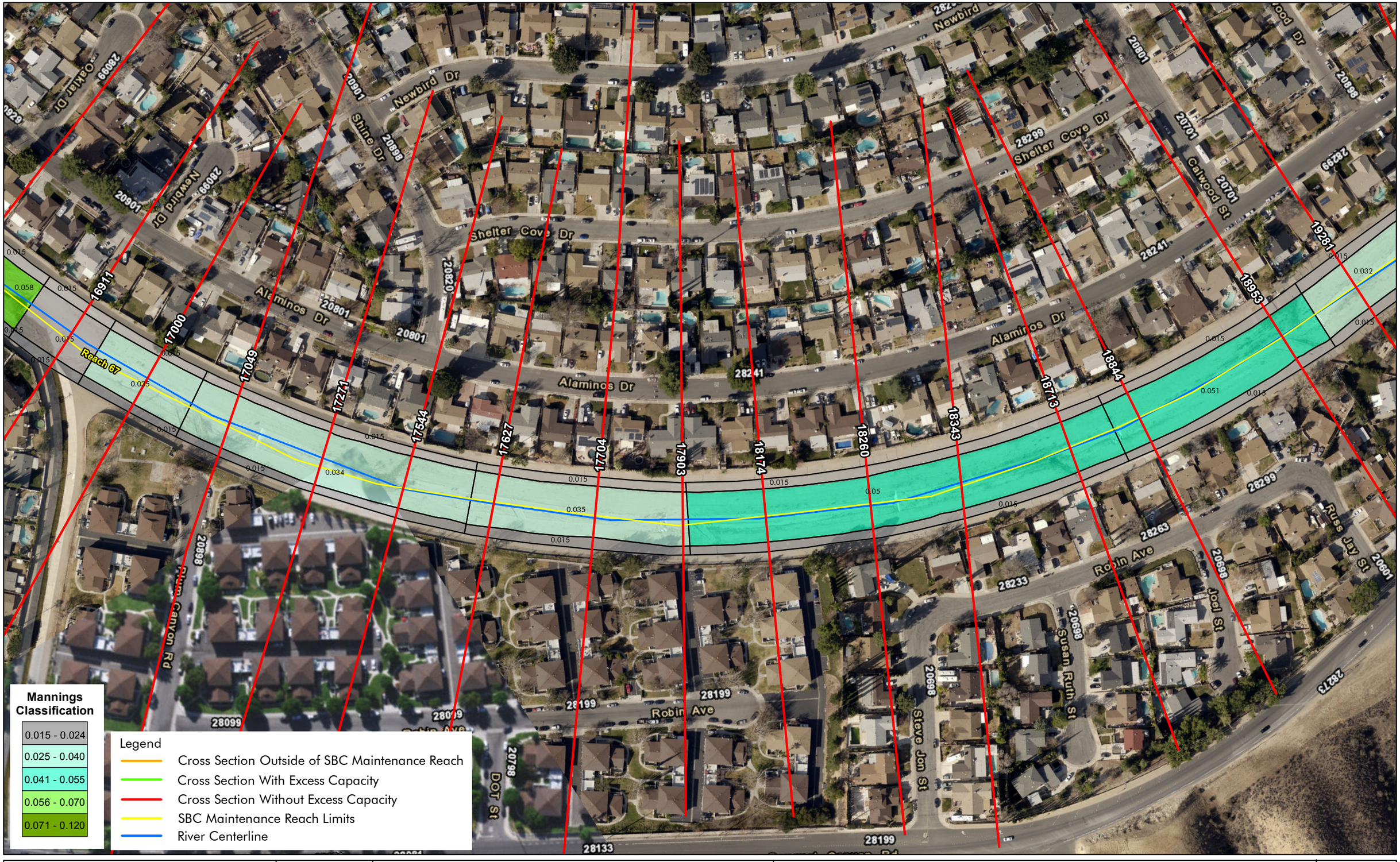
SOFT BOTTOM CHANNEL ANALYSIS
BOUQUET CANYON 67, 69, 70, & 103
EXISTING CAPACITY RESULTS
TITLE
FIGURE
12-2


Newbird Dr
Shelter Cove Dr
Alaminos Dr
Reach 67
Oahar Dr
Shine Dr
Newbird Ct
Calwood St
Rivm Canyon Rd
Robin Ave
Susan Ruth St
Joel St
Russ Jay St
Steve Jon St
DOT St
16911
17000
17049
17271
17544
17627
17704
17903
18174
18260
18343
18713
18844
18953
19281
0.058
0.034
0.035
0.05
0.051
0.032
0.015
Mannings Classification
0.015 - 0.024
0.025 - 0.040
0.041 - 0.055
0.056 - 0.070
0.071 - 0.120
Legend
Cross Section Outside of SBC Maintenance Reach
Cross Section With Excess Capacity
Cross Section Without Excess Capacity
SBC Maintenance Reach Limits
River Centerline
0
150
300
Feet
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SOFT BOTTOM CHANNEL ANALYSIS
BOUQUET CANYON 67, 69, 70, & 103
EXISTING CAPACITY RESULTS
TITLE
FIGURE
12-3


Wintersett Dr
Tothill Dr
Wellston Dr
Cero Dr
Oakiar Dr
Newbird Dr
Alaminos Dr
Kingscrest Dr
Cedarfalls Dr
Parkvale Dr
Larkmain Dr
Pinebank Dr
Honeycomb Dr
Urbandale Ave
21101
21051
21025
21001
20929
20901
21201
21133
21031
20839
20815
20801
28099
27999
27889
27835
15250
15639
15822
15882
16138
16417
16522
16911
17000
15047
14923
14817
14754
0.015
0.064
0.04
0.058
0.035
0.034
0.051
Reach 67
Reach 69
Mannings Classification
0.015 - 0.024
0.025 - 0.040
0.041 - 0.055
0.056 - 0.070
0.071 - 0.120
Legend
Cross Section Outside of SBC Maintenance Reach
Cross Section With Excess Capacity
Cross Section Without Excess Capacity
SBC Maintenance Reach Limits
River Centerline
0
150
300
Feet
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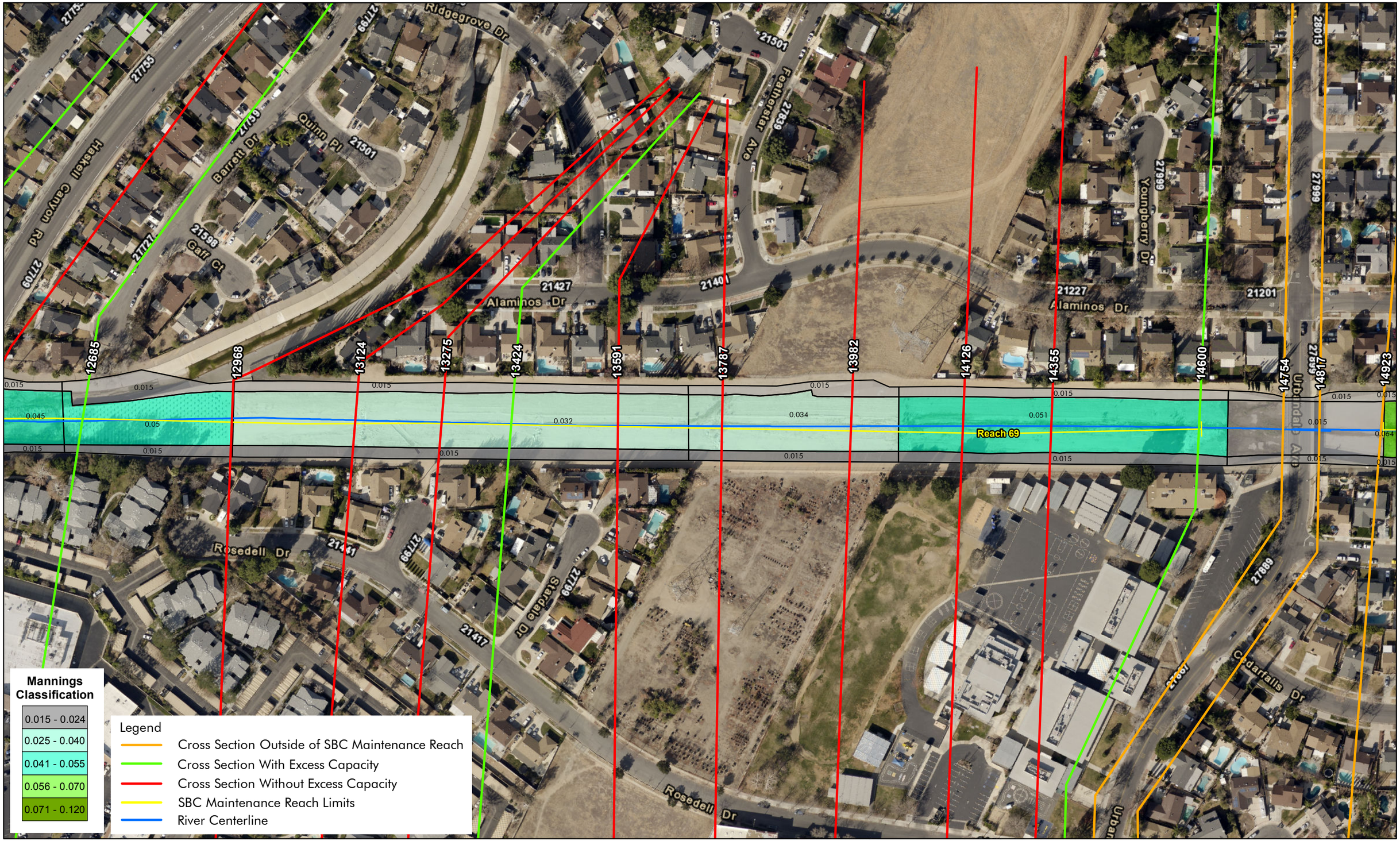
SOFT BOTTOM CHANNEL ANALYSIS
BOUQUET CANYON 67, 69, 70, & 103
EXISTING CAPACITY RESULTS
TITLE
FIGURE
12-4



0 150 300 Feet

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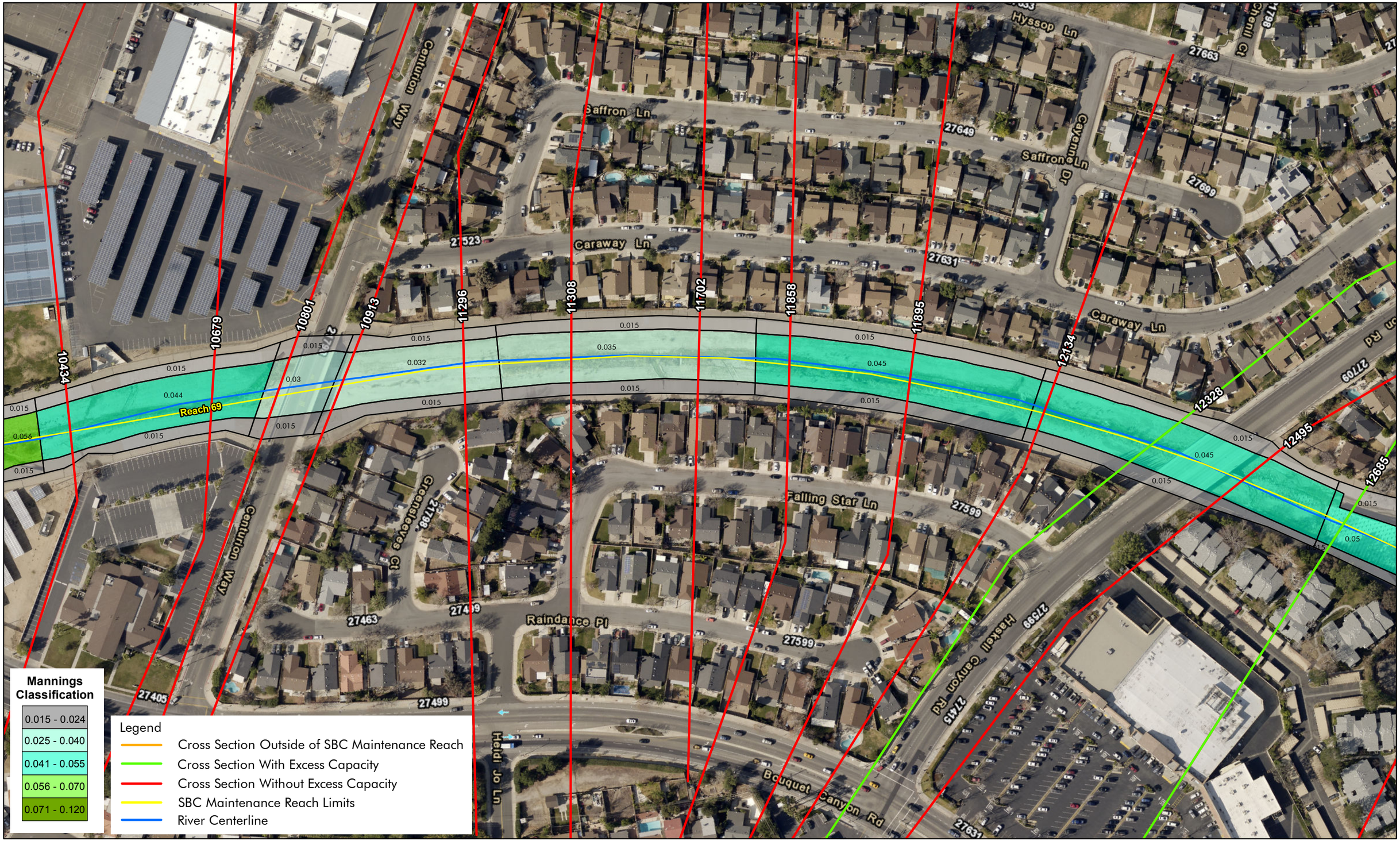
TITLE
BOUQUET CANYON 67, 69, 70, & 103
EXISTING CAPACITY RESULTS

FIGURE
12-5



0 150 300 Feet

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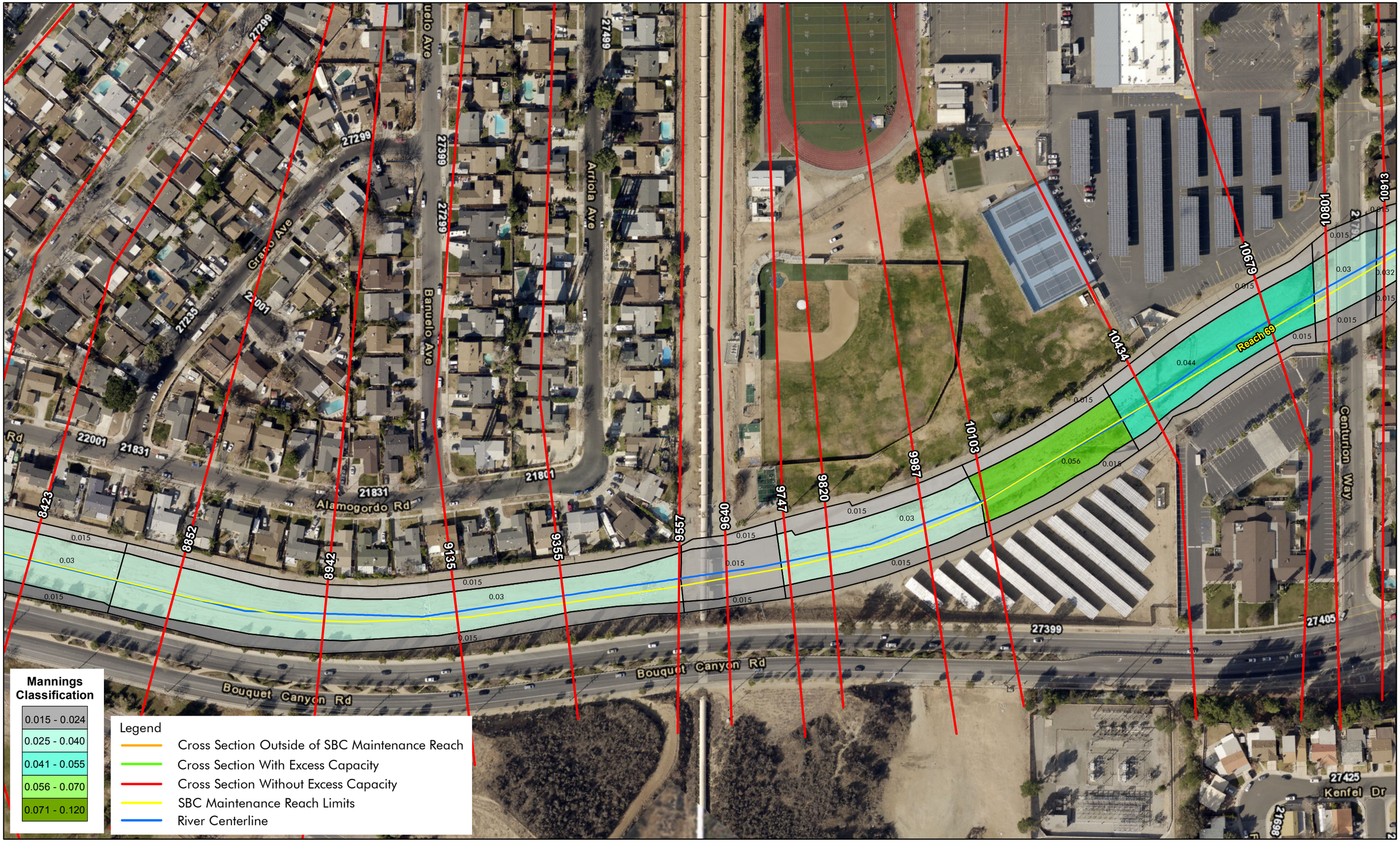
SOFT BOTTOM CHANNEL ANALYSIS

TITLE
BOUQUET CANYON 67, 69, 70, & 103
EXISTING CAPACITY RESULTS

FIGURE
12-6



0 150 300 Feet

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SOFT BOTTOM CHANNEL ANALYSIS

TITLE
BOUQUET CANYON 67, 69, 70, & 103
EXISTING CAPACITY RESULTS

FIGURE
12-7

Mannings Classification

0.015 - 0.024
0.025 - 0.040
0.041 - 0.055
0.056 - 0.070
0.071 - 0.120

Legend

- Cross Section Outside of SBC Maintenance Reach
- Cross Section With Excess Capacity
- Cross Section Without Excess Capacity
- SBC Maintenance Reach Limits
- River Centerline

0 200 400 Feet

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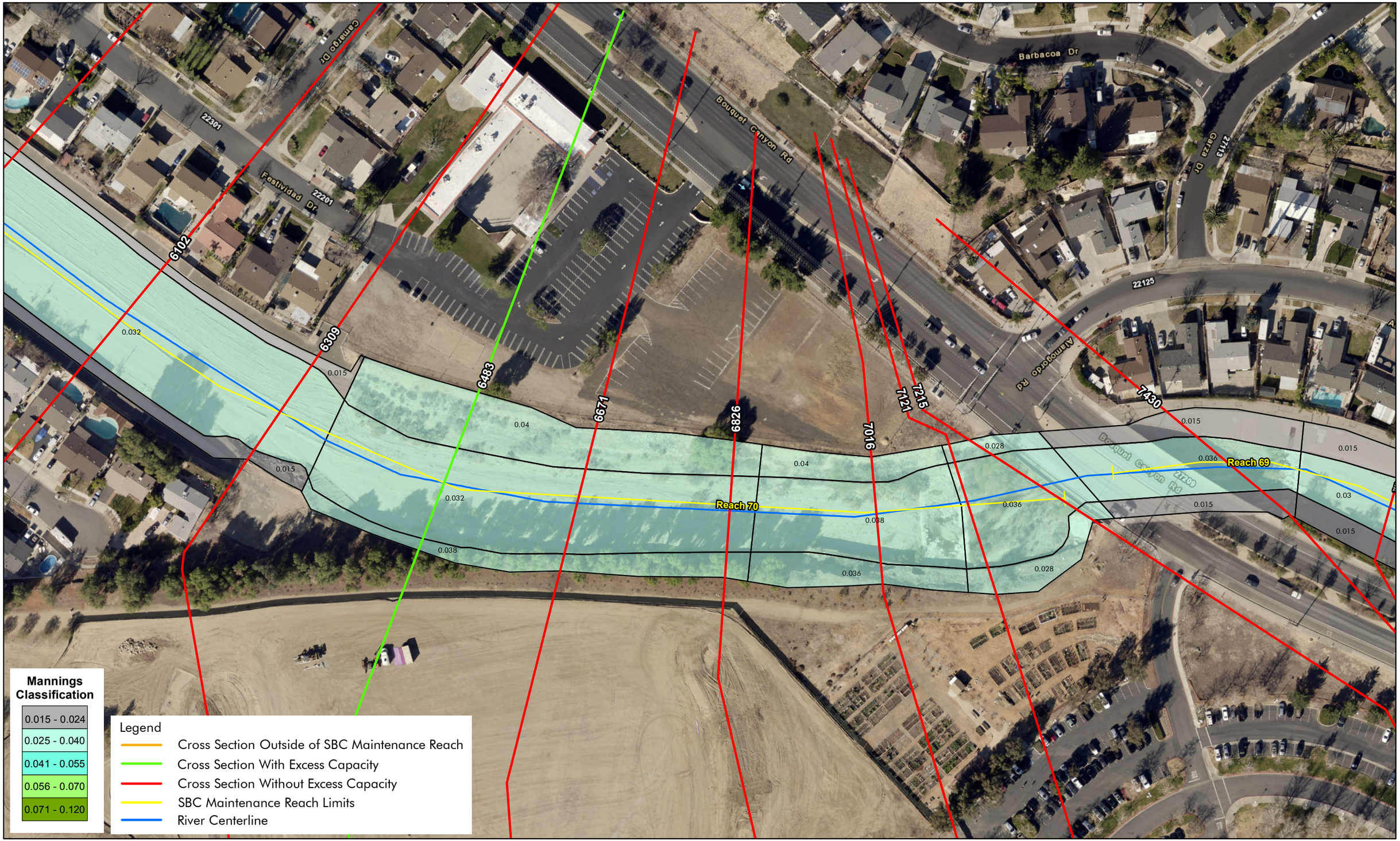
SOFT BOTTOM CHANNEL ANALYSIS

TITLE
BOUQUET CANYON 67, 69, 70, & 103
EXISTING CAPACITY RESULTS

FIGURE
12-8



0 100 200 Feet

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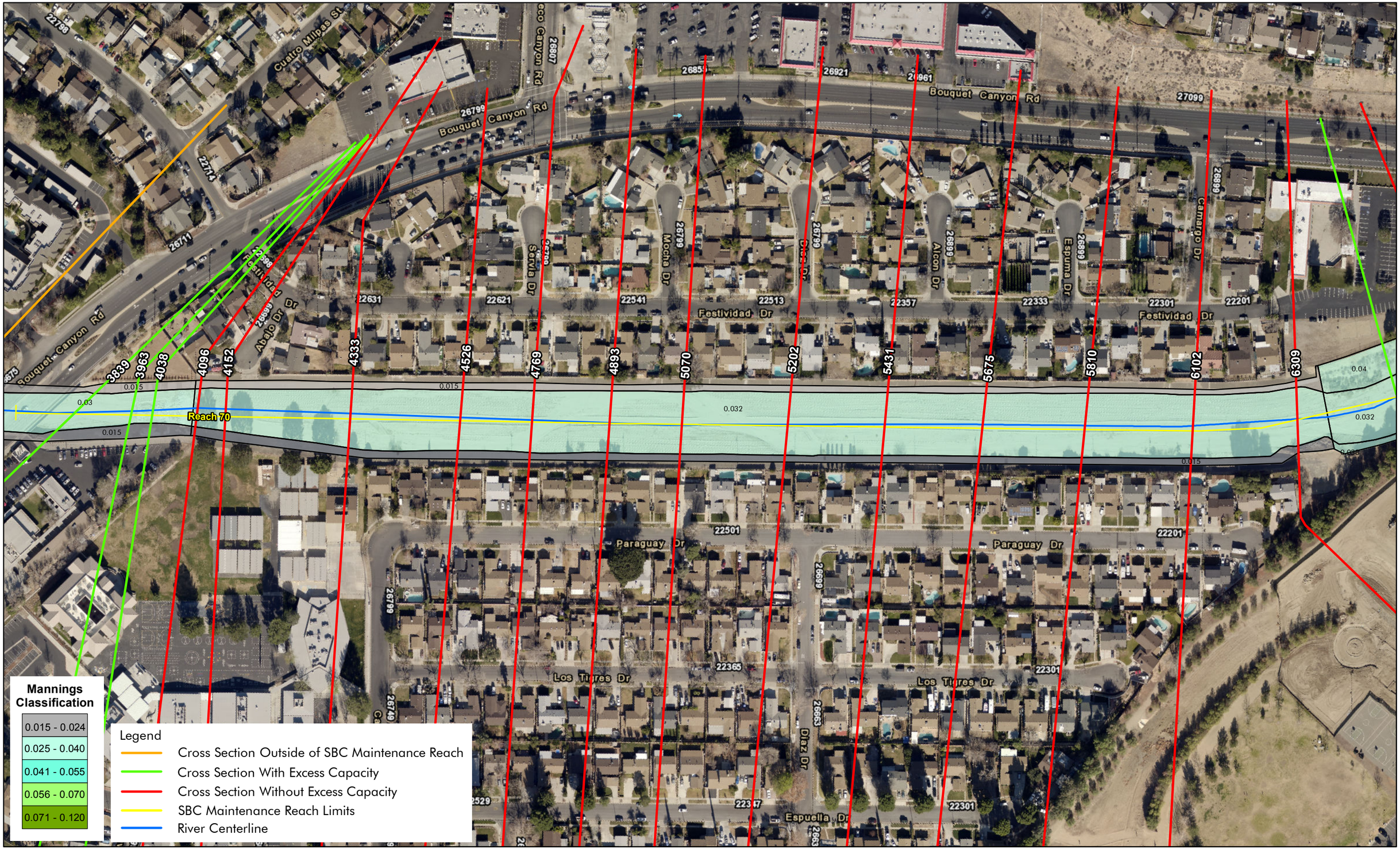
SANTA CLARA RIVER WATERSHED
SOFT BOTTOM CHANNEL ANALYSIS

TITLE

BOUQUET CANYON 67, 69, 70, & 103
EXISTING CAPACITY RESULTS

FIGURE

12-9



0 175 350 Feet

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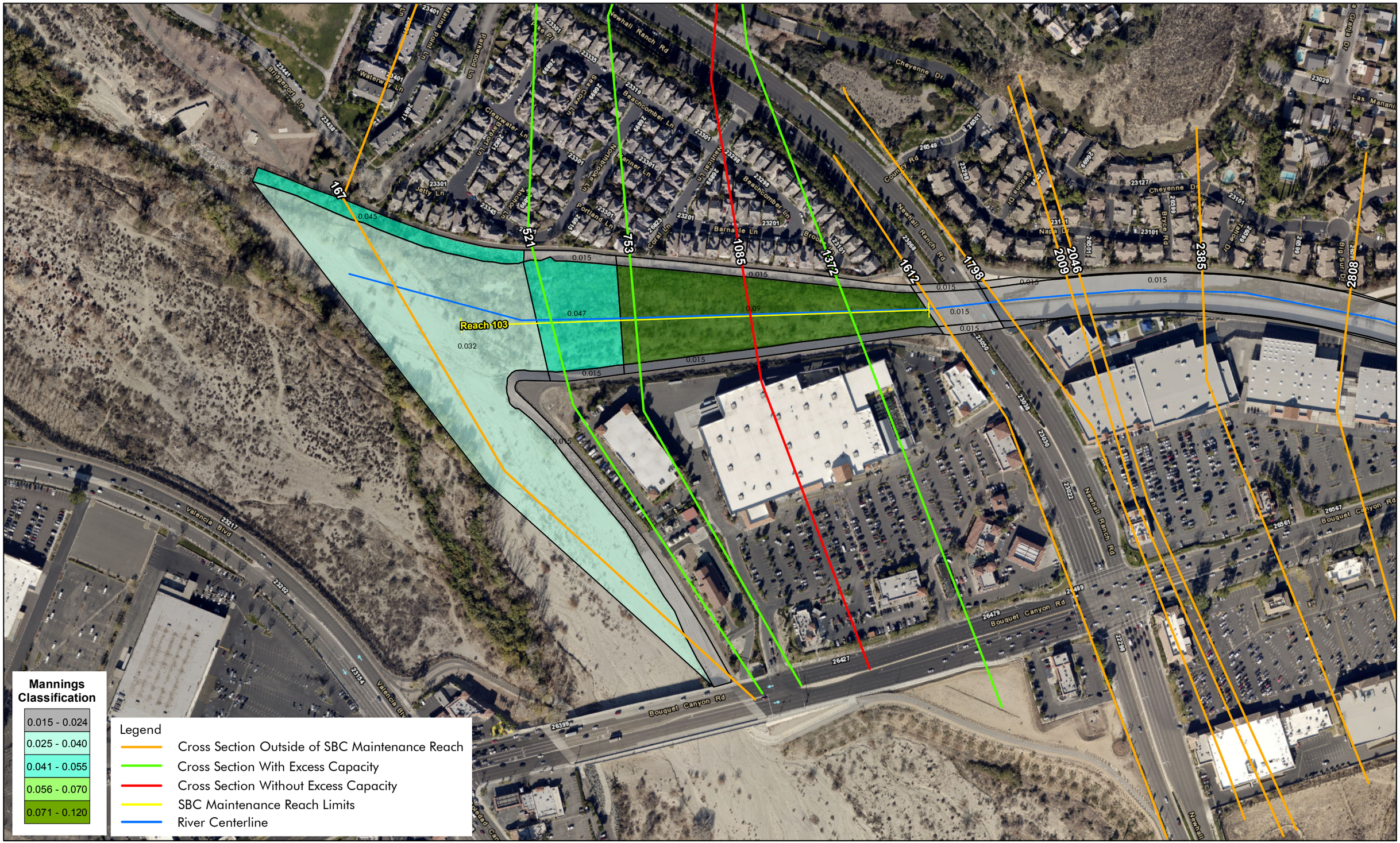
SOFT BOTTOM CHANNEL ANALYSIS

TITLE

BOUQUET CANYON 67, 69, 70, & 103
EXISTING CAPACITY RESULTS

FIGURE

12-10



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SOFT BOTTOM CHANNEL ANALYSIS

TITLE
BOUQUET CANYON 67, 69, 70, & 103
EXISTING CAPACITY RESULTS

FIGURE
12-11

13 South Fork SCR Reach 75

13.1 General Description

South Fork SCR is a tributary to the Santa Clara River. The study reach is nearly 3.1 miles in length, beginning approximately 1,400 feet upstream of Lyons Avenue and ending approximately 600 feet downstream of Magic Mountain Parkway. The surrounding land consists of mostly residential and commercial development with a few areas of brushy open space. The soft-bottom channel reach of interest along South Fork SCR measures 14,075 feet in length. The limits of the SBC reach are illustrated in Figure 13-1.

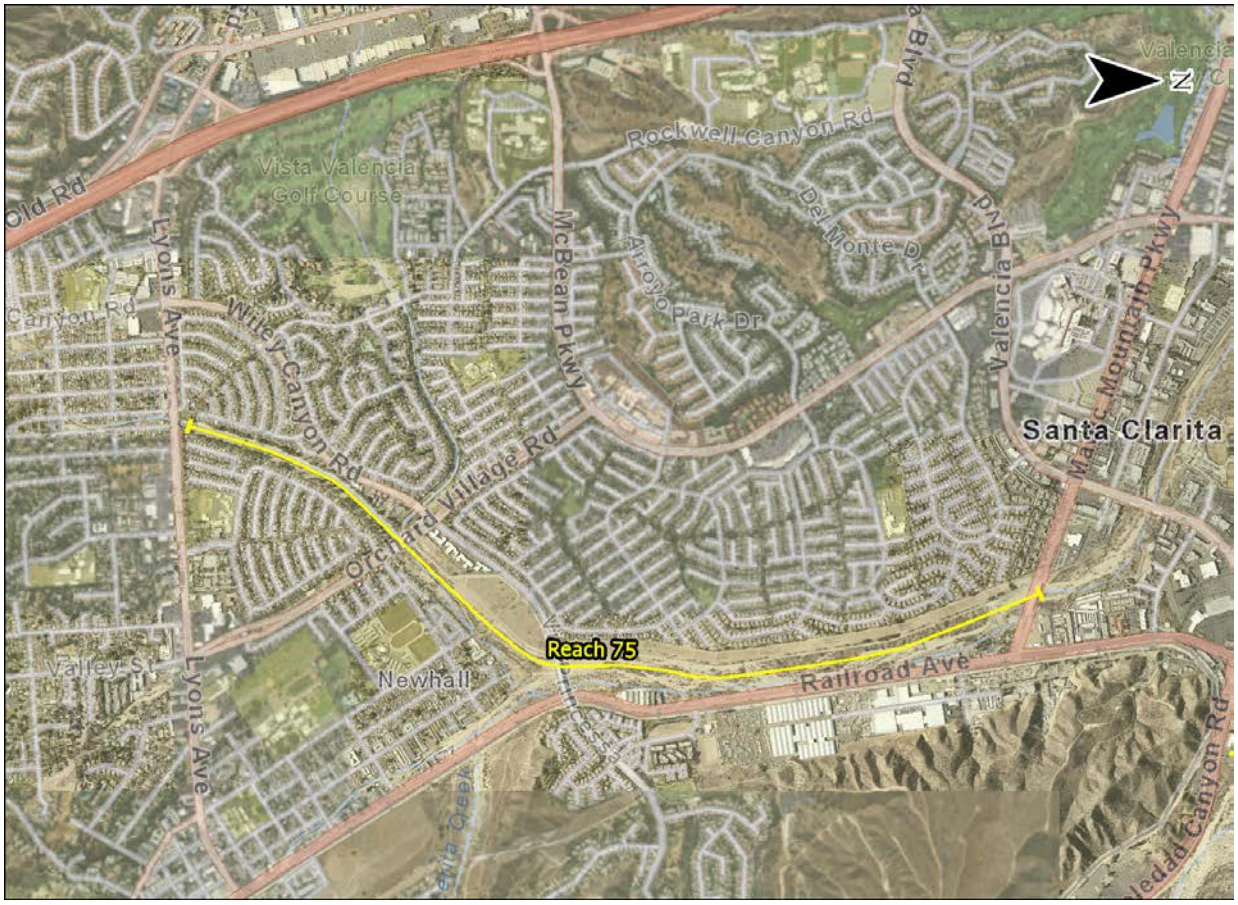


Figure 13-1: Reach 75 – South Fork SCR

13.2 Structures

The reach of interest for South Fork SCR is an engineered, concrete slope-lined channel with an earthen bottom. There are nine structures included in the model for South Fork SCR: one culvert, four bridges, and four inline structures. The structures included in the model are summarized in Table 13-1.

Table 13-1: Reach 75 – South Fork SCR Structures

Structure Number	HEC-RAS Station	Road Name	Type	Description	Structure Model Data Origin
1	20491	Lyons Avenue	Culvert	Box culvert with 2 – 19.5'W x 15'H cells	FEMA model
2	19430	–	Inline Structure	Broad crested weir – 8' width in the direction of flow	FEMA model
3	17559	–	Inline Structure	Broad crested weir – 1' width in the direction of flow	FEMA model
4	16558	Orchard Village Road	Bridge	5 – 1.5' wide, square-nosed pier walls	FEMA model
5	14885	Newhall Ave. Foot-bridge	Bridge	Clear span bridge (no piers)	FEMA model
6	14727	–	Inline Structure	Broad crested weir – 2' width in the direction of flow	FEMA model
7	13489	Wiley Canyon Road	Bridge	5 – 7' wide, square-nosed pier walls	FEMA model
8	7865	–	Inline Structure	Broad crested weir – 1' width in the direction of flow	FEMA model
9	6040	Magic Mountain Parkway	Bridge	2 – 5' wide, square-nosed pier walls	FEMA model

13.3 Manning's Roughness Coefficient

13.3.1 *Existing Conditions Manning's Coefficient*

Photographs documenting the existing channel conditions are provided in Appendix A. The existing conditions Manning's roughness coefficients are summarized in Table 13-2 with backup detail provided in Appendix B.

Table 13-2: Reach 75 – South Fork SCR Existing Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
21922 to 20556	0.015	0.015	0.015
20413 to 20166	0.015	0.050	0.015
20158 to 19724	0.015	0.046	0.015
19599 to 19441	0.015	0.044	0.015
19415 to 19383	0.015	0.064	0.015
19168 to 18496	0.015	0.047	0.015
18474 to 18248	0.015	0.056	0.015

HEC-RAS Station	Left Bank	Main Channel	Right Bank
18056 to 17574	0.015	0.052	0.015
17546 to 17383	0.015	0.040	0.015
17231 to 16899	0.015	0.058	0.015
16735	0.015	0.015	0.015
16690 to 16618	0.015	0.043	0.015
16492 to 15957	0.015	0.075	0.015
15715	0.030	0.042	0.015
15499 to 14987	0.015	0.033 / 0.044 [1]	0.015
14896 to 14867	0.033	0.044	0.015
14846	0.036	0.047	0.015
14802 to 14732	0.015	0.068	0.015
14711	0.015	0.059	0.085
14485 to 14301	0.015	0.069	0.085
14062	0.015	0.054	0.085
13807 to 13592	0.015	0.058	0.015
13365 to 13085	0.015	0.043	0.054
12864 to 12310	0.015	0.057	0.070
12066	0.015	0.061	0.032
11842 to 11678	0.015	0.054	0.032
11556 to 11507	0.015	0.054	0.053
11422 to 10902	0.015	0.050	0.042
10714 to 10602	0.015	0.051	0.015
10374	0.015	0.058	0.047
10095 to 9875	0.015	0.051	0.047
9626 to 8959	0.015	0.074	0.047
8878 to 8452	0.015	0.069	0.066
8224 to 8048	0.015	0.066	0.015
7877 to 7805	0.015	0.056	0.015
7676 to 7501	0.015	0.082	0.015
7354 to 6782	0.015	0.082	0.086
6755 to 6729	0.015	0.047	0.085
6699 to 6105	0.015	0.044	0.038
5927	0.015	0.062	0.037
5666 to 4751	0.042	0.042	0.042

Notes:
[1] *Cross sections 15499 to 14867 contain two channel Manning's n-values, with 0.033 for the left portion of the channel and 0.044 for the right portion of the channel.*

13.3.2 *Design Conditions Manning's Coefficient*

The Manning's roughness values for the design conditions HEC-RAS model are based on information provided in the as-built plans for the engineered channel. The Manning's roughness values used in the design conditions HEC-RAS models are summarized in Table 13-3.

Table 13-3: Reach 75 – South Fork SCR Design Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
20258 to 20166	0.015	0.050	0.015
20158 to 16899	0.015	0.025	0.015
16735	0.015	0.015	0.015
16618 to 16399	0.015	0.025	0.015
16328 to 15957	0.015	0.030	0.015
15715 to 14846	0.030	0.030	0.015
14802 to 14711	0.030	0.015	0.030
14485 to 13807	0.015	0.030	0.030
13592	0.015	0.025	0.025
13365 to 13085	0.015	0.025	0.042
12864 to 11687	0.015	0.025	0.025
11556 to 10902	0.015	0.025	0.042
10714 to 10602	0.015	0.025	0.015
10374 to 8452	0.015	0.025	0.042
8224 to 7501	0.015	0.025	0.015
7354 to 6105	0.015	0.025	0.025
5927	0.015	0.062	0.037

13.4 Hydrology

Design flow rates were obtained from multiple as-built channel design documents available from the LACFCD website: http://dpw.lacounty.gov. The design documents and discharges are summarized in Table 13-4.

Table 13-4: Reach 75 – South Fork SCR Design Flow Rates

Design Document No.	Year	Discharge (cfs)	HEC-RAS Station
PD 725	1966	10,450	21922
PD 725	1966	11,390	19441
PD 725	1966	11,730	19016
PD 725	1966	16,575	16690
PD 1041	1970	16,600	16492
PD 1041	1970	33,000	13807

13.5 Hydraulic Model

The study reach is modeled with 125 cross sections with the majority of cross sections spaced at roughly 150-foot intervals. The cross sections are cut using 2006 LIDAR topographic data provided by LACDPW. The cross section locations and SBC reach extents are presented in Figures 13-2 through 13-7.

Cross section spacing was chosen to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. Additional cross-sections were incorporated into the model (as needed) at transitional areas and sharp bends to better represent the conditions in these portions of the channel. The hydraulic model was run under "mixed flow" conditions so that potential areas of supercritical flow were adequately modeled. HEC-RAS input and output files are provided in Appendix E.

13.6 Boundary Conditions

The model consists of three sub-reaches with a junction where South Fork SCR confluences with the Santa Clara River. At the upstream and downstream extents of the model, normal depth is used as the boundary condition. The value of normal depth is estimated as the channel bed slope. Interior boundary conditions (i.e. at the junction) are automatically generated by HEC-RAS from the junction hydraulics. The boundary conditions are summarized in Table 13-5.

Table 13-5: Reach 75 – South Fork SCR Boundary Conditions

Sub-reach	Upstream Boundary Condition	Downstream Boundary Condition
SForkSantaClara – 1	Normal Depth – S = 0.007	Junction
SForkSantaClara – 2	Junction	Normal Depth – S = 0.004
SForkSantaClaraTrib – 1	Normal Depth – S = 0.006	Junction

13.7 Results

The water surface elevation from the existing conditions model is used to calculate freeboard at each cross section within the SBC reach. The existing conditions freeboard is compared to the required freeboard to determine whether there is excess freeboard (hydraulic capacity) at the cross section. Results of the freeboard calculations and capacity determination for each cross section are presented in Table 13-6, and in Figures 13-2 through 13-7. A detailed summary of these results is provided in Appendix C.

Table 13-6: Reach 75 – South Fork SCR Excess Capacity Determination

HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
20258	2.5	1.3	0.0	No
20166	2.5	1.1	0.0	No
20158	2.5	1.0	0.0	No
20046	2.5	0.4	0.0	No
19837	2.5	-0.3	0.0	No
19724	2.5	-1.1	0.0	No
19599	2.5	-1.8	0.0	No
19466	2.5	-1.6	0.0	No
19441	2.5	-2.5	0.0	No
19415	2.5	0.5	0.0	No
19383	2.5	0.1	0.0	No
19168	2.5	0.0	0.0	No
19016	2.5	1.0	0.0	No
18824	2.5	1.2	0.0	No

HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
18651	2.5	1.5	0.0	No
18524	2.5	1.8	0.0	No
18496	2.5	2.2	0.0	No
18474	2.5	1.8	0.0	No
18443	2.5	1.7	0.0	No
18248	2.5	0.7	0.0	No
18056	2.5	0.2	0.0	No
17955	2.5	0.2	0.0	No
17856	2.5	0.3	0.0	No
17790	2.5	0.4	0.0	No
17728	2.5	-0.1	0.0	No
17689	2.5	0.3	0.0	No
17654	2.5	-0.3	0.0	No
17633	2.5	0.2	0.0	No
17602	2.5	-0.6	0.0	No
17574	2.5	0.1	0.0	No
17546	2.5	1.4	0.0	No
17524	2.5	1.3	0.0	No
17383	2.5	0.5	0.0	No
17231	2.5	0.5	0.0	No
17060	2.5	0.7	0.0	No
16899	2.5	0.0	0.0	No
16735	2.5	-0.8	0.0	No
16690	2.5	0.3	0.0	No
16648	2.5	2.9	0.4	Yes
16618	2.5	4.8	2.3	Yes
16492	2.5	5.8	3.3	Yes
16428	2.5	1.4	0.0	No
16399	2.5	0.0	0.0	No
16328	2.5	-1.2	0.0	No
16108	2.5	-2.0	0.0	No
15957	2.5	-1.8	0.0	No
15715	2.5	-1.7	0.0	No
15499	2.5	1.0	0.0	No
15282	2.5	0.4	0.0	No
15108	2.5	1.0	0.0	No
14987	2.5	2.6	0.1	Yes
14896	2.5	0.9	0.0	No
14867	2.5	0.1	0.0	No
14846	2.5	0.7	0.0	No

HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
14802	2.5	2.8	0.3	Yes
14732	2.5	1.4	0.0	No
14711	2.5	1.0	0.0	No
14485	2.5	2.3	0.0	No
14301	2.5	2.9	0.4	Yes
14062	2.5	1.7	0.0	No
13807	2.5	1.3	0.0	No
13592	2.5	-0.5	0.0	No
13365	2.5	1.2	0.0	No
13085	2.6	-0.1	0.0	No
12864	2.7	-0.6	0.0	No
12581	2.8	-0.7	0.0	No
12310	2.8	-0.9	0.0	No
12066	2.8	-0.4	0.0	No
11842	2.8	-0.4	0.0	No
11678	2.8	-0.7	0.0	No
11556	2.8	0.3	0.0	No
11507	2.8	0.2	0.0	No
11422	2.8	0.0	0.0	No
11377	2.8	0.1	0.0	No
11108	2.8	-0.1	0.0	No
10902	2.8	0.6	0.0	No
10714	2.8	0.7	0.0	No
10602	2.8	0.0	0.0	No
10374	2.7	-0.4	0.0	No
10095	2.6	-0.8	0.0	No
9875	2.5	-1.5	0.0	No
9626	2.5	-1.9	0.0	No
9321	3.7	-0.7	0.0	No
9141	3.5	-0.8	0.0	No
8959	3.3	-1.4	0.0	No
8878	3.2	-0.9	0.0	No
8657	2.9	-1.6	0.0	No
8552	2.7	-2.4	0.0	No
8452	2.6	-2.6	0.0	No
8224	2.5	-2.3	0.0	No
8048	2.5	-0.7	0.0	No
7877	2.5	-1.4	0.0	No
7849	2.5	-2.0	0.0	No
7837	2.5	-2.1	0.0	No

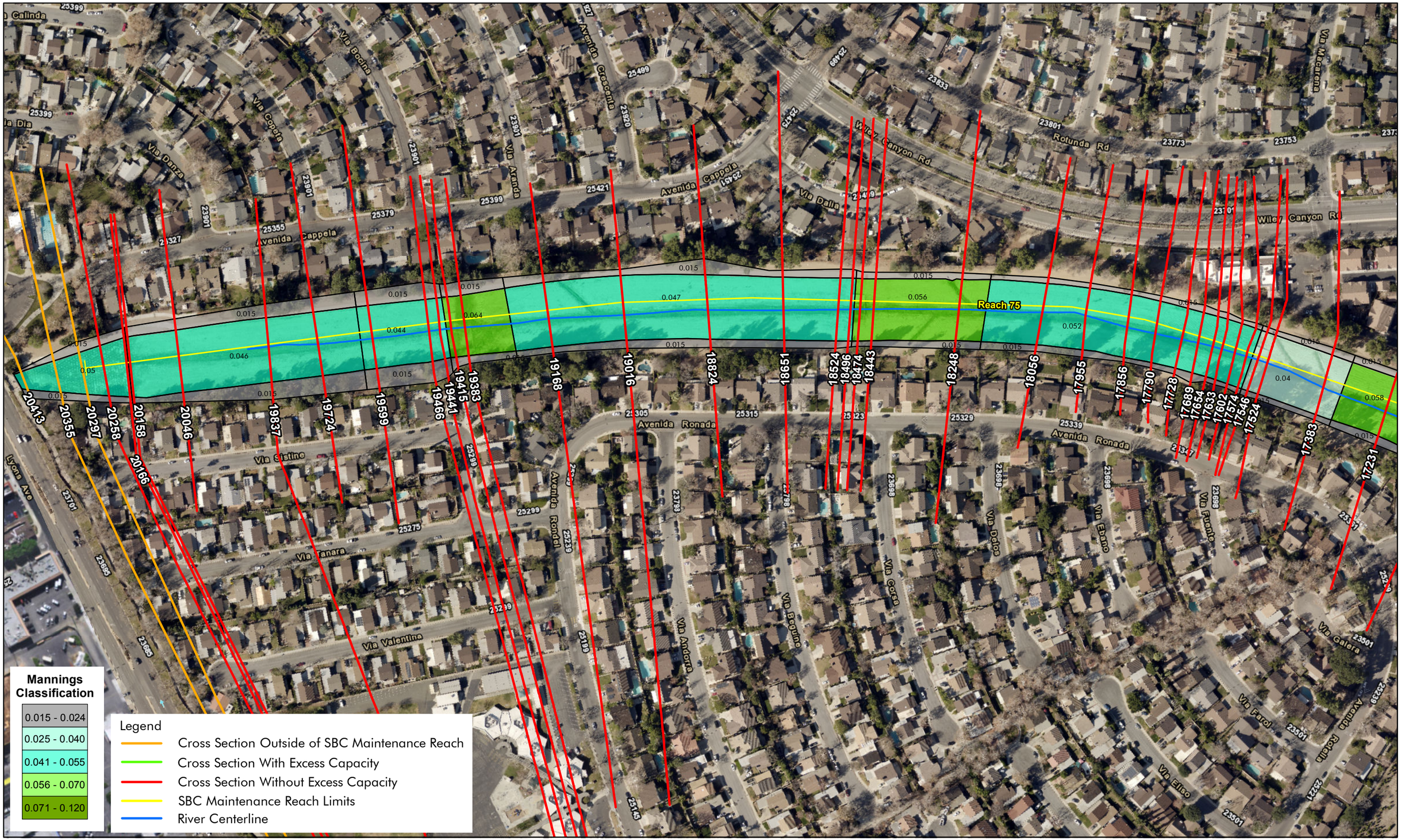
HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
7805	2.5	-1.9	0.0	No
7676	2.5	-1.4	0.0	No
7501	2.5	-1.6	0.0	No
7354	2.5	-2.1	0.0	No
7199	2.5	-3.4	0.0	No
7090	2.5	-3.4	0.0	No
6908	2.5	-3.6	0.0	No
6782	2.5	1.2	0.0	No
6755*	2.5	4.5	2.0	No*
6729*	2.5	7.2	4.7	No*
6699	2.5	-0.4	0.0	No
6548	2.5	1.2	0.0	No
6347	2.5	4.5	2.0	Yes
6263	2.5	7.0	4.5	Yes
6105	2.5	9.7	7.2	Yes

Notes:

The cross sections indicated with an asterisk (*) have excess freeboard (hydraulic capacity), but do not have capacity for additional vegetation because they are located in segments of the channel with hard bottom (concrete, rip-rap).

13.8 Additional Analysis

Reach 75 does not have excess hydraulic capacity under the existing conditions scenario for a majority of the SBC reach. The design conditions scenario was also reviewed. This reach has partial excess capacity under design conditions. However, the portions identified with excess capacity were predominately segmented and sporadic or are hard bottom. Therefore, no additional analysis was performed.



0 200 400 Feet

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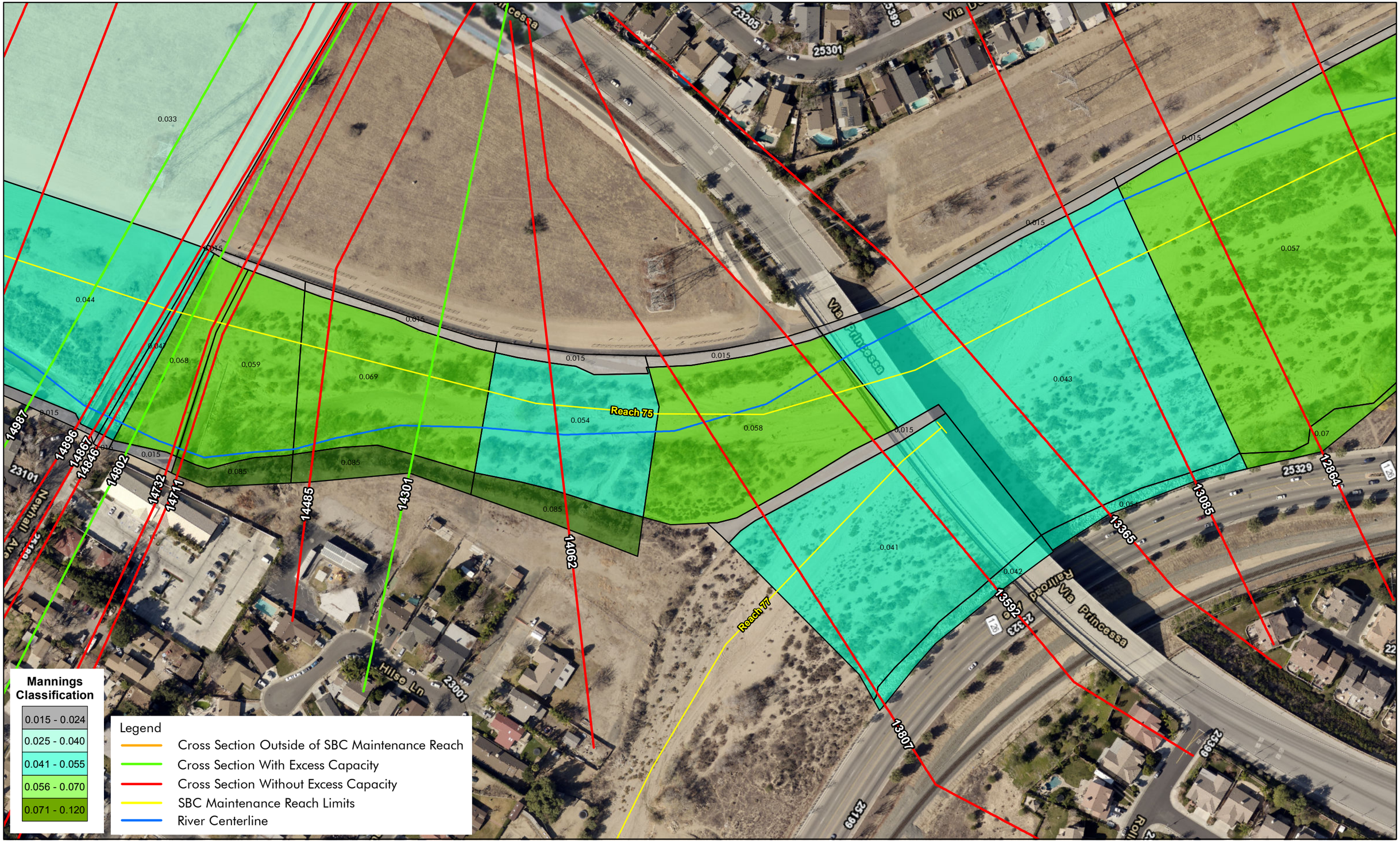
SANTA CLARA RIVER WATERSHED
SOFT BOTTOM CHANNEL ANALYSIS

TITLE
SOUTH FORK 75
EXISTING CAPACITY RESULTS

FIGURE
13-2


Reach 76
Reach 75
16690
16648
17524
17383
17231
17060
16899
16735
16618
16492
16428
16399
16328
16108
15957
15715
15499
15282
15108
14987
14896
14867
14846
14802
14732
14711
Orchard Village Rd
Avenida Fresca
Via Rana
Via Barra
Wiley Canyon Rd
Via Alcira
Via Macarena
Rotunda Rd
Avenida Ronada
Via Pueblo
Tristin Dr
16th St
Via Hispano
Yvette Ln
Kimmore Ter
Kelvis Ln
Via Pacifica
0.033
0.03
0.042
0.044
0.075
0.043
0.058
0.052
0.04
0.059
0.068
0.085
0.032
0.015
Mannings Classification
0.015 - 0.024
0.025 - 0.040
0.041 - 0.055
0.056 - 0.070
0.071 - 0.120
Legend
Cross Section Outside of SBC Maintenance Reach
Cross Section With Excess Capacity
Cross Section Without Excess Capacity
SBC Maintenance Reach Limits
River Centerline
0
200
400
Feet
PACE
Advanced Water Engineering
LACDPW
SANTA CLARA RIVER WATERSHED
SOFT BOTTOM CHANNEL ANALYSIS
SOUTH FORK 75
EXISTING CAPACITY RESULTS
TITLE
FIGURE
13-3



0 150 300 Feet

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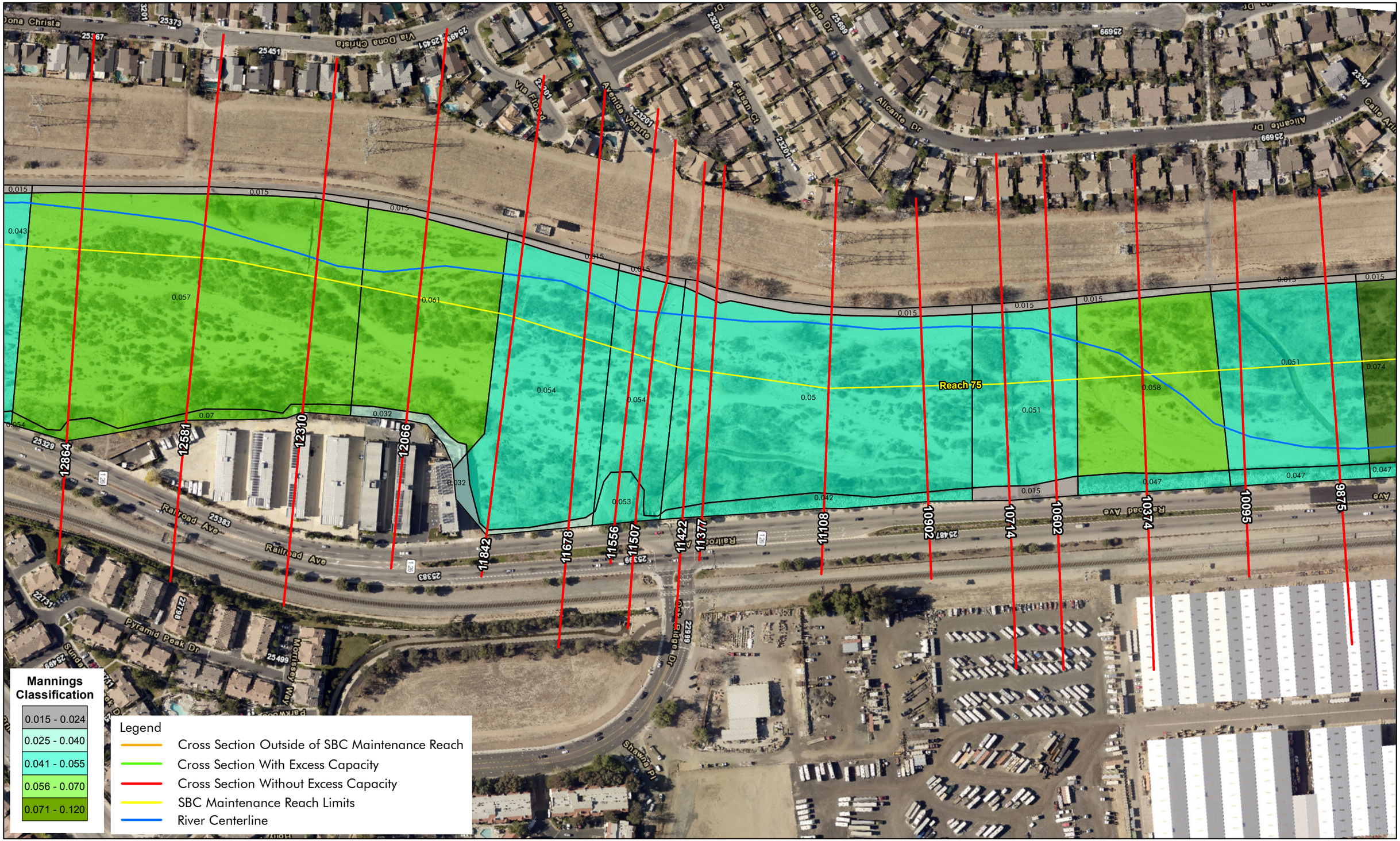
SANTA CLARA RIVER WATERSHED
SOFT BOTTOM CHANNEL ANALYSIS

TITLE
SOUTH FORK 75
EXISTING CAPACITY RESULTS

FIGURE
13-4



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SOFT BOTTOM CHANNEL ANALYSIS

TITLE
SOUTH FORK 75
EXISTING CAPACITY RESULTS

FIGURE
13-5

Covala Ct

Railroad Ave

Railroad Ave

Los Angeles County Metropolitan Tra

Reach 75

0.015
0.051
0.074
0.047
0.069
0.066
0.056
0.082
0.086

9626
9321
9141
8959
8878
8657
8552
8452
8224
8048
7877
7849
7837
7805
7676
7601

Mannings Classification

0.015 - 0.024
0.025 - 0.040
0.041 - 0.055
0.056 - 0.070
0.071 - 0.120

Legend

- Cross Section Outside of SBC Maintenance Reach
- Cross Section With Excess Capacity
- Cross Section Without Excess Capacity
- SBC Maintenance Reach Limits
- River Centerline

0 150 300 Feet

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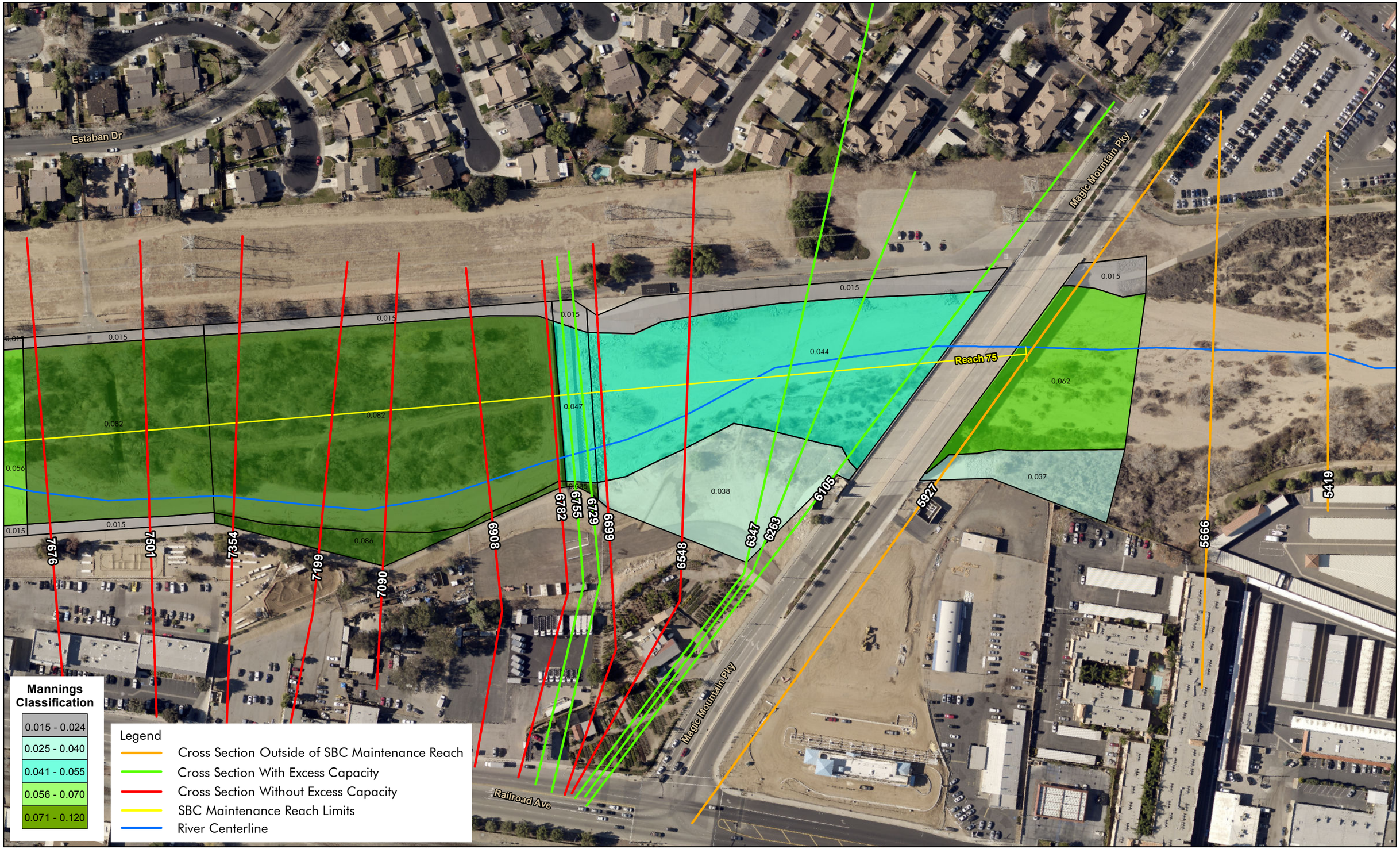
SANTA CLARA RIVER WATERSHED
SOFT BOTTOM CHANNEL ANALYSIS

TITLE
SOUTH FORK 75
EXISTING CAPACITY RESULTS

FIGURE
13-6



0 150 300 Feet

PACE Advanced Water Engineering

LACDPW
SANTA CLARA RIVER WATERSHED
SOFT BOTTOM CHANNEL ANALYSIS

TITLE
SOUTH FORK 75
EXISTING CAPACITY RESULTS

FIGURE
13-7

14 South Fork SCR (Valencia Blvd. Bridge Stabilizer) Reach 79

14.1 General Description

The reach of interest along SCR South Fork is located immediately downstream of Valencia Blvd Bridge. The study reach is nearly 2,000 feet in length, extending approximately 1,000 feet upstream and 900 feet downstream of Valencia Blvd. The surrounding land consists of commercial development and a few areas of brushy open space. The soft-bottom channel reach of interest along South Fork SCR measures 176 feet in length. This portion of the channel is the stabilizer for Valencia Blvd Bridge. The limits of the SBC reach are illustrated in Figure 14-1.

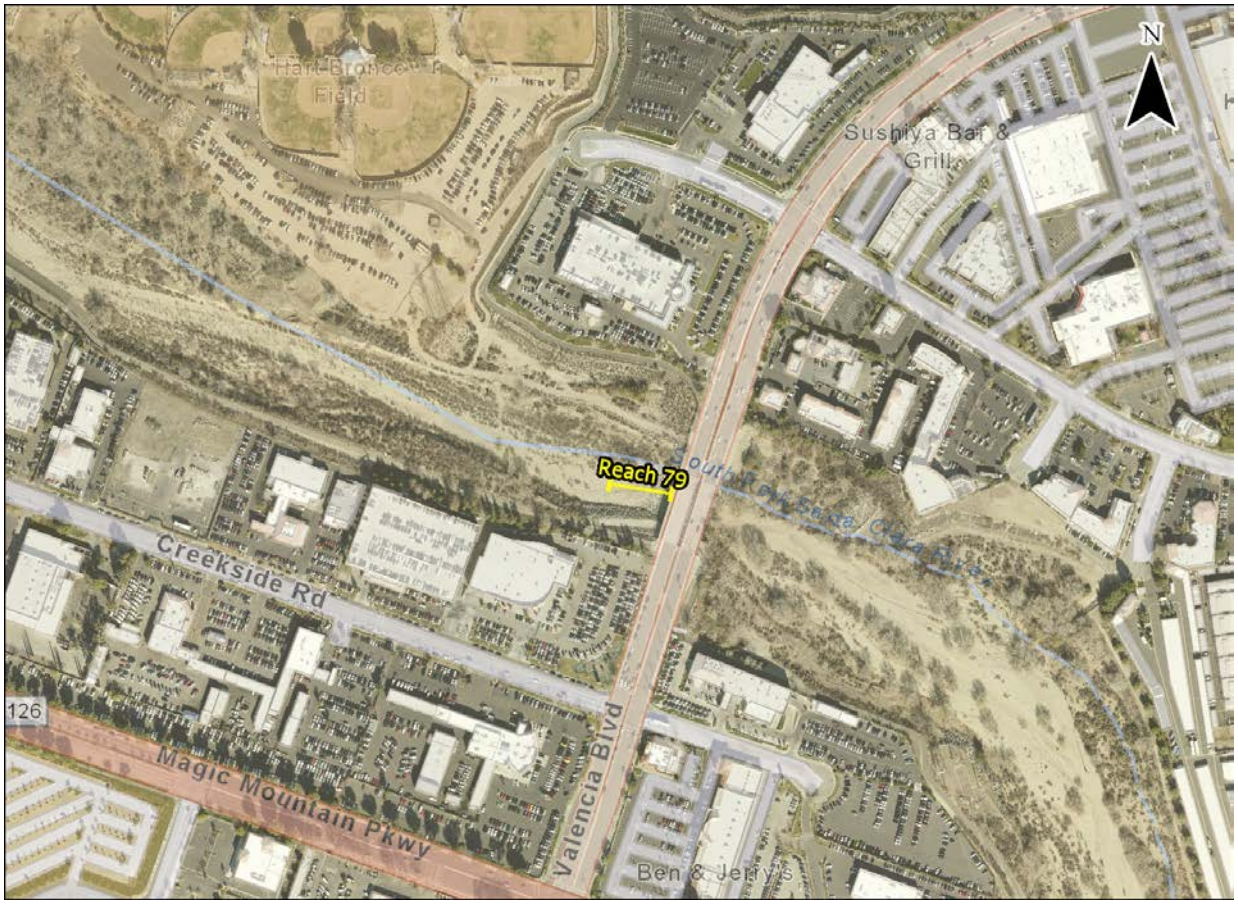


Figure 14-1: Reach 79 – South Fork SCR (Valencia Blvd. Bridge Stabilizer)

14.2 Structures

The reach of interest for the SCR South Fork is an engineered, grouted-rock stabilizer that separates the natural, earthen portions of the channel located upstream and downstream of the stabilizer. The structures included in the model are summarized in Table 14-1.

Table 14-1: Reach 79 – South Fork SCR Structures

Structure Number	HEC-RAS Station	Road Name	Type	Description	Structure Model Data Origin
1	3379	Valencia Boulevard	Bridge	2 – 1.5' wide, square-nosed pier walls	FEMA model

14.3 Manning's Roughness Coefficient

14.3.1 *Existing Conditions Manning's Coefficient*

Photographs documenting the existing channel conditions are provided in Appendix A. The existing conditions Manning's roughness coefficients are summarized in Table 14-2 with backup detail provided in Appendix B.

Table 14-2: Reach 79 – South Fork SCR Existing Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
4401 to 3640	0.042	0.042	0.042
3473	0.045	0.041	0.059
3285	0.040	0.040	0.040
3245 to 3090	0.040	0.038	0.045
2905	0.053	0.036	0.041
2775 to 2641	0.054	0.039	0.036

14.3.2 *Design Conditions Manning's Coefficient*

The Manning's roughness values for the design conditions HEC-RAS model are based on information provided in the as-built plans for the engineered channel. The Manning's roughness values used in the design conditions HEC-RAS models are summarized in Table 14-3.

Table 14-3: Reach 79 – South Fork SCR Design Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
3285 to 3166	0.035	0.035	0.035

14.4 Hydrology

Design flow rates were obtained from Dwg. 337-D27.1-D27.7 as-built channel design documents available from the LACFCD website: http://dpw.lacounty.gov. The design documents and discharges are summarized in Table 14-4.

Table 14-4: Reach 79 – South Fork SCR (Valencia Bridge Stabilizer) Design Flow Rates

Design Document No.	Year	Discharge (cfs)	HEC-RAS Station
Dwg 337-D27.1-D27.7	1992	57,200	4401

14.5 Hydraulic Model

The study reach is modeled with 12 cross sections with the majority of cross sections spaced at roughly 150-foot intervals. The cross sections are cut using 2006 LIDAR topographic data provided by LACDPW. The cross section locations and SBC reach extents are presented in Figure 14-2.

Cross section spacing was chosen to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. The spacing between cross sections near the drop structure was reduced to a minimum of 40 feet to better represent the geometry of the structure. The hydraulic model was run under "mixed flow" conditions so that potential areas of supercritical flow were adequately modeled. HEC-RAS input and output files are provided in Appendix E.

14.6 Boundary Conditions

The model consists of three sub-reaches with a junction where South Fork SCR confluences with the Santa Clara River. At the upstream and downstream extents of the model, normal depth is used as the boundary condition. The value of normal depth is estimated as the channel bed slope. Interior boundary conditions (i.e. at the junction) are automatically generated by HEC-RAS from the junction hydraulics. The boundary conditions are summarized in Table 14-5.

Table 14-5: Reach 79 – South Fork SCR Boundary Conditions

Sub-reach	Upstream Boundary Condition	Downstream Boundary Condition
SCR – 1	Normal Depth – S = 0.007	Junction
SCR – 2	Junction	Normal Depth – S = 0.007
South Fork – 1	Normal Depth – S = 0.005	Junction

14.7 Results

The water surface elevation from the existing conditions model is used to calculate freeboard at each cross section within the SBC reach. The existing conditions freeboard is compared to the required freeboard to determine whether there is excess freeboard (hydraulic capacity) at the cross section. Results of the freeboard calculations and capacity determination for each cross section are presented in Table 14-6, and in Figure 14-2. A detailed summary of these results are provided in Appendix C. The reach is located in an area that is constructed with grouted rip-rap and the capacity of the channel is deficient outside of the SBC reach.

Table 14-6: Reach 79 – South Fork SCR Excess Capacity Determination

HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
4401**	2.5	-0.8	0.0	No
3955**	2.5	1.6	0.0	No
3776**	2.5	-0.6	0.0	No
3640**	2.5	-1.5	0.0	No
3473**	2.5	-1.9	0.0	No
3285*	2.5	4.0	1.5	No*
3245	2.5	11.2	8.7	Yes
3166	2.5	5.8	3.3	Yes
3090**	2.5	-2.0	0.0	No
2905**	2.5	-2.9	0.0	No

HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
2775**	2.5	-3.6	0.0	No
2641**	2.5	-4.5	0.0	No

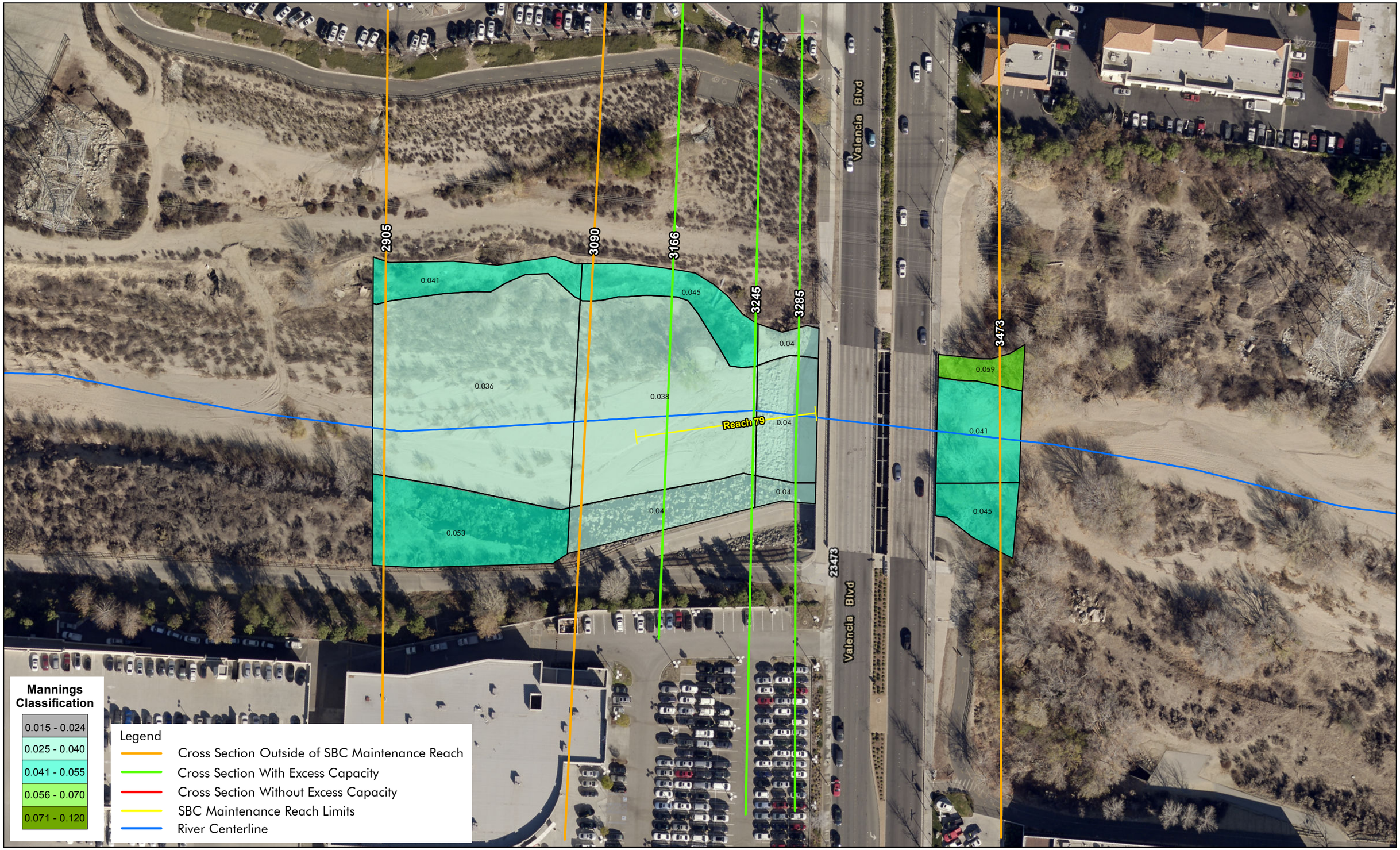
Notes:

The cross sections indicated with an asterisk (*) have excess freeboard (hydraulic capacity), but do not have capacity for additional vegetation because they are located in segments of the channel with hard bottom (concrete, rip-rap).

Reach 79 is located between Sta. 3285 & 3166. Stations indicated with double asterisks (**) are located outside of the SBC reach and are included to show upstream and downstream locations do not have excess capacity within the channel.

14.8 Additional Analysis

Reach 79 has partial excess capacity under the existing and design condition scenarios; however, this segment of the channel is in the location of the bridge stabilizer structure where vegetation cannot be planted. Furthermore, the segments of the channel located upstream and downstream of Reach 79 do not have excess capacity and adding vegetation could adversely affect the functionality of the stabilizer structure and the hydraulics through the bridge. Therefore, no additional analysis was performed.



0 80 160 Feet

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SOFT BOTTOM CHANNEL ANALYSIS

TITLE

SOUTH FORK VALENCIA STABILIZER 79
EXISTING CAPACITY RESULTS

FIGURE

14-2

15 Castaic Old Road Drain Outlet Reach 87

15.1 General Description

The Old Road Drain Outlet is a minor tributary to Castaic Creek. The outlet is located north of Castaic Creek and west of The Old Road. The study reach is nearly 500 feet in length, extending from the outlet at The Old Road to its confluence with Castaic Creek and continues 300 feet downstream of this point. The surrounding land consists of commercial development and areas of brushy open space. The soft-bottom reach of interest along Castaic Old Road Drain Outlet measures 225 feet. The limits of the SBC reach are illustrated in Figure 15-1.

Figure 15-1: Reach 87 – Castaic Old Road Drain Outlet

15.2 Structures

The reach of interest for The Old Road Drainage Outlet is an engineered, rip-rap slope-lined channel with an earthen bottom. There are no additional structures located in this SBC reach.

15.3 Manning's Roughness Coefficient

15.3.1 *Existing Conditions Manning's Coefficient*

Photographs documenting the existing channel conditions are provided in Appendix A. The existing conditions Manning's roughness coefficients are summarized in Table 15-2 with backup detail provided in Appendix B.

Table 15-1: Reach 87 – Castaic Old Road Drain Outlet Existing Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
382	0.015	0.015	0.015
341 to 313	0.047	0.042	0.042
287 to 256	0.061	0.047	0.078
155 to 35	0.069	0.061	0.015

15.3.2 *Design Conditions Manning's Coefficient*

The Manning's roughness values for the design conditions HEC-RAS model are based on information provided in the as-built plans for the engineered channel. The Manning's roughness values used in the design conditions HEC-RAS models are summarized in Table 15-2.

Table 15-2: Reach 87 – Castaic Old Road Drain Outlet Design Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
382	0.015	0.015	0.015
341 to 313	0.047	0.042	0.042
287 to 256	0.023	0.023	0.023

15.4 Hydrology

Design flow rates were obtained from multiple as-built channel design documents available from the LACFCD website: http://dpw.lacounty.gov. The design documents and discharges are summarized in Table 15-3.

Table 15-3: Reach 87 – Castaic Old Road Drain Outlet Design Flow Rates

Design Document No.	Year	Discharge (cfs)	HEC-RAS Station
PD 2484	1998	1,020	382
PD 1982	1998	32,200	155

15.5 Hydraulic Model

The study reach is modeled with seven cross-sections spaced at roughly 30-foot intervals. The cross sections are cut based on 2006 LIDAR topographic data provided by LACDPW. The cross section locations and SBC reach extents are presented in Figure 15-2.

Cross section spacing was chosen to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. The hydraulic model was run under "mixed flow" conditions so that potential areas of supercritical flow were adequately modeled. HEC-RAS input and output files are provided in Appendix E.

15.6 Boundary Conditions

Normal depth is used as the boundary condition for the upstream extent of the model. The value of normal depth is estimated as the channel bed slope. At the downstream extents of the model, a known water surface is used as the boundary condition. The water surface elevation was selected based on the results from the existing conditions HEC-RAS model for Reaches 97 and 104 using the Reach 104 plan at cross section 14603.25. The boundary conditions are summarized in Table 15-4.

Table 15-4: Reach 87 – Castaic Old Road Drain Outlet Boundary Conditions

Sub-reach	Upstream Boundary Condition	Downstream Boundary Condition
Castaic_87 – 1	Normal Depth – S = 0.030	Known WS – Elev. = 1029.54'

15.7 Results

The water surface elevation from the existing conditions model is used to calculate freeboard at each cross section within the SBC reach. The existing conditions freeboard is compared to the required freeboard to determine whether there is excess freeboard (hydraulic capacity) at the cross section. Results of the freeboard calculations and capacity determination for each cross section are presented in Table 15-5, and in Figure 15-2. A detailed summary of these results are provided in Appendix C.

Table 15-5: Reach 87 – Castaic Old Road Drain Outlet Excess Capacity Determination

HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
382	2.5	1.7	0.0	No
341*	2.5	3.3	0.8	No*
313*	2.5	3.3	0.8	No*
287	2.5	-0.2	0.0	No
256	2.5	-1.4	0.0	No

Notes:

The cross sections indicated with an asterisk (*) have excess freeboard (hydraulic capacity), but do not have capacity for additional vegetation because they are located in segments of the channel with hard bottom (concrete, rip-rap).

15.8 Additional Analysis

Reach 87 does not have excess hydraulic capacity under the existing and design conditions scenarios for a majority of the SBC reach. Therefore, no additional analysis was performed.

0 50 100 Feet

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SOFT BOTTOM CHANNEL ANALYSIS

TITLE
CASTAIC OLD ROAD DRAIN 87
EXISTING CAPACITY RESULTS

FIGURE
15-2

16 Pico Canyon Reach 108

16.1 General Description

Pico Canyon is a tributary to South Fork SCR Channel located in the Santa Clara River Watershed. The channel originates near the crossing of Stevenson Ranch Parkway and Pico Canyon Road, and flows east to its confluence with South Fork SCR. The study reach is nearly 4,800 feet in length, beginning immediately downstream of the debris basin near Stevenson Ranch Parkway and ending about 300 feet downstream of the Interstate 5 Northbound bridge. The surrounding land consists of residential and commercial development and recreational areas. The reach of interest along Pico Canyon measures 3,100 feet in length. The limits of the SBC reach are illustrated in Figure 16-1.

Figure 16-1: Reach 108 – Pico Canyon

16.2 Structures

The reach of interest for Pico Canyon is an engineered, concrete slope-lined channel with an earthen bottom. There are three structures included in the model for Pico Canyon: one culvert and two bridges. The structures are summarized in Table 16-1.

Table 16-1: Reach 108 – Pico Canyon Structures

Structure Number	HEC-RAS Station	Road Name	Type	Description	Structure Model Data Origin
1	7161	The Old Road	Culvert	Box culvert with 4 – 10'W x 10'H cells	USACE model
2	6192	Interstate 5 Southbound	Bridge	Clear span bridge (no piers)	USACE model
3	6079	Interstate 5 Northbound	Bridge	Clear span bridge (no piers)	USACE model

16.3 Manning's Roughness Coefficient

16.3.1 *Existing Conditions Manning's Coefficient*

Field investigations were performed after scheduled maintenance of Reach 108; therefore, the field photos could not be used to assess the Manning's roughness for this reach. In order to conduct the analysis, the existing conditions Manning's roughness coefficients are assigned based on 2014 aerial imagery. The existing conditions Manning's roughness coefficients are summarized in Table 16-2 with backup detail provided in Appendix B.

Table 16-2: Reach 108 – Pico Canyon Existing Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
10516 to 9905	0.015	0.087	0.015
9700 to 9330	0.015	0.077	0.015
9200 to 8888	0.015	0.087	0.015
87496 to 7545	0.015	0.087	0.015
7399 to 7243	0.015	0.015	0.015
6331 to 5864	0.030	0.030	0.030
5759	0.040	0.040	0.040

16.3.2 *Design Conditions Manning's Coefficient*

The Manning's roughness values for the design conditions HEC-RAS model are based on information provided in the as-built plans for the engineered channel. The Manning's roughness values used in the design conditions HEC-RAS models are summarized in Table 16-3.

Table 16-3: Reach 108 – Pico Canyon Design Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
10516 to 7545	0.015	0.036	0.015

16.4 Hydrology

Design flow rates were obtained from the PD 2528-2 as-built channel design documents available from the LACFCD website: http://dpw.lacounty.gov. The design documents and discharges are summarized in Table 16-4.

Table 16-4: Reach 108 – Pico Canyon Design Flow Rates

Design Document No.	Year	Discharge (cfs)	HEC-RAS Station
PD 2528-2	2002	5,616	10516
PD 2528-2	2002	5,641	10024
PD 2528-2	2002	5,648	9578
PD 2528-2	2002	5,652	9372
PD 2528-2	2002	5,659	9086
PD 2528-2	2002	6,311	7933
PD 2528-2	2002	6,316	7545
PD 2528-2	2002	6,329	7399

16.5 Hydraulic Model

The study reach is modeled with 35 cross-sections with the majority of cross sections spaced at roughly 250-foot intervals. The cross sections are cut using 2006 LIDAR topographic data provided by LACDPW. The cross section locations and SBC reach extents are presented in Figures 16-2 through 16-3.

Cross section spacing was chosen to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. Additional cross-sections were incorporated into the model (as needed) at transitional areas and sharp bends to better represent the conditions in these portions of the channel. The hydraulic model was run under “mixed flow” conditions so that potential areas of supercritical flow were adequately modeled. HEC-RAS input and output files are provided in Appendix E.

16.6 Boundary Conditions

Flow through the baffled concrete chute located at the upstream boundary is assumed to achieve critical depth. Therefore, critical depth is used as the boundary condition for the upstream extent of the model. The value for critical depth is computed in HEC-RAS based on the geometry of the initial upstream cross section. Normal depth is used as the boundary condition for the downstream extent of the model. The value of normal depth is estimated as the channel bed slope. The boundary conditions are summarized in Table 16-5.

Table 16-5: Reach 108 – Pico Canyon Boundary Conditions

Sub-reach	Upstream Boundary Condition	Downstream Boundary Condition
Pico – 1	Critical Depth	Normal Depth – S = 0.020

16.7 Results

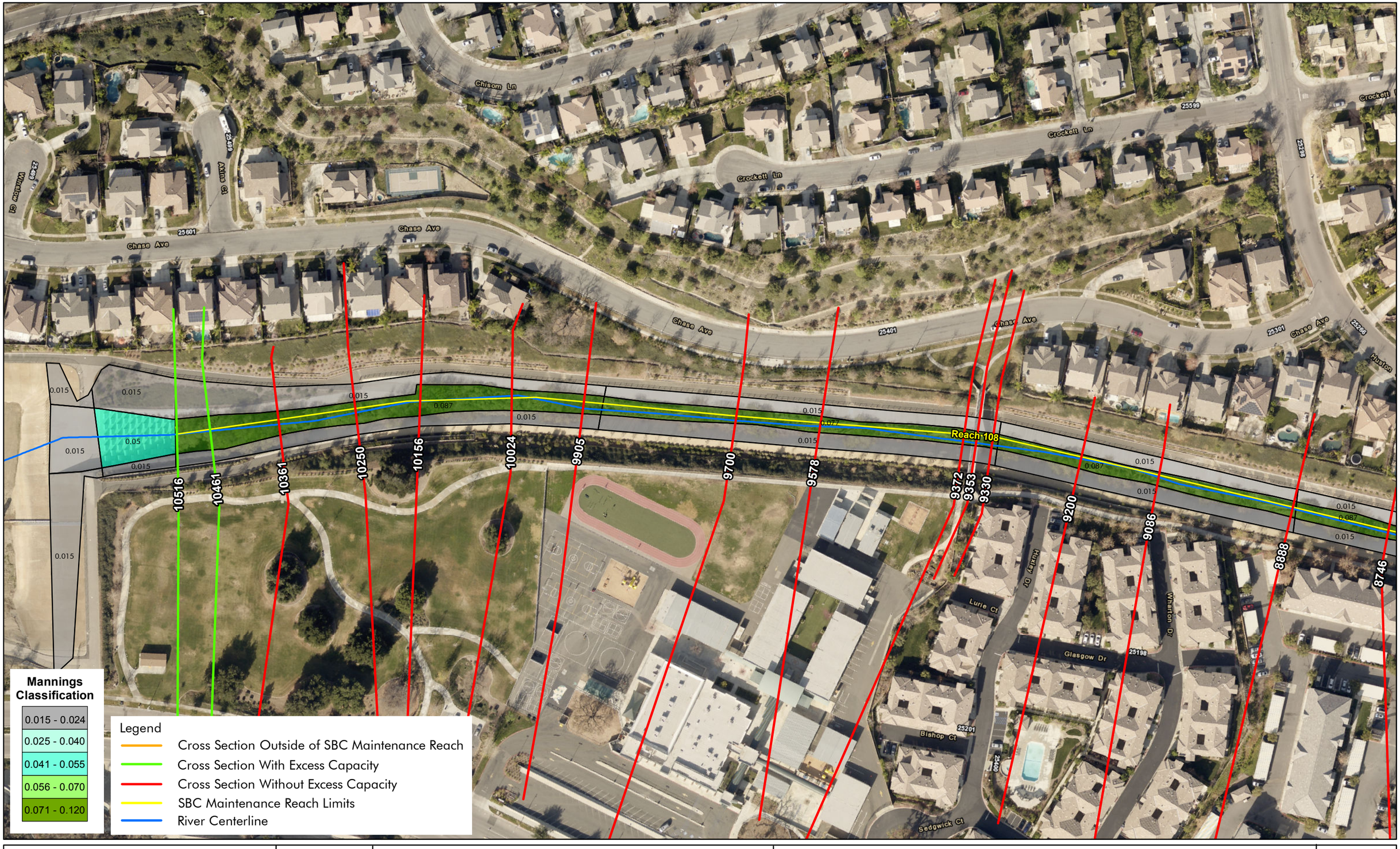
The water surface elevation from the existing conditions model is used to calculate freeboard at each cross section within the SBC reach. The existing conditions freeboard is compared to the required freeboard to determine whether there is excess freeboard (hydraulic capacity) at the cross section. Results of the freeboard calculations and capacity determination for each cross section are presented in Table 16-6, and in Figures 16-2 through 16-3. A detailed summary of these results are provided in Appendix C.

Table 16-6: Reach 108 – Pico Canyon Excess Capacity Determination

HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
10516	2.5	5.5	3.0	Yes
10461	2.5	4.0	1.5	Yes
10361	2.5	0.2	0.0	No
10250	2.5	0.2	0.0	No
10156	2.5	-0.3	0.0	No
10024	2.5	0.6	0.0	No
9905	2.5	0.9	0.0	No
9700	2.5	1.7	0.0	No
9578	2.5	1.5	0.0	No
9372	2.5	1.7	0.0	No
9353	2.5	1.6	0.0	No
9330	2.5	1.9	0.0	No
9200	2.5	1.6	0.0	No
9086	2.5	1.1	0.0	No
8888	2.5	0.8	0.0	No
8746	2.5	0.8	0.0	No
8535	2.5	0.6	0.0	No
8370	2.5	1.0	0.0	No
8248	2.5	1.4	0.0	No
8098	2.5	2.1	0.0	No
7933	2.5	2.2	0.0	No
7819	2.5	2.3	0.0	No
7712	2.5	3.7	1.2	Yes
7545	2.5	0.6	0.0	No

16.8 Additional Analysis

Reach 108 does not have excess hydraulic capacity under the existing conditions scenario for a majority of the SBC reach. The design conditions scenario was also reviewed and showed excess capacity under design conditions. However, this reach is narrow and minimal maintenance practices are in place. Therefore, no additional analysis was performed.



0 125 250 Feet

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SOFT BOTTOM CHANNEL ANALYSIS

TITLE
PICO CANYON 108
EXISTING CAPACITY RESULTS

FIGURE
16-2

0 125 250 Feet

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SANTA CLARA RIVER WATERSHED
SOFT BOTTOM CHANNEL ANALYSIS

TITLE
PICO CANYON 108
EXISTING CAPACITY RESULTS

FIGURE
16-3

17 Sand Canyon Maintenance Channel Inlet and Outlet Reach 45 and 46

17.1 General Description

Sand Canyon Maintenance Channel is a minor tributary that flows southerly to its confluence with SCR. The study reach of interest is located north of Soledad Canyon Road and east of Sand Canyon Road. A box culvert connects the maintenance channel inlet (Reach 45) to the maintenance channel outlet (Reach 46). The study reach is nearly 1,600 feet in length, beginning approximately 400 feet upstream of the culvert inlet and ending about 500 feet downstream of the culvert outlet. The surrounding land consists of residential development and areas of brushy open space. The reaches of interest along Sand Canyon measure 102 feet (Reach 45) and 84 feet (Reach 46) in length. The limits of the SBC reaches are illustrated in Figure 17-1.

Figure 17-1: Reaches 45 & 46 – Sand Canyon MCI & MCO

17.2 Structures

The reaches of interest for Sand Canyon Maintenance Channel are a natural, earthen channel (Reach 45) and an engineered, rip-rap slope-lined channel with an earthen bottom (Reach 46). There is one inline structure and one culvert along the study reach, as summarized in Table 17-1.

Table 17-1: Reaches 45 & 46 – Sand Canyon Channel Structures

Structure Number	River Station	Road Name	Type	Description	Structure Model Data Origin
1	1336	–	Inline Structure	Rail-and-Timber weir with 2" width in the direction of flow	Field measurements
2	910	–	Culvert	Box culvert with 1 – 6'W x 5'H cell	As-built plans and field measurements

17.3 Manning's Roughness Coefficient

17.3.1 *Existing Conditions Manning's Coefficient*

Photographs documenting the existing channel conditions are provided in Appendix A. The existing conditions Manning's roughness coefficients are summarized in Table 17-2 with backup detail provided in Appendix B.

Table 17-2: Reaches 45 & 46 – Sand Canyon Channel Existing Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
486 to 365	0.042	0.032	0.048
335 to 30	0.027	0.032	0.033

17.3.2 *Design Conditions Manning's Coefficient*

Lacking Manning's roughness data from the as-built plan design documents, the roughness values for the design conditions HEC-RAS model are assumed as bare earth soil conditions. The Manning's roughness values used in the design conditions HEC-RAS models are summarized in Table 17-3.

Table 17-3: Reach 46 – Sand Canyon Channel Design Conditions Manning's Roughness

Reach Number	HEC-RAS Station	Left Bank	Main Channel	Right Bank
46	456 to 395	0.025	0.025	0.025

17.4 Hydrology

Design flow rates were obtained from the PD T1307 as-built channel design documents available from the LACFCD website: http://dpw.lacounty.gov. The design documents and discharges are summarized in Table 17-4.

Table 17-4: Reaches 45 & 46 – Sand Canyon Channel Design Flow Rates

Design Document No.	Year	Discharge (cfs)	HEC-RAS Station
PD T1307	1976	555	1715
PD T1307	1976	714	486

17.5 Hydraulic Model

The study reach is modeled with 22 cross sections with the majority of cross sections spaced at roughly 50-foot intervals. The cross sections are cut using 2006 LIDAR topographic data provided by LACDPW. The cross section locations and SBC reach extents are presented in Figure 17-2.

Cross section spacing was chosen to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. The hydraulic model was run under "mixed flow" conditions so that potential areas of supercritical flow were adequately modeled. HEC-RAS model output data are provided in Appendix E.

17.6 Boundary Conditions

Normal depth is used as the boundary condition for the upstream and downstream extents of the model. The value of normal depth is estimated as the channel bed slope. The boundary conditions are summarized in Table 17-5.

Table 17-5: Reaches 45 & 46 – Sand Canyon Channel Boundary Conditions

Sub-reach	Upstream Boundary Condition	Downstream Boundary Condition
River – 1	Normal Depth – S = 0.0174	Normal Depth – S = 0.0396

17.7 Results

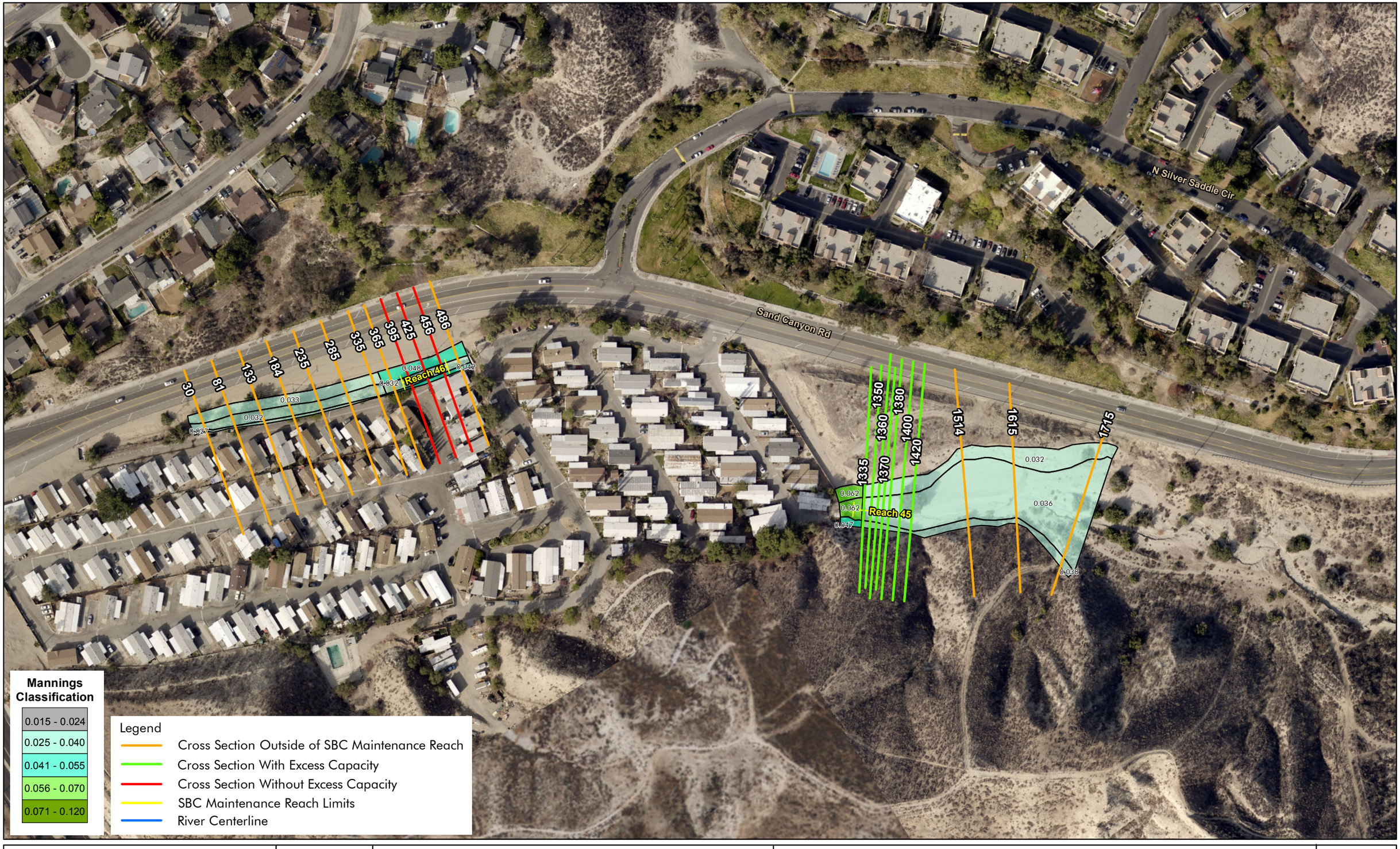
The water surface elevation from the existing conditions model is used to calculate freeboard at each cross section within the SBC reach. The existing conditions freeboard is compared to the required freeboard to determine whether there is excess freeboard (hydraulic capacity) at the cross section. Results of the freeboard calculations and capacity determination for each cross section of Reach 46 are presented in Table 17-6, and in Figure 17-2. A detailed summary of these results are provided in Appendix C.

Table 17-6: Reaches 45 & 46 – Sand Canyon Channel Excess Capacity Determination

Reach Number	HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
45	1420	2.5	16.2	13.7	Yes
	1400	2.5	16.7	14.2	Yes
	1380	2.5	13.4	10.9	Yes
	1370	2.5	11.1	8.6	Yes
	1360	2.5	10.6	8.1	Yes
	1350	2.5	9.9	7.4	Yes
	1335	2.5	7.4	4.9	Yes
46	456	2.5	-0.7	0.0	No
	425	2.5	-0.4	0.0	No
	395	2.5	-0.1	0.0	No

17.8 Additional Analysis

Reach 46 does not have excess hydraulic capacity under the existing and design condition scenarios. Reach 45 does have excess hydraulic capacity under existing and design condition scenarios. However, LACFCD does not have an easement for Reach 45. Additionally, the City of Santa Clarita has a proposed project at this location. Therefore, no additional analysis was performed.



0 150 300 Feet

PACE Advanced Water Engineering

LACDPW
SANTA CLARA RIVER WATERSHED
SOFT BOTTOM CHANNEL ANALYSIS

TITLE
SAND CANYON 45 & 46
EXISTING CAPACITY RESULTS

FIGURE
17-2

18 Mint Canyon Reaches 48, 49, 50, and 52

18.1 General Description

Mint Canyon Channel is a tributary to SCR located within the Santa Clara River Watershed. The stream originates in the mountains north-east of Sleepy Valley and flows southwesterly to its confluence with SCR. The study reach is nearly 9,000 feet in length, beginning approximately 1,700-feet upstream of Sierra Highway and ending about 700 feet downstream of Soledad Canyon Road. The surrounding land consists of mostly residential development with a few areas of commercial property and brushy open space. The soft-bottom reaches of interest along Mint Canyon Channel measure 2,505 feet (Reach 48), 385 feet (Reach 49), and 735 feet (Reach 50) in length. The Sierra Highway Road Drainage (Reach 52) measures 722 feet in length, and is located within the overbank area of Reach 50. The limits of the SBC reaches are illustrated in Figure 18-1.

Figure 18-1: Reaches 48, 49, 50, & 52 – Mint Canyon

18.2 Structures

The reaches of interest for Mint Canyon Channel (Reaches 48, 49 & 50) are engineered, earthen channels with pipe-and-wire revetment and concrete transitional segments. Reach 52 is a man-made earthen ditch and is located within the overbank area of Reach 50. There are ten structures included in the model for Mint Canyon Channel: one culvert, three bridges, and six inline structures. The structures included in the model are summarized in Table 18-1.

Table 18-1: Reaches 48, 49, 50, & 52 – Mint Canyon Structures

Structure Number	River Station	Road Name	Type	Description	Structure Model Data Origin
1	7650	Sierra Highway	Bridge	Clear span bridge (no piers)	USACE model
2	5090	Adon Avenue	Bridge	Clear span bridge (no piers)	USACE model
3	5020	–	Inline Structure	Rail-and-timber weir with 1' width in the direction of flow	As-built plans
4	4920	–	Inline Structure	Rail-and-timber weir with 1' width in the direction of flow	As-built plans
5	4820	–	Inline Structure	Rail-and-timber weir with 1' width in the direction of flow	As-built plans
6	4720	–	Inline Structure	Rail-and-timber weir with 1' width in the direction of flow	As-built plans
7	3100	Scherzinger Ln / Solamint Rd	Culvert	Box culvert with 2 – 19'W x 12'H cells	USACE model
8	1460	–	Inline Structure	Rail-and-timber weir with 1' width in the direction of flow	As-built plans
9	1120	–	Inline Structure	Rail-and-timber weir with 1' width in the direction of flow	As-built plans
10	850	Soledad Canyon Road	Bridge	Clear span bridge (no piers)	USACE model

18.3 Manning's Roughness Coefficient

18.3.1 *Existing Conditions Manning's Coefficient*

Photographs documenting the existing channel conditions are provided in Appendix A. The existing conditions Manning's roughness coefficients are summarized in Table 18-2 with backup detail provided in Appendix B.

Table 18-2: Reaches 48, 49, 50, & 52 – Mint Canyon Existing Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
9380 to 8000	0.044	0.044	0.044
7810 to 7730	0.044	0.032	0.044
7520	0.038	0.037	0.038
7460 to 7340	0.038	0.029	0.038
7210	0.042	0.032	0.048

HEC-RAS Station	Left Bank	Main Channel	Right Bank
7110 to 6600	0.045	0.027	0.045
6480 to 6220	0.038	0.030	0.042
6090	0.050	0.030	0.042
5960	0.038	0.028	0.042
5810 to 5360	0.041	0.030	0.051
5250	0.065	0.030	0.066
5130 to 5100	0.060	0.030	0.056
5030 to 5010	0.038	0.027	0.048
4930 to 4710	0.038	0.027	0.038
4660 to 4500	0.015	0.015	0.015
2520 to 1850	0.015	0.015	0.015
1800 to 1480	0.027	0.027	0.032
1440 to 1130	0.015	0.028	0.032
1115 to 1070	0.040	0.048	0.015
1040 to 100	0.015	0.015	0.015

18.3.2 *Design Conditions Manning's Coefficient*

The Manning's roughness values for the design conditions HEC-RAS model are based on information provided in the as-built plans for the engineered channel. The Manning's roughness values used in the design conditions HEC-RAS models are summarized in Table 18-3.

Table 18-3: Reaches 48, 49, 50, & 52 – Mint Canyon Design Conditions Manning's Roughness

Reach	HEC-RAS Station	Left Bank	Main Channel	Right Bank
48	7520 to 5100	0.025	0.025	0.025
49	5030 to 4710	0.025	0.025	0.025
50	1800 to 1480	0.025	0.025	0.025
	1440 to 1130	0.015	0.025	0.025
	1115 to 1070	0.040	0.048	0.015

18.4 Hydrology

Design flow rates were obtained from multiple as-built channel design documents available from the LACFCD website: http://dpw.lacounty.gov. The design documents and discharges are summarized in Table 18-4.

Table 18-4: Reaches 48, 49, 50, & 52 – Mint Canyon Design Flow Rates

Design Document No.	Year	Discharge (cfs)	HEC-RAS Station
PD 1991	1987	11,400	9380
PD 1991, RDD 368, PD 2056	1987, 1984, 1986	11,519 [1]	1070

Notes:
[1] *The flowrate of 11,519 cfs is the combined flowrate from the three as-built plans listed: 11,400 cfs (PD 1991), 34.1 cfs (RDD 368), and 84.8 cfs (PD 2056).*

18.5 Hydraulic Model

The study reach is modeled with 69 cross sections with the majority of cross sections spaced at roughly 50-foot intervals. The cross sections are cut using 2006 LIDAR topographic data provided by LACDPW. The cross section locations and SBC reach extents are presented in Figures 18-2 through 18-4.

Cross section spacing was chosen to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. Additional cross-sections were incorporated into the model (as needed) at transitional areas and sharp bends to better represent the conditions in these portions of the channel. The hydraulic model was run under "mixed flow" conditions so that potential areas of supercritical flow were adequately modeled. HEC-RAS input and output files are provided in Appendix E.

18.6 Boundary Conditions

Normal depth is used as the boundary condition for the upstream extent of the model. The value of normal depth is estimated as the channel bed slope. At the downstream extents of the model, a known water surface is used as the boundary condition. The water surface elevation was obtained from the existing conditions HEC-RAS model for SCR Reaches 47, 51, 55, 56, 58, 60, and 61 at cross section 294646. The boundary conditions are summarized in Table 18-5.

Table 18-5: Reaches 48, 49, 50, & 52 – Mint Canyon Boundary Conditions

Sub-reach	Upstream Boundary Condition	Downstream Boundary Condition
Mint – 1	Normal Depth – S = 0.014	Known WS – Elev = 1431.16'

18.7 Results

The water surface elevation from the existing conditions model is used to calculate freeboard at each cross section within the SBC reaches. The existing conditions freeboard is compared to the required freeboard to determine whether there is excess freeboard (hydraulic capacity) at the cross section. Results of the freeboard calculations and capacity determination for each cross section are presented in Table 18-6, and in Figures 18-2 through 18-4. A detailed summary of these results are provided in Appendix C.

Table 18-6: Reaches 48, 49, 50, & 52 – Mint Canyon Excess Capacity Determination

Reach Number	HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
48	7520	2.5	-4.0	0.0	No
	7460	2.5	-4.0	0.0	No
	7340	2.5	-1.7	0.0	No
	7210	2.5	-1.6	0.0	No
	7110	2.5	-1.5	0.0	No
	7000	2.5	-2.4	0.0	No
	6860	2.5	-1.4	0.0	No
	6710	2.5	-1.0	0.0	No
	6600	2.5	-2.1	0.0	No
	6480	2.5	-3.3	0.0	No
	6350	2.5	-0.2	0.0	No
	6220	2.5	-2.2	0.0	No
	6090	2.5	-1.9	0.0	No
	5960	2.5	-1.7	0.0	No
	5810	2.5	-3.0	0.0	No
	5660	2.5	-1.7	0.0	No
	5510	2.5	-2.7	0.0	No
	5360	2.5	-1.7	0.0	No
	5250	2.5	-2.7	0.0	No
	5130	2.5	-3.1	0.0	No
	5100	2.5	-3.6	0.0	No
49	5030	2.5	-1.1	0.0	No
	5010	2.5	-2.2	0.0	No
	4930	2.5	-2.5	0.0	No
	4910	2.5	-3.3	0.0	No
	4830	2.5	-4.9	0.0	No
	4810	2.5	-5.4	0.0	No
	4730	2.5	-7.0	0.0	No
	4710	2.5	-7.7	0.0	No
50/52 [1]	1800	2.5	0.4	0.0	No
	1730	2.5	-0.8	0.0	No
	1680	2.5	-0.7	0.0	No
	1620	2.5	0.3	0.0	No
	1520	2.5	1.1	0.0	No
	1480	2.5	0.7	0.0	No
	1440	2.5	-1.8	0.0	No
	1400	2.5	-2.2	0.0	No
	1340	2.5	-1.8	0.0	No
	1300	2.5	-1.6	0.0	No

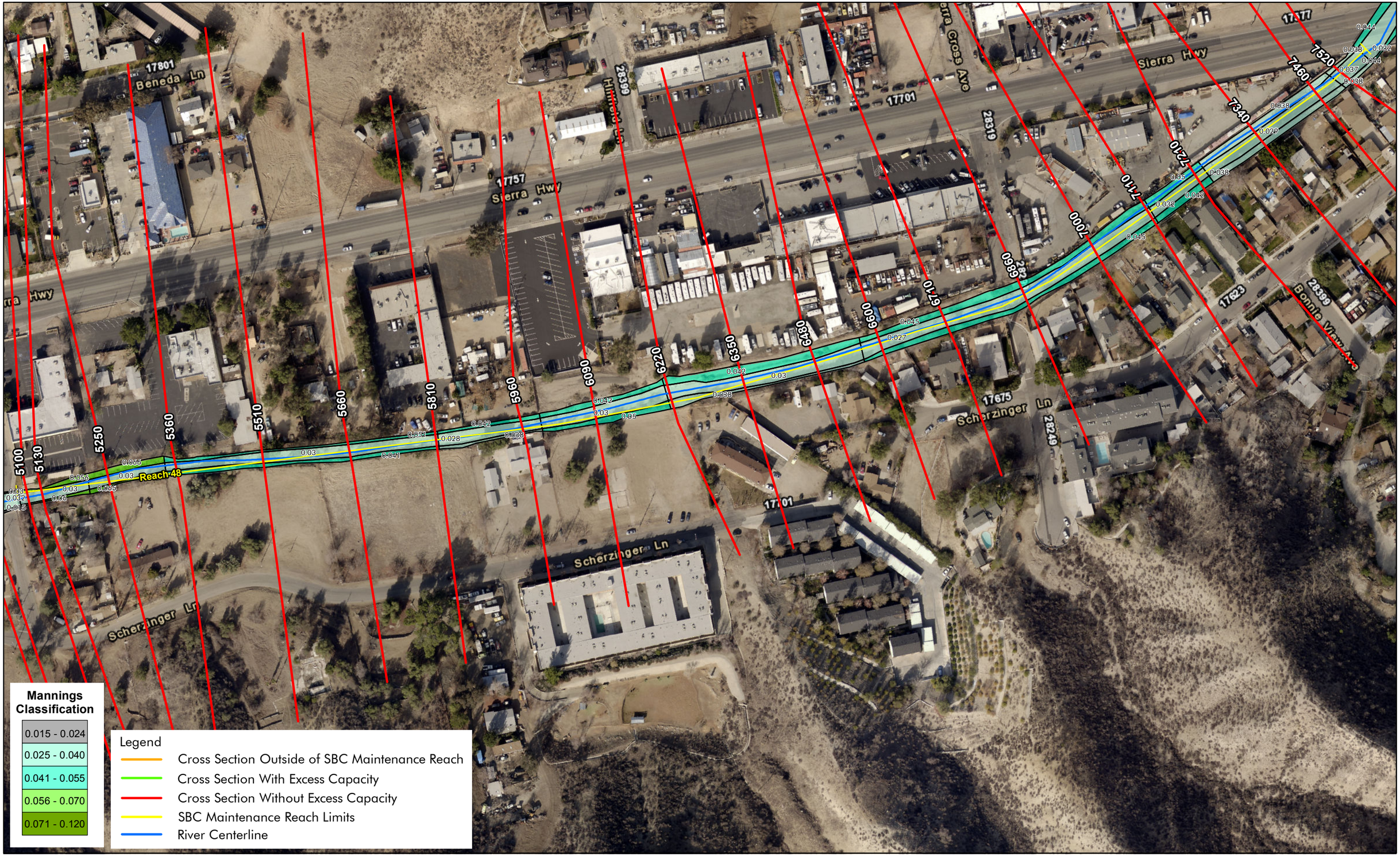
Reach Number	HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
50/52 [1]	1260	2.5	-0.6	0.0	No
	1200	2.5	-3.7	0.0	No
	1130	2.5	-4.4	0.0	No
	1115	2.5	-1.9	0.0	No
	1070	2.5	-5.0	0.0	No

Notes:

[1] Reach 52 is located within the floodplain for Reach 50; therefore the results for Reach 50 apply to both SBC reaches.

18.8 Additional Analysis

Reaches 48, 49, and 50 did not have excess hydraulic capacity under the existing and design condition scenarios. Reach 52 is within the floodplain of Reach 50 and LACFCD does not have an easement in this location. Therefore, a separate existing conditions model was not analyzed for Reach 52. Also, the City of Santa Clarita has a proposed project in the location of Reaches 50 and 52. Therefore, no additional analysis was performed for these reaches.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Beneda Ln
17757
Sierra Hwy
28399
17701
Sierra Cross Ave
28319
17777
Sierra Hwy
7460
7520
7340
7240
7110
7000
6890
6710
6600
6480
6350
6220
6090
5960
5810
5660
5510
5360
5250
5130
5100
Reach 48
17675
Scherzinger Ln
28249
17623
28399
Bonnie View Ave
Scherzinger Ln
17701
Scherzinger Ln
Mannings Classification
0.015 - 0.024
0.025 - 0.040
0.041 - 0.055
0.056 - 0.070
0.071 - 0.120
Legend
Cross Section Outside of SBC Maintenance Reach
Cross Section With Excess Capacity
Cross Section Without Excess Capacity
SBC Maintenance Reach Limits
River Centerline
0
150
300
Feet
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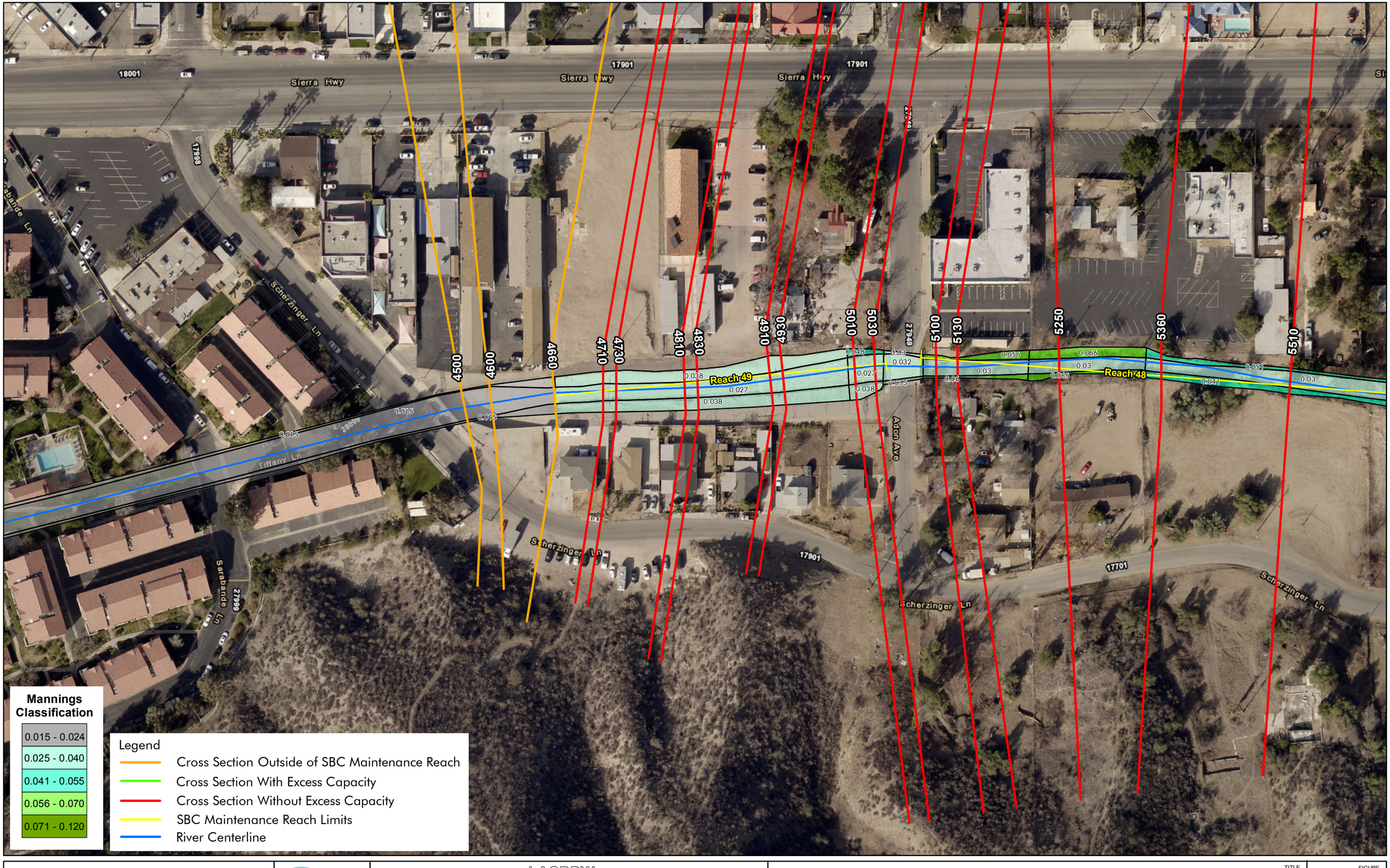
LACDPW
SANTA CLARA RIVER WATERSHED
SOFT BOTTOM CHANNEL ANALYSIS
MINT CANYON 48, 49, 50, & 52
EXISTING CAPACITY RESULTS
TITLE
FIGURE
18-2



0 100 200 Feet

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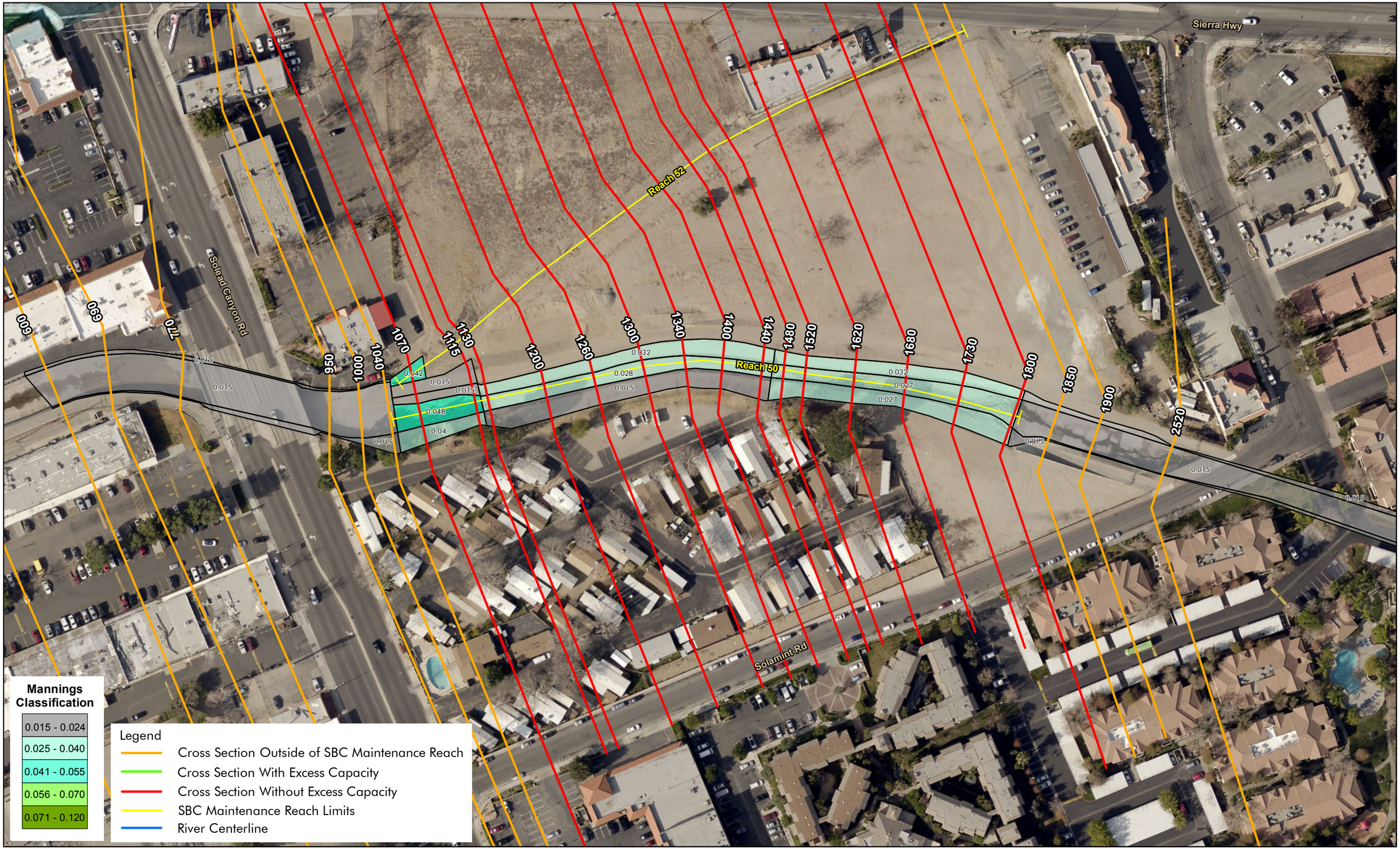
SOFT BOTTOM CHANNEL ANALYSIS

TITLE

MINT CANYON 48, 49, 50, & 52
EXISTING CAPACITY RESULTS

FIGURE

18-3



0 100 200 Feet

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SOFT BOTTOM CHANNEL ANALYSIS

TITLE
MINT CANYON 48, 49, 50, & 52
EXISTING CAPACITY RESULTS

FIGURE
18-4

19 SCR Tributary Maintenance Channel Inlet & Outlet Reaches 53 and 54

19.1 General Description

The SCR Maintenance Channel Inlet (MCI) and Maintenance Channel Outlet (MCO) are located along a minor tributary that flows northerly to its confluence with SCR near Sierra Highway. The study reach is nearly 1,500 feet in length, beginning approximately 400 feet upstream of Sierra Highway and ending at its confluence with SCR. The surrounding land consists of residential development with a few areas of brushy open space. The soft-bottom channel reaches of interest along the tributary maintenance channel measure 35 feet (Reach 53) and 316 feet (Reach 54) in length. The limits of the SBC reaches are illustrated in Figure 19-1.

Figure 19-1: Reaches 53 & 54 – SCR Tributary MCI & MCO

19.2 Structures

The reaches of interest for SCR Tributary MCI & MCO are engineered, hardened slope-lined channels with earthen bottoms. There is one bridge and one culvert located along the study reach, as summarized in Table 19-1.

Table 19-1: Reaches 53 & 54 – SCR Tributary Structures

Structure Number	River Station	Road Name	Type	Description	Structure Model Data Origin
1	1604	Southern Pacific Railroad	Bridge	2 - 3' wide, square-nosed pier walls	Field measurements
2	850	Jakes Way	Culvert	Box culvert with 2 - 10'W x 9.5'H cells	As-built plans

19.3 Manning's Roughness Coefficient

19.3.1 *Existing Conditions Manning's Coefficient*

Photographs documenting the existing channel conditions are provided in Appendix A. The existing conditions Manning's roughness coefficients are summarized in Table 19-2 with backup detail provided in Appendix B.

Table 19-2: Reaches 53 & 54 – SCR Tributary Existing Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
2014 to 1670	0.063	0.063	0.032
1658 to 1525	0.015	0.033	0.015
1475 to 1450	0.015	0.015	0.015
1399 to 1375	0.015	0.015	0.015
1340 to 928	0.036	0.015	0.036
768 to 730	0.015	0.015	0.050
700	0.015	0.042	0.050
690	0.015	0.038	0.039
668 to 609	0.015	0.032	0.049
551 to 487	0.042	0.027	0.051

19.3.2 *Design Conditions Manning's Coefficient*

Lacking Manning's roughness data from the as-built plan design documents, the roughness values for the design conditions HEC-RAS model are assumed as bare earth soil conditions except for hard surfaces (ie. rip rap, concrete) which use the field survey roughness coefficients. The Manning's roughness values used in the design conditions HEC-RAS models are summarized in Table 19-3.

Table 19-3: Reaches 53 & 54 – SCR Tributary Design Conditions Manning's Roughness

Reach Number	HEC-RAS Station	Left Bank	Main Channel	Right Bank
53	1602	0.015	0.025	0.015
	1525	0.015	0.025	0.015
54	730	0.015	0.015	0.015
	700	0.015	0.042	0.050
	690 to 609	0.015	0.025	0.025
	551 to 487	0.042	0.025	0.025

19.4 Hydrology

Design flow rates were obtained from the PD 832 as-built channel design documents available from the LACFCD website: http://dpw.lacounty.gov. The design documents and discharges are summarized in Table 19-4.

Table 19-4: Reaches 53 & 54 – SCR Tributary Design Flow Rates

Design Document No.	Year	Discharge (cfs)	HEC-RAS Station
PD 832	1967	2,660	2014

19.5 Hydraulic Model

The study reach is modeled with 28 cross sections with the majority of cross sections spaced at roughly 100-foot intervals. The cross sections are cut using 2006 LIDAR topographic data provided by LACDPW. The cross section locations and SBC reach extents are presented in Figure 19-2.

Cross section spacing was chosen to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. Additional cross-sections were incorporated into the model at transitional areas and sharp bends to better represent the conditions in these portions of the channel. Cross section spacing was reduced to a minimum of 13.5 feet to better represent the transitional areas through the concrete channel. The hydraulic model was run under "mixed flow" conditions so that potential areas of supercritical flow were adequately modeled. HEC-RAS input and output files are provided in Appendix E.

19.6 Boundary Conditions

The model consists of three sub-reaches with a junction where SCR Tributary MCI & MCO confluences with SCR. At the upstream and downstream extents of the model, normal depth is used as the boundary condition. The value of normal depth is estimated as the channel bed slope. Interior boundary conditions (i.e. at the junction) are automatically generated by HEC-RAS from the junction hydraulics. The boundary conditions are summarized in Table 19-5.

Table 19-5: Reaches 53 & 54 – SCR Tributary Boundary Conditions

Sub-reach	Upstream Boundary Condition	Downstream Boundary Condition
Santa Clara R – 1	Normal Depth – S = 0.0090	Junction
Santa Clara R – 2	Junction	Normal Depth – S = 0.0050
SCR Outlet – 1	Normal Depth – S = 0.0103	Junction

19.7 Results

The water surface elevation from the existing conditions model is used to calculate freeboard at each cross section within the SBC reaches. The existing conditions freeboard is compared to the required freeboard to determine whether there is excess freeboard (hydraulic capacity) at the cross section. Results of the freeboard calculations and capacity determination for each cross section are presented in Table 19-6, and in Figure 19-2. A detailed summary of these results are provided in Appendix C.

Table 19-6: Reaches 53 & 54 – SCR Tributary Excess Capacity Determination

Reach Number	HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
53	1602	2.5	-8.1	0.0	No
	1525	2.5	-6.1	0.0	No
54	690	6.7	-2.9	0.0	No
	668	6.7	-3.8	0.0	No
	609	6.7	-5.3	0.0	No
	551	6.7	-7.1	0.0	No
	487	6.4	-8.9	0.0	No

19.8 Additional Analysis

Reaches 53 and 54 do not have excess hydraulic capacity under the existing and design condition scenarios. Therefore, no additional analysis was performed.

0 100 200 Feet

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SOFT BOTTOM CHANNEL ANALYSIS

TITLE
SANTA CLARA RIVER NON-MAIN 53 & 54
EXISTING CAPACITY RESULTS

FIGURE
19-2

20 Whites Canyon Reach 57

20.1 General Description

Whites Canyon is a tributary to SCR located within the Santa Clara River Watershed. The stream originates in the mountains west of Mint Canyon and flows southwesterly to its confluence with SCR. The study reach is nearly 1,800 feet in length, extending approximately 500 feet upstream and 1,300 feet downstream of the Goodvale Road crossing. The surrounding land consists of residential development with a few areas of brushy open space. The soft-bottom reach of interest along Whites Canyon measures 695 feet in length. The limits of the reach are illustrated in Figure 20-1.

Figure 20-1: Reach 57 – Whites Canyon

20.2 Structures

The reach of interest for Whites Canyon is an engineered, earthen channel that transitions to an engineered, concrete slope-lined channel with an earthen bottom. There is inline structure located along the study reach, as summarized in Table 20-1.

Table 20-1: Reach 57 – Whites Canyon Structures

Structure Number	HEC-RAS Station	Road Name	Type	Description	Structure Model Data Origin
1	838	–	Inline Structure	Rail-and-timber weir with 0.5' width in the direction of flow	Field measurements

20.3 Manning's Roughness Coefficient

20.3.1 *Existing Conditions Manning's Coefficient*

Photographs documenting the existing channel conditions are provided in Appendix A. The existing conditions Manning's roughness coefficients are summarized in Table 20-2 with backup detail provided in Appendix B.

Table 20-2: Reach 57 – Whites Canyon Existing Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
1832 to 1449	0.025	0.025	0.025
1343	0.033	0.027	0.033
1243 to 1143	0.033	0.025	0.033
1043 to 943	0.033	0.025	0.027
843 to 830	0.015	0.015	0.015
743 to 690	0.015	0.028	0.015
643 to 543	0.015	0.015	0.015
443 to 046	0.015	0.015	0.015

20.3.2 *Design Conditions Manning's Coefficient*

Lacking Manning's roughness data from the as-built plan design documents, the roughness values for the design conditions HEC-RAS model are assumed as bare earth soil conditions except for hard surfaces (ie. concrete) which use the field survey roughness coefficients. The Manning's roughness values used in the design conditions HEC-RAS models are summarized in Table 20-3.

Table 20-3: Reach 57 – Whites Canyon Design Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
1243 to 943	0.025	0.025	0.025
843 to 830	0.015	0.015	0.015
743 to 690	0.015	0.025	0.015

20.4 Hydrology

Design flow rates were obtained from the PD T704 as-built channel design documents available from the LACFCD website: http://dpw.lacounty.gov. The design documents and discharges are summarized in Table 20-4.

Table 20-4: Reach 57 – Whites Canyon Design Flow Rates

Design Document No.	Year	Discharge (cfs)	HEC-RAS Station
PD T704	1966	1,260	1832
PD T704	1966	1,660	443

20.5 Hydraulic Model

The study reach is modeled with 21 cross sections with the majority of cross sections spaced at roughly 100-foot intervals. The cross sections are cut using 2006 LIDAR topographic data provided by LACDPW. The cross section locations and SBC reach extents are presented in Figure 20-2.

Cross section spacing was chosen to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. Additional cross sections were incorporated into the model at transitional areas and sharp bends to better represent the conditions in these portions of the channel. Cross section spacing was reduced to 12 feet near the location of the inline weir to better represent the hydraulics through this structure. The hydraulic model was run under "mixed flow" conditions so that potential areas of supercritical flow were adequately modeled. HEC-RAS input and output files are provided in Appendix E.

20.6 Boundary Conditions

Normal depth is used as the boundary condition for the upstream and downstream extents of the model. The value of normal depth is estimated as the channel bed slope. The boundary conditions are summarized in Table 20-5.

Table 20-5: Reach 57 – Whites Canyon Boundary Conditions

Sub-reach	Upstream Boundary Condition	Downstream Boundary Condition
River – 1	Normal Depth – S = 0.03619	Normal Depth – S = 0.02171

20.7 Results

The water surface elevation from the existing conditions model is used to calculate freeboard at each cross section within the SBC reach. The existing conditions freeboard is compared to the required freeboard to determine whether there is excess freeboard (hydraulic capacity) at the cross section. Results of the freeboard calculations and capacity determination for each cross section are presented in Table 20-6, and in Figure 20-2. A detailed summary of these results is provided in Appendix C.

Table 20-6: Reach 57 – Whites Canyon Excess Capacity Determination

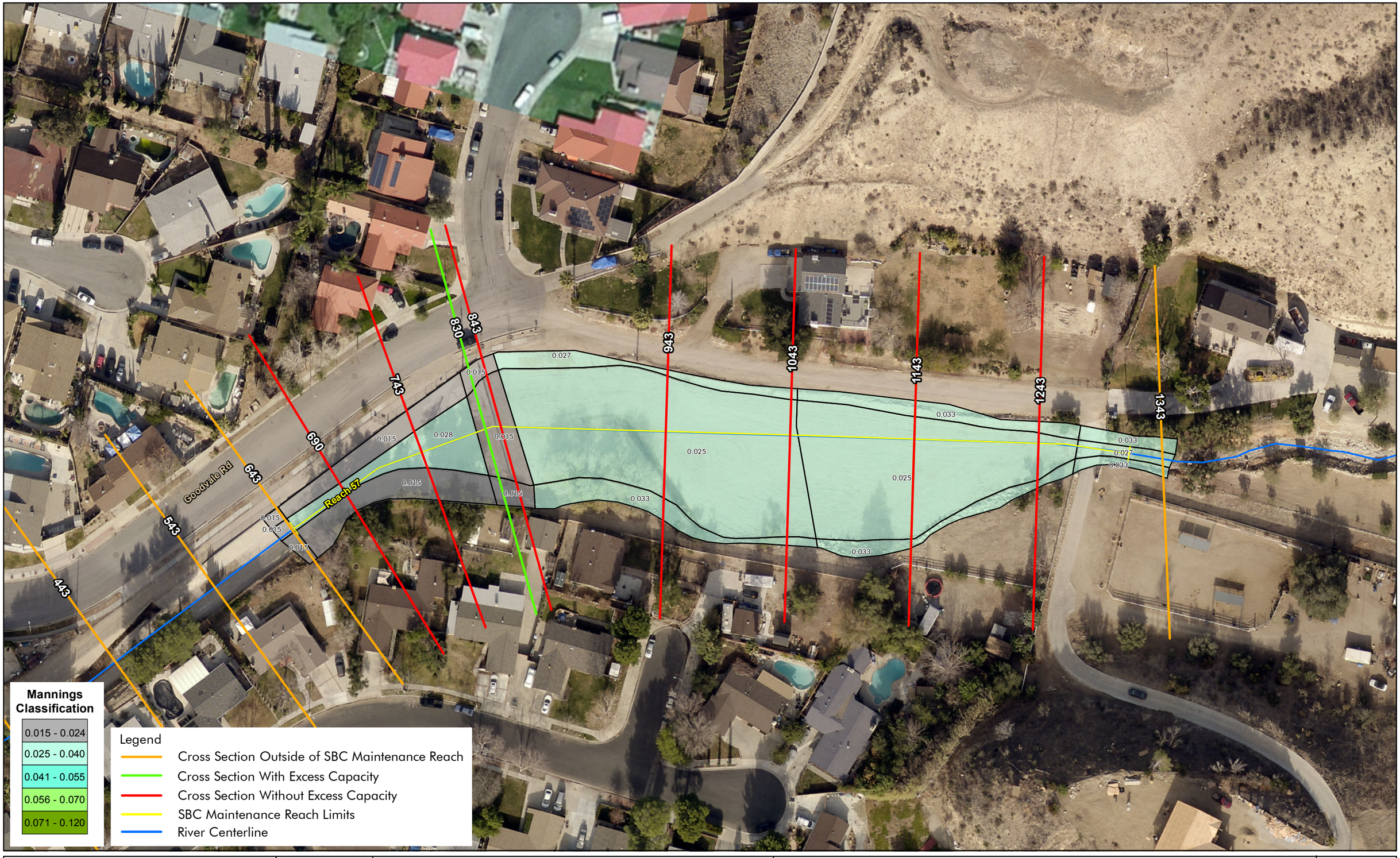
HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
1243	2.5	-0.2	0.0	No
1143	2.5	2.5	0.0	No
1043	2.5	1.7	0.0	No
943	2.5	-1.7	0.0	No
843	2.5	0.1	0.0	No
830*	2.5	3.2	0.7	No*
743	2.5	1.9	0.0	No
690	2.5	1.4	0.0	No

Notes:

The cross sections indicated with an asterisk (*) have excess freeboard (hydraulic capacity), but do not have capacity for additional vegetation because they are located in segments of the channel with hard bottom (concrete, rip-rap).

20.8 Additional Analysis

Reach 57 does not have excess hydraulic capacity under the existing and design condition scenarios for a majority of the SBC reach. Furthermore, one segment showing hydraulic capacity is located within a hard bottom portion of the SBC reach where vegetation cannot be planted. Therefore, no additional analysis was performed.



0 70 140 Feet

PACE Advanced Water Engineering

LACDPW
SANTA CLARA RIVER WATERSHED
SOFT BOTTOM CHANNEL ANALYSIS

TITLE
WHITES CANYON 57
EXISTING CAPACITY RESULTS

FIGURE
20-2

21 Soledad Canyon Road Drainage Reach 64

21.1 General Description

Soledad Canyon Road drainage is a minor tributary that flows parallel to the Soledad Siphon pipeline crossing until it confluences with SCR downstream of the pipeline. The study reach is nearly 2,400 feet in length, beginning at the culvert outlet for the concrete-lined drainage channel and ending approximately 800 feet downstream of the Soledad Siphon pipeline. The surrounding land consists of residential development. The soft-bottom reach of interest along Soledad Canyon Road Drainage measures 574 feet in length. The limits of the SBC reach are illustrated in Figure 21-1.

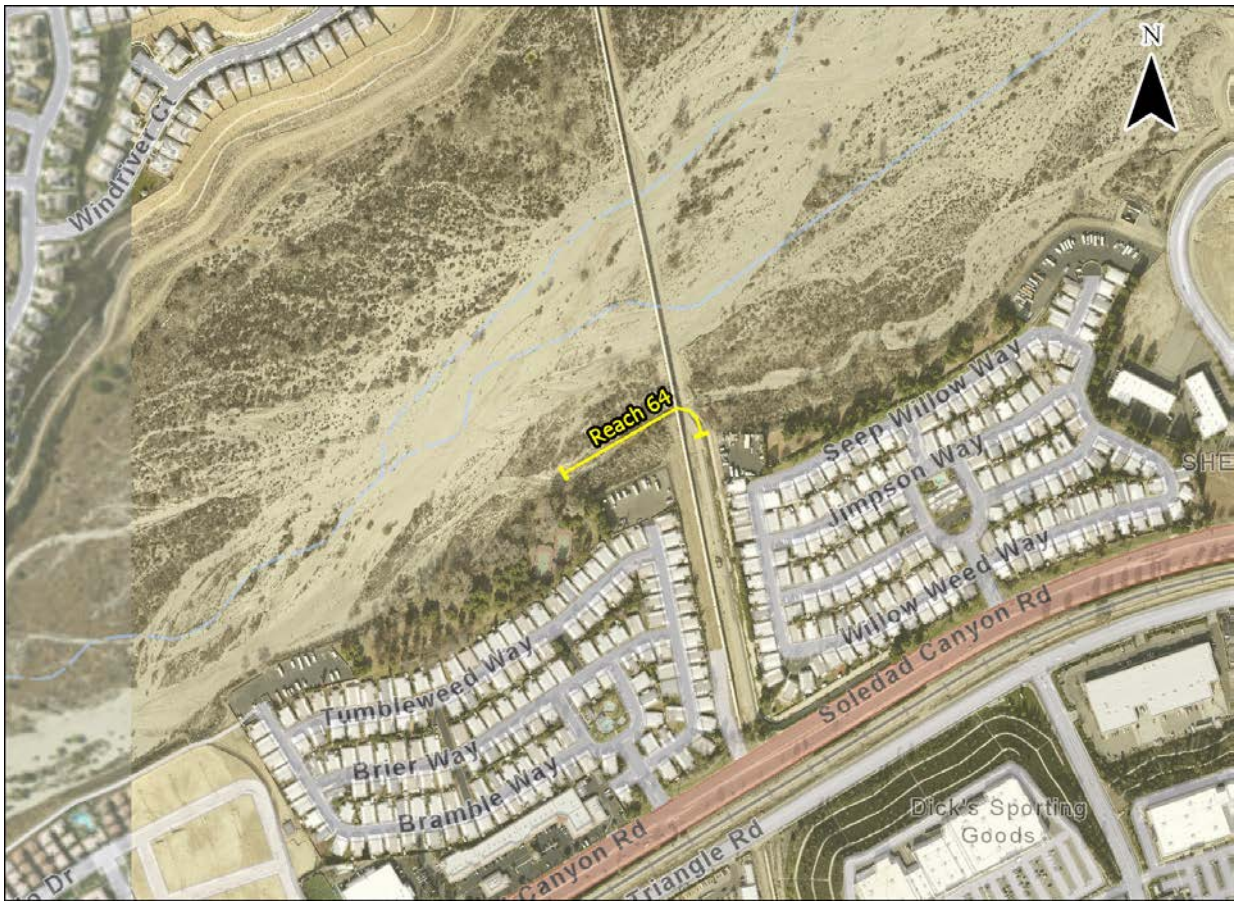


Figure 21-1: Reach 64 – Soledad Canyon Road Drainage

21.2 Structures

The reach of interest for Soledad Canyon Road Drainage is an engineered, earthen channel. There are no additional structures located in this SBC reach.

21.3 Manning's Roughness Coefficient

21.3.1 *Existing Conditions Manning's Coefficient*

Photographs documenting the existing channel conditions are provided in Appendix A. The existing conditions Manning's roughness coefficients are summarized in Table 21-1 with backup detail provided in Appendix B.

Table 21-1: Reach 64 – Soledad Canyon Road Drainage Existing Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
2500 to 1200	0.045	0.015	0.045
1100	0.025	0.027	0.015
1000	0.025	0.027	0.034
900 [1]	0.093	0.038	0.093
800 [1]	0.055	0.035	0.058
700 to 500 [1]	0.058	0.041	0.043
400 to 17 [2]	0.036	0.036	0.036

Notes:

[1] The n-values for sections 900 to 500 represent the roughness coefficients for Soledad Canyon Road Drainage (Reach 64).
[2] The n-values for sections 400 to 17 represent the roughness coefficients for SCR located downstream of the maintenance channel confluence.

21.3.2 *Design Conditions Manning's Coefficient*

Lacking Manning's roughness data from the as-built plan design documents, the roughness values for the design conditions HEC-RAS model are assumed as bare earth soil conditions. The Manning's roughness values used in the design conditions HEC-RAS models are summarized in Table 21-2.

Table 21-2: Reach 64 – Soledad Canyon Road Drainage Design Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
1000 to 500	0.025	0.025	0.025

21.4 Hydrology

Design flow rates were obtained from multiple as-built channel design documents available from the LACFCD website: http://dpw.lacounty.gov. The design documents and discharges are summarized in Table 21-3.

Table 21-3: Reach 64 – Soledad Canyon Road Drainage Design Flow Rates

Design Document No.	Year	Discharge (cfs)	HEC-RAS Station
RDD 234	1972	703	2500
RDD 234	1972	724	1983
PD 2032	1987	52,100	900

21.5 Hydraulic Model

The study reach is modeled with 26 cross sections with the majority of cross sections spaced at roughly 100-foot intervals. The cross sections are cut using 2006 LIDAR topographic data provided by LACDPW. The cross section locations and SBC reach extents are presented in Figure 21-2.

Cross section spacing was chosen to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. Additional cross-sections were incorporated into the model (as needed) at transitional areas and sharp bends to better represent the conditions in these portions of the channel. The hydraulic model was run under "mixed flow" conditions so that potential areas of supercritical flow were adequately modeled. HEC-RAS input and output files are provided in Appendix E.

21.6 Boundary Conditions

Normal depth is used as the boundary condition for the upstream extent of the model. The value of normal depth is estimated as the channel bed slope. At the downstream extents of the model, a known water surface is used as the boundary condition. The water surface elevation was obtained from the existing conditions HEC-RAS model for SCR Reaches 47, 51, 55, 56, 58, 60, and 61 at cross section 272252. The boundary conditions are summarized in Table 21-4.

Table 21-4: Reach 64 – Soledad Canyon Road Drainage Boundary Conditions

Sub-reach	Upstream Boundary Condition	Downstream Boundary Condition
River – 1	Normal Depth – S = 0.0026	Known WS – Elev = 1234.49'

21.7 Results

The water surface elevation from the existing conditions model is used to calculate freeboard at each cross section within the SBC reach. The existing conditions freeboard is compared to the required freeboard to determine whether there is excess freeboard (hydraulic capacity) at the cross section. Results of the freeboard calculations and capacity determination for each cross section are presented in Table 21-5, and in Figure 21-2. A detailed summary of these results is provided in Appendix C.

Table 21-5: Reach 64 – Soledad Canyon Road Drainage Excess Capacity Determination

HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
1000	2.5	-6.0	0.0	No
900	2.5	-4.4	0.0	No
800	2.5	-2.2	0.0	No
700	2.5	-3.7	0.0	No
600	2.5	-3.5	0.0	No
500	2.5	-2.4	0.0	No

21.8 Additional Analysis

Reach 64 does not have excess hydraulic capacity under the existing and design condition scenarios. Therefore, no additional analysis was performed.

0 30 60 Feet

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SOFT BOTTOM CHANNEL ANALYSIS

TITLE
SOLEDAD CANYON ROAD DRAIN 64
EXISTING CAPACITY RESULTS

FIGURE
21-2

22 South Fork SCR (Smizer Ranch MCI) Reach 72

22.1 General Description

Smizer Ranch Maintenance Channel Inlet (MCI) is located along South Fork SCR between Wiley Canyon Road and Interstate 5. The study reach is nearly 2,600 feet in length, beginning approximately 1,500 feet upstream of Wiley Canyon Road and ending about 200 feet downstream of Old Wiley Canyon Road. The surrounding land consists of residential development with areas of brushy open space. The soft-bottom reach of interest along South Fork SCR measures 101 feet in length. The limits of the SBC reach are illustrated in Figure 22-1.

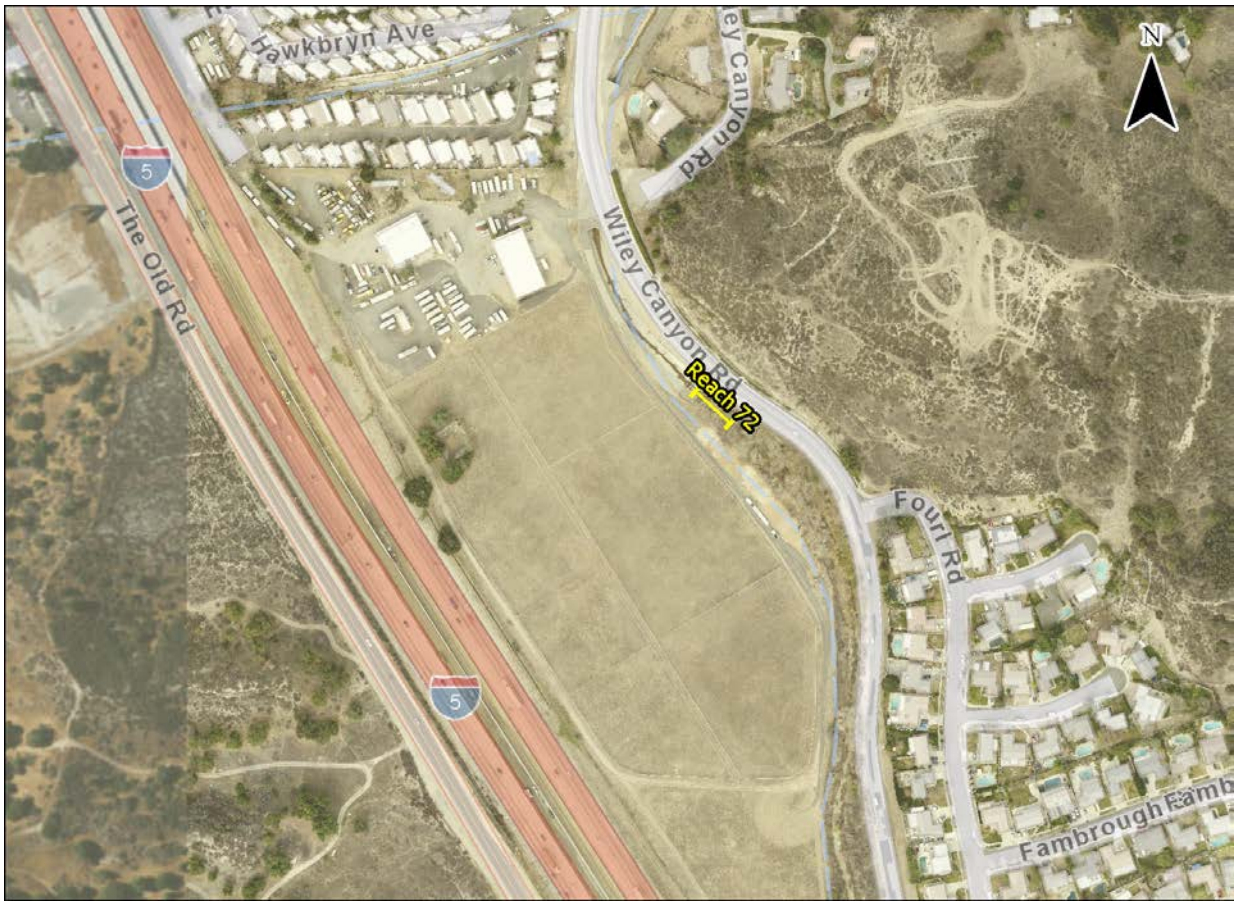


Figure 22-1: Reach 72 – South Fork SCR (Smizer Ranch MCI)

22.2 Structures

The reach of interest for South Fork SCR is an engineered, earthen channel that transitions to a grouted rock transition structure. Two bridges cross South Fork SCR along the study reach, as summarized in Table 22-1.

Table 22-1: Reach 72 – South Fork SCR Structures

Structure Number	HEC-RAS Station	Road Name	Type	Description	Structure Model Data Origin
1	6056	Wiley Canyon Road	Bridge	Clear span bridge (no piers)	USACE model
2	5500	Old Wiley Road	Bridge	Clear span bridge (no piers)	USACE model

22.3 Manning's Roughness Coefficient

22.3.1 *Existing Conditions Manning's Coefficient*

Photographs documenting the existing channel conditions are provided in Appendix A. The existing conditions Manning's roughness coefficients are summarized in Table 22-2 with backup detail provided in Appendix B.

Table 22-2: Reach 72 – South Fork SCR Existing Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
7726 to 6903	0.040	0.040	0.040
6842 to 6744	0.078	0.043	0.053
6702	0.078	0.032	0.053
6660	0.042	0.042	0.042
6600 to 5152	0.015	0.015	0.015

22.3.2 *Design Conditions Manning's Coefficient*

Lacking Manning's roughness data from the as-built plan design documents, the roughness values for the design conditions HEC-RAS model are assumed as bare earth soil conditions except for hard surfaces (i.e. grouted rip rap) which use the field survey roughness coefficients. The Manning's roughness values used in the design conditions HEC-RAS models are summarized in Table 22-3.

Table 22-3: Reach 72 – South Fork SCR Design Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
6744 to 6702	0.025	0.025	0.025
6660	0.042	0.042	0.042

22.4 Hydrology

Design flow rates were obtained from multiple as-built channel design documents available from the LACFCD website: http://dpw.lacounty.gov. The design documents and discharges are summarized in Table 22-4.

Table 22-4: Reach 72 – South Fork SCR Design Flow Rates

Design Document No.	Year	Discharge (cfs)	HEC-RAS Station
337-D22.1 – D22.32	1986	10,800	7726
337-D22.1 – D22.32	1986	12,300	5616

22.5 Hydraulic Model

The study reach is modeled with 43 cross sections with the majority of cross sections spaced at roughly 50-foot intervals. The cross sections are cut using 2006 LIDAR topographic data provided by LACDPW. The cross section locations and SBC reach extents are presented in Figure 22-2.

Cross section spacing was chosen to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. Additional cross-sections were incorporated into the model at transitional areas and sharp bends to better represent the conditions in these portions of the channel. The hydraulic model was run under "mixed flow" conditions so that potential areas of supercritical flow were adequately modeled. HEC-RAS input and output files are provided in Appendix E.

22.6 Boundary Conditions

Normal depth is used as the boundary condition for the upstream and downstream extents of the model. The value of normal depth is estimated as the channel bed slope. The boundary conditions are summarized in Table 22-5.

Table 22-5: Reach 72 – South Fork SCR Boundary Conditions

Sub-reach	Upstream Boundary Condition	Downstream Boundary Condition
River – 1	Normal Depth – S = 0.01500	Normal Depth – S = 0.01722

22.7 Results

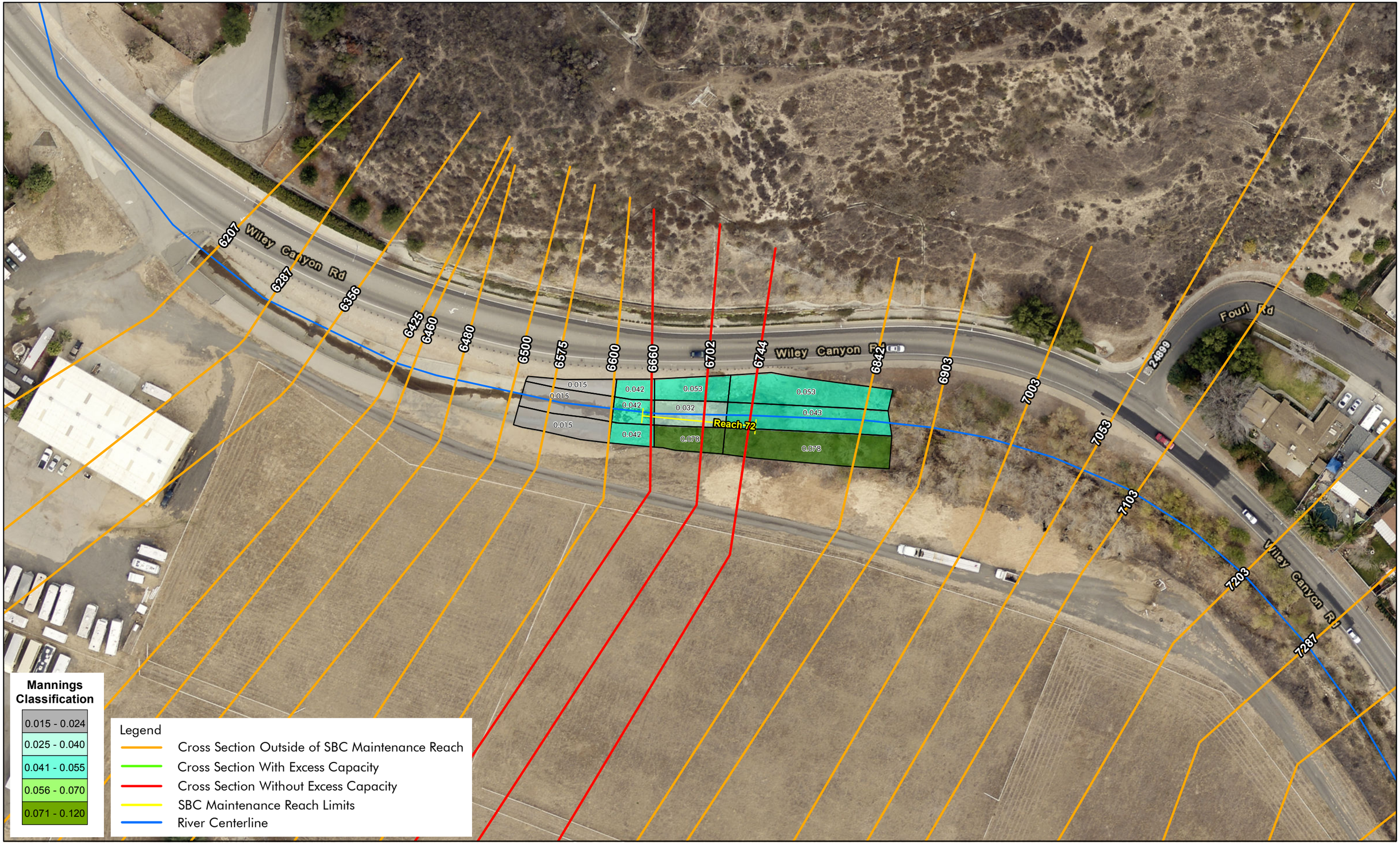
The water surface elevation from the existing conditions model is used to calculate freeboard at each cross section within the SBC reach. The existing conditions freeboard is compared to the required freeboard to determine whether there is excess freeboard (hydraulic capacity) at the cross section. Results of the freeboard calculations and capacity determination for each cross section are presented in Table 22-6, and in Figure 22-2. A detailed summary of these results is provided in Appendix C.

Table 22-6: Reach 72 – South Fork SCR Excess Capacity Determination

HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
6744	2.5	-4.0	0.0	No
6702	2.5	-5.2	0.0	No
6660	2.5	-7.8	0.0	No

22.8 Additional Analysis

Reach 72 does not have excess hydraulic capacity under the existing and design condition scenarios. Therefore, no additional analysis was performed.



0 50 100 Feet

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LACDPW
SANTA CLARA RIVER WATERSHED
SOFT BOTTOM CHANNEL ANALYSIS

TITLE
SOUTH FORK MCI 72
EXISTING CAPACITY RESULTS

FIGURE
22-2

23 Wildwood Canyon Channel Reach 73 and 74

23.1 General Description

Wildwood Canyon Channel a small drainage channel located in the city of Santa Clarita. The drainage channel runs parallel to Valley Street, approximately half a mile south of the intersection of Valley Street and Lyons Avenue. The study reach is nearly 400 feet in length, beginning approximately 20 feet upstream of Cedartown Street and ending at Valley Street. The surrounding land consists of residential development. The reaches of interest along Wildwood Canyon Channel measure 83 feet (Reach 73) and 365 feet (Reach 74) in length. The limits of the SBC reaches are illustrated in Figure 23-1.

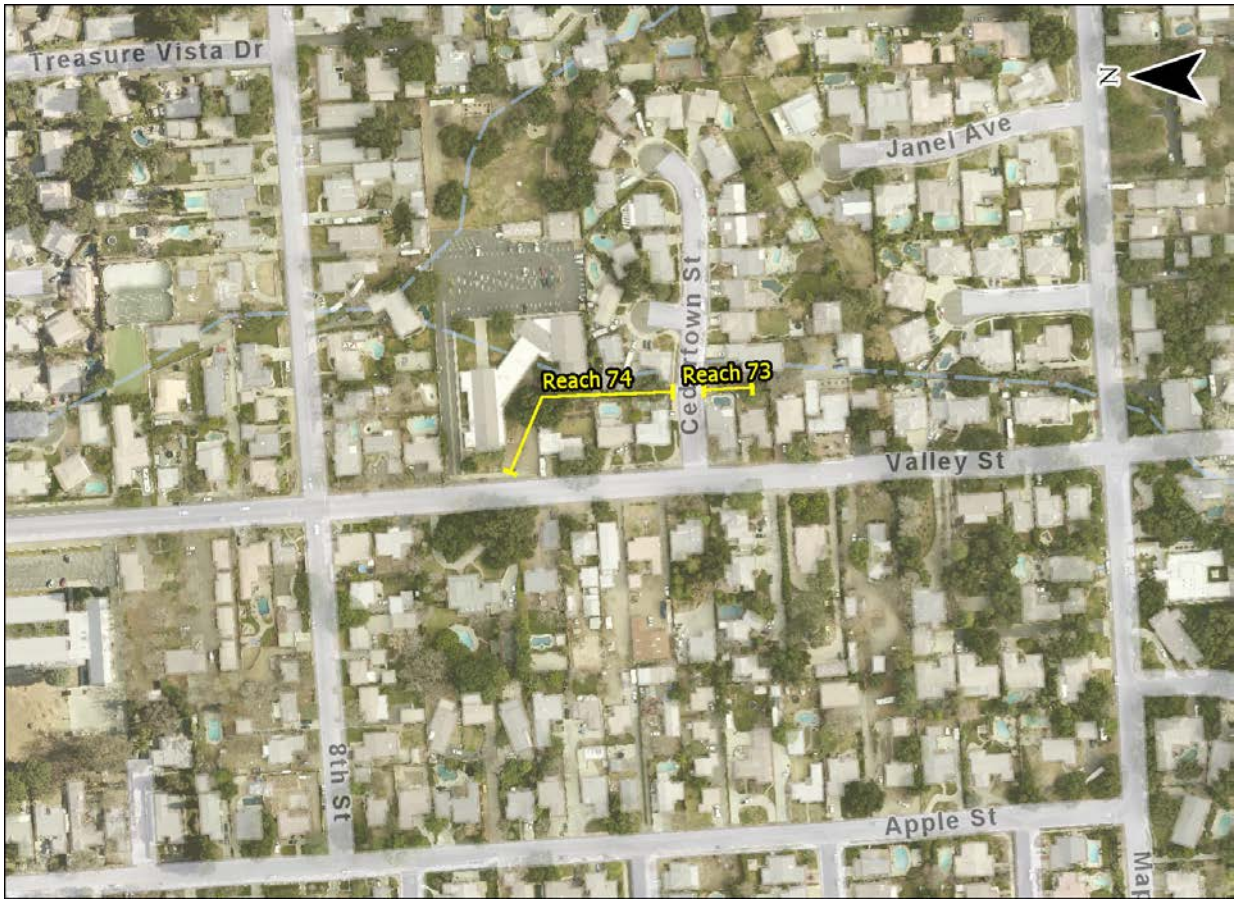


Figure 23-1: Reaches 73 & 74 – Wildwood Canyon Channel

23.2 Structures

The reaches of interest for Wildwood Canyon Channel are a concrete-lined, rectangular channel that transitions to a man-made, earthen channel (Reach 74) and a culvert inlet structure (Reach 73). There is one culvert located along the study reach, as summarized in Table 23-1.

Table 23-1: Reaches 73 & 74 – Wildwood Canyon Structures

Structure Number	River Station	Road Name	Type	Description	Structure Model Data Origin
1	390	Cedartown Street	Culvert	Box culvert with 1 - 10'W x 4'H cell	As-built plans

23.3 Manning's Roughness Coefficient

23.3.1 *Existing Conditions Manning's Coefficient*

Photographs documenting the existing channel conditions are provided in Appendix A. The existing conditions Manning's roughness coefficients are summarized in Table 23-2 with backup detail provided in Appendix B.

Table 23-2: Reaches 73 & 74 – Wildwood Canyon Existing Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
440	0.020	0.058	0.037
420 to 240	0.015	0.015	0.015
220 to 160	0.015	0.027	0.015
140 to 004	0.027	0.029	0.027

23.3.2 *Design Conditions Manning's Coefficient*

Lacking Manning's roughness data from the as-built plan design documents, the roughness values for the design conditions HEC-RAS model are assumed as bare earth soil conditions except for hard surfaces (i.e. concrete) which use the field survey roughness coefficients. The Manning's roughness values used in the design conditions HEC-RAS models are summarized in Table 23-3.

Table 23-3: Reaches 73 & 74 – Wildwood Canyon Design Conditions Manning's Roughness

Reach Number	HEC-RAS Station	Left Bank	Main Channel	Right Bank
73	420	0.015	0.015	0.015
74	360 to 240	0.015	0.015	0.015
	220 to 160	0.015	0.025	0.015
	140 to 4	0.025	0.025	0.025

23.4 Hydrology

The design flow rate at cross section 440 was obtained from PD T361 as-built channel design documents available from the LACFCD website: http://dpw.lacounty.gov. LACPDW provided the flow rate at cross section 280. The design documents and discharges are summarized in Table 23-4.

Table 23-4: Reaches 73 & 74 – Wildwood Canyon Design Flow Rates

Design Document No.	Year	Discharge (cfs)	HEC-RAS Station
PD T361	2000	16.5	440
–	–	21.5	280

23.5 Hydraulic Model

The study reach is modeled with 20 cross sections with the majority of cross sections spaced at roughly 20-foot intervals. The cross sections are cut using 2006 LIDAR topographic data provided by LACDPW. The cross section locations and SBC reach extents are presented in Figure 23-2.

Cross section spacing was chosen to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. Additional cross-sections were incorporated into the model (as needed) at transitional areas and sharp bends to better represent the conditions in these portions of the channel. The hydraulic model was run under "mixed flow" conditions so that potential areas of supercritical flow were adequately modeled. HEC-RAS input and output files are provided in Appendix E.

23.6 Boundary Conditions

Flow through the drop structure located at the upstream boundary is assumed to achieve critical depth. Therefore, critical depth is used as the boundary condition for the upstream extent of the model. The value for critical depth is computed in HEC-RAS based on the geometry of the initial upstream cross section. Normal depth is used as the boundary condition for the downstream extent of the model. The value of normal depth is estimated as the channel bed slope. The boundary conditions are summarized in Table 16-5.

Table 23-5: Reaches 73 & 74 – Wildwood Canyon Boundary Conditions

Sub-reach	Upstream Boundary Condition	Downstream Boundary Condition
Wildwood – 1	Critical Depth	Normal Depth – S = 0.020

23.7 Results

The water surface elevation from the existing conditions model is used to calculate freeboard at each cross section within the SBC reach. The existing conditions freeboard is compared to the required freeboard to determine whether there is excess freeboard (hydraulic capacity) at the cross section. Results of the freeboard calculations and capacity determination for each cross section are presented in Table 23-6, and in Figure 23-2. A detailed summary of these results is provided in Appendix C.

Table 23-6: Reaches 73 & 74 – Wildwood Canyon Excess Capacity Determination

Reach Number	HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
73	440	2.5	0.1	0.0	No
	420	2.5	4.4	1.9	No*
74	360*	2.5	3.1	0.6	No*
	340*	2.5	3.7	1.2	No*

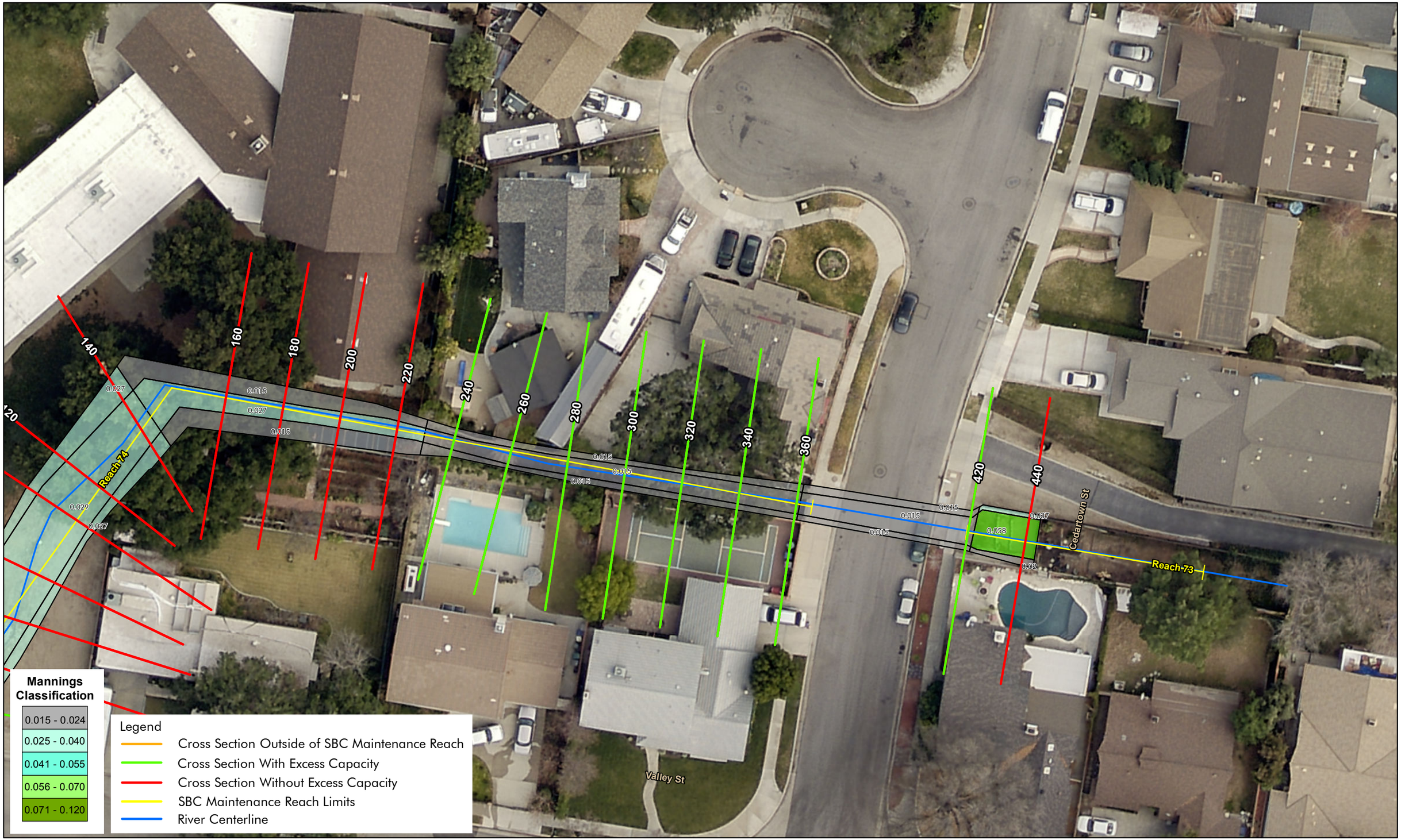
Reach Number	HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
74	320*	2.5	3.3	0.8	No*
	300*	2.5	3.2	0.7	No*
	280*	2.5	3.1	0.6	No*
	260*	2.5	3.0	0.5	No*
	240*	2.5	2.8	0.3	No*
	220	2.5	0.8	0.0	No
	200	2.5	0.8	0.0	No
	180	2.5	0.9	0.0	No
	160	2.5	1.0	0.0	No
	140	2.5	0.9	0.0	No
	120	2.5	0.2	0.0	No
	86	2.5	1.0	0.0	No
	58	2.5	0.6	0.0	No
	40	2.5	0.6	0.0	No
	22	2.5	1.3	0.0	No
	4	2.5	3.1	0.6	Yes

Notes:

The cross sections indicated with an asterisk (*) have excess freeboard (hydraulic capacity), but do not have capacity for additional vegetation because they are located in segments of the channel with hard bottom (concrete, rip-rap).

23.8 Additional Analysis

Reaches 73 and 74 have no excess or partial excess hydraulic capacity under the existing and design condition scenarios. Furthermore, segments showing hydraulic capacity are located within hard bottom portions of the channel where vegetation cannot be planted for Reach 74. LACFCD does not have an easement for either of these two reaches. Therefore, no additional analysis was performed.



0 30 60 Feet

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SANTA CLARA RIVER WATERSHED
SOFT BOTTOM CHANNEL ANALYSIS

TITLE
WILDWOOD CANYON 73 & 74
EXISTING CAPACITY RESULTS

FIGURE
23-2

24 Newhall Creek Reach 77

24.1 General Description

Newhall Creek is a tributary channel that flows northerly to its confluence with South Fork SCR. The study reach is nearly 2,500 feet in length, beginning approximately 500 feet downstream of 15th Street Bridge and ending at the Wiley Canyon Road / Via Princessa Bridge. The surrounding land consists of residential development and areas of brushy open space. The reach of interest along Newhall Creek measures 2,092 feet in length. The limits of the SBC reach are illustrated in Figure 24-1.

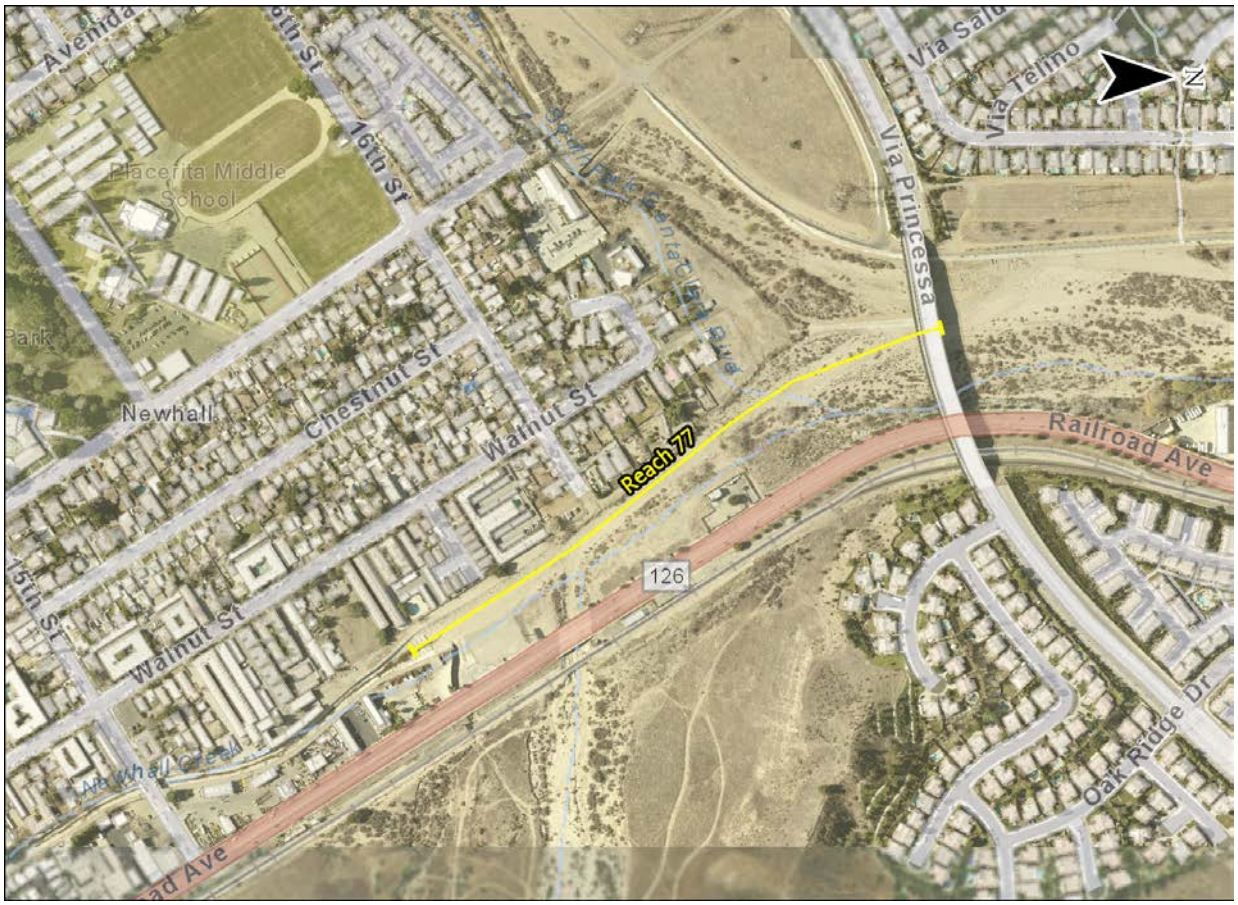


Figure 24-1: Reach 77 – Newhall Creek

24.2 Structures

The reach of interest for Newhall Creek is an engineered, earthen channel. There are no additional structures located in this SBC reach.

24.3 Manning's Roughness Coefficient

24.3.1 *Existing Conditions Manning's Coefficient*

Photographs documenting the existing channel conditions are provided in Appendix A. The existing conditions Manning's roughness coefficients are summarized in Table 24-2 with backup detail provided in Appendix B.

Table 24-1: Reach 77 – Newhall Creek Outlet Existing Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
2600 to 2300	0.015	0.015	0.015
2200 to 2100	0.015	0.050	0.015
2000 to 1500	0.027	0.028	0.027
1400 to 900	0.043	0.031	0.054
800 to 600	0.038	0.044	0.037
500 to 300	0.015	0.041	0.042

24.3.2 *Design Conditions Manning's Coefficient*

Lacking Manning's roughness data from the as-built plan design documents, the roughness values for the design conditions HEC-RAS model are assumed as bare earth soil conditions except for hard surfaces (i.e. grouted rip rap, concrete) which use the field survey roughness coefficients. The Manning's roughness values used in the design conditions HEC-RAS models are summarized in Table 24-3.

Table 24-2: Reach 77 – Newhall Creek Outlet Design Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
2000 to 600	0.025	0.025	0.025
500 to 300	0.015	0.025	0.042

24.4 Hydrology

Design flow rates were obtained from multiple as-built channel design documents available from the LACFCD website: http://dpw.lacounty.gov. The design documents and discharges are summarized in Table 24-4.

Table 24-3: Reach 77 – Newhall Creek Outlet Design Flow Rates

Design Document No.	Year	Discharge (cfs)	HEC-RAS Station
Dwg. 340-D4.1 – D4.16	1977	8,350	2600
Dwg. 340-D4.1 – D4.16	1977	14,820	1500
PD 1041	1970	33,000	400

24.5 Hydraulic Model

The study reach is modeled with 24 cross sections with the majority of cross sections spaced at roughly 100-foot intervals. The cross sections are cut using 2006 LIDAR topographic data provided by LACDPW. The cross section locations and SBC reach extents are presented in Figure 24-2.

Cross section spacing was chosen to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. Additional cross-sections were incorporated into the model (as needed) at transitional areas and sharp bends to better represent the conditions in these portions of the channel. The hydraulic model was run under "mixed flow" conditions so that potential areas of supercritical flow were adequately modeled. HEC-RAS input and output files are provided in Appendix E.

24.6 Boundary Conditions

Normal depth is used as the boundary condition for the upstream extent of the model. The value of normal depth is estimated as the channel bed slope. At the downstream extents of the model, a known water surface is used as the boundary condition. The water surface elevation was obtained from the existing conditions HEC-RAS model for South Fork SCR Reach 75 at cross section 13592. The boundary conditions are summarized in Table 19-5.

Table 24-4: Reach 77 – Newhall Creek Outlet Boundary Conditions

Sub-reach	Upstream Boundary Condition	Downstream Boundary Condition
River – 1	Normal Depth – S = 0.00771	Known WS – Elev = 1203.31'

24.7 Results

The water surface elevation from the existing conditions model is used to calculate freeboard at each cross section within the SBC reach. The existing conditions freeboard is compared to the required freeboard to determine whether there is excess freeboard (hydraulic capacity) at the cross section. Results of the freeboard calculations and capacity determination for each cross section are presented in Table 24-6, and in Figure 24-2. A detailed summary of these results is provided in Appendix C.

Table 24-5: Reach 77 – Newhall Creek Outlet Excess Capacity Determination

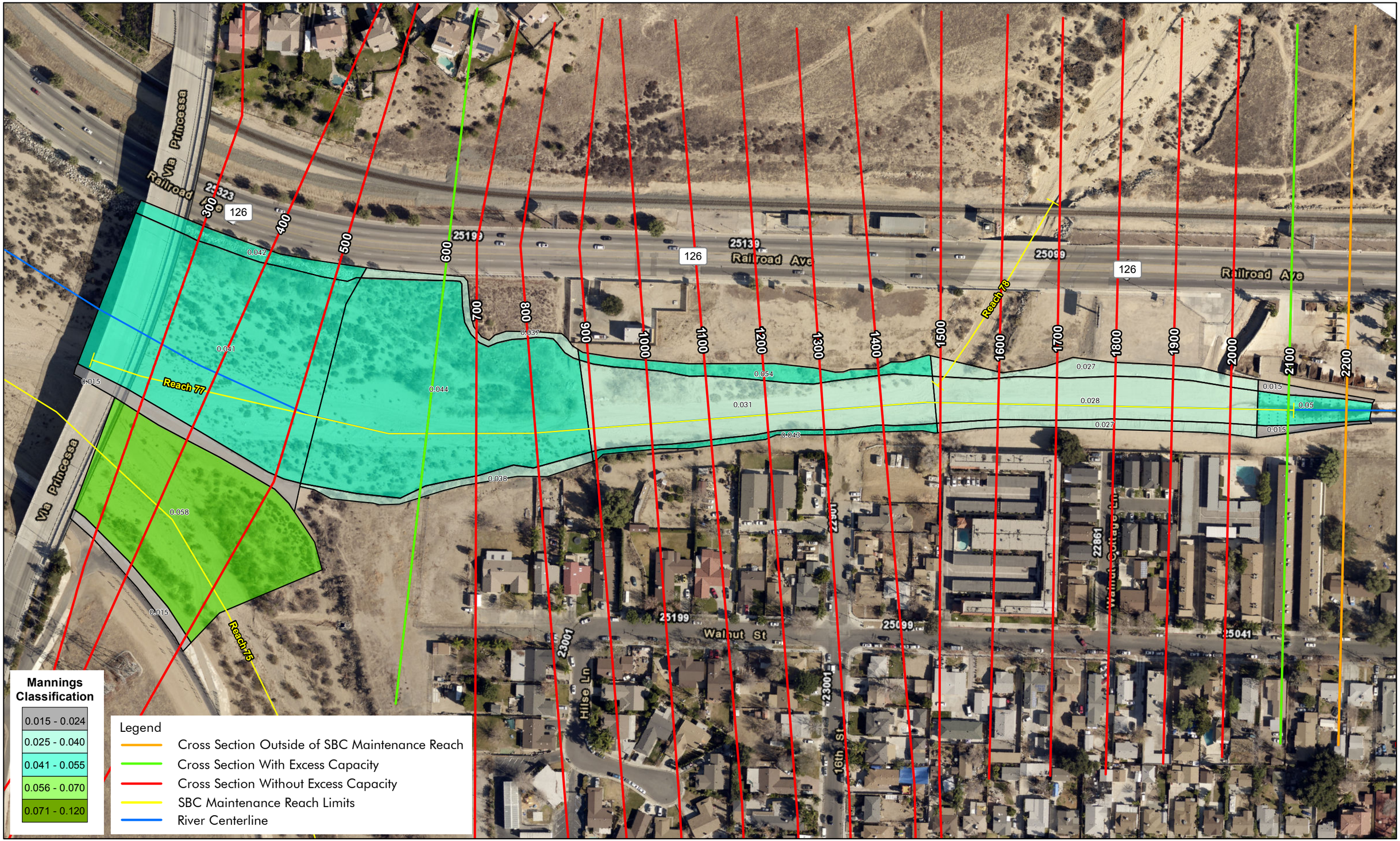
HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
2100*	2.5	3.8	1.3	No*
2000	2.5	0.6	0.0	No
1900	2.5	-0.7	0.0	No
1800	2.5	-2.1	0.0	No
1700	2.5	-3.9	0.0	No
1600	2.5	-5.6	0.0	No
1500	2.5	-3.9	0.0	No
1400	2.5	-4.3	0.0	No
1300	2.5	-3.1	0.0	No
1200	2.5	-2.7	0.0	No
1100	2.5	-1.2	0.0	No
1000	2.5	0.4	0.0	No
900	2.5	0.2	0.0	No
800	2.5	2.1	0.0	No
700	2.5	1.3	0.0	No
600	2.5	4.0	1.5	Yes
500	2.5	-3.9	0.0	No
400	2.5	-4.4	0.0	No
300	2.5	-5.9	0.0	No

Notes:

The cross sections indicated with an asterisk (*) have excess freeboard (hydraulic capacity), but do not have capacity for additional vegetation because they are located in segments of the channel with hard bottom (concrete, rip-rap).

24.8 Additional Analysis

Reach 77 does not have excess hydraulic capacity under the existing conditions scenario for a majority of the SBC reach. Furthermore, one segment showing hydraulic capacity is located within a hard bottom portion of the channel where vegetation cannot be planted. The design conditions scenario was also reviewed, this reach showed partial excess capacity under design conditions. However, portions identified with excess capacity were predominately segmented and sporadic and LACFCD does not have an easement in portions with excess capacity. Therefore, no additional analysis was performed.


Via Princessa
Railroad Ave
126
25323
25193
25139
25099
Reach 78
Reach 77
Reach 75
0.042
0.041
0.044
0.037
0.054
0.031
0.043
0.038
0.027
0.028
0.015
0.05
0.058
Walnut St
Hilse Ln
16th St
Walnut Cottage Ln
22861
23001
25199
25041
Mannings Classification
0.015 - 0.024
0.025 - 0.040
0.041 - 0.055
0.056 - 0.070
0.071 - 0.120
Legend
Cross Section Outside of SBC Maintenance Reach
Cross Section With Excess Capacity
Cross Section Without Excess Capacity
SBC Maintenance Reach Limits
River Centerline
0
150
300
Feet
PACE
Advanced Water Engineering
LACDPW
SANTA CLARA RIVER WATERSHED
SOFT BOTTOM CHANNEL ANALYSIS
TITLE
NEWHALL CREEK 77
EXISTING CAPACITY RESULTS
FIGURE
24-2

25 Placerita Creek Reach 78

25.1 General Description

Placerita Creek is a tributary channel that flows west to its confluence with Newhall Creek. The study reach is nearly 900 feet in length, beginning approximately 600 feet upstream of Railroad Avenue and ending at its confluence with Newhall Creek. The surrounding land consists of residential development and areas of brushy open space. The soft-bottom reach of interest along Placerita Creek measures 376 feet in length. The limits of the SBC reach are illustrated in Figure 25-1.

Figure 25-1: Reach 78 – Placerita Creek

25.2 Structures

The reach of interest for Placerita Creek is an engineered, earthen channel. Two bridges cross Placerita Creek along the study reach, as summarized in Table 25-1.

Table 25-1: Reach 78 – Placerita Creek Structures

Structure Number	HEC-RAS Station	Road Name	Type	Description	Structure Model Data Origin
1	379	Southern Pacific Railroad	Bridge	3 - 2' 8" wide, square-nosed pier walls	USACE model

Structure Number	HEC-RAS Station	Road Name	Type	Description	Structure Model Data Origin
2	279	Railroad Avenue	Bridge	2- 1' 3" wide, square-nosed pier walls	USACE model

25.3 Manning's Roughness Coefficient

25.3.1 *Existing Conditions Manning's Coefficient*

Photographs documenting the existing channel conditions are provided in Appendix A. The existing conditions Manning's roughness coefficients are summarized in Table 25-2 with backup detail provided in Appendix B.

Table 25-2: Reach 78 – Placerita Creek Existing Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
937 to 570	0.049	0.038	0.044
424 to 339	0.042	0.034	0.049
218	0.042	0.028	0.042
137	0.037	0.028	0.042
17	0.040	0.040	0.040

25.3.2 *Design Conditions Manning's Coefficient*

Lacking Manning's roughness data from the as-built plan design documents, the roughness values for the design conditions HEC-RAS model are assumed as bare earth soil conditions. The Manning's roughness values used in the design conditions HEC-RAS models are summarized in Table 25-3.

Table 25-3: Reach 78 – Placerita Creek Design Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
398 to 137	0.025	0.025	0.025

25.4 Hydrology

Design documents for the study reach were not available; therefore, the design flowrates used in the HEC-RAS analysis was provided by LACDPW. The discharge is summarized in Table 25-4.

Table 25-4: Reach 78 – Placerita Creek Design Flow Rates

Design Document No.	Year	Discharge (cfs)	HEC-RAS Station
–	–	6,470	937

25.5 Hydraulic Model

The study reach is modeled with 11 cross sections with the majority of cross sections spaced at roughly 120-foot intervals. The cross sections are cut using 2006 LIDAR topographic data provided by LACDPW. The cross section locations and SBC reach extents are presented in Figure 25-2.

Cross section spacing was chosen to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. Cross section spacing near the bridges was reduced to a minimum of 13 feet to better represent the hydraulics through these structures. The hydraulic model was run under “mixed flow” conditions so that potential areas of supercritical flow were adequately modeled. HEC-RAS input and output files are provided in Appendix E.

25.6 Boundary Conditions

Normal depth is used as the boundary condition for the upstream extent of the model. The value of normal depth is estimated as the channel bed slope. At the downstream extents of the model, a known water surface is used as the boundary condition. The water surface elevation was obtained from the existing conditions HEC-RAS model for Newhall Creek Reach 77 at cross section 1600. The boundary conditions are summarized in Table 19-5.

Table 25-5: Reach 78 – Placerita Creek Boundary Conditions

Sub-reach	Upstream Boundary Condition	Downstream Boundary Condition
Placerita – 1	Normal Depth – S = 0.010	Known WS – El = 1217.88'

25.7 Results

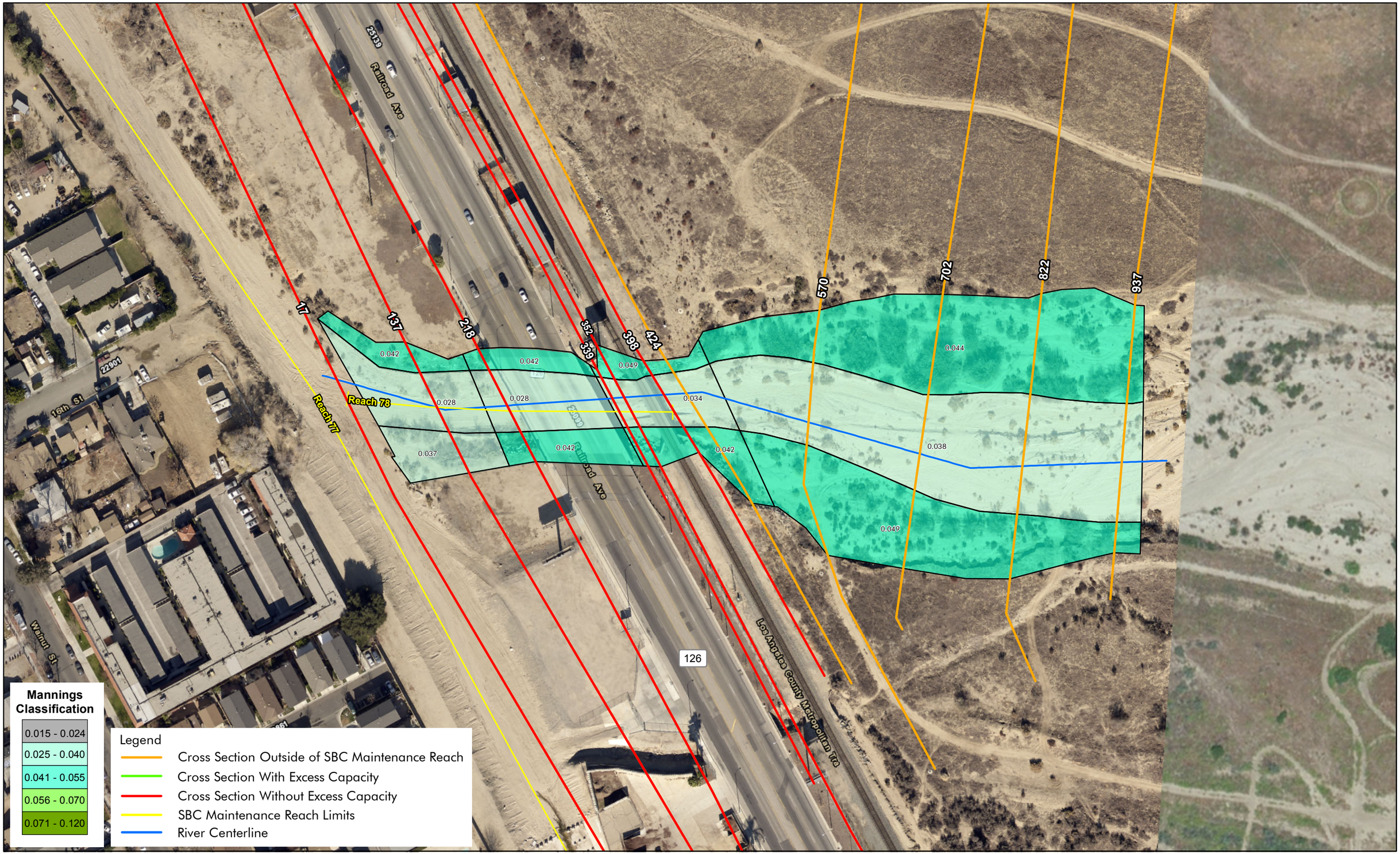
The water surface elevation from the existing conditions model is used to calculate freeboard at each cross section within the SBC reach. The existing conditions freeboard is compared to the required freeboard to determine whether there is excess freeboard (hydraulic capacity) at the cross section. Results of the freeboard calculations and capacity determination for each cross section are presented in Table 25-6, and in Figure 25-2. A detailed summary of these results is provided in Appendix C.

Table 25-6: Reach 78 – Placerita Creek Excess Capacity Determination

HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
398	2.5	-1.5	0.0	No
352	2.5	-1.8	0.0	No
339	2.5	-1.2	0.0	No
218	2.5	-0.2	0.0	No
137	2.5	-1.1	0.0	No
17	2.5	-3.8	0.0	No

25.8 Additional Analysis

Reach 78 does not excess hydraulic capacity under the existing and design condition scenarios. Therefore, no additional analysis was performed.



0 100 200 Feet

PACE Advanced Water Engineering

LACDPW
SANTA CLARA RIVER WATERSHED
SOFT BOTTOM CHANNEL ANALYSIS

TITLE
PLACERITA CREEK 78
EXISTING CAPACITY RESULTS

FIGURE
25-2

26 San Martinez-Chiquito Canyon Reach 91, 92, 93, and 94

26.1 General Description

San Martinez-Chiquito Canyon is a tributary that flows southeasterly to its confluence with SCR. The study reach is nearly 1.9 miles in length, beginning approximately 1,700 feet upstream of San Martinez Road and ending approximately 600 feet downstream of Lincoln Avenue. The surrounding land consists of residential development and areas of brushy open space. The soft-bottom reaches of interest along San Martinez-Chiquito Canyon measure 599 feet (Reach 91), 768 feet (Reach 92), 1,072 feet (Reach 93), and 2,446 feet (Reach 94) in length. The limits of the SBC reaches are illustrated in Figure 26-1.

Figure 26-1: Reaches 91, 92, 93, & 94 – SM Chiquito Canyon

26.2 Structures

The reaches of interest for San Martinez-Chiquito Canyon are engineered, earthen channels with segments of pipe-and-wire revetment and concrete transitional areas. There are six structures included in the model for South Fork SCR: three culverts and three bridges. The structures included in the model are summarized in Table 26-1.

Table 26-1: Reaches 91, 92, 93, & 94 – SM Chiquito Canyon Structures

Structure Number	HEC-RAS Station	Road Name	Type	Description	Structure Model Data Origin
1	20200	Delwood Street	Bridge	1 - 1' diameter circular pier	USACE model
2	19100	Verdale Avenue	Culvert	Box culvert with 1 - 10' 8"W x 2' 4"H cell	USACE model
3	17200	San Martinez Road	Culvert	Box culvert with 1 - 20'W x 4.39'H cell	USACE model and field measurements
4	14550	Loma Verde Mountainway	Culvert	3 - 2.5' diameter RCP	USACE model and field measurements
5	14310	–	Pedestrian bridge	Clear span bridge (no piers)	USACE model
6	12200	Chiquito Canyon Road	Bridge	Clear span bridge (no piers)	USACE model

26.3 Manning's Roughness Coefficient

26.3.1 *Existing Conditions Manning's Coefficient*

Photographs documenting the existing channel conditions are provided in Appendix A. The existing conditions Manning's roughness coefficients are summarized in Table 26-2 with backup detail provided in Appendix B.

Table 26-2: Reaches 91, 92, 93, & 94 – SM Chiquito Canyon Existing Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
18800 to 18200	0.040	0.040	0.040
18058 to 17994	0.041	0.027	0.042
17913	0.025	0.027	0.027
17847 to 17763	0.037	0.027	0.036
17554 to 17323	0.046	0.033	0.039
17302	0.015	0.032	0.015
17134 to 17068	0.068	0.032	0.064
16910 to 16642	0.064	0.034	0.052
16580	0.015	0.015	0.015
16540 to 16165	0.038	0.027	0.061
16090	0.029	0.028	0.038
15915 to 15736	0.034	0.028	0.047
15561 to 15491	0.041	0.031	0.054
15355 to 13399	0.040	0.040	0.040

HEC-RAS Station	Left Bank	Main Channel	Right Bank
13337 to 13115	0.032	0.028	0.042
12972 to 12450	0.032	0.026	0.050
12331	0.036	0.027	0.035
12292 to 12183	0.015	0.015	0.015
12102 to 11972	0.043	0.028	0.038
11824	0.038	0.028	0.032
11674 to 11519	0.035	0.028	0.034
11440	0.015	0.015	0.015
11400	0.033	0.033	0.052
11242	0.038	0.027	0.033
11092	0.029	0.027	0.058
11051	0.015	0.015	0.015
11027 to 10708	0.038	0.038	0.041
10602 to 9549	0.040	0.040	0.040
9514	0.015	0.015	0.015
9475 to 8954	0.040	0.040	0.040

26.3.2 *Design Conditions Manning's Coefficient*

Lacking Manning's roughness data from the as-built plan design documents, the roughness values for the design conditions HEC-RAS model are assumed as bare earth soil conditions except for hard surfaces (i.e. concrete) which use the field survey roughness coefficients. The Manning's roughness values used in the design conditions HEC-RAS models are summarized in Table 26-3.

Table 26-3: Reaches 91, 92, 93, & 94 – SM Chiquito Canyon Design Conditions Manning's Roughness

Reach Number	HEC-RAS Station	Left Bank	Main Channel	Right Bank
91	17134 to 16642	0.025	0.025	0.025
92	18058 to 17302	0.025	0.025	0.025
93	16540 to 15491	0.025	0.025	0.025
94	13337 to 12331	0.025	0.025	0.025
	12292 to 12183	0.015	0.015	0.015
	12102 to 11519	0.025	0.025	0.025
	11440	0.015	0.015	0.015
	11400 to 10960	0.025	0.025	0.025

26.4 Hydrology

Design flow rates were not specified in any of the design documents for the study reach; therefore, the design flowrates used in the HEC-RAS analysis were provided by LACDPW. The discharges are summarized in Table 26-4.

Table 26-4: Reaches 91, 92, 93, & 94 – SM Chiquito Canyon Design Flow Rates

Design Document No.	Year	Discharge [1] (cfs)	HEC-RAS Station
–	–	1,000	18800
–	–	2,690	17554
–	–	3,570	17134
–	–	4,240	16580
–	–	5,320	14133
–	–	6,100	12183
–	–	6,740	9889

26.5 Hydraulic Model

The study reach is modeled with 132 cross sections with the majority of cross sections spaced at roughly 100-foot intervals. The cross sections are cut using 2006 LIDAR topographic data provided by LACDPW. The cross section locations and SBC reach extents are presented in Figures 26-2 through 26-5.

Cross section spacing was chosen to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. Additional cross-sections were incorporated into the model (as needed) at transitional areas and sharp bends to better represent the conditions in these portions of the channel. The hydraulic model was run under “mixed flow” conditions so that potential areas of supercritical flow were adequately modeled. HEC-RAS input and output files are provided in Appendix E.

26.6 Boundary Conditions

The model consists of three sub-reaches with a junction where a small tributary channel confluences with San Martinez-Chiquito Canyon just upstream of San Martinez Road. At the upstream and downstream extents of the model, normal depth is used as the boundary condition. The value of normal depth is estimated as the channel bed slope. Interior boundary conditions (i.e. at the junction) are automatically generated by HEC-RAS from the junction hydraulics. The boundary conditions are summarized in Table 26-5.

Table 26-5: Reaches 91, 92, 93, & 94 – SM Chiquito Canyon Boundary Conditions

Sub-reach	Upstream Boundary Condition	Downstream Boundary Condition
SMChiq – 3	Normal Depth – S = 0.035	Junction
SMChiq – 2	Junction	Normal Depth – S = 0.020
SMChiq Trib – 1	Normal Depth – S = 0.035	Junction

26.7 Results

The water surface elevation from the existing conditions model is used to calculate freeboard at each cross section within the SBC reaches. The existing conditions freeboard is compared to the required freeboard to determine whether there is excess freeboard (hydraulic capacity) at the cross section. Results of the freeboard calculations and capacity determination for each cross section are presented in Table 26-6, and in Figures 26-2 through 26-5. A detailed summary of these results is provided in Appendix C.

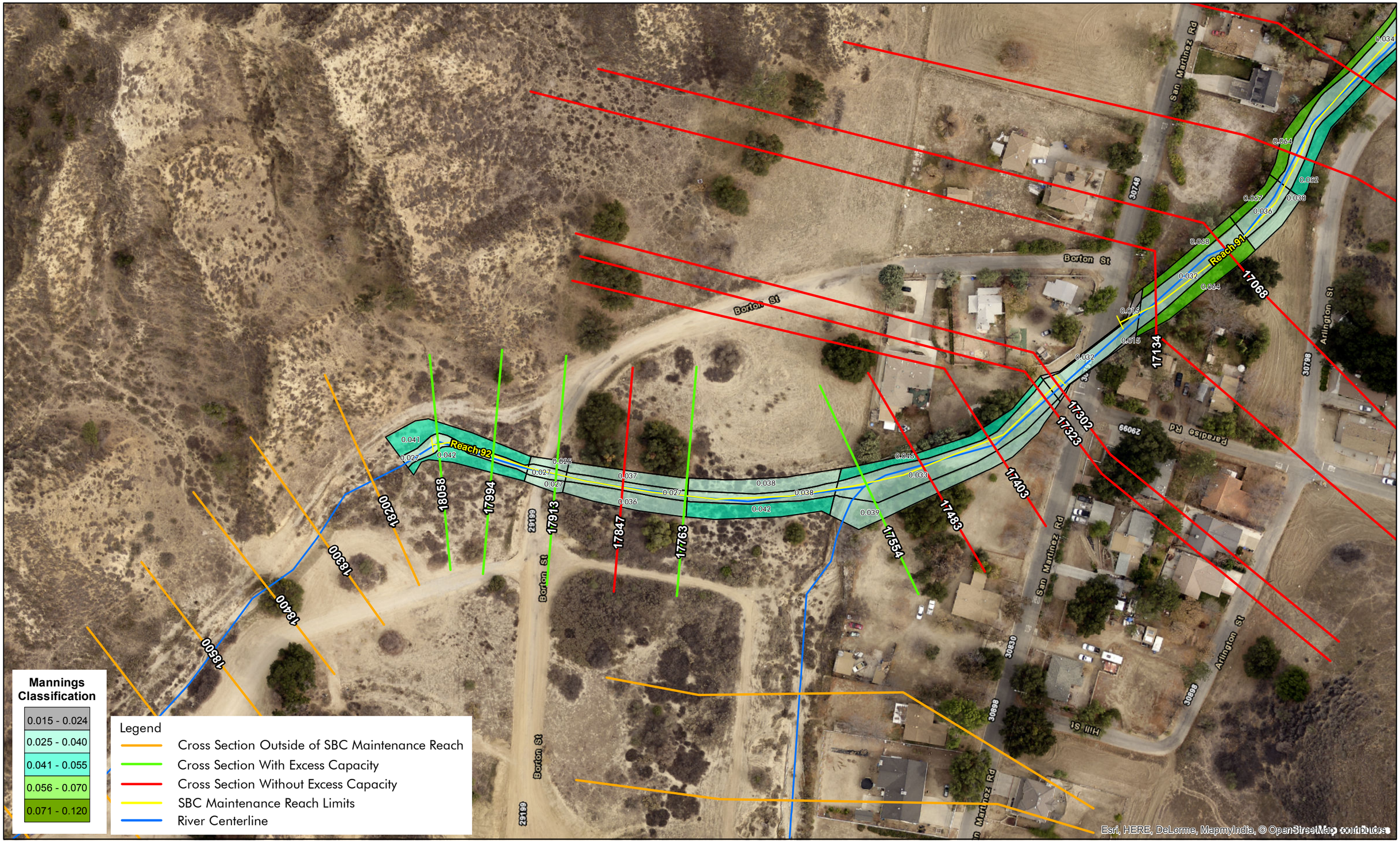
Table 26-6: Reaches 91, 92, 93, & 94 – SM Chiquito Canyon Excess Capacity Determination

Reach Number	HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
91	17134	2.5	-2.1	0.0	No
	17068	2.5	-1.0	0.0	No
	16910	2.5	-3.0	0.0	No
	16776	2.5	-1.7	0.0	No
	16642	2.5	-0.6	0.0	No
92	18058	2.5	5.7	3.2	Yes
	17994	2.5	3.3	0.8	Yes
	17913	2.5	2.6	0.1	Yes
	17847	2.5	0.6	0.0	No
	17763	2.5	2.9	0.4	Yes
	17554	2.5	3.9	1.4	Yes
	17483	2.5	2.0	0.0	No
	17403	2.5	-0.6	0.0	No
	17323	2.5	-0.3	0.0	No
	17302	2.5	-0.8	0.0	No
93	16540	2.5	0.9	0.0	No
	16390	2.5	3.9	1.4	Yes
	16315	2.5	2.5	0.0	No
	16240	3.5	0.7	0.0	No
	16165	4.1	0.7	0.0	No
	16090	2.5	4.5	2.0	Yes
	15915	3.0	0.7	0.0	No
	15736	4.1	0.7	0.0	No
	15561	3.8	-0.4	0.0	No
	15491	2.8	-0.8	0.0	No
94	13337	3.0	0.0	0.0	No
	13228	3.7	-2.0	0.0	No
	13115	4.3	-1.2	0.0	No
	12972	5.2	-1.2	0.0	No
	12908	5.6	-0.6	0.0	No
	12829	6.1	-1.2	0.0	No
	12764	6.5	-0.3	0.0	No
	12685	7.0	-1.2	0.0	No
	12589	7.5	-1.6	0.0	No
	12450	8.3	-0.8	0.0	No
	12331	9.1	-1.0	0.0	No
	12292	9.3	-2.4	0.0	No
	12183	10.0	-1.6	0.0	No
	12102	10.5	-0.5	0.0	No

Reach Number	HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
94	12057	10.8	0.8	0.0	No
	11972	11.4	-1.5	0.0	No
	11824	12.2	-1.6	0.0	No
	11674	13.1	-3.0	0.0	No
	11600	13.1	-1.5	0.0	No
	11519	13.1	-1.5	0.0	No
	11440	13.1	-3.0	0.0	No
	11400	13.1	-2.0	0.0	No
	11242	13.1	-2.0	0.0	No
	11092	13.1	-0.2	0.0	No
	11051	13.1	-1.4	0.0	No
	11027	13.1	-2.1	0.0	No
	10960	13.1	-0.5	0.0	No

26.8 Additional Analysis

Reaches 91 and 94 do not have excess hydraulic capacity under the existing and design condition scenarios. Reaches 92 and 93 have partial excess capacity, however for those portions LACFCD has limited or no easement. Therefore, no additional analysis was performed.



0 100 200 Feet

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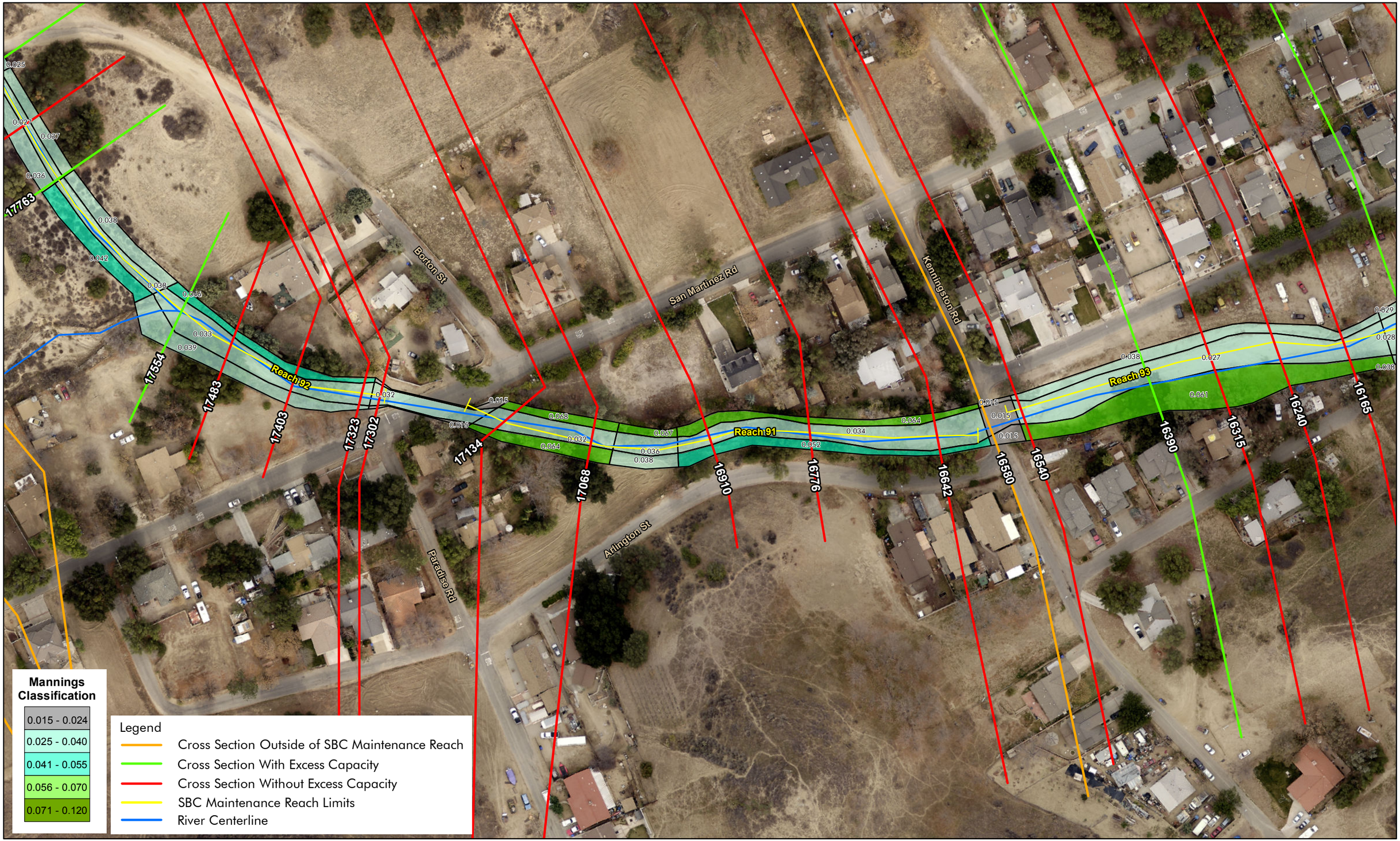
SOFT BOTTOM CHANNEL ANALYSIS

TITLE

CHIQUITO CANYON 91, 92, 93, & 94 EXISTING CAPACITY RESULTS

FIGURE

26-2



0 100 200 Feet

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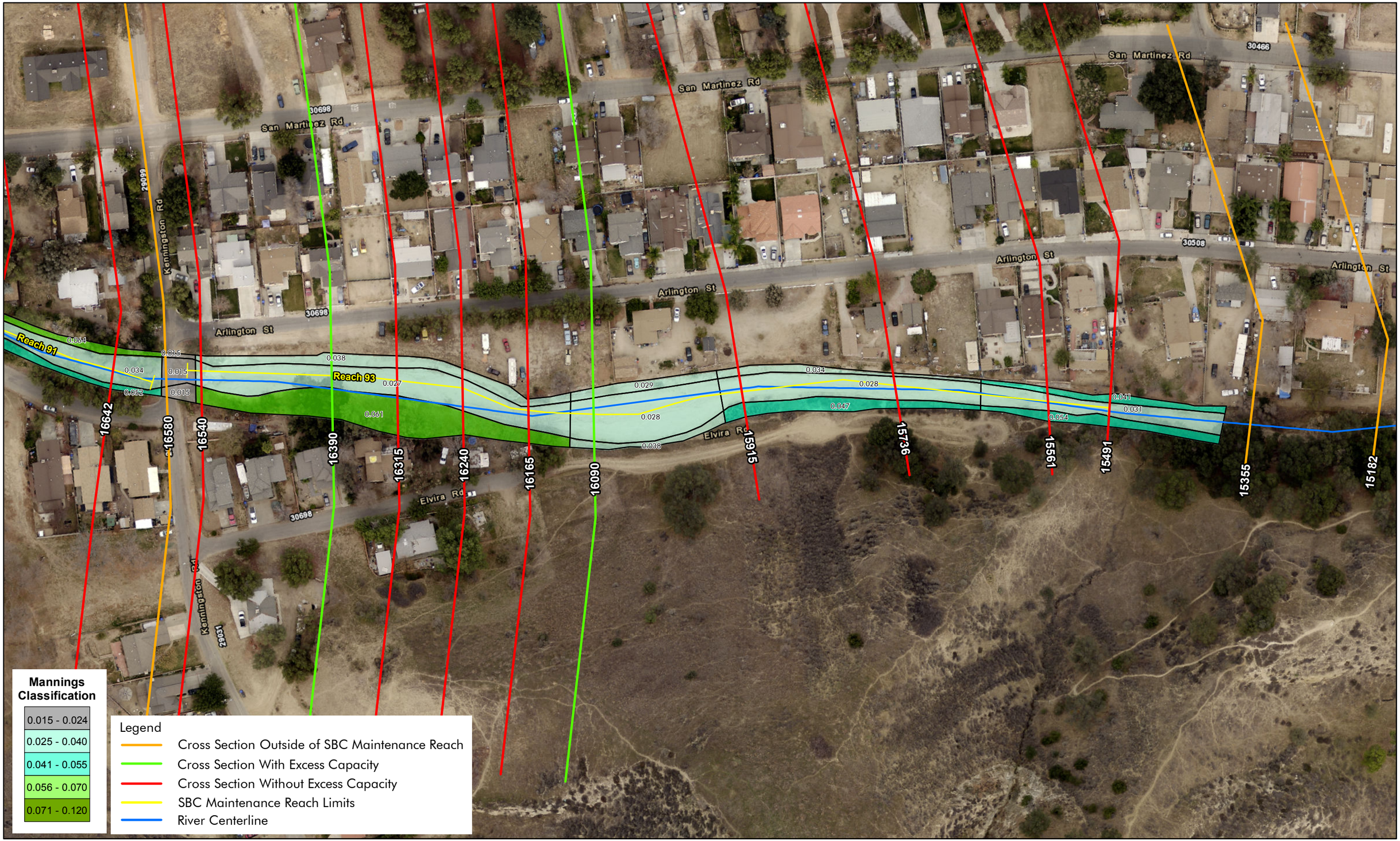
TITLE
CHIQUITO CANYON 91, 92, 93, & 94
EXISTING CAPACITY RESULTS

FIGURE
26-3



0 100 200 Feet

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TITLE
CHIQUITO CANYON 91, 92, 93, & 94
EXISTING CAPACITY RESULTS

FIGURE
26-4

San Martinez Rd

Chiquito Canyon Rd

Taylor St

Reach 94

13337 13328 13115 12972 12908 12829 12764 12685 12589 12450 12331 12292 12183 12102 12057 11972 11824 11674 11600 11519 11440 11400 11242 11092 11027 10960 10857 10788 10708

0.032 0.042 0.028 0.05 0.032 0.026 0.036 0.035 0.027 0.015 0.015 0.015 0.043 0.038 0.028 0.038 0.028 0.035 0.032 0.028 0.015 0.015 0.015 0.083 0.052 0.033 0.038 0.027 0.027 0.029 0.058 0.015 0.015 0.015 0.041 0.038 0.038

Mannings Classification

0.015 - 0.024
0.025 - 0.040
0.041 - 0.055
0.056 - 0.070
0.071 - 0.120

Legend

- Cross Section Outside of SBC Maintenance Reach
- Cross Section With Excess Capacity
- Cross Section Without Excess Capacity
- SBC Maintenance Reach Limits
- River Centerline

0 150 300 Feet

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SOFT BOTTOM CHANNEL ANALYSIS

TITLE
CHIQUITO CANYON 91, 92, 93, & 94
EXISTING CAPACITY RESULTS

FIGURE
26-5

27 Little Rock Wash Tributary Reach 95

27.1 General Description

Little Rock Wash Tributary flows northwesterly to its confluence with Little Rock Wash. The study reach is nearly 2,200 feet in length, beginning approximately 300 feet upstream of East Avenue T and ending at its confluence with Little Rock Wash. The surrounding land consists of residential development with areas of brushy open space. The soft-bottom reach of interest along Little Rock Wash Tributary measures 1,823 feet in length. The limits of the SBC reach are illustrated in Figure 27-1.

Figure 27-1: Reach 95 – Little Rock Wash Tributary

27.2 Structures

The reach of interest for Little Rock Wash Tributary is an engineered, earthen channel with pipe-and-wire revetment. There is one culvert located along the study reach, as summarized in Table 27-1.

Table 27-1: Reach 95 – Little Rock Wash Tributary Structures

Structure Number	HEC-RAS Station	Road Name	Type	Description	Structure Model Data Origin
1	1925	East Avenue T	Culvert	Box culvert with 1 - 13'W x 6'H cell	As-built plans

27.3 Manning's Roughness Coefficient

27.3.1 *Existing Conditions Manning's Coefficient*

Photographs documenting the existing channel conditions are provided in Appendix A. The existing conditions Manning's roughness coefficients are summarized in Table 27-2 with backup detail provided in Appendix B.

Table 27-2: Reach 95 – Little Rock Wash Tributary Existing Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
2300 to 2000	0.015	0.015	0.015
1850	0.033	0.042	0.033
1800 to 1300	0.032	0.027	0.027
1250 to 1200	0.042	0.027	0.042
1150 to 200	0.032	0.027	0.027
150 to 100	0.042	0.042	0.042
50	0.025	0.025	0.025

27.3.2 *Design Conditions Manning's Coefficient*

Lacking Manning's roughness data from the as-built plan design documents, the roughness values for the design conditions HEC-RAS model are assumed as bare earth soil conditions except for hard surfaces (i.e. grouted rip rap) which use the field survey roughness coefficients. The Manning's roughness values used in the design conditions HEC-RAS models are summarized in Table 27-3.

Table 27-3: Reach 95 – Little Rock Wash Tributary Design Conditions Manning's Roughness

HEC-RAS Station	Left Bank	Main Channel	Right Bank
1850	0.025	0.042	0.025
1800 to 1300	0.025	0.025	0.025
1250 to 1200	0.042	0.025	0.042
1150 to 200	0.025	0.025	0.025
150 to 100	0.042	0.042	0.042

27.4 Hydrology

The design flow rate was calculated based on an assumed flow depth using a minimum 2.5 feet of freeboard, assumed Manning's roughness value based on bare earth soil conditions, and channel geometry provided in the Project No. 1224 as-built channel design documents available from the LACFCD website: http://dpw.lacounty.gov. The design documents and discharge are summarized in Table 27-4.

Table 27-4: Reach 95 – Little Rock Wash Tributary Design Flow Rates

Design Document No.	Year	Discharge (cfs)	HEC-RAS Station
Project No. 1224	1973	2,200	2300

27.5 Hydraulic Model

The study reach is modeled with 44 cross sections with the majority of cross sections spaced at roughly 50-foot intervals. The cross sections are cut using 2006 LIDAR topographic data provided by LACDPW. The cross section locations and SBC reach extents are presented in Figure 27-2.

Cross section spacing was chosen to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. Additional cross-sections were incorporated into the model (as needed) at transitional areas and sharp bends to better represent the conditions in these portions of the channel. The hydraulic model was run under "mixed flow" conditions so that potential areas of supercritical flow were adequately modeled. HEC-RAS model output data are provided in Appendix E.

27.6 Boundary Conditions

Normal depth is used as the boundary condition for the upstream and downstream extents of the model. The value of normal depth is estimated as the channel bed slope. The boundary conditions are summarized in Table 27-5.

Table 27-5: Reach 95 – Little Rock Wash Tributary Boundary Conditions

Sub-reach	Upstream Boundary Condition	Downstream Boundary Condition
River – 1	Normal Depth – S = 0.0168	Normal Depth – S = 0.010

27.7 Results

The water surface elevation from the existing conditions model is used to calculate freeboard at each cross section within the SBC reaches. The existing conditions freeboard is compared to the required freeboard to determine whether there is excess freeboard (hydraulic capacity) at the cross section. Results of the freeboard calculations and capacity determination for each cross section are presented in Table 27-6, and in Figure 27-2. A detailed summary of these results is provided in Appendix C.

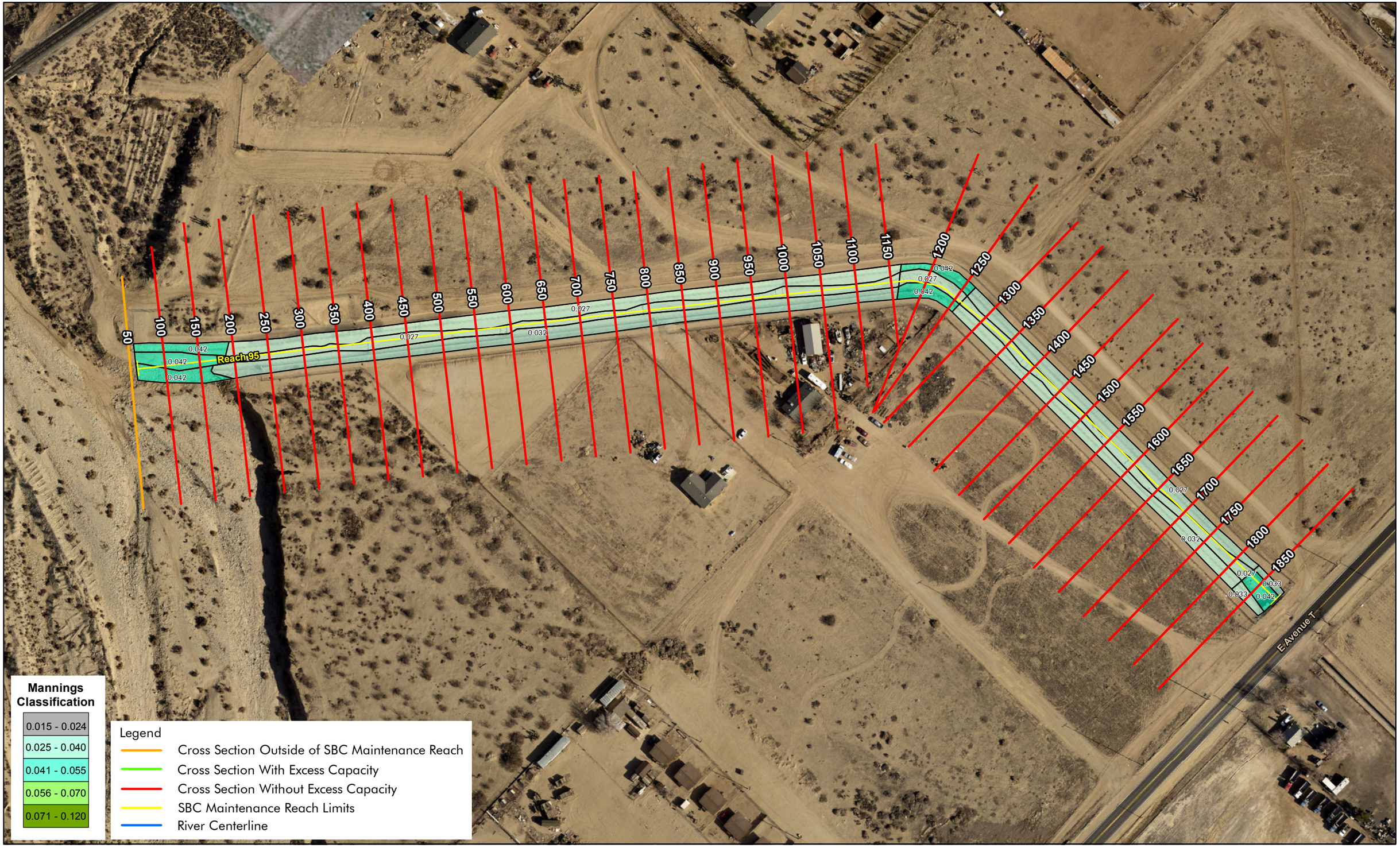
Table 27-6: Reach 95 – Little Rock Wash Tributary Excess Capacity Determination

HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
1850	2.5	0.8	0.0	No
1800	2.5	1.9	0.0	No
1750	2.5	0.3	0.0	No
1700	2.5	0.7	0.0	No
1650	2.5	0.5	0.0	No
1600	2.5	1.0	0.0	No
1550	2.5	1.1	0.0	No
1500	2.5	0.7	0.0	No
1450	2.5	0.1	0.0	No
1400	2.5	0.3	0.0	No
1350	2.7	1.3	0.0	No
1300	4.8	0.6	0.0	No
1250	4.8	1.5	0.0	No
1200	4.8	0.8	0.0	No

HEC-RAS Station	Required Freeboard (ft)	Existing Freeboard (ft)	Excess Freeboard (ft)	Capacity for Additional Vegetation (Yes/No)
1150	4.8	1.1	0.0	No
1100	4.8	1.1	0.0	No
1050	4.0	1.0	0.0	No
1000	2.5	1.0	0.0	No
950	2.5	1.5	0.0	No
900	2.5	-0.3	0.0	No
850	2.5	-0.6	0.0	No
800	2.5	0.6	0.0	No
750	2.5	-0.3	0.0	No
700	2.5	-0.5	0.0	No
650	2.5	-0.5	0.0	No
600	2.5	0.1	0.0	No
550	2.5	2.4	0.0	No
500	2.5	1.2	0.0	No
450	2.5	1.4	0.0	No
400	2.5	0.9	0.0	No
350	2.5	0.4	0.0	No
300	2.5	-0.4	0.0	No
250	2.5	-0.4	0.0	No
200	2.5	-1.3	0.0	No
150	2.5	-5.3	0.0	No
100	2.5	-3.7	0.0	No

27.8 Additional Analysis

Reach 95 does not have excess hydraulic capacity under the existing and design condition scenarios. Therefore, no additional analysis was performed.



0 125 250 Feet

PACE Advanced Water Engineering

LACDPW
SANTA CLARA RIVER WATERSHED
SOFT BOTTOM CHANNEL ANALYSIS

TITLE
LITTLE ROCK WASH 95
EXISTING CAPACITY RESULTS

FIGURE
27-2