APPENDIX B

HYDRAULIC ANALYSIS TECHNICAL ASSESSMENT REPORT

HYDRAULIC ANALYSIS
TECHNICAL ASSESSMENT REPORT

FOR
ENGINEERED EARTHEN-BOTTOM FLOOD CONTROL CHANNELS
LOCATED WITHIN THE
SAN GABRIEL RIVER WATERSHED

MAINTAINED AND OPERATED BY THE
LOS ANGELES COUNTY FLOOD CONTROL DISTRICT

IN COMPLIANCE WITH THE

WASTE DISCHARGE REQUIREMENTS
NUMBER R4-2015-0032

PREPARED FOR:

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Contents

1 Introduction 1
1.1 Study Reaches 1
1.2 Report Organization 4
1.3 Hydrologic Data 4
1.4 Hydraulic Models 4
1.5 Changes in Stream Flow 8
1.6 Changes in Stream Flow 12
2 Reach 39 – San Gabriel River, Beatty Channel Outlet 14
2.1 General Description 14
3 Reach 40 – San Gabriel River, downstream of Santa Fe Dam 16
3.1 General Description 16
3.2 Structures 16
3.3 Manning's Roughness Coefficients 17
3.4 Hydrology 17
3.5 Hydraulic Model 17
3.6 Boundary Conditions 18
3.7 Results 18
4 Reach 41 – Walnut Creek 29
4.1 General Description 29
4.2 Structures 29
4.3 Manning's Roughness Coefficients 29
4.4 Hydrology 30
4.5 Hydraulic Model 30
4.6 Boundary Conditions 30
4.7 Results 30
4.8 Additional Analysis 30
5 Reach 42 – San Jose Creek d/s 1000' from end of concrete 34
5.1 General Description 34
5.2 Structures 34
5.3 Manning's Roughness Coefficients 34
5.4 Hydrology 35
5.5 Hydraulic Model 35
5.6 Boundary Conditions 35
5.7 Results 35
6 Reach 43 & 44 – San Gabriel River (Upper & Rubber Dams) 38
6.1 General Description 38
6.2 Structures 38
6.3 Manning's Roughness Coefficients 39
6.4 Hydrology 39
6.5 Hydraulic Model 39
6.6 Boundary Conditions 39
6.7 Results 39
6.8 Additional Analysis 40

7 Reach 98 – Inlet Walnut Creek 52
7.1 General Description 52
7.2 Structures 52
7.3 Manning's Roughness Coefficients 52
7.4 Hydrology 52
7.5 Hydraulic Model 52
7.6 Boundary Conditions 53
7.7 Results 53
8 References 56

List of Tables

Table 1-1. Soft-Bottom Channel Reaches within San Gabriel River Watershed 2
Table 1-2. Soft-Bottom Channel Reaches Requiring Topographic Surveys 5
Table 1-3. Summary of the Hydraulic Modeling for the Soft-Bottom Channel Reaches within San Gabriel River Watershed 13
Table 3-1. Structures along San Gabriel River (downstream of Santa Fe Dam) 16
Table 4-1. Structures along Walnut Creek 29
Table 4-2. Biological Recommendations for Walnut Creek 30
Table 5-1. Structures along San Jose Creek 34
Table 6-1. Structures along San Gabriel River (Upper & Rubber Dams) 38
Table 6-2. Biological Recommendations for San Gabriel River (Upper & Rubber Dams) 40
Table 7-1. Structures along Inlet Walnut Creek 52

List of Figures

Figure 1-1. San Gabriel River Soft-bottom Reach Location Map 3
Figure 1-2. Base Values of Manning's n 7
Figure 1-3. Typical Flood Control Storm vs LID Storm 10
Figure 1-4. Example Watershed Runoff Peaks and Volume 11
Figure 2-1. Reach 39 – San Gabriel River, Beatty Channel Outlet 15
Figure 3-1 (a-e). Reach 40 – San Gabriel River (downstream of Santa Fe Dam) 19
Figure 3-2 (a-e). Reach 40 – San Gabriel River (downstream of Santa Fe Dam) Manning's Coefficient for Existing Conditions 22
Figure 4-1. Reach 41 – Walnut Creek 32
Figure 4-2. Reach 41 – Walnut Creek Manning's Coefficient for Existing Conditions 33
Figure 5-1. Reach 42 – San Jose Creek 36
Figure 5-2. Reach 42 – San Jose Creek Manning's Coefficient for Existing Conditions 37
Figure 6-1 (a-e). Reach 43 & 44 – San Gabriel River (Upper & Rubber Dams) 42
Figure 6-2 (a-e). Reach 43 & 44 – San Gabriel River (Upper & Rubber Dams) Manning's Coefficient for Existing Conditions 46
Figure 7-1. Reach 98 – Inlet Walnut Creek 54
Figure 7-2. Reach 98 – Inlet Walnut Creek Manning's Coefficient for Existing Conditions 55

Appendices

Appendix A – Annotated Reach Photographs
Appendix B – Manning's Roughness Calculations by Reach
Appendix C – HEC-RAS files

Note: Appendices are provided in accompanying CD.

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 (County). These channels convey storm flows from the canyons and surrounding areas. The LACFCD conducts annual maintenance on these facilities to protect life and property from potential flooding, fire hazards, control vector nuisance issues, and for the facilities to efficiently and effectively function.

On February 12, 2015, 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. R4-2015-0032. The WDR required that the LACFCD conduct Feasibility Studies of each watershed containing soft-bottomed channels (SBC) to determine whether "a potential may exist for native vegetation to remain within the soft-bottom portion of the channel or if additional hydraulic capacity is needed." WDR, Condition 17. The Los Angeles River Watershed Feasibility Study was completed in August 2013. The San Gabriel River Watershed was required to be the subject of the second Feasibility Study.

This report presents the results of a technical assessment of the hydraulic conditions for the seven earth-bottom channel reaches included in the WDR for the San Gabriel River Watershed. This report was prepared in conformance with Section 4.1 of the Study Work Plan for Engineered Earthen-Bottom Flood Control Channels Located within the San Gabriel River Watershed, June 2013.

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 vegetated areas must be removed. Flood control channels that were originally built by the United States Army Corps of Engineers (USACE) would need a Risk and Uncertainty analysis to identify reaches with potential for addition of native vegetation.

During the 2015 working group meetings for issuance of a new WDR, the USACE informed the LACFCD and the stakeholders that they require a Risk and Uncertainty analysis in order to evaluate the reaches built by the Corps. Any modifications to the channels including changes to maintenance practices would require a Risk and Uncertainty analysis to be submitted for their review and approval. This report doesn't include any Risk and Uncertainty analysis.

1.1 Study Reaches

The San Gabriel River Watershed covers an area of approximately 640 square miles. The San Gabriel River Watershed is located in the eastern portion of Los Angeles County. It is bound by the San Gabriel Mountains to the north, most of San Bernardino/Orange County to the east, the division of the Los Angeles River from the San Gabriel River to the west, and the Pacific Ocean to the south. The watershed

drains into the San Gabriel River from the San Gabriel Mountains flowing 58 miles south until its confluence with the Pacific Ocean. Major tributaries to the San Gabriel River include Walnut Creek, San Jose Creek, Coyote Creek, and numerous storm drains entering from the 19 cities that the San Gabriel River passes through.

There are seven defined soft-bottom reaches in the Regional Board's WDR within the San Gabriel River Watershed as shown in Figure 1-1. These seven channel reaches vary in length from 30 feet to as long as 31,900 feet, as noted in Table 1-1.

Table 1-1. Soft-Bottom Channel Reaches within San Gabriel River Watershed

Reach No.	Name	Length (ft)
39	San Gabriel River, Beatty Channel Outlet	145
40	San Gabriel River, downstream of Santa Fe Dam	31,370
41	Walnut Creek	5,438
42	San Jose Creek 1000' downstream from end of concrete at COE Station 87+25.00	80
43	San Gabriel River – Upper	6,500
44	San Gabriel River – Rubber Dams	31,900
98	Inlet Walnut Creek	30

Source: WDR Order No. R4-2015-0032

San Gabriel River
Soft-Bottom Reach Location Map

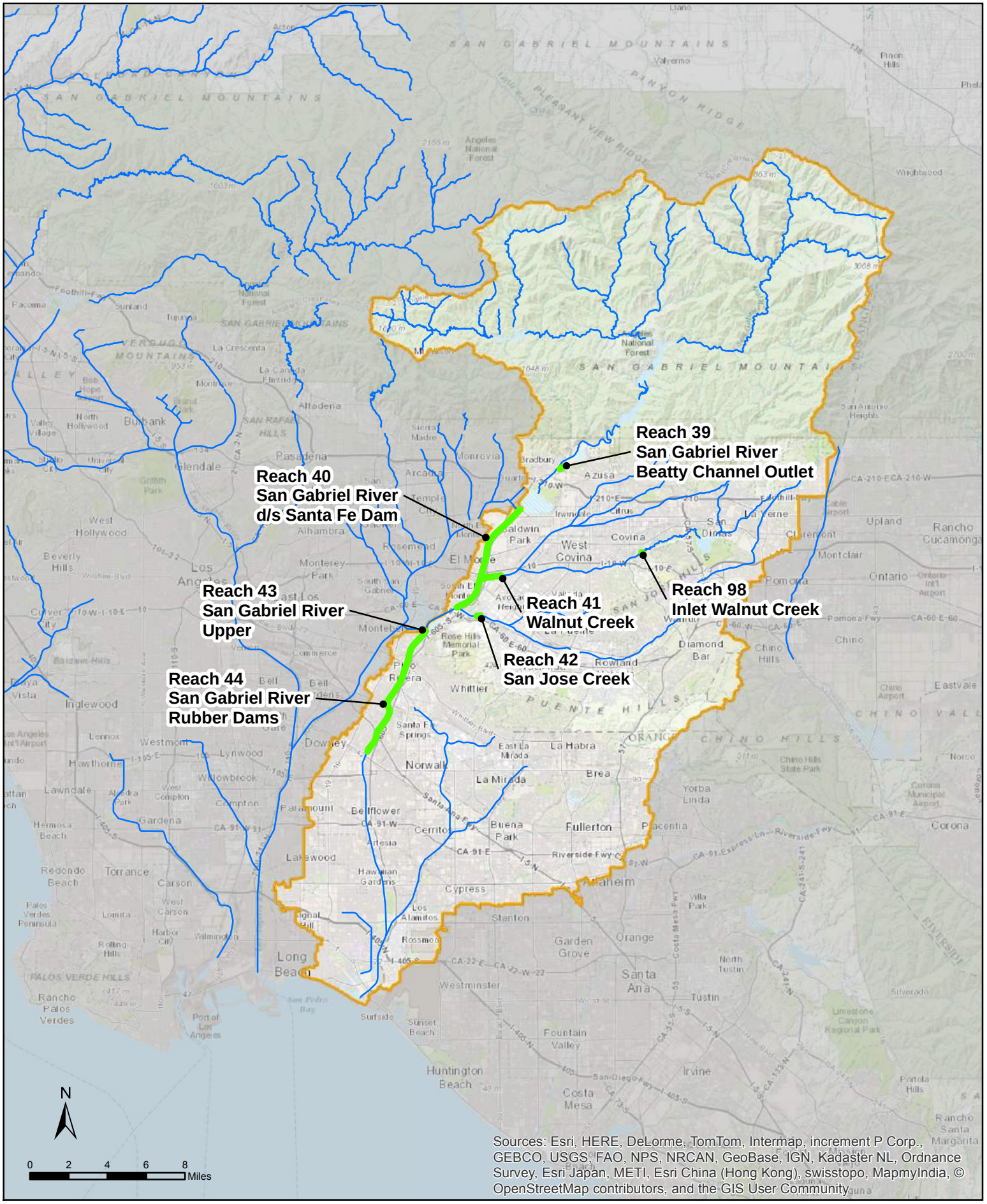


Figure 1-1

1.2 Report Organization

This report is organized into individual sections identifying and describing each soft-bottom channel reach analyzed for the San Gabriel River Watershed. The sections present the reaches in the same order as listed in Table I-1 above. In general, each section describes one soft-bottom reach. However, Reaches 40 and 41; and Reaches 43 and 44 were summarized in one section each, since they are hydraulically connected and were modeled as one single reach.

Additional supplementary information is provided in the Appendices. Appendix A includes annotated photographs of each reach showing vegetation levels observed in the field. Appendix B includes the results of the Manning's roughness values calculations for the reaches. Appendix C includes digital copies of the HEC-RAS input files.

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 was obtained from various sources, including channel design plans, hydraulic reports, and hydrologic studies. A discussion of the source of the flow data is provided in each reach's section.

1.4 Hydraulic Models

Hydraulic models were developed for all seven SBC reaches using the USACE's Hydrologic Engineering Center's River Analysis System (HEC-RAS) computer program. 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 includes design flow rates and existing vegetation levels in the channel reach.

For the reaches with insufficient capacity for existing vegetation levels, a second model was developed to determine whether the reach might have excess capacity for a "design conditions" scenario. The design conditions scenario is based on design flow rates and design roughness conditions. If there was no excess capacity in the design conditions model reach of interest, no further modeling was performed. However, if the model showed excess capacity under the design conditions scenario, a model was developed with added native vegetation in a quantity that does not exceed the design channel capacity. The type and species of the additional vegetation was determined in consultation with BonTerra Psomas, the LACFCD biological consultant.

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 D.

Field Investigations

Field site investigations were conducted for all seven SBC reaches to verify channel geometry, stability, and vegetation. The field site investigations were completed by LACFCD between July and September 2012 per the recommendation of BonTerra Psomas. They were conducted in these months to observe and document the maximum amount of expected vegetation re-growth prior to fall maintenance operations by LACFCD. Field notes and photographs were taken of all reaches to document the type, density, and size of vegetation.

Geometric Data and Cross-Sections

Recent topographic surveys were performed for all seven reaches. These topographic surveys were provided in NAD 1983, NGVD 29, and State Plane California V projection. The reaches requiring topographic surveys are listed in Table 1-2.

Table 1-2. Soft-Bottom Channel Reaches Requiring Topographic Surveys

Reach No.	Name	Length (ft)	Date of Topographic Survey
39	San Gabriel River, Beatty Channel Outlet	145	September 2012
40	San Gabriel River, downstream of Santa Fe Dam	31,370	December 2012
41	Walnut Creek	5,438	December 2012
42	San Jose Creek 1000' downstream from end of concrete at COE Station 87+25.00	80	September 2012
43	San Gabriel River – Upper	6,500	December 2012
44	San Gabriel River – Rubber Dams	31,900	December 2012
98	Inlet Walnut Creek	30	September 2012

Microstation, HEC-GeoRas and ArcGIS were used to produce the HEC-RAS models from the topographic survey data. This data was also used to reproduce channel features such as bridges, culverts, and drop structures. Cross-section cut lines were drawn using HEC-GeoRAS at all crucial sections of the channel including at changes in geometry, slope, discharge, and Manning's roughness. Also, cross-section cut lines were drawn immediately upstream and downstream of all bridges, culverts, and other hydraulic structures. All cross-sections were drawn normal to the main channel flow path.

Manning's Roughness

The references used in estimating the Manning's hydraulic 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. The earth-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, and
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 value, n_b.

Figure 1-2. Base Values of Manning's n

Base values of Manning's *n*

Bed material	Median size of bed material (in millimeters)	Base *n* value: Straight uniform channel[1]	Base *n* value: 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.

Source: USGS Water-Supply Paper 2339

The estimated Manning roughness values are summarized for each reach in Appendix B.

Bridges and Culverts

Ineffective flow areas were added at applicable cross sections upstream and downstream of bridges and drop structures with protruding walls. The ineffective flow area option was used to keep all the active flow in the area of the bridge or drop structure opening until the elevations associated with the ineffective flow areas was exceeded by the computed water surface elevation. The top of the ineffective flow was selected as the soffit of the bridge or drop structure walls. At this height, it is assumed the nominal effective flow area becomes sealed and the entire cross section becomes active.

Consistent with USACE policy, for debris loading in vertical piers, 2 feet of debris accumulation on each side of each pier for its entire height was assumed. For piers with sloping extensions, 2 feet of debris accumulation for a distance up to 6 feet below the water surface was assumed.

Expansion and Contraction Coefficients

The recommended contraction and expansion coefficients of 0.1 and 0.3 were 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 and drop structures, contraction and expansion coefficients were adjusted to 0.3 and 0.5, respectively.

Boundary Conditions and Flow Regime

The models were run assuming steady state conditions and using the mixed flow regime option. The mixed flow regime option was chosen to allow the model to predict transition between subcritical and supercritical flow regimes. The mixed flow regime requires both upstream and downstream boundary conditions. Normal depth water surfaces were applied to both upstream and downstream boundaries for each model. For reaches where water surface elevations were available from as-built plans or previous hydraulic models, the hydraulic grade line was used as a 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.

Freeboard

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; wave action. The USACE Engineering Manual (EM 1110-2-1601) on Hydraulic Design of Flood Control Channels was used to establish freeboard criteria for the study reaches. Freeboard allowances of 2 ft in rectangular channels, 2.5 ft in trapezoidal sections for riprap channels, and 3 ft for earth levees were used to determine if the reaches had sufficient capacity.

1.5 Changes in Stream Flow

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. Figure 1-3 compares a typical flood Control Storm (7 inches per 24-hour period) and a storm for which low impact development (LID) structures are designed (0.75 inches per 24-hour period) (LID Storm).

To assess the impact of the infiltration requirements set forth in Condition 48, an example watershed was modeled assuming that the entire surface of the watershed was designed to capture flows generated during the 85th percentile storm, which is the standard LID requirement (and which is contained in the current Los Angeles County MS4 permit). This assumption actually overestimates the impact of the infiltration requirements required to be assessed in the Feasibility Study, since those requirements do not apply watershed wide and are being implemented over multiple year time horizons. The example watershed further assumed that the infiltration infrastructure was not filled from previous storm events, which would reduce its effectiveness in handling new storm flows.

When these assumptions were applied in the example watershed, the results showed that the volume of only the first 4.5 hours of a Flood Control Storm hydrograph would be captured in the LID/infiltration infrastructure (the duration of a Flood Control Storm is 24 hours). After that point, any remaining volume would not infiltrate and would have to be contained in the flood control channels, as shown in Figure 1-4. Thus, while LID/infiltration facilities can be expected to reduce storm flows during typical (up to the 85th percentile) storm events, the presence of LID/infiltration infrastructure would not reduce the peak stream flows during major storms.

Figure 1-3. Typical Flood Control Storm vs LID Storm

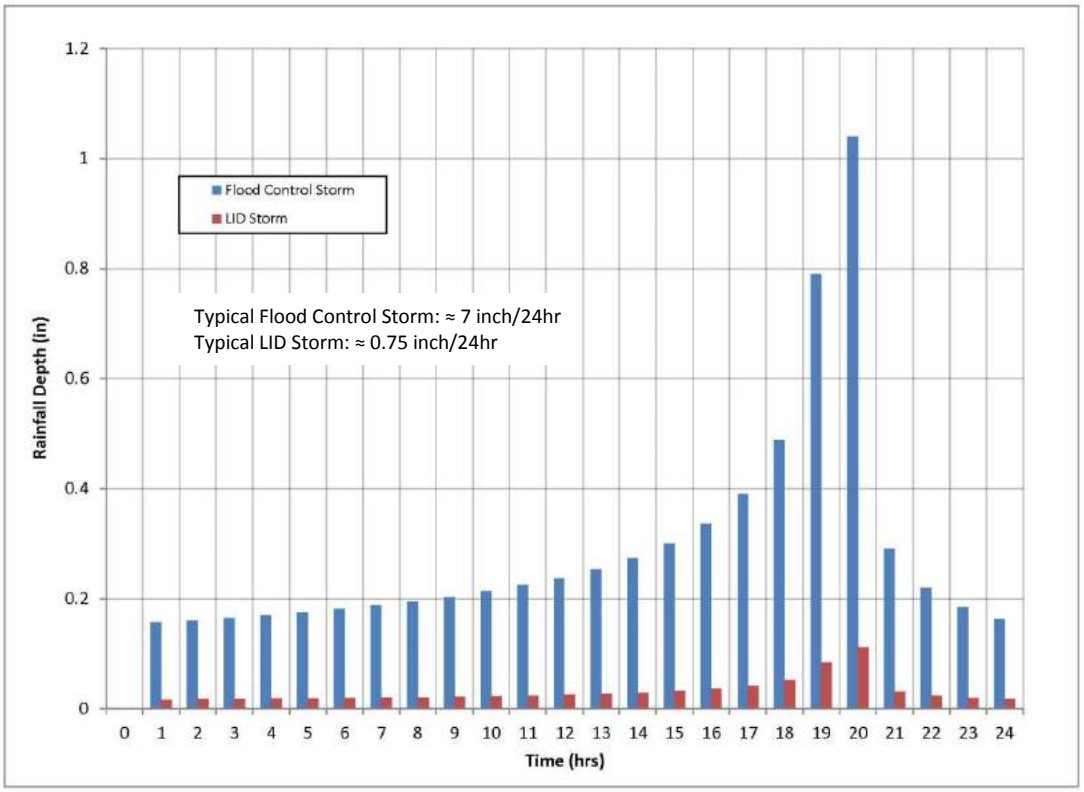
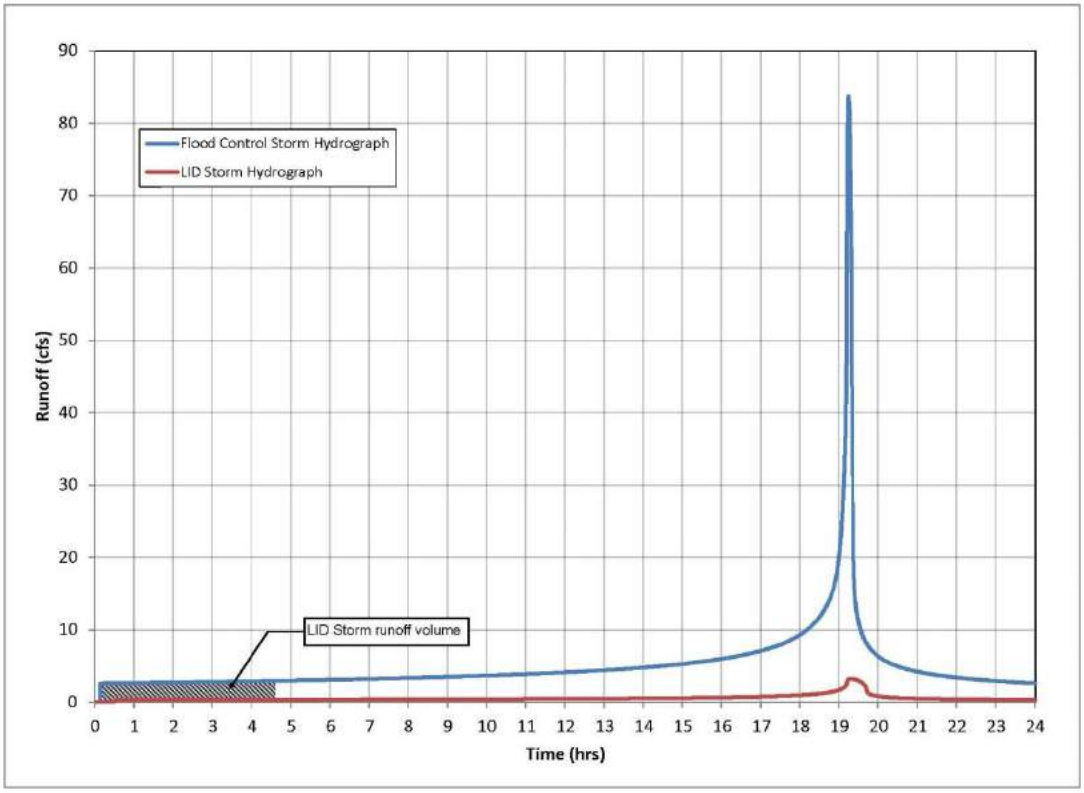


Figure 1-4. Example Watershed Runoff Peaks and Volume



1.6 Changes in Stream Flow

As discussed previously, seven soft-bottom reaches were analyzed assuming existing vegetation conditions. This analysis indicated that none of the reaches had sufficient capacity for their entire length. However, Reaches 41, 43, and 44 had segments that did show sufficient capacity. The roughness coefficients for these segments were then adjusted to represent the vegetation recommendations proposed by BonTerra Psomas. Assuming the vegetation levels recommended by BonTerra Psomas, the hydraulic analysis indicated sufficient capacity within those segments.

Reaches 40, 42, 98, and segments of the other reaches mentioned above that did not have sufficient capacity assuming existing vegetation levels were then modeled assuming a “clear” channel condition, to determine whether any excess capacity might exist if clear. The models showed that none of the reaches have any excess capacity in the clear condition. These results indicate that no additional vegetation can be allowed in these reaches. Table 1-3 summarizes the hydraulic modeling results for all the soft-bottom reaches under the different scenarios described.

Reach 39 was not hydraulically modeled since the maintenance reach is located within the San Gabriel River. Existing vegetation conditions could not be properly analyzed since this reach would be completely inundated by flows along the San Gabriel River.

Table 1-3. Summary of the Hydraulic Modeling for the Soft-Bottom Channel Reaches within San Gabriel River Watershed

Reach No.	Name	Hydraulic Modeling Results		
		Existing Vegetation Scenario [a]	"Design Conditions" Scenario [b]	BonTerra Psomas Recommendation Scenario
39	San Gabriel River, Beatty Channel Outlet	c	c	d
40	San Gabriel River, downstream of Santa Fe Dam	Insufficient Capacity	No Excess Capacity for Vegetation	-
41	Walnut Creek	Capacity from: Sta. 62+02.965 to Sta. 49+46.78	-	Capacity for Additional Vegetation
		Insufficient Capacity for rest of reach	No Excess Capacity for Vegetation	-
42	San Jose Creek, 1000' downstream from end of concrete at COE Station 87+25.00	Insufficient Capacity	No Excess Capacity for Vegetation	-
43	San Gabriel River – Upper	Capacity from: Sta. 1106+00 to Sta. 1044+27.7	-	Capacity for Additional Vegetation
		Capacity from: Sta. 1063+00 to Sta. 1049+00	-	Capacity for Additional Vegetation
		Insufficient Capacity for rest of reach	No Excess Capacity for Vegetation	-
44	San Gabriel River – Rubber Dams	Capacity from: Sta. 919+94.37 – Sta. 899+38.82	-	Capacity for Additional Vegetation
		Capacity from: Sta. 834+61 – Sta. 818+60.3	-	Capacity for Additional Vegetation
		Capacity from: Sta. 790+30.2 – Sta. 771+04	-	Capacity for Additional Vegetation
		Insufficient Capacity for rest of reach	No Excess Capacity for Vegetation	-
98	Inlet Walnut Creek	Insufficient Capacity	No Excess Capacity for Vegetation	-

a. Based on field site visit conducted in July/August 2012 prior to FMD channel maintenance activities.
b. "Design Conditions" Scenario uses the original design roughness coefficient which may assume no vegetation in the channel.
c. No hydraulic model was done since the reach is located inside the San Gabriel River.
d. Concerns relating to vector control require further analysis of current maintenance activities.

2 Reach 39 – San Gabriel River, Beatty Channel Outlet

2.1 General Description

Beatty Channel Outlet (Reach No. 39) is located in the City of Irwindale. The maintenance reach, which is approximately 145 feet in length, starts at the outlet of Beatty Canyon Channel and runs west into the San Gabriel River channel bottom. Beatty Canyon Channel and Outlet were originally constructed by the LACFCD in 1970. The San Gabriel River was originally constructed by the United States Army Corps of Engineers in 1961.

The study reach is located near residential and industrial areas as shown in Figure 2-1. Field pictures of the study reach are in Appendix A.

Since the study reach is located within the San Gabriel River, it will be inundated when the San Gabriel River is at its design flow rate of 98,000 cfs. Based on LACFCD as-built drawing no. 318-D1.2, Beatty Canyon Channel was designed for a flow rate 1,770 cfs and assumed a maximum water surface elevation of 629.5-ft in the San Gabriel River.

The purpose of LACFCD's clearing activities for this reach are to maintain a clear path for low flows to continue from the outlet of Beatty Channel to the San Gabriel River's low flow channel. There are concerns that stagnant water could create vector issues.

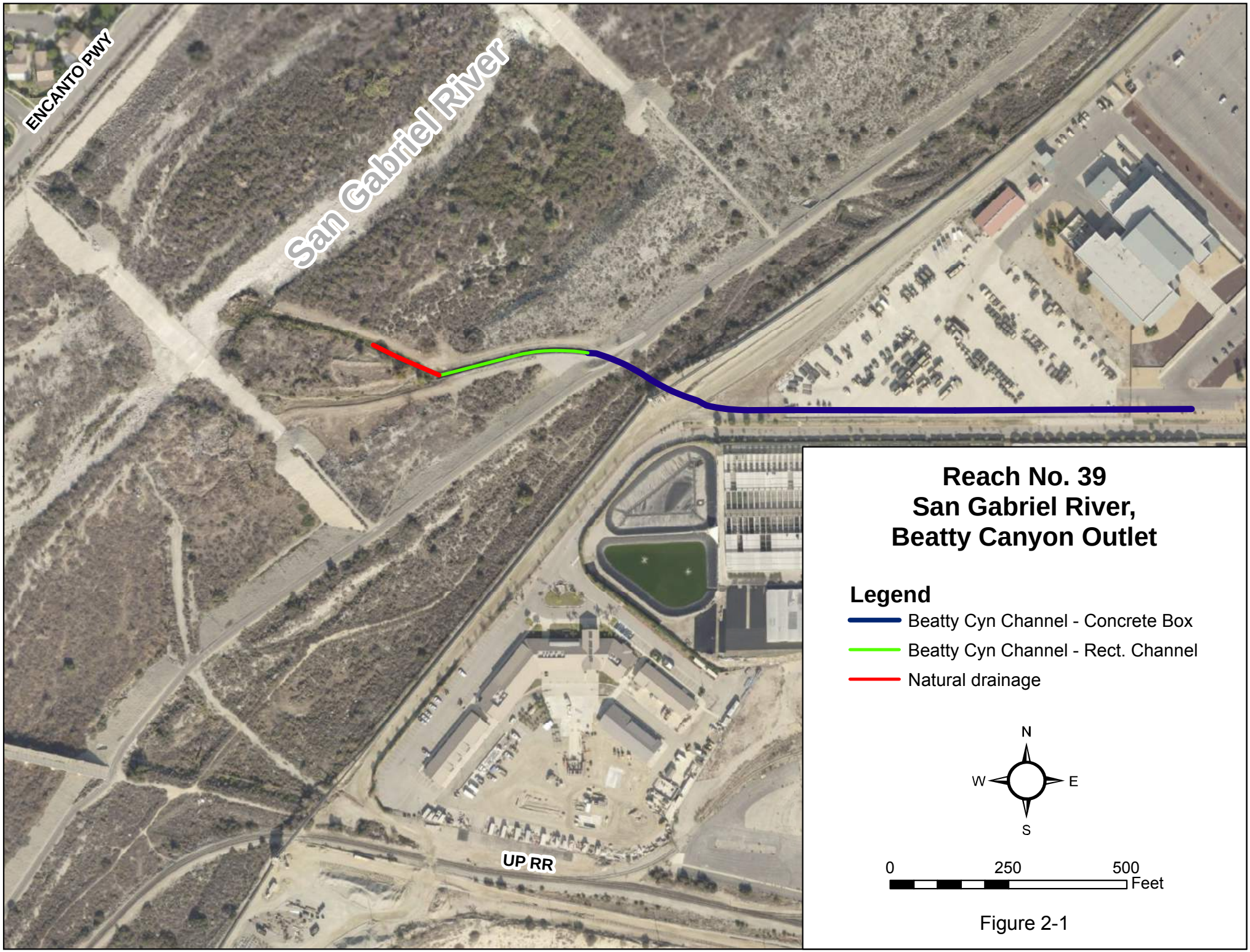

ENCANTO PWY
San Gabriel River
UP RR
Reach No. 39
San Gabriel River,
Beatty Canyon Outlet
Legend
Beatty Cyn Channel - Concrete Box
Beatty Cyn Channel - Rect. Channel
Natural drainage
N
W
E
S
0
250
500
Feet

Figure 2-1

3 Reach 40 – San Gabriel River, downstream of Santa Fe Dam

3.1 General Description

The maintenance reach of the San Gabriel River (Reach No. 40) starts at the outlet of Santa Fe Dam in the City of Irwindale and runs south to Thienes Avenue in the City of South El Monte just downstream of where San Jose Creek confluences with the San Gabriel River. This segment of the San Gabriel River was originally constructed by the United States Army Corps of Engineers in 1961. Operation and maintenance was transferred to the LACFCD shortly after construction.

The maintenance reach is approximately 31,400 feet in length. The study limits start at Santa Fe Dam and end approximately 5,100 feet downstream of Thienes Avenue before Whittier Narrows Flood Control Basin. The study reach is located within an urban setting surrounded by residential, commercial, and industrial areas as shown in Figures 3-1 (a-e).

3.2 Structures

This study reach starts as a concrete rectangular channel at the outlet of Santa Fe Dam with an energy dissipating structure under the Arrow Highway Bridge. Downstream of Arrow Highway Bridge, the river becomes an earthen-bottom trapezoidal channel with stone side slopes for the rest of the study reach. There are eleven bridges, seventeen drop structures, and three rubber dams within the study reach. Details of the structures within the study reach are summarized in Table 3-1.

Table 3-1. Structures along San Gabriel River (downstream of Santa Fe Dam)

Structure No.	River Station	Road Name	Type	Description
1	1559+72	Arrow Highway	Bridge	Bridge with 2 piers
2	1559+38.8	--	Energy dissipater	Concrete baffle blocks on channel bottom
3	1559+03	--	Transition	Concrete rectangular to soft bottom trapezoidal channel
4	1553+84.8	--	Drop structure	Energy dissipating structure
5	1537+72	--	Drop structure	Energy dissipating structure
6	1534+01	Live Oak Ave	Bridge	Bridge with 9 piers
7	1524+73.6	--	Drop structure	Energy dissipating structure
8	1512+77.7	--	Drop structure	Energy dissipating structure
9	1500+71.3	--	Drop structure	Energy dissipating structure
10	1493+74	San Gabriel River (605) Fwy	Bridge	Bridge with 7 piers
11	1488+68.5	--	Drop structure	Energy dissipating structure
12	1473+76.1	--	Drop structure	Energy dissipating structure
13	1459+78	--	Drop structure	Energy dissipating structure
14	1453+66	Lower Azusa Rd	Bridge	Bridge with 13 piers
15	1437+55.3	--	Drop structure	Energy dissipating structure

Structure No.	River Station	Road Name	Type	Description
16	1414+77	--	Drop structure	Energy dissipating structure
17	1397+91.8	--	Piers	Abandoned piers without bridge deck
18	1396+19	Ramona Blvd	Bridge	Bridge with 12 piers
19	1379+77.1	--	Drop structure	Energy dissipating structure
20	1348+78	San Bernardino (10) Fwy	Bridge	Bridge with 8 piers
21	1339+61.7	--	Drop structure	Energy dissipating structure
22	1324+61	Union Pacific Rail Road	Bridge	Bridge with 6 piers
23	1320+41	Valley Blvd	Bridge	Bridge with 7 piers
24	1308+26.7	--	Drop structure	Valley rubber dam
25	1281+88.4	--	Drop structure	Rubber Dam #2
26	1255+46.5	--	Drop structure	Rubber Dam #3
27	1216+72.5	--	Drop structure	Energy dissipating structure
28	1209+34	Pomona (60) Fwy	Bridge	Bridge with 8 piers
29	1202+56.8	--	Drop structure	Energy dissipating structure
30	1190+08	Peck Rd	Bridge	Bridge with 8 piers
31	1188+56.4	--	Drop structure	Energy dissipating structure
32	1175+87.8	--	Drop structure	Energy dissipating structure

3.3 Manning's Roughness Coefficients

The Manning's roughness coefficients were determined from field surveys of the channel conditions including base material, obstructions, vegetation, and other channel characteristics. Photographs documenting typical channel conditions are provided in Appendix A. Different regions of roughness coefficients within the San Gabriel River are depicted in Figures 3-2 (a-e). Detailed computations in determining these roughness coefficients are found in Appendix B.

3.4 Hydrology

Design flow rates were obtained from the United States Army Corps of Engineers' Operation and Maintenance Manual dated 1999. The peak discharge rates along the study reach are 41,000 cfs from Santa Fe Dam to the Walnut Creek confluence; 60,000 cfs from the Walnut Creek confluence to the San Jose Creek confluence; and 98,000 cfs downstream of the San Jose Creek confluence to the Whittier Narrows Flood Control Basin.

3.5 Hydraulic Model

Recent topographic surveys were used to create the HEC-RAS model for this reach of the San Gabriel River. The San Gabriel River was modeled with 1,025 cross-sections to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. HEC-RAS input and output files are provided in Appendix C.

3.6 Boundary Conditions

Normal depth (slope = 0.0081) was used as the upstream boundary condition for the study reach. The water surface elevation from the United States Army Corps of Engineers' LACDA HEC-RAS Hydraulic Models, Final Report dated 2011 was used as the downstream boundary condition for the San Gabriel River model (228.13 feet at Station 1174+11).

3.7 Results

A hydraulic model was developed for this study limit under existing vegetation levels. The model showed that the San Gabriel River contained some segments with sufficient capacity and others with insufficient capacity.

A second analysis was then performed assuming a design conditions scenario based on the design roughness coefficients originally used by the Corps of Engineers. This model run was developed to evaluate whether reducing the vegetation to this level would result in excess capacity. The analysis for a design conditions scenario showed similar capacity levels as the existing vegetation condition model. No other scenarios were explored. Manning's roughness coefficients for both model runs (existing conditions and design conditions) are summarized in Appendix B. HEC-RAS input and output files for both analyses are provided in Appendix C.

Santa Fe Dam
Arrow Hwy
STA 155875
Drop Structure #1
STA 155411
STA 155122.1
STA 154870
STA 154622.1
STA 154322.1
STA 154022.1
Drop Structure #2
STA 153809
Live Oak Ave
STA 153522.1
STA 153348.3
STA 152961.1
STA 152729.3
Drop Structure #3
STA 152505
STA 152122.1
STA 151863.1
STA 151622.1
Drop Structure #4
STA 151254
STA 150887.8
STA 150622.1
Drop Structure #5
STA 150110
STA 149887.7
STA 149573
San Gabriel Fwy (605)
STA 149174.9
STA 148961.1
Drop Structure #6
STA 148659
STA 148422.1
STA 148122.1

Reach No. 40
Upper San Gabriel River
(downstream of Santa Fe Dam)

Legend

HEC-RAS Cross-Sections

N E W S

0 500 1,000
Feet

Figure 3-1a


STA 148222.1
STA 147922.1
STA 147429
Drop Structure #7
STA 147017.4
STA 146722.1
STA 146422.1
STA 146122.1
Drop Structure #8
Lower Azusa Rd
STA 145897
STA 145428.1
STA 145206.6
STA 145002.2
STA 144604.7
STA 144311
Drop Structure #9
STA 143847.1
STA 143608
STA 143310.7
STA 143106.6
STA 142622.1
STA 142404.9
STA 142031
Drop Structure #10
STA 141722.1
STA 141455
STA 141111
STA 140612
STA 140317
STA 140010.8
STA 139776
Reach No. 40
Upper San Gabriel River
(downstream of Santa Fe Dam)
Legend
HEC-RAS Cross-Sections
N
E
W
S
0
500
1,000
Feet

Figure 3-1b

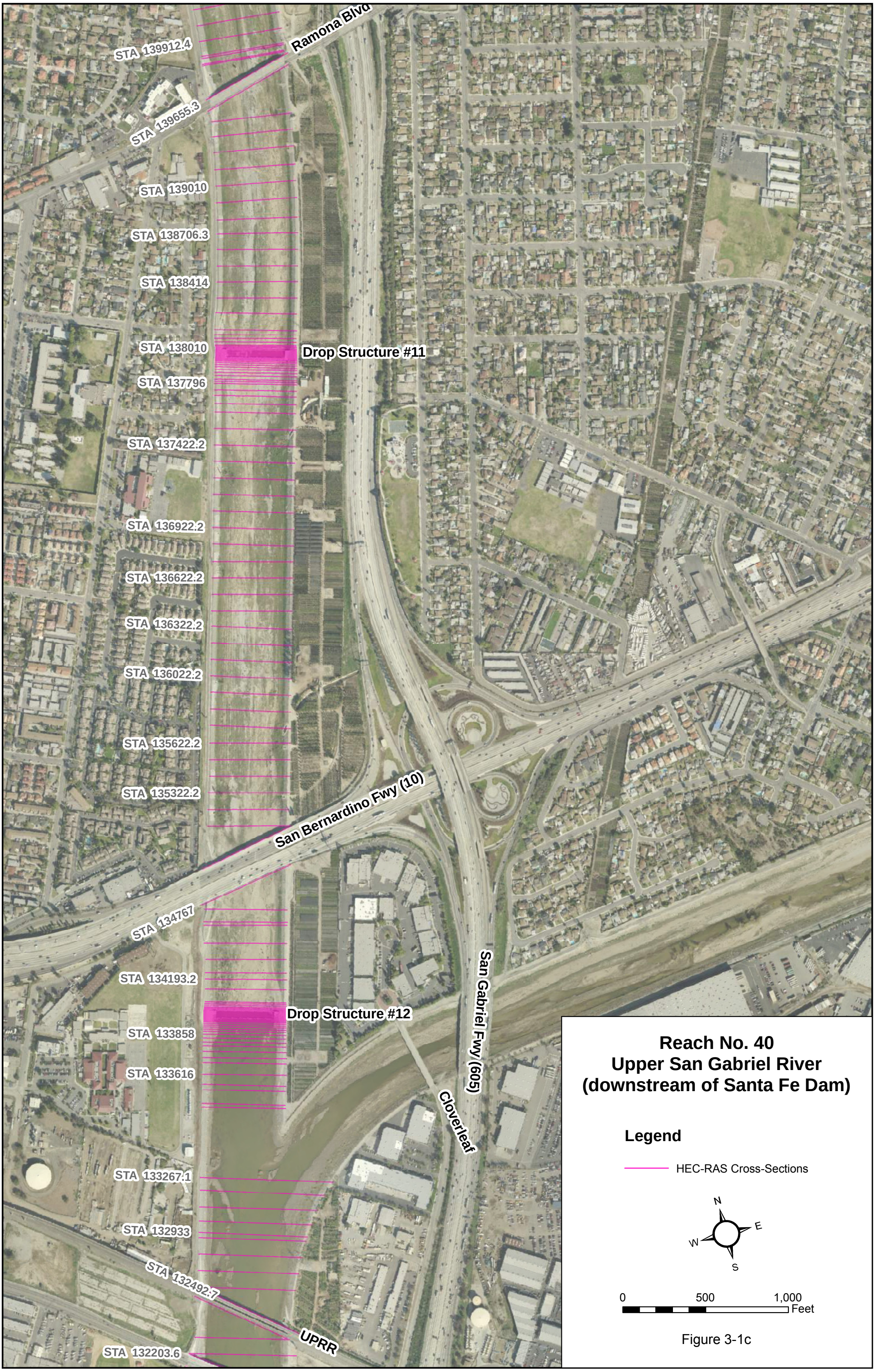

Ramona Blvd
STA 139912.4
STA 139655.3
STA 139010
STA 138706.3
STA 138414
STA 138010
Drop Structure #11
STA 137796
STA 137422.2
STA 136922.2
STA 136622.2
STA 136322.2
STA 136022.2
STA 135622.2
STA 135322.2
San Bernardino Fwy (10)
STA 134767
STA 134193.2
Drop Structure #12
STA 133858
STA 133616
STA 133267.1
STA 132933
STA 132492.7
UPRR
STA 132203.6
San Gabriel Fwy (605)
Cloverleaf
Reach No. 40
Upper San Gabriel River
(downstream of Santa Fe Dam)
Legend
HEC-RAS Cross-Sections
N
E
W
S
0
500
1,000
Feet

Figure 3-1c

STA 132492.7
UPRR
STA 131996.5
Valley Blvd
STA 131803.6
STA 131503.6
STA 131103.6
Valley Rubber Dam
STA 130851.2
STA 130625
STA 130352
STA 130103.6
STA 129785.9
STA 129456.1
STA 129200.7
STA 128703.6
STA 128442
STA 128193
Rubber Dam #2
STA 127963
STA 127712.6
STA 127213.7
STA 126807.9
STA 126570.1
STA 126300
STA 126002.7
STA 125773.4
STA 125398
STA 125148.9
Rubber Dam #3
STA 124803.6
STA 124503.6
STA 124216.5
STA 123960.1

Reach No. 40
Upper San Gabriel River
(downstream of Santa Fe Dam)

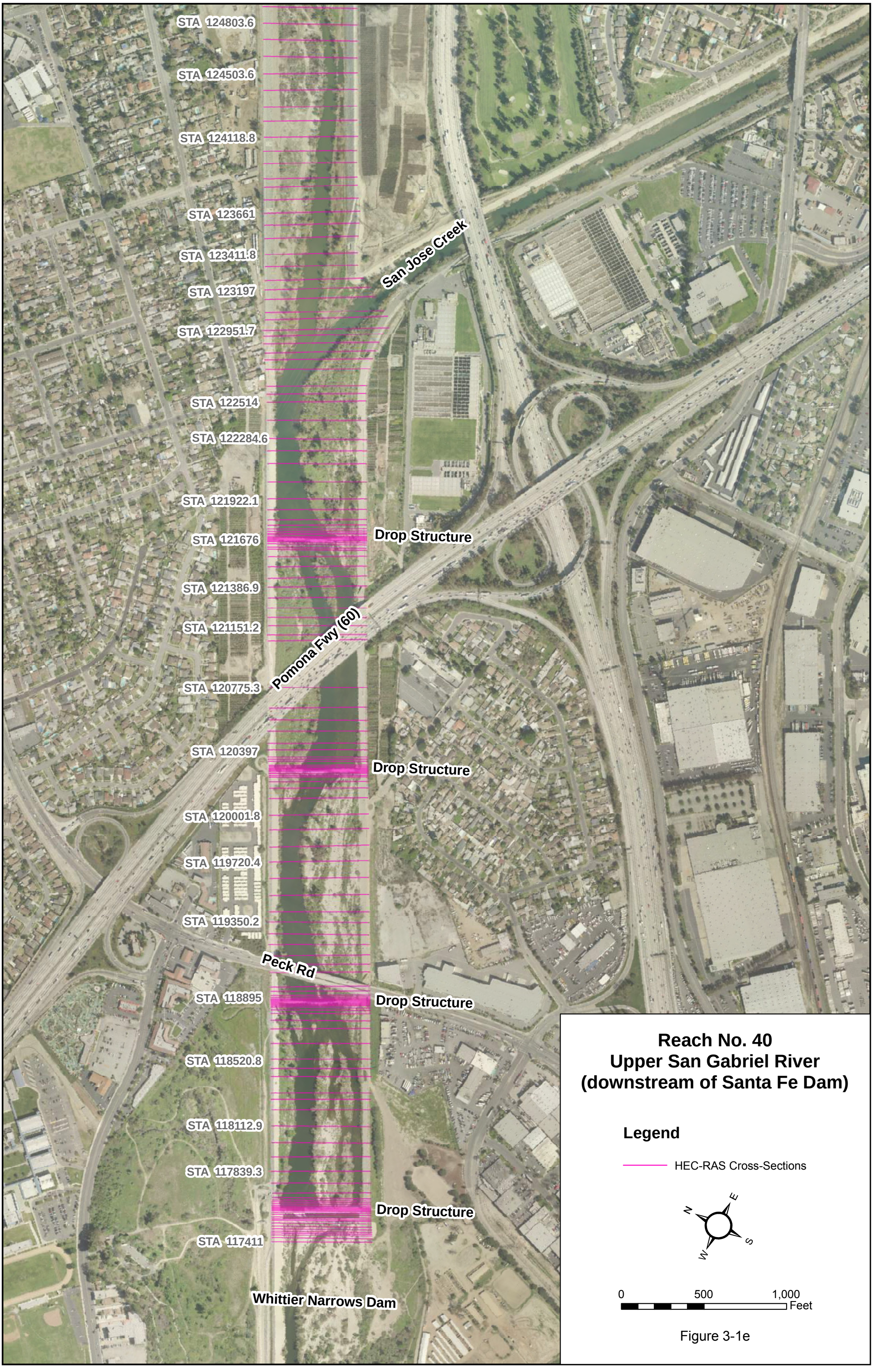
Legend

HEC-RAS Cross-Sections

N
E
W
S

0 500 1,000
Feet

Figure 3-1d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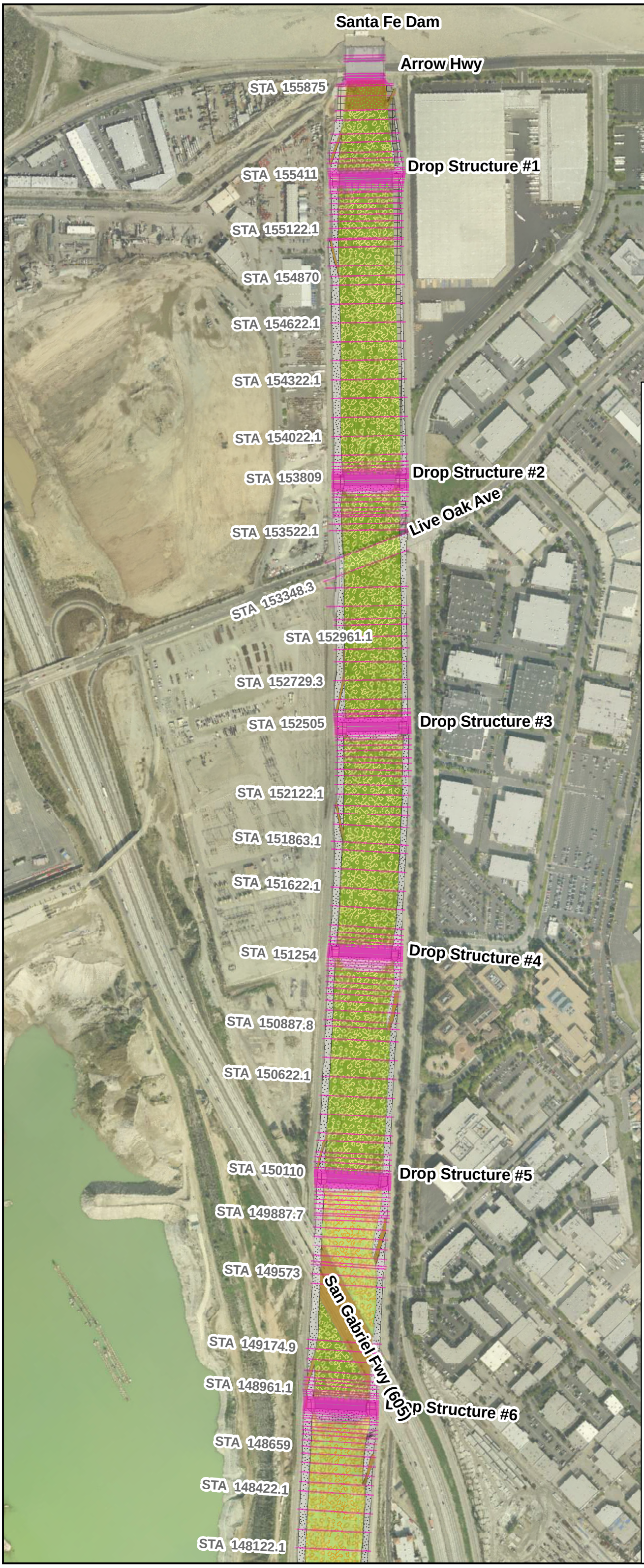
STA 123661
STA 123411.8
STA 123197
STA 122951.7
STA 122514
STA 122284.6
STA 121922.1
STA 121676
STA 121386.9
STA 121151.2
STA 120775.3
STA 120397
STA 120001.8
STA 119720.4
STA 119350.2
STA 118895
STA 118520.8
STA 118112.9
STA 117839.3
STA 117411
San Jose Creek
Pomona Fwy (60)
Peck Rd
Drop Structure
Drop Structure
Drop Structure
Drop Structure
Whittier Narrows Dam
Reach No. 40
Upper San Gabriel River
(downstream of Santa Fe Dam)
Legend
HEC-RAS Cross-Sections
N
E
S
W
0
500
1,000
Feet

Figure 3-1e



Reach No. 40
Upper San Gabriel River
(downstream of Santa Fe Dam)
Manning's Coefficient for
Existing Conditions

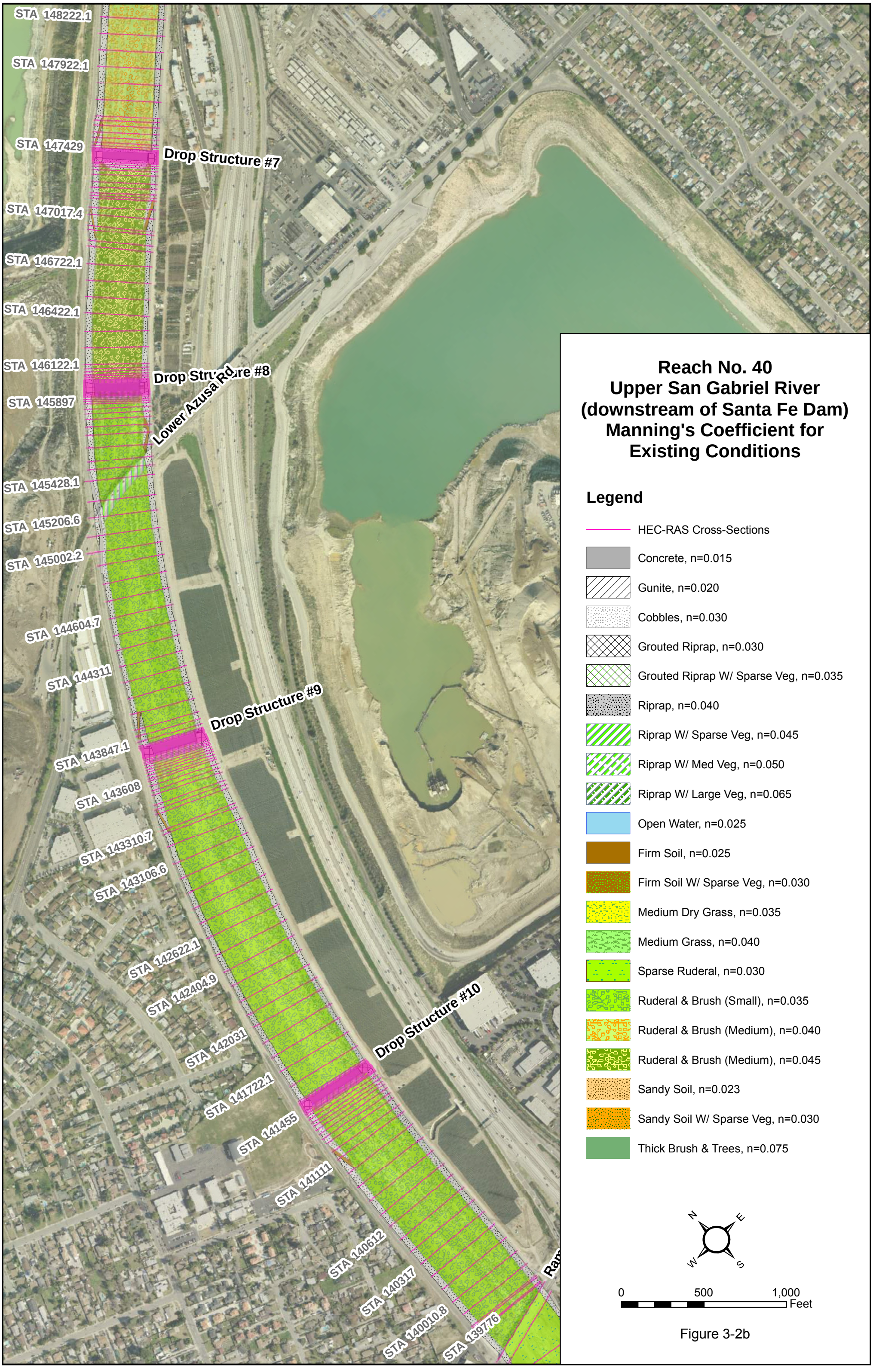
Legend

- HEC-RAS Cross-Sections
- Concrete, n=0.015
- Gunite, n=0.020
- Cobbles, n=0.030
- Grouted Riprap, n=0.030
- Grouted Riprap W/ Sparse Veg, n=0.035
- Riprap, n=0.040
- Riprap W/ Sparse Veg, n=0.045
- Riprap W/ Med Veg, n=0.050
- Riprap W/ Large Veg, n=0.065
- Open Water, n=0.025
- Firm Soil, n=0.025
- Firm Soil W/ Sparse Veg, n=0.030
- Medium Dry Grass, n=0.035
- Medium Grass, n=0.040
- Sparse Ruderal, n=0.030
- Ruderal & Brush (Small), n=0.035
- Ruderal & Brush (Medium), n=0.040
- Ruderal & Brush (Medium), n=0.045
- Sandy Soil, n=0.023
- Sandy Soil W/ Sparse Veg, n=0.030
- Thick Brush & Trees, n=0.075

N E W S

0 500 1,000 Feet

Figure 3-2a



Reach No. 40
Upper San Gabriel River
(downstream of Santa Fe Dam)
Manning's Coefficient for Existing Conditions

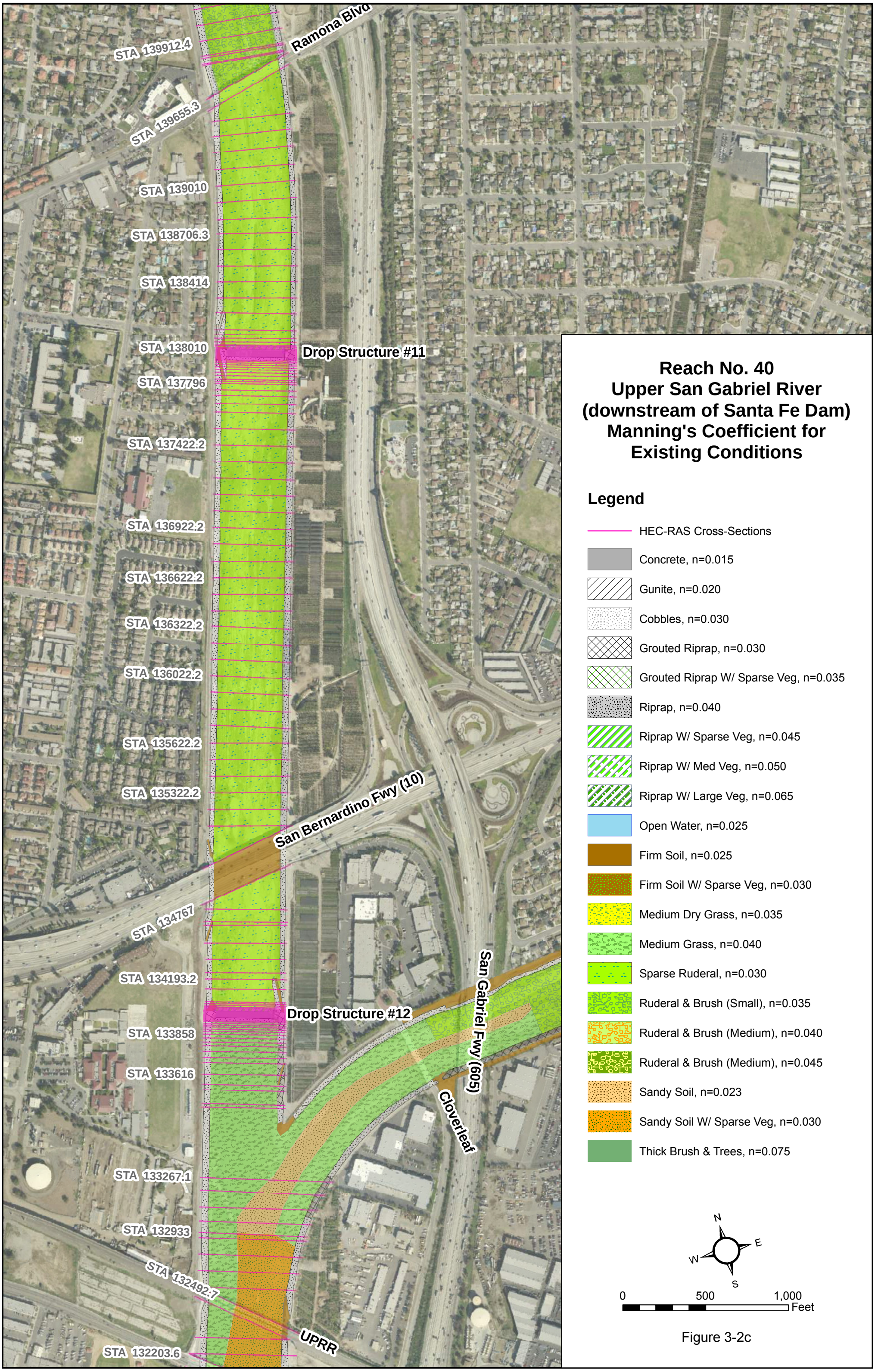
Legend

- HEC-RAS Cross-Sections
- Concrete, n=0.015
- Gunite, n=0.020
- Cobbles, n=0.030
- Grouted Riprap, n=0.030
- Grouted Riprap W/ Sparse Veg, n=0.035
- Riprap, n=0.040
- Riprap W/ Sparse Veg, n=0.045
- Riprap W/ Med Veg, n=0.050
- Riprap W/ Large Veg, n=0.065
- Open Water, n=0.025
- Firm Soil, n=0.025
- Firm Soil W/ Sparse Veg, n=0.030
- Medium Dry Grass, n=0.035
- Medium Grass, n=0.040
- Sparse Ruderal, n=0.030
- Ruderal & Brush (Small), n=0.035
- Ruderal & Brush (Medium), n=0.040
- Ruderal & Brush (Medium), n=0.045
- Sandy Soil, n=0.023
- Sandy Soil W/ Sparse Veg, n=0.030
- Thick Brush & Trees, n=0.075

N E S W

0 500 1,000 Feet

Figure 3-2b



Reach No. 40
Upper San Gabriel River
(downstream of Santa Fe Dam)
Manning's Coefficient for
Existing Conditions

Legend

- HEC-RAS Cross-Sections
- Concrete, n=0.015
- Gunite, n=0.020
- Cobbles, n=0.030
- Grouted Riprap, n=0.030
- Grouted Riprap W/ Sparse Veg, n=0.035
- Riprap, n=0.040
- Riprap W/ Sparse Veg, n=0.045
- Riprap W/ Med Veg, n=0.050
- Riprap W/ Large Veg, n=0.065
- Open Water, n=0.025
- Firm Soil, n=0.025
- Firm Soil W/ Sparse Veg, n=0.030
- Medium Dry Grass, n=0.035
- Medium Grass, n=0.040
- Sparse Ruderal, n=0.030
- Ruderal & Brush (Small), n=0.035
- Ruderal & Brush (Medium), n=0.040
- Ruderal & Brush (Medium), n=0.045
- Sandy Soil, n=0.023
- Sandy Soil W/ Sparse Veg, n=0.030
- Thick Brush & Trees, n=0.075

N
W
E
S

0 500 1,000 Feet

Figure 3-2c

Reach No. 40
Upper San Gabriel River
(downstream of Santa Fe Dam)
Manning's Coefficient for Existing Conditions

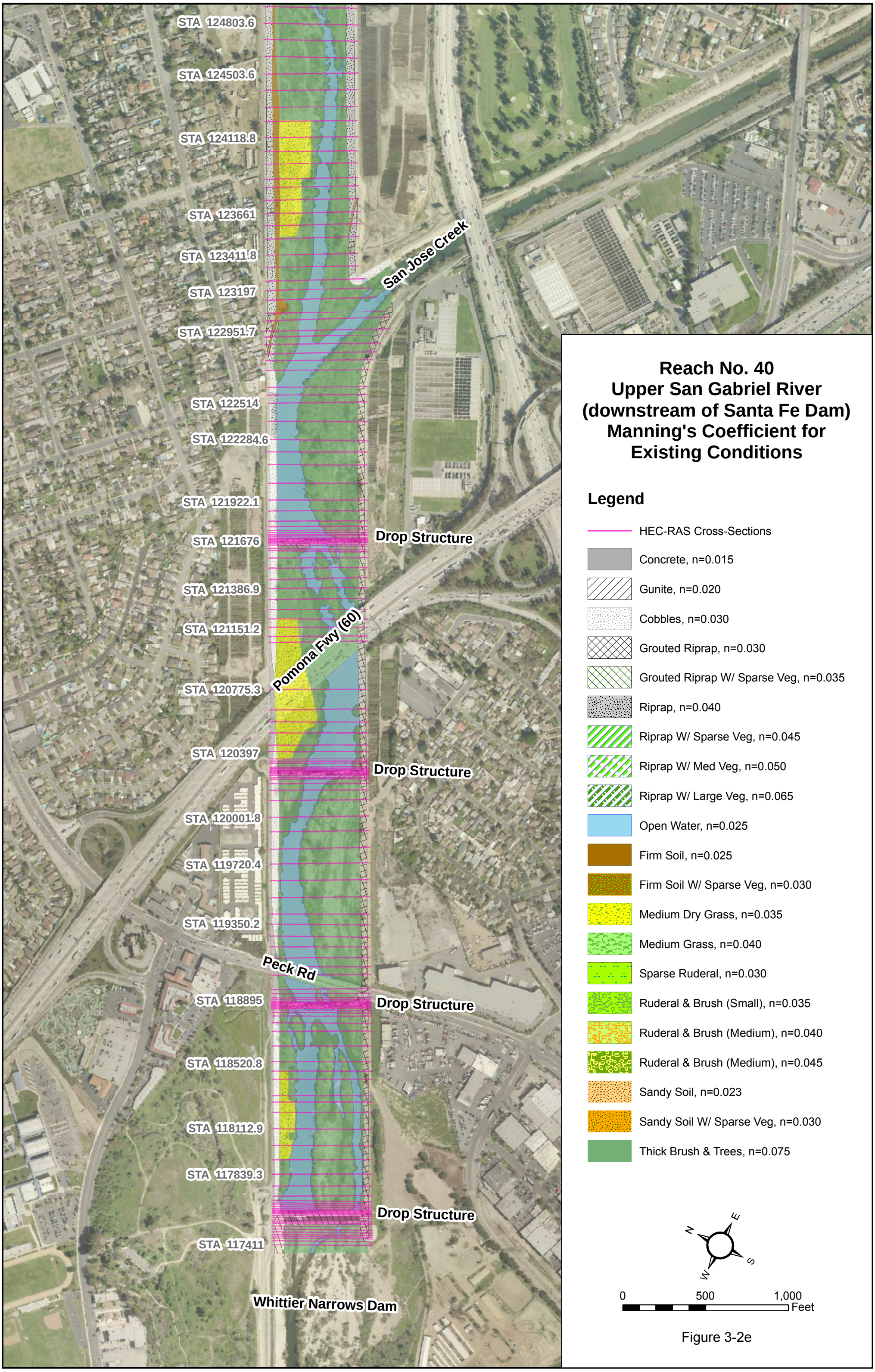
Legend

- HEC-RAS Cross-Sections
- Concrete, n=0.015
- Gunite, n=0.020
- Cobbles, n=0.030
- Grouted Riprap, n=0.030
- Grouted Riprap W/ Sparse Veg, n=0.035
- Riprap, n=0.040
- Riprap W/ Sparse Veg, n=0.045
- Riprap W/ Med Veg, n=0.050
- Riprap W/ Large Veg, n=0.065
- Open Water, n=0.025
- Firm Soil, n=0.025
- Firm Soil W/ Sparse Veg, n=0.030
- Medium Dry Grass, n=0.035
- Medium Grass, n=0.040
- Sparse Ruderal, n=0.030
- Ruderal & Brush (Small), n=0.035
- Ruderal & Brush (Medium), n=0.040
- Ruderal & Brush (Medium), n=0.045
- Sandy Soil, n=0.023
- Sandy Soil W/ Sparse Veg, n=0.030
- Thick Brush & Trees, n=0.075

N E S W

0 500 1,000 Feet

Figure 3-2d



Reach No. 40
Upper San Gabriel River
(downstream of Santa Fe Dam)
Manning's Coefficient for
Existing Conditions

Legend

- HEC-RAS Cross-Sections
- Concrete, n=0.015
- Gunite, n=0.020
- Cobbles, n=0.030
- Grouted Riprap, n=0.030
- Grouted Riprap W/ Sparse Veg, n=0.035
- Riprap, n=0.040
- Riprap W/ Sparse Veg, n=0.045
- Riprap W/ Med Veg, n=0.050
- Riprap W/ Large Veg, n=0.065
- Open Water, n=0.025
- Firm Soil, n=0.025
- Firm Soil W/ Sparse Veg, n=0.030
- Medium Dry Grass, n=0.035
- Medium Grass, n=0.040
- Sparse Ruderal, n=0.030
- Ruderal & Brush (Small), n=0.035
- Ruderal & Brush (Medium), n=0.040
- Ruderal & Brush (Medium), n=0.045
- Sandy Soil, n=0.023
- Sandy Soil W/ Sparse Veg, n=0.030
- Thick Brush & Trees, n=0.075

N E S W

0 500 1,000 Feet

Figure 3-2e

4 Reach 41 – Walnut Creek

4.1 General Description

The maintenance reach of Walnut Creek (Reach No. 41) is approximately 5,400 feet in length and begins at Baldwin Park Boulevard and ends at the creek's confluence with the San Gabriel River (Reach No. 40). Since Walnut Creek confluences with the San Gabriel River, one hydraulic model was created to include both maintenance reaches.

Walnut Creek extends east from Puddingstone Reservoir in the City of San Dimas and has Little Dalton Wash, Big Dalton Wash, and San Dimas Wash as tributaries. This maintenance reach of Walnut Creek was originally constructed by the United States Army Corps of Engineers in 1961. Operation and maintenance was transferred to the LACFCD shortly after construction.

The study limits of Walnut Creek start approximately 370 feet upstream of the Baldwin Park Boulevard Bridge and end at the creek's confluence with the San Gabriel River. The study reach is surrounded by residential and commercial properties as shown in Figure 4-1.

4.2 Structures

This study reach of Walnut Creek starts as a concrete rectangular channel, transitions to grouted riprap, and then to an earthen-bottom channel for the majority of the reach. There are three bridges, one drop structure, and one earthen-bottom to concrete channel transition within the study reach. Details of the structures within the study reach are summarized in Table 4-1.

Table 4-1. Structures along Walnut Creek

Structure No.	River Station	Road Name	Type	Description
1	74+41	Baldwin Park Blvd.	Bridge	Bridge with one pier.
2	72+95.15	--	Transition	Concrete rectangular channel to grouted riprap trapezoidal channel.
3	62+72.60	--	Drop structure	Energy dissipating structure.
4	30+95.54	San Gabriel Fwy.	Bridge	Bridge with 6 piers.
5	27+04.57	Cloverleaf Dr.	Bridge	Bridge with 6 piers.

4.3 Manning's Roughness Coefficients

The Manning's roughness coefficients were determined from field surveys of the channel conditions including base material, obstructions, vegetation, and other channel characteristics. Photographs documenting typical channel conditions are provided in Appendix A. Different regions of roughness coefficients within Walnut Creek are depicted in Figure 3-2. Detailed computations in determining these roughness coefficients are found in Appendix B.

4.4 Hydrology

Design flow rates were obtained from the United States Army Corps of Engineers' Operation and Maintenance Manual dated 1999. The peak discharge rate associated with Walnut Creek for this study reach is 40,000 cfs.

4.5 Hydraulic Model

Recent topographic surveys were used to create the HEC-RAS model for this reach of the Walnut Creek. Due to its proximity, Walnut Creek was modeled as a tributary to the San Gabriel River in the same HEC-RAS model. Walnut Creek was modeled with 79 cross-sections to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. HEC-RAS input and output files are provided in Appendix C.

4.6 Boundary Conditions

Normal depth (slope = 0.0081) was used as the upstream boundary condition for the Walnut Creek study reach. The downstream boundary condition was set as the water surface elevation computed by the HEC-RAS model at Walnut Creek's confluence with the San Gabriel River. The hydraulic model was extended approximately 1,400 feet upstream of the soft bottom reach to minimize boundary condition effects on the reach of interest.

4.7 Results

A hydraulic model was developed for Walnut Creek under existing vegetation levels. Channel and water surface profiles for the Walnut Creek hydraulic model are presented in Appendix C. The model showed sufficient capacity along the reach upstream of Station 49+46.78. Therefore, an additional analysis was conducted assuming vegetation levels as recommended by BonTerra Psomas. The additional analysis conducted is discussed in more detail in the following section.

4.8 Additional Analysis

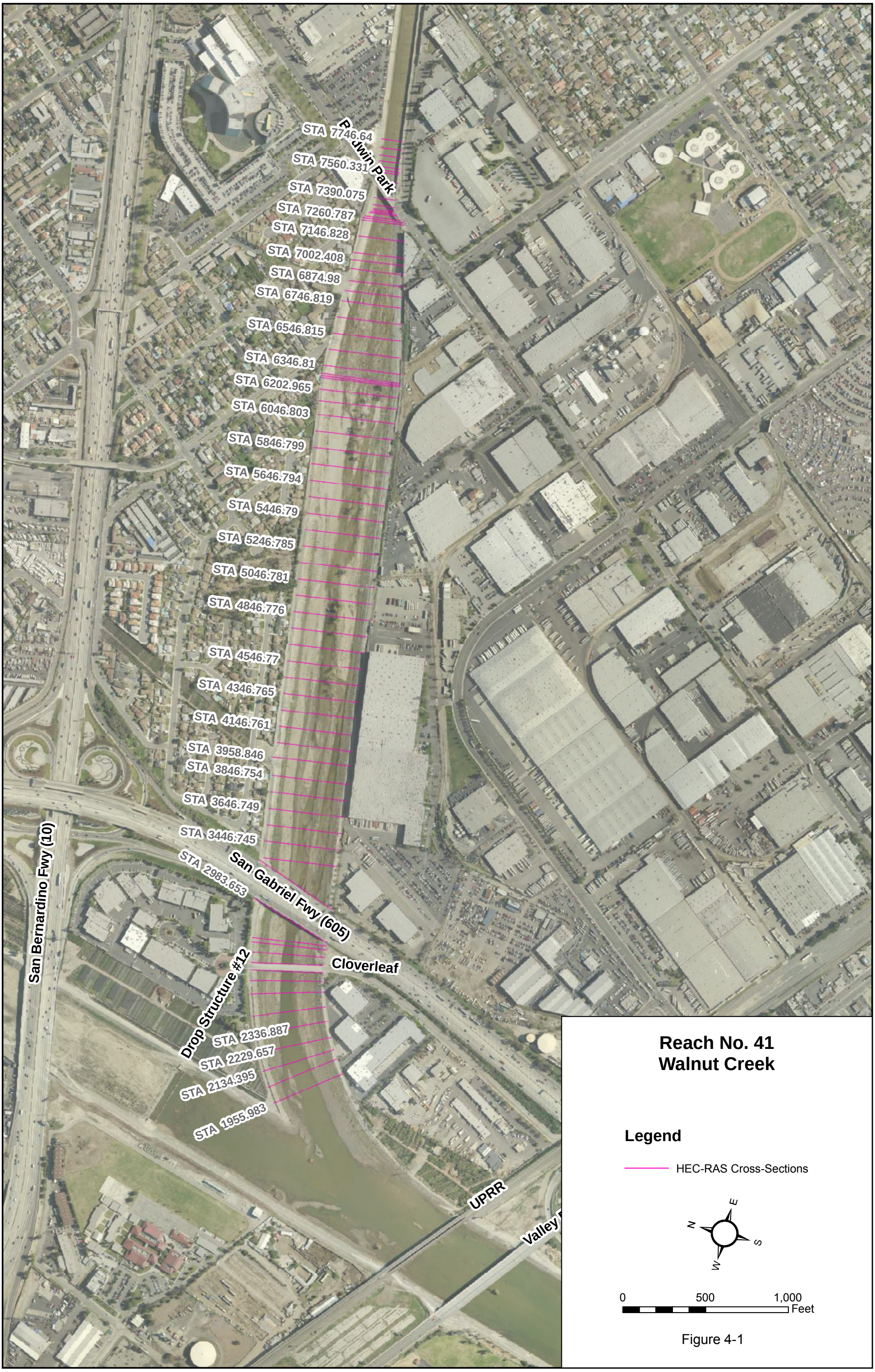
BonTerra Psomas provided a recommendation on potential vegetation growth for this reach. The recommendation is summarized in Table 4-2.

Table 4-2. Biological Recommendations for Walnut Creek

No.	Reach No.	Reach Location	Recommendation
1	41	Sta 62+02.965 – Sta 49+46.779	Within the 1.6-acre additional vegetation area, allow 15 willow saplings to mature on the left edge of low-flow channel (among existing mature willows).

Since the recommendation would have a direct impact on the amount and type of vegetation in the affected portion of the maintenance reach, a new Manning's roughness coefficient was determined for that reach and the hydraulic model was updated. Detailed computations for determining the Manning's roughness coefficients

affected by the biologist's recommendation are found in Appendix B. The revised hydraulic model based on the biologist's recommendation showed sufficient capacity along the reach. HEC-RAS hydraulic models for Walnut Creek are presented in Appendix C.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STA 4546.77
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STA 4146.761
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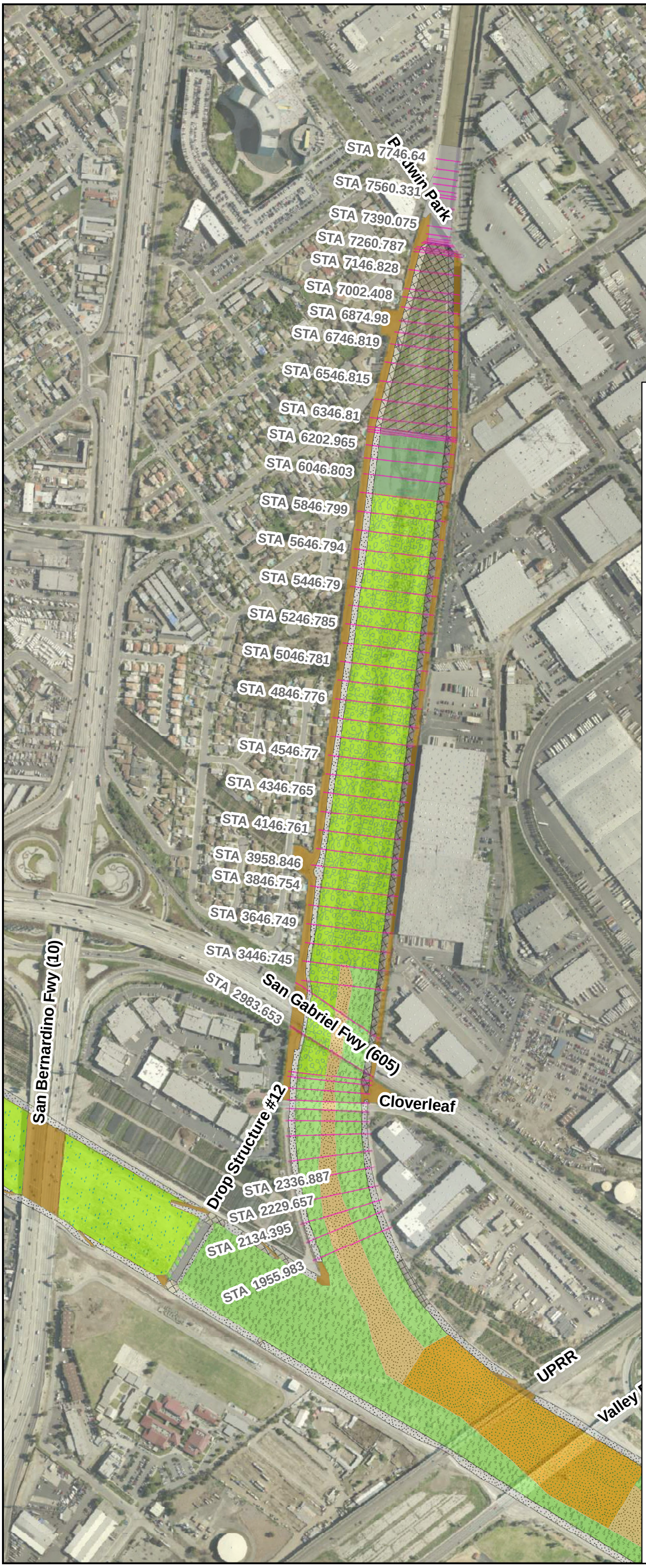
STA 3646.749
STA 3446.745
STA 2983.653
STA 2336.887
STA 2229.657
STA 2134.395
STA 1955.983
Puddingstone Park
San Gabriel Fwy (605)
San Bernardino Fwy (10)
Drop Structure #12
Cloverleaf
UPRR
Reach No. 41
Walnut Creek
Legend
HEC-RAS Cross-Sections
N
E
S
W
0
500
1,000
Feet

Figure 4-1



Reach No. 41
Walnut Creek
Manning's Coefficient for Existing Conditions

Legend

- HEC-RAS Cross-Sections
- Concrete, n=0.015
- Gunite, n=0.020
- Cobbles, n=0.030
- Grouted Riprap, n=0.030
- Grouted Riprap W/ Sparse Veg, n=0.035
- Riprap, n=0.040
- Riprap W/ Sparse Veg, n=0.045
- Riprap W/ Med Veg, n=0.050
- Riprap W/ Large Veg, n=0.065
- Open Water, n=0.025
- Firm Soil, n=0.025
- Firm Soil W/ Sparse Veg, n=0.030
- Medium Dry Grass, n=0.035
- Medium Grass, n=0.040
- Sparse Ruderal, n=0.030
- Ruderal & Brush (Small), n=0.035
- Ruderal & Brush (Medium), n=0.040
- Ruderal & Brush (Medium), n=0.045
- Sandy Soil, n=0.023
- Sandy Soil W/ Sparse Veg, n=0.030
- Thick Brush & Trees, n=0.075

N E S W

0 500 1,000 Feet

Figure 4-2

5 Reach 42 – San Jose Creek d/s 1000' from end of concrete

5.1 General Description

San Jose Creek generally flows from the east to the west, carrying water from Claremont in the northeast and confluences with the San Gabriel River just north of the intersection between the 605 and 60 Freeways. San Jose Creek was originally constructed by the United States Army Corps of Engineers in 1965. Operation and maintenance was transferred to the LACFCD shortly after its construction.

The maintenance reach within San Jose Creek (Reach No. 42) is only 800 feet, approximately between 1275 and 2075 feet from 3rd Avenue along the creek's centerline. The maintenance reach starts at the end of a concrete lined rectangular channel.

The study reach extends beyond the maintenance reach approximately 200 feet into the rectangular channel on the upstream end and approximately 2,000 feet on the downstream end. The study reach is surrounded by residential and commercial properties as shown in Figure 5-1.

5.2 Structures

The study reach of San Jose Creek consists of a concrete rectangular channel that transitions into a trapezoidal channel with a riprap channel-bottom and then an earthen bottom further down the reach. Details of the structures within the study reach are summarized in Table 5-1.

Table 5-1. Structures along San Jose Creek

Structure No.	River Station	Road Name	Type	Description
1	87+24	--	Transition	Transition from concrete rectangular channel to trapezoidal channel with rip-rap bottom.
2	79+91.89	--	Transition	Channel bottom transitions from rip-rap to firm soil.

5.3 Manning's Roughness Coefficients

The Manning's roughness coefficients were determined from field surveys of the channel conditions including base material, obstructions, vegetation, and other channel characteristics. Photographs documenting typical channel conditions are provided in Appendix A. Different regions of roughness coefficients within San Jose Creek are depicted in Figure 5-2. Detailed computations in determining these roughness coefficients are found in Appendix B.

5.4 Hydrology

Design flow rates were obtained from the United States Army Corps of Engineers' Operation and Maintenance Manual dated 1999. The peak discharge rate associated with San Jose Creek for this study reach is 43,000 cfs.

5.5 Hydraulic Model

Recent topographic surveys were used to create the HEC-RAS model for this reach of the San Jose Creek. The reach was modeled with 61 cross-sections to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. HEC-RAS input and output files are provided in Appendix C.

5.6 Boundary Conditions

Water surface elevations from the United States Army Corps of Engineers' LACDA HEC-RAS Hydraulic Models, Final Report dated 2011 were used as the boundary conditions for the San Jose Creek model (at Sta. 89+57.87 and Sta. 67+90). The corresponding upstream and downstream water surface elevations were 266.79 feet and 262.31 feet, respectively.

5.7 Results

A hydraulic model was developed for the San Jose Creek under existing vegetation levels. The model showed insufficient capacity in the channel.

A second analysis was then performed assuming a design conditions scenario based on the design roughness coefficients originally used by the Corps of Engineers. This model run was developed to evaluate whether reducing the vegetation to this level would result in excess capacity. The analysis for a design conditions scenario showed insufficient capacity in the model. No other scenarios were explored. Manning's roughness coefficients for both model runs (existing conditions and design conditions) are summarized in Appendix B. HEC-RAS input and output files for both analyses are provided in Appendix C.

Reach No. 42
San Jose Creek

Legend

HEC-RAS Cross-Sections

N
W E
S

0 250 500
Feet

Figure 5-1

Reach No. 42
San Jose Creek
Manning's Coefficient for Existing Conditions

Legend

- RAS_cross_sections
- Concrete, n=0.015
- Access Road, n=0.028
- Firm Soil, n=0.025
- Grouted Riprap, n=0.03
- Riprap W/ Small Veg, n=0.042
- Dense Mature Trees, n=0.085

N
W E
S

0 250 500 Feet

Figure 5-2

6 Reach 43 & 44 – San Gabriel River (Upper & Rubber Dams)

6.1 General Description

Reach Nos. 43 and 44 are two reaches along the San Gabriel River that were originally constructed by the United States Army Corps of Engineers from 1966 to 1968. Operation and maintenance was transferred to the LACFCD shortly after their construction. The maintenance limit of Reach No. 43 begins at Whittier Narrows Dam and ends at Beverly Boulevard. The maintenance limit of Reach No. 44 begins at Beverly Boulevard and ends at Firestone Boulevard. Since the downstream maintenance limit of Reach No. 43 corresponds with the upstream limit of Reach No. 44, one continuous hydraulic model was created to include both reaches.

The study limit starts approximately 400 feet downstream of the spillway toe of the Whittier Narrows Dam and ends approximately 500 feet downstream of Firestone Boulevard. The study reach is located within an urban setting surrounded by residential, commercial, and industrial areas as shown in Figures 6-1 (a-e).

6.2 Structures

This study reach of the San Gabriel River is an earthen-bottom trapezoidal channel with stone side slopes that transition into a fully concrete-lined channel near Firestone Boulevard. There are twelve bridges, one drop structure, one earthen-bottom to concrete channel transition, and seven rubber dams within the study reach. Details of the structures within the study reach are summarized in Table 6-1.

Table 6-1. Structures along San Gabriel River (Upper & Rubber Dams)

Structure No.	River Station	Road Name	Type	Description
1	1074+97	San Gabriel River Parkway	Bridge	Bridge with 5 piers.
2	1070+24.5	--	Drop structure	Energy dissipating structure.
3	1043+93	Beverly Blvd.	Bridge	Bridge with 4 piers.
4	1034+17	--	Bridge	Railroad overcrossing with 2 piers.
5	1029+32.4	--	Rubber dam	Rubber Dam #1
6	1001+98.8	Whittier Blvd.	Bridge	Bridge with 4 piers.
7	996+55.97	--	Rubber dam	Rubber Dam #2
8	921+72	Washington Blvd.	Bridge	Bridge with 4 piers.
9	920+42.47	--	Rubber dam	Rubber Dam #3
10	899+38.82	--	Rubber dam	Rubber Dam #4
11	884+41	--	Bridge	Railroad overcrossing with 6 piers.
12	883+54	Slauson Ave.	Bridge	Bridge with 4 piers.
13	872+16.5	--	Bridge	Railroad overcrossing with 6 piers.
14	835+37.34	--	Rubber dam	Rubber Dam #5
15	818+29	Telegraph Rd.	Bridge	Bridge with 5 piers.
16	791+56	Santa Ana Fwy.	Bridge	Bridge with 6 piers.
17	785+51	--	Rubber dam	Rubber Dam #6
18	771+04	Florence Ave.	Bridge	Bridge with 4 piers.
19	737+37.9	--	Rubber dam	Rubber Dam #7

Structure No.	River Station	Road Name	Type	Description
20	735+32.9	--	Transition	Transition from earthen-bottom channel to concrete channel
21	722+35	Firestone Blvd.	Bridge	Bridge with 4 piers.

6.3 Manning's Roughness Coefficients

The Manning's roughness coefficients were determined from field surveys of the channel conditions including base material, obstructions, vegetation, and other channel characteristics. Photographs documenting typical channel conditions are provided in Appendix A. Different regions of roughness coefficients within San Gabriel River are depicted in Figure 6-2. Detailed computations in determining these roughness coefficients are found in Appendix B.

6.4 Hydrology

Design flow rates were obtained from the United States Army Corps of Engineers' Operation and Maintenance Manual dated 1999. The peak discharge rates associated with San Gabriel River ranges from 13,000 cfs just below Whittier Narrows Dam to 19,000 cfs near Firestone Boulevard.

6.5 Hydraulic Model

Recent topographic surveys were used to create the HEC-RAS model for this reach of the San Gabriel River. The reach was modeled with 503 cross-sections to ensure a gradually varied flow profile and to adequately represent the channel geometry and structures along the study reach. HEC-RAS input and output files are provided in Appendix C.

6.6 Boundary Conditions

Normal Depths were used as boundary conditions for the study model. The upstream boundary slope was 0.000525 (the average slope between the four most upstream cross-sections). The downstream boundary slope was 0.0018 (the slope between the two most downstream cross-sections).

6.7 Results

A hydraulic model was developed for the San Gabriel River under existing vegetation levels. Channel and water surface profiles for the San Gabriel River hydraulic model are presented in Appendix C.

A hydraulic model was developed for the San Gabriel River under existing vegetation levels. Channel and water surface profiles for the San Gabriel River hydraulic model are presented in Appendix C.

For the existing vegetation scenario, the model showed sufficient capacity along the following reaches: Station 1106+00 to 1044+27.7 (Whittier Narrows Dam to Beverly Blvd), Station 920+42.4 to 899+38.82 (Rubber Dam #3 to Rubber Dam #4), Station 835+37.34 to 810+00 (Rubber Dam #5 to 800-ft downstream of Telegraph Rd), and Station 791+56 to 722+35 (Santa Ana Fwy to Firestone Blvd.). The remaining segments of the channel showed insufficient capacity.

An additional analysis was conducted assuming vegetation levels as recommended by BonTerra Psomas for the reaches that showed sufficient capacity. The additional analysis conducted is discussed in more detail in the following section.

6.8 Additional Analysis

BonTerra Psomas provided recommendations on potential vegetation for reaches with sufficient capacity. The recommendations are summarized in Table 6-2.

Table 6-2. Biological Recommendations for San Gabriel River (Upper & Rubber Dams)

No.	Reach No.	Reach Location	Recommendation
1	43	Sta 1106+00 – Sta 1044+27.7	Within the low-lying, 0.45-acre additional vegetation area, allow willow riparian forest vegetation to mature.
2	43	Sta 1063+00 – Sta 1049+00	Within the 1-acre additional vegetation area, allow 20 willow saplings to mature on left edge of low flow channel. This is intended to facilitate connectivity between adjacent willow riparian forest habitats.
3	44	Sta 919+94.37 – Sta 899+38.82	Within the 0.8-acre additional vegetation area, allow 50 willow saplings to mature on left edge of low-flow channel between Rubber Dam 3 and Rubber Dam 4, but not within 15-ft of the toe of the levee.
4	44	Sta 834+61 – Sta 818+60.3	Within the 1.9-acre additional vegetation area, allow 35 willow saplings to mature on left edge of low-flow channel between Rubber Dam 5 and Telegraph Road, but not within 15-ft of the toe of the levee.
5	44	Sta 790+30.2 – Sta 771+04	Within the 1.8-acre additional area, allow 100 willow saplings to mature on left edge of low-flow channel between I-5 Freeway and Florence Avenue, but not within 15-ft of toe of the levee.

Since the recommendations would have a direct impact on the amount and type of vegetation in the model, a new Manning's roughness coefficient was determined for the scenario and the hydraulic model was updated. However, a new Manning's roughness

coefficient was not determined for recommendation 1 since the existing conditions model already reflected this scenario. For recommendation 3, it was determined that the recommendation did not increase the amount of existing vegetation in the reach since the additional proposed willows will replace existing willows near the toe of the levee that are assumed to be removed due to the Corps of Engineers levee vegetation policy.

To model the other BonTerra Psomas recommendations, the Manning's roughness coefficient was modified for the following reaches: Station 1063+00 to 1049+00, Station 834+61 to 818+60.3 (Rubber Dam #5 to 800' d/s of Telegraph Rd), and Station 790+30.2 to 771+04 (Santa Ana Fwy to Florence Ave.). Additionally, the reaches with insufficient capacity were modeled using design condition roughness coefficients which assume no vegetation in the channel. Detailed computations in determining the roughness coefficient values based on the biologist's recommendations are found in Appendix B. The revised hydraulic models resulted in sufficient capacity along the reaches where the recommendations were made. HEC-RAS hydraulic models for San Gabriel River are presented in Appendix C.


Whittier Narrows Dam
STA 110500
STA 110300
STA 110100
STA 109900
STA 109700
STA 109500
STA 109300
STA 109100
STA 108900
STA 108493.6
STA 108293.6
STA 108193.6
STA 107993.6
STA 107793.6
San Gabriel River Pkwy
STA 107562.2
STA 107200
STA 107071.3
Drop Structure #1
STA 106900
STA 106700
STA 106500
STA 106300
STA 106100
STA 105900
STA 105700
STA 105400
STA 105200
STA 105000
STA 104800
STA 104600
Beverly Blvd
STA 104427.7
STA 104300
STA 104100
STA 103800
UPRR
STA 103600
Rubber Dam #1
STA 103200
STA 103000
San Gabriel River Fwy (605)
Reach No. 43 & 44
San Gabriel River
(Upper & Rubber Dams)
Legend
HEC-RAS Cross-Sections
N
E
W
S
0
500
1,000
Feet

Figure 6-1a


STA 103200
Rubber Dam #1
STA 103000
STA 102800
STA 102600
STA 102300
STA 102100
STA 101900
STA 101600
STA 101300
STA 101100
STA 100800
STA 100500
STA 100142.5
San Gabriel River Fwy (605)
Whittier Bl
STA 99900
Rubber Dam #2
STA 99700
STA 99500
STA 99300
STA 99100
STA 98900
STA 98700
STA 98400
STA 98200
STA 98000
STA 97700
STA 97500
STA 97300
STA 97000
STA 96800
STA 96500
STA 96300
STA 96000
STA 95700
STA 95400
STA 95100
STA 94900
Reach No. 43 & 44
San Gabriel River
(Upper & Rubber Dams)
Legend
HEC-RAS Cross-Sections
N
E
W
S
0
500
1,000
Feet

Figure 6-1b

STA 95100
STA 94900
STA 94700
STA 94400
STA 94200
STA 94000
STA 93800
STA 93600
STA 93400
STA 93200
STA 93000
STA 92700
STA 92500
STA 92300
Washington Blvd
STA 92100
Rubber Dam #3
STA 91800
STA 91600
STA 91400
STA 91200
STA 91000
STA 90800
STA 90600
STA 90400
STA 90200
STA 90000
STA 89890.2
Rubber Dam #4
STA 89700
STA 89500
STA 89400
STA 89300
STA 89200
STA 89100
STA 89000
STA 88900
STA 88800
STA 88700
Slauson Av
BNSF
STA 88388.7
STA 88300
STA 88200
STA 88100
STA 88000
STA 87900
STA 87800
STA 87700
STA 87600
UPRR
STA 87195.9
STA 87068.7
STA 86900
STA 86700
STA 86500
San Gabriel River Fwy (605)

Reach No. 43 & 44
San Gabriel River
(Upper & Rubber Dams)

Legend

HEC-RAS Cross-Sections

N
E
W
S

0 500 1,000
Feet

Figure 6-1c

STA 87025.6
STA 86900
STA 86700
STA 86500
STA 86300
STA 86000
STA 85800
STA 85600
STA 85400
STA 85200
STA 85000
STA 84800
STA 84500
STA 84300
STA 84000
STA 83800
STA 83600
STA 83461
STA 83300
STA 83100
STA 82900
STA 82700
STA 82400
STA 82100
STA 81860.3
STA 81500
STA 81300
STA 81100
STA 80900
STA 80600
STA 80400
STA 80200
STA 80000
STA 79800
STA 79700
STA 79600
STA 78800
STA 78600
STA 78483.64

San Gabriel River Fwy (605)
Rubber Dam #5
Telegraph Rd
Santa Ana Fwy (I-5)
Rubber Dam #6

Reach No. 43 & 44
San Gabriel River
(Upper & Rubber Dams)

Legend

HEC-RAS Cross-Sections

N
E
W
S

0 500 1,000
Feet

Figure 6-1d

Santa Ana Fwy (I-5)
Rubber Dam #6
STA 78800
STA 78600
STA 78483.64
STA 78300
STA 78000
STA 77800
STA 77500
STA 77300
STA 77137.9
Florence Av
STA 76900
STA 76700
STA 76400
STA 76100
STA 75900
STA 75700
STA 75500
STA 75300
STA 75100
STA 74900
STA 74600
STA 74300
STA 74100
STA 73900
Rubber Dam #7
STA 73721
STA 73600
STA 73400
STA 73200
STA 73000
STA 72800
STA 72500
Firestone Blvd
STA 72100
STA 71900
UPRR
San Gabriel River Fwy (605)

Reach No. 43 & 44
San Gabriel River
(Upper & Rubber Dams)

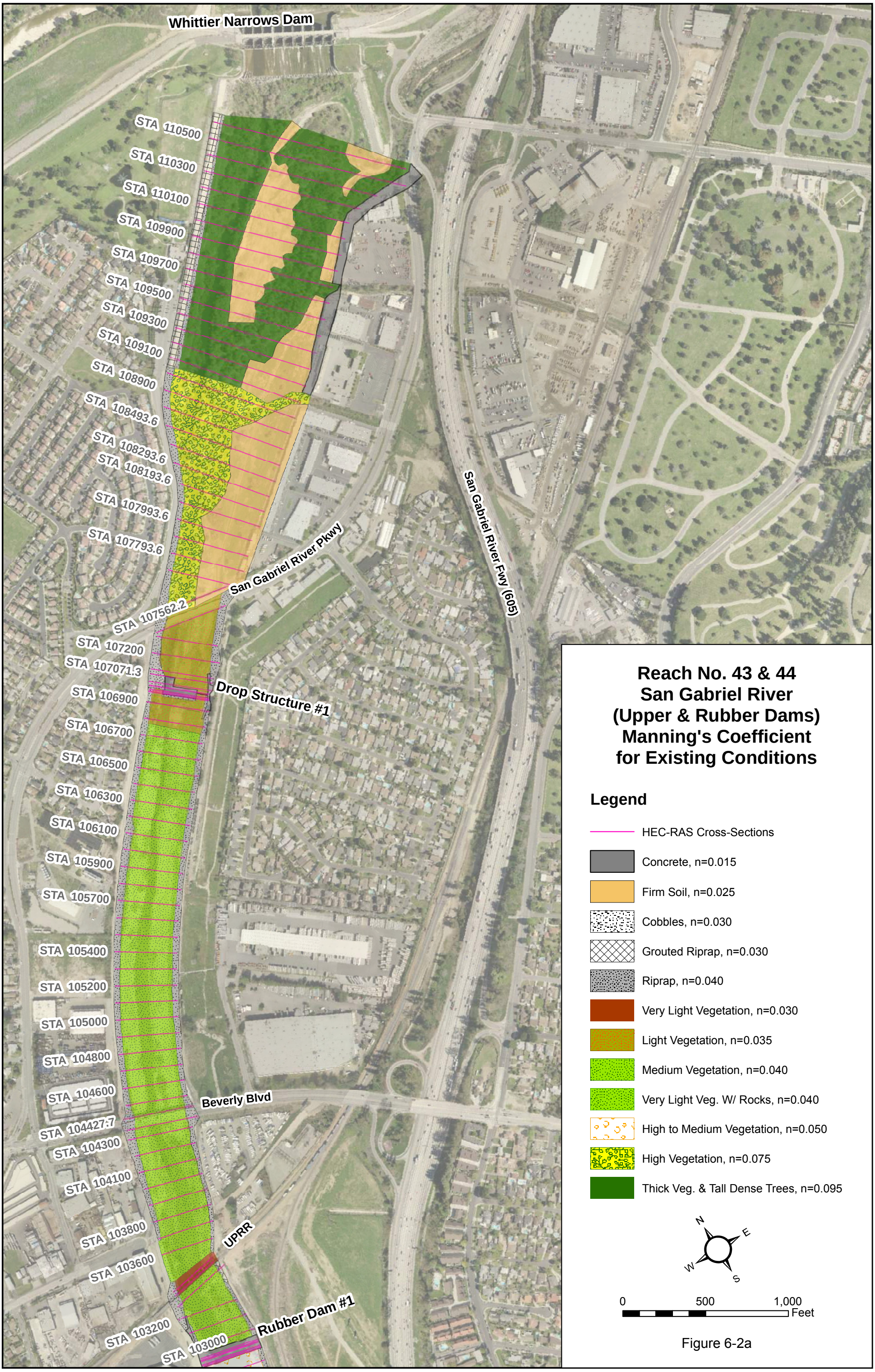
Legend

HEC-RAS Cross-Sections

N E S W

0 500 1,000 Feet

Figure 6-1e



Reach No. 43 & 44
San Gabriel River
(Upper & Rubber Dams)
Manning's Coefficient
for Existing Conditions

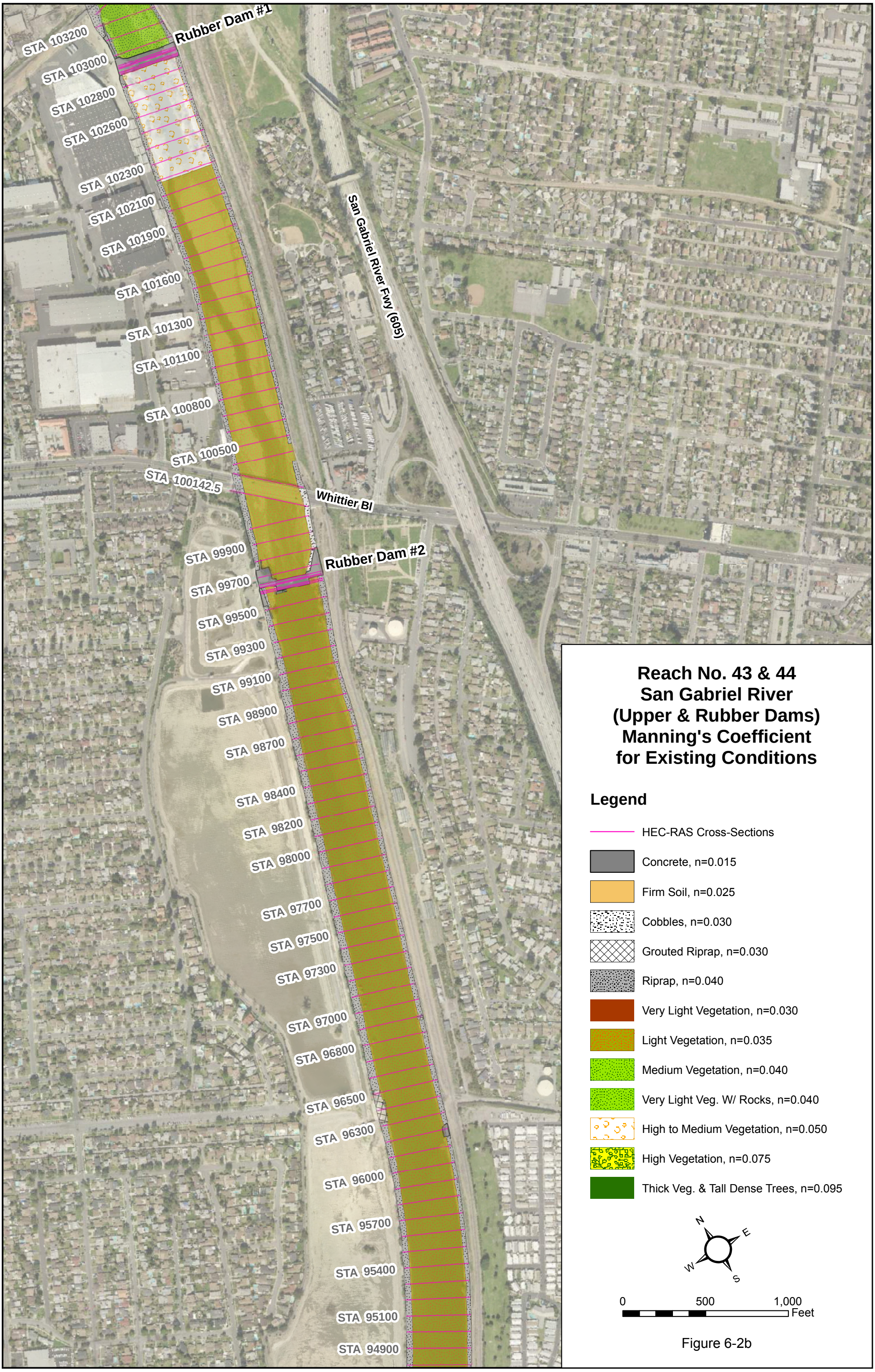
Legend

- HEC-RAS Cross-Sections
- Concrete, n=0.015
- Firm Soil, n=0.025
- Cobbles, n=0.030
- Grouted Riprap, n=0.030
- Riprap, n=0.040
- Very Light Vegetation, n=0.030
- Light Vegetation, n=0.035
- Medium Vegetation, n=0.040
- Very Light Veg. W/ Rocks, n=0.040
- High to Medium Vegetation, n=0.050
- High Vegetation, n=0.075
- Thick Veg. & Tall Dense Trees, n=0.095

N E W S

0 500 1,000 Feet

Figure 6-2a



Reach No. 43 & 44
San Gabriel River
(Upper & Rubber Dams)
Manning's Coefficient
for Existing Conditions

Legend

- HEC-RAS Cross-Sections
- Concrete, n=0.015
- Firm Soil, n=0.025
- Cobbles, n=0.030
- Grouted Riprap, n=0.030
- Riprap, n=0.040
- Very Light Vegetation, n=0.030
- Light Vegetation, n=0.035
- Medium Vegetation, n=0.040
- Very Light Veg. W/ Rocks, n=0.040
- High to Medium Vegetation, n=0.050
- High Vegetation, n=0.075
- Thick Veg. & Tall Dense Trees, n=0.095

N E W S

0 500 1,000 Feet

Figure 6-2b

STA 95100
STA 94900
STA 94700
STA 94400
STA 94200
STA 94000
STA 93800
STA 93600
STA 93400
STA 93200
STA 93000
STA 92700
STA 92500
STA 92300
Washington Blvd
STA 92100
Rubber Dam #3
STA 91800
STA 91600
STA 91400
STA 91200
STA 91000
STA 90800
STA 90600
STA 90400
STA 90200
STA 90000
STA 89890.2
Rubber Dam #4
STA 89700
STA 89500
STA 89400
STA 89300
STA 89200
STA 89100
STA 89000
STA 88900
STA 88800
STA 88700
Slauson Av
BNSF
STA 88388.7
STA 88300
STA 88200
STA 88100
STA 88000
STA 87900
STA 87800
STA 87700
STA 87600
UPRR
STA 87195.9
STA 87068.7
STA 86900
STA 86700
STA 86500
San Gabriel River Fwy (605)

Reach No. 43 & 44
San Gabriel River
(Upper & Rubber Dams)
Manning's Coefficient
for Existing Conditions

Legend

- HEC-RAS Cross-Sections
- Concrete, n=0.015
- Firm Soil, n=0.025
- Cobbles, n=0.030
- Grouted Riprap, n=0.030
- Riprap, n=0.040
- Very Light Vegetation, n=0.030
- Light Vegetation, n=0.035
- Medium Vegetation, n=0.040
- Very Light Veg. W/ Rocks, n=0.040
- High to Medium Vegetation, n=0.050
- High Vegetation, n=0.075
- Thick Veg. & Tall Dense Trees, n=0.095

N
E
W
S

0 500 1,000
Feet

Figure 6-2c

STA 87025.6
STA 86900
STA 86700
STA 86500
STA 86300
STA 86000
STA 85800
STA 85600
STA 85400
STA 85200
STA 85000
STA 84800
STA 84500
STA 84300
STA 84000
STA 83800
STA 83600
STA 83461
STA 83300
STA 83100
STA 82900
STA 82700
STA 82400
STA 82100
STA 81860.3
STA 81500
STA 81300
STA 81100
STA 80900
STA 80600
STA 80400
STA 80200
STA 80000
STA 79800
STA 79700
STA 79600
STA 78800
STA 78600
STA 78483.64

San Gabriel River Fwy (605)
Rubber Dam #5
Telegraph Rd
Santa Ana Fwy (I-5)
Rubber Dam #6

Reach No. 43 & 44
San Gabriel River
(Upper & Rubber Dams)
Manning's Coefficient
for Existing Conditions

Legend

- HEC-RAS Cross-Sections
- Concrete, n=0.015
- Firm Soil, n=0.025
- Cobbles, n=0.030
- Grouted Riprap, n=0.030
- Riprap, n=0.040
- Very Light Vegetation, n=0.030
- Light Vegetation, n=0.035
- Medium Vegetation, n=0.040
- Very Light Veg. W/ Rocks, n=0.040
- High to Medium Vegetation, n=0.050
- High Vegetation, n=0.075
- Thick Veg. & Tall Dense Trees, n=0.095

N E W S

0 500 1,000 Feet

Figure 6-2d

Santa Ana Fwy (I-5)

Rubber Dam #6

STA 78800

STA 78600

STA 78483.64

STA 78300

STA 78000

STA 77800

STA 77500

STA 77300

STA 77137.9

Florence Av

STA 76900

STA 76700

STA 76400

STA 76100

STA 75900

STA 75700

STA 75500

STA 75300

STA 75100

STA 74900

STA 74600

STA 74300

STA 74100

STA 73900

Rubber Dam #7

STA 73721

STA 73600

STA 73400

STA 73200

STA 73000

STA 72800

STA 72500

Firestone Blvd

STA 72100

STA 71900

UPRR

San Gabriel River Fwy (605)

Reach No. 43 & 44
San Gabriel River
(Upper & Rubber Dams)
Manning's Coefficient
for Existing Conditions

Legend

- HEC-RAS Cross-Sections
- Concrete, n=0.015
- Firm Soil, n=0.025
- Cobbles, n=0.030
- Grouted Riprap, n=0.030
- Riprap, n=0.040
- Very Light Vegetation, n=0.030
- Light Vegetation, n=0.035
- Medium Vegetation, n=0.040
- Very Light Veg. W/ Rocks, n=0.040
- High to Medium Vegetation, n=0.050
- High Vegetation, n=0.075
- Thick Veg. & Tall Dense Trees, n=0.095

N E W S

0 500 1,000 Feet

Figure 6-2e

7 Reach 98 – Inlet Walnut Creek

7.1 General Description

The maintenance reach of Inlet Walnut Creek (Reach No. 98) is approximately 30 feet in length and is located in the unimproved portion of Walnut Creek. Just downstream of the maintenance reach starts the improved portion of Walnut Creek Channel. Walnut Creek Channel was originally constructed by the United States Army Corps of Engineers in 1962. Operation and maintenance was transferred to the LACFCD shortly after its construction.

The study limit starts approximately 700 feet upstream and extends 400 feet downstream of the start of the improved portion of Walnut Creek Channel. The study reach is located near residential areas as shown in Figure 7-1.

7.2 Structures

The study reach is an unimproved natural channel that transitions into a rectangular concrete channel. Details of the structures are summarized in Table 7-1.

Table 7-1. Structures along Inlet Walnut Creek

Structure No.	River Station	Road Name	Type	Description
1	4+06.63	-	Channel Transition	Transition from an unimproved natural channel to rectangular concrete channel.

7.3 Manning's Roughness Coefficients

The Manning's roughness coefficients were determined from field surveys of the channel conditions including base material, obstructions, vegetation, and other channel characteristics. Photographs documenting typical channel conditions are provided in Appendix A. Different regions of roughness coefficients within Walnut Creek are depicted in Figure 7-2. Detailed computations in determining these roughness coefficients are found in Appendix B.

7.4 Hydrology

Design flow rates were obtained from the United States Army Corps of Engineers' Operation and Maintenance Manual dated 1999. The peak discharge rate associated with the inlet of Walnut Creek Channel is 8,000 cfs.

7.5 Hydraulic Model

Recent topographic surveys were used to create the HEC-RAS model for this reach of the Walnut Creek. The reach was modeled with 46 cross-sections to ensure a gradually varied flow profile and to adequately represent the improved and unimproved channel geometry along the study reach. HEC-RAS input and output files are provided in Appendix C.

7.6 Boundary Conditions

Normal Depth was used as the upstream (slope = 0.033) and downstream (slope = 0.020) boundary conditions for the study model.

7.7 Results

A hydraulic model was developed for the Inlet Walnut Creek under existing vegetation levels. The model showed insufficient capacity in the unimproved portion of Walnut Creek. Between Stations 11+01.646 to 4+22.498, the water levels reach the private properties adjacent to Walnut Creek. Below Station 4+06.6271, where Walnut Creek Channel begins, the improved channel does not have sufficient freeboard at several locations.

A second analysis was then performed assuming estimated design conditions vegetation to evaluate whether reducing the vegetation to this level would result in excess capacity. Manning's roughness coefficient values of 0.025 were used to represent the earth-bottom portions of Walnut Creek. The analysis for estimated design conditions showed no excess capacity at the above mentioned stations. No other scenarios were explored. HEC-RAS input and output files for all analyses are provided in Appendix C.


E NAVILLA PL
SHOUSE AV
BANNA AV
E NAVILLA PL
STA 1101.646
STA 1059.975
STA 977.1096
STA 798.1541
STA 744.7785
STA 719.571
STA 665.2112
STA 614.7784
STA 570.2384
STA 495.448
STA 422.498
STA 397.647
STA 344.7349
STA 294.736
STA 244.7373
STA 194.7411
STA 119.737
STA 69.73385
STA 4.727934
RAMBLING RD
RANCHO DEL MONICO RD
CHAPARRO RD
Reach No. 98
Inlet Walnut Creek
Legend
HEC-RAS Cross-Sections
N
W
E
S
0
150
300
Feet

Figure 7-1

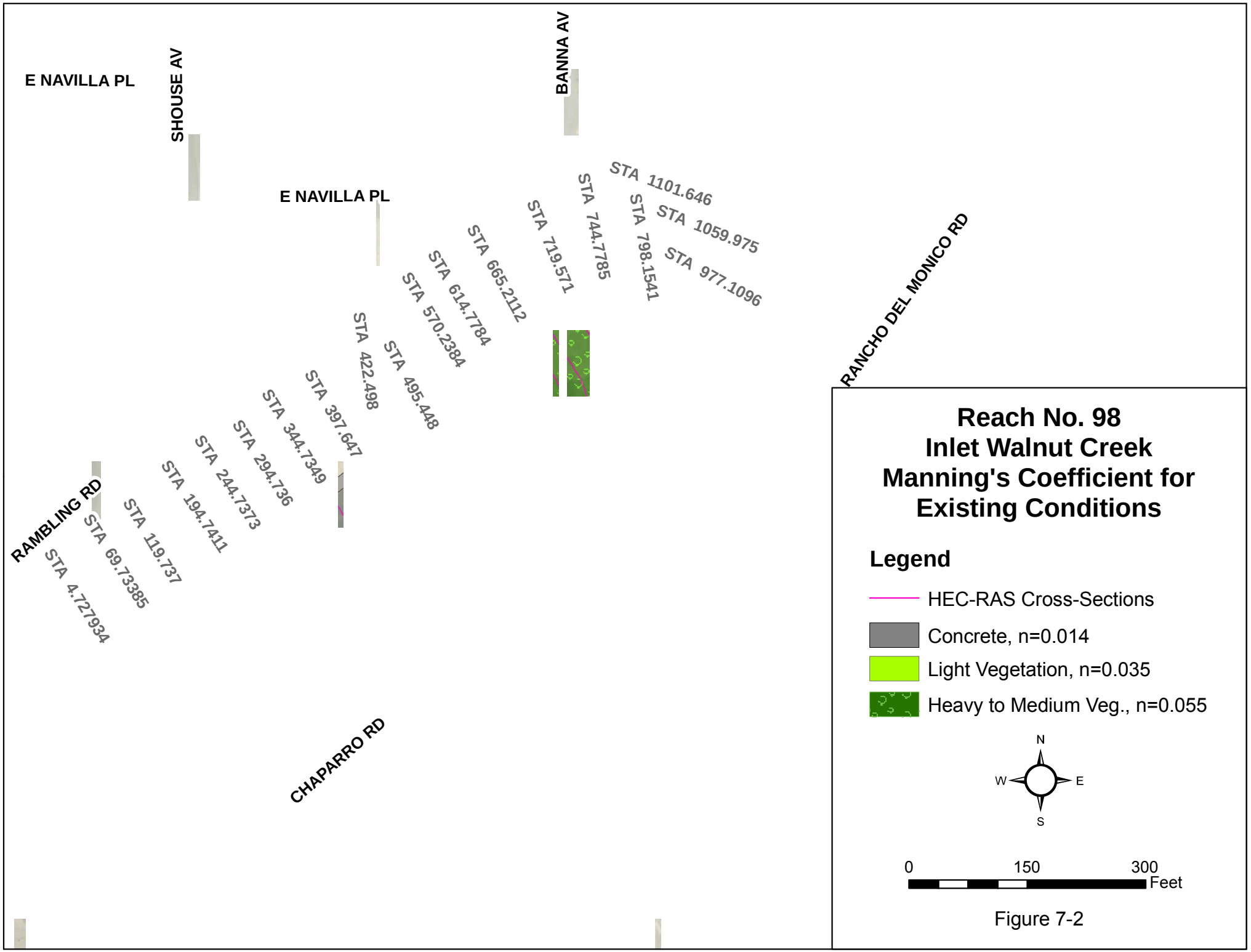

E NAVILLA PL
SHOUSE AV
BANNA AV
E NAVILLA PL
STA 1101.646
STA 1059.975
STA 977.1096
STA 798.1541
STA 744.7785
STA 719.571
STA 665.2112
STA 614.7784
STA 570.2384
STA 495.448
STA 422.498
STA 397.647
STA 344.7349
STA 294.736
STA 244.7373
STA 194.7411
STA 119.737
STA 69.73385
STA 4.727934
RAMBLING RD
CHAPARRO RD
RANCHO DEL MONICO RD
Reach No. 98
Inlet Walnut Creek
Manning's Coefficient for
Existing Conditions
Legend
HEC-RAS Cross-Sections
Concrete, n=0.014
Light Vegetation, n=0.035
Heavy to Medium Veg., n=0.055
N
W
E
S
0
150
300
Feet

Figure 7-2

8 References

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Appendix A

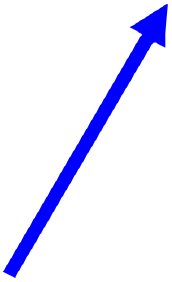
Annotated Reach Photographs

Reach No. 39 – San Gabriel River, Beatty Canyon Outlet

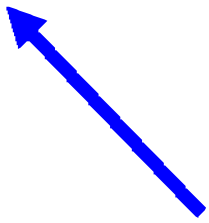
Site Visit: 9/12/2012

Looking u/s at Beatty Canyon Outlet

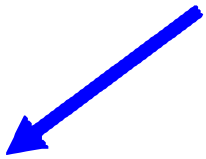
Looking d/s from top of Beatty Canyon Outlet into rectangular channel



Looking d/s near the end of rectangular channel



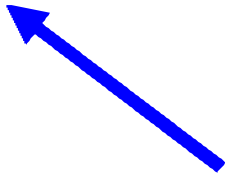
Looking u/s into rectangular channel



Reach No. 39 – San Gabriel River, Beatty Canyon Outlet

Site Visit: 9/12/2012

Looking d/s beyond the end of the rectangular channel



Site Visit: 09/10/2012

Looking along channel, u/s (left) to d/s (right) from Sta. 1558+22.1 (HEC-RAS Model)

Looking along channel, u/s (left) to d/s (right) from Sta. 1553+99.2 (HEC-RAS Model)

Site Visit: 09/10/2012

Looking along channel, u/s (left) to d/s (right) from Sta. 1537+97.5 (HEC-RAS Model)

Looking along channel, u/s (left) to d/s (right) from Sta. 1524+96.5 (HEC-RAS Model)

Site Visit: 09/10/2012

Looking along channel, u/s (left) to d/s (right) from Sta. 1524+96.5 (HEC-RAS Model)

Looking along channel, u/s (left) to d/s (right) from Sta. 1500+89.5 (HEC-RAS Model)

Site Visit: 09/10/2012

Looking along channel, u/s (left) to d/s (right) from Sta. 1500+89.5 (HEC-RAS Model)

Looking along channel, u/s (left) to d/s (right) from Sta. 1473+97.3 (HEC-RAS Model)

Site Visit: 09/10/2012

Looking along channel, u/s (left) to d/s (right) from Sta. 1459+95.5 (HEC-RAS Model)

Looking along channel, u/s (left) to d/s (right) from Sta. 1437+61.2 (HEC-RAS Model)

Site Visit: 09/10/2012

Looking along channel, u/s (left) to d/s (right) from Sta. 1414+87.3 (HEC-RAS Model)

Looking along channel, u/s (left) to d/s (right) from Sta. 1379+82.6 (HEC-RAS Model)

Site Visit: 09/10/2012

Looking along channel, u/s (left) to d/s (right) from Sta. 1362+22.2 (HEC-RAS Model)

Looking along channel, u/s (left) to d/s (right) from Sta. 1339+80.6 (HEC-RAS Model)

Site Visit: 09/10/2012

Looking along channel, u/s (left) to d/s (right) from Sta. 1330+03.6 (HEC-RAS Model)

Looking along channel, u/s (left) to d/s (right) from Sta. 1323+03.3 (HEC-RAS Model)

Site Visit: 09/10/2012

Looking along channel, u/s (left) to d/s (right) from Sta. 1308+51.2 (HEC-RAS Model)

Looking along channel, u/s (left) to d/s (right) from Sta. 1306+79.2 (HEC-RAS Model)

Site Visit: 09/10/2012

Looking along channel, u/s (left) to d/s (right) from Sta. 1282+60 (HEC-RAS Model)

Looking along channel, u/s (left) to d/s (right) from Sta. 1281+24.3 (HEC-RAS Model)

Site Visit: 09/10/2012

Looking along channel, u/s (left) to d/s (right) from Sta. 1264+00.5 (HEC-RAS Model)

Looking along channel, u/s (left) to d/s (right) from Sta. 1256+65.2 (HEC-RAS Model)

Site Visit: 09/10/2012

Looking along channel, u/s (left) to d/s (right) from Sta. 1255+13.3 (HEC-RAS Model)

Looking along channel, u/s (left) to d/s (right) from Sta. 1243+03.6 (HEC-RAS Model)

Site Visit: 09/10/2012

Looking along channel, u/s (left) to d/s (right) from Sta. 1225+59.4 (HEC-RAS Model)

Looking along channel, u/s (left) to d/s (right) from Sta. 1216+92.5 (HEC-RAS Model)

Site Visit: 09/10/2012

Looking along channel, u/s (left) to d/s (right) from Sta. 1215+72.7 (HEC-RAS Model)

Looking along channel, u/s (left) to d/s (right) from u/s of Sta. 1207+75.3, Pomona Fwy (HEC-RAS Model)

Site Visit: 09/10/2012

Looking along channel, u/s (left) to d/s (right) from Sta. 1202+76.9 (HEC-RAS Model)

Looking along channel, u/s (left) to d/s (right) from Sta. 1176+10.4 (HEC-RAS Model)

Reach No. 41 – Walnut Creek

Site Visit: 09/10/2012

Looking d/s from Sta. 72+95.15 (HEC-RAS Model)

Looking south across channel from Sta. 62+72.60 (HEC-RAS Model)

Reach No. 41 – Walnut Creek

Site Visit: 09/10/2012

Looking d/s from Sta. 62+72.60 (HEC-RAS Model)

Site Visit: 09/10/2012

Looking along channel from the north at Sta. 51+46.78 (HEC-RAS Model)

Looking along channel from the north at Sta. 28+60.56 (HEC-RAS Model)

Reach No. 41 – Walnut Creek

Site Visit: 09/10/2012

Looking d/s from Sta. 26+23.16 (HEC-RAS Model)

Site Visit: 09/10/2012

Looking u/s from Sta. 87+97.54 (HEC-RAS Model)

Looking north across channel from Sta. 87+24 (HEC-RAS Model)

K-rails are temporary and were not included in the HEC-RAS model.

Site Visit: 09/10/2012

Looking d/s from Sta. 86+51.6 (HEC-RAS Model)

Looking u/s from Sta. 81+36.14 (HEC-RAS Model)

Site Visit: 09/10/2012

Looking north across channel from Sta. 80+76.54 (HEC-RAS Model)

Looking d/s from Sta. 80+13.86 (HEC-RAS Model)

Site Visit: 09/10/2012

Reach 43 – D/s of Whittier Narrows Dam looking d/s from Sta. 1106+00 (HEC-RAS Model)

Reach 43 – D/s of Whittier Narrows Dam looking d/s from Sta. 1106+00 (HEC-RAS Model)

Site Visit: 09/10/2012

Reach 43 – Looking u/s at bank transition from grouted rip-rap to ungrouted rip-rap from Sta 1090+00 (HEC-RAS Model)

Reach 43 – Looking d/s at bank transition from grouted rip-rap to ungrouted rip-rap from Sta 1090+00 (HEC-RAS Model)

Site Visit: 09/10/2012

Reach 43 – U/s of San Gabriel River Parkway bridge looking d/s from Sta. 1076+93.6 (HEC-RAS Model)

Reach 43 – U/s of San Gabriel River Parkway bridge looking u/s from Sta. 1076+93.6 (HEC-RAS Model)

Site Visit: 09/10/2012

Reach 43 – D/s of San Gabriel River Parkway bridge looking u/s from Sta. 1073+00 (HEC-RAS Model)

Reach 43 – D/s of San Gabriel River Parkway bridge looking d/s from Sta. 1073+00 (HEC-RAS Model)

Site Visit: 09/10/2012

Reach 43 – Looking d/s from drop structure from Sta. 1069+63.6 (HEC-RAS Model)

Reach 43 – U/s of Beverly Blvd bridge looking d/s from Sta. 1045+00 (HEC-RAS Model)

Site Visit: 09/10/2012

Reach 43 – U/s of Beverly Blvd bridge looking u/s from Sta. 1045+00 (HEC-RAS Model)

Reach 43 – D/s of Beverly Blvd bridge looking u/s from 1043+00 (HEC-RAS Model)

Site Visit: 09/10/2012

Reach 43 – D/s of Beverly Blvd bridge looking d/s from 1043+00 (HEC-RAS Model)

Site Visits: 09/10/2012, 9/12/2012

Reach 44 – Looking d/s at railroad from Sta. 1036+00 (HEC-RAS Model)

Reach 44 – Looking u/s from railroad from Sta. 1036+00 (HEC-RAS Model)

Site Visits: 09/10/2012, 9/12/2012

Reach 44 – Looking d/s of Rubber Dam #1 from Sta. 1028+91.2 (HEC-RAS Model)

Reach 44 – Looking u/s of Rubber Dam #1 from Sta. 1028+91.2 (HEC-RAS Model)

Site Visits: 09/10/2012, 9/12/2012

Reach 44 – Looking u/s of Rubber Dam #1 from Sta. 1028+91.2 (HEC-RAS Model)

Reach 44 – Looking d/s from Sta. 1022+00 (HEC-RAS Model)

Site Visits: 09/10/2012, 9/12/2012

Reach 44 – Looking d/s from Sta. 1022+00 (HEC-RAS Model)

Reach 44 – U/s of Whittier Blvd looking d/s from Sta. 1005+00 (HEC-RAS Model)

Site Visits: 09/10/2012, 9/12/2012

Reach 44 – U/s of Whittier Blvd looking u/s from Sta. 1005+00 (HEC-RAS Model)

Reach 44 – D/s of Whittier Blvd looking u/s from Sta. 1000+00 (HEC-RAS Model)

Site Visits: 09/10/2012, 9/12/2012

Reach 44 – Just D/s of Whittier Blvd looking d/s from Sta. 1000+00 (HEC-RAS Model)

Reach 44 – D/s of Rubber Dam #2 looking u/s from Sta. 994+00 (HEC-RAS Model)

Site Visits: 09/10/2012, 9/12/2012

Reach 44 – D/s of Rubber Dam #2 looking d/s from Sta. 994+00 (HEC-RAS Model)

Reach 44 – U/s of Washington Blvd looking d/s from Sta. 923+00 (HEC-RAS Model)

Site Visits: 09/10/2012, 9/12/2012

Reach 44 – U/s of Washington Blvd looking u/s from Sta. 923+00 (HEC-RAS Model)

Reach 44 – Looking at Rubber Dam #3 from Sta. 920+12.98 (HEC-RAS Model)

Site Visits: 09/10/2012, 9/12/2012

Reach 44 – Looking d/s from Rubber Dam #3 from Sta. 920+12.98 (HEC-RAS Model)

Reach 44 – Looking at Rubber Dam #3 from Sta. 899+83.2 (HEC-RAS Model)

Site Visits: 09/10/2012, 9/12/2012

Reach 44 – Looking d/s of Rubber Dam #4 from Sta. 899+83.2 (HEC-RAS Model)

Reach 44 – U/s of Slauson Ave and Railroad looking d/s from Sta. 886+00 (HEC-RAS Model)

Site Visits: 09/10/2012, 9/12/2012

Reach 44 – U/s of Slauson Ave and Railroad looking u/s from Sta. 886+00 (HEC-RAS Model)

Reach 44 – D/s of Slauson Ave and Railroad looking d/s from Sta. 882+00 (HEC-RAS Model)

Site Visits: 09/10/2012, 9/12/2012

Reach 44 – U/s of Railroad looking d/s from Sta. 874+00 (HEC-RAS Model)

Reach 44 – U/s of Railroad looking u/s from Sta. 874+00 (HEC-RAS Model)

Site Visits: 09/10/2012, 9/12/2012

Reach 44 – D/s of Railroad looking u/s from Sta. 869+00 (HEC-RAS Model)

Reach 44 – D/s of Railroad looking d/s from Sta. 869+00 (HEC-RAS Model)

Site Visits: 09/10/2012, 9/12/2012

Reach 44 – Looking at Rubber Dam #5 from Sta. 835+18.59 (HEC-RAS Model)

Reach 44 – Looking u/s of Rubber Dam #5 from Sta. 835+18.59 (HEC-RAS Model)

Site Visits: 09/10/2012, 9/12/2012

Reach 44 – Looking d/s of Rubber Dam #5 from Sta. 835+18.59 (HEC-RAS Model)

Reach 44 – U/s of Telegraph Rd looking d/s from Sta. 820+00 (HEC-RAS Model)

Site Visits: 09/10/2012, 9/12/2012

Reach 44 – U/s of Telegraph Rd looking u/s from Sta. 820+00 (HEC-RAS Model)

Reach 44 – D/s of Telegraph Rd looking u/s from Sta. 817+00 (HEC-RAS Model)

Site Visits: 09/10/2012, 9/12/2012

Reach 44 – D/s of Telegraph Rd looking d/s from Sta. 817+00 (HEC-RAS Model)

Reach 44 – U/s of I-5 Freeway looking d/s from Sta. 795+00 (HEC-RAS Model)

Site Visits: 09/10/2012, 9/12/2012

Reach 44 – U/s of I-5 Freeway looking u/s from Sta. 795+00 (HEC-RAS Model)

Reach 44 – D/s of I-5 Freeway looking u/s from Sta. 788+00 (HEC-RAS Model)

Site Visits: 09/10/2012, 9/12/2012

Reach 44 – D/s of I-5 Freeway looking d/s from Sta. 795+00 (HEC-RAS Model)

Reach 44 – Looking at Rubber Dam #6 from Sta. 784+79.64 (HEC-RAS Model)

Site Visits: 09/10/2012, 9/12/2012

Reach 44 – Looking d/s from Rubber Dam #6 from Sta. 784+79.64 (HEC-RAS Model)

Reach 44 – U/s of Florence Ave looking d/s from Sta. 772+00 (HEC-RAS Model)

Site Visits: 09/10/2012, 9/12/2012

Reach 44 – U/s of Florence Ave looking u/s from Sta. 772+00 (HEC-RAS Model)

Reach 44 – D/s of Florence Ave looking u/s from Sta. 770+00 (HEC-RAS Model)

Site Visits: 09/10/2012, 9/12/2012

Reach 44 – D/s of Florence Ave looking d/s from Sta. 770+00 (HEC-RAS Model)

Reach 44 – Looking at Rubber Dam #7 from Sta. 737+37.9 (HEC-RAS Model)

Site Visits: 09/10/2012, 9/12/2012

Reach 44 – Looking u/s from Rubber Dam #7 from Sta. 737+37.9 (HEC-RAS Model)

Reach 44 – Looking at transition from Sta. 735+32.9 (HEC-RAS Model)

Site Visits: 09/10/2012, 9/12/2012

Reach 44 – Looking d/s from transition from Sta. 735+32.9 (HEC-RAS Model)

Reach 44 – U/s of Firestone Blvd looking d/s from Sta. 724+00 (HEC-RAS Model)

Site Visit: 9/10/2012

Looking d/s channel at Sta. 4+22.498 (HEC-RAS Model)

Looking u/s Sta. 4+47.7833 (HEC-RAS Model)

Site Visit: 9/10/2012

Looking u/s Sta. 4+95.448 (HEC-RAS Model)

Looking u/s Sta. 5+20.3828 (HEC-RAS Model)

Reach No. 98 – Inlet Walnut Creek

Site Visit: 9/10/2012

Looking u/s Sta. 6+90.2224 (HEC-RAS Model)

Looking u/s Sta. 8+71.3525 (HEC-RAS Model)

Appendix B

Manning's Roughness Calculations by Reach

Reach No. 40 - San Gabriel River (Existing Vegetation Scenario)

Reach, Station, or X-Sect		n_b Base "n"					n_1 Surface Irregularity				n_2 Variation in Channel Cross Section			n_3 Obstructions				n_4 Vegetation				m Meandering			Total "n"
		0.012 – 0.026	0.025 – 0.032	0.024 – 0.035	0.012 – 0.018	0.03 – 0.07	0	0.001 – 0.005	0.006 – 0.010	0.011 – 0.020	0	0.001 – 0.005	0.010 – 0.015	0.000 – 0.004	0.005 – 0.015	0.020 – 0.030	0.040 – 0.050	0.002 – 0.010	0.010 – 0.025	0.025 – 0.050	0.050 – 0.100	1	1.15	1.3	
		Sand	Firm Soil	Gravel	Concrete	Cobble / Boulder	Smooth	Minor	Moderate	Severe	Gradual	Alternating Occasionally	Alternating Frequently	Negligible	Minor	Appreciable	Severe	Small	Medium	Large	Very Large	Minor	Appreciable	Severe	
Sta. 1560+38.6 - Sta. 1559+10.8	Left Bank				0.015		0				0			0				0				1			0.015
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank				0.015		0				0			0				0				1			0.015
Sta. 1559+03 - Sta. 1558+22.1	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel		0.025				0				0			0				0.005				1			0.030
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1557+45.6 - Sta. 1554+39	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel		0.025				0				0			0					0.02			1			0.045
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1554+27.4 - Sta. 1554+09.8	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel					0.04	0				0			0					0.025			1			0.065
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1554+07.8 - Sta. 1553+63.2	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1553+61.7 - Sta. 1553+34.3	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel		0.025				0				0			0					0.025			1			0.050
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1553+17.3 - Sta. 1538+37.8	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel		0.025				0				0			0					0.02			1			0.045
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1538+30.1 - Sta. 1538+16.7	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel					0.04	0				0			0					0.01			1			0.050
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1538+10.7 - Sta. 1537+62.5	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1537+60.6 - Sta. 1537+30.9	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.04	0				0			0				0							0.040
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1537+17.7 - Sta. 1536+22.1	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0					0.02			1			0.045
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1536+05.1 - Sta. 1534+41.5	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel		0.025				0				0			0					0.02			1			0.045
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1533+48.3 - Sta. 1525+32.7	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0					0.02			1			0.045
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1525+27.9 - Sta. 1525+08.5	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel					0.04	0				0			0				0				1			0.040
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1525+06.3 - Sta. 1524+60.1	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1524+58.3 - Sta. 1524+45.3	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.04	0				0			0				0				1			0.040
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1524+29.6 - Sta. 1513+41.2	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0					0.02			1			0.045
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1513+25.1 - Sta. 1513+10.0	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel					0.04	0				0			0				0.01				1			0.050
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1513+08.1 - Sta. 1512+61.8	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1512+59.9 - Sta. 1512+47.7	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.04	0				0			0				0				1			0.040
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1512+34.1 - Sta. 1512+05.5	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel					0.04	0				0			0				0				1			0.040
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1511+85.6 - Sta. 1501+36.8	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0					0.02			1			0.045
	Right Bank					0.04	0				0			0				0				1			0.040

Reach No. 40 - San Gabriel River (Existing Vegetation Scenario)

Reach, Station, or X-Sect		n_b Base "n"					n_1 Surface Irregularity				n_2 Variation in Channel Cross Section			n_3 Obstructions				n_4 Vegetation				m Meandering			Total "n"
		0.012 – 0.026	0.025 – 0.032	0.024 – 0.035	0.012 – 0.018	0.03 – 0.07	0	0.001 – 0.005	0.006 – 0.010	0.011 – 0.020	0	0.001 – 0.005	0.010 – 0.015	0.000 – 0.004	0.005 – 0.015	0.020 – 0.030	0.040 – 0.050	0.002 – 0.010	0.010 – 0.025	0.025 – 0.050	0.050 – 0.100	1	1.15	1.3	
		Sand	Firm Soil	Gravel	Concrete	Cobble / Boulder	Smooth	Minor	Moderate	Severe	Gradual	Alternating Occasionally	Alternating Frequently	Negligible	Minor	Appreciable	Severe	Small	Medium	Large	Very Large	Minor	Appreciable	Severe	
Sta. 1501+25 - Sta. 1501+08.2	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel					0.04	0				0			0					0.01			1			0.050
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1501+06.5 - Sta. 1500+61.3	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1500+59.6 - Sta. 1500+47.9	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.04	0				0			0				0				1			0.040
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1500+40.5 - Sta. 1500+34.3	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel					0.04	0				0			0				0				1			0.040
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1500+15.1 - Sta. 1495+22.1	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0					0.015			1			0.040
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1492+22.1 - Sta. 1489+84.8	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel 1		0.025				0				0			0				0				1			0.025
	Main Channel 2		0.025				0				0			0					0.02						0.045
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1489+61.1 - Sta. 1489+36.9	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0					0.02			1			0.045
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1489+23.9 - Sta. 1489+08.8	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel					0.04	0				0			0					0.01			1			0.050
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1489+07.4 - Sta. 1488+62.7	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1488+61.6 - Sta. 1488+51.2	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.04	0				0			0				0				1			0.040
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1488+46.1 - Sta. 1488+08.8	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel					0.04	0				0			0				0				1			0.040
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1487+90.6 - Sta. 1474+29.0	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0					0.015			1			0.040
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1474+23.2 - Sta. 1474+08.5	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel					0.04	0				0			0				0				1			0.040
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1474+06.7 - Sta. 1473+62.0	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1473+59.8 - Sta. 1473+47.7	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.04	0				0			0				0				1			0.040
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1473+40.3 - Sta. 1473+16.4	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel					0.04	0				0			0				0				1			0.040
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1472+96.7 - Sta. 1460+32.3	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0					0.02			1			0.045
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1460+28.2 - Sta. 1460+07.6	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel					0.04	0				0			0					0.01			1			0.050
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1460+05.7 - Sta. 1459+59.2	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1459+56.8 - Sta. 1459+47.3	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.04	0				0			0						0.025		1			0.065
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1459+41.2 - Sta. 1459+19.7	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel					0.04	0				0			0						0.025		1			0.065
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1459+08.0 - Sta. 1455+41.4	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040

Reach No. 40 - San Gabriel River (Existing Vegetation Scenario)

Reach, Station, or X-Sect		n_b Base "n"					n_1 Surface Irregularity				n_2 Variation in Channel Cross Section			n_3 Obstructions				n_4 Vegetation				m Meandering			Total "n"
		0.012 – 0.026	0.025 – 0.032	0.024 – 0.035	0.012 – 0.018	0.03 – 0.07	0	0.001 – 0.005	0.006 – 0.010	0.011 – 0.020	0	0.001 – 0.005	0.010 – 0.015	0.000 – 0.004	0.005 – 0.015	0.020 – 0.030	0.040 – 0.050	0.002 – 0.010	0.010 – 0.025	0.025 – 0.050	0.050 – 0.100	1	1.15	1.3	
		Sand	Firm Soil	Gravel	Concrete	Cobble / Boulder	Smooth	Minor	Moderate	Severe	Gradual	Alternating Occasionally	Alternating Frequently	Negligible	Minor	Appreciable	Severe	Small	Medium	Large	Very Large	Minor	Appreciable	Severe	
Sta. 1454+91.5 - Sta. 1452+06.6	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel 1					0.04	0				0			0				0.005				1			0.045
	Main Channel 2		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1450+95.8 - Sta. 1438+47.1	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1438+22.5 - Sta. 1438+05.8	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel					0.04	0				0			0					0.01			1			0.050
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1438+02.7 - Sta. 1437+55.3	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1437+51.7 - Sta. 1437+15.0	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.04	0				0			0					0.01			1			0.050
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1437+05.9 - Sta. 1416+18.6	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1415+20.4 - Sta. 1414+99.2	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel					0.04	0				0			0					0.01			1			0.050
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1414+97.1 - Sta. 1414+59.2	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1414+58.0 - Sta. 1414+51.2	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.04	0				0			0					0.01			1			0.050
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1414+43.9 - Sta. 1414+27.9	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel					0.04	0				0			0					0.01			1			0.050
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1414+18.1 - Sta. 1396+55.3	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1395+84.4 - Sta. 1380+30.9	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0.005				1			0.030
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1380+24.4 - Sta. 1380+03.7	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel					0.04	0				0			0					0.01			1			0.050
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1380+01.3 - Sta. 1379+59.4	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1379+57.8 - Sta. 1379+50.8	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.04	0				0			0				0				1			0.040
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1379+44.1 - Sta. 1379+37.9	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel					0.04	0				0			0				0				1			0.040
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1379+30.6 - Sta. 1340+25.0	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0.005				1			0.030
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1340+17.8 - Sta. 1340+00.8	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel					0.04	0				0			0					0.01			1			0.050
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1339+98.8 - Sta. 1339+61.7	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1339+58.8 - Sta. 1339+39.3	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.04	0				0			0				0				1			0.040
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1339+32.9 - Sta. 1339+01.7	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel		0.025				0				0			0					0.015			1			0.040
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1338+89.3 - Sta. 1338+10.0	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0					0.015			1			0.040
	Right Bank					0.04	0				0			0				0				1			0.040

Reach No. 40 - San Gabriel River (Existing Vegetation Scenario)

Reach, Station, or X-Sect		n_b Base "n"					n_1 Surface Irregularity				n_2 Variation in Channel Cross Section			n_3 Obstructions				n_4 Vegetation				m Meandering			Total "n"
		0.012 – 0.026	0.025 – 0.032	0.024 – 0.035	0.012 – 0.018	0.03 – 0.07	0	0.001 – 0.005	0.006 – 0.010	0.011 – 0.020	0	0.001 – 0.005	0.010 – 0.015	0.000 – 0.004	0.005 – 0.015	0.020 – 0.030	0.040 – 0.050	0.002 – 0.010	0.010 – 0.025	0.025 – 0.050	0.050 – 0.100	1	1.15	1.3	
		Sand	Firm Soil	Gravel	Concrete	Cobble / Boulder	Smooth	Minor	Moderate	Severe	Gradual	Alternating Occasionally	Alternating Frequently	Negligible	Minor	Appreciable	Severe	Small	Medium	Large	Very Large	Minor	Appreciable	Severe	
Sta. 1337+86.3 - Sta. 1334+16.8	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel		0.025				0				0			0					0.015			1			0.040
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1332+67.1 - Sta. 1330+89.9	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel 1		0.025				0				0			0					0.015			1			0.040
	Main Channel 2	0.023					0				0			0				0				1			0.023
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1330+03.6 - Sta. 1317+03.6	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel 1	0.023					0				0			0				0.007				1			0.030
	Main Channel 2		0.025				0				0			0					0.015			1			0.040
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1316+03.6 - Sta. 1308+78.3	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel 1		0.025				0				0			0					0.015			1			0.040
	Main Channel 2	0.023					0				0			0				0				1			0.023
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1308+51.2 - Sta. 1307+82.8	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.03	0				0			0				0				1			0.030
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1307+81.0 - Sta. 1307+40.4	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1307+36.5 - Sta. 1307+20.2	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel					0.04	0				0			0				0				1			0.040
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1307+13.2 - Sta. 1282+36.1	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel 1		0.025				0				0			0				0				1			0.025
	Main Channel 2	0.023					0				0			0					0.01			1			0.033
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1282+13.3 - Sta. 1281+97.9	Left Bank				0.015		0				0			0				0				1			0.015
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank				0.015		0				0			0				0				1			0.015
Sta. 1281+93.0 - Sta. 1281+81.4	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.03	0				0			0				0				1			0.030
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1281+79.7 - Sta. 1281+33.7	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1281+31.6 - Sta. 1281+20.7	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel					0.04	0				0			0					0.01			1			0.050
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1281+14.8 - Sta. 1256+02.9	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel 1		0.025				0				0			0					0.01			1			0.035
	Main Channel 2	0.023					0				0			0				0				1			0.023
	Main Channel 3		0.025				0				0			0							0.05	1			0.075
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1255+87.9 - Sta. 1255+69.3	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel	0.023					0				0			0				0				1			0.023
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1255+65.8 - Sta. 1255+46.5	Left Bank				0.015		0				0			0				0				1			0.015
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank				0.015		0				0			0				0				1			0.015
Sta. 1255+39.7 - Sta. 1255+30.9	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.03	0				0			0				0				1			0.030
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1255+29.1 - Sta. 1254+84.8	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1254+83.0 - Sta. 1254+37.9	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel					0.04	0				0			0					0.01			1			0.050
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1254+26.7 - Sta. 1252+83.9	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0			0.05	1			0.075
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1252+51.1 - Sta. 1243+03.6	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel 1		0.025				0				0			0				0				1			0.025
	Main Channel 2		0.025				0				0			0							0.05	1			0.075
	Right Bank					0.04	0				0			0				0				1			0.040

Reach No. 40 - San Gabriel River (Existing Vegetation Scenario)

Reach, Station, or X-Sect		n_b Base "n"					n_1 Surface Irregularity				n_2 Variation in Channel Cross Section			n_3 Obstructions				n_4 Vegetation				m Meandering			Total "n"
		0.012 – 0.026	0.025 – 0.032	0.024 – 0.035	0.012 – 0.018	0.03 – 0.07	0	0.001 – 0.005	0.006 – 0.010	0.011 – 0.020	0	0.001 – 0.005	0.010 – 0.015	0.000 – 0.004	0.005 – 0.015	0.020 – 0.030	0.040 – 0.050	0.002 – 0.010	0.010 – 0.025	0.025 – 0.050	0.050 – 0.100	1	1.15	1.3	
		Sand	Firm Soil	Gravel	Concrete	Cobble / Boulder	Smooth	Minor	Moderate	Severe	Gradual	Alternating Occasionally	Alternating Frequently	Negligible	Minor	Appreciable	Severe	Small	Medium	Large	Very Large	Minor	Appreciable	Severe	
Sta. 1242+16.5 - Sta. 1235+89.6	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel 1		0.025				0				0			0							0.05	1			0.075
	Main Channel 2		0.025				0				0			0				0				1			0.025
	Main Channel 3		0.025				0				0			0					0.01			1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1235+09.0 - Sta. 1231+40.9	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel 1		0.025				0				0			0							0.05	1			0.075
	Main Channel 2		0.025				0				0			0				0				1			0.025
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1230+56.6 - Sta. 1223+99.0	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel 1		0.025				0				0			0							0.05	1			0.075
	Main Channel 2		0.025				0				0			0				0				1			0.025
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 1222+84.6 - Sta. 1216+87.5	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel 1		0.025				0				0			0							0.05	1			0.075
	Main Channel 2		0.025				0				0			0				0				1			0.025
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1216+82.5 - Sta. 1216+68.8	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.03	0				0			0				0				1			0.030
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1216+64.5 - Sta. 1216+56.9	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.04	0				0			0				0				1			0.040
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1216+45.2 - Sta. 1212+59.2	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel 1		0.025				0				0			0							0.05	1			0.075
	Main Channel 2		0.025				0				0			0				0				1			0.025
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1212+01.7 - Sta. 1211+51.2	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel 1		0.025				0				0			0							0.05	1			0.075
	Main Channel 2		0.025				0				0			0				0				1			0.025
	Main Channel 3		0.025				0				0			0					0.01			1			0.035
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1210+98.1 - Sta. 1210+65.7	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel 1		0.025				0				0			0							0.05	1			0.075
	Main Channel 2		0.025				0				0			0					0.01			1			0.035
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1207+75.3 - Sta. 1205+11.8	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel 1		0.025				0				0			0				0				1			0.025
	Main Channel 2		0.025				0				0			0							0.05	1			0.075
	Main Channel 3		0.025				0				0			0					0.01			1			0.035
	Right Bank				0.015		0				0			0				0				1			0.015
Sta. 1204+37.1 - Sta. 1202+81.6	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel 1		0.025				0				0			0							0.05	1			0.075
	Main Channel 2		0.025				0				0			0				0				1			0.025
	Main Channel 3		0.025				0				0			0					0.01			1			0.035
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1202+76.9 - Sta. 1202+65.2	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.03	0				0			0				0				1			0.030
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1202+56.8 - Sta. 1202+40.7	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.04	0				0			0				0				1			0.040
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1202+31.9 - Sta. 1192+77.9	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel 1		0.025				0				0			0							0.05	1			0.075
	Main Channel 2		0.025				0				0			0				0				1			0.025
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1192+14.4 - Sta. 1188+77.6	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel 1		0.025				0				0			0							0.05	1			0.075
	Main Channel 2		0.025				0				0			0				0				1			0.025
	Right Bank				0.015		0				0			0				0				1			0.015
Sta. 1188+73.1 - Sta. 1188+61.7	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.03	0				0			0				0				1			0.030
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1188+56.4 - Sta. 1188+44.2	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.04	0				0			0				0				1			0.040
	Right Bank					0.03	0				0			0				0				1			0.030

Reach No. 40 - San Gabriel River (Existing Vegetation Scenario)

Reach, Station, or X-Sect		n_b Base "n"					n_1 Surface Irregularity				n_2 Variation in Channel Cross Section			n_3 Obstructions				n_4 Vegetation				m Meandering			Total "n"
		0.012 – 0.026	0.025 – 0.032	0.024 – 0.035	0.012 – 0.018	0.03 – 0.07	0	0.001 – 0.005	0.006 – 0.010	0.011 – 0.020	0	0.001 – 0.005	0.010 – 0.015	0.000 – 0.004	0.005 – 0.015	0.020 – 0.030	0.040 – 0.050	0.002 – 0.010	0.010 – 0.025	0.025 – 0.050	0.050 – 0.100	1	1.15	1.3	
		Sand	Firm Soil	Gravel	Concrete	Cobble / Boulder	Smooth	Minor	Moderate	Severe	Gradual	Alternating Occasionally	Alternating Frequently	Negligible	Minor	Appreciable	Severe	Small	Medium	Large	Very Large	Minor	Appreciable	Severe	
Sta. 1188+32.0 - Sta. 1185+20.8	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel 1		0.025				0				0			0							0.05	1			0.075
	Main Channel 2		0.025				0				0			0				0				1			0.025
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1184+62.6 - Sta. 1180+14.2	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel 1		0.025				0				0			0							0.05	1			0.075
	Main Channel 2		0.025				0				0			0				0				1			0.025
	Main Channel 3		0.025				0				0			0					0.01			1			0.035
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1179+27.6 - Sta. 1176+29.2	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel 1		0.025				0				0			0							0.05	1			0.075
	Main Channel 2		0.025				0				0			0				0				1			0.025
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 1176+20.7 - Sta. 1175+39.5	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel				0.02		0				0			0				0				1			0.020
	Right Bank				0.02		0				0			0				0				1			0.020
Sta. 1175+22.9 - Sta. 1174+11.0	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel				0.02		0				0			0				0				1			0.020
	Right Bank				0.02		0				0			0				0				1			0.020

Reach No. 40 - San Gabriel River (Design Conditions)

Reach, Station, or X-Sect		n_b Base "n"					n_1 Surface Irregularity				n_2 Variation in Channel Cross Section			n_3 Obstructions				n_4 Vegetation				m Meandering			Total "n"
		0.012 – 0.026	0.025 – 0.032	0.024 – 0.035	0.012 – 0.018	0.03 – 0.07	0	0.001 – 0.005	0.006 – 0.010	0.011 – 0.020	0	0.001 – 0.005	0.010 – 0.015	0.000 – 0.004	0.005 – 0.015	0.020 – 0.030	0.040 – 0.050	0.002 – 0.010	0.010 – 0.025	0.025 – 0.050	0.050 – 0.100	1	1.15	1.3	
		Sand	Firm Soil	Gravel	Concrete	Cobble / Boulder	Smooth	Minor	Moderate	Severe	Gradual	Alternating Occasionally	Alternating Frequently	Negligible	Minor	Appreciable	Severe	Small	Medium	Large	Very Large	Minor	Appreciable	Severe	
Sta. 1560+38.6 - Sta. 1559+10.8	Left Bank				0.014		0				0			0				0				1			0.014
	Main Channel				0.014		0				0			0				0				1			0.014
	Right Bank				0.014		0				0			0				0				1			0.014
Sta. 1559+03 - Sta. 1553+99.2	Left Bank					0.035	0				0			0				0				1			0.035
	Main Channel					0.035	0				0			0				0				1			0.035
	Right Bank					0.035	0				0			0				0				1			0.035
Sta. 1553+92.7 - Sta. 1174+11	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.03	0				0			0				0				1			0.030
	Right Bank					0.03	0				0			0				0				1			0.030

Reach No. 41 - Walnut Creek (Existing Vegetation Scenario)

		n_b					n_1				n_2			n_3				n_4				m			Total "n"
		Base "n"					Surface Irregularity				Variation in Channel Cross Section			Obstructions				Vegetation				Meandering			
		0.012 – 0.026	0.025 – 0.032	0.024 – 0.035	0.012 – 0.018	0.03 – 0.07	0	0.001 – 0.005	0.006 – 0.010	0.011 – 0.020	0	0.001 – 0.005	0.010 – 0.015	0.000 – 0.004	0.005 – 0.015	0.020 – 0.030	0.040 – 0.050	0.002 – 0.010	0.010 – 0.025	0.025 – 0.050	0.050 – 0.100	1	1.15	1.3	
Reach, Station, or X-Sect		Sand	Firm Soil	Gravel	Concrete	Cobble / Boulder	Smooth	Minor	Moderate	Severe	Gradual	Alternating Occasionally	Alternating Frequently	Negligible	Minor	Appreciable	Severe	Small	Medium	Large	Very Large	Minor	Appreciable	Severe	
Sta. 77+46.640 - Sta. 73+02.847	Left Bank				0.015		0				0			0				0				1			0.015
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank				0.015		0				0			0				0				1			0.015
Sta. 72+95.153 - Sta. 70+46.826	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.03	0				0			0				0				1			0.030
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 70+02.408 - Sta. 63+46.810	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.03	0				0			0				0.005				1			0.035
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 62+95.206 - Sta. 60+46.803	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel		0.025				0				0			0						0.05		1			0.075
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 59+46.801 - Sta. 35+46.747	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 34+46.745 - Sta. 28+60.557	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel 1		0.025					0.005			0			0				0.01				1			0.040
	Main Channel 2	0.023					0				0			0				0				1			0.023
	Main Channel 3		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 28+34.599	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel 1		0.025				0	0.005			0			0				0.01				1			0.040
	Main Channel 2	0.023					0				0			0				0				1			0.023
	Main Channel 3		0.025				0	0.005			0			0				0.01				1			0.040
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 27+82.272	Left Bank		0.025				0				0			0				0				1			0.025
	Main Channel 1		0.025					0.005			0			0				0.01				1			0.040
	Main Channel 2	0.023					0				0			0				0				1			0.023
	Main Channel 3		0.025				0	0.005			0			0				0.01				1			0.040
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 27+26.612 - Sta. 19+55.983	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel 1		0.025				0	0.005			0			0				0.01				1			0.040
	Main Channel 2	0.023					0				0			0				0				1			0.023
	Main Channel 3		0.025				0	0.005			0			0				0.01				1			0.040
	Right Bank					0.04	0				0			0				0				1			0.040

Reach No. 41 - Walnut Creek (BonTerra Psomas Recommendation Scenario)

Reach, Station, or X-Sect		n_b Base "n"					n_1 Surface Irregularity				n_2 Variation in Channel Cross Section			n_3 Obstructions				n_4 Vegetation				m Meandering			Total "n"
		0.012 – 0.026	0.025 – 0.032	0.024 – 0.035	0.012 – 0.018	0.03 – 0.07	0	0.001 – 0.005	0.006 – 0.010	0.011 – 0.020	0	0.001 – 0.005	0.010 – 0.015	0.000 – 0.004	0.005 – 0.015	0.020 – 0.030	0.040 – 0.050	0.002 – 0.010	0.010 – 0.025	0.025 – 0.050	0.050 – 0.100	1	1.15	1.3	
		Sand	Firm Soil	Gravel	Concrete	Cobble / Boulder	Smooth	Minor	Moderate	Severe	Gradual	Alternating Occasionally	Alternating Frequently	Negligible	Minor	Appreciable	Severe	Small	Medium	Large	Very Large	Minor	Appreciable	Severe	
Sta. 77+46.640 - Sta. 73+02.847	Left Bank				0.015		0				0			0				0				1			0.015
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank				0.015		0				0			0				0				1			0.015
Sta. 72+95.153 - Sta. 70+46.826	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.03	0				0			0				0				1			0.030
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 70+02.408 - Sta. 63+46.810	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.03	0				0			0				0.005				1			0.035
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 62+95.206 - Sta. 62+72.601	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel		0.025				0				0			0						0.05		1			0.075
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 62+02.965 - Sta. 60+46.803	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel		0.025				0				0			0							0.06	1			0.085
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 59+46.801 - Sta. 49+46.779	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel		0.025				0				0			0					0.02			1			0.045
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 48+46.776 - Sta. 35+46.747	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 34+46.745 - Sta. 28+60.557	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel 1		0.025					0.005			0			0				0.01				1			0.040
	Main Channel 2	0.023					0				0			0				0				1			0.023
	Main Channel 3		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 28+34.599	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel 1		0.025				0	0.005			0			0				0.01				1			0.040
	Main Channel 2	0.023					0				0			0				0				1			0.023
	Main Channel 3		0.025				0	0.005			0			0				0.01				1			0.040
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 27+82.272	Left Bank		0.025				0				0			0				0				1			0.025
	Main Channel 1		0.025					0.005			0			0				0.01				1			0.040
	Main Channel 2	0.023					0				0			0				0				1			0.023
	Main Channel 3		0.025				0	0.005			0			0				0.01				1			0.040
	Right Bank					0.04	0				0			0				0				1			0.040
Sta. 27+26.612 - Sta. 19+55.983	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel 1		0.025				0	0.005			0			0				0.01				1			0.040
	Main Channel 2	0.023					0				0			0				0				1			0.023
	Main Channel 3		0.025				0	0.005			0			0				0.01				1			0.040
	Right Bank					0.04	0				0			0				0				1			0.040

Reach No. 42 - San Jose Creek d/s 1000' from end of concrete (Existing Vegetation Scenario)

Reach, Station, or X-Sect		n_b Base "n"					n_1 Surface Irregularity				n_2 Variation in Channel Cross Section			n_3 Obstructions				n_4 Vegetation				m Meandering			Total "n"
		0.012 – 0.026	0.025 – 0.032	0.024 – 0.035	0.012 – 0.018	0.03 – 0.07	0	0.001 – 0.005	0.006 – 0.010	0.011 – 0.020	0	0.001 – 0.005	0.010 – 0.015	0.000 – 0.004	0.005 – 0.015	0.020 – 0.030	0.040 – 0.050	0.002 – 0.010	0.010 – 0.025	0.025 – 0.050	0.050 – 0.100	1	1.15	1.3	
		Sand	Firm Soil	Gravel	Concrete	Cobble / Boulder	Smooth	Minor	Moderate	Severe	Gradual	Alternating Occasionally	Alternating Frequently	Negligible	Minor	Appreciable	Severe	Small	Medium	Large	Very Large	Minor	Appreciable	Severe	
Sta. 89+21.31 - Sta. 87+24	Left Bank				0.015		0				0			0				0				1			0.015
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank				0.015		0				0			0				0				1			0.015
Sta. 87+19.06 - Sta. 87+01.8	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.04	0				0			0				0.002				1			0.042
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 86+74.08 - Sta. 86+51.6	Left Bank		0.025				0				0			0				0				1			0.025
	Main Channel					0.04	0				0			0				0.002				1			0.042
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 86+16.39 - Sta. 80+13.86	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.04	0				0			0				0.002				1			0.042
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 79+91.89 - Sta. 65+77.16	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel 1		0.025				0				0			0				0				1			0.025
	Main Channel 2		0.025				0				0			0							0.06	1			0.085
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 65+23.55 - Sta. 64+60.85	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel					0.04	0				0			0				0.002				1			0.042
	Right Bank					0.03	0				0			0				0				1			0.030
Sta. 64+15.48 - Sta. 61+48.81	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel 1		0.025				0				0			0				0				1			0.025
	Main Channel 2		0.025				0				0			0							0.06	1			0.085
	Right Bank					0.03	0				0			0				0				1			0.030

Reach No. 42 - San Jose Creek d/s 1000' from end of concrete (Design Conditions)

Reach, Station, or X-Sect		n_b Base "n"					n_1 Surface Irregularity				n_2 Variation in Channel Cross Section			n_3 Obstructions				n_4 Vegetation				m Meandering			Total "n"
		0.012 – 0.026	0.025 – 0.032	0.024 – 0.035	0.012 – 0.018	0.03 – 0.07	0	0.001 – 0.005	0.006 – 0.010	0.011 – 0.020	0	0.001 – 0.005	0.010 – 0.015	0.000 – 0.004	0.005 – 0.015	0.020 – 0.030	0.040 – 0.050	0.002 – 0.010	0.010 – 0.025	0.025 – 0.050	0.050 – 0.100	1	1.15	1.3	
		Sand	Firm Soil	Gravel	Concrete	Cobble / Boulder	Smooth	Minor	Moderate	Severe	Gradual	Alternating Occasionally	Alternating Frequently	Negligible	Minor	Appreciable	Severe	Small	Medium	Large	Very Large	Minor	Appreciable	Severe	
Sta. 89+21.31 - Sta. 87+24	Left Bank				0.014		0				0			0				0				1			0.014
	Main Channel				0.014		0				0			0				0				1			0.014
	Right Bank				0.014		0				0			0				0				1			0.014
Sta. 87+19.06 - Sta. 80+13.86	Left Bank					0.035	0				0			0				0				1			0.035
	Main Channel					0.035	0				0			0				0				1			0.035
	Right Bank					0.035	0				0			0				0				1			0.035
Sta. 79+91.89 - Sta. 61+48.81	Left Bank		0.025				0				0			0				0				1			0.025
	Main Channel		0.025				0				0			0				0				1			0.025
	Right Bank		0.025				0				0			0				0				1			0.025

Reach No. 43 - San Gabriel River, Whittier Narrows Dam to Beverly Blvd (Existing Vegetation Scenario)

		n_b					n_1				n_2			n_3				n_4				m			Total "n"
		Base "n"					Surface Irregularity				Variation in Channel Cross Section			Obstructions				Vegetation				Meandering			
		0.026 – 0.035	0.025 – 0.032	0.024 – 0.035	0.012 – 0.018	0.03 – 0.07	0	0.001 – 0.005	0.006 – 0.010	0.011 – 0.020	0	0.001 – 0.005	0.010 – 0.015	0.000 – 0.004	0.005 – 0.015	0.020 – 0.030	0.040 – 0.050	0.002 – 0.010	0.010 – 0.025	0.025 – 0.050	0.050 – 0.100	1	1.15	1.3	
Reach, Station, or X-Sect		Sand	Firm Soil	Gravel	Concrete	Cobble / Boulder	Smooth	Minor	Moderate	Severe	Gradual	Alternating Occasionally	Alternating Frequently	Negligible	Minor	Appreciable	Severe	Small	Medium	Large	Very Large	Minor	Appreciable	Severe	
Sta 1106+00 - Sta 1091+00	Left Bank				0.015		0				0			0				0				1			0.015
	Main Channel 1		0.025				0				0			0				0				1			0.025
	Main Channel 2		0.025				0				0			0							0.07	1			0.095
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 1090+00 - Sta 1075+62.2	Left Bank		0.025				0				0			0				0				1			0.025
	Channel		0.025				0				0			0						0.05		1			0.075
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 1074+35.3 - Sta 1070+71.3	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 1070+24.5 - Sta 1069+63.6	Left Bank				0.015		0				0			0				0				1			0.015
	Main Channel 1				0.015		0				0			0				0				1			0.015
	Main Channel 2		0.025				0				0			0				0.01							0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 1069+00 - Sta 1068+00	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0					0.01			1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 1067+00 - Sta 1044+27.7	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0					0.015			1			0.040
	Right Bank					0.04	0				0			0				0				1			0.040

Reach No. 43 - San Gabriel River, Whittier Narrows Dam to Beverly Blvd (BonTerra Psomas Recommendation Scenario)

		n_b					n_1				n_2			n_3				n_4				m			Total "n"
		Base "n"					Surface Irregularity				Variation in Channel Cross Section			Obstructions				Vegetation				Meandering			
		0.026 – 0.035	0.025 – 0.032	0.024 – 0.035	0.012 – 0.018	0.03 – 0.07	0	0.001 – 0.005	0.006 – 0.010	0.011 – 0.020	0	0.001 – 0.005	0.010 – 0.015	0.000 – 0.004	0.005 – 0.015	0.020 – 0.030	0.040 – 0.050	0.002 – 0.010	0.010 – 0.025	0.025 – 0.050	0.050 – 0.100	1	1.15	1.3	
Reach, Station, or X-Sect		Sand	Firm Soil	Gravel	Concrete	Cobble / Boulder	Smooth	Minor	Moderate	Severe	Gradual	Alternating Occasionally	Alternating Frequently	Negligible	Minor	Appreciable	Severe	Small	Medium	Large	Very Large	Minor	Appreciable	Severe	
Sta 1106+00 - Sta 1091+00	Left Bank				0.015		0				0			0				0				1			0.015
	Main Channel 1		0.025				0				0			0				0				1			0.025
	Main Channel 2		0.025				0				0			0							0.07	1			0.095
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 1090+00 - Sta 1075+62.2	Left Bank		0.025				0				0			0				0				1			0.025
	Channel		0.025				0				0			0						0.05		1			0.075
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 1074+35.3 - Sta 1070+71.3	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 1070+24.5 - Sta 1069+63.6	Left Bank				0.015		0				0			0				0				1			0.015
	Main Channel 1				0.015		0				0			0				0				1			0.015
	Main Channel 2		0.025				0				0			0				0.01							0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 1069+00 - Sta 1068+00	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0					0.01			1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 1067+00 - Sta 1044+27.7	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0					0.025			1			0.050
	Right Bank					0.04	0				0			0				0				1			0.040

Reach No. 44 - San Gabriel River, Beverly Blvd to Firestone Blvd (Existing Vegetation Scenario)

		n_b					n_1				n_2			n_3				n_4				m			Total "n"
		Base "n"					Surface Irregularity				Variation in Channel Cross Section			Obstructions				Vegetation				Meandering			
		0.026 – 0.035	0.025 – 0.032	0.024 – 0.035	0.012 – 0.018	0.03 – 0.07	0	0.001 – 0.005	0.006 – 0.010	0.011 – 0.020	0	0.001 – 0.005	0.010 – 0.015	0.000 – 0.004	0.005 – 0.015	0.020 – 0.030	0.040 – 0.050	0.002 – 0.010	0.010 – 0.025	0.025 – 0.050	0.050 – 0.100	1	1.15	1.3	
Reach, Station, or X-Sect		Sand	Firm Soil	Gravel	Concrete	Cobble / Boulder	Smooth	Minor	Moderate	Severe	Gradual	Alternating Occasionally	Alternating Frequently	Negligible	Minor	Appreciable	Severe	Small	Medium	Large	Very Large	Minor	Appreciable	Severe	
Sta 1043+57.4 - Sta 1036+00	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0					0.015			1			0.040
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 1034+53.5 - Sta 1034+27.4	Left Bank		0.025				0				0			0				0.005				1			0.030
	Main Channel		0.025				0				0			0				0.005				1			0.030
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 1033+64.3 - Sta 1030+00	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0					0.015			1			0.040
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 1029+32.4 - Sta 1028+79.1	Left Bank				0.015		0				0			0				0				1			0.015
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank				0.015		0				0			0				0				1			0.015
Sta 1028+00 - Sta 1022+00	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0					0.025			1			0.050
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 1021+00 - Sta 1002+57.8	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 1001+42.5 - Sta 997+00	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 996+55.97 - Sta 996+00.23	Left Bank				0.015		0				0			0				0				1			0.015
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank				0.015		0				0			0				0				1			0.015
Sta 995+00 - Sta 922+06.9	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 921+36.9 - Sta 921+00	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.03	0				0			0				0				1			0.030
Sta 920+42.47 - Sta 919+99.47	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 919+00 - Sta 914+00	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0					0.015			1			0.040
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 913+00 - Sta 905+00	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel 1		0.025				0				0			0				0				1			0.025
	Main Channel 2		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 904+00 - Sta 899+83.2	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 899+38.82 - Sta 898+79.32	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank					0.03	0				0			0				0				1			0.030
Sta 898+78.32 - Sta 884+80	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0.005				1			0.030
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 884+23.4 - Sta 872+36.3	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 871+95.9 - Sta 835+47.59	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 835+37.34 - Sta 834+79.23	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 834+77.23 - Sta 818+60.3	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 817+97.3 - Sta 792+58.9	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040

Reach No. 44 - San Gabriel River, Beverly Blvd to Firestone Blvd (Existing Vegetation Scenario)

		n_b					n_1				n_2			n_3				n_4				m			Total "n"
		Base "n"					Surface Irregularity				Variation in Channel Cross Section			Obstructions				Vegetation				Meandering			
		0.026 – 0.035	0.025 – 0.032	0.024 – 0.035	0.012 – 0.018	0.03 – 0.07	0	0.001 – 0.005	0.006 – 0.010	0.011 – 0.020	0	0.001 – 0.005	0.010 – 0.015	0.000 – 0.004	0.005 – 0.015	0.020 – 0.030	0.040 – 0.050	0.002 – 0.010	0.010 – 0.025	0.025 – 0.050	0.050 – 0.100	1	1.15	1.3	
Reach, Station, or X-Sect		Sand	Firm Soil	Gravel	Concrete	Cobble / Boulder	Smooth	Minor	Moderate	Severe	Gradual	Alternating Occasionally	Alternating Frequently	Negligible	Minor	Appreciable	Severe	Small	Medium	Large	Very Large	Minor	Appreciable	Severe	
Sta 790+30.2 - Sta 786+00	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 785+51 - Sta 784+83.64	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 784+80.64 - Sta 771+37.9	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 770+68.6 - Sta 768+00	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0					0.025			1			0.050
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 767+00 - Sta 737+37.9	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 737+25.43 - Sta 737+22	Left Bank				0.015		0				0			0				0				1			0.015
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank				0.015		0				0			0				0				1			0.015
Sta 737+21 - Sta 735+32.9	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0				0.015			0.005				1			0.045
	Right Bank					0.03	0				0			0				0				1			0.030
Sta 735+00 - Sta 722+62.1	Left Bank				0.015		0				0			0				0				1			0.015
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank				0.015		0				0			0				0				1			0.015
Sta 722+62.1 - Sta 717+00	Left Bank				0.015		0				0			0				0				1			0.015
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank				0.015		0				0			0				0				1			0.015

Reach No. 44 - San Gabriel River, Beverly Blvd to Firestone Blvd (BonTerra Psomas Recommendation Scenario)

		n_b					n_1				n_2			n_3				n_4				m			Total "n"
		Base "n"					Surface Irregularity				Variation in Channel Cross Section			Obstructions				Vegetation				Meandering			
		0.026 – 0.035	0.025 – 0.032	0.024 – 0.035	0.012 – 0.018	0.03 – 0.07	0	0.001 – 0.005	0.006 – 0.010	0.011 – 0.020	0	0.001 – 0.005	0.010 – 0.015	0.000 – 0.004	0.005 – 0.015	0.020 – 0.030	0.040 – 0.050	0.002 – 0.010	0.010 – 0.025	0.025 – 0.050	0.050 – 0.100	1	1.15	1.3	
Reach, Station, or X-Sect		Sand	Firm Soil	Gravel	Concrete	Cobble / Boulder	Smooth	Minor	Moderate	Severe	Gradual	Alternating Occasionally	Alternating Frequently	Negligible	Minor	Appreciable	Severe	Small	Medium	Large	Very Large	Minor	Appreciable	Severe	
Sta 1043+57.4 - Sta 1036+00	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0				1			0.025
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 1034+53.5 - Sta 1034+27.4	Left Bank		0.025				0				0			0				0				1			0.025
	Main Channel		0.025				0				0			0				0				1			0.025
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 1033+64.3 - Sta 1030+00	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0				1			0.025
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 1029+32.4 - Sta 1028+79.1	Left Bank				0.015		0				0			0				0				1			0.015
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank				0.015		0				0			0				0				1			0.015
Sta 1028+00 - Sta 1022+00	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0				1			0.025
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 1021+00 - Sta 1002+57.8	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0				1			0.025
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 1001+42.5 - Sta 997+00	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel		0.025				0				0			0				0				1			0.025
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 996+55.97 - Sta 996+00.23	Left Bank				0.015		0				0			0				0				1			0.015
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank				0.015		0				0			0				0				1			0.015
Sta 995+00 - Sta 922+06.9	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0				1			0.025
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 921+36.9 - Sta 921+00	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel		0.025				0				0			0				0				1			0.025
	Right Bank					0.03	0				0			0				0				1			0.030
Sta 920+42.47 - Sta 919+99.47	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 919+00 - Sta 914+00	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0					0.015			1			0.040
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 913+00 - Sta 905+00	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel 1		0.025				0				0			0				0				1			0.025
	Main Channel 2		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 904+00 - Sta 899+83.2	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 899+38.82 - Sta 898+79.32	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank					0.03	0				0			0				0				1			0.030
Sta 898+78.32 - Sta 884+80	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0				1			0.025
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 884+23.4 - Sta 872+36.3	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0				1			0.025
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 871+95.9 - Sta 835+47.59	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0				1			0.025
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 835+37.34 - Sta 834+79.23	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 834+77.23 - Sta 818+60.3	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0					0.02			1			0.045
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 817+97.3 - Sta 792+58.9	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0								1			0.025
	Right Bank					0.04	0				0			0				0				1			0.040

Reach No. 44 - San Gabriel River, Beverly Blvd to Firestone Blvd (BonTerra Psomas Recommendation Scenario)

		n_b					n_1				n_2			n_3				n_4				m			Total "n"
		Base "n"					Surface Irregularity				Variation in Channel Cross Section			Obstructions				Vegetation				Meandering			
		0.026 – 0.035	0.025 – 0.032	0.024 – 0.035	0.012 – 0.018	0.03 – 0.07	0	0.001 – 0.005	0.006 – 0.010	0.011 – 0.020	0	0.001 – 0.005	0.010 – 0.015	0.000 – 0.004	0.005 – 0.015	0.020 – 0.030	0.040 – 0.050	0.002 – 0.010	0.010 – 0.025	0.025 – 0.050	0.050 – 0.100	1	1.15	1.3	
Reach, Station, or X-Sect		Sand	Firm Soil	Gravel	Concrete	Cobble / Boulder	Smooth	Minor	Moderate	Severe	Gradual	Alternating Occasionally	Alternating Frequently	Negligible	Minor	Appreciable	Severe	Small	Medium	Large	Very Large	Minor	Appreciable	Severe	
Sta 790+30.2 - Sta 786+00	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0					0.02			1			0.045
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 785+51 - Sta 784+83.64	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 784+80.64 - Sta 771+37.9	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0					0.02			1			0.045
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 770+68.6 - Sta 768+00	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0					0.025			1			0.050
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 767+00 - Sta 737+37.9	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.04	0				0			0				0				1			0.040
Sta 737+25.43 - Sta 737+22	Left Bank				0.015		0				0			0				0				1			0.015
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank				0.015		0				0			0				0				1			0.015
Sta 737+21 - Sta 735+32.9	Left Bank					0.04	0				0			0				0				1			0.040
	Main Channel		0.025				0				0				0.015			0.005				1			0.045
	Right Bank					0.03	0				0			0				0				1			0.030
Sta 735+00 - Sta 722+62.1	Left Bank				0.015		0				0			0				0				1			0.015
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank				0.015		0				0			0				0				1			0.015
Sta 722+62.1 - Sta 717+00	Left Bank				0.015		0				0			0				0				1			0.015
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank				0.015		0				0			0				0				1			0.015

Reach No. 98 - Inlet Walnut Creek (Existing Vegetation Scenario)

		n_b					n_1				n_2			n_3				n_4				m			Total "n"
		Base "n"					**Surface Irregularity**				**Variation in Channel Cross Section**			**Obstructions**				**Vegetation**				**Meandering**			
		0.026 – 0.035	0.025 – 0.032	0.024 – 0.035	0.012 – 0.018	0.03 – 0.07	0	0.001 – 0.005	0.006 – 0.010	0.011 – 0.020	0	0.001 – 0.005	0.010 – 0.015	0.000 – 0.004	0.005 – 0.015	0.020 – 0.030	0.040 – 0.050	0.002 – 0.010	0.010 – 0.025	0.025 – 0.050	0.050 – 0.100	1	1.15	1.3	
Reach, Station, or X-Sect		Sand	Firm Soil	Gravel	Concrete	Cobble / Boulder	Smooth	Minor	Moderate	Severe	Gradual	Alternating Occasionally	Alternating Frequently	Negligible	Minor	Appreciable	Severe	Small	Medium	Large	Very Large	Minor	Appreciable	Severe	
Sta 11+01.646 - Sta 4+22.498	Left Slope		0.025				0				0			0						0.03		1			0.055
	Main Channel		0.025				0				0			0					0.01			1			0.035
	Right Slope		0.025				0				0			0						0.03		1			0.055
Sta 4+06.6271 - Sta 0+04.7279	Left Slope				0.014		0				0			0				0				1			0.014
	Main Channel				0.014		0				0			0				0				1			0.014
	Right Slope				0.014		0				0			0				0				1			0.014

Reach No. 98 - Inlet Walnut Creek (Design Condition)

		n_b					n_1				n_2			n_3				n_4				m			Total "n"
		Base "n"					**Surface Irregularity**				**Variation in Channel Cross Section**			**Obstructions**				**Vegetation**				**Meandering**			
		0.026 – 0.035	0.025 – 0.032	0.024 – 0.035	0.012 – 0.018	0.03 – 0.07	0	0.001 – 0.005	0.006 – 0.010	0.011 – 0.020	0	0.001 – 0.005	0.010 – 0.015	0.000 – 0.004	0.005 – 0.015	0.020 – 0.030	0.040 – 0.050	0.002 – 0.010	0.010 – 0.025	0.025 – 0.050	0.050 – 0.100	1	1.15	1.3	
Reach, Station, or X-Sect		Sand	Firm Soil	Gravel	Concrete	Cobble / Boulder	Smooth	Minor	Moderate	Severe	Gradual	Alternating Occasionally	Alternating Frequently	Negligible	Minor	Appreciable	Severe	Small	Medium	Large	Very Large	Minor	Appreciable	Severe	
Sta 11+01.646 - Sta 4+22.498	Left Slope		0.025				0				0			0				0				1			0.025
	Main Channel		0.025				0				0			0				0				1			0.025
	Right Slope		0.025				0				0			0				0				1			0.025
Sta 4+06.6271 - Sta 0+04.7279	Left Slope				0.014		0				0			0				0				1			0.014
	Main Channel				0.014		0				0			0				0				1			0.014
	Right Slope				0.014		0				0			0				0				1			0.014

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Appendix C (Hydraulic Analysis Report)

HEC-RAS Files

(Provided as a separate attachment)

HEC-RAS program is required to open and view the files provided in Appendix C. HEC-RAS can be downloaded from http://www.hec.usace.army.mil/software/hec-ras/.