APPENDIX B

HYDRAULIC ANALYSIS
TECHNICAL ASSESSMENT REPORT

HYDRAULIC ANALYSIS
TECHNICAL ASSESSMENT REPORT

FOR
ENGINEERED EARTHEN-BOTTOM FLOOD CONTROL CHANNELS
LOCATED WITHIN THE
LOS ANGELES RIVER WATERSHED

MAINTAINED AND OPERATED BY THE
LOS ANGELES COUNTY FLOOD CONTROL DISTRICT

IN COMPLIANCE WITH THE

WASTE DISCHARGE REQUIREMENTS
NUMBER R4-2010-0021

PREPARED FOR:

Section 401 Certification Unit
California Regional Water Quality Control Board
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AUGUST 1, 2013

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Note: Appendices are provided in accompanying CD.

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 4, 2010, the Los Angeles Regional Water Quality Control Board (Regional Board) adopted Waste Discharge Requirements (WDR) for the maintenance of soft-bottomed flood control channels, Order No. R4-2010-0021. That 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 45. The Los Angeles River Watershed was required to be the subject of the first Feasibility Study.

This report presents the results of a technical assessment of the hydraulic conditions for the 25[1] earth-bottom channel reaches included in the WDR for the Los Angeles 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 Los Angeles River Watershed, July 2010.

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.

I.1 Study Reaches

The Los Angeles River Watershed covers an area of approximately 834 square miles. The eastern boundary spans from the Santa Monica Mountains to the Simi Hills and the western boundary from the Santa Susana Mountains to the San Gabriel Mountains. The watershed encompasses and is shaped by the path of the Los Angeles River, which flows from its headwaters in the mountains eastward to the northern corner of Griffith Park. Here the channel turns southward through the Glendale Narrows before it flows across the coastal plain and into San Pedro Bay near Long Beach.

[1] The WDR identified 26 SBC reaches in the Los Angeles River Watershed. However, on further investigation, it was determined that Reach 17, Sheep Corral Channel is owned, operated and maintained by the City of Glendale. Reach 17 is therefore not discussed in this report.

There are 25 defined soft-bottom reaches in the Regional Board's WDR within the Los Angeles River Watershed as shown in Figure I-1. These 25 channel reaches vary in length from 25 feet to as long as 11,000 feet, as noted in Table I-1.

Los Angeles River
Soft-Bottom Reach Location Map

MPM-GIS Services

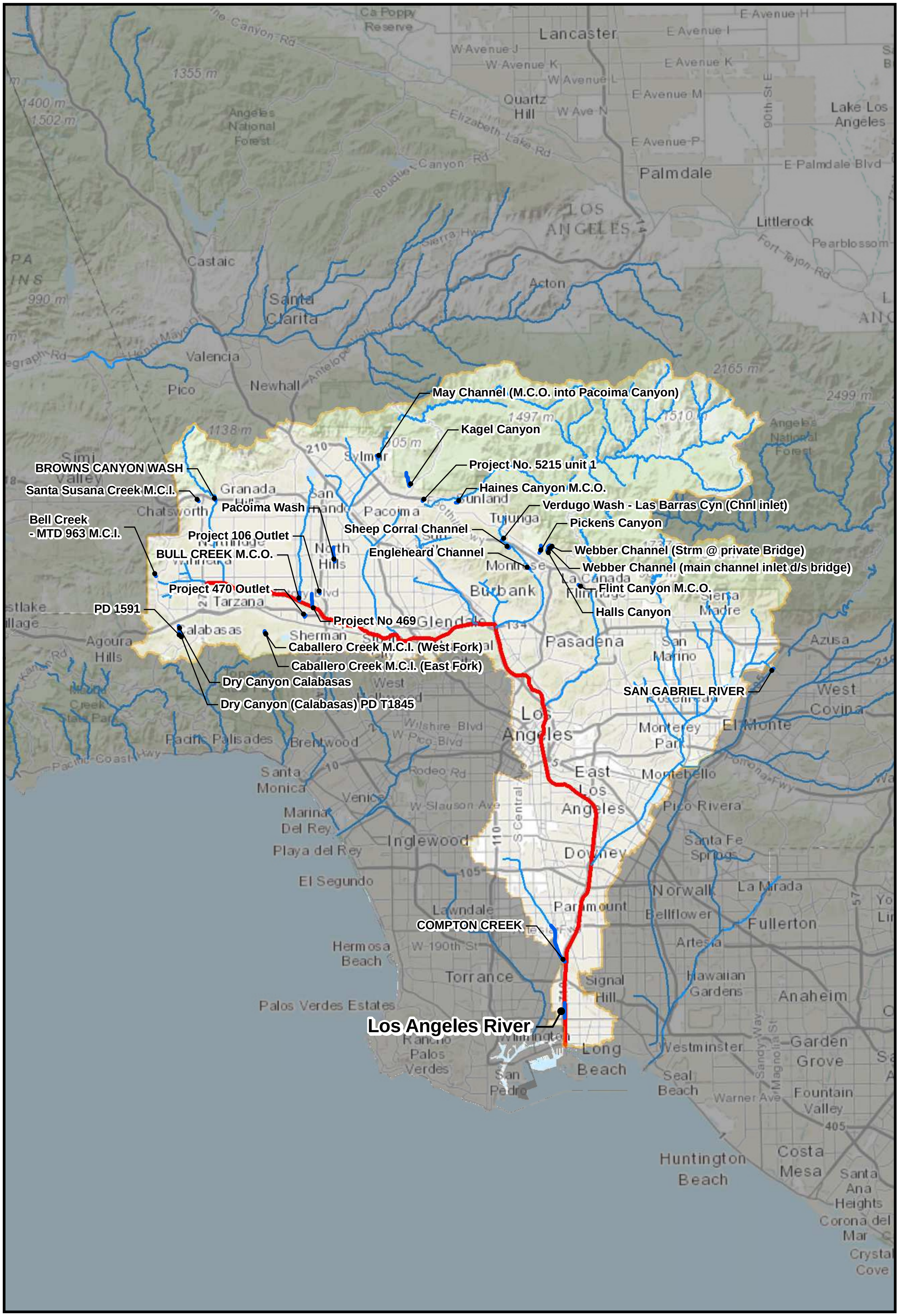

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Figure I-1

Table I-1. Soft-Bottom Channel Reaches within Los Angeles River Watershed

Reach No.	Name	Length (ft)
1	Bell Creek	196
2	Dry Canyon Creek	1,546
3	Santa Susana Creek tributary to Brown Canyon Creek	75
4	Browns Canyon Creek	1,243
5	Caballero Creek, West Fork	652
6	Caballero Creek M.C.I., East Fork	160
7	Bull Creek	300
8	Tributary to the Sepulveda Flood Control Basin Project No. 470 outlet	529
9	Tributary to the Sepulveda Flood Control Basin Project No.106	120
10	Tributary to the Sepulveda Flood Control Basin Project No. 469	4,194
12	Haines Canyon Creek	437
13	Tributary to Hansen Lake Project No. 5215 Unit1	537
14	May Canyon Creek	690
15	Pacoima Wash	4,762
16	Verdugo Wash-Las Barras Canyon channel inlet	130
18	Engleheard Channel, tributary to Verdugo Wash	800
19	Pickens Canyon, tributary to Verdugo Wash	2,406
20	Webber Channel, tributary to Halls Canyon Channel	115
21	Webber Channel (main channel inlet at bridge), tributary to Halls Canyon Channel	25
22	Halls Canyon Channel	2,290
24	Compton Creek	11,000
25	Los Angeles River	4,800
96	PD 1591 Calabasas	320
99	Kagel Canyon	4,858
100	Dry Canyon Calabasas	60

Source: WDR Order No. R4-2010-0021

I.2 Report Organization

This report is organized into individual sections identifying and describing each soft-bottom channel reach analyzed for the Los Angeles 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 2 and 96; Reaches 5 and

6; and Reaches 20 and 21 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.

I.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.

I.4 Hydraulic Models

Hydraulic models were developed for all 25 SBC reaches using the United States Army Corps of Engineers (USACE) Hydrologic Engineering Center's River Analysis System (HEC-RAS) computer program. Several iterations of the models were conducted for each channel reach.

First, a model of the existing conditions was developed. The model of the existing condition assumed design flow rates and existing vegetation levels in the channel reach. For the reaches that were found to have insufficient capacity under existing vegetation levels, a second model was then developed to determine whether the reach might have any excess capacity in the "clear" condition. The "clear" condition assumed design flow rates and that no vegetation was located within the channel. If the clear condition model showed no excess capacity in the channel reach, no further modeling was performed.

For reaches that were found to have sufficient channel capacity under existing vegetation levels, a model was developed to determine the amount and type of additional vegetation that might be allowed to remain in the channel reach without affecting that capacity. This was done in conjunction with recommendations from BonTerra Consulting, the LACFCD biological consultant, which identified the location and species of vegetation in those channel reaches.

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.

I.4.1 Field Investigations

Field site investigations were conducted for all 25 SBC reaches to verify channel geometry, stability, and vegetation. The field site investigations were completed by LACFCD between July and September 2010 per the recommendation of BonTerra Consulting. 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.

I.4.2 Geometric Data and Cross-Sections

Channel as-built plans, if available, were used to develop hydraulic models for several of the soft-bottom channel reaches. Field data and aerial photographs were also used in developing the hydraulic models. Light Detection and Ranging (LIDAR) topographic data were used if no as-built plans were available, as well as in conjunction with available as-built plans.

Recent topographic surveys also were performed for eight reaches in which as-built plans and LIDAR were unavailable or considered to be inadequate. These topographic surveys were provided in NAD 1983, NAVD 88, and State Plane California V projection. The reaches requiring topographic surveys are listed in Table I-2.

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

Reach No.	Name	Length (ft)	Date of Topographic Survey
2	Dry Canyon Creek	1,546	April-2011
4	Browns Canyon Creek	1,243	April-2011
5	Caballero Creek, West Fork	652	March-2011
6	Caballero Creek M.C.I., East Fork	160	March-2011
20	Webber Channel, tributary to Halls Canyon Channel	115	March-2011
21	Webber Channel (main channel inlet at bridge), tributary to Halls Canyon Channel	25	March-2011
96	PD 1591 Calabasas	320	April-2011
99	Kagel Canyon	4,858	April-2011

Microstation, HEC-GeoRas and ArcGIS were used to produce the HEC-RAS models from the LIDAR and topographic survey data. As-built plans and field measurements were 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.

I.4.3 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 I-2 was used to determine the base roughness value, n_b.

Figure I-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]	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.

I.4.4 Bridges and Culverts

Ineffective flow areas were added at applicable cross sections upstream and downstream of bridges or culverts. The ineffective flow area option was used to keep all the active flow in the area of the bridge 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 culvert or bridge. At this height, it is assumed the nominal effective flow area becomes sealed and the entire cross section becomes active.

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.

I.4.5 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, contraction and expansion coefficients were adjusted to 0.3 and 0.5, respectively.

I.4.6 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, 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 wouldn't affect the results within the study reach.

I.5 Changes in Stream Flow

Condition 48 of the 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 I-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 (.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 I-3. Thus, while LID/infiltration facilities will reduce storm flows during typical (up to the 85th percentile) storm events, flows from the major storms for which the flood control channels, including the soft bottom reaches, were designed will not be affected. Thus, the presence of LID/infiltration infrastructure would not affect expected stream flow during major storms.

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

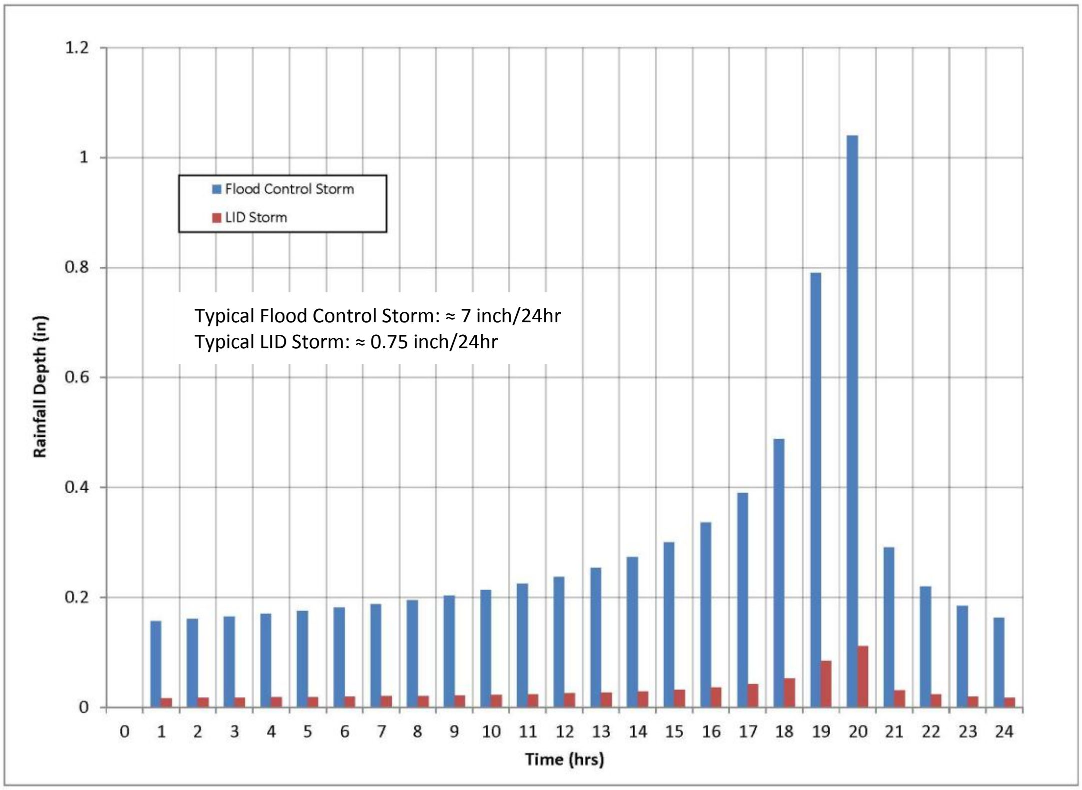
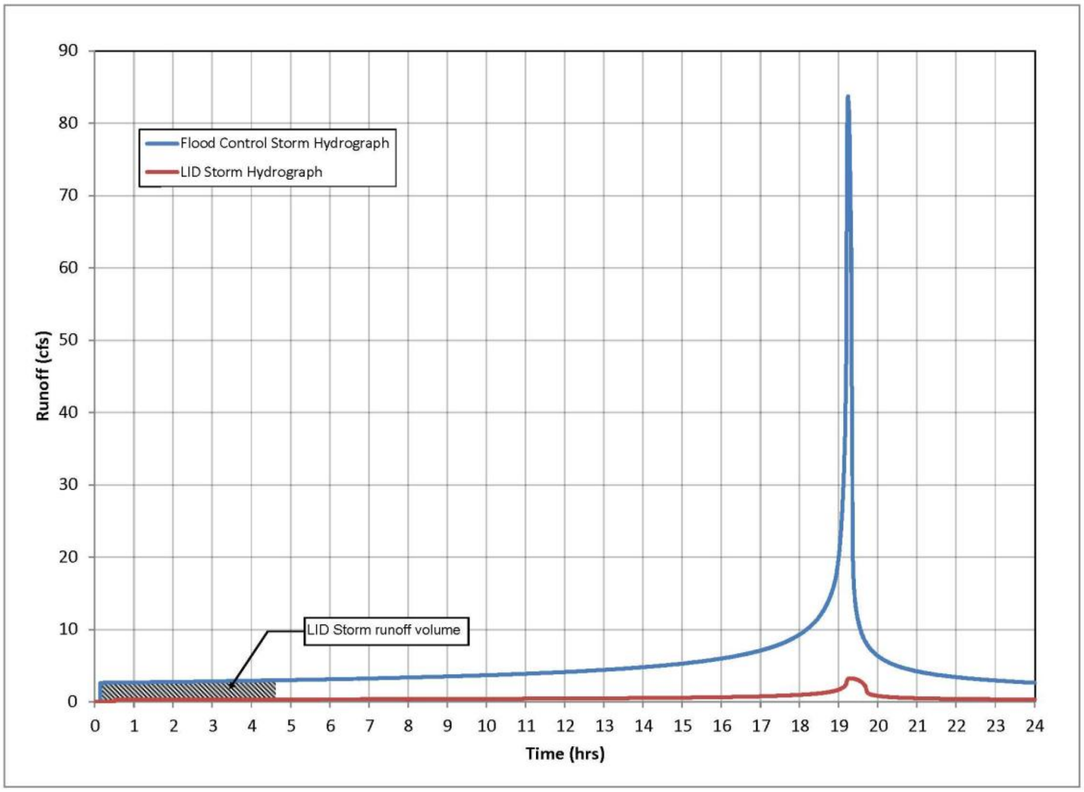


Figure I-4. Example Watershed Runoff Peaks and Volume



I.6 Summary of Results

As discussed previously, 25 soft-bottom reaches were analyzed assuming existing vegetation conditions. This analysis indicated that 17 reaches have insufficient capacity. These 17 reaches 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.

Under the existing vegetation condition, 8 soft-bottom reaches were found to have sufficient capacity. Seven of these reaches were then analyzed using adjusted roughness coefficients to represent the vegetation recommendations proposed by BonTerra Consulting.[2] Assuming the vegetation levels recommended by BonTerra, the hydraulic analysis indicated sufficient capacity in all 7 reaches. Table I-3 summarizes the hydraulic modeling results for all the soft-bottom reaches under the different scenarios described above.

[2] One of these reaches, Reach 7, was not recommended for further vegetation due to vector control concerns.

Table I-3. Summary of the Hydraulic Modeling for the Soft-Bottom Channel Reaches within Los Angeles River Watershed

Reach No.	Name	Hydraulic Modeling Results		
		Existing Vegetation Scenario [a]	"Clear" Channel Scenario [b]	BonTerra Consulting Recommendation Scenario
1	Bell Creek	Capacity	-	Capacity for Additional Vegetation
2	Dry Canyon Creek	Insufficient Capacity	No Excess Capacity for Vegetation	-
3	Santa Susana Creek tributary to Brown Canyon Creek	Insufficient Capacity	No Excess Capacity for Vegetation	-
4	Browns Canyon Creek	Insufficient Capacity	No Excess Capacity for Vegetation	-
5	Caballero Creek, West Fork	Insufficient Capacity	No Excess Capacity for Vegetation	-
6	Caballero Creek M.C.I., East Fork	Insufficient Capacity	No Excess Capacity for Vegetation	-
7	Bull Creek	Capacity	-	[c]
8	Tributary to the Sepulveda Flood Control Basin Project No. 470 outlet	Insufficient Capacity	No Excess Capacity for Vegetation	-
9	Tributary to the Sepulveda Flood Control Basin Project No.106	Capacity	-	Capacity for Additional Vegetation
10	Tributary to the Sepulveda Flood Control Basin Project No. 469	Insufficient Capacity	No Excess Capacity for Vegetation	-
12	Haines Canyon Creek	Insufficient Capacity	No Excess Capacity for Vegetation	-
13	Tributary to Hansen Lake Project No. 5215 Unit1	Insufficient Capacity	No Excess Capacity for Vegetation	-
14	May Canyon Creek	Insufficient Capacity	No Excess Capacity for Vegetation	-
15	Pacoima Wash	Insufficient Capacity	No Excess Capacity for Vegetation	-
16	Verdugo Wash-Las Barras Canyon channel inlet	Insufficient Capacity	No Excess Capacity for Vegetation	-
18	Engleheard Channel, tributary to Verdugo Wash	Insufficient Capacity	No Excess Capacity for Vegetation	-
19	Pickens Canyon, tributary to Verdugo Wash	Capacity	-	Capacity for Additional Vegetation
20	Webber Channel, tributary to Halls Canyon Channel	Capacity	-	Capacity for Additional Vegetation
21	Webber Channel (main channel inlet at bridge), tributary to Halls Canyon Channel	Capacity	-	Capacity for Additional Vegetation
22	Halls Canyon Channel	Capacity	-	Capacity for Additional Vegetation
24	Compton Creek	Insufficient Capacity	No Excess Capacity for Vegetation	-
25	Los Angeles River	Capacity	-	Capacity for Additional Vegetation
96	PD 1591 Calabasas	Insufficient Capacity	No Excess Capacity for Vegetation	-
99	Kagel Canyon	Insufficient Capacity	No Excess Capacity for Vegetation	-
100	Dry Canyon Calabasas	Insufficient Capacity	No Excess Capacity for Vegetation	-

a. Based on field site visit conducted in July/August 2010 prior to FMD channel maintenance activities.
b. "Clear" Channel Scenario assumes all vegetation in the channel is removed.
c. Concerns relating to vector control require further analysis of current maintenance activities.

Reach 1 - Bell Creek

1.1 General Description

Bell Creek is a 10-mile tributary of the Los Angeles River. The creek originates in Ventura County before traveling west into Los Angeles County. Bell Creek confluences with Calabasas Creek, which is tributary to the Los Angeles River.

The upper limit of the study reach is at about 1,160 feet upstream of Highland Road. The downstream limit of the study reach is immediately north of Highland Road. The study reach is located near mainly residential and open space areas as shown in Figure 1.1.

1.2 Structures

This study reach of Bell Creek is an earthen-bottom channel that transitions into a fully concrete-lined channel. Details of these structures are summarized in Table 1-1.

Table 1-1. Structures along Bell Creek

Structure No.	River Station	Road Name	Type	Description
1	7+37.88	-	Channel Transition	Transition from natural to concrete-lined channel.

1.3 Manning's Roughness Coefficients

The Manning's roughness coefficient was determined based on field site visits of the channel reach. Observations were made regarding base material, obstructions, vegetation type and density, and other channel characteristics. Photographs were taken to document channel conditions and are provided in Appendix A. The Manning's roughness coefficients used are summarized in Table 1-2. Detailed computations in determining these values are found in Appendix B.

Table 1-2. Manning's Roughness 'n' Value along Bell Creek

Reach Location	Left Bank	Main Channel	Right Bank
(Upstream Limit) Sta 11+57.125 – Sta 8+09.500	0.055	0.055	0.055
Sta 8+09.500 – Sta 7+37.788	0.030	0.015	0.030
Sta 7+37.788 – Sta 6+65.75	0.032	0.015	0.027
(Downstream Limit) Sta 6+65.75 – Sta 0+33.221	0.027	0.015	0.030

1.4 Hydrology

Design flow rates were obtained from LACFCD “MTD 693 - Bell Creek Channel Plan and Profile” as-built drawing no. 134F132 dated November, 16, 1981. The peak discharge rate associated with the subject reach is 7,101 cfs.

1.5 Hydraulic Model

LACFCD as-built drawings and LIDAR topography were used to create the HEC-RAS model for this reach of Bell Creek. The reach was modeled with 23 cross sections to ensure a gradually varied flow profile and to adequately represent the channel’s geometry and structures along the study reach. HEC-RAS input and output files are provided in Appendix C.

1.6 Boundary Conditions

Normal depths were used for both the upstream boundary condition (Slope = 0.02034) and downstream boundary condition (Slope = 0.0045).

1.7 Results

A hydraulic model was developed for the Bell Creek reach under existing vegetation levels. The soft-bottom portion of the study reach has subcritical flow. The flows switch to supercritical as they approach the concrete lined portion of the channel and remain supercritical to the downstream limits of the study reach. Channel and water surface profiles for the Bell Creek hydraulic model are presented in Appendix C. The model showed sufficient capacity along the reach. Therefore, an additional analysis was conducted assuming vegetation levels as recommended by BonTerra. The additional analysis conducted is discussed in more detail in the following section.

1.8 Additional Analysis

Bonterra Consulting provided a recommendation on potential vegetation growth for this reach. The recommendation is summarized as follows:

Biological Recommendation
Allow willow canopy to spread outside channel. Allow native shrubs such as coyote bush and mule fat to become established in this area. Relocate existing chain link fence as shown on exhibit to protect this area.

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

For the BonTerra recommendation, the Manning’s roughness coefficient was modified for the reach between Stations 8+09.5 and 7+37.788. Detailed computations in determining these values based on the biologist’s recommendations are found in Appendix B. The revised hydraulic models based on the final biologist’s recommendation indicated sufficient capacity along the reach. HEC-RAS hydraulic models for Bell Creek are presented in Appendix C.

LEGEND

HEC-RAS X-Sections

PREPARED BY
ER

LOS ANGELES COUNTY
DEPARTMENT OF PUBLIC WORKS

DATE
2/4/2013

Figure 1-1

SCALE
1" = 200'

Bell Creek
(SBC Reach No. 1)

Reach 2 & 96 - Dry Canyon Creek and PD 1591 Calabasas

2.1 General Description

The maintenance reach of PD 1591 Calabasas (County Reach No. 96) is approximately 250 feet upstream of the maintenance reach for Dry Canyon Creek (County Reach No. 2). Due to their close proximity to each other, one hydraulic model was created to include both maintenance reaches. Both reaches are upstream of another maintenance reach, Dry Canyon Calabasas (County Reach No. 100) which is tributary to Calabasas Creek and drains into the LA River.

The maintenance reach of PD 1591 Calabasas spans 85 feet upstream and 360 feet downstream of its culvert under Viscasa Drive in the City of Calabasas. The maintenance reach of Dry Canyon Creek spans 676 feet upstream and 870 feet downstream of the bridge at Park Ora Road.

The extents of the study reach are at the outer extents of these two maintenance reaches. The study reach is surrounded by residential properties as shown in Figure 2.1.

2.2 Structures

The study reach is comprised entirely of earthen-bottom channel. Details of the structures within the study reach are summarized in Table 2-1.

Table 2-1. Structures along Dry Canyon Creek and PD 1591 Calabasas

Structure No.	River Station	Road Name	Type	Description
1	21+34	Vicasa Drive	Culvert	A culvert under Vicasa Drive for the channel to flow under.
2	8+78.50	Park Ora Road	Bridge	A bridge for Park Ora Road to cross the channel.

2.3 Manning's Roughness Coefficients

The Manning's roughness coefficient was determined based on field site visits of the channel reach. Observations were made regarding base material, obstructions, vegetation type and density, and other channel characteristics. Photographs were taken to document channel conditions and are provided in Appendix A. The Manning's roughness coefficients used are summarized in Table 2-2. Detailed computations in determining these values are found in Appendix B.

Table 2-2. Manning's Roughness 'n' Value along Dry Canyon Creek and PD 1591 Calabasas

Reach Location	Left Bank	Main Channel	Right Bank
(Upstream Limit) Sta 25+17.29 – Sta 22+73.80	0.075	0.075	0.075
Sta 22+73.80 – Sta 21+86.39	0.038	0.038	0.038
Sta 21+86.39 – Sta 20+81.61	0.014	0.014	0.014
Sta 20+81.61 – Sta 20+40.61	0.065	0.065	0.065
Sta 20+40.61 – Sta 19+88.33	0.076	0.076	0.076
Sta 19+88.33 – Sta 15+94.72	0.075	0.075	0.075
Sta 15+94.72 – Sta 15+34.33	0.050	0.050	0.050
Sta 15+34.33 – Sta 12+78.47	0.030	0.030	0.030
Sta 12+78.47 – Sta 12+35.28	0.027	0.027	0.027
Sta 12+35.28 – Sta 11+70.35	0.034	0.034	0.034
Sta 11+70.35 – Sta 10+64.98	0.044	0.044	0.044
Sta 10+64.98 – Sta 9+06.27	0.074	0.074	0.074
Sta 9+06.27 – Sta 8+25.30	0.030	0.030	0.030
(Downstream Limit) Sta 8+25.30 –Sta 0+49.13	0.081	0.081	0.081

2.4 Hydrology

Design flow rates were obtained from the LACFCD PD 1845 (Drawing No. TR 43127) and PD 1591 (Drawing No. TR35008) dated August 14, 1984, and January 8, 1981, respectively. The peak discharge rate associated with the two maintenance reaches is 5,170 cfs.

2.5 Hydraulic Model

Recent topographic surveys were used to create the HEC-RAS model for this reach of Dry Canyon Creek and PD 1591 Calabasas. The reach was modeled with 54 cross sections to ensure a gradually varied flow profile and to adequately represent the channel's geometry and structures along the study reach. HEC-RAS input and output files are provided in Appendix C.

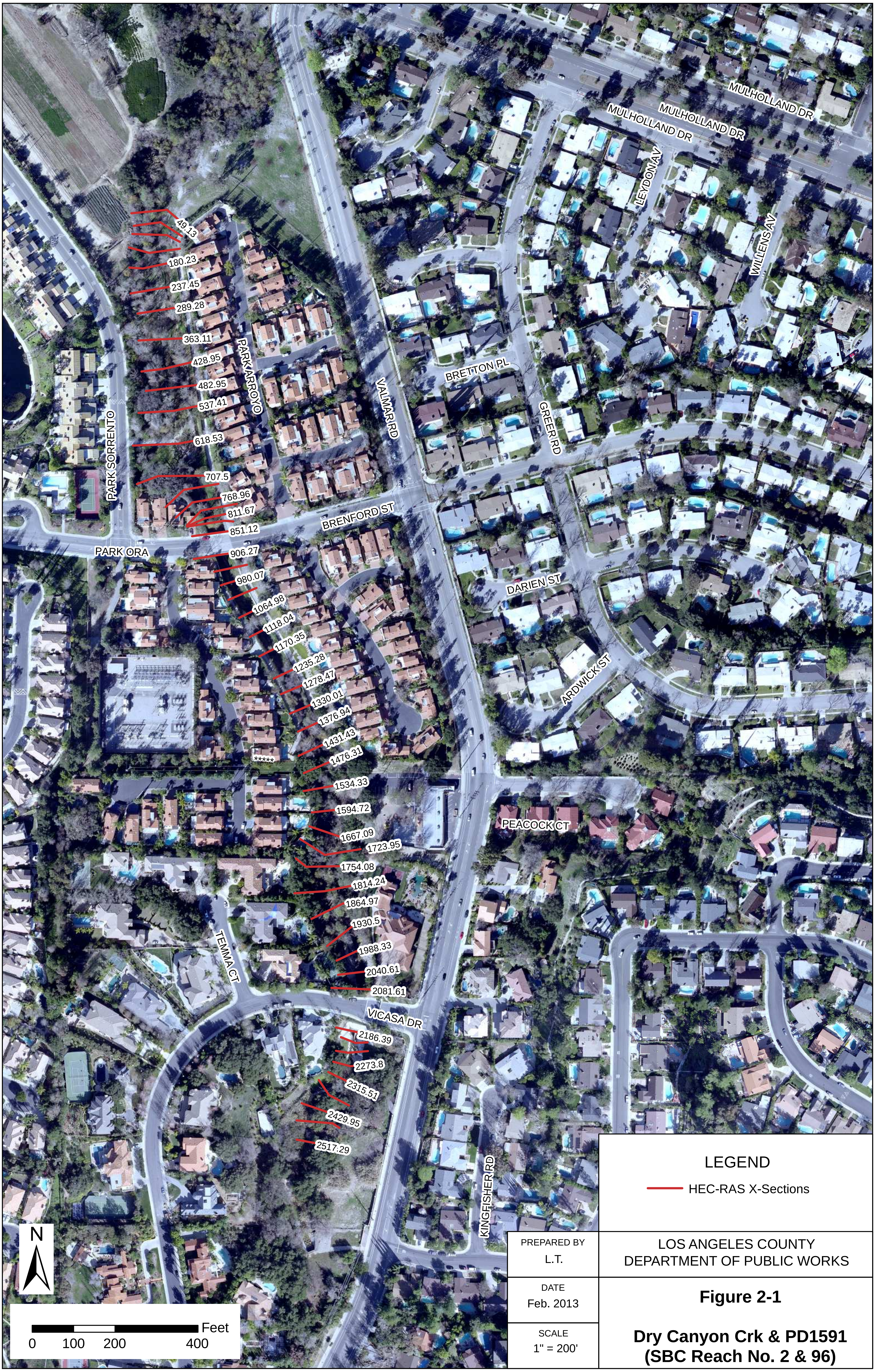
2.6 Boundary Conditions

Normal depths were used as boundary conditions for the PD 1591 Calabasas and Dry Canyon Creek model at the upstream (Slope = 0.0079) and downstream (Slope = 0.0120) study limits.

2.7 Results

A hydraulic model was developed for PD 1591 Calabasas and Dry Canyon Creek under existing vegetation levels. The model results showed insufficient capacity along the entire reach.

A second analysis was then performed assuming a “clear” channel (no vegetation) condition for the reach. A Manning’s roughness coefficient value from 0.025 to 0.036 was used to represent the earth-bottom portions of the reach. The analysis for a “clear” channel showed no excess capacity along the reach. Since the study reach showed no excess capacity for an assumed “clear” channel condition, no other scenarios were explored. HEC-RAS input and output files for all analyses are provided in Appendix C.



PREPARED BY L.T.	LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS
DATE Feb. 2013	**Figure 2-1**
SCALE 1" = 200'	**Dry Canyon Crk & PD1591 (SBC Reach No. 2 & 96)**

Reach 3 - Santa Susana Creek tributary to Brown Canyon Creek

3.1 General Description

Santa Susana Creek is a tributary of the Browns Canyon Wash. They both originate in the north and flow southerly, draining into the Los Angeles River. The maintenance reach of Santa Susana Creek is located approximately 5,600 feet upstream from the Creek's intersection to Devonshire Street in the south. The maintenance reach starts 75 feet upstream from, and ends at, the Creek's transition from a soft-bottom channel to a concrete-lined channel.

The study limits start approximately 250 feet upstream in the north beyond the maintenance limit. The study reach is surrounded by both undeveloped land to residential properties as shown in Figure 3.1.

3.2 Structures

The study reach for Santa Susana Creek is an earthen-bottom channel that transitions into a fully concrete-lined channel. Details of the structures within the study reach are summarized in Table 3-1.

Table 3-1. Structures along Santa Susana Creek

Structure No.	River Station	Road Name	Type	Description
1	5+84.48	--	Transition	Transition from soft-bottom channel to concrete channel

3.3 Manning's Roughness Coefficients

The Manning's roughness coefficient was determined based on field site visits of the channel reach. Observations were made regarding base material, obstructions, vegetation type and density, and other channel characteristics. Photographs were taken to document channel conditions and are provided in Appendix A. The Manning's roughness coefficients used are summarized in Table 7-2. Detailed computations in determining these values are found in Appendix B.

Table 3-2. Manning's Roughness 'n' Value along Santa Susana Creek

Reach Location	Left Bank	Main Channel	Right Bank
(Upstream Limit) Sta 9+04.71 – Sta 6+15.17	0.030	0.030	0.030
Sta 6+15.17 – Sta 5+99.82	0.028	0.028	0.028
Sta 5+99.82 – Sta 5+84.48	0.027	0.027	0.027
Sta 5+84.48 – Sta 5+55.68	0.025	0.025	0.025
(Downstream Limit) Sta 5+55.68 – Sta 0+12.79	0.015	0.015	0.015

3.4 Hydrology

Design flow rates were obtained from the LACFCD as-built drawings for the Santa Susana Creek (drawing number 89-D10.2) dated April 1968. The peak discharge rate associated with the subject reach is 3,460 cfs.

3.5 Hydraulic Model

LACFCD as-built drawings and LIDAR topography were used to create the HEC-RAS model for this reach of Santa Susana Creek. The reach was modeled with 28 cross sections to ensure a gradually varied flow profile and to adequately represent the channel's geometry and structures along the study reach. HEC-RAS input and output files are provided in Appendix C.

3.6 Boundary Conditions

Normal depths were used as boundary conditions for the Santa Susana Creek model at the upstream (Slope = 0.0309) and downstream (Slope = 0.0049) study limits.

3.7 Results

A hydraulic model was developed for Santa Susana Creek under existing vegetation levels. The model showed insufficient capacity from the upstream reach to Station 4+60.29.

A second analysis was then performed assuming a "clear" channel (no vegetation) condition for the reach. A Manning's roughness coefficient value of 0.025 was used to represent the earth-bottom portions of the reach. The analysis for a "clear" channel showed no excess capacity between the above mentioned stations. Since the study reach showed no excess capacity for an assumed "clear" channel condition, no other scenarios were explored. HEC-RAS input and output files for all analyses are provided in Appendix C.

PREPARED BY L.T.

DATE Feb. 2013

SCALE 1" = 150'

LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS

Figure 3-1

Santa Susana Creek (SBC Reach No. 3)

Reach 4 - Browns Canyon Creek

4.1 General Description

Browns Canyon Creek is a tributary of the Los Angeles River. The creek originates in the north and travels south to confluence with the Los Angeles River. The maintenance reach of Browns Canyon Creek starts in the north approximately 500 feet north of the Ronald Reagan (118) Freeway and is just downstream of a filled retaining wall structure that lies on the Creek's path within the canyon. The maintenance reach ends in the south at the transition from south-bottom to concrete lined channel. This transition is approximately 500 feet upstream from Rinaldi Street.

The study limit in the north is coincident with the maintenance reach limit. In the south, the study limit extends approximately 80 feet downstream of the maintenance limit into the concrete portion of Browns Wash. The study reach is surrounded by both undeveloped land to residential properties as shown in Figure 4.1.

4.2 Structures

This study reach of Browns Canyon Creek is an earthen-bottom channel that transitions into a fully concrete-lined channel. Details of the structures within the study reach are summarized in Table 4-1.

Table 4-1. Structures along Browns Canyon Creek

Structure No.	River Station	Road Name	Type	Description
1	12+26.62	-	Rail & Timber Structure	The boards have been removed from the rails
2	8+83.35	Ronald Reagan (118) Fwy	Bridge	The entire bridge spans the length of the channel, with no piers within and the soffit well above the top of channel
3	7+27.69	Freeway South Bound Off Ramp	Bridge	The entire bridge spans the length of the channel, with no piers within and the soffit well above the top of channel
4	0+71.09	-	Transition	Transition from soft-bottom channel to concrete channel

4.2 Manning's Roughness Coefficients

The Manning's roughness coefficient was determined based on field site visits of the channel reach. Observations were made regarding base material, obstructions, vegetation type and density, and other channel characteristics. Photographs were taken to document channel conditions and are provided in Appendix A. The Manning's roughness coefficients used are summarized in Table 4-2. Detailed computations in determining these values are found in Appendix B.

Table 4-2. Manning's Roughness 'n' Value along Browns Canyon Creek

Reach Location	Left Bank	Main Channel	Right Bank
(Upstream Limit) Sta 13+81.14 – Sta 11+53.98	0.085	0.085	0.085
Sta 11+53.98 – Sta 9+75.93	0.035	0.035	0.035
Sta 9+75.93 – Sta 7+97.19	0.017	0.03	0.017
Sta 7+97.19 – Sta 1+18.81	0.017	0.05	0.017
Sta 1+18.81 – Sta 0+71.09	0.018	0.029	0.018
(Downstream Limit) Sta 0+71.09 –Sta 0+09.37	0.015	0.015	0.015

4.3 Hydrology

Design flow rates were obtained from LACFCD Browns Creek Final Hydraulic Calculations (Nordhoff Street to Debris Basin) dated June 1968. The peak discharge rate associated with the subject reach is 14,800 cfs.

4.4 Hydraulic Model

A recent topographic survey was used to create the HEC-RAS model for this reach of Browns Canyon Creek. The reach was modeled with 52 cross sections to ensure a gradually varied flow profile and to adequately represent the channel's geometry and structures along the study reach. HEC-RAS input and output files are provided in Appendix C.

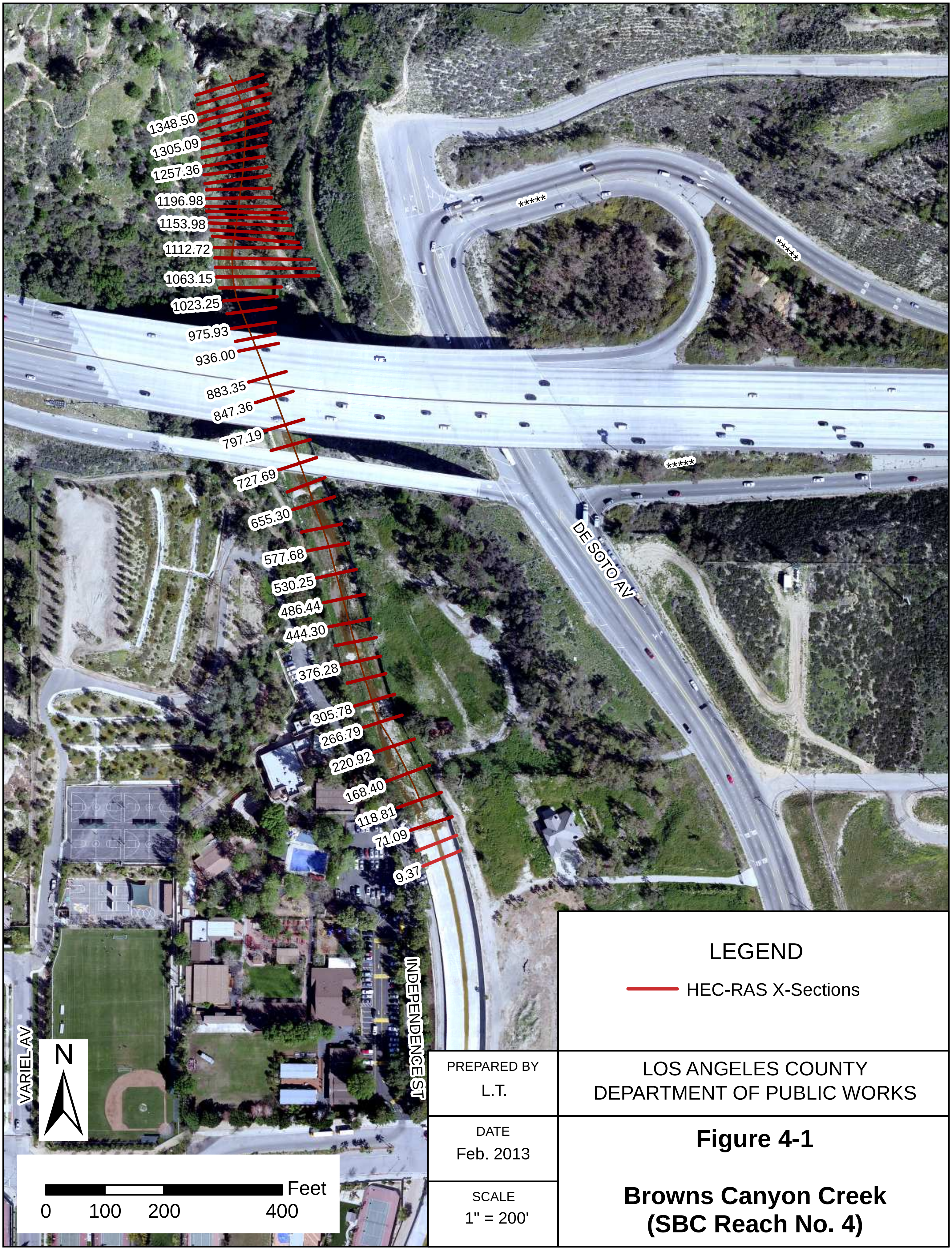
4.5 Boundary Conditions

Normal depths were used as boundary conditions for the Browns Canyon Creek model at the upstream (Slope = 0.0092) and downstream (Slope = 0.0030) study limits.

4.6 Results

A hydraulic model was developed for Browns Canyon Creek under existing vegetation levels. The model showed insufficient capacity of the soft-bottom channel at Stations 13+81.14 and 1+18.81.

A second analysis was then performed assuming a "clear" channel (no vegetation) condition for the reach. A Manning's roughness coefficient value of 0.025 was used to represent the earth-bottom portions of the reach. The analysis for a "clear" channel showed no excess capacity at the above mentioned stations. Since the study reach still showed no excess capacity for an assumed "clear" channel condition, no other scenarios were explored. HEC-RAS input and output files for all analyses are provided in Appendix C.



LEGEND

HEC-RAS X-Sections

PREPARED BY
L.T.

LOS ANGELES COUNTY
DEPARTMENT OF PUBLIC WORKS

DATE
Feb. 2013

SCALE
1" = 200'

Figure 4-1

Browns Canyon Creek (SBC Reach No. 4)

Reach 5 & 6 - Caballero Creek, West Fork and East Fork

5.1 General Description

Caballero Creek M.C.I. East Fork confluences with Caballero Creek West Fork. Because of their proximity and relationship to each other, these two study reaches were modeled as one single reach. The reaches are located northeast of the intersection of Reseda Boulevard and Paseo Nuevo Drive between the golf course and Reseda Boulevard. The downstream maintenance reach limit of Caballero Creek West Fork is at the transition of the soft-bottom channel to concrete-lined channel, near the Creek's underpass of Reseda Boulevard. Its upstream maintenance reach limit is approximately 700 feet upstream of this transition. The reach limits of Caballero Creek M.C.I. East Fork is from its confluence with the West Fork to its outlet from two culverts exiting from underneath the golf course maintenance road just east of the reaches.

The study reach is flanked by the golf course on the east and Reseda Boulevard on the west. The combined design flow rate from the East and West Fork overtops the median land separating their two streams, effectively making the entire East Fork into an extension of the West Fork's eastern bank. Therefore a model of the West Fork with its eastern bank expanded to include all of the East Fork effectively modeled both maintenance reaches. See Figure 5.1.

5.2 Structures

This study reach of Caballero Creek East and West Forks are earthen-bottom channels that confluence and then transition into a concrete-lined channel. Details of the structures within the study reach are summarized in Table 5-1.

Table 5-1. Structures along Caballero Creek East and West Forks

Structure No.	River Station	Road Name	Type	Description
1	1+01.37	--	Tansition	Transition from soft-bottom channel to concrete channel

5.3 Manning's Roughness Coefficients

The Manning's roughness coefficient was determined based on field site visits of the channel reach. Observations were made regarding base material, obstructions, vegetation type and density, and other channel characteristics. Photographs were taken to document channel conditions and are provided in Appendix A. The Manning's roughness coefficients used are summarized in Table 5-2. Detailed computations in determining these values are found in Appendix B.

Table 5-2. Manning's Roughness 'n' Value along Caballero Creek East and West Forks

Reach Location	Left Bank	Main Channel	Right Bank
(Upstream Limit) Sta 6+24.57 – Sta 3+30.70	0.024	0.055	0.040
Sta 3+30.70 – Sta 1+20.82	0.024	0.075	0.050
(Downstream Limit) Sta 1+20.82 – Sta 0+5.58	0.015	0.015	0.015

5.4 Hydrology

Design flow rates were obtained from the LACFCD Caballero Creek Hydraulic Design calculations dated January 1960. The peak discharge rate associated with the combined West and East Forks is 3,500 cfs.

5.5 Hydraulic Model

A recent topographic survey was used to create the HEC-RAS model for this reach of Caballero Creek East and West Fork. The reach was modeled with 33 cross sections to ensure a gradually varied flow profile and to adequately represent the channel's geometry and structures along the study reach. HEC-RAS input and output files are provided in Appendix C.

5.6 Boundary Conditions

Normal depths were used as boundary conditions for the Caballero Creek East and West Fork model at the upstream (Slope = 0.0099) and downstream (Slope = 0.0429) study limits.

5.7 Results

A hydraulic model was developed for the Caballero Creek East and West Fork reach under existing vegetation levels. Channel and water surface profiles for the Caballero Creek East and West Fork hydraulic model are presented in Appendix C. The model showed insufficient capacity.

A second analysis was then performed assuming a "clear" channel (no vegetation) condition for the reach. A combination of Manning's roughness coefficient values of 0.025 and 0.035 were used to represent the earth-bottom portions of the reach. The analysis for a "clear" channel showed no excess capacity. Since the study reach still showed no excess capacity for an assumed "clear" channel condition, no other scenarios were explored. HEC-RAS input and output files for all analyses are provided in Appendix C.

PREPARED BY L.T.	LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS
DATE Feb. 2013	**Figure 5-1**
SCALE 1" = 100'	**Caballero Creek East & West Fork (SBC Reach No. 5 & 6)**

Reach 7 - Bull Creek

7.1 General Description

Bull Creek originates at Bull Creek Retention Basin and discharges to the Sepulveda Dam at its downstream end. It is an engineered channel for approximately 9.5 miles and then it transitions into natural soft bottom channel. The soft bottom channel portion analyzed in this study is approximately 300 feet in length (maintenance reach) immediately downstream of the engineered channel. Bull Creek is tributary to the Sepulveda Dam and the Los Angeles River.

The upper limit of the study reach is at about 50 feet downstream of Victory Boulevard. The downstream limit is about 520 feet downstream of Victory Boulevard. The study reach is located downstream of a residential area as shown in Figure 7-1.

7.2 Structures

The study reach of Bull Creek is a trapezoidal open channel that transitions into an earthen-bottom channel. Details of these structures are summarized in Table 7-1.

Table 7-1. Structures along Bull Creek

Structure No.	River Station	Road Name	Type	Description
1	3+98.72	-	Channel Transition and Bridge	Transition from a trapezoidal open channel to a soft bottom channel. Bridge crossing over channel

7.3 Manning's Roughness Coefficients

The Manning's roughness coefficient was determined based on field site visits of the channel reach. Observations were made regarding base material, obstructions, vegetation type and density, and other channel characteristics. Photographs were taken to document channel conditions and are provided in Appendix A. The Manning's roughness coefficients used are summarized in Table 7-2. Detailed computations in determining these values are found in Appendix B.

Table 7-2. Manning's Roughness 'n' Value along Bull Creek

Reach Location	Left Bank	Main Channel	Right Bank
(Upstream Limit) Sta 4+88.120 - Sta 4+26.453	0.015	0.015	0.015
Sta 4+26.453 - Sta 3+00.650	0.030	0.030	0.030
Sta 3+00.650 - Sta 2+75.531	0.030	0.035	0.035
Sta 2+75.531 - Sta 2+48.611	0.030	0.030	0.030
Sta 2+48.611 - Sta 0+40.249	0.040	0.035	0.040
(Downstream Limit) Sta 0+40.249 - Sta 0+12.627	0.035	0.025	0.035

7.4 Hydrology

Design flow rates were obtained from LACFCD Bull Creek Plan and Profile as-built plan drawing no. 3-D26.4 dated April 1971. The peak discharge rate associated with the subject reach is 11,190 cfs.

7.5 Hydraulic Model

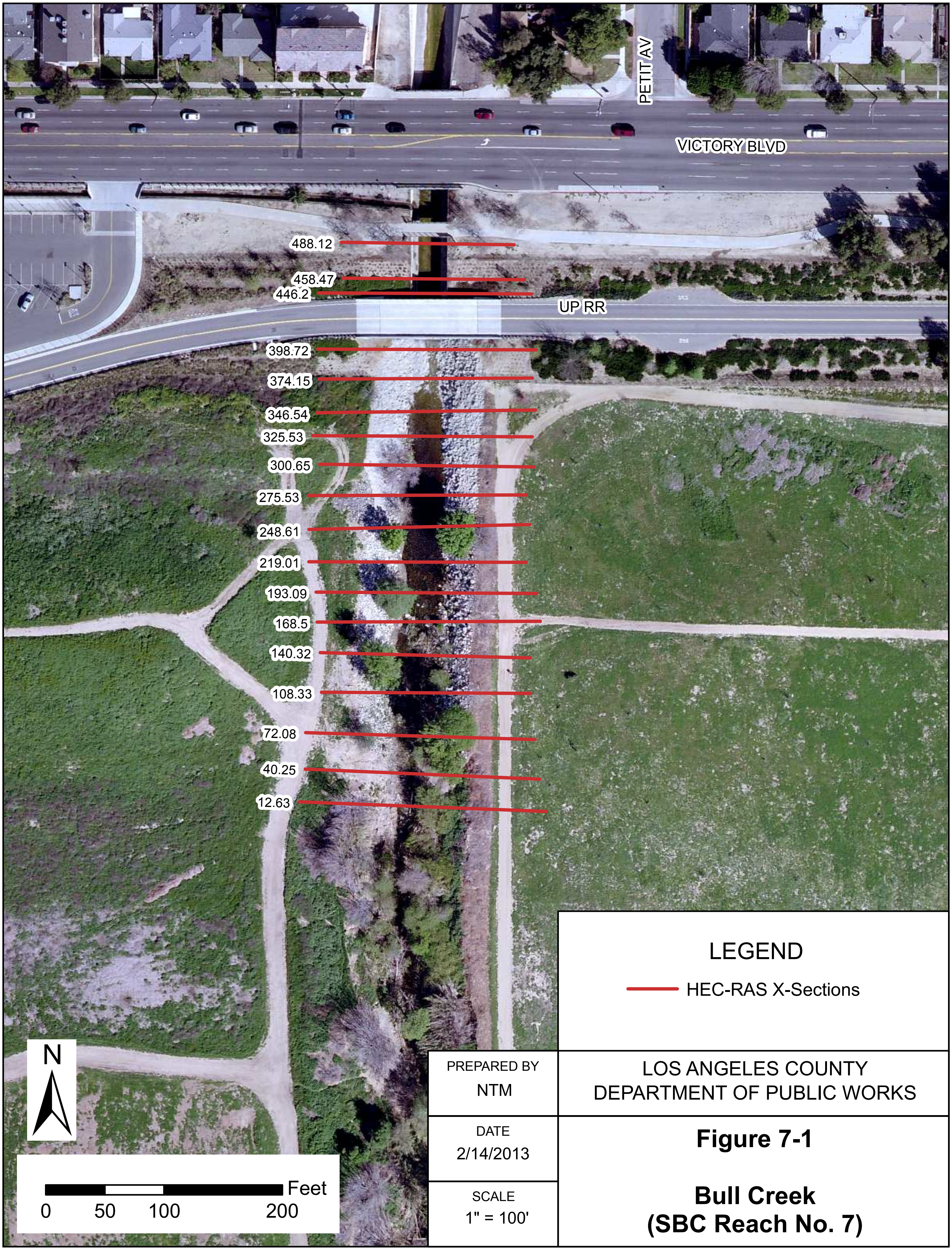
LACFCD as-built drawings and LIDAR topography were used to create the HEC-RAS model for this reach of Bull Creek. The reach was modeled with 18 cross sections to ensure a gradually varied flow profile and to adequately represent the channel's geometry and structures along the study reach. HEC-RAS input and output files are provided in Appendix C.

7.6 Boundary Conditions

Critical depth was used as the upstream boundary conditions for the study model. Normal depth (Slope = 0.00488) was used at downstream study limits.

7.7 Results

A hydraulic model was developed for the Bull Creek reach under existing vegetation levels. The model showed sufficient capacity along the reach. Channel and water surface profiles for the Bull Creek hydraulic model are presented in Appendix C. No additional analysis was conducted since concerns relating to vector control require further analysis of current maintenance activities.



LEGEND

HEC-RAS X-Sections

PREPARED BY NTM	LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS
DATE 2/14/2013	**Figure 7-1**
SCALE 1" = 100'	**Bull Creek (SBC Reach No. 7)**

Reach 8 - Tributary to the Sepulveda Flood Control Basin Project No. 470 outlet

8.1 General Description

Project No. 470 is a storm drain that is approximately 2 miles in length before transitioning into a soft-bottom channel. The soft-bottom channel portion is approximately 530 feet in length (maintenance reach) and then transitions into a culvert underneath the Ventura Freeway. Project No. 470 is tributary to the Sepulveda Dam and the Los Angeles River.

The upper limit of the study reach is at about 900 feet upstream of the Ventura Freeway. The downstream limit ends at the Ventura Freeway. The study reach is located downstream of a residential area as shown in Figure 8.1.

8.2 Structures

The study reach of Project No. 470 is a storm drain that transitions into an earthen-bottom channel and then transitions into a culvert. Details of these structures are summarized in Table 8-1.

Table 8-1. Structures along Project No. 470

Structure No.	River Station	Road Name	Type	Description
1	12+33.634	Hayvenhurst Ave	Channel Transition	Transition from a double RCB to a soft bottom channel
2	139+50	-	Channel Transition	Transition from a soft bottom channel to double RCB

8.2 Manning's Roughness Coefficients

The Manning's roughness coefficient was determined based on field site visits of the channel reach. Observations were made regarding base material, obstructions, vegetation type and density, and other channel characteristics. Photographs were taken to document channel conditions and are provided in Appendix A. The Manning's roughness coefficients used are summarized in Table 8-2. Detailed computations in determining these values are found in Appendix B.

Table 8-2. Manning's Roughness 'n' Value along Project No. 470

Reach Location	Left Bank	Main Channel	Right Bank
(Upstream Limit) Sta 14+40.177 – Sta 11+81.478	0.015	0.015	0.015
Sta 11+81.478 – Sta 8+07.090	0.030	0.025	0.030
Sta 8+07.090 – Sta 6+37.590	0.025	0.035	0.025
(Downstream Limit) Sta 6+37.590 – Sta 2+87.012	0.015	0.015	0.015

8.3 Hydrology

Design flow rates were obtained from LACFCD "Project No. 470 Hayvenhurst Ave. Line A - Plan, Profile, & Section" as-built drawing no. 275-470-D2.3 dated December 1962. The peak discharge rate associated with the subject reach is 2,900 cfs.

8.4 Hydraulic Model

LACFCD as-built drawings and LIDAR topography were used to create the HEC-RAS model for this reach of Project No. 470. The reach was modeled with 13 cross sections used to ensure a gradually varied flow profile and to adequately represent the channel's geometry and structures along the study reach. HEC-RAS input and output files are provided in Appendix C.

8.5 Boundary Conditions

Critical depths were used as boundary conditions for the study model at the upstream and downstream study limits.

8.6 Results

A hydraulic model was developed for Project No. 470 under existing vegetation levels. The analysis indicated insufficient capacity of the soft-bottom channel portion between Stations 10+05.382 and 6+82.050.

A second analysis was then performed assuming a "clear" channel (no vegetation) condition for the reach. A Manning's roughness coefficient value of 0.025 was used to represent the earth-bottom portions of the reach. The analysis for a "clear" channel showed no excess capacity at the above mentioned stations. Since the study reach showed no excess capacity for an assumed "clear" channel condition, no other scenarios were explored.

LEGEND

HEC-RAS X-Sections

PREPARED BY
NTM

LOS ANGELES COUNTY
DEPARTMENT OF PUBLIC WORKS

DATE
2/13/2013

SCALE
1" = 150'

Figure 8-1

Project No. 470
(SBC Reach No. 8)

Reach 9 - Tributary to the Sepulveda Flood Control Basin Project No. 106

9.1 General Description

Project No. 106 originates at Roscoe Boulevard and Haskell Avenue in the City of Los Angeles and discharges to the Sepulveda Dam at its downstream end. It is an engineered storm drain channel for approximately 2.5 miles and then it transitions into natural soft-bottom channel. The soft-bottom channel portion analyzed in this study is approximately 120 feet in length (maintenance reach) immediately downstream of the engineered channel. Project No. 106 is tributary to the Sepulveda Dam and the Los Angeles River.

The upper limit of the study reach is at about 220 feet downstream of Victory Boulevard. The downstream limit is about 560 feet downstream of Victory Boulevard. The study reach is located downstream of a residential area as shown in Figure 9-1.

9.2 Structures

The study reach of Project No. 106 is a trapezoidal open channel that transitions into an earthen-bottom channel. Details of these structures are summarized in Table 9-1.

Table 9-1. Structures along Project No. 106

Structure No.	River Station	Road Name	Type	Description
1	2+17.286	-	Channel Transition	Transition from a trapezoidal open channel to a soft-bottom channel

9.3 Manning’s Roughness Coefficients

The Manning’s roughness coefficient was determined based on field site visits of the channel reach. Observations were made regarding base material, obstructions, vegetation type and density, and other channel characteristics. Photographs were taken to document channel conditions and are provided in Appendix A. The Manning’s roughness coefficients used are summarized in Table 9-2. Detailed computations in determining these values are found in Appendix B.

Table 9-2. Manning's Roughness 'n' Value along Project No. 106

Reach Location	Left Bank	Main Channel	Right Bank
(Upstream Limit) Sta 3+41.084 - Sta 2+37.008	0.025	0.015	0.015
Sta 2+37.008 - Sta 2+17.286	0.015	0.030	0.015
Sta 2+17.286 - Sta 1+98.938	0.035	0.030	0.035
Sta 1+98.938 - Sta 1+88.739	0.035	0.025	0.035
(Downstream Limit) Sta 1+88.739 - Sta 0+02.184	0.035	0.050	0.035

9.4 Hydrology

Design flow rates were obtained from Project No. 106 Hydraulic Data Sheet dated September 1964. The peak discharge rate associated with the subject reach is 532 cfs.

9.5 Hydraulic Model

LACFCD as-built drawings and LIDAR topography were used to create the HEC-RAS model for this reach of Bull Creek. Project No. 106 was modeled with 33 cross sections ensure a gradually varied flow profile and to adequately represent the channel's geometry and structures along the study reach. HEC-RAS input and output files are provided in Appendix C.

9.6 Boundary Conditions

Critical depth was used as the upstream boundary conditions for the study model. Normal depth (Slope = 0.01942) was used at downstream study limits.

9.7 Results

A hydraulic model was developed for Project No. 106 under existing vegetation levels. Channel and water surface profiles for the Project No. 106 hydraulic model are presented in Appendix C. The model showed sufficient capacity along the reach. Therefore, an additional analysis was conducted assuming vegetation levels as recommended by BonTerra. The additional analysis conducted is discussed in more detail in the following section.

9.8 Additional Analysis

BonTerra Consulting provided a recommendation on potential vegetation growth for this reach which is summarized as follows:

Biological Recommendation
Remove non-native ash trees at top of both banks and replace with native trees. Sycamore trees are the preferred native trees to be planted per the maintenance plan that will be prepared for this task at a later date.

It was determined that the recommendation did not increase the amount of vegetation in the reach since non-native trees were to be replaced with native trees. Therefore, a new Manning's roughness coefficient was not determined for the recommendation. The hydraulic analysis results remain unchanged and indicated sufficient capacity in the channel.

PREPARED BY NTM	LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS
DATE 2/26/2013	**Figure 9-1**
SCALE 1" = 50'	**Project No. 106** **(SBC Reach No. 9)**

Reach 10 - Tributary to the Sepulveda Flood Control Basin Project No. 469

10.1 General Description

Project No. 469 conveys water from the north to the south and confluences directly with the Los Angeles River. The reach starts approximately 680 feet southwest of the intersection of Victory Boulevard and Woodley Avenue at its exit of a 15 feet by 8 feet reinforced concrete box structure. The maintenance reach ends approximately 4,200 feet downstream in the south at a berm structure just before the reach's confluence with the Los Angeles River. The study reach is surrounded by park areas as shown in Figure 10-1. This reach is fully cleared of vegetation annually.

10.2 Structures

The study reach of Project No. 469 is an earthen-bottom channel. Details of the structures within the study reach are summarized in Table 10-1.

Table 10-1. Structures along Project No. 469

Structure No.	River Station	Road Name	Type	Description
1	42+30	-	Channel Stabilizer 1	Concrete channel stabilizer on channel invert
2	36+63	-	Channel Stabilizer 2	Concrete channel stabilizer on channel invert

10.3 Manning's Roughness Coefficients

The Manning's roughness coefficient was determined based on field site visits of the channel reach. Observations were made regarding base material, obstructions, vegetation type and density, and other channel characteristics. Photographs were taken to document channel conditions and are provided in Appendix A. The Manning's roughness coefficients used are summarized in Table 10-2. Detailed computations in determining these values are found in Appendix B.

Table 10-2. Manning's Roughness 'n' Value along Project No. 469

Reach Location	Left Bank	Main Channel	Right Bank
(Upstream Limit) Sta 60+18.28 – Sta 52+48.75	0.015	0.015	0.015
Sta 52+48.75 – Sta 48+75.00	0.050	0.065	0.050
Sta 48+75.00 – Sta 42+70.00	0.030	0.025	0.040
Sta 42+70.00 – Sta 42+30.00	0.030	0.018	0.040
Sta 42+30.00 – Sta 39+30.00	0.030	0.035	0.040
Sta 39+30.00 – Sta 37+20.00	0.030	0.045	0.040
Sta 37+20.00 – Sta 36+63.00	0.030	0.035	0.040
Sta 36+63.00 – Sta 35+00.00	0.022	0.022	0.022
(Downstream Limit) Sta 35+00.00 – Sta 11+61.44	0.035	0.055	0.040

10.4 Hydrology

The flow rates were obtained from the Project 469 Hydrology Study dated July 2005.. The peak discharge rate associated with the subject reach is 2,762 cfs.

10.5 Hydraulic Model

LACFCD as-built drawings were used to create the HEC-RAS model for this reach of Project No. 469. The reach was modeled with 61 cross sections to ensure a gradually varied flow profile and to adequately represent the channel's geometry and structures along the study reach. HEC-RAS input and output files are provided in Appendix C.

10.6 Boundary Conditions

Normal depths were used as boundary conditions for the Caballero Project No. 469 model at the upstream (Slope = 0.0010) and downstream (Slope = 0.0026) study limits.

10.7 Results

A hydraulic model was developed for Project No. 469 under existing vegetation levels. The model showed insufficient capacity of the soft-bottom channel portion between Stations 35+00 to 14+22.75.

A second analysis was then performed assuming a "clear" channel (no vegetation) condition for the reach. A Manning's roughness coefficient value of 0.025 was used to represent the earth-bottom portions of the reach. The analysis for a "clear" channel showed no excess capacity. Since the study reach showed no excess capacity for an assumed "clear" channel condition, no other scenarios were explored. HEC-RAS input and output files for all analyses are provided in Appendix C.

LEGEND

HEC-RAS X-Sections

PREPARED BY L.T.	LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS
DATE Feb. 2013	**Figure 10-1**
SCALE 1" = 600'	**Project 469 (SBC Reach No. 10)**

Reach 12 - Haines Canyon Creek

12.1 General Description

Haines Canyon Creek originates in the Angeles National Forest and confluences with Tujunga Wash at its downstream end. It is a natural channel for approximately 2 miles upstream of the Haines Debris Basin. Downstream of the debris basin it transitions into 3.5 miles of storm drain and an engineered open channel. Downstream of the engineered channel portion, the canyon transitions back into a natural soft-bottom channel. The soft-bottom channel portion analyzed in this study is approximately 440 feet in length (maintenance reach) immediately downstream of the engineered channel. Haines Canyon Creek is tributary to the Tujunga Wash and the Los Angeles River.

The upper limit of the study reach is at about 650 feet downstream of the Wentworth Street. The downstream limit is about 1,350 feet downstream of the Wentworth Street. The study reach is located downstream of a residential area as shown in Figure 12-1.

12.2 Structures

The study reach of Haines Canyon Creek is a rectangular open channel that transitions into an earthen-bottom channel. Details of these structures are summarized in Table 12-1.

Table 12-1. Structures along Haines Canyon Creek

Structure No.	River Station	Road Name	Type	Description
1	7+15.248	-	Channel Transition	Transition from a rectangular open channel to a soft-bottom channel

12.3 Manning's Roughness Coefficients

The Manning's roughness coefficient was determined based on field site visits of the channel reach. Observations were made regarding base material, obstructions, vegetation type and density, and other channel characteristics. Photographs were taken to document channel conditions and are provided in Appendix A. The Manning's roughness coefficients used are summarized in Table 12-2. Detailed computations in determining these values are found in Appendix B.

Table 12-2. Manning's Roughness 'n' Value along Haines Canyon Creek

Reach Location	Left Bank	Main Channel	Right Bank
(Upstream Limit) Sta 8+91.725 - Sta 6+86.380	0.015	0.015	0.015
Sta 6+86.380 - Sta 5+74.096	0.035	0.030	0.027
Sta 5+74.096 - Sta 4+45.344	0.035	0.040	0.040
Sta 4+45.344 - Sta 2+39.964	0.035	0.045	0.045
(Downstream Limit) Sta 2+39.964 - Sta 1+88.032	0.035	0.050	0.045

12.4 Hydrology

Design flow rates were obtained from LACFCD "Haines Canyon Channel Debris Basin to Tujunga Wash Plan, Profile, & Sections" as-built drawing no. 62-D11.6 dated April 1936. The peak discharge rate associated with the subject reach is 12,050 cfs.

12.5 Hydraulic Model

LACFCD as-built drawings and LIDAR topography were used to create the HEC-RAS model for this reach of Haines Canyon Creek. The reach modeled with 16 cross sections to ensure a gradually varied flow profile and to adequately represent the channel's geometry and structures along the study reach. HEC-RAS input and output files are provided in Appendix C.

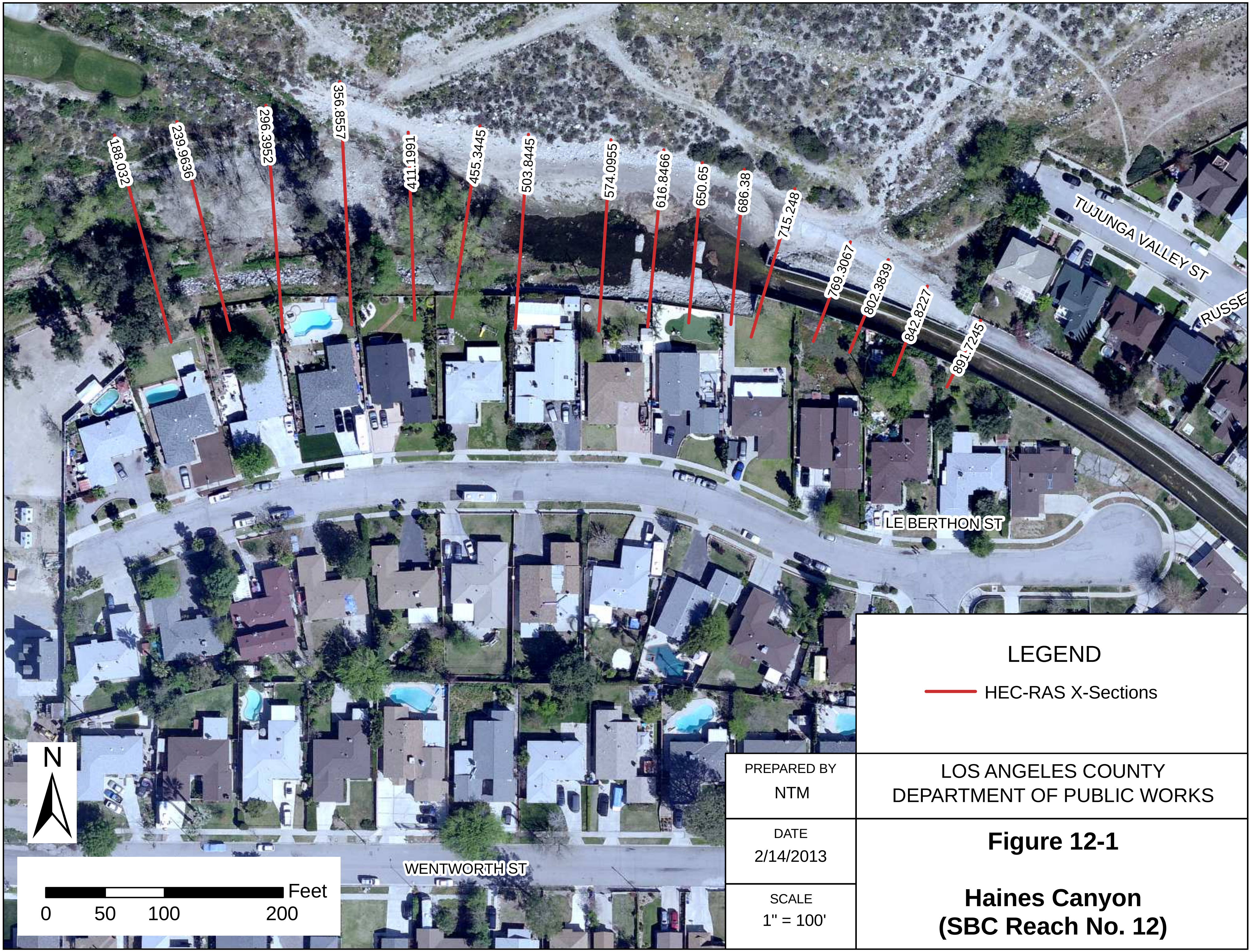
12.6 Boundary Conditions

Critical depth was used as the upstream boundary conditions for the study model. Normal depth (Slope = 0.01291) was used at downstream study limits.

12.7 Results

A hydraulic model was developed for Haines Canyon Creek under existing vegetation levels. The model showed insufficient capacity of the soft-bottom channel portion between Stations 8+91.725 and 1+88.032.

A second analysis was then performed assuming a "clear" channel (no vegetation) condition for the reach. A Manning's roughness coefficient value of 0.025 was used to represent the earth-bottom portions of the reach. The analysis for a "clear" channel showed no excess capacity at the above mentioned stations. Since the study reach showed no excess capacity for an assumed "clear" channel condition, no other scenarios were explored. HEC-RAS input and output files for all analyses are provided in Appendix C.



LEGEND

HEC-RAS X-Sections

PREPARED BY NTM	LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS
DATE 2/14/2013	**Figure 12-1**
SCALE 1" = 100'	**Haines Canyon (SBC Reach No. 12)**

Reach 13 - Tributary to Hansen Lake Project No. 5215, Unit 1

13.1 General Description

Project No. 5215, Unit 1 originates in the Angeles National Forest on Christy Avenue at Kurt Street and discharges to Hansen Dam at its downstream end where it confluences with Tujunga Wash. Project No. 5215, Unit 1 is approximately 0.5 mile in length of storm drain before transitioning into a soft-bottom channel. The soft-bottom channel portion analyzed in this study is approximately 540 feet in length (maintenance reach). Project No. 5215, Unit 1 is tributary to the Tujunga Wash and the Los Angeles River.

The upper limit of the study reach is at about 370 feet downstream of the Foothill Freeway. The downstream limit is about 1,070 feet downstream of the Foothill Freeway. The study reach is located downstream of a residential area as shown in Figure 13-1.

13.2 Structures

The study reach of Project No. 5215, Unit 1 is a reinforced concrete box that transitions into an earthen-bottom channel. Details of these structures are summarized in Table 13-1.

Table 13-1. Structures along Project No. 5215, Unit 1

Structure No.	River Station	Road Name	Type	Description
1	6+51.555	-	Channel Transition	Transition from a reinforced concrete box

13.3 Manning's Roughness Coefficients

The Manning's roughness coefficient was determined based on field site visits of the channel reach. Observations were made regarding base material, obstructions, vegetation type and density, and other channel characteristics. Photographs were taken to document channel conditions and are provided in Appendix A. The Manning's roughness coefficients used are summarized in Table 13-2. Detailed computations in determining these values are found in Appendix B.

Table 13-2. Manning's Roughness 'n' Value along Project No. 5215, Unit 1

Reach Location	Left Bank	Main Channel	Right Bank
(Upstream Limit) Sta 6+79.279 - Sta 6+00.530	0.015	0.015	0.015
Sta 6+00.530 - Sta 4+39.612	0.035	0.030	0.035
Sta 4+39.612 - Sta 1+98.674	0.050	0.030	0.050
(Downstream Limit) Sta 1+98.674 - Sta 0+73.747	0.050	0.032	0.050

13.4 Hydrology

Design flow rates were obtained from Project No. 5215 Pertinent Hydraulic Data Sheet dated November 25, 1966. The peak discharge rate associated with the subject reach is 750 cfs.

13.5 Hydraulic Model

LACFCD as-built drawings and LIDAR topography were used to create the HEC-RAS model for this reach of Project No. 5215, Unit 1. The reach was modeled with 10 cross sections to ensure a gradually varied flow profile and to adequately represent the channel's geometry and structures along the study reach. HEC-RAS input and output files are provided in Appendix C.

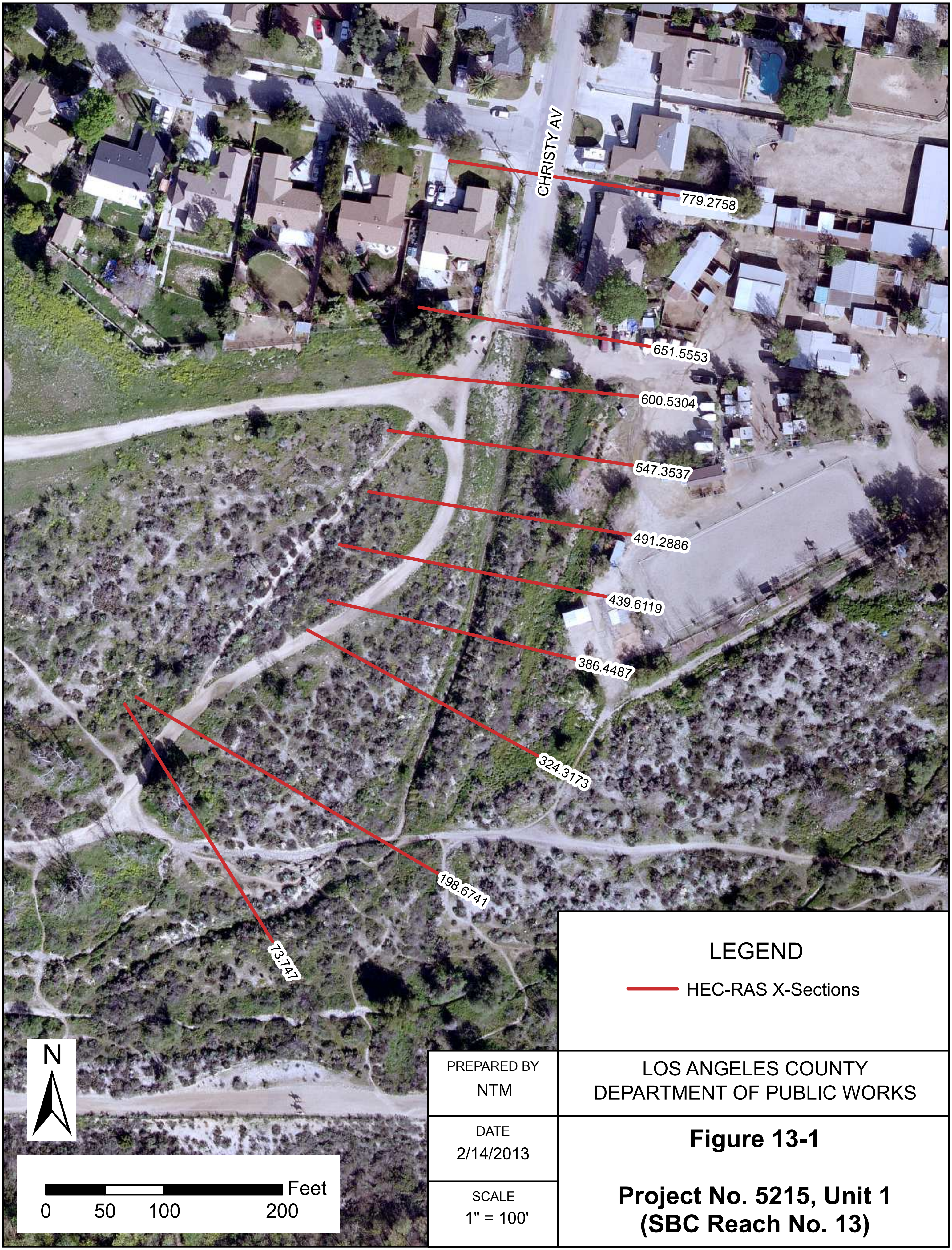
13.6 Boundary Conditions

Critical depth was used as the upstream and downstream boundary conditions for the study model.

13.7 Results

A hydraulic model was developed for Project No. 5215, Unit 1 under existing vegetation levels. The model showed insufficient capacity of the soft-bottom channel portion at Stations 4+39.612 to 3+86.449 and 1+98.674 to 0+73.747.

A second analysis was then performed assuming a "clear" channel (no vegetation) condition for the reach. A Manning's roughness coefficient value of 0.025 was used to represent the earth-bottom portions of the reach. The analysis for a "clear" channel showed no excess capacity at the above mentioned stations. Since the study reach showed no excess capacity for an assumed "clear" channel condition, no other scenarios were explored. HEC-RAS input and output files for all analyses are provided in Appendix C.



PREPARED BY NTM	LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS
DATE 2/14/2013	**Figure 13-1**
SCALE 1" = 100'	**Project No. 5215, Unit 1** **(SBC Reach No. 13)**

Reach 14 - May Canyon Creek

14.1 General Description

May Canyon Creek originates in the Angeles National Forest and confluences with Pacoima Wash at its downstream end. May Canyon Creek is approximately 1.75 miles in length of storm drain and engineered channel before transitioning into a soft-bottom channel. The soft-bottom channel portion analyzed in this study is approximately 690 feet in length (maintenance reach) immediately downstream of the engineered channel. May Canyon Creek is tributary to the Pacoima Wash and the Los Angeles River.

The upper limit of the study reach is at about 1,080 feet upstream of Harding Street. The downstream limit is about 150 feet upstream of Harding Street. The study reach is located downstream of a golf course as shown in Figure 14-1.

14.2 Structures

The study reach of May Canyon Creek is an engineered open channel that transitions into an earthen-bottom channel. There are two culverts within the study reach. Details of these structures are summarized in Table 14-1.

Table 14-1. Structures along May Canyon

Structure No.	River Station	Road Name	Type	Description
1	8+62.935	-	Culvert	Pedestrian overcrossing
2	5+24.404	-	Culvert	Access road

14.3 Manning's Roughness Coefficients

The Manning's roughness coefficient was determined based on field site visits of the channel reach. Observations were made regarding base material, obstructions, vegetation type and density, and other channel characteristics. Photographs were taken to document channel conditions and are provided in Appendix A. The Manning's Roughness coefficients used are summarized in Table 14-2. Detailed computations in determining these values are found in Appendix B.

Table 14-2. Manning's Roughness 'n' Value along May Canyon

Reach Location	Left Bank	Main Channel	Right Bank
(Upstream Limit) Sta 10+05.99 - Sta 8+62.935	0.030	0.018	0.030
Sta 8+62.935 - Sta 8+01.758	0.024	0.024	0.024
Sta 8+01.758 - Sta 5+24.404	0.055	0.030	0.055
Sta 5+24.404 - Sta 4+72.350	0.015	0.015	0.015
Sta 4+72.350 – Sta 4+53.220	0.030	0.030	0.030
(Downstream Limit) Sta 4+53.220 - Sta 0+68.929	0.050	0.050	0.050

14.4 Hydrology

Design flow rates were obtained from LACFCD "May Canyon Channel Debris Basins to Pacoima Wash Concrete Conduit General Plan" as-built drawing no. 48-D9.1 dated April 1952. The peak discharge rate associated with the subject reach is 2,420 cfs.

14.5 Hydraulic Model

LACFCD as-built drawings and LIDAR topography were used to create the HEC-RAS model for this reach of May Canyon Creek. The reach was modeled with 28 cross sections to ensure a gradually varied flow profile and to adequately represent the channel's geometry and structures along the study reach. HEC-RAS input and output files are provided in Appendix C.

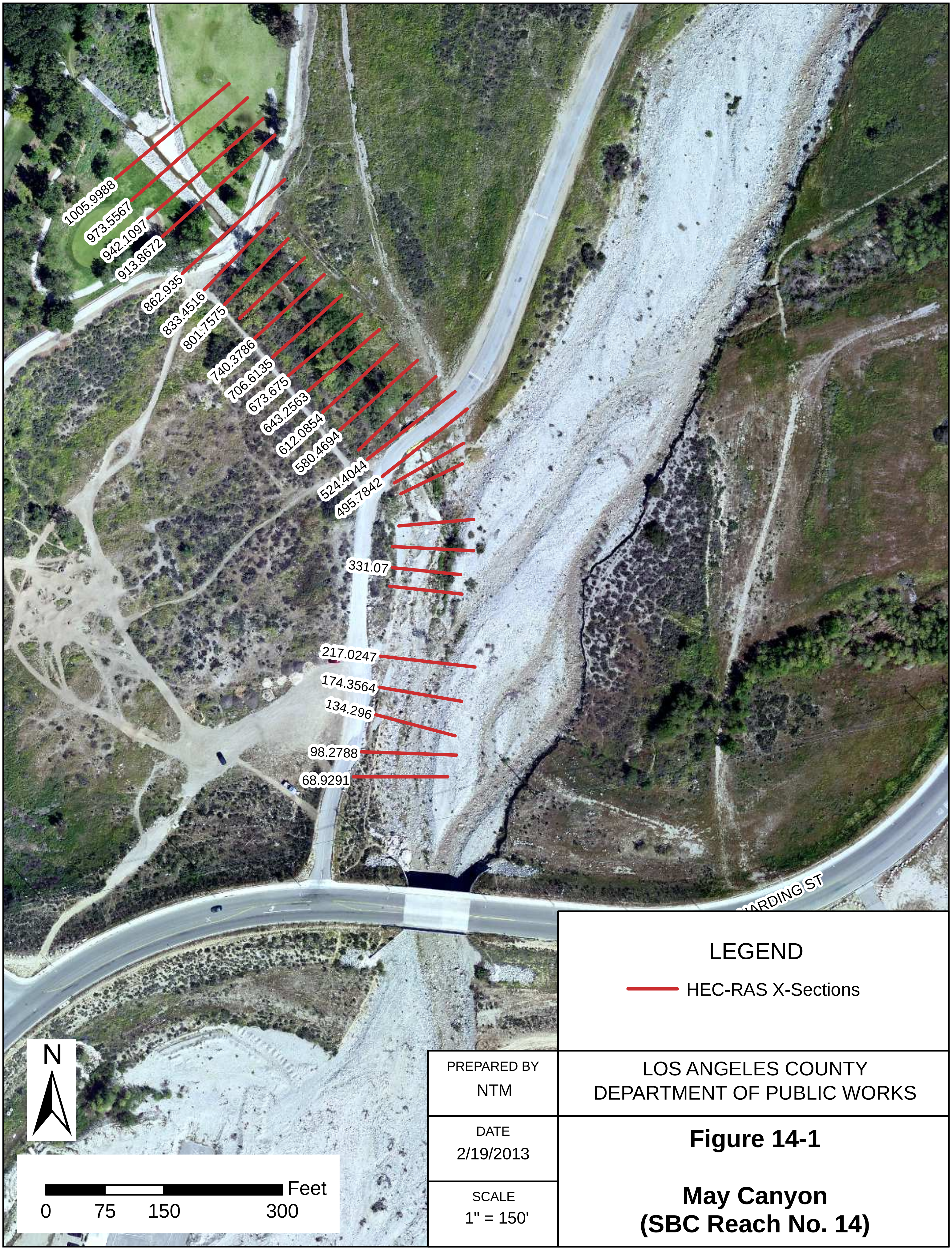
14.6 Boundary Conditions

Normal Depth was used as the upstream (Slope = 0.00495) and downstream (Slope = 0.02808) boundary conditions for the study model.

14.7 Results

A hydraulic model was developed for May Canyon Creek under existing vegetation levels. The model showed insufficient capacity of the soft-bottom channel portion at Stations 10+05.999 to 8+33.452, 6+43.256 to 4+95.784, and 3+96.251 to 0+68.929.

A second analysis was then performed assuming a "clear" channel (no vegetation) condition for the reach. Manning's roughness coefficient values of 0.025 to 0.035 were used to represent the earth-bottom portions of the reach. The analysis for a "clear" channel showed no excess capacity at the above mentioned stations. Since the study reach showed no excess capacity for an assumed "clear" channel condition, no other scenarios were explored. HEC-RAS input and output files for all analyses are provided in Appendix C.



PREPARED BY NTM	LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS
DATE 2/19/2013	**Figure 14-1**
SCALE 1" = 150'	**May Canyon (SBC Reach No. 14)**

Reach 15 - Pacoima Wash

15.1 General Description

Pacoima Wash originates at Pacoima Dam as a natural stream traveling southerly along Pacoima Canyon Road before entering into Lopez Dam. Downstream of Lopez Dam, Pacoima Wash becomes a concrete trapezoidal channel traveling in a southerly direction through the City of San Fernando. At Interstate 5, near the Pacoima Wash Spreading Grounds, the channel splits off to the Pacoima Diversion Channel.

The upstream limit of the study reach is Parthenia Street and the downstream limit is the transition structure near Marson Street. The study reach has a total length of 0.9 miles. It is located in an area consisting of mainly residential with some commercial, educational, and park areas as shown in Figure 15-1.

15.2 Structures

The study reach of Pacoima Wash consists of an earthen-bottom channel with concrete side slopes. The channel transitions into a fully concrete-lined channel near Marson Street. Two Bridges, several channel stabilizers, and maintenance access roads are also present in this reach. Details of these structures are summarized in Table 15-1.

Table 15-1. Structures along Pacoima Wash

Structure No.	River Station	Road Name	Type	Description
1	140+06.20	Chase Street	Pedestrian Bridge	Pedestrian overcrossing with one pier
2	139+50	-	Channel Stabilizer 1	Buried concrete stabilizer
3	136+00	-	Channel Stabilizer 2	Buried concrete stabilizer
4	132+34.01	-	Channel Stabilizer 3	Buried concrete stabilizer
5	128+29.31	Roscoe Blvd	Vehicular Bridge	Bridge with two piers
6	121+90	-	Channel Stabilizer 4	Buried concrete stabilizer
7	114+50	-	Channel Stabilizer 5	Buried concrete stabilizer
8	109+30	-	Channel Stabilizer 6	Buried concrete stabilizer

15.3 Manning's Roughness Coefficients

The Manning's roughness coefficient was determined based on field site visits of the channel reach. Observations were made regarding base material, obstructions, vegetation type and density, and other channel characteristics. Photographs were taken to document channel conditions and are provided in Appendix A. The side slopes consisted of concrete and were assigned a roughness coefficient of 0.013. The earthen-bottom portion of the channel was assigned a roughness coefficient based on the observations made. The Manning's roughness coefficients used in the model are summarized in Table 15-2. Detailed computations can be found in Appendix B.

Table 15-2. Manning's Roughness 'n' Value along Pacoima Wash

Reach Location	Left Bank	Main Channel	Right Bank
(Upstream Limit) Sta 150+87.04 – Sta 105+55.01	0.013	0.037	0.013
(Downstream Limit) Sta 105+55.01 – Sta 103+25.01	0.013	0.047	0.013

15.4 Hydrology

Design flow rates were obtained from LACFCD "Pacoima Wash Parthenia St. to Raymer St." as-built drawing no. 21-D43.1 dated June 1956. The peak discharge rate associated with this reach of Pacoima Wash is 4,460 cfs.

15.5 Hydraulic Model

LACFCD as-built drawings were used to create the HEC-RAS model for this reach of Pacoima Wash. The reach was modeled with 73 cross sections to ensure a gradually varied flow profile and to adequately represent the channel's geometry and structures along the study reach. HEC-RAS input and output files are provided in Appendix C.

15.6 Boundary Conditions

Normal depth was initially used as the upstream boundary condition and the design water surface elevation from the as-built plans was used as the downstream boundary condition for the Pacoima Wash model. The slope used in computing the upstream normal depth corresponded to the channel invert slope as shown in the as-built plans. A sensitivity analysis using different boundary conditions showed that only the downstream boundary condition had a noticeable effect on model results. However, it was determined that the water surface elevation shown on the as-built plan is best available information and the appropriate downstream boundary condition.

15.7 Results

A hydraulic model was developed for Pacoima Wash under existing vegetation levels. The model showed insufficient capacity insufficient capacity from Stations 141+00 to 140+20.20 and 129+50 to 128+69.81.

A second analysis was then performed assuming a "clear" channel (no vegetation) condition for the reach. A Manning's roughness coefficient value of 0.022 was used to represent the earth-bottom portions of the reach. The analysis for a "clear" channel showed no excess capacity at the above mentioned stations. Since the study reach showed no excess capacity for an assumed "clear" channel condition, no other scenarios were explored. HEC-RAS input and output files for all analyses are provided in Appendix C.

PREPARED BY
M.A.

DATE
Feb. 2013

SCALE
1" = 300'

LOS ANGELES COUNTY
DEPARTMENT OF PUBLIC WORKS

Figure 15-1

Pacoima Wash (SBC Reach No. 15)

Reach 16 - Verdugo Wash-Las Barras Canyon channel inlet

16.1 General Description

The Las Barras Canyon Inlet is a tributary to the Las Barras Channel. Approximately 50 feet downstream of the inlet junction, Las Barras Channel confluences with Verdugo Wash, which is a tributary to the Los Angeles River. Las Barras Inlet is located in La Crescenta immediately north of the 210 Foothill Freeway.

The upstream limit of the study reach is about 240 feet upstream of Las Barras Channel and the downstream limit of is the inlet structure transition to Las Barras Channel. The study reach is located near residential and open space areas as shown in Figure 16-1.

16.2 Structures

This study reach of Las Barras Inlet consists of an earthen-bottom channel that transitions into a fully concrete-lined channel. The only structure for this reach is the inlet junction structure at the downstream end into Las Barras Channel.

16.3 Manning's Roughness Coefficients

The Manning's roughness coefficient was determined based on field site visits of the channel reach. Observations were made regarding base material, obstructions, vegetation type and density, and other channel characteristics. Photographs were taken to document channel conditions and are provided in Appendix A. The Manning's roughness coefficients used are summarized in Table 16-1. Detailed computations in determining these values are found in Appendix B.

Table 16-1. Manning's Roughness 'n' Value along Las Barras Canyon Inlet

Reach Location	Left Bank	Main Channel	Right Bank
(Upstream Limit) Sta 2+32.648 - Sta 1+32.392	0.060	0.042	0.060
Sta 1+32.392 - Sta 45.068	0.033	0.038	0.033
(Downstream Limit) Sta 0+45.068 – Sta 0+5.1204	0.017	0.017	0.017

16.4 Hydrology

Design flow rates were obtained from the Las Barras Canyon Capital Flood Q's report dated June 1968. The peak discharge rate associated with the subject reach is 160 cfs.

16.5 Hydraulic Model

LACFCD as-built drawings and LIDAR topography were used to create the HEC-RAS model for this reach of Las Barras Canyon. The reach was modeled with nine cross sections to ensure a gradually varied flow profile and to adequately represent the channel's geometry and structures along the study reach. HEC-RAS input and output files are provided in Appendix C.

16.6 Boundary Conditions

Normal depth (Slope = 0.0505) was used as the upstream boundary conditions for the study model. Normal depth (Slope = 0.2070) was used at downstream study limits.

16.7 Results

A hydraulic model was developed for the Las Barras Canyon reach under existing vegetation levels. Channel and water surface profiles for the Las Barras Canyon hydraulic model are presented in Appendix C. The model showed insufficient capacity.

A second analysis was then performed assuming a "clear" channel (no vegetation) condition for the reach. A combination of Manning's roughness coefficient values of 0.025 and 0.030 were used to represent the earth-bottom portions of the reach. The analysis for a "clear" channel showed no excess capacity. Since the study reach still showed no excess capacity for an assumed "clear" channel condition, no other scenarios were explored. HEC-RAS input and output files for all analyses are provided in Appendix C.

LEGEND

HEC-RAS X-Sections

PREPARED BY
ER

LOS ANGELES COUNTY
DEPARTMENT OF PUBLIC WORKS

DATE
Aug. 2012

Figure 16-1

SCALE
1" = 60'

Las Barras Inlet
(SBC Reach No. 16)

Reach 18 - Engleheard Channel, tributary to Verdugo Wash

18.1 General Description

Engleheard Channel is a tributary to Verdugo Wash, which is a tributary to the Los Angeles River. Engleheard Channel is located in the City of Glendale.

The upstream limit of the study reach is about 900 feet upstream of Verdugo Wash and the downstream limit is the Verdugo Wash confluence. The study reach is located near mainly residential areas as shown in Figure 18-1.

18.2 Structures

This study reach of Engleheard Channel is an earthen-bottom channel that transitions into a fully concrete-lined channel. Details of these structures are summarized in Table 18-1.

Table 18-1. Structures along Engleheard Channel

Structure No.	River Station	Road Name	Type	Description
1	7+58	Private Driveway	Culvert	Culvert for private driveway
2	2+37.26	-	Transition	Transition structure at the confluence with Verdugo Wash

18.3 Manning's Roughness Coefficients

The Manning's roughness coefficient was determined based on field site visits of the channel reach. Observations were made regarding base material, obstructions, vegetation type and density, and other channel characteristics. Photographs were taken to document channel conditions and are provided in Appendix A. The Manning's roughness coefficients used are summarized in Table 18-2. Detailed computations in determining these values are found in Appendix B.

Table 18-2. Manning's Roughness 'n' Value along Engleheard Channel

Reach Location	Left Bank	Main Channel	Right Bank
(Upstream Limit) Sta 9+00.408 - Sta 8+50.774	0.035	0.035	0.035
Sta 8+50.774 - Sta 7+43.277	0.035	0.035	0.040
Sta 7+43.277 - Sta 4+60.709	0.040	0.029	0.045
Sta 4+60.709 - Sta 3+60.741	0.045	0.031	0.055
Sta 3+60.741 - Sta 3+09.860	0.030	0.031	0.035
Sta 3+09.860 - Sta 2+37.261	0.040	0.033	0.035
(Downstream Limit) Sta 2+37.261 – Sta 0+71.922	0.015	0.015	0.015

18.4 Hydrology

Design flow rates were obtained from the LACFCD "Engleheard Canyon & Engleheard South Fork Design Q's" study dated September 1971. The peak discharge rate associated with the subject reach is 3,010 cfs.

18.5 Hydraulic Model

LIDAR topography was used to create the HEC-RAS model for this reach of Engleheard Canyon. The reach was modeled with 26 cross sections to ensure a gradually varied flow profile and to adequately represent the channel's geometry and structures along the study reach. HEC-RAS input and output files are provided in Appendix C.

18.6 Boundary Conditions

Normal depth (Slope = 0.0079) was used as the upstream boundary conditions for the study model. Normal depth (Slope = 0.0203) was used at downstream study limits.

18.7 Results

A hydraulic model was developed for Engleheard Canyon under existing vegetation levels. The model showed insufficient capacity of the soft-bottom channel portion between Stations 7+72.725 and 7+58.

A second analysis was then performed assuming a "clear" channel (no vegetation) condition for the reach. A Manning's roughness coefficient value of 0.025 for banks and 0.027/0.030 for the channel invert was used to represent the reach. The analysis for a "clear" channel showed no excess capacity at the above mentioned stations. Since the study reach showed no excess capacity for an assumed "clear" channel condition, no other scenarios were explored. HEC-RAS input and output files for all analyses are provided in Appendix C.

PREPARED BY ER	LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS
DATE Aug. 2012	**Figure 18-1**
SCALE 1" = 100'	**Engleheard Channel (SBC Reach No. 18)**

Reach 19 - Pickens Canyon, tributary to Verdugo Wash

19.1 General Description

Pickens Canyon originates in the Angeles National Forest and discharges into the Verdugo Wash at its downstream end. It is an engineered storm drain for approximately 0.4 miles and then it transitions into natural soft-bottom channel. The soft-bottom channel portion analyzed in this study is approximately 2,400 feet in length (maintenance reach) immediately downstream of the engineered channel. Pickens Canyon is tributary to the Verdugo Wash.

The upper limit of the study reach is at about 530 feet downstream of Chapman Road. The downstream limit is about 2,950 feet downstream of Chapman Road. The study reach is located downstream of a residential area as shown in Figure 19-1.

19.2 Structures

The study reach of Pickens Canyon is an earthen-bottom channel. Details of structures within the reach are summarized in Table 19-1.

Table 19-1. Structures along Pickens Canyon

Structure No.	River Station	Road Name	Type	Description
1	7+43.165	-	Bridge	Pedestrian overcrossing

19.3 Manning's Roughness Coefficients

The Manning's roughness coefficient was determined based on field site visits of the channel reach. Observations were made regarding base material, obstructions, vegetation type and density, and other channel characteristics. Photographs were taken to document channel conditions and are provided in Appendix A. The Manning's roughness coefficients used are summarized in Table 19-2. Detailed computations in determining these values are found in Appendix B.

Table 19-2. Manning's Roughness 'n' Value along Pickens Canyon

Reach Location	Left Bank	Main Channel	Right Bank
(Upstream Limit) Sta 24+42.12 - Sta 20+04.5	0.017	0.032	0.040
Sta 20+04.5 - Sta 18+78.07	0.017	0.032	0.060
Sta 18+78.07 - Sta 13+12.07	0.017	0.032	0.062
Sta 13+12.07 - Sta 12+50.11	0.017	0.032	0.027
Sta 12+50.11 - Sta 11+43.84	0.017	0.032	0.044
Sta 11+43.84 - Sta 9+13.85	0.017	0.032	0.040
Sta 9+13.85 - Sta 1+30.225	0.017	0.032	0.045
(Downstream Limit) Sta 1+30.225 - Sta 0+33.119	0.017	0.026	0.026

19.4 Hydrology

The Capital Flood was obtained from LACDPW Water Resources Division's "Pickens Canyon Debris Basin Hydrology Study" dated October 1999. The peak discharge rate associated with the subject reach is 5,970 cfs.

19.5 Hydraulic Model

LACFCD as-built drawings and LIDAR topography were used to create the HEC-RAS model for this reach of Pickens Canyon. The reach was modeled with 54 cross sections used to ensure a gradually varied flow profile and to adequately represent the channel's geometry and structures along the study reach. HEC-RAS input and output files are provided in Appendix C.

19.6 Boundary Conditions

Normal depth (Slope = 0.0396) was used as the upstream boundary conditions for the study model. Normal depth (Slope = 0.0458) was used at downstream study limits.

19.7 Results

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

19.8 Additional Analysis

BonTerra Consulting provided a recommendation on potential vegetation growth for this reach. The recommendation is summarized as follows:

Biological Recommendation
Except for on the crib structures, allow native shrubs to grow on the invert of the channel reach from the upstream end to the pedestrian bridge at Mountain Ave. Selectively protect native shrubs by removing non-native vegetation. Native trees will not be allowed to grow in the invert.

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

In evaluating the recommendation, the Manning's roughness coefficient was modified for the entire study reach. Detailed computations in determining these values based on 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 Bull Creek are presented in Appendix C.

PREPARED BY	LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS
NTM	
DATE 2/26/2013	**Figure 19-1**
SCALE 1" = 200'	**Pickens Canyon (SBC Reach No. 19)**

Reach 20 & 21 - Webber Channel, tributary to Halls Canyon Channel and (main channel inlet at bridge), tributary to Halls Canyon Channel

20.1 General Description

Webber Channel Reach Nos. 20 and 21 are approximately 250 feet apart. Due to their close proximity to each other, one hydraulic model was created to include both reaches. They are located approximately 500 feet northeast of Webber Channel's intersection with Los Amigos Street, which is near the intersection of Los Amigos Street and Castle Road. The Webber Channel flows from the northeast to the southwest and is tributary to Halls Canyon Channel. Halls Canyon Channel is tributary to Verdugo Wash which is tributary to the Los Angeles River.

The maintenance limit of Reach No. 20 starts approximately 860 feet upstream of Webber Channel's intersection with Los Amigos Street and runs downstream 115 feet. Reach No. 21 starts 250 feet downstream of this and has a length of 25 feet.

The study limit starts approximately 150 feet upstream of Reach No. 20 and extends over 50 feet downstream of Reach No. 21. The study reach is surrounded by mostly undeveloped land with some residential property as shown in Figure 20-1.

20.2 Structures

The study reach is comprised entirely of earthen-bottom channel, except for a portion under the bridge where it is concrete. Details of the structures within the study reach are summarized in Table 20-1.

Table 20-1. Structures along Webber Channel

Structure No.	River Station	Road Name	Type	Description
1	3+97.01	Private Driveway	Bridge	Channel is concrete under the bridge
2	0+51.22	-	Transition	Transition from soft-bottom channel to concrete channel

20.3 Manning's Roughness Coefficients

The Manning's roughness coefficient was determined based on field site visits of the channel reach. Observations were made regarding base material, obstructions, vegetation type and density, and other channel characteristics. Photographs were taken to document channel conditions and are provided in Appendix A. The Manning's roughness coefficients used are summarized in Table 20-2. Detailed computations in determining these values are found in Appendix B.

Table 20-2. Manning's Roughness 'n' Value along Webber Channel

Reach Location	Left Bank	Main Channel	Right Bank
(Upstream Limit) Sta 6+46.82 – Sta 4+24.97	0.027	0.027	0.030
Sta 4+24.97 – Sta 3+76.89	0.015	0.015	0.015
Sta 3+76.89 – Sta 0+51.22	0.030	0.027	0.026
(Downstream Limit) Sta 0+51.22 – Sta 0+0.50	0.015	0.015	0.015

20.4 Hydrology

Design flow rates were obtained from LACFCD "Webber Channel Plans" as-built drawing no. 75B-D6 dated April 1983. The peak discharge rate associated with the two reaches is 590 cfs.

20.5 Hydraulic Model

Recent topographic surveys were used to create the HEC-RAS model for the two reaches of Webber Channel. The reaches were modeled with 30 cross sections to ensure a gradually varied flow profile and to adequately represent the channel's geometry and structures along the study reach. HEC-RAS input and output files are provided in Appendix C.

20.6 Boundary Conditions

Normal depth (Slope = 0.0099) was used as the upstream boundary conditions for the study model. Normal depth (Slope = 0.0058) was used at downstream study limits.

20.7 Results

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

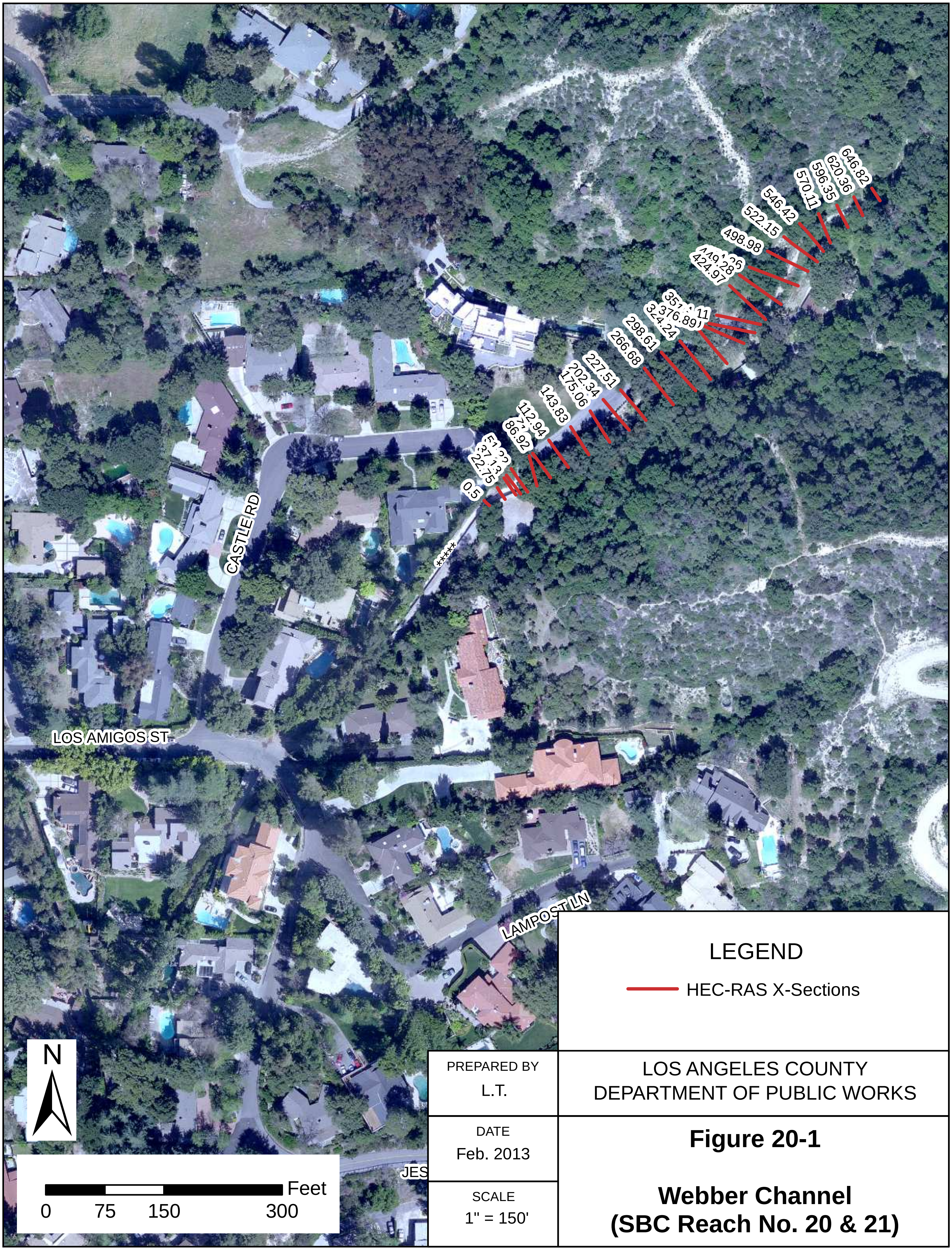
20.8 Additional Analysis

BonTerra Consulting provided recommendations on potential vegetation growth for each reach. The BonTerra recommendations are summarized as follows:

Webber Channel Reach No. 20 Biological Recommendation
Allow native herbaceous and shrub species to grow on right bank looking downstream. Selectively remove non-native species from right bank. Do not allow oaks or other additional trees to grow on the banks.

Webber Channel Reach No. 21 Biological Recommendation
Allow native herbaceous and shrub species to grow on left bank looking downstream underneath the coast live oak woodland. Selectively remove non-native ground cover species (e.g. ivy) from left bank. Do not allow additional oaks or other trees to grow on the banks.

Both recommendations from the biologist resulted in no change in the Manning's roughness coefficients compared to the existing conditions that were modeled. This was due to the native species having similar roughness coefficients to the non-native species. Detailed computations in determining these values are found in Appendix B. The revised hydraulic models based on the biologist's recommendations showed sufficient capacity along the reach. HEC-RAS hydraulic models based on both recommendations for Webber Channel are presented in Appendix C.



LEGEND

HEC-RAS X-Sections

PREPARED BY L.T.	LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS
DATE Feb. 2013	**Figure 20-1**
SCALE 1" = 150'	**Webber Channel (SBC Reach No. 20 & 21)**

Reach 22 - Halls Canyon Channel

22.1 General Description

Halls Canyon Channel is located in the City of La Cañada Flintridge. Halls Canyon Channel originates in the Angeles National Forest before its confluence with Snover Canyon and Webber Canyon Channels. The channel travels southwest through La Cañada Flintridge, the community of La Crescenta, and the City of Glendale before discharging into Verdugo Wash. Verdugo Wash is tributary to the Los Angeles River.

The upstream maintenance limit of the Halls Canyon Channel reach starts approximately 1,370 feet upstream of Jessen Drive and extends to Halls Canyon Debris Basin. The study reach is surrounded by undeveloped and residential areas as shown in Figure 22-1.

22.2 Structures

The study reach is comprised of an earthen-bottom channel with the exception of several concrete drop structures along the channel reach. Details of the structures within the study reach are summarized in Table 22-1.

Table 22-1. Structures along Halls Canyon Channel

Structure No.	River Station	Road Name	Type	Description
1	25+38	-	Drop Structure	Concrete Crib Structure
2	23+06	-	Drop Structure	Concrete Crib Structure
3	20+22	-	Drop Structure	Concrete Crib Structure
4	17+31	-	Drop Structure	Concrete Crib Structure
5	11+93	-	Drop Structure	Concrete Crib Structure
6	10+69.78	Jessen Drive	Bridge	No Bridge Piers
7	8+62	-	Drop Structure	Concrete Crib Structure
8	5+57	-	Drop Structure	Concrete Crib Structure
9	2+86	-	Drop Structure	Concrete Crib Structure

22.3 Manning's Roughness Coefficients

The Manning's roughness coefficient was determined based on field site visits of the channel reach. Observations were made regarding base material, obstructions, vegetation type and density, and other channel characteristics. Photographs were taken to document channel conditions and are provided in Appendix A. The Manning's roughness coefficients used are summarized in Table 22-2. Detailed computations in determining these values are found in Appendix B.

Table 22-2. Manning's Roughness 'n' Value along Halls Canyon Channel

Reach Location	Left Bank	Main Channel	Right Bank
(Upstream Limit) Sta 27+49.92 - Sta 25+45.30	0.05	0.03	0.04
Sta 25+45.30 - Sta 25+29.49	0.015	0.015	0.015
Sta 25+29.49 - Sta 23+11.28	0.04	0.031	0.035
Sta 23+11.28 - Sta 22+97.65	0.015	0.015	0.015
Sta 22+97.65 - Sta 20+27.34	0.04	0.03	0.032
Sta 20+27.34 - Sta 20+14.53	0.015	0.015	0.015
Sta 20+14.53 - Sta 17+39.40	0.05	0.03	0.028
Sta 17+39.40 - Sta 17+24.28	0.015	0.015	0.015
Sta 17+24.28 - Sta 11+96.42	0.05	0.03	0.027
Sta 11+96.42 - Sta 11+87.16	0.015	0.015	0.015
Sta 11+87.16 - Sta 10+89.98	0.050	0.03	0.027
Sta 10+89.98 - Sta 10+49.04	0.015	0.031	0.015
Sta 10+49.04 - Sta 8+65.94	0.027	0.031	0.050
Sta 8+65.94 - Sta 8+56.88	0.015	0.015	0.015
Sta 8+56.88 - Sta 5+64.51	0.060	0.031	0.04
Sta 5+64.51 - Sta 5+49.13	0.015	0.015	0.015
Sta 5+49.13 - Sta 3+56.13	0.015	0.035	0.015
Sta 3+56.13 - Sta 2+89.79	0.015	0.035	0.045
Sta 2+89.79 - Sta 2+81.77	0.015	0.015	0.015
(Downstream Limit) Sta 2+81.77 – Sta 0+0.71	0.050	0.031	0.045

Note: Reach locations near drop structures modeled with n = 0.15

22.4 Hydrology

Design flow rates were obtained from the Halls Debris Basin Hydrology dated March 1996. The peak discharge rate associated with the subject reach is 1,730 cfs.

22.5 Hydraulic Model

LIDAR topography was used to create the HEC-RAS model for this reach of Halls Canyon Channel. The reach was modeled with 148 cross sections to ensure a gradually varied flow profile and to adequately represent the channel's geometry and structures along the study reach. HEC-RAS input and output files are provided in Appendix C.

22.6 Boundary Conditions

Normal depth (Slope = 0.0503) was used as the upstream boundary conditions for the study model. Normal depth (Slope = 0.0398) was used at downstream study limits.

22.7 Results

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

22.8 Additional Analysis

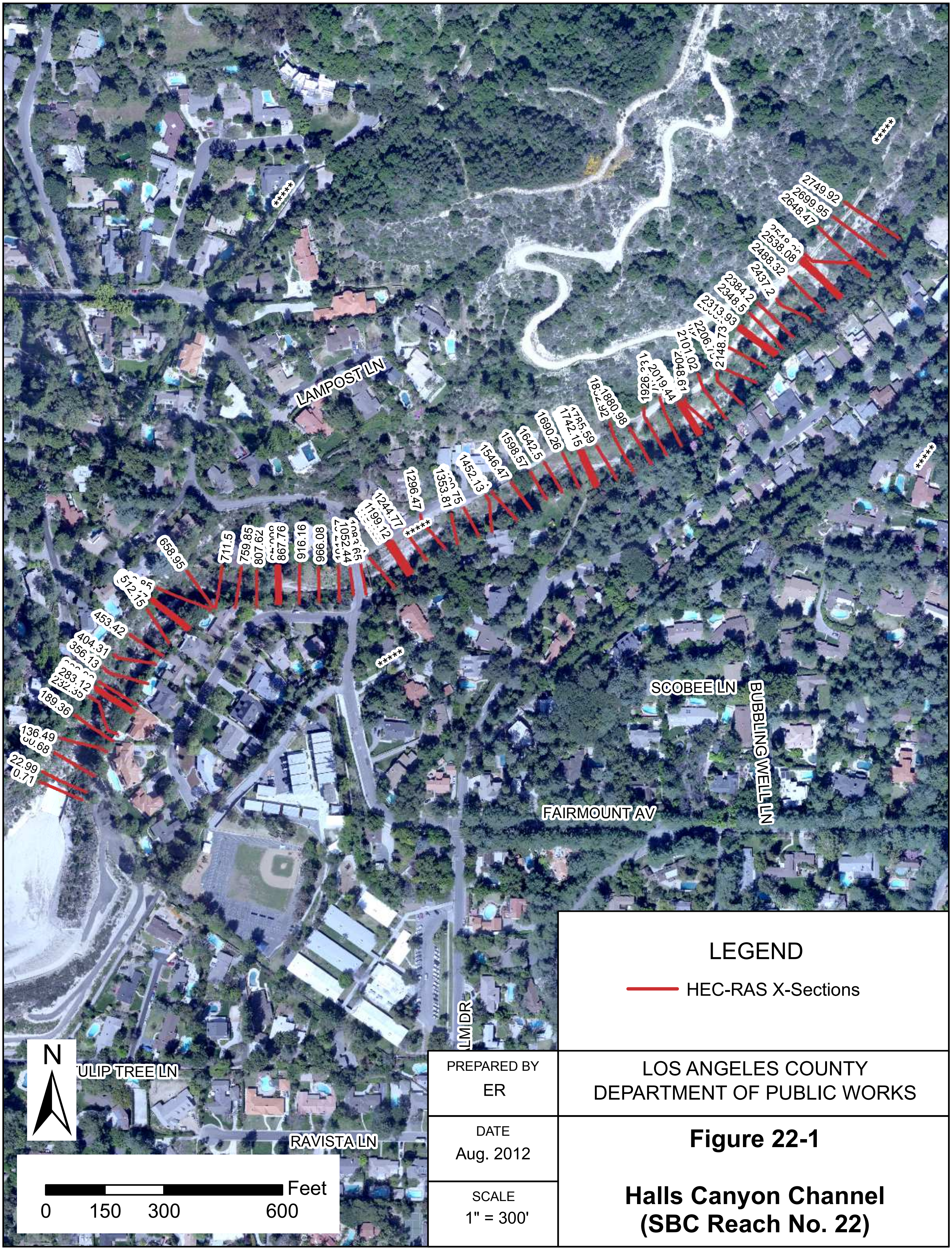
BonTerra Consulting provided a recommendation on potential vegetation growth for this reach, which is summarized as follows:

Biological Recommendation
Except for on the crib structures, allow native shrubs (but not trees) to grow on the invert of the entire channel reach. Selectively protect native shrubs by removing non-native vegetation. Native trees will not be allowed to mature on the channel invert.

Since the recommendation would have a direct impact on the amount and type of vegetation in the reach, a new Manning's roughness coefficient was determined for it and the hydraulic models were updated.

The recommendation resulted in a 0.025 increase in the Manning's roughness coefficients on the channel invert to account for the additional expected vegetation. This increase in roughness coefficients resulted in higher maximum water surface depths of about 3 feet compared to the existing conditions model. For this recommendation, the model showed sufficient capacity along the reach.

Detailed computations in determining the Manning's roughness values based on the biologist's recommendations are found in Appendix B. Also, HEC-RAS hydraulic models for Halls Canyon Channel are presented in Appendix C.



PREPARED BY ER	LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS
DATE Aug. 2012	**Figure 22-1**
SCALE 1" = 300'	**Halls Canyon Channel (SBC Reach No. 22)**

Reach 24 - Compton Creek

24.1 General Description

Compton Creek is tributary to the Los Angeles River. The reach starts approximately at the its intersection to Alameda Street, just south of the Gardena (91) Freeway, and ends at the channel's transition to a concrete-lined channel, approximately 11,000 feet downstream just before the channel's confluence with the Los Angeles River.

The study limits start approximately 1,300 feet upstream of the maintenance reach and ends approximately 100 feet downstream of maintenance reach limit into the concrete lined portion of the channel before its confluence with the Los Angeles River. The study reach is surrounded by mixed land use consisting of residential and industrial properties as shown in Figure 24-1.

24.2 Structures

This study reach of Compton Creek is an earthen-bottom channel that transitions into a fully concrete-lined channel. Details of the structures within the study reach are summarized in Table 24-1.

Table 24-1. Structures along Compton Creek

Structure No.	River Station	Road Name	Type	Description
1	207+63.17	Artesia Blvd	Bridge	2 piers
2	204+01.84	Gardena (91) Fwy	Bridge	2 piers
3	200+16.25	Alameda St & Southern Pacific Rail Road	Bridge	3 piers
4	154+70.57	Santa Fe Ave	Bridge	3 piers
5	100+49.32	Del Amo Blvd	Bridge	3 piers
6	85+94.90	Long Beach Fwy	Bridge	2 piers
7	80+30	-	Transition	Transition from soft-bottom channel to concrete channel

24.3 Manning's Roughness Coefficients

The Manning's roughness coefficient in the study model was set to 0.025, representing a "clear" channel (no vegetation) condition. Photographs taken to document typical vegetation within the channel reach are provided in Appendix A. The Manning's Roughness coefficients used are summarized in Table 24-2. Detailed computations for determining these values are provided in Appendix B.

Table 24-2. Manning's Roughness 'n' Value along Compton Creek

Reach Location	Left Bank	Main Channel	Right Bank
(Upstream Limit) Sta 212+24.92 – Sta 80+30	0.025	0.025	0.025
(Downstream Limit) Sta 80+30 – Sta 79+27	0.018	0.018	0.018

24.4 Hydrology

Design flow rates were obtained from the United States Army Corps of Engineers' (USACE) 1991 "Los Angeles County Drainage Area Final Feasibility Interim Report, Part 1 Hydrology Technical Report, Base Conditions". The peak discharge rate associated with the study reach is 16,500 cfs.

24.5 Hydraulic Model

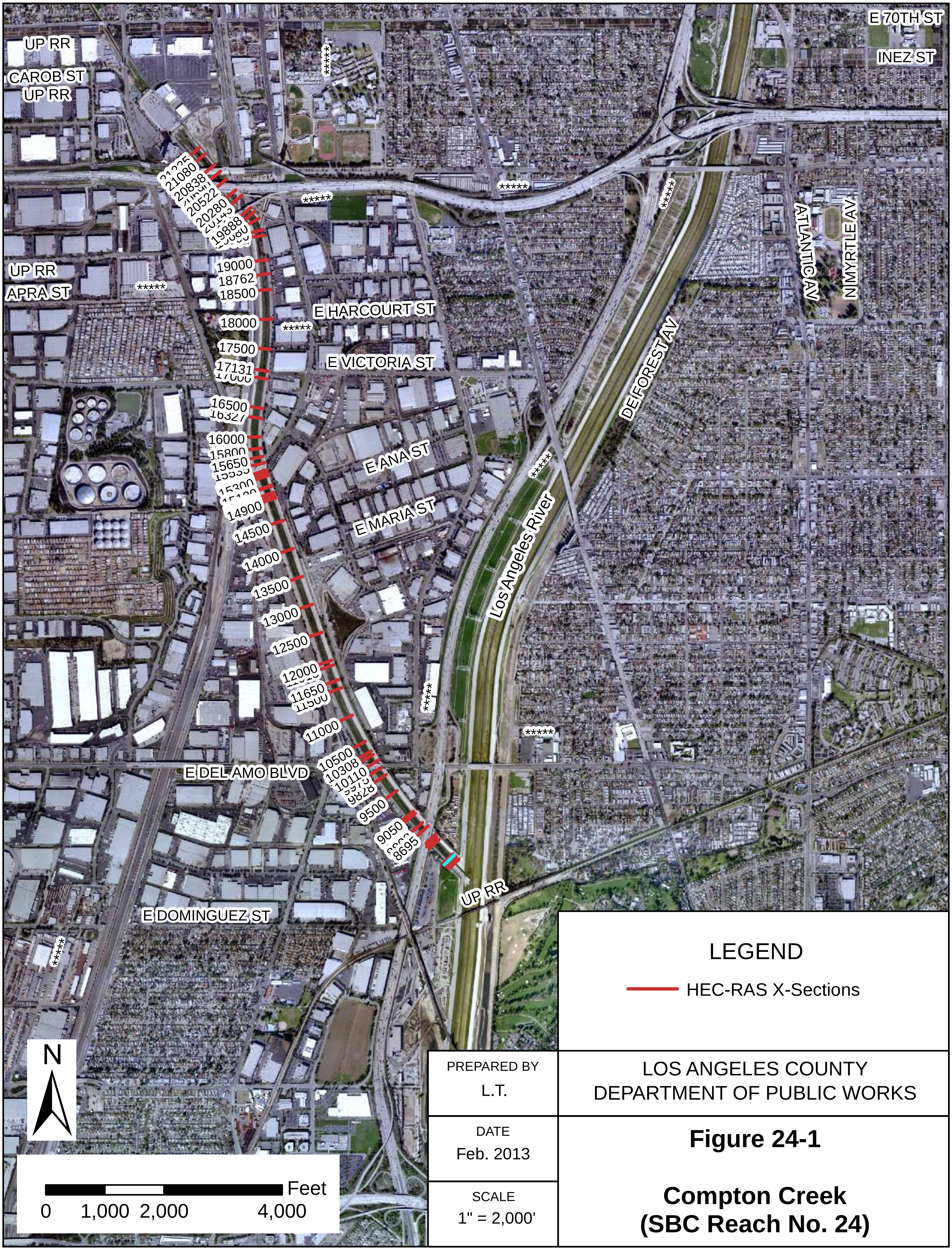
The HEC-RAS hydraulic model for Compton Creek was developed by LACDPW in 2009 as part of the Levee Certification Project. Topographic survey data was used to set up the model. The channel geometry consisted of 72 cross sections to ensure a gradually varied flow profile and to adequately represent the channel's geometry and structures along the study reach. HEC-RAS input and output files are provided in Appendix C.

24.6 Boundary Conditions

Critical Depth was used as the upstream boundary condition. For the downstream boundary condition, a water surface elevation of approximately 51 feet corresponding to the tail water of the Los Angeles River was used.

24.7 Results

As part of the 2009 Levee Certification Project, a hydraulic model was developed for Compton Creek assuming a "clear" channel (no vegetation) condition for the reach. A Manning's roughness coefficient value of 0.025 was used to represent the earth-bottom portions of the reach. The model showed no excess capacity of the soft-bottom channel at many of the stations. Since the study reach showed no excess capacity for an assumed "clear" channel condition, no other scenarios were explored. HEC-RAS input and output files of the analysis are provided in Appendix C.



PREPARED BY
L.T.

DATE
Feb. 2013

SCALE
1" = 2,000'

LOS ANGELES COUNTY
DEPARTMENT OF PUBLIC WORKS

Figure 24-1

Compton Creek (SBC Reach No. 24)

Reach 25 - Los Angeles River

25.1 General Description

The Los Angeles River begins at the confluence of Calabasas Creek and Bell Creek in the San Fernando Valley. The river flows for about 50 miles before it discharges into the Long Beach harbor.

The upper limit of the study reach is at about 900 feet upstream of Willow Street. The downstream limit of the study reach is about 1,000 feet downstream of Pacific Coast Highway. The study reach is located near residential and industrial areas as shown in Figure 25-1.

25.2 Structures

This study reach of Los Angeles River is an earthen-bottom channel that transitions into a fully concrete-lined channel. Details of the structures within the study reach are summarized in Table 25-1.

Table 25-1. Structures along Los Angeles River

Structure No.	River Station	Road Name	Type	Description
1	166+00	-	Transition	Transition from Concrete to soft-bottom
2	157+80	Willow Street	Bridge	Road Bridge
3	145+05	Barnett Street	Bridge	Utility Bridge
4	106+13	Pacific Coast Hwy	Bridge	Road Bridge
5	78+75	Anaheim Street	Bridge	Road Bridge

25.3 Manning's Roughness Coefficients

The Manning's roughness coefficient was determined based on field site visits of the channel reach. Observations were made regarding base material, obstructions, vegetation type and density, and other channel characteristics. Photographs were taken to document channel conditions and are provided in Appendix A. The Manning's roughness coefficients used are summarized in Table 25-2. Detailed computations in determining these values are found in Appendix B.

Table 25-2. Manning's Roughness 'n' Value along Los Angeles River

Reach Location	Left Bank	Main Channel	Right Bank
(Upstream Limit) Sta 169+00 - Sta 165+02	0.014	0.014	0.014
Sta 165+02 - Sta 162+00	0.014	0.042	0.014
Sta 162+00 - Sta 154+24	0.014	0.012	0.014
Sta 154+24 - Sta 154+00	0.014	0.025	0.014
Sta 154+00 - Sta 105+73	0.040	0.035	0.040
Sta 105+73 - Sta 105+00	0.045	0.025	0.040
Sta 105+00 - Sta 96+98.8	0.045	0.045	0.040
Sta 96+98.8 - Sta 78+32	0.040	0.050	0.040
(Downstream Limit) Sta 78+32 – 76+87	0.030	0.020	0.030

25.4 Hydrology

Design flow rates were obtained from USACE "Los Angeles County Drainage Area, Rio Hondo Channel and Los Angeles River, Whittier Narrows to Pacific Ocean, Storm Water Management Plan" dated July 2004. The peak discharge rate associated with this study reach is 182,000 cfs.

25.5 Hydraulic Model

The HEC-RAS hydraulic model for the Los Angeles River reach was obtained from USACE report cited in the previous section. The model was modified with the Manning's roughness coefficients determined in Section 25.3.

25.6 Boundary Conditions

Design water surface elevations were used at the upstream and downstream boundary conditions for the Los Angeles River model. The water surface elevations were obtained from the USACE report.

25.7 Results

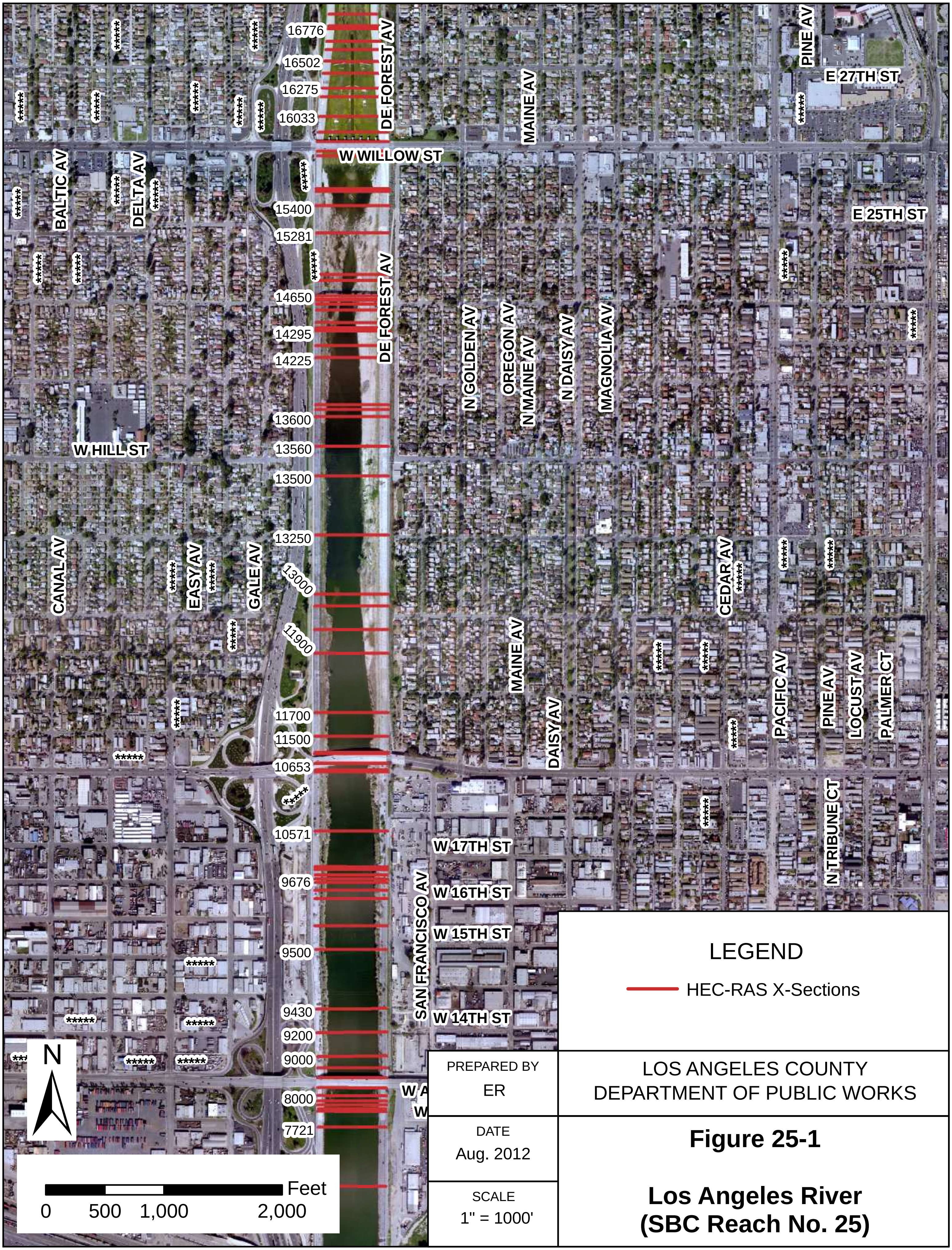
A hydraulic model was developed for the Los Angeles River reach under existing vegetation levels. Channel and water surface profiles for the Los Angeles River hydraulic model are presented in Appendix C. The model showed sufficient capacity along the reach. Therefore, an additional analysis was conducted assuming vegetation levels as recommended by BonTerra. The additional analysis conducted is discussed in more detail in the following section.

25.8 Additional Analysis

BonTerra Consulting provided a recommendation on potential vegetation growth for this reach, which is summarized as follows:

Biological Recommendation
In the last 500 feet of the reach (downstream end of reach) and on the left bank looking downstream, allow four willow trees to grow and mature at edge of water. Note that these willow trees will be maintained under existing maintenance plan that allows for trimming of lower branches.

It was determined that the recommendation proposes similar vegetation to what was observed during the site visit of the channel. Therefore, the Manning's roughness coefficient was not modified for the reach. Hence, the recommendation will not affect channel capacity.



PREPARED BY ER	LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS
DATE Aug. 2012	**Figure 25-1**
SCALE 1" = 1000'	**Los Angeles River (SBC Reach No. 25)**

Reach 99 - Kagel Canyon

99.1 General Description

Kagel Canyon originates in the Angeles National Forest and discharges into the Hansen Dam at its downstream end. Kagel Canyon is approximately 2.1 miles in length. The soft-bottom channel portion analyzed in this study is approximately 4,900 feet in length (maintenance reach). Kagel Canyon is tributary to the Hansen Dam, Tujunga Wash, and the Los Angeles River.

The upper limit of the study reach is at about 160 feet upstream of Blue Sage Drive. The downstream limit ends at Osborne Street. The study reach is located within a rural area with some residential development as shown in Figure 99-1.

99.2 Structures

The study reach of Kagel Canyon is an earthen-bottom channel with several bridge crossings. However, since the bridge decks clear spanned the channel and have no piers they were not included in the model.

99.3 Manning's Roughness Coefficients

The Manning's roughness coefficient was determined based on field site visits of the channel reach. Observations were made regarding base material, obstructions, vegetation type and density, and other channel characteristics. Photographs were taken to document channel conditions and are provided in Appendix A. The Manning's roughness coefficients used are summarized in Table 99-1. Detailed computations in determining these values are found in Appendix B.

Table 99-1. Manning's Roughness 'n' Value along Kagel Canyon

Reach Location	Left Bank	Main Channel	Right Bank
(Upstream Limit) Sta 63+47.047 - Sta 58+16.381	0.030	0.030	0.030
Sta 58+16.381 - Sta 51+98.224	0.045	0.028	0.045
Sta 51+98.224 - Sta 51+55.646	0.035	0.031	0.028
Sta 51+55.646 - Sta 51+02.358	0.018	0.028	0.018
Sta. 51+02.358 - Sta 50+58.283	0.043	0.028	0.043
Sta 50+58.283 - Sta 48+91.829	0.046	0.031	0.046
Sta 48+91.829 - Sta 44+45.26	0.018	0.038	0.046
Sta 44+45.26 - Sta 43+35.692	0.068	0.053	0.043
Sta 43+35.692 - Sta 40+47.506	0.046	0.030	0.046
Sta 40+47.506 - Sta 37+79.316	0.048	0.028	0.018
Sta 37+79.316 - Sta 36+49.373	0.043	0.028	0.053
Sta 36+49.373 - Sta 33+83.451	0.046	0.028	0.018
Sta 33+83.451 - Sta32+62.96	0.046	0.053	0.050
Sta 32+62.96 - Sta 31+10.859	0.046	0.028	0.018
Sta 31+10.859 - Sta 30+17.919	0.053	0.030	0.053
Sta 30+17.919 - Sta 29+48.735	0.018	0.063	0.046
Sta 29+48.735 - Sta 28+18.615	0.043	0.028	0.043
Sta 28+18.615 - Sta 26+74.839	0.055	0.053	0.055
Sta 26+68.22 - Sta 26+24.054	0.046	0.028	0.046
Sta 26+24.054 - Sta 24+27.048	0.068	0.053	0.043
Sta 24+04.036 - Sta 22+88.806	0.046	0.031	0.046
Sta 22+88.806 - Sta 22+13.585	0.018	0.028	0.046
Sta 21+84.784 - Sta 21+10.713	0.018	0.028	0.018
Sta 21+10.713 - Sta 13+10.216	0.018	0.058	0.030
Sta 13+10.216 - Sta 11+30.348	0.018	0.058	0.060
(Downstream Limit) Sta 11+30.348 - Sta 0+05.277	0.050	0.050	0.050

99.4 Hydrology

Design flow rates were obtained from LACFCD "Kagel Canyon Channel - Little Tujunga Wash to Debris Basin - Preliminary Hydraulic Plan & Profile & R/W" as-built drawing no. 103-D1-5 dated August 1962. The peak discharge rate associated with the subject reach ranges from 2,300 cfs to 3,020 cfs.

99.5 Hydraulic Model

Recent topographic surveys were used to create the HEC-RAS model for this reach of Kagel Canyon. The reach was modeled with 396 cross sections to ensure a gradually varied flow profile and to adequately represent the channel's geometry along the study reach. HEC-RAS input and output files are provided in Appendix C.

99.6 Boundary Conditions

Critical Depth was used as the upstream and Normal Depth was used as the downstream (S = 0.044) boundary conditions for the study model.

99.7 Results

A hydraulic model was developed for Kagel Canyon under existing vegetation levels. The model showed insufficient capacity throughout the channel reach.

A second analysis was then performed assuming a “clear” channel (no vegetation) condition for the reach. A Manning’s roughness coefficient value of 0.025 was used to represent the earth-bottom portions of the reach. The analysis for a “clear” channel showed no excess capacity throughout the channel reach. Since the study reach showed no excess capacity for an assumed “clear” channel condition, no other scenarios were explored. HEC-RAS input and output files for all analyses are provided in Appendix C.

Figure 99-1

Kagel Canyon (SBC Reach No. 99)

Reach 100 - Dry Canyon Calabasas

100.1 General Description

Dry Canyon Calabasas reach conveys water from the south to the north and is a tributary to Calabasas Creek. Calabasas Creek and Bell Creek confluence to form the headworks of the Los Angeles River.

The Dry Canyon Calabasas reach is located approximately 1,850 feet upstream (south) of the channel's intersection with Avenue San Luis. The reach ends where the soft-bottom channel feeds into the concrete-lined channel and starts 60 feet upstream of this transition in the soft-bottom portion. The study reach is surrounded by commercial and residential properties as shown in Figure 100-1.

100.2 Structures

The study reach of Dry Canyon Calabasas is an earthen-bottom channel that transitions into a fully concrete-lined channel. Details of the structures within the study reach are summarized in Table 100-1.

Table 100-1. Structures along Dry Canyon Calabasas

Structure No.	River Station	Road Name	Type	Description
1	between Sta 6+15.26 and Sta 5+84.98	-	Transition	Transition from soft-bottom channel to concrete channel

100.3 Manning's Roughness Coefficients

The Manning's roughness coefficient was determined based on field site visits of the channel reach. Observations were made regarding base material, obstructions, vegetation type and density, and other channel characteristics. Photographs were taken to document channel conditions and are provided in Appendix A. The Manning's roughness coefficients used are summarized in Table 100-2. Detailed computations in determining these values are found in Appendix B.

Table 100-2. Manning's Roughness 'n' Value along Dry Canyon Calabasas

Reach Location	Left Bank	Main Channel	Right Bank
(Upstream Limit) Sta 8+31.41 – Sta 6+77.03	0.035	0.035	0.035
Sta 6+77.03 – Sta 6+15.26	0.040	0.040	0.040
Sta 6+15.26 – Sta 5+84.98	0.025	0.015	0.025
(Downstream Limit) Sta 5+84.98 – Sta 5+18.78	0.020	0.015	0.020

100.4 Hydrology

Design flow rates were obtained from LACFCD “Dry Canyon (Calabasas Area) R.C. Rectangular Channel” as-built drawing number PD013648 dated April 5, 1995. The peak discharge rate associated with the subject reach is 5,610 cfs.

100.5 Hydraulic Model

LACFCD as-built drawings and LIDAR topography were used to create the HEC-RAS model for this reach of Dry Canyon Calabasas. The reach was modeled with 11 cross sections to ensure a gradually varied flow profile and to adequately represent the channel’s geometry and structures along the study reach. HEC-RAS input and output files are provided in Appendix C.

100.6 Boundary Conditions

Critical depth was used as the upstream boundary condition. Normal depth (Slope = 0.0076) was used as the downstream boundary condition.

100.7 Results

A hydraulic model was developed for Dry Canyon Calabasas under existing vegetation levels. The model showed insufficient capacity throughout the soft-bottom channel reach.

A second analysis was then performed assuming a “clear” channel (no vegetation) condition for the reach. Manning’s roughness coefficient values of 0.025 and 0.030 were used to represent the earth-bottom portions of the reach. The analysis for a “clear” channel showed no excess capacity throughout the channel reach. Since the study reach showed no excess capacity for an assumed “clear” channel condition, no other scenarios were explored. HEC-RAS input and output files for all analyses are provided in Appendix C.

LEGEND

HEC-RAS X-Sections

PREPARED BY	LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS
L.T.	
DATE Feb. 2013	**Figure 100-1**
SCALE 1" = 100'	**Dry Canyon Calabasas (SBC Reach No. 100)**

References

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United States Geological Survey (USGS). (1989). *Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains*. Water-Supply Paper 2339.

Ven Te Chow. (1973). *Open-Channel Hydraulics*. McGraw-Hill, Inc.

Appendix A

Annotated Reach Photographs

Reach No. 1 - Bell Creek

Site Visit: 8/15/2010

Looking d/s Sta. 6+22 (HEC-RAS Model)

Looking u/s Sta. 7+78 (HEC-RAS Model)

Site Visit: 8/15/2010

Looking u/s Sta. 8+05 (HEC-RAS Model)

Looking u/s Sta. 8+20 (HEC-RAS Model)

Site Visit: 7/28/2010

Looking u/s Sta. 21+86 (HEC-RAS Model)

Looking u/s Sta. 20+81 (HEC-RAS Model)

Reach Nos. 2 & 96 – Dry Canyon Creek & PD 1591 Calabasas

Site Visit: 7/28/2010

Looking d/s Sta. 20+40 (HEC-RAS Model)

Looking d/s Sta. 19+30 (HEC-RAS Model)

Site Visit: 7/28/2010

Looking d/s Sta. 15+00 (HEC-RAS Model)

Looking d/s Sta. 12+10 (HEC-RAS Model)

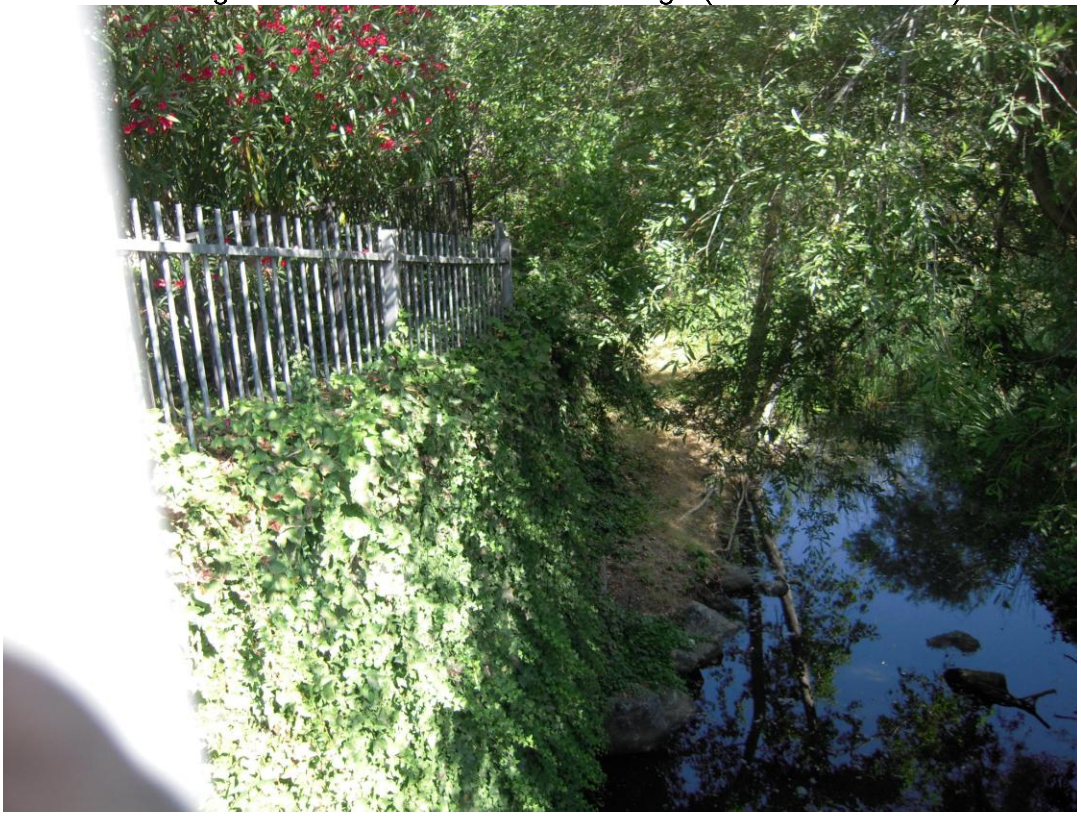
Site Visit: 7/28/2010

Looking d/s Sta. 10+90 (HEC-RAS Model)

Looking u/s Sta. 9+06 (HEC-RAS Model)

Site Visit: 7/28/2010

Looking d/s Sta. 8+50 – Park Ora Bridge (HEC-RAS Model)



Looking u/s Sta. 8+00 (HEC-RAS Model)

Site Visit: 7/28/2010

Looking d/s Sta. 7+70 (HEC-RAS Model)

Looking d/s Sta. 3+85 (HEC-RAS Model)

Reach No. 3 – Santa Susana Creek

Site Visit: 8/18/2010

Looking u/s Sta. 5+60 (HEC-RAS Model)

Looking d/s Sta. 5+50 (HEC-RAS Model)

Site Visit: 8/25/2010

Looking u/s from De Soto Ave. at the retaining wall beyond the start of study reach.

Looking u/s from De Soto Ave. at the foot of the retaining wall.

Reach No. 4 – Browns Canyon Creek

Site Visit: 8/25/2010

Looking west from De Soto Ave onto Sta.12+73.49 (HEC-RAS model)

Looking west from De Soto Ave onto Sta.11+96.98 (HEC-RAS model)

Reach No. 4 – Browns Canyon Creek

Site Visit: 8/25/2010

Looking d/s from De Soto Ave onto the 118 Freeway

Looking u/s from underneath onto the 118 Freeway

Reach No. 4 – Browns Canyon Creek

Site Visit: 8/25/2010

Looking west into the channel from under the 118 Freeway

Looking southwest d/s into the channel from under the 118 Freeway

Site Visit: 8/25/2010

Looking northwest u/s into the opened rail & timber structure around Sta. 11+96.98 (HEC-RAS Model)

Looking u/s from Sta. 11+30.66 (HEC-RAS Model)

Site Visit: 8/25/2010

Looking u/s from Sta. 11+12.72 (HEC-RAS Model)

Looking west onto Sta. 11+30.66 (HEC-RAS Model)

Site Visit: 8/25/2010

Looking d/s from Sta. 11+30.66 (HEC-RAS Model)

Looking southeast d/s into Sta. 10+79.12 (HEC-RAS Model)

Reach No. 4 – Browns Canyon Creek

Site Visit: 8/25/2010

Looking u/s from Sta. 9+75.93 (HEC-RAS Model)

Looking d/s from Sta. 9+75.93 (HEC-RAS Model)

Site Visit: 8/25/2010

Looking u/s from the east side of Sta. 9+75.93 (HEC-RAS Model)

Looking west along Sta. 9+53.44 (HEC-RAS Model)

Reach No. 4 – Browns Canyon Creek

Site Visit: 8/25/2010

Looking d/s from Sta. 9+53.44 (HEC-RAS Model)

Looking d/s from Sta. 10+01.67 (HEC-RAS Model) at east side of channel

Reach No. 4 – Browns Canyon Creek

Site Visit: 8/25/2010

Looking west along Sta. 10+44.56 (HEC-RAS Model)

Looking d/s from Sta. 10+23.25 (HEC-RAS Model) at west side of channel

Reach No. 4 – Browns Canyon Creek

Site Visit: 8/25/2010

Looking d/s from approximately Sta. 8+47.36 (HEC-RAS Model)

Looking u/s from approximately Sta. 8+47.36 (HEC-RAS Model)

Site Visit: 8/25/2010

Looking east at approximately Sta. 7+97.19 (HEC-RAS Model)

Looking d/s from approximately Sta. 7+97.19 (HEC-RAS Model) at west wall of channel

Site Visit: 8/25/2010

Looking d/s from Sta. 7+97 (HEC-RAS Model) at east wall of channel

Looking east from Sta. 7+27.69 (HEC-RAS Model)

Reach No. 4 – Browns Canyon Creek

Site Visit: 8/25/2010

Looking d/s from Sta. 7+27.69 (HEC-RAS Model)

Looking west approximately along 5+30.25 (HEC-RAS Model)

Site Visit: 8/25/2010

Looking west approximately along Sta. 3+76.28 (HEC-RAS Model)

Looking east approximately along Sta. 3+76.28 (HEC-RAS Model)

Site Visit: 8/25/2010

Looking u/s at approximately Sta. 3+05.78 (HEC-RAS Model)

Looking u/s, slightly west, at approximately Sta. 3+05.78 (HEC-RAS Model)

Reach No. 4 – Browns Canyon Creek

Site Visit: 8/25/2010

Looking d/s, southeast, from approximately Sta. 2+66.79 (HEC-RAS Model)

Looking d/s, southwest, from approximately Sta. 2+66.79 (HEC-RAS Model)

Reach No. 4 – Browns Canyon Creek

Site Visit: 8/25/2010

Looking d/s from approximately Sta. 2+66.79 (HEC-RAS Model)

Looking d/s, south, from approximately Sta. 2+20.92 (HEC-RAS Model)

Site Visit: 8/25/2010

Looking d/s, southeast, from approximately Sta. 2+20.92 (HEC-RAS Model)

Looking u/s, northwest, from approximately Sta. 1+68.40 (HEC-RAS Model)

Reach No. 4 – Browns Canyon Creek

Site Visit: 8/25/2010

Looking u/s, northeast, from approximately Sta. 1+68.40 (HEC-RAS Model)

Looking d/s from Sta. 1+18.81 (HEC-RAS Model)

Site Visit: 8/25/2010

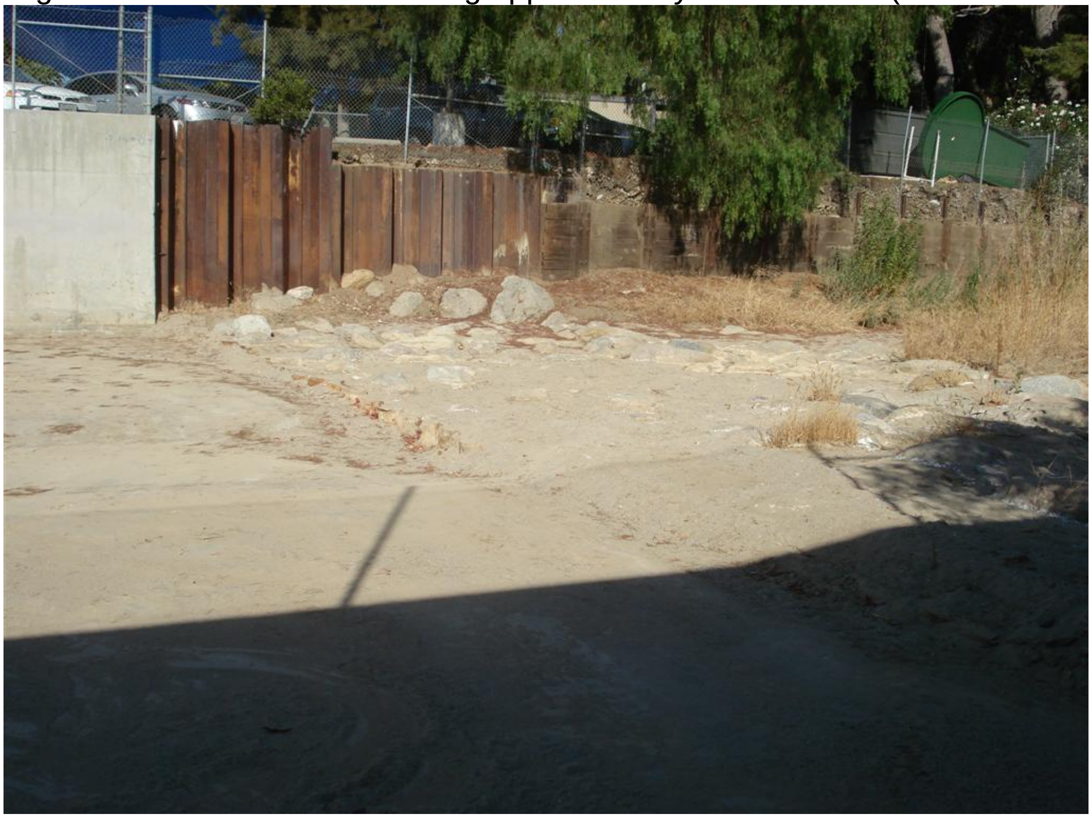
Looking east along approximately Sta. 0+71.09 (HEC-RAS Model)

Looking east along approximately Sta. 0+66.00 (HEC-RAS Model)

Site Visit: 8/25/2010

Looking at eastern channel wall along approximately Sta. 0+66.00 (HEC-RAS Model)

Looking at western channel wall along approximately Sta. 0+66.00 (HEC-RAS Model)



Site Visit: 8/25/2010

Looking u/s from Sta. 0+36.48 (HEC-RAS Model)

Looking u/s from Sta. 0+9.37 (HEC-RAS Model)

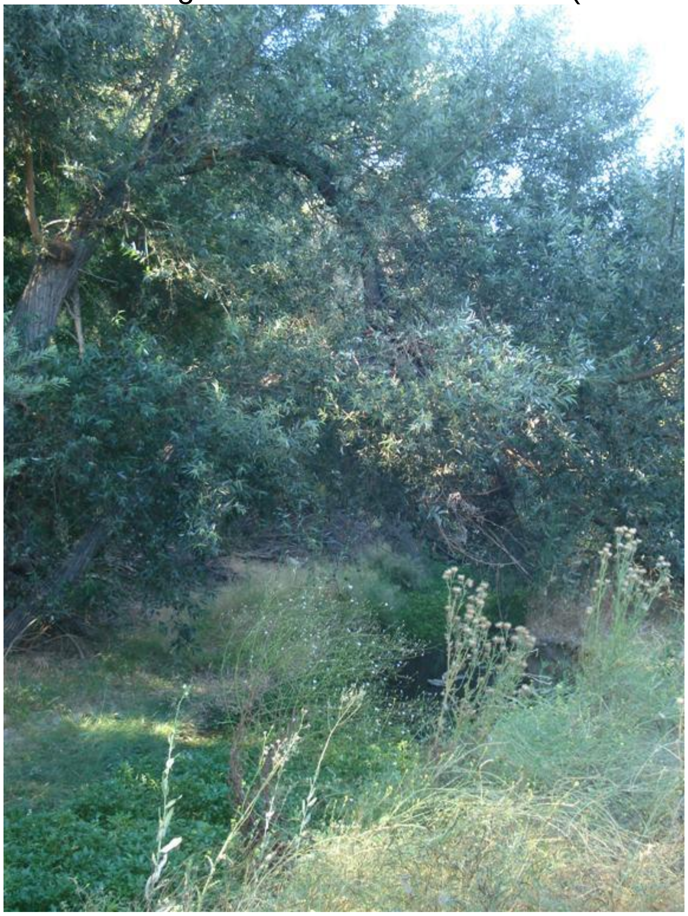
Site Visit: 8/25/2010

Looking u/s from Sta. 0+9.37 (HEC-RAS Model) on east side of channel

Site Visit: 08/23/2010

WEST FORK – Looking south u/s of Sta. 6+24.57 (HEC-RAS Model)

WEST FORK – Looking south u/s of Sta. 6+24.57 (HEC-RAS Model)



Site Visit: 08/23/2010

WEST FORK – Looking southeast u/s of Sta. 6+24.57 (HEC-RAS Model)

WEST FORK – Looking northeast u/s in channel at Sta. 6+24.57 (HEC-RAS Model)

WEST FORK – Looking north u/s on access road into channel
at Sta. 6+24.57 (HEC-RAS Model)

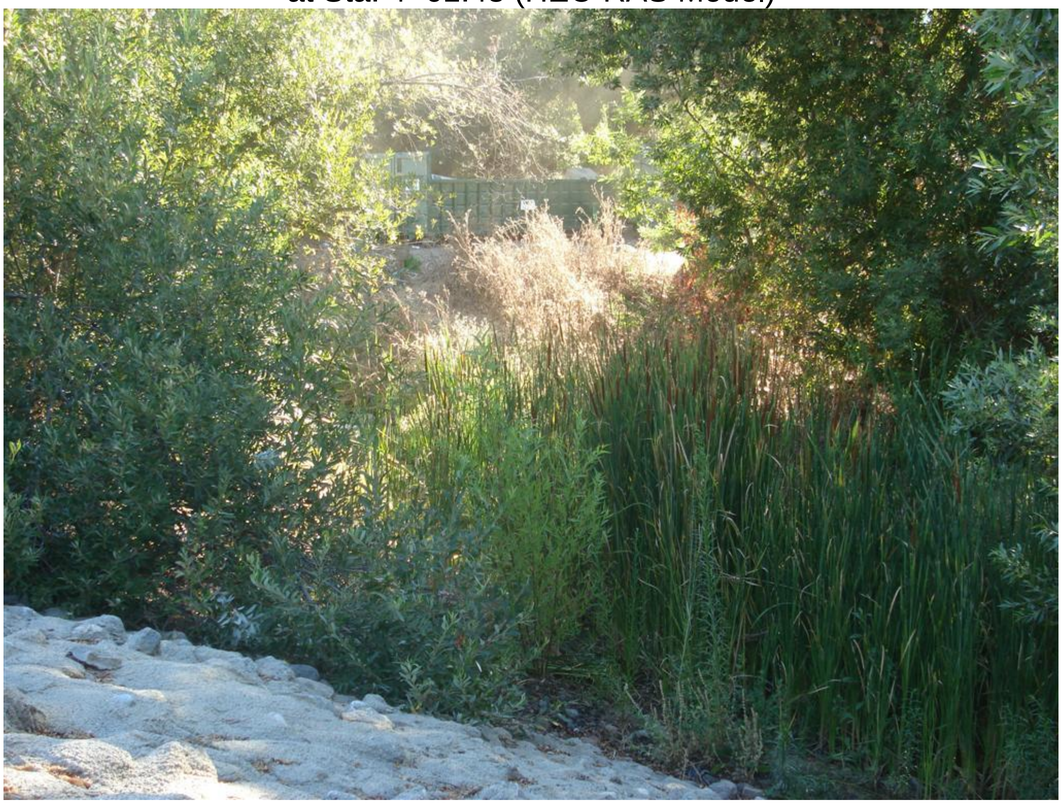
WEST FORK – Looking northeast u/s on access road into channel
at Sta. 6+01.88 (HEC-RAS Model)

WEST FORK – Looking east on access road into channel
at Sta. 6+01.88 (HEC-RAS Model)

WEST FORK – Looking u/s on access road
at Sta. 5+34.32 (HEC-RAS Model)

WEST FORK – Looking u/s on access road into channel
at Sta. 5+34.32 (HEC-RAS Model)

WEST FORK – Looking northeast u/s on access road into channel
at Sta. 4+61.48 (HEC-RAS Model)



WEST FORK – Looking d/s on access road into channel
at Sta. 4+12.95 (HEC-RAS Model)

WEST FORK – Looking east across channel from access road
at Sta. 3+88.02 (HEC-RAS Model)

WEST FORK – Looking south d/s on access road into channel at Sta. 2+90.65 (HEC-RAS Model)

WEST FORK – Looking east into channel at Sta. 2+90.65 (HEC-RAS Model)

WEST FORK – Looking u/s in channel
at Sta. 2+90.65 (HEC-RAS Model)

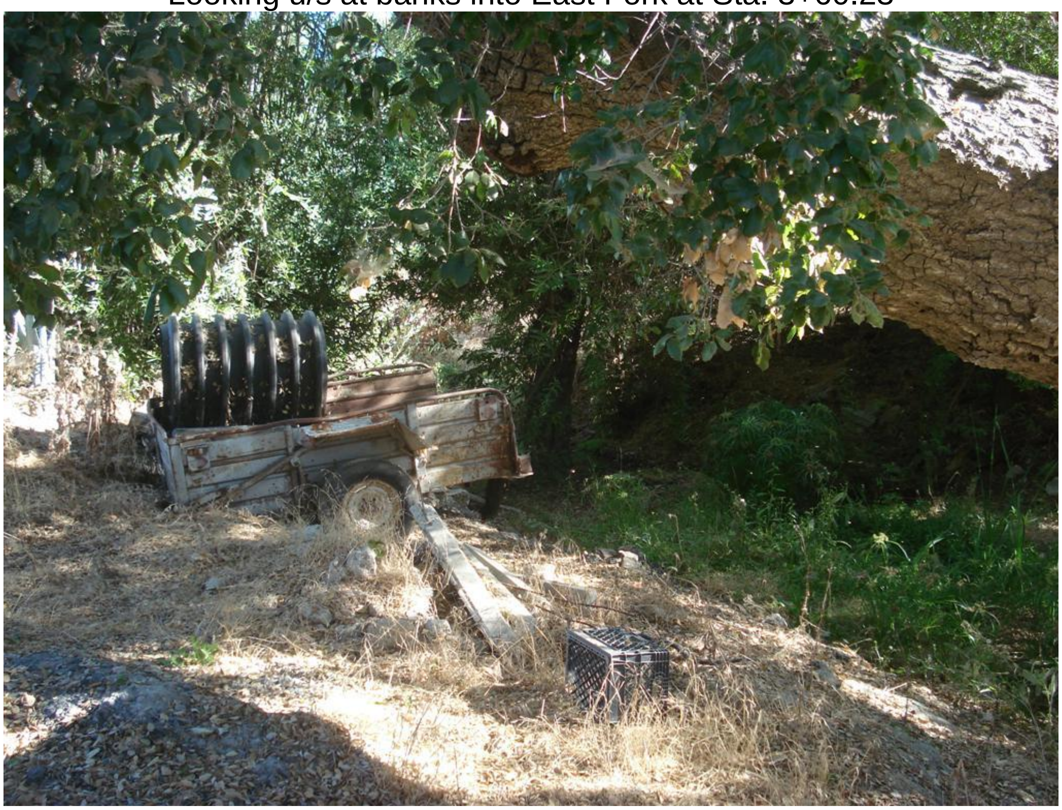
WEST FORK – Looking southeast d/s into channel
at Sta. 2+52.10 (HEC-RAS Model)

WEST FORK – Looking southeast d/s from access ramp
at Sta. 2+13.28 (HEC-RAS Model)

WEST FORK – Looking north u/s
at Sta. 2+13.28 (HEC-RAS Model)

Looking u/s into East Fork at Sta. 3+60.23

Looking u/s at banks into East Fork at Sta. 3+60.23



Site Visit: 08/23/2010

Looking east u/s of East Fork at Sta. 3+60.23
to the Fork's concrete structure and pipe outlets

Reach No. 7 – Bull Creek

Site Visit: 7/26/2010

Looking u/s Sta. 2+48.611 (HEC-RAS Model)

Looking d/s Sta. 2+48.611 (HEC-RAS Model)

Reach No. 8 – Project No. 470

Site Visit: 8/10/2010

Looking d/s Sta. 11+81.478 (HEC-RAS Model)

Looking u/s Sta. 8+80.611 (HEC-RAS Model)

Site Visit: 8/10/2010

Looking d/s Sta. 8+07.089 (HEC-RAS Model)

Site Visit: 7/27/2010

Looking d/s Sta. 2+17.286 (HEC-RAS Model)

Looking u/s Sta. 1+88.739 (HEC-RAS Model)

Reach No. 9 – Project No. 106

Site Visit: 7/27/2010

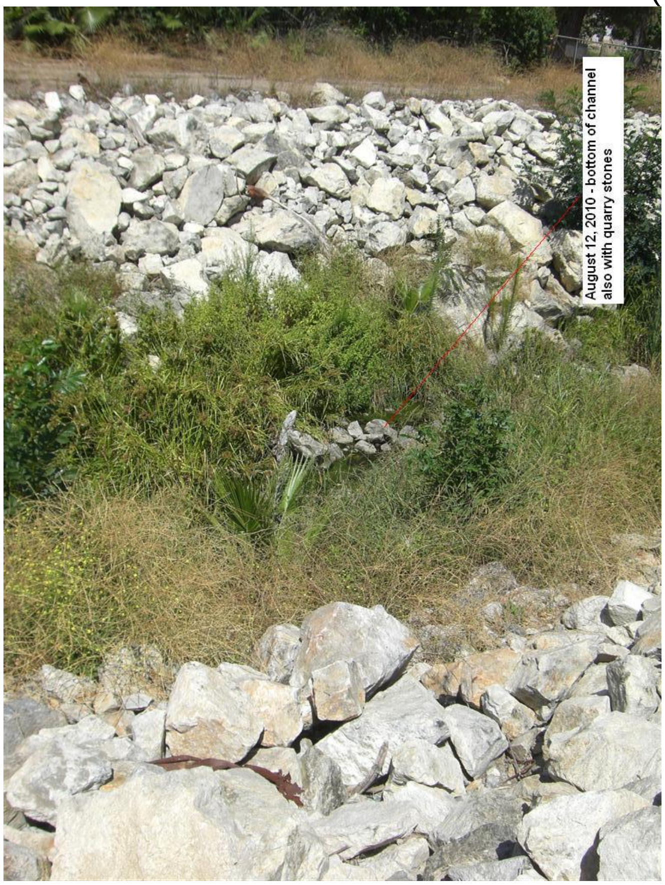
Looking d/s Sta. 1+88.739 (HEC-RAS Model)

Reach No. 10 – Project No. 469

Site Visit: 8/12/2010

Looking u/s at Sta. 52+30 (HEC-RAS Model)

Looking west into channel between Sta. 51+45 and Sta. 50+60 (HEC-RAS Model)



Site Visit: 8/12/2010

Looking u/s at Sta. 48+75 (HEC-RAS Model)

Looking west into channel at Sta. 48+75 (HEC-RAS Model)

Site Visit: 8/12/2010

Looking d/s of Sta. 48+75, transition from riprap to soft-bottom (HEC-RAS Model)

Looking at channel bank stabilization fabric at Sta. 48+25 (HEC-RAS Model)

Reach No. 10 – Project No. 469

Site Visit: 8/12/2010

Looking d/s at Sta. 47+37.5 (HEC-RAS Model)

Looking u/s at Sta. 44+75 (HEC-RAS Model)

Site Visit: 8/12/2010

Looking d/s at Sta. 43+87.5 (HEC-RAS Model)

Looking west at stabilization fabric at channel bottom at Sta. 43+00 (HEC-RAS Model)

Reach No. 10 – Project No. 469

Site Visit: 8/12/2010

Looking d/s at Sta. 42+70 (HEC-RAS Model)

Looking west into concrete stretch of channel between
Sta. 42+70 and Sta. 42+30 (HEC-RAS Model)

Site Visit: 8/12/2010

Looking at stone stabilizer located between
Sta. 42+30 and Sta. 41+30 (HEC-RAS Model)

Looking d/s at Sta. 41+30 (HEC-RAS Model)

Reach No. 10 – Project No. 469

Site Visit: 8/12/2010

Looking u/s at Sta. 40+30 (HEC-RAS Model)

Looking west into channel at Sta. 40+30 (HEC-RAS Model)

Site Visit: 8/12/2010

Looking d/s at Sta. 39+30 (HEC-RAS Model)

Looking west into channel Sta. 37+90 (HEC-RAS Model)

Reach No. 10 – Project No. 469

Site Visit: 8/12/2010

Looking u/s at Sta. 36+63 (HEC-RAS Model)

Looking west into channel between Sta. 36+63 and Sta. 36+00 (HEC-RAS Model)

Reach No. 10 – Project No. 469

Site Visit: 8/12/2010

Looking d/s at Sta. 36+00 (HEC-RAS Model)

Looking d/s into Sta. 35+00 (HEC-RAS Model)

Site Visit: 8/12/2010

Looking d/s into Sta. 34+00 (HEC-RAS Model)

Looking u/s into Sta. 34+00 (HEC-RAS Model)

Reach No. 10 – Project No. 469

Site Visit: 8/12/2010

Looking d/s into Sta. 33+00 (HEC-RAS Model)

Looking u/s into Sta. 31+00 (HEC-RAS Model)

Site Visit: 8/12/2010

Looking into channel between Sta. 31+00 and Sta. 30+00 (HEC-RAS Model)

Looking d/s into Sta. 30+00 (HEC-RAS Model)

Reach No. 10 – Project No. 469

Site Visit: 8/12/2010

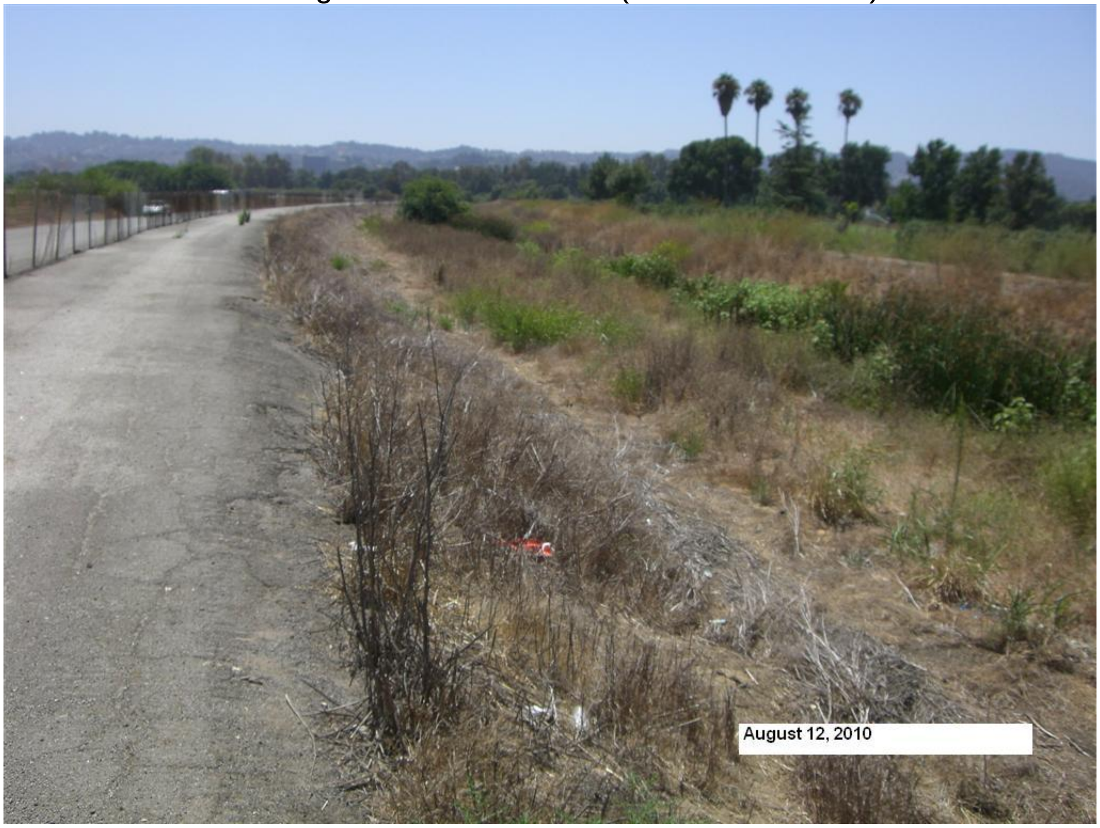
Looking u/s from Sta. 30+00 (HEC-RAS Model)

Looking west into channel at Sta. 30+00 (HEC-RAS Model)

Reach No. 10 – Project No. 469

Site Visit: 8/12/2010

Looking d/s into Sta. 29+00 (HEC-RAS Model)



Looking u/s into Sta. 28+00 (HEC-RAS Model)

Reach No. 10 – Project No. 469

Site Visit: 8/12/2010

Looking d/s into Sta. 27+00 (HEC-RAS Model)

Looking west at mature tree in channel just d/s of Sta. 27+00 (HEC-RAS Model)

Reach No. 10 – Project No. 469

Site Visit: 8/12/2010

Looking u/s from Sta. 24+00 (HEC-RAS Model)

Looking west into channel at stone stabilizer at Sta. 24+00 (HEC-RAS Model)

Site Visit: 8/12/2010

Looking d/s from Sta. 24+00 (HEC-RAS Model)

Looking u/s from Sta. 22+00 (HEC-RAS Model)

Reach No. 10 – Project No. 469

Site Visit: 8/12/2010

Looking west into channel at Sta. 22+00 (HEC-RAS Model)

Looking d/s from Sta. 22+00 (HEC-RAS Model)

Reach No. 10 – Project No. 469

Site Visit: 8/12/2010

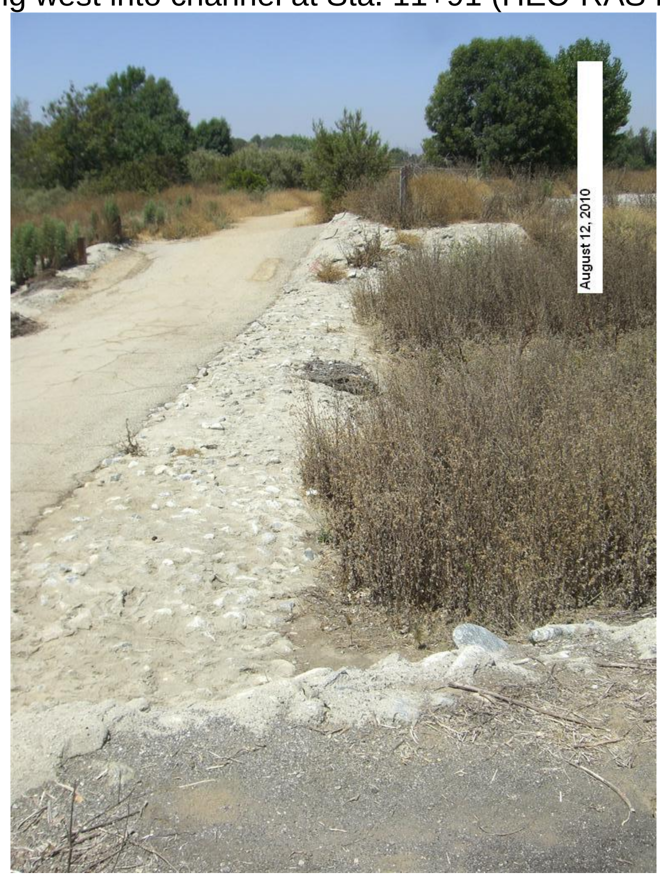
Looking u/s from Sta. 15+00 (HEC-RAS Model)

Looking west into channel at Sta. 15+00 (HEC-RAS Model)

Site Visit: 8/12/2010

Looking d/s into Sta. 14+22.75 (HEC-RAS Model)

Looking west into channel at Sta. 11+91 (HEC-RAS Model)

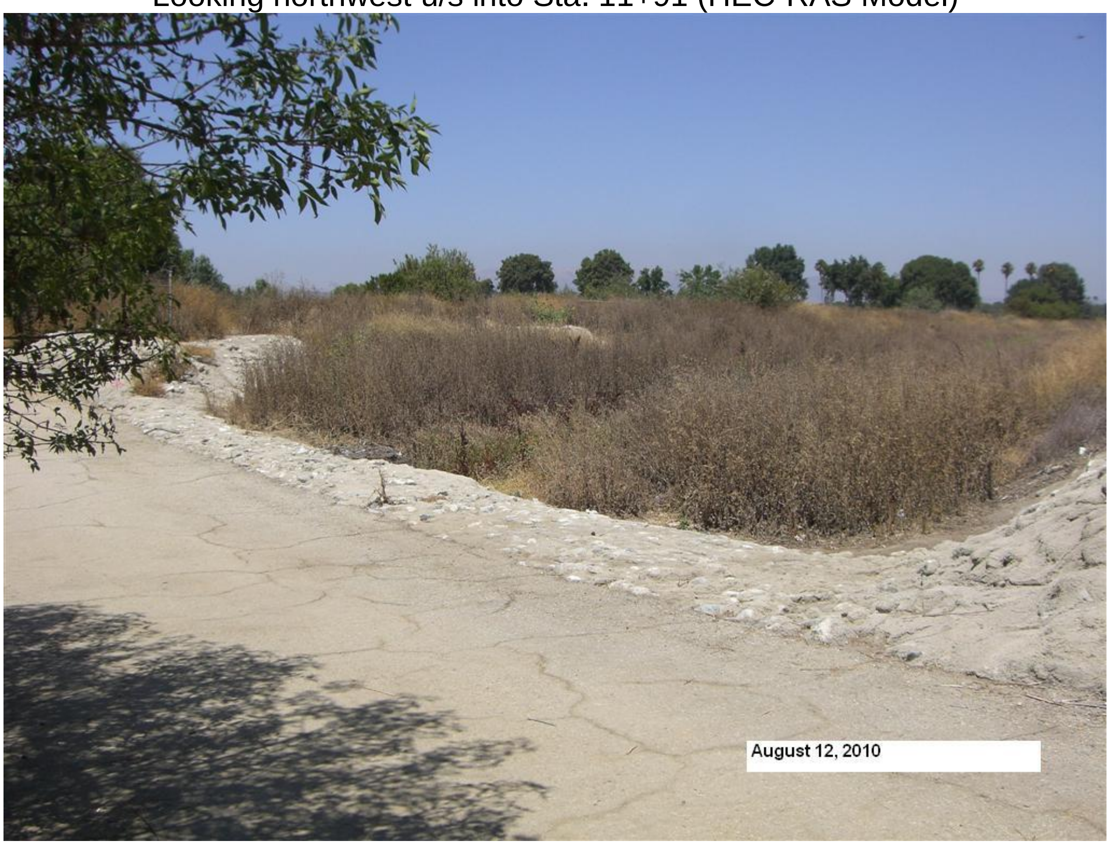


Reach No. 10 – Project No. 469

Site Visit: 8/12/2010

Looking d/s from Sta. 11+91 (HEC-RAS Model)

Looking northwest u/s into Sta. 11+91 (HEC-RAS Model)



Site Visit: 8/12/2010

Looking u/s at left bank into Sta. 11+91 (HEC-RAS Model)

Looking west at access road located d/s of Sta. 11+91 (HEC-RAS Model)

Site Visit: 7/27/2010

Looking d/s Sta. 6+86.38 (HEC-RAS Model)

Looking d/s Sta. 4+45.344 (HEC-RAS Model)

Site Visit: 7/27/2010

Looking d/s Sta. 2+39.964 (HEC-RAS Model)

Site Visit: 7/27/2010

Looking d/s Sta. 6+00.530 (HEC-RAS Model)

Looking d/s Sta. 4+39.612 (HEC-RAS Model)

Site Visit: 7/27/2010

Looking u/s Sta. 3+24.317 (HEC-RAS Model)

Reach No. 14 – May Canyon

Site Visit: 7/27/2010

Looking d/s Sta. 8+33.452 (HEC-RAS Model)

Looking u/s Sta. 5+47.482 (HEC-RAS Model)

Reach No. 14 – May Canyon

Site Visit: 7/27/2010

Looking d/s Sta. 4+53.220 (HEC-RAS Model)

Reach No. 15 – Pacoima Wash

Site Visit: 8/10/2010

Looking d/s Sta. 150+00 (HEC-RAS Model)

Looking d/s Sta. 147+00 (HEC-RAS Model)

Site Visit: 8/10/2010

Looking d/s Sta. 140+16 (HEC-RAS Model)

Looking u/s Sta. 139+50 (HEC-RAS Model)

Reach No. 15 – Pacoima Wash

Site Visit: 8/10/2010

Looking d/s Sta. 134+00 (HEC-RAS Model)

Looking d/s Sta. 130+00 (HEC-RAS Model)

Reach No. 15 – Pacoima Wash

Site Visit: 8/10/2010

Looking u/s Sta. 121+90 (HEC-RAS Model)

Looking d/s Sta. 107+00 (HEC-RAS Model)

Reach No. 16 – Verdugo Wash – Las Barras Inlet

Site Visit: 8/03/2010

Looking u/s Sta. 1+55.92 (HEC-RAS Model)

Looking d/s Sta. 1+55.92 (HEC-RAS Model)

Site Visit: 8/03/2010

Looking u/s Sta. 0+45.07 (HEC-RAS Model)

Site Visit: 8/03/2010

Looking u/s Sta. 8+50.77 (HEC-RAS Model)

Looking u/s Sta. 7+72.72 (HEC-RAS Model)

Reach No. 18 – Engleheard Channel

Site Visit: 8/03/2010

Looking u/s Sta. 7+03.25 (HEC-RAS Model)

Looking u/s Sta. 5+11.03 (HEC-RAS Model)

Reach No. 18 – Engleheard Channel

Site Visit: 8/03/2010

Looking u/s Sta. 4+60.71 (HEC-RAS Model)

Looking d/s Sta. 4+60.71 (HEC-RAS Model)

Reach No. 18 – Engleheard Channel

Site Visit: 8/03/2010

Looking u/s Sta. 2+37.26 (HEC-RAS Model)

Looking d/s Sta. 2+37.26 (HEC-RAS Model)

Reach No. 19 – Pickens Canyon

Site Visit: 8/05/2010

Looking d/s Sta. 23+92.25 (HEC-RAS Model)

Looking u/s Sta. 19+69.27 (HEC-RAS Model)

Reach No. 19 – Pickens Canyon

Site Visit: 8/05/2010

Looking d/s Sta. 19+69.27 (HEC-RAS Model)

Looking d/s Sta. 17+20.34 (HEC-RAS Model)

Site Visit: 8/05/2010

Looking u/s Sta. 13+49.49 (HEC-RAS Model)

Looking d/s Sta. 13+49.49 (HEC-RAS Model)

Reach No. 19 – Pickens Canyon

Site Visit: 8/05/2010

Looking u/s Sta. 8+47.73 (HEC-RAS Model)

Looking d/s Sta. 8+47.73 (HEC-RAS Model)

Reach No. 19 – Pickens Canyon

Site Visit: 8/05/2010

Looking u/s Sta. 4+17.74 (HEC-RAS Model)

Looking d/s Sta. 4+17.74 (HEC-RAS Model)

Reach No. 19 – Pickens Canyon

Site Visit: 8/05/2010

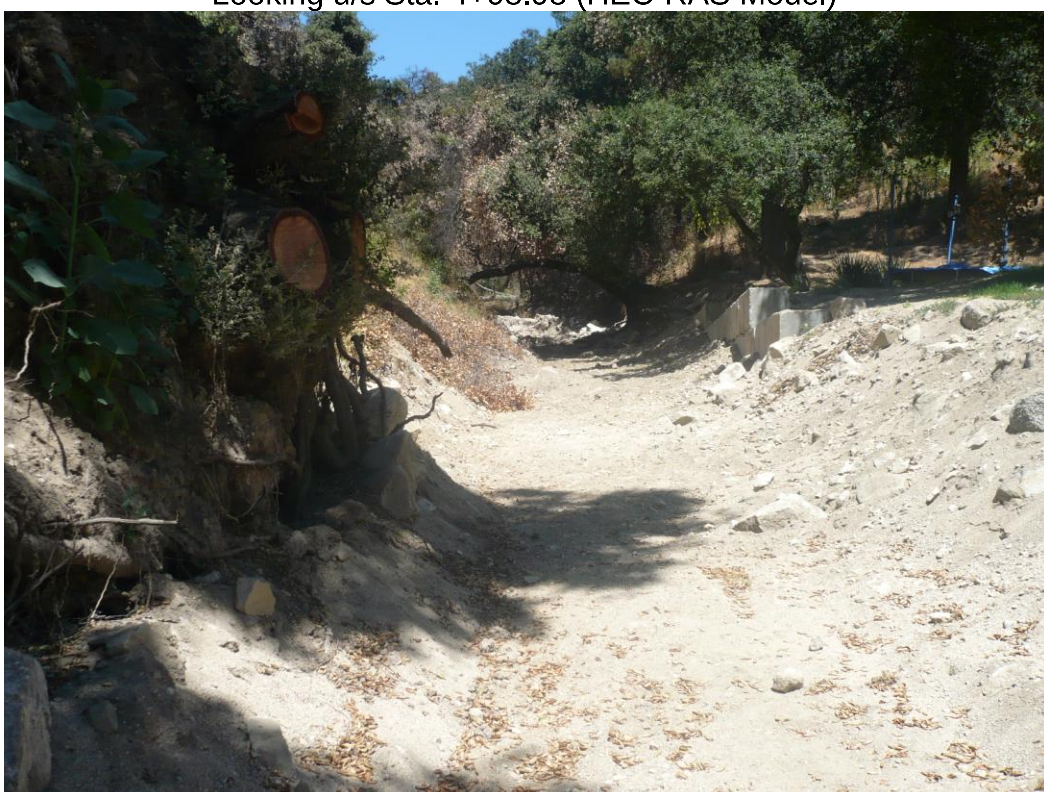
Looking u/s Sta. 0+88.91 (HEC-RAS Model)

Looking d/s Sta. 0+88.91 (HEC-RAS Model)

Site Visit: 8/03/2010

Looking d/s Sta. 5+22.15 (HEC-RAS Model)

Looking u/s Sta. 4+98.98 (HEC-RAS Model)



Reach Nos. 20 & 21 – Webber Channel

Site Visit: 8/03/2010

Looking u/s Sta. 4+74.26 (HEC-RAS Model)

Looking u/s Sta. 4+24.97 (HEC-RAS Model)

Reach Nos. 20 & 21 – Webber Channel

Site Visit: 8/03/2010

Looking u/s Sta. 2+98.61 (HEC-RAS Model)

Looking d/s Sta. 51.22 (HEC-RAS Model)

Site Visit: 08/03/2010

Looking u/s from Sta. 0+0.71 (HEC-RAS Model)

Looking u/s from Sta. 0+80.68 (HEC-RAS Model)

Site Visit: 08/03/2010

Looking u/s northeast from Sta. 1+36.49 (HEC-RAS Model)

Looking west from Sta. 1+36.49 (HEC-RAS Model)

Reach No. 22 – Halls Canyon Channel

Site Visit: 08/03/2010

Looking u/s at Sta. 2+83.12 (HEC-RAS Model)

Looking d/s from Sta. 2+83.12 (HEC-RAS Model)

Reach No. 22 – Halls Canyon Channel

Site Visit: 08/03/2010

Looking u/s from Sta. 3+6.96 (HEC-RAS Model)

Looking u/s from Sta. 4+53.42 (HEC-RAS Model)

Reach No. 22 – Halls Canyon Channel

Site Visit: 08/03/2010

Looking northwest from Sta. 5+12.15 (HEC-RAS Model)

Looking d/s from Sta. 5+56.47 (HEC-RAS Model)

Reach No. 22 – Halls Canyon Channel

Site Visit: 08/03/2010

Looking u/s from Sta. 6+16.85 (HEC-RAS Model)

Looking u/s from Sta. 8+07.62 (HEC-RAS Model)

Site Visit: 08/03/2010

Looking u/s from Sta. 8+67.76 (HEC-RAS Model)

Looking u/s from Sta. 9+16.16 (HEC-RAS Model)

Reach No. 22 – Halls Canyon Channel

Site Visit: 08/03/2010

Looking u/s from Sta. 10+17.07 (HEC-RAS Model)

Looking d/s from Sta. 11+34.21 (HEC-RAS Model)

Site Visit: 08/03/2010

Looking u/s from Sta. 11+34.21 (HEC-RAS Model)

Looking u/s to Sta. 12+44.77 (HEC-RAS Model)

Site Visit: 08/03/2010

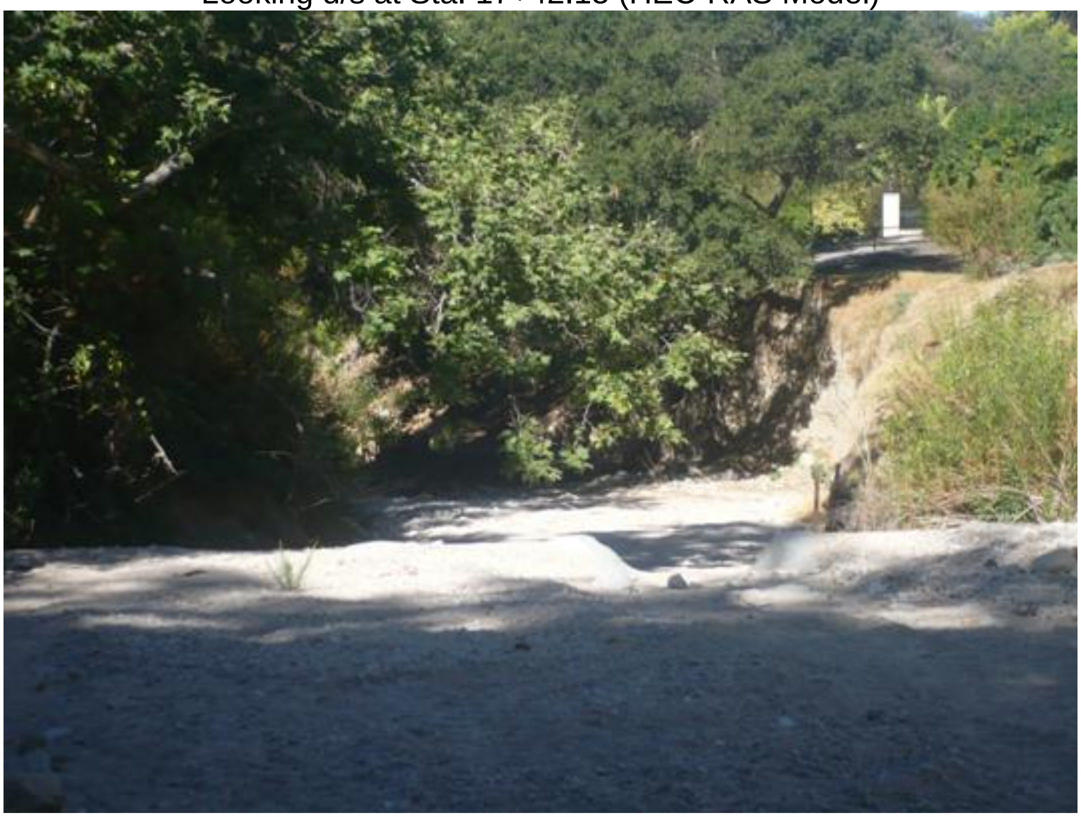
Looking u/s and north at Sta. 12+96.47 (HEC-RAS Model)

Looking u/s from Sta. 14+97.04 (HEC-RAS Model)

Site Visit: 08/03/2010

Looking u/s from Sta. 16+42.50 (HEC-RAS Model)

Looking d/s at Sta. 17+42.15 (HEC-RAS Model)



Reach No. 22 – Halls Canyon Channel

Site Visit: 08/03/2010

Looking southwest from Sta. 18+32.92 (HEC-RAS Model)

Looking northeast from Sta. 18+32.92 (HEC-RAS Model)

Site Visit: 08/03/2010

Looking u/s from Sta. 18+32.92 (HEC-RAS Model)

Looking u/s from Sta. 19+73.07 (HEC-RAS Model)

Reach No. 22 – Halls Canyon Channel

Site Visit: 08/03/2010

Looking d/s from Sta.20+19.44 (HEC-RAS Model)

Looking d/s at the right bank from Sta. 20+19.44 (HEC-RAS Model)

Site Visit: 08/03/2010

Looking d/s at left bank from Sta. 20+19.44 (HEC-RAS Model)

Looking u/s at Sta. 20+48.61 (HEC-RAS Model)

Site Visit: 08/03/2010

Looking u/s at Sta. 22+57.70 (HEC-RAS Model)

Looking u/s from Sta. 22+57.70 (HEC-RAS Model)

Reach No. 22 – Halls Canyon Channel

Site Visit: 08/03/2010

Looking northwest from Sta. 22+57.70 (HEC-RAS Model)

Looking d/s from Sta. 23+03.38 (HEC-RAS Model)

Reach No. 22 – Halls Canyon Channel

Site Visit: 08/03/2010

Looking d/s from Sta. 23+03.38 (HEC-RAS Model)

Looking d/s from Sta. 25+38.08 (HEC-RAS Model)

Reach No. 22 – Halls Canyon Channel

Site Visit: 08/03/2010

Looking d/s from Sta. 25+38.08 (HEC-RAS Model)

Looking southeast along Sta. 25+38.08 (HEC-RAS Model)

Reach No. 22 – Halls Canyon Channel

Site Visit: 08/03/2010

Looking u/s from Sta. 25+48.26 (HEC-RAS Model)

Site Visit: 10/30-31/2007

Looking u/s at Artesia Blvd & Artesia Fwy (91)
near Sta. 202+80.50 (HEC-RAS Model)

Looking u/s at Alameda St and South Pacific Rail Road (SPRR)
near Sta. 198+88.25 (HEC-RAS Model)

Reach No. 24 - Compton Creek

Site Visit: 10/30-31/2007

Looking d/s at Santa Fe Ave
near Sta. 155+35 (HEC-RAS Model)

Looking u/s at Santa Fe Ave
near Sta. 154+00 (HEC-RAS Model)

Reach No. 24 - Compton Creek

Site Visit: 10/30-31/2007

Looking d/s at Del Amo Blvd near Sta. 101+10 (HEC-RAS Model)

Looking u/s at Del Amo Blvd near Sta. 99+75 (HEC-RAS Model)

Site Visit: 10/30-31/2007

Looking d/s at Long Beach Fwy (710)
near Sta. 86+95 (HEC-RAS Model)

Looking at Compton Creek and Los Angeles River Confluence
near Sta. 79+27 (HEC-RAS Model)

Site Visit: 7/15/2010

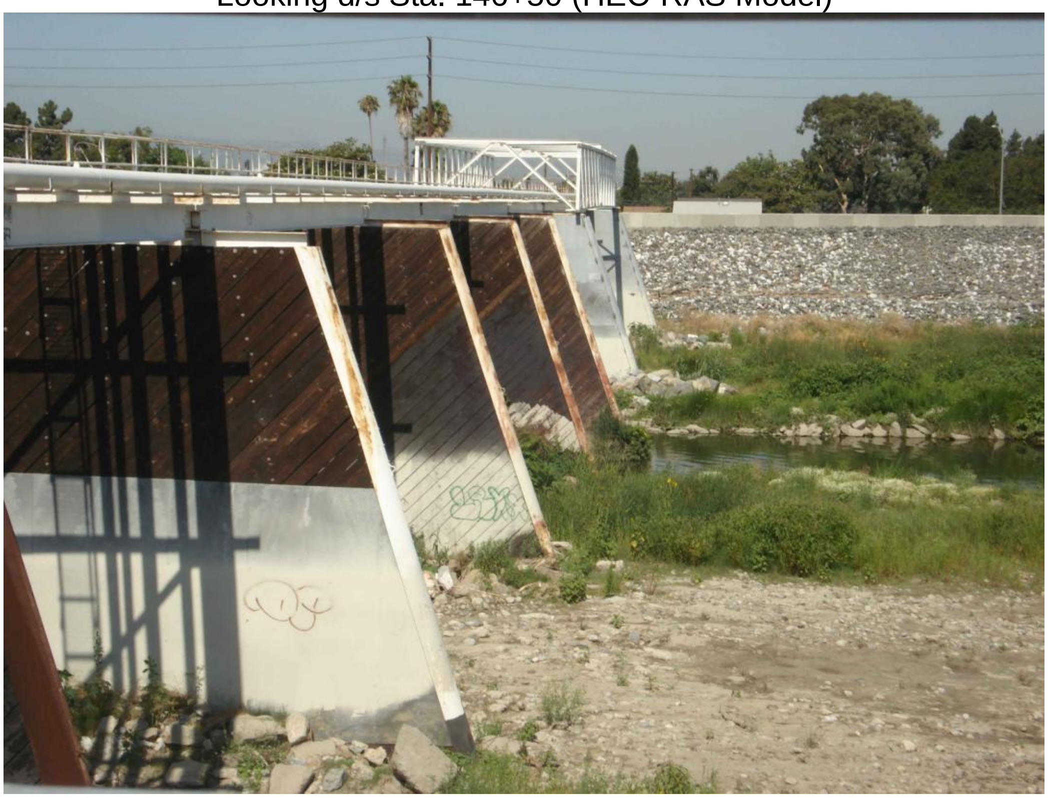
Looking d/s Sta. 159+00 (HEC-RAS Model)

Looking u/s Sta. 157+00 (HEC-RAS Model)

Site Visit: 7/15/2010

Looking u/s Sta. 152+81 (HEC-RAS Model)

Looking d/s Sta. 146+50 (HEC-RAS Model)



Reach No. 25 – Los Angeles River

Site Visit: 7/15/2010

Looking u/s Sta. 136+00 (HEC-RAS Model)

Looking u/s Sta. 135+00 (HEC-RAS Model)

Reach No. 25 – Los Angeles River

Site Visit: 7/15/2010

Looking u/s Sta. 132+50 (HEC-RAS Model)

Looking u/s Sta. 117+00 (HEC-RAS Model)

Reach No. 25 – Los Angeles River

Site Visit: 7/15/2010

Looking d/s Sta. 117+00 (HEC-RAS Model)

Looking u/s Sta. 105+71 (HEC-RAS Model)

Reach No. 99 – Kagel Canyon

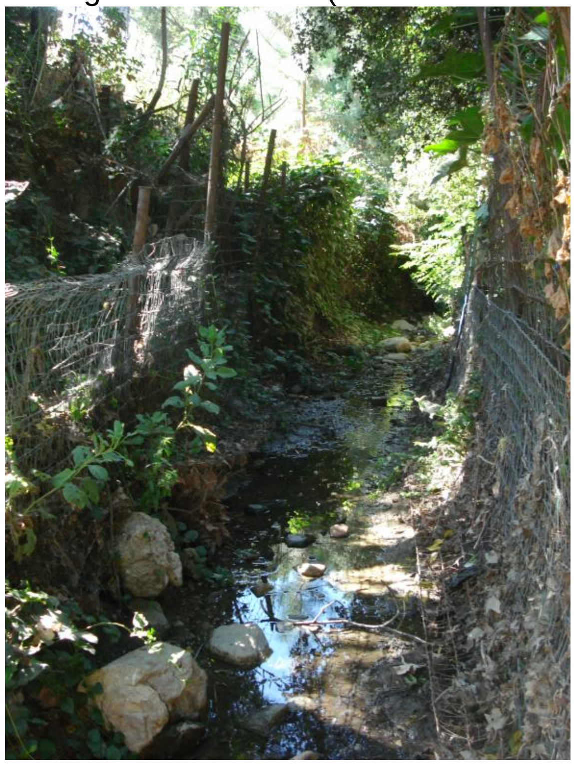
Site Visit: 8/19/2010

Looking d/s Sta. 61+75 (HEC-RAS Model)

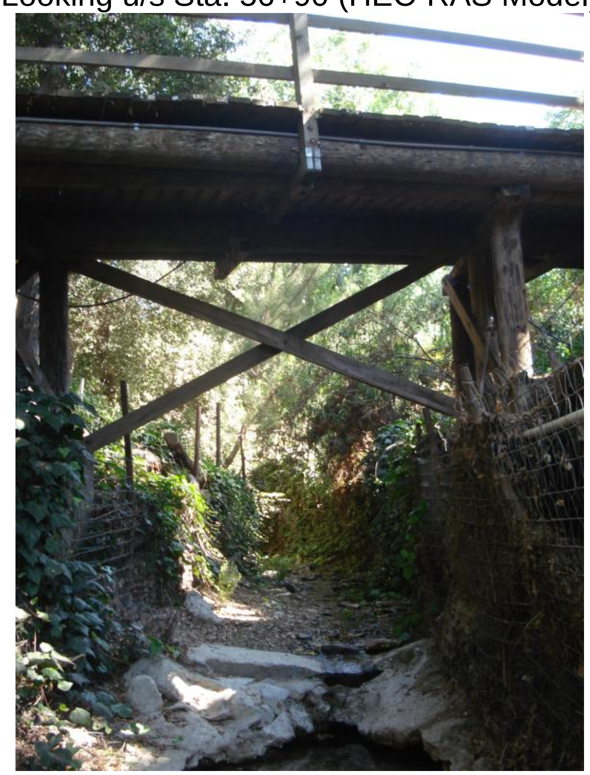
Looking u/s Sta. 60+26.61 (HEC-RAS Model)

Site Visit: 8/19/2010

Looking d/s Sta. 58+16 (HEC-RAS Model)



Looking u/s Sta. 56+90 (HEC-RAS Model)



Reach No. 99 – Kagel Canyon

Site Visit: 8/19/2010

Looking d/s Sta. 51+55 (HEC-RAS Model)

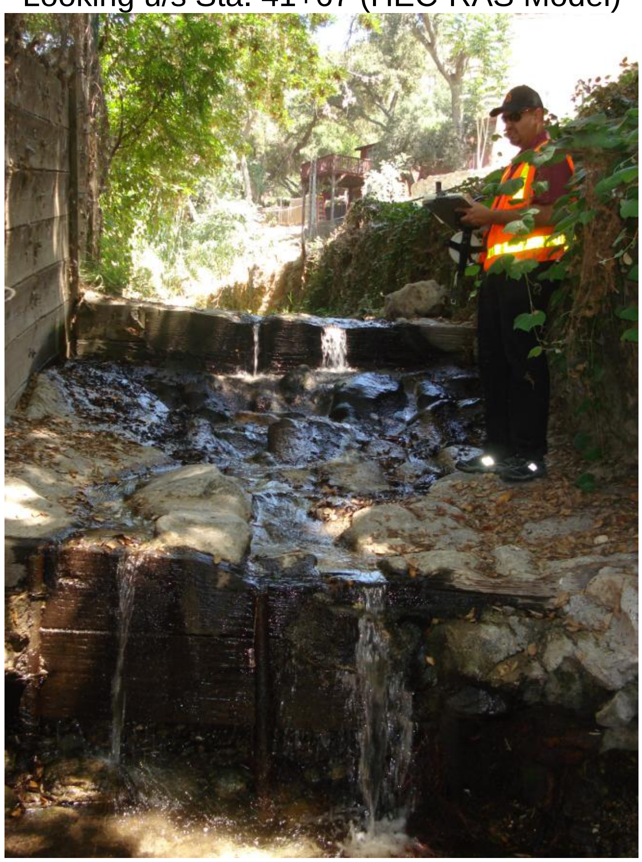
Looking d/s Sta. 50+58 (HEC-RAS Model)

Reach No. 99 – Kagel Canyon

Site Visit: 8/19/2010

Looking d/s Sta. 47+85 (HEC-RAS Model)

Looking u/s Sta. 41+67 (HEC-RAS Model)



Reach No. 99 – Kagel Canyon

Site Visit: 8/19/2010

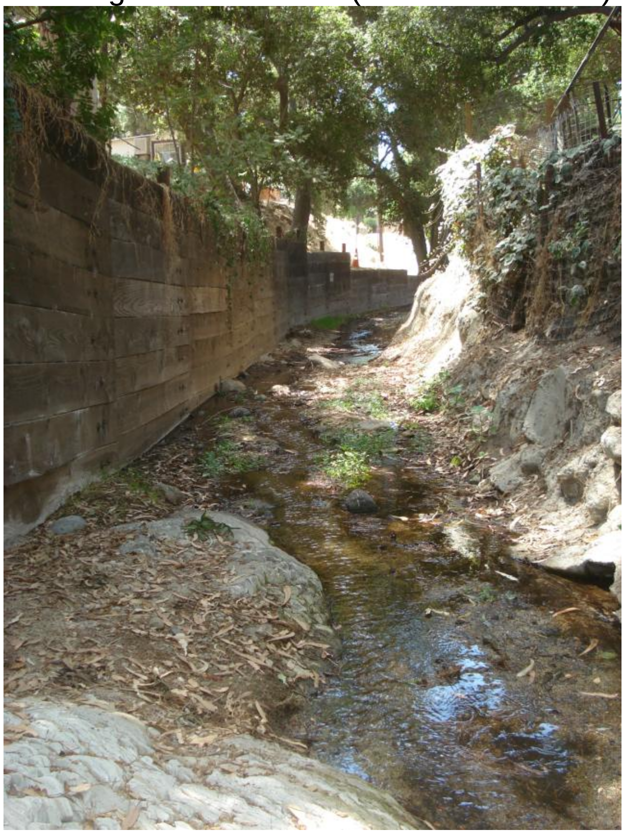
Looking d/s Sta. 40+34 (HEC-RAS Model)

Looking u/s Sta. 36+76 (HEC-RAS Model)

Site Visit: 8/19/2010

Looking u/s Sta. 27+05 (HEC-RAS Model)

Looking d/s Sta. 23+14 (HEC-RAS Model)



Site Visit: 8/19/2010

Looking u/s Sta. 22+13 (HEC-RAS Model)

Looking d/s Sta. 21+50 (HEC-RAS Model)

Site Visit: 8/19/2010

Looking d/s Sta. 21+29 (HEC-RAS Model)

Looking u/s Sta. 15+13 (HEC-RAS Model)

Site Visit: 9/15/2010

Looking u/s Sta. 9+52 (HEC-RAS Model)

Site Visit: 7/28/2010

Looking d/s Sta. 7+40 (HEC-RAS Model)

Looking towards east bank at Sta. 6+40 (HEC-RAS Model)

Reach No. 100 – Dry Canyon Calabasas

Site Visit: 7/28/2010

Looking u/s Sta. 6+40 (HEC-RAS Model)

Looking d/s Sta. 6+15 (HEC-RAS Model)

Appendix B

Manning's Roughness Calculations by Reach

Reach No. 1 - Bell Creek (Existing Vegetation Scenario)

Reach, Station, or X-Sect		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	
		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+57.125 - Sta 8+09.5	Left Bank		0.025				0				0				0.005				0.025			1			0.055
	Main Channel		0.025				0				0				0.005				0.025			1			0.055
	Right Bank		0.025				0				0				0.005				0.025			1			0.055
Sta 8+09.5 - Sta 7+37.788	Left Bank		0.025				0				0			0				0.005				1			0.030
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank		0.025				0				0			0				0.005				1			0.030
Sta 7+37.788 - Sta 6+65.75	Left Bank		0.025				0				0			0				0.007				1			0.032
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank		0.025				0				0			0				0.002				1			0.027
Sta 6+65.75 - Sta 0+33.221	Left Bank		0.025				0				0			0				0.002				1			0.027
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank		0.025				0				0			0				0.005				1			0.030

Reach No. 1 - Bell Creek (Recommendation Scenario)

Reach, Station, or X-Sect		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	
		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+57.125 - Sta 8+09.5	Left Bank		0.025				0				0				0.005				0.025			1			0.055
	Main Channel		0.025				0				0				0.005				0.025			1			0.055
	Right Bank		0.025				0				0				0.005				0.025			1			0.055
Sta 8+09.5 - Sta 7+37.788	Left Bank		0.025				0				0			0					0.025			1			0.050
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank		0.025				0				0			0				0.005				1			0.030
Sta 7+37.788 - Sta 6+65.75	Left Bank		0.025				0				0			0				0.007				1			0.032
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank		0.025				0				0			0				0.002				1			0.027
Sta 6+65.75 - Sta 0+33.221	Left Bank		0.025				0				0			0				0.002				1			0.027
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank		0.025				0				0			0				0.005				1			0.030

Reach Nos. 2 & 96 - Dry Canyon and PD 1591 (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"
		0.026 – 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	
		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. 25+17.29 – Sta. 22+73.80	Left Bank		0.025				0				0			0						0.05		1			0.075
	Main Channel		0.025				0				0			0						0.05		1			0.075
	Right Bank		0.025				0				0			0						0.05		1			0.075
Sta. 22+73.80 – Sta. 21+86.39	Left Bank	(Soil & grouted rocks approaching culvert, 0.026)					0				0			0					0.012			1			0.038
	Main Channel	(Soil & grouted rocks approaching culvert, 0.026)					0				0			0					0.012			1			0.038
	Right Bank	(Soil & grouted rocks approaching culvert, 0.026)					0				0			0					0.012			1			0.038
Sta. 21+86.39 – Sta. 20+81.61	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. 20+81.61 – Sta. 20+40.61	Left Bank	(Concrete outlet open to downstream, 0.015)					0				0						0.05	0				1			0.065
	Main Channel	(Concrete outlet open to downstream, 0.015)					0				0						0.05	0				1			0.065
	Right Bank	(Concrete outlet open to downstream, 0.015)					0				0						0.05	0				1			0.065
Sta. 20+40.61 – Sta. 19+88.33	Left Bank	(Roughly grouted riprap, 0.036)					0				0			0						0.04		1			0.076
	Main Channel	(Roughly grouted riprap, 0.036)					0				0			0						0.04		1			0.076
	Right Bank	(Roughly grouted riprap, 0.036)					0				0			0						0.04		1			0.076
Sta. 19+88.33 – Sta. 15+94.72	Left Bank		0.025				0				0			0						0.05		1			0.075
	Main Channel		0.025				0				0			0						0.05		1			0.075
	Right Bank		0.025				0				0			0						0.05		1			0.075
Sta. 15+94.72 – Sta. 15+34.33	Left Bank		0.025				0				0			0						0.025		1			0.050
	Main Channel		0.025				0				0			0						0.025		1			0.050
	Right Bank		0.025				0				0			0						0.025		1			0.050
Sta. 15+34.33 – Sta. 12+78.47	Left Bank	(Both sides cribwalls, bed sandy soil, 0.026)					0				0			0.004				0				1			0.030
	Main Channel	(Both sides cribwalls, bed sandy soil, 0.026)					0				0			0.004				0				1			0.030
	Right Bank	(Both sides cribwalls, bed sandy soil, 0.026)					0				0			0.004				0				1			0.030
Sta. 12+78.47 – Sta. 12+35.28	Left Bank		0.025				0				0			0				0.002				1			0.027
	Main Channel		0.025				0				0			0				0.002				1			0.027
	Right Bank		0.025				0				0			0				0.002				1			0.027
Sta. 12+35.28 – Sta. 11+70.35	Left Bank		0.025				0				0			0				0.009				1			0.034
	Main Channel		0.025				0				0			0				0.009				1			0.034
	Right Bank		0.025				0				0			0				0.009				1			0.034
Sta. 11+70.35 – Sta. 10+64.98	Left Bank		0.025				0				0			0					0.019			1			0.044
	Main Channel		0.025				0				0			0					0.019			1			0.044
	Right Bank		0.025				0				0			0					0.019			1			0.044
Sta. 10+64.98 – Sta. 9+06.27	Left Bank		0.025				0				0			0						0.049		1			0.074
	Main Channel		0.025				0				0			0						0.049		1			0.074
	Right Bank		0.025				0				0			0						0.049		1			0.074
Sta. 9+06.27 – Sta. 8+25.30	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		0.025				0				0			0				0.005				1			0.030
Sta. 8+25.30 – Sta. 0+49.13	Left Bank		0.025						0.006		0					0.025			0.025			1			0.081
	Main Channel		0.025						0.006		0					0.025			0.025			1			0.081
	Right Bank		0.025						0.006		0					0.025			0.025			1			0.081

Reach No. 3 - Santa Susana Creek (Existing Vegetation Scenario)

		n_b					n_1				n_2			n_3				n_4				m			
		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	**Total "n"**
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. 9+04.71 – Sta. 6+15.17	Left Bank		0.025				0					0.001		0.001				0.003				1			0.030
	Main Channel		0.025				0					0.001		0.001				0.003				1			0.030
	Right Bank		0.025				0					0.001		0.001				0.003				1			0.030
Sta. 6+15.17 – Sta. 5+99.82	Left Bank		0.025				0				0			0				0.003				1			0.028
	Main Channel		0.025				0				0			0				0.003				1			0.028
	Right Bank		0.025				0				0			0				0.003				1			0.028
Sta. 5+99.82 – Sta. 5+84.48	Left Bank		0.025				0				0			0				0.002				1			0.027
	Main Channel		0.025				0				0			0				0.002				1			0.027
	Right Bank		0.025				0				0			0				0.002				1			0.027
Sta. 5+84.48 – Sta. 5+55.68	Left Bank	(Transition from soil to concrete, 0.02)					0					0.003		0				0.002				1			0.025
	Main Channel	(Transition from soil to flush grouted cobble, 0.025)					0				0			0				0				1			0.025
	Right Bank	(Transition from soil to concrete, 0.02)					0					0.003		0				0.002				1			0.025
Sta. 5+55.68 – Sta. 0+12.79	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. 4 - Browns Canyon Creek (Existing Vegetation Scenario)

		n_b					n_1				n_2			n_3				n_4				m			
		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	**Total "n"**
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. 13+81.14 – Sta. 11+53.98	Left Bank		0.025				0				0			0							0.06	1			0.085
	Main Channel		0.025				0				0			0							0.06	1			0.085
	Right Bank		0.025				0				0			0							0.06	1			0.085
Sta. 11+53.98 – Sta. 9+75.93	Left Bank		0.025				0				0			0					0.01			1			0.035
	Main Channel		0.025				0				0			0					0.01			1			0.035
	Right Bank		0.025				0				0			0					0.01			1			0.035
Sta. 9+75.93 – Sta. 7+97.19	Left Bank	n= 0.017, wooden plank walls w/ battens					0				0			0				0				1			0.017
	Main Channel		0.025				0				0			0.002				0.003				1			0.030
	Right Bank	n= 0.017, wooden plank walls w/ battens					0				0			0				0				1			0.017
Sta. 7+97.19 – Sta. 1+18.81	Left Bank	n= 0.017, wooden plank walls w/ battens					0				0			0				0				1			0.017
	Main Channel		0.025				0				0			0					0.025			1			0.050
	Right Bank	n= 0.017, wooden plank walls w/ battens					0				0			0				0				1			0.017
Sta. 1+18.81 – Sta. 0+71.09	Left Bank	n = 0.018, staggered, vertical metal beam wall					0				0			0				0				1			0.018
	Main Channel		0.025				0				0			0.004				0				1			0.029
	Right Bank	n = 0.018, staggered, vertical metal beam wall					0				0			0				0				1			0.018
Sta. 0+71.09 – Sta. 0+9.37	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 Nos. 5 & 6 - Caballero Creek (East and West) (Existing Vegetation Scenario)

		n_b					n_1				n_2			n_3				n_4				m			
		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	**Total "n"**
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 6+24.567 - Sta 3+30.702	Left Bank			0.024			0				0			0				0				1			0.024
	Main Channel					0.03	0				0			0					0.025			1			0.055
	Right Bank			0.025			0				0				0.005			0.01				1			0.040
Sta 3+30.702 - Sta 1+20.820	Left Bank			0.024			0				0			0				0				1			0.024
	Main Channel		0.025				0				0			0						0.05		1			0.075
	Right Bank		0.025				0				0			0					0.025			1			0.050
Sta 1+20.820 - Sta 0+05.577	Conc Channel				0.015		0				0			0				0				1			0.015

Reach No. 7 - Bull Creek (Existing Vegetation Scenario)

Reach, Station, or X-Sect		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	
		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 4+88.120 - Sta 4+26.453	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 4+26.453 - Sta 3+00.650	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 3+00.650 - Sta 2+75.531	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				0.005				1			0.035
Sta 2+75.531 - Sta 2+48.611	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 2+48.611 - Sta 0+40.249	Left Bank		0.035				0				0			0				0.005				1			0.040
	Main Channel		0.035				0				0			0				0				1			0.035
	Right Bank		0.035				0				0			0				0.005				1			0.040
Sta 0+40.249 - Sta 12.627	Left Bank		0.025				0				0			0					0.01			1			0.035
	Main Channel		0.025				0				0			0				0				1			0.025
	Right Bank		0.025				0				0			0					0.01			1			0.035

Reach No. 8 - Project No. 470 (Existing Vegetation Scenario)

		n_b					n_1				n_2			n_3				n_4				m			
		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	Total "n"
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 14+40.177 - Sta 11+81.478	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 11+81.478 - Sta 8+07.090	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 8+07.090 - Sta 6+37.590	Left Bank		0.025				0				0			0				0				1			0.025
	Main Channel		0.025				0				0			0				0.01				1			0.035
	Right Bank		0.025				0				0			0				0				1			0.025
Sta 6+37.590 - Sta 2+87.012	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. 9 - Tributary to Sepulvada Basin Project No. 106 (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"
		0.026 – 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	
		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 3+41.084 - Sta 2+37.008	Left Bank		0.025				0				0			0				0				1			0.025
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank				0.015		0				0			0				0				1			0.015
Sta 2+37.008 - Sta 2+17.286	Left Bank				0.015		0				0			0				0				1			0.015
	Main Channel					0.03	0				0			0				0				1			0.030
	Right Bank				0.015		0				0			0				0				1			0.015
Sta 2+17.286 - Sta 1+98.938	Left Bank		0.025				0				0				0.005			0.005				1			0.035
	Main Channel					0.03	0				0			0				0				1			0.030
	Right Bank		0.025				0				0				0.005			0.005				1			0.035
Sta 1+98.938 - Sta 1+88.739	Left Bank		0.025				0				0				0.005			0.005				1			0.035
	Main Channel			0.025			0				0			0				0				1			0.025
	Right Bank		0.025				0				0				0.005			0.005				1			0.035
Sta 1+88.739 - Sta 0+02.184	Left Bank		0.025				0				0				0.005			0.005				1			0.035
	Main Channel					0.035	0				0				0.01			0.005				1			0.050
	Right Bank		0.025				0				0				0.005			0.005				1			0.035

Reach No. 9 - Tributary to Sepulvada Basin Project No. 106 (Recommendation Scenario)

Proposed recommendations warrant no change to existing Manning's Roughness values

Reach No. 10 - Tributary to Sepulveda Basin Project No. 469 (Existing Vegetation Scenario)

		n_b					n_1				n_2			n_3				n_4				m			
		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	**Total "n"**
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 60+18.28 - Sta 52+48.75	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 52+48.75 - Sta 48+75	Left Bank					0.05	0				0			0				0				1			0.050
	Main Channel					0.04	0				0			0					0.025			1			0.065
	Right Bank					0.05	0				0			0				0				1			0.050
Sta 48+75 - Sta 42+70	Left Bank		0.025				0				0			0				0.005				1			0.030
	Main Channel		0.025				0				0			0				0				1			0.025
	Right Bank		0.025				0				0			0					0.015			1			0.040
Sta 42+70 - Sta 42+30	Left Bank		0.025				0				0			0				0.005				1			0.030
	Main Channel				0.018		0				0			0				0				1			0.018
	Right Bank		0.025				0				0			0					0.015			1			0.040
Sta 42+30 - Sta 39+30	Left Bank		0.025				0				0			0				0.005				1			0.030
	Main Channel		0.025				0				0			0					0.01			1			0.035
	Right Bank		0.025				0				0			0					0.015			1			0.040
Sta 39+30 - Sta 37+20	Left Bank		0.025				0				0			0				0.005				1			0.030
	Main Channel		0.025				0				0			0					0.02			1			0.045
	Right Bank		0.025				0				0			0					0.015			1			0.040
Sta 37+20 - Sta 36+63	Left Bank		0.025				0				0			0				0.005				1			0.030
	Main Channel		0.025				0				0			0					0.01			1			0.035
	Right Bank		0.025				0				0			0					0.015			1			0.040
Sta 36+63 - Sta 35+00	Left Bank	(Rough Gunite Portion, n =0.022)					0				0			0				0				1			0.022
	Main Channel	(Rough Gunite Portion, n =0.022)					0				0			0				0				1			0.022
	Right Bank	(Rough Gunite Portion, n =0.022)					0				0			0				0				1			0.022
Sta 35+00 - Sta 11+64.11	Left Bank		0.025				0				0			0					0.01			1			0.035
	Main Channel		0.025				0				0			0						0.03		1			0.055
	Right Bank		0.025				0				0			0					0.015			1			0.040

Reach No. 12 - Haines Canyon Creek (Existing Vegetation Scenario)

		n_b					n_1				n_2			n_3				n_4				m			
		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	Total "n"
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 8+91.725 - Sta 6+86.38	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 6+86.38 - Sta 5+74.096	Left Bank					0.03		0.005			0			0				0				1			0.035
	Main Channel		0.025				0				0				0.005			0				1			0.030
	Right Bank		0.025				0				0			0				0.002				1			0.027
Sta 5+74.096 - Sta 4+45.344	Left Bank					0.03		0.005			0			0				0				1			0.035
	Main Channel		0.025				0				0			0					0.015			1			0.040
	Right Bank		0.025				0				0			0					0.015			1			0.040
Sta 4+45.344 - Sta 2+39.964	Left Bank					0.035	0				0			0				0				1			0.035
	Main Channel		0.025				0				0			0					0.02			1			0.045
	Right Bank		0.025				0				0			0					0.02			1			0.045
Sta 2+39.964 - Sta 1+88.032	Left Bank					0.035	0				0			0				0				1			0.035
	Main Channel		0.025				0				0				0.005				0.02			1			0.050
	Right Bank		0.025				0				0			0					0.02			1			0.045

Reach No. 13 - Tributary to Hansen Lake Project No. 5215 Unit 1 (Existing Vegetation Scenario)

Reach, Station, or X-Sect		n_b Base "n" 0.026 – 0.035 Sand	0.025 – 0.032 Firm Soil	0.024 – 0.035 Gravel	0.012 – 0.018 Concrete	0.03 – 0.07 Cobble / Boulder	n_1 Surface Irregularity 0 Smooth	0.001 – 0.005 Minor	0.006 – 0.010 Moderate	0.011 – 0.020 Severe	n_2 Variation in Channel Cross Section 0 Gradual	0.001 – 0.005 Alternating Occasionally	0.010 – 0.015 Alternating Frequently	n_3 Obstructions 0.000 – 0.004 Negligible	0.005 – 0.015 Minor	0.020 – 0.030 Appreciable	0.040 – 0.050 Severe	n_4 Vegetation 0.002 – 0.010 Small	0.010 – 0.025 Medium	0.025 – 0.050 Large	0.050 – 0.100 Very Large	m Meandering 1 Minor	1.15 Appreciable	1.3 Severe	Total "n"
Sta 779.276 - Sta 6+00.530	Left Bank				0.015		0				0			0								1			0.015
	Main Channel				0.015		0				0			0								1			0.015
	Right Bank				0.015		0				0			0								1			0.015
Sta 6+00.530 - Sta 4+39.612	Left Bank		0.025				0				0				0.005			0.005				1			0.035
	Main Channel		0.025				0				0			0				0.005				1			0.030
	Right Bank		0.025				0				0				0.005			0.005				1			0.035
Sta 4+39.612 - Sta 1+98.674	Left Bank		0.025				0				0			0						0.025		1			0.050
	Main Channel		0.025				0				0			0				0.005				1			0.030
	Right Bank		0.025				0				0			0						0.025		1			0.050
Sta 1+98.674 - Sta 73.747	Left Bank		0.025				0				0			0						0.025		1			0.050
	Main Channel		0.025				0				0			0.002				0.005				1			0.032
	Right Bank		0.025				0				0			0						0.025		1			0.050

Reach No. 14 - May Canyon Creek (Existing Vegetation Scenario)

		n_b					n_1				n_2			n_3				n_4				m			
		Base "n"					**Surface Irregularity**				**Variation in Channel Cross Section**			**Obstructions**				**Vegetation**				**Meandering**			**Total "n"**
		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 10+05.999 - Sta 8+62.935	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel				0.018		0				0			0				0				1			0.018
	Right Bank					0.03	0				0			0				0				1			0.030
Sta 8+62.935 - Sta 8+01.758	Left Bank	(Corrugated Metal Pipe, 0.024)					0				0			0				0				1			0.024
	Main Channel	(Corrugated Metal Pipe, 0.024)					0				0			0				0				1			0.024
	Right Bank	(Corrugated Metal Pipe, 0.024)					0				0			0				0				1			0.024
Sta 8+01.758 - Sta 5+24.404	Left Bank		0.025				0				0				0.005					0.025		1			0.055
	Main Channel		0.025				0				0				0.005			0				1			0.030
	Right Bank		0.025				0				0				0.005					0.025		1			0.055
Sta 5+24.404 - Sta 4+72.350	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 4+72.350 - Sta 4+53.220	Left Bank		0.025				0				0			0				0.005				1			0.030
	Main Channel		0.025					0.005			0			0				0				1			0.030
	Right Bank		0.025					0.005			0			0				0				1			0.030
Sta 4+53.220 - Sta 68.929	Left Bank					0.035		0.005			0			0					0.01			1			0.050
	Main Channel					0.035		0.005			0			0					0.01			1			0.050
	Right Bank					0.035		0.005			0			0					0.01			1			0.050

Reach No. 15 - Pacoima Wash (Existing Vegetation Scenario)

Reach, Station, or X-Sect		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	
		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 150+87.04 - Sta 105+55.01	Left Bank				0.013		0				0			0				0				1			0.013
	Main Channel			0.022			0				0			0					0.015			1			0.037
	Right Bank				0.013		0				0			0				0				1			0.013
Sta 105+55.01 - Sta 103+25.01	Left Bank				0.013		0				0			0				0				1			0.013
	Main Channel			0.022			0				0			0					0.025			1			0.047
	Right Bank				0.013		0				0			0				0				1			0.013

Reach No. 16 - Verdugo Wash - Las Barras Canyon Channel Inlet (Existing Vegetation Scenario)

		n_b					n_1				n_2			n_3				n_4				m			
		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	Total "n"
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 2+32.648 - Sta 1+32.392	Left Bank		0.025				0				0			0						0.035		1			0.060
	Main Channel		0.027					0.005			0			0				0.01				1			0.042
	Right Bank		0.025				0				0			0						0.035		1			0.060
Sta 1+32.392 - Sta 0+45.068	Left Bank					0.03	0				0			0				0.003				1			0.033
	Main Channel					0.03	0				0			0				0.008				1			0.038
	Right Bank					0.03	0				0			0				0.003				1			0.033
Sta 0+45.068 - Sta 0+31.361	Left Bank				0.017		0				0			0				0				1			0.017
	Main Channel				0.017		0				0			0				0				1			0.017
	Right Bank				0.017		0				0			0				0				1			0.017

Reach No. 18 - Engleheard Channel, Tributary to Verdugo Wash (Existing Vegetation Scenario)

		n_b					n_1				n_2			n_3				n_4				m			
		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	**Total "n"**
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 9+00.408 - Sta 8+50.774	Left Bank		0.025				0				0			0					0.01			1			0.035
	Main Channel					0.03	0				0			0				0.005				1			0.035
	Right Bank		0.025				0				0			0					0.01			1			0.035
Sta 8+50.774 - Sta 7+43.277	Left Bank		0.025				0				0			0					0.01			1			0.035
	Main Channel					0.03	0				0			0				0.005				1			0.035
	Right Bank		0.025				0				0			0					0.015			1			0.040
Sta 7+43.277 - Sta 4+60.709	Left Bank		0.025				0				0				0.005				0.01			1			0.040
	Main Channel	0.027					0				0			0.002				0				1			0.029
	Right Bank		0.025				0				0				0.01				0.01			1			0.045
Sta 4+60.709 - Sta 3+60.741	Left Bank		0.025				0				0				0.01				0.01			1			0.045
	Main Channel	0.027					0				0			0				0.004				1			0.031
	Right Bank		0.025				0				0				0.01				0.02			1			0.055
Sta 3+60.741 - Sta 3+09.860	Left Bank		0.025				0				0			0				0.005				1			0.030
	Main Channel	0.027					0				0			0				0.004				1			0.031
	Right Bank		0.025				0				0				0.005			0.005				1			0.035
Sta 3+09.860 - Sta 2+37.261	Left Bank		0.025				0				0				0.005				0.01			1			0.040
	Main Channel	0.027					0				0			0				0.006				1			0.033
	Right Bank		0.025				0				0				0.005			0.005				1			0.035
Sta 2+37.261 - Sta 0+71.922	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. 19 - Pickens Canyon (Existing Vegetation Scenario)

Reach, Station, or X-Sect		n_b					n_1				n_2			n_3				n_4				m			n
		Base "n"					Surface Irregularity				Variation in Channel Cross Section			Obstructions				Vegetation				Meandering			Total "n"
		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	
		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 24+42.12 - Sta 20+04.5	Left Bank				0.017		0				0			0				0				1			0.017
	Main Channel					0.032	0				0			0				0				1			0.032
	Right Bank		0.025					0.005			0			0				0.01				1			0.040
Sta 20+04.5 - Sta 18+78.07	Left Bank				0.017		0				0			0				0				1			0.017
	Main Channel					0.032	0				0			0				0				1			0.032
	Right Bank		0.025				0				0			0						0.035		1			0.060
Sta 18+78.07 - Sta 13+12.07	Left Bank				0.017		0				0			0				0				1			0.017
	Main Channel					0.032	0				0			0				0				1			0.032
	Right Bank		0.025					0.005			0					0.02			0.012			1			0.062
Sta 13+12.07 - Sta 12+50.11	Left Bank				0.017		0				0			0				0				1			0.017
	Main Channel					0.032	0				0			0				0				1			0.032
	Right Bank		0.025					0.002			0			0				0				1			0.027
Sta 12+50.11 - Sta 11+43.84	Left Bank				0.017		0				0			0				0				1			0.017
	Main Channel					0.032	0				0			0				0				1			0.032
	Right Bank			0.027				0.005			0			0					0.012			1			0.044
Sta 11+43.84 - Sta 9+13.85	Left Bank				0.017		0				0			0				0				1			0.017
	Main Channel					0.032	0				0			0				0				1			0.032
	Right Bank					0.03		0.005			0			0				0.005				1			0.040
Sta 9+13.85- Sta 1+30.23	Left Bank				0.017		0				0			0				0				1			0.017
	Main Channel					0.032	0				0			0				0				1			0.032
	Right Bank		0.025					0.005			0			0					0.015			1			0.045
Sta 1+30.23 - Sta 33.118	Left Bank				0.017		0				0			0				0				1			0.017
	Main Channel	0.026					0				0			0								1			0.026
	Right Bank	0.026					0				0			0								1			0.026

Reach No. 19 - Pickens Canyon (Recommendation Scenario)

Reach, Station, or X-Sect		n_b					n_1				n_2			n_3				n_4				m			n
		Base "n"					Surface Irregularity				Variation in Channel Cross Section			Obstructions				Vegetation				Meandering			Total "n"
		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	
		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 24+42.12 - Sta 20+04.5	Left Bank				0.017		0				0			0				0				1			0.017
	Main Channel					0.032	0				0			0				0.01				1			0.042
	Right Bank		0.025					0.005			0			0				0.01				1			0.040
Sta 20+04.5 - Sta 18+78.07	Left Bank				0.017		0				0			0				0				1			0.017
	Main Channel					0.032	0				0			0				0.01				1			0.042
	Right Bank		0.025				0				0			0						0.035		1			0.060
Sta 18+78.07 - Sta 13+12.07	Left Bank				0.017		0				0			0				0				1			0.017
	Main Channel					0.032	0				0			0				0.01				1			0.042
	Right Bank		0.025					0.005			0					0.02			0.012			1			0.062
Sta 13+12.07 - Sta 12+50.11	Left Bank				0.017		0				0			0				0				1			0.017
	Main Channel					0.032	0				0			0				0.01				1			0.042
	Right Bank		0.025					0.002			0			0				0				1			0.027
Sta 12+50.11 - Sta 11+43.84	Left Bank				0.017		0				0			0				0				1			0.017
	Main Channel					0.032	0				0			0				0.01				1			0.042
	Right Bank			0.027				0.005			0			0					0.012			1			0.044
Sta 11+43.84 - Sta 9+13.85	Left Bank				0.017		0				0			0				0				1			0.017
	Main Channel					0.032	0				0			0				0.01				1			0.042
	Right Bank					0.03		0.005			0			0				0.005				1			0.040
Sta 9+13.85 - Sta 7+36	Left Bank				0.017						0			0				0				1			0.017
	Main Channel					0.032					0			0				0.01				1			0.042
	Right Bank		0.025								0			0				0				1			0.025
Sta 7+36- Sta 1+30.23	Left Bank				0.017		0				0			0				0				1			0.017
	Main Channel					0.032	0				0			0				0				1			0.032
	Right Bank		0.025					0.005			0			0					0.015			1			0.045
Sta 1+30.23 - Sta. 33.118	Left Bank				0.017		0				0			0				0				1			0.017
	Main Channel	0.026					0				0			0				0				1			0.026
	Right Bank	0.026					0				0			0				0				1			0.026

Reach Nos. 20 & 21 - Webber Channel (Existing Vegetation Scenario)

		n_b					n_1				n_2			n_3				n_4				m			
		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	Total "n"
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 6+46.82 - Sta 4+24.97	Left Bank	0.026						0.001			0			0				0				1			0.027
	Main Channel	0.026						0.001			0			0				0				1			0.027
	Right Bank	0.025						0.005			0			0				0				1			0.030
Sta 4+24.97- Sta 3+76.89	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 3+76.89 - Sta 0+51.22	Left Bank	0.025						0.003			0			0.002				0				1			0.030
	Main Channel	0.026						0.001			0			0				0				1			0.027
	Right Bank	0.025						0.001			0			0				0				1			0.026
Sta 0+51.22 - Sta 0+00.50	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. 20 - Webber Channel (Recommendation Scenario)

Proposed recommendations warrant no change to existing Manning's Roughness values

Reach No. 21 - Webber Channel (Recommendation Scenario)

Proposed recommendations warrant no change to existing Manning's Roughness values

Reach No. 22 - Halls Canyon Channel (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"
		0.026 – 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	
		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 27+49.92 - Sta 25+45.30	Left Bank		0.025					0.001			0			0.004					0.02			1			0.050
	Main Channel			0.026				0.001			0			0.001				0.002				1			0.030
	Right Bank		0.025					0.001			0			0.004					0.01			1			0.040
Sta 25+45.30 - Sta 25+29.49	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 25+29.49 - Sta 23+11.28	Left Bank		0.025					0.001			0			0.004					0.01			1			0.040
	Main Channel			0.026				0.001			0			0.004				0				1			0.031
	Right Bank		0.025					0.001			0			0.004				0.005				1			0.035
Sta 23+11.28 - Sta 22+97.65	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 22+97.65 - Sta 20+27.34	Left Bank		0.025					0.001			0			0.004					0.01			1			0.040
	Main Channel			0.026				0.001			0			0.003				0				1			0.030
	Right Bank		0.025					0.002			0			0.003				0.002				1			0.032
Sta 20+27.34 - Sta 20+14.53	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 20+14.53 - Sta 17+39.40	Left Bank		0.025					0.002			0				0.005				0.018			1			0.050
	Main Channel			0.026				0.001			0			0.003				0				1			0.030
	Right Bank		0.025					0.001			0			0				0.002				1			0.028
Sta 17+39.40 - Sta 17+24.28	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 17+24.28 - Sta 11+96.42	Left Bank		0.025					0.001			0			0.004					0.02			1			0.050
	Main Channel			0.026				0.001			0			0.003				0				1			0.030
	Right Bank		0.025					0.001			0			0.001				0				1			0.027
Sta 11+96.42 - Sta 11+87.16	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 11+87.16 - Sta 10+89.98	Left Bank		0.025					0.001			0			0.004					0.02			1			0.050
	Main Channel			0.026				0.001			0			0.003				0				1			0.030
	Right Bank		0.025					0.001			0			0.001				0				1			0.027
Sta 10+89.98 - Sta 10+49.04	Left Bank				0.015		0				0			0				0				1			0.015
	Main Channel			0.026				0.001			0			0.004				0				1			0.031
	Right Bank				0.015		0				0			0				0				1			0.015
Sta 10+49.04 - Sta 8+65.94	Left Bank		0.025					0.001			0			0.001				0				1			0.027
	Main Channel			0.026				0.001			0			0.004				0				1			0.031
	Right Bank		0.025					0.001			0			0					0.024			1			0.050
Sta 8+65.94 - Sta 8+56.88	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 8+56.88 - Sta 5+64.51	Left Bank		0.027					0.002			0				0.006				0.025			1			0.060
	Main Channel			0.026				0.001			0			0.004				0				1			0.031
	Right Bank		0.027					0.001			0			0.002					0.01			1			0.040
Sta 5+64.51 - Sta 5+49.13	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 5+49.13 - Sta 3+56.13	Left Bank				0.015		0				0			0				0				1			0.015
	Main Channel			0.026				0.001			0				0.005				0.003			1			0.035
	Right Bank				0.015		0				0			0				0				1			0.015
Sta 3+56.13 - Sta 2+89.79	Left Bank				0.015		0				0			0				0				1			0.015
	Main Channel			0.026				0.001			0				0.006			0.002				1			0.035
	Right Bank			0.026			0				0			0				0	0.019			1			0.045
Sta 2+89.79 - Sta 2+81.77	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 2+81.77 - Sta 0+00.71	Left Bank		0.025					0.001			0			0.004					0.02			1			0.050
	Main Channel			0.026				0.001			0			0.002				0.002				1			0.031
	Right Bank		0.027					0.001			0			0.004					0.013			1			0.045

Reach No. 22 - Halls Canyon Channel (Recommendation Scenario)

Reach, Station, or X-Sect		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 27+49.92 - Sta 25+91.82	Left Bank		0.025					0.001			0			0.004					0.02			1			0.050
	Main Channel			0.026				0.001			0			0.001				0.002				1			0.030
	Right Bank		0.025					0.001			0			0.004					0.01			1			0.040
Sta 25+91.82 - Sta 25+45.30	Left Bank		0.025					0.001			0			0.004					0.02			1			0.050
	Main Channel			0.026				0.001			0			0.001						0.027		1			0.055
	Right Bank		0.025					0.001			0			0.004					0.01			1			0.040
Sta 25+45.30 - Sta 25+29.49	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 25+29.49 - Sta 23+11.28	Left Bank		0.025					0.001			0			0.004					0.01			1			0.040
	Main Channel			0.026				0.001			0			0.004						0.025		1			0.056
	Right Bank		0.025					0.001			0			0.004				0.005				1			0.035
Sta 23+11.28 - Sta 22+97.65	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 22+97.65 - Sta 20+27.34	Left Bank		0.025					0.001			0			0.004					0.01			1			0.040
	Main Channel			0.026				0.001			0			0.003						0.025		1			0.055
	Right Bank		0.025					0.002			0			0.003				0.002				1			0.032
Sta 20+27.34 - Sta 20+14.53	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 20+14.53 - Sta 17+39.40	Left Bank		0.025					0.002			0				0.005				0.018			1			0.050
	Main Channel			0.026				0.001			0			0.003						0.025		1			0.055
	Right Bank		0.025					0.001			0			0				0.002				1			0.028
Sta 17+39.40 - Sta 17+24.28	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 17+24.28 - Sta 11+96.42	Left Bank		0.025					0.001			0			0.004					0.02			1			0.050
	Main Channel			0.026				0.001			0			0.003						0.025		1			0.055
	Right Bank		0.025					0.001			0			0.001				0				1			0.027
Sta 11+96.42 - Sta 11+87.16	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 11+87.16 - Sta 10+89.98	Left Bank		0.025				0	0.001			0			0.004					0.02			1			0.050
	Main Channel			0.026				0.001			0			0.003						0.025		1			0.055
	Right Bank		0.025					0.001			0			0.001				0				1			0.027
Sta 10+89.98 - Sta 10+49.04	Left Bank				0.015		0				0			0				0				1			0.015
	Main Channel			0.026				0.001			0			0.004						0.025		1			0.056
	Right Bank				0.015		0				0			0				0				1			0.015
Sta 10+49.04 - Sta 8+65.94	Left Bank		0.025					0.001			0			0.001				0				1			0.027
	Main Channel			0.026				0.001			0			0.004						0.025		1			0.056
	Right Bank		0.025					0.001			0			0					0.024			1			0.050
Sta 8+65.94 - Sta 8+56.88	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 8+56.88 - Sta 5+64.51	Left Bank		0.027					0.002			0				0.006				0.025			1			0.060
	Main Channel			0.026				0.001			0			0.004						0.025		1			0.056
	Right Bank		0.027					0.001			0			0.002					0.01			1			0.040
Sta 5+64.51 - Sta 5+49.13	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 5+49.13 - Sta 3+56.13	Left Bank				0.015		0				0			0				0				1			0.015
	Main Channel			0.026				0.001			0				0.005					0.028		1			0.060
	Right Bank				0.015		0				0			0				0				1			0.015
Sta 3+56.13 - Sta 2+89.79	Left Bank				0.015		0				0			0					0			1			0.015
	Main Channel			0.026				0.001			0				0.006					0.027		1			0.060
	Right Bank			0.026			0				0			0					0.019			1			0.045
Sta 2+89.79 - Sta 2+81.77	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 2+81.77 - Sta 0+00.71	Left Bank		0.025					0.001			0			0.004					0.02			1			0.050
	Main Channel			0.026				0.001			0			0.002						0.027		1			0.056
	Right Bank		0.027					0.001			0			0.004				0	0.013			1			0.045

Reach No. 24 - Compton Creek (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"
		0.026 – 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	
		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. 212+24.92 – Sta. 80+30	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
Sta. 80+30 – Sta. 79+27	Left Bank				0.018		0				0			0				0				1			0.018
	Main Channel				0.018		0				0			0				0				1			0.018
	Right Bank				0.018		0				0			0				0				1			0.018

Reach No. 25 - Los Angeles River (Existing Vegetation Scenario)

Reach, Station, or X-Sect		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	
		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 169+00 - Sta 165+02	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 165+02 - Sta 162+00	Left Bank				0.014		0				0			0				0				1			0.014
	Main Channel		0.025				0				0				0.005				0.012			1			0.042
	Right Bank				0.014		0				0			0				0				1			0.014
Sta 162+00 - Sta 154+24	Left Bank				0.014		0				0			0				0				1			0.014
	Main Channel				0.012		0				0			0				0				1			0.012
	Right Bank				0.014		0				0			0				0				1			0.014
Sta 154+24 - Sta 154+00	Left Bank				0.014		0				0			0				0				1			0.014
	Main Channel		0.025				0				0			0				0				1			0.025
	Right Bank				0.014		0				0			0				0				1			0.014
Sta 154+00 - Sta 144+90	Left Bank					0.03	0				0			0				0.01				1			0.040
	Main Channel		0.025				0				0				0.005			0.005				1			0.035
	Right Bank					0.03	0				0			0				0.01				1			0.040
Sta 144+90 - Sta 105+73	Left Bank					0.03	0				0			0				0.01				1			0.040
	Main Channel		0.025				0				0			0				0.01				1			0.035
	Right Bank					0.03	0				0			0				0.01				1			0.040
Sta 105+73 - Sta 105+00	Left Bank					0.03	0				0			0					0.015			1			0.045
	Main Channel		0.025				0				0			0								1			0.025
	Right Bank					0.03	0				0			0					0.01			1			0.040
Sta 105+00 - Sta 96+98.8	Left Bank					0.03	0				0			0					0.015			1			0.045
	Main Channel		0.025				0				0			0					0.02			1			0.045
	Right Bank					0.03	0				0			0					0.01			1			0.040
Sta 96+98.8 - Sta 78+32	Left Bank					0.03	0				0			0					0.01			1			0.040
	Main Channel		0.025				0				0			0					0.025			1			0.050
	Right Bank					0.03	0				0			0					0.01			1			0.040
Sta 78+32 - Downstream Limit	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel		0.02				0				0			0				0				1			0.020
	Right Bank					0.03	0				0			0				0				1			0.030

Reach No. 25 - Los Angeles River (Recommendation Scenario)

Proposed recommendations warrant no change to existing Manning's Roughness values

Reach No. 99 - Kagel Canyon (Existing Vegetation Scenario)

		n_b					n_1				n_2			n_3				n_4				m			
		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	**Total "n"**
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 63+47.047 - Sta 58+16.381	Left Bank					0.03	0				0			0				0				1			0.030
	Main Channel		0.025				0				0				0.005			0				1			0.030
	Right Bank					0.03	0				0			0				0				1			0.030
Sta 58+16.381 - Sta 51+98.224	Left Bank					0.043	0				0			0				0.002				1			0.045
	Main Channel		0.025				0				0			0.003				0				1			0.028
	Right Bank					0.043	0				0			0				0.002				1			0.045
Sta 51+98.224 - Sta 51+55.646	Left Bank		0.025				0				0			0				0.01				1			0.035
	Main Channel		0.025				0				0			0.003				0.003				1			0.031
	Right Bank		0.025				0				0			0				0.003				1			0.028
Sta 51+55.646 - Sta 51+02.358	Left Bank				0.018		0				0			0				0				1			0.018
	Main Channel		0.025				0				0			0.003				0				1			0.028
	Right Bank				0.018		0				0			0				0				1			0.018
Sta 51+02.358 - Sta 50+58.283	Left Bank					0.043	0				0			0				0				1			0.043
	Main Channel		0.025				0				0			0.003				0				1			0.028
	Right Bank					0.043	0				0			0				0				1			0.043
Sta 50+58.283 - Sta 48+91.829	Left Bank					0.043	0				0			0				0.003				1			0.046
	Main Channel		0.025				0				0			0.003				0.003				1			0.031
	Right Bank					0.043	0				0			0				0.003				1			0.046
Sta 48+91.829- Sta 44+45.26	Left Bank				0.018		0				0			0				0				1			0.018
	Main Channel		0.025				0				0			0.003				0.01				1			0.038
	Right Bank					0.043	0				0			0				0.003				1			0.046
Sta 44+45.26- Sta 43+35.692	Left Bank					0.043	0				0			0						0.025		1			0.068
	Main Channel		0.025				0				0			0.003						0.025		1			0.053
	Right Bank				0.018		0				0			0						0.025		1			0.043
Sta 43+35.692- Sta 40+47.506	Left Bank					0.043	0				0			0				0.003				1			0.046
	Main Channel					0.03	0				0			0				0				1			0.030
	Right Bank					0.043	0				0			0				0.003				1			0.046
Sta 40+47.506- Sta 37+79.316	Left Bank					0.043	0				0			0				0.005				1			0.048
	Main Channel		0.025				0				0			0.003				0				1			0.028
	Right Bank				0.018		0				0			0				0				1			0.018
Sta 37+79.316- Sta 36+49.373	Left Bank					0.043	0				0			0				0				1			0.043
	Main Channel		0.025				0				0			0.003				0				1			0.028
	Right Bank					0.043	0				0			0				0.01				1			0.053
Sta 36+49.373- Sta 33+83.451	Left Bank					0.043	0				0			0				0.003				1			0.046
	Main Channel		0.025				0				0			0.003				0				1			0.028
	Right Bank				0.018		0				0			0				0				1			0.018
Sta 33+83.451- Sta 32+62.96	Left Bank					0.043	0				0			0				0.003				1			0.046
	Main Channel		0.025				0				0			0.003					0.025			1			0.053
	Right Bank					0.03	0				0			0					0.02			1			0.050
Sta 32+62.96- Sta 31+10.859	Left Bank					0.043	0				0			0				0.003				1			0.046
	Main Channel		0.025				0				0			0.003				0				1			0.028
	Right Bank				0.018		0				0			0				0				1			0.018
Sta 31+10.859- Sta 30+17.919	Left Bank					0.043	0				0			0				0.01				1			0.053
	Main Channel		0.025				0				0			0.003				0.002				1			0.030
	Right Bank					0.043	0				0			0				0.01				1			0.053
Sta 30+17.919- Sta 29+48.735	Left Bank				0.018		0				0			0				0				1			0.018
	Main Channel		0.025				0				0			0.003						0.035		1			0.063
	Right Bank					0.043	0				0			0				0.003				1			0.046
Sta 29+48.735- Sta 28+18.615	Left Bank					0.043	0				0			0				0				1			0.043
	Main Channel		0.025				0				0			0.003				0				1			0.028
	Right Bank					0.043	0				0			0				0				1			0.043
Sta 28+18.615- Sta 26+68.88	Left Bank					0.03	0				0			0						0.025		1			0.055
	Main Channel		0.025				0				0			0.003						0.025		1			0.053
	Right Bank					0.03	0				0			0						0.025		1			0.055
Sta 26+68.88- Sta 26+24.054	Left Bank					0.043	0				0			0				0.003				1			0.046
	Main Channel		0.025				0				0			0.003				0				1			0.028

Reach No. 99 - Kagel Canyon (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"
		0.026 – 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	
		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	
	Right Bank					0.043	0				0			0				0.003				1			0.046
Sta 26+24.054- Sta 24+04.036	Left Bank					0.043	0				0			0						0.025		1			0.068
	Main Channel		0.025				0				0			0.003						0.025		1			0.053
	Right Bank				0.018		0				0			0						0.025		1			0.043
Sta 24+04.036- Sta 22+88.806	Left Bank					0.043	0				0			0				0.003				1			0.046
	Main Channel		0.025				0				0			0.003				0.003				1			0.031
	Right Bank					0.043	0				0			0				0.003				1			0.046
Sta 22+88.806- Sta 21+84.784	Left Bank				0.018		0				0			0				0				1			0.018
	Main Channel		0.025				0				0			0.003				0				1			0.028
	Right Bank					0.043	0				0			0				0.003				1			0.046
Sta 21+84.784- Sta 21+10.713	Left Bank				0.018		0				0			0				0				1			0.018
	Main Channel		0.025				0				0			0.003				0				1			0.028
	Right Bank				0.018		0				0			0				0				1			0.018
Sta 21+10.713- Sta 13+10.216	Left Bank				0.018		0				0			0				0				1			0.018
	Main Channel		0.025				0				0			0.003						0.03		1			0.058
	Right Bank					0.03	0				0			0				0				1			0.030
Sta 13+10.216- Sta 11+30.348	Left Bank				0.018		0				0			0				0				1			0.018
	Main Channel		0.025				0				0			0.003						0.03		1			0.058
	Right Bank					0.03	0				0			0						0.03		1			0.060
Sta 11+30.348 - Sta 5.277	Left Bank		0.025				0				0			0						0.025		1			0.050
	Main Channel		0.025				0				0			0						0.025		1			0.050
	Right Bank		0.025				0				0			0						0.025		1			0.050

Reach No. 100 - Dry Canyon Calabasas (Existing Vegetation Scenario)

		n_b					n_1				n_2			n_3				n_4				m			
		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	**Total "n"**
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. 8+31.41 – Sta. 6+77.03	Left Bank			0.03			0				0			0				0.005				1			0.035
	Main Channel			0.03			0				0				0.005			0				1			0.035
	Right Bank			0.03			0				0			0				0.005				1			0.035
Sta. 6+77.03 – Sta. 6+15.26	Left Bank		0.025				0				0			0					0.015			1			0.040
	Main Channel		0.025				0				0				0.005				0.01			1			0.040
	Right Bank		0.025				0				0			0					0.015			1			0.040
Sta. 6+15.26 – Sta. 5+84.98	Left Bank				0.015				0.01		0			0				0				1			0.025
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank				0.015		0		0.01		0			0				0				1			0.025
Sta. 5+84.98 – Sta. 5+18.78	Left Bank				0.015		0	0.005			0			0				0				1			0.020
	Main Channel				0.015		0				0			0				0				1			0.015
	Right Bank				0.015		0	0.005			0			0				0				1			0.020

Appendix C

HEC-RAS Files

(Provided as a separate attachment)