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Location Hydraulic Study

Old Mountain View-Alviso Road Bridge (Replace) at Calabazas Creek

Project No. BHLS-5213(040)

Prepared for:
Biggs Cardosa Associates

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This report has been prepared under the direct supervision of Charles D. Anderson, who hereby certifies that he is a Registered Professional Engineer in the State of California.

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1. Introduction

1.1. Description

The City of Sunnyvale (City) is replacing the Old Mountain View-Alviso Road Bridge (37C-0254) at Calabazas Creek. One aspect of this project is to conduct a location hydraulic study as proscribed in 23 CFR 650A, §650.111(b)(c)(d).

1.2. Setting

The project site is located on Calabazas Creek, which forms the border between the cities of Sunnyvale and Santa Clara in Santa Clara County, California. The bridge is located along Old Mountain View-Alviso Road between Patrick Henry Drive and Reamwood Avenue. The structure is jointly owned by the Cities of Sunnyvale and Santa Clara; the City of Sunnyvale is the lead agency and there is a cooperative agreement between the two jurisdictions. Old Mountain View-Alviso Road is located approximately 2,380 feet upstream of the confluence of Calabazas Creek with Guadalupe Slough and San Tomas Aquino Creek, which is itself about 33,530 feet (6.35 miles) upstream of the open San Francisco Bay. Figure 1 shows the location of the Old Mountain View-Alviso Road Bridge.

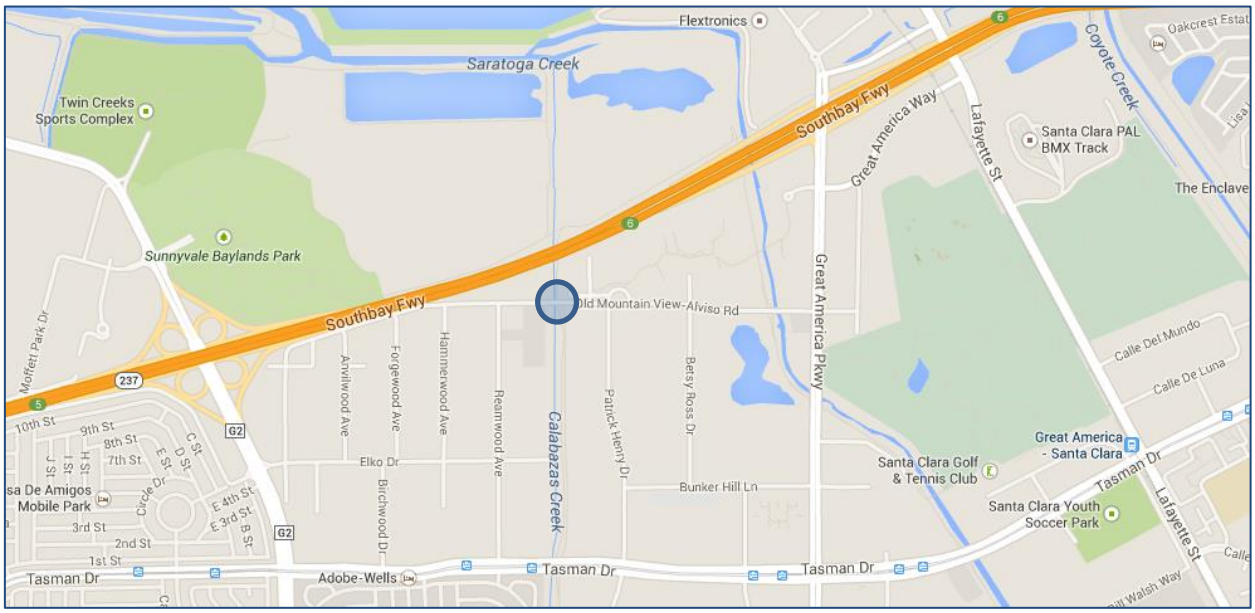

FIGURE 1. OLD MOUNTAIN VIEW-ALVISO ROAD BRIDGE LOCATION

Calabazas Creek's watershed extends from the Santa Cruz Mountain foothills west of the Santa Clara Valley to San Francisco Bay. Tributaries are concentrated in the upper part of the watershed and include Prospect Creek, Regnart Creek and the Junipero Serra Channel located at Interstate 280. Calabazas Creek and its natural tributaries are contained within incised natural channels or improved earthen channels with periodic concrete lining from the headwaters downstream to Lawrence Expressway. From the expressway to U.S. Highway 101 the creek is contained within a concrete-lined channel. In the lower reaches between Highway 101 and Guadalupe Slough, the reach in which Old Mountain View-Alviso Road is located, levees and/or floodwalls provide flood protection to adjacent properties.

The area has a relatively mild climate, with ninety percent of the annual rainfall occurring in the late fall and winter months. The mean annual precipitation within the watershed varies from 12 inches at San Francisco Bay to nearly 50 inches at the ridge of the Santa Cruz Mountains.

1.3. Existing Conditions

The Old Mountain View-Alviso Road Bridge was originally constructed as a three-span structure in the mid-1960s. The bridge was raised and lengthened in 1974 by the Santa Clara Valley Water District (SCVWD) to its existing configuration as a five-span, cast-in-place, reinforced concrete T-girder bridge supported on pier wall bents. These bents are founded on a single row of driven piles. The creek channel at Old Mountain View-Alviso Road is generally trapezoidal in shape with a bottom width between 20 feet and 25 feet, and side slopes of roughly 2.5:1 horizontal to vertical. The low chord of the existing bridge is at elevation 14.21 feet NGVD. The channel invert elevation (surveyed November 2011) is approximately at elevation -0.5 foot NGVD. The clear width from abutment to abutment at the Old Mountain View-Alviso Road Bridge is 103 feet. There are four solid square-edged pier walls of varying width. There is no artificial channel lining in this location, and this reach of Calabazas Creek is prone to sediment accumulation as noted in the maintenance records of the SCVWD and by field inspection. An earthen trail passes between the first and second piers as referenced from the east (Santa Clara) bank as shown in Figure 2.

FIGURE 2. OLD MOUNTAIN VIEW - ALVISO ROAD BRIDGE FROM UPSTREAM

2. Project Description

The westbound and eastbound portions of the structure are separated by a continuous longitudinal joint that runs the full length of the structure. The bridge structure was seismically retrofitted in 1991 as part of the Mandatory Seismic Retrofit Program using cable restrainers; and retrofitted a second time in 1997 with abutment shear keys, end diaphragms and pier cap retrofits. Caltrans declared the bridge to be "structurally deficient" in June 2005, in "critical condition" by 2008 and rated as "imminent failure condition" in 2012.

2.1. Scope of Bridge Replacement

Based on the Type Selection Report prepared by Biggs Cardosa Associates, the existing concrete bridge will be replaced with a 125 feet long precast, prestressed concrete voided slab unit with cast-in-place concrete deck overlay. The replacement structure will be comprised of three spans supported on precast concrete seated abutments that will be supported on driven steel pipe piles. The two bents will be comprised of a single row of driven steel pipe piles supporting a precast concrete bent cap. The steel pipe piles will be encased in a cast-in-place concrete facing to protect the steel piles and to provide improved hydraulic performance. Rapid construction techniques are proposed to reduce the road closure duration and minimize floodplain impacts. Prefabricated and precast elements will be used to reduce construction time. Environmental and floodplain impacts will be minimized by staging the construction to be performed from a combination of the partially demolished existing structure and the partially completed replacement structure, leading to a reduction in habitat disturbance and areas requiring a replanting and monitoring program. The proposed structure will consist of the following:

Footprint	125'-0" by 52'-0"
Spans	37-6"; 50'-0"; 37'-6"
Superstructure	Precast, prestressed concrete voided slab unit with cast-in-place concrete deck overlay
Bents	Single row of steel pipe piles encased in a cast-in-place concrete facing supporting a precast concrete bent cap
Abutments	Precast concrete seated abutments supported on driven steel pipe piles
Wing Walls	Precast cantilever type concrete wing wall at southeast corner only
Approach Slabs	Caltrans standard cast-in-place concrete (Type EQ10)

2.2. Scope of Location Hydraulic Study

The purpose of this Location Hydraulic Study is to document the existing 100-year water surface elevation at Old Mountain View-Alviso Road, calculate the post-project 100-year water surface elevation at the same location, and ascertain the impact of the project on the 100-year water surface elevation and flood protection provided against the base flood. Information for the 50-year return period is also provided.

3. Existing Base Flood Elevations

Existing base flood (100-year) elevations for Calabazas Creek at Old Mountain View-Alviso Road are established as described herein.

3.1. National Flood Insurance Rate Map

Special flood hazards in the vicinity of Old Mountain View-Alviso Road at Calabazas Creek are shown on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) for Santa Clara County, effective May 18, 2009. This location is shown on consolidated Panel 61 (Figure 3). The one-percent annual chance flood is contained within Calabazas Creek. The Santa Clara side of the creek is shown within Shaded Zone X outside of the Special Flood Hazard Area (SFHA) and the Sunnyvale side of the creek is within the SFHA, but not one caused by Calabazas Creek spill. Rather, it is mapped as Zone AE (Elevation 11 feet NAVD) which is indicative of tidal inundation from San Francisco Bay since the protective outboard levee system is not accredited by FEMA. A Special Flood Hazard Area is an area having special flood, mudflow or flood-related erosion hazards and shown on a Flood Hazard Boundary Map (FHBM) or a Flood Insurance Rate Map (FIRM) as Zone A, AO, A1-A30, AE, A99, AH, AR, AR/A, AR/AE, AR/AH, AR/AO, AR/A1-A30, V1-V30, VE or V. The average depth of one-percent (100-year) flooding within a Special Flood Hazard Area is generally at least one foot.

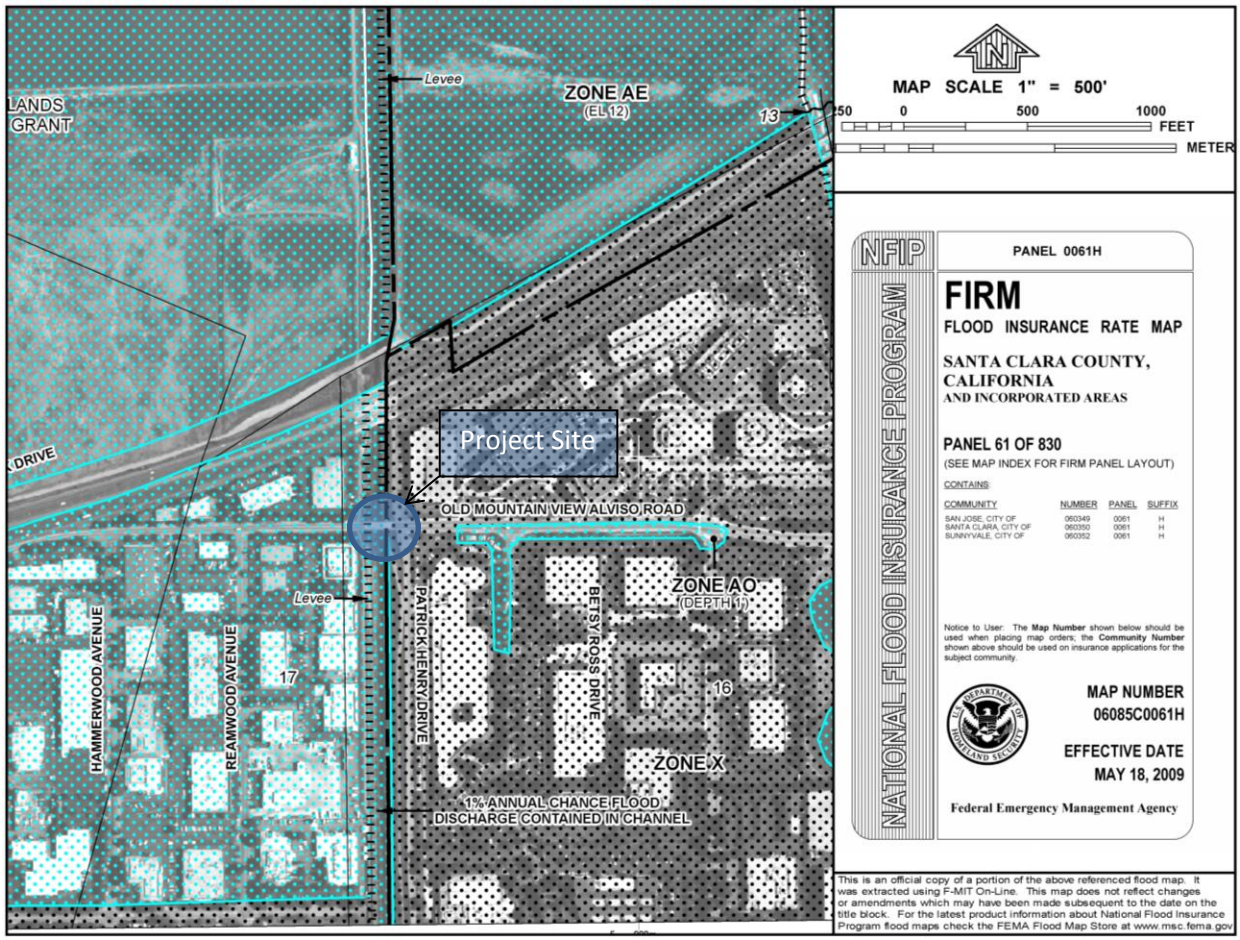

FIGURE 3. EFFECTIVE FLOOD INSURANCE RATE MAP

3.2. Published Discharge Values for Calabazas Creek

Flow rates for the analysis of project impacts to 100-year water surface elevations are based on a corrected effective model using published flow rates from the March 14, 2013 LOMR for the City of Cupertino, Santa Clara, California (FEMA Case # 13-09-0871P). Downstream of Highway 101, simulations are performed using the SCVWD's 100-year design discharge of 4,300 cfs.

3.3. Hydraulic Modeling

The SCVWD prepared a HEC-RAS model for Calabazas Creek extending from its confluence with the Guadalupe Slough to Miller Avenue as part of the referenced LOMR application to FEMA. This model, known as the "effective model" for FEMA regulation, is used as a baseline for evaluating hydraulic impacts of proposed bridge replacement. A "corrected effective model" has been developed to reflect existing field conditions and design discharges for Calabazas Creek. For the Location Hydraulic Study, baseline modeling work is concentrated between the Guadalupe Slough confluence and Highway 101, which coincides with the reach of Calabazas Creek surveyed by SCVWD in November 2011. Highway 101 is also safely upstream of any hydraulic impacts that might result from the proposed replacement of the Old Mountain View-Alviso Road Bridge.

3.3.1. Methodology

The updates made to the effective model to develop the corrected effective model are described briefly below and summarized in Table 1. Unless specifically described herein, all other modeling parameters are unchanged from the effective model.

1. The SCVWD furnished a cross section survey of Calabazas Creek between the Bay and the upstream face of U.S. Highway 101 conducted in November 2011 on the NAVD88 vertical datum, and provided elevations converted to NGVD29 by subtracting 2.75 feet. (That is, an elevation in NAVD88 minus 2.75 feet equals the elevation in NGVD29.) Surveyed cross sections have been mirrored to present in the conventional upstream to downstream modeling direction, looking left to right.

2. All but one of the cross sections from the SCVWD survey have replaced the cross sections in the effective model from the confluence with Guadalupe Slough [River Station (RS) 0+49] to the upstream face of Hwy 101. (The omitted survey cross section is missing data points and does not form a complete cross section.) Survey stations are related to the effective model stationing based on distances from known structures such as bridges.

3. The model geometry for each bridge in the reach extending from RS 00+49 to RS 106+67 has been updated based on surveyed ground and bridge deck elevations.

4. Channel bank stations have been adjusted to reflect the tops of the surveyed banks.

5. Encroachments have been placed at all cross sections extending from Baylands Park Trail to Guadalupe Slough in accordance with the alignment of levees and floodwalls along the channel per plan set titled "Map and Construction Plan for Calabazas Creek, Phase II- Guadalupe Slough to Arques Avenue, Santa Clara Valley Water District," dated April 25, 1994.

6. A pedestrian bridge that exists north of (downstream from) Highway 101, but is not included in the effective model, has been added based on surveyed ground and bridge elevations.

7. The modeled bridge north of (and downstream from) Highway 237 previously known as Moffett Park Drive is renamed Baylands Park Trail.

8. Some of the flow rates used in the effective model do not match the flow rates published in the Flood Insurance Study (FIS) report for Santa Clara County or any subsequent LOMRs. (See Table 2 for a summary of flow rates used in the effective HEC-RAS model.) The flow rates for the 100-year storm have been adjusted upstream of Hwy 101 and flow rates for the 50-year storm have been added to the corrected effective model using published flow rates from the March 14, 2013 LOMR for the City of Cupertino, Santa Clara, California (FEMA Case # 13-09-0871P). Downstream of Highway 101, simulations are performed using the District's 100-year design discharge of 4,300 cfs.

TABLE 1: SUMMARY OF CHANGES MADE TO DEVELOP CORRECTED EFFECTIVE MODEL

Effective Model	Corrected Effective Model
Reflects cross sections before recent dredging	Reflects the effects of dredging and sediment removal
Hwy 101 Bridge modeled with only 1 pier	Model reflects 2 piers based on survey
Missing pedestrian bridge north of Hwy 101	Includes pedestrian bridge north of Hwy 101
Tasman Rd bridge modeled with only 1 pier	Model includes 2 piers based on survey
OMR-Alviso Road bridge modeled with only 1 pier	Model includes 4 piers based on record drawings
Pedestrian Bridge downstream of Hwy 237	Corrected the name to reflect Baylands Park Trail Model reflects 4 piers based on survey

TABLE 2: SUMMARY OF EFFECTIVE MODEL FLOW RATES AND LOCATIONS

Effective Model River Station	Location	Flow Rate Q_{100} (cfs)	Reference
18+96	State Hwy 237	4,300	SCVWD Design Discharge for Calabazas Creek
168+07	UPRR (Caltrain)	3,800	Could not be verified
237+75	El Camino Real	3,100	Could not be verified; most likely rounded up from March 14, 2013 LOMR
367+50	Interstate 280	3,000	Could not be verified, most likely rounded up from March 14, 2013 LOMR
402+00	Miller Avenue	2,800	FIS Report, rounded at "Below La Mar Court"

TABLE 3: SUMMARY OF CORRECTED EFFECTIVE MODEL FLOW RATES AND LOCATIONS

Corrected Effective Model River Station	Location	Flow Rate Q_{100} (cfs)	Flow Rate Q_{50} (cfs)	Reference
7+59	Baylands #2 Pump Station	4,300[1]	3,600[2]	[1]SCVWD Design Discharge [2]March 14, 2013 LOMR
106+26	Hwy 101	4,300[1]	3,500[2]	[1]SCVWD Design Discharge [2]March 14, 2013 LOMR
171+02	UPRR (Caltrain)	3,600	3,300	March 14, 2013 LOMR
183+98	Monroe Street	3,150	2,900	March 14, 2013 LOMR
238+96	El Camino Real	3,050	2,800	March 14, 2013 LOMR
367+50	Interstate 280	2,900	2,600	March 14, 2013 LOMR
402+00	Miller Avenue	2,650	2,400	March 14, 2013 LOMR

3.3.2. Baseline Hydraulic Modeling

Existing base flood conditions are evaluated using the methodologies described herein.

3.3.2.1. Boundary Conditions

Boundary conditions are necessary to establish the starting water surface at the ends of the river system (upstream and downstream). In the subcritical flow regime that controls the lower reaches of Calabazas Creek, a boundary condition is only necessary for stage (water level) at the downstream end of the river. A known water surface elevation (WSEL) of 12.25 feet NGVD29 for the 100-year discharge at the confluence with Guadalupe Slough and San Tomas Aquino Creek is used in the effective model. The effective model reference is to the 1992 EIR document for Calabazas Creek, which has been provided to us by the SCVWD, and the SCVWD has confirmed the validity of this WSEL.

A known water surface elevation for the 50-year discharge is not available. An average slope of 0.003 foot/foot for Calabazas Creek is entered into the program to approximate the downstream energy slope for the channel during the design 50-year storm conditions. The average energy gradient is determined by approximating the low flow energy grade slope based on water surface information collected during the survey. Normal depth at the boundary is calculated by the program using the Manning's equation based on the entered energy slope, establishing a starting water surface for water surface profile calculations for the 50-year storm. (Water surface elevations at Old Mountain View-Alviso Road are not sensitive to the starting energy gradient.) Although not particularly relevant to hydraulic analyses in the vicinity of Old Mountain View-Alviso Road, the upstream normal depth boundary condition for supercritical (mixed) flow analyses within the concrete lined portions of Calabazas Creek also assume an energy gradient of 0.003 foot/foot.

3.3.2.2. Manning's Roughness Coefficient

Manning's Roughness Coefficient 'n' represents the resistance to flow in a given channel or floodplain. The major factors in the selection of 'n' are the channel's surface irregularities, variations in shape and size of the channel cross sections, obstructions, vegetation, and channel meander.

The 'n' values used in the corrected effective Calabazas Creek hydraulic model have not been changed from the effective model unless otherwise noted herein. A Manning's 'n' value of 0.035, which represents natural channels with some stone and short weeds, is modeled for natural sections of the creek channel and an 'n' value of 0.050, which is representative of floodplains with scattered brush and weeds, is modeled for the downstream reaches of creek channel which are subject to tidal inundation. A Manning's 'n' value of 0.015, which represents concrete lined channel, is used for concrete-lined channel segments and at locations where concrete aprons are present. A Manning's 'n' value of 0.020 is used in the corrected model at the Old Mountain View-Alviso Road crossing to represent bare earth and slope paving below the bridge.

3.3.2.3. Expansion and Contraction Coefficients

HEC-RAS computes energy losses due to the changes in flow area by multiplying the changes in the velocity head with the corresponding expansion or contraction coefficient as appropriate. Gradual changes in the river cross sections when the flow is subcritical will typically have coefficients of contraction and expansion on the order of 0.1 and 0.3, respectively. More abrupt transitions as applied to the bridge will have expansion coefficients of 0.3 and contraction coefficients of 0.5. The majority of Calabazas Creek model had consistent gradual transitions between the cross sections with the exception of the road crossings where the higher expansion and contraction coefficients were used. Expansion and Contraction Coefficients have not been changed from the effective model.

3.3.2.4. Ineffective Flow Areas, Levees and Blocked Obstructions

HEC-RAS is a one-dimensional energy-balancing model that does not account for abrupt changes in flow conveyance and secondary eddies. The program assumes that all of the area in a given cross section is effective. If areas of a given cross-section are not entirely effective adjustments to account for the loss in conveyance can be made by blocking an area or increasing the roughness "n" values.

Ineffective flow areas are used to define areas of a cross section where water is not actively being conveyed. Areas where secondary eddies are expected are considered dead storage. Typical examples of such areas are the "flow shadows" behind embankments while flows go through contracted bridge openings. The ineffective flow areas are established using the generally accepted ratio of flow direction to cross-sectional direction of 1:1 for contraction and 4:1 for expansion.

3.3.2.5. Hydraulic Structures

The limits of this study include six (6) existing hydraulic structures, all of which are bridges. The geometry of all six bridges has been revised during the development of the corrected effective model to accurately reflect surveyed field conditions. Table 1 provides a summary of updates that were made to the geometry of the bridges based on field survey.

3.3.3. Corrected Effective Model

The corrected effective model has been developed using the HEC-RAS effective model cross sections to represent the river reach along Calabazas Creek from upstream of the Highway 101 Bridge to upstream of the Miller Avenue Bridge, and field survey cross sections from 49 feet upstream of the confluence of

Calabazas Creek with Guadalupe Slough to just upstream of the Highway 101 Bridge. The field survey cross sections reflect existing ground elevations, which may differ from than those in the effective model due to recent dredging and sediment removal, or conversely, sediment accumulation. The corrected effective model accounts for those cross sections aligned with bridge skew. The surveyed vertical datum of NAVD88 is converted to the model datum of NGVD29 by subtracting 2.75 feet from each surveyed ground elevation.

Friction losses are computed with the average conveyance method, which is the default in HEC-RAS. The corrected effective conditions have been modeled under a mixed flow regime to check for supercritical flow in the concrete-lined sections. The energy slope is entered to calculate the normal depth for the downstream boundary condition. The average slope of the channel 0.003 ft/ft for the main stem is approximated for the average energy gradient.

Low flow computations for the bridge routines are computed using the highest energy result from the energy equation and the momentum balance. High flow bridge routine computations for the model are computed using the pressure and/or weir flow equations, which default to the energy equation if a bridge is not pressurized. The pressure and/or weir flow equations are applicable for situations where the bridge deck is impacted by the water surface but not submerged, or situations where the deck is submerged and drawdown is occurring, characteristic of weir flow situations. Weir flow is not allowed nor predicted within the study reach.

3.3.4. Analysis of Existing 100-year Water Surface Elevations

The corrected effective HEC-RAS model is run under the mixed flow regime, with subcritical flow dominating the lower reaches and supercritical flow in the upstream concrete lined sections. Although a detailed review of the effective model has not been made upstream of Highway 101, it is noted that the modeled 100-year discharge is not always contained within the upstream channel due to changes in channel geometry between Tasman Drive and Highway 101, which are subsequently described.

3.3.4.1. Sediment Accumulation between Tasman Drive and Highway 101

Figure 4 compares the one-percent energy grade profile of the corrected effective model to that of the effective model, showing increased energy losses between Tasman Drive and Highway 101. Based on the SCVWD field survey, substantial sediment has accumulated within Calabazas Creek within this reach relative to the assumed effective model geometry. Figure 5 compares surveyed creek cross sections to the nearest effective model sections (recognizing that river stationing is not identical) on the NGVD29 datum with the surveyed sections shifted horizontally to overlay the effective model sections.

Manning's roughness has not been modified to reflect vegetation growth that might differ from conditions at the time the Calabazas Creek LOMR was prepared, but even without any roughness modifications, the smaller channel cross sections shown in Figure 5 cause pressurization of the Highway 101 Bridge and upstream overflows. However, the working assumption for the hydraulic elevation of Old Mountain View-Alviso Road Bridge replacement impacts is that full design discharges are delivered to the creek downstream of Highway 101.

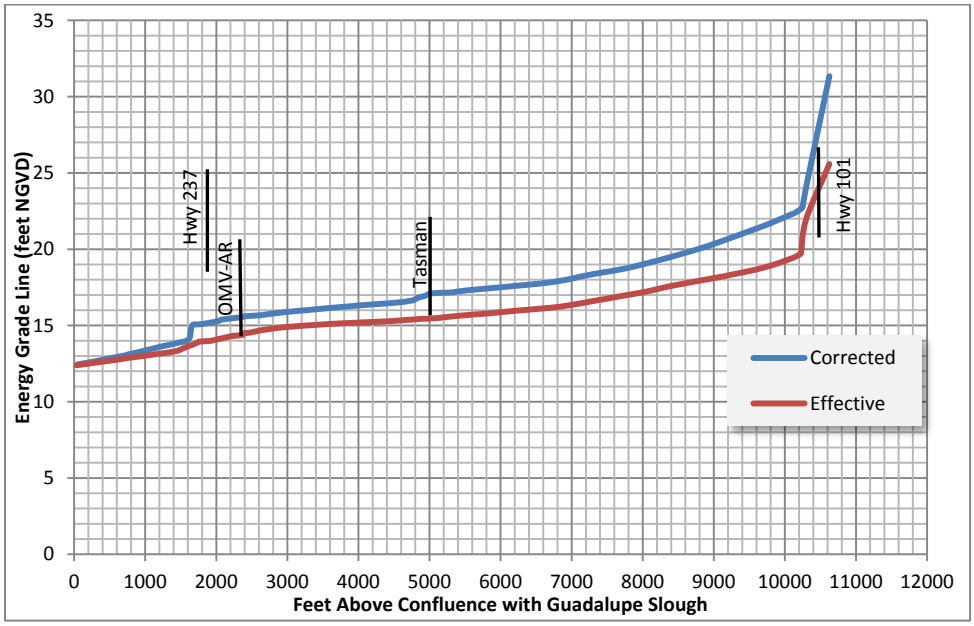

FIGURE 4. 100-YEAR ENERGY GRADE PROFILE FOR CALABAZAS CREEK

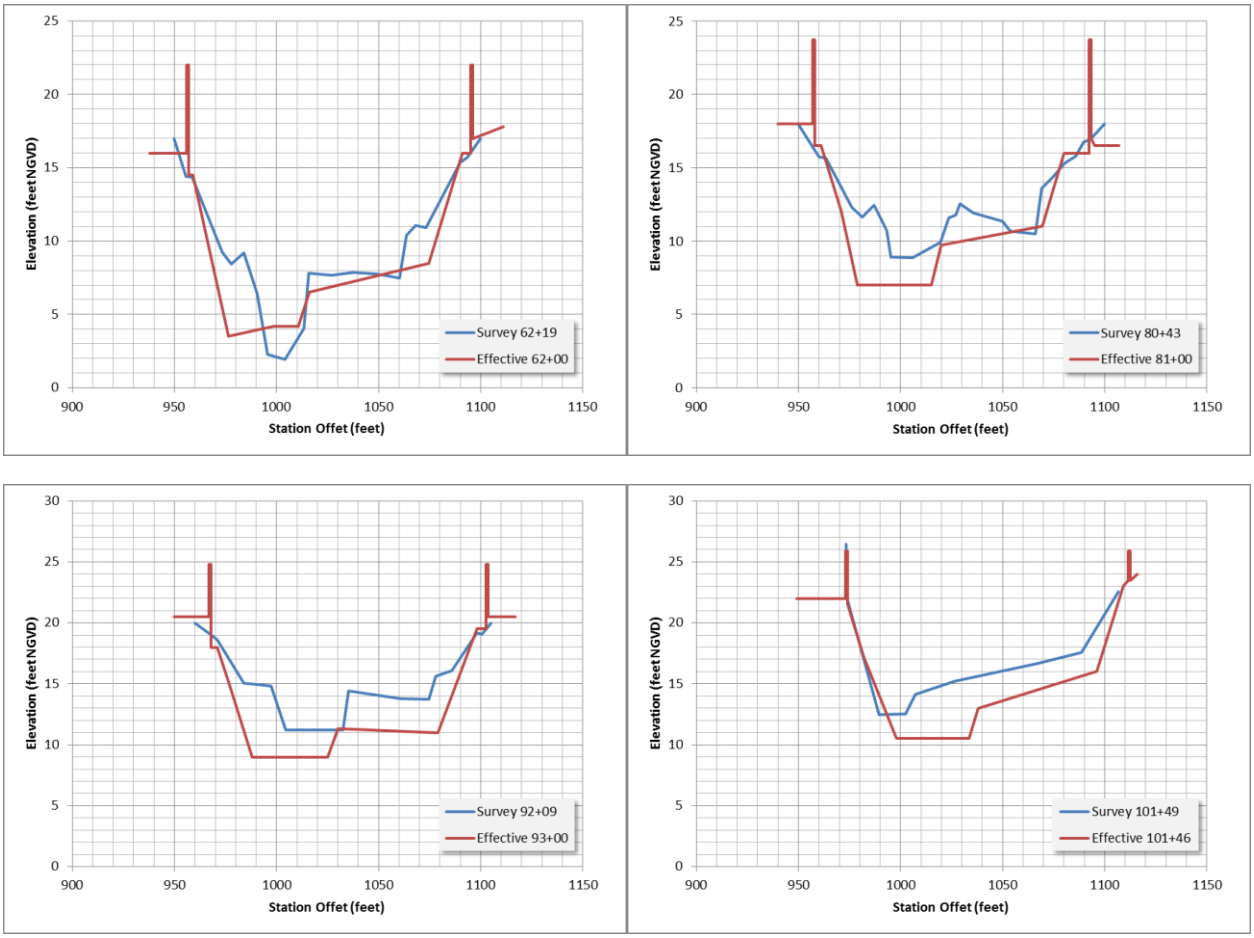

FIGURE 5. REPRESENTATIVE CROSS SECTION COMPARISONS

3.4. Existing Base Flood Elevation

Table 4 provides a comparison of the effective model and corrected effective model results for 100-year FEMA discharges and the SCVWD design discharge. Table 5 provides a hydraulic summary at Old Mountain View-Alviso Road, which is also graphically shown as Figure 6. The existing OMV-AR Bridge pressurizes with the corrected effective model's geometry, as well as with the effective model's geometry and 100-year starting water surface elevation. These data form the baseline against which proposed bridge replacement alternatives are hydraulically evaluated.

TABLE 4: SUMMARY OF SELECTED 100-YEAR CORRECTED EFFECTIVE MODEL RESULTS

Model Simulation	WSEL at Guadalupe Slough (feet NGVD)	WSEL at Highway 237 (feet NGVD)	WSEL at OMV-Alviso Road (feet NGVD)
CLOMR Model Furnished by SCVWD (w/ Design Q = 3,800 cfs)	12.25	13.56	14.35
Corrected Effective Model (w/ Design Q = 4,300 cfs)	12.25	14.76	15.49

TABLE 5: SELECTED HYDRAULIC PARAMETERS AT EXISTING OLD MOUNTAIN VIEW-ALVISO ROAD BRIDGE

Parameter	50-year recurrence	100-year recurrence
Discharge (cfs)	3,500	4,300
Upstream water surface elevation (feet NGVD)	13.00	15.49
Downstream water surface elevation (feet NGVD)	12.97	15.21
Velocity through bridge (feet per second)	4.19	4.47
Bridge flow type	Yarnell	Pressure Only
Upstream energy elevation (feet NGVD)	13.23	15.70
Downstream energy elevation (feet NGVD)	13.20	15.42

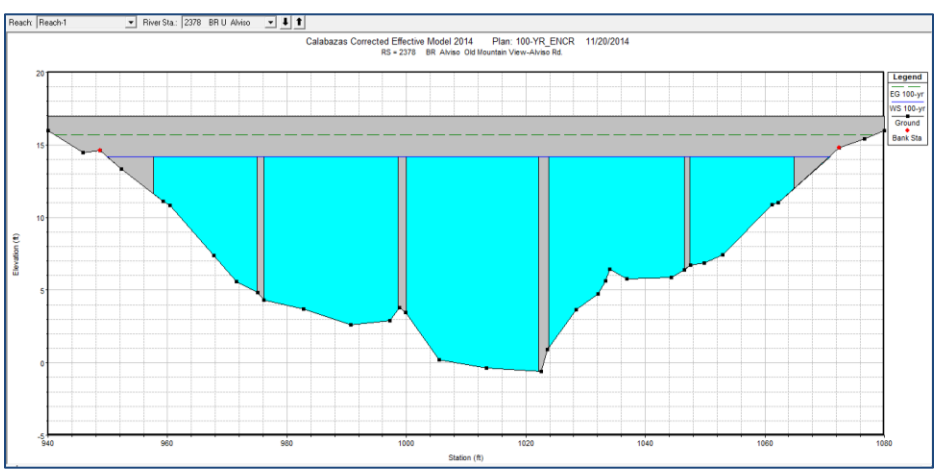

FIGURE 6: EXISTING OLD MOUNTAIN VIEW-ALVISO ROAD BRIDGE HYDRAULICS

4. Project Impact

This section of the Location Hydraulic Study discusses potential project impacts with respect to content required by 23 CFR 650A §650, the Caltrans "Location Hydraulic Study Form" (appended), and the seven items outlined in the Caltrans "Floodplain Encroachment Summary Form". First the basis of impact analysis is described.

4.1. Hydraulic Modeling with Bridge Replacement

The corrected effective model is modified to reflect the replacement of Old Mountain View-Alviso Road Bridge in conformance with "Structure Type Selection Report, Old Mountain View-Alviso Road Bridge (Replace) at Calabazas Creek, Bridge No. 37C-0254" by Biggs Cardosa Associates, dated September 24, 2014.

All hydraulic parameters (boundary conditions, Manning's roughness coefficient, expansion and contraction coefficients, ineffective/blocked flow area, and structures) of the corrected effective model are preserved in the proposed conditions model. Only the geometry of the Old-Mountain View Alviso Road Bridge is revised in the proposed conditions model to reflect the upgrades proposed to the bridge, per the referenced type selection report. It is noted that although the upstream and downstream faces of the replacement bridge are 12 feet away from their corresponding existing bridge faces, survey information is not available in those locations and the surveyed cross sections at the existing bridge faces are not changed in the model.

4.1.1. Bridge Replacement

The geometry of the Old Mountain View-Alviso Road Bridge is revised from the corrected effective model to reflect the proposed bridge geometry. The proposed bridge includes two 3 feet wide piers spaced 50 feet apart center to center. The nose of the proposed piers has been conservatively modeled as square nosed pending finalization of the project aesthetics. (Ultimately, a rounded or chamfered nose is anticipated). The total length of the proposed bridge is 125 feet and it is 52 feet wide in the direction of flow. The minimum bridge deck elevation (soffit) is 15.28 feet NGVD. The centerline alignment of the replacement bridge matches the centerline alignment of the existing bridge, so that the downstream face of the replacement bridge is 12 feet downstream of the existing bridge face and the upstream face of the replacement bridge is 12 feet upstream of the existing bridge face.

4.1.2. Hydraulic Modeling

The HEC-RAS post-project conditions model has been developed using the HEC-RAS corrected effective model and updating only the geometry of the OMV-AR Bridge to reflect the proposed replacement bridge design, as explained above. Table 6 provides a hydraulic summary at Old Mountain View-Alviso Road with the replacement bridge, which is also graphically shown as Figure 4. The replacement OMV-AR Bridge does not pressurize with the proposed geometry and 100-year design parameters stated herein.

TABLE 6: SELECTED HYDRAULIC PARAMETERS AT PROPOSED OLD MOUNTAIN VIEW-ALVISO ROAD BRIDGE

Parameter	50-year recurrence	100-year recurrence
Discharge (cfs)	3,500	4,300
Upstream water surface elevation (feet NGVD)	12.99	15.25
Downstream water surface elevation (feet NGVD)	12.96	15.21
Velocity through bridge (feet per second)	4.16	3.92
Bridge flow type	Yarnell	Energy Only
Upstream energy elevation (feet NGVD)	13.23	15.46
Downstream energy elevation (feet NGVD)	13.19	15.42

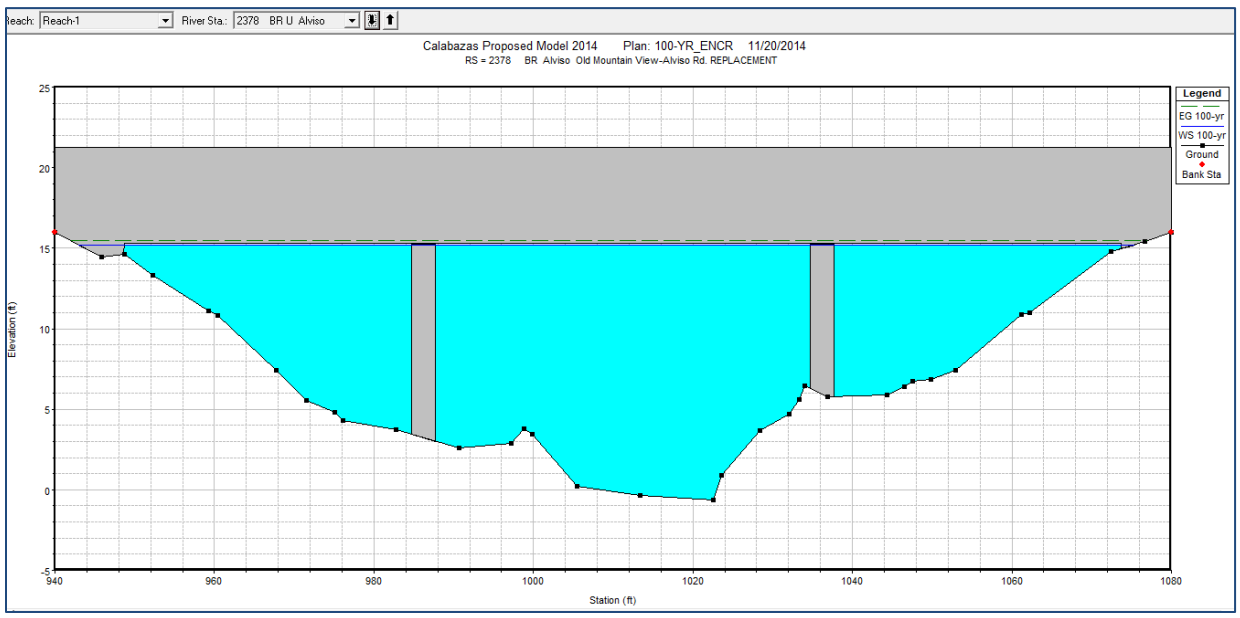

FIGURE 7: PROPOSED OLD MOUNTAIN VIEW-ALVISO ROAD BRIDGE HYDRAULICS

4.2. Hydraulic Changes due to Bridge Replacement

The HEC-RAS proposed conditions model has been developed using the HEC-RAS corrected effective model and updating the geometry of the OMV-AR Bridge to reflect the proposed bridge replacement design, as explained above. Table 7 compares relevant 100-year hydraulic parameters with the existing bridge in place to those same parameters with the replacement bridge in place. The proposed replacement bridge does not cause any increase in water surface elevation, flow velocity, or energy grade; and adequate freeboard is preserved upstream from Old Mountain View-Alviso Road. (Four feet minimum freeboard is required at a bridge structure.)

Since there is no increase in base flood elevation and adequate freeboard is preserved upstream from Old Mountain View-Alviso Road in the post-project condition, there is no project impact to the floodplain or change in mapped regulatory flood hazards as a result of the proposed action.

TABLE 7: SELECTED HYDRAULIC PARAMETERS COMPARISON AT OLD MOUNTAIN VIEW-ALVISO ROAD BRIDGE

Parameter	Existing Bridge	Replacement Bridge
100-year Discharge (cfs)	4,300	4,300
Upstream water surface elevation (feet NGVD)	15.49	15.25
Downstream water surface elevation (feet NGVD)	15.21	15.21
Velocity through bridge (feet per second)	4.47	3.92
Bridge flow type	Pressure Only	Energy Only
Upstream energy elevation (feet NGVD)	15.70	15.46
Downstream energy elevation (feet NGVD)	15.42	15.42
D/S WSEL at Tasman Drive Bridge (feet NGVD)	16.56	16.44
U/S WSEL at Tasman Drive Bridge (feet NGVD)	16.86	16.73
D/S WSEL at Highway 101 Bridge (feet NGVD)	20.70	20.69

4.3. Evaluation of Risk Severity and/or Environmental Impact

The following discussion addresses project impacts to the floodplain.

4.3.1. The Risk Associated with Implementation of the Action

The Old Mountain View-Alviso Road Bridge replacement project has no impact to water surface elevations in Calabazas Creek or the floodplain at Old Mountain View-Alviso Road, since the floodplain is contained within the channel banks and levees/floodwalls. The only work within the floodplain is the construction of the replacement bridge and this work will not affect flood flows or flooding. There is no change to the 100-year backwater in Calabazas Creek. There is no long-term risk associated with implementation of the proposed action. To the contrary, there is a slight improvement (decrease) in the base flood profile.

4.3.2. The Impacts on Natural and Beneficial Floodplain Values

The project is limited to the replacement of an existing bridge. There will be no impact to the natural and beneficial values of the floodplain, since the floodplain will remain unchanged.

4.3.3. The Support of Incompatible Floodplain Development

The proposed action will improve seismic bridge safety, but it will not change roadway capacity and thereby induce or support incompatible floodplain development.

4.3.4. Measures to Minimize Floodplain Impacts Associated with the Action

As discussed above, the project has been designed such that there will be no long-term impacts to the floodplain. Further, the project will be constructed during the non-rainy season, so there will be no short-term impacts to the floodplain.

4.3.5. Measures to Restore and Preserve the Natural and Beneficial Floodplain Values Impacted by the Action

Natural and beneficial floodplain values are not impacted by the action, so these measures are not required.

4.3.6. The Practicality of Alternatives to any Significant Encroachment

The project will have no floodplain impacts, significant or otherwise. Therefore it is not necessary to evaluate alternatives that avoid significant encroachment.

4.3.7. The Practicality of Alternatives to any Longitudinal Encroachment

The Old Mountain View-Alviso Road Bridge crosses Calabazas Creek at a right angle. The project, therefore, is a transverse crossing of the floodplain and not a longitudinal encroachment.

4.4. Discussion of Items 1 – 7 on Summary of Floodplain Encroachment Report

4.4.1. Is the proposed action a longitudinal encroachment of the base flood plain?

No. The Old Mountain View-Alviso Road Bridge crosses Calabazas Creek at a right angle. The project, therefore, is a transverse crossing of the floodplain.

4.4.2. Are the risks associated with the implementation of the proposed action significant?

The only work within the floodplain is the driving of steel foundation piles and pile encasement, but the piles will be driven from the concrete superstructures above in two phases. This work will be accomplished during the non-rainy season and will not affect flood flows or flooding. Therefore, the risks associated with the implementation of the proposed action will not be significant.

4.4.3. Will the proposed action support probable incompatible floodplain development?

The proposed action will improve structural bridge safety, but it will not change roadway capacity or induce/support incompatible floodplain development.

4.4.4. Are there any significant impacts on natural and beneficial floodplain values?

No. The project is limited to the replacement of an existing bridge. There will be no impact to the natural and beneficial values of the floodplain, since the floodplain will remain unchanged.

4.4.5. Routine construction procedures are required to minimize impacts on the floodplain. Are there any special mitigation measures necessary to minimize impacts or restore and preserve natural and beneficial floodplain values? If yes, explain.

Access to the creek below the bridge will be restricted to minimize the removal of riparian vegetation. The selected construction alternative reduces the amount of excavation within the creek channel by using a single row of piles to directly support the cast-in-place pier walls rather than a multiple row buried pile cap system. The selected alternative relocates the new bridge bents to avoid conflicts with existing pile foundations. Significant impacts to the stream will be avoided because the duration of work within the low-flow channel is short.

4.4.6. Does the proposed action constitute a significant floodplain encroachment as defined in 23 CFR, Section 650.105(q)?

No. The project will have no adverse effects on flood flows or flooding. Therefore, it does not constitute a significant floodplain encroachment, as defined in 23 CFR 650.105(q).

4.4.7. Are Location Hydraulic Studies that document the above answers on file. If not, explain.

Yes.

CALTRANS LOCATION HYDRAULIC STUDY FORM

Dist. 04 Co. Santa Clara Rte. Local K.P. at Calabazas Creek
EA _____ Bridge No. 37C0254

Floodplain Description:
The Calabazas Creek floodplain is confined to the channel and its associated levee/floodwalls. The floodplain adjacent to the creek is not from the creek as a flooding source; but rather, San Francisco Bay tides behind non-accredited levees.

1. Description of Proposal (Include any physical barriers i.e. concrete barriers, soundwalls, etc. and design elements to minimize floodplain impacts.)
Replace existing concrete bridge with 125 feet long precast, prestressed concrete voided slab unit with cast-in-place concrete deck overlay. The structure is comprised of three spans supported on precast concrete seated abutments that are supported on driven steel pipe piles. The two bents are comprised on a single row of driven steel pipe piles supporting a precast concrete bent cap. The steel pipe piles are encased in a cast-in-place concrete facing to protect the steel piles and to provide improved hydraulic performance. Rapid construction techniques are proposed to reduce the road closure duration and minimize floodplain impacts. Prefabricated and precast elements are used to reduce construction time. Environmental and floodplain impacts are minimized by staging the construction to be performed from a combination of the partially demolished existing structure and the partially completed replacement structure, leading to a reduction in habitat disturbance and areas requiring a replanting and monitoring program.

2. ADT: Current 2,700 (2002) Projected 2,876 (2029)

3. Hydraulic Data: Base Flood Q_{100}= 4,300cfs
WSE_{100}= 15.25 ft NGVD The flood of record, if greater than Q_{100}:
Q= n/a cfs WSE= n/a
Overtopping flood Q= n/a cfs WSE= n/a
Are NFIP maps and studies available? YES x NO_____

4. Is the highway location alternative within a regulatory floodway?
YES_____ NO x

5. Attach map with flood limits outlined showing all buildings or other improvements within the base floodplain. *See body of report.*

Potential Q_{100} backwater damages:

A. Residences? NO x YES_____
B. Other Bldgs? NO x YES_____
C. Crops? NO x YES_____
D. Natural and beneficial Floodplain values? NO x YES_____

6. Type of Traffic:

A. Emergency supply or evacuation route? NO_____ YES x
B. Emergency vehicle access? NO_____ YES x
C. Practicable detour available? NO_____ YES x
D. School bus or mail route? NO_____ YES x

7. Estimated duration of traffic interruption for 100-year event hours:_____0_____

8. Estimated value of Q_{100} flood damages (if any) – moderate risk level.

A.	Roadway	$_____0_____
B	Property	$_____0_____
	Total	$_____0_____

9. Assessment of Level of Risk Low___x_____
Moderate_____
High_____

For high risk projects, during design phase additional design study risk analysis may be necessary to determine design alternative.

Signature – Local Hydraulic Engineer_____Date_3/17/15__
(Item numbers 3,4,5,7,9)

Is there any longitudinal encroachment, significant encroachment, or any support of incompatible floodplain development? NO___x_____YES_____

If yes, provide evaluation and discussion of practicability of alternatives in accordance with 23 CFR 650.113

Information developed to comply with the Federal requirement for the Location Hydraulic Study shall be retained in the project files.

Signature – Local Project Engineer_____Date_____
(Item numbers 1,2,6,8)

Signature – Caltrans Environmental Branch Chief_____Date_____

SUMMARY FLOODPLAIN ENCROACHMENT REPORT

Dist. 04 Co. Santa Clara Rte. Local K.P. at Calabazas Creek
Project No.: BHLS-5213(040) Bridge No. 37C0254
Limits: Old Mountain View-Alviso Road at Calabazas Creek
Floodplain Description: The base flood from Calabazas Creek is contained within its banks, levees and floodwalls upstream and downstream of Old Mountain View-Alviso Road. The adjacent floodplain is not associated with Calabazas Creek, but rather tidal inundation from San Francisco Bay due to non-accredited outboard levees.

		No	Yes
1.	Is the proposed action a longitudinal encroachment of the base floodplain?	_x_	___
2.	Are the risks associated with the implementation of the proposed action significant?	_x_	___
3.	Will the proposed action support probable incompatible floodplain development?	_x_	___
4.	Are there any significant impacts on natural and beneficial floodplain values?	_x_	___
5.	Routine construction procedures are required to minimize impacts on the floodplain. Are there any special mitigation measures necessary to minimize impacts or restore and preserve natural and beneficial floodplain values? If yes, explain.	_x_	___
6.	Does the proposed action constitute a significant floodplain encroachment as defined in 23 CFR, Section 650.105(q).	_x__	___
7.	Are Location Hydraulic Studies that document the above answers on file? If not explain.	___	_x_

PREPARED BY:

Charles D. Anderson — 3/17/15
Signature – Local Hydraulic Engineer — Date

_____ _____
Signature – Caltrans Environmental Branch Chief — Date

_____ _____
Signature – Local Project Engineer — Date