DOCUMENT 4

HYDRAULIC AND SEDIMENT TRANSPORT ANALYSES FOR THE CAMINO DEL MAR BRIDGE REPLACEMENT ALTERNATIVES 1.1, 2.1, AND 9.2

(BRIDGE NO. 57C-0209)

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FOR REVIEW ONLY

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INTRODUCTION

The City of Del Mar proposes to replace the existing Camino Del Mar bridge (Bridge No. 57C-0209) over the San Dieguito River. The bridge is located within the city of Del Mar and carries Camino Del Mar (formerly US Highway 101) over the river. The bridge is immediately east of the Pacific Ocean and adjacent to the San Dieguito Lagoon mouth (see the Vicinity Map). The existing bridge is an eleven-span cast-in-place structure approximately 596-feet long and 61-feet wide with 54-foot span lengths. The bridge contains two vehicular lanes (northbound and southbound) with adjacent bike lanes, a raised median, and a pedestrian walkway along the west edge. The original bridge was constructed in 1932 and was widened in 1953. Repairs and crash test rails were added in 2001. The bridge is structurally deficient, so is on the Eligible Bridge List for rehabilitation.

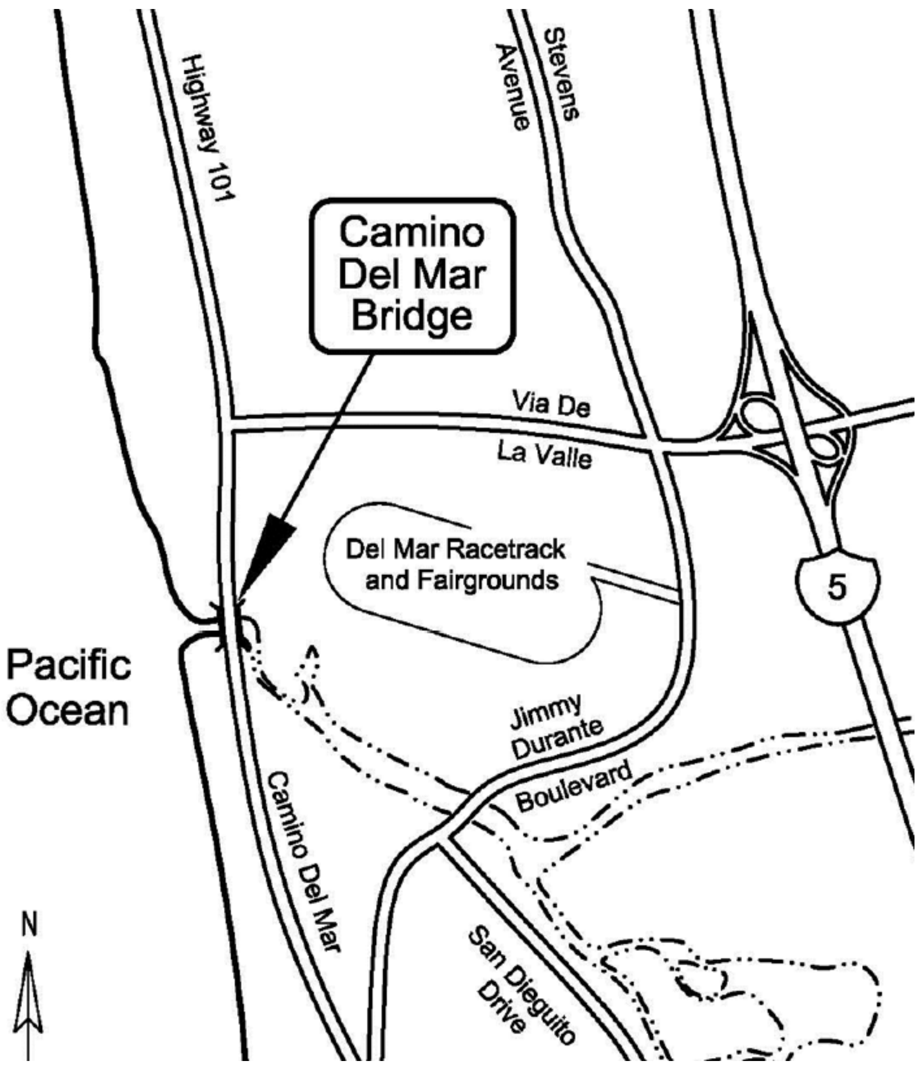


Figure 1. Vicinity Map

Kleinfelder initially developed nine preliminary bridge replacement alternatives labeled Alternative 1 through 9. The nine alternatives were analyzed in Chang Consultants' September 8, 2018, *Hydraulic and Sediment Transport Analyses for the Camino Del Mar Bridge Replacement*. Kleinfelder has now developed three refined alternatives labeled Alternative 1.1, 2.1, and 9.2, which are covered by this report. Bridge plans for the three alternatives are included in the map pocket. The alternatives will follow the same horizontal alignment as the existing bridge; however, the overall span will be lengthened to 624 feet and the width will be increased to 68.5 feet. The bridge profiles will be designed to provide the required freeboard. Each alternative includes semi-circular pedestrian overlooks spaced at intervals along both edges that extend 6 feet beyond the edges.

The bridge plans also include Alternatives 2.2 and 9.1. Alternative 2.2 is similar to Alternative 9.2 except for the pier spacing and haunches. Alternative 9.1 is similar to Alternative 2.1 except for the pier spacing and haunches. The haunches under all alternatives will be elevated above the design water surface elevations, so will not impact hydraulics or sediment transport. The pier spacing variations between Alternatives 2.2/9.2 and 2.1/9.1 will have minimal impact on hydraulics or sediment transport, so the Alternative 9.2 hydraulics will be similar to Alternative 2.2 and the Alternative 2.1 hydraulics will be similar to Alternative 9.1. Therefore, additional analyses were not performed for Alternatives 2.2 and 9.1.

The design variations between each alternative are as follows. Alternative 1.1 will contain a haunched superstructure with five spans and four sets of piers. The two end spans will be 109.5-feet long while the three middle spans will be 135-feet long. Each pier will contain two oblong (7.5-foot by 5-foot) flared columns. The columns will be supported by 10-foot diameter cast-in-drilled-hole (CIDH) piles within an 11-foot diameter casing. Alternative 2.1 will contain a haunched superstructure with six spans and five sets of piers. The two end spans will be 88-feet long while the four middle spans will be 112-feet long. Each pier will contain two oblong (7-foot by 4.5-foot) flared columns. The columns will be supported by 9-foot diameter CIDH piles within a 10-foot diameter casing. Alternative 9.2 will contain a constant depth superstructure with six spans and five sets of piers. All spans will be 104-feet long. Each pier will contain four 4-foot diameter circular columns. The columns will be supported by 6-foot diameter CIDH piles within a 7-foot diameter casing.

The Federal Emergency Management Agency (FEMA) has mapped the 100-year floodplain and floodway along this section of the San Dieguito River on their *Flood Insurance Rate Maps* (FIRMs). The effective FIRMs in the vicinity of the bridge are 06073C1307H and 0673C1309H dated December 20, 2019 (a FIRMette covering the site is included after this report text). The FIRMs show that the floodplain extends broadly across the overbank areas approaching the bridge, while the floodway is mostly contained within the main channel as well as within the existing bridge opening. The floodplain represents the area subject to inundation during a 100-year flood, while the floodway is a regulatory area reserved in order to convey the 100-year flood without increasing its water surface elevation more than a foot. FEMA has performed detailed coastal engineering analyses, which encompasses the coastline along the lagoon mouth.

This report contains hydraulic and scour analyses for the bridge alternatives. The analyses are used to assess the feasibility, freeboard requirements, and scour countermeasures for each alternative. This information will be used to aid in selecting the preferred alternative(s).

HYDRAULIC ANALYSES

Hydraulic analyses of the San Dieguito River were performed for Alternatives 1.1, 2.1, and 9.2 using the US Army Corps of Engineers' HEC-RAS model. Caltrans' December 2017 "Memo to Designers 16-1" (included after this report text) states that a bridge soffit should pass the greater of the 50-year flood plus freeboard or the 100-year flood without freeboard. Section 821.3 of Caltrans' 2019 *Highway Design Manual* (HDM – Sixth Edition) provides similar requirements. The HDM indicates that a bridge should pass a 50-year flood with freeboard sufficient to accommodate the effects of bedload and debris (2 feet of freeboard is often assumed). In addition, the 100-year flood should be conveyed without freeboard. The 100-year flood criteria is required to be met for no sea level rise and for 38 inches of sea level rise. The alternatives have been designed to meet the 50-year flood plus 2-feet of freeboard and both 100-year flood with no freeboard criteria.

Caltrans' 2-feet of freeboard accounts for the effects of bedload and debris (drift). The sediment transport analyses in the next section determined that several feet of scour will occur at the Camino Del Mar bridge, so bedload will not adversely impact the bridge conveyance. The source of debris is from the upstream watershed. Much of the watershed nearest the bridge is developed, so will not generate large debris. On the other hand, mature brush and trees exist in portions of the San Dieguito River and Lagoon floodplain immediately upstream of the site. The lagoon is broad with a mild slope, so these portions will experience low flow velocities. FEMA's analysis determined 100-year flow velocities of around 4 feet per second upstream of Jimmy Durante Boulevard. These low velocities are not likely to remove nor readily transport large vegetation. Large debris can be captured by the upstream railroad and Jimmy Durante Boulevard bridges prior to reaching the Camino Del Mar bridge. Furthermore, the proposed bridge opening width is over 580-feet, the columns will have rounded noses, and the piers will be spaced at least 104-feet apart, so there is low potential for large amounts of debris to be accumulate against the bridge. Therefore, Caltrans' 2-feet of freeboard requirement is appropriate to account for drift passage.

The HEC-RAS one-dimensional model has been used extensively for modeling of the San Dieguito Lagoon near the project site. This includes modeling for the San Dieguito Wetlands Restoration project, FEMA floodplain and floodway mapping, and the San Dieguito River Bridge Replacement, Double Track and Del Mar Fairgrounds Special Events Platform project. This model is also appropriate for the Camino Del Mar bridge project. The effective flow area is primarily one-dimensional. This is evident in Figure 2, which is a view of the San Dieguito River during the February 21, 1980 flood with a peak discharge of approximately 22,000 cfs. The dominant flow path is in the downstream direction, which can be modeled with the one-dimensional HEC-RAS routine. The HEC-RAS input and results are discussed next.

The HEC-RAS cross-sections are delineated on the Hydraulic and Sediment Transport Work Map in the map pocket. The HEC-RAS study reach extends from the Pacific Ocean to nearly 1,000 feet upstream of Jimmy Durante Boulevard. The cross-section locations were selected to adequately represent the hydraulic conditions along the study reach. Kleinfelder provided August 2017 topographic mapping at the project site. The mapping is at a 1-foot contour interval and on NAVD 88. Spot elevations of the channel bed below the water surface are provided just upstream and downstream of the bridge. This data was used to create the cross-sections closest to the bridge (cross-sections 0.0439, 0.0705, 0.0837, and 0.1027). The remaining cross-sections were obtained from a prior existing condition analysis by Chang Consultants and are on NGVD 29. The prior data was used because it provides elevation information below the water surface that is not reflected on the recent topographic mapping. According to FEMA's April 5, 2016, *Flood Insurance Study, San Diego County, California* (FIS), 2.1 feet is added to NGVD 29 elevations to convert to NAVD 88 (see the excerpt in Appendix A). The remaining cross-sections were increased by 2.1 feet to convert to NAVD 88. Since the project is adjacent to the Pacific Ocean, the river channel contains sandy material, is subject to continuous tidal influences, and undergoes ongoing physical changes. As a result, the actual field conditions will vary from the topographic mapping over time.

Figure 2. February 21, 1980 San Dieguito River Flood

FEMA's 50- and 100-year flow rates were used for the analyses. The 50- and 100-year flow rates are 31,400 and 41,800 cubic feet per second at the bridge, respectively (see Appendix A). The 50- and 100-year starting water surface elevations at the Pacific Ocean were based on the San Dieguito River Flood Profiles from FEMA's recent December 20, 2019 FIS (see the map pocket) and are approximately 9.0 and 10.2 feet, respectively. The Flood Profiles start approximately 90 feet downstream of the Camino Del Mar bridge. The FIRMette indicates that the 100-year Zone AE floodplain elevation is 8 feet at the Pacific Ocean. The higher 100-year elevation of 10.2 feet from the Flood Profiles was chosen in order to generate conservative results in establishing soffit elevations.

A roughness coefficient of 0.025 was assigned to reflect the main river channel, which contains sandy material as well as a base flow. The roughness was increased in the overbank areas to between 0.030 to 0.045 to reflect increased roughness associated with existing improvements, vegetation, or riprap. Encroachments were used to model ineffective flow areas associated with bridge contraction and expansion.

The proposed bridge under each alternative has a longer span than the existing bridge. However, the existing abutments will remain, so the overall flow conveyance width through the proposed condition bridge will be the same as existing conditions. The bridge pier widths and locations as well as the roadway and haunch profiles were modeled based on Kleinfelder's plans. The Alternative 1.1 and 1.2 bridge piers are oblong. The piers will be aligned 20 degrees counterclockwise from a line perpendicular to the bridge centerline in order to more closely follow the flow direction. The superstructure is haunched under Alternative 1.1 and 1.2 with a greater depth at the piers and smaller depth midspan.

The bridge is skewed to the river's flow direction. The FIRMette includes FEMA's flow line that has an approximately 8 degree skew. A better indication of the skew angle is seen in Figure 2. The bridge skew angle from the flow direction is approximately 30 to 40 degrees. The San Dieguito River Bridge Replacement, Double Track and Del Mar Fairgrounds Special Events Platform project proposes to widen the upstream railroad bridge to the north, which will reduce the skew angle. A conservative skew angle of 40 degrees was assumed for the proposed bridge alternatives. In addition, the widths of the oblong piers were increased to account for the greater flow obstruction associated with the skew. Since the Platform project is upstream of Camino Del Mar and the river flow is subcritical, the Platform project will not change water surface elevations at the proposed bridge.

Additional proposed condition analyses for each alternative were requested assuming sea level rises of 38 inches, 66 inches, and 8.8 feet. The starting 50- and 100-year water surface elevations were increased by these amounts. At the higher water surface elevations, the flow is not contained with some cross-sections. Since the results are merely used for a relative comparison and large sea level rise is speculative, the cross-sections were not extended, but can be during final engineering for the preferred alternative, as needed.

The proposed condition 50- and 100-year HEC-RAS results with and without sea level rise are included in Appendix A. The results at the upstream edge of the Camino Del Mar bridge (cross-section 0.0771) are summarized in Table 1. Table 1 also summarizes the minimum required soffit elevations based on the typical Caltrans' criteria of the 50-year flood plus 2 feet of freeboard and the 100-year flood with no freeboard. Caltrans' added that the 100-year flood with 38 inches of sea level rise and no freeboard should be considered. The 50-year plus freeboard criteria results in a higher soffit than both 100-year criteria for all three alternatives. Kleinfelder has designed the bridge soffit of Alternatives 1.1, 2.1, and 9.2 to be above the 50-year flood minimum soffit elevations in Table 1.

Alternative	Flood Event	Sea Level Rise, inches	Water Surface Elevation, feet	Minimum Soffit Elevation, feet[1]
1.1	50-Year	0	12.55	14.55
1.1	50-Year	38	12.76	
1.1	50-Year	66	14.63	
1.1	50-Year	105.6 (8.8’)	17.81	
1.1	100-Year	0	14.09	14.09
1.1	100-Year	38	14.14	14.14
1.1	100-Year	66	15.86	
1.1	100-Year	105.6 (8.8')	18.99	
2.1	50-Year	0	12.55	14.55
2.1	50-Year	38	12.76	
2.1	50-Year	66	14.63	
2.1	50-Year	105.6 (8.8’)	17.81	
2.1	100-Year	0	14.11	14.11
2.1	100-Year	38	14.15	14.15
2.1	100-Year	66	15.86	
2.1	100-Year	105.6 (8.8')	18.99	
9.2	50-Year	0	12.48	14.48
9.2	50-Year	38	12.75	
9.2	50-Year	66	14.63	
9.2	50-Year	105.6 (8.8’)	17.81	
9.2	100-Year	0	14.03	14.03
9.2	100-Year	38	14.11	14.11
9.2	100-Year	66	15.86	
9.2	100-Year	105.6 (8.8')	19.00	

[1]Minimum soffit elevation to be the greater of the 50-year flood plus 2-feet of freeboard, 100-year flood with no freeboard, and 100-year flood with 38-inch of sea level rise and no freeboard. The 50-year flood plus freeboard criteria governs for all three alternatives (elevations in red).

Table 2. HEC-RAS Results at Upstream Edge of Camino Del Mar Bridge (Cross-Section 0.0771)

SEDIMENT TRANSPORT ANALYSES

The HEC-RAS results indicate that the 100-year flow velocities at the proposed bridge range from 7.4 to 14.9 feet per second depending on the alternative and sea level rise, which are considered erosive. Stream bed scour consists of general scour and local scour. General scour is related to the sediment supplied into and transported out of a channel reach. Local scour is due to a local flow obstruction by a bridge pier/bent or abutment. The total scour is the general scour plus the local scour. The total scour should be considered in the design of the proposed bridge.

General Scour

The FLUVIAL-12 model as described in the County of San Diego's September 2014, *Hydraulic Design Manual*, was used to assess the proposed sediment transport trends and general scour. The model was developed by Dr. Howard Chang from Chang Consultants and has been used on dozens of projects in southern California, nationally, and internationally. The following describes the model and its input.

Stream hydraulics, sediment transport, and channel changes may be studied through physical modeling, mathematical modeling, or both. Physical modeling has been relied upon traditionally for stream projects, but mathematical modeling has become popular as this capability expands rapidly. The FLUVIAL-12 program is a mathematical model that has been formulated and developed since 1972 for water and sediment routing in natural and improved streams. The combined effects of flow hydraulics, sediment transport, and stream channel changes are simulated for given flow events and periods.

The model simulates the inter-related changes in channel-bed profile and channel width based upon a streams tendency to seek uniformities in sediment discharge and power expenditure. At each time step, scour and fill in a channel bed are computed based on the spatial variation in sediment discharge along the channel. Channel-bed corrections for scour and fill will reduce the non-uniformity in sediment discharge. Width changes are also made at each time step, resulting in a movement toward uniformity in power expenditure along the channel. Because the energy gradient is a measure of the power expenditure, uniformity in power expenditure also means a uniform energy gradient or linear water surface profile. A river channel may not have a uniform power expenditure or linear water-surface profile, but it is constantly adjusting itself toward that direction. The FLUVIAL-12 model was calibrated using twelve sets of field data. Such calibration studies are listed in the FLUVIAL-12 *User's Manual.* Most of the calibration studies were peer-reviewed.

FLUVIAL-12 is applicable to ephemeral streams as well as streams with long-term, continuous flow. Because dynamic changes have transient behavior, ephemeral streams require more complicated model formulation techniques. Stream impacts simulated by the FLUVIAL-12 model include channel bed scour and fill (degradation and aggradation), width variation, and bed topography changes induced by channel curvature (i.e., bend scour associated with channel curvature). These inter-related changes are coupled at individual time steps over an entire flow event or series of flow events. While the model is applicable for erodible channels, physical constraints such as bank protection or armoring, grade-control structures, bedrock outcroppings, etc. may also be specified. Furthermore, the erodible material limits, bank erodibility, angle of repose, and channel roughness (e.g., channel bed and bank material, vegetation density, etc.) are included. Typical model applications include evaluations of sand and gravel mining, channelization, sediment delivery, etc.

FLUVIAL-12 is an *erodible-boundary* model. An erodible-boundary model is different from an erodible-bed model such as HEC-6, HEC-6T, and the sediment transport module in HEC-RAS in some or all of following ways:

1. An erodible-bed model does not simulate channel width changes. Since channel-bed profile changes are closely related to width changes, these should not be separated.

2. An erodible-bed model assumes uniform channel bed profile changes in the erodible zone, i.e., all cross-section points adjust up and down by an equal amount during aggradation and degradation. Actual bed changes are not uniform and, therefore, may not be accurately simulated by an erodible-bed model.

3. An erodible-bed model does not consider channel curvature. In actuality, bed topography is highly non-uniform in a curved channel, especially during high flow.

4. An erodible zone needs to be specified at cross-sections in an erodible-bed model. The model does not determine the extent of channel erosion. The user has to delineate the erodible portion of the channel bed. On the other hand, the erosion boundary is computed and provided by the FLUVIAL-12 model, and the boundary changes with discharge and time.

5. Sediment inflow into the channel reach needs to be specified for other models. This requires a sediment rating curve, which is typically not available for stream channels. In the FLUVIAL-12 model, the sediment inflow may be specified or it may be computed based on the upstream cross-section flow hydraulics.

6. FLUVIAL-12 has been tested and calibrated with field data from several streams in both semi-arid and humid regions. An erodible-bed model may not be calibrated with field data of natural streams.

For the reasons described above, the FLUVIAL-12 model is appropriate for sediment transport analysis of the San Dieguito River. The following describes the model input and results.

The FLUVIAL-12 model uses cross-sectional data to model the physical shape of a channel similar to HEC-RAS. The cross-sections and roughness coefficients were based on the proposed condition HEC-RAS geometry as well as prior modeling data by Chang Consultants extending upstream of El Camino Real. The model is on NAVD 88. In addition to cross-sectional data, FLUVIAL-12 requires a flow hydrograph, bed material gradations, and an appropriate sediment transport formula.

A flow hydrograph represents the relationship between flow rate (cubic feet per second) versus time (hours) for a given flood event. Sediment transport is directly related to the flow rate, i.e., a higher flow rate can transport more sediment. Caltrans' December 2017 "Memo to Designers 16-1" states that scour should be investigated for the design flood and check flood. The check flood is typically a 200-year event. Since the check flood is greater than the 100-year design flood, the 200-year hydrograph was used in FLUVIAL-12. The 200-year peak flow rate was interpolated from the FEMA 10-, 50, 100-, and 500-year flow rates using a log-probability graph and is

60,000 cfs at the bridge (see Appendix A). Figure 3 illustrates the 200-year hydrograph used for the analysis.

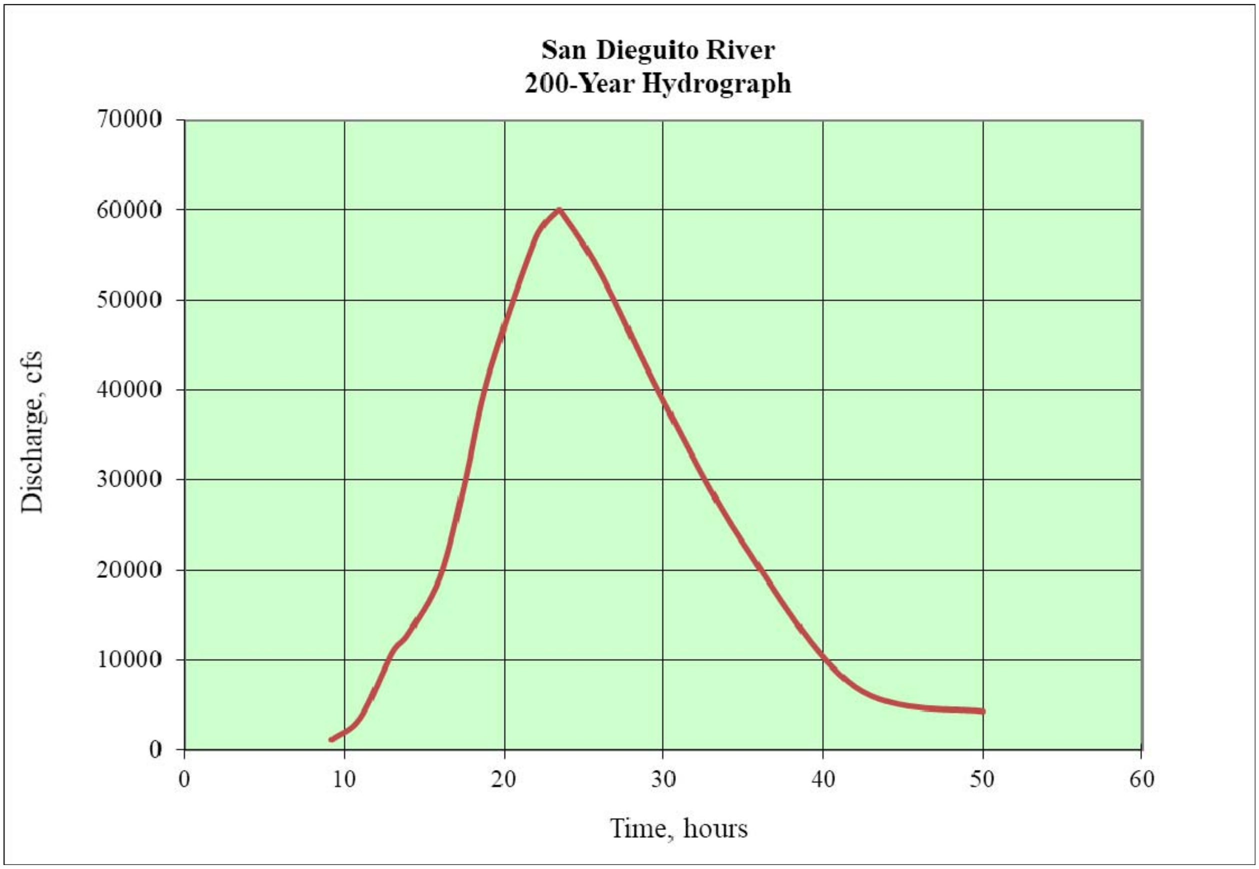


Figure 3. 200-Year Hydrograph

The bed material gradations and Engelund-Hansen sediment transport formula are from prior data used for extensive modeling for the San Dieguito Lagoon Restoration project. Finally, since the San Dieguito River delta extends into the Pacific Ocean, an additional cross-section was added within the ocean and tidal data was entered so that the peak 200-year flow rate corresponds to low tide. This will yield conservative results, i.e., a greater potential for scour.

The FLUVIAL-12 results at the Camino Del Mar bridge are included in Figure 4. The cross-section is looking in the downstream direction. The figure shows general scour predicted during the peak and end of the 200-year flood. The results indicate greater scour during the peak of the event followed by some backfill towards the end of the event. The maximum scour reached over the entire duration of the 200-year flood is also plotted and extends to elevation -14.5 feet NAVD 88. The main channel at the Camino Del Mar bridge can meander over time, so this maximum scour elevation shall be assumed across the entire bridge opening for design purposes.

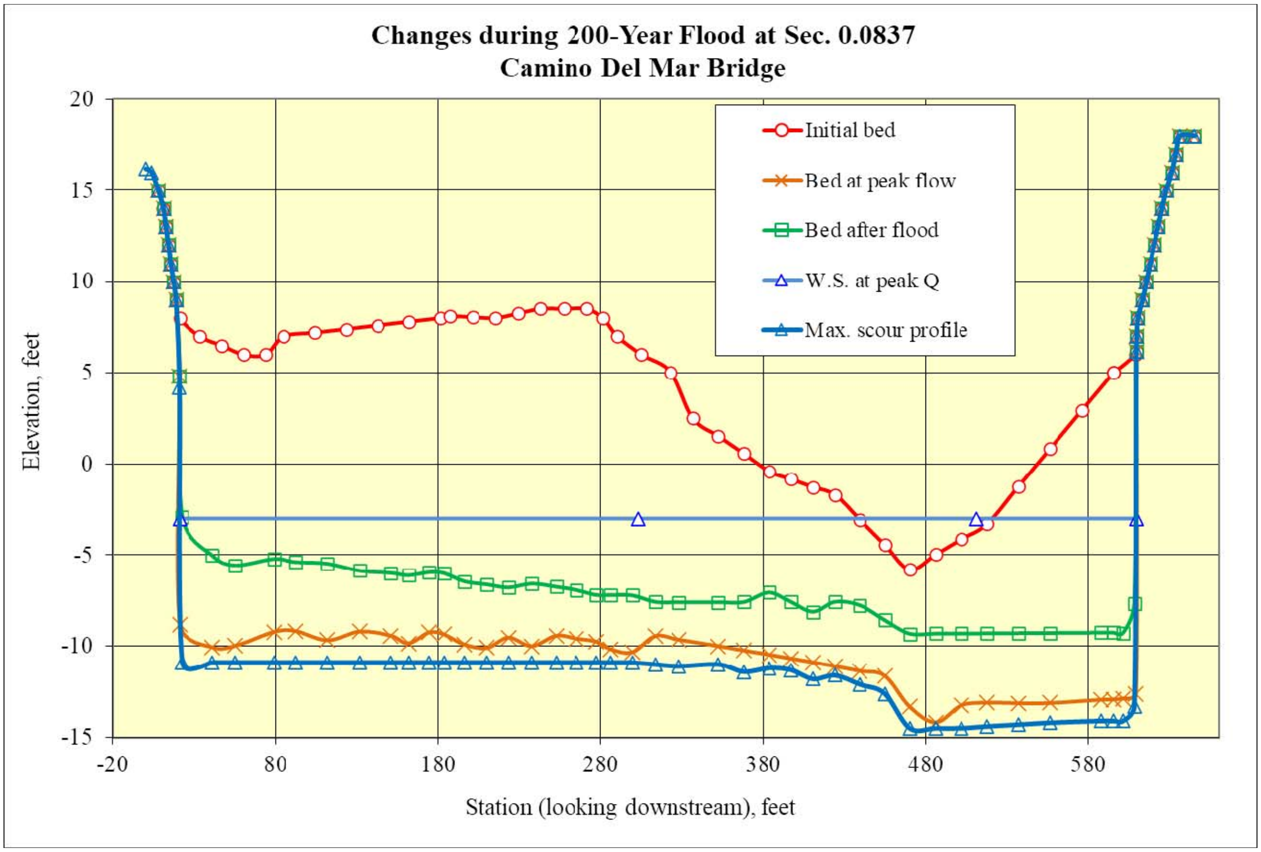


Figure 4. FLUVIAL-12 General Scour Results

Local Scour

Local scour analyses were performed to determine the pier scour, which is associated with accelerated flow and the resulting vortices leading to a removal of material near a bridge pier. Per Caltrans' criteria, the local scour was based on the 200-year flood. Appendix A contains 200-year HEC-RAS hydraulic results at the proposed bridge for Alternatives 1.1, 2.1, and 9.2. The 200-year HEC-RAS analyses use the same assumptions as the 50- and 100-year analyses except the starting water surface elevation estimated from the FEMA Flood Profiles is 12 feet. The Colorado State University (CSU) equation from Hydraulic Engineering Circular No. 18 (HEC-18) is the standard pier scour formula and has the following form:

$$y_s/a = 2.0\, K_1 K_2 K_3 (y_1/a)^{0.35} F_r^{0.43}$$

where,

y_s = scour depth, feet
y_1 = flow depth directly upstream of the pier, feet
a = pier width, feet (this is based on the pile casing diameter)
K_1 = correction factor for pier nose shape
K_2 = correction factor for angle of attack of flow
K_3 = correction factor for bed condition
F_r = Froude Number directly upstream of pier

The CSU equation input values are: y_1 = flow depth from the HEC-RAS 200-year results at cross-section 0.0771, a = 7 to 11 feet depending on alternative, K_1 = 1.0 for a round nose or cylindrical piers and 1.1 for square nose piers, K_2 = 1.0 for no angle of attack, K_3 = 1.1 for a plane bed, and F_r = Froude number from the HEC-RAS results at cross-section 0.0771. Table 3 summarizes the pier scour input and results.

Alternative	y_1, ft	a, ft	F_r	y_S, ft
1.1	22.27	11	0.41	21.1
2.1	22.32	10	0.41	19.9
9.2	22.22	7	0.41	15.7

Note: K_1=1.0, K_2 = 1.0, and K_3 = 1.1 for all alternatives.

Table 3. Summary of Pier Scour

Pier scour is most impacted by the pier width and nose shape. Pier scour is directly related to the width, while the nose shape can reduce scour by 10 percent. Therefore, narrower piers with rounded noses will require a lesser design depth. The piers shall be designed for the total scour, which is the sum of the general scour and pier scour.

Local scour can occur around abutments due to the flow obstruction caused when abutments protrude into the active river channel. As mentioned in the Hydraulic Analyses section, the existing abutments will remain. The proposed abutments will be constructed behind the existing abutments. Therefore, the abutment scour will not be altered by the project and the current abutment protection will be maintained.

CONCLUSION

Hydraulic and sediment transport analyses have been performed for the proposed Camino Del Mar bridge over the San Dieguito River/Lagoon. The bridge will replace an existing bridge that has been identified for rehabilitation. Hydraulic analyses have been performed for Kleinfelder’s Alternatives 1.1, 2.1, and 9.2. Kleinfelder also prepared plans for Alternatives 2.2 and 9.1, but the hydraulic results for these are represented by the results for Alternatives 9.2 and 2.1, respectively, since the openings and piers are similar. Kleinfelder has designed the superstructure of each alternative to be above Caltrans’ minimum required soffit elevations, which are governed by the 50-year flood with 2-feet of freeboard. In addition, the piles will be over 140-feet deep, so will extend well below the predicted local and general scour depths. The existing bridge abutments and abutment protection will remain. Tables 4 and 5 contain Caltrans’ Hydrologic Summary Table and Scour Data Table, respectively.

Caltrans emailed tsunami hazard information and design guidelines, which are included after the report text. The guidelines state that a “tsunami can damage a bridge if the waves are high enough to strike the deck.” The maximum tsunami wave elevation is given as 10.7 feet NAVD 88 and sea level rise for year 2100 is 3.7 feet. Adding these values yields a tsunami design elevation of 14.4 feet. This elevation is just below the minimum required soffit elevations in Table 1, so the superstructure will avoid tsunami wave strikes. The piers can be subject to local scour from a tsunami. The maximum flow depth at the piers from a tsunami wave at elevation 14.4 feet is 20.2 feet. Based on a Froude number of 1, the pier scour from the HEC-18 formula is 29.9 feet. As mentioned above, the piles will be over 140-feet deep, so the piers will be protected from the tsunami-induced pier scour. The maximum tsunami flow velocity is listed as 3 meters per second (9.8 feet per second). This velocity is lower than the 100-year flow velocities, so riprap used to protect the abutments will be capable of resisting the tsunami forces.

Hydrologic Summary for Bridge No. 57C-0209 (Camino Del Mar)			
Drainage Area = 346 square miles			
Frequency	**Design Flood**	**Base Flood**	**Flood of Record**
	50-Year	100-Year	Unknown. Ungaged.
Discharge	31,400 cfs	41,800 cfs	N/A
Water Surface Elevation at Bridge	Alt 1.1 = 12.55 feet Alt 2.1 = 12.55 feet Alt 9.2 = 12.48 feet	Alt 1.1 = 14.09 feet Alt 2.1 = 14.11 feet Alt 9.2 = 14.03 feet	N/A

Table 4. Hydrologic Summary Table

Support No.	Long Term (Degradation and Contraction) Scour Elevation, feet NAVD 88	Short Term (Local) Scour Depth, feet
Abutment 1 (South)	-14.5	0
Alternative 1.1 Piers	-14.5	21.1
Alternative 2.1 Piers	-14.5	19.9
Alternative 9.2 Piers	-14.5	15.7
Abutment 4 (North)	-14.5	Per existing.

Table 5. Scour Data Table

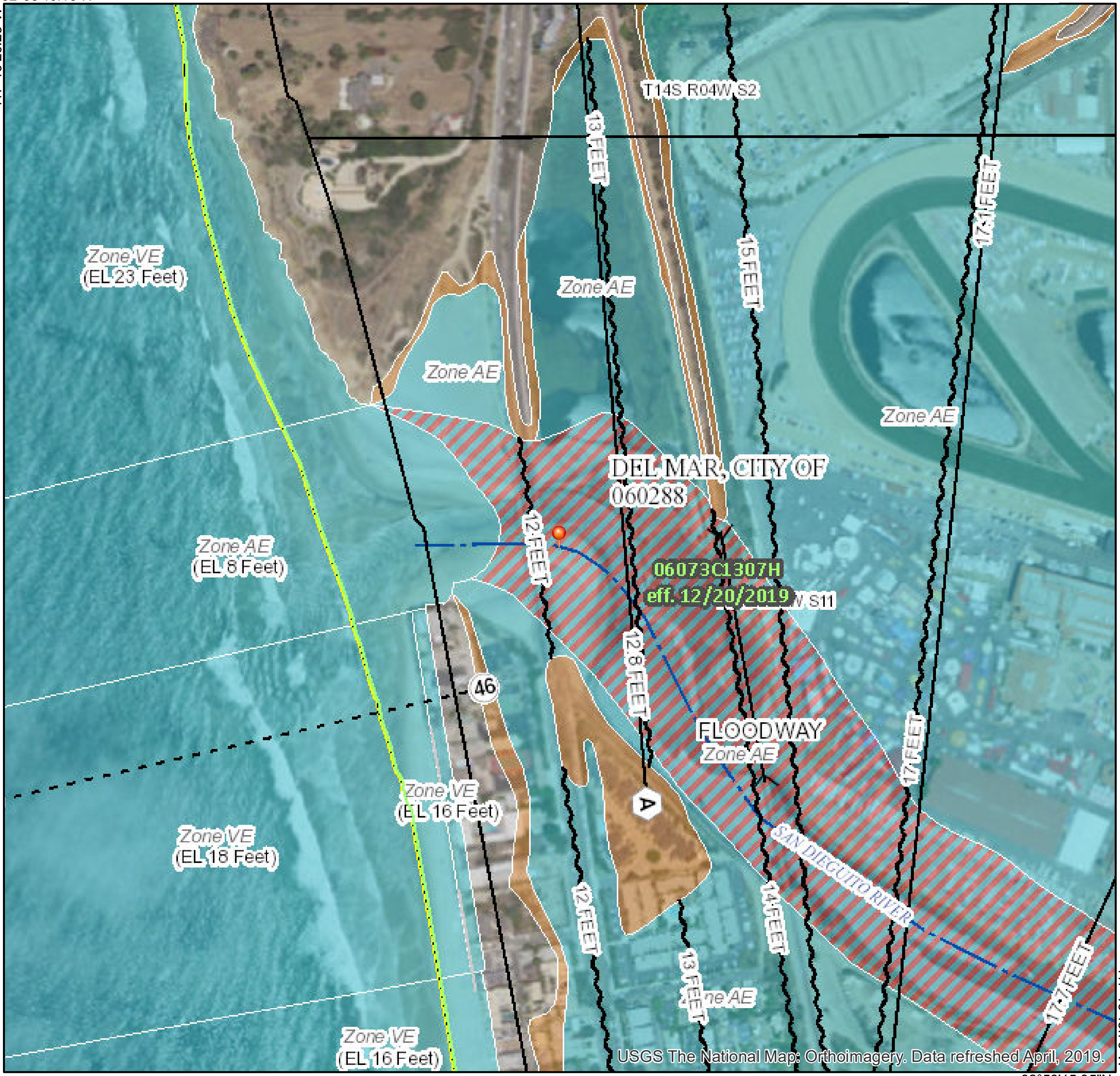
Since the proposed bridge will encroach into the FEMA floodplain and floodway, FEMA's no-rise criteria will be met. The existing abutments will remain, so the overall opening width will not change. The existing bridge contains ten piers whose widths vary from 4-feet along the lower portion to 6-feet near the deck. The proposed alternatives will contain between 4 to 5 piers. The total width of the proposed piers will be less than the existing piers. In addition, the proposed soffit will be raised. Therefore, each of the proposed alternatives will provide greater flow conveyance and a no-rise will be achieved.

National Flood Hazard Layer FIRMette

FEMA

32°58'46.13"N

117°16'26.25"W



117°15'48.79"W

32°58'15.95"N

Feet 1:6,000

0 250 500 1,000 1,500 2,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 6/3/2020 at 12:46:17 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

SUPERSEDES MEMO TO DESIGNERS 1-23 DATED OCTOBER 2003

16-1 HYDRAULIC DESIGN FOR STRUCTURES OVER WATERWAYS

Introduction

This memorandum provides direction for the hydraulic design of structures over waterways on the State Highway System (SHS). The intent is to assist the structure designer in understanding the recommendations provided in the Bridge Hydraulics Reports.

The hydraulic design of a bridge must include the scour condition. Generally, scour is increased with high flow velocities in the waterway. Other factors such as turbulence, complex flow patterns around the abutments, or a bridge location on a bend in the stream can contribute to the scour condition. The hydraulic design of the bridge should aim to accommodate waterway conveyance with the least amount of impact to velocities and water surface levels.

Policy Statement

Structures over waterways on the SHS shall be designed in accordance with the AASHTO LRFD Bridge Design Specifications, current California Amendments (AASHTO LRFD-BDS-CA) and the Highway Design Manual (HDM). Design Flood is defined in the Highway Design Manual (HDM 818.1) as:

Design Flood - The peak discharge (when appropriate, the volume, stage, or wave crest elevation) of the flood associated with the probability of exceedance selected for the design of a highway encroachment.

Design flood frequencies adopted as a standard for design and their application are listed below:

- 50-year or 100-year flood used for adequate waterway conveyance OR as specified by any flood control agency.
- 100-year flood used for scour analysis.
- Minimum of 200-year flood or a maximum of 500-year flood used for check flood.

The general criteria for setting the soffit elevation is to pass the greater of (1) Design Flood (typically Q50 + freeboard), or (2) Base Flood (Q100 without freeboard). Per HDM 818.2 & 821.3, design practice recommends that a range of peak flows be considered and that the Design Flood be established which best satisfies the specific site conditions and associated risks. There will be rare situations where the risks of a lower water crossing is acceptable, but typically the highways shall not be inundated by the Design Flood. At low water crossings subject to inundation as an accepted risk, the overtopping flood will be used as the Design Flood. Deviation from the standard design criteria requires project-specific design criteria to be included in the hydraulic reports.

In accordance with the Local Assistance Procedures Manual (LAPM), Chapter 11, local-agency-funded projects with bridges on the SHS must be designed in accordance with current SHS standards outlined in the Caltrans bridge design manuals and the HDM. All local bridge and structure projects off the SHS and either on or off the National Highway System (NHS) must use similar design criteria. For all state or local bridges, the effects of objectionable backwater conditions must be considered.

Certain regions throughout the state are regulated by local flood control agencies and bridge structures within their jurisdiction must satisfy their design requirements. Certain local agencies have established higher design standards than Caltrans requires. Local agencies that choose to require higher standards of design may complicate the ability to receive federal funding. There may be circumstances where the risks of a lower water crossing are acceptable. The hydraulic studies must provide justification for deviating from the standard design criteria.

The AASHTO LRFD-BDS requires scour at bridge foundations to be investigated for two conditions: (1) design flood and (2) check flood. Scour for the design flood is based on the 100-year event or from an overtopping flood of a lesser recurrence interval. Scour for the check flood is based on a higher flood discharge; typically a 200-year event.

For all capital projects, a hydraulic study report is required for any bridge over a waterway to address adverse flood risk potential. Environmental approvals often hinge on compliance with local flood control agencies or other regulatory agencies. The hydraulic study reports must comply with the requirements set forth in this document. Reports may not be necessary for structure maintenance projects.

Scour of Geologic Material

The geologic material underlying a waterway may be either: (1) granular or fine material, (2) cohesive or non-cohesive, (3) erodible or non-erodible rock. Various geologic materials erode at different rates. Non-cohesive materials scour more readily than cohesive materials, while cohesive or cemented soils typically are less scour-resistant than some rocks. The geotechnical analysis studies the in-situ soil properties and the hydraulic conditions of the flow to determine the erosional susceptibility of the foundation material during a single flood event or long-term erosion.

The geologic properties and hydraulic conditions of water flow may vary during the life of the bridge. The geologic and soil factors include the sediment or rock type, its porosity and basins having areas in excess of 320 acres than for small basins.

821.3 Selection of Design Flood

As discussed in Index 818.2, there are two recognized alternatives to selecting the design flood frequency (probability of exceedance) in the hydraulic design of bridges and culverts. They are:

- By policy - using a preselected recurrence interval.
- By analysis - using the recurrence interval that is most cost effective and best satisfies the specific site conditions and associated risks.

Although either of these alternatives may be used exclusive of the other, in actual practice both alternatives are often considered and used jointly to select the flood frequency for hydraulic design. For culverts and bridges, apply the following general rules for first consideration in the process for ultimate selection of the design flood.

(1) *Bridges.* The basic rule for the hydraulic design of bridges (but not including those culvert structures that meet the definition of a bridge) is that they should pass a 2 percent probability flood (50-year). Freeboard, vertical clearance between the lowest structural member and the water surface elevation of the design flood, sufficient to accommodate the effects of bedload and debris should be provided. Alternatively, a waterway area sufficient to pass the 1 percent probability flood without freeboard should be provided. Two feet of freeboard is often assumed for preliminary bridge designs. The effects of bedload and debris should be considered in the design of the bridge waterway.

(2) *Culverts.* There are two primary design frequencies that should be considered:

- A 10% probability flood (10-year) without causing the headwater elevation to rise above the inlet top of the culvert and,
- A 1% probability flood (100-year) with-out headwaters rising above an elevation that would cause objectionable backwater depths or outlet velocities.

The designer must use discretion in applying the above criteria. Design floods selected on this basis may not be the most appropriate for specific project site locations or conditions. The cost of providing facilities to pass peak discharges suggested by these criteria need to be balanced against potential damage to the highway and adjacent properties upstream and downstream of the site. The selection of a design flood with a lesser or greater peak discharge may be warranted and justified by economic analysis. A more frequent design flood than a 4% probability of exceedance (25-year) should not be used for the hydraulic design of culverts under freeways and other highways of major importance. Alternatively, where predictive data is limited, or where the risks associated with drainage facility failure are high, the greatest flood of record or other suitably large event should be evaluated by the designer.

When channels or drainage facilities under the jurisdiction of local flood control agencies or Corps of Engineers are involved, the design flood must be determined through negotiations with the agencies involved.

821.4 Headwater and Tailwater

(1) *Headwater.* The term, headwater, refers to the depth of the upstream water surface measured from the invert of the culvert entrance. Any culvert which constricts the natural stream flow will cause a rise in the upstream water surface.

It is not always economical or practical to utilize all the available head. This applies particularly to situations where debris must pass through the culvert, where a headwater pool cannot be tolerated, or where the natural gradient is steep and high outlet velocities are objectionable.

The available head may be limited by the fill height, damage to the highway facility, or the effects of ponding on upstream property. The extent of ponding should be brought to the attention of all interested functions, including Project Development, Maintenance, and Right of Way.

Full use of available head may develop some vortex related problems and also develop

Wayne W. Chang

Subject: FW: EXTERNAL: ACTION: BHLO 5356(008) - Camino Del Mar (57C-0209), Caltrans DES Tsunami Hazard information

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From: Thiele, Tim <TTHIELE@mbakerintl.com>
Sent: Thursday, April 30, 2020 3:14 PM
To: Don Bloodworth <DBloodworth@kleinfelder.com>; Nganha Vu <NVu@kleinfelder.com>; Jim Frost <JFrost@kleinfelder.com>
Subject: RE: EXTERNAL: ACTION: BHLO 5356(008) - Camino Del Mar (57C-0209), Caltrans DES Tsunami Hazard information

External Email.

Is this what you were looking for?

From: Pham, Anh-Vu D@DOT <anh-vu.pham@dot.ca.gov>
Sent: Thursday, April 30, 2020 1:16 PM
To: Don Bloodworth <DBloodworth@kleinfelder.com>; Thiele, Tim <TTHIELE@mbakerintl.com>; Mohsen Maali <mmaali@delmar.ca.us>; Nganha Vu <NVu@kleinfelder.com>; Jim Frost <JFrost@kleinfelder.com>
Subject: EXTERNAL: ACTION: BHLO 5356(008) - Camino Del Mar (57C-0209), Caltrans DES Tsunami Hazard information

Hi, Mohsen and City Team

Based on the City's consultant recent request for Tsunami Hazard information from Caltrans for the above subject bridge (attached), the Division of Engineering Services (DES)- Structures Local Assistance (SLA) requested Tsunami Hazard information from DES- Office of Earthquake Engineering (OEE).

The following project-specific Tsunami Hazard information for the City's bridge replacement project was provided by DES-OEE:

Br #57C0209 32.9754, -117.2690
Max wave elevation (ft): 6.3 ft MHW
8.2 ft MSL
10.7 ft NAVD88
Max flow velocity: 3 m/s.
Sea Level Rise: 3.7 feet for year 2100

SLA notes and recommendations:

1. Please note that the Sea Level Rise (SLR) value provided (above) by Caltrans DES is applicable to Tsunami Hazard. The design SLR value proposed for flood waterway conveyance and/or project permitting may differ but should be documented clearly in proposed project-specific design criteria. Proposed project-specific bridge design criteria is subject to both HBP eligibility and SLA technical concurrence reviews.

2. Based on SLA's prior coordination with DES-OEE several months ago, DES-OEE has prioritized their preparation of a draft Structure Technical Policy (STP) related to Tsunami Hazard, however, a companion draft Structure Technical Guidelines (STG) has not been developed yet. Below is a short excerpt of the current draft Tsunami STP under development, where further Caltrans revisions might occur until finally adopted/approved, as there are some differences with the current MTD 20-13. The City/consultant may utilize the draft STP excerpt at their

own risk, and as such, please do not share OEE's draft STP 20.13 excerpt with others not involved on the City's project.

3. SLA recommends that the City's consultant should initially evaluate whether the proposed Design Tsunami wave would impact or be below the proposed bridge superstructure(s) under draft type selection consideration, and notify Caltrans District 11 Local Assistance of the results for follow-up technical discussions with SLA, if warranted.

Also, please consider the following:

DRAFT STP 20.13 excerpt follows

20.13 TSUNAMI LOADS FOR BRIDGES (DRAFT)

20.13.1 GENERAL

Caltrans requires that the design of all new bridges within five miles of the coast (and in bays) must include an evaluation for tsunami loads. Caltrans evaluates bridges for the tsunami hazard consistent with a 5% probability of being exceeded in 50 years.

A tsunami can damage a bridge if the waves are high enough to strike the deck. However, the design tsunami at most locations along California's coast should be below the superstructure. Therefore, wherever possible, new bridges should be designed so the tsunami flows below the soffit (or bottom girder flange). If this is not possible the bridge should be designed for ground shaking hazards and checked to ensure that the bridge can resist the tsunami loads as described in Section 20.13.4.

The critical demand parameters (described below and in Figure 20.13.1.1) can be obtained from Caltrans Office of Structure Hydraulics and Hydrology (or from the liaison engineer for consultant-designed projects)

Tsunami flow velocity, μ.

Tsunami Flow Depth, η **= wave elevation – ground elevation (in feet). Sea Level**

Rise, δ.

Scour Depth, y_s.

The policies presented here are based on Caltrans-funded research (Azadbakht, 2015), on the work by the Pooled Fund Tsunami Project (AASHTO, 2020), on wave flume experiments (Hoshikuma, 2013) and (Istrati, 2016), and from Computational Fluid Dynamic Analyses (Amini, 2019). The results of these studies are the simplified tsunami loading equations discussed in Section 20.13.4 of this document.

It is preferable for new bridges along the coast to be monolithically-constructed with continuous superstructures. Existing bridges along the coast often have superstructures supported on drop bent caps and bearings. For these bridges, the tsunami loads must be resisted by shear keys, cross-bracing, restrainers, and/or special bearings. When the space between the girders can trap air that increases superstructure buoyancy, the analysis should determine if the girders can be picked up and removed by the tsunami. Vents can be designed in the bridge deck to allow air to escape and reduce superstructure buoyancy during the tsunami (AASHTO, 2020). Once the superstructure and its connections on existing bridges are determined to be adequate, the load will be carried to the substructure, which must meet the performance standards for new and existing bridges as described in Section 20.13.4).

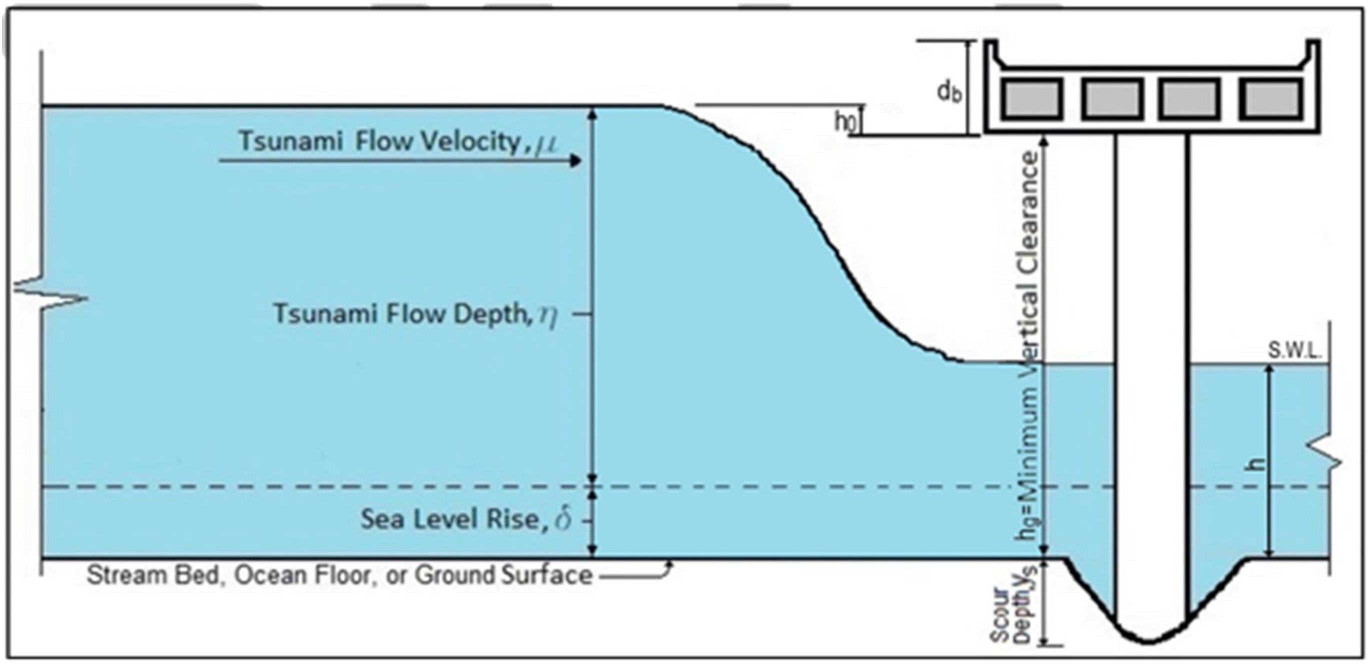
Scour of bridge foundations must be considered for the Design Tsunami (see Section 20.13.5). Approach embankments may also experience substantial erosion and undermining by scour that could severely impact the function of the bridge unless protective measures are included in the embankment design.

These guidelines apply to both state and local-agency owned new and existing bridges. Regional emergency response plans should consider the expected performance of bridges under tsunami loading. This document along with the **Structural Technical Guidelines 20.13** can be used to develop and assess mitigation alternatives.

20.13.2 DEFINITIONS

Design Tsunami: Design tsunami hazards with 5% probability of occurring in 50 years. **Tsunami:** A series of waves usually created by a vertical fault offset on the ocean floor. **Tsunami Flow Depth,** η = (wave elevation – ground elevation at the bridge site).

Tsunami Flow Velocity, μ = tsunami flow velocity at the bridge site.



Thank you,

Anh-Vu Pham
California Department of Transportation
Local Programs Engineer
D11 – Planning & Local Assistance (MS 244)
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Caltrans Mission: *Provide a safe, sustainable, integrated, and efficient transportation system to enhance California's economy and livability.*
Caltrans Vision: *A performance-driven, transparent, and accountable organization that values its people, resources and partners, and meets new challenges through leadership, innovation, and teamwork.*

APPENDIX A

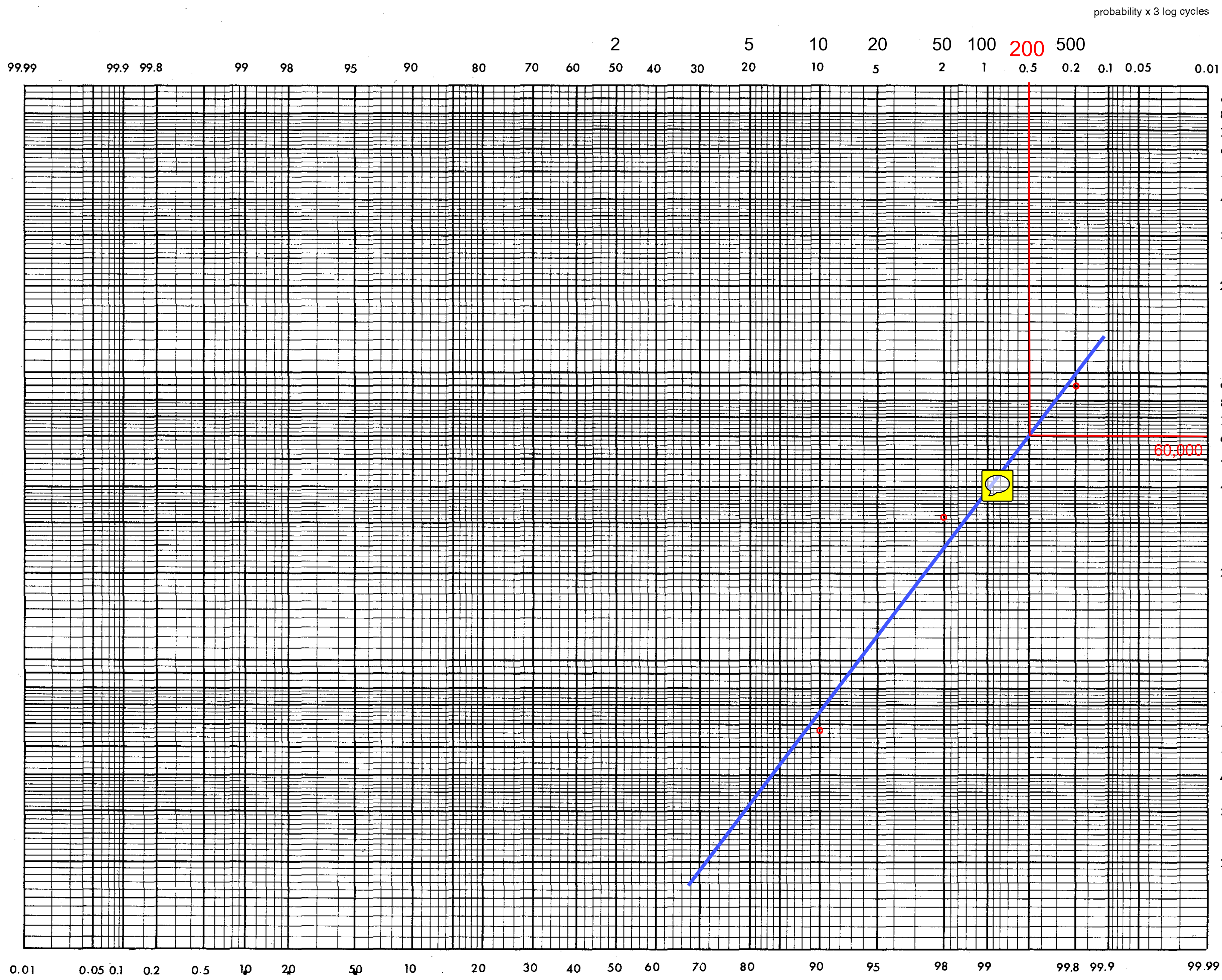
PROPOSED CONDITION
HYDRAULIC DATA
AND
HEC-RAS ANALYSES

TABLE 12: FLOODING SOURCE DATUM SHIFT VALUES

Stream Name	Elevation (feet NAVD above NGVD)
Moosa Creek (North Branch)	+2.3
Moosa Creek (South Branch)	+2.3
Murphy Canyon Creek	+2.1
Murray Canyon Creek	+2.1
Nestor Creek	+2.1
North Avenue Tributary	+2.3
North Branch Poway Creek	+2.1
North Tributary to Santa Maria Creek	+2.2
Olive Creek	+2.4
Otay River	+2.2
Pala Mesa Creek	+2.2
Paradise Creek	+2.1
Paradise Creek – Valley Road Branch	+2.1
Pilgrim Creek	+2.3
Poggi Canyon Creek	+2.2
Pomerado Creek	+2.1
Poway Creek	+2.1
Rainbow Creek (Main Branch)	+2.3
Rainbow Creek (West Branch)	+2.3
Rattlesnake Creek	+2.1
Rattlesnake Creek Split Flow at Heritage Hills	+2.1
Rattlesnake Creek Split Flow at Midland Road	+2.1
Reidy Creek	+2.3
Reidy Creek Split Flow	+2.3
Rice Canyon Creek	+2.1
Rincon Avenue Tributary	+2.3
Rose Canyon Creek	+2.1
Samagutuma Creek	+2.4
San Clemente Canyon Creek	+2.1
San Diego Bay	+2.2
San Diego River	+2.1
San Dieguito River	+2.1
San Elijo Creek	+2.2
San Luis Rey River	+2.3
San Marcos Creek	+2.3
San Marcos Creek (Below Lake San Marcos)	+2.3
San Marcos Creek Highway 78 Split Flow	+2.3

Table 10: Summary of Discharges, continued

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
San Diego River	Just Downstream of Confluence of San Vicente Creek	290.0	2,500	*	*	31,000	*
San Dieguito River	Upstream of Camino Del Mar Bridge	*	5,700	*	31,400	41,800	90,000
San Dieguito River	Upstream of Atchison, Topeka & Santa Fe Railway Bridge	*	5,700	*	31,400	41,800	90,000
San Dieguito River	Upstream of Jimmy Durante Bridge	*	5,800	*	32,100	42,400	90,000
San Dieguito River	Upstream of U.S. Interstate Highway 5 Bridge	*	5,900	*	32,500	42,800	90,000
San Elijo Creek	0.1 Mile Upstream of El Camino Road	5.4	500	*	1,600	2,100	5,500
San Luis Rey River	At Mouth	560.0	6,600	*	31,000	51,000	120,000
San Luis Rey River	Downstream of Confluence with Moosa Canyon	355.6	6,200	*	30,000	48,000	110,000
San Luis Rey River	Downstream of Confluence with Keys Canyon	252.3	5,000	*	25,000	41,000	98,000
San Luis Rey River	Upstream of Confluence with Keys Canyon	180.4	4,000[5]	*	20,000	33,000	85,000


probability x 3 log cycles
2 5 10 20 50 100 200 500
99.99 99.9 99.8 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.2 0.1 0.05 0.01
60,000
0.01 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.8 99.9 99.99

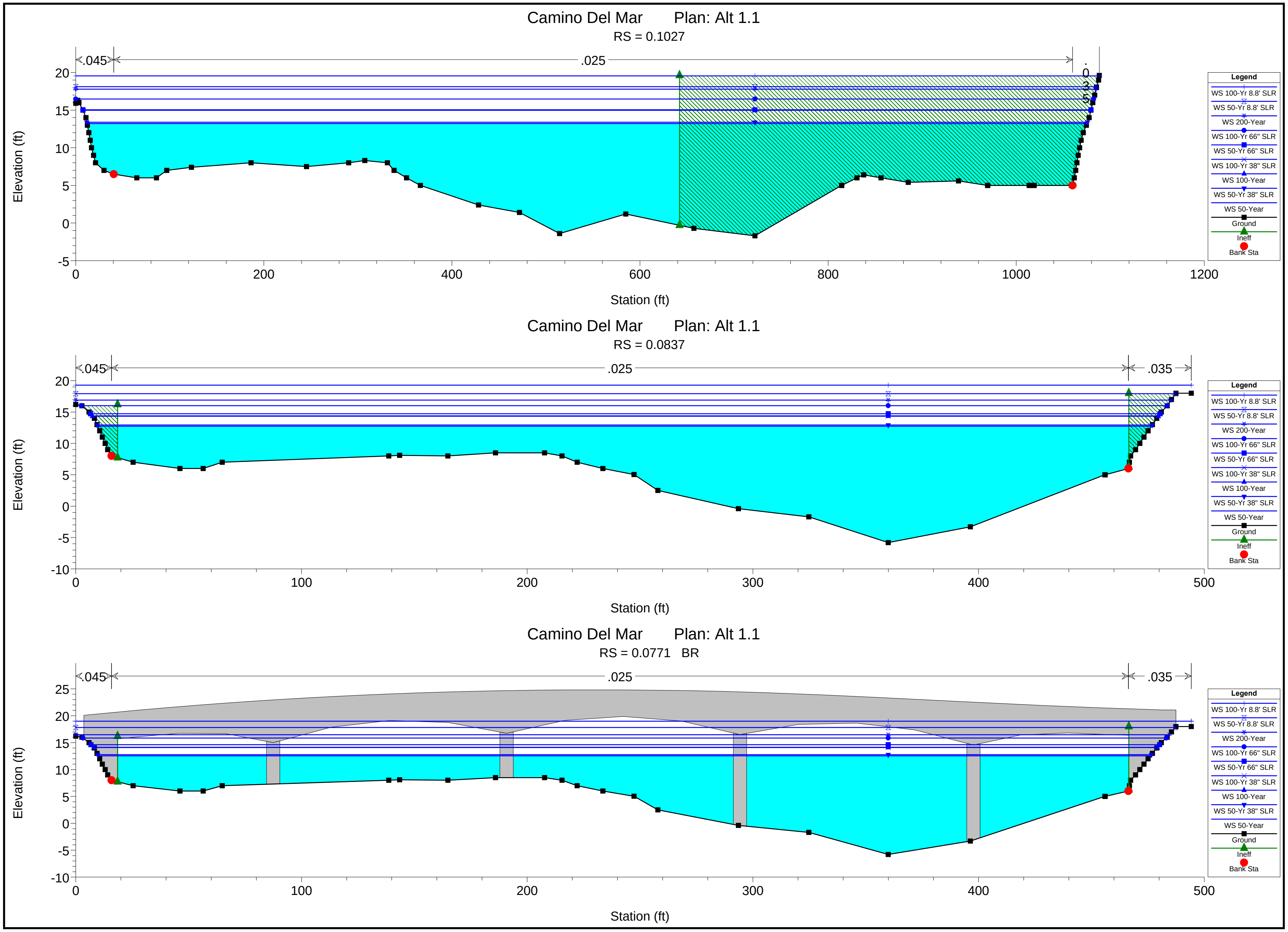
Alternative 1.1 Bridge Results

HEC-RAS Plan: Alt 1.1 River: RIVER-1 Reach: Reach-1

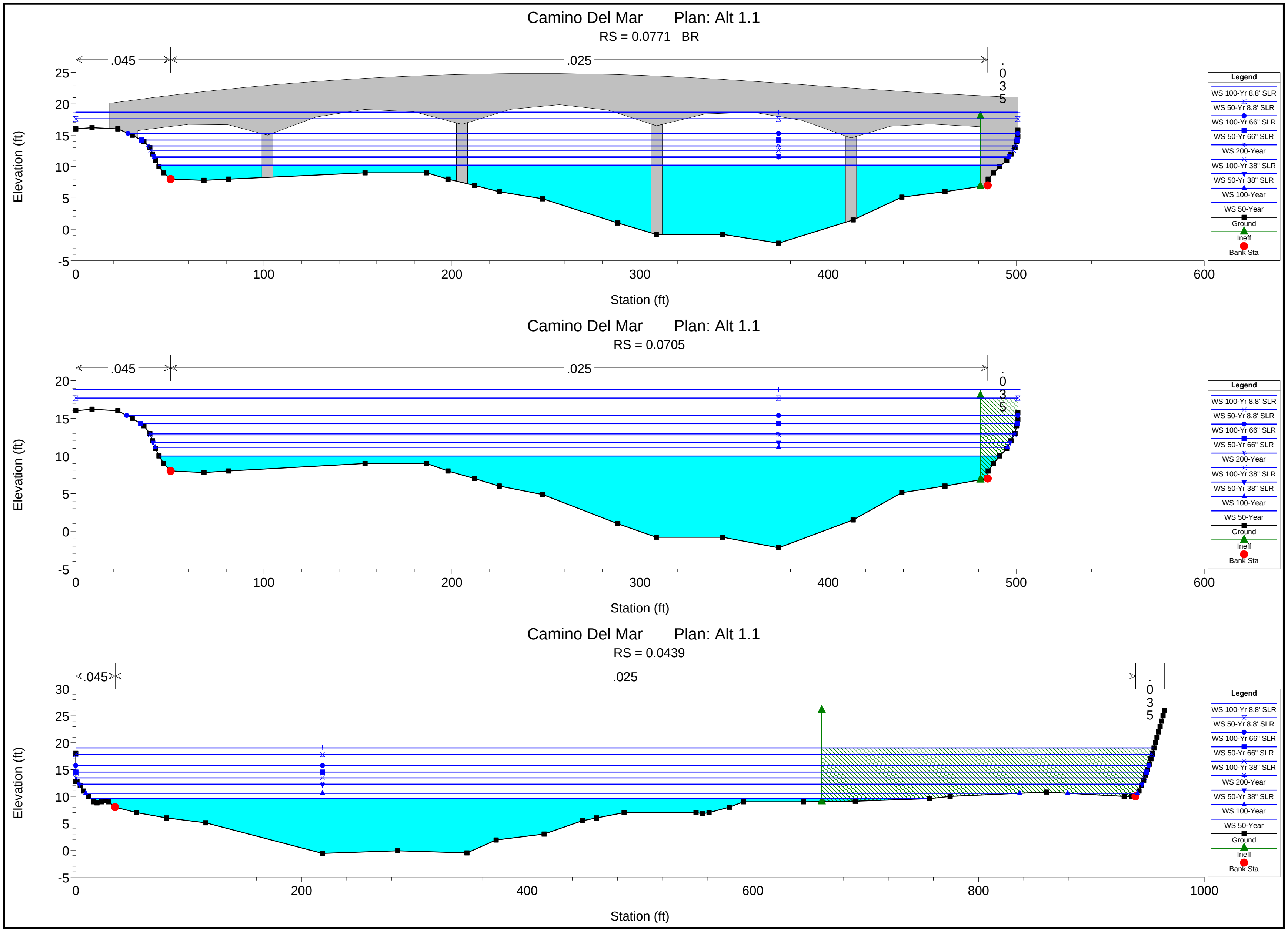
Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
Reach-1	0.1027	50-Year	13.75	13.21		0.06	0.07	1063.22	322.13	31077.87		5.94
Reach-1	0.1027	100-Year	15.64	14.97		0.06	0.10	1071.63	483.23	41316.77		6.57
Reach-1	0.1027	50-Yr 38" SLR	13.91	13.39		0.06	0.07	1064.02	327.53	31072.47		5.82
Reach-1	0.1027	100-Yr 38" SLR	15.67	15.01		0.06	0.09	1071.84	484.08	41315.92		6.54
Reach-1	0.1027	50-Yr 66" SLR	15.41	15.04		0.03	0.05	1072.04	363.99	31036.01		4.90
Reach-1	0.1027	100-Yr 66" SLR	16.99	16.48		0.04	0.07	1082.39	500.33	41299.67		5.74
Reach-1	0.1027	50-Yr 8.8' SLR	18.33	18.11		0.01	0.03	1085.58	435.61	30964.39		3.79
Reach-1	0.1027	100-Yr 8.8' SLR	19.87	19.55		0.02	0.04	1088.32	634.42	41165.58		4.55
Reach-1	0.1027	200-Year	18.62	17.77		0.06	0.13	1084.89	811.25	59188.76		7.42
Reach-1	0.0837	50-Year	13.62	12.74	8.79	0.01	0.03	466.78		31398.37	1.63	7.55
Reach-1	0.0837	100-Year	15.48	14.34	9.92	0.01	0.04	472.20		41797.61	2.39	8.57
Reach-1	0.0837	50-Yr 38" SLR	13.79	12.94	8.79	0.01	0.03	467.40		31398.34	1.66	7.39
Reach-1	0.0837	100-Yr 38" SLR	15.52	14.38	9.92	0.01	0.04	472.40		41797.60	2.40	8.53
Reach-1	0.0837	50-Yr 66" SLR	15.33	14.74	8.79	0.01	0.02	473.94		31398.17	1.83	6.21
Reach-1	0.0837	100-Yr 66" SLR	16.88	16.02	9.92	0.01	0.03	481.14		41797.43	2.57	7.42
Reach-1	0.0837	50-Yr 8.8' SLR	18.29	17.93	8.79	0.00	0.02	487.33	81.35	31316.61	2.04	4.81
Reach-1	0.0837	100-Yr 8.8' SLR	19.81	19.29	9.92	0.00	0.05	494.24	135.10	41405.93	258.97	5.81
Reach-1	0.0837	200-Year	18.43	16.91	11.68	0.01	0.07	485.30	121.15	59875.07	3.78	9.89
Reach-1	0.0771 BR U	50-Year	13.58	12.55	9.01	0.16	0.36	424.41		31399.77	0.23	8.15
Reach-1	0.0771 BR U	100-Year	15.43	14.09	10.17	0.17	0.42	424.41		41799.70	0.30	9.27
Reach-1	0.0771 BR U	50-Yr 38" SLR	13.75	12.76	9.01	0.12	0.16	424.41		31399.77	0.23	7.96
Reach-1	0.0771 BR U	100-Yr 38" SLR	15.47	14.14	10.17	0.14	0.23	424.41		41799.70	0.30	9.23
Reach-1	0.0771 BR U	50-Yr 66" SLR	15.31	14.63	9.01	0.06	0.06	424.41		31397.78	2.22	6.63
Reach-1	0.0771 BR U	100-Yr 66" SLR	16.84	15.86	10.17	0.08	0.08	388.12		41796.70	3.30	7.97
Reach-1	0.0771 BR U	50-Yr 8.8' SLR	18.27	17.81	9.01	0.04	0.02	196.50	4.50	31395.25	0.25	5.42
Reach-1	0.0771 BR U	100-Yr 8.8' SLR	19.76	18.99	10.17	0.09	0.04	74.83	12.36	41779.31	8.33	7.02
Reach-1	0.0771 BR U	200-Year	18.34	16.47	12.01	0.21	0.50	339.81	1.04	59998.51	0.45	10.98
Reach-1	0.0771 BR D	50-Year	13.06	10.22	10.22	0.06	0.04	413.54	23.51	31376.49		13.52
Reach-1	0.0771 BR D	100-Year	14.85	11.43	11.43	0.05	0.05	415.69	66.54	41733.46		14.84
Reach-1	0.0771 BR D	50-Yr 38" SLR	13.47	11.66	10.22	0.02	0.10	416.09	55.53	31344.47		10.78
Reach-1	0.0771 BR D	100-Yr 38" SLR	15.09	12.61	11.43	0.03	0.15	417.47	104.49	41695.51		12.67
Reach-1	0.0771 BR D	50-Yr 66" SLR	15.20	14.23	10.22	0.01	0.05	422.55	110.69	31289.31		7.92
Reach-1	0.0771 BR D	100-Yr 66" SLR	16.68	15.29	11.43	0.01	0.07	414.75	192.89	41607.11		9.50
Reach-1	0.0771 BR D	50-Yr 8.8' SLR	18.20	17.62	10.22	0.00	0.04	225.56	152.90	31247.10		6.11
Reach-1	0.0771 BR D	100-Yr 8.8' SLR	19.63	18.68	11.43	0.01	0.12	114.10	263.82	41536.18		7.86
Reach-1	0.0771 BR D	200-Year	17.64	13.29	13.29	0.05	0.06	418.92	178.52	59821.48		16.75

HEC-RAS Plan: Alt 1.1 River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
Reach-1	0.0705	50-Year	12.72	9.99	9.99	0.45	0.57	447.01	16.47	31383.53		13.27
Reach-1	0.0705	100-Year	14.45	11.14	11.14	0.44	0.66	453.13	49.59	41750.40		14.58
Reach-1	0.0705	50-Yr 38" SLR	13.34	11.80	9.99	0.14	0.38	455.69	49.86	31350.14		9.97
Reach-1	0.0705	100-Yr 38" SLR	14.91	12.81	11.14	0.16	0.53	459.34	93.36	41706.64		11.65
Reach-1	0.0705	50-Yr 66" SLR	15.14	14.29	9.99	0.06	0.20	466.03	92.15	31307.85		7.43
Reach-1	0.0705	100-Yr 66" SLR	16.60	15.38	11.14	0.07	0.29	473.81	146.17	41653.83		8.89
Reach-1	0.0705	50-Yr 8.8' SLR	18.15	17.68	9.99	0.02	0.11	500.91	201.47	31198.53		5.49
Reach-1	0.0705	100-Yr 8.8' SLR	19.51	18.84	11.14	0.03	0.15	500.91	369.44	41088.59	341.97	6.60
Reach-1	0.0705	200-Year	17.14	12.95	12.95	0.41	0.83	459.84	139.35	59860.64		16.45
Reach-1	0.0439	50-Year	10.90	9.58		0.37	0.06	740.82	18.77	31381.23		9.20
Reach-1	0.0439	100-Year	12.24	10.58		0.34	0.02	889.63	82.10	41717.90		10.33
Reach-1	0.0439	50-Yr 38" SLR	12.82	12.23		0.08	0.02	941.73	141.59	31258.41		6.17
Reach-1	0.0439	100-Yr 38" SLR	14.23	13.44		0.09	0.02	946.98	265.32	41534.68		7.12
Reach-1	0.0439	50-Yr 66" SLR	14.88	14.53		0.03	0.01	948.84	250.15	31149.85		4.78
Reach-1	0.0439	100-Yr 66" SLR	16.24	15.74		0.04	0.02	950.84	395.62	41404.38		5.70
Reach-1	0.0439	50-Yr 8.8' SLR	18.02	17.82		0.01	0.01	953.85	358.34	31041.66		3.62
Reach-1	0.0439	100-Yr 8.8' SLR	19.33	19.03		0.02	0.01	955.50	512.86	41287.14		4.43
Reach-1	0.0439	200-Year	14.40	12.29		0.29	0.02	942.05	275.63	59724.37		11.70



Camino Del Mar Plan: Alt 1.1
RS = 0.1027
.045
.025
Elevation (ft)
Station (ft)
Legend
WS 100-Yr 8.8' SLR
WS 50-Yr 8.8' SLR
WS 200-Year
WS 100-Yr 66" SLR
WS 50-Yr 66" SLR
WS 100-Yr 38" SLR
WS 100-Year
WS 50-Yr 38" SLR
WS 50-Year
Ground
Ineff
Bank Sta
Camino Del Mar Plan: Alt 1.1
RS = 0.0837
.045
.025
.035
Elevation (ft)
Station (ft)
Camino Del Mar Plan: Alt 1.1
RS = 0.0771 BR
.045
.025
.035
Elevation (ft)
Station (ft)


Camino Del Mar Plan: Alt 1.1
RS = 0.0771 BR
.045
.025
.035
Elevation (ft)
Station (ft)
Legend
WS 100-Yr 8.8' SLR
WS 50-Yr 8.8' SLR
WS 100-Yr 66" SLR
WS 50-Yr 66" SLR
WS 200-Year
WS 100-Yr 38" SLR
WS 50-Yr 38" SLR
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta
Camino Del Mar Plan: Alt 1.1
RS = 0.0705
.045
.025
.035
Elevation (ft)
Station (ft)
Camino Del Mar Plan: Alt 1.1
RS = 0.0439
.045
.025
.035
Elevation (ft)
Station (ft)

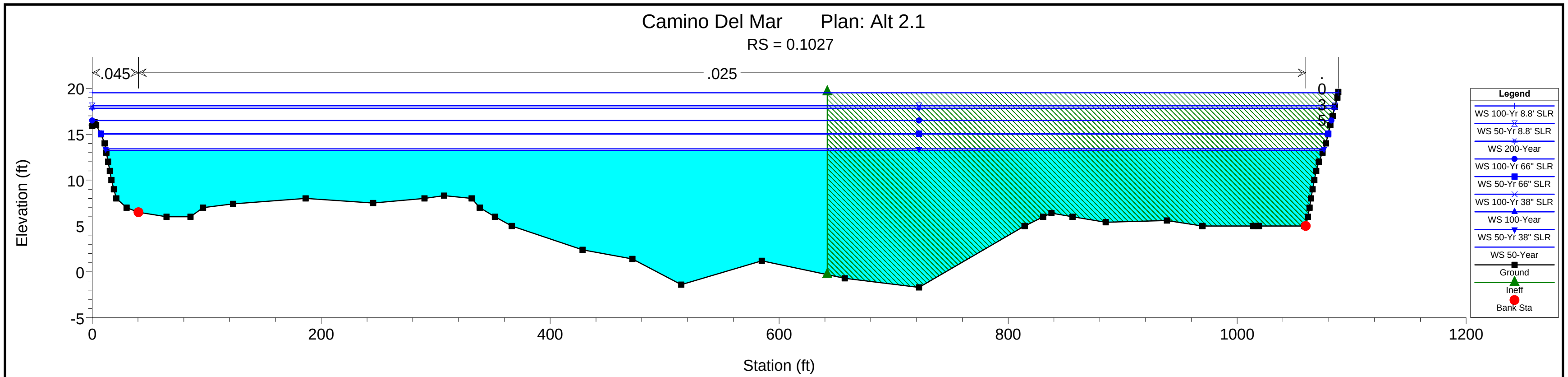
Alternative 2.1 Bridge Results

HEC-RAS Plan: Alt 2.1 River: RIVER-1 Reach: Reach-1

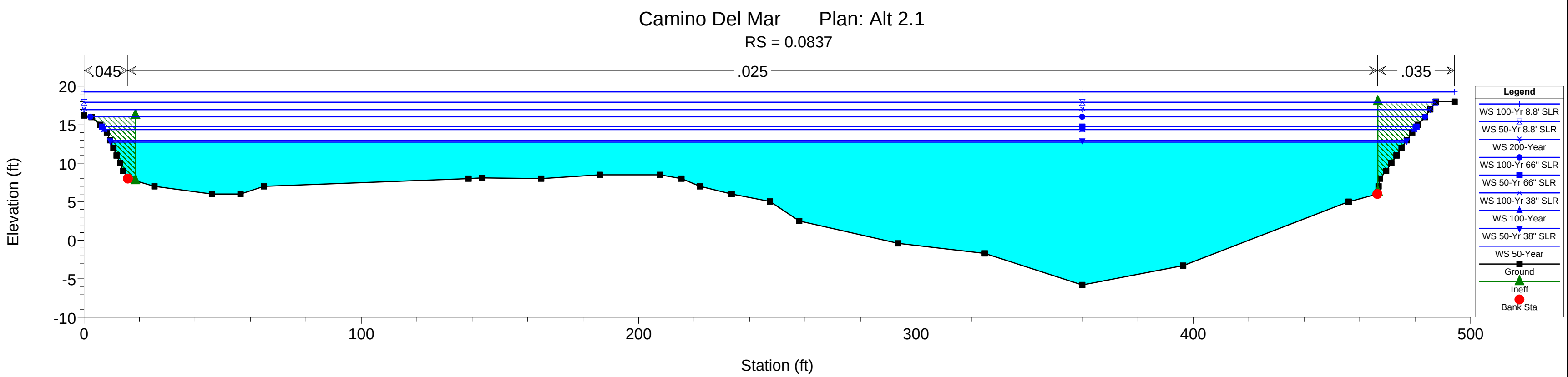
Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
Reach-1	0.1027	50-Year	13.77	13.23		0.06	0.07	1063.30	322.63	31077.37		5.93
Reach-1	0.1027	100-Year	15.67	15.01		0.06	0.09	1071.81	483.99	41316.00		6.55
Reach-1	0.1027	50-Yr 38" SLR	13.92	13.40		0.06	0.06	1064.08	327.97	31072.03		5.81
Reach-1	0.1027	100-Yr 38" SLR	15.69	15.04		0.06	0.09	1072.00	484.47	41315.53		6.53
Reach-1	0.1027	50-Yr 66" SLR	15.42	15.05		0.03	0.05	1072.09	364.10	31035.90		4.90
Reach-1	0.1027	100-Yr 66" SLR	17.00	16.49		0.04	0.07	1082.41	500.90	41299.09		5.73
Reach-1	0.1027	50-Yr 8.8' SLR	18.32	18.10		0.01	0.03	1085.55	435.18	30964.82		3.79
Reach-1	0.1027	100-Yr 8.8' SLR	19.84	19.52		0.02	0.04	1088.28	633.38	41166.62		4.56
Reach-1	0.1027	200-Year	18.66	17.82		0.06	0.13	1084.98	814.20	59185.79		7.40
Reach-1	0.0837	50-Year	13.64	12.75	8.79	0.01	0.03	466.84		31398.36	1.64	7.53
Reach-1	0.0837	100-Year	15.51	14.38	9.92	0.01	0.04	472.37		41797.60	2.40	8.54
Reach-1	0.0837	50-Yr 38" SLR	13.80	12.96	8.79	0.01	0.03	467.46		31398.34	1.66	7.37
Reach-1	0.0837	100-Yr 38" SLR	15.54	14.41	9.92	0.01	0.04	472.53		41797.60	2.40	8.51
Reach-1	0.0837	50-Yr 66" SLR	15.34	14.75	8.79	0.01	0.02	473.98		31398.17	1.83	6.21
Reach-1	0.0837	100-Yr 66" SLR	16.89	16.03	9.92	0.01	0.03	481.32		41797.43	2.57	7.42
Reach-1	0.0837	50-Yr 8.8' SLR	18.28	17.92	8.79	0.00	0.02	487.31	81.12	31316.84	2.04	4.81
Reach-1	0.0837	100-Yr 8.8' SLR	19.78	19.26	9.92	0.00	0.04	494.24	134.52	41408.11	257.38	5.82
Reach-1	0.0837	200-Year	18.47	16.96	11.68	0.01	0.07	485.40	123.07	59873.14	3.79	9.85
Reach-1	0.0771 BR U	50-Year	13.59	12.55	9.02	0.17	0.36	421.01		31399.76	0.24	8.19
Reach-1	0.0771 BR U	100-Year	15.46	14.11	10.19	0.18	0.42	421.01		41799.69	0.31	9.31
Reach-1	0.0771 BR U	50-Yr 38" SLR	13.76	12.76	9.02	0.12	0.16	421.01		31399.76	0.24	8.00
Reach-1	0.0771 BR U	100-Yr 38" SLR	15.49	14.15	10.19	0.15	0.23	421.01		41799.69	0.31	9.28
Reach-1	0.0771 BR U	50-Yr 66" SLR	15.32	14.63	9.02	0.06	0.06	421.01		31399.77	0.23	6.67
Reach-1	0.0771 BR U	100-Yr 66" SLR	16.85	15.86	10.19	0.08	0.08	411.18		41796.71	3.29	8.00
Reach-1	0.0771 BR U	50-Yr 8.8' SLR	18.26	17.81	9.02	0.04	0.02	253.59	4.28	31395.47	0.24	5.36
Reach-1	0.0771 BR U	100-Yr 8.8' SLR	19.73	18.99	10.19	0.08	0.04	111.35	11.90	41780.04	8.05	6.89
Reach-1	0.0771 BR U	200-Year	18.38	16.52	12.02	0.21	0.50	351.32	1.24	59993.50	5.26	10.95
Reach-1	0.0771 BR D	50-Year	13.06	10.21	10.21	0.06	0.05	410.13	23.53	31376.47		13.55
Reach-1	0.0771 BR D	100-Year	14.86	11.42	11.42	0.05	0.06	412.28	66.96	41733.04		14.89
Reach-1	0.0771 BR D	50-Yr 38" SLR	13.47	11.66	10.21	0.02	0.11	412.67	55.99	31344.01		10.82
Reach-1	0.0771 BR D	100-Yr 38" SLR	15.10	12.59	11.42	0.03	0.16	414.05	105.59	41694.41		12.73
Reach-1	0.0771 BR D	50-Yr 66" SLR	15.20	14.22	10.21	0.01	0.05	419.12	112.90	31287.10		7.96
Reach-1	0.0771 BR D	100-Yr 66" SLR	16.69	15.28	11.42	0.01	0.07	421.01	196.88	41603.12		9.54
Reach-1	0.0771 BR D	50-Yr 8.8' SLR	18.19	17.63	10.21	0.00	0.04	286.92	144.05	31255.96		6.04
Reach-1	0.0771 BR D	100-Yr 8.8' SLR	19.62	18.70	11.42	0.01	0.10	134.60	256.03	41543.97		7.70
Reach-1	0.0771 BR D	200-Year	17.67	13.30	13.30	0.05	0.07	415.54	181.78	59818.22		16.81

HEC-RAS Plan: Alt 2.1   River: RIVER-1   Reach: Reach-1 (Continued)

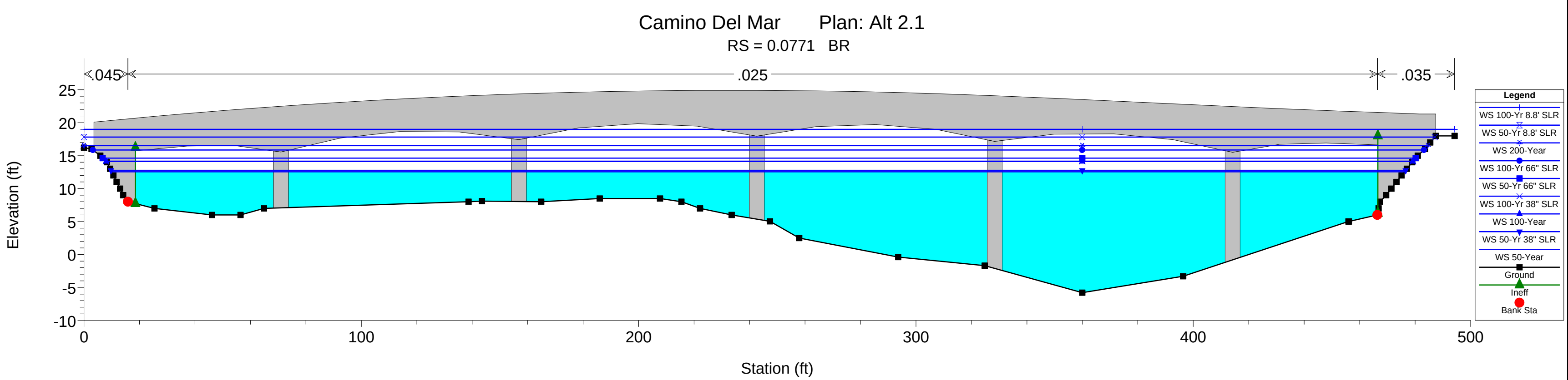
Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
Reach-1	0.0705	50-Year	12.72	9.99	9.99	0.45	0.57	447.01	16.47	31383.53		13.27
Reach-1	0.0705	100-Year	14.45	11.14	11.14	0.44	0.66	453.13	49.59	41750.40		14.58
Reach-1	0.0705	50-Yr 38" SLR	13.34	11.80	9.99	0.14	0.38	455.69	49.86	31350.14		9.97
Reach-1	0.0705	100-Yr 38" SLR	14.91	12.81	11.14	0.16	0.53	459.34	93.36	41706.64		11.65
Reach-1	0.0705	50-Yr 66" SLR	15.14	14.29	9.99	0.06	0.20	466.03	92.15	31307.85		7.43
Reach-1	0.0705	100-Yr 66" SLR	16.60	15.38	11.14	0.07	0.29	473.81	146.17	41653.83		8.89
Reach-1	0.0705	50-Yr 8.8' SLR	18.15	17.68	9.99	0.02	0.11	500.91	201.47	31198.53		5.49
Reach-1	0.0705	100-Yr 8.8' SLR	19.51	18.84	11.14	0.03	0.15	500.91	369.44	41088.59	341.97	6.60
Reach-1	0.0705	200-Year	17.14	12.95	12.95	0.41	0.83	459.84	139.35	59860.64		16.45
Reach-1	0.0439	50-Year	10.90	9.58		0.37	0.06	740.82	18.77	31381.23		9.20
Reach-1	0.0439	100-Year	12.24	10.58		0.34	0.02	889.63	82.10	41717.90		10.33
Reach-1	0.0439	50-Yr 38" SLR	12.82	12.23		0.08	0.02	941.73	141.59	31258.41		6.17
Reach-1	0.0439	100-Yr 38" SLR	14.23	13.44		0.09	0.02	946.98	265.32	41534.68		7.12
Reach-1	0.0439	50-Yr 66" SLR	14.88	14.53		0.03	0.01	948.84	250.15	31149.85		4.78
Reach-1	0.0439	100-Yr 66" SLR	16.24	15.74		0.04	0.02	950.84	395.62	41404.38		5.70
Reach-1	0.0439	50-Yr 8.8' SLR	18.02	17.82		0.01	0.01	953.85	358.34	31041.66		3.62
Reach-1	0.0439	100-Yr 8.8' SLR	19.33	19.03		0.02	0.01	955.50	512.86	41287.14		4.43
Reach-1	0.0439	200-Year	14.40	12.29		0.29	0.02	942.05	275.63	59724.37		11.70



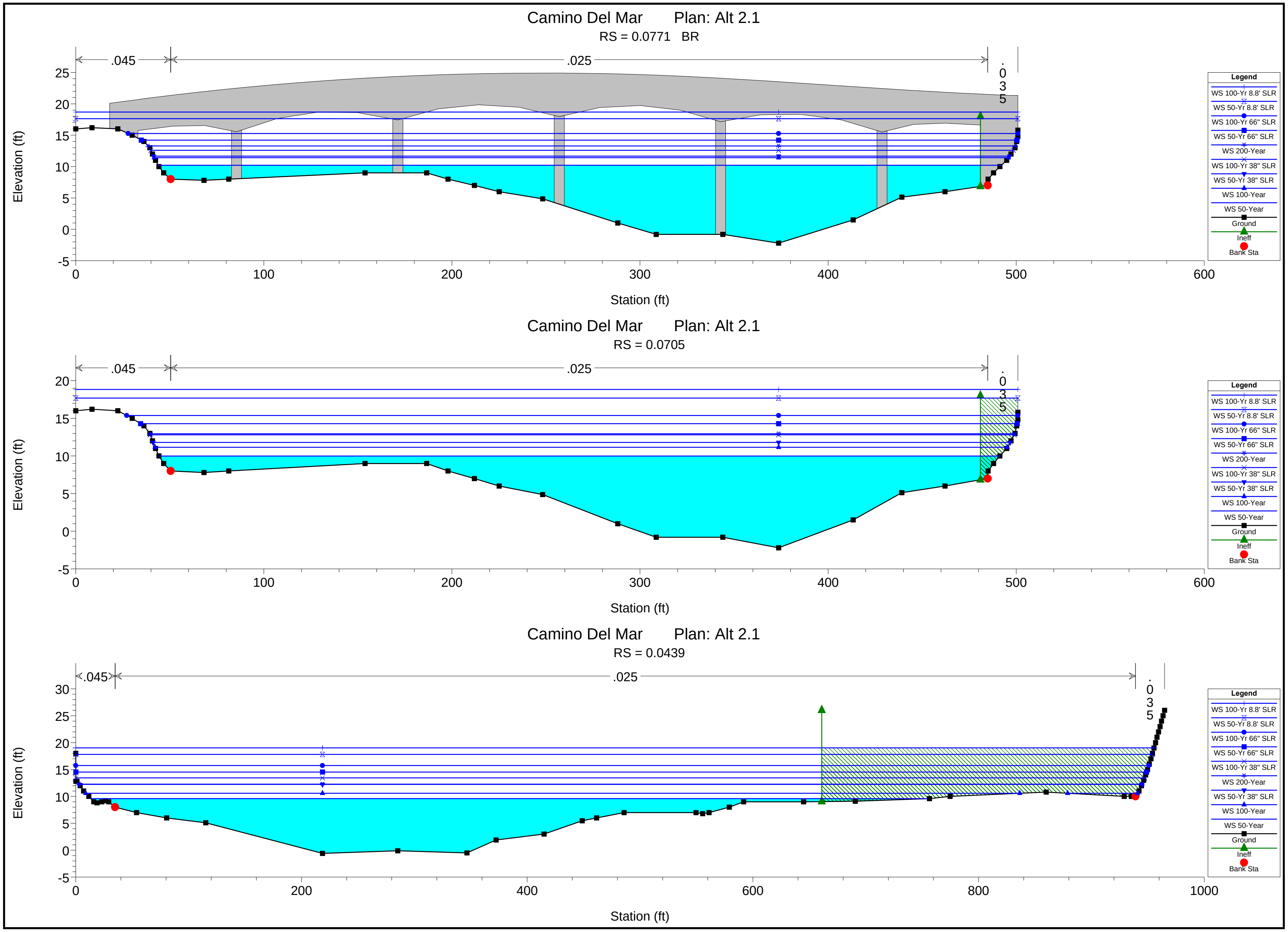
Camino Del Mar Plan: Alt 2.1
RS = 0.1027
.045
.025
Elevation (ft)
Station (ft)
Legend
WS 100-Yr 8.8' SLR
WS 50-Yr 8.8' SLR
WS 200-Year
WS 100-Yr 66" SLR
WS 50-Yr 66" SLR
WS 100-Yr 38" SLR
WS 100-Year
WS 50-Yr 38" SLR
WS 50-Year
Ground
Ineff
Bank Sta



Camino Del Mar Plan: Alt 2.1
RS = 0.0837
.045
.025
.035
Elevation (ft)
Station (ft)
Legend
WS 100-Yr 8.8' SLR
WS 50-Yr 8.8' SLR
WS 200-Year
WS 100-Yr 66" SLR
WS 50-Yr 66" SLR
WS 100-Yr 38" SLR
WS 100-Year
WS 50-Yr 38" SLR
WS 50-Year
Ground
Ineff
Bank Sta



Camino Del Mar Plan: Alt 2.1
RS = 0.0771 BR
.045
.025
.035
Elevation (ft)
Station (ft)
Legend
WS 100-Yr 8.8' SLR
WS 50-Yr 8.8' SLR
WS 200-Year
WS 100-Yr 66" SLR
WS 50-Yr 66" SLR
WS 100-Yr 38" SLR
WS 100-Year
WS 50-Yr 38" SLR
WS 50-Year
Ground
Ineff
Bank Sta



Camino Del Mar Plan: Alt 2.1
RS = 0.0771 BR
.045
.025
.035
Elevation (ft)
Station (ft)
Legend
WS 100-Yr 8.8' SLR
WS 50-Yr 8.8' SLR
WS 100-Yr 66" SLR
WS 50-Yr 66" SLR
WS 200-Year
WS 100-Yr 38" SLR
WS 50-Yr 38" SLR
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta
Camino Del Mar Plan: Alt 2.1
RS = 0.0705
.045
.025
.035
Elevation (ft)
Station (ft)
Legend
WS 100-Yr 8.8' SLR
WS 50-Yr 8.8' SLR
WS 100-Yr 66" SLR
WS 50-Yr 66" SLR
WS 200-Year
WS 100-Yr 38" SLR
WS 50-Yr 38" SLR
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta
Camino Del Mar Plan: Alt 2.1
RS = 0.0439
.045
.025
.035
Elevation (ft)
Station (ft)
Legend
WS 100-Yr 8.8' SLR
WS 50-Yr 8.8' SLR
WS 100-Yr 66" SLR
WS 50-Yr 66" SLR
WS 100-Yr 38" SLR
WS 200-Year
WS 50-Yr 38" SLR
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

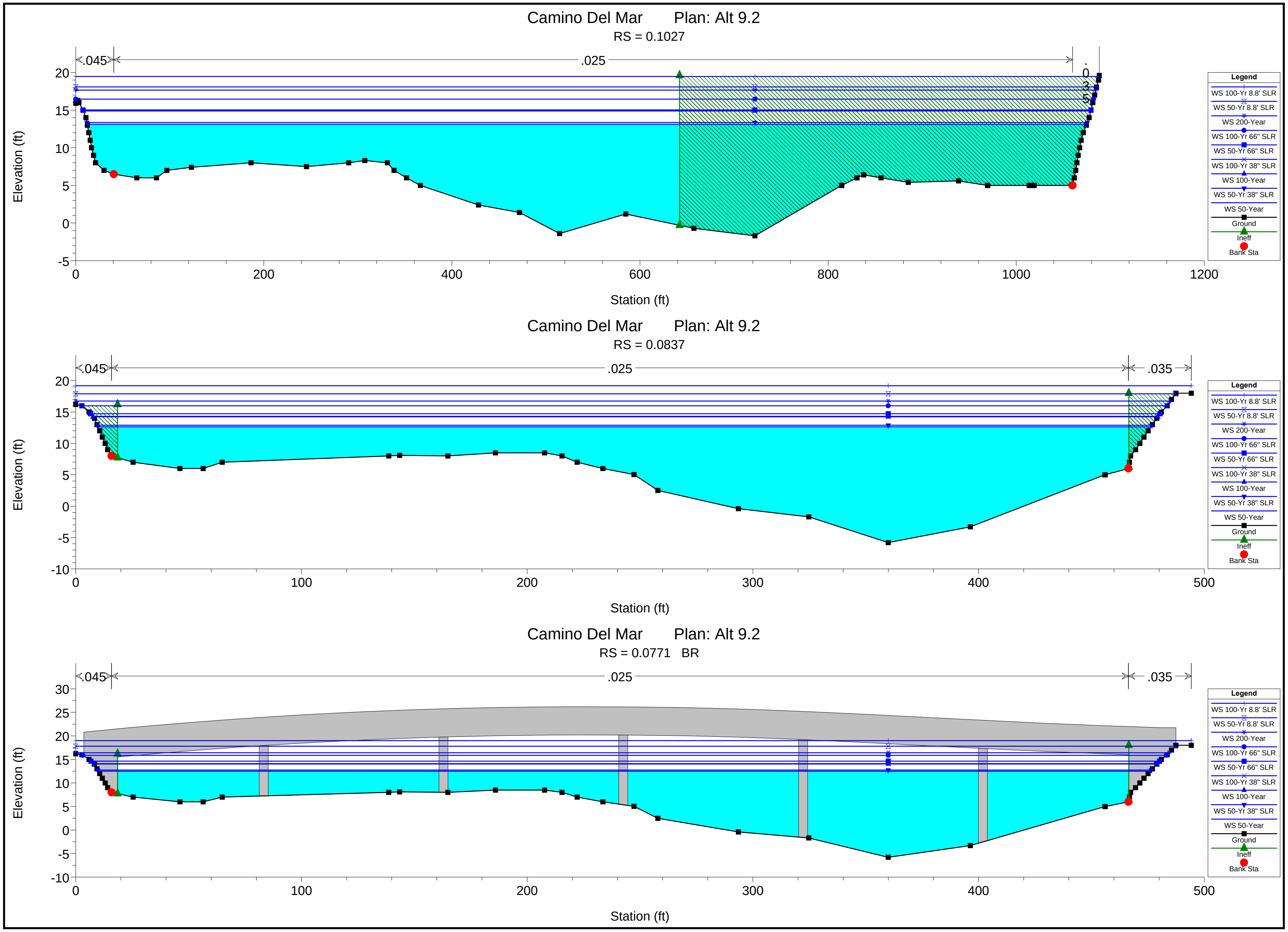
Alternative 9.2 Bridge Results

HEC-RAS Plan: Alt 9.2 River: RIVER-1 Reach: Reach-1

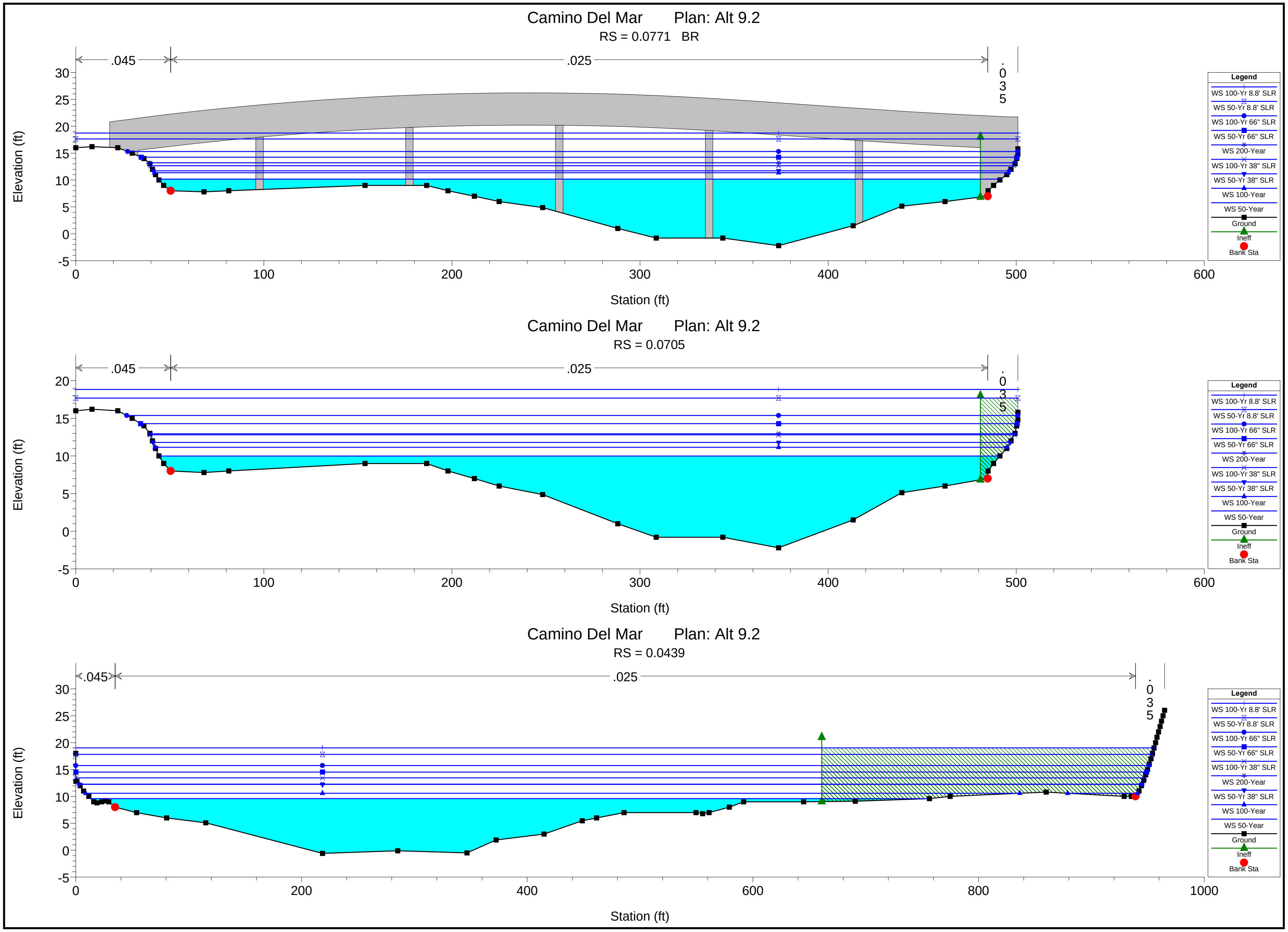
Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
Reach-1	0.1027	50-Year	13.68	13.13		0.06	0.07	1062.86	319.61	31080.38		6.00
Reach-1	0.1027	100-Year	15.56	14.89		0.06	0.10	1071.19	480.98	41319.02		6.62
Reach-1	0.1027	50-Yr 38" SLR	13.88	13.35		0.06	0.07	1063.84	326.36	31073.63		5.85
Reach-1	0.1027	100-Yr 38" SLR	15.62	14.96		0.06	0.10	1071.54	482.73	41317.27		6.58
Reach-1	0.1027	50-Yr 66" SLR	15.40	15.03		0.03	0.05	1071.95	363.83	31036.17		4.91
Reach-1	0.1027	100-Yr 66" SLR	16.96	16.45		0.04	0.07	1082.34	498.89	41301.11		5.75
Reach-1	0.1027	50-Yr 8.8' SLR	18.30	18.08		0.01	0.03	1085.50	434.52	30965.48		3.80
Reach-1	0.1027	100-Yr 8.8' SLR	19.78	19.46		0.02	0.04	1088.20	631.42	41168.58		4.58
Reach-1	0.1027	200-Year	18.51	17.65		0.06	0.14	1084.65	803.14	59196.86		7.49
Reach-1	0.0837	50-Year	13.55	12.64	8.79	0.01	0.02	466.49		31398.38	1.62	7.62
Reach-1	0.0837	100-Year	15.40	14.24	9.92	0.01	0.03	471.75		41797.62	2.38	8.65
Reach-1	0.0837	50-Yr 38" SLR	13.75	12.89	8.79	0.01	0.02	467.27		31398.35	1.65	7.42
Reach-1	0.0837	100-Yr 38" SLR	15.46	14.32	9.92	0.01	0.03	472.10		41797.61	2.39	8.59
Reach-1	0.0837	50-Yr 66" SLR	15.32	14.72	8.79	0.01	0.01	473.87		31398.17	1.83	6.22
Reach-1	0.0837	100-Yr 66" SLR	16.85	15.99	9.92	0.01	0.02	480.77		41797.43	2.57	7.44
Reach-1	0.0837	50-Yr 8.8' SLR	18.26	17.90	8.79	0.00	0.01	487.26	80.77	31317.20	2.03	4.82
Reach-1	0.0837	100-Yr 8.8' SLR	19.72	19.20	9.92	0.00	0.03	494.24	133.40	41412.21	254.38	5.85
Reach-1	0.0837	200-Year	18.31	16.76	11.68	0.01	0.06	485.01	115.90	59880.33	3.77	10.00
Reach-1	0.0771 BR U	50-Year	13.51	12.48	8.97	0.17	0.36	428.01		31399.77	0.24	8.13
Reach-1	0.0771 BR U	100-Year	15.36	14.03	10.13	0.18	0.42	428.01		41799.69	0.31	9.24
Reach-1	0.0771 BR U	50-Yr 38" SLR	13.72	12.75	8.97	0.12	0.15	428.01		31399.76	0.23	7.90
Reach-1	0.0771 BR U	100-Yr 38" SLR	15.42	14.11	10.13	0.14	0.22	428.01		41799.69	0.31	9.16
Reach-1	0.0771 BR U	50-Yr 66" SLR	15.30	14.63	8.97	0.06	0.06	428.01		31399.77	0.23	6.57
Reach-1	0.0771 BR U	100-Yr 66" SLR	16.83	15.86	10.13	0.08	0.08	419.88		41796.76	3.24	7.88
Reach-1	0.0771 BR U	50-Yr 8.8' SLR	18.24	17.81	8.97	0.04	0.02	289.62	4.09	31395.69	0.22	5.23
Reach-1	0.0771 BR U	100-Yr 8.8' SLR	19.69	19.00	10.13	0.06	0.03	209.12	10.65	41782.09	7.26	6.64
Reach-1	0.0771 BR U	200-Year	18.24	16.42	11.94	0.20	0.50	388.23	0.82	59998.75	0.42	10.85
Reach-1	0.0771 BR D	50-Year	12.99	10.17	10.17			417.05	22.42	31377.58		13.47
Reach-1	0.0771 BR D	100-Year	14.76	11.36	11.36			419.17	64.38	41735.62		14.82
Reach-1	0.0771 BR D	50-Yr 38" SLR	13.44	11.70	10.17	0.02	0.08	419.75	56.45	31343.55		10.60
Reach-1	0.0771 BR D	100-Yr 38" SLR	15.06	12.66	11.36	0.03	0.12	421.15	106.66	41693.34		12.44
Reach-1	0.0771 BR D	50-Yr 66" SLR	15.19	14.24	10.17	0.01	0.04	426.24	111.82	31288.18		7.82
Reach-1	0.0771 BR D	100-Yr 66" SLR	16.67	15.31	11.36	0.01	0.05	428.01	195.88	41604.12		9.37
Reach-1	0.0771 BR D	50-Yr 8.8' SLR	18.18	17.64	10.17	0.00	0.03	316.51	131.24	31268.76		5.89
Reach-1	0.0771 BR D	100-Yr 8.8' SLR	19.59	18.73	11.36	0.01	0.08	239.31	219.27	41580.73		7.44
Reach-1	0.0771 BR D	200-Year	17.54	13.21	13.21	0.05	0.05	422.28	176.70	59823.30		16.72

HEC-RAS Plan: Alt 9.2   River: RIVER-1   Reach: Reach-1 (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
Reach-1	0.0705	50-Year	12.72	9.99	9.99	0.45	0.57	447.01	16.47	31383.53		13.27
Reach-1	0.0705	100-Year	14.45	11.14	11.14	0.44	0.66	453.13	49.59	41750.40		14.58
Reach-1	0.0705	50-Yr 38" SLR	13.34	11.80	9.99	0.14	0.38	455.69	49.86	31350.14		9.97
Reach-1	0.0705	100-Yr 38" SLR	14.91	12.81	11.14	0.16	0.53	459.34	93.36	41706.64		11.65
Reach-1	0.0705	50-Yr 66" SLR	15.14	14.29	9.99	0.06	0.20	466.03	92.15	31307.85		7.43
Reach-1	0.0705	100-Yr 66" SLR	16.60	15.38	11.14	0.07	0.29	473.81	146.17	41653.83		8.89
Reach-1	0.0705	50-Yr 8.8' SLR	18.15	17.68	9.99	0.02	0.11	500.91	201.47	31198.53		5.49
Reach-1	0.0705	100-Yr 8.8' SLR	19.51	18.84	11.14	0.03	0.15	500.91	369.44	41088.59	341.97	6.60
Reach-1	0.0705	200-Year	17.14	12.95	12.95	0.41	0.83	459.84	139.35	59860.64		16.45
Reach-1	0.0439	50-Year	10.90	9.58	8.11	0.37	0.06	740.82	18.77	31381.23		9.20
Reach-1	0.0439	100-Year	12.24	10.58	9.32	0.34	0.02	889.63	82.10	41717.90		10.33
Reach-1	0.0439	50-Yr 38" SLR	12.82	12.23	8.11	0.08	0.02	941.73	141.59	31258.41		6.17
Reach-1	0.0439	100-Yr 38" SLR	14.23	13.44	9.32	0.09	0.02	946.98	265.32	41534.68		7.12
Reach-1	0.0439	50-Yr 66" SLR	14.88	14.53	8.11	0.03	0.01	948.84	250.15	31149.85		4.78
Reach-1	0.0439	100-Yr 66" SLR	16.24	15.74	9.32	0.04	0.02	950.84	395.62	41404.38		5.70
Reach-1	0.0439	50-Yr 8.8' SLR	18.02	17.82	8.11	0.01	0.01	953.85	358.34	31041.66		3.62
Reach-1	0.0439	100-Yr 8.8' SLR	19.33	19.03	9.32	0.02	0.01	955.50	512.86	41287.14		4.43
Reach-1	0.0439	200-Year	14.40	12.29	10.73	0.29	0.02	942.05	275.63	59724.37		11.70



Camino Del Mar Plan: Alt 9.2
RS = 0.1027
.045
.025
Elevation (ft)
Station (ft)
Legend
WS 100-Yr 8.8' SLR
WS 50-Yr 8.8' SLR
WS 200-Year
WS 100-Yr 66" SLR
WS 50-Yr 66" SLR
WS 100-Yr 38" SLR
WS 100-Year
WS 50-Yr 38" SLR
WS 50-Year
Ground
Ineff
Bank Sta
Camino Del Mar Plan: Alt 9.2
RS = 0.0837
.045
.025
.035
Elevation (ft)
Station (ft)
Camino Del Mar Plan: Alt 9.2
RS = 0.0771 BR
.045
.025
.035
Elevation (ft)
Station (ft)


Camino Del Mar Plan: Alt 9.2
RS = 0.0771 BR
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Elevation (ft)
Station (ft)
Legend
WS 100-Yr 8.8' SLR
WS 50-Yr 8.8' SLR
WS 100-Yr 66" SLR
WS 50-Yr 66" SLR
WS 200-Year
WS 100-Yr 38" SLR
WS 50-Yr 38" SLR
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta
Camino Del Mar Plan: Alt 9.2
RS = 0.0705
.045
.025
.035
Elevation (ft)
Station (ft)
Legend
WS 100-Yr 8.8' SLR
WS 50-Yr 8.8' SLR
WS 100-Yr 66" SLR
WS 50-Yr 66" SLR
WS 200-Year
WS 100-Yr 38" SLR
WS 50-Yr 38" SLR
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta
Camino Del Mar Plan: Alt 9.2
RS = 0.0439
.045
.025
.035
Elevation (ft)
Station (ft)
Legend
WS 100-Yr 8.8' SLR
WS 50-Yr 8.8' SLR
WS 100-Yr 66" SLR
WS 50-Yr 66" SLR
WS 100-Yr 38" SLR
WS 200-Year
WS 50-Yr 38" SLR
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

200-Year Results for Pier Scour

HEC-RAS River: RIVER-1 Reach: Reach-1 Profile: 200-Year

Reach	River Sta	Profile	Plan	Q Total	Froude # Chl	W.S. Elev	Top Width	Vel Chnl
				(cfs)		(ft)	(ft)	(ft/s)
Reach-1	0.1027	200-Year	Alt 1.1	60000.00	0.36	17.77	1084.89	7.42
Reach-1	0.1027	200-Year	Alt 2.1	60000.00	0.36	17.82	1084.98	7.40
Reach-1	0.1027	200-Year	Alt 9.2	60000.00	0.36	17.65	1084.65	7.49
Reach-1	0.0837	200-Year	Alt 1.1	60000.00	0.48	16.91	485.30	9.89
Reach-1	0.0837	200-Year	Alt 2.1	60000.00	0.47	16.96	485.40	9.85
Reach-1	0.0837	200-Year	Alt 9.2	60000.00	0.48	16.76	485.01	10.00
Reach-1	0.0771 BR U	200-Year	Alt 1.1	60000.00	0.41	16.47	339.81	10.98
Reach-1	0.0771 BR U	200-Year	Alt 2.1	60000.00	0.41	16.52	351.32	10.95
Reach-1	0.0771 BR U	200-Year	Alt 9.2	60000.00	0.41	16.42	388.23	10.85
Reach-1	0.0771 BR D	200-Year	Alt 1.1	60000.00	0.75	13.29	418.92	16.75
Reach-1	0.0771 BR D	200-Year	Alt 2.1	60000.00	0.75	13.30	415.54	16.81
Reach-1	0.0771 BR D	200-Year	Alt 9.2	60000.00	0.75	13.21	422.28	16.72
Reach-1	0.0705	200-Year	Alt 1.1	60000.00	1.00	12.95	459.84	16.45
Reach-1	0.0705	200-Year	Alt 2.1	60000.00	1.00	12.95	459.84	16.45
Reach-1	0.0705	200-Year	Alt 9.2	60000.00	1.00	12.95	459.84	16.45
Reach-1	0.0439	200-Year	Alt 1.1	60000.00	0.72	12.29	942.05	11.70
Reach-1	0.0439	200-Year	Alt 2.1	60000.00	0.72	12.29	942.05	11.70
Reach-1	0.0439	200-Year	Alt 9.2	60000.00	0.72	12.29	942.05	11.70

100-Year Results of Alternatives 1.1, 2.1, and 9.2 for Comparison along Entire Study Reach

HEC-RAS River: RIVER-1 Reach: Reach-1 Profile: 100-Year

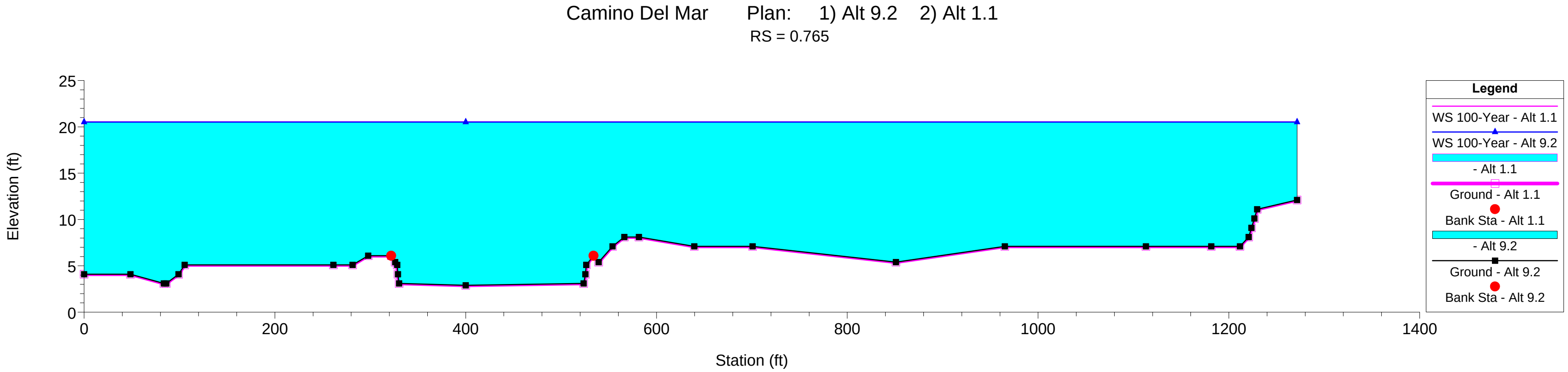
Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	0.765	100-Year	Alt 1.1	42400	2.90	20.52		20.61	0.000055	2.94	18615.01	1271.44	0.12
Reach-1	0.765	100-Year	Alt 2.1	42400	2.90	20.53		20.61	0.000055	2.94	18621.20	1271.44	0.12
Reach-1	0.765	100-Year	Alt 9.2	42400	2.90	20.52		20.60	0.000055	2.94	18607.45	1271.44	0.12
Reach-1	0.704	100-Year	Alt 1.1	42400	2.90	20.43		20.59	0.000095	3.71	14086.20	1000.69	0.16
Reach-1	0.704	100-Year	Alt 2.1	42400	2.90	20.44		20.59	0.000095	3.70	14091.15	1000.69	0.16
Reach-1	0.704	100-Year	Alt 9.2	42400	2.90	20.43		20.58	0.000095	3.71	14080.16	1000.69	0.16
Reach-1	0.662	100-Year	Alt 1.1	42400	2.90	20.38		20.56	0.000120	4.30	12902.17	943.31	0.18
Reach-1	0.662	100-Year	Alt 2.1	42400	2.90	20.38		20.57	0.000120	4.30	12906.89	943.31	0.18
Reach-1	0.662	100-Year	Alt 9.2	42400	2.90	20.37		20.56	0.000120	4.30	12896.40	943.31	0.18
Reach-1	0.617	100-Year	Alt 1.1	42400	2.90	20.11		20.51	0.000223	5.75	9054.25	682.31	0.25
Reach-1	0.617	100-Year	Alt 2.1	42400	2.90	20.12		20.51	0.000222	5.75	9057.83	682.31	0.25
Reach-1	0.617	100-Year	Alt 9.2	42400	2.90	20.11		20.50	0.000223	5.75	9049.88	682.31	0.25
Reach-1	0.582	100-Year	Alt 1.1	41800	2.80	18.63	13.63	20.31	0.000976	10.59	4408.92	460.45	0.50
Reach-1	0.582	100-Year	Alt 2.1	41800	2.80	18.64	13.63	20.31	0.000974	10.59	4412.47	460.45	0.50
Reach-1	0.582	100-Year	Alt 9.2	41800	2.80	18.62	13.63	20.30	0.000978	10.60	4404.59	460.45	0.50
Reach-1	0.575			Bridge									
Reach-1	0.568	100-Year	Alt 1.1	41800	2.80	16.59		19.12	0.001772	12.84	3460.16	451.05	0.66
Reach-1	0.568	100-Year	Alt 2.1	41800	2.80	16.60		19.12	0.001766	12.82	3464.56	451.05	0.66
Reach-1	0.568	100-Year	Alt 9.2	41800	2.80	16.56		19.10	0.001786	12.87	3448.70	451.05	0.66
Reach-1	0.531	100-Year	Alt 1.1	41800	2.90	17.24	12.71	18.50	0.000830	9.76	5086.32	488.67	0.46
Reach-1	0.531	100-Year	Alt 2.1	41800	2.90	17.24	12.71	18.51	0.000828	9.75	5089.82	488.67	0.46
Reach-1	0.531	100-Year	Alt 9.2	41800	2.90	17.22	12.71	18.48	0.000834	9.78	5077.21	488.67	0.46
Reach-1	0.486	100-Year	Alt 1.1	41800	2.80	17.07		18.30	0.000765	9.44	5051.18	408.85	0.45
Reach-1	0.486	100-Year	Alt 2.1	41800	2.80	17.08		18.31	0.000763	9.43	5054.58	408.85	0.45
Reach-1	0.486	100-Year	Alt 9.2	41800	2.80	17.05		18.29	0.000769	9.45	5042.35	408.85	0.45
Reach-1	0.442	100-Year	Alt 1.1	41800	2.60	16.99		18.09	0.000741	9.35	5569.44	483.80	0.44
Reach-1	0.442	100-Year	Alt 2.1	41800	2.60	17.00		18.09	0.000739	9.34	5573.66	483.80	0.44
Reach-1	0.442	100-Year	Alt 9.2	41800	2.60	16.97		18.07	0.000746	9.37	5558.45	483.80	0.44
Reach-1	0.398	100-Year	Alt 1.1	41800	2.90	16.32		17.84	0.001062	10.61	4758.79	485.44	0.52
Reach-1	0.398	100-Year	Alt 2.1	41800	2.90	16.33		17.85	0.001059	10.60	4764.25	485.44	0.52
Reach-1	0.398	100-Year	Alt 9.2	41800	2.90	16.29		17.82	0.001072	10.64	4744.54	485.44	0.52

HEC-RAS River: RIVER-1 Reach: Reach-1 Profile: 100-Year (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	0.356	100-Year	Alt 1.1	41800	2.90	15.39		17.49	0.001643	12.34	3983.84	495.52	0.63
Reach-1	0.356	100-Year	Alt 2.1	41800	2.90	15.41		17.50	0.001634	12.32	3991.92	495.52	0.63
Reach-1	0.356	100-Year	Alt 9.2	41800	2.90	15.34		17.46	0.001669	12.40	3962.53	495.52	0.64
Reach-1	0.321	100-Year	Alt 1.1	41800	1.50	14.19		17.06	0.002189	14.85	3563.49	450.00	0.75
Reach-1	0.321	100-Year	Alt 2.1	41800	1.50	14.24		17.08	0.002157	14.78	3581.51	450.00	0.74
Reach-1	0.321	100-Year	Alt 9.2	41800	1.50	14.06		17.02	0.002286	15.07	3510.30	450.00	0.76
Reach-1	0.293	100-Year	Alt 1.1	41800	1.10	15.74	9.43	16.21	0.000375	6.72	8602.37	778.30	0.32
Reach-1	0.293	100-Year	Alt 2.1	41800	1.10	15.77	9.43	16.24	0.000372	6.71	8623.51	778.35	0.31
Reach-1	0.293	100-Year	Alt 9.2	41800	1.10	15.67	9.43	16.15	0.000382	6.77	8545.96	778.15	0.32
Reach-1	0.2895			Bridge									
Reach-1	0.286	100-Year	Alt 1.1	41800	1.10	15.61		16.09	0.000388	6.80	8501.64	778.04	0.32
Reach-1	0.286	100-Year	Alt 2.1	41800	1.10	15.64		16.12	0.000385	6.78	8522.98	778.09	0.32
Reach-1	0.286	100-Year	Alt 9.2	41800	1.10	15.54		16.03	0.000396	6.85	8444.59	777.89	0.32
Reach-1	0.262	100-Year	Alt 1.1	41800	2.90	15.71		16.00	0.000220	4.35	9863.96	959.45	0.23
Reach-1	0.262	100-Year	Alt 2.1	41800	2.90	15.74		16.03	0.000218	4.34	9889.83	959.52	0.23
Reach-1	0.262	100-Year	Alt 9.2	41800	2.90	15.64		15.94	0.000225	4.38	9794.80	959.26	0.23
Reach-1	0.229	100-Year	Alt 1.1	41800	2.90	15.56		15.95	0.000303	5.02	8590.00	884.98	0.27
Reach-1	0.229	100-Year	Alt 2.1	41800	2.90	15.59		15.98	0.000300	5.00	8614.85	885.14	0.27
Reach-1	0.229	100-Year	Alt 9.2	41800	2.90	15.49		15.88	0.000310	5.05	8523.52	884.55	0.27
Reach-1	0.198	100-Year	Alt 1.1	41800	2.90	15.37		15.88	0.000405	5.80	7440.88	800.12	0.31
Reach-1	0.198	100-Year	Alt 2.1	41800	2.90	15.40		15.91	0.000402	5.78	7462.52	800.12	0.31
Reach-1	0.198	100-Year	Alt 9.2	41800	2.90	15.29		15.81	0.000416	5.84	7382.95	800.12	0.32
Reach-1	0.167	100-Year	Alt 1.1	41800	2.90	15.31		15.82	0.000387	5.79	7495.08	798.27	0.31
Reach-1	0.167	100-Year	Alt 2.1	41800	2.90	15.34		15.84	0.000384	5.77	7516.61	798.33	0.31
Reach-1	0.167	100-Year	Alt 9.2	41800	2.90	15.23		15.74	0.000397	5.83	7437.36	798.11	0.31
Reach-1	0.133	100-Year	Alt 1.1	41800	2.10	15.35		15.72	0.000241	4.93	8588.39	1353.70	0.25
Reach-1	0.133	100-Year	Alt 2.1	41800	2.10	15.38		15.75	0.000239	4.92	8609.48	1353.79	0.25
Reach-1	0.133	100-Year	Alt 9.2	41800	2.10	15.27		15.65	0.000246	4.97	8531.87	1353.47	0.25
Reach-1	0.1027	100-Year	Alt 1.1	41800	-1.70	14.97		15.64	0.000535	6.57	6488.20	1071.63	0.36
Reach-1	0.1027	100-Year	Alt 2.1	41800	-1.70	15.01		15.67	0.000529	6.55	6509.01	1071.81	0.36
Reach-1	0.1027	100-Year	Alt 9.2	41800	-1.70	14.89		15.56	0.000550	6.62	6432.33	1071.19	0.36

HEC-RAS River: RIVER-1 Reach: Reach-1 Profile: 100-Year (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	0.0837	100-Year	Alt 1.1	41800	-5.80	14.34	9.92	15.48	0.000865	8.57	4878.84	472.20	0.46
Reach-1	0.0837	100-Year	Alt 2.1	41800	-5.80	14.38	9.92	15.51	0.000855	8.54	4895.85	472.37	0.46
Reach-1	0.0837	100-Year	Alt 9.2	41800	-5.80	14.24	9.92	15.40	0.000893	8.65	4832.96	471.75	0.46
Reach-1	0.0771			Bridge									
Reach-1	0.0705	100-Year	Alt 1.1	41800	-2.20	11.14	11.14	14.45	0.004827	14.58	2878.28	453.13	1.00
Reach-1	0.0705	100-Year	Alt 2.1	41800	-2.20	11.14	11.14	14.45	0.004827	14.58	2878.28	453.13	1.00
Reach-1	0.0705	100-Year	Alt 9.2	41800	-2.20	11.14	11.14	14.45	0.004827	14.58	2878.28	453.13	1.00
Reach-1	0.0439	100-Year	Alt 1.1	41800	-0.60	10.58		12.24	0.002522	10.33	4075.22	889.63	0.72
Reach-1	0.0439	100-Year	Alt 2.1	41800	-0.60	10.58		12.24	0.002522	10.33	4075.22	889.63	0.72
Reach-1	0.0439	100-Year	Alt 9.2	41800	-0.60	10.58	9.32	12.24	0.002522	10.33	4075.22	889.63	0.72
Reach-1	0.0208	100-Year	Alt 1.1	41800	0.70	10.11		11.88	0.003015	10.68	3936.74	674.95	0.77
Reach-1	0.0208	100-Year	Alt 2.1	41800	0.70	10.11		11.88	0.003015	10.68	3936.74	674.95	0.77
Reach-1	0.0208	100-Year	Alt 9.2	41800	0.70	10.11		11.88	0.003015	10.68	3936.74	674.95	0.77
Reach-1	0.0001	100-Year	Alt 1.1	41800	0.40	10.20	7.72	11.52	0.001502	9.22	4582.77	585.43	0.57
Reach-1	0.0001	100-Year	Alt 2.1	41800	0.40	10.20	7.72	11.52	0.001502	9.22	4582.77	585.43	0.57
Reach-1	0.0001	100-Year	Alt 9.2	41800	0.40	10.20	7.72	11.52	0.001502	9.22	4582.77	585.43	0.57


Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.765
Elevation (ft)
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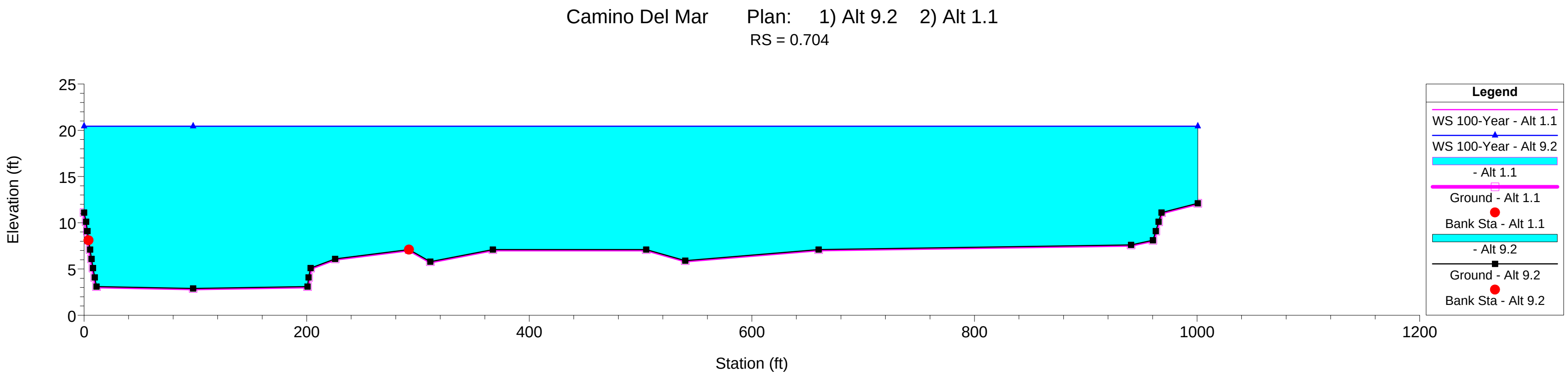
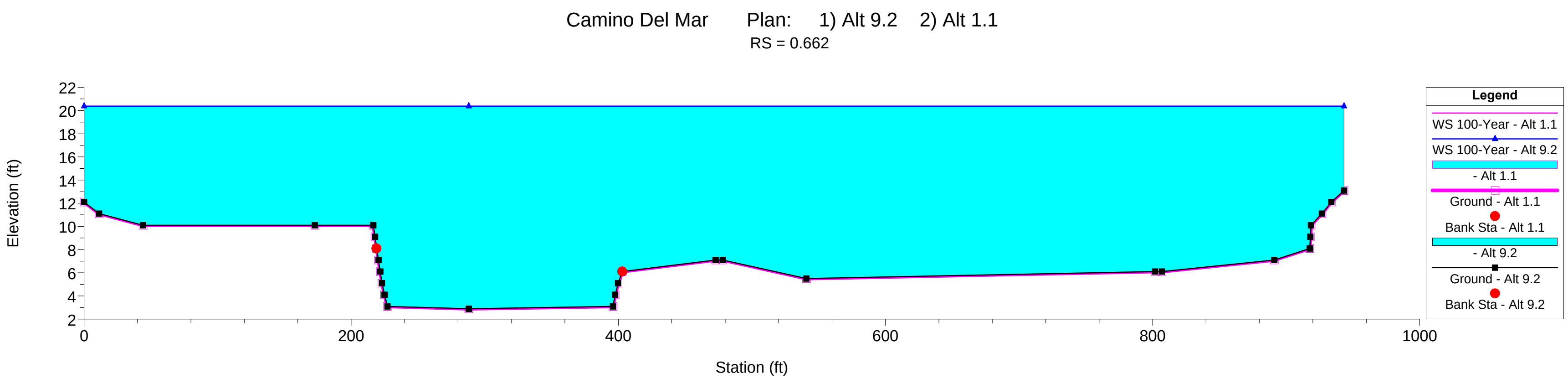
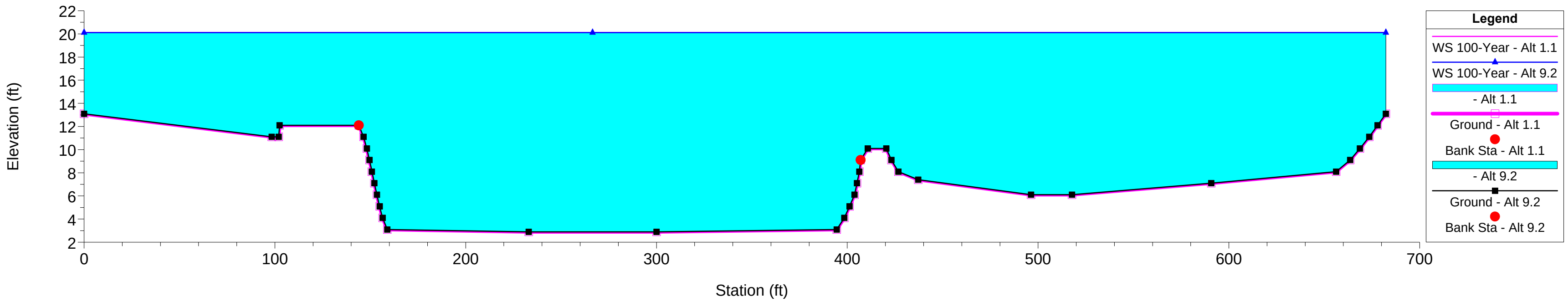
20
15
10
5
0
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS 100-Year - Alt 1.1
WS 100-Year - Alt 9.2
- Alt 1.1
Ground - Alt 1.1
Bank Sta - Alt 1.1
- Alt 9.2
Ground - Alt 9.2
Bank Sta - Alt 9.2

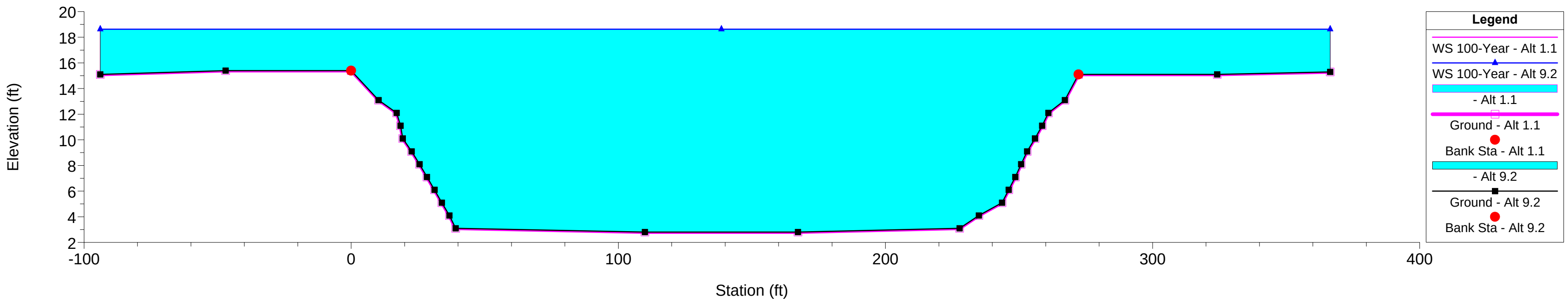

Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.704
Elevation (ft)
25
20
15
10
5
0
0
200
400
600
800
1000
1200
Station (ft)
Legend
WS 100-Year - Alt 1.1
WS 100-Year - Alt 9.2
- Alt 1.1
Ground - Alt 1.1
Bank Sta - Alt 1.1
- Alt 9.2
Ground - Alt 9.2
Bank Sta - Alt 9.2


Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.662
Elevation (ft)
22
20
18
16
14
12
10
8
6
4
2
0
200
400
600
800
1000
Station (ft)
Legend
WS 100-Year - Alt 1.1
WS 100-Year - Alt 9.2
- Alt 1.1
Ground - Alt 1.1
Bank Sta - Alt 1.1
- Alt 9.2
Ground - Alt 9.2
Bank Sta - Alt 9.2

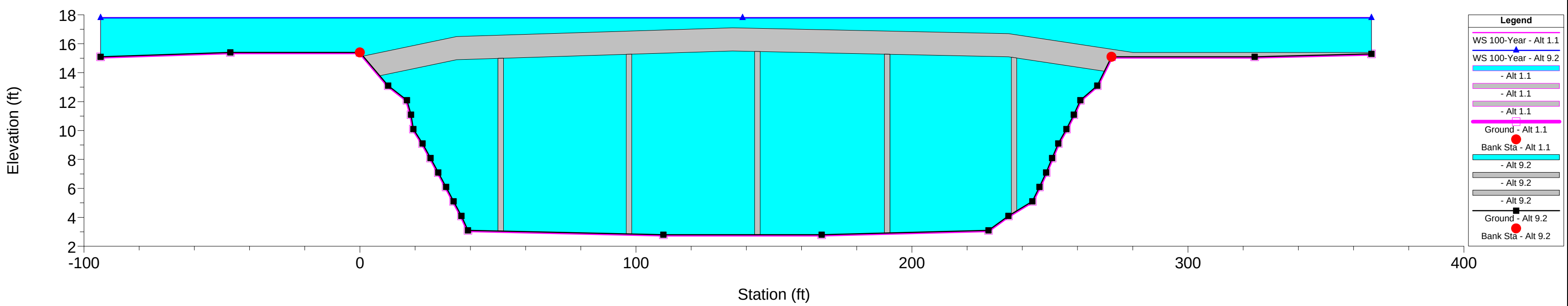
Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.617



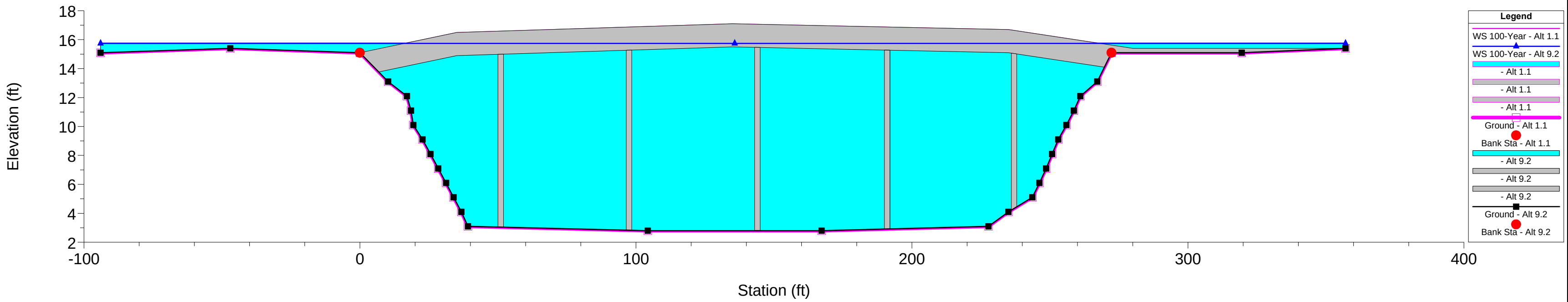
Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.582



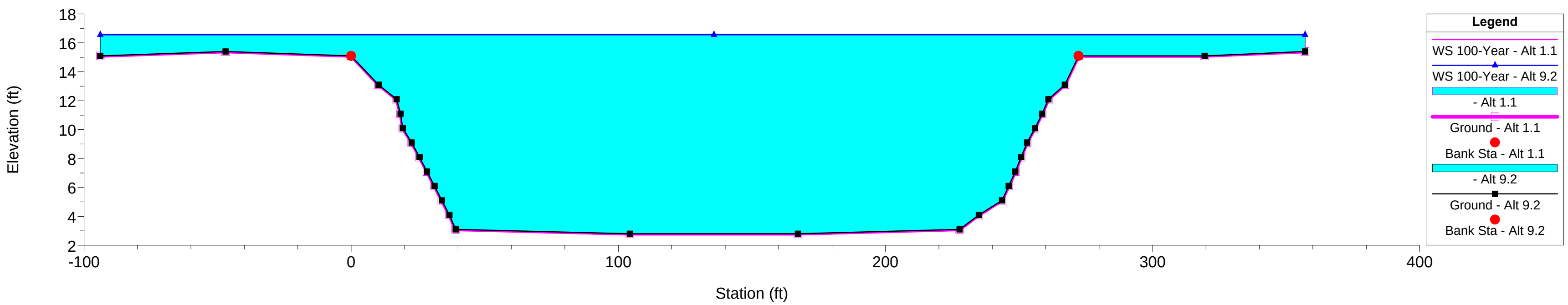
Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.575 BR



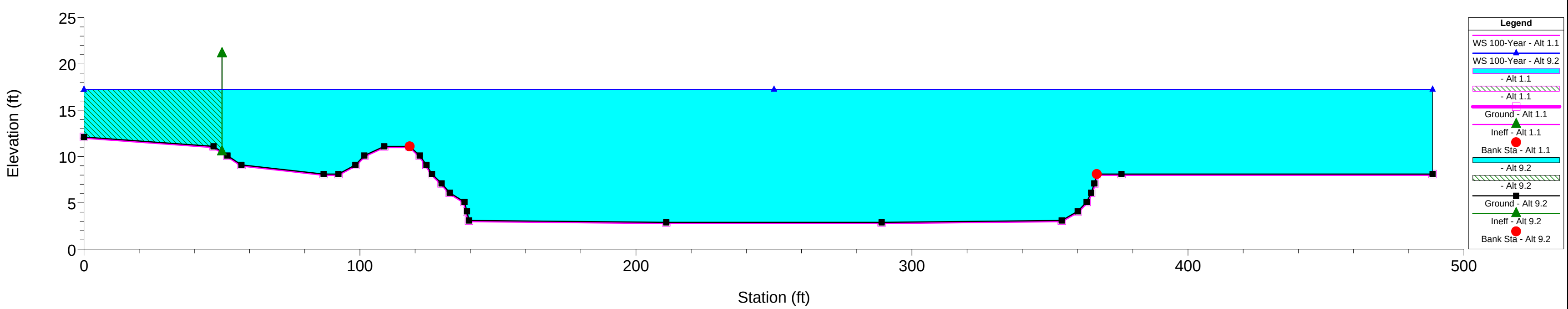
Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.575 BR

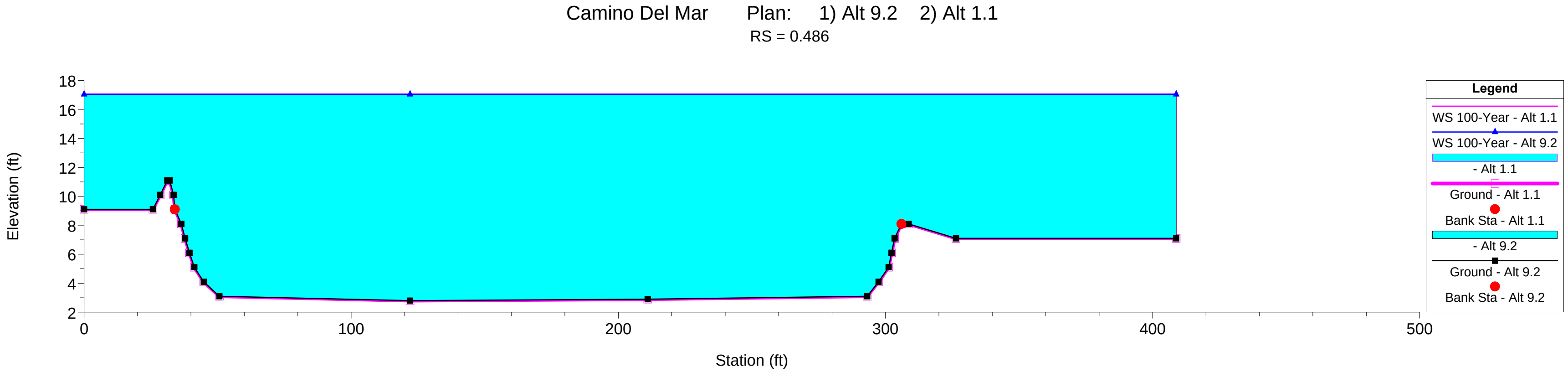


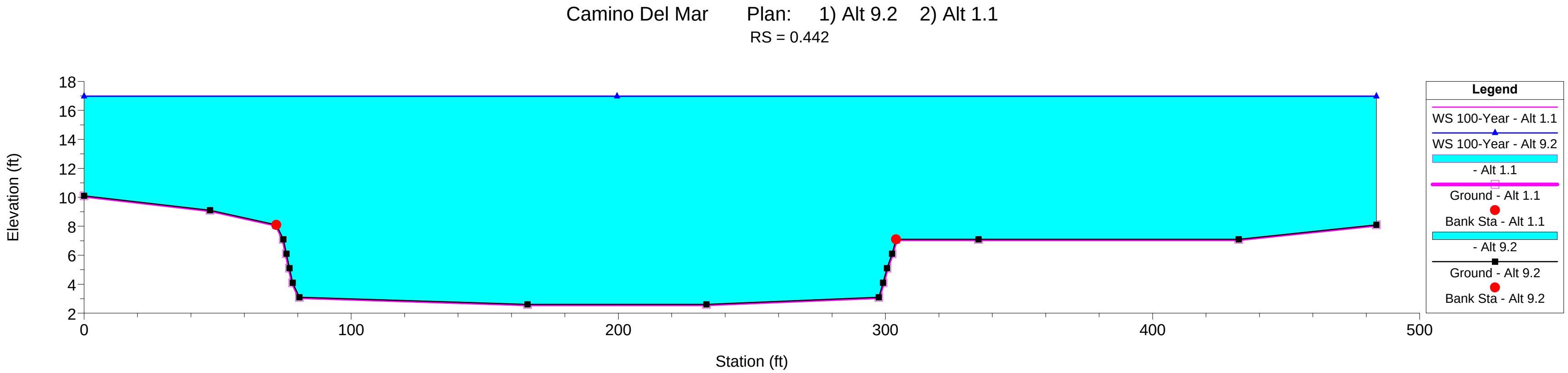
Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.568

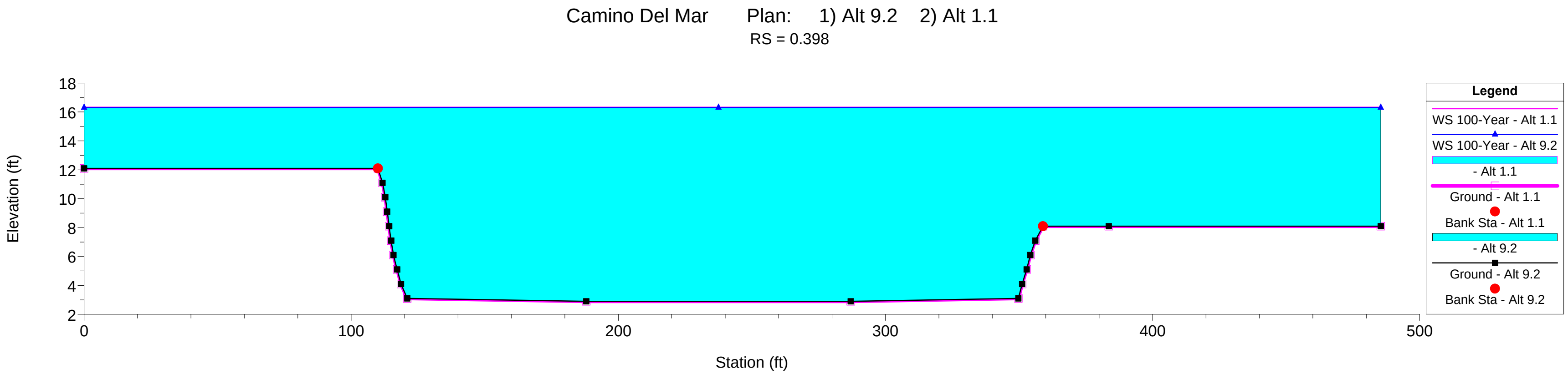


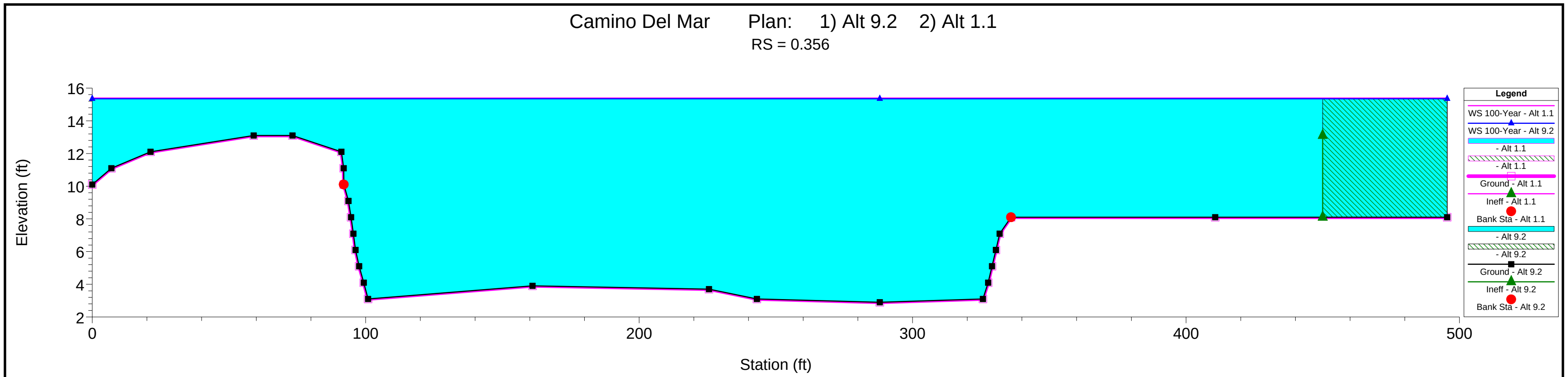
Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.531



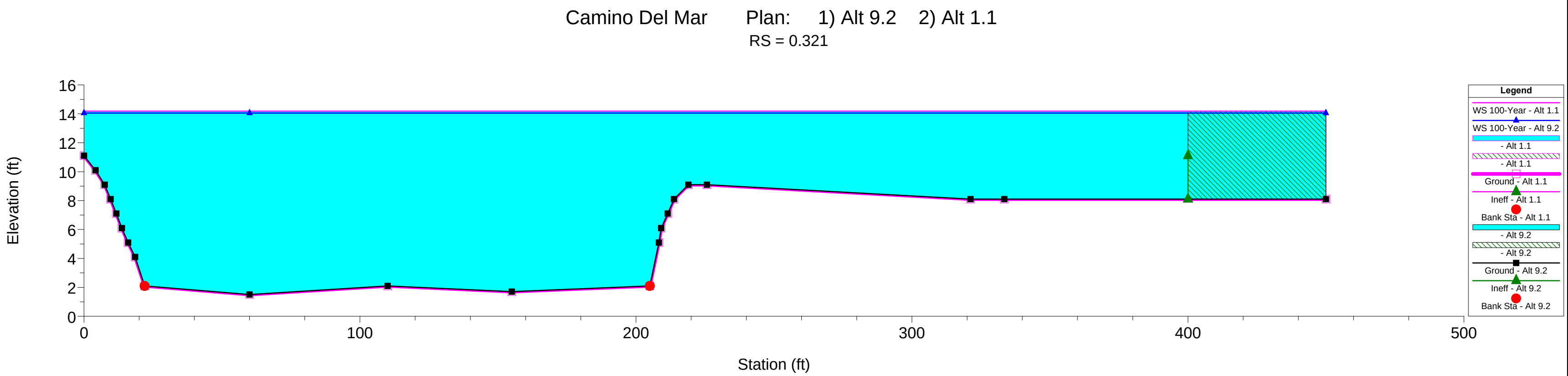

Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.486
Elevation (ft)
Station (ft)
Legend
WS 100-Year - Alt 1.1
WS 100-Year - Alt 9.2
- Alt 1.1
Ground - Alt 1.1
Bank Sta - Alt 1.1
- Alt 9.2
Ground - Alt 9.2
Bank Sta - Alt 9.2


Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.442
Elevation (ft)
Station (ft)
Legend
WS 100-Year - Alt 1.1
WS 100-Year - Alt 9.2
- Alt 1.1
Ground - Alt 1.1
Bank Sta - Alt 1.1
- Alt 9.2
Ground - Alt 9.2
Bank Sta - Alt 9.2

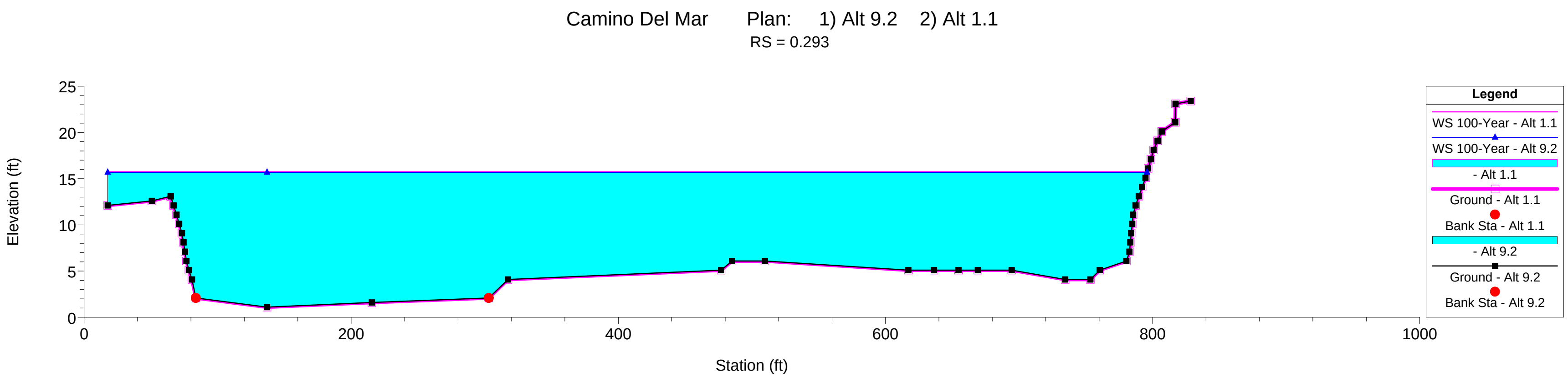

Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.398
Elevation (ft)
Station (ft)
Legend
WS 100-Year - Alt 1.1
WS 100-Year - Alt 9.2
- Alt 1.1
Ground - Alt 1.1
Bank Sta - Alt 1.1
- Alt 9.2
Ground - Alt 9.2
Bank Sta - Alt 9.2



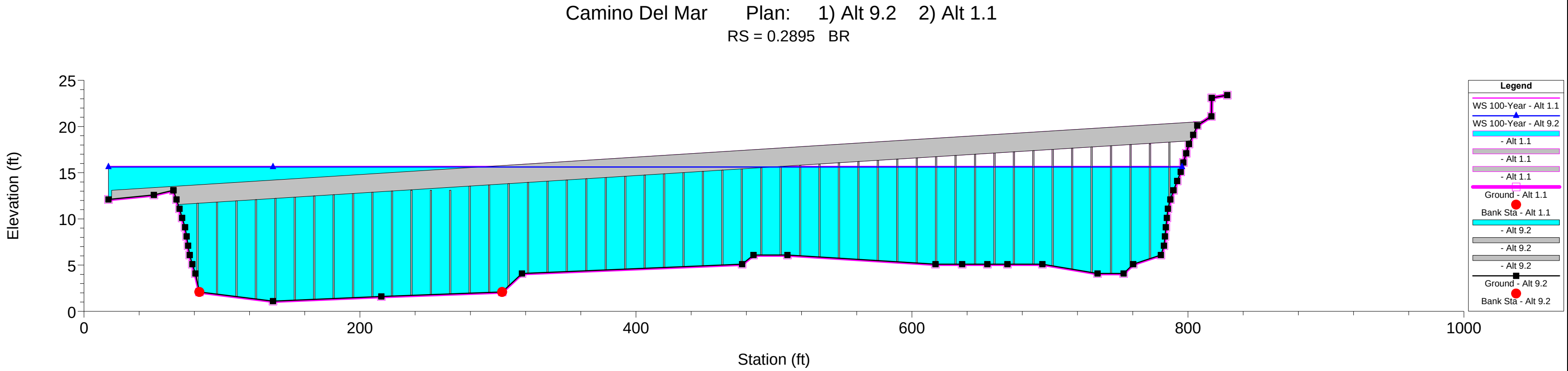
Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.356
Elevation (ft)
Station (ft)
Legend
WS 100-Year - Alt 1.1
WS 100-Year - Alt 9.2
- Alt 1.1
- Alt 1.1
Ground - Alt 1.1
Ineff - Alt 1.1
Bank Sta - Alt 1.1
- Alt 9.2
- Alt 9.2
Ground - Alt 9.2
Ineff - Alt 9.2
Bank Sta - Alt 9.2

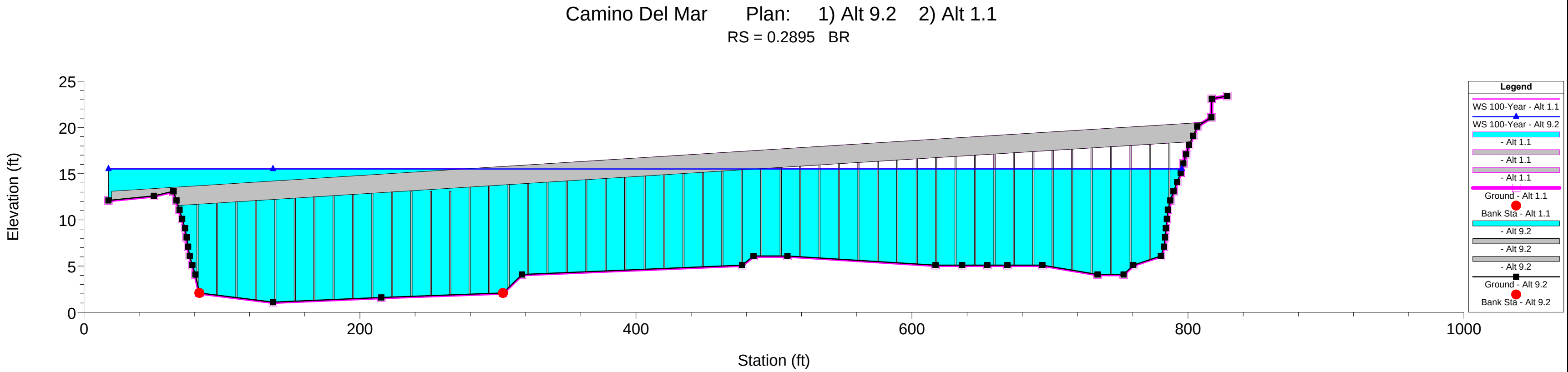


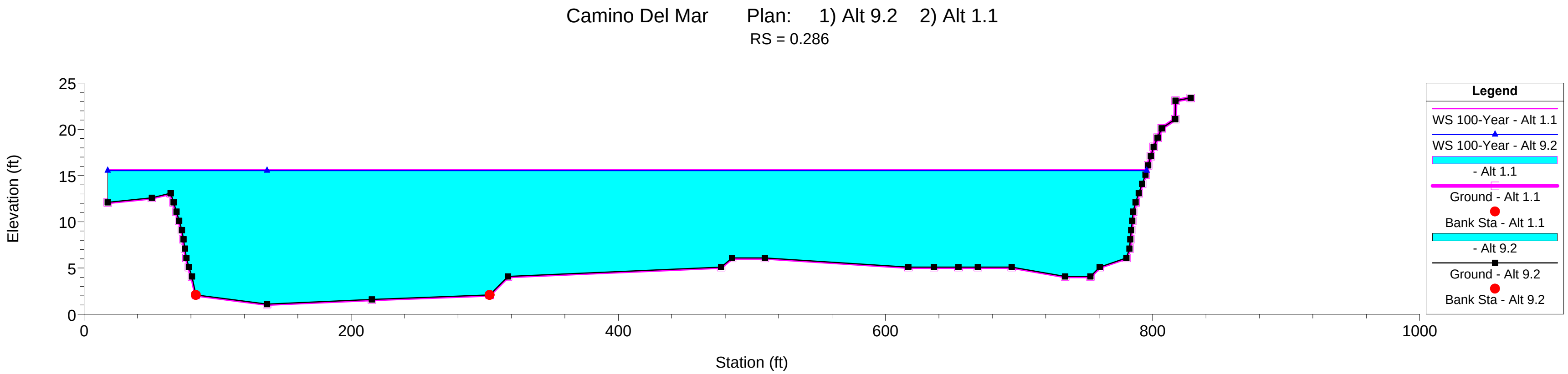
Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.321
Elevation (ft)
Station (ft)
Legend
WS 100-Year - Alt 1.1
WS 100-Year - Alt 9.2
- Alt 1.1
- Alt 1.1
Ground - Alt 1.1
Ineff - Alt 1.1
Bank Sta - Alt 1.1
- Alt 9.2
- Alt 9.2
Ground - Alt 9.2
Ineff - Alt 9.2
Bank Sta - Alt 9.2



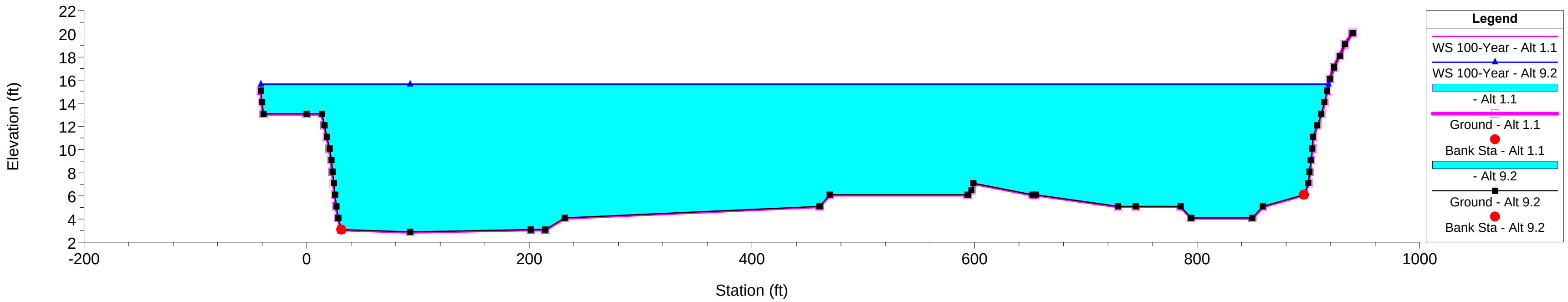
Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.293
Elevation (ft)
Station (ft)
Legend
WS 100-Year - Alt 1.1
WS 100-Year - Alt 9.2
- Alt 1.1
Ground - Alt 1.1
Bank Sta - Alt 1.1
- Alt 9.2
Ground - Alt 9.2
Bank Sta - Alt 9.2


Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.2895 BR
Elevation (ft)
Station (ft)
0
5
10
15
20
25
0
200
400
600
800
1000
Legend
WS 100-Year - Alt 1.1
WS 100-Year - Alt 9.2
- Alt 1.1
- Alt 1.1
- Alt 1.1
Ground - Alt 1.1
Bank Sta - Alt 1.1
- Alt 9.2
- Alt 9.2
- Alt 9.2
Ground - Alt 9.2
Bank Sta - Alt 9.2

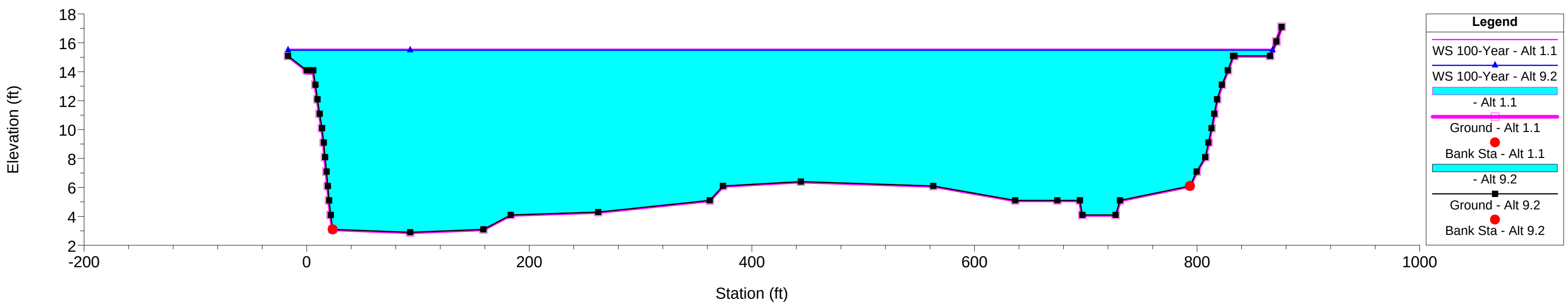

Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.2895 BR
Elevation (ft)
Station (ft)
0
5
10
15
20
25
0
200
400
600
800
1000
Legend
WS 100-Year - Alt 1.1
WS 100-Year - Alt 9.2
- Alt 1.1
- Alt 1.1
- Alt 1.1
Ground - Alt 1.1
Bank Sta - Alt 1.1
- Alt 9.2
- Alt 9.2
- Alt 9.2
Ground - Alt 9.2
Bank Sta - Alt 9.2


Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.286
Elevation (ft)
Station (ft)
0
5
10
15
20
25
0
200
400
600
800
1000
Legend
WS 100-Year - Alt 1.1
WS 100-Year - Alt 9.2
- Alt 1.1
Ground - Alt 1.1
Bank Sta - Alt 1.1
- Alt 9.2
Ground - Alt 9.2
Bank Sta - Alt 9.2

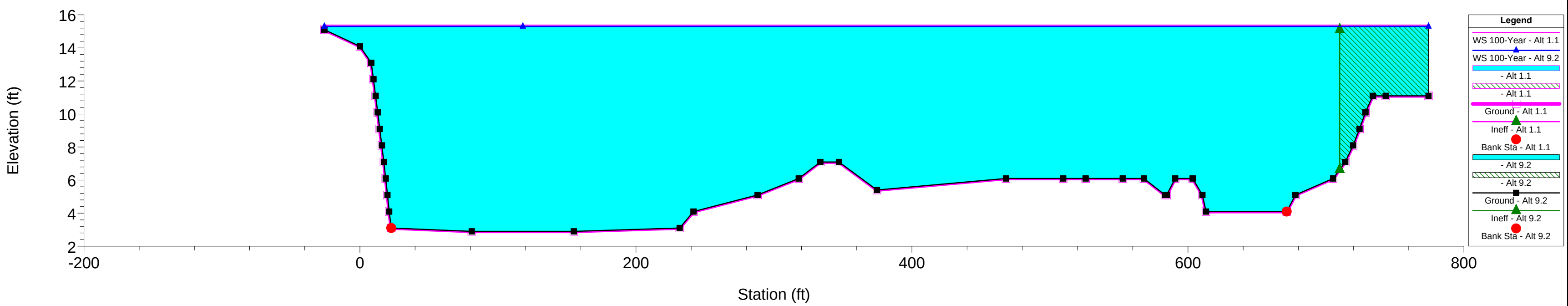
Camino Del Mar   Plan: 1) Alt 9.2   2) Alt 1.1
RS = 0.262

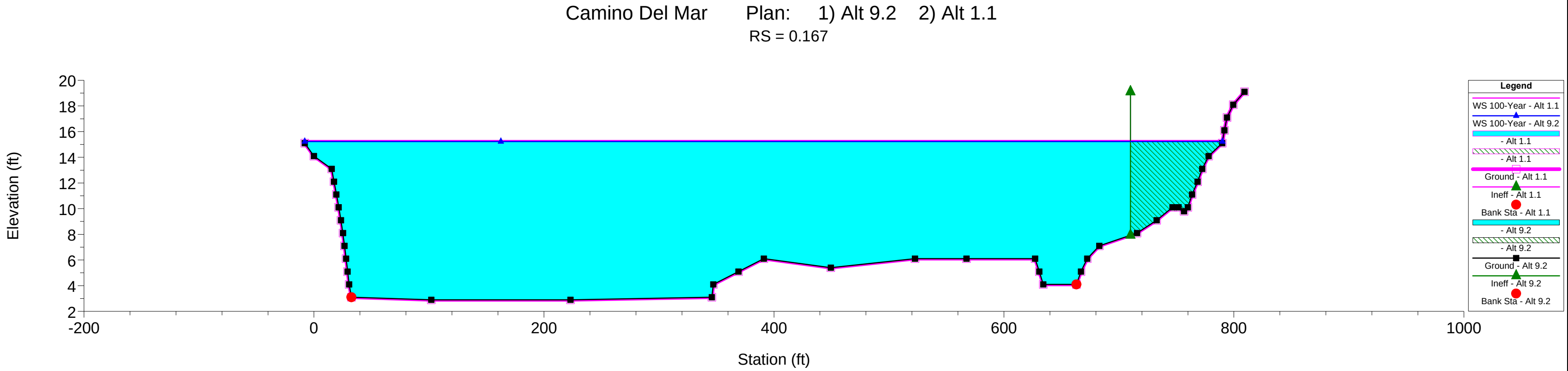


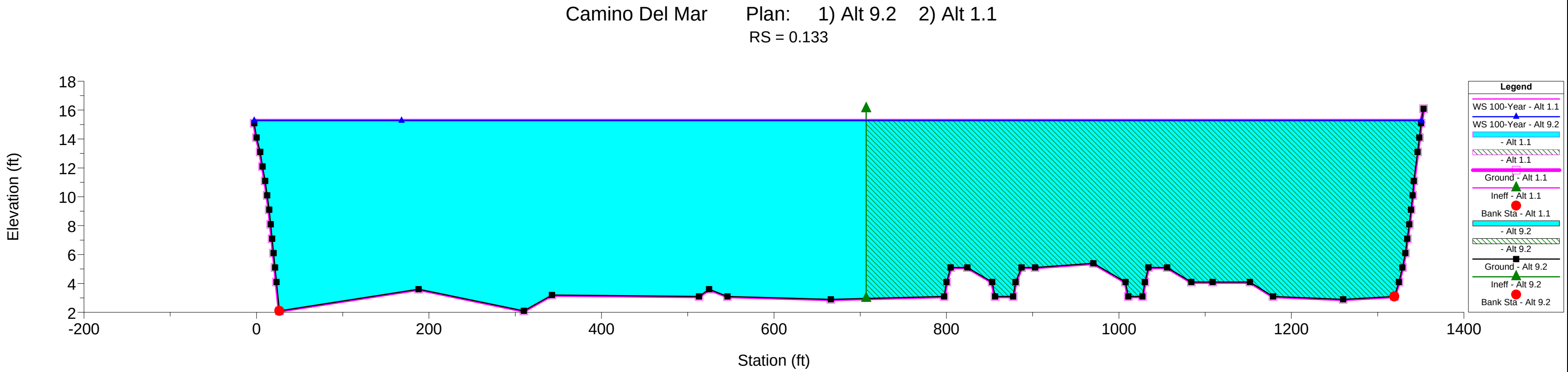
Camino Del Mar   Plan: 1) Alt 9.2   2) Alt 1.1
RS = 0.229

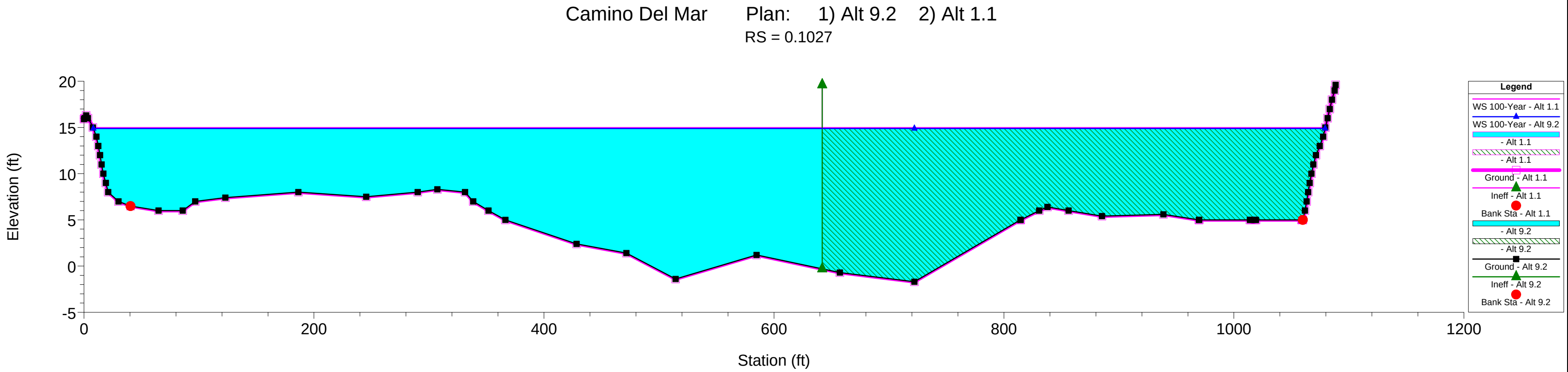


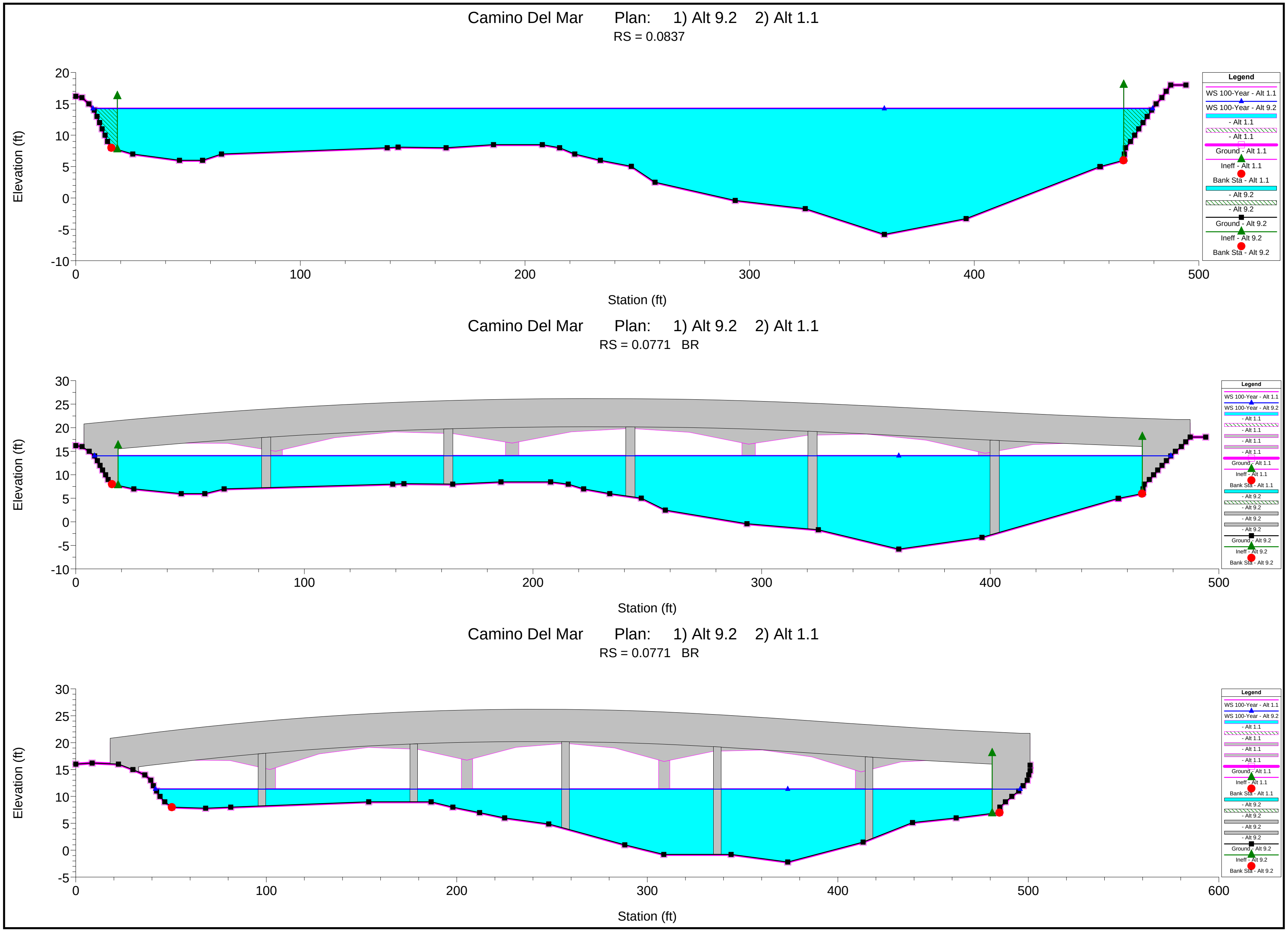
Camino Del Mar   Plan: 1) Alt 9.2   2) Alt 1.1
RS = 0.198

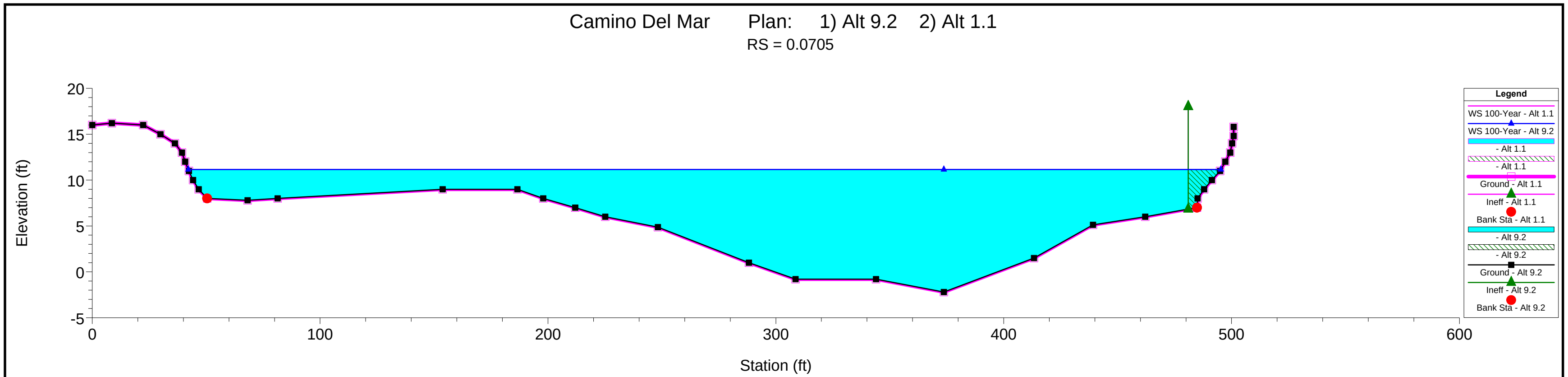



Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.167
Elevation (ft)
Station (ft)
Legend
WS 100-Year - Alt 1.1
WS 100-Year - Alt 9.2
- Alt 1.1
- Alt 1.1
Ground - Alt 1.1
Ineff - Alt 1.1
Bank Sta - Alt 1.1
- Alt 9.2
- Alt 9.2
Ground - Alt 9.2
Ineff - Alt 9.2
Bank Sta - Alt 9.2

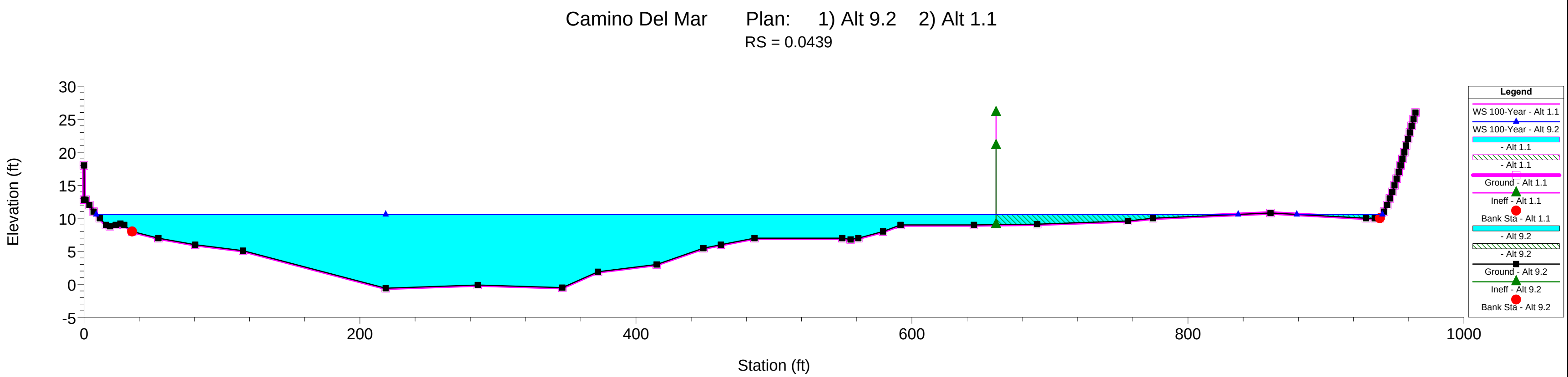

Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.133
Elevation (ft)
Station (ft)
Legend
WS 100-Year - Alt 1.1
WS 100-Year - Alt 9.2
- Alt 1.1
- Alt 1.1
Ground - Alt 1.1
Ineff - Alt 1.1
Bank Sta - Alt 1.1
- Alt 9.2
- Alt 9.2
Ground - Alt 9.2
Ineff - Alt 9.2
Bank Sta - Alt 9.2


Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.1027
Elevation (ft)
Station (ft)
Legend
WS 100-Year - Alt 1.1
WS 100-Year - Alt 9.2
- Alt 1.1
- Alt 1.1
Ground - Alt 1.1
Ineff - Alt 1.1
Bank Sta - Alt 1.1
- Alt 9.2
- Alt 9.2
Ground - Alt 9.2
Ineff - Alt 9.2
Bank Sta - Alt 9.2

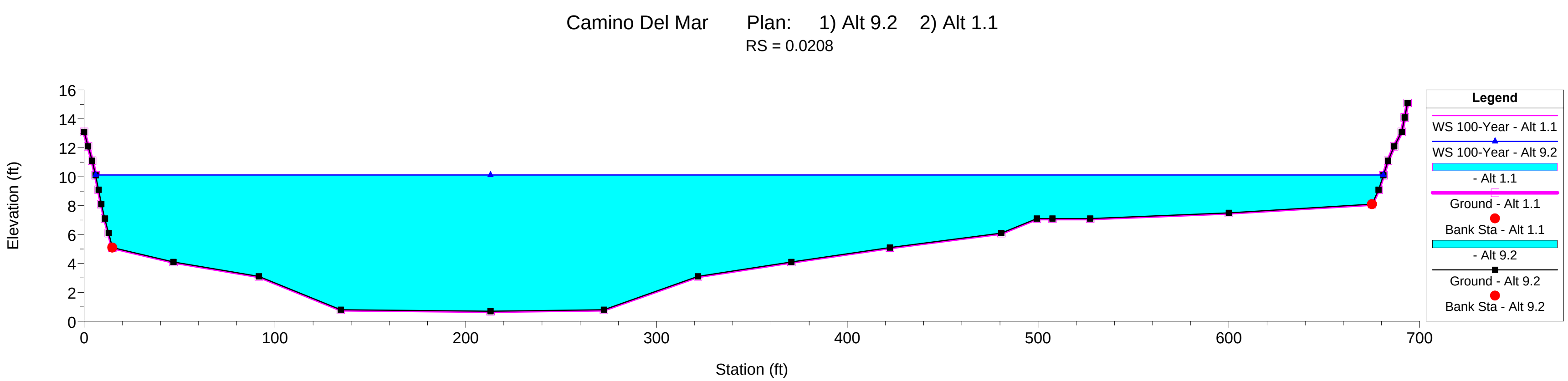

Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.0837
Elevation (ft)
Station (ft)
Legend
WS 100-Year - Alt 1.1
WS 100-Year - Alt 9.2
Ground - Alt 1.1
Ineff - Alt 1.1
Bank Sta - Alt 1.1
Ground - Alt 9.2
Ineff - Alt 9.2
Bank Sta - Alt 9.2
Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.0771 BR
Elevation (ft)
Station (ft)
Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.0771 BR
Elevation (ft)
Station (ft)



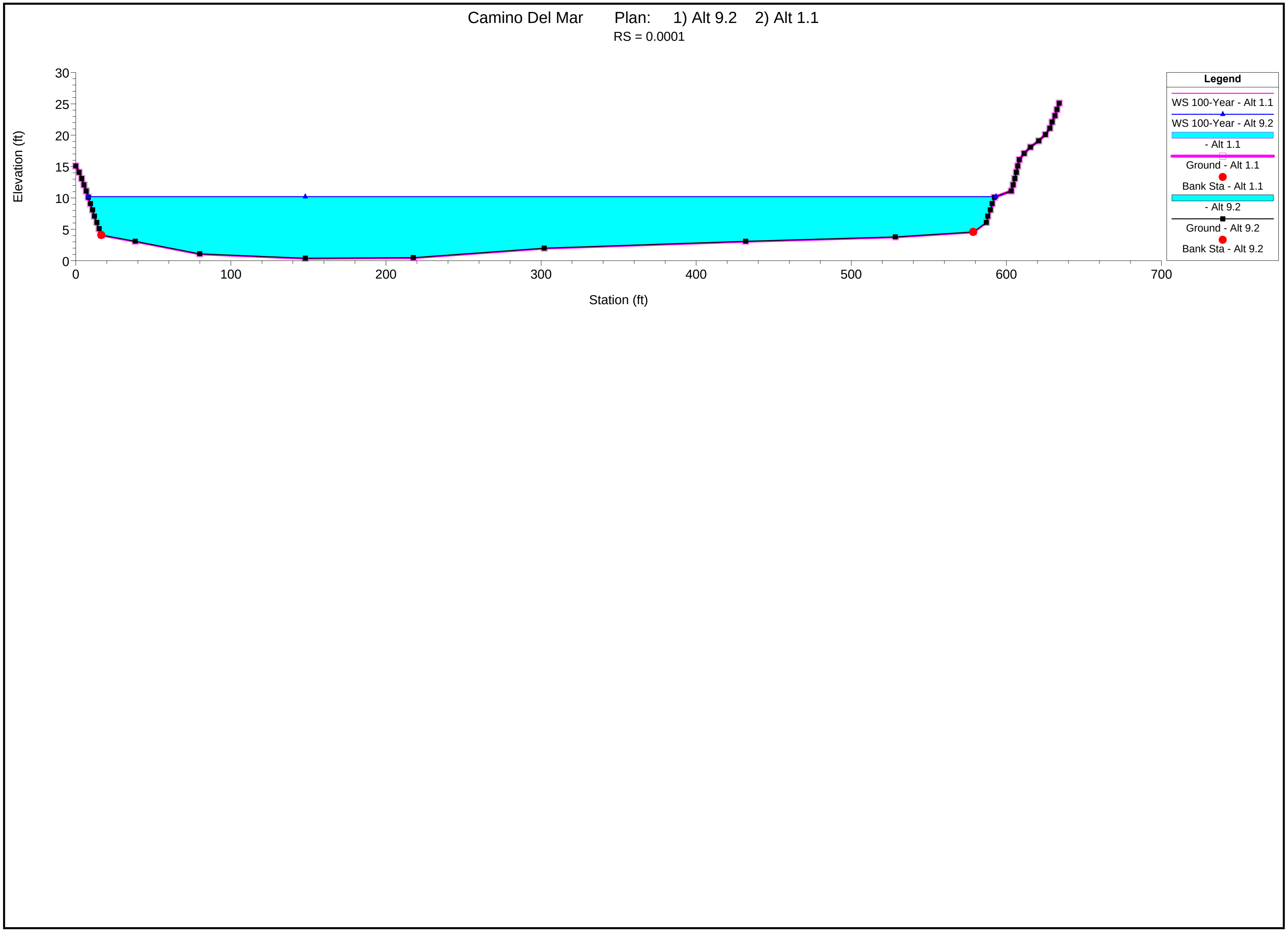
Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.0705
Elevation (ft)
Station (ft)
20
15
10
5
0
-5
0
100
200
300
400
500
600
Legend
WS 100-Year - Alt 1.1
WS 100-Year - Alt 9.2
- Alt 1.1
- Alt 1.1
Ground - Alt 1.1
Ineff - Alt 1.1
Bank Sta - Alt 1.1
- Alt 9.2
- Alt 9.2
Ground - Alt 9.2
Ineff - Alt 9.2
Bank Sta - Alt 9.2



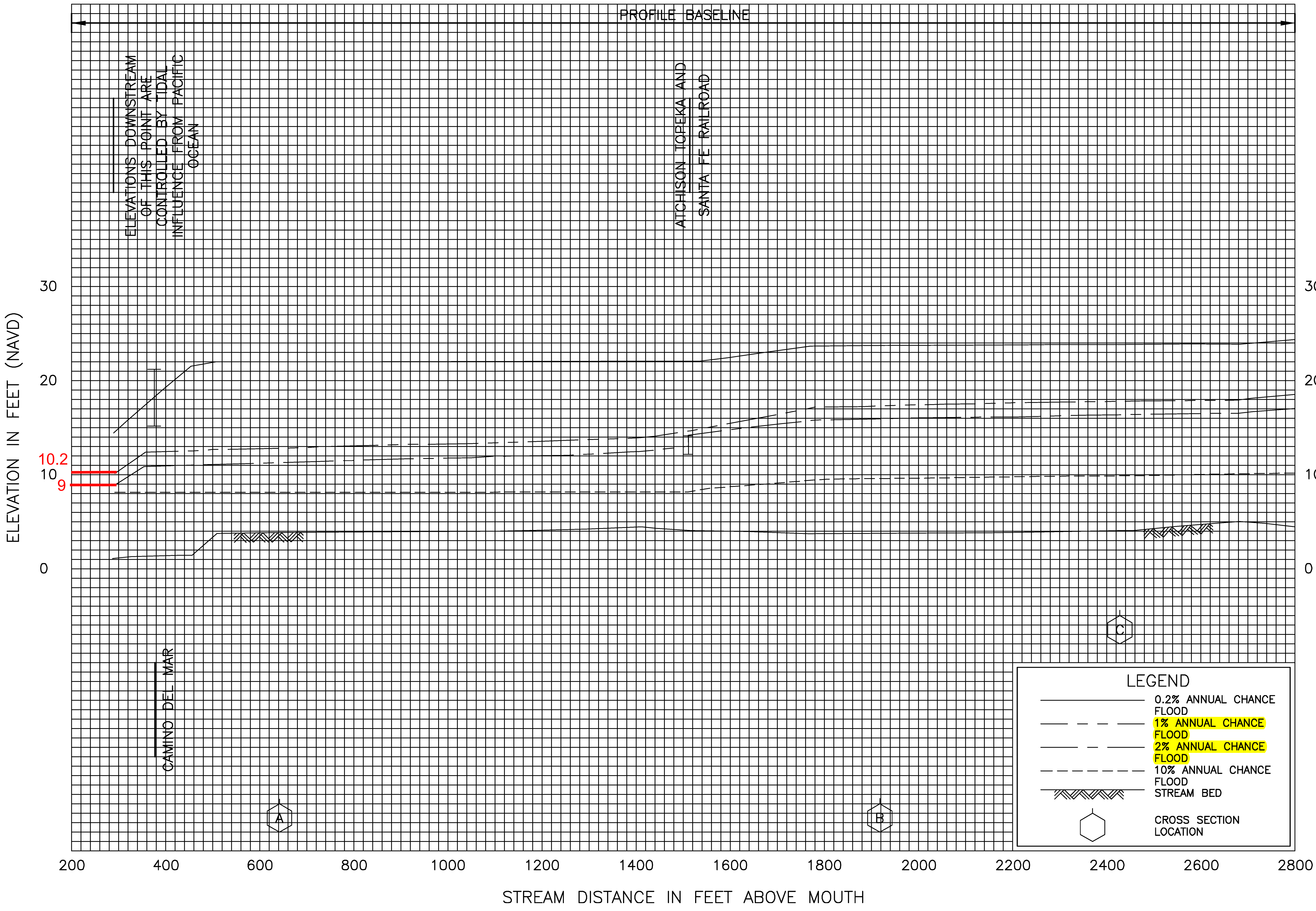
Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.0439
Elevation (ft)
Station (ft)
30
25
20
15
10
5
0
-5
0
200
400
600
800
1000
Legend
WS 100-Year - Alt 1.1
WS 100-Year - Alt 9.2
- Alt 1.1
- Alt 1.1
Ground - Alt 1.1
Ineff - Alt 1.1
Bank Sta - Alt 1.1
- Alt 9.2
- Alt 9.2
Ground - Alt 9.2
Ineff - Alt 9.2
Bank Sta - Alt 9.2



Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.0208
Elevation (ft)
Station (ft)
16
14
12
10
8
6
4
2
0
0
100
200
300
400
500
600
700
Legend
WS 100-Year - Alt 1.1
WS 100-Year - Alt 9.2
- Alt 1.1
Ground - Alt 1.1
Bank Sta - Alt 1.1
- Alt 9.2
Ground - Alt 9.2
Bank Sta - Alt 9.2



Camino Del Mar Plan: 1) Alt 9.2 2) Alt 1.1
RS = 0.0001
Elevation (ft)
Station (ft)
0
5
10
15
20
25
30
0
100
200
300
400
500
600
700
Legend
WS 100-Year - Alt 1.1
WS 100-Year - Alt 9.2
- Alt 1.1
Ground - Alt 1.1
Bank Sta - Alt 1.1
- Alt 9.2
Ground - Alt 9.2
Bank Sta - Alt 9.2



FLOOD PROFILES

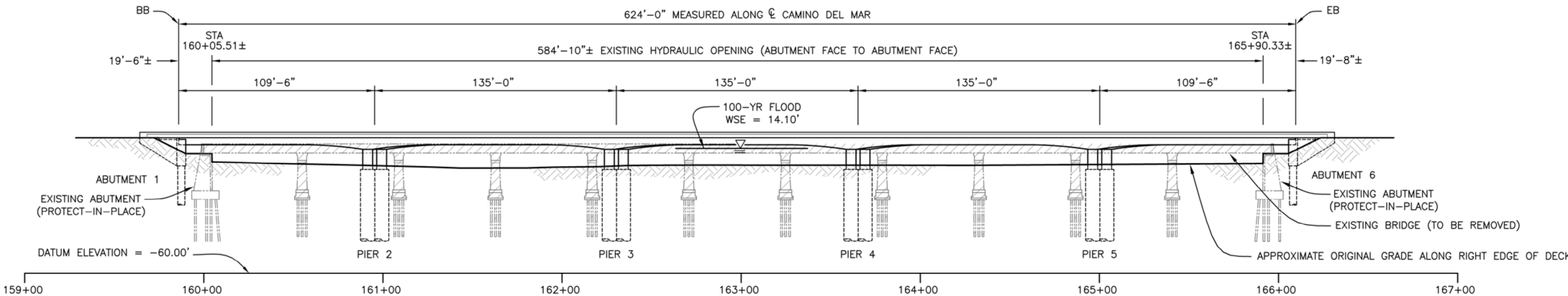
SAN DIEGUITO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

SAN DIEGO COUNTY, CA

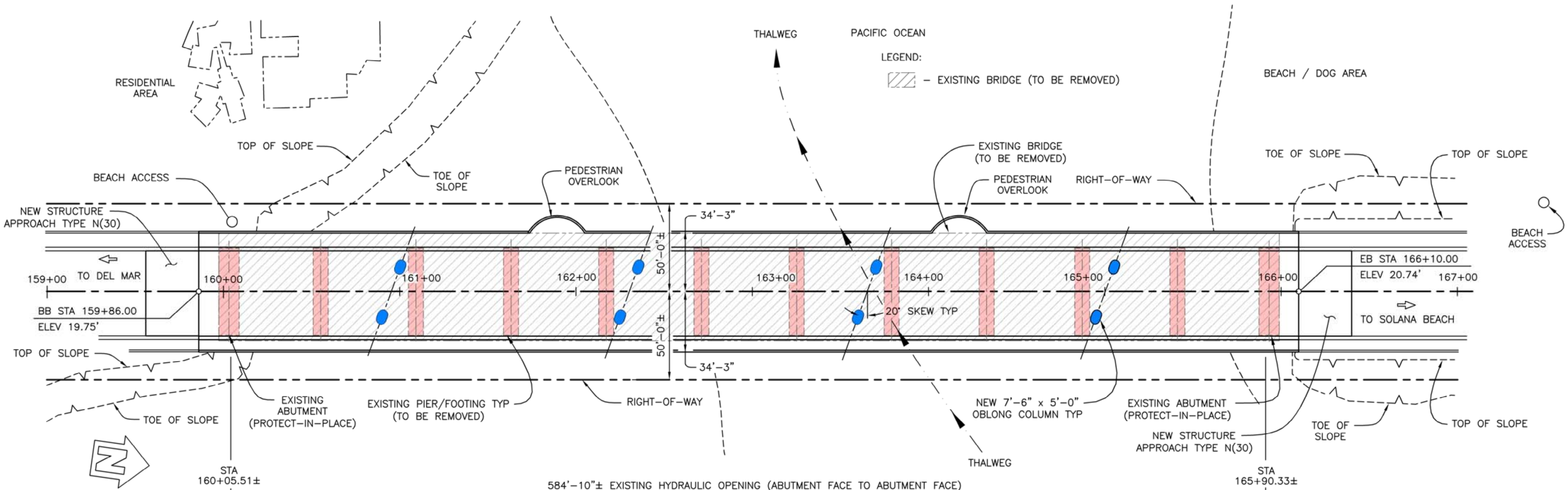
(AND INCORPORATED AREAS)

HYDRAULIC AND SEDIMENT TRANSPORT WORK MAP



ELEVATION

1" = 30'–0"



PLAN

1" = 30'–0"

Number of Spans	Total Permanent Obstruction Area (Sq. Ft.)
11	2,350±

Number of Spans	Total Permanent Obstruction Area (Sq. Ft.)
5	257

ALTERNATIVE 1.1: 5-SPAN VARIABLE DEPTH CAST-IN-PLACE PRESTRESSED CONCRETE BOX GIRDER BRIDGE WITH TWO COLUMNS PER PIER

REVISION	DESCRIPTION	APPROVED	DATE	SCALE: AS SHOWN	DESIGNED: N. VU	DRAWN: T. BRITTAIN	CHECKED: D. BLOODWORTH
				ACAD FILE NO.	ENGINEER OF WORK	R.C.E. NO.	DATE
				PROJECT NO.			

KLEINFELDER
Bright people. Right Solutions.
550 WEST C STREET, SUITE 1200 SAN DIEGO, CA. 92101 (619) 831-4600

DRAFT

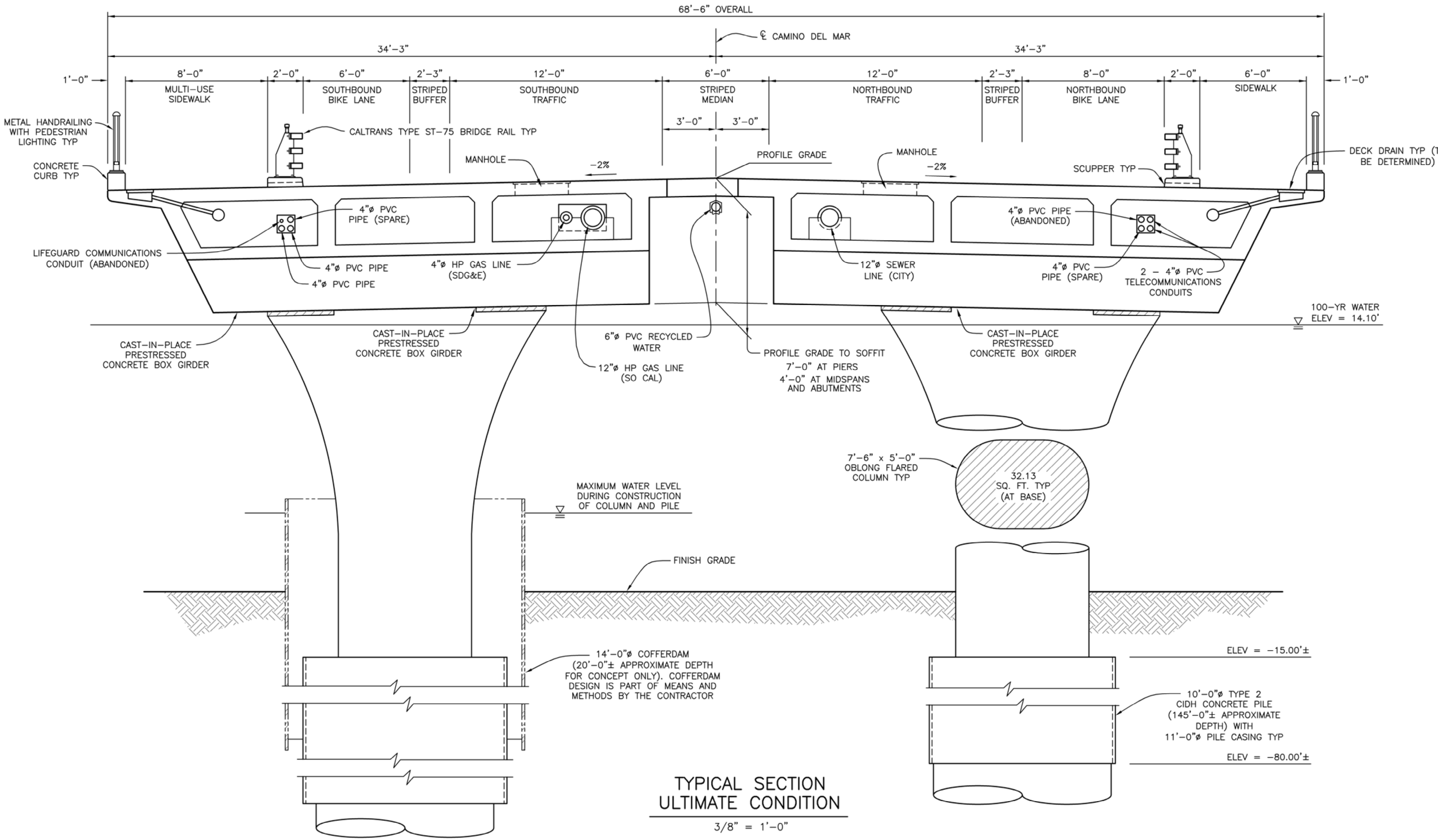
APPROVED

PUBLIC WORKS DIRECTOR — DATE

CITY OF DEL MAR
CAMINO DEL MAR BRIDGE OVER SAN DIEGUITO RIVER
REPLACEMENT ALTERNATIVE 1.1
GENERAL PLAN (1 OF 2)

BR-08

ORIGINAL SCALE: 0 1 2 3 4 INCHES



TYPICAL SECTION
ULTIMATE CONDITION
3/8" = 1'-0"

ALTERNATIVE 1.1: 5-SPAN VARIABLE DEPTH CAST-IN-PLACE PRESTRESSED CONCRETE BOX GIRDER BRIDGE WITH TWO COLUMNS PER PIER

REVISION	DESCRIPTION	APPROVED	DATE

SCALE: AS SHOWN
ACAD FILE NO.
PROJECT NO.

DESIGNED: N. VU | DRAWN: T. BRITTAIN | CHECKED: D. BLOODWORTH

ENGINEER OF WORK | R.C.E. NO. | DATE

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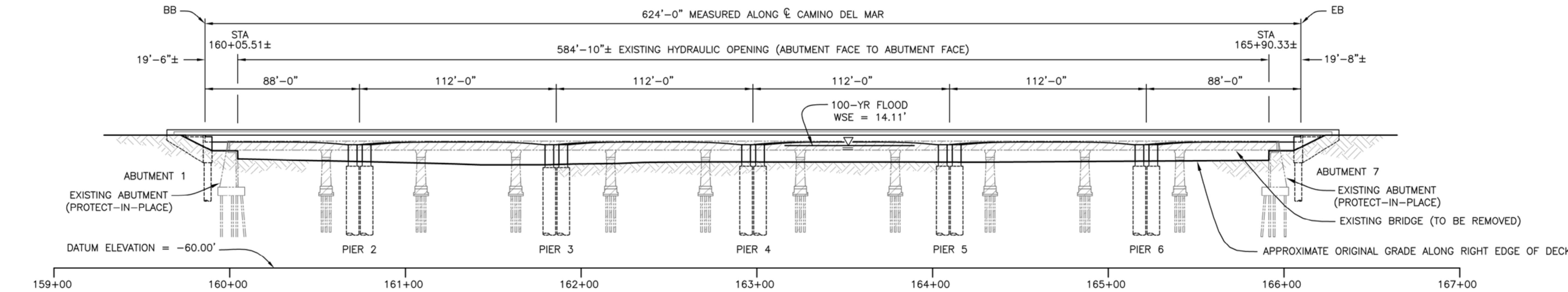
APPROVED
PUBLIC WORKS DIRECTOR | DATE

CITY OF DEL MAR
CAMINO DEL MAR BRIDGE OVER SAN DIEGUITO RIVER
REPLACEMENT ALTERNATIVE 1.1
GENERAL PLAN (2 OF 2)

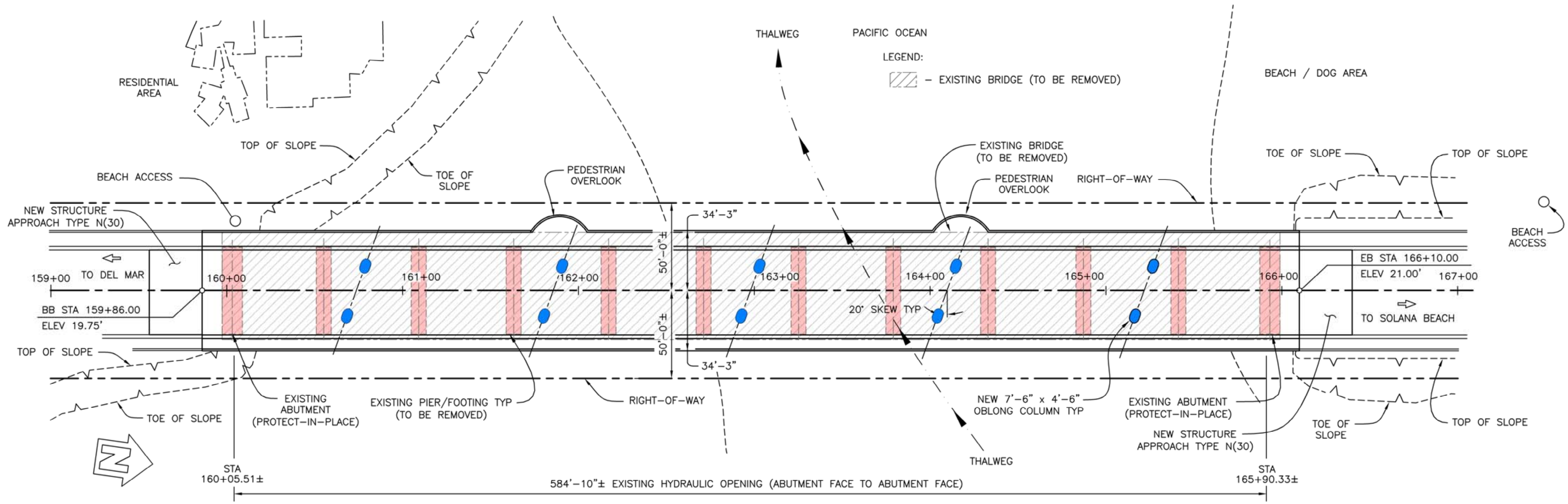
BR-09

ORIGINAL SCALE: 0 1 2 3 4 INCHES



ELEVATION

1" = 30'–0"



PLAN

1" = 30'–0"

Number of Spans	Total Permanent Obstruction Area (Sq. Ft.)
11	2,350±

Number of Spans	Total Permanent Obstruction Area (Sq. Ft.)
5	272

ALTERNATIVE 2.1: 6-SPAN VARIABLE DEPTH CAST-IN-PLACE PRESTRESSED CONCRETE BOX GIRDER BRIDGE WITH TWO COLUMNS PER PIER (BASELINE)

REVISION	DESCRIPTION	APPROVED	DATE

SCALE: AS SHOWN
ACAD FILE NO.
PROJECT NO.

DESIGNED: N. VU | DRAWN: T. BRITTAIN | CHECKED: D. BLOODWORTH

ENGINEER OF WORK | R.C.E. NO. | DATE

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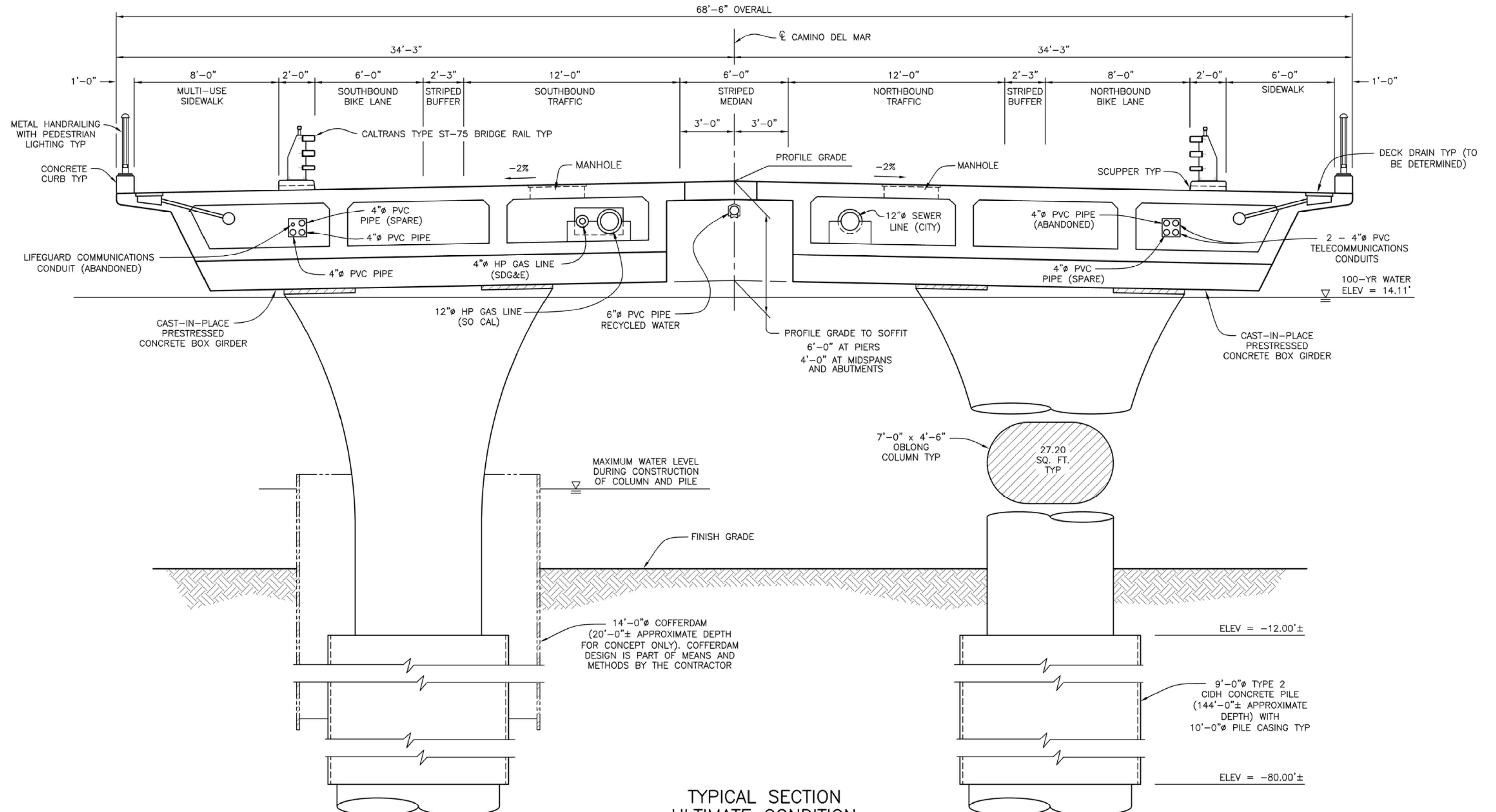
APPROVED
PUBLIC WORKS DIRECTOR | DATE

CITY OF DEL MAR
CAMINO DEL MAR BRIDGE OVER SAN DIEGUITO RIVER
REPLACEMENT ALTERNATIVE 2.1
GENERAL PLAN (1 OF 2)

BR-10

ORIGINAL SCALE: INCHES 0 1 2 3 4



TYPICAL SECTION
ULTIMATE CONDITION

3/8" = 1'-0"

ALTERNATIVE 2.1: 6-SPAN VARIABLE DEPTH CAST-IN-PLACE PRESTRESSED CONCRETE BOX GIRDER BRIDGE WITH TWO COLUMNS PER PIER (BASELINE)

REVISION	DESCRIPTION	APPROVED	DATE	SCALE: AS SHOWN	DESIGNED: N. VU	DRAWN: T. BRITTAIN	CHECKED: D. BLOODWORTH
				ACAD FILE NO.			
				PROJECT NO.	ENGINEER OF WORK	R.C.E. NO.	DATE

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DRAFT

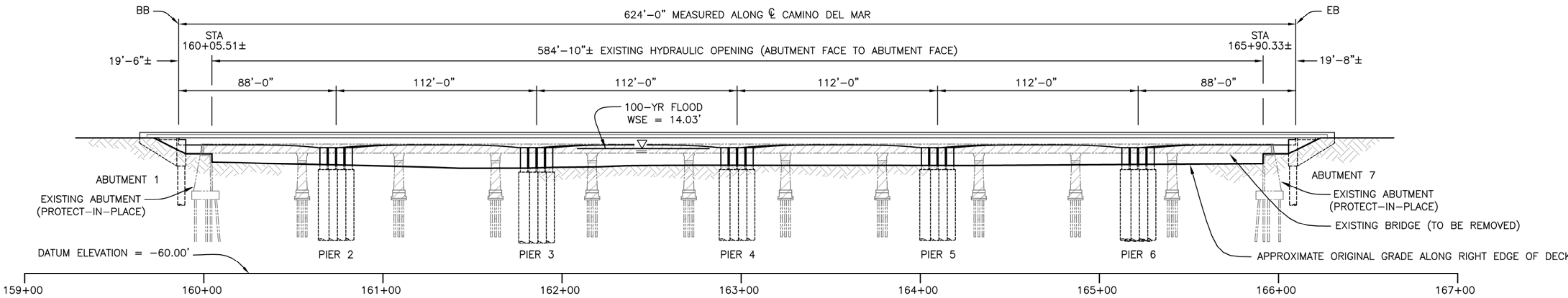
APPROVED

PUBLIC WORKS DIRECTOR — DATE

CITY OF DEL MAR
CAMINO DEL MAR BRIDGE OVER SAN DIEGUITO RIVER
REPLACEMENT ALTERNATIVE 2.1
TYPICAL SECTION

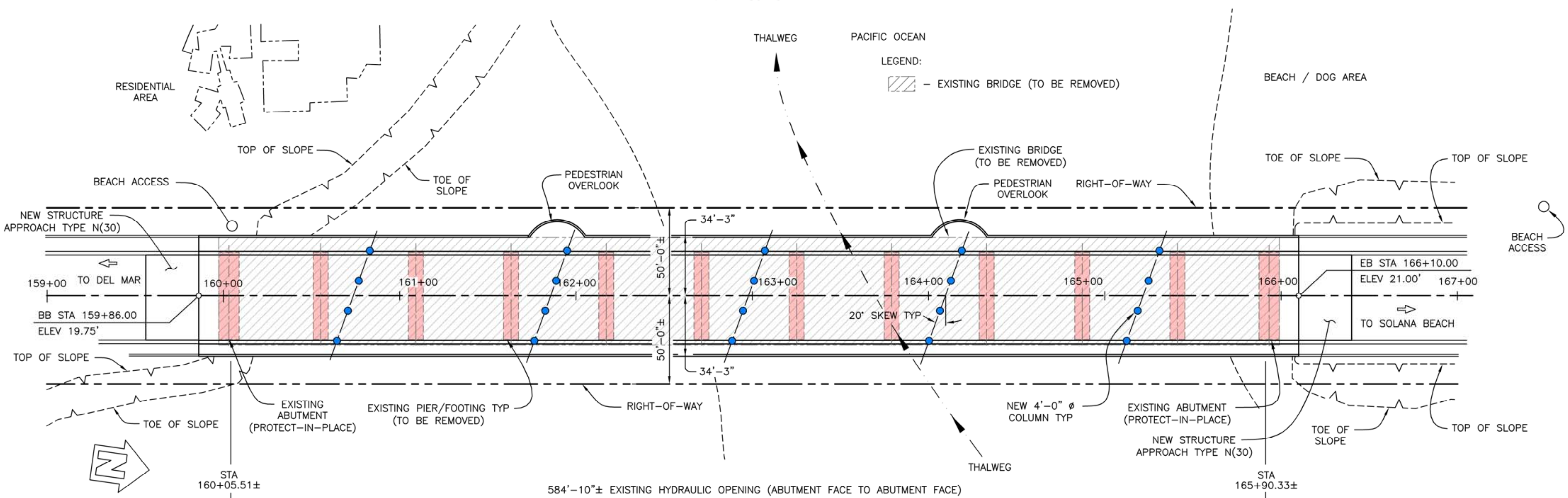
BR-11

ORIGINAL SCALE: 0 1 2 3 4 INCHES



ELEVATION

1" = 30'–0"



PLAN

1" = 30'–0"

Number of Spans	Total Permanent Obstruction Area (Sq. Ft.)
11	2,350±

Number of Spans	Total Permanent Obstruction Area (Sq. Ft.)
5	272

ALTERNATIVE 2.2: 6-SPAN VARIABLE DEPTH CAST-IN-PLACE PRESTRESSED CONCRETE BOX GIRDER BRIDGE WITH FOUR COLUMNS PER PIER

REVISION	DESCRIPTION	APPROVED	DATE	SCALE: AS SHOWN	DESIGNED: N. VU	DRAWN: T. BRITTAIN	CHECKED: D. BLOODWORTH
				ACAD FILE NO.			
				PROJECT NO.	ENGINEER OF WORK	R.C.E. NO.	DATE

KLEINFELDER
Bright people. Right Solutions.
550 WEST C STREET, SUITE 1200 SAN DIEGO, CA. 92101 (619) 831-4600

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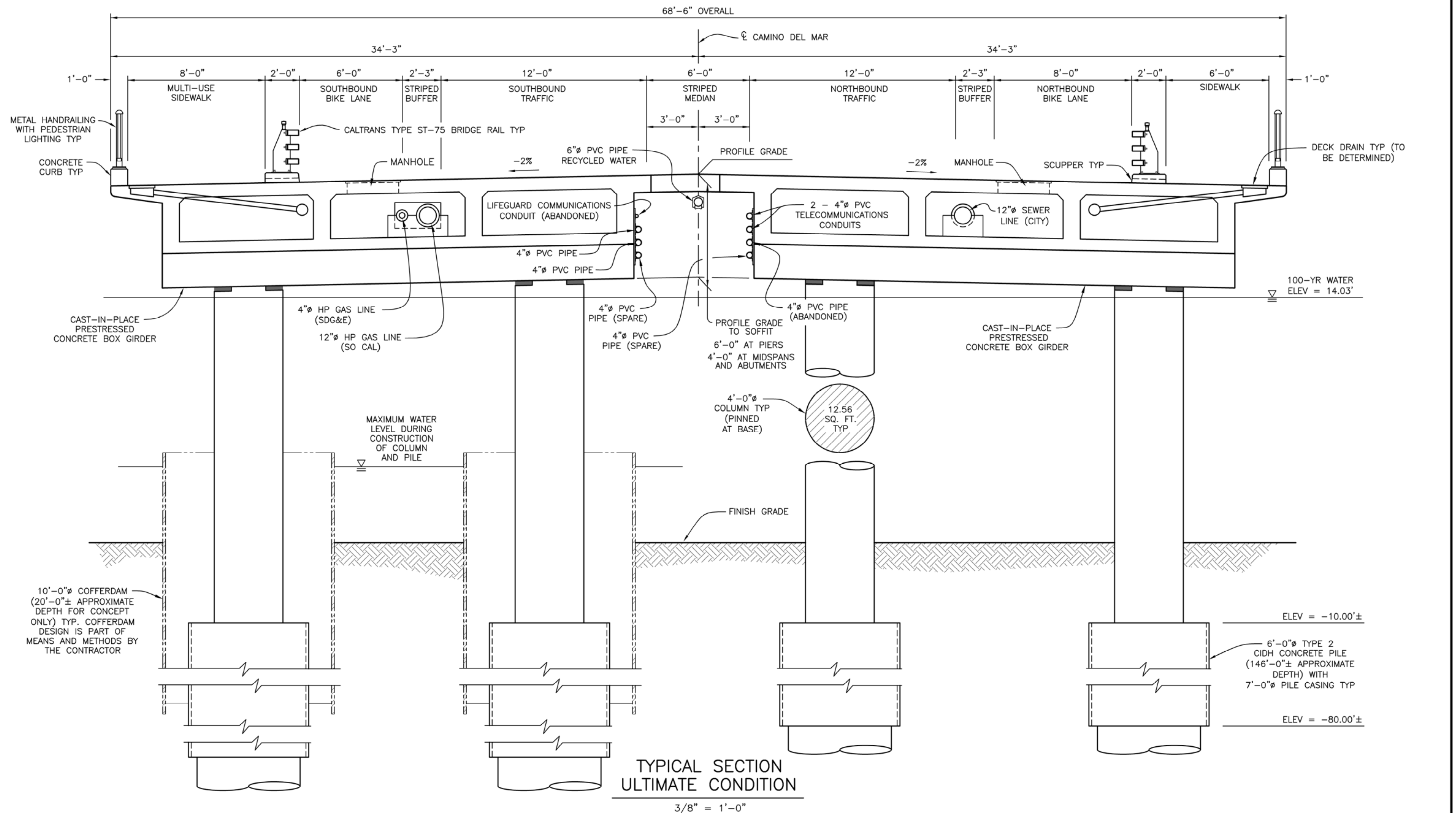
PUBLIC WORKS DIRECTOR — DATE

CITY OF DEL MAR
CAMINO DEL MAR BRIDGE OVER SAN DIEGUITO RIVER
REPLACEMENT ALTERNATIVE 2.2
GENERAL PLAN (1 OF 2)

BR-12

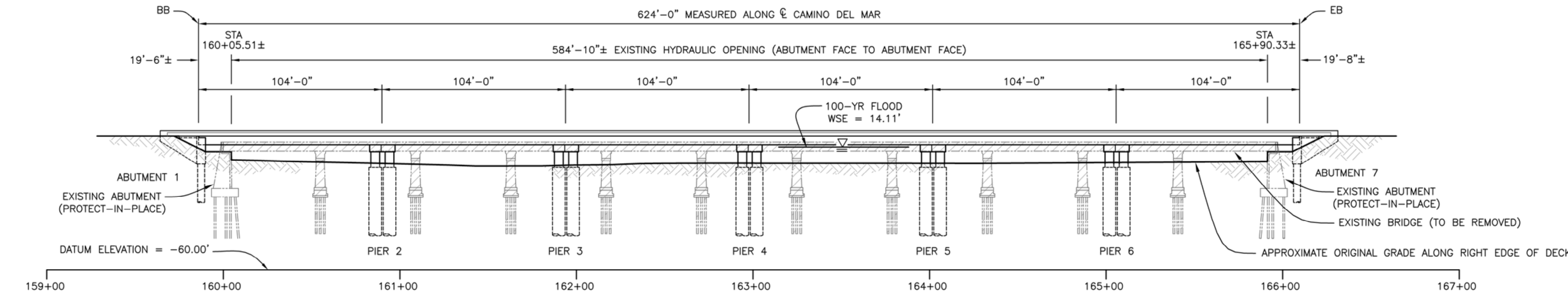
ORIGINAL SCALE: INCHES 0 1 2 3 4



TYPICAL SECTION
ULTIMATE CONDITION
3/8" = 1'-0"

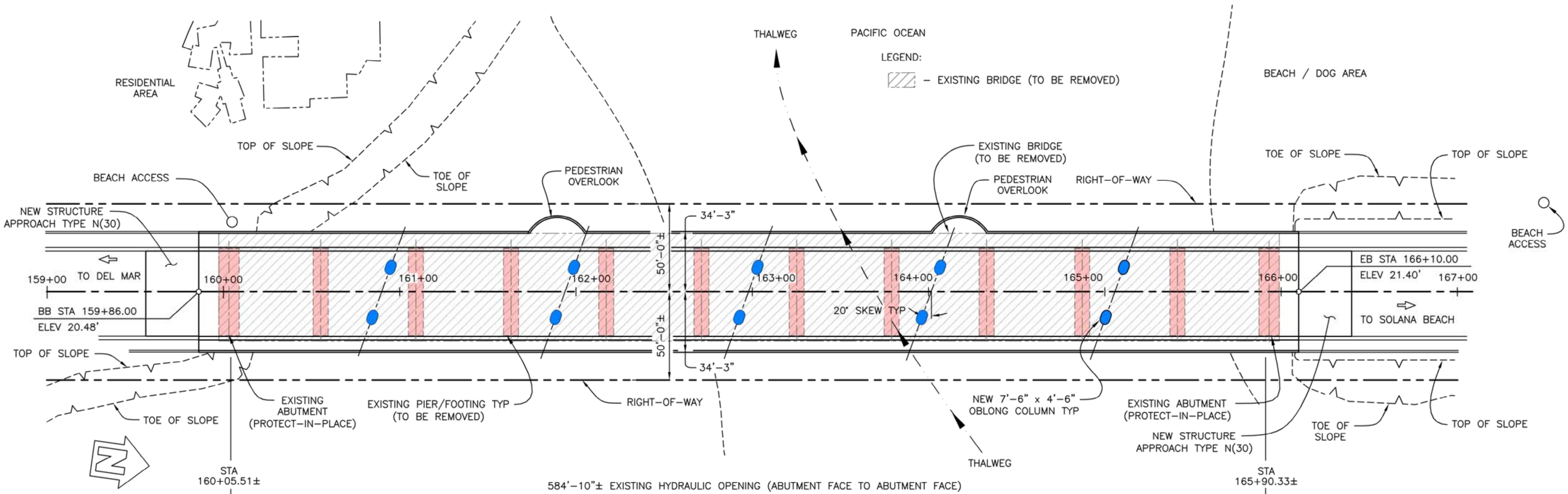
ALTERNATIVE 2.2: 6-SPAN VARIABLE DEPTH CAST-IN-PLACE PRESTRESSED CONCRETE BOX GIRDER BRIDGE WITH FOUR COLUMNS PER PIER

REVISION	DESCRIPTION	APPROVED	DATE	SCALE: AS SHOWN	DESIGNED: N. VU	DRAWN: T. BRITTAIN	CHECKED: D. BLOODWORTH	KLEINFELDER	DRAFT	APPROVED	CITY OF DEL MAR	BR-13
				ACAD FILE NO.	ENGINEER OF WORK		R.C.E. NO. / DATE	Bright people. Right Solutions. 550 WEST C STREET, SUITE 1200 SAN DIEGO, CA. 92101 (619) 831-4600		PUBLIC WORKS DIRECTOR / DATE	CAMINO DEL MAR BRIDGE OVER SAN DIEGUITO RIVER REPLACEMENT ALTERNATIVE 2.2 TYPICAL SECTION	
				PROJECT NO.								



ELEVATION

1" = 30'–0"



PLAN

1" = 30'–0"

Number of Spans	Total Permanent Obstruction Area (Sq. Ft.)
11	2,350±

Number of Spans	Total Permanent Obstruction Area (Sq. Ft.)
5	272

ALTERNATIVE 9.1: 6-SPAN PRECAST PRESTRESSED CONCRETE WIDE-FLANGE GIRDER BRIDGE WITH TWO COLUMNS PER PIER

REVISION	DESCRIPTION	APPROVED	DATE	SCALE: AS SHOWN	DESIGNED: N. VU	DRAWN: T. BRITTAIN	CHECKED: D. BLOODWORTH
				ACAD FILE NO.			
				PROJECT NO.	ENGINEER OF WORK	R.C.E. NO.	DATE

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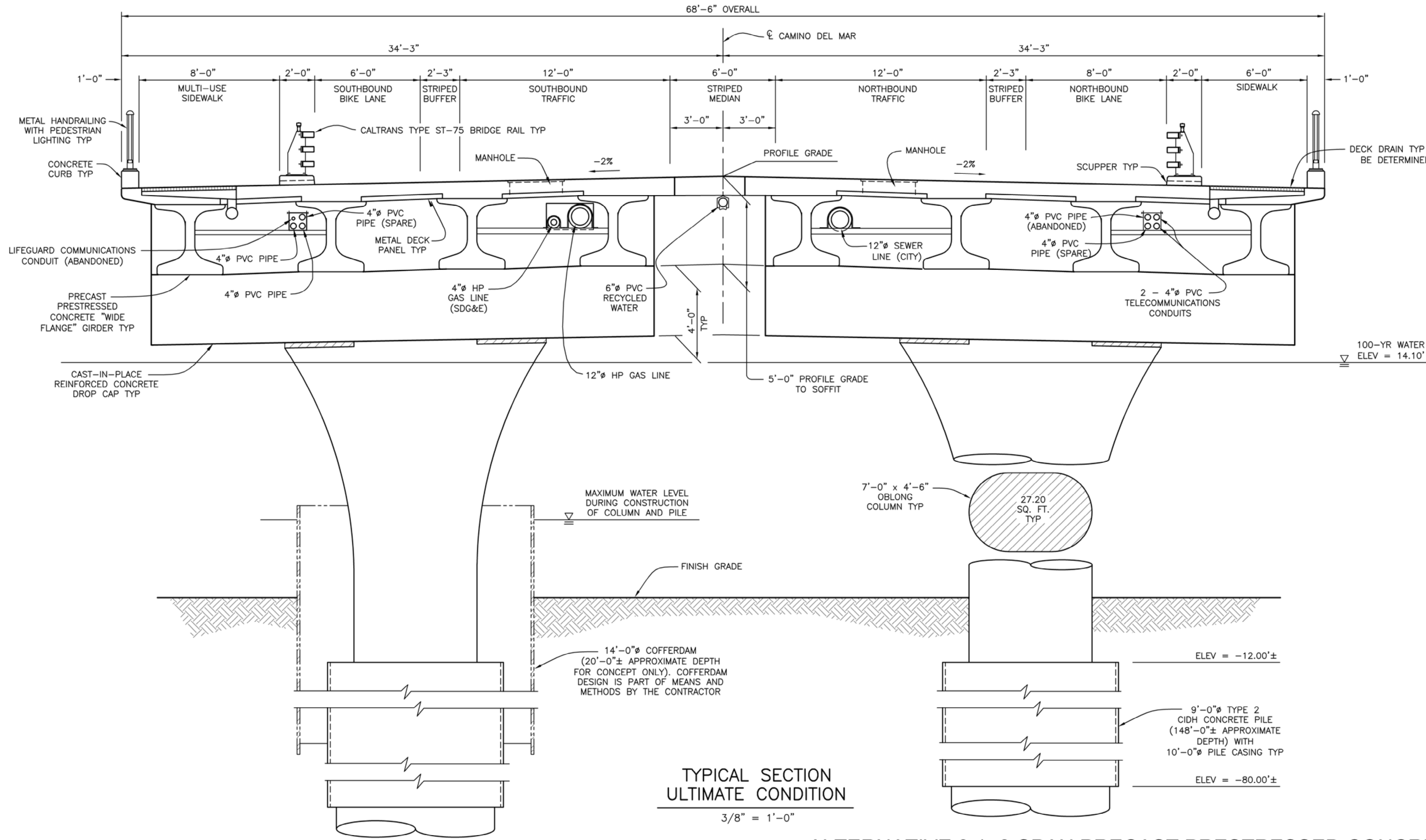
CITY OF DEL MAR

CAMINO DEL MAR BRIDGE OVER SAN DIEGUITO RIVER
REPLACEMENT ALTERNATIVE 9.1
GENERAL PLAN (1 OF 2)

BR-14

ORIGINAL SCALE: INCHES 0 1 2 3 4

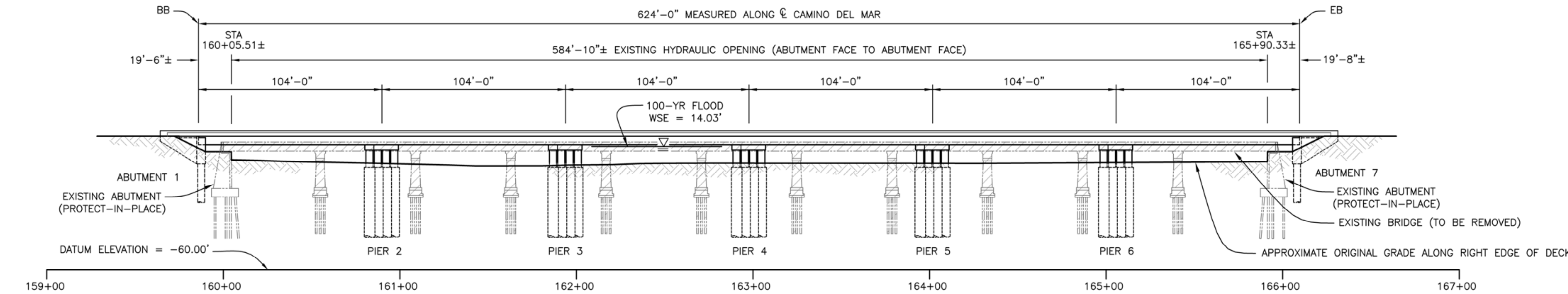


TYPICAL SECTION
ULTIMATE CONDITION
3/8" = 1'-0"

ALTERNATIVE 9.1: 6-SPAN PRECAST PRESTRESSED CONCRETE WIDE-FLANGE GIRDER BRIDGE WITH TWO COLUMNS PER PIER

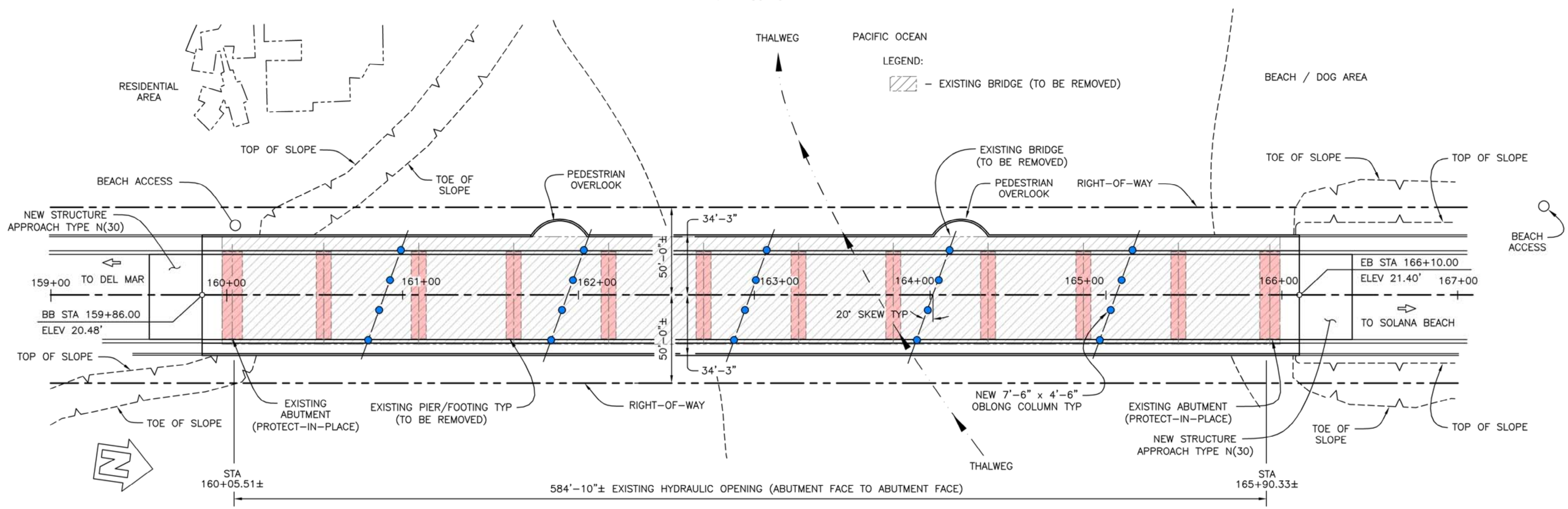
REVISION	DESCRIPTION	APPROVED	DATE	SCALE: AS SHOWN	DESIGNED: N. VU	DRAWN: T. BRITTAIN	CHECKED: D. BLOODWORTH	KLEINFELDER Bright people. Right Solutions.	DRAFT	APPROVED	CITY OF DEL MAR	BR-15
				ACAD FILE NO.							CAMINO DEL MAR BRIDGE OVER SAN DIEGUITO RIVER	
				PROJECT NO.	ENGINEER OF WORK	R.C.E. NO.	DATE	550 WEST C STREET, SUITE 1200 SAN DIEGO, CA. 92101 (619) 831-4600		PUBLIC WORKS DIRECTOR / DATE	REPLACEMENT ALTERNATIVE 9.1 GENERAL PLAN (2 OF 2)	

ORIGINAL SCALE: 0 1 2 3 4 INCHES



ELEVATION

1" = 30'–0"



PLAN

1" = 30'–0"

Number of Spans	Total Permanent Obstruction Area (Sq. Ft.)
11	2,350±

Number of Spans	Total Permanent Obstruction Area (Sq. Ft.)
5	272

ALTERNATIVE 9.2: 6-SPAN PRECAST PRESTRESSED CONCRETE WIDE-FLANGE GIRDER BRIDGE WITH FOUR COLUMNS PER PIER

REVISION	DESCRIPTION	APPROVED	DATE

SCALE: AS SHOWN
ACAD FILE NO.
PROJECT NO.

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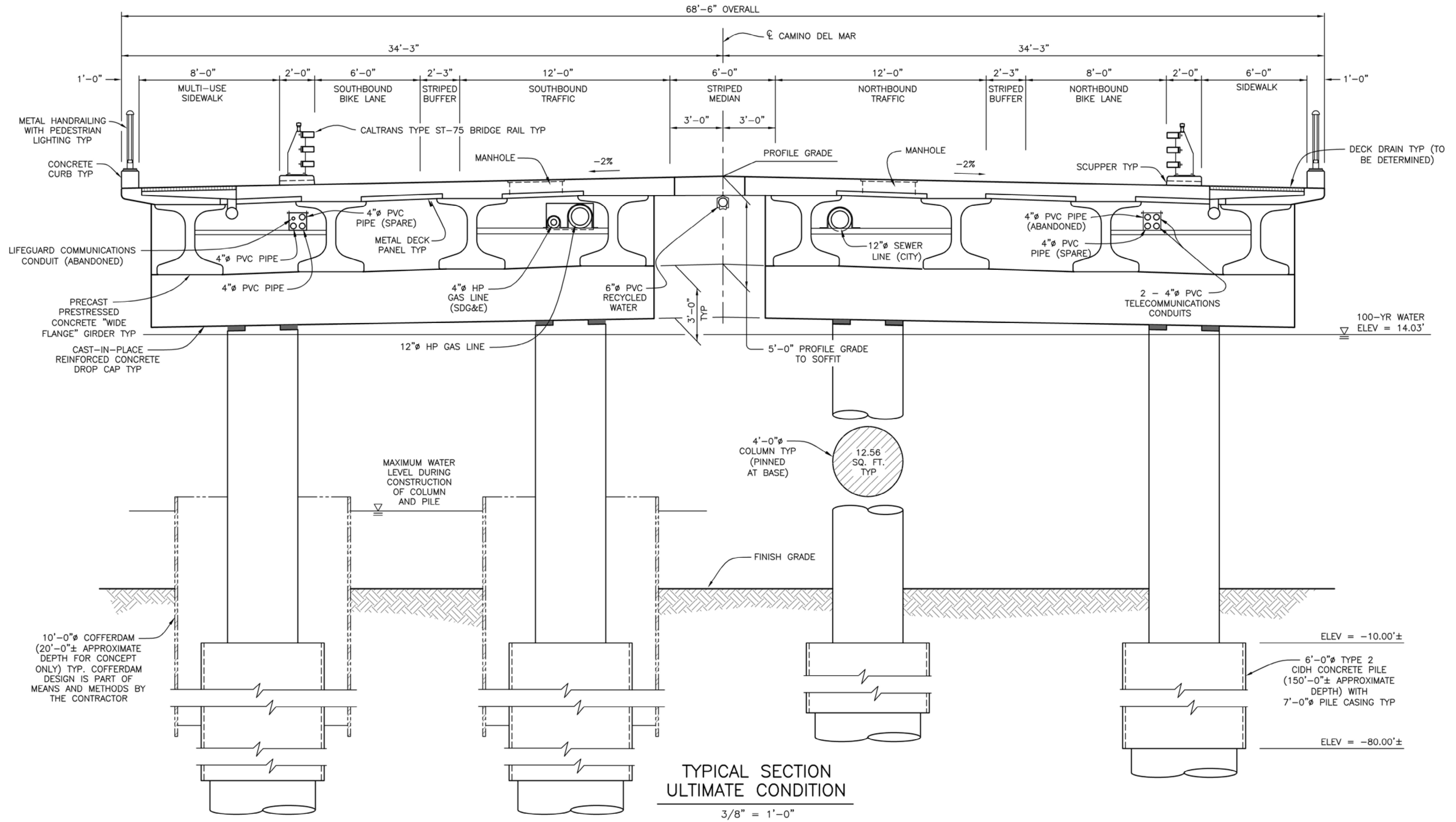
CITY OF DEL MAR
CAMINO DEL MAR BRIDGE OVER SAN DIEGUITO RIVER
REPLACEMENT ALTERNATIVE 9.2
GENERAL PLAN (1 OF 2)

BR-16

ORIGINAL SCALE: INCHES 0 1 2 3 4



TYPICAL SECTION
ULTIMATE CONDITION
3/8" = 1'–0"

ALTERNATIVE 9.2: 6-SPAN PRECAST PRESTRESSED CONCRETE WIDE-FLANGE GIRDER BRIDGE WITH FOUR COLUMNS PER PIER

REVISION	DESCRIPTION	APPROVED	DATE

SCALE: AS SHOWN
ACAD FILE NO.
PROJECT NO.

DESIGNED: N. VU
DRAWN: T. BRITTAIN
CHECKED: D. BLOODWORTH
ENGINEER OF WORK — R.C.E. NO. — DATE

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CITY OF DEL MAR
CAMINO DEL MAR BRIDGE OVER SAN DIEGUITO RIVER
REPLACEMENT ALTERNATIVE 9.2
GENERAL PLAN (2 OF 2)

BR-17

ORIGINAL SCALE: INCHES 0 1 2 3 4