Dewberry

MEMORANDUM

DATE: January 10, 2023

SUBJECT: Sea Level Rise Analysis for the Coast Highway (Hill Street) Bridge Replacement Project (Bridge No. 57C-0322) Federal Project Number BRLS-5079

Introduction

The City of Oceanside (City) proposes to replace the existing structurally deficient Coast Highway (Hill Street) Bridge (Br. No. 57C-0322) over the San Luis Rey River (proposed project). The proposed project is funded by the federal-aid Highway Bridge Program (HBP) administered by the Federal Highway Administration (FHWA) through the California Department of Transportation (Caltrans) Local Assistance. The replacement bridge would meet current applicable City, American Association of State Highway and Transportation Officials (AASHTO), and Caltrans design standards.

This document constitutes the analysis of the potential impacts to sea level rise (SLR) on the proposed project. Caltrans's SLR risk assessment decision was made to make sure that the proposed project is consistent with a number of policies and guidance which address the threat of SLR on infrastructure projects. The policies and guidance discussed in this analysis include the 2018 California Coastal Commission Policy Sea Level Rise Policy Guidance, 2018 California Ocean Protection Council (OPC) and California Natural Resources Agency SLR Guidance (2018 OPC Guidance), National Oceanic and Atmospheric Administration (NOAA) predictions of sea level rise, and Section 30253 of the California Coastal Act. This analysis also includes adaptation strategies to be utilized should this transportation link be threatened by an extreme flooding event. Lastly, the concluding decision according to the above referenced policies and guidance is that this proposed project would not be affected by future SLR based on the project design.

Project Location

The proposed project is located approximately 0.3 miles south of Harbor Drive, immediately west of and parallel to Interstate 5 (I-5), in the City of Oceanside, San Diego County, California (Attachment A, Figures 1 and 2). The Townsite neighborhood is located immediately west of, and parallel to, I-5. The Eastside Capistrano neighborhood is located immediately east of I-5 at the proposed project site. The proposed project is located within the Coastal Zone.

Project Location and Existing Conditions

Coast Highway (Hill Street) (referred to as Coast Highway in this memorandum) at the bridge is classified as a "secondary collector" and accommodates an average daily traffic (ADT) of approximately 10,100 vehicles a day and a level of service (LOS) rating "D" (Coast Highway Bridge Replacement Transportation Analysis, 2017). The existing Coast Highway (Hill Street) Bridge was constructed in 1929. It is a 950-foot-long five-span bridge with a cast-in-place concrete deck. The approach spans (Spans 1 and 5) are rolled steel girders. Spans 2, 3, and 4 are each 268-foot-long steel truss spans. The truss spans have a total depth of approximately 40 feet, constructed of dual simple span riveted steel trusses. Piers 3 and 4 are located in the main river supported on piles. Piers 2 and 5, located near the edges of the river are supported on spread footings. The existing abutments are seat type concrete abutments on spread

footings. The bridge was widened to the east in 1952. The widening was removed in 1971 when the I-5 freeway was built, and the bridge was restored to its original configuration. The bridge is a total of approximately 49 feet wide, with a curb-to-curb width of approximately 40 feet providing two 12-foot traffic lanes plus 8-foot shoulders. It has a raised sidewalk along the west edge of deck (Figures 3, 4, and 5). The San Luis Rey River Trail runs along the southern riverbank. It provides recreational and commuter uses for bicyclists and pedestrians (Figure 6).



Figure 3. Existing bridge facing south



Figure 4. Existing bridge facing north



Figure 5. I-5 bridge (left) and existing bridge (right) from river level



Figure 6. San Luis Rey River Trail under existing I-5 and Coast Highway (Hill Street) bridges

Project Purpose and Need

The proposed project is needed because the existing bridge was built in 1929 and is in poor structural condition. At 93 years old, the bridge is past its useful service life. The bridge is a "Fracture Critical" steel truss because it is structurally non-redundant and has steel members loaded in tension (if one of these members fractured, it would cause a collapse of a span).

The purpose of this project is to remove the deteriorated, structurally deficient, fracture critical and seismically vulnerable, existing structure and replace it with a new bridge designed to current structural and geometric standards while minimizing adverse impacts on the San Luis Rey River and the surrounding riparian area.

Project Description

The Coast Highway runs from southeast to northwest at approximately a 30-degree angle to true north. For purposes of this analysis, the Coast Highway is assumed to run north to south, and the San Luis Rey River flows from east to west. The proposed bridge would include two 12-foot-wide travel lanes and two 8-foot-wide shoulders for a curb-to-curb width of 40 feet, the same as the existing bridge. A single 8-foot-wide sidewalk is proposed for the west side of the proposed bridge. The foundations for the proposed bridge would be supported by Cast-In-Drilled-Hole (CIDH) piles that would be up to 144 inches in diameter and up to 200 feet deep. The proposed bridge would be a cast-in-place concrete bridge. The piers and abutments would be constructed on site by installing rebar, placing forms, and pouring concrete. Once the piers

and abutments are complete, falsework would be constructed to support the wet concrete for the superstructure. The falsework could be removed before the existing bridge is demolished (Attachment A, Figure 7).

Staging areas would be located at the Oceanside Harbor Parking Lot number 1 on the north side of the San Luis Rey River and within the cloverleaf of the I-5 to the State Route (SR) 76 offramp (currently not in use) and the existing paved path on the south side of the San Luis Rey River. Access to the proposed project site south of the San Luis Rey River would be from SR 76 east of the proposed project site. Access to the proposed project site north of the San Luis Rey River would be from Monterey Drive and Riverside Drive.

Construction is currently scheduled to start in 2025 and take approximately 24 to 30 months to complete.

Sea Level Rise (SLR) Screening Criteria

Projects that are within the California Coastal Zone are required to conduct a SLR analysis. In order to analyze the level of impacts and risk to SLR projections for the proposed project, the following screening criteria were used:

- Project design life of 75+ years
- Redundancy/alternative routes
- Anticipated Travel Delays
- Goods movement/interstate commerce
- Evacuations/emergencies
- Traveler safety, in delaying the project to incorporate SLR design
- Expenditure of public funds
- Scope of project
- Interconnectivity issues with local streets and roads
- Environmental constraints, i.e., increase in project footprint into environmentally sensitive areas

Proposed Project Design and SLR Scenarios Conducted

The proposed project elevation for the bottom of the bridge is 49 feet. The proposed bridge has been designed to accommodate the 100-year storm event plus the Extreme Risk Aversion H++ scenario with a freeboard of approximately 16 feet, in order to remain open to provide access and emergency routes away from flood areas. The proposed project has also been designed to match with adjacent projects such as the I-5 Bridge over San Luis Rey River, and North Pacific Street Bridge over San Luis Rey River. This proposed project design would comply with applicable City, American Association of State Highway and Transportation Officials (AASHTO), FHWA, and Caltrans design standards. The proposed project would not impact site stability nor create hazardous waste.

The potential impact of local SLR associated with global climate change was considered in the design of the proposed project. The design considered federal consistency review and coastal development permit submittals for the proposed project. This includes an analysis of the design in relation to projected future changes in sea level rise to ensure the proposed project is designed to eliminate or minimize, to the maximum extent feasible, hazards associated with anticipated sea level rise over the expected design life of the structure.

A Hydraulic Report was prepared for the proposed project (Tory R. Walker Engineering Inc., 2021) and used two proposed HEC-RAS models, one without the projected SLR and one with the projected SLR. For the HEC-RAS model with SLR, raising the downstream boundary water surface elevation by 7 feet considering SLR had no impact on the water surface elevations in the project reach of the river channel for the 100-year design flood because the flow passes through critical depth at the ocean outlet. The Hydraulic Report concluded that SLR is not expected to have any meaningful impacts on the water surface elevation and general hydraulics surrounding the proposed project for the 100-year design flood.

Adaption Strategies to SLR

Based on this analysis, the proposed project would not be impacted by SLR (see discussion below). The proposed project would remain open to serve the communities as a route away from flooding. In case of an extreme event (above the Extreme Risk Aversion H++ scenario), the City would implement different strategies such as deploying water pumps, removing existing sediment under the existing bridge at San Luis Rey River, and temporary road closures to minimize impacts during extreme events. In addition, alternative routes exist so that traffic could be rerouted during periods of minor to moderate inundation. These strategies are considered appropriate for the risk level identified.

2018 California Ocean Protection Council (OPC) SLR Guidance

This analysis utilizes the 2018 State of California Sea Level Rise Guidance prepared by the California Ocean Protection Council (OPC) and the California Natural Resources Agency (2018 OPC Guidance) probabilistic approach to determine the probability of inundation for the proposed project. Using Table 34 (p78) of the OPC guidelines which projects SLR in feet in San Diego and a proposed project design life of 75 years, the proposed project falls under the year 2100 measurements. The California Coastal Commission (CCC) recommends that the Extreme Risk Aversion H++ scenario should be used for projects with little to no adaptive capacity, which may include highways.

The proposed bridge is a local highway. The bottom elevation of the proposed Coast Highway Bridge is very high, set at approximately 49 feet above sea level; hence, vulnerability to rising sea level is relatively low. Two scenarios were determined to be appropriate. The first scenario is the 1 in 200 chance scenario (0.5% probability) Medium-High Risk Aversion with high emissions. The second scenario is the Extreme Risk Aversion H++ scenario. Using Table 34 (Attachment A, Figure 8) to identify SLR under these two scenarios, the Medium-High Risk Aversion scenario SLR inundation would not exceed 7 feet by year 2100, while the Extreme Risk Aversion H++ scenario SLR inundation would not exceed 10.2 feet by year 2100.

Table 1 provides the depth below bottom chord (freeboard) for the proposed bridge under the mean higher high-water (MHHW) level, 100-year fluvial storm level, MHHW level plus SLR, and 100-year fluvial storm plus SLR for both the Medium-High Risk Aversion with high emissions and Extreme Risk Aversion H++ scenarios. The proposed project would accommodate projected SLR of either 7 feet or 10.2 feet by year 2100 and would not be affected by SLR during its life cycle (Attachment A, Figure 9).

Table 1. Water Elevations and Freeboard

	Elevation (ft) [NAVD 88]	Depth Below Bottom Chord (Freeboard) (ft)
Bottom Chord	49.00	-
MHHW	5.17	43.83
100-Year Storm	22.65	26.35
1. MHHW + 7.0 ft SLR	12.17	36.83
2. MHHW + 10.2 ft SLR	15.37	33.63
3. 100-Year + 7.0 ft SLR	29.65	19.35
4. 100-Year + 10.2 ft SLR	32.85	16.15

National Oceanic and Atmospheric Administration (NOAA) Predictions of SLR

The 2022 NOAA current sea level viewer was used to identify the impact that the OPC guidance of 7 feet SLR has on the project under the Medium-High Risk Aversion with high emissions scenario. Figure 10 shows that 7 feet of SLR would affect the San Luis Rey River and banks within the proposed project area. The proposed project would have approximately 19 feet of freeboard under the 100-year fluvial storm plus SLR scenario. The proposed project would span the inundated area shown in Figures 9 and 10. Therefore, the proposed bridge would not experience water inundation from SLR during its life cycle.



Figure 10. Sea Level Rise at 7 feet (Source: NOAA 2022)

The 2023 NOAA current sea level viewer was used to identify the impact that the OPC guidance of 10.2 feet SLR has on the project under the Extreme Risk Aversion H++ scenario. Figure 11 shows that 10 feet of SLR would affect the San Luis Rey River and banks within the proposed

project area. In addition, low lying areas west and east of the proposed project could be vulnerable. The proposed project would have approximately 16 feet of freeboard under the 100-year fluvial storm plus SLR scenario. The proposed project would span the inundated area shown in Figures 9 and 11. Therefore, the proposed bridge would not experience water inundation from SLR during its life cycle.

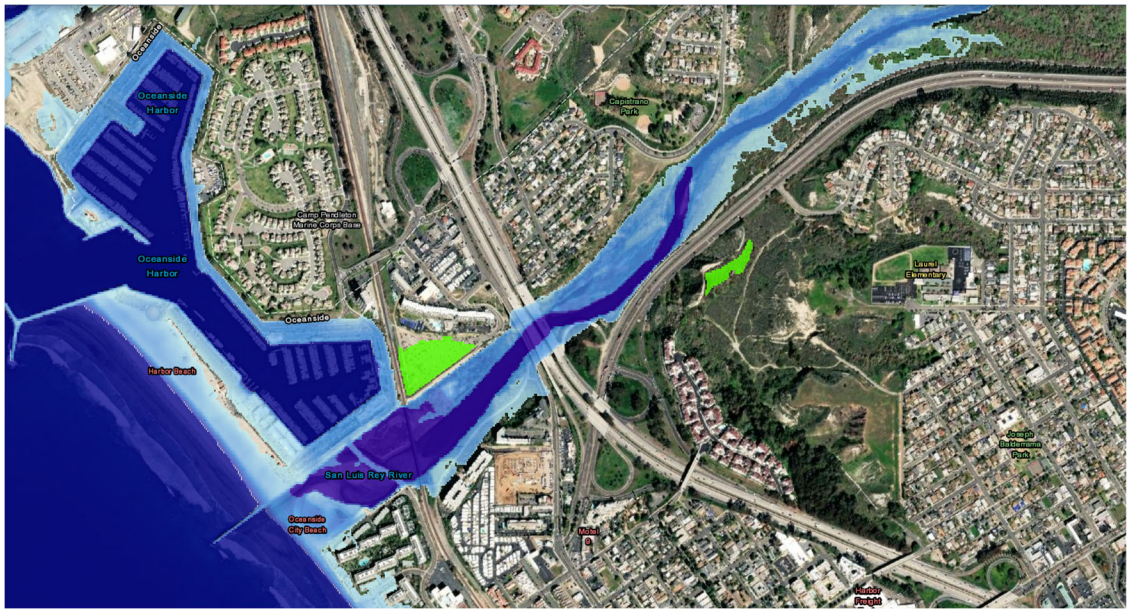


Figure 11. Sea Level Rise at 10 feet (Source: NOAA 2023)

Conclusion

As stated above, Coast Highway is a two-lane secondary collector road which becomes a major arterial south of the proposed project site, linking the communities on either side of the San Luis Rey River. The proposed project would have a minimum elevation for the bottom of the bridge of 49 feet. According to the 2018 OPC Guidance and NOAA Sea Level Views for SLR of 7 feet, the proposed project would not be affected by SLR. In addition, under the Extreme Risk Aversion H++ scenario with a SLR of 10.2 feet, the bridge would continue to have sufficient freeboard. The proposed bridge has been designed to accommodate the 100-year storm event plus the Extreme Risk Aversion H++ scenario with a freeboard of approximately 16 feet.

In case of an extreme event, the City would implement the appropriate adaption strategies, such as deploying water pumps, removing existing sediment under the existing bridge at San Luis Rey River, and temporary road closures with alternative routes. However, the proposed project design would serve the communities by remaining open in an extreme event in order to provide access and emergency routes away from flood areas. The proposed project has been designed to match with adjacent projects such as the I-5 Bridge over San Luis Rey River, and North Pacific Street Bridge over San Luis Rey River.

The proposed project is consistent with Coastal Act Section 30253(a) and (b). The proposed project would minimize risks to life and property in areas of high geologic, flood, and fire hazards by remaining open during an extreme event in order to serve the communities and

provide access away from flooded areas. In addition, the proposed project would assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs.

Given the above information, the proposed project would not be impacted by SLR during its life cycle.

References

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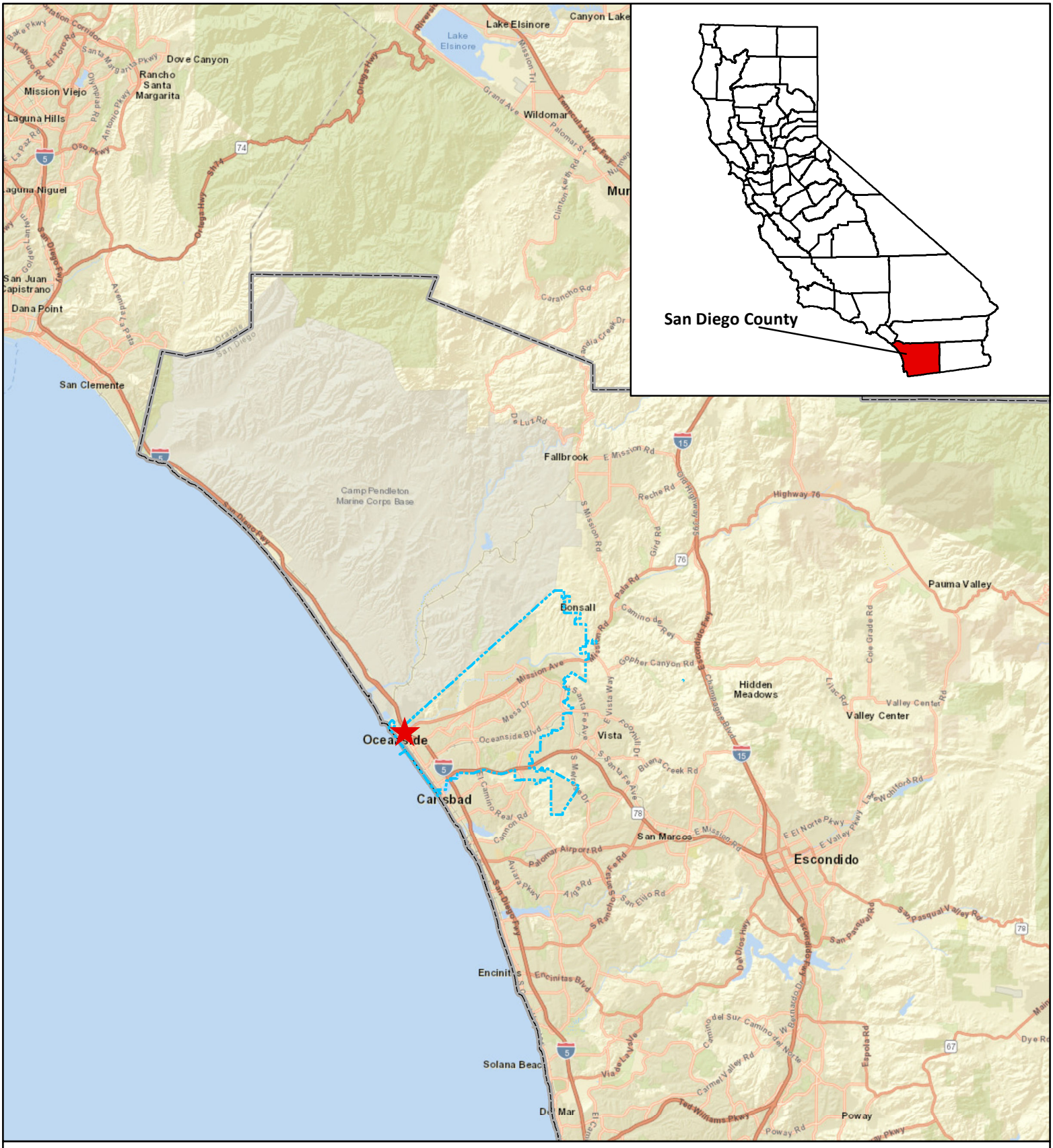
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Tory R. Walker Engineering, Inc. 2021. Preliminary Hydraulic Report for Coast Highway Bridge over San Luis Rey River. May 2021.

Attachment A

Figures

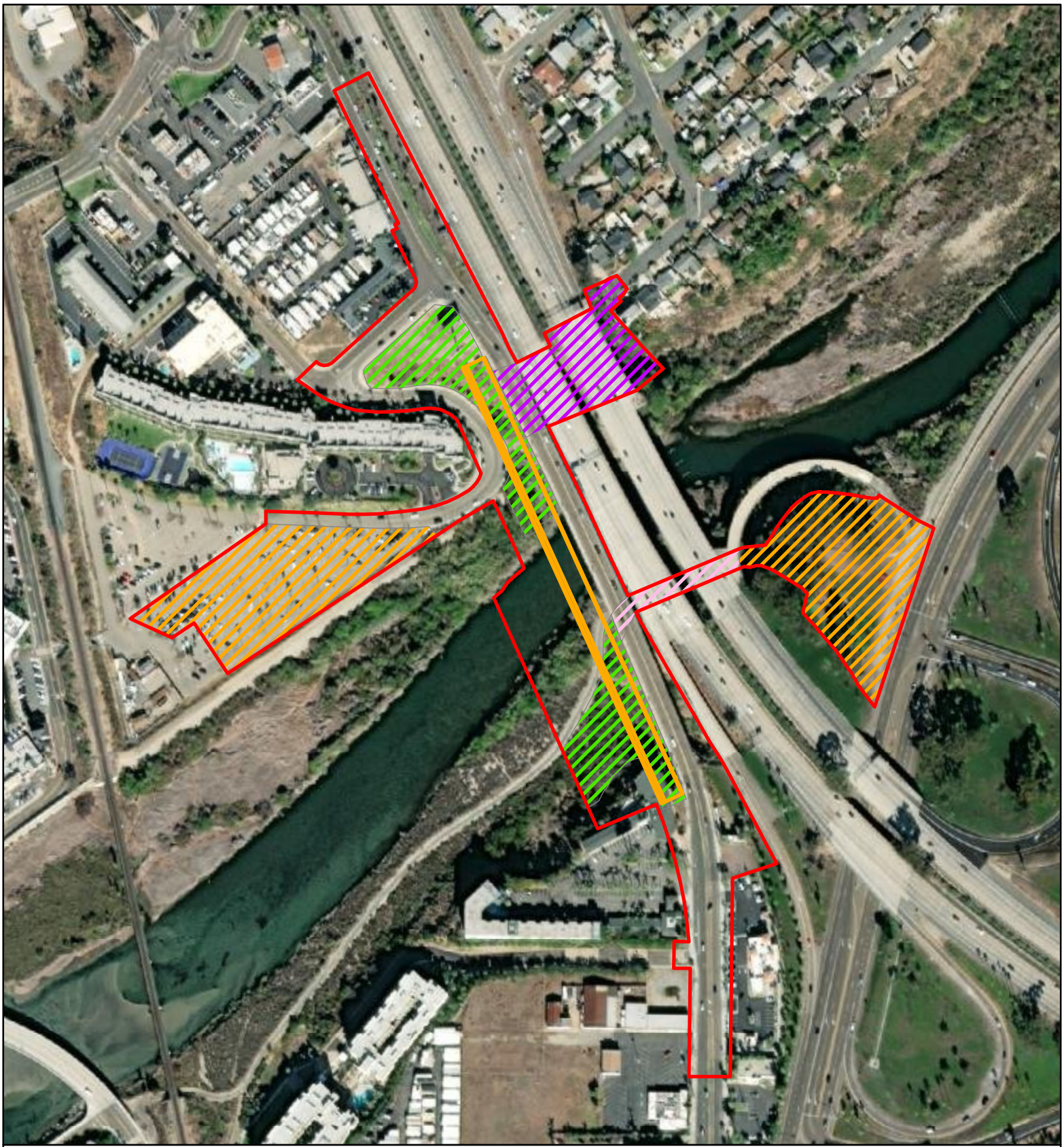


Source: ESRI Online Basemap, Aerial Imagery, San Diego County Coordinate System NAD 83 State Plane California VI FIPS 0406 Feet; Notes: This map was created for informational and display purposes only

Coast Highway (Hill Street) over San Luis Rey River Bridge (57C-0322) Replacement Project
City of Oceanside, California

Regional Location

Figure 1



Proposed Project Limits

Proposed Bridge

Staging Areas

Temporary Access

Temporary Construction Access and Staging Area

Temporary Construction Area

Temporary Staging Area

N

0 80 160 320 Feet

Source: ESRI Online Basemap, Aerial Imagery, San Diego County Coordinate System NAD 83 State Plane California VI FIPS 0406 Feet; Notes: This map was created for informational and display purposes only

Coast Highway (Hill Street) over San Luis Rey River Bridge (57C-0322) Replacement Project
City of Oceanside, California

Project Footprint

Figure 2

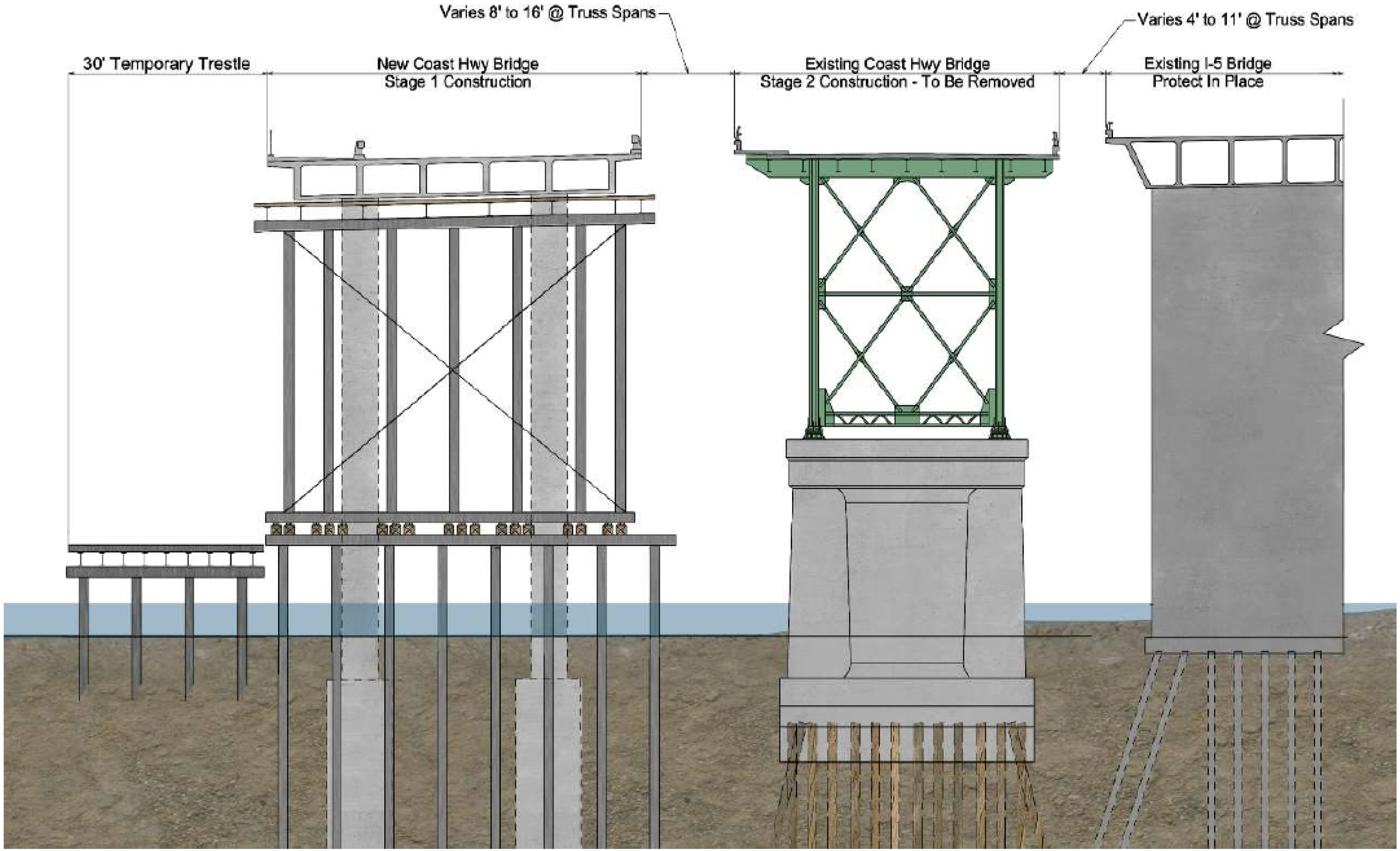


Figure 7. Temporary Trestle, Proposed Bridge, Existing Bridge, and Existing I-5 Bridge

Figure 8. Table 34 of the 2018 OPC Guidance

TABLE 34: Projected Sea-Level Rise (in feet) for San Diego

Probabilistic projections for the height of sea-level rise shown below, along with the H++ scenario (depicted in blue in the far right column), as seen in the Rising Seas Report. The H++ projection is a single scenario and does not have an associated likelihood of occurrence as do the probabilistic projections. Probabilistic projections are with respect to a baseline of the year 2000, or more specifically the average relative sea level over 1991 - 2009. High emissions represents RCP 8.5; low emissions represents RCP 2.6. ***Recommended projections for use in low, medium-high and extreme risk aversion decisions are outlined in blue boxes below.***

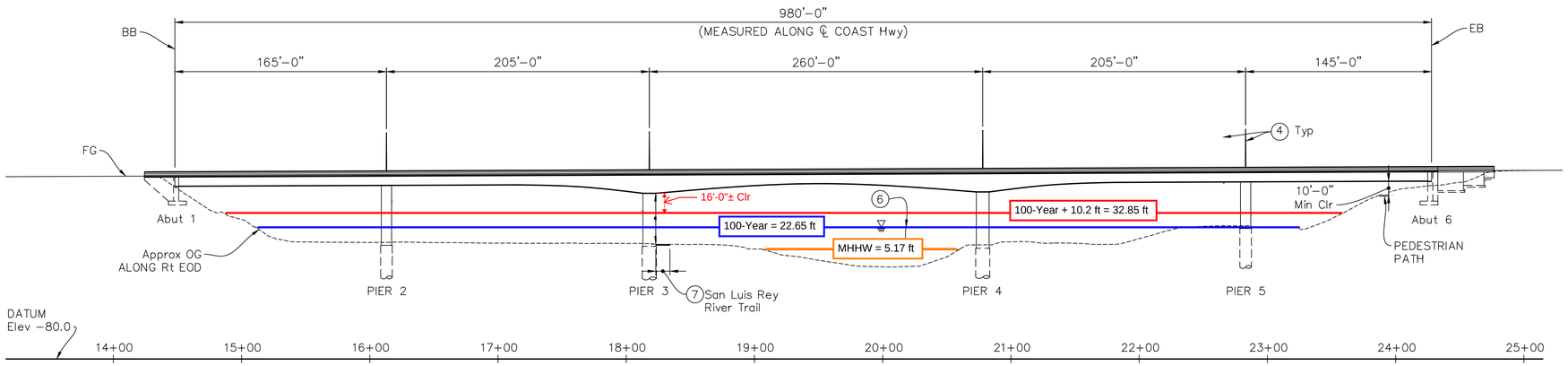
		Probabilistic Projections (in feet) (based on Kopp et al. 2014)					*H++ scenario (Sweet et al. 2017) *Single scenario*
		MEDIAN	**LIKELY RANGE**		**1-IN-20 CHANCE**	**1-IN-200 CHANCE**	
		50% probability sea-level rise meets or exceeds...	*66% probability sea-level rise is between...*		*5% probability sea-level rise meets or exceeds...*	*0.5% probability sea-level rise meets or exceeds...*	
				Low Risk Aversion		**Medium - High Risk Aversion**	**Extreme Risk Aversion**
High emissions	2030		0.4 -	0.6	0.7	0.9	1.1
	2040	0.7	0.5 -	0.9	1.0	1.3	1.8
	2050	0.9	0.7 -	1.2	1.4	2.0	2.8
Low emissions	2060	1.0	0.7 -	1.3	1.7	2.5	
High emissions	2060	1.2	0.9 -	1.6	1.9	2.7	3.9
Low emissions	2070	1.2	0.9 -	1.6	2.0	3.1	
High emissions	2070	1.5	1.1 -	2.0	2.5	3.6	5.2
Low emissions	2080	1.4	1.0 -	1.9	2.4	3.9	
High emissions	2080	1.9	1.3 -	2.5	3.1	4.6	6.7
Low emissions	2090	1.6	1.0 -	2.2	2.9	4.8	
High emissions	2090	2.2	1.6 -	3.0	3.7	5.7	8.3
Low emissions	2100	1.7	1.1 -	2.5	3.3	5.8	
High emissions	2100	2.6	1.8 -	3.6	4.5	7.0	10.2
Low emissions	2110*	1.9	1.3 -	2.7	3.5	6.4	
High emissions	2110*	2.8	2.0 -	3.7	4.7	7.5	12.0
Low emissions	2120	2.0	1.3 -	3.0	4.1	7.6	
High emissions	2120	3.1	2.3 -	4.3	5.5	8.8	14.3
Low emissions	2130	2.2	1.4 -	3.3	4.6	8.6	
High emissions	2130	3.5	2.6 -	4.9	6.3	10.2	16.6
Low emissions	2140	2.4	1.5 -	3.6	5.1	9.8	
High emissions	2140	3.9	2.8 -	5.4	7.1	11.7	19.2
Low emissions	2150	2.5	1.5 -	3.9	5.7	11.1	
High emissions	2150	4.3	3.0 -	6.1	7.9	13.3	22.0

**Most of the available climate model experiments do not extend beyond 2100. The resulting reduction in model availability causes a small dip in projections between 2100 and 2110, as well as a shift in uncertainty estimates (see Kopp et al. 2014). Use of 2110 projections should be done with caution and with acknowledgement of increased uncertainty around these projections.*



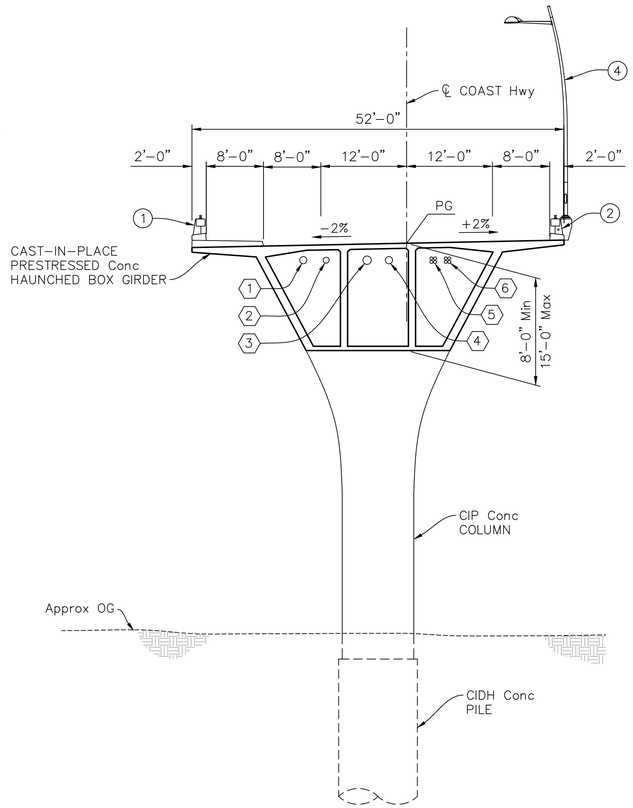
PROFILE GRADE

NO SCALE



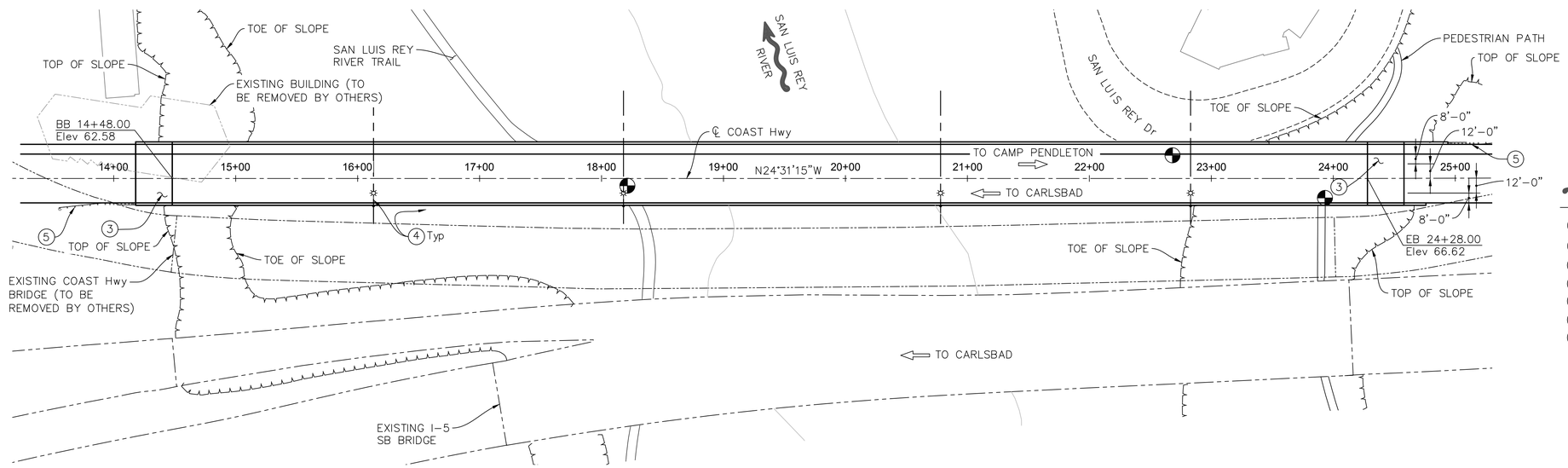
ELEVATION

1" = 50'–0"



TYPICAL SECTION

1" = 10'–0"



PLAN

1" = 50'–0"

DATE OF ESTIMATE: = 11/05/2019
STR. DEPTH: = VARIES
LENGTH: = 980'–0"
WIDTH = 52'–0"
AREA: = 50,960 SF
COST/SF INCLUDING
10% MOBILIZATION
& 25% CONTINGENCIES = _____

TOTAL COST: = _____

LEGEND:

- Direction of traffic
- Direction of flow
- Existing structure
- (1) Concrete Barrier Type 85 SW (Mod)
- (2) Concrete Barrier Type 85
- (3) Structure Approach Slab Type N(30)
- (4) Bridge Lighting
- (5) MGS
- (6) MHHW=5.17, 100yr WSE=22.65
- (7) Falsework opening to be provided during construction

UTILITIES:

- (1) 12" Water
- (2) 10" Water
- (3) 14" Sewer
- (4) 12" Gas
- (5) 4–5" Conduits for Electrical
- (6) 4–4" Conduits for Telecom

Figure 9. Proposed Project in Relation to San Luis Rey Water Elevations

moffatt & nichol
1660 Hotel Circle North, Ste. 500
San Diego, Ca. 92108

Designed by: A. FORD	Date: 11/05/19
Drawn by: I. MARTIN	Date: 11/05/19
Reviewed by: P. SCHACHT	Date:

WDID NO. PROJECT FILE NO.

SHEET | CITY OF OCEANSIDE ENGINEERING DIVISION | SHEETS

PLANNING STUDY FOR

COAST HIGHWAY BRIDGE OVER SAN LUIS REY RIVER

ALTERNATIVE 2
GENERAL PLAN

ENGINEER OF WORK
Sign:
NAME: DATE:

Checked By:
Approval Date:

PLAN NUMBER
S-101
Rxx-xxxxx

Q:\SD_8827 N Coast Highway Bridge_CADD_Active_Sheets\Structures\88275-s-101-b-h.dwg; Apr 02, 2021 - 3:12pm; imartin