Orange County Transportation Authority

Coastal Rail Resiliency Study

Initial Assessment Technical Memorandum

Cities of Dana Point and San Clemente, CA

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Executive Summary

The Orange County Transportation Authority (OCTA) embarked on the Coastal Rail Resiliency Study (CRRS) in fall of 2023 with the goal of developing alternative concepts for maintaining railroad operations within the existing railroad corridor for the next 30 years. Concurrently, multiple inland bluff failures and coastal erosion events created state of emergencies in which operators such as Metrolink, Amtrak and BNSF had to cease operations. Acknowledging that these shutdowns in operations are causing financial burdens on taxpayers, OCTA is expediting an Initial Assessment of this coastal railroad corridor from Mile Post 200.0 to MP 207.4, which will be an appendix to the overall CRRS document.

The Goals and Objectives of the Initial Assessment are to conduct an existing conditions assessment of the railroad corridor by identifying areas that are susceptible to risk from bluff failures and coastal erosion within the next two years, resulting in a shutdown of railroad operations. This will build upon previous studies that OCTA, the County, and the Cities of San Clemente and Dana Point have conducted over the last several years. Finally, it will identify potential solutions and strategies along with next steps that OCTA and other stakeholders could take to keep the tracks operational. The potential solutions and strategies are documented under the Recommendations and are categorized in three areas by degree of concern: Potential Reinforcement Areas, Potential Monitoring Areas, and Potential Emergent Areas. All three of these categories will require further engineering and environmental studies to determine preferred remediation solution with a defined scope, schedule and budget that would be integrated into an Implementation Plan.

Providing potential solutions is only a portion of the overall plan needed to address the needs along this coastal railroad corridor. The next steps address Governance challenges by revealing the need for better definition of roles and responsibilities of key stakeholders. The lead agency must develop an Implementation Plan that will be informed by a clear strategy on how to navigate the Regulatory Permitting process. Future emergencies are unavoidable but the response can be enhanced by the development of procedures which incorporate lessons learned from past emergencies. Given the nature of the bluff failures and coastal erosion, emergency response time can be expedited by stockpiling of Materials typically used in an emergency situation. Lastly, timely engagement of stakeholders must be considered so that each of their constituents are informed.

Introduction/Background

The coastal Rail Corridor in southern Orange County is owned by OCTA and operated by the Southern California Regional Rail Authority (SCRRA or Metrolink) and Amtrak Pacific Surfliner for passenger service and by the Burlington Northern-Santa Fe Railroad (BNSF) for freight service. This segment of railroad is part of the greater 351-mile Los-Angeles-San Diego-San Luis Obispo Rail Corridor (LOSSAN Corridor). The Department of Defense (DOD) has designated this key railroad line as a part of the Strategic Rail Corridor Network (STRACNET). Over the past three years, coastal Rail Corridor operations have been adversely affected by the processes of coastal bluff erosion, beach loss, revetment loss, and bluff failures. Recent bluff failures at MP 204.2 Mariposa Pedestrian Bridge, MP 204.6 Casa Romantica, and reactivation of an ancient landslide at MP 206.7 Cyprus Shore (Figure 1) have resulted in significant interruptions to railroad operations. The coastal Rail Corridor is subject to future similar threats, which can further impact railroad operations. OCTA, along with its rail operators, are seeking solutions to further reinforce this critical Rail Corridor.

Figure 1 MP 206.8 Track Stabilization Project (Cyprus Shore)

To reinforce the coastal Rail Corridor, OCTA is leading a CRRS to develop short to medium-term solutions for the seven-mile segment of coastal Rail Corridor between Mile Post (MP) 200.0 to MP 207.4 (see Figure 2 below). The CRRS will develop alternative concepts to protect the railroad in its current corridor for the next 30 years. The alternative concepts will be implementable in the short term (up to 10 years) and the medium term (11 to 30 years). The CRRS will coordinate with key stakeholders and interest groups in the region to take into consideration their needs and also participate in regional solutions. A long-term study that will examine future coastal railroad corridor solutions beyond the 30-year horizon. Planning for the long-term study is under discussion and the lead agency has not yet been determined for that effort.

As an initial assessment to address immediate needs (next 2 years), the project team has conducted field reconnaissance to identify and assess areas along the OCTA coastal

railroad corridor (MP 200.0–207.4). The assessment resulted in identification of areas warranting immediate monitoring and/or requiring corrective action and mitigation. The objective of this assessment is to identify and prioritize areas of immediate action to avoid and minimize potential emergencies that impact railroad operations. This segment of the railroad in South Orange County has experienced extended service disruptions over the last several years that have severely impacted the reliability of passenger rail service and thus, the riders who depend on the service. The measures identified within this Initial Assessment are intended to be actionable by OCTA and its railroad operator and maintainer, Metrolink.

The potential reinforcement areas identified will require additional design advancement, environmental approach, and permitting strategy to implement. The areas cover direct actions that can be implemented by OCTA or Metrolink to protect its infrastructure and avoid impacts to operations. Additionally, there are other solutions and efforts being led by other stakeholders to address regional erosion issues and OCTA will coordinate with the respective parties. While this Initial Assessment is limited to immediate actions to be performed by the railroad, the short- and medium-term solutions being explored will not be limited to that narrowed scope and will consider other regional solutions as well.

Goals and Objectives

The goals and objectives of the Initial Assessment summarized in this memorandum is to (1) review the existing conditions of the coastal rail corridor, (2) research historical events and actions that have taken place to protect the railroad and coastline, (3) conduct field reconnaissance to note emergent areas, and (4) make recommendations for monitoring areas and potential reinforcement along the coastal Rail Corridor. This technical memorandum provides a roadmap of projects and implementation strategies that are immediately actionable by the railroad.

Methodology

The project team conducted a review of coastal processes, readily available literature, and a geologic/geotechnical reconnaissance of the site to develop recommendations for monitoring and identification of potential reinforcement areas.

The monitoring areas are identified as locations with observed signs of potential near-term concern. The areas should be monitored for additional movements and any signs of emerging distress using topographic surveys, site observations, and monitoring equipment. The tracked data should be utilized to develop a baseline condition and to compare against possible thresholds for future action.

Furthermore, the project team has identified potential reinforcement areas that are recommended to reinforce critical rail infrastructure and avoid an emergency that impacts rail operations. These potential reinforcement areas may need to be studied further through alternatives analysis to select a recommended path forward and develop environmental and permitting strategies to be ready for construction.

The areas were identified based on the project team’s research and field reconnaissance; however, the risk of additional wave erosion impacts, bluff instability impacts and local erosion in other areas still exists with changing climate conditions and landscape. The

potential reinforcement solutions presented in this memorandum, along with additional site-specific alternatives, can be implemented elsewhere throughout the corridor.

Previous Efforts by OCTA

This Initial Assessment builds on previous OCTA efforts in its pledge to study climate change impacts and implement sustainability measures. In January 2021, OCTA released its "OCTA Rail Defense Against Climate Change Plan," which focused on the approximately 25-mile section of railway from Jeffery Road in Irvine to the Orange/San Diego County border and evaluated Metrolink Stations in Orange County south of Irvine, CA. The purpose of the plan was to characterize and understand future climate-related risk to the rail system and passengers to identify strategies to help mitigate those risks and to preserve the continuity of the rail service into the future.

Areas of previous bluff and coastal erosion were also reviewed, as has occurred most recently at MP 204.2 Mariposa Pedestrian Bridge bluff failure, MP 204.6 at Casa Romantica, and the reactivated ancient landslide at MP 206.8 at Cyprus Shore. Metrolink maintenance crews continue to observe, inspect, and place riprap slope protection for shoreline erosion areas as they develop. This Initial Assessment considers previously impacted areas and suggests other complementary solutions and strategies to maintain railroad operations.

Overview of Baseline Conditions

The project team collected data to document the existing conditions through field reconnaissance with Metrolink maintenance staff, geotechnical desktop studies pertinent to the coastal corridor, and mining through Metrolink's storage office, which contained records for maintenance through the coastal corridor. The project team compiled the existing conditions informed by the data collection and organized per expertise:

- Coastal and geotechnical identifying possible causes for erosion and degradation; and
- Impacts on Metrolink assets: track, drainage, signals.

Data Collection

Site Visits

Two site visits were conducted to observe existing conditions and identify vulnerabilities to coastal erosion, potential bluff failures, and impacts to the coastal rail corridor. The first covered MP 203.7 to Calafia State Beach at MP 206.0 on November 28, 2023; the second covered the remaining reach from MP 206.0 to MP 207.4 on January 12, 2024. Key observations related to coastal erosion, bluff stability and local erosion, and related flooding/overtopping vulnerability are summarized as follows:

- Metrolink personnel indicated there were no coastal erosion issues north of Metrolink Station (MP 203.7) except at Capistrano Beach Park where there is a rail crossing. The County of Orange has been managing shoreline protection along this reach. The Rail Corridor is not threatened at this location.
- Metrolink personnel identified an area of recent shoreline erosion and subsequent riprap installation near MP 203.85.

  - The riprap slope, historically stacked from railcars along this reach, has face profiles exceeding ratios of 1:1 (horiz:vert) (see Figure 8 and Figure 12, below).

- Metrolink personnel cited another erosional hotspot location at Mariposa Point near MP 204.2 and spanning the length of an elevated pile-supported pedestrian walk/ bridge paralleling the shoreline. After the site visit, this area experienced a bluff failure with runout onto the track at MP 204.2 on January 24, 2024, which halted rail operations. This area is known to have lost significant beach deposits and riprap shore protection in recent years (see Figure 9, below). Recent riprap was placed between Mariposa Point and the marine safety building. Additionally, failures and groundwater seepage are a chronic occurrence within the adjacent bluff.
- No additional areas vulnerable to coastal erosion and flooding were identified from the San Clemente Pier southward to San Clemente State Beach (MP 206.5).
- From just south of the Califia State Beach parking lot, near MP 206 to approximately MP 206.6, the rail corridor has little or no riprap shore protection. The shoreline fronting the rail corridor indicates advancing erosion, with vertical scarps in the native beach material exceeding 10 feet near the rail line (see Figure 10).
- Metrolink personnel indicated continued chronic maintenance issues following storm events within the limits of the San Clemente State Beach Campground, MP 206.0 to MP 206.5, with sediments generated by bluff erosion and the mouths of canyons.
- In the vicinity of MP 207, Metrolink personnel indicated emergency riprap repairs have been required.
- Riprap was observed to also include much smaller stone and the upper portions of the slope are very steep (steeper than 1:1) (see Figure 11).

Desktop Studies

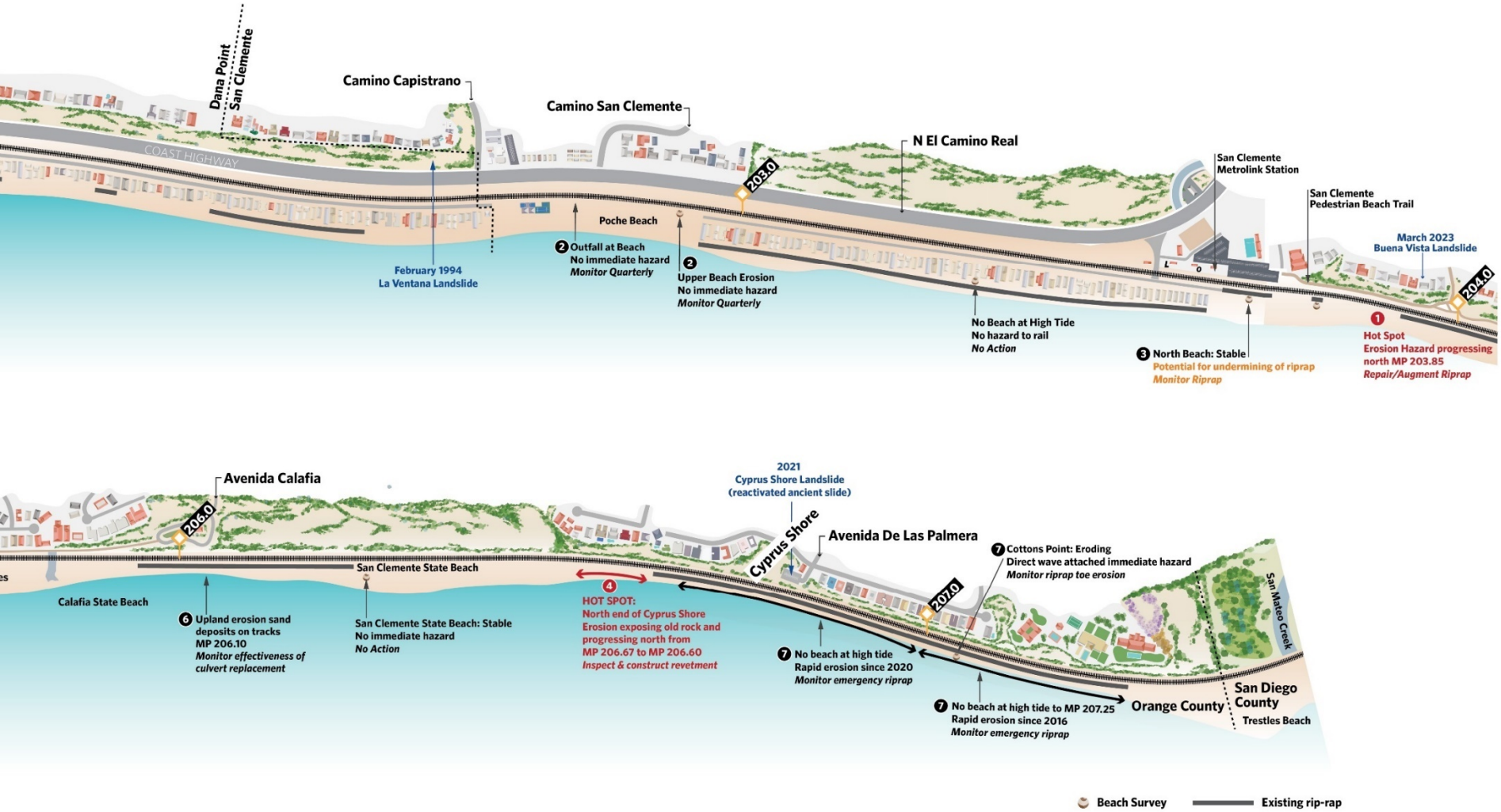
The project team performed a search of available literature including published geologic maps, state hazard maps, and historical aerial photographs. The documents were reviewed to identify areas of historical bluff instability and establish levels of potential risk to future impacts along the coastal Rail Corridor.

While no new beach profile data were collected for this effort, the City of San Clemente recently initiated a fall and spring beach profile survey program to cover years 2022 through 2025. The program measures changes in shoreline topography and bathymetry at 12 sites from Doheny Beach to San Mateo Point. Figure 2 shows the locations of the beach profile sites in relation to the OCTA Coastal Railroad ROW (MP 200.2–MP 207.4). The purpose of the shoreline monitoring program is to facilitate and plan shoreline projects and to document the impact of natural events such as El Niño and sea level rise (SLR). The program augments historic data sets acquired by the U.S. Army Corps of Engineers (USACE) in the 1980s and a prior City of San Clemente monitoring program covering 2001–2007.

Figure 3 shows the mean high water (MHW) level beach width, which represents the width of the beach from the backshore edge of sand seaward to the MHW elevation. The MHW beach width is generally considered to represent the *dry beach width*. The shaded gray area illustrates the envelope of historical measured beach widths based on available data from 1983–2009. The dark blue line shows the beach width measured in fall 2022, when beach

survey monitoring was reinitiated. Between MP 202 to 203, the beach monitoring results show the fall 2022 beach width to be at or below historic minimums, and up to 50 feet narrower than the historical range; however, dry beach width remains in this area and the rail is set back from the shore. Between MP 203 to 204, most of the beach remains at or near historic minimum width, with no dry beach through much of this area. A more dramatic reduction in dry beach width is demonstrated in the vicinity of Cyprus Shore (MP 207.05) where, in fall 2022, there was no dry beach measured. Survey measurements prior to 2009 (range shown in gray) near Cyprus Shore indicate a beach not narrower than 100 feet. These measurements are consistent with the onset of coastal erosion and related flooding and damage within the Rail Corridor that warranted emergency remedial shore protection and stabilization construction at that location.

Figure 4 includes the fall 2023 beach width and illustrates relatively little change compared to the fall 2022 shoreline position.


Dana Point
San Clemente
Camino Capistrano
Camino San Clemente
N El Camino Real
COAST HIGHWAY
203.0
San Clemente
Metrolink Station
San Clemente
Pedestrian Beach Trail
Poche Beach
March 2023
Buena Vista Landslide
February 1994
La Ventana Landslide
2 Outfall at Beach
No immediate hazard
Monitor Quarterly
2 Upper Beach Erosion
No immediate hazard
Monitor Quarterly
204.0
No Beach at High Tide
No hazard to rail
No Action
3 North Beach: Stable
Potential for undermining of riprap
Monitor Riprap
1 Hot Spot
Erosion Hazard progressing
north MP 203.85
Repair/Augment Riprap
Avenida Calafia
206.0
2021
Cyprus Shore Landslide
(reactivated ancient slide)
Cyprus Shore
Avenida De Las Palmera
7 Cottons Point: Eroding
Direct wave attached immediate hazard
Monitor riprap toe erosion
San Clemente State Beach
Calafia State Beach
4 HOT SPOT:
North end of Cyprus Shore
Erosion exposing old rock and
progressing north from
MP 206.67 to MP 206.60
Inspect & construct revetment
207.0
San Mateo Creek
6 Upland erosion sand
deposits on tracks
MP 206.10
Monitor effectiveness of
culvert replacement
San Clemente State Beach: Stable
No immediate hazard
No Action
7 No beach at high tide
Rapid erosion since 2020
Monitor emergency riprap
7 No beach at high tide to MP 207.25
Rapid erosion since 2016
Monitor emergency riprap
Orange County
San Diego
County
Trestles Beach
Beach Survey
Existing rip-rap

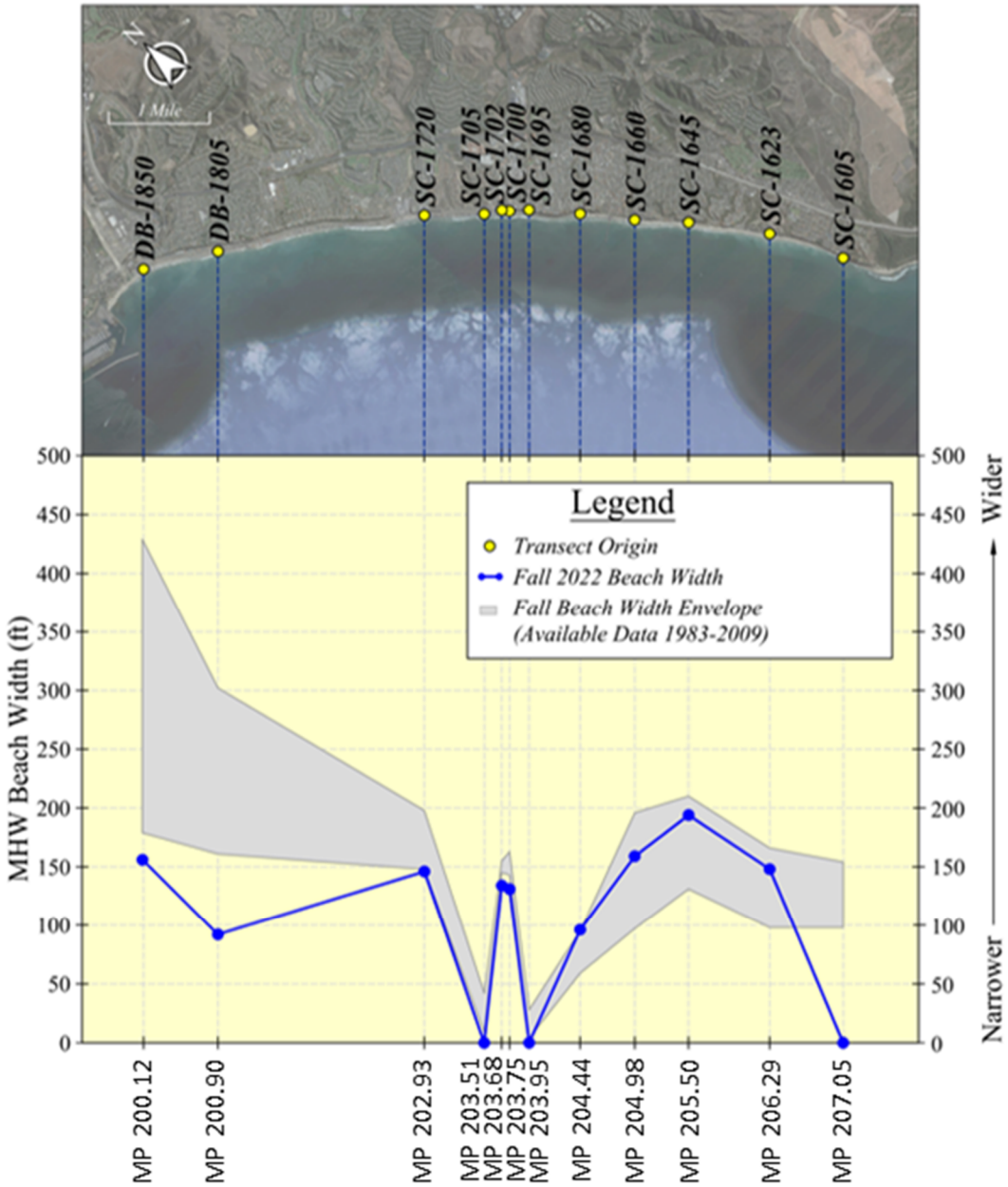


Figure 3 Fall 2022 Beach Widths Relative to Historic Shoreline Position per Survey Comparisons Conducted by Coastal Frontiers

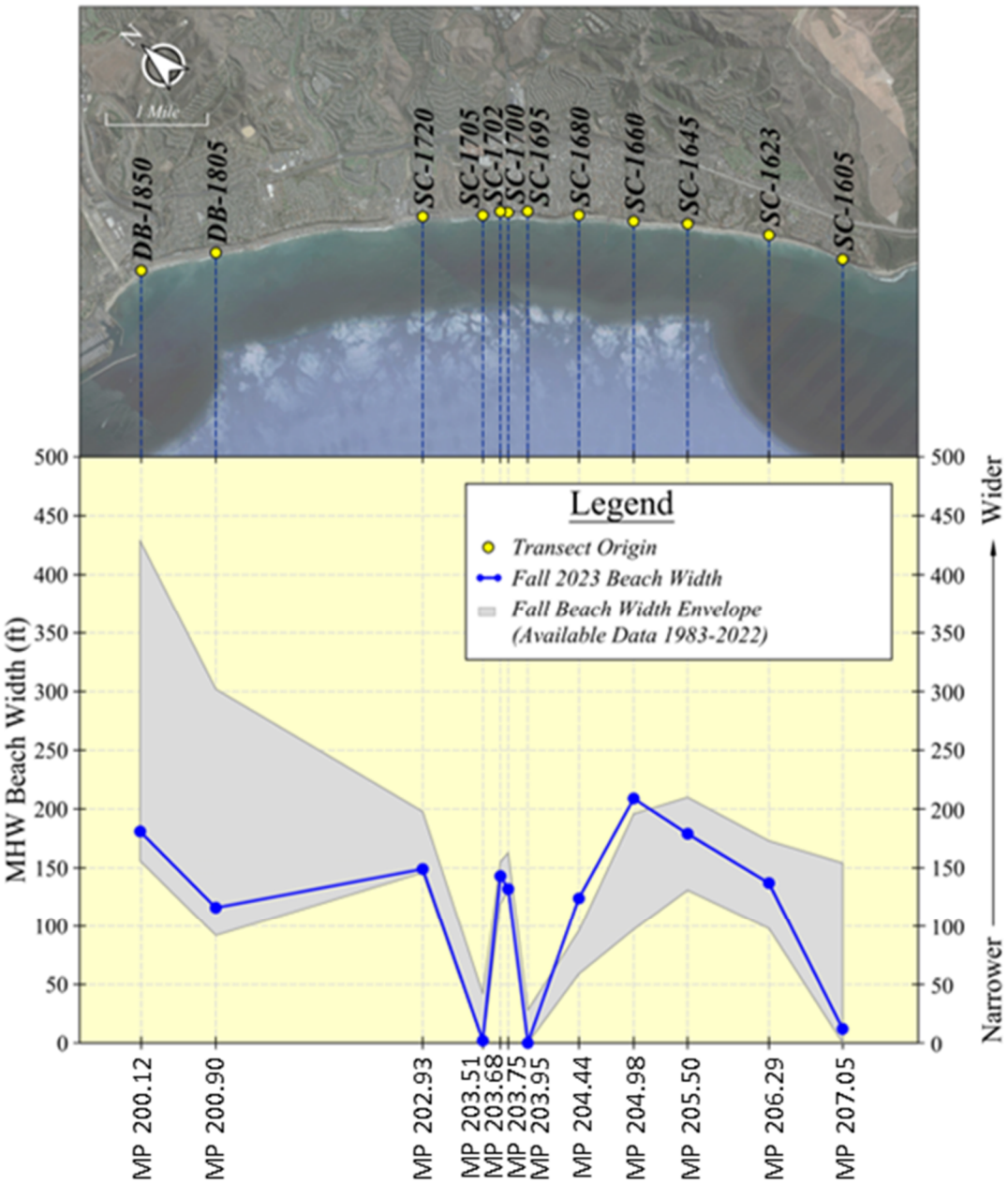


Figure 4 Fall 2023 Beach Widths Relative to Historic Shoreline Position per Survey Comparisons Conducted by Coastal Frontiers

Mining through Metrolink's Storage

As part of the project team's effort to document past maintenance activity along the ROW between MP 200.0 and 207.4 on the Orange Subdivision, representatives made a visit to SCRRA's Melbourne warehouse on December 12, 2023, to search for relevant track maintenance records, project as-builts, and various historical documents stored within the vault. As part of this research, six documents were found relevant to the project area:

- Preliminary Geotechnical Investigation for proposed site of Metrolink North Beach commuter rail station in San Clemente, dated March 4, 1994. The report details soil

conditions within the project area and notes the site being an active floodplain at the time as well as an instance of flooding within the area. Page 3 of 25 states, “Prior for the general development of the area, the site was considered an active floodplain. The winter storms of 1993 caused the Segunda Deshecha Cañada drainage channel to flood.”

- Railroad Cross-Sections at Dana Point, dated January 16, 1998. This survey report generated in response to a request by the Capistrano Bay District regarding ROW encroachment from a non-reinforced concrete block garden wall. The report describes existing conditions of the wall relative to the OCTA ROW, as well as impacts (i.e., interference) to any future ROW maintenance and future construction.
- Plan set for Metrolink North Beach commuter rail station in San Clemente (at 1850 Avenida Estacion), dated May 27, 1994. Of note are the grading plans (sheet PC-0004) and cross-sections (PC-0007) showing changes within ROW and immediate vicinity.
- City of Dana Point Landslide Remediation and Slope Reconstruction Construction Documents, dated May 5, 1994. This plan set details a proposed tieback system to stabilize the slope along the Coast Highway. The project is not railroad-related, as the slope in question is located on the other side of the Coast Highway away from the tracks, but the grading plan (sheet C-2) does show proposed impacts within OCTA ROW (i.e., removal of retaining wall).
- Preliminary Plans for Multi-Use Beach Trail within City of San Clemente, dated unknown. Project-related impacts/modifications (pedestrian access, overpasses) within the railroad ROW are marked up throughout the set, with the last sheet in the set (C-14) detailing the proposed trail in relation to the existing tracks.
- FEMA/OES Disaster 1585 for 2/16/05–2/23/05 Winter Storms. A collection of project worksheets, images, and correspondences related to repairs made at various locations throughout the SCRRA network following storm damage within the as-specified time frame (incident period). Each site worksheet details the type(s) of damage done by the storms.

Additionally, SCRRA has noted the potential presence of historical track outages and emergency responses documented within its internal database system. HDR was not provided access and this information has not yet been provided to HDR.

Existing Conditions

Coastal

Shoreline monitoring since 2022 indicates that most shorelines in the study area are retreating (eroding), with historical minimum beach widths at the northern extent of the study area (MP 200 to 204.3) and the southern extent (MP 206.6 to 207.2 - Cyprus Shores). Ongoing actions by the City of San Clemente to monitor the beach profile and rate of change will continue. Recent action (December 2023) by the USACE to nourish the beach with 250,000 cubic yards of sand will supplement the lack of supply to the beach system but is unlikely to affect the overall trajectory of beach erosion in the near term.

Vulnerabilities related to shoreline erosion and related wave overtopping have been identified to present near-term imminent risk (0 to 2 years) to rail operations and/or infrastructure. For vulnerabilities related to reduced shore protection resulting from damage to existing sloping riprap, the only viable short-term strategy is to repair the damaged structure. Repair options include addition of riprap in areas where it has been dislodged and displaced downslope and seaward. Minor improvements that would not represent new development may include use of larger armor stone, with repair operations supported by placement operations from the seaward side of the riprap slope when sufficient dry beach is available to support construction operations during low tide conditions. Rock placement from beach side of the slope generally results in higher-quality construction via improved nesting of adjacent stone and tighter placement density, resulting in greater stability and durability.

Recent coastal erosion has also been observed along the reach between MP 206 and MP 206.6 where little to no riprap exists. This may present an opportunity to construct sections of engineered revetment, which provide significantly greater shore protection performance in the longer term. Compared to the rocks placed in riprap slope protection, the rocks placed in a properly engineered revetment will remain in place, thereby providing more protection from wave-induced beach erosion and associated wave overtopping. The key advantages of an engineered revetment versus a riprap slope are listed below:

- Founding the toe of revetment in a keyway excavation, preferably established in shallow bedrock to minimize erosional undermining.
- Placement of geotextile filter fabric within the temporary back-cut behind the revetment to reduce loss of finer embankment material by piping.
- Employment of specialized revetment stone design to promote added hydraulic stability, including revetment-perpendicular long-axis placement and careful nesting and armor stone size placement.

Construction constraints include beach accessibility, sufficient beach width, availability of equipment, and time-sensitive construction hours during periods of low tides. Based on site observations, discussions with Metrolink personnel, and analysis of beach profile survey data, potential reinforcement areas for the coastal rail corridor shoreline protection include:

- Ongoing revetment damage and deterioration at MP 203.8.
- Ongoing revetment damage and deterioration along Mariposa Point between MP 204.1 and MP 204.5.
- Unprotected Rail Corridor from MP 206 to MP 206.6.
- Ongoing revetment damage and deterioration in localized areas between MP 206.6 and MP 207.4.

Geotechnical

A majority of the coastal bluff along the coastal rail corridor has experienced failures in some manner as part of natural and/or anthropogenic processes of landward retreat. Such typically involve a failure of bluff-top terrace deposits, weathered bedrock within the bluff face, and surface vegetation. Causes can often be attributed to construction of unpermitted bluff-top retaining structures by private property owners acting as dams to subsurface waters and increased hydrostatic pressures. Where bluffs are set back a greater distance from the

coastal rail corridor, these failures commonly result in runout of deposits that do not reach the corridor. In locations where the bluff lies in closer proximity to the corridor, these failures can encroach into/over the tracks requiring removal of debris and sometimes installation of pile-lagging walls parallel to the tracks. While these failures are often spectacular from a general public and media perspective, they tend to pose only a low threat to the integrity of the corridor, requiring short-lived maintenance efforts to restore track service.

Rare along the bluff is the occurrence of larger deep-seated landslides involving bedrock with basal ruptures projecting beneath the tracks. Such tend to involve reactivation of older pre-existing ancient landslides in response to a loss of beach support, conditions of natural or anthropogenic groundwater, anthropogenic modification of driving forces in areas landward of the corridor, or combinations thereof.

Track

The existing track alignment consists of a single track line within the project limits. The operational speeds vary from 40 miles per hour (mph) to 90 mph for passenger trains and 40 mph to 50 mph for freight trains. There are two passenger stations within the project limits at San Clemente North Beach and San Clemente Pier.

The track corridor has various cross sections throughout the project limits. The typical cross sections are summarized below:

- MP 200.00–MP 201.20: Pacific Coast Highway to the east of the track alignment and Beach Road and Doheny State Beach and Capistrano State Park to the west of the track.
- MP 201.20–MP 202.65: Pacific Coast Highway to the east of the track alignment and residential homes to the west of the track.
- MP 202.65–MP 202.95: Pacific Coast Highway to the east of the track alignment and Poche Beach to the west of the track.
- MP 202.95–MP 203.60: Pacific Coast Highway to the east of the track alignment and residential homes to the west of the track.
- MP 203.60–MP 207.70: Bluffs to the east of the track and various widths of beach to the west of the track.

Drainage

Surface drainage issues persist within various segments of the coastal rail corridor. The primary issues tend to occur in close proximity to the toe of bluffs. Local graded track-side drainage ditches have been installed as part of maintenance efforts to control surface waters locally, but many have been eroded and/or become infilled with sediment over time, causing ponding. Locations of poor drainage are highlighted below.

Signals

Signal equipment in the area requires more maintenance than other areas outside of the coastal corridor due to the corrosive forces from the marine atmosphere. Additional coatings and selected materials are used for the signal equipment throughout the project limits; however, the frequent maintenance needs remain necessary.

Summary of Emergent Areas

The project team reviewed recent and historical aerial photography, beach profile surveys, and publicly available studies to characterize long-term and recent trends. As evidenced by extensive armoring along nearly the entire study area, shoreline erosion has been a historical concern and has recently reemerged as a major concern in several locations. An extensive historical investigation was not performed for this study as the project team's efforts focused on immediate (up to 2 years) issues throughout the study area. Aerial maps of the coastal rail corridor are provided in the appendix of this report for reference to areas summarized below. Below is a color-coded summary of potential emergent impacts to the rail corridor associated with bluff stability. Areas highlighted in green are considered representative of a low potential impact. Those of moderate impact are highlighted in yellow. Areas considered a higher potential emergent impact to the rail corridor are highlighted in red.

Table 1. Summary of Emergent Areas, MP 200–201

MP 200.0–201.0	Bluff setback relatively distant from the Rail Corridor; periodic bluff failures involving terrace and weathered bedrock deposits notable historically; potential impact to Rail Corridor considered low. Coastal erosion potential impact is low, due to wide beaches and park infrastructure between the Rail Corridor and shoreline.

Table 2. Summary of Emergent Areas, MP 201–202

MP 201.0–201.7	Bluff set-back relatively distant from the Rail Corridor; steep/high bluff profile; periodic bluff failures involving terrace and weathered bedrock deposits notable historically; potential impact to Rail Corridor considered low. Coastal erosion potential impact is low, due to park infrastructure and private properties between the Rail Corridor and shoreline.
MP 201.7–201.9	Bluff set-back relatively distant from Rail Corridor; periodic bluff failures involving terrace and weathered bedrock deposits notable historically; potential for bedrock landslide runout into Rail Corridor is low in near term and potentially moderate in long term. Coastal erosion potential impact is low, due to private properties between the Rail Corridor and shoreline.
MP 201.9–202.1	Bluff set back relatively distant from Rail Corridor ; steep/high bluff profile; periodic bluff failures involving terrace and weathered bedrock deposits notable historically; potential impact to Rail Corridor considered low. Coastal erosion potential impact is low, due to private properties between the Rail Corridor and shoreline.

Table 3. Summary of Emergent Areas, MP 202–203

MP 202.1–202.3	Bluff set-back relatively distant from Rail Corridor; periodic bluff failures involving terrace and weathered bedrock deposits notable historically; potential for bedrock landslide runout onto Rail Corridor considered low in the near term and elevated in in the long term. Coastal erosion potential impact is low, due to private properties between the Rail Corridor and shoreline.
MP 202.3–202.5	Bluff set back relatively distant from Rail Corridor; steep/high bluff profile; periodic bluff failures involving terrace and weathered bedrock deposits notable historically; potential impact to Rail Corridor considered low. Coastal erosion potential impact is low, due to private properties between the Rail Corridor and shoreline.
MP 202.5–202.65	Location of large past bedrock landslide with runout over/beyond Rail Corridor; bluff stabilized by wall repair; potential future impact considered low. Coastal erosion potential impact is low, due to private properties between the Rail Corridor and shoreline.
MP 202.65–202.8	Bluff condition absent due to mouth of canyon crossing; Rail Corridor subject to potential liquefaction, lateral spreading, and tsunami hazards; threat assessment to Rail Corridor requires geotechnical exploration. Coastal erosion potential impact is moderate. Drainage crossing armor should be monitored and some repair needed following major storms.
MP 202.8–202.98	Location of past bluff instability; bluff stabilized by wall repair; potential impact to Rail Corridor considered low. Coastal erosion potential impact is moderate, as dry beach remains.
MP 202.98–203.01	Location of 2:1 (horiz:vert) bluff layback and surface drain installation; potential impact to Rail Corridor considered low. Coastal erosion potential impact is low, due to private properties between the Rail Corridor and shoreline.

Table 4. Summary of Emergent Areas, MP 203–204

MP 203.01–203.11	Bluff set-back relatively distant from Rail Corridor; steep/high bluff profile; periodic bluff failures involving terrace and weathered bedrock deposits notable historically; potential impact to Rail Corridor considered low. Coastal erosion potential impact is low, due to private properties between the Rail Corridor and shoreline.
MP 203.11–203.5	Location of 2:1 (horiz:vert) bluff layback and surface drain installation; potential impact to Rail Corridor considered low. Coastal erosion potential impact is low, due to private properties between the Rail Corridor and shoreline.
MP 203.5–203.71	Bluff condition absent due to canyon crossing; area subject to potential liquefaction, lateral spreading, and tsunami hazards; threat assessment to Rail Corridor requires geotechnical exploration. Coastal erosion potential impact is low, due to private properties between the Rail Corridor and shoreline.
MP 203.71–204.1	Bluff set-back relatively distant from Rail Corridor; periodic bluff failures involving terrace and weathered bedrock deposits notable historically; potential for terrace/bedrock landslide runout into Rail Corridor considered low in near-term, more elevated in long term.
MP 203.71-203.80	Coastal erosion potential impact is moderate from 203.71 to 203.80.
MP 203.80–203.90	Coastal erosion potential impact is high near MP 203.80 to 203.90 due to beach narrowing and ongoing erosion progressing north from the existing riprap.

Table 5. Summary of Emergent Areas, MP 204–205

MP 204.1–204.3	Rail Corridor located on/or adjacent to bluff; periodic bluff failures involving terrace and weathered bedrock deposits notable historically; shoreline eroded; heavy riprap protection in place; heavy seepage in bluff face; track bed underlain by older slide debris that is saturated and subject to potential liquefaction and lateral spreading; high potential for terrace/bedrock landslide, liquefaction, and/or wave erosion impacts to Rail Corridor. Coastal erosion potential impact is high due to direct wave attack, displaced stones, ongoing maintenance requirements, and steep riprap slopes.
MP 204.2	January 24, 2024, bluff failure occurred on adjacent property with runout onto tracks, impacting Mariposa Pedestrian Bridge and halting rail service; slide movement sheared sections of pedestrian bridge deck from its bents due to lateral pressure on the structure; slide debris shifted Enviro-blocks at former slope toe onto the Rail Corridor; slide mass graded to 2:1 (h:v) and covered with Visqueen; threat of future bluff failures and Rail Corridor closures remains high. Coastal erosion potential impact is high due to direct wave attack, displaced stones, ongoing maintenance requirements, and steep riprap slopes.
MP 204.3–204.37	Bluff set-back relatively distant from Rail Corridor; steep/high bluff profile; periodic bluff failures involving terrace and weathered bedrock deposits notable historically; potential for terrace/bedrock landslides and runout onto Rail Corridor considered low in the near-term, more elevatedlong term.
MP 204.3–204.37	Coastal erosion potential impact is high due to direct wave attack, displaced stones, ongoing maintenance requirements, and steep riprap slopes.
MP 204.37–204.42	Location of past terrace/bedrock landslide (Pumphouse Landslide); unrepaired slide mass remains in relatively close proximity to Rail Corridor; potential reactivation of slide and runout onto Rail Corridor considered moderate; potential damage to sewer pumpstation due to continued landslide creep, and possible runout onto Rail Corridor requiring maintenance considered low to moderate in the near-term. Coastal erosion potential impact is moderate due to narrow beach and condition of existing riprap exposed to wave action and beach. Monitoring is warranted.
MP 204.42–204.46	Bluff condition absent; potential impact to Rail Corridor considered low.
MP 204.46–204.55	Existing building mitigates bluff stability concerns; potential impact to Rail Corridor considered low.
MP 204.55–204.58	Bluff set back relatively distant from Rail Corridor; low bluff height; periodic bluff failures involving terrace and weathered bedrock deposits notable historically; potential impact to tracks considered low; potential impacts to railroad signal house and railroad switching system at Corto Lane Ped Crossing near the toe bluff considered moderate. Coastal erosion potential impact is low to moderate in this vicinity due to beach width and existing infrastructure.
MP 204.58–204.65	Location of past terrace/bedrock landslide (Casa Romantica Landslide); slide mass stabilization in progress; timber/pile wall installed at toe; potential impact to Rail Corridor considered low.
MP 204.65–204.75	Low bluff profile; Rail Corridor subject to potential liquefaction, lateral spreading, and tsunami hazards; threat assessment to Rail Corridor requires geotechnical exploration.
MP 204.75–204.91	Bluff set back relatively distant from Rail Corridor; moderate bluff profile; periodic bluff failures involving terrace and weathered bedrock deposits notable historically; potential impact to Rail Corridor considered low.

Table 6. Summary of Emergent Areas, MP 205–206

MP 204.91–205.11	Bluff height relatively moderate; periodic bluff failures involving terrace and weathered bedrock deposits notable historically; potential impact to Rail Corridor considered low.
MP 205.11–205.25	Bluff height relatively high; location of past terrace/bedrock landslides (SCL Mayor Landslide); slide debris remains; potential impacts to Rail Corridor due to slide reactivation considered moderate.
MP 205.25–205.38	Bluff condition absent; potential impact to Rail Corridor considered low.
MP 205.38–205.5	Bluff set back relatively distant from Rail Corridor; steep bluff profile; potential impact to Rail Corridor considered low.
MP 205.5–205.58	Bluff set back relatively distant from Rail Corridor; steep/high bluff profile; periodic bluff failures involving terrace and weathered bedrock deposits notable historically; potential impacts to Rail Corridor considered low.
MP 205.58–205.7	Bluff set back relatively distant from Rail Corridor; steep/high bluff profile; periodic bluff failures involving terrace and weathered bedrock deposits notable historically; potential terrace/bedrock landslide runout onto Rail Corridor considered moderate.
MP 205.7–205.82	Bluff condition absent; potential impacts to Rail Corridor considered low.
MP 205.82–205.95	Bluff set back relatively distant from; steep/high bluff; bedrock relatively stable; potential impact to Rail Corridor considered low. Coastal erosion potential impact is moderate due to narrow beach and existing exposed riprap.
MP 205.95–206.03	Bluff set back sufficient distance from Rail Corridor; potential impact to Rail Corridor considered low. Coastal erosion potential impact is moderate due to narrow beach and existing exposed riprap.

Table 7. Summary of Emergent Areas, MP 206–207

MP 206.03–206.3	Bluff set back relatively distant from Rail Corridor; steep/high bluff profile; bedrock relatively stable, area subject to canyon outwash flooding and erosion; potential impact to Rail Corridor considered low to moderate.
MP 206.3–206.55	Bluff set back relatively distant from Rail Corridor; steep/high bluff profile; bluffs susceptible to potential bedrock landslides; potential for landslide runout into Rail Corridor considered moderate.
MP 206.55–206.64	Location of recent landslide with runout onto Rail Corridor; landslide remains unmitigated; potential slide reactivation and runout into Rail Corridor considered moderate to high. Coastal erosion potential impact is high due to narrow beach, recent erosion and exposure of the fill slope supporting the track between MP 206.6 and 206.65.
MP 206.64–206.72	Bluff set back relatively distant from Rail Corridor; bluff height moderate; bluff susceptible to bedrock landslides; potential bluff impacts to Rail Corridor considered moderate to high. Coastal erosion potential impact is high due to narrow beach, recent erosion and exposure of the fill slope supporting the track in the vicinity of MP 206.6 to 206.65.
MP 206.72–207.34	Bluff set back relatively distant from Rail Corridor; area of ancient Calle Ariana Landslide (repaired) extending beneath Rail Corridor; moderate bluff height; bluff susceptible to bedrock landslides; future potential impact to Rail Corridor considered low to moderate. Coastal erosion potential impact is moderate to high due to lack of a dry beach and riprap placed to stabilize the shoreline. Ongoing monitoring and reinforcement of the existing riprap is expected near Cypress Shore.

Recommendations

Potential Strategies and Solutions

Strategy 1. **Proactive Monitoring of the Shoreline.** The project team recommends OCTA and SCRRA implement a monitoring program that combines topographic survey and site observations at various locations and frequencies. These data will allow OCTA and SCRRA to establish baseline conditions that will support other strategies. This strategy can be implemented in a matter of months. We also suggest up to three low-cost water level sensors be installed at appropriate locations (bridge crossings, pier, and Dana Point) for a real-time alert of high-water conditions and potential wave damage. These real-time high-water conditions in concert with real-time offshore wave buoy data could help establish coastal metrics for threshold and support rationale for reinforcement actions.

Strategy 2. **Establish Thresholds for Reinforcement.** Long-term, short-term, and seasonal shoreline position (MHW contour) relative to the Rail Corridor centerline of track should be assessed, and thresholds set for acting against imminent emergent conditions. Thresholds may vary spatially based on the geometry and elevation of the Rail Corridor and comparison longer term trends. Establishing thresholds will allow OCTA and SCRRA to plan responses for the coming storm(s) or storm season and provide a rationale to regulatory agencies to support action and emergency after-the-fact permitting. This strategy can be implemented within six months of implementing Strategy 1.

Strategy 3. **Prepare for Maintenance.**

3A. OCTA and SCRRA should stockpile sufficient tonnage of rock to reinforce existing riprap when stones are displaced and to add rock to emerging erosion areas as identified by monitoring. At minimum, not less than 5,500 tons of 2–6-ton rock should be stockpiled at the ready for responding to erosion of existing riprap and emergent hot spots.

3B. OCTA to coordinate with SCRRA and its maintenance contractor to develop a 2 to 5-year scope, estimated cost, and schedule to respond to short-term recurring slope movements and coastal erosion. This plan could include but is not limited to stockpiling riprap in various sizes, acquiring or leasing areas accessible by rail equipment to stage and load the stockpiled riprap, and ensuring that adequate equipment such as rail side dumps and large excavators are readily available.

Solution A. **Engineered Revetment.** The project team recommends OCTA pursue design and implementation of engineered revetment sections in potential reinforcement areas that currently have limited or no riprap shore protection. These structures will provide greater durability and survivability, plus are more effective at dissipating wave energy to minimize wave overtopping and associated track inundation. Constructing an engineered revetment will entail

access on the dry beach, which requires advanced planning to work at low tide.

Solution B. **Riprap Reinforcement.** Continued placement (stacking) of riprap to repair and reinforce existing riprap from the trackway will continue to be needed as stones are displaced and undermined by storms. This method is a stopgap measure and is not expected to resist all storms or withstand significant erosion of the beach beyond the toe of the riprap slope.

Monitoring Areas

A coastal shoreline monitoring program (see Figure 5) is recommended to quantify changes in both the condition of the shore protection and the overall shoreline position relative to the rail ROW. The recommended monitoring program includes on-the-ground site observations and drone-based topographic and aerial photogrammetric surveys conducted at low tide.

Site Observations

Potential reinforcement areas should be visually observed by a qualified coastal engineer after storm events and on a monthly basis during winter. The purpose is to observe the existing condition of the existing shoreline and existing protection for signs of further deterioration or damage.

Drone-based Photogrammetry and Topographic Survey

Each potential reinforcement area should be monitored monthly and after significant coastal storm events to assess the vulnerability of the railway to damage from coastal erosion. The monitoring should include acquisition of topographic and photographic data (orthometric and oblique aerial imagery) documenting the condition of the region between the railroad and the Mean Higher High Water (MHHW) contour (i.e., the dry beach and rock shore protection). The recommended program could be conducted using a small Unmanned Aircraft System (sUAS) operated by personnel with Federal Aircraft Administration (FAA) Remote Pilot Certification (Small UAS, Part 107) and a Real-Time Kinematic Global Navigation Satellite System (RTK GNSS). Structure-from-Motion (SfM) techniques can then be used to develop an ortho-rectified composite image (orthomosaic) of the survey area and a detailed Digital Elevation Model (DEM) from the sUAS and RTK GNSS data with a resolution of approximately 0.1 foot or better. This technique has recently been used to monitor rock shore protection in Southern California and to rapidly identify localized areas of revetment deterioration, including rock displacement. Both the DEM and aerial imagery can be used to assess changes in the beach configuration and rock shore protection to identify potential areas of concern. Long-term changes also can be assessed using historical topographic data obtained in the vicinity, and physical reconnaissance by professional geologists and engineers where available.

Proactive monitoring would allow OCTA to set a baseline condition and evaluate the progression of erosion, movement of tracks in areas of underlying instability, establish thresholds for immediate maintenance, and justify actions to regulatory bodies when emergent issues arise. Drone-based monitoring allows efficient capture of large areas, including those areas that do not require intensive monitoring efforts at this time.

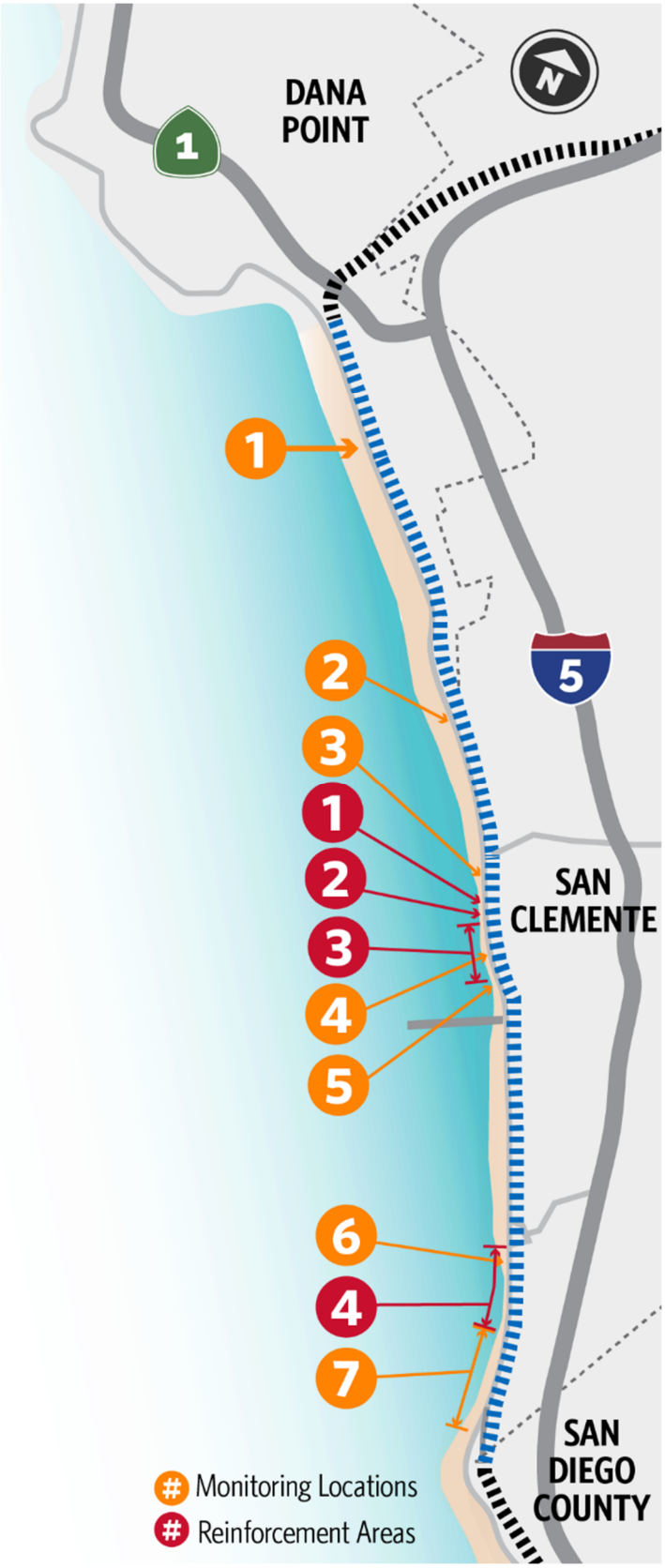


Figure 5. Summary of Monitoring Locations and Reinforcement Areas

Site 1: Doheny South, MP 200.9

The adjacent shoreline infrastructure at Doheny State Beach (see Figure 6) to the west and Capistrano Beach Park to the east have experienced erosion, and erosion control measures have been implemented. The project team recommends shoreline monitoring in this area where beach has not yet eroded to the point of imminent threat to the rail but may do so in the future. Semi-annual monitoring concurrent with spring/fall beach monitoring is recommended.

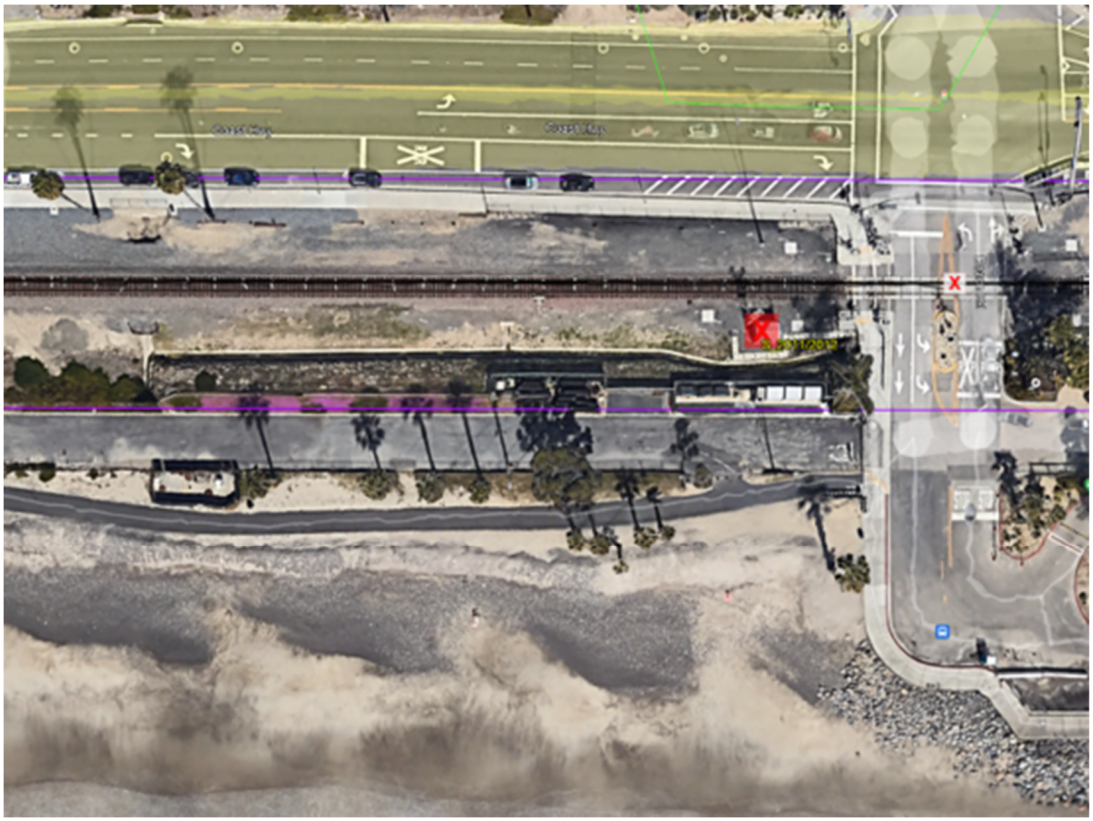


Figure 6. Monitoring Site 1: South Doheny Beach Erosion near Parking Lot

Site 2: Poche Beach, MP 202.75

Outfalls and drainages allow waves to propagate inland, and in combination with ongoing beach erosion may erode the rail ROW in future. Quarterly monitoring is recommended. See Figure 7.

Figure 7. Monitoring Site 2: MP 202.70, Poche Beach Outfall and Pedestrian Underpass

Site 3: North Beach, MP 203.65

There is ongoing coastal erosion at the base of the riprap slope causing stone to be undermined and dislodged downslope. This reach should be monitored as part of the coastal shoreline monitoring program. See Figure 8.

Figure 8. Monitoring Site 3: MP 203.65, North Beach

Site 4: Mariposa Pedestrian Bridge, MP 204.1–204.3

The project team recommends installation of a series of slope inclinometers along an approximately 1,000-linear foot rail corridor section, between the rail corridor and existing pedestrian bridge. Casings should be installed approximately 100 feet on-center and

penetrate saturated surficial sediments (fill, colluvium, slide debris), and extend into competent bedrock at depth. Baseline readings (monitoring) should be performed during the week following installation. Future rounds of monitoring should be conducted twice within the next month and once a month thereafter for a year. Subsequent readings should be performed twice annually. Monitoring should also take place following significant events that could potentially manifest in track movement, including, but not limited, to future earthquakes, bluff failures, significant storms, or significant beach erosion.

There is ongoing coastal (beach) erosion along the base of riprap slopes causing stone to be undermined and dislodged seaward. This reach should be monitored as part of the coastal shoreline monitoring program. See Figure 9.

Figure 9. Monitoring Sites 4 and 5: MP 204.1–204.3, Mariposa Pedestrian Bridge – January 21, 2024.

Site 5: Linda Lane, MP 204.5

There is ongoing coastal erosion at the base of the riprap slope causing stone to be undermined and dislodged seaward. This reach should be monitored as part of the coastal shoreline monitoring program.

Site 6: Avenida Calafia, MP 206.1

The face of the sea cliff is entrenched by several small to large size re-entrant canyons generating periodic sediment discharge into low-lying terrain along the landward Rail Corridor margin. Impacts have included flooding, blocking of drainage structures, and deposition of sediment within the Rail Corridor during larger storm events. See Figure 10. Frequent post-storm maintenance efforts have been required to preserve train service, including removal of sediment and ponded water, restoration of surface flow, and installation of concrete blocks at the mouth of canyons in attempt to restrain sediment transport.

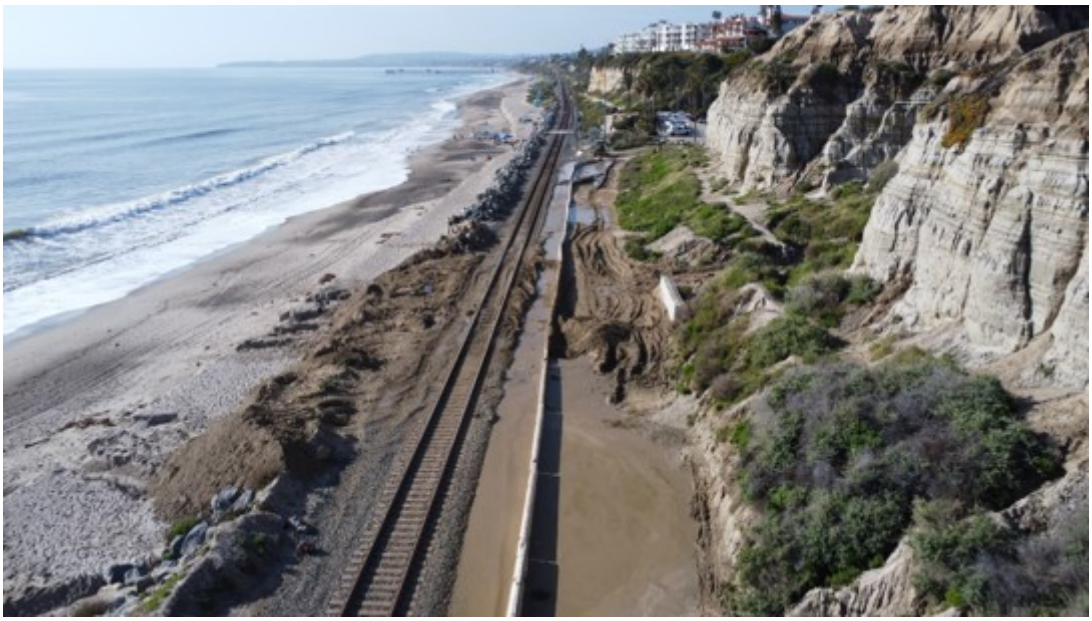


Figure 10. Monitoring Site #6: MP 206.1, Calafia State Beach

Possible solutions to mitigate the above conditions may include the following:

- Construction of sediment catchment ditches or walls at toe of bluff;
- Construction of drainage channels at toe of bluff to improve surface drainage and act as sediment catchment ditches;
- Improve, enlarge, and/or install additional under-track drainage outlets connecting to the beach;
- Improve surface drainage by grading the northeastern track zone to accommodate the distribution of runoff to new and/or existing outlets;
- Stabilize erosion-prone areas of bluff and canyons with jute-matting or similar methods to minimize erosion of bare ground;
- Introduce native plants on slopes underlain by colluvium/slope wash and older alluvium); and
- Improve sediment barriers at canyon discharge points.
- Construction of drainage channels at toe of bluff to improve surface drainage and act as sediment catchment ditches.
- Improve, enlarge, and/or install additional under-track drainage outlets connecting to the beach.
- Improve surface drainage by grading the northeastern track zone to accommodate the distribution of runoff to new and/or existing outlets,
- Stabilize erosion prone areas of bluff and canyons with jute-matting or similar methods to minimize erosion of bare ground.

Site 7: Cyprus Shore to County Line, MP 206.7–207.25

This reach (see Figure 11) should be monitored as part of the coastal shoreline monitoring program to ensure that the riprap section is stable and withstanding wave and weather conditions.

Figure 11. Monitoring Site 7: MP 206.7–207.25, Cyprus Shore to County Line

Table 8. Summary of Monitoring Areas

Site	Location (MP)	Description	Monitoring (Frequency)
1	200.80–201.00	Doheny South: Eroding Beach	Riprap condition and beach erosion (Semi-annually, Post-storm)
2	202.70	Poche Beach South Shore Pedestrian Underpass and outfall at beach	Beach erosion and scour protection around structures (Quarterly)
3	203.65–203.70	North Beach: Potential for undermining of riprap	Riprap condition and beach erosion (Semi-annually, Post-storm)
4	204.10–204.30	Mariposa Pedestrian Bridge	Install inclinometers to monitor potential track-bed movement (Monthly, post-storm, post-landslide, and post-earthquake)
5	204.50	Linda Lane: Stable beach but narrow	Riprap condition and beach erosion (Semi-annually, Post-storm)
6	206.10	Calafia State Beach: upland erosion sand deposits on tracks	Effectiveness of culvert replacement (Post-storm, King Tides)
7	207.60–207.25	Cyprus Shore to County Line	Monitor effectiveness of emergency riprap (Semi-annually, Post-storm)

Potential Reinforcement Areas

Four areas were identified by the project team through its initial assessment for potential reinforcement to further solidify the stability of the railroad corridor. The potential reinforcement areas are initial concepts that will require additional analysis and investigation in terms of alternative analysis, site access, constructability, and permitting. Each site has potential limitations that need to be examined further.

Site 1: MP 203.85

Place new rock and/or rework existing rock that has fallen out of section to restore the structure slope and crest elevation, thereby providing beach erosion protection and reduction in wave overtopping. Where possible, place new, larger rock and/or rework existing rock in a way that reduces the slope, thereby improving the stability of the rocks. See Figure 12 and Figure 13.

Figure 12. Potential Reinforcement Area 1: MP 203.85 to MP 203.90

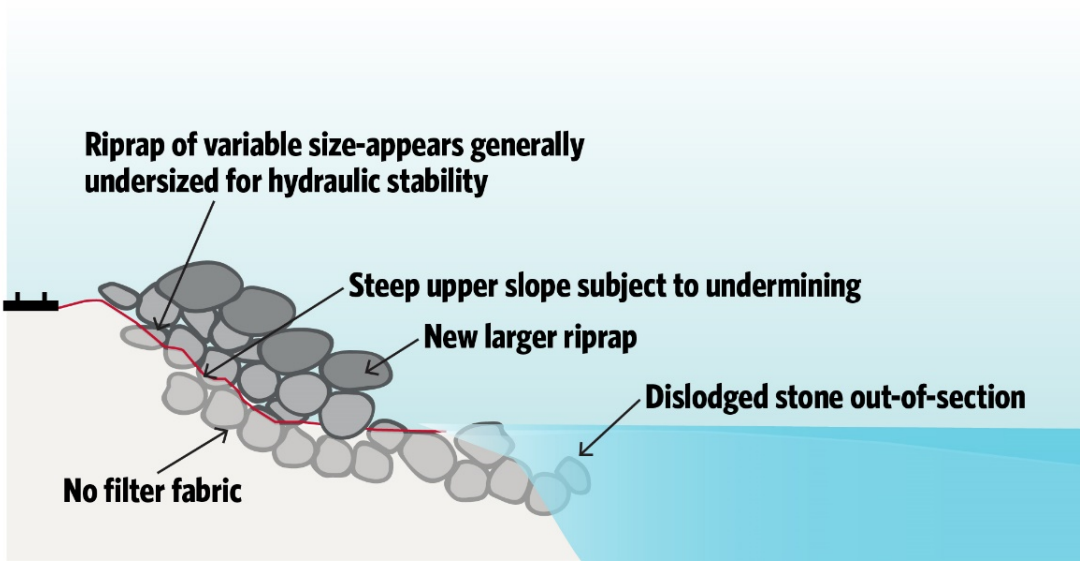


Figure 13. Potential Temporary Reinforcement Solution for Sites 1 and 2 where existing riprap exists

Site 2: MP 204.1

Place new rock and/or rework existing rock that has fallen out of section to restore the structure slope and crest elevation, thereby providing beach erosion protection and reduction in wave overtopping. Where possible, place new, larger rock and/or rework existing rock in a way that reduces the slope, thereby improving the stability of the rocks. See Figure 13.

Figure 14. Potential Reinforcement Site 2: MP 204.00 to MP 204.40

Site 3: San Clemente City Beaches

Remove and reconstruct pedestrian bridge incorporating a retaining wall structure with suitable subsurface and surface drainage control. The wall should be designed to protect the Rail Corridor from encroachment of failure debris in the Rail Corridor. Investigate the source(s) of chronic water issuing from the bluff face, which could relate to broken irrigation or other water lines in the nearby bluff-top development. See Figure 15 and Figure 16.

Figure 15. Potential Reinforcement Site 3: MP 204.00 to 204.50, steep bluffs, potential to impact tracks, poor track-side drainage with potential for liquefaction – January 21, 2024

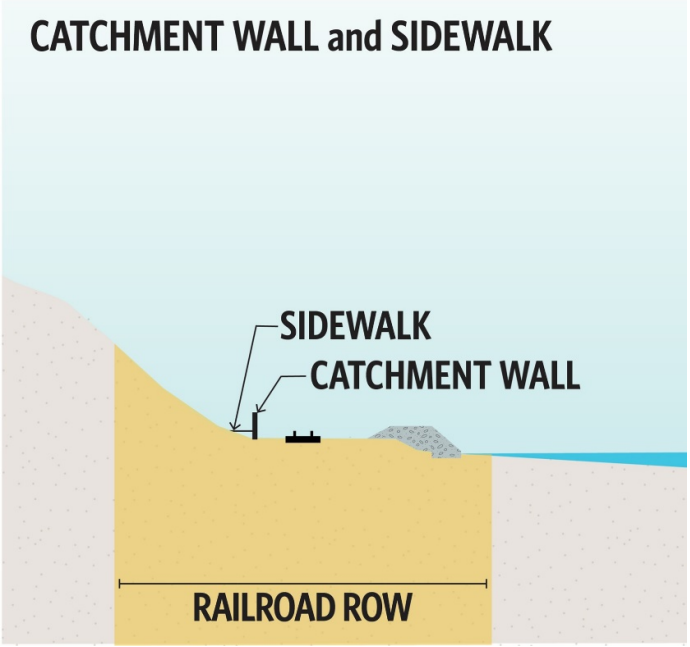


Figure 16. Potential Solution for Reinforcement Site 3

Site 4: North End Cyprus Shore

Installation of an engineered revetment with filter fabric to minimize piping (movement of fine-grained sediment through voids in the rocks) and a layered-stone placement design with keyway founded in bedrock or to a toe elevation of +2 ft or lower is recommended. Dual purpose of revetment is to arrest continued landward retreat of soils into Rail Corridor. See Figure 17 and Figure 18.

Figure 17. Potential Reinforcement Site 4: MP 206.00 to 206.67, North End of Cyprus Shore Project.

Loss of riprap exposes unstable deposits of beach sand, slide debris, and/or fill deposits beneath ROW, subject to rapid retreat as erosion and toppling during future storms.

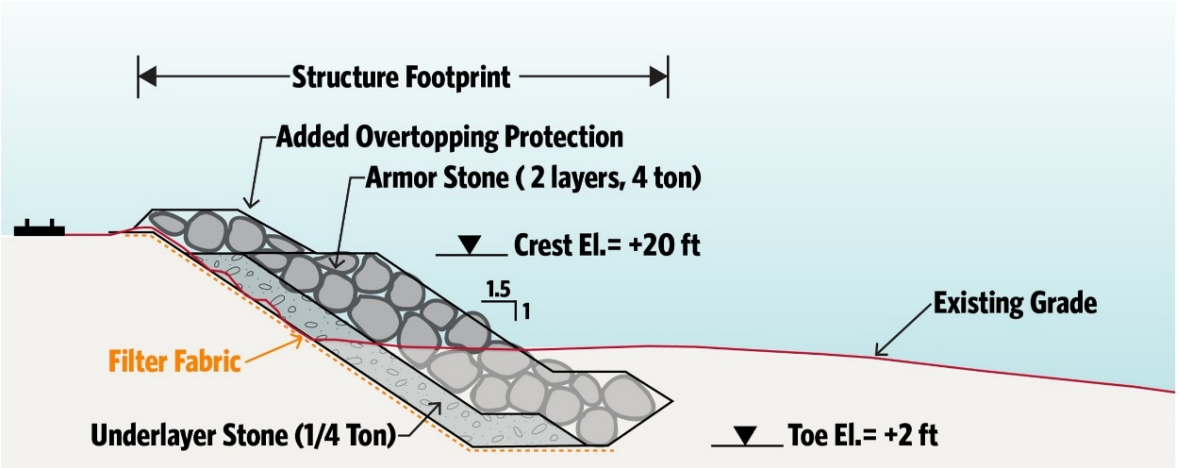


Figure 18. Potential Solution for Reinforcement Site 4 with Engineered Revetment Section

Table 9. Summary of Potential Reinforcement Areas

Site	Location (MP)	Description	Potential Solution(s)	Potential Limitation(s)
1	203.80–203.90	Erosion Hazard deteriorating	Repair/Augment Riprap	Access, constructability, permitting
2	204.0–204.40	Erosion: No beach at high tide and direct wave attack	Stockpile rock for maintenance	Access, constructability, permitting
3	204.00–204.50	Geologic: Major seepage from bluff face and poor surface drainage lead to track-bed saturation and potential for liquefaction and lateral spreading of track-bed	Build subdrain cutoff for groundwater, catchment structure for slope debris surface drainage control	Access, constructability, utility conflicts
4	206.00–206.67	North end of Cyprus Shore: Erosion exposing old riprap	Inspect and construct revetment as needed	Access, constructability, permitting

Other Key Considerations

Governance (Roles and Responsibilities)

As a part of the next steps for the Coastal Rail Resiliency Study, OCTA will develop a Governance Plan to provide a vision for roles, responsibilities, and an implementation plan for capital projects. OCTA is the owner of the ROW and Metrolink is the operator and maintainer of the ROW. However, both agencies have professional services and construction contracts that enable them to deliver capital projects. Roles and the implementation plan will consider the roles and responsibilities of OCTA and other key stakeholders in the region.

Environmental Clearance Strategy

As defined by State Legislature, California Environmental Quality Act (CEQA) Statutory Exemptions (SE) exist to cover specific types of projects with special qualifications. These exemptions are delineated in Public Resource Code (PRC) Section 21080 et seq.

California Code of Regulations, Title 14, Section 15269(b) allows for emergency repairs to publicly owned service facilities “necessary to maintain service essential to the public health, safety or welfare.” This includes emergency repairs that “require a reasonable amount of planning to address an anticipated emergency.” Further, Section 15269(c) allows for an SE for:

> Specific actions necessary to prevent or mitigate an emergency. This does not include long-term projects undertaken for the purpose of preventing or mitigating a situation that has a low probability of occurrence in the short-term, but this exclusion does not apply:
>
> (i) If the anticipated period of time to conduct an environmental review of such a long-term project would create a risk to public health, safety or welfare, or

(ii) If activities (such as fire or catastrophic risk mitigation or modifications to improve facility integrity) are proposed for existing facilities in response to an emergency at a similar existing facility.

Given the amount of recent storm damage including shoreline erosion, land subsidence, gradual earth movements, and landslides, there is a high probability that further damage will occur within this corridor that jeopardizes the continued use of the existing railroad infrastructure.

To streamline the environmental process for the recommended maintenance activities proposed for potential reinforcement areas, it is recommended that a single, corridor-wide SE be utilized. This SE should identify the extent of the project corridor, Dana Point (MP 200.0) to San Clemente (MP 207.4), and list all potential improvements, including, but not limited to, placing riprap from the railroad ROW, constructing engineered revetment with riprap, and building catchment walls. The SE should specifically use language to include emergency actions that may be required within the corridor (see further discussion below). Alternately, an SE can be filed for individual potential reinforcement areas projects identified in this study.

If a federal nexus is established through a federal permit (such as a USACE permit) or federal funds are applied either entirely or in part by the federal government to any of the work in this corridor, the National Environmental Policy Act (NEPA) may apply. The NEPA Class of Action (Categorical Exclusion, Environmental Assessment, or Environmental Impact Statement) would be coordinated with and determined by the federal lead agency.

Regulatory Permitting Strategy

Potential reinforcement areas may also need to comply with other applicable federal, state, and local laws. All potential reinforcement areas identified above are located within the Coastal Zone Boundary. As such, all potential reinforcement areas require some level of coordination with the California Coastal Commission (CCC). Depending on the location and extent of potential improvements, USACE, Regional Water Quality Control Board (RWQCB), United States Fish and Wildlife Service (USFWS), and California Department of Fish and Wildlife (CDFW) regulatory requirements, among others, may need to be addressed, as discussed below.

Coastal Development Permitting

All work proposed on tidelands, submerged lands, and other public trust lands must be coordinated with and potentially receive a permit from the CCC. In addition, activities authorized, funded, or carried out by the federal government that affect coastal zone resources must be reviewed by the CCC for consistency with the federally approved California Coastal Management Program, including the California Coastal Act (CCA) (PRC 30330, and 30400).

Coastal Development Permits (CDPs) are the regulatory mechanism by which proposed projects in the coastal zone comply with the policies of Chapter 3 of the CCA. Specifically, California Code of Regulations, Title 14 – Natural Resources, Section 13252 details repair and maintenance activities pertinent to this transportation corridor that require a CDP and including repair and/or maintenance of surface or subsurface structures. CDPs are required for any repair or maintenance to facilities or structures or work located in an environmentally

sensitive habitat area, any sand area, within 50 feet of the edge of a coastal bluff or environmentally sensitive habitat area, or within 20 feet of coastal waters or streams that include the placement or removal of materials (including riprap, sand, etc.) or when the presence of mechanized equipment or construction materials is needed.

The executive director of the CCC has the discretion to exempt ongoing routine repair and maintenance activities of local governments, state agencies, and public utilities (such as railroads) involving shoreline works protecting transportation roadways per Cal. Code Regs. tit. 14 §13252 3(c)(e). Therefore, it is recommended as a first step that OCTA request an exemption from the Executive Director of the Commission for any maintenance work and/or work in all potential reinforcement areas.

If an exemption is not granted, a secondary option is to apply for a singular Ongoing Maintenance Activities Permit for the corridor, as allowable under Cal. Code Regs. tit. 14 § 13252 3(d). The CCC may issue a permit for maintenance activities for a term in excess of the two-year term provided by these regulations. Issuance of this permit may also require preparation of an associated CDP to address potential effects maintenance activities may have on natural/coastal resources. Therefore, it is recommended that OCTA prepare, process, and obtain Ongoing Maintenance Activities Permit for maximum time allowable, since this step is crucial to streamlining proactive prevention of damage to railroad infrastructure moving forward.

To move forward with discussions for this type of a Maintenance Activities Permit, it is recommended that OCTA request a pre-application meeting with Coastal Staff to discuss the preparation of a Maintenance Improvement Plan for the Reinforcement Areas that includes:

- Type of maintenance/improvement required (materials, quantities, etc.).
- Environmental footprint, including construction access, temporary, and permanent impact areas.
- Post-maintenance/improvement requirements (materials, quantities), where warranted.
- Drone footage and/or LiDAR for the corridor as proof of existing conditions for permitting purposes.
- Discussion of preparation of a CDP in support of this work.

It is also recommended that field surveys (Biological Resources, Aquatic Resources Delineation, and Cultural Resources) be completed for the corridor with the subsequent reports used for the support of the permitting process and mitigation.

There is an alternate option for CDP available for federal activities, development projects, permits and licenses, and/or support to state and local governments. The CCC has a Federal Consistency Unit that implements the Coastal Zone Management Act (CZMA) of 1972. All federal activities affecting the coastal zone must undergo a review for consistency with the CZMA process called a Consistency Determination for federal agencies activities and development projects or a Consistency Certification for federal permits and licenses, and/or federal funding to state and local agencies. This process is intended to allow for coordination among federal agencies, plus allowing the public an opportunity to participate in the process.

Clean Water Act Permitting
Depending upon the location(s) and extent of each proposed improvement and/or maintenance activity and their impacts to aquatic resources, Clean Water Act permitting may be required with the USACE and RWQCB or State Water Resources Control Boards (Water Boards). Permits for Section 404 of the Clean Water Act are addressed through USACE and may be covered under nationwide permits, such as Nationwide Permit 13 (NWP 13), which covers bank stabilization less than 500 feet in length solely for erosion protection, Regional Permits, which cover projects considered to have insignificant environmental impacts, or Individual Permits for projects with severe impacts with no practical alternative. Individual Permits may require environmental assessment under NEPA. Implementation of Section 401 of the Clean Water Act Water Quality Certification and Waste Discharge is delegated to the State Water Boards.

Porter-Cologne Water Quality Control Act
Depending upon the location(s) and extent of each proposed improvement and/or maintenance activity and their impacts to aquatic resources, the Porter-Cologne Water Quality Control Act may need to be addressed. The Porter Cologne Water Quality Control Act is the clean water act of California that expanded the enforcement authority of the Water Boards in California.

Lake and Streambed Alteration Agreement
If any portion of proposed improvement and/or maintenance activity is determined to substantially divert or obstruct the natural flow of, or substantially change or use any material from the bed, channel, or bank of, any river, stream, or lake, or deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it may pass into any river, stream, or lake, per the CDFW Fish and Game Code Section 1602 a Streambed Alteration Agreement (SAA) may be needed.

Endangered Species
Depending upon the location(s) and extent of each proposed improvement and/or maintenance activity and their proximity to biological resources, state and or federally listed species may be affected. Depending on the species and the presence of a federal nexus, consultation with USFWS and/or National Oceanic and Atmospheric Administration may be necessary in addition to CDFW to comply with the California Endangered Species Act (CESA).

Other Coordination
The California State Lands Commission (SLC) has jurisdiction of the landward boundary of “sovereign lands,” defined as the area between the ordinary high-water mark for tidal waterways and the ordinary low-water mark for navigable non-tidal waterways. The area between the ordinary low-water mark and the ordinary high-water mark at navigable non-tidal waterways are subject to the Public Trust Easement. As such, the location of improvements should be overlain with the Mean High Tide Line (MHTL) and early coordination should occur with the SLC to decide whether a lease is required to complete the activity.

Procedures for Emergency Response

Emergency Response Protocol

It is recommended that a coordination protocol be put into place between OCTA and Metrolink to streamline emergency responses, as follows:

1) Metrolink Maintenance identifies immediate emergency maintenance need within the corridor.
2) OCTA, Metrolink, and Professional Services Support meet to discuss scope of maintenance required and suggests the following level staff are included:
    a. OCTA: Executive Leadership, Project Manager(s), Environmental Program Manager.
    b. Metrolink: Executive Leadership Project Manager(s), Metrolink Maintenance.
    c. Professional Services Support: Engineering Lead(s), Geotechnical Lead(s), Environmental Leads
3) Metrolink emails OCTA and HDR the following information about the emergency response:
    a. Type of maintenance activity (e.g., riprap placement).
    b. Project limits.
    c. Quantity of material import.
    d. Type of construction equipment required.
    e. Construction access requirements (rail, beach, etc.).
    f. Proposed construction timeframe and whether the improvement is temporary or permanent.
    g. Provide as-builts and plans as soon as available.
4) The team determines if environmental clearance or permitting is required and notifies agencies (if needed). Critical factors to consider include but are not limited to whether maintenance locations are outside the railroad ROW and/or locations in the railroad ROW that have the potential to impact sensitive natural/coastal resources.

Emergency Environmental Clearance

If any of the key maintenance locations turns into an emergency, the SE for the corridor (recommended above in Environmental Clearance Strategy Section) should be leveraged for environmental clearance without the need for a new SE for each emergency location. Until a corridor-wide SE is in place, each location would require a new SE be filed for individual potential reinforcement areas projects identified in this study.

Emergency Regulatory Permitting

The CCC defines emergency work as "… generally a period of 24 to 72 hours after the emergency occurrence …." If the Ongoing Maintenance Activities Permit, discussed above, is not yet in place at the time of the emergency, early coordination with the CCC and any other location-appropriate agencies should occur as soon as possible after the incident (and preferably prior to the repair) to assess the need for the following emergency permitting:

- CCC Emergency CDP, followed by a formal CDP application, potentially with mitigation included.
- USACE Regional General Permit (RGP) #63 and coordination with RWQCB:
    - RGP #63 provides for a rapid respond for protection activities in emergency situations, defined specifically by USACE when there is a “clear, sudden, unexpected, and imminent threat to life or property demanding immediate action to prevent or mitigate loss of, or damage to, life, health, property, or essential public services (i.e., a situation that could potentially result in an unacceptable hazard to life or a significant loss of property if corrective action requiring a permit is not undertaken immediately).
- Section 401/Section 404/Porter Cologne Act/CDFW 1602/FESA/CESA.
- Coordination with SLC for MHTL and potential lease needed for emergency location(s).

Stockpiles of Materials Needed in Emergency

Stockpiles of armor stone (2– to 6-ton tons in size) should be established so that materials can be readily delivered to reinforcement and repair areas as needed. For existing riprap with direct wave attack (not including Cyprus Shore), stockpiled materials should be approximately 2 tons per foot length. Therefore, about 5,500 tons of stone should be prepared at the ready. This stone could be used for engineered revetment or riprap placement.

For emergent areas at developing reinforcement areas at the north end of Cyprus Shore, additional new armor stone will be needed and the amount will depend upon the design and length selected by OCTA for reinforcement. These areas may require about 10 tons per foot length.

Engagement of Stakeholders

There are a number of stakeholders that will be engaged throughout the life of the study to obtain input and feedback. OCTA is actively collaborating and soliciting input from stakeholders and interest groups to help inform and shape the short- and medium-term design concepts. OCTA will host listening sessions with the following groups:

- Project Development Team (PDT).
- Stakeholder Working Group (SWG).
- Freight and Goods Movement.
- Coastal and Marine Habitat Community-Based Organizations.
- Emergency Responders.
- Major Employers, Key Destinations, and Other Business Interests.
- Residential Groups.
- Elected Officials Roundtable.
- General Public.

A listening session was held to present the draft monitoring and potential reinforcement areas to solicit feedback from key stakeholders and interest groups to understand how the solutions can coincide with and contribute to ongoing efforts to develop a resilient coastline.

Next Steps

The monitoring sites and the potential reinforcement areas identified within this technical memorandum should be studied further and advanced through the design, environmental, and permitting processes. Each project needs to be evaluated further and have a more detailed design developed, as well as have an environmental and permitting strategy developed so projects can be advanced to construction in a timely manner. The areas were identified based on the project team's research and field reconnaissance; however, the risk of additional coastal wave impacts, bluff instability impacts, and local erosion in other areas still exists with changing climate conditions and landscape.

The potential reinforcement areas will also need to be coordinated with key stakeholders such as the City of San Clemente, City of Dana Point, CCC, State Parks, SLC, Metrolink, BNSF, Amtrak, and others. This coordination will take place through outreach efforts to gather input and inform key stakeholders of improvements to the railroad corridor.

It is recommended that OCTA develop a Project Delivery Plan that expands on each of these recommended areas by developing an Alternatives Analysis and select a Preferred Alternative to advance to Project Acceptance and Environmental Document (PA/ED). Key stakeholders and permitting agencies should be engaged during this process. With concurrence, the projects should be advanced to Final Design and Construction. The Project Delivery Plan should also consider the potential for bundling projects together for greater efficiency.