Point Dume and Zuma Beach, Malibu, CA

County of Los Angeles – Department of Beaches and Harbors

Coastal Resilience Project Implementation

Phase 1: Feasibility Study – Interim Report

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COUNTY OF LOS ANGELES – DEPARTMENT OF BEACHES AND HARBORS

COASTAL RESILIENCE PROJECT IMPLEMENTATION

PHASE 1: FEASIBILITY STUDY – INTERIM REPORT

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Coastal Resilience Project Implementation

Phase 1: Feasibility Study – Interim Report

1 Introduction

This interim report has been prepared to solicit feedback on the work conducted to date. A final report will be issued based on the feedback received and the remaining analyses to be completed as part of the project. The remaining analyses include economic considerations (cost-benefit analysis), selection of the preferred alternative, development of a sand source investigation plan, and identification of next steps.

1.1 Background

In December 2023, the Los Angeles County Department of Beaches and Harbors (LACDBH) completed a *Coastal Resilience Study* (Moffatt & Nichol, 2023) designed to identify areas threatened by coastal erosion, enhance climate resilience, and advance equitable coastal access to the 18 beaches owned or maintained by the County. As part of the study, three adaptation strategies were proposed at sites deemed to be most vulnerable and of significant value to the community:

- **Zuma Beach & Point Dume Beach**
  Increase sediment supply and expand habitat through beach nourishment and dune creation.

- **Dockweiler State Beach**
  Enhance dune habitat through (1) the installation of sand fencing to promote sand deposition within the dune field, and (2) construction of a low barrier to prevent sediment transport from the dunes into adjacent improved areas (bike path, sidewalk, parking lot).

- **Redondo Beach**
  Increase beach widths and create dune habitat between Topaz Groin and Redondo Pier through beach nourishment. Investigate feasibility to construct an eco-friendly sand retention device at Redondo Pier to enhance sediment retention.

Implementation of these projects is best achieved using a phased approach (Figure 1-1), beginning with this feasibility study and progressing through design and engineering, environmental review and permitting, construction, and project monitoring. This approach is modeled after the successful Regional Beach Sand Projects (RBSP I and II) conducted on behalf of the San Diego Association of Governments (SANDAG) in 2001 and 2012 and is similar to that currently being used for RBSP III.

Figure 1-1. Coastal Resilience Project Implementation Phases

1.2 Feasibility Study Objectives and Scope

The objectives of the Phase 1 Feasibility Study are to (1) outline the steps needed for project implementation, (2) develop the proposed resilience concepts, (3) evaluate project alternatives, (4) identify the preferred alternative, (5) develop the economic benefit to cost ratios for funding applications, and (6) provide clear and concise communication to facilitate public understanding and ownership.

1.3 Interim Report Scope

As noted above, the intent of this report is to solicit feedback on the work conducted to date, which includes characterization of the project sites, development of the project concepts and alternatives, and evaluation of their expected performance.

1.4 Project Team

The multi-disciplinary project team assembled for this project is comprised of firms with extensive experience in all six project phases and a track record of successful collaboration on similar projects. The team includes Coastal Frontiers Corporation (CFC), Moffatt & Nichol, Rincon Consultants, Summit Environmental, Ceto Consulting, and Coastal Restoration Consultants.

2 Site Conditions

The following section summarizes the primary factors that influence coastal processes, biological resources, dune habitat, and socio-economic activity at each of the three project sites in order to provide a basis from which to evaluate the project alternatives.

2.1 Coastal Processes

2.1.1 Regional Overview

The Los Angeles County coast is generally divided into the three coastal regions shown in Figure 2-1: Malibu, Santa Monica Bay, and Palos Verdes Peninsula (Noble, 2016; Noble & Larry Paul, 2017). The Malibu Region extends from the Los Angeles County - Ventura County line in the west to Topanga Canyon in the east and generally consists of narrow, crescent-shaped beaches bounded by rocky headlands. For the most part, beaches in this 25-mile-long region face south and are relatively narrow compared to other LACDBH beaches; however, wider stretches of beach are present at Zuma Beach.

The Santa Monica Bay region is 20 miles long and extends from Santa Ynez Canyon (immediately east of Topanga Beach) in the northwest to the Palos Verdes Peninsula in the southeast. Beaches in this area generally face southwest and are backed by cliffs at both the north and south ends. Past projects, including beach nourishment, harbor construction, and the construction of sediment retention structures, have significantly impacted the shoreline in this region, resulting in artificially wide beaches in most areas.

The Palos Verdes Peninsula Region is approximately 16 miles long and extends from the south end of Torrance Beach to the Port of Long Beach. The shoreline in this area consists of narrow, rocky, pocket beaches backed by cliffs that are up to 150-ft high (Noble, 2016). Shoreline changes in this region tend to be small and related to landslides emanating from the cliffs, rather than from oceanographic processes.

As shown in Figure 2-1, the Zuma Beach and Point Dume Resilience Project is located in the Malibu Region, and the Dockweiler and Redondo Beach Projects are located in the Santa Monica Bay region.

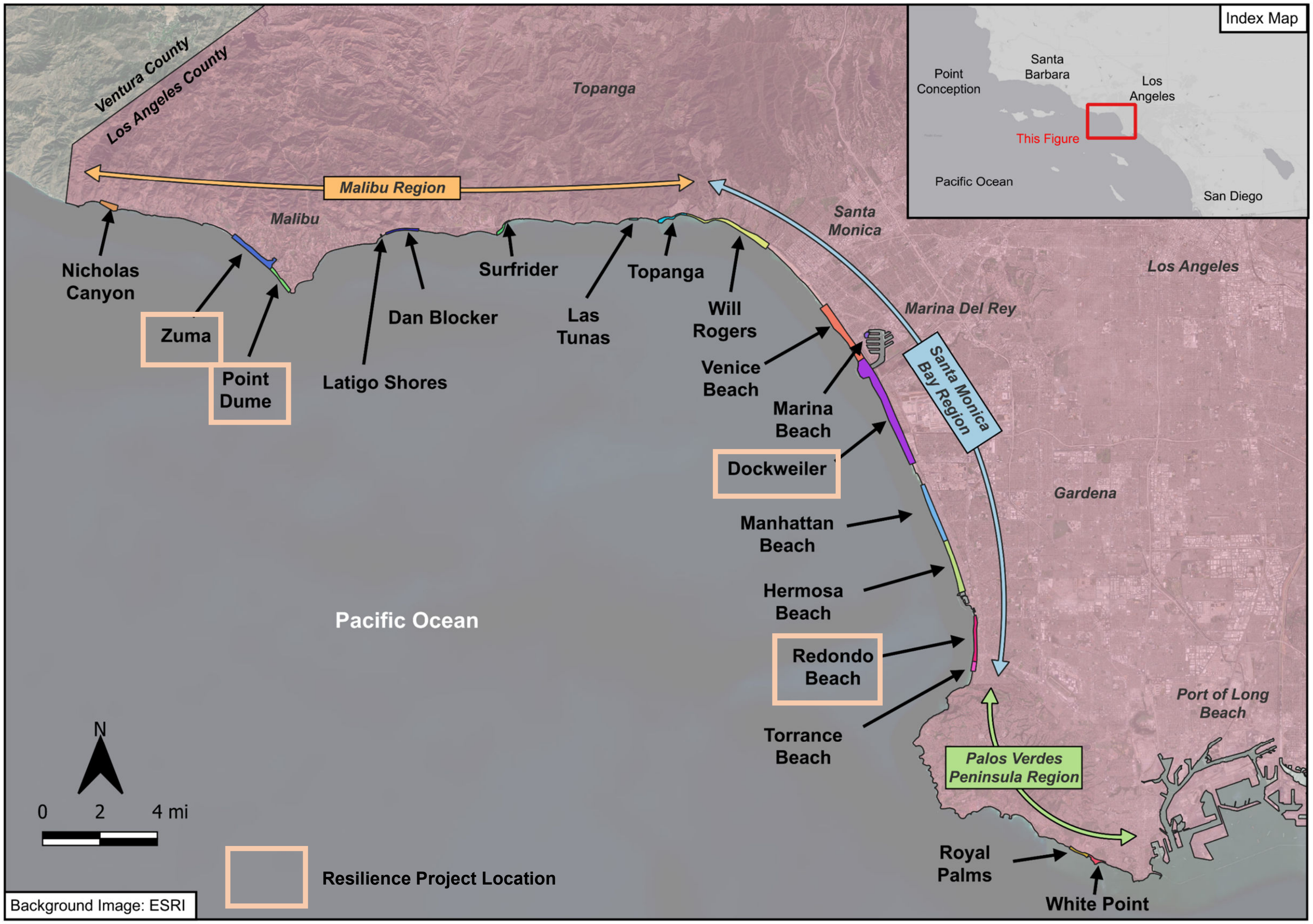

Figure 2-1. Los Angeles County-Operated & Maintained Beaches, Coastal Regions, and Resilience Project Locations

2.1.2 Littoral Processes

The quantification of coastal processes and sediment transport (sand movement) along the California coast is based primarily on the concept of littoral cells, or beach compartments, and provides a valuable beach and shoreline planning framework. A littoral cell is a closed coastal compartment or physiographic unit that contains sediment sources, transport paths, and sediment sinks (Inman and Chamberlain, 1960). A budget of sediment may be developed for a littoral cell to evaluate and interpret coastal sedimentation and overall shoreline stability. This conceptual model applies the principle of conservation of mass to the fluxes of sediment into and out of the littoral cell. Accretion occurs if the balance is positive (*i.e.*, more sand is entering the littoral cell than leaving it), while erosion occurs if the balance is negative (*i.e.*, more sand leaving the littoral cell than entering it).

Figure 2-2 illustrates the littoral cells in the project area, based on work by Griggs and Patsch (2018). As shown in the figure, the region encompassing the three resilience projects (between Malibu and the Redondo Beach) is comprised of two littoral cells: the Zuma Littoral Cell and the Santa Monica Littoral Cell.

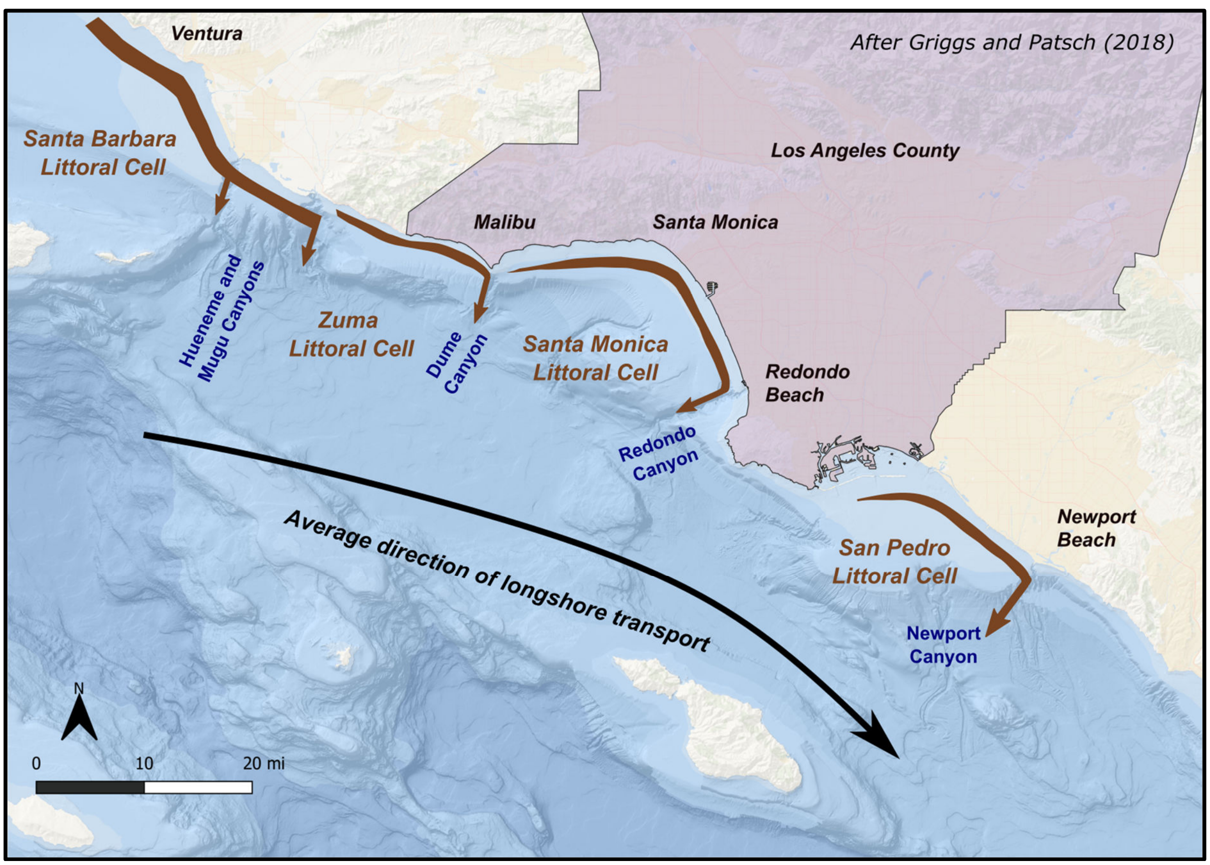

Figure 2-2. Regional Littoral Cells

Longshore sediment transport in both the Zuma and Santa Monica Littoral Cells is bidirectional and varies in accordance with seasonal changes in swell direction. The net direction of sediment transport is from west to east in the Zuma Littoral Cell and from northwest to southeast in the Santa Monica Littoral Cell (Patsch and Griggs, 2007). As described below, an exception occurs at the southern end of the Santa Monica Littoral Cell where sediment transport is predominantly from south to north in the region south of the Redondo Submarine Canyon due to the distinct change in shoreline orientation from southwest-facing to west-facing

Zuma Littoral Cell

The Zuma Littoral Cell begins at the Mugu Submarine Canyon and extends east to the Dume Submarine Canyon. Griggs & Patsch (2018) estimate that the primary sources of sediment within the cell are runoff from small streams and creeks (~34,000 cy/yr) and contributions from bluff erosion (~5,000 cy/yr). While in the past, a portion of the sediment travelling from west to east in the Santa Barbara Littoral Cell was able to bypass the head of Mugu Canyon and enter the Zuma Cell, Griggs & Patsch (2018) note that onshore migration of the canyon head has effectively blocked all sediment input along the western boundary, leading to a deficit of sediment since the late 1990's.

The primary sediment sinks within the Zuma Cell are material lost into Dume Canyon and material transported around Point Dume into the Santa Monica Littoral Cell. While investigators agree that Point Dume acts as a partial barrier to longshore sediment transport, they have not yet reached consensus regarding the percentage of material transported into the canyon versus that which is transported around Point Dume into the Santa Monica Littoral Cell (Inman, 1986; Orme, 1991; Knur & Kim, 1999; Everts & Eldon, 2005; Normark *et al.*, 2009; Everts, 2012; Griggs & Patsch, 2018, George *et al.*, 2018). For the purpose of this study, we have adopted the conclusions presented by Everts (2012), summarized below, as they are directly related to beach nourishment placed upcoast of Point Dume (Broad Beach), and the likelihood that such material will benefit downdrift beaches in Santa Monica Bay.

> *If artificially placed at Broad Beach, sand, with the appropriate size distribution (and, of course, taken from outside any littoral zone) will initially benefit Broad Beach. Over time, it will move east thereby temporarily benefiting Zuma and Westward Beaches. But in due course, almost all of it will pass Point Dume and most of it will pass Malibu. It will eventually end up at Santa Monica and Venice. Its behavior as it moves east will be the same as that of sand that entered the coastal stream in the past from as far away as Port Hueneme.*

Beach widths within the Zuma Littoral Cell are generally characterized by short-term periods of erosion during intense storm events and decadal changes that vary in accordance with the Pacific

Decadal Oscillation (PDO). During warm phases of the PDO, beaches within the Zuma Cell tend to erode, while beaches tend to accrete during the cool phase (Griggs and Patsch, 2018).

Santa Monica Littoral Cell

The Santa Monica Littoral Cell begins at Point Dume and ends at the Redondo Submarine Canyon (Figure 2-2). As noted above, the Point Dume Submarine Canyon acts only as a partial barrier to sediment transport and we have assumed that almost all the sediment moving east through the Zuma Littoral Cell will enter the Santa Monica Littoral Cell. Presently, the only additional natural source of sediment within the Santa Monica Cell is that which is contributed through bluff erosion. Sediment delivery from creeks and streams has largely been eliminated by dams constructed within the Malibu Creek Watershed, with the Rindge Dam being the largest (Griggs and Patsch, 2018). This reduction in natural sediment delivery caused beaches in the northwestern portion of the Santa Monica Cell to become narrow and sand retention structures, including 33 groins, were built to stabilize the shoreline along the Topanga Beach and Will Rogers section of western Santa Monica Bay. Many of these structures are now either buried, severely damaged, or destroyed (Patsch and Griggs, 2007). The Will Rogers groin field is an exception, as it continues to provide effective sand retention to artificially widen an otherwise narrow stretch of coast.

East and south of Will Rogers, beaches are much wider, reflecting the significant quantities of sand that have been delivered to the coast via beach nourishment projects. Since 1926, over 31 million cy of sand has been placed on Santa Monica Bay beaches (Leidersdorf *et al.,* 1994), most of which was derived from major coastal infrastructure construction projects, such as the Hyperion Sewage Treatment Facility and Pacific Coast Highway (PCH). In recent decades, the absence of similar large-scale public infrastructure projects has led to a significant decrease in the frequency and volume of beach nourishment activities in Santa Monica Bay.

The net direction of sediment transport in the Santa Monica Littoral Cell is from west to east between Point Dume and Santa Monica, and from north to south between Santa Monica and King Harbor, which lies immediately north of the Redondo Submarine Canyon. South of the Redondo Submarine Canyon, in the area where the Redondo Beach Resilience Project is proposed, sediment transport is predominantly from south to north due to the distinct change in shoreline orientation from southwest-facing to west-facing. Per Patsch and Griggs (2007), the *Redondo Submarine Canyon is the confluence of the southern and northern trending alongshore transport of sand established in the Santa Monica Littoral Cell. With its head located within 200 yards of the shoreline, Redondo Submarine Canyon serves as an effective sink for this cell.*

2.1.3 Wave Climate

In general, waves that occur along the Southern California coast can be categorized as North Pacific swell, southern swell, or locally generated seas. North Pacific swell is generated by extra-tropical storms that form in the northern hemisphere during the winter months and approach the coast from the west and northwest. Southern swell typically occurs in the summer and fall when intense storms form in the southern hemisphere and eastern Pacific. Locally generated seas can occur year-round and typically approach from the west and southwest; however, pre-frontal seas can be generated from the southeast in winter. Figure 2-3 illustrates the general wave exposure at the three project sites.

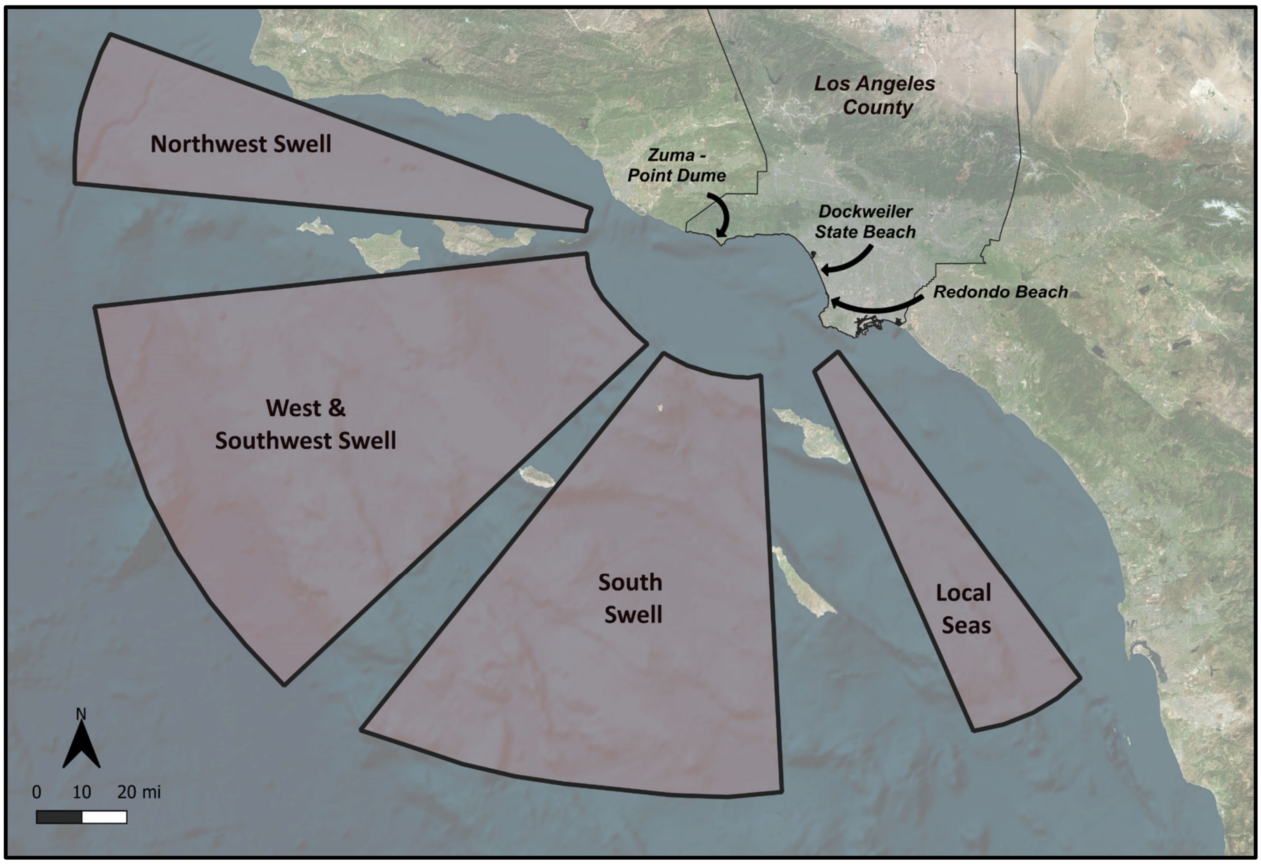

Figure 2-3. Wave Exposure Windows at Project Sites

2.1.4 Sea Level Rise

Planning decisions related to any project development within the coastal zone must consider the potential impacts of future sea level rise (SLR). In California, the currently accepted planning guidance for SLR is provided in the California Ocean Protection Council's (COPC) *State of California Sea-Level Rise Guidance: 2024 Science and Policy Update* (COPC, 2024).

The COPC guidance includes several projections that differ based on the greenhouse gas emissions scenario selected. The "low risk aversion" scenario is specifically recommended for living shoreline projects (COPC, 2024); however, the intermediate-low scenario has been adopted for this study in the interest of conservatism. The assumed design life of each project is 20 years, with a base year of 2030. Table 2-1 delineates the CPOC SLR projections for Santa Monica in years 2030 through 2050 under the intermediate-low risk aversion scenario.

Table 2-1. Projected Sea Level Rise for Santa Monica

Year	Sea Level Rise (ft) Intermediate-Low Risk Aversion Scenario
2030	0.3
2040	0.4
2050	0.6

Source: COPC, 2024

2.1.5 Shoreline Configuration

This section presents information related to the shoreline configuration at each of the three project sites, including relevant short- and long-term shoreline changes.

Zuma Beach & Point Dume Beach

Zuma Beach and Point Dume Beach are adjoining sites located in the City of Malibu, northwest of Santa Monica Bay (Figure 2-4). Zuma Beach is the widest and longest continuous beach in north LA County, with 1.8 miles of beach frontage and 105 acres of property, making it a popular destination for visitors and nearby residents. It is bound by Broad Beach to the northwest and Point Dume Beach to the southeast.

Shoreline changes in this area have been studied in detail as part of the Broad Beach Geologic Hazard Abatement District's (BBGHAD) Broad Beach Restoration Project (Coastal Frontiers Corporation, 2023). As part of the project, CFC conducted 26 beach profile surveys between 2009 and 2023, documenting the shoreline configuration at up to 16 sites between Lechuza Point and Point Dume Beach. The surveys were conducted in the Fall (October) or Spring (May), corresponding to the beginning and end of the winter wave season, respectively. Figure 2-5 illustrates representative beach profiles obtained at Broad Beach, Zuma Beach, and Point Dume Beach between October 2013 and October 2023, as well as the envelope of profiles obtained between May 2002 and November 2022. As shown in the figure, the above-water portion of Zuma Beach is considerably wider than that at Broad Beach and Point Dume Beach. In addition, the nearshore slope tends to be flattest at Broad Beach and steepest at Point Dume Beach.

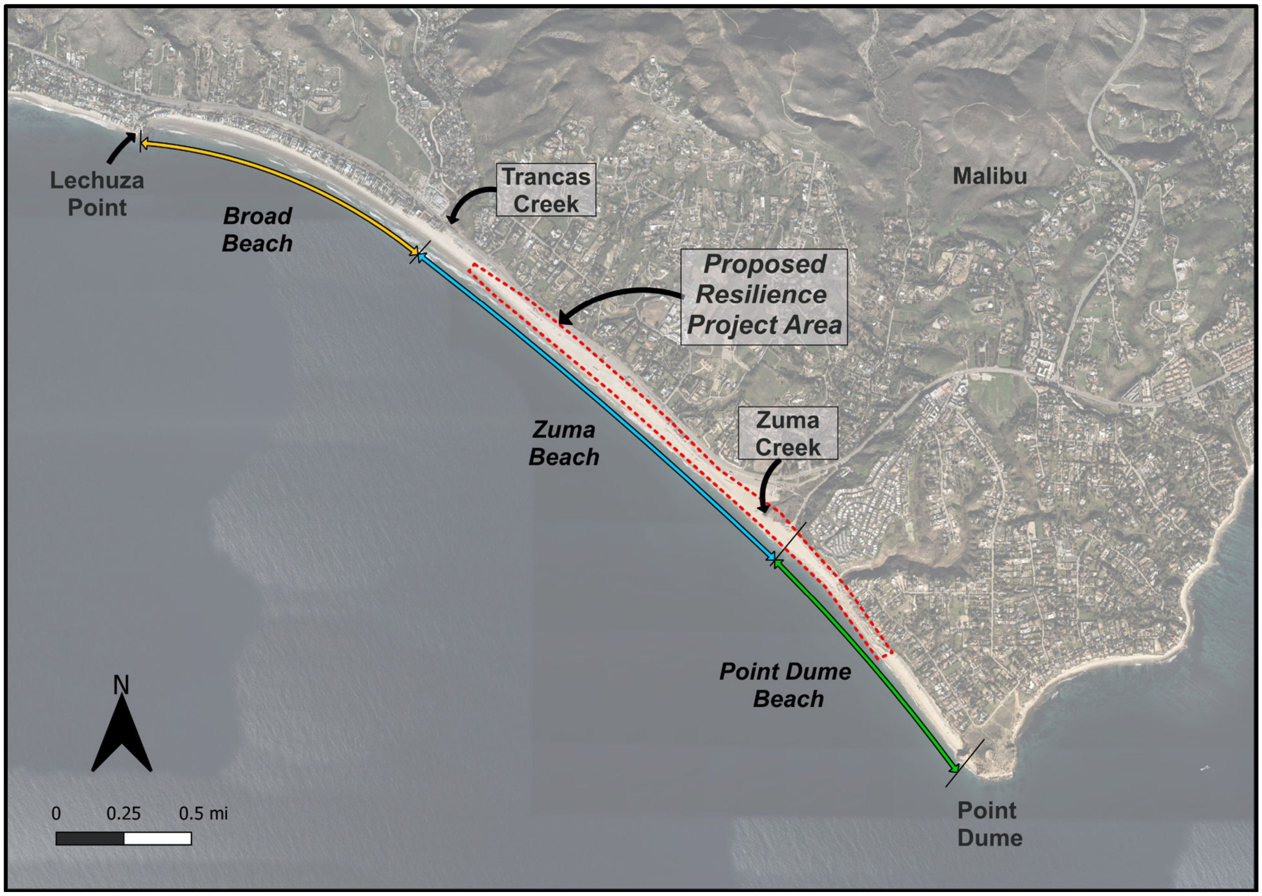

Figure 2-4. Zuma Beach and Point Dume Beach Project Location

Figure 2-6 shows the average Fall Mean Sea Level (MSL) beach width measured during the past decade at Broad Beach, Zuma Beach, and Point Dume Beach. Between 2013 and 2019, Broad Beach was considerably narrower than both Zuma Beach and Point Dume Beach. Since that time, Broad Beach and Zuma Beach have gradually widened, while Point Dume Beach has gradually narrowed. At the time of the most recent survey (Fall 2023), the average beach width at Zuma Beach (268 ft) was almost twice that at Broad Beach (133 ft) and Point Dume Beach (158 ft).

One of the critical issues that the proposed resilience project seeks to address is the vulnerability of Westward Beach Road, which serves as the only access point to Point Dume Beach. In Summer 2021, the road was undermined, requiring emergency repairs and shore protection. Storms in winter 2022-23 damaged the emergency shore protection and threatened portions of the road and the restroom at Point Dume Beach. To prevent loss of the road and damage to the Point Dume Beach facilities, additional rock was imported and used to construct the revetment shown in Photo 2-1.

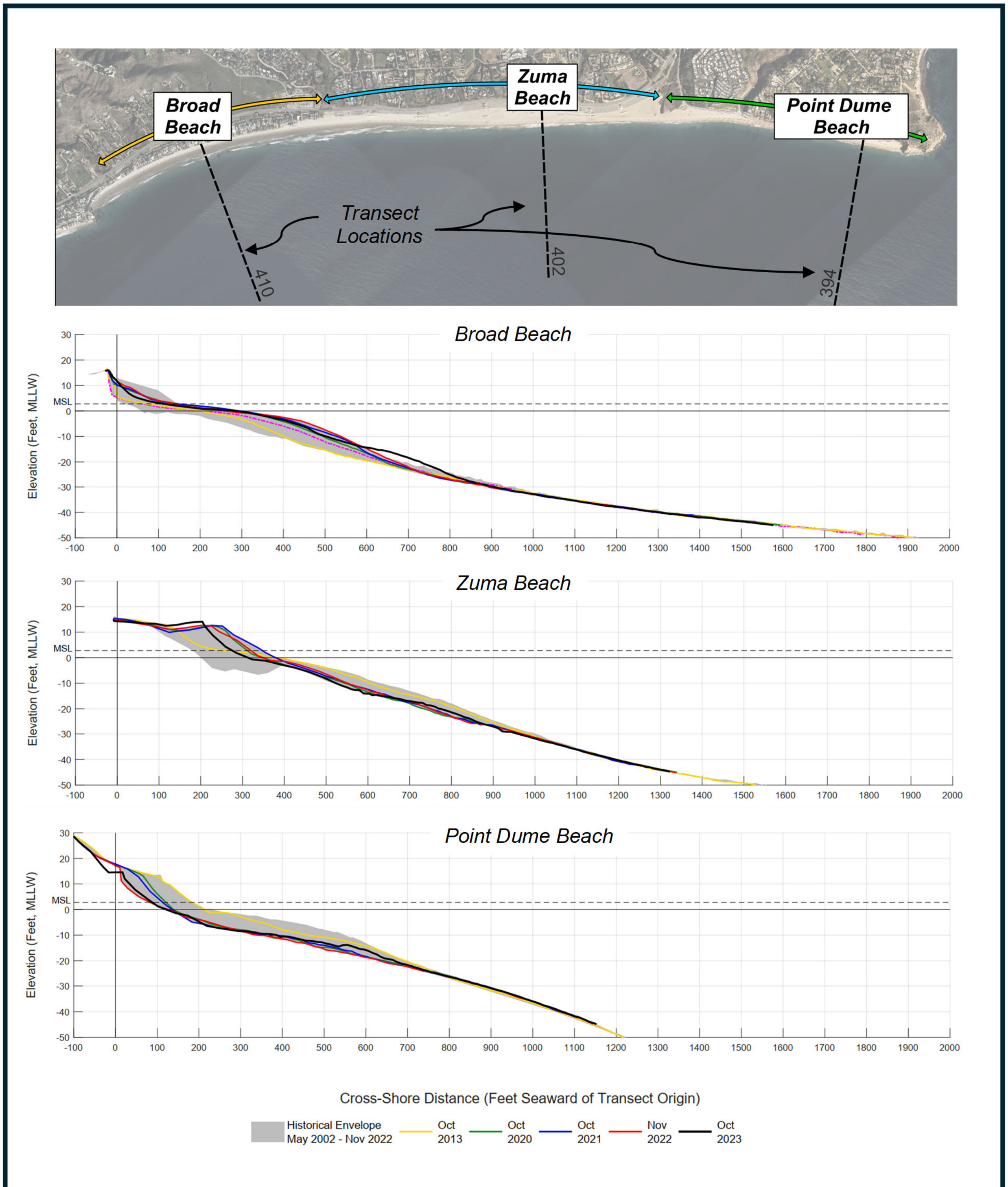

Figure 2-5. Representative Beach Profiles at Broad Beach, Zuma Beach, and Point Dume Beach

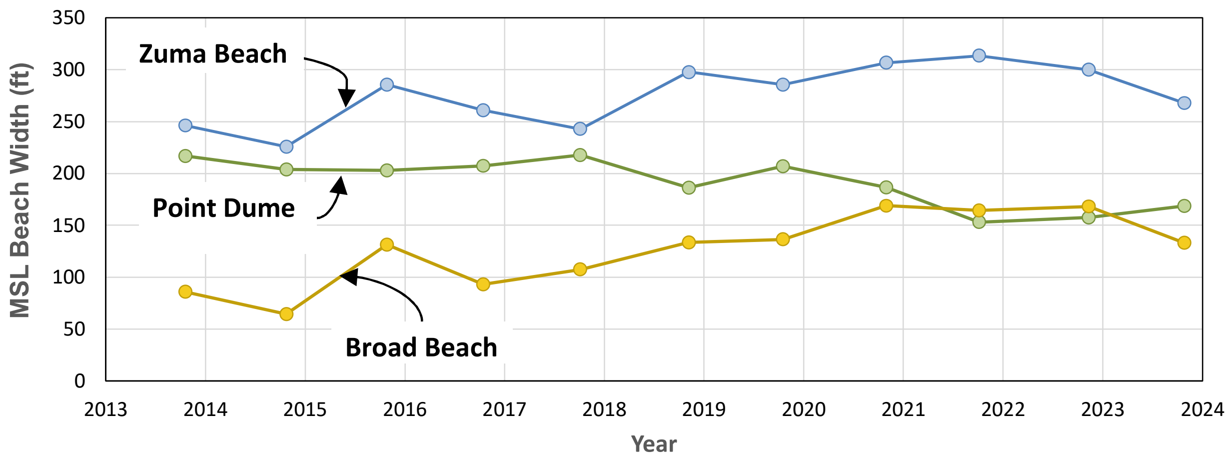

Figure 2-6. Average MSL Beach Widths at Broad Beach, Zuma Beach, and Point Dume Beach

Photo 2-1. Point Dume Beach and Westward Beach Road (March 16, 2023)

Dockweiler State Beach

Dockweiler State Beach is located in the southeast portion of Santa Monica Bay, south of Marina del Rey (Figure 2-1), in the Playa del Rey neighborhood of Los Angeles. The west-facing beach is approximately four miles long, with amenities that include fire rings, volleyball nets, a youth center, bike path, and hang glider facilities. It is a popular destination for local residents and visitors, garnering an average of 1.1 million beach day visits per year (Moffatt & Nichol, 2023).

Figure 2-7 illustrates the southern portion of Dockweiler State Beach, near the site of the proposed resilience project. The area consists of wide, sandy beaches stabilized by rock groins and has historically benefitted from sand bypassed from Marina del Rey Harbor maintenance dredging. The surplus of sediment, however, can be wind-driven onto landward amenities, such as the Marvin Braude Bike Trail and parking lots, creating a hazard to public safety and increasing maintenance costs. The proposed resilience project aims to reduce this hazard through construction of a low sand barrier and active maintenance of the dune system that fronts the bike path (Moffatt & Nichol, 2023).

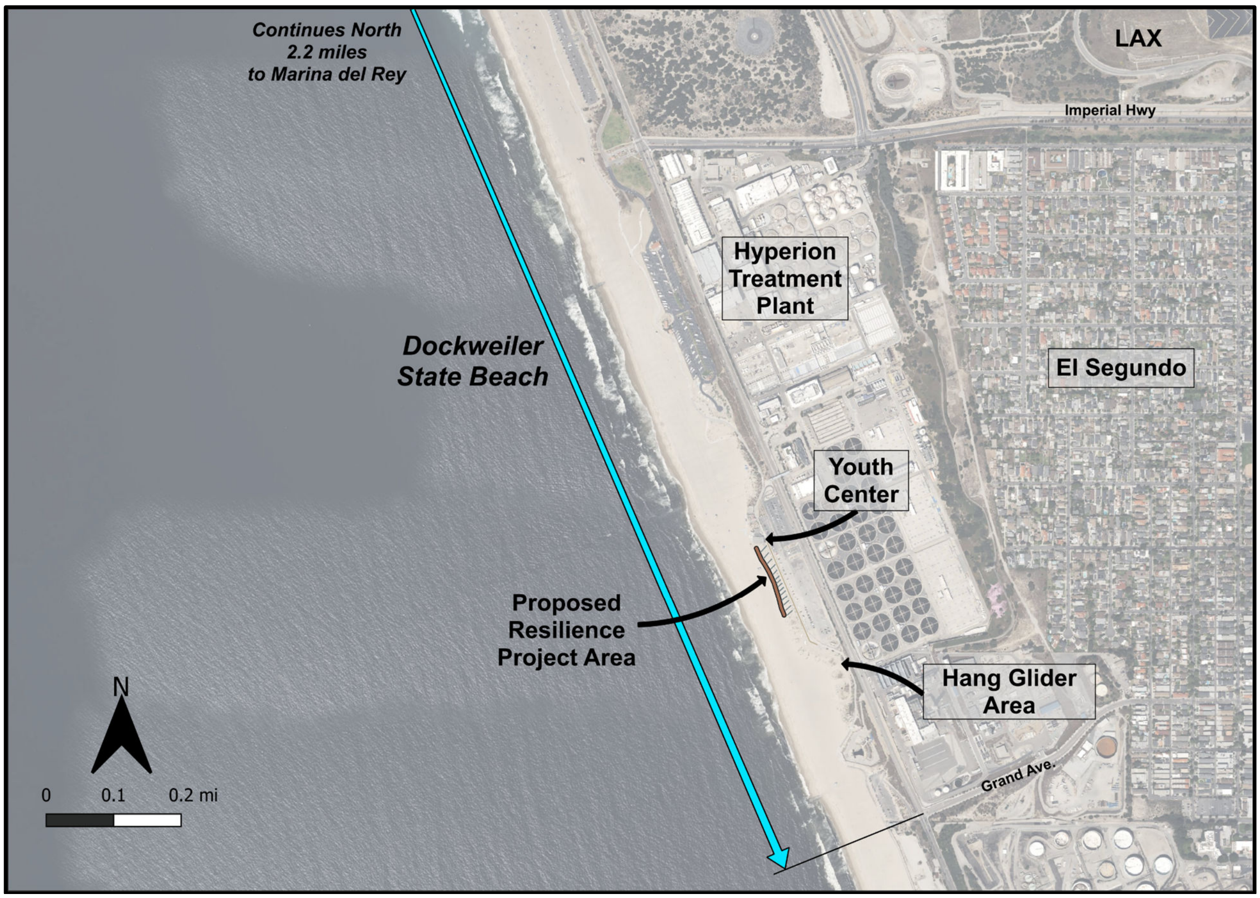

Figure 2-7. Dockweiler State Beach Project Location

Figure 2-8 illustrates representative beach profiles obtained approximately 1 mile north of the proposed resilience project site. The profiles were obtained in June 2002 and June 2005 on behalf of the U.S. Army Corps of Engineers (USACE), and in May 2024 on behalf of LACDBH as part of the County's Sand Compatibility and Opportunistic Use Program (SCOUP). As noted above, and shown in the figure, the beach is very wide. Based on the available profile data, the site is relatively stable, with only minor differences evident between the 2002 and 2024 profiles.

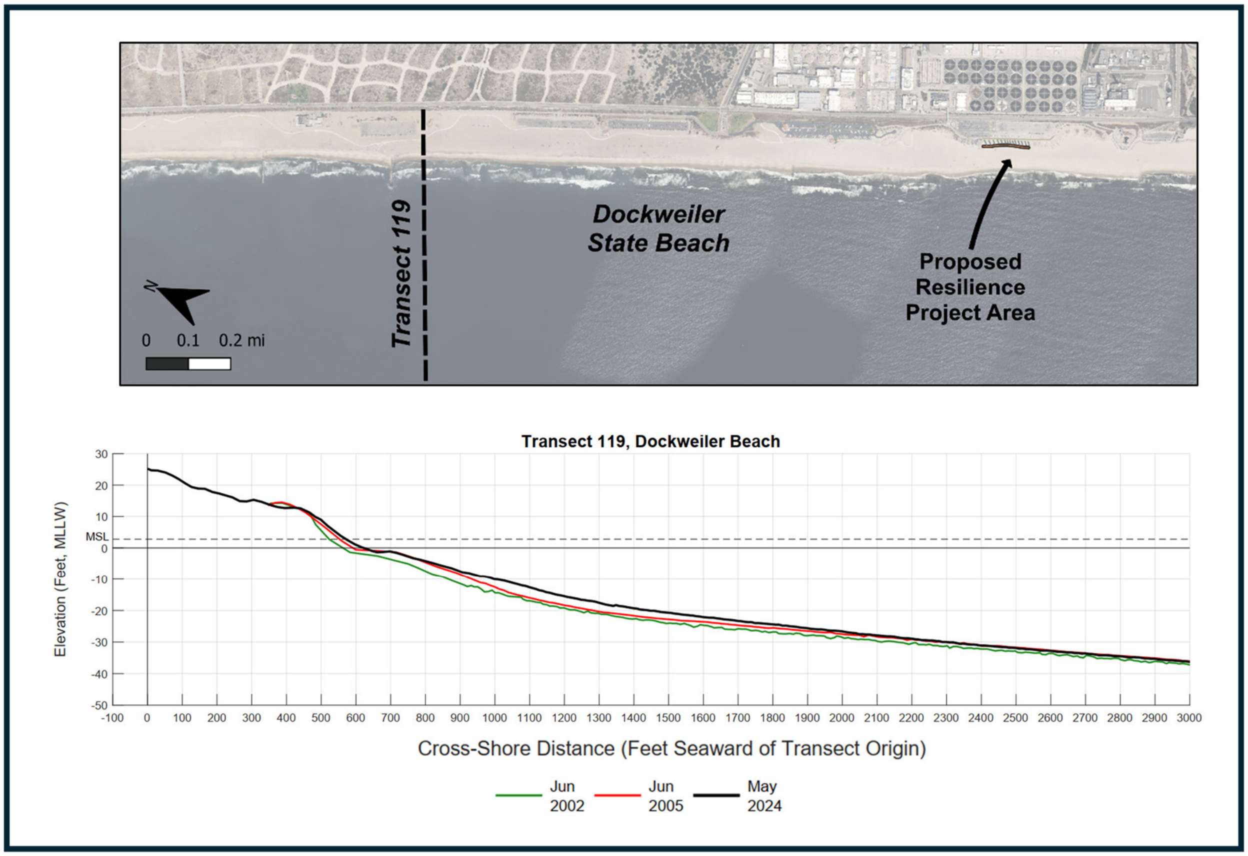

Figure 2-8. Representative Beach Profiles at Dockweiler State Beach

Redondo Beach

Redondo Beach is located near the southeast end of Santa Monica Bay, in the City of Redondo Beach (Figure 2-1). The entire beach is over a mile and a half long, beginning at the Redondo Beach Pier and ending at Miramar Park and Torrance Beach (Figure 2-9).

The beach consists of two primary regions, separated by Topaz Groin. South of the groin, the beach is relatively wide and stable, due to the retention of sediment travelling along the coast from south to north (Section 2.1.2). In fact, Patsch and Griggs (2007) note that much of the sand placed in the area as part of a large beach nourishment project in 1968 and 1969 still exists along this stretch of coast. North of the groin, the beach is narrow due to the reduction in sediment supply caused by the groin, as well as the loss of sediment into the Redondo Submarine Canyon and King Harbor.

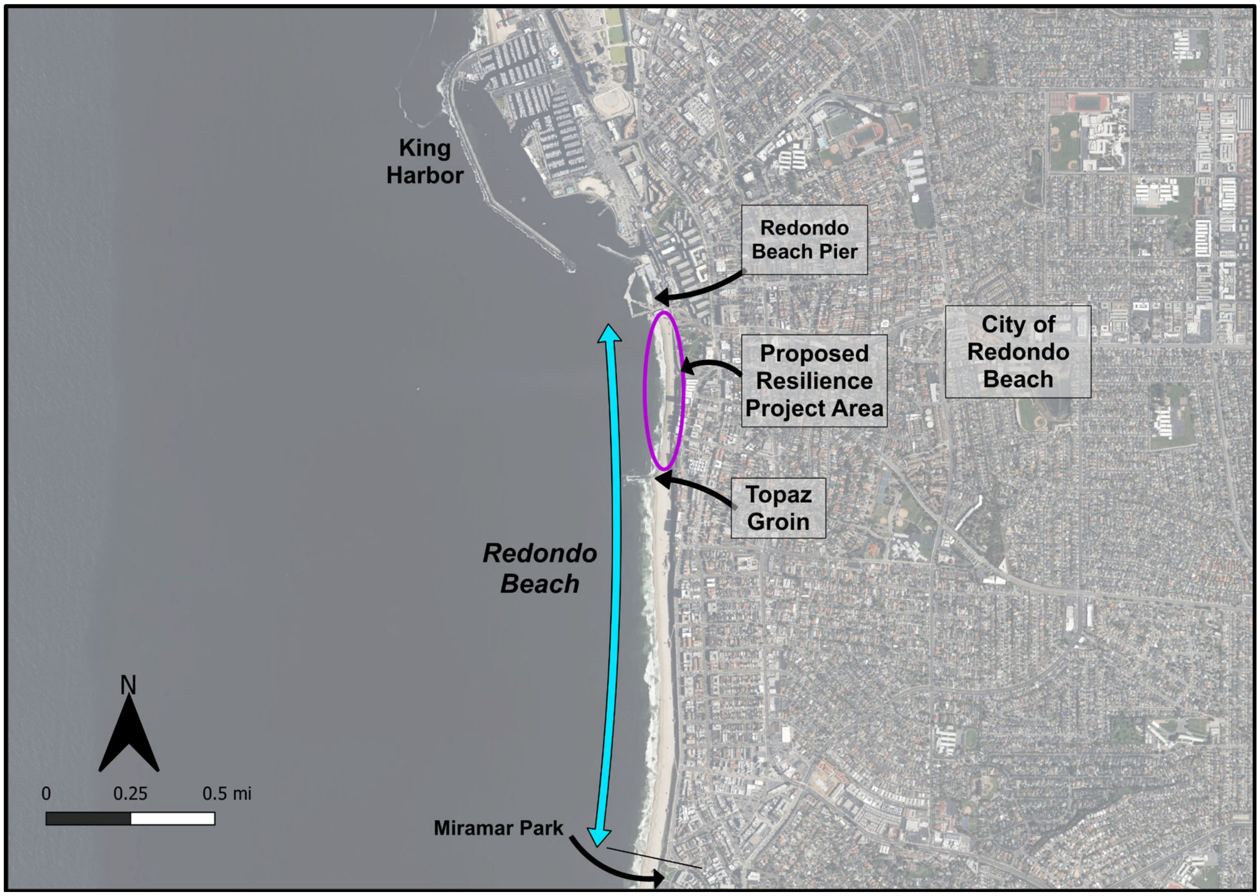

Figure 2-9. Redondo Beach Project Location

Figure 2-10 illustrates representative beach profiles obtained on the north and south sides of Topaz Groin in June 2002, June 2005, and May 2024. As shown in the figure, the beach north of the groin (Transect 028) is considerably narrower and steeper than that to the south (Transect 016), given the proximity of the northern monitoring transect to the Redondo Submarine Canyon. The area north of Topaz Groin has been used as a beach nourishment receiver site on several occasions. Most recently, approximately 160,000 cy of sand was placed on the beach and in the nearshore region in 2012. While both areas appear to be relatively stable based on the limited profile data available, the area north of Topaz Groin is chronically narrow and depends on periodic nourishment to maintain the width. The proposed resilience project aims to increase recreational opportunities and storm damage resilience by widening the beach.

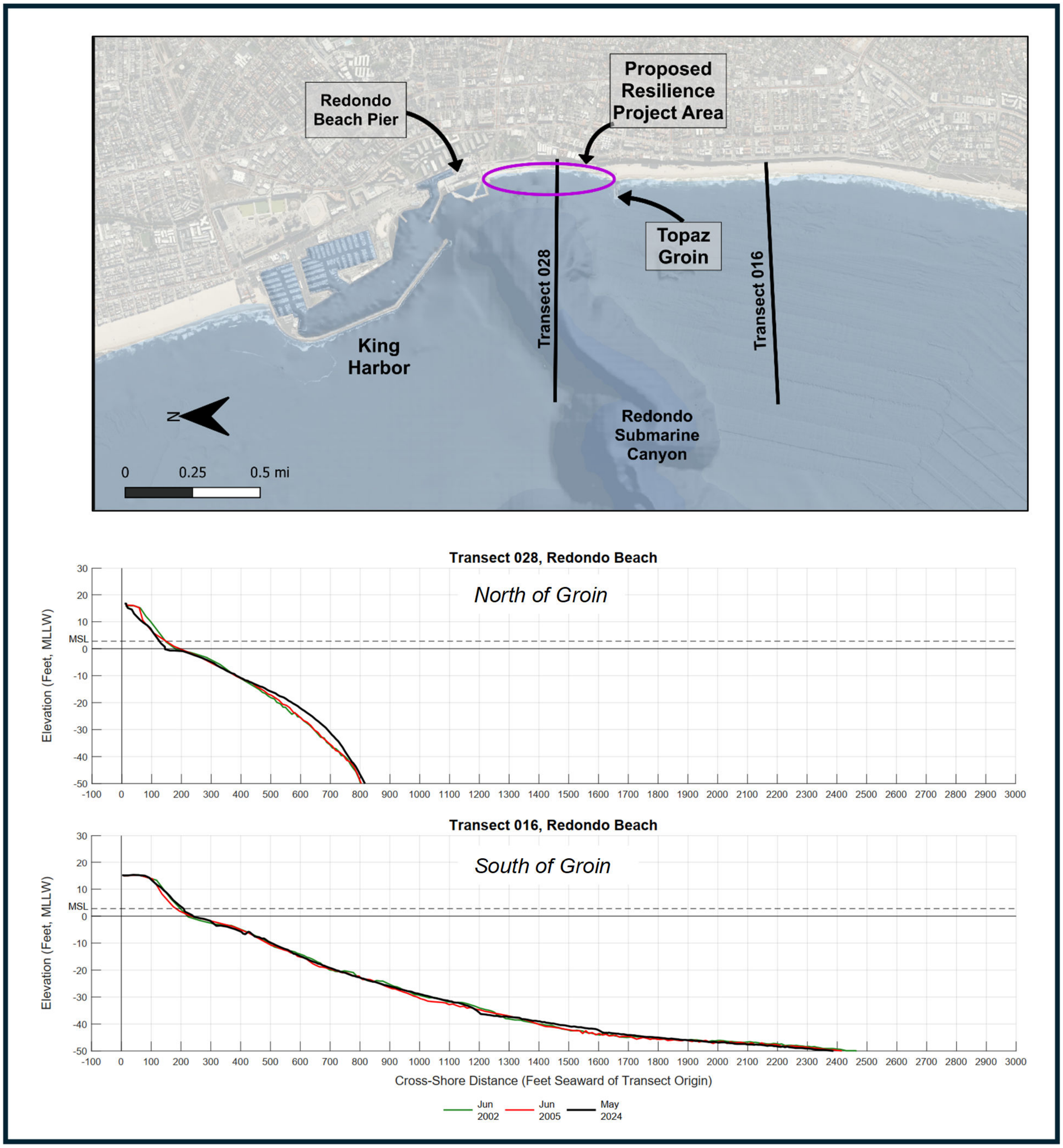

Figure 2-10. Representative Beach Profiles at Redondo Beach

2.1.6 Sediment Size

Table 2-2 summarizes the median grain size at elevations ranging from +12 to -30 ft (MLLW) at each of the three project sites. The samples at Zuma Beach were obtained in Spring 2016 as part of the Broad Beach Restoration Project (data provided courtesy of BBGHAD), while those at

Dockweiler State Beach and Redondo Beach were obtained in Spring 2024 as part of the LACDBH SCOUP Project. Figure 2-11 through Figure 2-13 illustrate the envelope of grain sizes at each site. As shown in both the table and figures, the sediments at Zuma and Dockweiler State Beach were similar in size, while those at Redondo Beach tended to be coarser.

Table 2-2. Median Grain Size Distribution, Resilience Project Sites

Elevation (ft, MLLW)	D_{50} (mm)					
	Zuma Beach		Dockweiler State Beach		Redondo Beach	
	Transect 402	Transect 406	Transect 119	Transect 115	Transect 028	Transect 016
+12	0.31	0.32	0.35	0.37	0.55	0.45
+6	0.53	0.29	0.28	0.33	0.75	0.36
0	0.20	0.20	0.21	0.24	1.08	0.38
-6	0.37	0.22	0.25	0.24	0.44	0.27
-12	0.20	0.19	0.22	0.20	0.31	0.24
-18	0.18	0.17	0.11	0.17	0.19	0.16
-24	0.14	0.13	0.11	0.16	0.16	0.14
-30	0.14	0.12	0.10	0.11	0.21	0.13

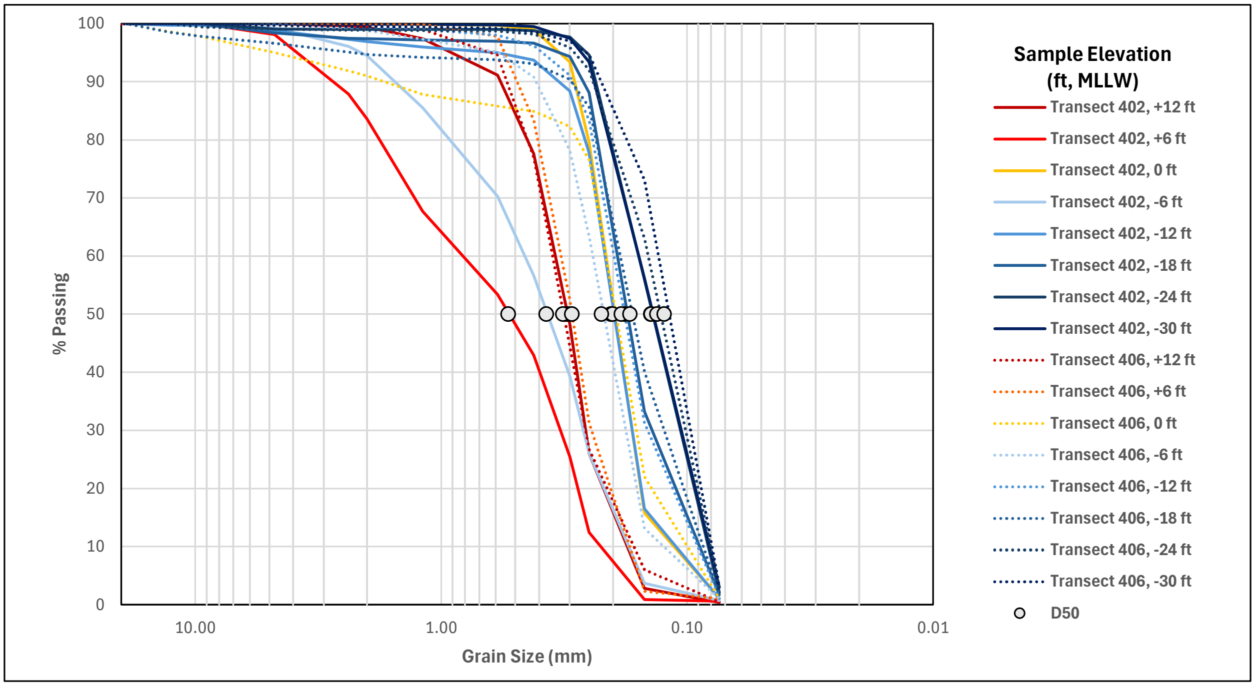

Figure 2-11. Envelope of Grain Sizes, Zuma Beach

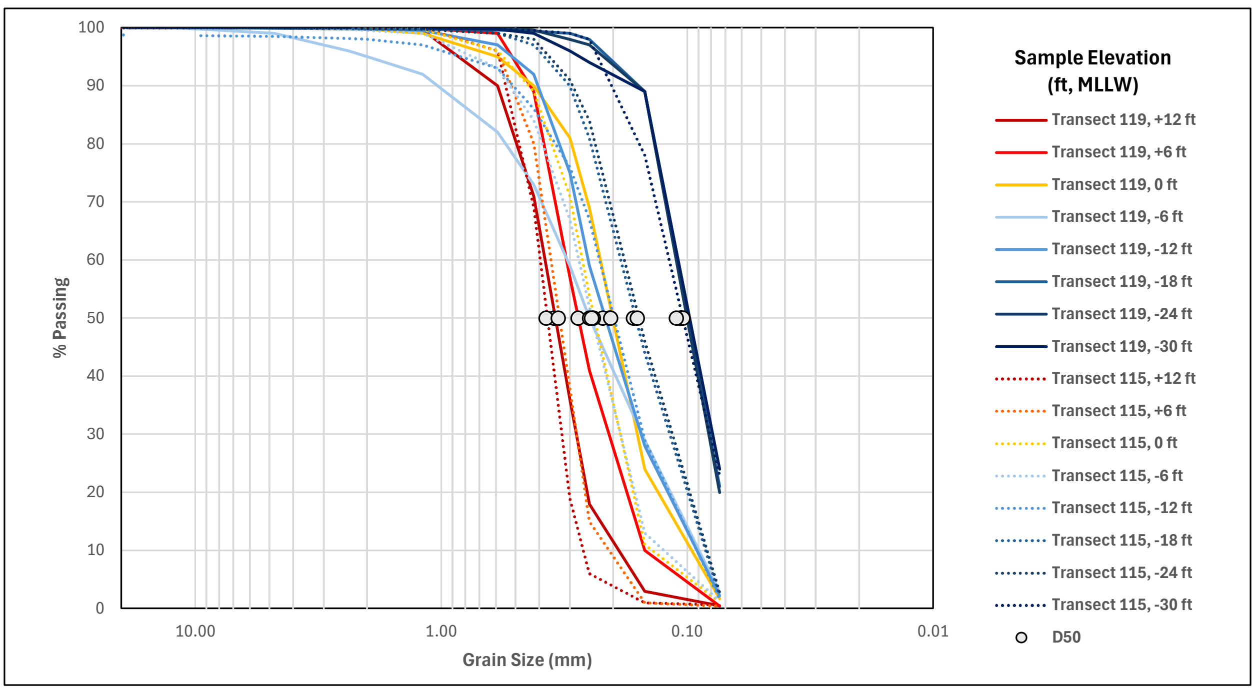

Figure 2-12. Envelope of Grain Sizes, Dockweiler State Beach

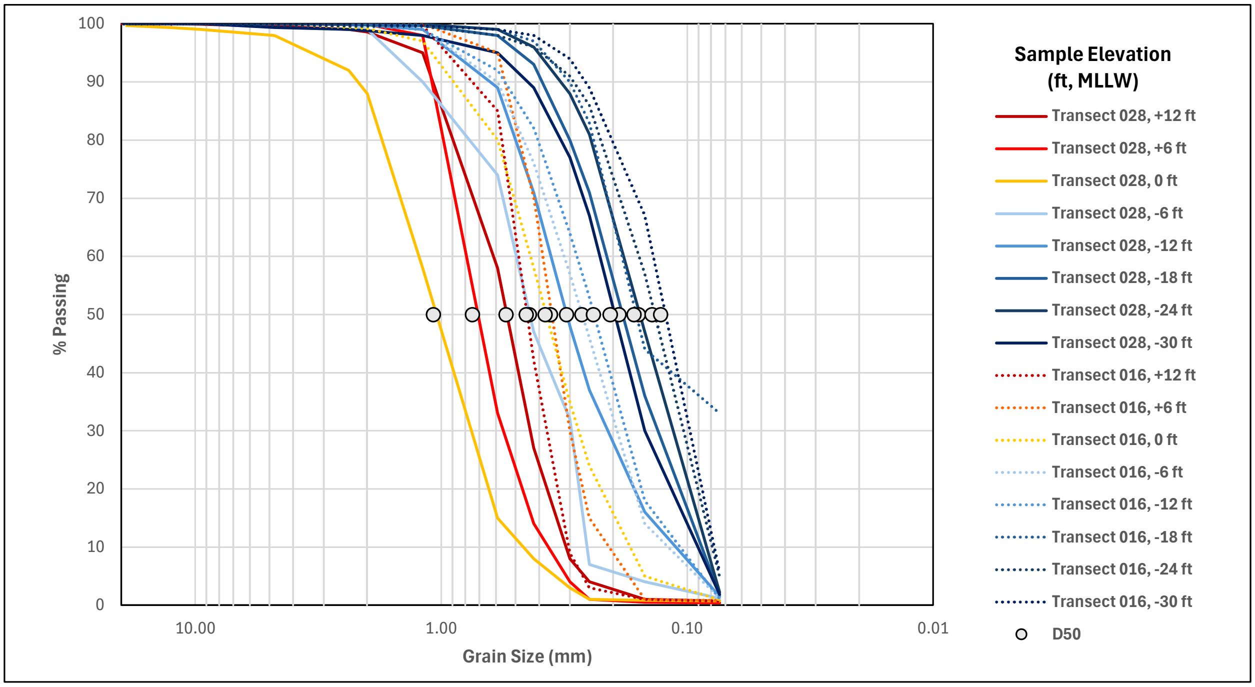

Figure 2-13. Envelope of Grain Sizes, Redondo Beach

2.2 Biological Resources

The subsections that follow summarize the regulated or sensitive biological resources relevant to the three project locations. The summary was prepared by Rincon Consultants (2024).

2.2.1 Data Sources

A variety of literature was reviewed to obtain baseline biological information at the three project sites. The literature review included information from standard biological reference materials and regionally applicable regulatory guiding documents including (but not limited to) the following:

- Los Angeles Department of Beaches and Harbors Coastal Resiliency Study (Moffatt & Nichol, 2023)
- Sand Compatibility and Opportunistic Use Program for Los Angeles County Beaches – Planning Study & Framework Report (Coastal Frontiers Corporation, 2023)
- Los Angeles County Public Beach Sea-Level Rise Vulnerability Assessment (Noble, 2016)
- California Regional Sediment Management Plan Los Angeles County Coast (Noble, 2012)

Other sources of information about the project sites included aerial photographs, topographic maps, bathymetric charts, geologic maps, climatic data, and project plans. The results of database queries from the California Natural Diversity Data Base (CNDDB; CDFW, 2024a), United States Fish and Wildlife Service (USFWS) Information, Planning, and Conservation System (USFWS, 2024b), species managed by National Oceanic Atmospheric Administration (NOAA, 2024b & 2024c), and the California Native Plant Society (CNPS, 2024) were recently compiled for the LACDBH SCOUP Project, which included a review of the three project site locations. The preliminary list of special status species for the SCOUP Project was used to evaluate which species may have a potential to occur within the three project sites. The evaluation included 83 terrestrial special-status plant species and 80 terrestrial and marine/anadromous special-status wildlife species. Species that have potential to occur at the project site locations are described below.

Queries were conducted of several relevant scientific databases which provide information about regulated or sensitive biological resources, including the USFWS Critical Habitat Portal (USFWS, 2024a), the USFWS National Wetlands Inventory (NWI) (USFWS, 2024c), the National Hydrography Dataset (NHD) (USGS, 2024), the United States Department of Agriculture National Cooperative Web Soil Survey (USDA, 2024a), the Natural Resource Conservation Service (NRCS) List of Hydric Soils (USDA, 2024b), and the Essential Fish Habitat (EFH) Mapper (NOAA, 2024a).

In addition to the literature review and databases mentioned above, team staff reviewed state Marine Protected Areas (MPAs), which have been established to protect ecosystems and/or sustain fisheries production, as well as specific species regulated through the goals, objectives, policies, and mandates of the Marine Life Management Act (MLMA) and Areas of Special Biological Significance (ASBS), which were created in order to help maintain natural water quality within some of the most pristine and biologically diverse sections of California's coast.

2.2.2 Regulated Biological Resources

Special-Status Species

Special-status species include those listed, proposed for listing, or candidates for listing as threatened, endangered or species of concern by the USFWS or NOAA under the Federal Endangered Species Act (FESA); those listed or proposed for listing as rare, threatened, or endangered by the CDFW under the California Endangered Species Act (CESA); animals designated as "Fully Protected" and Species of Special Concern (SSC) by the CDFW; and species on the Special Animals List. Additionally, special-status resources include those protected under the Marine Mammal Protection Act (MMPA) and sensitive aquatic communities, such as eelgrass beds (*Zostera* spp.) or managed fisheries (MF) such as California grunion (*Leuresthes tenuis*).

No special-status plants are expected to occur within the project sites based on the absence of suitable habitat types and/or soils and being located outside the known range for these species. The following special-status terrestrial and marine/anadromous wildlife species have potential to occur at the three project sites.

- El Segundo blue butterfly (*Euphilotes battoides allyni*) (Federally Endangered [FE]) – Dockweiler State Beach
- California grunion (MF) – Zuma Beach & Point Dume Beach, Dockweiler State Beach, Redondo Beach
- Green sea turtle (*Chelonia mydas*) (Federally Threatened [FT]) – Zuma Beach & Point Dume Beach, Dockweiler State Beach, Redondo Beach
- Western snowy plover (*Charadrius nivosus nivosus*) (FT/ SSC)– Zuma Beach & Point Dume Beach and Dockweiler State Beach
- California brown pelican (*Pelecanus occidentalis*) (Federally and State Delisted) – Zuma Beach & Point Dume Beach, Dockweiler State Beach, Redondo Beach
- California least tern (*Sterna antillarum browni*) (FE/State Endangered) – Dockweiler State Beach and Redondo Beach
- Gray whale (*Eschrichtius robustus*) (FE/MMPA) – Zuma Beach & Point Dume Beach, Dockweiler State Beach, Redondo Beach
- Harbor seal (*Phoca vitulina*) (MMPA) – Zuma Beach & Point Dume Beach, Dockweiler State Beach, Redondo Beach
- Common bottlenose dolphin (*Tursiops truncatus*) (MMPA) – Zuma Beach & Point Dume Beach, Dockweiler State Beach, Redondo Beach
- California sea lion (*Zalophus californianus*) (MMPA) – Zuma Beach & Point Dume Beach, Dockweiler State Beach, Redondo Beach

Invertebrates

The El Segundo blue butterfly resides in the El Segundo sand dunes near Dockweiler State Beach and has been observed foraging in areas with their natural food source, coast buckwheat (*Eriogonum latifolium*). There is a low potential for the species to occur in the vegetated areas near the project site and they are not expected to occur due to lack of their food source.

Fish

The California grunion spawns on sandy beaches in southern California. Immediately following high tides from mid-March through August, grunion may come ashore to lay eggs in the sand near the High Tide Line (HTL). The eggs are incubated in the sand until the following series of high tide conditions, when the eggs hatch and area washed into the ocean. The Zuma Beach and Redondo Beach project sites occur in the sandy beach and subtidal sand overlapping the HTL and therefore have the potential to impact incubating eggs if project activities occur during their spawning season.

Green Sea Turtle

The green sea turtle is common in southern California bays, lagoons, and other nearshore waters close to coastal inlets. Individuals would not be expected at the project site but could occur foraging or transiting through the Santa Monica Bay in warm water years. The project activities could temporarily alter nearshore water quality but the potential for substantial impacts is relatively low. The project should be designed to limit the discharge of sediment or material into the nearshore waters and develop a water quality monitoring plan, as described in Section 4.7 BIO-7.

Birds

The western snowy plover exhibits strong fidelity to overwintering sites, which provide connectivity for dispersal between breeding sites. Breeding western snowy plovers have not been observed at the Redondo Beach project site since 2020 but they may occur at Zuma Beach and Dockweiler State Beach. While the beach within the project sites may provide important overwintering habitat, the project sites are frequently disturbed by public use and the species is likely accustomed to ambient disturbance. If the species were present during project activities, potential direct impacts could include mortality or injury of individuals. Potential indirect impacts to the species may include increased noise and displacement of food; however, these indirect impacts to habitat are anticipated to be temporary and will not affect the long-term quality of overwinter, foraging, or nesting habitat.

The California least tern is not known to nest at the project sites but could be found in the nearshore waters foraging; therefore, direct impacts are not expected. Project activities have the potential to indirectly impact foraging individuals if present during project activities.

The California brown pelican is present at the project sites. However, suitable nesting habitat does not exist within the sites. Should the species be present during the project, potential direct impacts could include mortality or injury of individuals. Potential indirect impacts to the species may include increased noise and displacement of food.

The project should be designed to be constructed outside of the nesting bird season or incorporate western snowy plover monitoring and nesting bird survey measures, as described in Section 4.7 BIO-1, BIO-2 and BIO-4.

Marine Mammals

The offshore waters of the project sites are relatively shallow (< 40-ft Mean Lower Low Water) reducing the potential for cetaceans (e.g., gray whale) to occur. The common bottlenose dolphin, California sea lion and harbor seal have a moderate to high potential to occur. Noise from project implementation is not expected to cause a disturbance to marine mammals since no underwater sound is proposed, but increased turbidity may temporarily alter foraging or migration patterns but the potential for substantial impacts is relatively low.

To minimize disturbance to special-status marine mammals, general guidelines set forth in the MMPA should be implemented. Equipment and foot traffic should remain at least 150 ft from stranded or hauled-out seals and sea lions that could occur on the sandy beach, as described in Section 4.7 BIO-5. Project activities are not expected to have direct impacts on marine mammals if the guidelines set forth in the MMPA are followed. Indirect impacts to marine mammals could include alteration or disturbance of foraging or haul-out habitat.

Nesting Birds

To avoid disturbance to nesting and special-status birds, including raptor species protected by the Migratory Bird Treaty Act (MBTA) and California Fish and Game Code (CFGC) 3503, activities related to the project including, but not limited to, vehicle traffic, foot traffic, and demobilization, should occur outside of the bird breeding season for migratory birds (generally February 1 through September 15), if practicable. Should any birds nest on or near the project sites, project activities could directly impact breeding by destroying the nest, or through disruption of normal biological behaviors during construction of the project resulting in nest failure. Indirect impacts could include disturbance of breeding habitat. The loss of a nest or disturbance of nesting habitat during the breeding season due to construction activities would be a violation of the MBTA and CFGC Section 3503.

Watershed and Drainages

The Zuma Beach & Point Dume site is in the Zuma Canyon-Frontal Pacific Ocean watershed within Hydraulic Unit Code (HUC 12-180701040203), which drains directly into the Pacific Ocean (USGS 2024). The south face of the Santa Monica Mountains drains to the Pacific Ocean through several small simple watersheds draining a few hundred to a few thousand acres. The streams and coastal bluffs contribute sand sources into the Santa Monica littoral cell, which extends from Mugu Canyon in Ventura County to Palos Verdes Peninsula in Los Angeles County.

Five ephemeral drainages which originate in residential areas direct stormwater under the Pacific Coast Highway and terminate at a culvert outlet along the back beach (USGS 2024). Zuma Creek, an intermittent creek, is located west of Point Dume. The creek originates in the Santa Monica Mountains and flows through Zuma Canyon before terminating at the Pacific Ocean.

Dockweiler State Beach is located along the Manhattan Beach-Frontal Santa Monica Bay watershed within Hydraulic Unit Code (HUC 12-180701040500), which drains directly into the Pacific Ocean. No other drainages occur on the project site.

Redondo Beach is in the Manhattan Beach-Frontal Santa Monica Bay watershed within Hydraulic Unit Code (HUC 12-180701040500), which drains directly into the Santa Monica Bay / Pacific Ocean. The NHD identifies two ephemeral drainages channeling stormwater flows from the residential areas west of the project site.

The nearshore Pacific Ocean is regulated by the USACE, Regional Water Quality Control Board (RWQCB) & State Water Resources Control Board (SWRCB), and California Coastal Commission (CCC). Temporary direct impacts to waters of the US/State/Coastal Waters will occur during project activities at Zuma Beach & Point Dume Beach and at Redondo Beach. Potential impacts include altered turbidity, salinity, pH, light transmittance, total suspended solids, and other constituents during beach placement operations. Potential indirect impacts from project activities could occur if sediment or pollutants were allowed to enter the Pacific Ocean through stormwater runoff.

No culverts or other drainages occur in the project site and therefore the project will not result in a diversion, diking, or filling of the culverts and will not alter the existing flow of stormwater.

Designated Critical Habitat

The Zuma Beach & Point Dume Beach project site is located within designated critical habitat for the western snowy plover and tidewater goby (*Eucyclogobius newberryi*). The Dockweiler State Beach project site is located within designated critical habitat for western snowy plover. The Redondo Beach project site is approximately 1.1 miles south of designated critical habitat for the species. The primary constituent elements (PCEs) essential to western snowy plover include the following (NOAA, 2012):

- Sandy beaches, dune systems immediately inland of an active beach face, salt flats, mud flats, seasonally exposed gravel bars, artificial salt ponds and adjoining levees, and dredge spoil sites, with:
    - Areas that are below heavily vegetated areas or developed areas and above the daily high tides;

- Shoreline habitat areas for feeding, with no or very sparse vegetation, that are between the annual low tide or low water flow and annual high tide or highwater flow, subject to inundation but not constantly under water, that support small invertebrates, such as crabs, worms, flies, beetles, spiders, sand hoppers, clams, and ostracods, which are essential food sources;
- Surf- or water-deposited organic debris, such as seaweed (including kelp and eelgrass) or driftwood located on open substrates that supports and attracts small invertebrates described in PCE 2 for food, and provides cover or shelter from predators and weather, and assists in avoidance of detection (crypsis) for nests, chicks, and incubating adults; and
- Minimal disturbance from the presence of humans, pets, vehicles, or human-attracted predators, which provide relatively undisturbed areas for individual and population growth and for normal behavior.

Project activities are not expected to permanently impact or adversely modify critical habitat. Temporary impacts to these areas could include changes to water quality (*e.g.,* turbidity, pH, dissolved oxygen), increased noise, temporary removal of foraging habitat, and other increased human activity during project activities.

On July 19, 2023, NMFS issued a *Proposed Rule to Designate Marine Critical Habitat for Six Distinct Population Segments of Green Sea Turtles*. CA04: San Onofre to Santa Monica Bay is proposed and overlaps the Dockweiler State Beach and Redondo Beach project sites. Under the FESA, critical habitat designations are finalized at the same time the final listing rule is complete. For this report, we have assumed the Final Rule will include the Dockweiler State Beach and Redondo Beach project sites, which would extend from the HTL to 20-meter depth. This area is considered an essential foraging/resting area for green sea turtle.

Essential Fish Habitat/ Habitat Areas of Particular Concern

The offshore portion of each project site is designated as EFH for two Fishery Management Plans (FMPs): Pacific Fishery Management Council's Groundfish Management Plan (GMP) and the Pacific Fishery Management Council's Coastal Pelagic Species Fishery Management Plan (CPSMP; NOAA, 2024a). EFH is defined as those waters and substrate necessary to fish for spawning. Substrate includes the sediment, hard bottom, structures underlying the waters and the associated biological communities. Several species regulated by the plans include:

- Pacific sanddab (*Citharichthys sordidus*); lingcod (*Ophiodon elongatus*); leopard shark (*Triakis semifasciata*): GMP regulated

- Pacific sardine (*Sardinops sagaz*); northern anchovy (*Engraulis mordax*); Pacific mackerel (*Scomber japonicas*); krill species (*Thysanoessa spinifera, Euphausia pacifica*, and other krill species) and jack mackerel (*Trachurus symmetricus*): CPSMP regulated

Habitat Areas of Particular Concern (HAPC) are a subset of EFH that exhibit one or more of the following traits: rare, stressed by development, provide important ecological functions for federally managed species, or are especially vulnerable to anthropogenic (or human impact) degradation. The rocky reefs HAPC includes those waters, substrates and other biogenic features associated with hard substrate (bedrock, boulders, cobble, gravel, etc.) to the Mean Higher High Water (MHHW) Line. In general, these areas support a diverse assemblage of algae, invertebrates and fish species. Surfgrass is also common in the intertidal rocky reef.

The canopy kelp HAPC includes those waters, substrate, and other biogenic habitat associated with canopy-forming kelp species (*e.g., Macrocystis pyrifera* [giant kelp]). Kelp beds are not only important spawning areas for fishes, but they are important as nursery areas for juveniles. Kelp beds in southern California have fluctuated in extent over the past three decades. Kelp beds are susceptible to turbidity, grazing, sedimentation, displacement by storm surge, and lack of growth related to high temperatures and low nutrients associated with El Niño events.

Dockweiler State Beach borders Marina del Rey harbor, the estuaries present within the harbor are classified as HAPC. Estuary HAPCs include nearshore areas such as bays, sounds, inlets, river mouths and deltas, pocket estuaries, and lagoons influenced by ocean and freshwater. Because of tidal cycles and freshwater runoff, salinity varies within estuaries and results in great diversity, offering freshwater, brackish and marine habitats within close proximity. Such areas tend to be shallow, protected, nutrient rich, and are biologically productive, providing important habitat for marine organisms.

Project activities may temporarily alter EFH and HAPCs or interfere with the movement of fish or wildlife species and could temporarily impede the use of wildlife nursery sites. However, project activities are not expected to have any significant impacts on these habitats, populations or the fisheries that depend on them. The project as designed will help preserve natural habitats and reduce erosion in the nearshore zone, providing additional soft bottom habitat suitable for foraging. Temporary impacts to these areas could include changes to water quality (*e.g.,* turbidity, pH, dissolved oxygen), increased noise, and other increased human activity during construction.

Marine Protected Areas

The Marine Life Protection Act of 1999 directs the state to redesign California's system of MPAs to function as a network to increase coherence and effectiveness in protecting the state's marine life and habitats, marine ecosystems, and marine natural heritage, as well as to improve recreational, educational and study opportunities provided by marine ecosystems subject to minimal human disturbance. Zuma Beach is located within Point Dume Marine Conservation Area (Point Dume SMCA). The Point Dume SMCA extends four miles along the coast and is adjacent to the Point Dume Marine Reserve (SMR) that extends around Point Dume. The Point Dume SMR has the more restrictive regulations. Take of all living marine resources is prohibited in this area.

Take pursuant to beach nourishment and other sediment management activities is allowed inside the SMCA pursuant to any required federal, state and local permits, or as otherwise authorized by the CDFW (California Code of Regulations Title 14, Section 632). Indirect impacts may occur related to increased turbidity and burial of benthic infauna.

Areas of Special Biological Significance

The California State Water Resources Control Board created ASBS to help maintain natural water quality within some of the most pristine and biologically diverse sections of California's coast. No pollutants are allowed to be discharged within these protected areas. Malibu is home to the largest ASBS, Number (No.) 24, which was designated in 1974. ASBS No. 24 stretches 24 miles along the coast from Latigo Point to Laguna Point near Point Mugu, covering about half of the Malibu coast. The Zuma Beach & Point Dume site is located within this ASBS.

The project will not result in direct impacts, such as wastewater and pollutant discharges. However, indirect impacts due to increased turbidity or a change in other water quality standards may occur.

2.3 Dune Habitat Conditions and Restoration Opportunities

The following subsections summarize the feasibility of restoring dunes under current conditions (CRC, 2024). In this context, dune restoration is being considered as an approach to protecting infrastructure from wave damage and preserving sandy beach areas for recreation while providing ecological co-benefits.

2.3.1 Background

Prior to human alterations, most of the beaches in southern California supported at least some dunes. Development has led to the loss of significant areas of dunes. Other activities such as beach grooming have converted dunes to flat, mostly unvegetated beaches. Dunes act as a physical barrier to wave runup, and if sufficiently wide and tall, they protect inland areas from flooding and other damage related to high tides and large wave events. It is natural for the seaward extent of dunes to erode during large wave events. The sand eroded out of the foredunes moves onto the beach and into nearshore waters where it helps attenuate wave energy, adding to the overall resilience of the system. Dune vegetation traps blowing sand, rebuilds topography, and replenishes the sand storage and protective functions of the dunes. This process, known as "self-repair", is a hallmark of the best nature-based solutions for shoreline resiliency. Restored dunes also provide substantial ecological lift.

On beaches that are sufficiently wide, dunes can be restored to achieve ecological and coastal resilience benefits at relatively low cost (Johnston *et al.*, 2023). Where beaches are narrow, actions such as managed retreat (Kochnower *et al.,* 2015) or nourishment along with sand retention structures can create space for dunes. Hybrid approaches such as dunes with cobble cores can be engineered to increase coastal protection offered by dunes alone. These are all nature-based approaches to building coastal resilience.

Assessing the space available for dunes is crucial in determining the types of nature-based actions that may be appropriate for a stretch of coast. For dunes to even be considered as a strategy, the sandy space available between development (or bluffs or other types of inland habitat) and the shoreline needs to be sufficiently wide to allow room for dunes to persist even after severe winter storms erode the beach and foredunes. Beyond this minimum width (which will vary depending on the wave climate of a given reach of the coast), wider dunes can be considered for increased coastal protection and ecological benefits that will be more likely to persist as sea level rises. In most cases though, preserving recreational space on the beach in front of dunes is the most desirable approach where there is sufficient space. In some cases, this means that managed retreat and/or nourishment will be crucial to providing space for dunes and recreation.

In order to provide self-repairing shoreline protection and ecological benefits, restored dunes need to function naturally. The key components for natural functioning are appropriate substrate (sand that matches the natural beach sand), native vegetation (in sufficient cover), and landscape position (appropriate distance from the beach face). Restoring dunes generally involves removing disturbances such as beach grooming, driving, and intense trampling and then seeding native dune plants (Johnston *et al.*, 2023). Topography can be enhanced as part of restoration (*i.e.*, building dunes; Kochnower *et al*., 2015) to jump-start coastal resilience benefits.

Restored dunes are generally self-sustaining if the sand supply to the beach is stable and significant disturbance is prevented. Over the long-term, sea level rise (SLR) will cause sandy shorelines to narrow, and where there is room, to migrate inland. Where inland migration is prevented by infrastructure, shorelines that are currently wide enough to support dunes will eventually become too narrow. At that point, actions such as managed retreat or beach nourishment would be needed to sustain the dune system.

2.3.2 Methods

This shoreline assessment methodology has been developed by CRC to provide a quantitative basis for determining the potential for dune restoration on sandy beaches at a scale that can inform restoration project planning and implementation. This approach is applicable throughout southern California and is based on measuring existing ecological zone widths under winter conditions. This methodology was developed to be an efficient, low-cost approach that does not require expensive survey equipment while providing data on a scale that can inform decisions on locations for small pilot projects to larger-scale restoration efforts.

While minimum ecological zone widths are best measured in late winter or spring, fall surveys were conducted for this evaluation by necessity. For Zuma Beach, field measurements conducted by CRC in September 2024 were adjusted to late winter/spring conditions based on the long-term monitoring data obtained by CFC as part of the Broad Beach Restoration Project (Coastal Frontiers Corporation, 2023). Minimum widths for Dockweiler and Redondo Beaches were estimated based on analysis of aerial photos.

Field Measurements

Intact beach and dune habitats in southern California are characterized by several ecological zones (Table 2-3). The lower zones are controlled mostly by the energy of waves and tides; higher up, vegetation and aeolian sand transport become increasingly important. In general, beach systems lose the upper zones as they narrow. On beaches with high disturbance (*e.g.,* driving, grooming, etc.), vegetation characteristic of coastal strand, foredune, and dune zones can be absent or, as is often the case, limited to small areas where disturbance is less intense (*e.g.*, along the edge of walls and paved paths, around storm drain outfalls, etc.). When present, these small pockets of vegetation are often good indicators of where dunes can potentially be restored.

Zone widths were measured in each project area in contiguous segments (along-shore). Each segment represents a length of the coast characterized by a single back beach type (revetment, bluff, lagoon, building, parking lot, etc.) or a consistent width. In other words, each segment has a different back beach type and/or width compared to adjacent segments. Segments can be any length but tend to be between 50 and 600 ft long.

For each segment, the distance is measured from the back beach to the dune crest, the seaward toe of the dunes, the seaward toe of vegetation, the high tide line (HTL), the water table outcrop (WTO), and the bottom of the swash zone. Not all these features are present in all segments. The elevation of the WTO will depend on tide level during the field measurements and the elevation of the HTL will depend on recent tides and wave energy.

Additional data collection includes any plant species present, percentage of the beach that is sand, gravel, and cobble, typical cobble size, and beach face slope.

Table 2-3. Typical Ecological Zones on Southern California Beaches

Ecological Zone	Limits of the Zone	Field Indicator of Upper Limit	Typical Plants	Physical Drivers
Swash	Below the water table outcrop (WTO)	Saturated sand (WTO)	None	Waves and tides
Wet Sand	WTO to the high tide line (HTL)	Highest recent wrack	None	Waves and tides
Dry Sand	HTL to toe of vegetation	Dry sand without vegetation	None	High waves and king tides
Coastal Strand	Toe of vegetation to toe of the foredunes	Highest seasonal wrack or vegetation	Sea rocket, beach salt bush, red sand verbena	High waves, king tides, and aeolian sand transport
Foredune	Toe of foredunes to first dune ridge	Hummocky dunes & vegetation	Sea rocket, beach salt bush, red sand verbena, beach bur	High waves and aeolian sand transport
Dunes	First dune ridge to development or non-dune habitat	Active dunes & vegetation	Red sand verbena, beach bur, beach evening primrose	Extreme waves and aeolian sand transport

Ideally, field measurements are obtained at low tide (during spring tide sequences), with low wave energy, when the WTO elevation is close to Mean Sea Level (MSL), and the HTL is representative of normal high-water levels. This ensures that measurements obtained at different sites are directly comparable and easy to compare to other GPS- or LIDAR-based beach surveys where MSL is easy to discern. If field measurements are obtained during higher tides, the WTO will be higher than MSL. The distance from the back beach to MSL can be calculated in these cases using the water level elevation during the survey as a proxy for the WTO elevation and the slope of the beach (measured on the wet sand), as shown in equation (1):

$$D = 1 \Big/ \frac{\sin a}{B} \qquad (1)$$

where **D** is the distance from the measured WTO to MSL along the beach face, ***a*** is the slope of the beach face in radians, and **B** is the estimated elevation of the WTO relative to MSL. The value calculated for D is added to the distance from the back beach to the WTO to estimate the distance from the back beach to MSL. This adjustment was only needed for Zuma Beach as all other surveys were conducted on low tides.

When field measurements are obtained in the summer or fall, it is necessary to estimate the ecological zone widths that would prevail under winter conditions when beaches are typically narrower. This can be done using aerial photos obtained in different seasons and years, or from topographic survey data obtained in winter/spring and summer/fall.

Aerial photos of the Dockweiler site from the same time period showed seasonal erosion of about zero to about 50 ft. As such, a typical seasonal erosion value of 30 ft and a maximum seasonal erosion value of 50 ft were adopted.

The Redondo Beach site showed almost no winter erosion in seasonal aerial photos between 2014 and 2024. The maximum seasonal erosion was estimated at 20 ft. This was based on the narrowest beach width observed in the aerial photos.

In the case of Zuma Beach, seasonal beach profile data obtained between 2012 and 2017 were used to estimate the difference between fall and winter/spring conditions. At the four transects shown in Figure 2-14, the winter seasonal change in MSL beach width was computed for the years 2012 through 2017. The results, shown in Table 2-4, indicate that erosion predominates at all four sites, and increases from north to south. All the maximum seasonal changes occurred in 2015, an El Niño year. The beach widths measured by CRC during the fall field program were adjusted to winter/spring conditions by subtracting 75 to 25 ft for a “typical winter” and 110 to 75 ft for an “El Niño winter” at Transects 400 to 406, respectively. Winter berms are erected in front of buildings in this reach (Figure 2-14), although any potential effects of this practice on measured seasonal beach widths are not known.

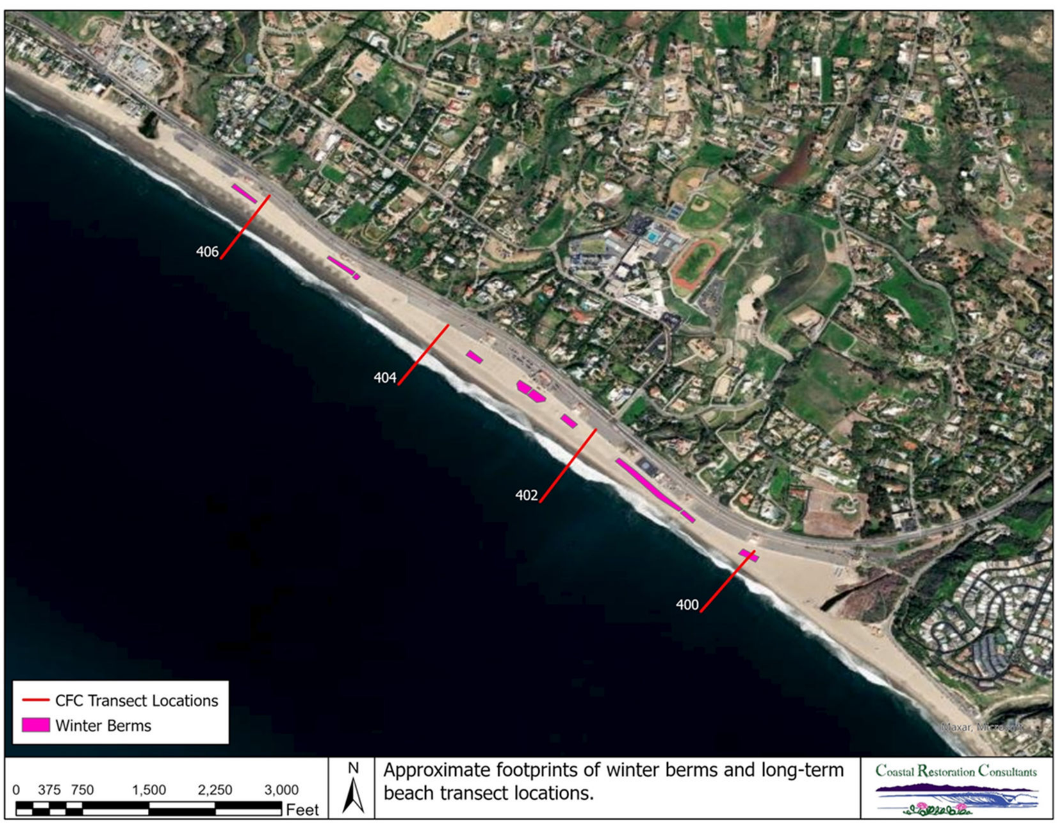

Figure 2-14. Locations of Monitoring Transects and Typical Winter Beach Berms

Table 2-4. Winter Seasonal Beach Width Change, Zuma Beach (Fall 2012 to Spring 2017)

Transect	Winter Seasonal Beach Width Change (ft)		
	Average	Minimum	Maximum
400	-72	-43	-105
402	-79	-39	-129
404	-57	-13	-102
406	-24	11	-73

Note: Negative values indicate erosion over the winter season. Positive values indicate accretion.

2.3.3 Results

All the beaches evaluated were sandy. No gravel or cobbles were observed. All the beaches are heavily used for recreation. Driving by public safety officials was evident at all sites. Evidence of grooming was observed at all sites, although the narrowest stretches of Westward Beach did not appear to be groomed. Grooming at Redondo Beach seemed to be limited to removal of wrack along the high tide line.

Zuma Beach & Point Dume Beach

The Zuma Beach reach was divided into 24 segments, the majority of which (19), are backed by a low concrete wall (Figure 2-15) located just seaward of a paved pedestrian path. Beyond the north end of the wall is Trancas Creek Lagoon and some degraded dunes (somewhat impacted by ongoing construction of the PCH bridge). At the south end of the wall is Zuma Creek Lagoon, which has dune habitat to the north (in front of the wall) and to the south (in front of upland habitat and a bathroom). Excepting the area in front of Trancas Creek, the whole beach was recently groomed from about the HTL to within 6 to 8 ft of the wall.

When adjusted to MSL, the beach widths measured by CRC in September 2024 were within the historic range, but narrower than the average values computed as part of the Broad Beach Restoration Project between 2012 and 2023 (Table 2-5). When all segments are considered, beach widths in September 2024 ranged from 141 to 611 ft, with an average width of 248 ft (Figure 2-16).

Dune vegetation was found in 12 of 24 segments (Figure 2-16). Except in the above-noted dune areas around the lagoons, this vegetation consisted of one to just a few plants per segment, with sea rocket, beach evening primrose, beach bur, and seaside heliotrope being the only species found. All these plants were immediately in front of the wall in a zone that was not groomed.

Figure 2-15. Beach Back Type for Zuma Beach

Table 2-5. Fall MSL Beach Width, Zuma Beach

Transect #	Fall MSL Beach Width (ft)				
	CRC	Coastal Frontiers Corporation[1] (2012 to 2023)			
	2024	2023	Average	Minimum	Maximum
400	263	263	290	263	318
402	221	282	298	249	354
404	246	272	269	198	321
406	216	254	234	168	287

Note: CRC widths derived from the segment in which the CFC transect is located.

[1] Broad Beach Restoration Project (Coastal Frontiers Corporation, 2023)

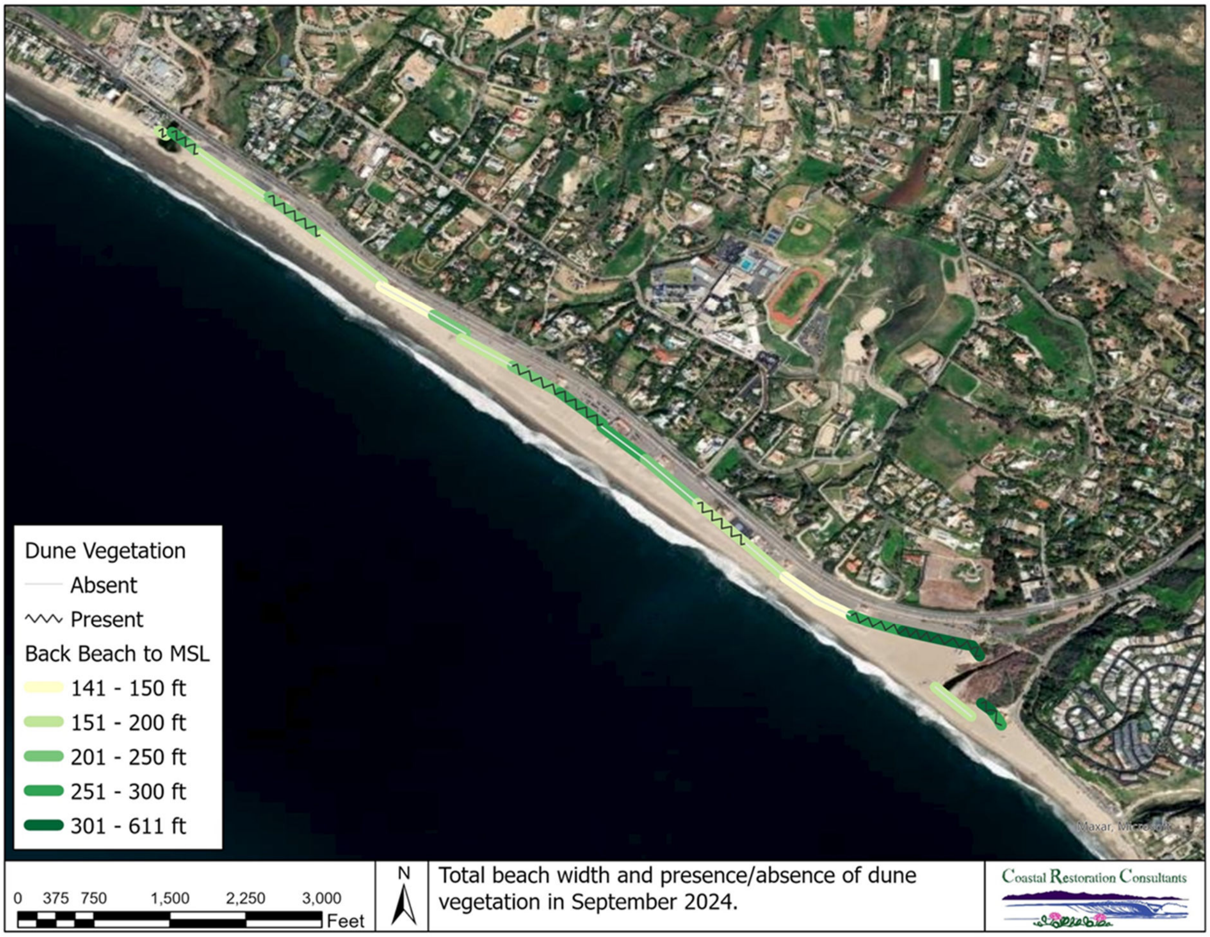

Figure 2-16. Measured MSL Beach Widths, Zuma Beach

Estimated winter MSL beach widths for each segment were computed and are shown in Table 2-6. The values ranged from 70 to 536 ft and averaged 190 ft. Estimated minimum beach widths (*i.e.*, those occurring during an El Niño winter) ranged from 35 to 501 ft and averaged 146 ft. There was not a clear geographical trend in beach width.

The Point Dume Beach reach was divided into 21 segments, the majority of which (11), were backed by a road or parking lot (Figure 2-17). Six segments were backed by a rock revetment and two by buildings. The two segments at the southern end of the reach were backed by natural bluff/upland habitats.

Table 2-6. MSL Beach Width at Zuma Beach during Typical and El Niño Winters

Value	MSL Beach Width (ft)		
	September 2024	Typical Winter	El Niño Winter
Minimum	141	70	35
Maximum	611	536	501
Average	248	190	146

Note: Data derived from all 24 segments at Zuma Beach.

Figure 2-17. Back Beach Type for Point Dume Beach

The beach widths measured during the October 2024 field survey were within the historic range and similar to the average of fall survey data along CFC transects between 2012 and 2023 (Table 2-7). When all segments are considered, beach widths in October 2024 ranged from 30 to 302 ft (Figure 2-18) with an average width of 180 ft.

Dune vegetation was found in 13 of 21 segments (Figure 2-18). Dune topography was found in 8 of the 21 segments, mostly in front of the parking lot towards the southern end of the site. Vegetation consisted of sea rocket, beach evening primrose, beach bur, pink sand verbena, and red sand verbena. Most of the dune areas were part of a restoration project implemented over the last few years, though vegetation cover and plant diversity were low. Symbolic fencing around dunes and a couple short lengths of sand fencing in these areas are left over from the restoration project.

Table 2-7. Fall MSL Beach Width, Point Dume Beach

Transect #	Fall MSL Beach Width (ft)				
	CRC	Coastal Frontiers Corporation[2] (2012 to 2023)			
	2024	2023	Average	Minimum	Maximum
394	197	195	234	190	292
396	56	74	70	2	102
398	292	236	269	235	303

Note: CRC widths derived from the segment in which the CFC transect is located.

Estimated winter beach widths for each segment at Point Dume Beach were computed and are shown in Table 2-8. The values ranged from 45 to 317 ft (averaging 188 ft) for typical winter conditions and from 60 to 331 ft (averaging 194 ft) for El Niño winter conditions. Estimated winter beach widths are slightly narrower to the north to slightly wider to the south compared to fall 2024 measurements. As noted above, the southern end of this reach typically accretes sand in the winter as northwest swells erode sand from Zuma Beach and push it south.

Table 2-8. MSL Beach Width at Point Dume Beach during Typical and El Niño Winters

Value	MSL Beach Width (ft)		
	October 2024	Typical Winter	El Niño Winter
Minimum	30	45	60
Maximum	302	317	331
Average	180	188	194

Note: Data derived from all 24 segments at Zuma Beach.

[2] Broad Beach Restoration Project (Coastal Frontiers Corporation, 2023)

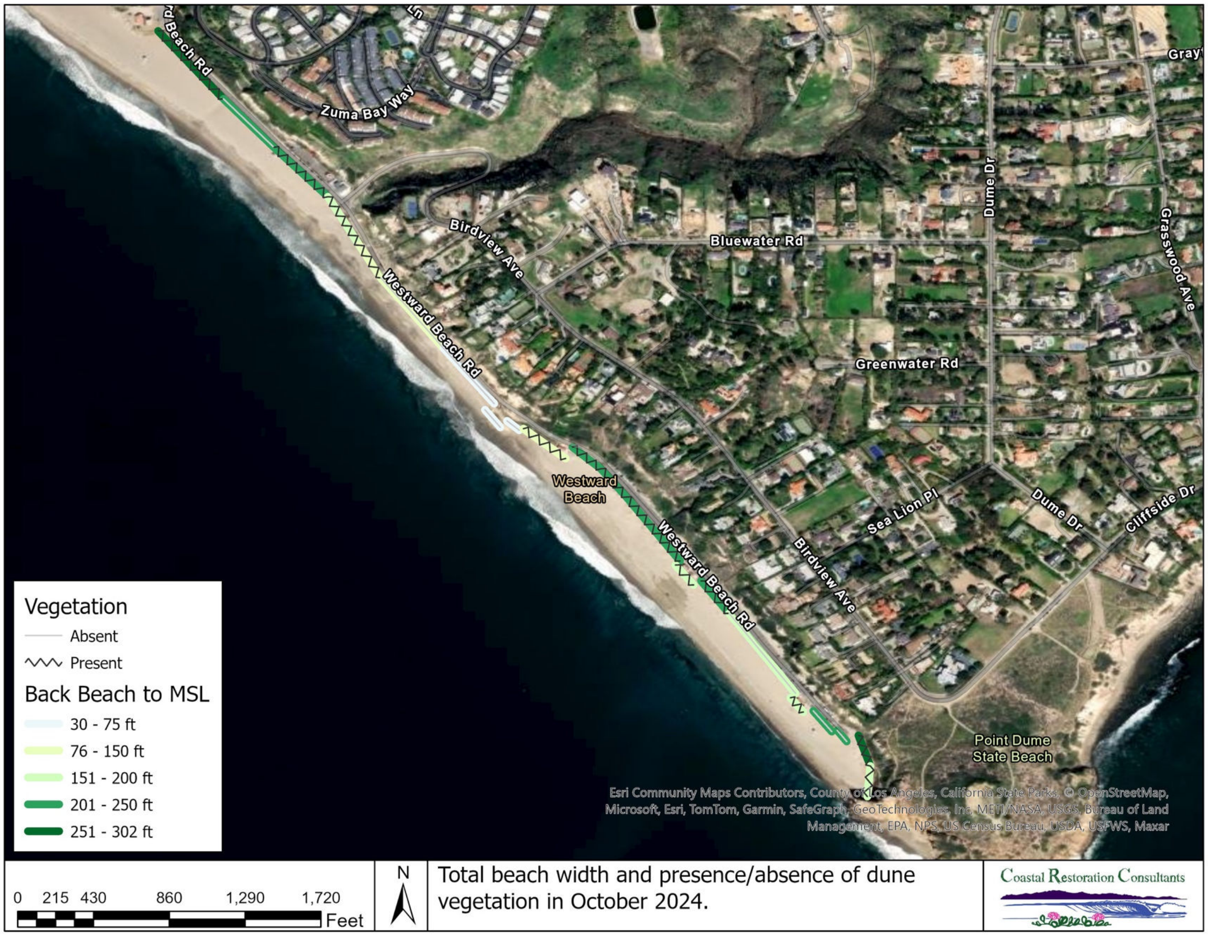

Figure 2-18. Measured MSL Beach Widths, Point Dume Beach

Dockweiler State Beach

The project area at Dockweiler State Beach was divided into four segments, three of which were backed by a bike path and one was backed by buildings (Figure 2-19). The beach widths measured in October 2024 ranged from 328 to 574 ft (Figure 2-20) with an average width of 419 ft.

Dune vegetation and topography were found in three of four segments (Figure 2-20). Vegetation consisted of sea rocket, beach evening primrose, beach bur, seaside buckwheat, and iceplant. The dune habitat occurs on a steep slope between the fairly flat upper beach and the bike path. There is considerable trampling through the dunes.

Estimated typical winter beach widths for each segment at Dockweiler State Beach ranged from 298 to 544 ft, with an average value of 389 ft. Estimated minimum beach widths during El Niño winters ranged from 278 to 524 ft and averaged 369 ft.

Figure 2-19. Back Beach Type for Dockweiler State Beach

Figure 2-20. Measured MSL Beach Widths, Dockweiler State Beach

Redondo Beach

The project area at Redondo Beach was divided into nine segments, seven of which were backed by a bike path, one was backed by a building and one by a wall/staircase (Figure 2-21). The beach widths measured in October 2024 ranged from 105 to 177 ft (Figure 2-22) with an average width of 136 ft.

Figure 2-21. Back Beach Type for Redondo Beach

Figure 2-22. Measured MSL Beach Widths, Redondo Beach

Dune vegetation was found in two segments (Figure 2-22) and consisted of a patch of iceplant next to a bathroom and a sea rocket plant at the mouth of a storm drain. No dune topography was observed.

Estimated typical winter beach widths for each segment at Redondo Beach ranged from 105 to 177 ft, with an average value of 136 ft. Estimated minimum beach widths during El Niño winters ranged from 85 to 157 ft and averaged 116 ft.

2.3.4 Implications for Nature-Based Solutions

Current state guidance (Newkirk *et al.,* 2018) recommends that dunes restored as a nature-based solution for protecting inland areas from flooding should be at least 50 ft wide with 100 to 200 ft of beach in front of them (Figure 2-23). It is assumed that the recommended beach width applies to summer/fall (maximum width) conditions, although this is not explicit. Additionally, this guidance is meant to apply to all of California, including northern California beaches where wave energy is significantly higher. Based on this guidance and measurements and estimates of maximum winter erosion, the minimum recommended beach is at least 100 ft of beach in front of dunes at Zuma Point Dume, and Dockweiler Beaches and at least 50 ft of beach in front of dunes at Redondo Beach.

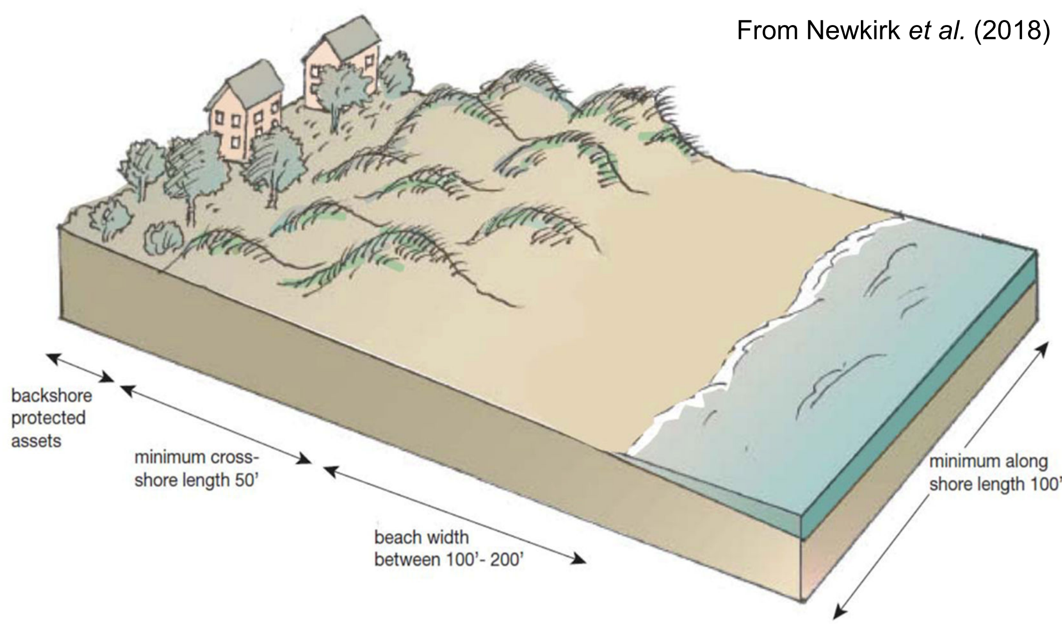

Figure 2-23. Current Design Guidance for Dune Use in Nature-Based Adaptation Strategies

Zuma Beach and Point Dume Beach

Assuming a minimum of 50-ft-wide dunes, segments that are greater than 150 ft wide in the fall and greater than 50 ft wide under minimum beach width conditions are potential candidates for restoration of sustainable, self-repairing dunes. Segments that are 150 to 200 ft wide in fall 2024 are considered marginal candidates for restoration. These segments might need taller dunes with a consistent dune ridge to prevent flooding, for instance. Segments that exceed 200 ft wide in fall 2024 have a high potential for supporting self-sustaining dunes. All of the segments identified as marginal, high potential, or sufficient are greater than 100 ft long and therefore meet the along-shore width criteria from Newkirk et al (2018) as well.

Figure 2-24 categorizes the 24 Zuma Beach segments using the criteria above. As shown in the figure, two regions were identified as being too narrow to accommodate healthy, self-repairing dunes; one just west of the entrance to Zuma Beach and one near the restrooms at the west end. Four additional areas were identified as marginal, most of which were located along the west half of the beach. The remaining areas were considered to have high potential, or to be sufficient to support the desired dune system.

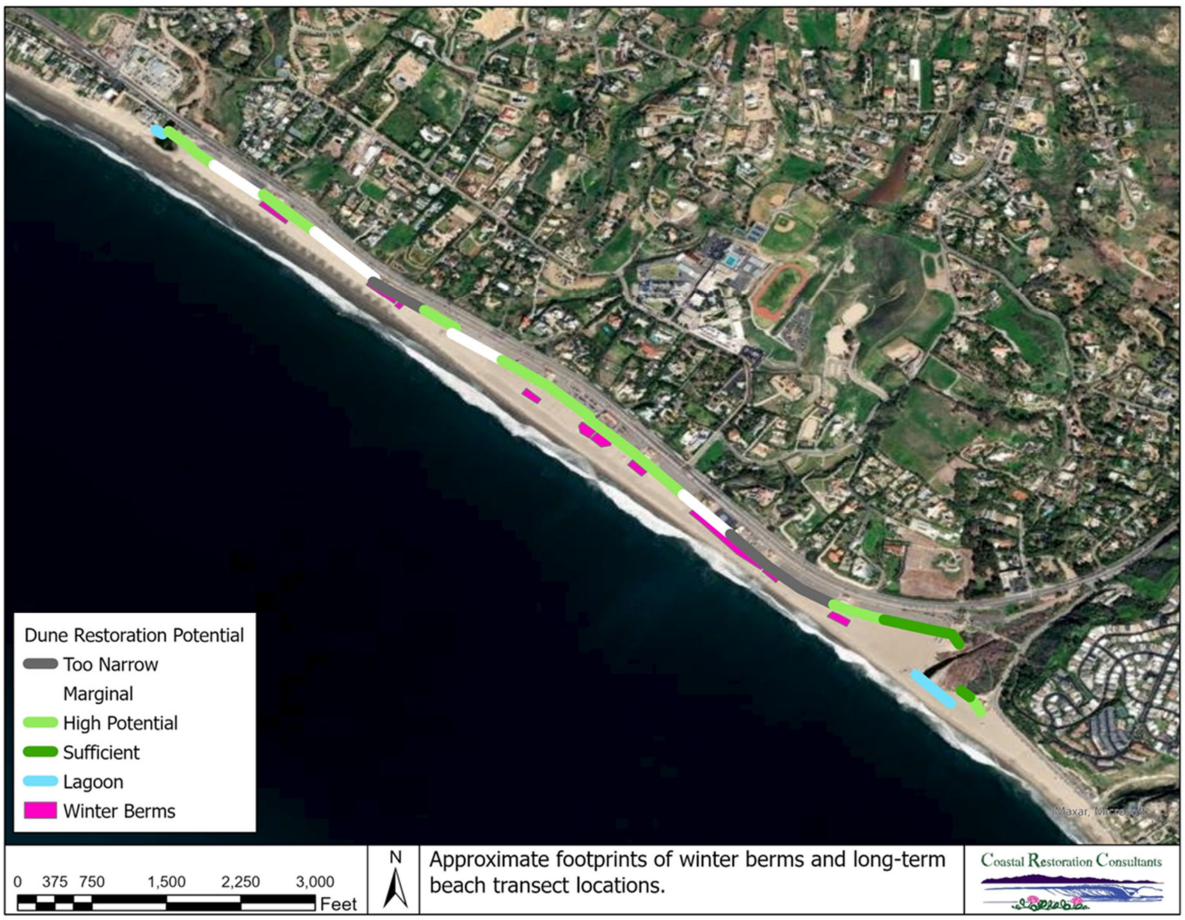

Figure 2-24. Potential for Restoring Self-Sustaining Dunes at Zuma Beach

The dune potential at the 21 Point Dume Beach segments is illustrated in Figure 2-25 using the same criteria. As shown in the figure, only one small area was identified as being too narrow to accommodate healthy, self-repairing dunes (just north of the restroom where the revetment extends further onto the dry beach). Two additional areas were identified as marginal, both located adjacent to the aforementioned revetment section. The remaining areas were considered to have high potential, or to be sufficient to support the desired dune system.

Figure 2-25. Potential for Restoring Self-Sustaining Dunes at Point Dume Beach

Dockweiler State Beach

The wide beach at this site could support expanded dunes throughout the reach (Figure 2-26). Existing dunes could be enhanced by reducing trampling, seeding with native dune species, and removal of non-native vegetation. New dunes could be constructed in front of the existing dunes and buildings or dune topography could be built over time using a combination of sand fencing and revegetation. Paths through the dunes would allow pedestrian access between the beach and the bike path/parking lot. Restored and enhanced dunes with focused pedestrian pathways would virtually eliminate wind-blown sand on the bike path and parking lot.

Figure 2-26. Potential for Restoring Self-Sustaining Dunes at Dockweiler State Beach

Redondo Beach

Despite the narrower beach width at this site, the apparently lower seasonal erosion means that this beach could support at least a narrow self-sustaining dune field throughout most of the reach (Figure 2-27). If the beach is nourished and that sand is retained, the beach would be wide enough to support dunes along with considerable recreation space. Dunes here would decrease wind-blown sand on the bike path and provide protection from wave run-up.

Figure 2-27. Potential for restoring self-sustaining dunes at Redondo Beach

2.4 Socio-Economic Characteristics

The following subsections summarize data obtained in support of the economic analyses to be conducted as part of the Project, along with preliminary site profiles for each of the proposed resilience projects (Ceto Consultants, 2024). The final economic analysis will be conducted once following submittal of this report.

2.4.1 Necessary Data for Economic Analysis

Attendance

1. **Visitor Cellphone Data:** Data on visitor origins will be derived using cellphone derived locations from Placer AI. Cellphone derived visitation, or attendance, information will be aggregated by Placer AI for preselected points of interest (POIs) and will include date, visitors binned by home census block, daily unique visitor counts, and hourly counts. The cellphone derived location data will be aggregated and processed by the Placer AI, ensuring the removal of any personally identifiable information, and used to derive valuable insights such as foot traffic patterns and visitor origins at the census block group level. To ensure standardization, Placer AI will be used for all POIs. Where available, these data will be paired with periodic, on-the-ground, attendance counts and intercept surveys to validate visitation estimates.

   Visitor cellphone data will be used to:

- **Generate Annual Attendance Reports:** Using cellphone data, annual attendance reports will be generated for each site. Beach attendance records (lifeguard counts) will be used to corroborate the cellphone data where available.
- **Revise travel cost estimates:** Revised travel cost estimates will be provided for regional beaches based on the cellphone data. Cellphone data indicates the residence of the visitor, and this information will be used to update travel costs estimates looking at how much visitors are willing to pay to visit.
- **Determine visitor turnover rates.** Using cellphone data, determine visitor turnover rates and revise carrying capacity estimates for specific beaches.

2. **Beach Attendance Records (lifeguard counts):** Beach attendance records from county or state agencies will be used to validate the attendance estimates derived from cellphone data. While King and McGregor (2012) noted that lifeguard counts in Southern California can be imprecise, these counts historically served as the primary source for estimating beach attendance and assessing the non-market value of beach recreation, as well as the economic impact on coastal communities, prior to the availability of more precise

cellphone data. To strengthen the analysis, attendance records will be requested from LACDBH and local lifeguard agencies for comparison.

Environmental Justice

1. **Census Data:** The most recent U.S. Census American Community Survey (2020) will be used to understand the demographics of beach visitors and coastal communities. The vendor used to purchase cellphone-derived mobility data (Placer AI) aggregates visitors according to the "home" US Census blockgroup of the device. The visitor data will be merged with ACS statistics to understand the visitors at each location of interest. In addition, ACS data will be used to create a profile of the communities within a 1-km, 10-km, 25-km, 50-km and 100-km driving distance to each location of interest (the "Access-shed"). Coupling these profiles will provide an understanding of who has access to California beaches and who actually goes to the beach. This will allow the project team to provide accurate estimates of beach recreational value and the corresponding economic impact of the proposed project.

2. **CalEnviroScreen:** CalEnviroScreen 4.0 will be used to capture environmental justice considerations for visitation to the locations of interest. Developed by California's Office of Environmental Health Hazard Assessment (OEHHA), CalEnviroScreen 4.0 is an advanced tool designed to assess cumulative pollution burdens and socio-economic challenges at the census tract level. It surpasses traditional risk assessments by integrating 21 indicators across four key areas: Exposures, Environmental Effects, Sensitive Populations, and Socioeconomic Factors, such as pollutant sources, air and water quality, toxic cleanup sites, asthma rates, and poverty levels. By utilizing a percentile-based scoring system, the tool offers a comprehensive and comparative evaluation of environmental and health risks, helping to identify vulnerable communities across California.

   CalEnviroScreen 4.0's methodology involves averaging percentiles for individual indicators within each component, resulting in Pollution Burden and Population Characteristics scores. These scores are then scaled and combined to produce an overall ***CalEnviroScreen*** score for each census tract, which serves as a measure of vulnerability. With a maximum score of 100, the percentile ranking of a specific area indicates the percentage of all ordered CalEnviroScreen scores that fall below that area's score. This relative scoring system allows for the identification of communities with the highest cumulative environmental burdens and vulnerabilities, providing valuable insights for targeted resource allocation and environmental justice initiatives.

Going beyond traditional risk assessments, CalEnviroScreen 4.0 considers the totality of factors influencing a community's exposure to environmental pollutants. By integrating pollution burden with population characteristics, including the identification of sensitive populations and socioeconomic factors, the tool enables a nuanced understanding of environmental justice issues.

3. **Coastal Access Data California Coastal Commission Coastal Access Database:** The project team will use a combination of the California Coastal Commission's Coastal Access Database as well as the updated access database created by Patsch and Reineman (2024) to examine the ease of access at each site. The database will allow examination of access in terms of entry and egress points, parking availability, and amenities.

Economic Benefits and Impact

Economic benefits and impacts of beach visitation will be determined using the best available data. Economic benefits (non-market value) will be estimated using methods developed for Manhattan Beach, Hermosa Beach, and, most recently, the SANDAG Regional Beach Nourishment Project III (RSBP III). Based on these methods and the data mentioned above, the non-market value of beach visitation will be estimated at each site.

In addition, the best available data will be used to determine the economic impact on beach spending. Given the limited data available for such a task, the project team will either update old survey data (more than 10 years old) or use more recent data from Santa Barbara and Ventura counties, interpolated to apply to Los Angeles County. Using these data, including spending in various categories (*e.g.,* lodging), and information on the local sales and transient occupancy tax rates, the fiscal impacts of changes in beach recreation and visitation will be estimated with the proposed projects.

2.4.2 Preliminary Site Profiles

The attendance data described above (cellphone data and lifeguard counts) will inform a detailed analysis of attendance, access, and the economic value of Zuma, Dockweiler, and Redondo beaches. Access information, however, is publicly available, and provides a preliminary profile of each beach.

Zuma Beach & Point Dume Beach

Zuma and Point Dume Beach are significant coastal areas characterized by wide, sandy shorelines. Zuma Beach serves as a heavily frequented site for recreational activities such as swimming, surfing, and beach sports, supported by infrastructure including lifeguard stations, restrooms, showers, and parking facilities. Point Dume Beach is less developed than Zuma Beach, while still offering amenities such as restrooms, showers, lifeguards, and restaurants in close proximity (Figure 2-28). This area has four known access points, over a dozen amenities, more than 2,000 paid parking spaces, and a little over 500 free parking spaces.

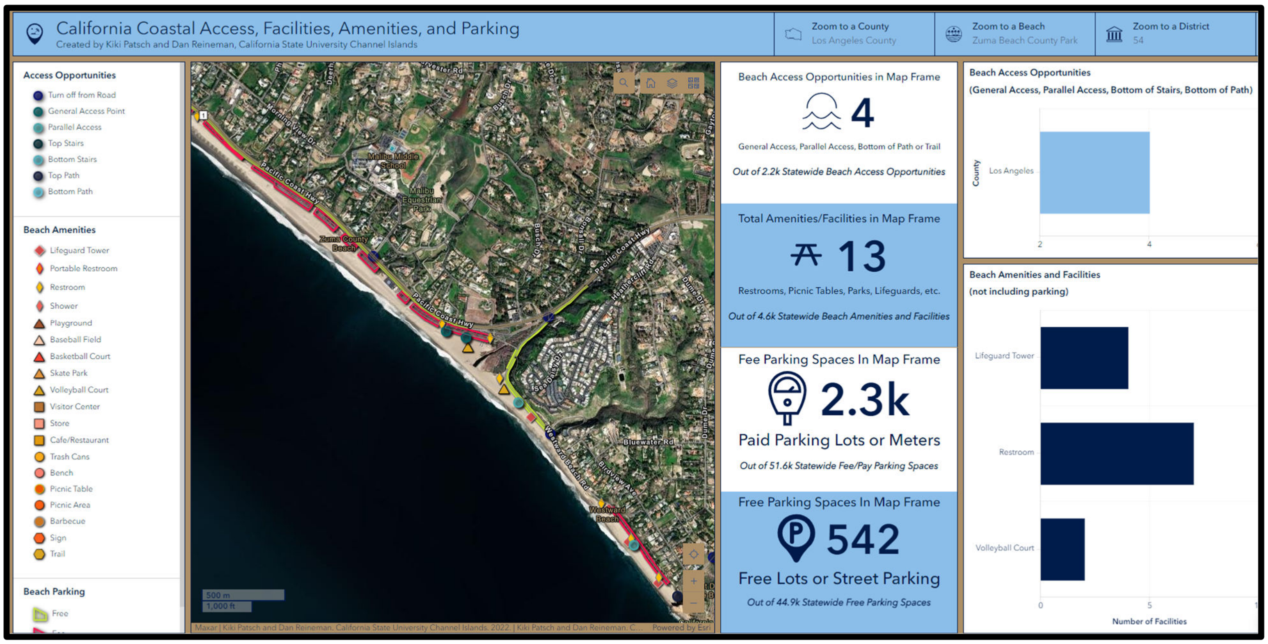

Figure 2-28: Snapshot of Coastal Access Dashboard, Zuma and Point Dume Beach

Utilizing the network analysis tool in esri's ArcGIS Pro software, service area buffers were constructed around the Zuma Beach Access Point delineating the areas that are within 1, 10, 25, 50, and 100 km from the access point (Figure 2-29). In Los Angeles County, depending on the time of day and year, these drive times will range from several minutes to several hours, but are considered a reasonable distance that people will travel to go to the beach. Once generated, demographic and socioeconomic data were summarized using the Enrich Tool in ArcGIS Pro.

Information can be gleaned using this methodology to characterize the population that theoretically has access to Zuma Beach. Table 2-9 and Figure 2-30 and Figure 2-31 characterize the 11 million potential visitors to Zuma Beach, as well as the demographic and socioeconomic snapshot of the region. Moving away from the coast, the population tends to get more diverse, housing prices drop, and the median age of the population drops. In addition, the area that is considered to be vulnerable according to CES4 increases with distance from the coast.

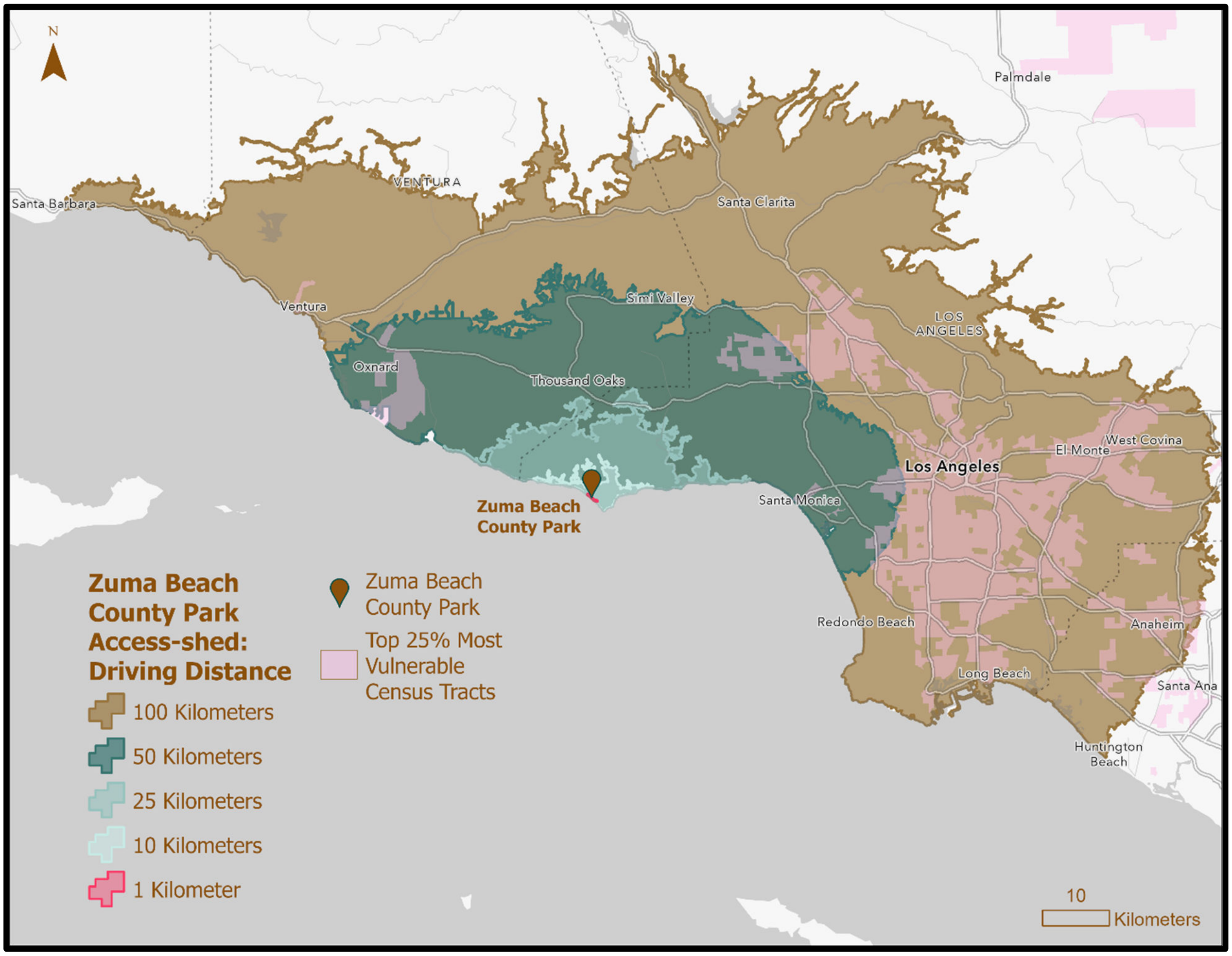

Figure 2-29. Access-Sheds, Zuma Beach

Table 2-9. Socioeconomic Information, Zuma Beach's Access-Sheds

Zuma Beach: Access-shed Statistics								
Driving Distance Buffer	Total Population (2020)	Population over 65 (2020)	Median Age (2020)	Total Households (2020)	Median Home Value (2024)	Average Home Value (2024)	Median Household Income	Mean Census Diversity Index (2020)
1 km	39	10	48.3	4	$ 2,000,001	$ 1,916,667	$ 200,001	2
10 km	6,230	1,583	51.0	2,537	$ 2,000,001	$ 1,860,591	$ 189,324	18
25 km	33,979	7,610	46.4	12,419	$ 1,468,490	$ 1,535,574	$ 178,687	33
50 km	2,200,582	363,827	39.0	858,451	$ 1,005,804	$ 1,212,620	$ 109,479	46
100 km	11,405,265	1,697,230	37.9	3,886,505	$ 865,350	$ 999,202	$ 90,955	49

The mean Census Diversity Index measures the likelihood that two randomly chosen individuals in a given area will belong to different racial or ethnic groups, with values ranging from 0 (no diversity) to 100 (complete diversity).

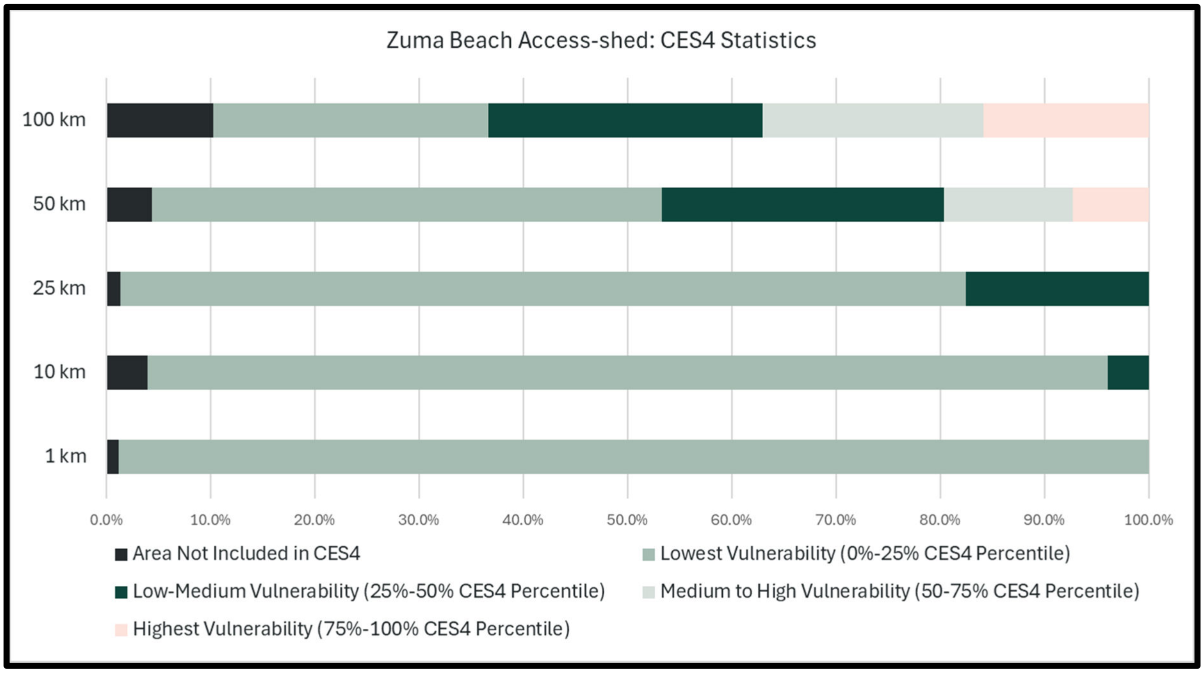

Figure 2-30. CES4 Assessment of Vulnerability, Zuma Beach Access-Sheds

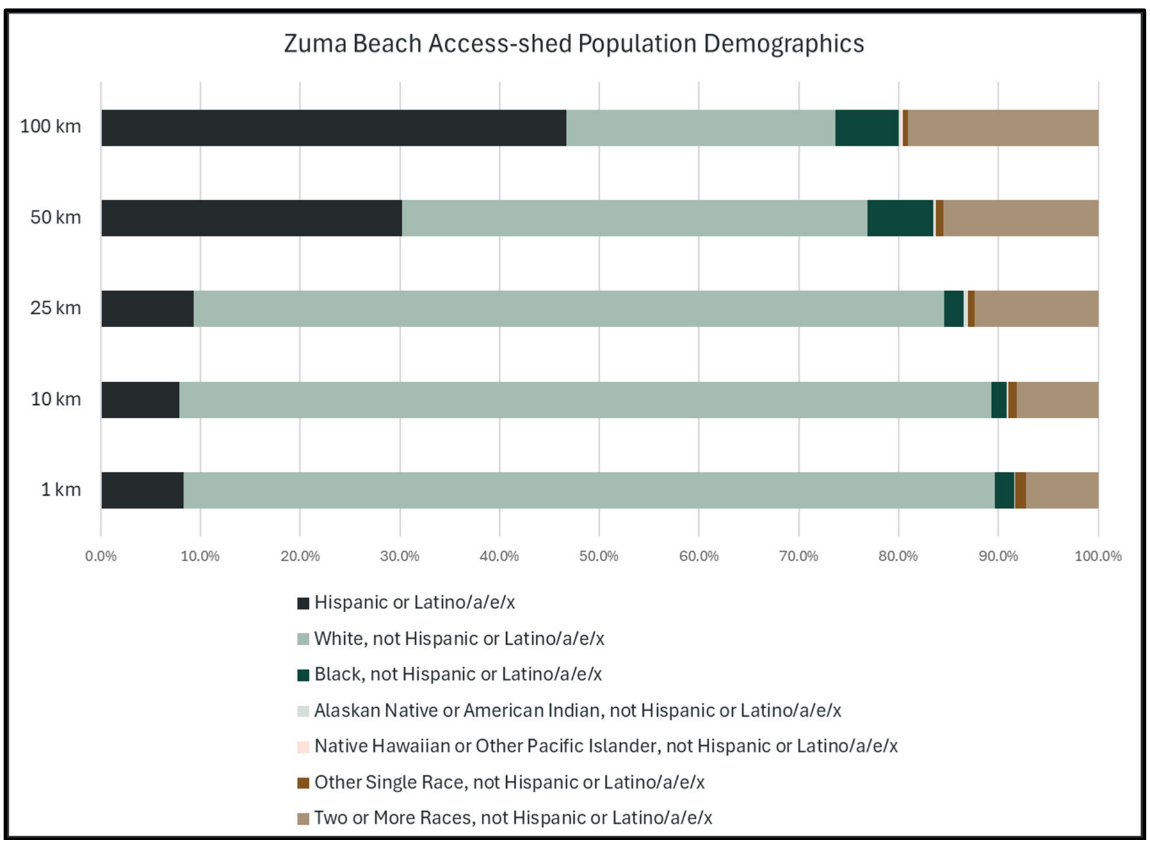

Figure 2-31. Race and Ethnicity, Zuma Beach Access-Sheds

Dockweiler State Beach

Dockweiler State Beach is known for its wide sandy shoreline and recreational opportunities. The beach has over 30 areas to access the beach with a variety of amenities, including cafes, restaurants, lifeguards, picnic areas, playgrounds, restrooms, showers, and volleyball courts (Figure 2-32). There are over 2,000 paid parking spaces and over 150 free parking spaces. Figure 2-33 delineates the access-sheds for Dockweiler State Beach withing a 1, 10, 25, 50, and 100-km driving distance. With more than 14.5 million people with reasonable access to this beach, the region is diverse, both in terms of its vulnerability classification as well as race and ethnicity (Figure 2-34 and Figure 2-35), with a diversity index of 52 (Table 2-10). Home values average nearly $1 million dollars in this area with a median age in the upper 30s.

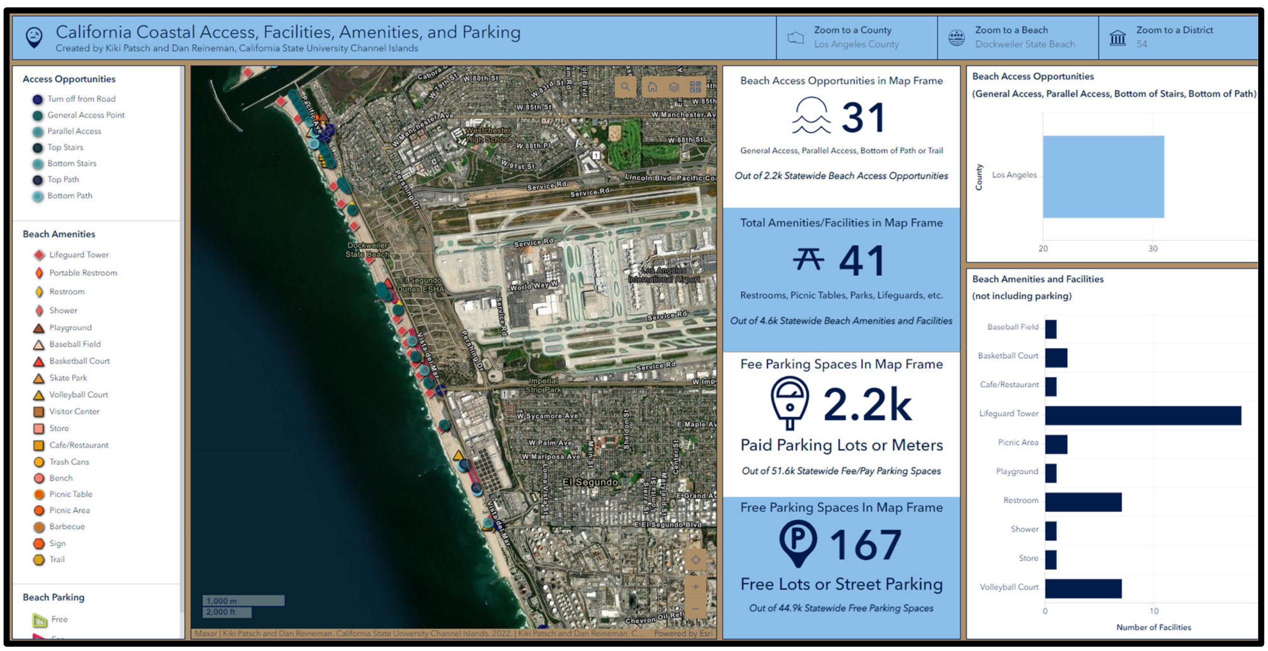

Figure 2-32. Snapshot of Coastal Access Dashboard, Dockweiler State Beach

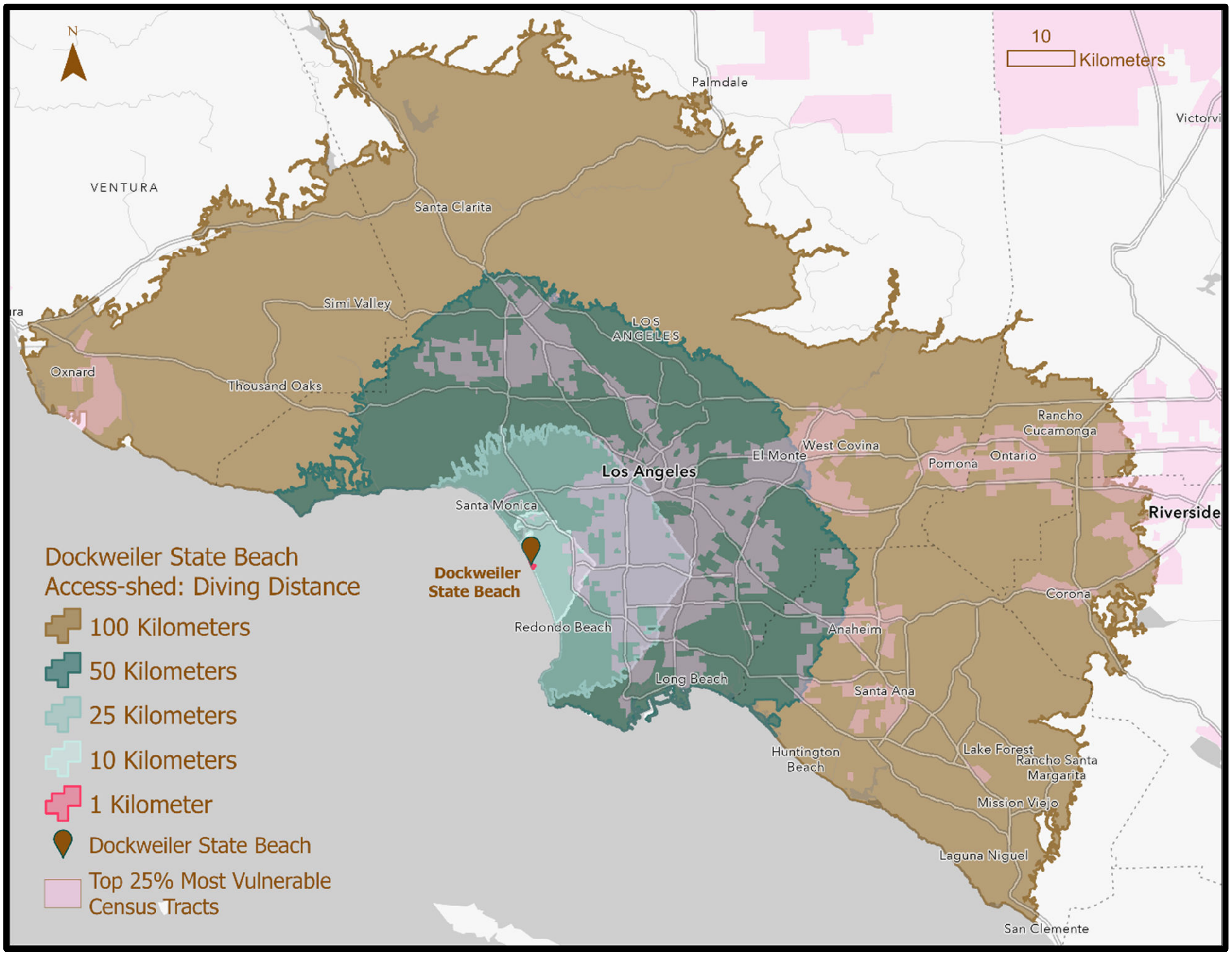

Figure 2-33. Access-Sheds, Dockweiler State Beach

Table 2-10. Socioeconomic Information, Dockweiler State Beach's Access-Sheds

Dockweiler Beach: Access-shed Statistics								
Driving Distance Buffer	Total Population (2020)	Population over 65 (2020)	Median Age (2020)	Total Households (2020)	Median Home Value (2024)	Average Home Value (2024)	Median Household Income (2024)	Mean Census Diversity Index (2020)
1 km	-	-	-	-	$ -	$ -	$ -	2
10 km	285,044	38,975	37.8	112,925	$ 1,335,513	$ 1,413,904	$ 121,208	55
25 km	3,070,585	419,701	36.5	1,111,578	$ 962,939	$ 1,162,205	$ 85,484	49
50 km	8,741,467	1,274,558	37.6	3,036,662	$ 883,845	$ 1,035,382	$ 86,821	50
100 km	14,632,094	2,159,387	37.9	4,934,406	$ 860,103	$ 989,806	$ 96,367	52

**The mean Census Diversity Index measures the likelihood that two randomly chosen individuals in a given area will belong to different racial or ethnic groups, with values ranging from 0 (no diversity) to 100 (complete diversity).*

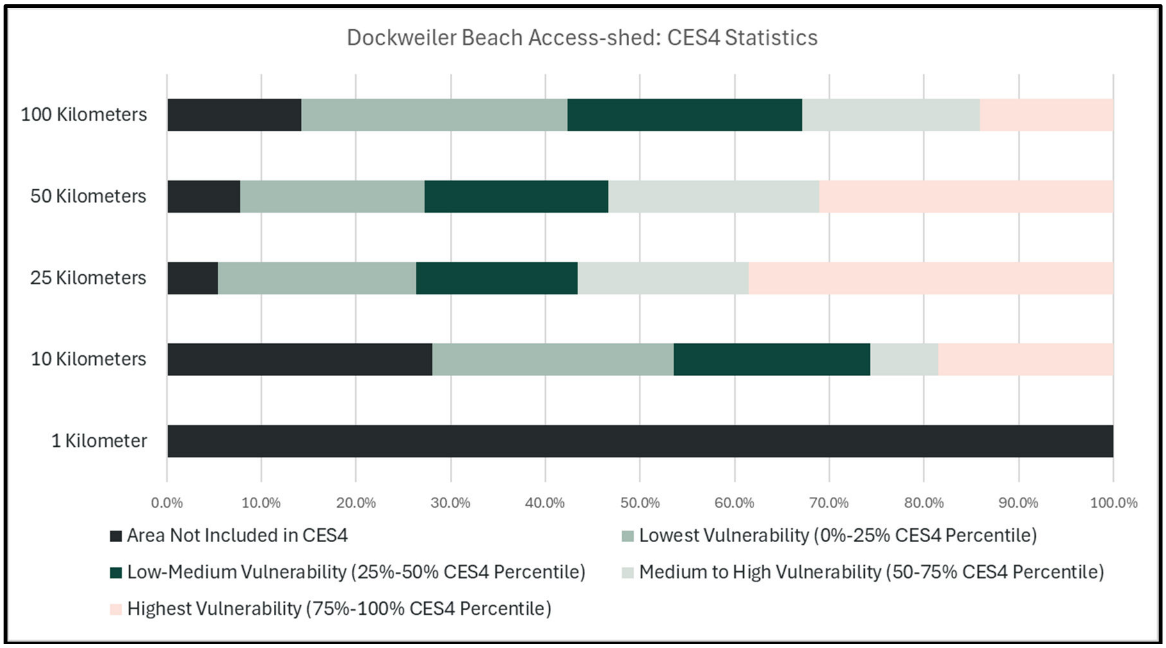

Figure 2-34. CES4 Assessment of Vulnerability, Dockweiler State Beach Access-Sheds

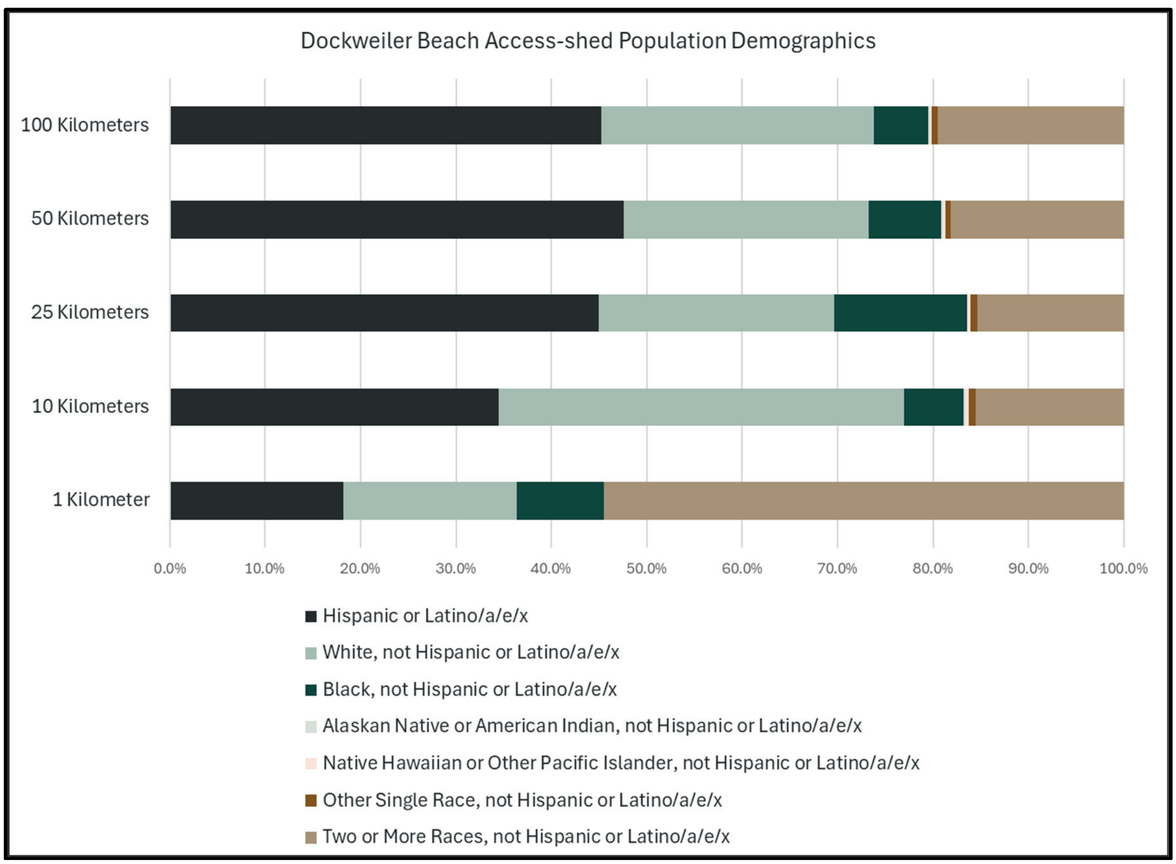

Figure 2-35. Race and Ethnicity, Dockweiler State Beach Access-Sheds

Redondo Beach

Redondo Beach is a highly developed coastal area featuring a mix of recreational spaces, a pier, and residential properties. The beach is popular for swimming, surfing, volleyball, and other water activities, with amenities such as restrooms, parking, and lifeguard stations (Figure 2-36). Parking can be challenging in this area with only a little over 800 spaces for fee parking. With more than 14.5 million people with reasonable access to this beach (Figure 2-37), the region is diverse in both in terms of its vulnerability classification as well as race and ethnicity (Figure 2-38 and Figure 2-39), with a diversity index around 50 (Table 2-11). Home values average nearly $1 million dollars in this area with a median age in the upper 30s to lower 40s.

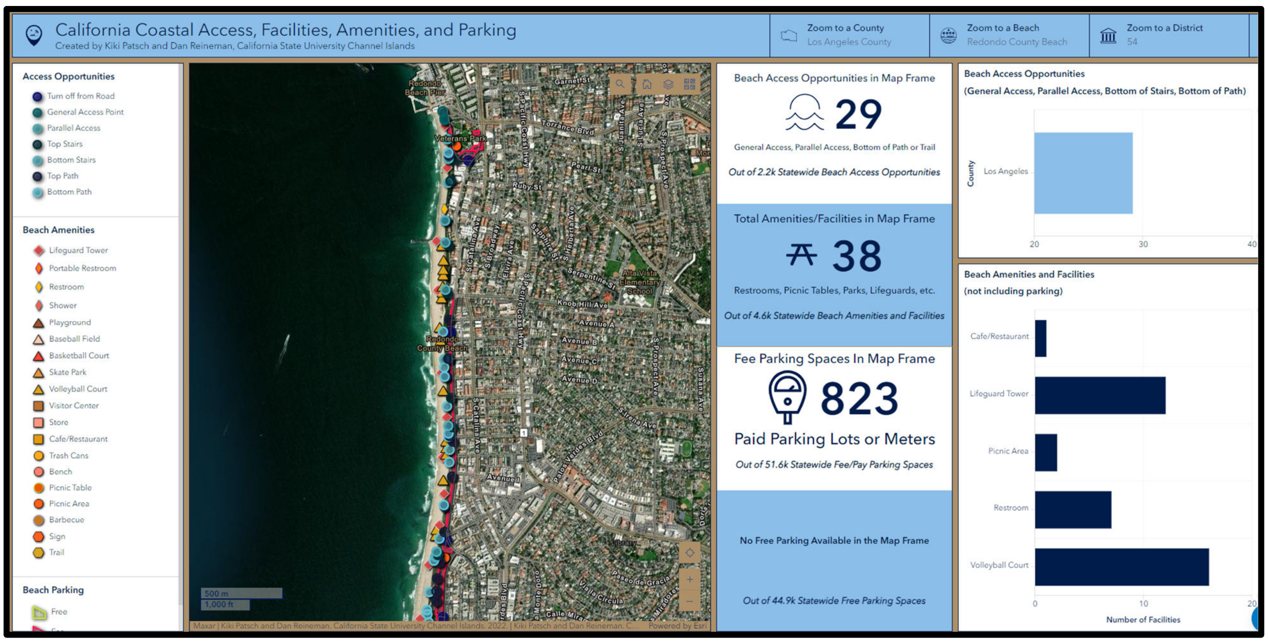

Figure 2-36. Snapshot of Coastal Access Dashboard, Redondo Beach

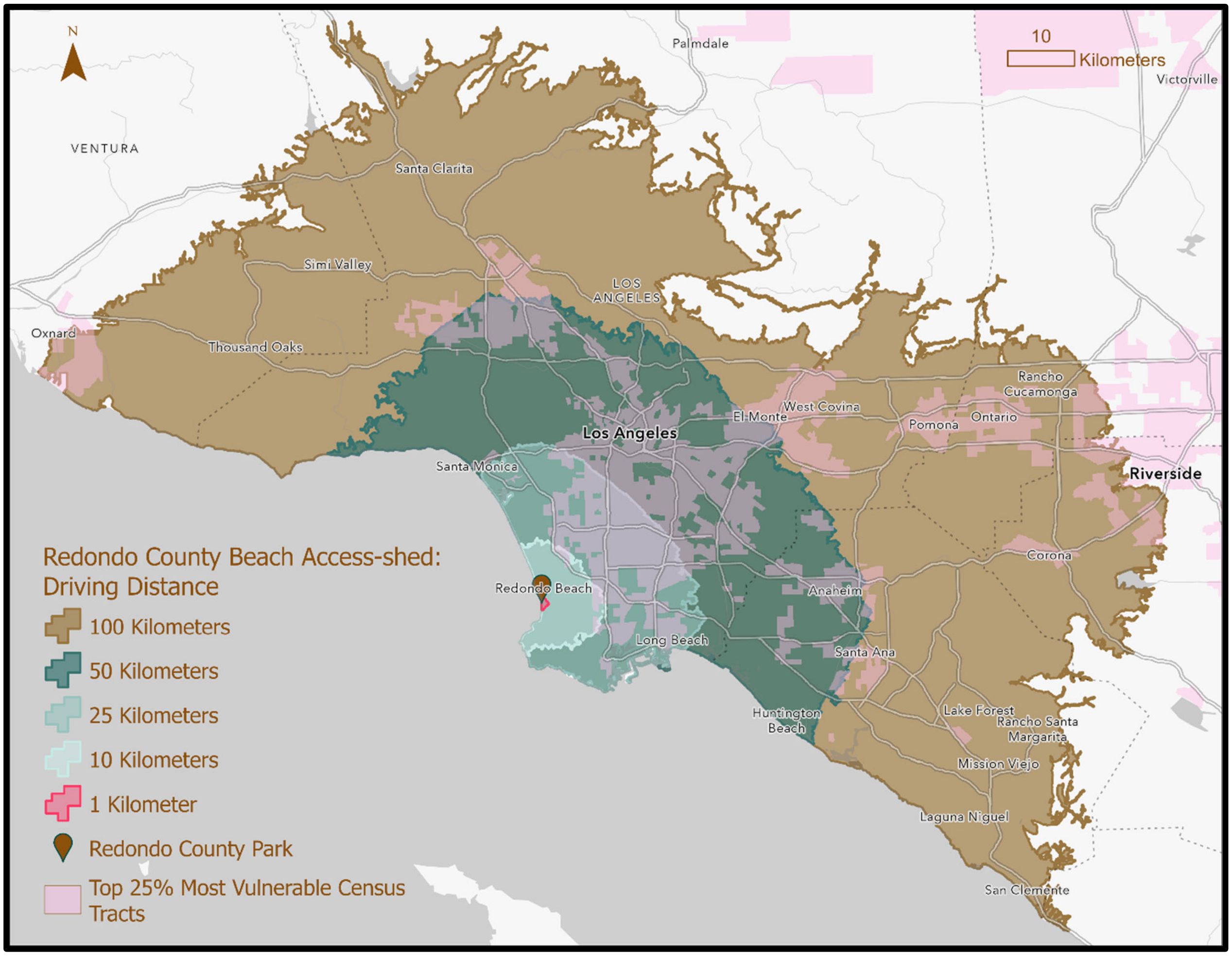

Figure 2-37. Access-Sheds, Redondo Beach

Table 2-11. Socioeconomic Information, Redondo Beach's Access-Sheds

Redondo Beach: Access-shed Statistics								
Driving Distance Buffer	Total Population (2020)	Population over 65 (2020)	Median Age (2020)	Total Households (2020)	Median Home Value (2024)	Average Home Value (2024)	Median Household Income (2024)	Mean Census Diversity Index (2020)
1 km	6,691	1,314	46.6	3,464	$ 1,437,870	$ 1,533,340	$ 124,757	35
10 km	396,587	67,418	41.9	151,593	$ 1,155,374	$ 1,286,169	$ 124,507	57
25 km	2,421,998	331,424	37.0	836,514	$ 872,708	$ 1,023,993	$ 86,917	56
50 km	8,406,714	1,208,177	37.4	2,913,349	$ 882,837	$ 1,031,788	$ 85,823	51
100 km	14,496,499	2,141,554	38.0	4,897,425	$ 863,194	$ 994,606	$ 96,474	51

**The mean Census Diversity Index measures the likelihood that two randomly chosen individuals in a given area will belong to different racial or ethnic groups, with values ranging from 0 (no diversity) to 100 (complete diversity).*

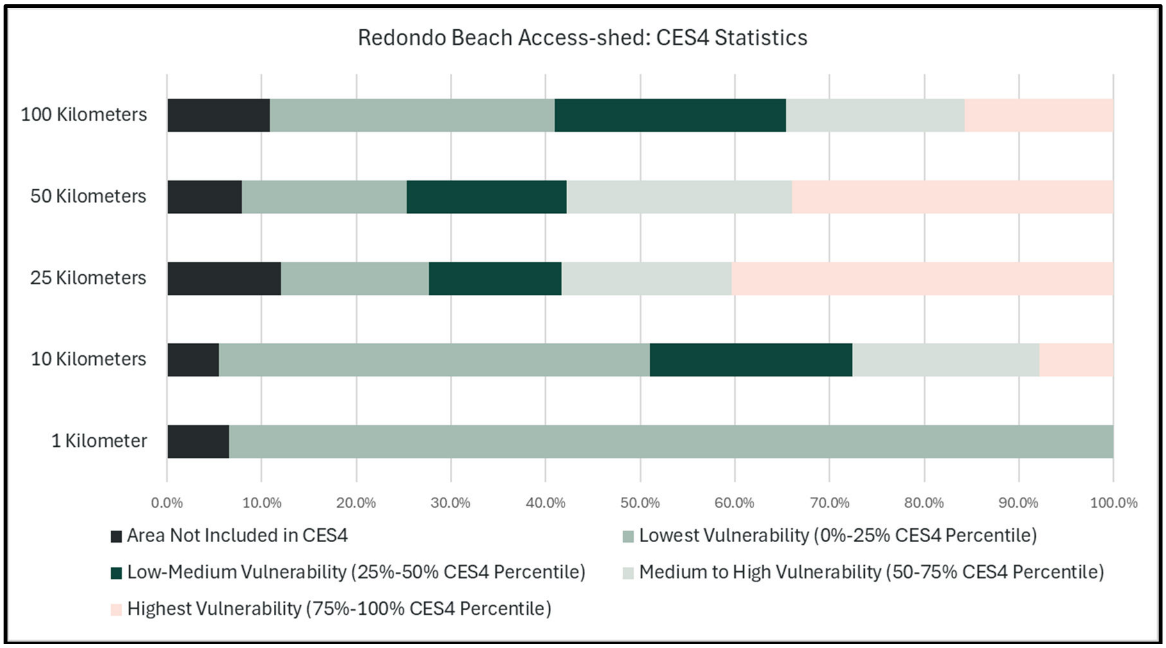

Figure 2-38. CES4 Assessment of Vulnerability, Redondo Beach Access-Sheds

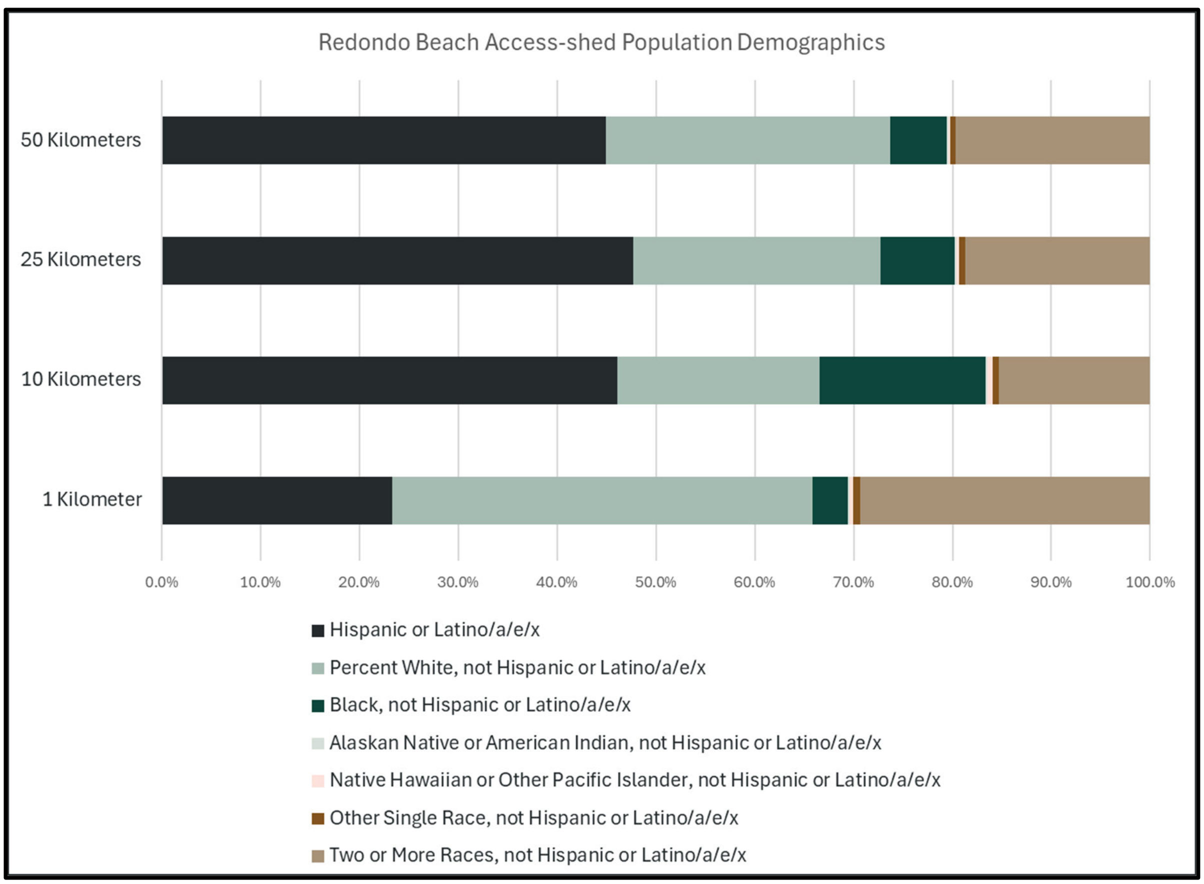

Figure 2-39. Race and Ethnicity, Redondo Beach Access-Sheds

3 Related projects

Numerous projects with elements relevant to the coastal resilience projects proposed for LACDBH have been drawn upon for this planning study and are summarized in the subsections that follow. Key lessons learned from these projects are presented in Section 4.

3.1 San Diego Regional Beach Sand Projects (RBSP)

The San Diego Association of Governments (SANDAG) conducted two Regional Beach Sand Projects in 2001 and 2012 called Regional Beach Sand Project I (RBSP I) and Regional Beach Sand II Project (RBSP II).

RBSP I was intended to serve as a pilot project to demonstrate that regional nourishment could benefit the coast without causing significant environmental impacts. As part of the project, 2.1 million cy of sand was placed at 12 beaches. Beach width gains and economic benefits were documented throughout the project and found to be significant.

RBSP II was a follow-up to the original pilot that incorporated lessons learned. The primary change was to place relatively coarse-grained sand at the receiver site to extend the longevity of benefits and avoid environmental impacts. As part of the project, 1.5 million cy of sand was placed at eight beaches, all of which were included in RBSP I. Shoreline and economic monitoring indicate that the project was very beneficial and an improvement from RBSP I.

3.2 U.S. Army Corps of Engineers Coast of California Storm and Tidal Wave Study

The USACE Coast of California Study for the Los Angeles Region was an extensive effort by the federal agency authorized with shoreline protection to present an assessment of existing conditions, areas of concern, and determine the need for any actions. This study presents the shoreline history, its position over time and trends, beach profiles, longshore sediment transport, sand sources and sinks, maintenance dredging, beach nourishment, structures, particularly unique areas and/or sensitivities, and any specific needs for shoreline protection.

3.3 Los Angeles County Public Beach - Sea Level Rise Vulnerability Assessment

Noble Consultants (2016) prepared an assessment of the vulnerability of Los Angeles County public beach facilities to future SLR. The study includes an overview of the shoreline conditions, separated into three general regions: Malibu Region, Santa Monica Bay Region and Palos Verdes Peninsula Region. An inventory of facility assets for each of the County-operated beaches is provided, including parking lots, restroom buildings, concessions, lifeguard safety stations, maintenance yards, utilities, and other recreational amenities.

The state of the current SLR science at the time was provided. Vulnerability of the public beach assets to coastal hazards was assessed using their ground elevation, proximity to the shoreline, and exposure to beach erosion, wave runup and inundation. Results from the USGS CoSMoS 3.0 model (Barnard *et al.*, 2018) were used to estimate the potential percentage of shoreline loss for SLR scenarios of 100 cm and 200 cm. Impacts on beach assets were evaluated for several SLR scenarios concurrent with a 100-yr storm event.

Finally, a public beach asset management strategy was presented. Future planning included implementation of the *Los Angeles County Coastal Regional Sediment Management Plan* (Noble Consultants & Larrry Paul and Associates, 2017), which cites beach nourishment as the primary strategy. Longer term strategies of retreat, elevate, and/or protect are also discussed.

3.4 Mugu Submarine Canyon Sand Bypassing Project

The USACE commissioned a study of submarine canyons for the purposes of assessing possible approaches to preventing sand loss. As part of the study, Moffatt & Nichol (2009) presented a strategy to dredge the nearshore zone upcoast of the canyon and pump the sand south of Mugu Rock. This action would allow sand to continue its travel path south from Ventura County to Los Angeles County, thus restoring the historic sand supply to LA County beaches. The dredge pit, created within the nearshore area adjacent to Naval Base Ventura County (NBVC) – Point Mugu, would refill rapidly with more sand transported southward to the site from upcoast, thus maintaining beaches within the Naval Base vicinity.

3.5 Broad Beach Restoration Project

This project is particularly relevant to the Zuma Beach and Point Dume resilience project based on comparable project features and proximity. The following summary is derived from public documents available on the Broad Beach Geologic Hazard Abatement District (BBGHAD) website (http://www.bbghad.com).

The Broad Beach Restoration Project (BBRP) is located immediately west of Zuma Beach, between Lechuza Point and Trancas Creek. The purpose of the BBRP is to protect residences from coastal erosion by creating and maintaining a wide sandy beach backed by a restored dune system similar to that which historically existed along this reach of coastline. Key relevant project features include (1) beach nourishments of up to 300,000 cy each approximately every five years; (2) restored dune habitat area; (3) sand backpassing designed to prolong nourishment; and (4) retaining the emergency rock revetment constructed in 2010 as a permanent feature.

3.6 Westward Beach Living Shoreline Project

This project is located within the Zuma Beach and Point Dume Beach resilience project area. As noted previously, severe coastal erosion occurred adjacent to Westward Beach Road during Summer 2021. A portion of the road was undermined, and a water line and drainage pipe were damaged. An emergency revetment was constructed to prevent further damage to the access road. In winter 2022-2023, additional coastal erosion resulted in the need to extend the emergency revetment east to protect the road and a restroom.

CFC prepared a draft coastal engineering study in summer/fall 2022 to evaluate a range of solutions, including nature-based elements. Currently, CFC is assisting LACDBH in a long-term solution to protect Westward Beach Road and impacted public beach facilities. The present coastal resilience project at Zuma Beach and Point Dume Beach supports the overall goal of reducing the magnitude of present and future coastal erosion threats at this location.

3.7 Malibu Creek Ecosystem Restoration Project (Rindge Dam Removal)

The Malibu Creek Ecosystem Restoration Project entails the removal of Rindge Dam, which is situated approximately 3 miles upstream of Malibu Lagoon, and eight smaller dams upstream of the main one. Dam removal would restore ecological integrity to Malibu Creek and the lagoon by reestablishing the fluvial connection of lower and upper Malibu Creek with Malibu Lagoon, and its oceanic outlet. The dam has significantly inhibited natural sand replenishment from upstream Malibu Creek to the coastline and associated nearshore habitats and presented a barrier to the endangered Southern Steelhead Trout. There are approximately 780,000 cy of impounded sediment behind Rindge Dam that would otherwise flow downstream and reach the coastline. The Project is assessing the suitability for the 170,000 cy of gravel and 280,000 cy of sandy materials to be used for inshore habitat creation and littoral zone nourishment, respectively. The proposed placement strategy supports existing subtidal hard-bottom habitat for benthic species or creates new habitat (*e.g.,* to create a rubble field that promotes the recruitment of and successful attachment for kelp species). Excavated sandy material is being considered for beneficial reuse at nearby nearshore locations and/or via direct beach placement to nourish the littoral cell and enhance the resiliency of the nearby coastline. Direct beach placement would likely occur on the beach to the east of Malibu Pier and nearshore placement would occur at a location near the end of the pier. This sediment would then feed downcoast beaches to the east of the placement site.

3.8 Topanga Lagoon Restoration Project

The Topanga Lagoon Restoration Project seeks to expand the existing habitat area and return the lagoon to its historic footprint. Construction of the surrounding segments of the Pacific Coast Highway (PCH) and the PCH bridge that spans the lagoon obstructed the natural fluvial and tidal flushing of the lagoon habitat and artificially impounded sediments that constrict the lagoon, decreasing roughly 93% of the natural habitat area from the original historic lagoon footprint. By lengthening the existing 79-ft long Pacific Coast Highway (PCH) bridge that spans the lagoon and removing up to approximately 256,000 cy of sediment from the site, this project will create up to 10 acres of valuable coastal wetland habitat. Excavated sediment from the project has been approved for beneficial reuse at a nearby nearshore location to nourish the littoral cell. The sediment will be pumped to a location offshore of Topanga Point. This type of nearshore placement will allow naturally driven processes to push sandy material onto the beaches while disbursing finer clays and silts offshore, leaving any rocks in the placement footprint. This will enhance resilience of surrounding beaches and benefit the system by adding locally-sourced sediment to the littoral cell.

3.9 Santa Monica Beach Living Shoreline Project

The Santa Monica Beach Living Shoreline Project was constructed in 2016 by The Santa Monica Bay Foundation to restore approximately three acres of coastal dune habitat on Santa Monica Beach. A living shoreline was constructed by installing sand fencing and seeding native vegetation to encourage vegetated dune growth. Vegetated dunes not only provide essential coastal habitat but also increase coastal resilience to sea level rise, coastal flooding, and erosion. Integrated beach pathways and interpretive signs were installed to accommodate beach goers and provide educational opportunities on native plants and living shorelines. Scientific monitoring of this pilot project is being used to inform other living shoreline projects throughout Southern California.

3.10 Marina del Rey Maintenance Dredging Projects

Marina del Rey is a small craft harbor located in Santa Monica Bay. While the harbor is managed by LACDBH, maintenance of the ocean entrance navigation channel is under the authority of the USACE, Los Angeles District, as part of their civil works mission. Sediment accumulates in both the north and south ocean entrance channels of the marina. The source of sediment trapped in the north entrance channel is littoral transport from the northwest and is comprised of beach sand from within the littoral system. Conversely, the source of sediment trapped in the south entrance channel is Ballona Creek. Sediments discharged at the mouth of Ballona Creek are generally too fine for beach nourishment and contain contaminants.

Since 1969, the average shoaling rate at the north entrance to the marina is approximately 45,000 cy/yr based on dredge volume data provided by the USACE. The material is typically dredged and placed downdrift at Dockweiler State Beach. Material is occasionally dredged and placed updrift at Venice Beach or placed further downdrift at Redondo Beach.

3.11 Manhattan Beach Living Shoreline Project

The Manhattan Beach Living Shoreline Project aims to enhance three acres of existing dunes along Manhattan Beach from 36th to 23rd Street. The Bay Foundation along with the City of Manhattan Beach, Los Angeles County Department of Beaches and Harbors, and California State Coastal Conservancy implemented this project in 2022. This restoration project involved the removal of non-native vegetation, the seeding and planting of native vegetation, installation of temporary sand fencing to promote dune and vegetation growth, and installation of educational features and interpretive signage. The overall objective was to increase resiliency of the shoreline by implementing green infrastructure for protection against sea level rise, coastal flooding, and erosion.

3.12 Hermosa Beach Resilience Project and Living Shoreline Project

The City of Hermosa Beach conducted a feasibility study that included installing a living shoreline at the north end of the City near the boundary with Manhattan Beach. Project objectives were to install a pilot resilience project, create additional habitat, and manage sand from blowing onto the pedestrian/bicycle pathway at the Strand. The conceptual designs consisted of two alternative layouts with sand dune habitat along the northern City boundary, toward the back beach. The site was positioned to provide resilience and sand management opportunities, minimize interference with public recreation such as beachgoing and volleyball, and prevent conflicts with two existing storm drainage outfalls along the City's northern boundary.

4 Project Concepts and Alternatives

The *Coastal Resilience Study* (Moffatt & Nichol, 2023) provided conceptual descriptions of the proposed projects at Zuma Beach and Point Dume, Dockweiler State Beach, and Redondo Beach. Each project was developed to proactively preserve and enhance LA County Beaches, including infrastructure and facilities, recreational open space, natural and cultural resources, and habitat for sensitive species. These concepts were used as a framework to develop a proposed project and two alternatives for each site.

The subsections that follow summarize the objectives of each project, opportunities and constraints that are present the sites, and the proposed projects and alternatives. The expected performance is discussed in Section 5.

4.1 Zuma Beach and Point Dume

The concept proposed at Zuma Beach and Point Dume as part of the *Coastal Resilience Study* included widening Zuma Beach via beach nourishment and creating or enhancing dune habitat at both Zuma and Point Dume Beach. The objectives of the project are to:

- Expand public access and recreational opportunities for LA County residents and visitors;
- Increase protection of coastal infrastructure;
- Increase and enhance sensitive sandy beach and dune habitat; and
- Expand local and regional economic benefits.

4.1.1 Opportunities and Constraints

Opportunities

Opportunities that can be leveraged as part of the resilience project include:

- Sediment placed at Zuma Beach is expected to widen vulnerable portions of Point Dume Beach, where direct placement of sand is prohibited (see constraints, below), via natural processes.
- Beach nourishment within the Zuma Littoral Cell is expected to nourish downdrift beaches within Santa Monica Bay, further leveraging the economic benefits.
- The existing emergency revetment located along portions of Westward Beach Road may require some form of mitigation for impacts to the sandy beach. Two revetment segments were approved and constructed under emergency coastal development permits (ECDPs) from the CCC and will ultimately require a standard coastal development permit (CDP).

The beach nourishment could provide in-kind impact mitigation for any permanent shoreline protective device included as part of the long-term Westward Beach Road shore protection project.

- Coastal Restoration Consultants identified significant portions of the Zuma Beach shoreline as having "high potential" for self-sustaining dunes (Section 2.3), including areas where winter sand dikes are constructed.
- The net economic benefits of the project are indicated to be on the order of three times the project cost based on initial studies (Moffatt & Nichol, 2023).

Constraints

The primary constraints warranting careful consideration in the project planning stage are related to the existence of regulated or sensitive biological resources, as noted in Section 2.2 and summarized below:

- The regions below the Mean High Tide Line (MHTL) at Zuma Beach and Point Dume Beach are located within the Point Dume State Marine Conservation Area (Point Dume SMCA) and Point Dume State Marine Reserve (SMR), respectively (Figure 4-1). An important difference between these two areas, as it relates to this study, is that beach nourishment is permitted within the Point Dume SMCA (*i.e.,* Zuma Beach), but is not allowed in the Point Dume SMR (*i.e.,* Point Dume Beach). California Code of Regulations Title 14, Section 632 specifically states the following:

  Point Dume SMCA

  Beach nourishment and other sediment management activities are allowed inside the conservation area pursuant to any required federal, state and local permits, or as otherwise authorized by the department.

  Point Dume SMR

  In a state marine reserve, it is unlawful to injure, damage, take, or possess any living, geological, or cultural marine resource, except under a scientific collecting permit issued by the department pursuant to Section 650 or specific authorization from the commission for research, restoration, or monitoring purposes.

Figure 4-1. Pt. Dume State Marine Conservation Area & Pt. Dume State Marine Reserve

- The project site is located within designated critical habitat for the western snowy plover and tidewater goby (*Eucyclogobius newberryi*). While project activities are not expected to permanently impact or adversely modify this habitat, temporary impacts could include changes to water quality (*e.g.,* turbidity, pH, dissolved oxygen), increased noise, temporary removal of foraging habitat, and other increased human activity during project activities.
- The offshore portion of the site is designated as EFH. Project activities may temporarily alter EFH and HAPCs or interfere with the movement of fish or wildlife species and could temporarily impede the use of wildlife nursery sites. However, project activities are not expected to have any significant impacts on these habitats, populations or the fisheries that depend on them. The project will help preserve natural habitats and reduce erosion in the nearshore zone, providing additional soft bottom habitat suitable for foraging. Temporary impacts to these areas could include changes to water quality (*e.g.,* turbidity, pH, dissolved oxygen), increased noise, and other increased human activity during construction.
- The Zuma Beach & Point Dume site is located within ASBS No. 24. The project will not result in direct impacts, such as wastewater and pollutant discharges. However, indirect impacts due to increased turbidity or a change in other water quality standards may occur.

Additional constraints include:

- Recreational beach area (“towel space”) will be reduced in areas where dunes are created.
- Vertical access through dune areas must be provided for and managed.
- Dunes may impact view corridors and should be considered in project planning.

4.1.2 Proposed Project and Alternatives

Key components of the proposed project and the project alternatives are provided in Table 4-1 and described in detail below. The project life is 20 years, with an assumed base year of 2030.

Table 4-1. Key Elements of Proposed Project & Alternatives, Zuma Beach & Point Dume

Project	Beach Nourishment	Renourishment Interval	New Dune Habitat	Enhanced Dune Habitat
Proposed	500,000	5 years	2.5 acres	4.5 acres
Alternative 1	500,000	5 years	7.5 acres	4.5 acres
Alternative 2	750,000	8 years	2.5 acres	4.5 acres

Proposed Project

The Proposed Project includes an initial beach nourishment of 500,000 cubic yards (cy) at Zuma Beach, with renourishment events of the same magnitude every five years. New dune habitat (2.5 acres) will be created along Zuma beach where sand dikes are constructed each winter and existing dunes at Zuma Creek and Point Dume will be enhanced or expanded (4.5 acres).

Figure 4-2 conceptually illustrates all project elements, while Figure 4-3 provides a detailed plan view and cross-section of the beach fill construction template and dune element at Zuma Beach. The beach fill is template is 5,900 ft long with a 190 to 360 ft wide berm at an elevation of +12 ft (MLLW) and a foreshore slope of 1:5 (V:H). The dunes at Zuma Beach will be constructed on the back beach in areas typically occupied by winter berms used to reduce flooding at County facilities. The dunes will be approximately 100 ft wide, 6 ft high, and vegetated with native dune plants (e.g., beach sand verbena, beach primrose, coast woolley heads). A post and rope barrier will be placed on the perimeter to discourage trespassing, with informational signage for the public as an educational/interpretive opportunity.

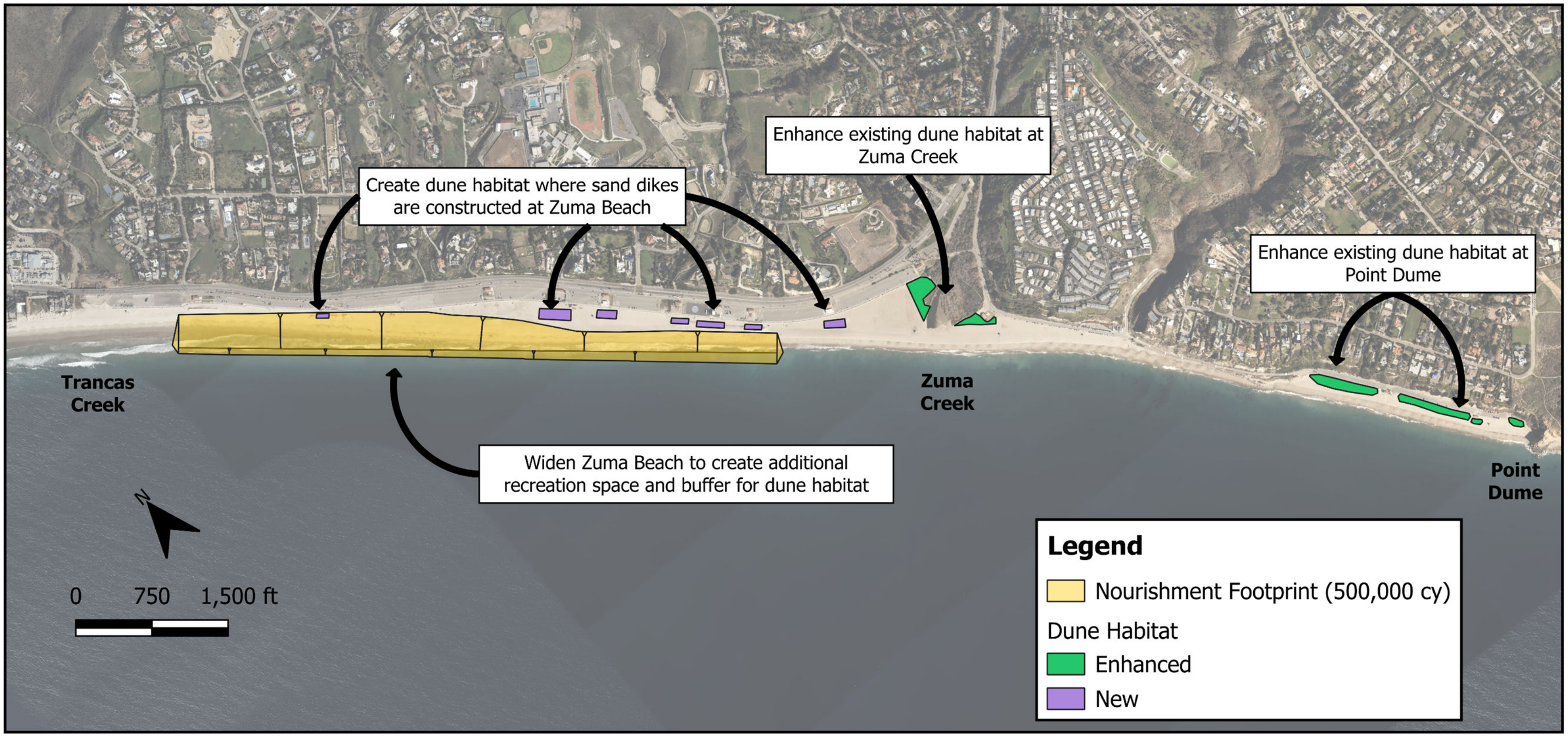

Figure 4-2. Proposed Project at Zuma Beach and Point Dume Beach

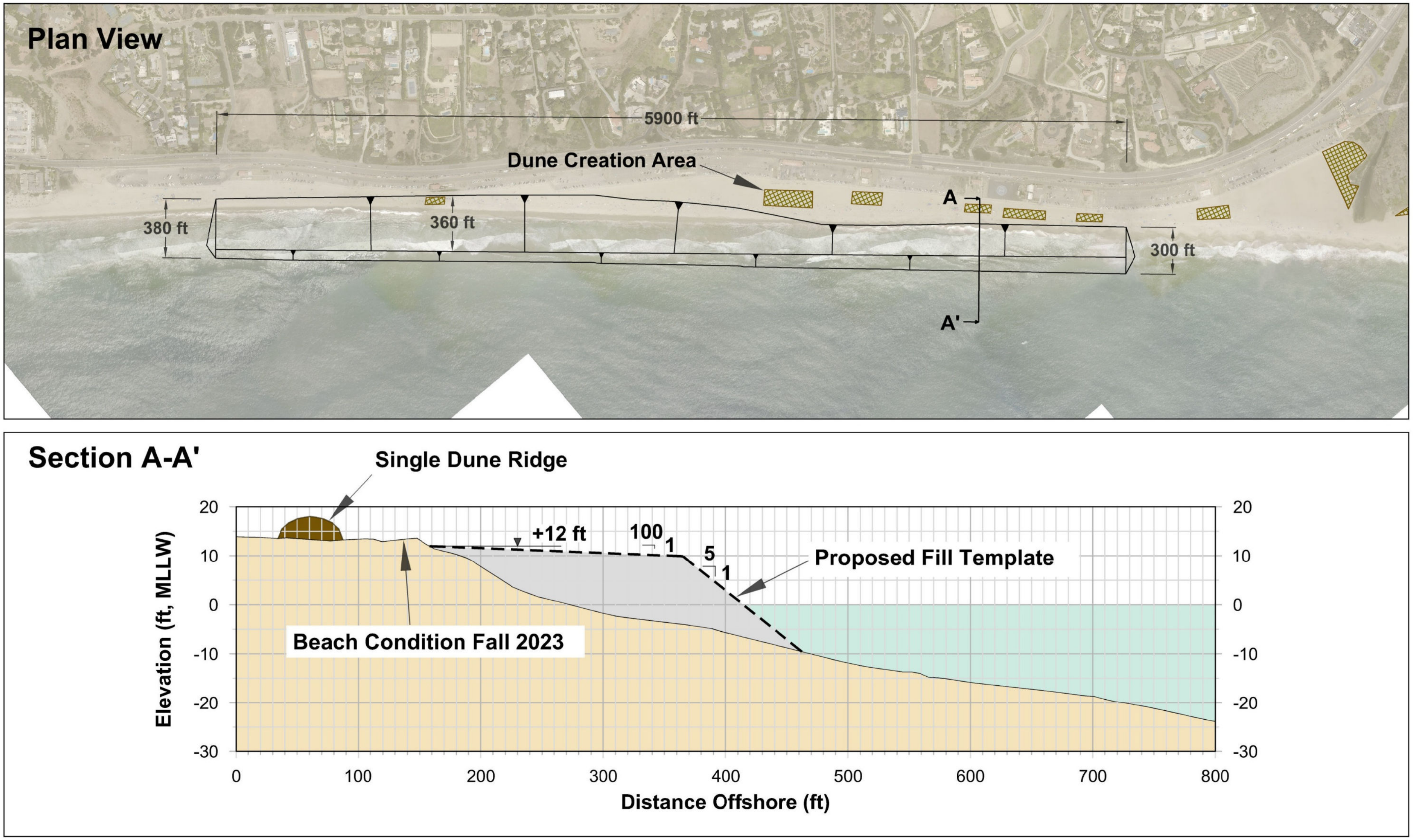

Figure 4-3. Beach Nourishment and Dune at Zuma Beach, Proposed Project

At Zuma Creek and Point Dume, the existing dunes will be enhanced or expanded. The County will partner with and build upon the Malibu Living Shoreline Project currently being conducted by The Bay Foundation in both areas (The Bay Foundation, 2024). At Zuma Creek, the surface of the dunes will consist of randomly positioned small mounds ("hillocks") interspersed with swales. The hillocks will be vegetated with native dune plants and designated paths will be provided to reduce trampling by foot traffic. Figure 4-2, prepared as part of the Malibu Living Shoreline Project (Rios Clemente Hale Studios and Coastal Restoration Consultants, 2019), provides an artistic rendering of the dunes at Zuma Creek following completion of the project.

Figure 4-4. Artistic Rendering of Dunes at Zuma Creek following Project Completion

At Point Dume, the existing dune system will be enhanced by removing non-native species, seeding with native species, and creating designated corridors to the beach thereby reducing trampling by foot traffic. The dune height will be such that sight lines to the beach are not obscured and sand collection fencing will be installed to encourage dune growth and limit deposition in unwanted areas, such as the parking lot. Figure 4-5 provides an artistic rendering of the dune concept (CRC, 2024).

It is likely that sediment used for the project will be dredged from an offshore borrow site within Santa Monica Bay and hydraulicly pumped onto the beach from offshore. Prior sand source investigations (Coastal Frontiers Corporation, 2012) have located high quality sand offshore in Santa Monica Bay that is compatible with the native sediments at the site.

Source: Coastal Restoration Consultants, 2024b

Figure 4-5. Artistic Rendering of Dunes at Point Dume Beach following Project Completion

Alternative 1

Alternative 1, illustrated in Figure 4-6, includes all the elements of the Proposed Project along with an additional 5.0 acres (7.5 acres total) of new dune habitat along Zuma Beach. As was the case at Point Dume, designated corridors to the beach will be provided through the dune system and sand collection fencing will be installed to encourage dune growth. Given that the nourishment element is identical to the Proposed Project, refer to Figure 4-3 for the plan view and representative cross section of the beach fill.

Alternative 2

As part of Alternative 2, the beach nourishment and renourishment events are increased to 750,000 cy and the renourishment frequency is increased to 8 years. The dune creation and enhancement areas are identical to the Proposed Project. Figure 4-7 conceptually illustrates all project elements, while Figure 4-8 provides a detailed plan view and cross-section of the beach fill construction template and dune element at Zuma Beach. The beach fill is template is 8,000 ft long with a 200 to 380 ft wide berm at an elevation of +12 ft (MLLW) and a foreshore slope of 1:5 (V:H).

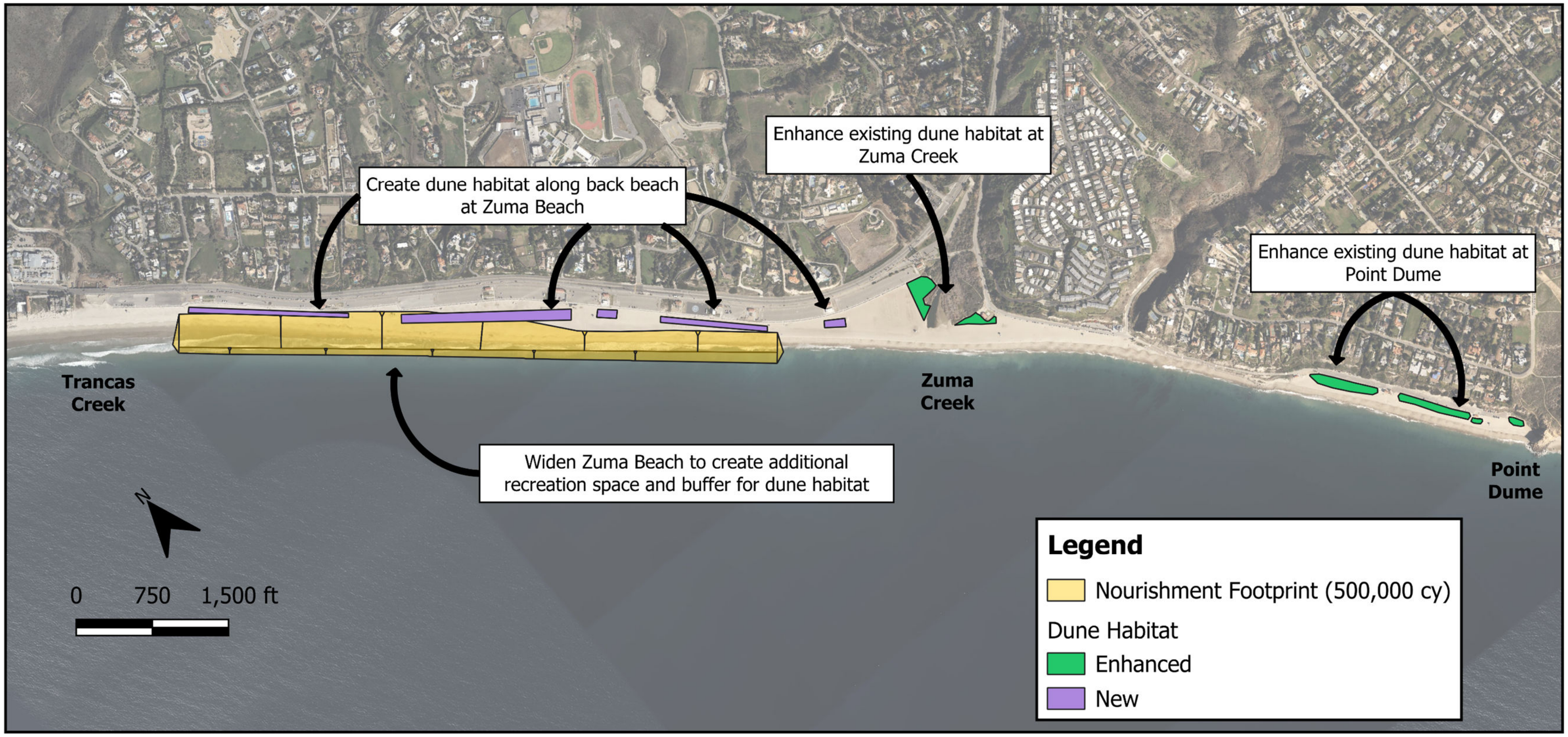

Figure 4-6. Project Alternative 1 at Zuma Beach and Point Dume Beach

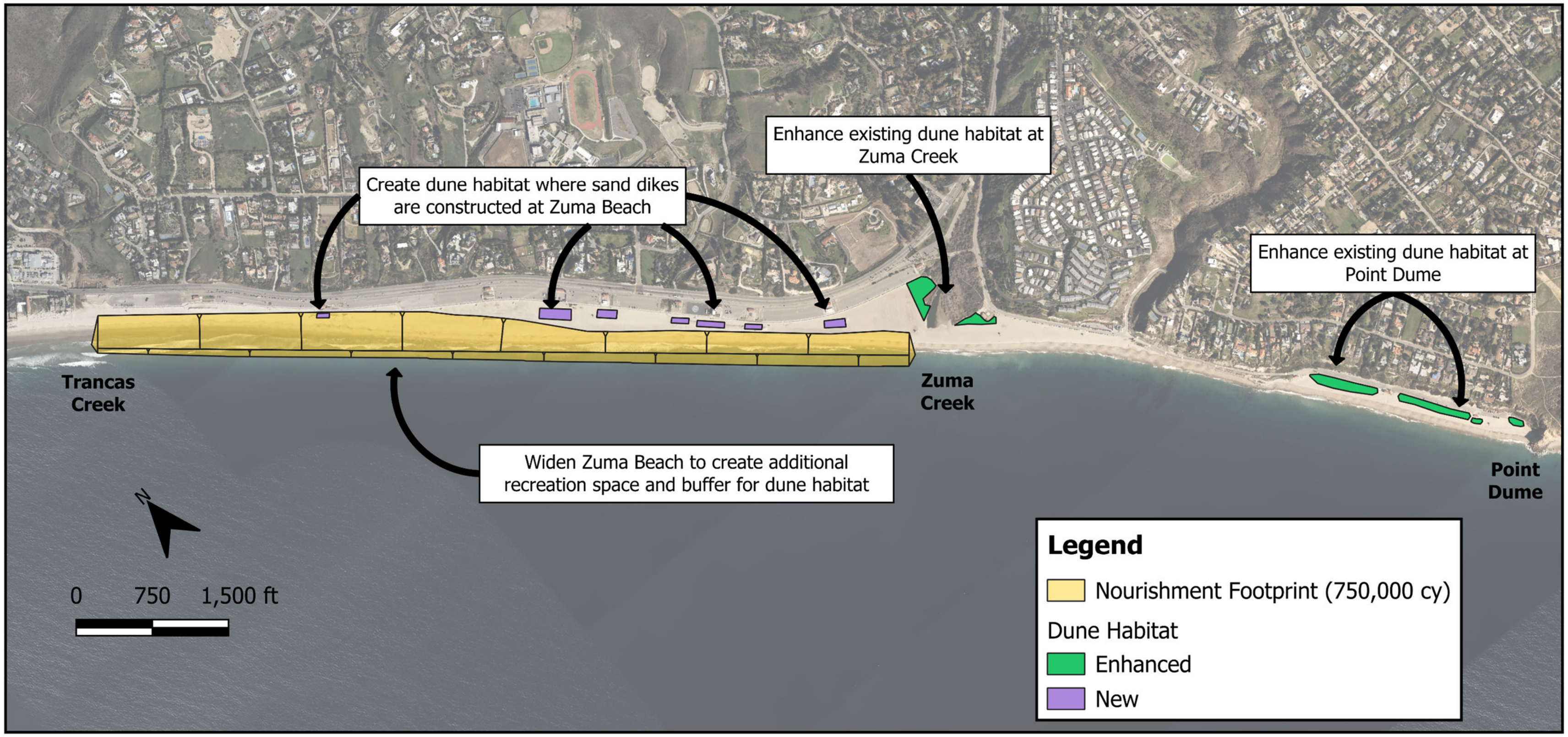

Figure 4-7. Project Alternative 2 at Zuma Beach and Point Dume Beach

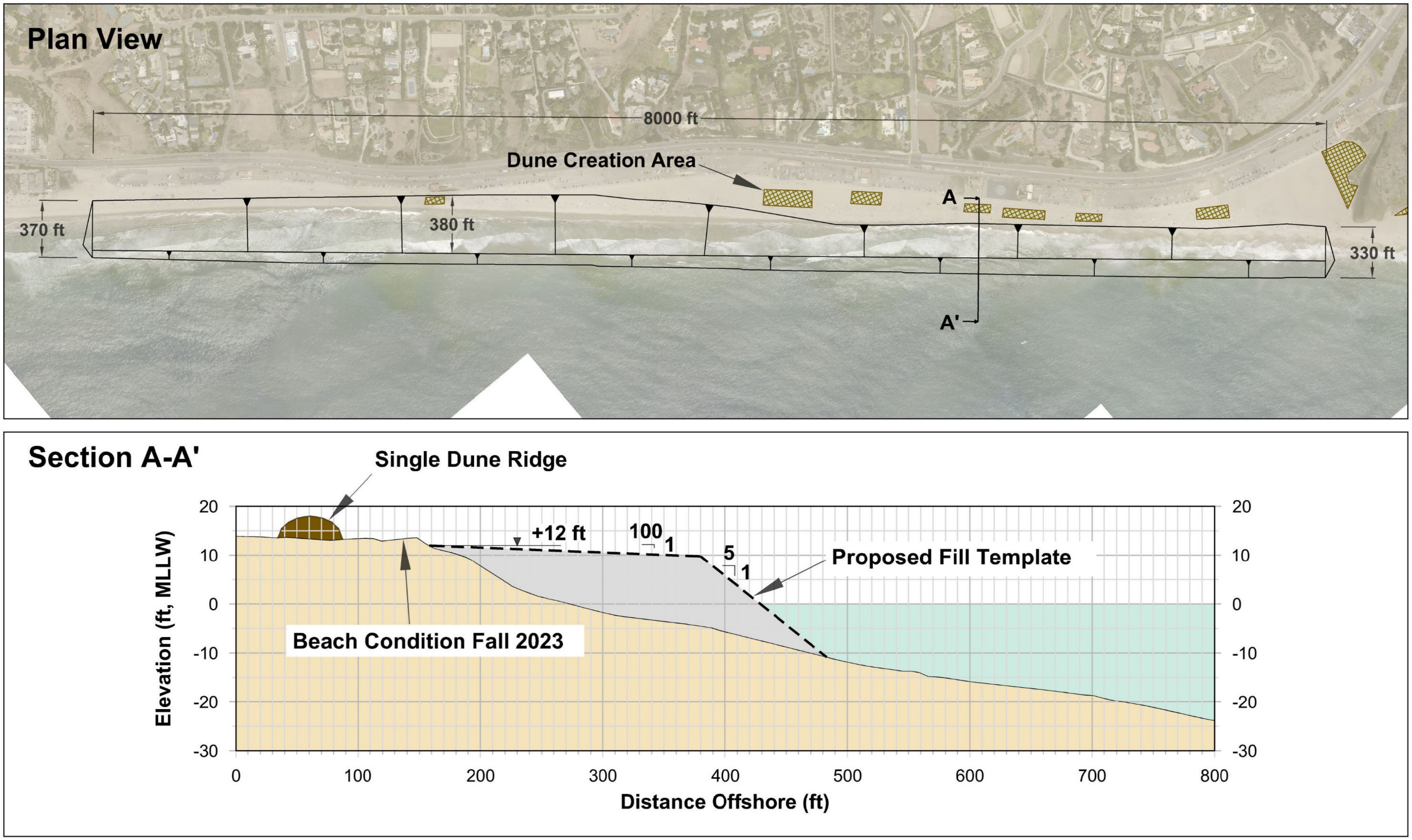

Figure 4-8. Beach Nourishment and Dune at Zuma Beach, Alternative 2

4.2 Dockweiler State Beach

The concept presented at Dockweiler State Beach as part of the *Coastal Resilience Study* (Moffatt & Nichol, 2023) included two elements: (1) installation of a sediment barrier along the bicycle and pedestrian path and parking lot, and (2) active management of the existing dune system between the Youth Center and the Hang Glider area. The specific objectives of the project are to:

- Reduce the quantity of sediment that is blown onto the path and parking lot;
- Manage and expand the existing dune system at the site; and
- Provide educational information related to the role that dunes play in habitat creation, risk reduction, and resilience planning.

4.2.1 Opportunities and Constraints

Opportunities

Opportunities that can be leveraged as part of the resilience project include:

- Dunes presently exist at the site.
- Project scale is relatively small, thereby improving likelihood for funding and expedited construction.

Constraints

The primary constraints warranting careful consideration in the project planning stage are:

- Any barrier constructed to limit sediment transport onto the bike path should be low enough to allow a person of average height to easily cross while carrying beach gear and should utilize a narrow foundation to limit the footprint.
- Vertical access to the beach and horizontal access along the beach must be provided.
- Hang Gliding is a popular activity at the south end of the site. The project should not impact established takeoff points.
- The project site is located within designated critical habitat for the western snowy plover. While project activities are not expected to permanently impact or adversely modify this habitat, temporary impacts could include changes to water quality (*e.g.,* turbidity, pH, dissolved oxygen), increased noise, temporary removal of foraging habitat, and other increased human activity during project activities.
- The El Segundo blue butterfly resides in the El Segundo sand dunes near Dockweiler State Beach and has been observed foraging in areas with their natural food source, coast

buckwheat. There is a low potential for the species to occur in the vegetated areas near the project site and they are not expected to occur due to lack of food sources.

4.2.2 Proposed Project and Alternatives

Key components of the proposed project and the project alternatives are provided in Table 4-2 and described in detail below. The project life is 20 years, with an assumed base year of 2030.

Table 4-2. Key Elements of Proposed Project & Alternatives, Dockweiler State Beach

Project	Enhanced Dune Habitat	Restored Dune Habitat	Length of Sand Barrier	Number of Beach Access Points
Proposed	1.3 acres	1.3 acres	850 ft	3
Alternative 1	1.3 acres	1.5 acres	850 ft	2
Alternative 2	1.3 acres	1.4 acres	700 ft	4

Proposed Project

The Proposed Project is illustrated in Figure 4-9. The primary components include a low barrier wall along the west edge of the bicycle path, enhancement and restoration of the existing dune field, and creation of established accessways between the parking lot and beach.

The barrier wall is intended to prevent wind-blown sand from reaching the bike path and parking lot and will be similar to that found at other County-managed beaches, such as Zuma Beach (Figure 4-10). There are two segments with a combined length of 850 ft, beginning at the Youth Center and ending east of the Hang Glider takeoff area to the south. The wall is a little more than 2 ft tall with a base that is about 1 ft wide.

The existing dune system will be enhanced through active management that includes installation of sand fencing within the dune field, installation of boundary fencing along the border, removal of non-native species, and seeding with native species. In addition, sand and boundary fencing will be installed west of the existing dune field in an effort to restore former dune habitat.

Public access to the beach will be provided at three locations: via the stairs on the south side of the Youth Center, along a designated path immediately south of the Youth Center, and at the Hang Glider takeoff area. Breaks in the barrier wall will be provided at all three locations.

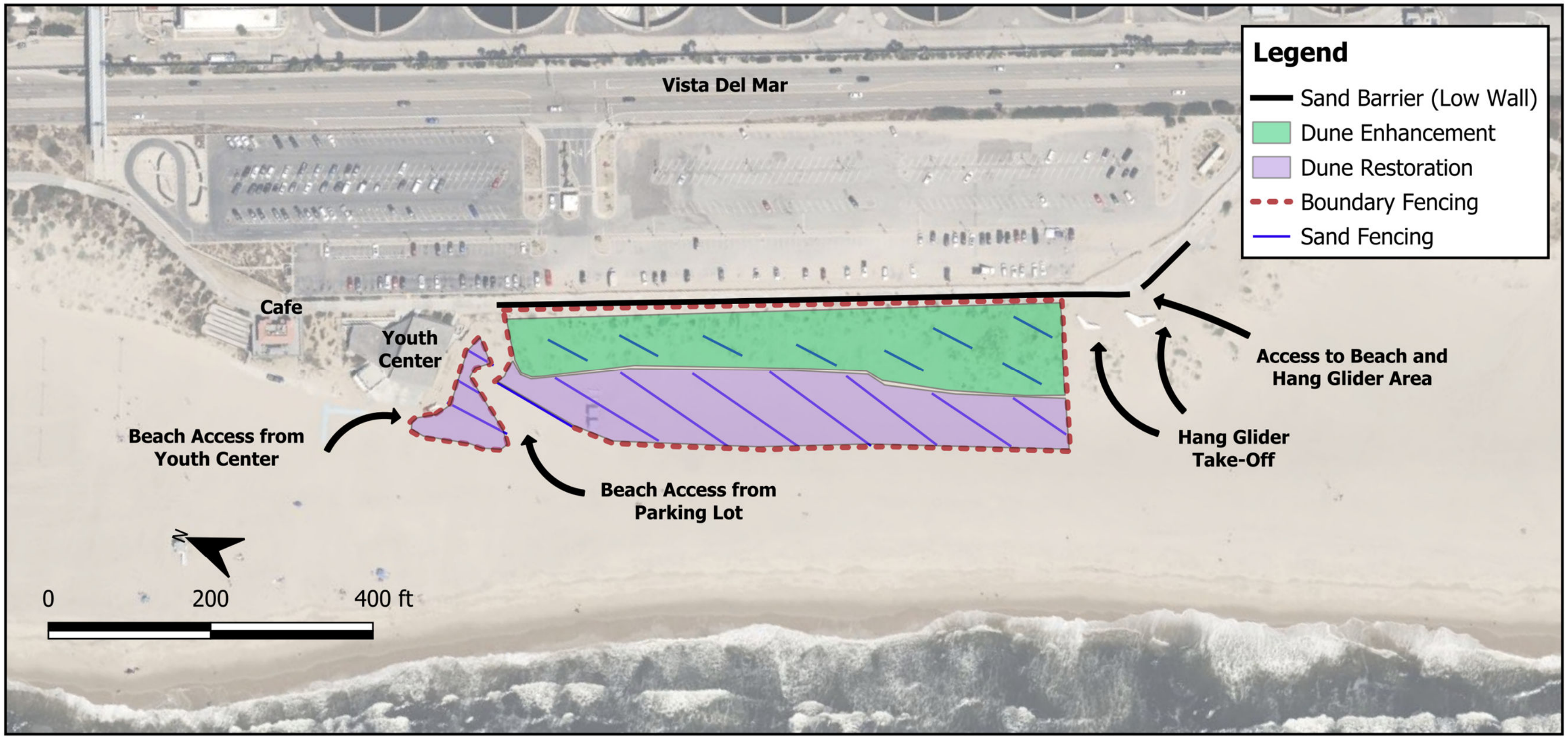

Figure 4-9. Proposed Project at Dockweiler State Beach

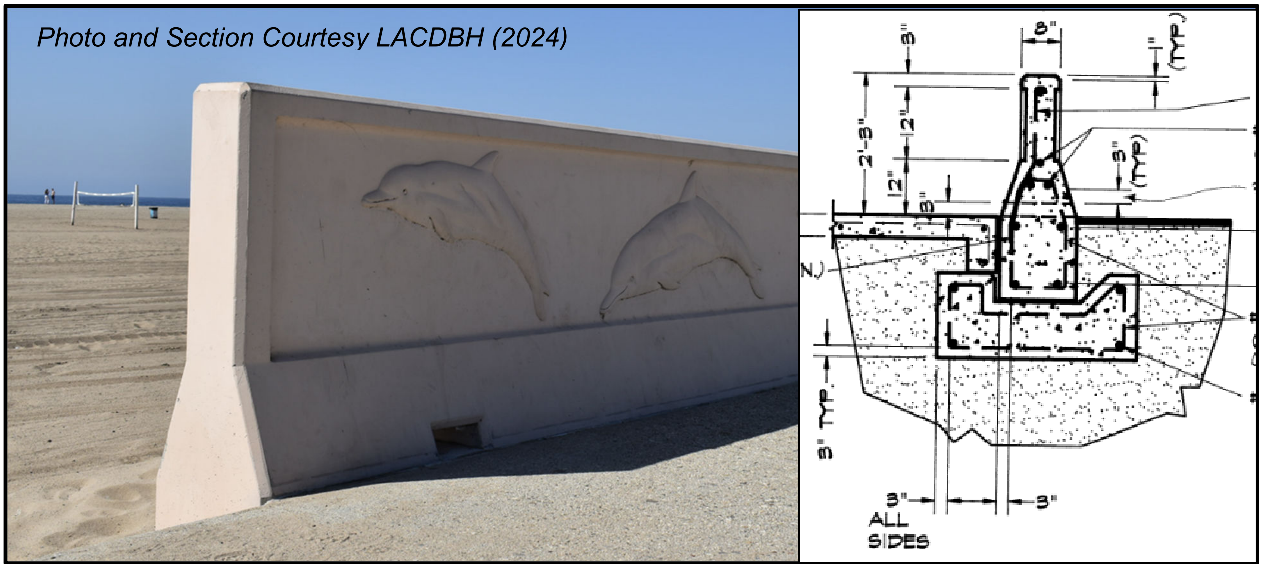

Figure 4-10. Photo and Cross Section of Low Sand Barrier at Zuma Beach

Alternative 1

Alternative 1 is illustrated in Figure 4-11. The barrier wall is identical to that in the Proposed Project. The beach access point immediately south of the Youth Center is removed, resulting in a continuous dune area from the Youth Center to the Hang Glider take-off area. Access to the beach is maintained at the Youth Center stairs and at the Hang Glider area. The enhanced dune area is identical to the Proposed Project (1.3 acres) and the restored dune area is slightly larger (1.5 acres).

Alternative 2

As part of Alternative 2, the barrier wall is terminated at the south end of the dune system, resulting in a single segment with a total length of 700 ft. As shown in Figure 4-12 the dune restoration area is expanded to the north and extends along the entire offshore edge of the Youth Center. Four beach access points are provided: at the base of the Youth Center, on the south side of the Youth Center, and immediately south of the Youth Center and at the Hang Glider area. The restored dune area is slightly larger than the Proposed Project (1.4 acres) and the enhanced dune area is identical (1.3 acres).

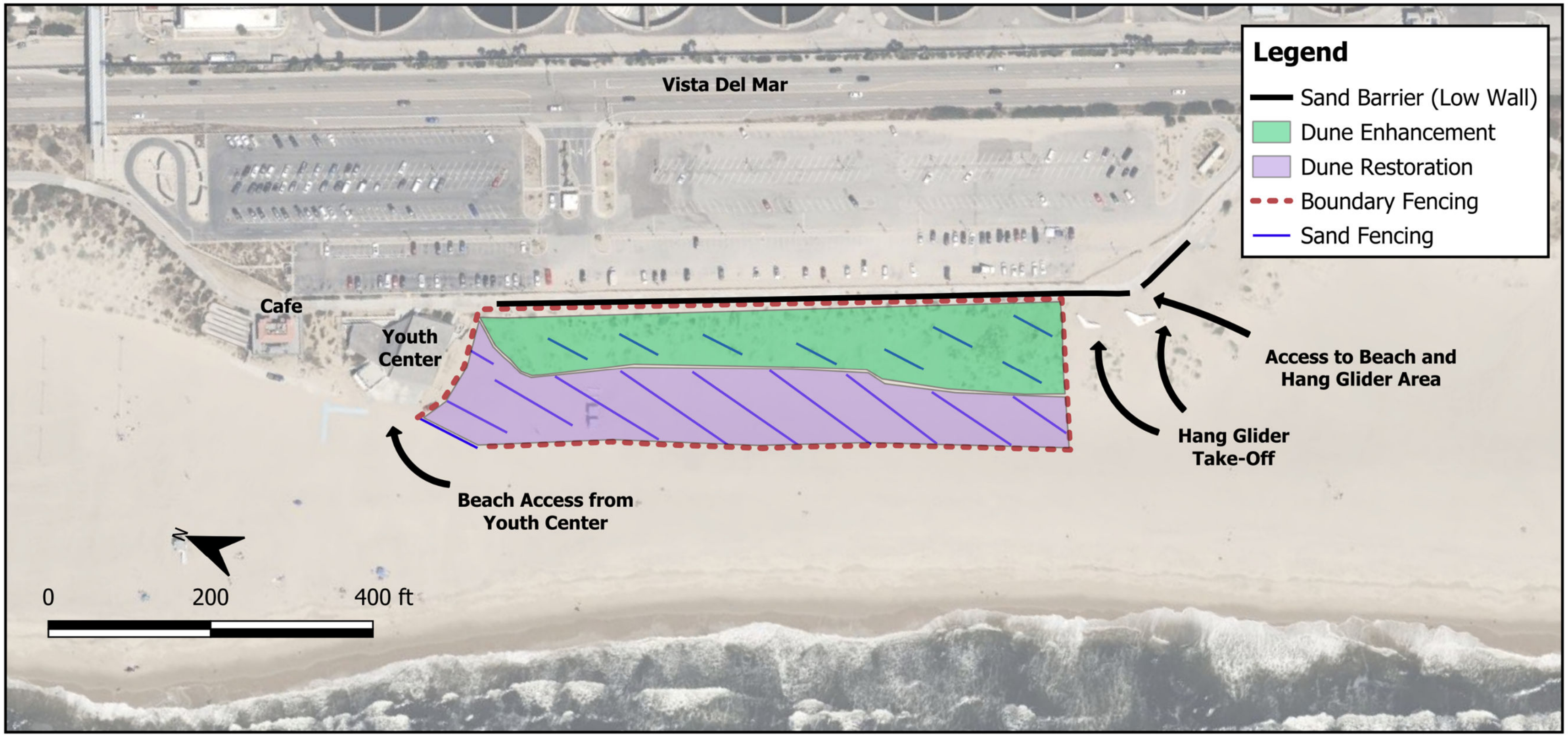

Figure 4-11. Project Alternative 1 at Dockweiler State Beach

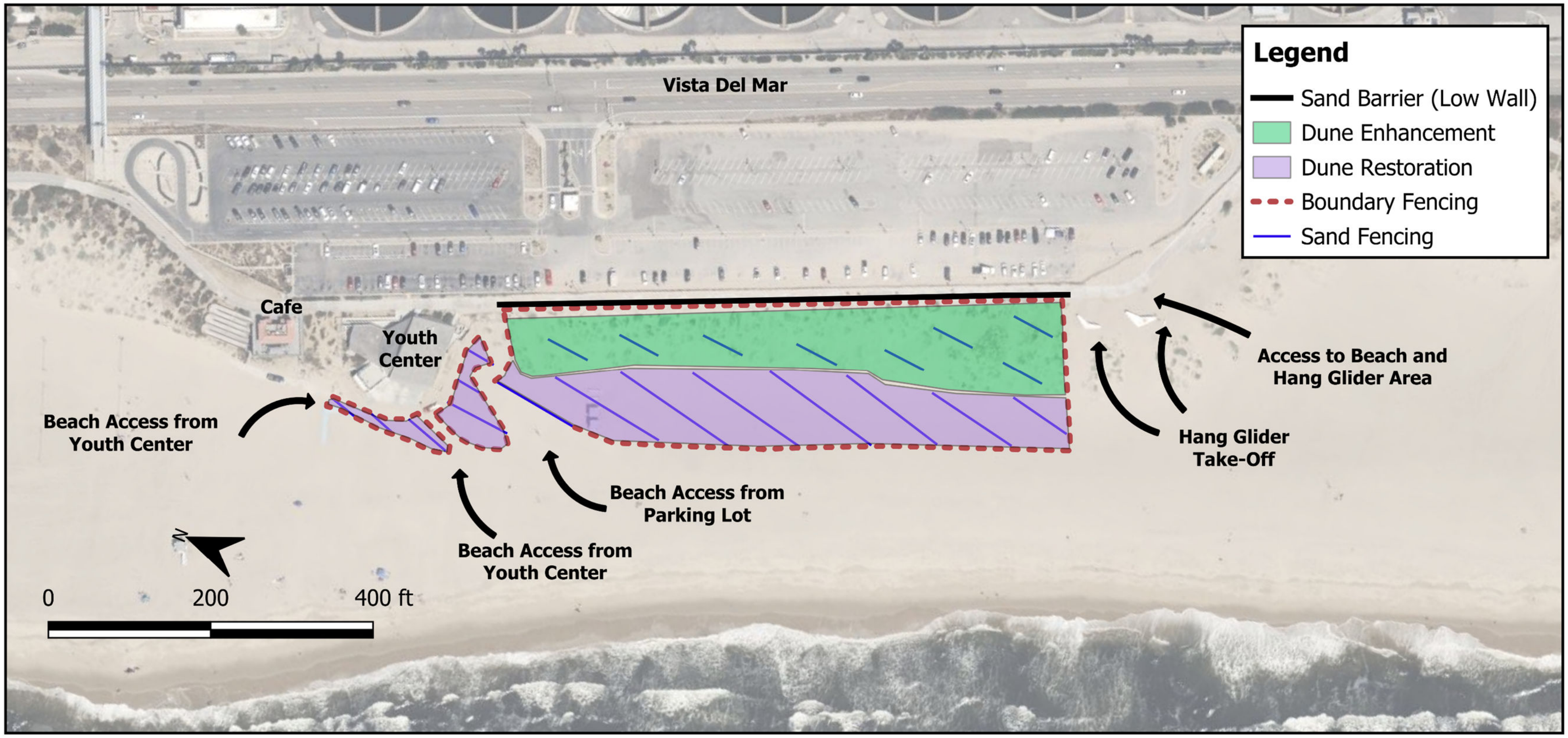

Figure 4-12. Project Alternative 2 at Dockweiler State Beach

4.3 Redondo Beach

The concept proposed at Redondo Beach as part of the *Coastal Resilience Study* (Moffatt & Nichol, 2023) included widening the beach via nourishment between Topaz Groin and Redondo Pier, installation of a sheet-pile groin at the Pier to reduce the quantity of sand transported into King Harbor, and creation of dune habitat in selected areas along the back beach. The objectives of the project are to:

- Expand public access and recreational opportunities for LA County residents and visitors;
- Increase protection of coastal infrastructure;
- Increase and enhance sensitive sandy beach and dune habitat; and
- Expand local and regional economic benefits.

4.3.1 Opportunities and Constraints

Opportunities

Opportunities that can be leveraged as part of the resilience project include:

- Prior use as a beach nourishment receiver site by the USACE.
- Pier structure provides an optimal location to add a non-intrusive sediment retention device.
- The Pier is adjacent to the entrance to King Harbor, resulting in no negative down-drift impacts from sediment retention device.

Constraints

The primary constraints warranting careful consideration in the project planning stage are:

- Recreational beach area (“towel space”) will be reduced in areas where dunes are created.
- Vertical access through dune areas must be provided for and managed.
- Dunes may impact view corridors and should be considered in project planning.
- The California grunion spawns on sandy beaches in southern California. Immediately following high tides from mid-March through August, grunion may come ashore to lay eggs in the sand near the High Tide Line (HTL). The eggs are incubated in the sand until the following series of high tide conditions, when the eggs hatch and area washed into the ocean. The Zuma Beach and Redondo Beach project sites occur in the sandy beach

and subtidal sand overlapping the HTL and therefore have the potential to impact incubating eggs if project activities occur during their spawning season.

4.3.2 Design Concept and Alternatives

Key components of the proposed project and the project alternatives are provided in Table 4-3 and described in detail below. The project life is 20 years, with an assumed base year of 2030.

Table 4-3. Key Elements of Proposed Project & Alternatives, Redondo Beach

Project	Beach Nourishment	Renourishment Interval	Sediment Retention	New Dune Habitat
Proposed	300,000	None	Yes	4.5 acres
Alternative 1	300,000	None	No	4.5 acres
Alternative 2	150,000	None	Yes	4.5 acres

Proposed Project

The Proposed Project, shown in Figure 4-13, includes a one-time placement of 300,000 cy of sand between Topaz Groin and Redondo Beach Pier, construction of a sand retention device on the south side of Redondo Beach Pier, and creation of dune habitat fronting the County facility near Topaz Groin.

The beach nourishment construction template (Figure 4-13) is comprised of a berm up to 265 ft wide with a crest elevation of +12 ft (MLLW) and a foreshore slope of 1:5 (V:H). The fill is stabilized by Topaz Groin on the south end and a newly-constructed sheet-pile groin on the north end as described below.

The purpose of the sediment retention device is twofold: (1) to extend the longevity of the beach nourishment benefits, and (2) to reduce the quantity of sediment that travels north and is deposited in King Harbor, thereby creating impediments to navigation. A sheet-pile groin, similar to that which currently exists on the north side of Seal Beach Pier, is proposed based on the reduced footprint relative to a rock structure, and ability to blend with the pier structure. Figure 4-14 illustrates the effectiveness of the Seal Beach Pier groin in retaining sediment travelling from south to north within the pocket beach between Seal Beach Pier and the Alamitos Bay north jetty.

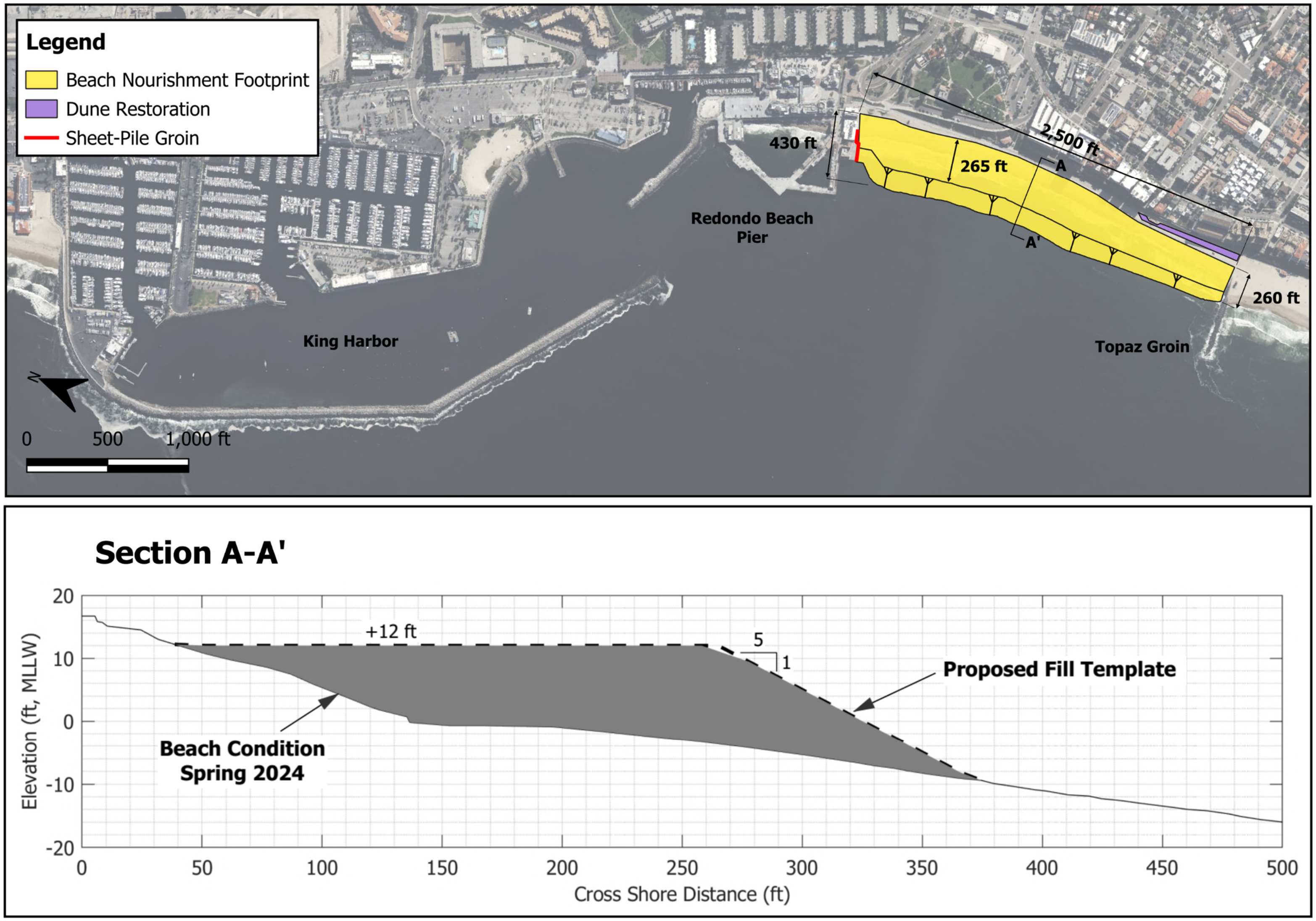

Figure 4-13. Proposed Project at Redondo Beach

Figure 4-14. Beach Retained by Sheet Pile Groin at Seal Beach Pier

Negative impacts typically associated with sediment retention devices, such as down-drift erosion, are not applicable at Redondo Beach, given that little to no beach presently exists between the pier and the harbor. In addition, the proposed structure will include a façade of ECOncrete, a patented product that encourages biological recruitment, increases carbon sequestration, and improves water quality (ECOncrete, 2024). Figure 4-15 provides a conceptual illustration of the proposed structure, a cross section and photo of the Seal Beach Pier Groin, and illustration of ECOncrete used at a pier in Spain. It is estimated that the structure will be approximately 180 ft long.

Following placement of the beach fill, dunes will be constructed offshore and south of the County facility near Topaz Groin (Figure 4-13). This area was selected based on the location of the facility and the fact that it is distant from popular beach access points near the pier. The total dune area is 4.5 acres.

It is likely that sediment used for the project will be dredged from an offshore borrow site within Santa Monica Bay and hydraulicly pumped onto the beach from offshore. Prior sand source investigations (Coastal Frontiers Corporation, 2012) have located high quality sand offshore of Santa Monica Bay that is compatible with the native sediments at the site.

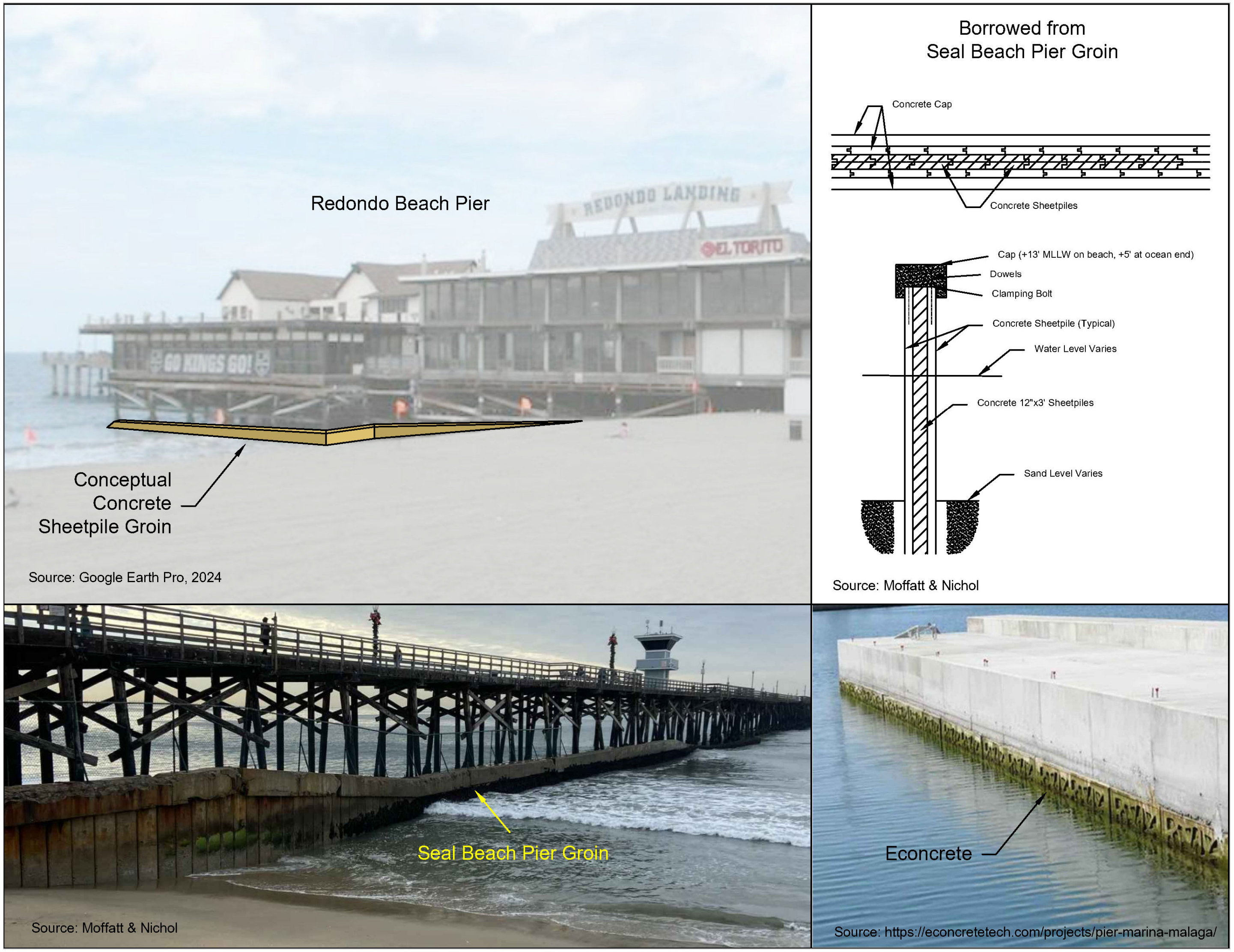

Figure 4-15. Conceptual Illustration of Proposed Sheet Pile Groin, Seal Beach Pier Groin, and ECOncrete Finish

Alternative 1

Alternative 1, shown in Figure 4-16, is identical to the Proposed Project, but without the sand retention structure at the pier.

Alternative 2

While the dune and sediment retention components of Alternative 2 are identical to the Proposed Project, the volume of sediment placed on the beach is reduced by 50% from 300,000 to 150,00 cy. Figure 4-17 illustrates the project components and provides a representative cross section through the beach nourishment construction template.

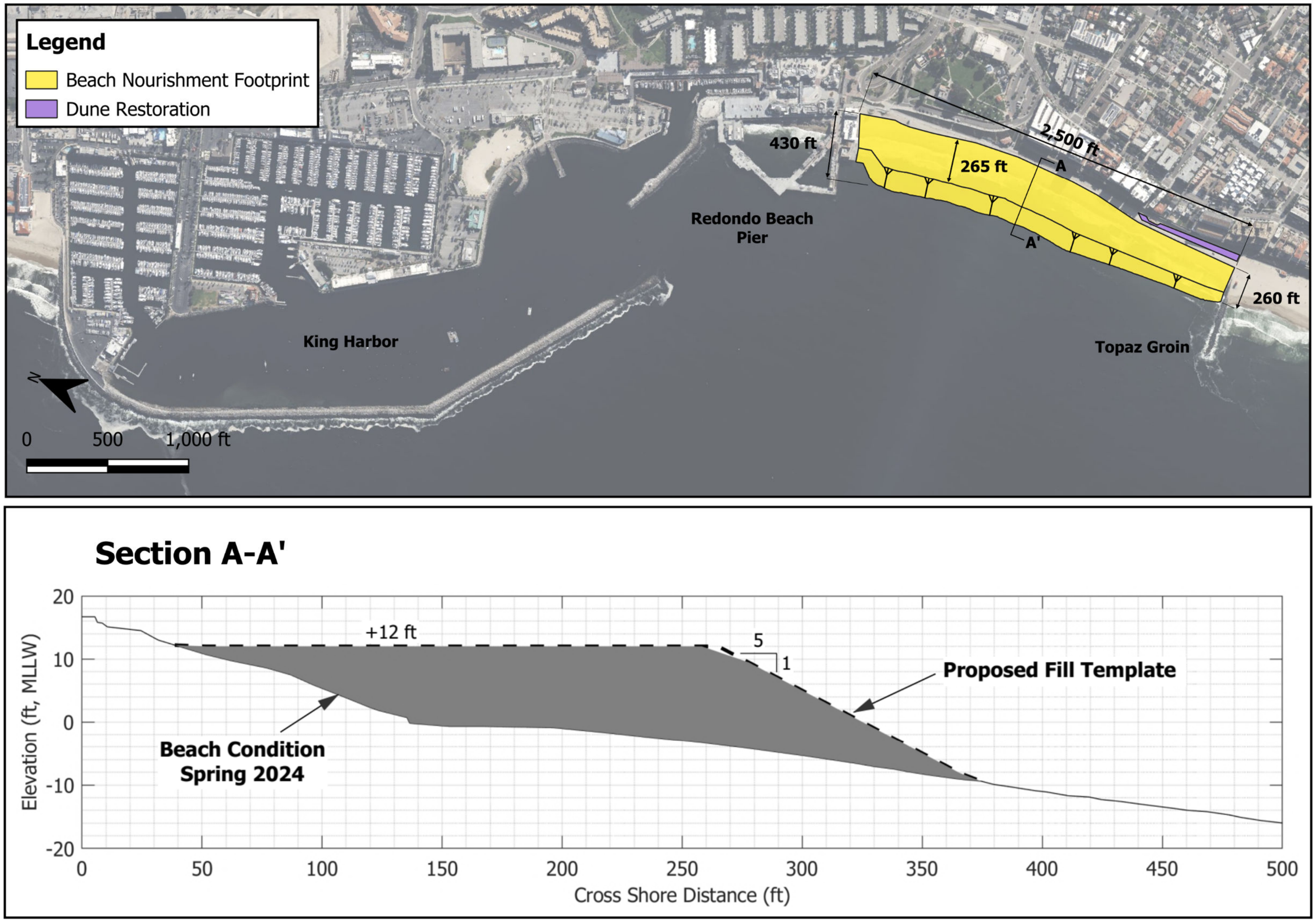

Figure 4-16. Project Alternative 1 at Redondo Beach

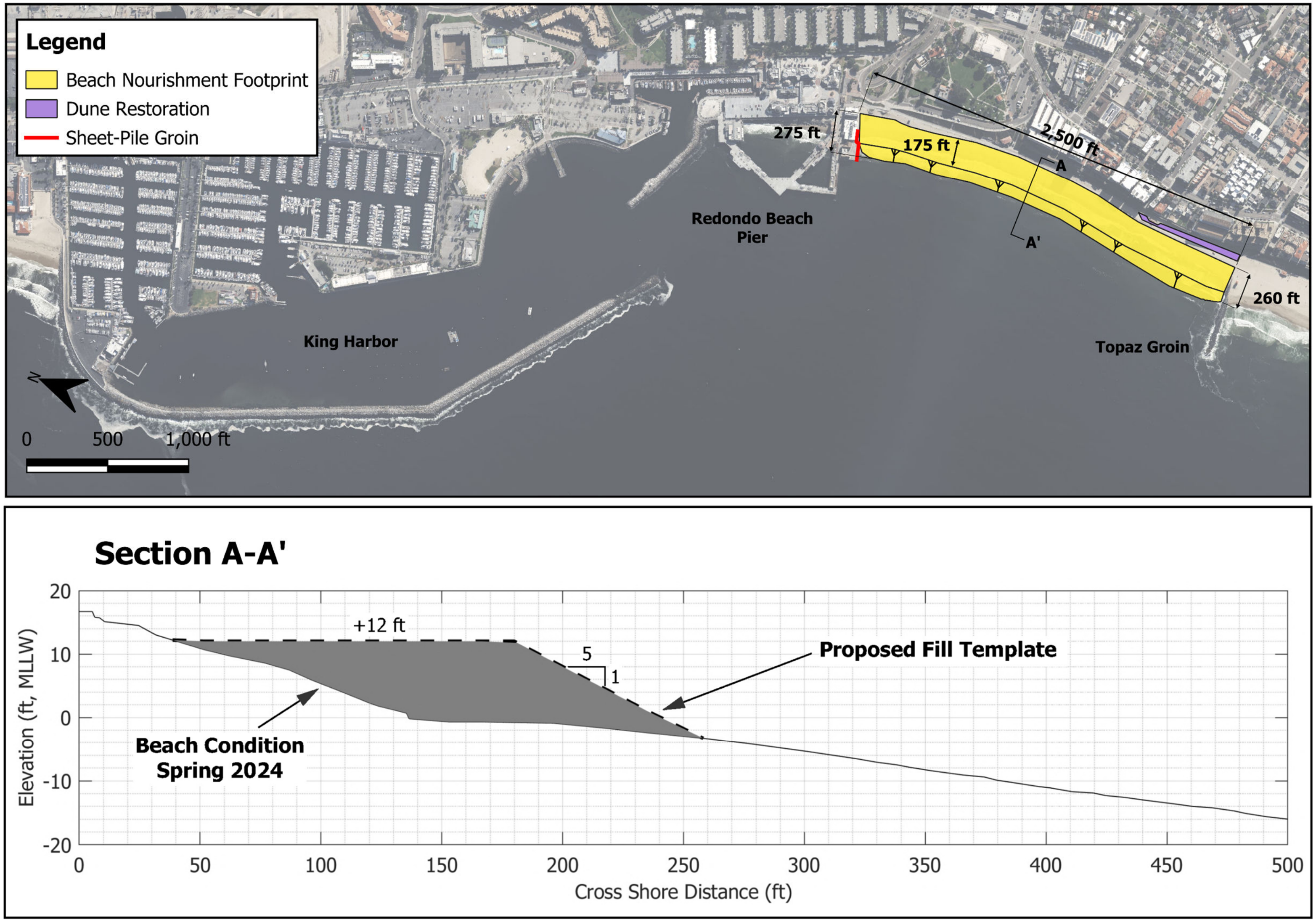

Figure 4-17. Project Alternative 2 at Redondo Beach

5 Alternatives Analysis

This section summarizes analyses conducted to evaluate the anticipated outcome of the proposed projects and project alternatives. The intent is to identify potential benefits and impacts to physical and environmental factors, with a focus on achieving the project objectives while minimizing impacts. The findings provide key inputs to the upcoming benefit-cost analysis and alternative selection tasks to be completed in early 2025.

The performance of each project was evaluated over the assumed project life of 20 years, with a base year of 2030. The metrics used in the evaluation are:

- Net increase in beach width relative to the pre-nourishment condition
- Quantity of dune habitat
- Potential for environmental benefits / impacts
- Potential for public access benefits / impacts

5.1 Zuma Beach and Point Dume

As noted in Section 4, the primary components of the Zuma Beach and Point Dume Project are beach nourishment and dune creation or enhancement. An overview of the key elements is provided in Table 5-1.

Table 5-1. Overview of Key Project Elements, Zuma Beach & Point Dume

Project	Beach Nourishment	Renourishment Interval	New Dune Habitat	Enhanced Dune Habitat
Proposed	500,000	5 years	2.5 acres	4.5 acres
Alternative 1	500,000	5 years	7.5 acres	4.5 acres
Alternative 2	750,000	8 years	2.5 acres	4.5 acres

5.1.1 Shoreline Modeling

To assess the potential benefits and impacts related to the beach nourishment activities, numerical simulations of shoreline evolution were conducted using the GenCade model (Frey *et al.*, 2012) developed by the USACE. GenCade is a one-line model of shoreline change and wave-induced longshore sediment transport applicable to open coasts and inlets. Inputs to the model include the initial shoreline configuration, sediment characteristics, location of coastal structures (e.g., seawalls, jetties, breakwaters, or groins), sediment sources (e.g., contributions from rivers, bluffs, and beach nourishment), and sediment sinks (e.g., harbors, submarine canyons, offshore losses, losses resulting from sea level rise). The model is driven by nearshore wave conditions and typically is calibrated using measured shoreline data obtained in the area of interest.

Beach Profile Equilibration following Nourishment

When beach nourishment projects are constructed, sand is initially placed high on the profile in a wide berm, as is shown in Figure 4-3. This is done to maximize the recreational area for immediate benefit and to facilitate construction. The fill material, however, is quickly dispersed offshore and alongshore by nearshore waves and currents. As the material is redistributed, the beach undergoes a process of equilibration to a more natural condition. This condition, referred to as the "equilibrium beach profile", is related to the sediment grain size, berm height, and nearshore wave conditions (Dean, 2002).

For example, the construction template for the Proposed Project at Zuma Beach shown in Figure 4-3 adds approximately 200 ft to the width of the berm. Following equilibration, it is estimated that the additional berm width may be reduced to as little as 50 ft, as is illustrated in Figure 5-1. This estimate is based on the assumption that the fill and native grain sizes are the same. It should be noted that coarser than native material can be used to increase the equilibrated beach width and extend the fill longevity. However, in the interest of conservatism, the analyses presented herein do not include such changes and it has been assumed that the fill and native material are the same size.

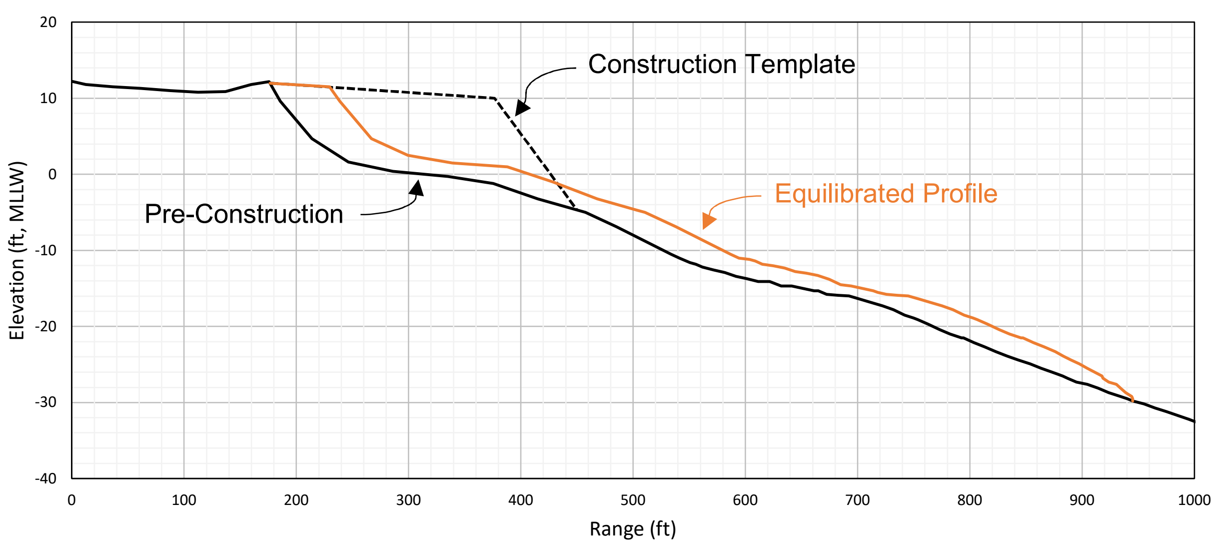

Figure 5-1. Pre-Construction, Construction Template, and Equilibrium Beach Profile

Model Configuration and Calibration

The domain selected for the numerical simulations is illustrated in Figure 5-2. It begins at Point Dume and extends west to Lechuza Point. Sediment characteristics were derived from the samples obtained at Zuma Beach in 2016 (Section 2.1.6), resulting in an average median grain size diameter of 0.23 mm. Beach profile data obtained between 2016 and 2023 (Coastal Frontiers Corporation, 2023a) were used to estimate the typical berm elevation (+9 ft, MHHW) and depth of closure (-34 ft, MHHW). Coastal structures included in the model consisted of revetments at Broad Beach and Westward Beach Road and those structures that limit landward migration of the beach, such as parking lots, coastal facilities, and roads.

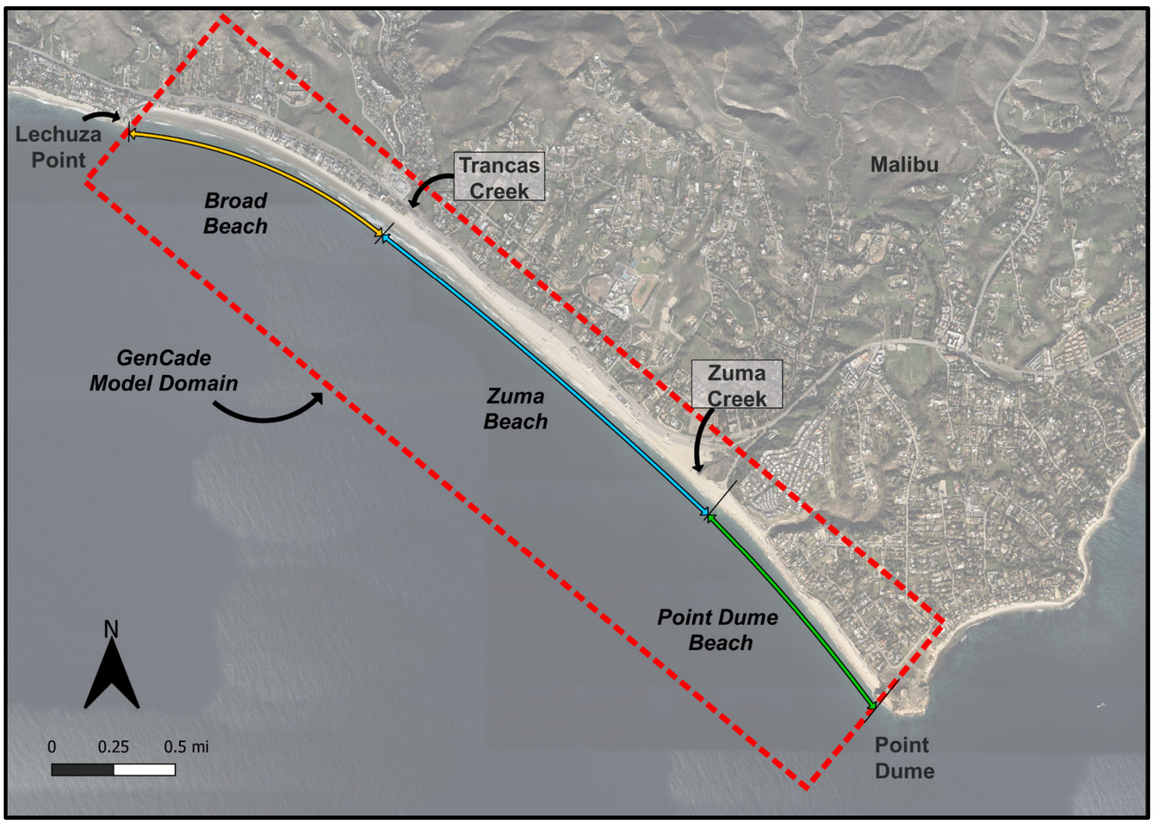

Figure 5-2. GenCade Model Domain

As noted in Section 2.1.2, sediment input to the Zuma littoral cell is derived primarily from local creeks and streams. For the purposes of the numerical simulations, two sources were used: 19,500 cy/yr at Trancas Creek and 19,500 cy/yr at Zuma Creek (total input of 39,000 cy/yr).

Shoreline data derived from Light Detection and Ranging (LiDAR) datasets obtained in 2009 by the USACE as part of the National Coastal Mapping Program (NCMP) and in 2016 by Los Angeles County as part of the Los Angeles Region Imagery Acquisition Consortium (LARIAC) were used to calibrate the model. Given that the LiDAR data becomes less reliable near the water surface, the Mean Higher High Water (MHHW) elevation was used as the basis for the shoreline data. In the project area, MHHW lies 5.43 ft above MLLW (NOS, 2024). To begin the simulations as close to the base year (2030) as possible, beach profile data obtained in October 2023 (Coastal Frontiers, 2023a) were used to develop the initial shoreline position for the forecast runs.

Wave conditions used to drive the model were obtained from the California Coastal Wave Monitoring and Prediction System (MOP; O'Reilly *et al.*, 2016) maintained by the Coastal Data Information Program (CDIP, 2024) and from wave conditions forecast as part of the USGS CoSMoS simulations (Barnard *et al.*, 2018). Two sources of wave data were necessary to bridge the calibration (2009 to 2016) and forecast (2023 to 2050) phases of the study. Fortunately, the MOP and CoSMoS wave stations are in nearly identical locations and water depths and inspection of the two datasets indicate that the results are comparable.

Figure 5-3 illustrates the results of the model calibration, including the initial (2009) shoreline position, the measured 2016 shoreline position derived from the LARIAC data, and the modeled 2016 shoreline position generated by GenCade. The RMS error between the measured and modeled shorelines was 22 ft and the model skill, a measure of the model's accuracy, was 0.8. This value exceeds the threshold typically accepted by the USACE, 0.3, by a comfortable margin.

Forecast Shoreline Simulations

The calibrated model was used to evaluate the Proposed Project and the two alternatives over the 20-year design life, beginning on January 1, 2030, and ending on January 1, 2050. To reach the base year (2030), the model was advanced from October 26, 2023, to January 1, 2030. As noted above, the October 2023 shoreline position was developed from beach profile data obtained by CFC (Coastal Frontiers Corporation, 2023a). Shoreline recession due to sea level rise was included in the forecast simulations (October 2023 to January 2050) based on the values presented in Section 2.1.4 and the Bruun Rule (Bruun, 1962). Given the relatively minor increase in sea level over this period, the erosion due to sea level rise was only 26 ft over the nearly 26-year simulation.

5.1.2 Beach Width Changes

As noted above, one of the primary metrics used to assess the relative performance of each project is the net increase in beach width relative to the pre-nourishment condition. The following subsection summarizes the beach width changes derived from the shoreline modeling results.

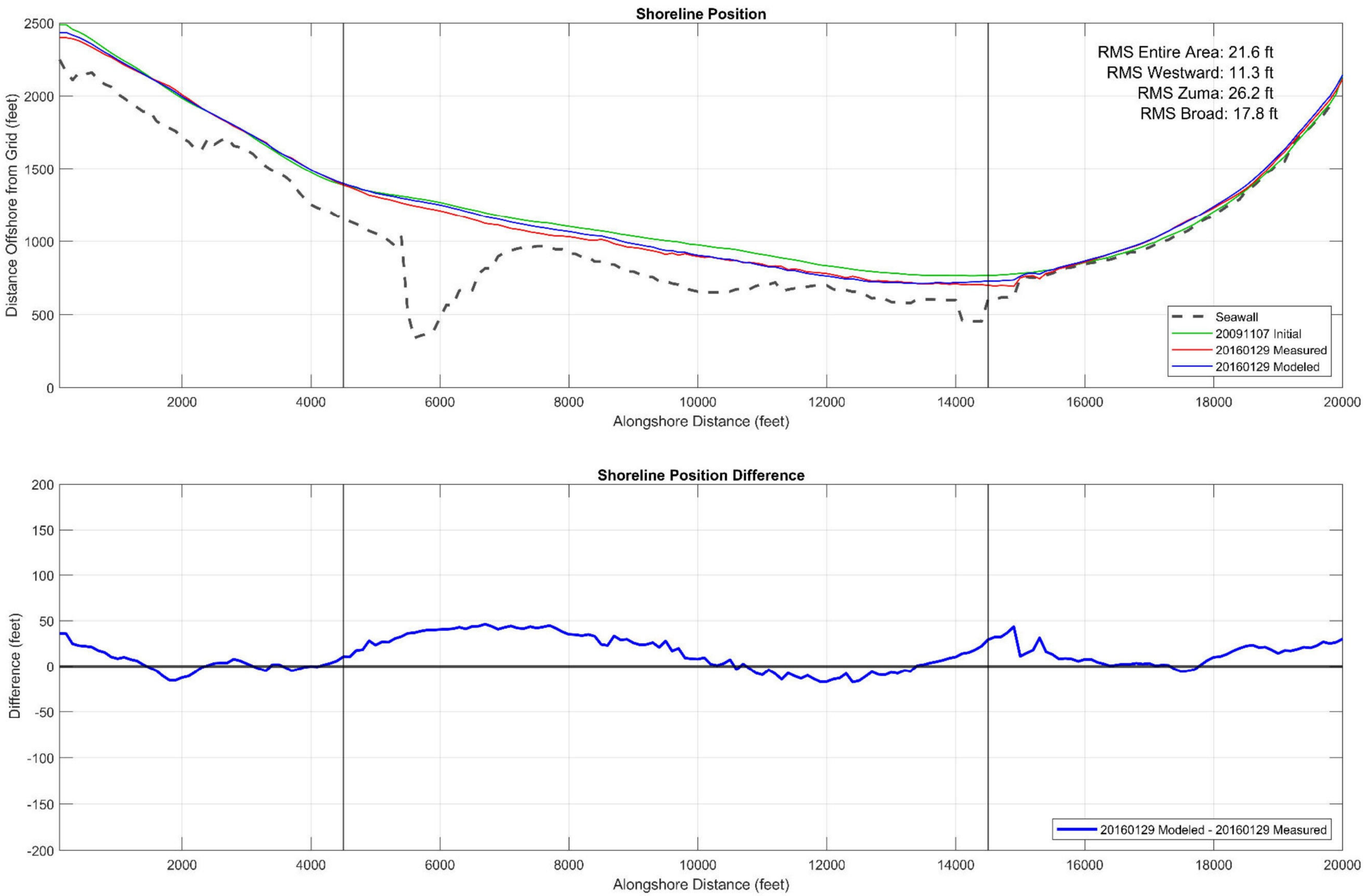

Figure 5-3. Model Calibration Results

Proposed Project

Figure 5-4 illustrates the results of the shoreline simulations conducted for the Proposed Project (500,000 cy beach nourishment). The figure shows the additional beach width within the model domain relative to the pre-construction condition (January 1, 2030) over the first five years of the Proposed Project (2030 to 2035). As expected, the increase in beach width is greatest within the fill footprint initially, and over time the material spreads downcoast toward Point Dume. By 2035 (year 5), most of the added material within the fill footprint has dispersed, indicating that a 5-year renourishment interval is necessary to maintain project-related benefits over the 20-year design life.

Figure 5-5 illustrates the average added beach width at Zuma and Point Dume Beach over the first 5-year nourishment cycle. As shown in the figure, the average increase in beach width within the Zuma Beach fill footprint is 25 ft. While Point Dume Beach does not receive direct sand placement due to its location within the Point Dume State Marine Reserve (SMR), sand from the Zuma Beach fill is transported east by winter swell arriving from the northwest, resulting in an average beach width increase of 4 ft over the same 5-year period.

Alternative 1

The beach fill configuration for Alternative 1 is identical to that used for the Proposed Project. As a result, the shoreline evolution is expected to be the same.

Alternative 2

As noted in Section 4, the initial and renourishment volumes for Alternative 2 are 750,000 cy and the renourishment interval is 8 years. Figure 5-6 illustrates the additional beach width relative to the pre-construction condition (January 1, 2030) for Alternative 2 over the first eight years of the project. Due to the additional volume and length of the fill, the down-coast benefits at Point Dume are greater than in the Proposed Project. In addition, the project benefits are retained, on average, three years longer when the entire reach from Zuma to Point Dume is considered.

The average increase in dry beach width over the first 8-year nourishment cycle is shown in Figure 5-7. Within the fill footprint, the average increase in beach width is 23 ft, whereas the average at Point Dume is 7 ft, with the greatest benefits occurring in the damage prone areas along Westward Beach Road.

5.1.3 Quantity of Dune Habitat

The quantity of dune habitat for the Proposed Project and the project alternatives is outlined in Section 4 and summarized in Table 5-1. The Proposed Project and Alternative 2 have equal dune areas (7 acres), while Alternative 1 includes 5 acres more (total of 12 acres).

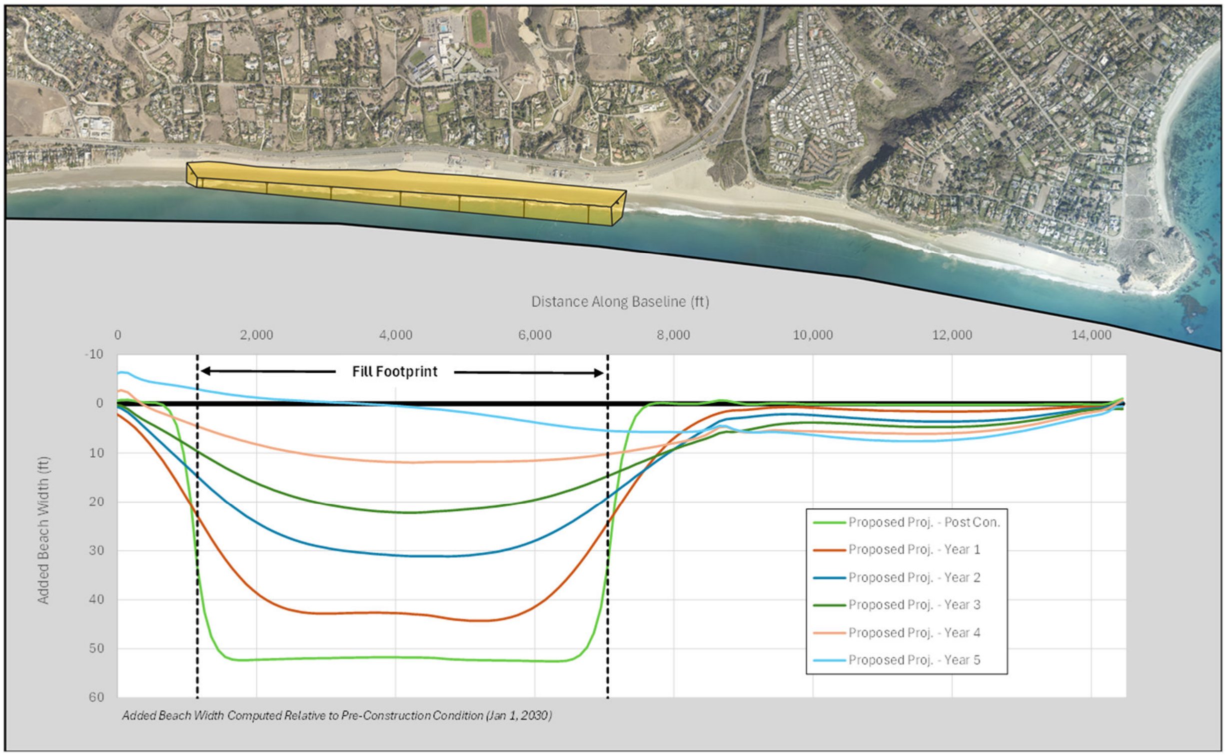

Figure 5-4. Added Beach Width, Proposed Project, Year 1 to 5

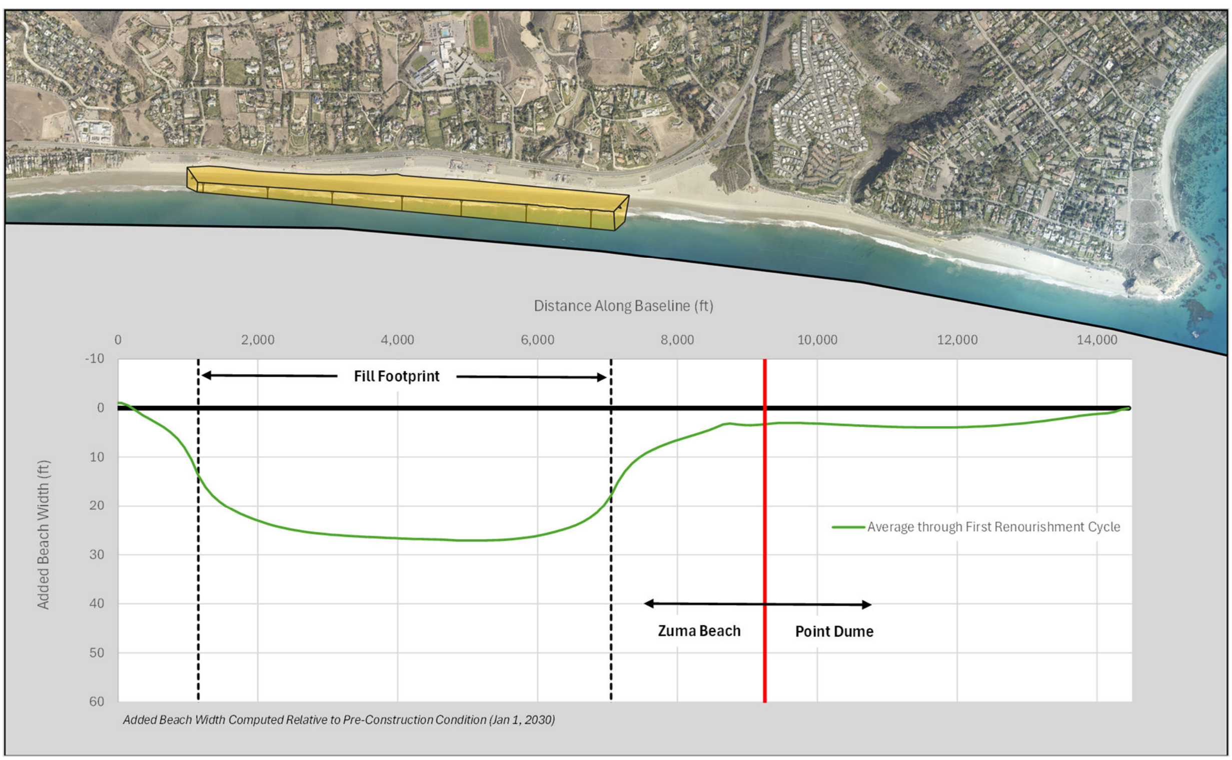

Figure 5-5. Average Added Beach Width, Proposed Project, Year 1 to 5

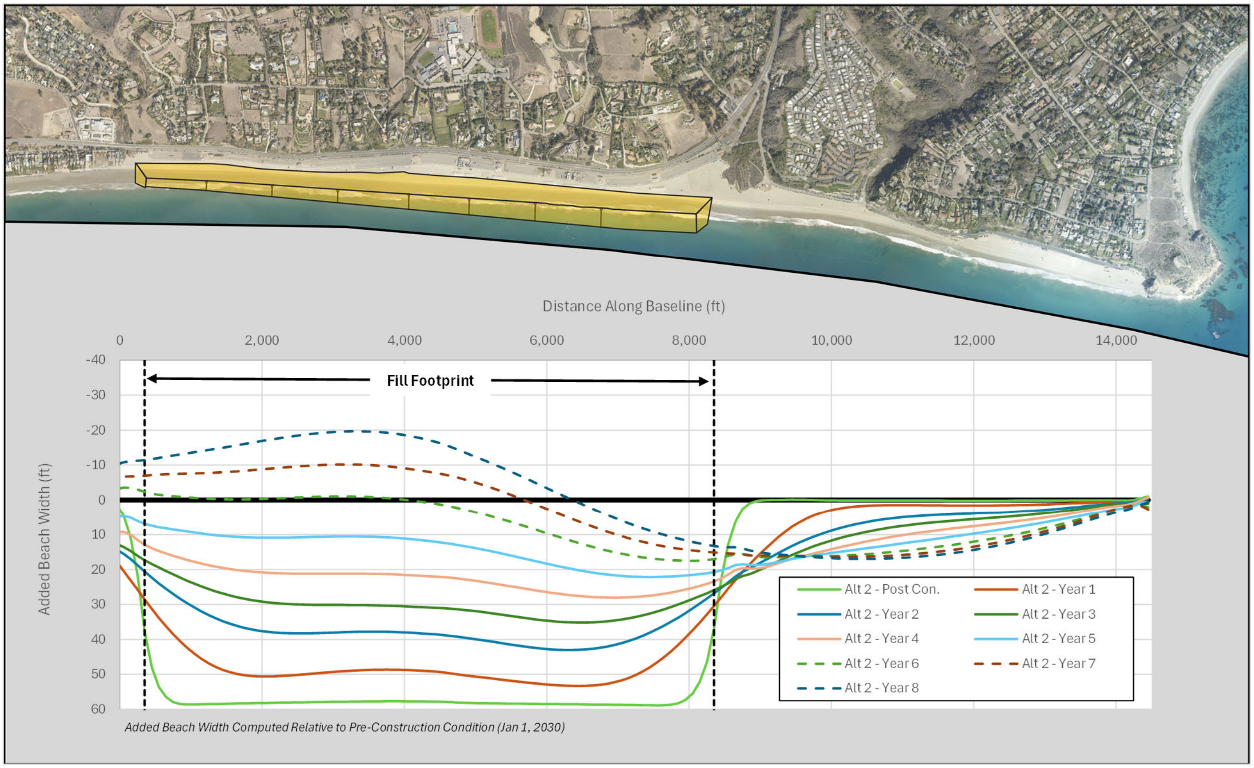

Figure 5-6. Added Beach Width, Alternative 2, Year 1 to 8

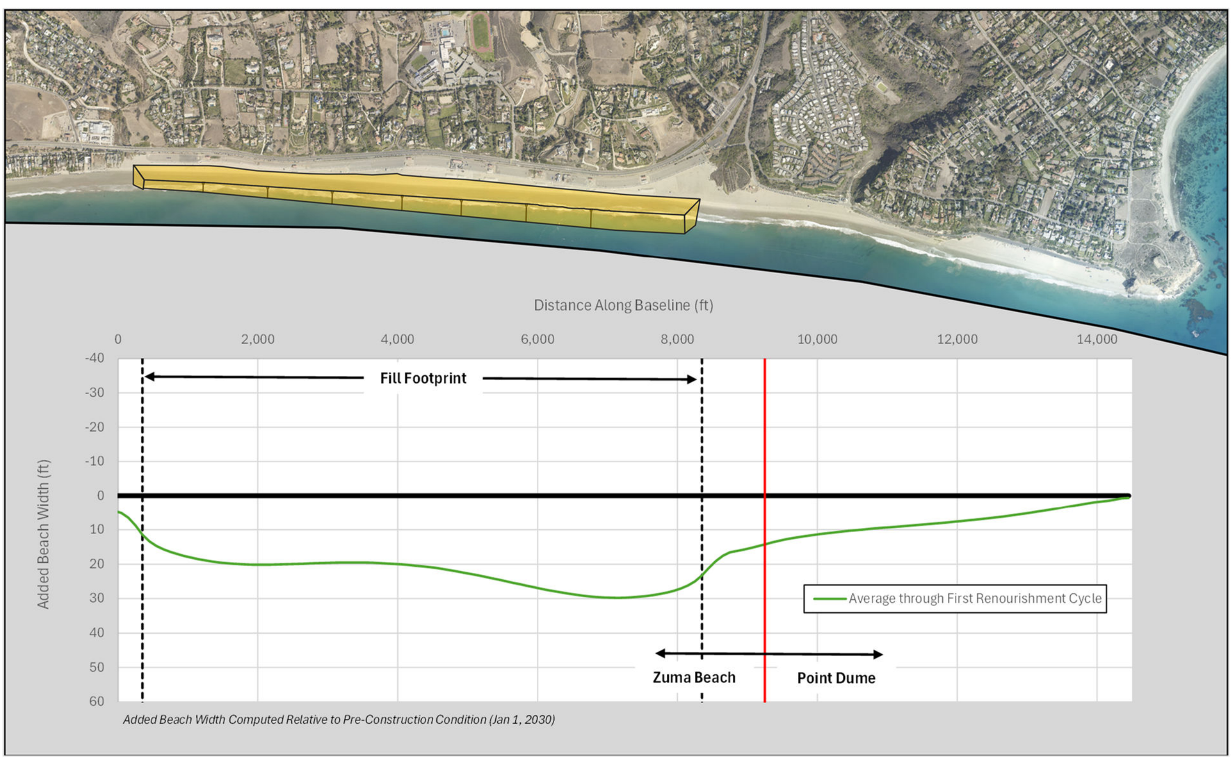

Figure 5-7. Average Added Beach Width, Alternative 2, Year 1 through 8

5.1.4 Potential for environmental benefits and impacts

Potential environmental benefits resulting from the Zuma and Point Dume projects include increases in sandy beach and dune habitat, both of which are quantified through the additional beach width and quantity of dune habitat discussed above.

Potential environmental impacts include those to regulated or sensitive biological resources, such as western snowy plover, tidewater goby, and its designated critical habitat, other special status species (*i.e.,* California grunion), Essential Fish Habitat, Marine Protected Areas, and Areas of Special Biological Significance. While similar impacts have been successfully mitigated as part of beach nourishment programs of similar magnitude conducted in Southern California (e.g., SANDAG Regional Beach Sand Projects), the potential impacts for Alternative 2 are considered to be greater than those for the Proposed Project and Alternative 1, given that the size of the beach fill is 50% larger.

5.1.5 Potential for public access benefits and impacts

Potential benefits and impacts to public access include the additional dry beach area (benefit) resulting from the beach nourishment activities and potential impediments related to dune creation (impact). In a relative sense, the greatest benefits lie with Alternative 2, as the additional beach width is distributed over a larger area. The greatest impacts, on the other hand, result from Alternative 1, due to the increase in dune area along Zuma Beach.

5.2 Dockweiler State Beach

The proposed project and project alternatives at Dockweiler State Beach were assessed based on the quantity of dune habitat, potential for environmental benefits and impacts, and potential for public access benefits and impacts. None of the projects are expected to influence shoreline changes in the area, thus beach width was not considered. Key elements of the projects are provided in Table 5-2.

Table 5-2. Overview of Key Project Elements, Dockweiler State Beach

Project	Enhanced Dune Habitat	Restored Dune Habitat	Length of Sand Barrier	Number of Beach Access Points
Proposed	1.3 acres	1.3 acres	850 ft	3
Alternative 1	1.3 acres	1.5 acres	850 ft	2
Alternative 2	1.3 acres	1.4 acres	700 ft	4

5.2.1 Quantity of Dune Habitat

The quantity of dune habitat for the Proposed Project and the two project alternatives is outlined in Section 4 (Table 5-2). Of the three projects, the Proposed Project includes the least dune area (2.6 acres), while Alternative 1 includes the greatest area (2.8 acres).

5.2.2 Potential for environmental benefits and impacts

Potential environmental benefits resulting from the Dockweiler projects are primarily related to increases in and enhancement of dune habitat. All three alternatives include enhancement of 1.3 acres of existing dune but differ in the quantity of added/restored dune as shown in Table 4-2.

As noted in Section 4, project activities are not expected to permanently impact or adversely modify habitat in the area. Temporary impacts to western snowy plover could include changes to water quality (e.g., turbidity, pH, dissolved oxygen), increased noise, temporary removal of foraging habitat, and other increased human activity during project activities. Given the temporary nature of the impacts and the modest differences in the project areas, it is assumed that all three projects carry the same low risk for adverse environmental impacts.

5.2.3 Potential for public access benefits and impacts

Potential benefits and impacts to public access are directly related to the number of access points provided as part of each project. To this end, Alternative 2 provides the greatest benefit (4 access points), while Alternative 1 provides the least (2 access points).

5.3 Redondo Beach

The primary components of the Redondo Beach Project are beach nourishment, sediment retention, and dune creation (Table 5-3). Potential benefits and impacts of each component have been evaluated and are summarized below.

Table 5-3. Overview of Key Project Elements, Redondo Beach

Project	Beach Nourishment	Renourishment Interval	Sediment Retention	New Dune Habitat
Proposed	300,000	None	Yes	4.5 acres
Alternative 1	300,000	None	No	4.5 acres
Alternative 2	150,000	None	Yes	4.5 acres

5.3.1 Beach Width Changes

Given the complex nearshore bathymetry, proximity to coastal structures, such as the King Harbor Breakwaters, and relatively short alongshore reach, detailed numerical modeling such as that used at Zuma Beach is not appropriate at Redondo Beach. However, shoreline changes prior to and following nourishment projects conducted at the site in 2000 and 2012 serve as a reasonable proxy for the expected performance of the proposed beach fills.

The shoreline data were derived from *CoastSat* (Vos, et al. 2019), a web-based toolkit that derives global shoreline position from historic satellite imagery. Figure 5-8 illustrates the change in shoreline position between Topaz Groin and the Pier from 1985 to 2022. The influence of the two nourishment events is clear, with instantaneous increases in beach width in both 2000 and 2012, and similar rates of retreat following each event. Between 2000 and 2012, the erosion rate estimated using the available data was 2.6 ft/yr. A similar rate, 1.7 ft/yr, prevailed between 2012 and 2022.

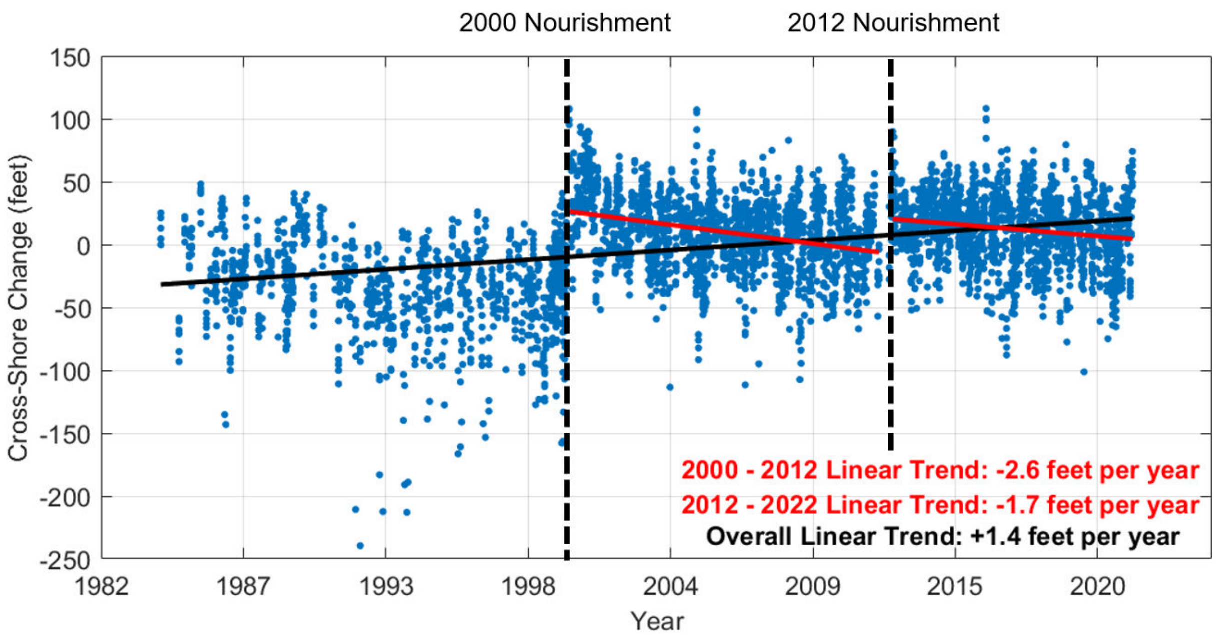

Figure 5-8. Historic Shoreline Changes at Redondo Beach (Topaz Groin to Pier)

For the purposes of this study, it is assumed that the rate of retreat following the proposed nourishment projects without sediment retention will be 2 ft/yr, roughly representing the average retreat rate following each event. With sediment retention, it is assumed that the rate will be half of the natural value, or 1 ft/yr. While this is merely an assumption, it should not markedly influence the outcome, given the relatively modest rate of retreat.

The additional equilibrated beach width for the Proposed Project and Alternative 1, both of which include a 300,000-cy nourishment event, is 90 ft. Alternative 2, which includes a 150,000-cy beach fill results in an additional equilibrated beach width of 45 ft. Using the rates of retreat outlined above, the average additional retained beach width over the project life is 70 ft for the Proposed project, 50 ft for Alternative 1, and 25 ft for Alternative 2.

5.3.2 Quantity of Dune Habitat

The Proposed Project and both alternatives include 4.5 acres of new dune habitat (Table 5-3).

5.3.3 Potential for Environmental Benefits and Impacts

Potential environmental benefits include the 4.5 acres of new dune habitat noted above, the additional sandy beach habitat resulting from the nourishment events, and new habitat related to the use of ECOncrete on the sheet pile groin.

Potential impacts are limited to California grunion. As noted previously, this impact can be mitigated by planning construction, monitoring, and maintenance activities outside of the spawning season.

5.3.4 Potential for public access benefits and impacts

Potential benefits and impacts to public access include the additional dry beach area (benefit) resulting from the beach nourishment activities and potential impediments related to dune creation (impact). In a relative sense, the proposed project includes the greatest benefit based on the average beach width added over the life of the project (70 ft), whereas Alternative 2 represents the least benefit (25 ft).

Impacts to public access are related to the dune area for each project, which is the same in all three cases.

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