4.0 ALTERNATIVES

4.1 INTRODUCTION

An important element in analyzing the effects of a project, such as the Broad Beach Restoration Project (Project), on public trust resources is to identify and assess reasonable alternatives that may avoid or reduce adverse effects on such resources and feasibly attain the majority of Project objectives. In this Revised Draft Analysis of Public Trust Resources (APTR), the California State Lands Commission (CSLC) analyzes nine Project alternatives at a programmatic comparison level based on input from California Coastal Commission (CCC), city of Malibu, and other public agency staffs, the public, and the Broad Beach Geological Hazard Abatement District (BBGHAD or Applicant).[1] Alternatives were screened using the following criteria:

- The extent to which project objectives could be accomplished;
- The potential to avoid or reduce public trust impacts; and/or
- The potential feasibility of the alternative considering site suitability, availability of infrastructure, and consistency with local and State coastal plans and regulations.

The following alternatives were selected for full evaluation and are described and analyzed in this section.

Alternative 1	Relocation of Improved Revetment Landward of January 2010 Mean High Tide Line (MHTL) with Beach Nourishment and Dune Restoration
Alternative 2	Relocation of Improved Revetment Landward of Lateral Access Easements with Beach Nourishment and Dune Restoration
Alternative 3	Maximum Pull-back of Seawall with Beach Nourishment and Dune Restoration
Alternative 4	Reduced Beach Nourishment Volume and Dune Restoration with Revetment in Current Location
Alternative 5	Beach Nourishment and Dune Restoration with No Shore Protection Structure
Alternative 6	Relocation of Improved Revetment along Upgraded Leach Fields with Beach Nourishment and Dune Restoration
Alternative 7	Removal of Existing Emergency Revetment on the Eastern End of Broad Beach with Beach Nourishment and Restoration
Alternative 8	No Beach Nourishment at West Broad Beach with Revetment at Current Location
Alternative 9	Reduced and Phased Beach Nourishment at West Broad Beach with Existing Revetment

[1] The 2012 Draft APTR analyzed six project alternatives and three sand source alternatives, including the use of offshore sources of sand. Offshore sources have since been found to be infeasible; consequently, alternatives related to offshore sand sources are not analyzed in this Revised APTR.

Appendix L, *Alternatives Screening*, contains the methodology, rationale for selecting alternatives, and results of the alternatives screening process. Several of the alternatives listed above involve relocation or construction of a hard coastal protection structure landward of all public lands and easements. These approaches would leave areas of private property lying seaward of these coastal protection structures, raising potential beach and dune design, public and private access, and wastewater management issues, including potential tradeoffs regarding private land management, public access, and the effectiveness and extent of the Applicant's proposed habitat restoration and beach nourishment.

In response to agency direction, the Applicant's consultant, Moffatt & Nichol (2013), provided preliminary design proposals for a reinforced revetment, (using geofilter fabric and larger 3- to 5-ton boulders as armoring stone), a seawall, and a range of approaches to beach nourishment and dune creation. This Revised APTR analyzes these design suggestions and, as needed, has amended them to reflect the primary focus of the APTR on protection of public trust resources in balance with meeting Project objectives. Prior to construction of any of these alternatives presented in this analysis, the BBGHAD would be required to submit detailed design plans for review and approval by the CSLC and other applicable agencies.

4.2 EFFECTS OF ALTERNATIVES ON PUBLIC TRUST RESOURCES

This Revised APTR considers a range of reasonable alternatives to the Project, which would avoid or minimize adverse effects on public trust resources and feasibly attain most of the basic objectives of the Project. Each alternative is described below, analyzed for potential adverse effects on public trust resources, and then compared to the effects associated with the Project. This allows interested parties and decision-makers to compare the impacts of each to those of the proposed Project.

New impacts to a resource area, or impacts that have the potential for a noteworthy increase or decrease in severity as a result of a particular alternative, are discussed in detail. Impacts with minimal or no changes in severity are discussed only briefly by resource area in a table specific to each alternative. Table ES-2 in the Executive Summary of this Revised APTR provides a comparative summary of the environmental impacts of the Project and alternatives.

During the implementation of an alternative, a different approach or a combination of approaches may result in corresponding changes to the impacts discussed below. For example, while relocation of the revetment landward of the January 2010 Mean High Tide Line (MHTL) and reduced beach nourishment at west Broad Beach are analyzed separately, these alternatives could be combined resulting in corresponding increases or decreases in the severity of impacts described for each separate alternative and tradeoffs regarding public access and protection of public trust resources.

4.2.1 Alternative 1: Relocation of Improved Revetment Landward of January 2010 MHTL with Beach Nourishment and Dune Restoration

Description

This alternative would be similar to the Project as it would include beach and dune restoration identical to the Project along with the retention of a landward relocated revetment. Under this alternative, the existing emergency revetment would be moved landward of the January 2010 MHTL surveyed by CSLC staff and off of all public trust lands.[2] Much of the revetment would only require minor landward movement of 3 to 5 feet to avoid public trust lands, but several sections on the eastern end of Broad Beach would require more extensive relocation of 15 to 20 feet landward. This alternative would also include placing relocated rock over geotextile filter fabric to reduce the chance of settling and strengthening the relocated revetment with an outer lining of 3- to 5-ton boulders over existing smaller rock (see Figure 4-1). These measures would reduce chance of revetment damage or failure and mobilization of boulders if the revetment were to become exposed due to long-term wave action and persistent wave attack. The reinforced revetment would be no wider than the existing 38-foot width at its base with a crest elevation of approximately 15 feet above Mean Low Low Water (MLLW). This design would be required to demonstrate that the armoring of the existing revetment would not increase the width of the revetment to minimize beach coverage, which may require removal of existing smaller stones, or incorporation of these smaller stones into a steeper reinforced revetment.

Beach nourishment, dune creation, and habitat restoration components under this alternative would remain similar to those described for the Project, with approximately 43,000 haul heavy trips being required to haul 600,000 cubic yards (cy) of sand from inland quarry sources. Similar to the Project, post construction beach width would range from 85 feet on the west end in Lechuza Cove to as wide as 230 feet near the east end of the beach. Dune habitats would be established and restored by creating a sand berm that would run along the length of the beach, with a minimum of 2 feet of sand over the rock revetment. The berm would extend approximately 30 to 50 feet inland and 0 to 10 feet seaward of the revetment, depending on location. The dune system, consisting of hummocks varying in height from 17 to 22 feet above MLLW would be constructed on top of this berm. The width of the dune system would vary from 40 to 60 feet. Landward relocation of the revetment would result in the exposure of additional existing sand volume seaward of the revetment, potentially incrementally increasing the life of the initial nourishment event and reducing the probability of revetment exposure.

[2] This APTR acknowledges that there is a disagreement among experts between CSLC and Applicant surveyors as to which surveyed MHTL represents the best evidence of the last MHTL prior to artificial fill and accretion (and the boundary between state-owned land and private upland). Since the January 2010 MHTL was surveyed just prior to the emergency revetment construction, this alternative reflects revetment relocation assuming the January 2010 MHTL.

Similar to the Project, public use and access under this alternative would be permitted along the beach to the toe of the restored dunes where a line of rope or cable and signs would prohibit access to potential environmentally sensitive habitat areas (ESHA) within the dunes. This rope or cable system, combined with the approximately 40- to 60-foot-wide dune system, would also ensure residential privacy. In addition, rather than provide for 112 coastal access walkways across the restored dunes as included in the Project, this alternative would include installation of shared private coastal access walkways, with one walkway approximately every 300 feet to be shared between six homes. These walkways would be connected by a shared path along the back dune, lined with a sand fence along the seaward side to minimize sand migration into private yards and minimize resident and pet access into the dune ESHA. Each of these walkways would be roped off to minimize private access into the dunes. This distance was selected as an intermediate value that would improve dune habitat quality while minimizing disruption to private homeowner beach access.

The existing two public vertical coastal access points along Broad Beach Road would remain open and the two public trails across the dunes would be roped off to limit access into the dunes. Since the revetment would be located on private property and not public trust lands, public trust lands would be available for public access, recreation, and habitat restoration. This alternative may still interfere with public rights to pass along existing Lateral Access Easements (LAEs), many of which would remain beneath or landward of the revetment. This alternative would also recognize the public's rights to pass along public land below the January 2010 MHTL and across existing LAEs. This would ensure that over the long-term after nourishment ceases, the revetment is removed, and the beach and dunes erode, the public would continue to have access across the beach. Public access to and along these LAEs would be available when the sensitive dune habitats that overlie these LAEs eventually erode over the long-term and public access to these LAEs becomes necessary and available.

This alternative would involve additional new major construction activities compared to the Project. Installing a properly engineered revetment would involve the use of heavy equipment to remove some of the boulders, move some of the existing boulders inland, and install larger boulders. Revetment reconfiguration would require an estimated 4,500 new haul truck trips (approximately two or three boulders per truck) to deliver additional boulders to the beach in order to armor approximately 3,650 feet of the revetment.[3] Armoring would consist of placing a layer of boulders, one or two boulders deep; from below the revetment toe to its crest. A larger staging area within Zuma Beach Parking Lot 12 may be needed to accommodate additional equipment and material storage.

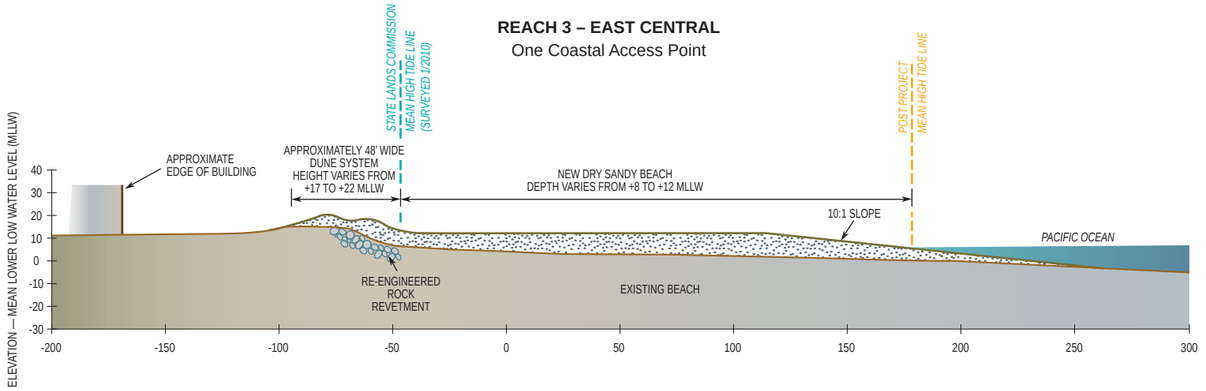
[3] The westernmost 470 feet of the emergency revetment was built to a different standard and incorporated larger boulders; thus it would not receive further armoring.

SCALE IN FEET
0 370

Detail

SCALE IN FEET
0 150

REACH 3 – EAST CENTRAL
One Coastal Access Point



LEGEND

- Existing Public Access
- Approximate Limits of Beach Nourishment/ New Beach
- Existing Emergency Revetment Relocated and Armored
- Proposed New Dry Sandy Beach
- Proposed New Intertidal Beach Area
- Proposed Restored Dune
- Area of Dune or Beach Face (3:1 and 10:1 slopes)
- State Lands Commission Mean High Tide Line (surveyed 1/2010)
- Applicant Mean High Tide Line (surveyed 10/15/2009)
- Post Project Mean High Tide Line
- Existing Septic Tank
- Existing Leach Field/Drain Field
- Impacted Leach Field
- Existing Lateral Access Easements (LAEs)
- Easement on file, but no dry beach to dedicate
- Surf Grass
- ##### Property Address

Note: Beach dimensions and post project average high water line reflect beach status immediately after completion of beach nourishment and construction/shaping activities; the equilibrium beach that would result from dynamics such as waves, tidal and wind action would likely be of somewhat different dimensions.

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Landward Location of Improved Revetment Inland of Mean High Tide Line Off Public Land with Beach Nourishment and Dune Restoration

FIGURE 4-1

This page reserved for 11X17" figure.

Additional construction equipment, such as one or two heavy cranes and bulldozers, and additional construction personnel would also be required to relocate the existing rock revetment, and move and position new rock. This would result in increased fueling activity and additional traffic along the beach. This additional truck traffic would increase that associated with sand importation by approximately 10 percent. Traffic control measures for sand haul trucks entering and leaving the parking lot, as well as transiting along the beach would be implemented.

Under this alternative, as many as five onsite wastewater treatment systems (OWTS) would need to be relocated, as the relocated revetment would displace all or portions of the OWTS. Alternately, these short segments of the relocated revetment could be narrowed through steepening slopes of armor stone or narrowing the base of the revetment. This may also require removal of some private improvements, such as patios.

Similar to the Project, approximately 7 acres of the west end of Zuma Beach, including Parking Lot 12 and the beach fronting this area, would be used for construction staging. Equipment storage and staging would occur within the parking lot, sand storage, handling and transfer would occur on the beach. Heavy equipment and truck haul routes would be established on the beach. Most of Broad Beach and western Zuma Beach would remain closed to public access during weekday construction periods.

Major components of this alternative would include:

- Relocating the existing revetment 5 to 20 feet inland using heavy cranes and bulldozers;
- Importing large 3- to 5-ton boulders via an estimated 4,500 heavy haul truck trips and potentially exporting a portion of the smaller rock;
- Placing new larger boulders over and at the toe of the existing revetment using heavy cranes and bulldozers;
- Transporting sand from inland quarries to Broad Beach via 43,000 heavy haul truck trips;
- Transporting the sand from storage areas at Zuma Beach and hauling it up coast to Broad Beach with heavy trucks or scrapers;
- Redistributing sand on Broad Beach as needed with earthmoving equipment, such as bulldozers, and grading the beach fills to required dimensions;
- Creating a system of shared walkways to provide private lateral and vertical private coastal access for homeowners across the new dune system;
- Providing two vertical public access trails across the dunes to connect existing public access points to the widened beach and ensuring public lateral access along the widened beach seaward of the January 2010 MHTL;

- Performing backpassing of the sand, ranging of approximately 25,000 to 35,000 cy, from the east to west end of the beach based on triggers and using heavy equipment such as scrapers and bulldozers; and
- Initiating one future major renourishment event of approximately 450,000 cy in roughly 10 years.

Potential Impacts to Public Trust Resources

This alternative to the Project would result in additional construction activities associated with the landward relocation of the revetment above the January 2010 MHTL. This alternative would result in major changes to impacts associated with terrestrial biological resources, recreation, and public access. Adverse impacts resulting from this alternative may include effects on coastal dune ESHAs on the eastern end of Broad Beach, described in the Malibu Local Coastal Program (LCP), as well as an incremental increase in potential for hazardous spills in the terrestrial and marine environment. Further, public access during construction activities would be incrementally reduced relative to the Project due to increased heavy equipment use. However, beneficial impacts associated with this alternative would include improved protection of created dune habitat through a reduction in private coastal access walkways and associated disruption of sensitive dune habitats, as well as improvement of the Project's consistency with coastal public access and recreation polices, as the revetment would be moved landward of the January 2010 MHTL and off of public trust lands. Resource areas with major changes to impacts relative to the Project are discussed in detail below, while the resource areas with negligible changes to impacts are summarized in Table 4-1.

Table 4-1. Alternative 1 – Potential for Landward Relocation of OWTS

Address	Number of Affected OWTS	Potential for Landward Relocation Behind Revetment[1]	Potential for Relocation Landward of Home [2]
31324	1	Potentially Feasible	Insufficient Area
31336	1	Potentially Feasible	Insufficient Area
31280	1	Potentially Feasible	Insufficient Area
31250	1	Feasible	Feasible
31228	1	Feasible	Insufficient Area
Total Affected Properties	**Total Affected System Components**	**Number of OWTS Feasible to Relocate Landward of Revetment**	**Number of OWTS Feasible to Relocate Landward of Home**
5	5	2	1

Source: Topanga Underground 2012.
[1]Feasibility determined via aerial imagery and CAD files provided by the city of Malibu.
[2]Feasibility determined via the recommendations of Topanga Underground (2012).

Air Quality and Greenhouse Gases: Under Alternative 1, criteria pollutant emissions would incrementally increase relative to the Project associated with the 4,500 additional heavy haul truck trips used to transport armoring boulders, as well as operation of additional heavy equipment needed to relocate and improve the revetment. These

emissions would increase the severity of Impact AQ-1 and exceed South Coast Air Quality Management District (SCAQMD) and Ventura County Air Pollution Control District (VCAPCD) thresholds and SCAQMD Localized Significance Criteria (LSTs) for construction activities, particularly for project-level emissions of volatile organic compounds (VOCs), and onsite and project-level emissions of nitrogen oxides (NO_x). Relative to the Project, emissions of both of these criteria pollutants would incrementally increase under this alternative as there would be additional construction activities as well as a 10 percent increase in heavy haul truck trips (Appendix G). Additionally, there would be an incremental increase in other criteria pollutants including carbon monoxide (CO), sulfur oxides (SO_x), and particulate matter (PM). This increase in emissions relative to the Project, particularly the increase in VOC and NO_x emissions, would require additional avoidance and minimization measures (AMMs) such as use of newer haul trucks with clean-burning diesel engines. Greenhouse gas (GHG) emissions described in Impact AQ-2 would be incrementally increased but would remain below SCAQMD and VCAPCD thresholds. Finally, increased truck traffic and heavy equipment operation associated with reinforcement and relocation of the rock revetment would incrementally increase toxic air contaminant emissions; however Impact AQ-3 would remain minor as thresholds would not be exceeded.

While implementation of Alternative 1 would increase short-term construction-related air quality impacts, this alternative may incrementally reduce the severity of construction emissions from backpassing (see Impact AQ-1). As previously described, additional sand would be made available with the seaward relocation of the revetment behind the January 2010 MHTL. This would incrementally delay the exposure of the revetment after the initial nourishment event based on a continued average sand loss rate of about 35,000 to 45,000 cy per year (Moffatt & Nichol 2013).[4] However, while the need for backpassing may be incrementally reduced, backpassing would still be required to maintain the wide sandy beach, and backpassing construction emissions would be a major adverse effect.

Coastal Processes, Sea Level Rise, and Geologic Hazards: Reinforcement of the revetment with 3- to 5-ton armoring stones would reduce potential impacts of coastal processes on existing private improvements including septic systems across the length of the 4,100-foot revetment. Erosion of beach and dunes after cessation of nourishment would continue as described under the Project, with the benefits of nourishment enduring for an estimated 10 to 20 or more years and the revetment then becoming exposed as a result of persistent wave action. Anticipated sea level rise (SLR) of approximately 8.5 inches by 2030 would further exacerbate erosion effects, including increased frequency and intensity of storm surges and wave attack. However, under

[4] Estimates of sand loss rates vary from 25,000 cy/year based on past observations to 100,000 cy/year based on the GENESIS model; a loss rate of 45,000 cy/year has been determined to be a reasonable worst case estimate (see Section 3.1, *Coastal Processes, Sea Level Rise, and Geologic Hazards*).

this alternative, after the revetment is exposed, potential impacts of coastal processes on the revetment identified in Impact CP/GEO-2 would be reduced as the revetment would be substantially strengthened by addition of heavier armor stones. Consequently, impacts to public trust resources identified in Impact CP/GEO-3 (e.g., water quality) due to damage to homes, OWTS, and accessory structures from coastal erosion would be reduced. The reengineered revetment would also provide long-term protection for this existing development from coastal erosion.

Similar to the impact of the existing revetment, the reengineered revetment would also impact coastal processes by incrementally increasing wave refraction when exposed and negligibly depriving down coast beaches (e.g., Zuma Beach) of a minor source of sand from dune erosion. However, Impact CP/GEO-7 would remain beneficial as effects of the longshore currents on nourishment and renourishment of sand in the short- to mid-term include both erosion of sand from Broad Beach and accretion of sand at down coast beaches, and additional sand would be exposed seaward of the relocated revetment. Over the long-term, longshore currents would transport this additional sand farther down coast and possibly offshore.

The reinforced revetment with larger boulders as armoring would increase the structural stability of the revetment, reducing potential adverse impacts associated persistent wave attack. This alternative would substantially reduce the adverse effects associated with Impact CP/GEO-1. However, as the revetment could likely not be keyed into the bedrock located at 16 feet below ground level (SubSurface Designs, Inc. 2006), the risk of liquefaction, seismic settlement, and lateral spreading in the event of an earthquake would still exist as described for the Project. Impacts related to sand compatibility (CP/GEO-4), wave height and direction, tides, and currents (CP/GEO-5), wave run-up (CP/GEO-6), and sea level rise (CP/GEO-8) would be similar to those described for the proposed Project, as beach nourishment activities would remain the same.

Terrestrial Biological Resources: Relocation of the existing 4,100-foot revetment would require use of heavy cranes and bulldozers that would have major adverse effects on the existing, but often degraded southern foredune habitat. With landward relocation, the revetment would overly remaining southern foredune habitat, particularly on the eastern reach of Broad Beach. However, the most recent

Illustration 4-1*: Relocation of the revetment beyond the CSLC-surveyed MHTL would adversely affect ESHA located behind the revetment's current location. However, winter storms in 2013-2014 and the major storm event of March 2, 2014, substantially eroded remaining dune habitat leaving a large escarpment, destroying Sakrete and sand bag revetments leaving exposed debris.*

reconnaissance survey at Broad Beach found that the eastern reaches of Broad Beach were eroded extensively during storm events in March 2014 exposing and damaging sand bag and Sakrete revetments and further eroding degraded southern foredune habitat (Illustration 4-1). While heavy equipment would generally operate on the seaward side of the revetment, relocation of the structure would result in large boulders being laid into this southern foredune habitat, potentially adversely impacting native vegetation and/or sensitive wildlife species and increasing the severity of the adverse effects associated with Impact TBIO-2. Adverse effects to ESHAs resulting from this alternative would be similar in type to those described in Impact TBIO-2, but the area of impact would be increased under as additional ESHA would be disturbed due to revetment relocation prior to beach nourishment activities. Impact TBIO-4 may also become more severe due to operation of additional heavy equipment within ESHAs necessary to relocate the revetment. This alternative would also slightly increase the short-term impacts of TBIO-5 as additional sand would be exposed seaward of the relocated revetment. However, the potential beneficial effects of dune restoration associated with Impact TBIO-6 and TBIO-7 would still occur under this alternative. Requiring shared private coastal access walkways would also substantially reduce disturbance of the proposed dune system, protecting this established and restored dune habitat. Impacts related to installation of the existing revetments (TBIO-1), backpassing operations (TBIO-3), and long term erosion of the newly created dune habitat (TBIO-8) would remain largely similar to those described for the Project.

Recreation and Public Access: This alternative would result in the operation of additional heavy equipment, which would increase short-term adverse effects to public access associated with Impact REC-1. However, backpassing operations and associated impacts identified in Impact REC-2 would remain similar to those described for the Project. Landward relocation of the revetment off of public trust land would improve Project consistency with coastal public use and recreation policies. However, the revetment would still cover or cut off access to approximately one acre of LAEs. Although the revetment would be moved landward of the January 2010 MHTL and the beach and dune system is expected to sustain itself marginally longer than the Project, the wide sandy beach would still erode after the cessation of nourishment, leaving the revetment exposed after cessation of beach nourishment and erosion of the newly widened beach in 10 to 20 or more years and ultimately impacting long-term public lateral access as detailed in Impact REC-4. Medium- and short-term benefits to public recreation opportunities due to a wide sandy beach berm and increased lateral access would remain similar to those identified for the Project in Impact REC-3.

Marine Water Quality: Installation of a properly engineered revetment would substantially reduce potential impacts to Marine Water Quality. Potential damage to homes, OWTS, and accessory structures from coastal erosion, and beneficial impacts to public trust resources identified in Impact MWQ-3 would be increased, as the reengineered revetment would provide long-term protection of existing development

from coastal erosion. However, leach fields west of 31022 Broad Beach Road would be located within 15 feet of the wave uprush limit calculated by Moffatt & Nichol (2013). Consequently, after cessation of beach nourishment and erosion of the newly widened beach in 10 to 20 or more years these leach fields may experience splashing or minor seawater intrusion from waves overtopping the improved revetment during large 100-year storm events which may incrementally impact near shore water quality. However, this would also require waves to erode the overlying seaward end of the dune system. Further, after cessation of nourishment and erosion of the beach in 10 to 20 or more years, the CSLC would consider disposition of all improvements that overlie state sovereign lands or LAEs and would address any outstanding wastewater treatment issues at that time. Construction-related impacts to impairment of area waters from operation of heavy equipment and potential for oil leaks or spills described in Impact MWQ-1 would be slightly increased due to the additional construction activities associated with relocation and reinforcement of the revetment. However, as the total quantity of sand added would remain the same as for the Project, Impacts MWQ-2 and MWQ-4 would remain similar.

Utilities and Service Systems: Relocation of the revetment inland of the January 2010 MHTL would require potential landward relocation of as many as five OWTS or the steepening of the landward slope and narrowing of the reinforced revetment in these locations to retain room for septic leach fields. If landward movement of these systems were not possible the revetment would have to be redesigned fronting these residences or potentially relocated landward, but still partially on or in front of the January 2010 MHTL in these areas. This decision would result in potential tradeoff between impacts to recreation and utilities and public systems. Based on aerial imagery it appears feasible for at least two of the systems to be relocated landward and potentially feasible for the remaining two. However, this aerial analysis does not take into consideration underlying utilities that may further complicate landward relocation of the OWTS.

Potential for relocation of OWTS may be limited due to space restraints and code issues. Additionally, relocation of the revetment landward of the January 2010 MHTL west of 31022 Broad Beach Road may cause future permitting issues with the city of Malibu and potentially other agencies as all properties must comply with city code if repairs or upgrades are made to an existing treatment system. Such repairs are required for major remodels or home expansion and also for resale and as such Ensitu (2013) have cited such relocation as infeasible. However, as discussed Section 3.7.6 *Utilities and Service Systems*, the city of Malibu Municipal Code does not appear to directly conflict with this alternative. Further, the feasibility of revetment relocation off public lands does not consider the ability to expand existing homes, but rather the ability of the OWTS to serve the existing home. Finally, Applicant-prepared studies have identified a requirement for septic system leach fields to be setback a minimum of 15 feet from a wave uprush zone, effectively requiring a 15 foot setback from the landward toe of the relocated revetment. As noted above, such uprush is projected to occur only

during a 100 year event and after erosion of the beach and overlying dune system in 10 to 20 or more years. The reinforced revetment would limit, but not fully eliminate the size and intensity of such wave uprush; however, limited amounts of water overtopping the revetment would likely have only moderate effects on water quality as contact with any released septic effluent with marine waters would be limited by the revetment.

Under this alternative, beach nourishment and to a greater degree reinforcement of the existing revetment would reduce potential impacts to Utilities and Service Systems. This alternative would substantially increase the beneficial impacts associated with UTL-1. Potential damage to OWTS from coastal erosion, and associated indirect impacts to public trust resources identified in Impact UTL-2, including adverse effects to water quality as well as public use and enjoyment of the beach and ocean would be greatly reduced, as the reinforced revetment would provide long-term protection of existing OWTS from coastal erosion. However, leach fields west of 31022 Broad Beach Road would be located within 15 feet of the wave uprush limit calculated by Moffatt & Nichol (2013) after cessation of nourishment activities and erosion of the newly widened beach and dune system in 10 to 20 or more years. Consequently, these leach fields may experience splashing or minor seawater intrusion from waves overtopping the improved revetment during large 100-year storm events.

Relocation of the revetment closer inland would also result in similar public drainage-related impacts of the Project as discussed in Impact UTL-3 as construction of the restored dunes and beach nourishment will bury or obstruct public drains. Similar to the Project, Impact UTL-3, such impacts would be a minor adverse effect with implementation of AMM UTL-3 (Master Drainage Plan).

Other Resource Areas: This alternative would have similar impacts to the Project in terms of its effects on scenic resources, marine biological resources, and environmental justice. Effects on transportation, traffic, parking, and noise would be somewhat more severe due to increase levels of vehicular activity and congestion related to construction phases (Table 4-2). Effects on public health and safety hazards and historic resources may be incrementally increased due to increased construction activity associated with the relocation and reinforcement of the revetment.

Table 4-2. Alternative 1 – Changes in Impact Severity

Resource Area	Relative Change in Impact Severity	Discussion
Scenic Resources	No Major Change in Adverse Impacts	Additional construction equipment associated with landward relocation of the revetment may intensify the adverse impacts associated with temporary construction activities, with a slight increase in the severity of adverse effects associated with Impact SR-2 and SR-4. Similar to the Project, permanent authorization of the revetment through a long-term lease and approval of Coastal Development Permits (CDPs) would create the potential for long-term degradation of the visual environment of Broad Beach after nourishment activities end and natural coastal erosion causes the revetment to become exposed as described in Impact SR-1.
Marine Biological Resources	Incremental Decrease in Indirect Adverse Impacts	Placement of sand and potential burial of rocky intertidal and subtidal marine biological resources would have a major adverse effect to intertidal habitats and offshore habitats of Broad Beach similar to the Project as described in Impacts MB-1, MB-2, MB-3, MB-4, MB-5, and MB-8. Additionally, similar to the Project, impacts to down coast habitats would be negligible as discussed in Impact MB-7. However, potential indirect impacts associated with water pollution from damage to OWTS from coastal erosion would be reduced along the length of the existing revetment. The potential for fuel or oil release described in Impact MB-6 would be slightly increased due to increased construction activities.
Cultural and Paleontological Resources	Incremental Increase in Adverse Impacts	Disturbance of the near shore environment associated with the landward relocation of the revetment would result in a slightly increased potential to disturb cultural resources, resulting in an additional adverse impact similar in type to Impact CR-1. However, implementation of standard Best Management Practices (BMPs) (e.g., work stoppage and notification of the State archeologist) would substantially reduce this impact.
Noise	Incremental Increase in Adverse Impacts	A temporary increase in noise due to additional construction activities associated with the landward relocation of the revetment would result in adverse impacts to beach users and residents on PCH. Consequently, this alternative would result in slight increases in adverse effects associated with Impact N-1 and N-2. However, these impacts would be reduced through implementation of AMM N-1a, similar to the Project.
Public Health and Safety Hazards	No Major Change in Adverse or Beneficial Impacts	This alternative would result in a slight increase in the adverse effects associated with Impact HAZ-2, as the presence of additional heavy construction equipment (i.e., bulldozers, cranes, and haul trucks) would increase the potential for an incidental release of hazardous material on Broad Breach. Additionally, the increase in construction equipment and construction personnel would result in increased inaccessibility and hazardous conditions during construction, slightly increasing the severity of adverse effects associated with Impact HAZ-3. These impacts would be reduced through implementation of AMMs HAZ-2, HAZ-3a, and HAZ-3b.
Traffic and Parking	Incremental Increase in Adverse Impacts	The landward relocation of the revetment would require an estimated 4,500 additional heavy haul truck trips as well as additional heavy construction equipment and construction

Table 4-2. Alternative 1 – Changes in Impact Severity

Resource Area	Relative Change in Impact Severity	Discussion
		personnel, which would likely increase traffic and congestion on Pacific Coast Highway (PCH) and in the Zuma Beach parking lot, potentially prolonging construction activities and incrementally increasing the severity of the adverse effects associated with Impact TR-1. These impacts would be reduced through implementation of AMM TR-1.
Environmental Justice	No Major Change in Adverse Impacts	There would be no appreciable difference in impacts relative to the Project.

4.2.2 Alternative 2: Relocation of Improved Revetment Landward of Lateral Access Easements with Beach Nourishment and Dune Restoration

Description

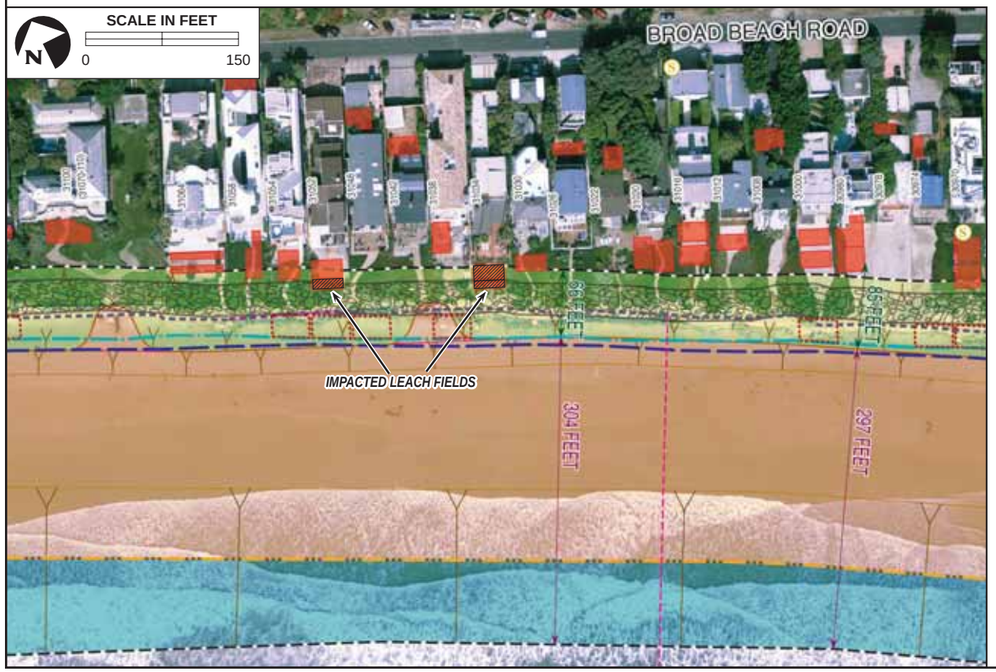
This alternative would be similar to the Project and Alternative 1 as it would include beach and dune restoration identical to the Project along with retention of a landward relocated revetment. Under this alternative, the revetment would be relocated substantially landward from its current location off of all public land below the January 2010 MHTL, including most of the existing LAEs dedicated for public lateral beach access. Landward relocation would include moving the revetment approximately 15 to 60 feet landward across portions of the beach, including the eastern 3,000 feet, where existing homes are set back further from the shoreline (see Figure 4-2). Limited space exists for landward relocation on the western portion of Broad Beach in front of the residences at 31350 and 31346 Broad Beach Road; consequently the current revetment location, approximately 50 feet in length, would be retained in this area.

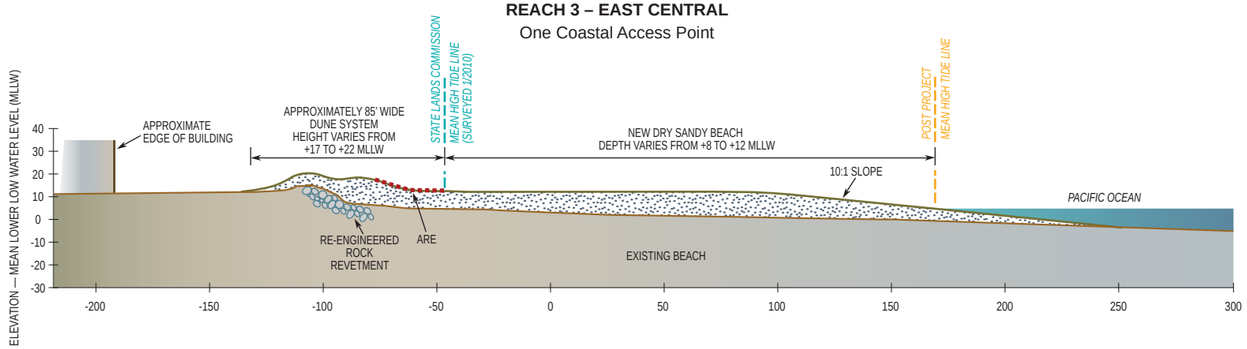
Similar to Alternative 1, this alternative would also include laying relocated rock over geotextile filter fabric to reduce the chance of settling and strengthening the relocated revetment with an outer lining of 3- to 5-ton boulders over existing smaller rock. These measures would reduce chance of revetment damage or failure and mobilization of boulders if the revetment were to become exposed due to long-term wave action and persistent wave attack. The reinforced revetment would be no wider than the existing 38-foot width at its base with a crest elevation of approximately 15 feet above MLLW. Similar to Alternative 1, in order to minimize beach coverage and reduce impacts to OWTS leach fields, this would require removal of existing smaller stones, or incorporation of these smaller stones into a steeper reinforced revetment.

A key goal of this alternative is to reduce impacts to public lateral beach access. Lateral access along Broad Beach is affected by a complicated mix of public trust land, LAEs, and private property. In general, the area below the Ordinary High Water Mark (OHWM) constitutes tidal and submerged lands under the California Constitution and the Public Trust Doctrine, and is thus open for public use and enjoyment. Approximately 51 of the 121 private parcels along Broad Beach have granted and accepted easements, deed restrictions, or other legal documents providing the public with the right to lateral coastal access across the seaward edge of these private properties. The CSLC holds a total of 36 LAEs along Broad Beach; 16 are outside the revetment area (i.e., associated with properties on Broad Beach to the east or west of the revetment), and 20 are directly impacted by the revetment. LAEs vary in terms, but they mainly consist of dry sandy beach extending 25 feet inland from the “daily high water line” or the MHTL; in some cases LAEs are restricted on the landward side by set-back buffers from the residential structures. Most of these LAEs are currently partially or entirely covered by the emergency rock revetment and frequently extend landward of the revetment.

SCALE IN FEET
0 370

Detail





LEGEND

- Existing Public Access
- Approximate Limits of Beach Nourishment/ New Beach
- Existing Emergency Revetment Relocated and Armored
- Proposed New Dry Sandy Beach
- Proposed New Intertidal Beach Area
- Proposed Restored Dune
- Area of Dune or Beach Face (3:1 and 10:1 slopes)
- State Lands Commission Mean High Tide Line (surveyed 1/2010)
- Applicant Mean High Tide Line (surveyed 10/15/2009)
- Post Project Mean High Tide Line
- Existing Septic Tank
- Existing Leach Field/Drain Field
- Impacted Leach Field
- Existing Lateral Access Easements (LAEs)
- Easement on file, but no dry beach to dedicate
- Surf Grass
- ###### Property Address

Note: Beach dimensions and post project average high water line reflect beach status immediately after completion of beach nourishment and construction/shaping activities; the equilibrium beach that would result from dynamics such as waves, tidal and wind action would likely be of somewhat different dimensions.

amec

Landward Relocation of Improved Revetment Landward of Easements with Beach Nourishment and Dune Restoration

FIGURE 4-2

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Beach nourishment, dune creation, and habitat restoration concepts would remain similar to those under the Project, with approximately 43,000 haul heavy trips being required to haul 600,000 cy of sand from inland quarry sources. The post-construction dry sand beach berm is projected to extend seaward of the dunes by 90 to 230 feet, with the beach narrower at the west end and wider in the central and eastern sections. For example, beach widths in Lechuza Cove would be as narrow as 90 feet while the entire area east of 31330 Broad Beach Road would be 200 feet wide or wider. This alternative would retain roughly the same profile of the sandy beach as the Project; however, dune width would be substantially increased from the currently proposed approximately 50-foot width. Under this alternative, the restored dune would extend up to 140 feet on the eastern end of Broad Beach. This would require the importation of up to 75,000 additional cy of sand from the inland sand sources, necessary to create the wider dune field. This would also require an additional 5,300 truck trips and incrementally increased construction period of approximately one month. Landward relocation of the revetment would result in the exposure of additional existing sand volume seaward of the revetment, potentially incrementally increasing the life of the initial nourishment event and reducing the probability of revetment exposure.

Similar to Alternative 1, public use and access would be permitted to the toe of the restored dunes, which would lie on public land where a line of rope or cable and signs would prohibit access to coastal dune ESHA. However, in contrast to the Project where the majority of the proposed dunes would be located on private land, under this alternative a major amount of the dune system would be located on public land over overlying LAEs. Additionally, similar to Alternative 1, rather than provide for 112 coastal access walkways across the restored dunes, this alternative would channel residential access across the dunes into shared walkways. The access proposal would be similar to that described for Alternative 1; however, in places, due to the limited setback between the relocated revetment and homes, more frequent beach access walkways would be required as insufficient room would exist for a backdune walkway.

This alternative would also recognize the public's rights to pass along public land below the January 2010 MHTL and across existing LAEs. This would ensure that over the long-term after nourishment ceases, the revetment is removed, and the beach and dunes erode, the public would continue to have access across the beach. Public access to and along these LAEs would be available when the sensitive dune habitats that overlie these LAEs eventually erode over the long-term and public access to these LAEs becomes necessary and available.

This alternative would involve additional new major construction activities associated with revetment armoring as described for Alternative 1. In addition, because the revetment would be located further landward, patio and landscape removal, as well as potential abandonment/removal and relocation of existing septic systems, would also entail additional excavation and construction. These activities may be scheduled

concurrently with or preceding beach nourishment and thus would extend the projected construction horizon beyond the proposed 8 months by at least 1 additional month. Further, the quarrying and transport of additional sand would result in 5,350 truck trips in addition to the 4,500 additional truck trips required for boulder armoring stone transport.

Relocation and armoring of the revetment may disrupt existing OWTS, up to 14 patios, landscaping, and other private improvements (see Illustration 4-2). This alternative would require potential landward relocation of as many as 22 OWTS or steepening or the landward slope or narrowing of the reinforced revetment in these locations. If landward movement of these systems were not possible the revetment would have to be redesigned fronting these residences or potentially relocated landward, but still partially on or in front of the January 2010 MHTL in these areas. This decision would result in potential tradeoff between impacts to recreation and utilities and service systems.

Illustration 4-2: *The landward relocation of the revetment off of all public trust lands, including those below the MHTL as well as most LAEs, would have major adverse effects as it would require the relocation of private landscape improvements (i.e., patios), as well the decommissioning of up to 22 OWTS.*

Similar to the Project, approximately 7 acres of the west end of Zuma Beach, including Parking Lot 12 and the beach fronting this area, would be used for construction staging. Equipment storage and staging would occur within the parking lot, sand storage, handling and transfer would occur on the beach. Heavy equipment and truck haul routes would be established on the beach. Most of Broad Beach and western Zuma Beach would remain closed to public access during weekday construction periods. Major components of this alternative would include:

- Relocating of the existing revetment anywhere from 15 to 60 feet landward off of public lands and LAEs using heavy cranes and bulldozers;
- Demolishing and reconstructing up to 14 patios and potentially relocating up to 22 OWTS;
- Importing large 3- to 5-ton boulders via an estimated 4,500 heavy haul truck trips and potentially exporting a portion of the smaller rock;
- Placing new larger boulders over and at the toe of the existing revetment using heavy cranes and bulldozers, exporting smaller armor stone and/or steepening and narrowing the revetment on certain properties as needed ;

- Transport of an estimated 675,000 cy of sand from the inland quarries and to Broad Beach via an estimated 48,350 truck trips;
- Transporting the sand from storage areas on Zuma Beach up coast via heavy truck or scraper up coast to Broad Beach;
- Redistributing sand on Broad Beach as needed with earthmoving equipment, such as bulldozers, and grading the beach fills to required dimensions;
- Constructing a wider sand dune system up to 140 feet wide in the east to be planted with native dune species;
- Creating a system of shared walkways to provide private lateral and vertical private coastal access for homeowners across the new dune system;
- Providing two vertical public access trails across the dunes to connect existing access points to the widened beach and ensuring public lateral access along the widened beach seaward of the January 2010 MHTL
- Performing backpassing of the sand from the east to west end of the beach using heavy equipment such as scrapers and bulldozers on a roughly annual basis based on beach profile and width measurement trigger; and
- Initiating one future major renourishment event of approximately 450,000 cy in approximately 10 years.

Potential Impacts to Public Trust Resources

This alternative would include landward relocation of the revetment off of public land and the majority of LAEs. Implementation of Alternative 2 would have similar impacts to Alternative 1 in terms of coastal processes and geological resources, which would be reduced when compared to the Project. Additionally, similar to the Alternative 1, this alternative would also result in additional construction activities, including use of additional heavy equipment and construction personnel, resulting in greater impacts than the Project. The effects would be somewhat more severe than Alternative 1 due to major additional landward movement of the revetment as well as potential relocation of up to 22 OWTS and demolition of 14 patios. This alternative would also require a longer period of construction and importation of additional sand. These activities would incrementally increase construction related impacts, particularly to terrestrial biological resources. Resource areas with major changes to impacts relative to the Project are discussed in detail below, while the resource areas with negligible changes to impacts are summarized in Table 4-4 at the end of this subsection.

Air Quality and Greenhouse Gases Under Alternative 2, there would be a major increase in criteria pollutant emissions relative to the Project. Similar to Alternative 1, this increase in emissions would be directly associated with the almost 10,000 additional heavy haul truck trips, necessary to transport armor stone and additional sand, the operation of additional heavy equipment to relocate and improve the

revetment and to demolish and reconstruct private improvements (e.g., patios). Major revetment relocation would also incrementally increase emission from operation of heavy equipment relative to Alternative 1. These emissions would increase the severity of Impact AQ-1, particularly for emissions of VOCs which would exceed SCAQMD and VCAPCD thresholds for project-level significance and for NO_x which would exceed SCAQMD and VCAPCD thresholds for onsite and project-level significance similar to the Project, including SCAQMD LSTs for construction activities. Emissions of both of these criteria pollutants would substantially increase under this alternative when compared to the Project due to additional construction activities and a 20 percent increase in heavy haul truck trips (Appendix G). Additionally, there would be an incremental increase in other criteria pollutants including CO, SO_x, and PM. This increase in emissions relative to the Project, particularly the increase in VOC and NO_x emissions, would require additional AMMs such as use of newer haul trucks with clean-burning diesel engines. Greenhouse gas (GHG) emissions described in Impact AQ-2 would be incrementally increased but would remain below SCAQMD and VCAPCD thresholds. Finally, increased truck traffic and heavy equipment operation associated with reinforcement and relocation of the rock revetment would incrementally increase toxic air contaminant emissions; however Impact AQ-3 would remain minor as thresholds would not be exceeded.

Coastal Processes, Sea Level Rise, and Geologic Hazards: Similar to Alternative 1, reinforcement of the revetment with 3- to 5-ton armor stones would reduce the potential impacts of coastal processes on existing private improvements including septic systems across the length of the 4,100-foot revetment. Erosion of the beach and dunes after cessation of nourishment would continue as described under the Project, with the benefits of nourishment enduring for an estimated 10 to 20 or more years and the revetment then becoming exposed as a result of persistent wave action.[5] Anticipated SLR of approximately 8.5 inches by 2030 would further exacerbate erosion effects, including increased frequency and intensity of storm surges and wave attack. However, after the revetment is exposed, potential impacts of coastal processes on the revetment identified in Impact CP/GEO-2 would be reduced as the revetment would be substantially strengthened by addition of heavier armor stones. Consequently, impacts to public trust resources identified in Impact CP/GEO-3 (e.g., water quality) due to damage to homes, OWTS, and accessory structures from coastal erosion would be reduced. The reengineered revetment would also provide long-term protection for this existing development from coastal erosion.

Similar to the impact of the existing revetment, the reengineered revetment would also impact coastal processes by incrementally increasing wave refraction when exposed and negligibly depriving down coast beaches (e.g., Zuma Beach) of a minor source of

[5] The additional nourishment of 75,000 cy of sand for dune creation at the east end of the beach may prolong beach life by 2 or more years in that area.

sand from dune erosion. However, Impact CP/GEO-7 would remain beneficial as effects of the longshore currents on nourishment and renourishment of sand in the short- to mid-term include both erosion of sand from Broad Beach and accretion of sand at down coast beaches. This beneficial impact would be incrementally increased under Alternative 2 as additional sand would be exposed seaward of the relocated revetment. There would be slightly more exposed sand relative to Alternative 1 as the revetment would be relocated further landward off all public lands, including most LAEs. However, over the long-term, longshore currents would transport this sand farther down coast and possibly offshore.

Under Alternative 2, the reinforced revetment with larger boulders as armoring would increase the structural stability of the revetment, reducing potential adverse impacts under the Project associated with persistent wave attack. Similar to Alternative 1, this alternative would substantially reduce the adverse effects associated with Impact CP/GEO-1. However, if the revetment could not be keyed into the bedrock located at 16 feet below ground level (SubSurface Designs, Inc. 2006), the risk of liquefaction, seismic settlement, and lateral spreading in the event of an earthquake would still exist as described for the Project. Impacts related to sand compatibility (CP/GEO-4), wave height and direction, tides, and currents (CP/GEO-5), and sea level rise (CP/GEO-8) would be similar to those described for the Project. Short- and medium-term beneficial impacts to wave run-up (Impact CP/GEO-6) would remain similar, but may be extended due to the addition of more sand.

Terrestrial Biological Resources: The relocation of the existing 4,100-foot revetment would require use of heavy cranes and bulldozers that would have major adverse effects on the existing, but often degraded southern foredune habitat fronting the homes along Broad Beach, increasing the impacts identified in Impact TBIO-2. Although much of the habitat in these areas has been subject to landscaping with non-native and invasive plant species associated with adjacent residential development, this area consists of southern foredunes, a habitat type identified as rare by the California Natural Diversity Database (CNNDB) and the California Native Plant Society (CNPS). Moreover, due to the rarity and biological significance of dune habitat in Southern California, southern foredunes are designated as ESHA under the Malibu City LCP.

Installation of large boulders in these existing degraded dunes would create potential adverse impacts to native southern foredune vegetation and/or sensitive wildlife. As the revetment would be relocated up to 60 feet further landward under this alternative relative to the Project, the relocation and reinforcement of the revetment would substantially increase the impacts to existing degraded southern foredune habitat; however, much of the highest quality remaining dune habitat at the east end of Broad Beach was eroded and destroyed by wave action in the winter of 2013-2014, particular during the storm of March 2, 2014. Adverse effects to ESHAs resulting from this alternative would be substantially more severe than those that occurred from past installation of the existing

revetments described in Impact TBIO-1, although this impact would be largely offset by successful dune creation. Impact TBIO-4 may also become more severe due to operation of additional heavy equipment within ESHAs necessary to relocate the revetment. This alternative would also slightly increase the short-term impacts of TBIO-5 as additional sand would be exposed seaward of the relocated revetment. However, the potential beneficial effects of dune restoration associated with Impact TBIO-6 would still occur and may incrementally increased due to the additional sand volume required under this alternative, offsetting adverse impacts to existing degraded ESHA. Additionally, requiring shared private coastal access walkways would also substantially reduce disturbance of the proposed dune system described in Impact TBIO-7, protecting this newly established and restored dune habitat. Impacts related to backpassing operations (TBIO-3), and long term erosion of the newly created dune habitat (TBIO-8) would remain largely similar to those described for the Project.

Recreation and Public Access: This alternative would result in the operation of additional pieces of heavy equipment by additional construction personnel, which would increase short-term adverse effects to public access associated with Impact REC-1. This alternative incorporates the public's rights to pass along public land below the January 2010 MHTL and across existing LAEs. This would ensure that over the long-term after nourishment ceases, the revetment is removed, and the beach and dunes erode, the public would continue to have access across the beach. Public access to and along these LAEs would be available when the sensitive dune habitats that overlie these LAEs eventually erode, thus, this alternative would also address Impact REC-4.

Landward relocation of the revetment off of all public trust lands would improve Project consistency with coastal public use and recreation policies. Under this alternative the revetment would cover a negligible area of LAEs fronting 31350 and 31346 Broad Beach Road, where space for landward relocation of the revetment is limited. Additionally, after the 10- to 20- or more year Project life, nourishment sand would be washed away and the beach would recede back to the new revetment, leaving little to no dry-sand beach area for recreation without continued renourishment. However, a maximum landward relocated revetment combined with increased dune width at the beaches' east end would provide additional room for public beach use, particularly at low and moderate tides. This may be gradually offset by SLR after 2050. Backpassing operations and associated impacts to recreational users identified in Impact REC-2 would be similar to those described for the Project. Additionally, medium- and short-term benefits to public recreation opportunities due to a wide sandy beach berm and increased lateral access would remain similar to those identified for the Project in Impact REC-3.

Marine Water Quality: Installation of a properly engineered revetment would substantially reduce potential impacts to Marine Water Quality. Potential damage to homes, OWTS, and accessory structures from coastal erosion, and beneficial impacts

to public trust resources identified in Impact MWQ-3 would be increased, as the reengineered revetment would provide long-term protection of existing development from coastal erosion. However, leach fields west of 30970 Broad Beach Road would be located within 15 feet of the wave uprush limit calculated by Moffatt & Nichol (2013). Consequently, after cessation of beach nourishment and erosion of the newly widened beach in 10 to 20 or more years these leach fields may experience splashing or minor seawater intrusion from waves overtopping the improved revetment during large 100-year storm events which may incrementally impact near shore water quality. However, this would also require waves to erode the overlying seaward end of the dune system. Further, after cessation of nourishment and erosion of the beach in 10 to 20 or more years, the CSLC would consider disposition of all improvements on state sovereign lands and those overlying LAEs and any actions associated with lease extension or termination needed to protect marine water quality. Construction-related impacts to impairment of area waters and the possibility of sand contaminant resuspension would be slightly increased due to the additional construction activities associated with relocation and reinforcement of the revetment and the additional volumes of sand to be added.

Utilities and Service Systems: As previously described, relocation of the revetment inland of the January 2010 MHTL would require potential landward relocation of as many as 22 OWTS or the steepening of the landward slope or narrowing of the reinforced revetment in these locations. If landward movement of these systems were not possible the revetment would have to be redesigned fronting these residences or potentially relocated landward, but still partially on or in front of the public lands in these areas. This decision would result in potential tradeoff between impacts to recreation and utilities and service systems. Based on aerial imagery, it appears that it is infeasible to relocate at least three of the OWTS fronting 31138 and 31122 Broad Beach Road. Additionally, it appears only potentially feasible for seven of the remaining 20 residences. Further, this aerial analysis does not take into consideration underlying utilities that may further complicate or preclude landward relocation of the OWTS.

Potential for relocation of OWTS may be limited due to space restraints and code issues. Additionally, relocation of the revetment landward of the landward of the January 2010 MHTL and most LAEs west of 30970 Broad Beach Road may cause future permitting issues with the city of Malibu and potentially other agencies as all properties must comply with city code if repairs or upgrades are made to an existing treatment system. Such repairs are required for major remodels or home expansion and also for resale and as such have cited such relocation as infeasible (Ensitu 2013). However, as discussed Section 3.7.6, *Utilities and Service Systems*, the city of Malibu Municipal Code does not appear to directly conflict with this alternative for the majority of affected homes. Further, the feasibility of revetment relocation off public lands does not consider ability to expand existing homes, but rather the ability of the OWTS to serve the existing

Table 4-3. Alternative 2 – Potential for Landward Relocation of OWTS

Address	Number of Affected OWTS	Potential for Landward Relocation Behind Revetment[1]	Potential for Relocation Landward of Home [2]
31324	1	Potentially Feasible	Insufficient Area
31316	1	Feasible	Feasible
31280	1	Potentially Feasible	Insufficient Area
31250	3	Feasible	Feasible
31228	1	Feasible	Insufficient Area
31138	1	Not Feasible	Insufficient Area
31122	2	Not Feasible	Insufficient Area
31058	1	Feasible	Feasible
31054	1	Potentially Feasible	Insufficient Area
31052	2	Potentially Feasible	Insufficient Area
31034	2	Feasible	Insufficient Area
30970	2	Potentially Feasible for at Least One Component	Insufficient Area
30966	1	Feasible	Insufficient Area
30952	1	Feasible	Feasible
30928	1	Potentially Feasible	Insufficient Area
30842	1	Feasible	Insufficient Area
Total Affected Properties	**Total Affected System Components**	**Number of OWTS Feasible to Relocate Landward of Revetment**	**Number of OWTS Feasible to Relocate Landward of Home**
16	22	8	4

Source: Topanga Underground 2012.
[1]Feasibility determined via aerial imagery and CAD files provided by the city of Malibu.
[2]Feasibility determined via the recommendations of Topanga Underground (2012).

home. Under this Alternative, it appears that at least six existing homes may lose that ability to dispose of wastewater without major alterations to the relocated revetment alignment and design. Finally, Applicant-prepared studies have also identified a requirement for septic system leach fields to be setback a minimum of 15 feet from a wave uprush zone. As noted above, such uprush is projected to occur only during a 100 year event and after erosion of the beach and overlying dune system in 10 to 20 or more years. Further, the reinforced revetment would limit, but not fully eliminate the size and intensity of such wave uprush. Limited amounts of water overtopping the revetment would likely have only moderate effects on water quality as contact with any released septic effluent with marine waters would be limited by the revetment.

Maintaining or relocating the OWTS for the impacted homes is necessary because there are no feasible opportunities to connect to a centralized public or private sewer system. In order to address potential impacts to the operation of existing leach fields the revetment's design location could be altered to allow space for existing OWTS that cannot be relocated. Altering the revetment's design would require narrowing of the revetment or moving the revetment location seaward where it would again impact and

cover LAEs. While the latter is feasible, it would be contrary to the intent of this alternative. Further, revetment design does not permit or allow for sharp breaks in direction, so any adjustment for one house would affect LAEs on adjacent parcels.

Under this alternative, beach nourishment and to a greater degree reinforcement of the existing revetment would reduce potential impacts to Utilities and Service Systems. This alternative would substantially increase the beneficial impacts associated with UTL-1. Potential damage to OWTS from coastal erosion, and associated indirect impacts to public trust resources identified in Impact UTL-2, including adverse effects to water quality and public use and enjoyment of the beach and ocean, would be greatly reduced, as the reinforced revetment would provide long-term protection of existing OWTS from coastal erosion. However, leach fields west of 30970 Broad Beach Road would be located within 15 feet of the wave uprush limit calculated by Moffatt & Nichol (2013) after cessation of nourishment activities and erosion of the newly widened beach and dune system in 10 to 20 or more years. Consequently, these leach fields may experience splashing or minor seawater intrusion from waves overtopping the improved revetment during large 100-year storm events. Relocation of the revetment closer inland would also result in similar public drainage-related impacts of the Project as discussed in Impact UTL-3 as construction of the restored dunes and beach nourishment will bury or obstruct public drainages. Similar to the Project, Impact UTL-3, such impacts would be a minor adverse effect with implementation of AMM UTL-3 (Master Drainage Plan).

Other Resource Areas: This alternative would have similar impacts to the Project in terms of its effects on scenic resources, marine biological resources, historic, and paleontological resources, and environmental justice. Effects on transportation, traffic, parking, and noise would be somewhat more severe due to increase levels of vehicular activity and congestion related to construction phases. Effects on public health and safety hazards and historic resources may be incrementally increased due to increased construction activity associated with the relocation and reinforcement of the revetment (Table 4-4).

Table 4-4. Alternative 2 – Changes in Impact Severity

Resource Area	Relative Change in Impact Severity	Discussion
Scenic Resources	No Major Change in Adverse Impacts	Additional construction equipment associated with landward relocation of the revetment may intensify the adverse impacts associated with temporary construction activities, with a slight increase in the severity of adverse effects associated with Impact SR-2 and SR-4. Similar to the Project, permanent authorization of the revetment through a long-term lease and approval of CDPs would create the potential for long-term degradation of the visual environment of Broad Beach after nourishment activities end and natural coastal erosion causes the revetment to become exposed as described in Impact SR-1.

Table 4-4. Alternative 2 – Changes in Impact Severity

Resource Area	Relative Change in Impact Severity	Discussion
Marine Biological Resources	Incremental Decrease in Indirect Adverse Impacts	Placement of sand and potential burial of rocky intertidal and subtidal marine biological resources would have a major adverse effect to intertidal habitats and offshore habitats of Broad Beach similar to the Project as described in Impacts MB-1, MB-2, MB-3, MB-4, MB-5, and MB-8. Additionally, similar to the Project, impacts to down coast habitats would be negligible as discussed in Impact MB-7. Potential indirect impacts associated with water pollution from coastal erosion damage to OWTS would be reduced along the length of the existing revetment. The potential for fuel or oil release described in Impact MB-6 would be slightly increased due to increased construction activities.
Cultural and Paleontological Resources	Incremental Increase in adverse Impacts	Disturbance of the near shore environment associated with the landward relocation of the revetment would result in a slightly increased potential to disturb cultural resources, resulting in an additional adverse impact similar in type to Impact CR-1. Implementation of standard BMPs would reduce this impact.
Noise	Incremental Increase in Adverse Impacts	A temporary increase in noise due to additional construction associated with the landward relocation of the revetment would result in adverse impacts to beach users and receptors along affected roadways. Consequently, this alternative would result in slight increases in adverse effects associated with Impact N-1. Impacts would be reduced through implementation of AMM N-1a, similar to the Project.
Public Health and Safety Hazards	No Major Change in Adverse or Beneficial Impacts	This alternative would result in a slight increase in the adverse effects associated with Impact HAZ-2, as additional heavy construction equipment (i.e., bulldozers, cranes, and haul trucks) would increase the potential for an incidental release of hazardous material on Broad Breach. Additional construction equipment and construction personnel would also increase inaccessibility and hazardous conditions during construction, slightly increasing the severity of adverse effects associated with Impact HAZ-3. These impacts would be reduced through implementation of AMMs HAZ-2, HAZ-3a, and HAZ-3b.
Traffic and Parking	Incremental Increase in Adverse Impacts	Landward relocation of the revetment and a wider dune system on the beach's east end would require an estimated 10,000 more heavy haul truck trips and additional heavy construction equipment and construction personnel, which would likely increase traffic and congestion on PCH and in the Zuma Beach parking lot, incrementally increasing the severity of adverse effects associated with Impact TR-1. These impacts would be reduced through implementation of AMM TR-1.
Environmental Justice	No Major Change in Adverse Impacts	There would be no appreciable difference in impacts relative to the Project.

4.2.3 Alternative 3: Maximum Pull-back of Seawall with Beach Nourishment and Dune Restoration

Description

Under this alternative, the existing emergency revetment would be removed and replaced with a vertical seawall located on private property as far landward and as close to the existing primary residences as physically feasible, while also maintaining a minimum setback of 6 feet seaward from the existing OWTS, including septic tanks, leach fields, and other treatment infrastructure. Although the seawall could be feasibly located more closely to the OTWS and their leach fields, this 6-foot setback would decrease potential impacts of wastewater pooling behind the seawall, which would affect the structure's stability and prevent reliable percolation of wastewater effluent. Similar to the Project, the installation of the seawall would be accompanied by beach nourishment and dune restoration, annual backpassing activities, and a follow-up renourishment event (see Figure 4-3).

Construction of a new 2-foot thick, 20-foot high, 4,700-foot long seawall could be accomplished by one of two approaches: 1) use of steel sheet piles with a concrete cap, or 2) use of poured and formed concrete. In either case, the seawall would be fronted by a 10-foot-wide subsurface boulder toe apron to prevent foundation scour by wave action and potential wall collapse (refer to Figure 4-3). A sheet pile seawall would be preferred due to the smaller construction footprint and the close proximity of OWTS and leach fields. Construction of a cast-in-place concrete seawall would require a larger footprint and may not be able to protect existing systems in place. Construction of a cast-in-place concrete seawall would likely require the relocation of OWTS, which may be feasible in some instances, limited in others due to space constraints and code issues as described for Alternatives 1 and 2, and further described below.

Construction of either type of seawall in such close proximity to the residences or OWTS would eliminate area available for dune restoration landward of the seawall. Consequently, all restored dunes would be located seaward of the seawall. Further, the seawall could rise as much as 3 feet above the level of the proposed dunes because the seawall must be taller than a revetment to avoid wave overtopping and potential pooling of seawater behind the wall following complete erosion of the nourished beach.

The new seawall would be constructed through existing backyards, patios, and remnant disturbed dune habitat (see Illustration 4-3). While the existing buildings fronting Broad Beach are unevenly set back from the OHWM, the engineered design of the seawall must be as linear as possible to maximize strength of the wall and to minimize erosion. The proposed seawall would be located no less than 6 feet from the existing leach fields, entirely on private land; however, the distance of the seawall from each residence would vary depending on the location of existing leach fields. The average setback from the toe of the seawall would extend 45 feet and the maximum setback would be about

Illustration 4-3: *Construction of a seawall approximately 6 feet from the homes along Broad Beach would require major increases in construction activities. A large number of patios would require demolition and reconstruction. Additionally, a large number of OWTS would require relocation and or abandonment, which would also substantially increase adverse impacts at Broad Beach.*

110 feet. Construction of a seawall using either method would require major disruption or removal of existing private improvements, including a number of patios, pools, landscaping, and other accessory use improvements. Construction of the seawall would not necessitate removal or relocation of any portion of primary structures, such as habitable spaces within existing residential units.

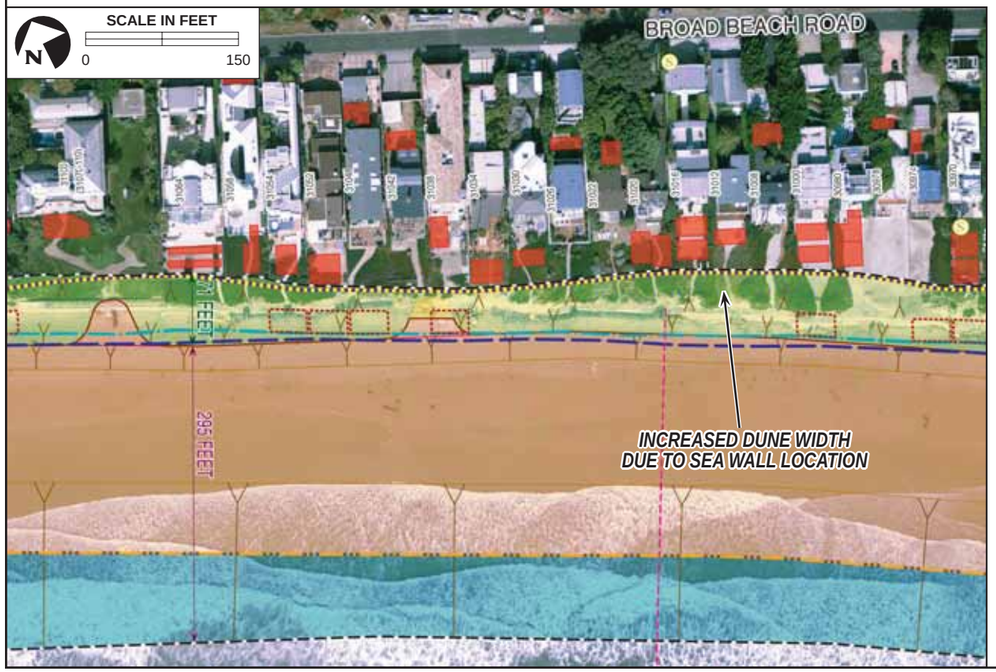
Beach nourishment, dune creation, and habitat restoration would be included under this alternative and habitat restoration concepts would remain similar to those proposed under the Project. However, in this scenario, dune restoration would be confined to the seaward side of the seawall. However, the proposed seawall would be constructed as far inland of the OHWM and the boundary between public and private land as possible while also maintaining a 6-foot setback from existing leach fields. On the eastern side of Broad Beach, this would result in a large landward setback from the OHWM compared to the location of the existing revetment, with increasingly small amounts of landward movement along the central and west beach areas. In some locations near the western end of the existing revetment, the seawall alignment would match the existing revetment location since the revetment is already located 6 feet from the existing leach fields.

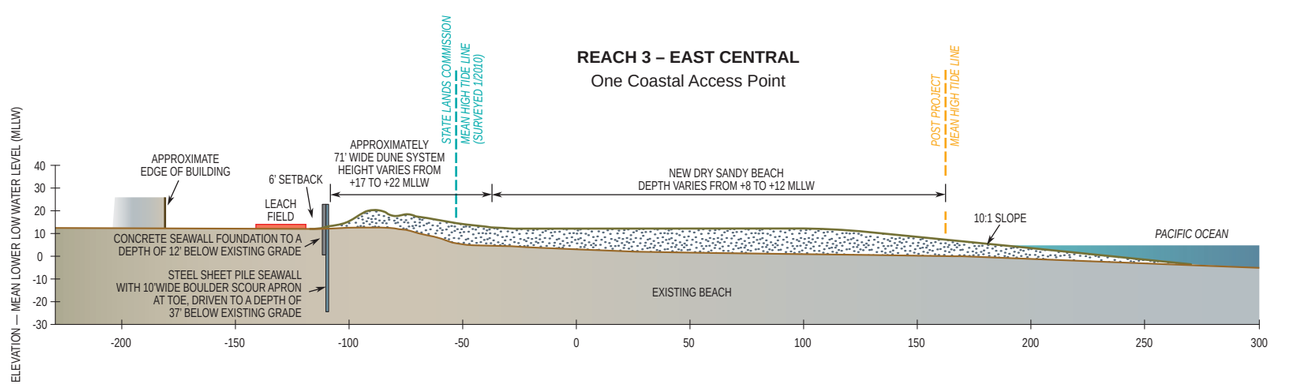
This alternative would generate beach and dune design and access management issues regarding how best to redesign the Project to achieve the objectives while also accommodating the seawall. In particular, within the eastern and central segments of the beach, approximately 100 to 150 feet of private property that currently supports backyards, patios, and walkways would be located on the ocean-side of the seawall. This alternative would narrow availability of private property to approximately 0 to 20 feet toward the west-central end of the beach. Several approaches to this issue are possible and are discussed in detail in Appendix L, *Alternatives Screening*.

SCALE IN FEET
0 370

Detail

SCALE IN FEET
0 150





LEGEND

- Existing Public Access
- Approximate Limits of Beach Nourishment/ New Beach
- Seawall Alternative
- Proposed New Dry Sandy Beach
- Proposed New Intertidal Beach Area
- Proposed Restored Dune
- Area of Dune or Beach Face (3:1 and 10:1 slopes)
- State Lands Commission Mean High Tide Line (surveyed 1/2010)
- Applicant Mean High Tide Line (surveyed 10/15/2009)
- Post Project Mean High Tide Line
- Existing Septic Tank
- Existing Leach Field/Drain Field
- Existing Lateral Access Easements (LAEs)
- Easement on file, but no dry beach to dedicate
- Surf Grass
- ###### Property Address

Note: Beach dimensions and post project average high water line reflect beach status immediately after completion of beach nourishment and construction/shaping activities; the equilibrium beach that would result from dynamics such as waves, tidal and wind action would likely be of somewhat different dimensions.

amec

Maximum Pull-back of Seawall with Beach Nourishment and Dune Restoration

FIGURE 4-3

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This alternative includes the creation of a wider dune system along the central and eastern reaches of Broad Beach due to the increased setback of the seawall behind the OHWM relative to the existing emergency rock and sand bag revetment. This approach would increase the width of the dune system and habitat restoration area over all private land seaward of the seawall, while also continuing to provide the same wide sandy beach as described under the Project. However, this alternative would require major additional sand (120,000 cy) for dune creation, with an associated 8,500 additional haul truck trips. This alternative may also pose issues regarding the management of public and private property delineated on either side of the seawall. However, this approach would be the most consistent with overall Project objectives.

Under this alternative, the profile of the sandy beach would be the same as that described in the Project, with a beach width of approximately 100 feet on the west, increasing to over 200 feet in the central and eastern areas of Broad Beach. However, the dune width would be substantially increased from the currently proposed approximately 50feet and would instead range from approximately 220 feet wide in the east to approximately 125 feet wide in the central west section, tapering down to approximately 70 feet on the west.

Full public access would be permitted along the entire beach, but restricted from the dunes where a line of rope or cable and signs would prohibit access to ESHA. This rope or cable system, combined with the dune system would also ensure resident privacy. This alternative would channel resident access across the dunes into unpaved shared walkways spaced every 300 feet (each combining access for up to six homes). These shared walkways traversing the dune system from the beach would be connected to a back dune walkway lined with low fencing, located adjacent to the ocean side of the seawall due to limited space available on the landward side. The back dune walkway would be inland of, and parallel to, the restored dunes to restrict or inhibit access by residents and pets into this potential ESHA. However, because the seawall may extend 3 feet above the finished grade, this alternative may require up to 112 stairways (one stairway for each private primary structure at Broad Beach) be constructed up and over the seawall to connect to the private properties at Broad Beach.

This alternative would also recognize the public's rights to pass along public land below the January 2010 MHTL and across existing LAEs. This would ensure that over the long-term after nourishment ceases, the revetment is removed, and the beach and dunes erode, the public would continue to have access across the beach. Public access to and along these LAEs would be available when the sensitive dune habitats that overlie these LAEs eventually erode over the long-term and public access to these LAEs becomes necessary and available.

Initially, construction would require use of additional bulldozers and a crane. This alternative would also require approximately 1,794 new trips by heavy haul trucks to

remove a major portion of the existing emergency revetment while retaining some of the rocks for use in the boulder toe apron of the seawall.[6] This would be followed by the excavation of a foundation for the seawall, which would cover approximately 8 to 12 feet in both depth and width. This foundation would be necessary to support a poured concrete seawall or to permit emplacing the rock toe apron for the steel sheet pile seawall. For the poured concrete seawall, construction would be accompanied by excavation and recompaction of sand dunes and soil behind the wall to provide stability for the seawall to withstand wave action. Activities associated with this approach would require an approximately 40-foot-wide construction corridor. If a concrete seawall were installed, up to approximately 3,920 cement truck trips would be required for foundation and wall construction. In contrast, construction of the steel sheet pile seawall would require only a 20-foot-wide corridor to permit access of heavy equipment necessary to drive the sheet piles down into deep sand or bedrock using vibratory hammers suspended from cranes. Seawall construction would also include a major increase in the number of construction workers, vehicles, and equipment relative to the Project.

The proposed seawall would be 20 feet high in order to prevent wave overtopping and therefore, would rise up to approximately 8 feet taller than the existing revetment, which currently ranges in height from 12 to 15 feet. Given that the dune system would range in height from 17 to 20 feet along the eastern and central portion of the beach, up to 3 feet of the seawall would be exposed. The increased height of the seawall when compared to the revetment is necessary because revetments tend to absorb wave energy into spaces between boulders while seawalls repel waves, leading to greater impact forces from waves and potential overtopping, if and when the seawall becomes exposed.

This alternative would require installation of many of the same improvements as the Project and associated construction activities. Major components would include:

- Removing most of the existing rock revetment using heavy cranes, bulldozers and an estimated 1,794 haul truck trips to transport sand bags, and other materials composing the existing revetment off of the beach, while retaining some of the rocks for use in the boulder toe apron;
- Redistribution of beach sand within the sand bags and removal of sand bag liners and other remaining debris;
- Importing steel sheet piles on flatbed semi-trucks, or pre-mixed concrete in 3,920 cement trucks;
- Constructing approximately 4,700 feet of seawall using cranes and vibratory hammers to force steel sheet piles 37 feet into sand and bedrock; or excavation of a trench, measuring 8- to 12-feet in depth and width to accommodate the foundation and installation of forms, rebar and concrete to create the seawall;

[6] The number of trips is an estimate, as an unknown number of the existing larger 2-ton stones would be retained to construct the seawall's rock toe apron.

- Use stone from the existing emergency revetment to construct a 10-foot-wide boulder toe apron fronting the seawall using heavy cranes and bulldozers;
- Transport of an additional estimated 120,000 cy of sand from the inland quarries to Broad Beach via an estimated 8,560 truck trips for a total of approximately 51,560 sand haul truck trips;
- Redistributing the sand as needed with earthmoving equipment, such as bulldozers, and grading the beach fills to required dimensions;
- Constructing a system of sand dunes up to approximately 220 feet wide at the east end of the beach to be planted with native dune species;
- Creating a system of shared walkways to provide private lateral and vertical coastal access across the new dune system, including up to 112 stairways on the on the face of the seawall to connect private properties to the shared walkways;
- Providing two vertical public access trails up and over the seawall and across the dunes to connect existing access points to the widened beach and ensuring public lateral access along the widened beach seaward of the OHWM
- Performing backpassing of the sand from the east to west end of the beach based on triggers and using heavy equipment such as scrapers and bull dozers; and
- Initiating one future major renourishment event of approximately 450,000 cy in roughly 10 years following initial nourishment activities.

Potential Impacts to Public Trust Resources

This alternative would include removal of a major portion of the existing emergency revetment while retaining some of the rocks for use in the boulder toe apron of the seawall, as well as the installation of a seawall entirely within the private property boundary of the residences fronting Broad Beach. This alternative is the most construction-intensive alternative of any included in this APTR. . This alternative would also involve demolition of up to approximately 55 patios and relocation of up to 54 OWTS, if the cast-in-place seawall were selected. This alternative would also require a longer period of construction of up to an additional 2 to 3 months for revetment removal, seawall construction and transport and distribution of the additional 120,000 cy of inland sand. These activities would incrementally increase construction related impacts, particularly those related to terrestrial biological resources. Resource areas with major changes to impacts relative to the Project are discussed in detail below, while the resource areas with negligible changes to impacts are summarized in Table 4-6 at the end of this subsection.

Air Quality and Greenhouse Gases: There would be a major increase in air pollutant and GHG emissions associated with increased heavy haul and cement truck trips and the operation of additional heavy equipment during Project construction. Similar to Alternatives 1 and 2, emissions of VOCs and NO_x would be increased under this alternative; however, due to the major increase in construction required under this

alternative, Impact AQ-1 would be substantially more severe than under the Project, including under SCAQMD's LSTs for construction activities. Given the potential impacts to air quality, this alternative would require the use of AMMs as outlined in the Project (e.g., use of new trucks with clean-burning engines); however, total impacts to air quality would still increase above those associated with the Project (Appendix G). Greenhouse gas (GHG) emissions described in Impact AQ-2 would be incrementally increased but would remain below SCAQMD and VCAPCD thresholds. Finally, increased truck traffic and heavy equipment operation associated with reinforcement and relocation of the rock revetment would incrementally increase toxic air contaminant emissions; however impact AQ-3 would remain minor as thresholds would not be exceeded.

Whereas implementation of Alternative 3 would substantially increase the severity of construction-related air quality impacts over the short-term, this alternative may incrementally reduce the severity of construction-related air quality emissions from backpassing. As previously described, additional beach width would be made available with the landward construction of the seawall as close to the existing leach fields as possible. This would incrementally delay the exposure of the seawall after the initial nourishment event based on a continued average estimated sand loss rate of between 30,000 and 45,000 cy per year (Moffatt & Nichol 2013). However, while the need for backpassing may be incrementally reduced, backpassing would still be required to maintain the evenly distributed wide sandy beach, and air pollutant and GHG emissions would still be considered a major adverse impact.

Coastal Processes, Sea Level Rise, and Geologic Hazards: Construction of a seawall far landward of the January 2010 MHTL accompanied by a much wider dune system would change potential impacts to coastal processes relative to those described for the Project. Erosion of beach and dunes after the cessation of nourishment would continue as described under the Project; however, in the central and eastern segments of the beach, the substantially wider restored dune system may extend the beneficial effects identified in Impact CP/GEO-3 beyond the estimated 10 to 20 or more years associated with the Project. Anticipated SLR of approximately 8.5 inches by 2030 would further exacerbate erosion effects, including increased frequency and intensity of storm surges and wave attack. In addition, adverse impacts associated with Impact CP/GEO-2 would be greatly reduced, including potential damage to homes, OWTS and accessory structures from coastal erosion. Further, associated indirect impacts to public trust resources identified in Impact CP/GEO-2, such as adverse effects on water quality, would also be greatly reduced. The seawall would provide long-term protection of existing OWTS, primary structures, and relocated patios; however, construction of a cast-in-place concrete seawall would require relocation of up to 54 OWTS, which appears to be infeasible due to space limitation and city code requirements.

The seawall may also potentially result in long-term impacts to sand exchange between the nourished beach and remaining southern foredune habitat present in the rear yards of the residences on Broad Beach. Hard stabilization structures tend to reduce sand exchange between these environments, consequently resulting in accelerated erosion of the beach described in Impact CP/GEO-8 (Pilkey and Wright 1988). Further, while additional sand being exposed seaward of the seawall may incrementally increase short-term benefits to sediment transport to down coast beaches, if and when the seawall becomes exposed, as a hard stabilization structure it may also have adverse down coast impacts, potentially resulting in accelerated erosion down coast in the direction of long-shore transport (Kelly 2000). Consequently, beneficial impacts associated with down-coast sediment transport identified in Impact CP/GEO-7 may be incrementally increased in the short- and medium-term but may be reduced in the long-term.

Construction of a properly engineered seawall would avoid potential adverse impacts associated with liquefaction and wave impacts and eventual damage to homes, ancillary structures, and OWTS with adverse indirect consequences for public trust resources. Relocation of up to 54 OWTS would be required in order to avoid the cast-in-place concrete seawall footprint, which may be infeasible due to space limitation and city code requirements, as discussed further for this alternative under *Utilities and Service Systems* below. This alternative would substantially reduce the long-term adverse effects associated with Impact CP/GEO-1; however, should effluent from OWTS and/or groundwater pooling behind the seawall, it may weaken the seawall and foundation, resulting in potential catastrophic structural failure of this hard stabilization structure and related additional adverse impacts.

Impacts related to sand compatibility (CP/GEO-4) and tides, currents, and wave height and direction (CP/GEO-5) would remain largely similar to those described for the Project. Short- and medium-term beneficial impacts to wave run-up (Impact CP/GEO-6) would remain similar, but may be extended due to the addition of more sand.

Marine Water Quality: Construction of a properly engineered seawall, installation of a wider dune field, and possible relocation of OWTS and other structures landward of the seawall would substantially reduce potential impacts to Marine Water Quality as long as the seawall remains intact. Protection for structures and OWTS would be increased and exceed the lifetime of the restored dunes as a last line of defense, as discussed by Impact MWQ-3. The seawall would provide long-term protection of existing development from coastal erosion.

Terrestrial Biological Resources: Removal of the existing revetment and construction of a seawall would require use of heavy cranes and bulldozers and major excavation and construction in backyards and degraded southern foredune areas, increasing the short-term construction effects on terrestrial biological resources described in Impact TBIO-2.

Although much of the habitat fronting the homes along Broad Beach has been subject to landscaping with non-native and invasive plant species associated with adjacent residential development, this area consists of degraded southern foredune habitat, a habitat type identified as rare by the CNNDB and CNPS. Moreover, due to the rarity and biological significance of dune habitat in southern California, southern foredunes are designated as ESHA under the Malibu City LCP. Construction activities including foundation excavation for the seawall in the southern foredunes would create potential temporary adverse impacts to native southern foredune vegetation and/or sensitive wildlife.[7] Adverse effects to ESHAs resulting from this alternative would be substantially more severe than those that occurred from previous installation of the existing revetments described in Impact TBIO-1. These activities would also increase the severity of Impact TBIO-2, as operation of heavy equipment could result in increased trampling of the degraded coastal dune ESHA. Impact TBIO-4 may also become more severe relative to the Project due to the operation of additional heavy equipment within ESHAs, resulting in a higher potential for hazardous spills. This risk would be compounded if a cast-in-place concrete seawall were selected, as removal of up to 54 OWTS would require additional construction activities and would contribute to the potential for accidents or spills.

However, restoration of a significantly larger dune field would substantially increase short- to mid-term benefits of dune restoration associated with Impact TBIO-6. This would potentially reduce the severity of the overall adverse impacts associated with the landward relocation of the revetment. Additionally, under this alternative the shared walkways would reduce habitat fragmentation and adverse effects of private access across the restored dune, increasing the beneficial effects identified in Impact TBIO-6 and slightly reducing the adverse effects described in Impact TBIO-7. However, long term erosion under this alternative would increase impacts to dune habitat described in Impact TBIO-8, as the dunes would be located almost entirely seaward of the seawall. The additional volume of sand would increase impacts related to longshore sand transport, identified in Impact TBIO-5. Impacts related to backpassing operations would be similar to those described for the Project in Impact TBIO-3.

Recreation and Public Access: Construction of a seawall landward of all public lands and all LAEs would incrementally increase adverse short-term construction impacts identified in Impact REC-1 due to the disruption of public use and enjoyment of public trust lands; however, due to constraints related to existing leach fields, not all portions of the seawall would be able to be located behind existing LAEs. Construction of a seawall as landward of the OHWM as possible would be substantially more consistent with shoreline protection and access policies. However, while this alternative would provide beneficial impacts associated with recreation and public access over the short- to mid-

[7] The highest quality remaining dune habitat suffered serious erosion damage during the winter of 2013-2014, with dunes eroding landward up to 100 feet at the east end of Broad Beach.

term as identified in Impact REC-3, this alternative may substantially increase long-term public access impacts identified in REC-4. Following the cessation of nourishment and erosion of the beach in 10 to 20 or more years, the beach is likely to vary in width seasonally and in relation to climate cycles and El Nino events; however, the beach could possibly erode as far back as the seawall, which would completely eliminate public access along Broad Beach during moderate and high tides. Backpassing operations and associated impacts to recreational users identified in Impact REC-2 would be similar to those described for the Project.

Utilities and Service Systems: Construction of a properly engineered seawall would substantially reduce potential damage to OWTS from coastal erosion, and associated indirect impacts to public trust resources identified in Impact UTL-2. Impacts to water quality and public use and enjoyment of the beach and ocean would be greatly reduced, as the engineered seawall would provide long-term protection of existing or relocated OWTS from coastal erosion.

While a steel sheet pile seawall could be installed fronting existing leach fields, a cast-in-place concrete seawall foundation would require relocation of up to 54 OWTS. However, it would not be feasible to relocate many of these OWTS due to space limitations and potentially city code requirements (see Table 4-5). According to a study prepared by the Applicant, (Moffatt & Nichol September 2012) and review of known OWTS locations, there is insufficient area for the landward relocation of a number of effected OWTS. Up to 26 residences would have insufficient area to accommodate landward relocation of their OWTS landward of Broad Beach. Further, some of these systems might feasibly be relocated between the home and seawall (refer to Table 4-5 and Figure 4-3), this option would require additional research regarding the feasibility for each OWTS and compatibility with the structural stability of the seawall (see discussion above regarding Coastal Processes, Sea Level Rise, and Geologic Hazards).

As no capacity exists in nearby public or private sewer systems, only one option exists to address potential impacts to the operation of existing OWTS if a cast-in-place concrete seawall is selected. The seawall would be sited 6 feet seaward of existing leach fields to reduce the potential for pooling of wastewater behind the structure. Adjusting seawall location would require siting the seawall towards the ocean where it would impact LAEs by overlying this land and restricting public access. This impact would be similar to existing impacts of the emergency rock and sand bag revetment, which overly and block access to these LAEs. While siting the seawall seaward to accommodate existing leach fields is feasible, it would be contrary to the intent of this alternative. Further, seawall design does not permit sharp breaks in direction, so any adjustment for one house would affect adjacent parcels and potentially additional LAEs.

Since the seawall would be relatively impermeable, and would extend far below grade (e.g., more than 30 feet for steel sheet pile wall) it could inhibit the lateral, shoreward

migration of effluent through the natural sand filtration. This may cause pooling of effluent below the remaining leach fields increasing hydrostatic pressure behind the wall, potentially contributing to wall failure of the wall and leach field malfunction (Moffatt & Nichol 2012).

Installation of the seawall under the alternative would likely result in substantially greater impacts to the storm drain system than the Project. As discussed in Section 3.7.6, *Utilities and Service Systems*, only six of the 11 buried storm drains are currently visible either under existing homes or through the existing revetment, and the specific size and detailed location of the remaining five storm drains are not fully known. However, although this alternative would likely require reconstruction of existing storm drains through private patios and other improvements and result in a commensurate increase in construction-related impacts, Impact UTL-3 would be a minor adverse effect with implementation of AMM UTL-3 (Master Drainage Plan), as described for the Project.

Other Resource Areas: This alternative would have similar impacts to the Project in terms of its effects on scenic resources, marine water quality, marine and biological resources, and environmental justice. Effects on transportation, traffic, parking, and noise would be somewhat more severe due to increase levels of vehicular activity and congestion related to construction phases. Effects on public health and safety hazards and historic resources may be incrementally increased due to increased construction activity associated with construction of the seawall (Table 4-6).

Table 4-5. Alternative 3 – Potential for Landward Relocation of OWTS

Address	Number of Affected OWTS	Potential for Landward Relocation Behind Seawall[1]	Potential for Relocation Landward of Home [2]
31336	1	Not Feasible	Insufficient Area
31324	1	Potentially Feasible	Insufficient Area
31316	1	Feasible	Feasible
31280	1	Potentially Feasible	Insufficient Area
31250	3	Feasible	Feasible
31240	1	Not Feasible	Insufficient Area
31228	1	Potentially Feasible	Insufficient Area
31220	1	Not Feasible	Insufficient Area
31122	2	Not Feasible	Insufficient Area
31100	2	Feasible	Feasible
31064	2	Not Feasible	Insufficient Area
31058	1	Feasible	Feasible
31054	1	Potentially Feasible	Insufficient Area
31052	2	Not Feasible	Insufficient Area
31038	1	Not Feasible	Insufficient Area
30134	2	Potentially Feasible for at Least One Component	Insufficient Area
31030	1	Feasible	Feasible
31020	2	Not Feasible	Insufficient Area
31012	1	Feasible	Feasible
31000	2	Feasible	Feasible
30970	2	Potentially Feasible for at Least One Component	Insufficient Area
30966	2	Potentially Feasible for at Least One Component	Insufficient Area
30956	1	Potentially Feasible	Insufficient Area
30952	2	Feasible	Feasible
30944	1	Not Feasible	Insufficient Area
30930	1	Not Feasible	Insufficient Area
30928	2	Not Feasible	Insufficient Area
30924	2	Potentially Feasible for at Least One Component	Insufficient Area
30918	1	Feasible	Feasible
30908	1	Not Feasible	Insufficient Area
30900	2	Potentially Feasible for at Least One Component	Insufficient Area
30866	1	Potentially Feasible	Insufficient Area
30860	2	Feasible	Feasible
30842	2	Potentially Feasible for at Least One Component	Insufficient Area
30830	2	Potentially Feasible for at Least One Component	Insufficient Area
30804	1	Not Feasible	Insufficient Area
Total Properties Affected	**Total System Components Affected**	**Number of OWTS Feasible to Relocate Landward of Seawall**	**Number of OWTS Feasible to Relocate Landward of Home**
36	54	10	10

Source: Topanga Underground 2012.

[1]Feasibility determined via aerial imagery provided by the city of Malibu.

[2]Feasibility determined via the recommendations of Topanga Underground (2012).

Table 4-6. Alternative 3 – Changes in Impact Severity

Resource Area	Relative Change in Impact Severity	Discussion
Scenic Resources	Incremental Increase in Adverse Impacts	Additional construction equipment associated with construction of a landward-located seawall would incrementally increase adverse impacts associated with temporary construction activities; this would slightly increase in the severity of adverse effects associated with Impact SR-2 and SR-4. Further, when exposed after erosion of the beach, the seawall would become more and more visible above beachgoers, incrementally increasing the severity of Impact SR-1 over the long term.
Marine Water Quality	No Major Change in Adverse Impacts	There would be a slight increase in the potential for hazardous spills, as additional heavy equipment would be used in seawall construction and additional sand would be added for beach nourishment. The beneficial impact to marine water quality due to protection of OWTSs would be increased under this alternative, due to the improved strength of the seawall.
Marine Biological Resources	No Major Change in Adverse Impacts	There would be no major changes in impacts to marine biological resources. The potential for fuel or oil release described in Impact MB-6 would be slightly increased due to increased construction activities.
Noise	Incremental Increase in Adverse Impacts	Revetment removal and seawall construction would result in major temporary increase in noise and adverse impacts to beach users associated with Impact N-1 and sensitive receptors associated with Impact N-2 and N-3.
Cultural and Paleontological Resources	Incremental Increase in Adverse Impacts	Additional disturbance of the nearshore environment associated with the removal of the emergency revetment and the construction of the seawall, in particular with foundation excavation, as well as the possible demolition and removal of OWTS would result in an increased potential to disturb cultural resources, potentially increasing the adverse effects associated with Impact CR-1.
Public Health and Safety Hazards	Incremental Increase in Adverse Impacts	Demolition and relocation of OWTS associated with selection of the cast-in-place concrete seawall would increase the potential for incidental leaks, increasing the potential for adverse effects associated with to Impact HAZ-2. Operation of additional heavy construction equipment would increase the potential for incidental spills, further increasing potential adverse effects associated with Impact HAZ-2. Increased heavy construction equipment operation would also increase potential adverse effects on safety associated with Impact HAZ-3.
Traffic and Parking	Incremental Increase in Adverse Impacts	Revetment removal would require additional heavy haul truck trips, which may also increase traffic on Pacific Coast Highway and in Zuma Beach Parking Lot 12. When combined with up to 3,920 cement truck trips, 1,750 revetment removal haul truck trips and 8,560 trucks for added sand, these activities would increase the severity of the adverse effects associated with Impact TR-1. However, these impacts would be reduced through implementation of AMM TR-1
Environmental Justice	No Major Change in Adverse Impacts	There would be no appreciable difference in impacts relative to the Project.

4.2.4 Alternative 4: Reduced Beach Nourishment Volume and Dune Restoration with Revetment in Current Location

Description

Under this alternative, less sand would be imported from inland sources for each beach nourishment event and the existing emergency revetment would be retained in place. During the initial nourishment event, this alternative would entail importing up to 400,000 cy of sand to Broad Beach, with 100,000 cy used to create the sand dunes and cover the revetment, and 300,000 cy used for beach nourishment.[8] Under this alternative, sand dune design would remain the same as described under the Project, with the dunes ranging between approximately 40 to 60 feet in width and dune hummocks varying in height from 17 to 22 feet above MMLW. However, post-construction beach berm width would be reduced to approximately 50 feet along the western 1,000 feet of Broad Beach and 100 feet along the eastern 5,000 feet of Broad Beach. Similarly, beach berm depth would be reduced from 17 to 12 feet in the western reaches and to 10 feet on the eastern reach (see Figure 4-4). Consequently, the total Broad Beach footprint would be reduced to approximately 30 acres from 46 acres.

This alternative would also include three smaller beach renourishment events of a shorter duration, rather than one larger renourishment event as described for the Project. The first event, which would occur after approximately 3 to 5 years, would include the deposition of up to 150,000 cy of sand. The second event, which would be approximately 8 to 10 years following the first nourishment event, would include up to 200,000 cy of sand. The third event would occur approximately 15 years after the first nourishment and include up to 300,000 cy of sand. The overall nourishment volume over the 20-year project duration would be equal to the Project, including the deposition of no more than 1,050,000 cy in total. As with the Project, sand would continue to be obtained from the three quarry sites located in the Moorpark/Simi area of Simi Valley, approximately 20 to 25 miles north of Broad Beach. More frequent nourishment events would likely require smaller annual or less frequent backpassing of sand using the Project objective triggers. The optimum size and timing of future renourishment would be determined based on monitoring data gathered during each phase of Project operation.

This alternative is intended to restore the beach and dunes while providing information on the beach's optimum equilibrium profile. This information would allow adaptive management to best implement long-term shoreline protection and beach restoration goals on Broad Beach and in the sub-littoral cell. By employing reduced nourishment events, this alternative may reduce the volume of sand lost offshore from post-

[8] This quantity is suggested as a potential value; a detailed study would be required to identify what the minimum sand volume would be to provide a viable beach and allow for assessment of sand transport.

construction beaches, as nourishment volumes can be best adapted to reflect the equilibrium beach.

As with alternatives described above, full public access would be permitted along the entire wide sandy beach, but it would be restricted at the toe of the dunes where a line of rope or cable as well as posted signs would prohibit access to this ESHA. This rope or cable system, combined with the approximately 40- to 80-foot-wide dune system would ensure resident privacy. This alternative would channel private access across the dunes into shared unpaved walkways spaced every 300 feet (each combining access for approximately six homes), which would be connected to a back dune walkway lined with low fencing inland of and parallel to the restored dunes.

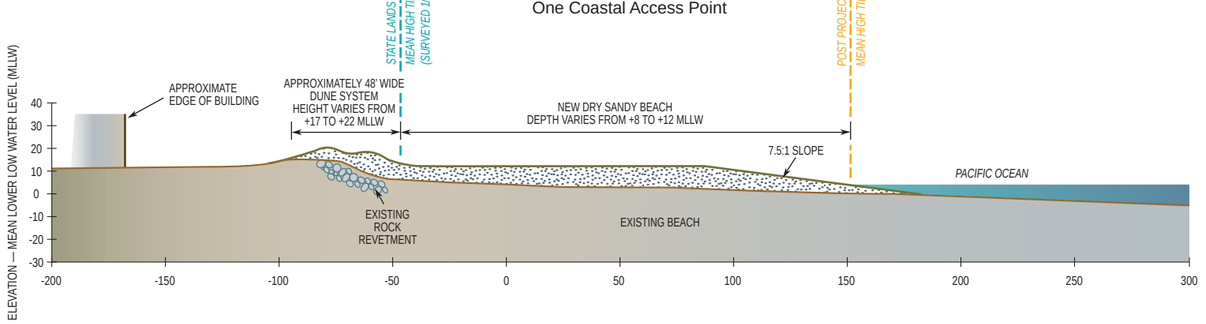
The existing two public vertical coastal access points along Broad Beach Road would remain open and the two public trails across the dunes would be roped off to limit access into the dunes. Additionally, this alternative would also recognize the public's rights to pass along public land below the January 2010 MHTL and across existing LAEs. This would ensure that over the long-term after nourishment ceases, the revetment is removed, and the beach and dunes erode, the public would continue to have access across the beach. Public access to and along these LAEs would be available when the sensitive dune habitats that overlie these LAEs eventually erode over the long-term and public access to these LAEs becomes necessary and available.

This alternative would require installation of many of the same improvements as the Project and associated construction activities. Major components would include:

- Transport of 400,000 cy sand from inland quarries to Broad Beach via 28,700 heavy haul truck trips;
- Transporting the sand from storage areas at Zuma Beach and hauling it up coast to Broad Beach with heavy trucks or scrapers;
- Redistributing sand on Broad Beach as needed with earthmoving equipment, such as bulldozers, and grading the beach fills to required dimensions;
- Creating a system of shared walkways to provide private lateral and vertical private coastal access for homeowners across the new dune system;
- Providing two vertical public access trails across the dunes to connect existing access points to the widened beach and ensuring public lateral access along the widened beach seaward of the OHWM;
- Backpassing of 25,000 to 35,000 cy of sand from the east to west end of the beach based using heavy equipment such as scrapers and bulldozers and employing nourishment triggers to account for beach width and profile; however, backpassing quantities are expected to be lower than the Project due to the increased frequency of nourishment activities under this alternative; and

Detail

REACH 3 – EAST CENTRAL
One Coastal Access Point



LEGEND

- Existing Public Access
- Approximate Limits of Beach Nourishment/ New Beach
- Existing Emergency Revetment to be Permanently Permitted
- Proposed New Dry Sandy Beach
- Proposed New Intertidal Beach Area
- Proposed Restored Dune
- Area of Dune or Beach Face (3:1 and 10:1 slopes)
- State Lands Commission Mean High Tide Line (surveyed 1/2010)
- Applicant Mean High Tide Line (surveyed 10/15/2009)
- Post Project Mean High Tide Line
- Ⓢ Existing Septic Tank
- Existing Leach Field/Drain Field
- Existing Lateral Access Easements (LAEs)
- * Easement on file, but no dry beach to dedicate
- Surf Grass
- ##### Property Address

Note: Beach dimensions and post project average high water line reflect beach status immediately after completion of beach nourishment and construction/shaping activities; the equilibrium beach that would result from dynamics such as waves, tidal and wind action would likely be of somewhat different dimensions.

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Reduced Beach Nourishment Volume and Dune Restoration with Revetment in Current Location

FIGURE 4-4

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- Initiating three future renourishment events, with the first (150,000 cy) in roughly 3 to 5 years, followed by a second, potentially larger renourishment event of up to 200,000 cy in 8 to 10 years, and a third renourishment event up to 300,000 cy in approximately 15 years.

Potential Impacts to Public Trust Resources

Similar to the Project, this alternative would result in the total deposition of 1,050,000 cy of sand over the course of four individual nourishment events throughout the Project life, though each deposition would be substantially smaller than the nourishment events proposed in the Project. This alternative would have similar impacts to the Project; however, the reduction in sand volume per deposition would potentially change effects on coastal processes, SLR, and geologic hazards, marine biological resources, terrestrial biological resources, recreation, and public access. Major changes to impacts to these resource areas relative to the Project are discussed in detail below, while the resource areas with negligible changes to impacts are summarized in Table 4-7 at the end of this subsection.

The emergency revetment would remain in its current location with dune restoration and beach nourishment burying the revetment as described for the Project. While other alternatives could be combined with this alternative (e.g., Alternative 1 or Alternative 2), no relocated or modified structures are proposed under this alternative. Under this alternative, the nourished beach would be as wide as 100 feet near the east end of Broad Beach and reduced to 50 feet on the west end. As a part of this alternative, backpassing frequency and potential volumes may be reduced, as backpassing would likely not occur the same year as a major renourishment event.[9] However, the timing and quantity of renourishment events would vary depending on results of the intensive monitoring plan and backpassing, with amounts adjusted to reflect beach width and profile.

Coastal Processes, Sea Level Rise and Geologic Hazards: Implementation of the reduced Project alternative would substantially reduce the amount of initial sand lost offshore and down coast of Broad Beach during the establishment of sand equilibrium on the beach. Further, depending upon the rate at which beach erosion proceeds, damage to the dune system and exposure of the revetment could occur as early as the second year at the west end of the beach, although this may be delayed by backpassing activities. Adding sand in smaller, more frequent increments would alter the benefits identified in Impact CP/GEO-3 by potentially exposing the beach to more rapid erosion earlier than described for the Project, but this would be offset with three additional nourishment events. The overall longevity of this effort is difficult to estimate,

[9] Precise renourishment volumes are difficult to forecast for a variety of reasons. A much smaller beach footprint would need to be recharged with sand, but backpassing may provide less effective at extending beach life due to the more limited Project area and lower sand volumes available to backpassing.

but smaller more frequent renourishment events may allow for adaptive management, potentially resulting in a wider beach profile over the long term and reduced loss of sand to longshore transport. This could prolong Project life under this alternative beyond the 10 to 20 or more years forecast for the Project. Anticipated SLR of approximately 8.5 inches by 2030 would further exacerbate erosion effects stated in Impact CP/GEO-8, including increased frequency and intensity of storm surges and wave attack.

This alternative may also result in reduced indirect closure of the Trancas Creek Lagoon mouth and reduced nourishment of Zuma Beach. However, long-term impacts would remain similar to those identified in Impact CP/GEO-2, as the beach erodes and the inadequately engineered revetment becomes exposed to damaging coastal process and wave action over the long term, leading to indirect impacts to public trust resources. Impacts CP/GEO-1, CP/GEO-4, CP/GEO-5, CP/GEO-6, and CP/GEO-7 would remain similar to the Project.

Marine Biological Resources: The reduced size and more frequent nourishment events would -incrementally increase adverse effects identified in Impacts MB-2 and MB-3 due to repeated burial of rocky intertidal and sandy intertidal habitats. Impacts to near shore subtidal marine habitats, including surfgrass, kelp, and other sensitive marine organisms as stated in MB-4 would be slightly less adverse due to decreased indirect burial. By reducing the beach width in the 1,000 feet of Reach 6 on the west end of the beach to 90 feet from more than 160 feet under the Project, this alternative would substantially reduce both direct and indirect burial of rocky habitats. In particular, by pulling back the toe of beach fill by 70 feet, this alternative would substantially reduce direct and indirect burial of surfgrass, which is concentrated within Lechuza Cove at the west end of Broad Beach. Both the depth and duration of such surfgrass burial would be reduced. Additionally, this alternative would substantially reduce indirect turbidity impacts and impacts to offshore and down coast marine resources as stated in Impact MB-7, including subtidal reefs, as less sand would be lost offshore during each nourishment event. Further, although nourishment events would occur more frequently under this alternative than described for the Project, if Alternative 4 would reduce the need for backpassing, it may incrementally reduce impacts to Impact MB-5, on sandy intertidal organisms between nourishment events. However, mortality of marcoinvertebrates and loss of beach wrack as stated in Impact MB-3 would increase under this alternative as the entire beach would be disturbed more frequently by renourishment, four times under this alternative compared to twice under the Project. Under this alternative, the duration of the nourished beach may be extended, delaying exposure of the revetment. Additionally, more renourishment events would increase the potential for accidents or spills as identified in Impact MB-6. Impacts MB-1 and MB-8 would be similar to the Project.

Terrestrial Biological Resources: Impacts TBIO-1, TBIO-6, and TBIO-8 would be similar to the Project; however, if adaptive management for this alternative is successful and the life of the nourished beach is extended, impacts to coastal dune ESHA would be

delayed. Additionally, as described above for marine biological resources, as less backpassing is anticipated under this alternative, impacts to terrestrial biological resources from backpassing identified in Impact TBIO-3 would also be reduced but similar to the Project. Further, smaller more frequent nourishment events may reduce adverse effects on the hydrology of the Trancas Creek Lagoon identified in Impact TBIO-5. Additionally, creation of shared walkways would reduce habitat fragmentation impacts identified in TBIO-7, and increase the beneficial effects associated with Impact TBIO-6. However, three major renourishment events would increase the frequency of disturbance of the entire beach, with associated mortality of marine marcoinvertebrates and diminishment of value of Broad Beach for foraging shorebirds as described in TBIO-2. Additional nourishment events would also incrementally increase adverse effects of construction activities identified in Impact TBIO-4, due to increased risk of accidental hazardous spills and resulting degradation of habitat resources.

Recreation and Public Access: Implementation of the reduced Project alternative would result in more frequent major short-term disturbance impacts to public access during construction activities identified in REC-1 with all or most of Broad Beach likely being closed to public access for several months during nourishment and renourishment events. Additionally, the east end of Zuma Beach would be disturbed during these activities, as Zuma Beach Parking Lot 12 is proposed for use for equipment staging and the beach for sand storage. Under this alternative, three renourishment events would occur after the initial nourishment, two more than included in Project; however, each of these renourishment events would be smaller, requiring a shorter duration of construction. As fewer backpassing events are anticipated, impacts identified in REC-2 would be less adverse. This alternative may also increase the beneficial recreational effects identified in Impact REC-3 by potentially incrementally extending the life of the beach through adaptive management. Long-term effects to recreation identified in Impact REC-4 would remain similar to the Project.

Other Resource Areas: This alternative would have similar or slightly incremental impacts to the Project in terms of its effects on scenic resources, air quality and GHGs, marine water quality, cultural and paleontological resources, noise, public health and safety hazards, utilities and service systems, traffic and parking, and environmental justice.

Table 4-7. Alternative 4 – Changes in Impact Severity

Resource Area	Relative Change in Impact Severity	Discussion
Scenic Resources	No Major Change in Adverse Impacts	There would be negligible changes in short-term visual and aesthetic impacts relative to the Project. While the adverse impacts associated with beach nourishment in SR-2 would occur for a shorter duration under this alternative, they would also occur at a greater frequency.
Air Quality and Greenhouse Gases	No Major Change in Adverse Impacts	There would be negligible changes in air emissions under this alternative. While there would be two additional renourishment events under this alternative relative to the Project, total sand

Table 4-7. Alternative 4 – Changes in Impact Severity

Resource Area	Relative Change in Impact Severity	Discussion
		deposition under Alternative 4 would be identical to the Project. Consequently, this alternative would have similar total emissions from trucking over the long-term, although these emissions would be spread out over a longer period.
Marine Water Quality	Incremental Increase in Adverse Impacts	There would be an incremental increase in the potential for accidents or spills relative to the Project as there would be three renourishment events under Alternative 4. In decreasing sand lost from the post construction beach, this alternative may incrementally reduce the severity of turbidity and tidal exchange impacts in MWQ-1 and MWQ-2, but increase their frequency. However, other marine water quality impacts would generally be similar to those described for the Project.
Cultural and Paleontological Resources	No Major Change in Adverse Impacts	Cultural and paleontological resource impacts would be similar to those described in the Project. This alternative would increase the number of renourishment events on Broad Beach. However, each of the renourishment events associated with this alternative would be shorter in duration relative to those described for the Project. Over the Project life, this alternative may slightly increase the amount of time heavy equipment is mobilized on Broad Beach, which could negligibly increase the adverse impacts associated with Impact CR-2. However, these impacts would be similar to those described for the Project.
Noise	Incremental Increase in Adverse Impacts	This alternative would result in two additional smaller renourishment events of shorter duration when compared to the Project. These additional renourishment events would create two additional periods of construction noise, the shorter duration of the events would result in slightly more adverse overall noise impacts on recreational users and sensitive receptors identified in Impacts N-1,N-2, and N-3 to those described for the Project.
Public Health and Safety Hazards	No Major Change in Adverse Impacts	Increased nourishment event frequency may slightly increase the potential for hazardous spills to occur, which could incrementally increase adverse effects identified in Impact HAZ-2. The increased frequency of construction under this alternative would result in negligible or similar changes to Impacts HAZ-1, HAZ-3, HAZ-4, and HAZ-5.
Utilities and Service Systems	No Major Change in Beneficial Impacts	Impacts would remain similar to the Project, as the emergency revetment would become exposed after the cessation of nourishment, resulting in the potential for damage to OWTS and other improvements. Damage to these features may also result in indirect effects to public trust resources.
Traffic and Parking	No Major Change in Adverse Impacts	Traffic impacts from construction would be similar to but reduced from the Project; less sand would be hauled during each nourishment event and there would be less severe transportation impacts for each nourishment event relative to the Project. However, two additional renourishment events would increase the frequency of traffic disruptions.
Environmental Justice	No Major Change in Adverse Impacts	There would be no appreciable difference in impacts relative to the Project.

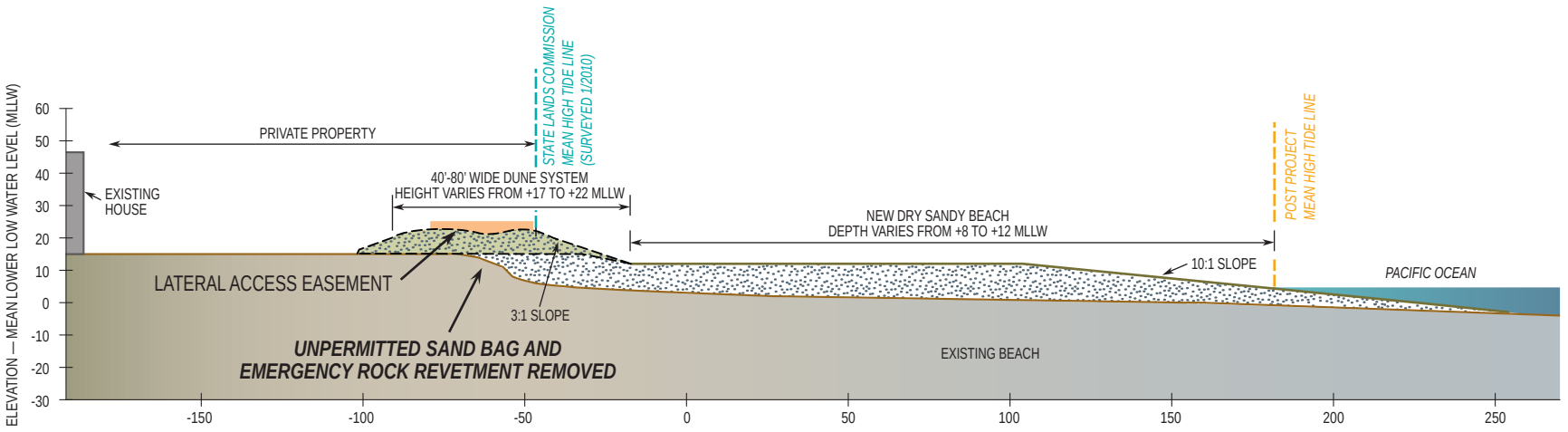
4.2.5 Alternative 5: Beach Nourishment and Dune Restoration with No Shore Protection Structure

Description

Under this alternative, Broad Beach would undergo beach nourishment, dune restoration with 600,000 cy of sand, and habitat restoration as described for the Project (see Figure 4-5.). Similar to the Project, post-construction beach width would range from 85 feet on the west end of Broad Beach (i.e., Lechuza Cove) to as wide as 230 feet near the east end of Broad Beach. Dune design would remain the same as described under the Project with dunes of approximately 40 to 60 feet wide and 17 to 22 feet above MLLW. The new post-construction dry sand beach berm and dune system would extend approximately 30 to 50 feet inland and 0 to 10 feet seaward of the OHWM. This alternative would also involve annual backpassing activities and a renourishment event following 10 years after initial beach nourishment, similar to the Project.

This alternative would involve removal of the existing shoreline stabilization structures on Broad Beach, including the existing 4,100 foot-long rock revetment and underlying sand bag revetments that were approved under emergency permits (the sand bag revetments are presumed to be intact, at least in some locations, beneath the existing visible rock revetment). Erosion of the nourished beach and dune system would occur over time similar to the Project, but under this alternative, the existing revetment would not re-emerge and provide shoreline protection in the absence of beach nourishment and backpassing activities. While removal of the emergency revetment would reduce impacts associated with recreation and public access policy inconsistencies, it would also result in major future long-term impacts associated with coastal processes and potential damage to private improvements, including private OWTS, such as septic systems and leach fields, and resultant indirect impacts to public resources.

Similar to the Project, under this alternative, public use of and access along the beach berm would be permitted to the toe of the restored dune system where a line of rope or cable and signs would prohibit access to the dune habitats. This rope or cable system, combined with the approximately 50-foot-wide dune system, would also ensure resident privacy. In addition, rather than provide for 112 coastal access walkways across the restored dunes, as proposed by the Project, this alternative would include installation of shared private coastal access walkways, with one unpaved and demarcated walkway approximately every 300 feet to be shared between six homes. The approximate 300-foot distance between walkways was selected as an intermediate value that would improve dune habitat quality while minimizing disruption to private homeowner beach access. These walkways would be connected by a shared path along the back dune, lined with a sand fence along the seaward side to minimize sand migration into private yards and minimize resident and pet access into the dune ESHA, and be roped off to minimize private access into the dune ESHA.



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Beach Nourishment and Dune Restoration with No Shore Protection Structure

FIGURE 4-5

The existing two public vertical coastal access points along Broad Beach Road would remain open and the two public trails across the dunes would be roped off to limit access into the dunes. Additionally, this alternative would also recognize the public's rights to pass along public land below the January 2010 MHTL and across existing LAEs. This would ensure that over the long-term after nourishment ceases, the revetment is removed, and the beach and dunes erode, the public would continue to have access across the beach. Public access to and along these LAEs would be available when the sensitive dune habitats that overlie these LAEs eventually erode over the long-term and public access to these LAEs becomes necessary and available.

Construction under this alternative would be similar to the Project; however, under this alternative, additional heavy construction equipment and approximately 3,600 new heavy haul truck trips would be required to remove the entire existing emergency revetment prior to initial beach nourishment activities. The removed materials would be transported to an approved location or facility (e.g., a rock quarry). Major components of this alternative would include:

- Removing the 4,100-foot long existing revetment using heavy cranes, backhoes, bulldozers and an estimated 3,600 heavy haul truck trips to transport boulders, sand bags, and other materials composing the existing revetment off of the beach;
- Redistribution of beach sand within the sand bags and removal of sand bag liners and other remaining debris;
- Transport of 600,000 cy of sand from inland quarries to Broad Beach via 43,000 heavy haul truck trips;
- Transporting the sand from storage areas at Zuma Beach and hauling it up coast to Broad Beach with heavy trucks or scrapers;
- Distributing the nourishment sand on Broad Beach with earthmoving equipment, such as bulldozers, and grading the nourished beach to dimensions similar to the Project;
- Delineating a distributed system of shared walkways (one walkway per six homes) to provide private lateral and vertical coastal access across the new dune system;
- Provide two vertical public access trails across the dunes to connect existing access points to the widened beach and ensuring public lateral access along the widened beach seaward of the OHWM;
- Backpassing of 25,000 to 35,000 cy of sand from the east to west end of the beach using heavy equipment, such as scrapers and bull dozers, with a generally annual frequency based on beach width and profile measurement triggers; and
- Initiating one future major renourishment event of approximately 450,000 cy in roughly 10 years following initial nourishment activities.

Potential Impacts to Public Trust Resources

This alternative would remove the existing emergency rock and sand bag revetment with accompanying proposed beach nourishment and dune restoration, returning Broad Beach to a wide sandy beach backed by coastal dunes. Removal of the revetment would substantially affect a number of resource areas, including coastal processes, SLR, and geological hazards, air quality, GHGs, terrestrial biological resources, utilities and service systems, recreation, and public access. Major changes to impacts of these resource areas are discussed in detail below, while the resource areas with negligible changes to impacts are summarized in Table 4-8 at the end of this subsection.

Air Quality and Greenhouse Gases: Under this alternative, criteria pollutant emissions would incrementally increase relative to the Project associated with the 3,600 additional heavy haul truck trips used to transport armor boulders offsite, as well as the operation of additional heavy equipment, necessary to remove the revetment. These emissions would increase the severity of Impact AQ-1, particularly for emissions of VOCs, which would exceed SCAQMD and VCAPCD thresholds for project-level significance under the Project, and NO_x, which would exceed SCAQMD and VCAPCD thresholds for onsite and project-level significance under the Project, including SCAQMD LSTs for construction activities. Relative to the Project, emissions of both of these criteria pollutants would incrementally increase under this alternative, as there would be additional construction activities and an increase in heavy haul truck trips associated with the removal of the revetment (Appendix G). Additionally, there would be an incremental increase in other criteria pollutants. GHG emissions described in Impact AQ-2 would remain below SCAQMD and VCAPCD thresholds. TAC emissions related to diesel engines and construction activities would also increase, with Impact AQ-3 becoming incrementally more severe.

Coastal Processes, Sea Level Rise and Geologic Hazards: Removal of the revetment would substantially increase the potential impacts of coastal processes on existing private improvements, including OWTS across the length of the 4,100-foot revetment. Erosion of beach and dunes after cessation of nourishment would continue as described under the Project, with the benefits of nourishment enduring for an estimated 10 to 20 or more years as described in Impact CP/GEO-3. Following the effective life of the beach nourishments and backpassing activities, existing homes, OWTS, and other improvements would once again become exposed to coastal processes as a result of persistent erosion associated with wave action. Under this alternative, after the revetment is removed potential impacts of coastal processes on the revetment identified in Impact CP/GEO-2 would no longer apply, as the revetment would be removed. However, as a consequence of removing the revetment, it would no longer act as a last line of defense to coastal processes, and damage to homes, OWTS, and accessory structures would be increased from coastal erosion, as well as associated indirect

impacts to public trust resources identified in Impact CP/GEO-2, such as impacts to water quality.

Removal of the existing rock and sand bag revetments would also affect coastal processes by initially decreasing wave refraction and allowing the created dune system to erode, thereby increasing nourishment of down coast beaches (e.g., Zuma Beach). Impact CP/GEO-7 would remain beneficial, as effects of the longshore currents on nourishment and renourishment of sand in the short- to mid-term include both erosion of sand from Broad Beach and accretion of sand at down coast beaches. This beneficial impact would be incrementally increased under this Alternative as additional dune sand would be exposed seaward of the homes. However, over the long-term, longshore currents would transport this sand farther down coast and possibly offshore. Further, when erosion reaches homes and OWTS, adverse impacts would occur as debris, pollutants, and other materials are washed into the surf zone following damage from wave action.

With cessation of beach nourishment, impacts to homes, OWTS, and accessory structures from coastal erosion described in Impact CP/GEO-2 would become substantially more severe. The dune system would erode and homes would be exposed to damage and destruction as the dune field alone does not appear to constitute adequate protection from wave attack during major storm events. As demonstrated by dune erosion occurring during the winter of 2013-2014, where sand erosion of up to 100 feet was observed at the beaches' west end, the dune system may slow, but not halt, coastal erosion absent major changes in climatic cycles and the sediment budget of this littoral cell or continuing renourishment beyond the life of the Project or this alternative. Sea level rise, anticipated to be approximately 8.5 inches by 2030 would further exacerbate erosion effects stated in Impact CP/GEO-8.

Removal of the revetment would substantially increase direct impacts to revetment stability identified in Impact CP/GEO-1, while exposing homes, OWTS and other improvements to impacts from wave action. The removal of the revetment and eventual erosion of the dunes would lead to more damage to homes, private improvements, and/or OWTS, resulting in adverse indirect consequences for public trust resources. These effects would be experienced over the long-term and would be temporarily reduced by backpassing activities and the follow-up renourishment event. Following the cessation of nourishment, homeowners may again request or install emergency coastal protection structures to prevent the impacts resulting from long-term erosion, which may result in major geological impacts related to the public trust resources. Impacts CP/GEO-4, CP/GEO-5, and CP/GEO-6 would remain similar to the Project.

Terrestrial Biological Resources: The removal of the revetment under this alternative would directly impact the existing degraded dune habitats, as heavy equipment would operate on and near these degraded dunes to remove the existing rock and sand bag

revetments. This would potentially increase the adverse effects of short-term construction associated with Impact TBIO-2. Although this equipment would be operated from the seaward side of the revetment, impacts to ESHA would still be likely to occur. These impacts would be largely offset by successful implementation of dune restoration. Hazardous spill impacts due to the removal of the revetment may also increase impacts described in TBIO-4.

However, removal of the existing rock and sand bag revetment would allow for the more natural movement of windblown sand within the restored active coastal dunes relative to the Project, resulting in less beneficial impacts to dune habitat functions under this alternative, at least over the next 10 to 20 years. Additionally, the construction of shared walkways at 300-foot intervals would reduce dune habitat fragmentation, ultimately reducing the adverse effects of private access across the restored dune system as stated in TBIO-7. However, over the long term, cessation of nourishment and elimination of the revetment would eventually lead to the erosion of the restored southern foredune habitat in the rear yards of private residences over the long-term, as no hard stabilization structure would be in place as a last line of defense to protect this area. This would represent an additional long-term adverse impact to terrestrial biological resources at Broad Beach as stated in Impact TBIO-8. Implementation of the long-term monitoring and maintenance activities and adaptive management strategies described in AMM TBIO-1a, would reduce, but not eliminate this impact. Impacts TBIO-1, TBIO-3 and TBIO-5 would remain similar to the Project.

Utilities and Service Systems: The removal of the existing emergency rock and sand bag revetments would eliminate the beneficial impacts identified in UTL-1 associated with these shoreline stabilization structures with regards to protection of OWTS from coastal erosion. Following long-term erosion of beach and dunes, approximately 60 OWTS in the rear yards of private residences would become exposed to the effects of coastal erosion, substantially increasing impacts to public trust resources associated with release of sewage effluent identified in Impact UTL-2. However, revetment removal will reduce impacts to drainage systems described in UTL-3. The analysis of impacts to OWTS in the Broad Beach Coastal Engineering Report, completed by Moffatt & Nichol in 2013, projects that coastal erosion could reach and destroy exposed OWTS for many homes that lack sufficient area for landward relocation (Appendix B).

Potential for such dune erosion was recently exemplified in the winter of 2013-2014 when wave action largely destroyed existing sand bag and Sakrete revetments protecting homes and dunes at the east end of Broad Beach. As a result of this wave attack and destruction of sand bar and Sakrete revetments, the wide dune system at the east end of Broad Beach was eroded landward by 80 to 100 feet to within 30 to 50 feet of existing homes. Following cessation of nourishment and erosion of the beach and dune system in 10 to 20 or more years, another emergency revetment would likely be

requested by homeowners to prevent destruction of homes and OWTS by wave attack and the associated indirect impacts to public trust resources.

Recreation and Public Access: This alternative would result in increased adverse effects associated with Impact REC-1, as heavy equipment utilized for revetment removal would reduce public access during construction activities. However, by removing the sand bag and rock revetments, this alternative would be the most consistent with coastal policies concerning public access and minimizing use of hard coastal protection structures. Short to medium-term beneficial impacts in REC-3 would also increase due to the removal of the revetment. Impact REC-2 would remain similar to the Project.

As identified in Impact CP/GEO-2, after cessation of nourishment and eventual erosion of the wide sandy beach and dune system, impacts described in Impact REC-4 would be less adverse as the revetment would no longer be in place after long-term cessation of beach nourishment. However, the public access benefits of the wide sandy beach of this alternative would be eliminated. Lateral access would again be restricted to low and medium tides. Further, as the beach erodes back to the dunes, public access would be dependent upon a patchwork of LAEs, the locations of which are often uncertain to beachgoers. This could again bring homeowners and beachgoers into conflict over private versus public property. Eventually, as erosion reaches homes, OWTS, and other improvements, beachgoers would encounter obstacles to lateral access, including debris, OWTS, effluent, or other barrier to use and enjoyment of public trust resources; owners may also request or install emergency coastal protection structures, further limiting public access.[10]

Marine Water Quality: Removal of the emergency rock and sand bag revetment would result in the potential for impacts to marine water quality to occur resulting from long-term erosion and potential damage to existing OWTS occurring behind existing revetments. Construction related to revetment removal would have more adverse impacts to water turbidity as described in Impact MWQ-1. Under this alternative, the beneficial impacts described under Impact MWQ-3 would not occur as the existing revetment would be removed and would no longer serve as the last line of defense for existing development along Broad Beach. This would constitute a major adverse impact and would likely cause homeowners to install or request installation of additional emergency revetments in response to the long-term erosion of Broad Beach after the cessation of proposed nourishment activities. Impacts MWQ-2 and MWQ-4 would remain similar to the Project.

[10] Although permits are required prior to installing emergency coastal protection structures, in some emergency situations homeowners have installed structures in order to protect their homes without first obtaining authorization. This would likely occur again in future emergencies.

Other Resource Areas: This alternative would have similar impacts to the Project for scenic resources, marine biological resources, cultural and paleontological resources, noise, public health and safety hazards, traffic and parking, and environmental justice.

Table 4-8. Alternative 5 – Changes in Impact Severity

Resource Area	Relative Change in Impact Severity	Discussion
Scenic Resources	Incremental Short-term Increase and Long-term Decrease in Adverse Impacts	There would be a slight increase in adverse effects associated with Impact SR-2, as this alternative would result in additional construction equipment relative to the Project. However, removal of the revetment would eliminate the potential for long-term exposure eliminating the adverse effects associated with Impact SR-1. Eventual destruction of homes, patios and OWTS by coastal erosion would create additional aesthetic impacts. All other impacts to scenic resources would be either negligible or similar to the Project.
Marine Biological Resources	No Major Change in Adverse Impacts	There would be no appreciable difference in direct effects relative to the Project. Under this alternative, impacts to marine biological resources would remain similar or slightly increased relative to the Project. However, over the long-term, exposure of OWTS to wave attack could create indirect impacts to such marine biological resources due to release of septic effluent into the surf zone.
Cultural and Paleontological Resources	No Major Change in Adverse Impacts	Additional disturbance of the near shore environment associated with removal of the emergency revetment would result in an increased potential to disturb cultural resources, slightly increasing the severity of the adverse effects associated with Impact CR-1. However, as heavy equipment would only be operated on the seaward side of the revetment, the probability of uncovering cultural resources would be minimal. All other cultural and paleontological impacts would be similar to the Project.
Noise	Incremental Increase in Adverse Impacts	Operation of additional heavy haul trucks, cranes, and bulldozers used during revetment removal would incrementally increase the severity of the adverse effects associated with Impact N-1. All other noise impacts would be either similar or slightly increased in relation to the Project.
Public Safety and Health Hazards	Incremental Increase in Adverse Impacts	Additional heavy equipment used during revetment removal would increase the potential for incidental release of hazardous materials, resulting in an incremental increase in the severity of Impact HAZ-2. Further, operation of additional heavy equipment on the beach would increase the short-term hazardous conditions during construction, incrementally increasing the severity of Impact HAZ-3. Impact HAZ-5 would also become a long-term or permanent beneficial impact instead of having a short- to mid-term duration. Impact HAZ-1 would also no longer be relevant, as the revetment would no longer be present to create potential hazards.
Traffic and Parking	Incremental Increase in Adverse Impacts	Revetment removal would require an additional 3,600 truck trips and additional heavy equipment over that required for the Project. This would incrementally increase severity of the adverse effects associated with Impact TR-1 and potentially TR-2, depending on the disposal location of the removed

Table 4-8. Alternative 5 – Changes in Impact Severity

Resource Area	Relative Change in Impact Severity	Discussion
		boulders (i.e., rock quarry). Other traffic impacts would be similar to the Project.
Environmental Justice	No Change	There would be no appreciable difference in impacts relative to the Project.

4.2.6 Alternative 6: Relocation of Improved Revetment along Upgraded Leach Fields with Beach Nourishment and Dune Restoration

Description

A key goal of this alternative would be to ensure improved disposal of wastewater at Broad Beach, consistent with existing codes. This alternative would include beach and dune restoration identical to the Project, as well as strengthening of the existing revetment and relocation of segments of this revetment. However, this alternative would differ from the Project and the other alternatives in that the existing OWTS located seaward of the residences at Broad Beach would be upgraded to meet current code. Because leach fields for such upgraded OWTS are space-intensive, parcels with limited room for such upgrades near the west end of the existing revetment would require seaward relocation of the revetment. Under this alternative, the majority of the revetment would remain in place, with eastern segments relocated substantially landward and areas to the west relocated seaward onto public trust lands.

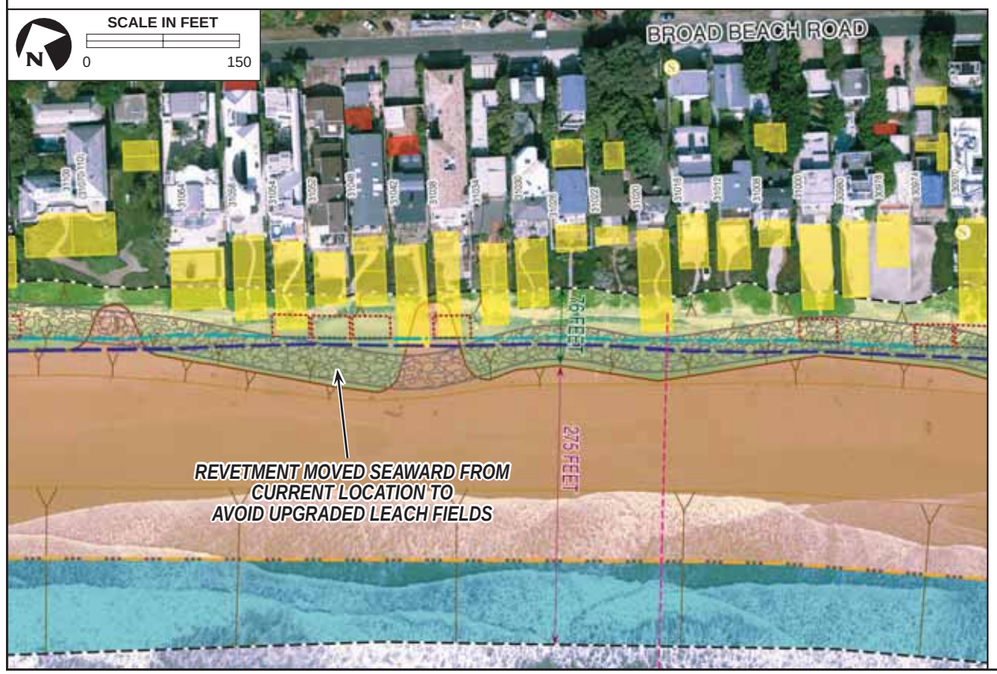
Beach nourishment, dune creation, and habitat restoration components under this alternative would remain similar to those described for the Project, with approximately 43,000 haul heavy trips being required to haul 600,000 cy of sand from inland quarry sources. Similar to the Project, post-construction beach width would range from 85 feet on the west end of the Project area (i.e., Lechuza Cove) to as wide as 230 feet near the east end of Broad Beach. Dune habitats would be established and restored by creating a sand berm that would run along the length of the beach, with a minimum of 2 feet of sand over the existing rock and sand bag revetment. The beach berm would extend approximately 30 to 50 feet inland and 0 to 10 feet seaward of the revetment, depending on location. The restored dune system, consisting of hummocks varying in height from 17 to 22 feet above MLLW would be constructed on top of this berm. The width of the dune system would vary from 50 to 60 feet wide. In places, these dunes would overlie expanded leach fields of OWTS and in places would extend further seaward below OHWM than under the Project.

This alternative would include upgrades to and relocation of OWTS and/or leach fields as far landward as feasible, consistent with the location of existing primary residences, but regardless of existing auxiliary buildings, landscape, and hardscape (Moffatt & Nichol 2013). Most properties at Broad Beach would require significantly larger leach fields to meet current code, in most cases this would include doubling of the size of the leach field. Homes along the eastern reaches of the beach often have setbacks of 75 to 100 feet or more from the revetment, providing space for leach field expansion. In contrast, homes in the central and western reaches of the beach have smaller setbacks from the existing revetment, which limits space necessary for expansion of existing leach fields.

SCALE IN FEET
0 370

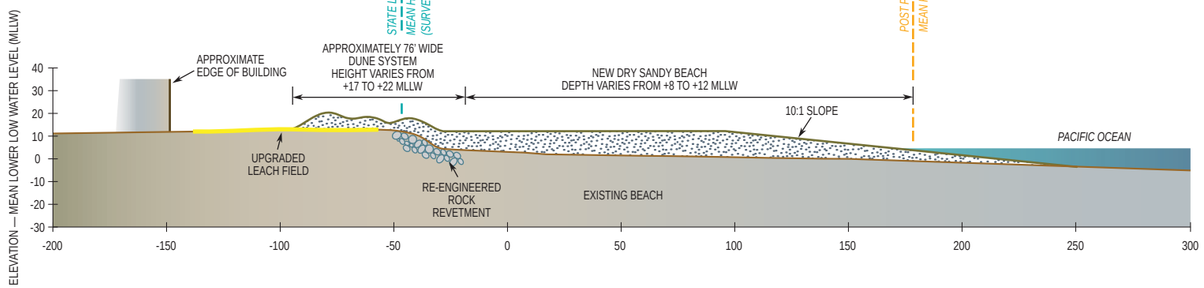
Detail

SCALE IN FEET
0 150



REACH 3 – EAST CENTRAL

One Coastal Access Point



LEGEND

- Existing Public Access
- Approximate Limits of Beach Nourishment/ New Beach
- Existing Emergency Revetment to be Permanently Permitted
- Proposed New Dry Sandy Beach
- Proposed New Intertidal Beach Area
- Proposed Restored Dune
- Area of Dune or Beach Face (3:1 and 10:1 slopes)
- State Lands Commission Mean High Tide Line (surveyed 1/2010)
- Applicant Mean High Tide Line (surveyed 10/15/2009)
- Post Project Mean High Tide Line
- Existing Septic Tank
- Existing Leach Field/Drain Field Not Requiring Upgrade
- Upgraded Leach Field
- Existing Lateral Access Easements (LAEs)
- * Easement on file, but no dry beach to dedicate
- Surf Grass
- ##### Property Address

Note: Beach dimensions and post project average high water line reflect beach status immediately after completion of beach nourishment and construction/shaping activities; the equilibrium beach that would result from dynamics such as waves, tidal and wind action would likely be of somewhat different dimensions.

amec

Relocation of Improved Revetment along Upgraded Leach Fields with Beach Nourishment and Dune Restoration

FIGURE 4-6

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Under this alternative, the emergency revetment would be relocated landward where feasible along the upgraded leach fields. Ensitu (2013) estimated that landward relocation of the revetment would be infeasible for all properties west of 30918 Broad Beach Road due to leach field encroachment within the wave run-up zone. However, research into required setbacks for OWTS did not uncover a documented requirement between an OWTS and Wave-Uprush Line. In addition, the OWTS would be protected by both the revetment and overlying sand dunes, which are projected to endure for 10 to 20 or more years. The revetment and sand dunes would minimize potential for wave uprush to affect the OWTS. Therefore, wave run-up was not used to guide design of this alternative, but is assessed as a potential impact.

Consequently, this alternative includes landward relocation to the maximum extent feasible consistent with expanded leach fields, but acknowledges that after the cessation of nourishment and erosion of the beach and overlying dunes in 10 to 20 or more years there may be OWTS impacts due to splashing or overtopping of the exposed revetment during large storms (see *Utilities and Service Systems* discussion below). Regardless, as a result of increasing the leach field size for each property, it is likely that segments of the revetment would be relocated *further* seaward onto public land in some locations west of 30918 Broad Beach Road. This would result in major trade-offs between potential impacts to water quality and recreation, and public access. The reinforced revetment would be no wider than the existing 38-foot width at its base with a crest elevation of approximately 15 feet above Mean Low Low Water (MLLW). This design would be required to demonstrate that the armoring of the existing revetment would not increase the width of the revetment to minimize beach coverage, which may require removal of existing smaller stones, or incorporation of these smaller stones into a steeper reinforced revetment.

Similar to the Project, public use of and access along the beach berm under this alternative would be permitted to the toe of the restored dunes where a line of rope or cable and signs would prohibit access to potential ESHA within the dunes. This rope or cable system, combined with the approximately 50-foot-wide dune system, would also ensure resident privacy. In addition, rather than provide for 112 unpaved coastal access walkways across the restored dunes, as included in the Project, this alternative would include installation of shared private coastal access walkways, with one walkway approximately every 300 feet to be shared between six homes. These walkways would be connected by a shared path along the back dune, lined with a sand fence along the seaward side to minimize sand migration into private yards and minimize resident and pet access into the dune habitat. Each of these walkways would be roped off to minimize private access into the dune habitats. This distance was selected as an intermediate value that would retain dune habitat continuity and quality while minimizing disruption to private homeowner beach access.

The existing two public vertical coastal access points along Broad Beach Road would remain open and the two public trails across the dunes would be roped off to limit access into the dunes. Additionally, this alternative would also recognize the public's rights to pass along public land below the January 2010 MHTL and across existing LAEs. This would ensure that over the long-term after nourishment ceases, the revetment is removed, and the beach and dunes erode, the public would continue to have access across the beach. Public access to and along these LAEs would be available when the sensitive dune habitats that overlie these LAEs eventually erode over the long-term and public access to these LAEs becomes necessary and available.

This alternative would involve additional new major construction activities compared to the Project. Installing a properly engineered revetment would require use of heavy equipment to remove some of the boulders, move some of the existing boulders inland, and install larger boulders to enhance revetment stability. Revetment reconfiguration would require an estimated 4,500 new haul truck trips to deliver additional boulders (approximately two or three boulders per truck) to the beach in order to armor approximately 3,650 feet of the revetment, as well as for potential export of smaller stones as needed.[11] Armoring would consist of placing a layer of boulders (one or two boulders deep) from below the revetment toe to its crest. A somewhat larger staging area within the Zuma Beach Parking Lot 12 may also be required to accommodate additional equipment and material storage. Additional construction equipment would also be required to relocate the existing rock revetment and move and position new rock, such as one or two heavy cranes and bulldozers along with additional associated construction personnel,. This would result in increased fueling activity and additional traffic along the beach. This additional truck traffic would increase congestion associated with sand importation by approximately 10 percent. Traffic control measures for sand haul trucks entering and leaving the parking lot, as well as transiting along the beach would be implemented.

In addition, because the revetment would be located further landward, additional excavation and construction would be requires for patio and landscape removal, as well as upgrade and relocation of existing OWTS. These activities may be scheduled concurrently or preceding beach nourishment and thus would extend the projected construction horizon beyond the proposed 8 months by at least 1 to 2 months.

- Upgrade and expansion of all OWTS that are located seaward of primary structures to roughly double the size of leach fields, thereby meeting existing code requirements and improving wastewater disposal;
- Relocation of the existing rock and sand bag revetment using heavy cranes and bulldozers to an inland configuration, where feasible, along the seaward edge of

[11] The westernmost 470 feet of the emergency revetment was built to a different standard and incorporated larger boulders; thus it would not receive further armoring.

the upgraded OWTS locations (in some locations, the revetment may have to be relocated seaward to accommodate the upgraded leach fields);

- Importing large 3- to 5-ton boulders via an estimated 4,500 heavy haul truck trips and potentially exporting a portion of the smaller existing rock revetment;
- Placing new larger boulders over and at the toe of the existing revetment using heavy cranes and bulldozers;
- Transporting 600,000 cy of sand from inland quarries to Zuma Beach via 43,000 heavy haul truck trips;
- Transporting the sand from storage areas at Zuma Beach and hauling it up coast to Broad Beach with heavy trucks or scrapers
- Redistributing sand on Broad Beach as needed with earthmoving equipment, such as bulldozers, and grading the beach fills to required dimensions;
- Creating a system of shared unpaved walkways to provide private lateral and vertical private coastal access for homeowners across the new dune system;
- Provide two vertical public access trails across the dunes to connect existing access points to the widened beach and ensuring public lateral access along the widened beach seaward of the OHWM;
- Performing backpassing of the sand, ranging from 25,000 to 35,000 cy, from the east to west end of the beach based on triggers and using heavy equipment, such as scrapers and bull dozers; and
- Initiating one future major sand supply renourishment event of approximately 450,000 cy in roughly 10 years.

Potential Impacts to Public Trust Resources

This alternative to the Project would result in additional construction activities associated with upgrade of the existing OWTS, demolition of improvements to provide space for such upgrades, and landward relocation of the revetment where feasible or required to accommodate OWTS upgrades. This alternative would result in major trade-offs concerning potential water quality impacts and impacts to recreation and public access (see Illustration 4-4). This alternative would also result in major changes to impacts associated with terrestrial biological resources. Adverse impacts resulting from this alternative may include effects on coastal dune ESHAs on the eastern end of Broad Beach identified in the Malibu LCP, as well as an incremental increase in potential for hazardous spills in the terrestrial environment. Further, public access during construction activities would be incrementally reduced relative to the Project due to increased heavy equipment use. Beneficial impacts associated with this alternative would include reduced long-term potential impacts to marine water quality protection. However, this alternative may be less consistent with coastal public access and recreation policies, as the revetment would remain in its current location partially overlying public lands for more than 50 percent of its reach. Further, seaward relocation

of the existing revetment may even be required in front of up to 20 homes in order to permit OWTS expansion. Resource areas with major changes to impacts relative to the Project are discussed in detail below, while the resource areas with negligible changes to impacts are summarized in Table 4-9 at the end of this subsection.

Air Quality and Greenhouse Gases: Criteria pollutant emissions would increase by more than 10 percent relative to the Project associated with the 4,500 additional heavy haul truck trips used to transport armor stone and the operation of additional heavy equipment necessary to upgrade and relocate the OWTS. Further, operation of additional heavy equipment would be necessary to relocate and improve the revetment. These emissions would increase the severity of Impact AQ-1, particularly for emissions of VOCs, which would exceed SCAQMD and VCAPCD thresholds for project-level significance, and for $NO_{X,}$ which would exceed SCAQMD and VCAPCD thresholds for both onsite and project-level significance similar to the Project, including SCAQMD LSTs for construction activities. Emissions of these criteria pollutants would substantially increase under this alternative when compared to the Project due to additional construction activities and a 10 percent increase in heavy haul truck trips (Appendix G). Additionally, this alternative would incrementally increase other criteria pollutants including CO, SO_x, and PM. This increase in emissions relative to the Project, particularly the increase in VOC and NO_x emissions, would require implementation of AMMs, such as use of newer haul trucks with clean-burning diesel engines, but would still have a major adverse effect. GHG emissions described in Impact AQ-2 would remain below SCAQMD and VCAPCD thresholds. TAC emissions related to diesel engines and construction activities as stated in Impact AQ-3 would also incrementally increase, but would remain below thresholds.

Coastal Processes, Sea Level Rise, and Geologic Hazards: Similar to Alternatives 1 and 2, reinforcement of the revetment with 3- to 5-ton armor stone would reduce the potential impacts of coastal processes on existing private improvements, including upgraded OWTS across the majority of the length of the existing 4,100-foot revetment. Erosion of the beach and dunes after cessation of nourishment would continue as described under the Project, with the benefits of nourishment enduring for an estimated 10 to 20 or more years, followed by a reemerging revetment as a result of persistent wave action. Anticipated SLR of approximately 8.5 inches by 2030 would have the same erosion effects described in Impact CP/GEO-8 as the Project, including increased frequency and intensity of storm surges and wave attack. However, after the revetment is exposed, potential impacts of coastal processes on the revetment identified in Impact CP/GEO-2 would be reduced as the revetment would be substantially strengthened by addition of heavier armor stones. Consequently, beneficial impacts to public trust resources identified in Impact CP/GEO-3 (e.g., water quality) due to protection to homes, OWTS, and accessory structures from coastal erosion would be increased. Although, the reengineered revetment would provide long-term protection for existing

development from coastal erosion, its potential relocation further below the OHWM might incrementally alter coastal processes and impact public trust lands.

Similar to the impact of the existing revetment, the reengineered revetment would also impact coastal processes by incrementally increasing wave refraction when exposed and negligibly depriving down coast beaches (e.g., Zuma Beach) of a minor source of sand from dune erosion. However, Impact CP/GEO-7 would remain beneficial as effects of the longshore currents on nourishment and renourishment of sand in the short- to mid-term include both erosion of sand from Broad Beach and accretion of sand at down coast beaches.

The reinforced revetment with larger boulders as coastal armoring would increase the structural stability of the revetment, reducing potential adverse impacts under the Project associated with persistent wave attack. This alternative would substantially reduce the adverse effects associated with Impact CP/GEO-1. However, if the revetment could not be keyed into the bedrock located at 16 feet below ground level, the risk of liquefaction, seismic settlement, and lateral spreading in the event of an earthquake would still exist as described for the Project (SubSurface Designs, Inc. 2006). Impacts CP/GEO-4, CP/GEO-5 and CP/GEO-6 would remain similar to the Project.

Terrestrial Biological Resources: The upgrade and relocation of existing OWTS and the relocation of approximately 1,000 feet of the eastern segment of the existing revetment would require use of heavy cranes and bulldozers that would have major adverse effects on the existing, but often degraded southern foredune habitat fronting the homes along Broad Beach. Although much of the habitat in these areas has been subject to landscaping with non-native and invasive plant species associated with adjacent residential development, this area consists of southern foredunes, a habitat type identified as rare by the CNNDB and the CNPS. Moreover, due to the rarity and biological significance of dune habitat in Southern California, southern foredunes are designated as ESHA under the Malibu City LCP. Upgrade and relocation of the existing OWTS and installation of large boulders in these existing degraded dunes would create major adverse impacts to native southern foredune vegetation and/or sensitive wildlife as stated in Impact TBIO-2. As the revetment would be relocated up to approximately 20 feet further landward in places under this alternative relative to the Project, the relocation and reinforcement of the revetment would substantially increase the impacts to existing degraded southern foredune habitat; however, much of the highest quality remaining dune habitat at the east end of Broad Beach was eroded and destroyed by wave action in the winter of 2013-2014, particular during the storm of March 2, 2014.

Adverse effects to ESHAs resulting from this alternative would be similar to those described in Impact TBIO-1 for the Project. Additionally, due to the upgrade and relocation of OWTS, this alternative would result in even more severe impacts than

Alternative 1 and 2 to remnant dune habitats although this impact would be largely offset by successful dune creation. Impact TBIO-4 may also become more severe due to operation of additional heavy equipment within ESHAs necessary to upgrade and relocate the existing OWTS as well as the revetment. However, the potential beneficial effects of dune restoration associated with Impact TBIO-6 would be less beneficial this alternative, offsetting adverse impacts to existing degraded ESHA. Additionally, requiring shared private coastal access walkways would also substantially reduce disturbance of the proposed dune system as described in TBIO-7, protecting this newly established and restored dune habitats. Impacts TBIO-3 and TBIO-5 would remain similar to the Project.

Recreation and Public Access: This alternative would result in the operation of substantial additional heavy equipment on Broad Beach which would increase short-term adverse effects to public access associated with Impact REC-1. However, while landward relocation of the revetment along the upgraded and relocated leach fields would increase consistency with coastal public use and recreation policies in some locations, particularly east of 30918 Broad Beach Road, in other locations leach field expansion would result in relocation of the revetment seaward, *further* onto public lands. Consequently, under this alternative, the revetment could cover larger areas of public trust land or LAEs than described for the Project. This would result in a major increase in the severity of Impact REC-4. This alternative would be substantially less consistent with coastal polices for recreation and public access.

After the 10- to 20- or more year Project life, nourishment sand would be washed away through erosion and the beach would recede back to the new revetment, leaving little to no dry-sand beach area for recreation without continued renourishment. However, a maximum landward-relocated revetment combined with increased dune width at the east end of Broad Beach would provide limited additional room for public beach use at the east end of Broad Beach, particularly at low and moderate tides. This would decrease the beneficial effects of Impact REC-3. However, this benefit may be offset by less accessible beach on the west end of Broad Beach and by rising sea levels after 2050. In addition, impacts related to backpassing as stated in Impact REC-2 would be similar to the Project.

Marine Water Quality: Unlike the Project or any of the other alternatives, this alternative would see the upgrade of each of the OWTS for many of the residences along Broad Beach Road. This alternative would bring each of the existing systems up to city code and move each of the systems as far landward as practicable. Further, this alternative would include the installation of a properly engineered revetment that would substantially reduce potential impacts to marine water quality. Potential damage to homes, OWTS, and accessory structures from coastal erosion would be reduced and beneficial impacts to public trust resources identified in Impact MWQ-3 would be increased, as the reengineered revetment would provide long-term protection of existing development from coastal erosion. However, leach fields west of 30918 Broad Beach

Road would be located within 15 feet of the wave uprush limit calculated by Moffatt & Nichol (2013). Consequently, after cessation of beach nourishment and erosion of the newly widened beach in 10 to 20 or more years these leach fields may experience splashing or minor seawater intrusion from waves overtopping the improved revetment during large 100-year storm events, which may incrementally impact near shore water quality. However, this would also require waves to erode the overlying seaward end of the dune system.

Further, after cessation of nourishment and erosion of the beach in 10 to 20 or more years, the CSLC would consider disposition of all improvements overlying state sovereign lands and LAEs and would address these issues as part of lease extension or termination. However, while impacts to marine water quality would be substantially reduced under this alternative, Alternative 6 would involve major trade-offs which recreation and public access, as discussed above. All other impacts identified in Section 3.5, *Marine Water Quality* would be similar to the Project.

Utilities and Service Systems: As previously described, this alternative differs from the Project and each of the alternatives in that it includes upgrades and relocation of the OWTS many of the residences along Broad Beach Road. Additionally, similar to Alternative 1 and 2, the alternative would relocate the revetment inland where feasible, though, due to the increase in the size of the upgraded leach fields, the revetment would be extended *further* seaward onto public land in some locations. West of 30918 Broad Beach Road, where landward movement is not possible in front up to 20 residences, the revetment would be redesigned and narrowed, but would still lie partially on or in front of the public lands in these areas, resulting in a major adverse effect to recreation and public access.

This alternative would resolve future potential permitting issues with the city of Malibu and potentially other agencies as properties are reviewed for compliance with city code if repairs or upgrades are made to an existing OWTS. Such repairs are required for major remodels or home expansion and for resale (Ensitu 2013) (see Illustration 4-4).

Illustration 4-4: *This alternative would include the upgrade and landward relocation of OWTS for all residences fronting the Project area (pictured). This would reduce potential adverse impacts associated with water quality and utilities, but would result in major trade-offs with regard to recreation and public access as the revetment would have to be located seaward of the existing location in many areas in order to accommodate additional leach field space.*

Under this alternative, beach nourishment, OWTS upgrades, and, to a greater degree, reinforcement of the existing revetment would reduce potential impacts to Utilities and

Service Systems. This alternative would substantially increase the beneficial impacts associated with UTL-1. Potential damage to OWTS from coastal erosion, and associated indirect impacts to public trust resources identified in Impact UTL-2, including adverse effects to water quality and public use and enjoyment of the beach and ocean would be substantially reduced, as the reinforced revetment would provide long-term protection of OWTS from coastal erosion. However, leach fields west of 30918 Broad Beach Road would be located within 15 feet of the wave uprush limit calculated by Moffatt & Nichol (2013) after cessation of nourishment activities and erosion of the newly widened beach and dune system in 10 to 20 or more years. Consequently, these leach fields may experience splashing or minor seawater intrusion from waves overtopping the improved revetment during large 100-year storm events.

Relocation of the revetment inland would also result in similar public drainage-related impacts of the Project as discussed in Impact UTL-3, as construction of the restored dunes and beach nourishment would bury or obstruct public drainages. Similar to the Project, Impact UTL-3, such impacts would be a minor adverse effect with implementation of AMM UTL-3 (Master Drainage Plan).

Other Resource Areas: This alternative would have similar or incremental changes to impacts in comparison to the Project for scenic resources, marine biological resources, cultural and paleontological resources, noise, public health and safety hazards, traffic and parking, and environmental justice.

Table 4-9. Alternative 6 – Changes in Impact Severity

Resource Area	Relative Change in Impact Severity	Discussion
Scenic Resources	No Major Change in Adverse Impacts	Additional construction equipment associated with OWTS upgrade and landward relocation of the revetment may intensify the adverse impacts associated with temporary construction activities, with a slight increase in the severity of adverse effects associated with Impact SR-2. Similar to the Project, permanent authorization of the revetment through a long-term lease and approval of CDPs would create the potential for long-term degradation of the visual environment of Broad Beach after nourishment activities end and natural coastal erosion causes the revetment to become exposed as described in Impact SR-1. All other scenic resource impacts would be similar or slightly increased in comparison to the Project.
Marine Biological Resources	Incremental Decrease in Indirect Adverse Impacts	Placement of sand and potential burial of rocky intertidal and subtidal marine biological resources would have a major adverse effect to intertidal habitats and offshore habitats of Broad Beach similar to the Project as described in Impacts MB-2, MB-3, and MB-4. Additionally, similar to the Project, impacts to down coast habitats would be negligible as discussed in Impact MB-7. However, potential indirect impacts associated with water pollution from damage to OWTS from coastal erosion would be reduced along the length of the

Table 4-9. Alternative 6 – Changes in Impact Severity

Resource Area	Relative Change in Impact Severity	Discussion
		existing revetment with improved coastal armoring. Further, this alternative would potentially conflict with the city of Malibu LCP and California Coastal Act policies resulting in increased impacts as stated in MB-8.
Cultural and Paleontological Resources	No Major Change in Adverse Impacts	Disturbance of the near shore environment associated with the OWTS upgrades and landward relocation of the revetment would result in a slightly increased potential to disturb cultural resources, resulting in an additional adverse impact similar in type to Impact CR-1. However, implementation of standard BMPs would reduce this impact. All other cultural and paleontological impacts would be similar to the Project.
Noise	Incremental Increase in Adverse Impacts	A temporary increase in noise due to additional construction activities associated with the landward relocation of the revetment would result in adverse impacts to beach users. Consequently, this alternative would result in slight increases in adverse effects associated with Impact N-1. However, these impacts would be reduced through implementation of AMM N-1a, similar to the Project. All other noise impacts would be similar to the Project.
Public Health and Safety Hazards	No Major Change in Adverse or Beneficial Impacts	This alternative would result in a slight increase in the adverse effects associated with Impact HAZ-2, as the presence of additional heavy construction equipment (i.e., bulldozers, cranes, and haul trucks) would increase the potential for an incidental release of hazardous material on Broad Beach. The increase in construction equipment and construction personnel would also result in increased inaccessibility and hazardous conditions during construction, slightly increasing the severity of adverse effects associated with Impact HAZ-3. These impacts would be reduced through implementation of AMMs HAZ-2, HAZ-3a, and HAZ-3b. All other public health and safety hazard impacts would be similar to the Project.
Traffic and Parking	Incremental Increase in Adverse Impacts	Landward relocation of the revetment would require an estimated 4,500 additional heavy haul truck trips and additional heavy construction equipment and construction personnel, which would likely increase traffic and congestion on PCH and in the Zuma Beach Parking Lot 12, incrementally increasing the severity of the adverse effects associated with Impact TR-1. These impacts would be reduced through implementation of AMM TR-1. All other traffic and parking impacts would be similar or slightly increased in comparison to the Project.
Environmental Justice	No Major Change in Adverse Impacts	There would be no appreciable difference in impacts relative to the Project.

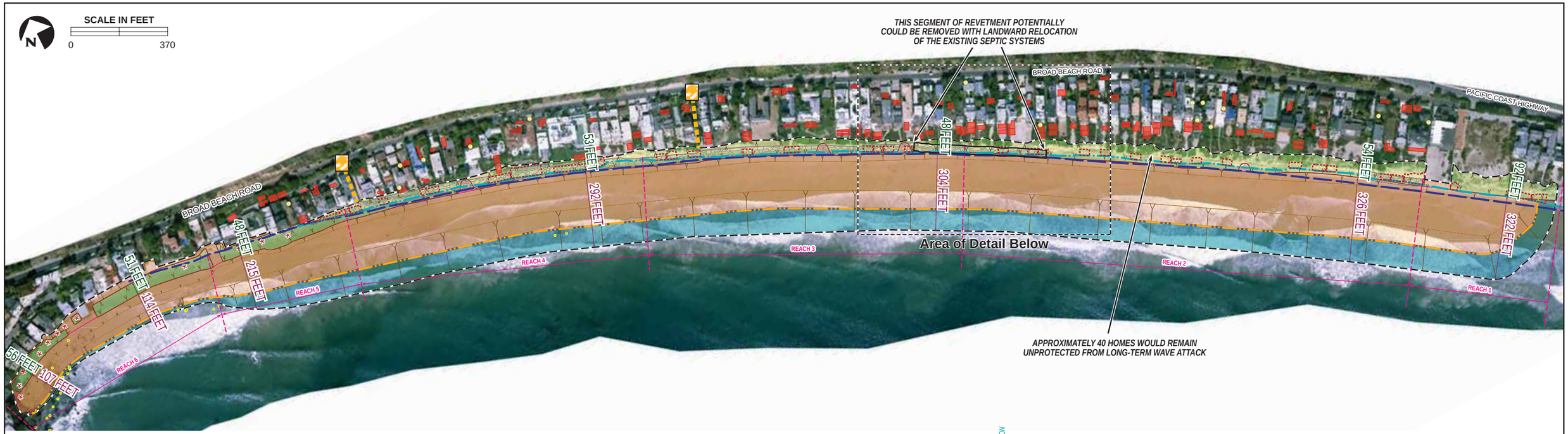
4.2.7 Alternative 7: Removal of Existing Emergency Revetment on the Eastern End of Broad Beach with Beach Nourishment and Restoration

Description

Similar to the Project, this alternative would include beach nourishment, dune creation and restoration across the length of Broad Beach. However, this alternative would include removal of the revetment on the eastern end of Broad Beach. Two different options were considered for Alternative 7. One of which would involve removal of approximately 1,617 feet of revetment on the eastern end with onsite wastewater treatment system (OWTS) upgrades, including septic tanks, leach fields, and/or other treatment infrastructure. The other would involve removal of 1,136 feet, a slightly shorter section of the revetment, without any upgrades to the existing systems. In addition, this alternative would also involve receiving permits for installation of up to 1,617 feet of sand bag revetment at the east end of Broad Beach, if necessitated by severe erosion conditions. The goal of this alternative would be to improve consistency with coastal public access and recreation.

Implementation of this alternative with upgrades to the OWTS on the eastern end of Broad Beach would allow for the removal of approximately 1,617 feet of the revetment, with the remaining 2,483 feet (i.e., 61 percent) being retained in place. Under this option, septic systems and leach fields that could be moved landward would be moved. For added safety, these systems would be located outside of the 15-foot wave uprush line on the eastern end of Broad Beach, as calculated by Moffatt & Nichol (2013). While this alternative is analyzed separately from Alternative 1 and 2, it is possible that Alternative 7 could be combined with one of these alternatives to further remove the retained revetment off public lands. However, as noted in Alternative 2, potential for maximum landward revetment relocation the revetment landward of all LAEs may be limited due to lack of space to accommodate landward OWTS relocation and city code issues.

The second option under Alternative 7 would include removal of the approximately 25 percent of the existing emergency rock and sand bag revetments at the east end of Broad Beach without any upgrades to the existing OWTS. Under this alternative, approximately 1,136 feet of revetment would be removed on the eastern end of Broad beach with the remaining 2,964 feet (i.e., 72 percent) of the existing revetment being retained in place. Moffatt & Nichol (2013) determined that without landward relocation, existing leach fields behind the eastern segment of the revetment would have adequate setbacks to withstand potential short- to mid-term erosion following removal of the revetment in this location.



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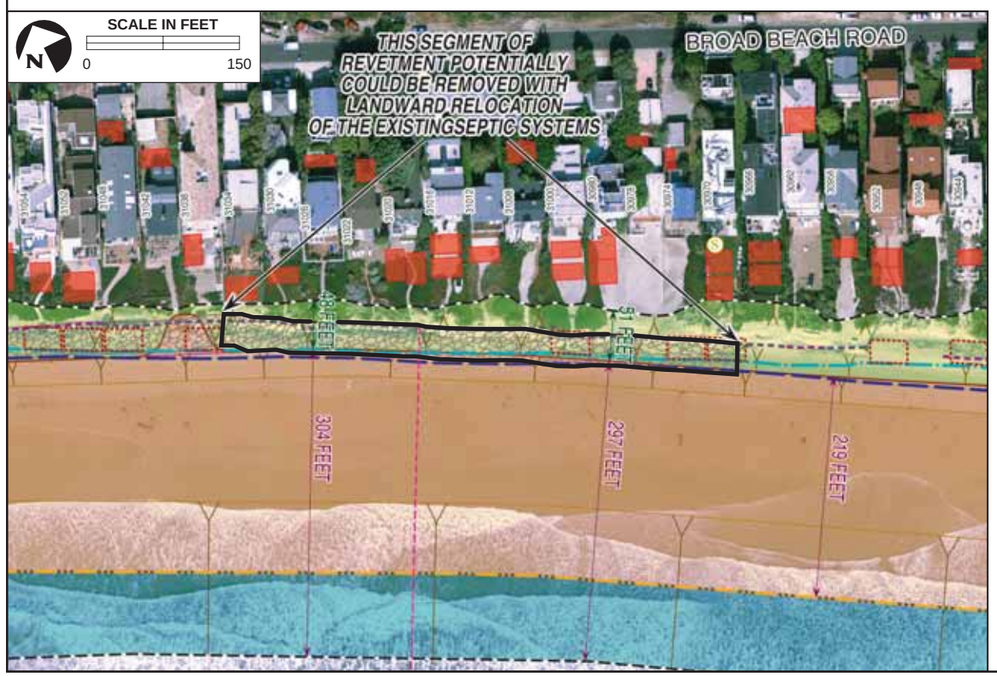

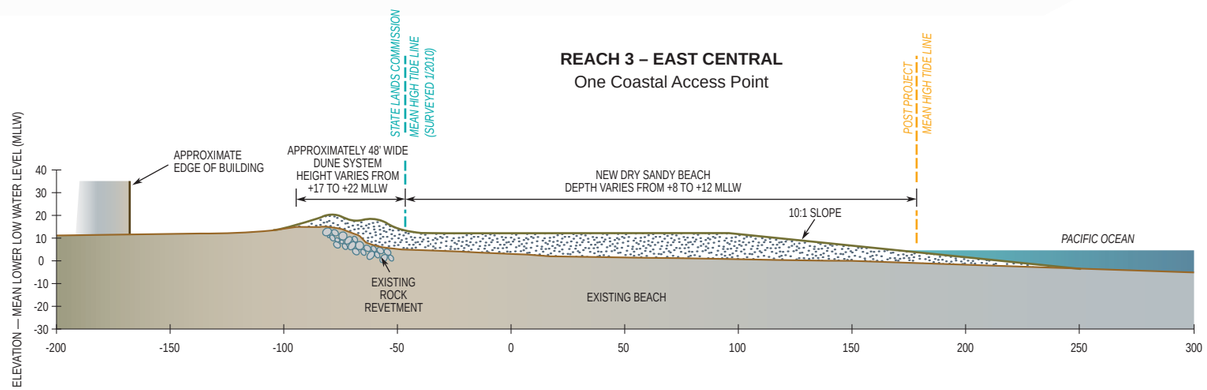

LEGEND

- Existing Public Access
- Approximate Limits of Beach Nourishment/ New Beach
- Existing Emergency Revetment to be Permanently Permitted
- Proposed New Dry Sandy Beach
- Proposed New Intertidal Beach Area
- Proposed Restored Dune
- Area of Dune or Beach Face (3:1 and 10:1 slopes)
- State Lands Commission Mean High Tide Line (surveyed 1/2010)
- Applicant Mean High Tide Line (surveyed 10/15/2009)
- Post Project Mean High Tide Line
- Existing Septic Tank
- Existing Leach Field/Drain Field
- Existing Lateral Access Easements (LAEs)
- * Easement on file, but no dry beach to dedicate
- Surf Grass
- ##### Property Address

Note: Beach dimensions and post project average high water line reflect beach status immediately after completion of beach nourishment and construction/shaping activities; the equilibrium beach that would result from dynamics such as waves, tidal and wind action would likely be of somewhat different dimensions.

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Removal of the 2012 Emergency Revetment on the Eastern End of Broad Beach with Beach Nourishment and Dune Restoration

FIGURE 4-7

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However, as discussed further below, approximately 500 feet of dunes at the east end of Broad Beach that were either unprotected or protected by sand bag or Sakrete revetments were eroded landward 80 to 100 feet in the winter of 2013-2014 after wave attack destroyed these coastal protections structures (Illustration 4-5). This erosion brought the shoreline to within 30 to 50 feet of some of these homes and into close proximity with OWTS serving these homes.

Illustration 4-5: *This alternative would involve the removal of the eastern end of the existing emergency rock and sand bag revetments. While leach fields and other improvements would remain approximately 15 feet from the calculated wave run-up zone, this area of Broad Beach has sustained substantial damage within the 2013-2014 storm season when a 25-year storm event substantially damaged and removed existing sand bag revetments.*

Similar to the Project, public use of, and access along, the beach berm under this alternative would be permitted along the beach to the toe of the restored dunes where a line of rope or cable and signs would prohibit access to dune habitats. This rope or cable system, combined with the approximately 50-foot-wide dune system, would also ensure resident privacy. In addition, rather than provide for 112 coastal access walkways across the restored dunes as included in the Project, this alternative would include installation of unpaved shared private coastal access walkways, with one walkway approximately every 300 feet to be shared between six homes. These walkways would be connected by a shared path along the back dune, lined with a sand fence along the seaward side to minimize sand migration into private yards and minimize resident and pet access into the dune habitat. Each of these walkways would be roped off to minimize private access into the dunes. This distance was selected as an intermediate value that would improve dune habitat quality while minimizing disruption to private homeowner beach access.

The existing two public vertical coastal access points along Broad Beach Road would remain open and the two public trails across the dunes would be roped off to limit access into the dunes. Additionally, this alternative would also recognize the public's rights to pass along public land below the January 2010 MHTL and across existing LAEs. This would ensure that over the long-term after nourishment ceases, the revetment is removed, and the beach and dunes erode, the public would continue to have access across the beach. Public access to and along these LAEs would be available when the sensitive dune habitats that overlie these LAEs eventually erode over the long-term and public access to these LAEs becomes necessary and available.

Construction would be similar under this alternative in terms of beach nourishment, and grading of the beach and dunes by heavy equipment. However, under this alternative, additional bulldozers and cranes would be necessary to remove the eastern portion of the revetment. Additionally, up to 1,000 new trips by heavy haul trucks would be required initially to transport armor stones from the eastern segment of the emergency revetment off Broad Beach. Further, additional heavy construction equipment would be required if OWTS were upgraded on the eastern end of Broad Beach. Major components of this alternative would include:

- Removing approximately 1,617 feet (with septic system upgrades) or 1,136 feet (without upgrades) of the existing revetment, using heavy cranes, bulldozers, and up to 1,000 heavy haul truck trips to transport boulders off of the beach;
- Potentially relocating up to 19 OWTS on the eastern end of Broad Beach;
- Transport of 600,000 cy of sand from inland quarries to Broad Beach via 43,000 heavy haul truck trips;
- Transporting the sand from storage areas at Zuma Beach and hauling it up coast to Broad Beach with heavy trucks or scrapers;
- Redistributing sand on Broad Beach as needed with earthmoving equipment, such as bulldozers, and grading the beach fills to required dimensions;
- Creating a system of unpaved shared walkways to provide private lateral and vertical private coastal access for homeowners across the new dune system;
- Providing two vertical public access trails across the dunes to connect existing access points to the widened beach and ensuring public lateral access along the widened beach seaward of the OHWM;
- Backpassing of 25,000 to 35,000 cy of sand annually from the east to west end of the beach based using heavy equipment such as scrapers and bulldozers; backpassing would be initiated based on beach width and profile changes;
- Initiating one future major renourishment event of approximately 450,000 cy in roughly 10 years; and
- Potential use of up to 1,617 feet of sand bag revetments during coastal erosion events to protect the dune system and homes from wave attack.

Potential Impacts to Public Trust Resources

This alternative would differ from the Project in that it would remove at least 1,136 feet of the revetment on the eastern end of Broad Beach. With landward relocation of up to 19 OWTS on the eastern end of Broad Beach, approximately 480 additional feet of revetment would be removed for a total of 1,617 feet. However, landward relocation of the existing OWTS would result in additional construction-related impacts. Even without landward relocation of the existing OWTS, approximately 27 percent of the revetment would be removed on the eastern end of Broad Beach.

However, depending upon storm intensity and direction, removal of revetment could risk impacts to private improvements over the short- to mid-term. While both implementation strategies of this alternative would provide a hard stabilization structure protecting the shore along middle portions of Broad Beach where erosion is greatest, recent storm damage at the east end of Broad Beach may indicate heightened vulnerability of this area to erosion. Although a soft stabilization, using a newly widened dune system, to provide protection for the eastern end of Broad Beach would likely provide protection over the short- to mid-term, improvements closest to the shoreline could be subject to damage. This alternative would result in major changes to impacts with regard to coastal processes, terrestrial biological resources, recreation, and public access, public health and safety hazards, and utilities and service systems. Major changes to impacts to these resource areas are discussed in detail below, while the resource areas with negligible changes to impacts are summarized in Table 4-10 at the end of this subsection.

Air Quality and Greenhouse Gases: Criteria pollutant emissions would incrementally increase relative to the Project due to the operation of additional heavy equipment necessary to remove the revetment, including up to 1,000 additional heavy haul trips to remove the revetment rock. These emissions would increase the severity of Impact AQ-1, particularly for emissions VOCs, which would exceed SCAQMD and VCAPCD thresholds for project-level significance under the Project, and NO_x, which would exceed SCAQMD and VCAPCD thresholds for both onsite and project-level significance under the Project, including SCAQMD LSTs for construction activities. Relative to the Project, emissions of both of these criteria pollutants would incrementally increase under this alternative, as there would be additional construction activities, as well as heavy haul truck trips (Appendix G). Additionally, there would be an incremental increase in other criteria pollutants including CO, SO_x, and PM. This increase in emissions relative to the Project, particularly the increase in VOC and NO_x emissions, would require additional AMMs, such as use of newer haul trucks with clean-burning diesel engines, but would still have a major adverse effect. GHG emissions described in Impact AQ-2 would remain below SCAQMD and VCAPCD thresholds. Increased TAC emissions from diesel construction equipment would incrementally increase the severity of Impact AQ-3, although emissions would remain below thresholds.

Coastal Processes, Sea Level Rise, and Geologic Hazards: Erosion of the sandy beach and dune after the cessation of nourishment would continue as described under the Project, with potential benefits of beach nourishment enduring for an estimated 10 to 20 or more years with renourishment and backpassing. Under this alternative, potential damage to homes, OWTS, and accessory structures from coastal erosion, as well as associated indirect impacts to public trust resources identified in Impact CP/GEO-2, would be substantially increased in the eastern area of Broad Beach, where a large segment of the revetment would be removed. While beneficial impacts to these homes would increase and likely be protected by the nourished beach and dune system over

the short- to mid-term as described in Impact CP/GEO-3, over the long-term, without the revetment as a last line of defense against wave attack, these homes, OWTS, and other private improvements would be more vulnerable to damage resulting from coastal erosion.

Potential for such damage is illustrated by the recent landward erosion of the dune system at the eastern end of Broad Beach during winter 2013-2014. During this winter, dunes at the eastern 500 feet of Broad Beach were eroded 80 to 100 feet landward and coastal protection structures (i.e., sand bag and Sakrete revetments) were damaged or destroyed. Although there was a major storm event on March 2, 2014, it has been estimated that this was a 25-year storm. Similar storm events would overwhelm the dune system, potentially exposing the houses and septic systems to damage, particularly during a 100-year event. Such a storm may also overwhelm and destroy any sand bag revetments installed under this alternative. Anticipated SLR of approximately 8.5 inches by 2030 would have less erosion effects as described in Impact CP/GEO-8, including increased frequency and intensity of storm surges and wave attack.

While creation of a wider beach and dune system, and use of sand bag revetments would likely provide protection to homes and OWTS over at least the short- to mid-term, removal of the revetment under this alternative his may ultimately result in potential major indirect impacts to public trust resources due to the release of septic effluent and debris from damaged structures (e.g., septic tanks and leach fields). These impacts would exhibit a similar character and extent under both implementation strategies. Implementation of this alternative without OWTS upgrades would involve a larger portion of revetment being retained; however, the existing OWTS would be closer to wave run-up and would be more likely to experience persistent wave attack. Relocating the OWTS landward may result in reduced potential for septic effluent release, but landward retreat and reliance on dunes and sand bag revetments would eventually leave improvements subject to damage due to increased potential for wave attack.

Removal of the revetment on the eastern end of Broad Beach would lead to more erosion and rapid damage to homes, ancillary structures, and OWTS over the long-term after the cessation of nourishment. This would ultimately likely result in adverse indirect effects on public trust resources and may trigger future requests for installation of another emergency revetment. Removal of the revetment would also decrease structural stability and increase impacts described in CP/GEO-1. All other impacts described in Section 3.1, *Coastal Processes, Sea Level Rise, and Geological Resources* would be similar to the Project.

Utilities and Service Systems: While the existing OWTS on the eastern end of Broad Beach would be protected by beach nourishment and dune restoration over the short- to mid-term, following the cessation of nourishment activities, these OWTS would be vulnerable to wave attack as the beach erodes in 10 to 20 or more years. This would

decrease the beneficial impacts described in Impact UTL-1. Installation of a sand bag revetment along up to 1,617 of beach may prevent damage to these systems during minor storm or a single major event, but may be ineffective during a severe storm season and over the long term. Under this alternative up to 19 OWTS could be feasibly relocated landward which would reduce the long term potential for effluent release following the cessation of nourishment; however, as demonstrated by recent wave attack and erosion of 80 to 100 feet of dunes, all septic systems seaward of the residences lacking revetment protection would still have some potential to be impacted. This would substantially increases impacts to public trust resources associated with release of sewage effluent identified in Impact UTL-2. An analysis of impacts to leach fields is included in the Broad Beach Coastal Engineering Report, completed by Moffatt & Nichol (Appendix B). Following cessation of nourishment and erosion of the beach and dunes after 10 to 20 or more years, residents of threatened homes may request or install another emergency revetment to prevent these impacts to septic OWTS and the associated indirect impacts to public trust resources. Effects on public drainage systems as described in Impact UTL-3 would be similar to the Project.

Terrestrial Biological Resources: Removal of the revetment on the eastern end would entail the operation of heavy construction equipment within degraded dune habitats, resulting in additional major adverse effects associated with Impact TBIO-2. This impact could be compounded by the landward relocation of existing OWTS. However, the most recent reconnaissance survey at Broad Beach found that the eastern reaches of Broad Beach were eroded extensively during storm events in March 2014 exposing and damaging sand bag and Sakrete revetments and further eroding degraded southern foredune habitat. Use of heavy construction equipment would also increase adverse effects associated with Impact TBIO-4 due to the increased potential for hazardous spills in ESHAs. Removal of the revetment on the eastern end would increase the severity of Impact TBIO-5. Additionally, the removal of the revetment on the eastern end of Broad Beach presents another adverse long-term impact as wave action may potentially erode southern foredune habitat in this area following the erosion of the nourishment material, increasing impacts described in TBIO-8. Creation of shared walkways would also reduce habitat fragmentation impacts identified in Impact TBIO-7. Impacts TBIO-1 and TBIO-3 would be similar to the Project.

Recreation and Public Access: Removal of the revetment on the eastern end of Broad Beach would increase short-term adverse disruption of recreational access associated with Impact REC-1. However, this alternative would be incrementally more consistent with coastal public access and recreation policies as the revetment would be removed off public lands on the eastern end of Broad Beach. However, up to 72 percent of the existing revetment would be retained in place. The retention of the western portions of the revetment would continue to make this alternative inconsistent with coastal public access policies. Further, depending on location, installation of emergency sand bag revetments could also constrain public lateral access or obstruct LAEs. Alternative 6

would increase short-term beneficial effects identified in Impact REC-3, and decrease long-term impacts related to cessation of nourishment described in Impact REC-4. Impact REC-2 would be similar to the Project.

Marine Water Quality: Removal of the eastern end of the revetment would result in the potential for impacts to marine water quality to occur resulting from long-term erosion and potential damage to existing OWTS occurring behind the existing revetment. Under this alternative, the beneficial impacts described under Impact MWQ-3 would be much less beneficial as the existing revetment would be removed and would no longer serve as the last line of defense for existing development at Broad Beach. This would constitute a major adverse impact and would likely require the construction of an additional temporary emergency revetment following the long-term erosion of Broad Beach after the cessation of nourishment activities. Impacts MWQ-1, MWQ-2 and MWQ-4 would either have similar or incrementally increased impacts in relation to the Project.

Other Resource Areas: This alternative would have similar or incrementally more severe impacts relative to the Project for scenic resources, marine biological resources, cultural and paleontological resources, noise, public health and safety hazards, traffic and parking, and environmental justice.

Table 4-10. Alternative 7 – Changes in Impact Severity

Resource Area	Relative Change in Impact Severity	Discussion
Scenic Resources	Incremental Short-term Increase and Long-term Decrease in Adverse Impacts	There would be a slight increase in adverse effects associated with Impact SR-2, as this alternative would result in additional construction equipment relative to the Project. However, removal of the revetment along the eastern end of Broad Beach would eliminate the potential for long-term exposure in this area incrementally reducing the adverse effects associated with Impact SR-1. The use of emergency sand bag revetments could leave litter along the beach if and when destroyed by wave action. All other scenic resource impacts would be similar to the Project.
Marine Biological Resources	No Major Change in Adverse Impacts	Impacts to marine biological resources would remain similar or slightly increased relative to the Project. However, over the long term after cessation of nourishment as the beach and dunes erode in 10 to 20 or more years, OWTS could be damaged or destroyed leading to release of effluent into the marine environment.
Cultural and Paleontological Resources	No Major Change in Adverse Impacts	Additional disturbance of the near shore environment associated with removal of the eastern end of the emergency revetment would result in an increased potential to disturb cultural resources, slightly increasing the severity of the adverse effects associated with Impact CR-1. However, as heavy equipment would only be operated on the seaward side of the revetment, the probability of uncovering undocumented cultural resources would be minimal. All other cultural and

Table 4-10. Alternative 7 – Changes in Impact Severity

Resource Area	Relative Change in Impact Severity	Discussion
		paleontological impacts would be similar to the Project.
Noise	Incremental Increase in Adverse Impacts	Operation of additional heavy haul trucks, cranes, and bulldozers used during revetment removal would incrementally increase the severity of Impacts N-1, N-2 and N-3.
Public Safety and Health Hazards	Incremental Increase in Adverse Impacts	Additional heavy equipment used during revetment removal would increase the potential for incidental release of hazardous materials, resulting in an incremental increase in the severity of Impact HAZ-2. Further, operation of additional heavy equipment on the beach would increase the short-term hazardous conditions during construction, incrementally increasing the severity of Impact HAZ-3. Impact HAZ-5 would also become a long-term or permanent beneficial impact instead of having a short- to mid-term duration. Impact HAZ-1 would also no longer be relevant, as the revetment would no longer be present to create potential hazards.
Traffic and Parking	Incremental Increase in Adverse Impacts	Revetment removal would require additional truck trips and additional heavy equipment over that required for the Project. This would incrementally increase severity of the adverse effects associated with Impact TR-1 and potentially TR-2, depending on the drop-off location of the removed boulders.
Environmental Justice	No Change	There would be no appreciable difference in impacts relative to the Project.

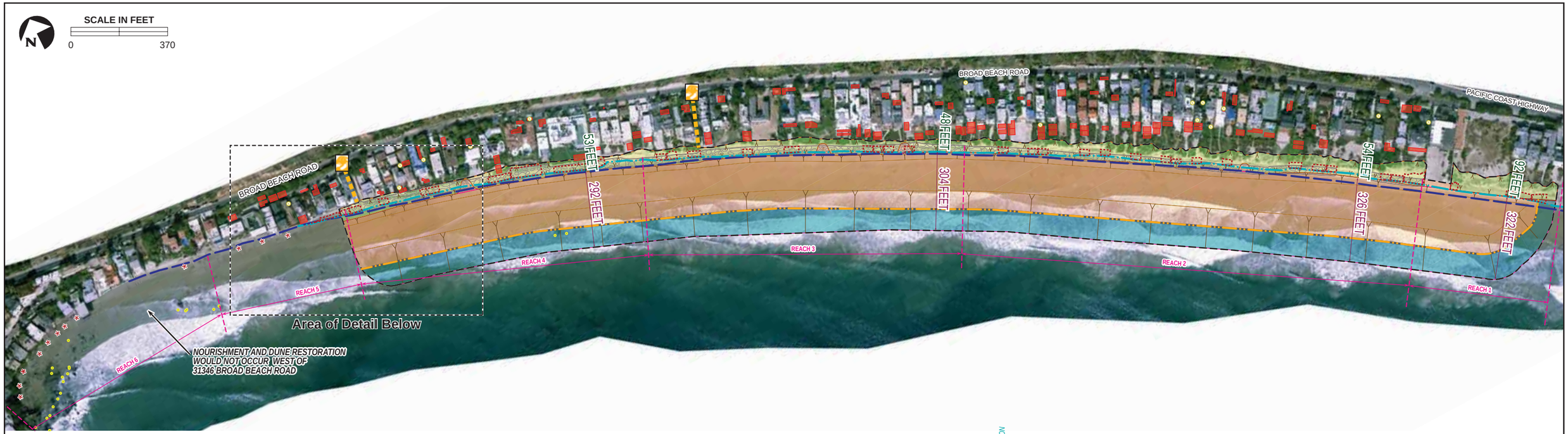
4.2.8 Alternative 8: No Beach Nourishment at West Broad Beach with Revetment at Current Location

Description

This alternative would include beach and dune restoration as well as retention of the existing revetment, as described for the Project. However, this alternative would also include a major reduction in beach nourishment and dune restoration both in terms of the footprint of nourished beach affected and the volume of sand placement. Under this alternative, the proposed nourishment Project would be reduced by 25 percent to approximately 4,650 feet of nourished beach, approximately 1,550 feet less than the 6,200 feet described for the Project. Additionally, the nourishment would only occur on the central and eastern segments of Broad Beach. Nourishment would extend from Trancas Creek west 4,650 feet and terminate at 31346 Broad Beach Road at the western end of the emergency revetment, just west of the existing western public coastal access point. For the western 25 percent of Broad Beach, this alternative would emphasize protection of public trust resources represented by rocky intertidal and subtidal habitats rather than those provided by sandy beach habitats, public coastal access, recreation, and natural coastal protection. The Project would remain unchanged along approximately 75 percent of the beach under this alternative.

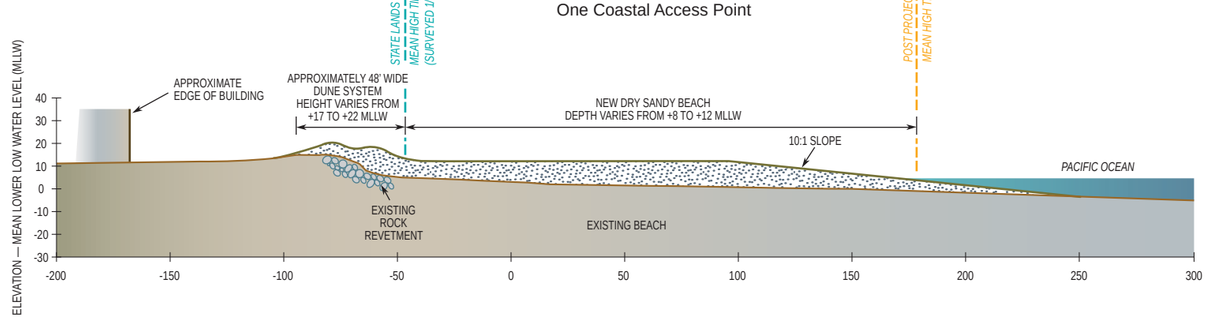
The existing emergency revetment would remain in its current location with dune restoration and beach nourishment burying the revetment as described for the Project. While other alternatives could be combined with this alternative (e.g., Alternative 1 or Alternative 2), no relocated or modified structures are proposed under this alternative. This alternative would include placement of approximately 460,000 cy of sand on the central and eastern regions of Broad Beach, with volumes adjusted based on the Project's beach nourishment and dune restoration design and profile over this reduced length. Under Alternative 8, the nourished beach would be as wide as 300 feet near the east end of Broad Beach. As a part of this alternative, a renourishment event including the deposition of approximately 380,000 cy within the same central and eastern areas of the beach would occur after approximately 10 years.[12] However, the timing and quantity of renourishment event may vary depending on results of the intensive monitoring plan and backpassing.

[12] Precise renourishment volumes are difficult to forecast. A much smaller beach footprint would need to be recharged with sand, but backpassing may provide less effective at extending beach life due to the more limited Project area and lower sand volumes available to backpassing.



Detail

REACH 3 – EAST CENTRAL
One Coastal Access Point



LEGEND

- Existing Public Access
- Approximate Limits of Beach Nourishment/ New Beach
- Existing Emergency Revetment to be Permanently Permitted
- Proposed New Dry Sandy Beach
- Proposed New Intertidal Beach Area
- Proposed Restored Dune
- Area of Dune or Beach Face (3:1 and 10:1 slopes)
- State Lands Commission Mean High Tide Line (surveyed 1/2010)
- Applicant Mean High Tide Line (surveyed 10/15/2009)
- Post Project Mean High Tide Line
- Existing Septic Tank
- Existing Leach Field/Drain Field
- Existing Lateral Access Easements (LAEs)
- Easement on file, but no dry beach to dedicate
- Surf Grass
- ##### Property Address

Note: Beach dimensions and post project average high water line reflect beach status immediately after completion of beach nourishment and construction/shaping activities; the equilibrium beach that would result from dynamics such as waves, tidal and wind action would likely be of somewhat different dimensions.

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No Beach Nourishment at West Broad Beach with Revetment at Current Location

FIGURE 4-8

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Additionally, dune habitats would be established and restored in the central and eastern reaches of the beach by creating a sand berm that would run along the length of the beach, with a minimum of 2 feet of sand over the rock revetment. The berm would extend approximately 30 to 50 feet inland and 0 to 10 feet seaward of the revetment, depending on location. The dune system, consisting of hummocks varying in height from 17 to 22 feet above MLLW would be constructed on top of this berm. The width of the dune system would vary from 40 to 60 feet, with most sections being approximately 50feet wide. The western 1,500 feet of beach would remain a mix of rocky intertidal areas and sandy beach, depending on seasonal sand flow in the littoral cell.

Similar to the Project, public use of, and access along, the beach berm under this alternative would be permitted along the central and eastern segments of the beach to the toe of the restored dunes where a line of rope or cable and signs would prohibit access to the dunes. This rope or cable system, combined with the approximately 40- to 80-foot-wide dune system, would also ensure resident privacy. In addition, rather than provide for 112 coastal access walkways across the restored dunes as included in the Project, this alternative would include installation of shared private coastal access walkways, with one walkway approximately every 300 feet to be shared between six homes. These walkways would be connected by a shared path along the back dune, lined with a sand fence along the seaward side to minimize sand migration into private yards and minimize resident and pet access into the dunes. Each of these walkways would be roped off to minimize private access into the dunes. This distance was selected as an intermediate value that would improve dune habitat quality while minimizing disruption to private homeowner beach access. Public access to the west would continue, but be feasible primarily during lower tides as the beach is largely submerged during medium and high tides. Direct beach access from the approximately 27 homes on the western end of Broad Beach, including the areas of newly widened beach to the east, would also be restricted to lower tides.

The existing two public vertical coastal access points along Broad Beach Road would remain open and the two public trails across the dunes would be roped off to limit access into the dunes. However, beach access from the western coastal access point would be available generally only on the nourished beach to the east as the western end of Broad Beach would largely be tide-limited. Additionally, this alternative would also recognize the public's rights to pass along public land below the January 2010 MHTL and across existing LAEs. This would ensure that over the long-term after nourishment ceases, the revetment is removed, and the beach and dunes erode, the public would continue to have access across the beach. Public access to and along these LAEs would be available when the sensitive dune habitats that overlie these LAEs eventually erode over the long-term and public access to these LAEs becomes necessary and available.

Major components of this alternative would include:

- Transport of approximately 460,000 cy of sand from inland quarries to Broad Beach via approximately 33,000 heavy haul truck trips;
- Transporting the sand from storage areas at Zuma Beach up coast to the central and eastern segments of Broad Beach using heavy trucks or scrapers;
- Redistributing sand on eastern and central Broad Beach as needed with earthmoving equipment, such as bulldozers, and grading the beach fills to required dimensions;
- Creating a system of shared walkways to for homes along eastern and central Broad Beach to provide private lateral and vertical private coastal access for homeowners across the new dune system;
- Providing two vertical public access trails across the dunes to connect existing access points to the widened beach and ensuring public lateral access along the widened beach seaward of the OHWM;
- Performing backpassing of the sand, ranging from 25,000 to 35,000 cy, from the east to central portion of Broad Beach based on triggers and using heavy equipment such as scrapers and bull dozers; and
- Initiating one future major renourishment event of approximately 380,000 cy in roughly 10 years.

Potential Impacts to Public Trust Resources

This alternative to the Project would largely avoid or substantially reduce direct and indirect burial of intertidal and near shore subtidal habitats as well as minimizing indirect turbidity impacts to marine biological resources. Burial of rocky intertidal and subtidal habitats within Lechuza Cove and offshore of Lechuza Point would be largely avoided. This alternative would limit direct burial and indirect offshore turbidity impacts by eliminating nourishment described for the Project along the 1,500 feet of beach west of 31346 Broad Beach Road at the western terminus of the emergency revetment just west of the existing western public coastal access point.

This alternative would result in changes to impacts associated with air quality and terrestrial biological resources. Additionally, this alternative would result in the greatest trade-offs between different public trust resources, with protection of rocky marine habitats prioritized over public coastal access and beach recreation, sandy beach habitats and coastal protection. By eliminating nourishment west of 31346 Broad Beach Road, approximately 25 percent of Broad Beach that would have been fully accessible and usable by the public and existing residents under the Project would not be widened, with access primarily limited to low tides. Rather, this area would remain similar to existing conditions over the short- to mid-term, with beach erosion potentially continuing or accelerating over the long-term. Approximately 27 homes, septic systems and other private improvements would not receive protection from wave attack provided by the wider beach and dune system and would continue to be exposed to coastal processes.

Additionally, this alternative would not reduce impacts associated with the Project's consistency with coastal public access and recreation polices. However, this alternative could be combined with either Alternative 1 or Alternative 2, which would relocate the existing revetment landward, but this would also result in associated impacts described for these alternatives above. Resource areas with major changes to impacts under Alternative 8 relative to the Project are discussed in detail below, while the resource areas with negligible changes to impacts are summarized in Table 4-11 at the end of this subsection.

Air Quality and Greenhouse Gases: Under Alternative 9, criteria pollutant emissions would be reduced relative to the Project as there would be approximately a 25 percent reduction in the number of heavy haul truck trips corresponding to reduced nourishment volume. Under this alternative there would be approximately 10,000 fewer truck trips relative to the Project. However, while emissions would be reduced under this alternative it would not substantially reduce the severity of Impact AQ-1, particularly for emissions of VOCs, which would continue to exceed SCAQMD and VCAPCD thresholds for project-level significance, and NO_x, which would continue to exceed SCAQMD and VCAPCD thresholds for onsite and project-level significance, including SCAQMD LSTs for construction activities (Appendix G). Similarly, GHG emissions described in Impact AQ-2 would decrease and would be further below SCAQMD and VCAPCD thresholds, and toxic air contaminants would also be incrementally reduced.

Coastal Processes, Sea Level Rise and Geologic Hazards: Under this alternative erosion of beach and dunes after cessation of nourishment and central and eastern Broad Beach east of 31346 Broad Beach Road would continue as described under the Project, with the benefits of nourishment in these areas enduring for an estimated 10 to 20 or more years and the revetment then becoming exposed as a result of persistent wave action. Anticipated SLR of approximately 8.5 inches by 2030 would further exacerbate erosion effects, including increased frequency and intensity of storm surges and wave attack. However, it is unclear as to whether the nourished beach would erode more quickly under this alternative as it would be unprotected along the western edge due to the lack of nourishment in Lechuza Cove and more exposed to wave attack. Further, it is unclear as to whether backpassing under this alternative would be as effective as described for the Project. Due to the reduced volume of sand included in the nourishment event it is likely that less sand would be available for subsequent backpassing and backpassing would not occur at the far west end of the Beach in Lechuza Cove.

As no nourishment would occur on the western end of Broad Beach under this alternative, approximately 27 homes and associated improvements (e.g., OWTS) along the western 1,500 feet of Broad Beach would potentially continue to erode over this 20 year period as this area would not experience the benefits of two nourishment events described in Impact CP/GEO-6 and would be more susceptible to the adverse impacts

related to sea level rise identified in Impact CP/GEO-8. This would represent a major adverse effect relative to the Project as erosion of the western end of Broad Beach could result in additional indirect impacts to the residences and private improvements in this area, particularly the residences that are not fronted by individual shoreline protection devices. Approximately 27 homes and associated improvements exist along these 1,500 feet of beach on the western end of Broad Beach. Based on reconnaissance level field surveys a total of three of these homes are unprotected and 15 have what appears to be substandard seawalls, revetments, or pilings that may expose these homes and improvements to damage in major storm events. Under this alternative, after the revetment is exposed, potential impacts of coastal processes on the revetment identified in Impact CP/GEO-2 and associated indirect impacts to public trust resources identified in Impact CP/GEO-3 would remain similar to those described for the Project as the revetment would not be redesigned or reinforced under this alternative. However, exposure of 27 homes to wave attack would create a new major adverse impact not identified for the Project. Based on initial review of existing coastal protection structures, 18 of these homes may construct or apply for permits to construct improved coastal protection.

Additionally, the reduced sand volume under Alternative 8 would result in corresponding reductions to beneficial impacts associated with Impact CP/GEO-7, as approximately 140,000 cy that would have been available for down coast movement under the Project would be reduced but would not be deposited on the western 25 percent of Broad Beach. Impact CP/GEO-7 would remain beneficial under Alternative 8 as the effects of the longshore currents on the remaining 460,000 cy of sand deposited on Broad Beach would still occur over the short- to mid-term. However, over the long-term, longshore currents would transport this sand farther down coast and possibly offshore as described for the Project. Impacts related to the existing revetment (CP/GEO-1), sand compatibility (CP/GEO-4), and tides, currents, and wave height and direction (CP/GEO-5) would remain similar to those described for the Project.

Terrestrial Biological Resources: Under Alternative 8, a revegetated dune system would not be established west of 31346 Broad Beach Road or the western end of emergency revetment as this area would not be nourished as described for the Project. This alternative would eliminate dune restoration over approximately 1,500 feet or approximately 25 percent of CSLC Lease Area, reducing beneficial impacts to terrestrial biological resources identified in Impact TBIO-6 associated with creation of sandy intertidal habitats, such as grunion spawning areas and shorebird foraging habitat. However, the benefit of this impact as it applies to the western portion of Broad Beach is questioned, as the dune restoration would displace sensitive marine habitat (discussed below). The remaining 75 percent of dune system described for the Project would still be restored and revegetated with native species. Consequently, though lessened, beneficial impacts associated with TBIO-6 would still occur.

The reduced nourishment volume, approximately 140,000 cy less sand than described for the Project, would reduce impacts associated with the increased closure period of Trancas Lagoon and the Zuma Wetlands described in Impact TBIO-5. However, as 76 percent of the nourishment volume would still be applied up coast of these features, this sizable reduction in nourishment volume would not substantially reduce these impacts.

Construction-related impact to terrestrial biological resources identified in Impacts TBIO-2, TBIO-3, and TBIO-4 would be incrementally reduced due to the reduction in direct impact area, total sand volume applied, and number of truck trips used for hauling. Additionally, requiring shared private coastal access walkways would also substantially reduce disturbance of the proposed dune system described in Impact TBIO-7, protecting this newly established and restored dune habitat.

Marine Biological Resources: The reduced and phased nourishment west of 31346 Broad Beach Road, within Lechuza Cove would substantially reduce impacts to rocky intertidal and near shore subtidal marine habitats, including impacts to surfgrass, kelp, and other sensitive marine organisms. Implementation of Alternative 8 would substantially eliminate direct impacts to rocky intertidal habitats within Lechuza Cove and off Lechuza Point described in Impact MB-2 and associated conflicts with ESHA policies identified in Impact MB-8, with direct burial impacts limited to scattered rocky outcrops and limited cluster of surf grass along central Broad Beach. While some nourishment sand could move back up coast, over the long-term, no nourishment in this area would mean that rocks would continue to be exposed in spring when sand levels are seasonally low, and buried during the fall when sand levels are typically high. Therefore, this alternative, in combination with monitoring for potential indirect burial of intertidal habitats west of 31346 Broad Beach Road would substantially reduce adverse impacts to intertidal habitats would be appropriately mitigated.

AMM MB-ALT-8: Baseline Surveys for Sensitive Rocky Intertidal Habitats. In coordination with AMM MB-2b, the Project Applicant shall contract with qualified biologists to conduct regular monitoring of biological resources and habitat quality of sensitive rocky intertidal habitats west of 31346 Broad Beach Road. The transects shall be consistent with those used to establish baseline intertidal habitat conditions. Surveys shall be conducted prior to Project completion, following Project completion and again prior to renourishment. A control site shall be established that is acceptable to the California State Lands Commission (CSLC) staff. The summaries of these monitoring surveys shall be prepared and submitted to CSLC staff for review. Any adverse impacts to sensitive rocky intertidal habitats shall be provided to the agencies as part of AMM MB-2b (applies to Alternatives 8 and 9 only).

For reasons similar to those described above for rocky intertidal habitat, this alternative would also substantially reduce Impact MB-4 to subtidal habitats and organisms. As the

footprint of the beach would be reduced by approximately 25 percent under this alternative, Alternative 8 would reduce nourishment by 140,000 cy and largely avoid even indirect impacts to shallow subtidal reefs along the western 1,500 feet of Broad Beach, including mortality of surfgrass and kelp off Lechuza Point. This would substantially reduce the smothering or burial of additional subtidal habitat beyond the actual footprint of the expansion. However, known and potential subtidal reefs that occur off of central Broad Beach outside of the seaward edge of proposed fill could still be covered by remobilized sand, particularly during post construction reshaping of the beach by waves and tides. Therefore, although greatly reduced, Impact MB-4 (subtidal habitats) would still have a major adverse effect.

Impacts to subtidal reefs off of the rest of Broad Beach, including burial and indirect turbidity impacts, would still occur. The reduced nourishment volumes may also result in an incremental decrease in impacts to down coast marine resources, as a reduced volume of sand would be available for down coast transport to Zuma Beach, Point Dume State Beach, and Los Angeles county beaches. Additionally, intertidal habitat areas and shoreline marine biological resources farther south may be indirectly affected by changes in sand supply and distribution through littoral drift. This may result in additional reductions to impacts to marine biological resources down coast as identified in Impact MB-7. However, as 76 percent of the proposed nourishment volume would still be applied to Broad Beach under this alternative, this reduction in the severity of down coast transport impacts likely would be incremental for down coast marine biological resources.

The reduced volume of sand and the absence of construction activities on the west end of Broad Beach would incrementally reduce short-term construction related impacts to marine biological resources identified for the Project in Impacts MB-3, MB-4, MB-5, and MB-6.

Recreation and Public Access: As the emergency revetment would be retained under this alternative, Alternative 8 would have similar impacts associated with recreation and public access described in REC-4.

Alternative 8 would incrementally reduce public access benefits associated with a wider dry sandy beach realized under the Project. Under the Project, the nourished beach and dune profile described for the Project would end at 31346 Broad Beach Road. This would leave the western end of Broad Beach (approximately 25 percent of the CLSC Lease Area) in its current condition, generally inaccessible to the public except at low tides and would limit opportunities to use this area for sunning, swimming, and other forms of beach recreation. However, the majority of Broad Beach would provide enhanced opportunities for this type of beach recreation within the proposed beach and dune areas. Broad Beach west of the existing rock revetment is unique from the rest of Broad Beach, because of the rocky intertidal habitat and biological resources that exist

at this location. A 2012 public survey of beachgoers at Broad Beach indicated that tidepooling was an attraction for some beachgoers. Under existing conditions, swimming and playing in the surf zone are attractive at the east end of Broad Beach, and less so at the far west end. Although access would not be enhanced at the west end of Broad Beach and would continue to be limited to low tide conditions, this alternative would help maintain the unique existing habitats and tidepooling as a recreation resource. The public would still have improved access for the remainder of Broad Beach.

Private homeowners with beach stairways from the 27 homes along the west end of the beach would be unable to access newly widened beaches on central and west Broad beach, except at low tides or by walking along the road to a public coastal access point. Finally, the existing narrow intertidal beach would be expected to narrow more quickly over the 20 year Project life. Additionally, SLR may further reduce public access during low tide conditions. Consequently, under this alternative, impacts described for REC-3 pertaining to public access would be less beneficial than those described for the Project. Construction-related impacts from initial nourishment and backpassing operations would remain similar to those identified for the Project in Impacts REC-1 and REC-2.

Marine Water Quality: Under this alternative turbidity impacts identified in MWQ-1 within Lechuza Cove would be minimized resulting in a corresponding reduction to impacts described for marine biological resources. Additionally, reduced construction-related activities associated with this alternative would incrementally reduce impacts to Trancas Lagoon and to resuspension of sand contaminants identified in MWQ-2 and MWQ-4. However, while rocky intertidal habitats are concentrated in the western end of Broad Beach, across the length of Broad Beach this reduction in turbidity would not substantially reduce marine water quality impacts described for the Project. Additionally, as no nourishment would occur within the western end of Broad Beach the OWTS at the 18 homes with either no protection or substandard shoreline protection measures would be exposed to wave attack, which would substantially reduce the beneficial impacts of MWQ-3 described for the Project.

Utilities and Service Systems: As described for marine water quality impacts above, under this alternative the revetment would be retained in place similar to the Project, but the western end of Broad Beach would not be nourished. Consequently, potential impacts to OWTS on the western end of Broad Beach would be increased substantially, particularly for those residences without individual shoreline protection devices. This exposure to wave attack would substantially reduce the beneficial impacts of UTL-1 and increase the potential impacts associated with long-term exposure of the OWTS

Other Resource Areas: This alternative would have similar impacts to the Project in terms of its effects on scenic resources, environmental justice, and utilities and service systems. Impacts to traffic and parking, cultural, historic, and paleontological resources,

public health and safety hazards, and noise would be incrementally reduced due to the decreased levels construction activity associated with the reduced sand volumes.

Table 4-11. Alternative 8 – Changes in Impact Severity

Resource Area	Relative Change in Impact Severity	Discussion
Scenic Resources	Incremental Reduction in Adverse Impacts	Over the short-term, beneficial impacts of nourishment would not be realized on the western end of Broad Beach as the individual revetments and exposed house pylons in this area would not be covered. Similar to the Project, permanent authorization of the revetment through a long-term lease and approval of CDPs would create the potential for long-term degradation of the visual environment of Broad Beach after nourishment activities end and natural coastal erosion causes the revetment to become exposed as described in Impact SR-1.
Cultural and Paleontological Resources	No Major Change in Adverse Impacts	There would be no appreciable difference in impacts relative to the Project, although construction-related Impacts identified in Impacts CR-2 and CR-3 may be incrementally reduced due to the reduced construction and hauling activities.
Noise	No Major Change in Adverse Impacts	Residences on the western end of Broad Beach would experience less noise and nourishment would terminate at the end of the existing revetment. While there may be a reduced duration of nourishment due to the reduced nourishment volume on the western end of Broad Beach, this reduction would be incremental at most, consequently the remaining residences and public users along Broad Beach would experience similar noise levels as described in Impact N-1, N-2, and N-3.
Public Health and Safety Hazards	Incremental Reduction in Adverse Impacts	This alternative would result in a slight decrease in the adverse effects associated with Impact HAZ-2, as the duration of nourishment and the presence of heavy construction equipment would be reduced as no nourishment volume would occur on the western end of Broad Beach. However, this reduction in the duration of nourishment would be incremental at most and would not substantially reduce Impact HAZ-2. Similar to the Project adverse effects under this alternative would be reduced through implementation of AMMs HAZ-2, HAZ-3a, and HAZ-3b.
Traffic and Parking	Incremental Reduction in Adverse Impacts	The reduction in nourishment volume would result in a corresponding reduction of approximately 10,000 heavy haul truck trips, which would likely incrementally reduce traffic and congestion on PCH and the inland routes, and in Zuma Beach Parking Lot 12, incrementally reducing the severity of the adverse effects associated with Impact TR-1. These impacts would be further reduced through implementation of AMM TR-1.
Environmental Justice	No Major Change in Adverse Impacts	There would be no appreciable difference in impacts relative to the Project.

4.2.9 Alternative 9: Reduced and Phased Beach Nourishment at West Broad Beach with Existing Revetment

Description

Similar to the Project, this alternative would include beach and dune restoration as well as retention of the existing revetment at Broad Beach; however, this alternative would differ from the Project and the other alternatives described above in three key ways:

1. Reduced beach nourishment volume at the west end of Broad Beach and Lechuza Cove with 60,000 cy of sand placed within a nourishment footprint reduced by 50 percent west of 31346 Broad Beach Road and the western public coastal point;
2. Phased nourishment events at the west end of Broad Beach and within Lechuza Cove, with approximately 30,000 cy of sand placed within the same reduced footprint during each of the two phases to reduce post construction sand dispersal and loss; and
3. An unvegetated dune berm within Lechuza Cove west of 31502 Broad Beach, the house on pilings overlying beach.

The goal of this alternative would be to minimize burial of rocky intertidal and subtidal habitats by significantly reducing beach width and sand volumes within and adjacent to these sensitive resources on the western end of Broad Beach, while still restoring a wider sandy beach in this area. This alternative would include a reduced beach nourishment and dune restoration volume of 520,000 cy due to a reduced sand volume and placement footprint west of 31346 Broad Beach Road and the western coastal access point, where the existing emergency revetment ends. This alternative would minimize direct and indirect impacts associated with burial of intertidal and shallow subtidal habitat near Lechuza Point while also providing some benefits of beach nourishment for coastal access and for protection of properties along the western 1,500 feet of Broad Beach. Beginning west of 31346 Broad Beach Road and western public coastal access point this alternative would taper the profile of the renourished beach within Lechuza Cove, reducing beach width, footprint and profile. Under the Project, the dune system would be approximately 51 feet in width with a 114 foot wide sandy beach protruding seaward a total of 165 feet from existing homes. In contrast, under this alternative the dune system would be reduced to approximately 20 feet in width and the beach width would be reduced to approximately 60 feet, protruding seaward only 80 feet from existing homes. This would represent more than a 50 percent reduction in total renourishment footprint within the western end of Broad Beach. This tapering of the beach from east to west would likely necessitate lighter duty vehicles to distribute sand at the western end of Broad Beach, where the narrow beach would restrict access and turning radius for heavy duty equipment (i.e., scrapers) proposed by the Project for the sand deposition activities.

Additionally, nourishment within Lechuza Cove would occur in two phases under this alternative. It is estimated that approximately 25 percent of initial sand nourishment volume moves offshore or down coast immediately following construction as the beach reaches equilibrium. This phased approach would minimize post construction sand loss and reduce indirect burial and turbidity impacts to the rocky intertidal and subtidal habitats off of Lechuza Cove. The first phase would occur at the beginning of the initial beach nourishment event, with haul trucks or scrapers transporting the sand to the western end of Broad Beach. Following the deposition of 30,000 cy of sand west of 31346 Broad Beach Road within the reduced footprint, the nourishment of the remainder of Broad Beach east of 31346 Broad Beach Road would occur. After completion of the nourishment east of 31346 Broad Beach Road, another 30,000 cy of cubic sand would be deposited on the western end of Broad Beach with the same reduced footprint. Each of these phased nourishment events would occur over the same footprint west of 31346 Broad Beach Road; however, the first phase would be filled to a reduced depth. For example, the first phase would establish a dune berm approximately 8.5 feet deep and a beach berm approximately 7 feet deep within the reduced footprint. The second phase would increase the depth of the dune berm to up to 17 feet and increase the depth of the beach berm up to 14 feet.[13] Similar to the Project, a renourishment event including the deposition of 450,000 cy would occur after approximately 10 years; however, this re-nourishment event would also in two phases on the west end of Broad Beach, within a similarly limited nourishment footprint. Additionally, the timing and quantity of renourishment event may vary depending on results of the intensive monitoring plan and success of backpassing.

Under this alternative, dune restoration would take three different approaches. East of 31502 Broad Beach Road dune restoration would remain identical to that described for the Project. Dune habitats would be established and restored by creating a sand berm that would run along the length of the beach, with a minimum of two feet of sand over the rock revetment. The berm would extend approximately 30 to 50 feet inland and 0 to 10 feet seaward of the revetment, depending on location. The dune system, consisting of hummocks varying in height from 17 to 22 feet above MLLW would be constructed on top of this berm. The width of the dune system would vary from 50 to 60 feet wide.

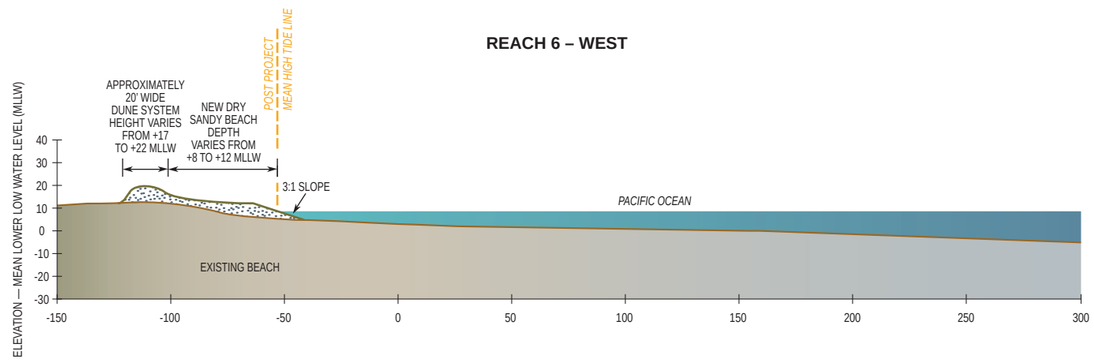
[13] Ultimate post construction beach depth would also be governed by wave action and tides that would reshape the beach and disperse sand. Beach depth and width would likely change during the intervening 6 months between deposition phases at the west end of Broad Beach. However, under this alternative, the second phase of nourishment would be restricted to the 60 foot wide initial footprint.

SCALE IN FEET
0 370

Detail

SCALE IN FEET
0 150

REACH 6 – WEST



LEGEND

- Existing Public Access
- Approximate Limits of Beach Nourishment/ New Beach
- Existing Emergency Revetment to be Permanently Permitted
- Proposed New Dry Sandy Beach
- Proposed New Intertidal Beach Area
- Proposed Restored Dune
- Area of Dune or Beach Face (3:1 and 10:1 slopes)
- State Lands Commission Mean High Tide Line (surveyed 1/2010)
- Applicant Mean High Tide Line (surveyed 10/15/2009)
- Post Project Mean High Tide Line
- Existing Septic Tank
- Existing Leach Field/Drain Field
- Existing Lateral Access Easements (LAEs)
- Easement on file, but no dry beach to dedicate
- Surf Grass
- ##### Property Address

Note: Beach dimensions and post project average high water line reflect beach status immediately after completion of beach nourishment and construction/shaping activities; the equilibrium beach that would result from dynamics such as waves, tidal and wind action would likely be of somewhat different dimensions.

amec

Reduced Beach Nourishment at West Broad Beach Revetment at Current Location

FIGURE 4-9

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However, in the 1,500 feet of nourished beach west of 31346 Broad Beach Road and the western coastal access point the dune berm would be narrowed to 20 feet in width. While the dune berm between 31346 Broad Beach Road and 31052 Broad Beach Road (i.e., the house on pilings) would be subject to dune restoration activities described for the Project, the 450 feet of narrow dune west of 31052 Broad Beach Road would not be vegetated with native dune species. This area would remain an unvegetated berm as habitat within the cove appears to be historically more characteristic of coastal bluff and beach (see Illustration 4-6).

Illustration 4-6: *Under this alternative the narrow dunes to the west of 31502 Broad Beach Road would not be vegetated. This area would be attractive for walking and tide pooling but would not provide restoration for terrestrial dune habitat.*

Similar to the Project, public use of, and access along, the beach berm under this alternative would be permitted along the beach to the toe of the restored dunes where a line of rope or cable and signs would prohibit access to ESHAs within the dunes. This rope or cable system, combined with the approximately 50 -foot-wide dune system east of 31052 Broad Beach Road and the 20-foot-wide dune system west of 31052 Broad Beach Road, would ensure resident privacy. In addition, rather than provide for 112 coastal access walkways across the restored dunes as included in the Project, this alternative would include installation of shared private coastal access walkways, with one walkway approximately every 300 feet to be shared between six homes. These walkways would be connected by a shared path along the back dune, lined with a sand fence along the seaward side to minimize sand migration into private yards and minimize resident and pet access into the dune habitat. Each of these walkways would be roped off to minimize private access into the dunes. This distance was selected as an intermediate value that would improve dune habitat quality while minimizing disruption to private homeowner beach access. However, west of 31346 Broad Beach Road and the western public coastal point extending west to 31052 Broad Beach Road (i.e., the house on pilings), the narrow beach and dune habitat would appear to limit opportunities for a shared back dune walkway; individual walkways for each would be permitted, but would be lined by bollards and ropes to limit both public and private access into the dunes. In the 450 feet west of 31052 Broad Beach Road (house on pilings), dunes would be sand only and would not be roped off or fenced.

The existing two public vertical coastal access points along Broad Beach Road would remain open and the two public trails across the dunes would be roped off to limit access into the dunes. Additionally, this alternative would also recognize the public's rights to pass along public land below the January 2010 MHTL and across existing

LAEs. This would ensure that over the long-term after nourishment ceases, the revetment is removed, and the beach and dunes erode, the public would continue to have access across the beach. Public access to and along these LAEs would be available when the sensitive dune habitats that overlie these LAEs eventually erode over the long-term and public access to these LAEs becomes necessary and available.

Major components of this alternative would include:

- Transport of 520,000 cy of sand from inland quarries to Broad Beach via 37,300 heavy haul truck trips;
- Transporting of sand from storage areas at Zuma Beach up coast to Broad Beach with heavy trucks or scrapers;
- Redistributing sand, beginning with the western end of Broad Beach, as needed with earthmoving equipment, such as bulldozers, and grading the beach fills to required dimensions;
- Implementing phased nourishment west of 31346 Broad Beach Road and the western coastal access point, with the first phase depositing sand at a reduced depth over a footprint that extends not more than 80 feet seaward from existing homes, and the second phase, occurring after the nourishment of the rest of Broad Beach, depositing sand over the same footprint to a full depth (i.e., up to 17 foot deep dune berm and 14 foot deep beach berm);
- Creating a system of shared walkways to provide private lateral and vertical private coastal access for homeowners across the new dune system east of 31346 Broad Beach Road and the western coastal access point;
- Permitting individual walkways for homes west 31346 Broad Beach Road and the western coastal access point, with dunes roped off and revegetated in the area extending west to 31052 Broad Beach Road (i.e., the house on pilings), but with dunes not revegetated or roped off in the 450 feet of Lechuza Cove;
- Providing two vertical public access trails across the dunes to connect existing access points to the widened beach and ensuring public lateral access along the widened beach seaward of the OHWM;
- Performing backpassing of the sand, ranging from 25,000 to 35,000 cy, from the east to west end of the beach based on triggers and using heavy equipment such as scrapers and bulldozers (average of 25,000 cy/year); and
- Initiating one future major renourishment event of approximately 450,000 cy in roughly 10 years.

Potential Impacts to Public Trust Resources

This alternative would reduce direct burial of intertidal and near shore subtidal habitats as well as potentially reduce indirect turbidity impacts to marine biological resources within Lechuza Cove and offshore of Lechuza Point. This alternative would limit direct burial by reducing the footprint of nourishment west of 31346 Broad Beach Road by

more than 50 percent to 80 from 160 feet when compared to the Project. It would also reduce indirect offshore burial and turbidity through phased nourishment which would reduce initial sand volume losses from the post construction beach.

This alternative would also result in changes to impacts associated with air quality and terrestrial biological resources. Additionally, this alternative would result in trade-offs between protection of marine biological resources and public access and recreation. By narrowing the width of the renourished beach west of 31346 Broad Beach Road, approximately 25 percent of Broad Beach would be reduced somewhat in terms of accessibility to both resident and public users relative to the Project. Additionally, this alternative would not reduce impacts associated with the Project's consistency with coastal public access and recreation polices. However, this alternative could be combined with either Alternative 1 or Alternative 2, which would relocate the revetment landward, but this would also result in associated impacts described for these alternatives above. Resource areas with major changes to impacts under Alternative 9 relative to the Project are discussed in detail below, while the resource areas with negligible changes to impacts are summarized in Table 4-12 at the end of this subsection.

Air Quality and Greenhouse Gases: Under Alternative 9, criteria pollutant emissions would be incrementally reduced relative to the Project as there would be a reduction in the number of heaving haul truck trips corresponding to reduced nourishment volume. Under this alternative there would be approximately 5,700 fewer truck trips relative to the Project (Appendix G). However, while emissions would be reduced under this alternative it would not substantially reduce the severity of Impact AQ-1, particularly for emissions of VOCs, which would continue to exceed SCAQMD and VCAPCD thresholds for onsite and project-level significance, and NO_x, which would continue to exceed SCAQMD and VCAPCD thresholds for onsite and project-level significance, including SCAQMD LSTs for construction activities. Similarly, GHG emissions described in Impact AQ-2 would decrease and would be further below SCAQMD and VCAPCD thresholds, and toxic air contaminants would also be incrementally reduced.

However, while this alternative would reduce criteria pollutant emissions and GHG emissions associated with hauling sand for initial nourishment, it may incrementally increase construction emissions from backpassing as described Impact AQ-1. Due to the narrow profile of the renourished beach west of 31346 Broad Beach Road, backpassing triggers may be met more often on the western end of broad beach. It is not expected that backpassing would occur more than once a year, but the unanticipated loss of sand during large storm events may increase the pressure for backpassing from residences on the western end of the beach.

Coastal Processes, Sea Level Rise, and Geologic Hazards: Under this alternative erosion of beach and dunes after cessation of nourishment would continue as described

under the Project, with the benefits of nourishment enduring for an estimated 10 to 20 or more years and the revetment then becoming exposed as a result of persistent wave action. Anticipated SLR of approximately 8.5 inches by 2030 would further exacerbate erosion effects, including increased frequency and intensity of storm surges and wave attack. However, under this alternative, erosion of the west end of the beach would occur more quickly relative to the Project due to the reduced width of the nourished beach in this area. Consequently, impacts from coastal processes identified in Impact CP/GEO-8 may be more substantial on the western end of Broad Beach, and short term beneficial impacts related to nourishment identified in impact CP/GEO-6 would be reduced. Under this alternative, after the revetment is exposed, potential impacts of coastal processes on the revetment identified in Impact CP/GEO-2 and associated indirect impacts to public trust resources would remain similar to those described for the Project as the revetment would not be redesigned or reinforced under this alternative. In addition, impacts to unprotected homes, or those with substandard revetments or pilings along west broad beach would be potentially exposed to damage from wave attack, with more severe impacts than those for the Project as identified in Impact CP/GEO-3 (See Figure 4-10). Impacts related to the existing revetment (CP/GEO-1), sand compatibility (CP/GEO-4), and tides, currents, and wave height and direction (CP/GEO-5) would remain similar to those described for the Project.

The reduced sand volume under Alternative 9 would result in corresponding reductions to beneficial impacts associated with Impact CP/GEO-7, as approximately 80,000 cy that would have been available for down coast movement under the Project would not be deposited on the western 25 percent of Broad Beach. Impact CP/GEO-7 would remain beneficial under Alternative 9 as the effects of the longshore currents on the remaining 520,000 cy of beach sand deposited on Broad Beach would still occur over the short- to mid-term. However, over the long-term, longshore currents would transport this sand farther down coast and possibly offshore as described for the Project.

Terrestrial Biological Resources: This alternative would result in reduced dune restoration over approximately 1,500 feet or approximately 25 percent of the CSLC Lease Area. Under Alternative 9, the dune berm to the west of 31346 Broad Beach Road and the western coastal access point would not be sculpted into hummocks and would be narrowed to 20 feet and crossed by approximately 19 private walkways in 1,100 feet (one walkway every 60 feet). Further, in the 450 feet west of 31502 Broad Beach Road (i.e., the house on pilings) the dune would remain 20 feet wide and would not be revegetated with native species. However, as described above, the habitat within Lechuza Cove appears to have been historically more characteristic of coastal bluffs and beach. Additionally, the majority of the dunes along the remainder of Broad Beach would continue to be revegetated with native species and subject to access management provisions. Consequently, beneficial impacts associated would continue elsewhere along Broad Beach, while protection of marine biological resources would receive greater emphasis within Lechuza Cove. However, the benefit of this impact as it

applies to the western portion of Broad Beach is questioned, as the dune restoration would displace sensitive marine habitat (discussed below).

The reduced nourishment volume, approximately 80,000 cy less sand than described for the Project, would reduce impacts associated with the increased closure period of Trancas Lagoon identified in TBIO-5. However, as 86 percent of the nourishment volume would still be applied up coast of these features, this incremental reduction in nourishment volume would not substantially reduce these impacts. This reduction in the nourishment volume on the western end of Broad Beach may increase the pressure for backpassing by residents in this area following unanticipated large losses of sand following storm events. However, only one backpassing event would be expected to occur annually and the total area affected by backpassing would be less; therefore impacts associated with TBIO-3 may be slightly reduced. Other construction-related impact to terrestrial biological resources identified in Impacts TBIO-2 and TBIO-4 would be incrementally reduced due to the reduction in direct impact area, total sand volume applied, and number of truck trips used for hauling. Additionally, requiring shared private coastal access walkways would also substantially reduce disturbance of the proposed dune system described in Impact TBIO-7, protecting this newly established and restored dune habitat. Finally, long-term degradation would have similar impacts to newly created dune habitat to those described for the Project in Impact TBIO-8.

Illustration 4-7: *This alternative would substantially reduce impacts to marine biological resources within Lechuza Cove. However, it would also leave the boulder field on the western end of Broad Beach relatively exposed and would result in a narrow beach width west of 31346 Broad Beach Road and the western public access point. Consequently, this alternative would include trade-offs with recreation and public access.*

Marine Biological Resources: The reduced and phased nourishment west of 31346 Broad Beach Road and the western public coastal access point would reduce direct burial of rocky intertidal and near shore subtidal marine habitats, including surfgrass, kelp, and other sensitive marine organisms (see Figure 4.10). As discussed below, this alternative would also reduce indirect impacts to marine biological resources by limiting post-construction offshore loss of beach sand and subsequent potential for indirect habitat burial. However, this would result in trade-offs, with regards to decreases in recreational and public access and coastal protection benefits realized under the Project (Illustration 4-7).

Implementation of Alternative 9 would substantially reduce the severity of impacts to rocky intertidal habitats within Lechuza Cove and off Lechuza Point described in Impact

MB-2. As the beach width would be decreased by approximately 50 percent, this alternative would reduce the direct burial and coverage of rocky intertidal by up to 50 percent (see Figure 4.10). Over the long-term, the reduced cover means that more rocks would be exposed in spring when sand levels are seasonally low, and burial during the fall when sand levels are typically high would be reduced both in terms of area and duration relative to the Project. Additionally, while nourishment would still result in the 100 percent mortality of sessile organisms within most of the beach footprint, the phased nourishment approach would result in reduced mortality of mobile organisms immediately following the nourishment event as some of these organisms in the rocky intertidal may be able to burrow through the reduced overburden following the first and second phases of nourishment. Further, reduced sand volumes, footprint and phased nourishment would likely reduce the duration of both direct and indirect burial, a key factor in marine organism survival.[14] Several factors determine survival of beach invertebrate fauna during burial, including sand depth, the ability for vertical migration through the sand overburden, duration of burial and the recruitment potential of larvae, juveniles, and adult organisms from adjacent areas (Greene 2002).

For reasons similar to those described above for rocky intertidal habitat, this alternative would also substantially reduce Impact MB-4 to subtidal habitats and organisms. As the footprint of the beach would be substantially reduced under this alternative, Alternative 9 would substantially limit impacts, likely avoid all or most direct burial of shallow subtidal reefs during sand placement and associated mortality of surfgrass and kelp described in Impact MB-4 and MB-8. While it is more difficult to estimate the total reduction in indirect impacts that occur when the beach is reshaped and sand moved offshore, it can reasonably be assumed that indirect impacts to these habitats would also be substantially reduced due to narrower beach width and substantially reduced sand volumes. Additionally, remaining impacts to rocky intertidal and subtidal habitats under this alternative would be reduced through implementation of AMMs MB-2a and MB-2b.

Additionally, the phased placement of sand on the western end of Broad Beach would result in a decrease in nearshore turbidity and indirect burial compared to the Project as approximately 25 percent of placed sand is remobilized immediately post construction. Therefore under this alternative, only 7,500 cy of sand would be immediately lost after each of the two initial nourishment phases rather than the 35,000 cy that would be lost in the same area under the Project. This would substantially reduce the indirect smothering or burial of additional rocky intertidal and subtidal habitat beyond the actual footprint of the expansion as both the depth and duration of burial would be reduced.

[14] Many rocky intertidal and subtidal organisms are adapted to periods of burial by sand and can survive weeks or even months of burial, dependent upon the species. By limiting both the extent and duration of burial, this alternative would materially improve marine organism survival rates.

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Summary of West End Properties not Protected by the 2010 Emergency Revetment

FIGURE 4-10

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However, phased nourishment may increase the mortality of organisms within the sandy intertidal as the second phase may occur after intertidal organisms are beginning to recover. Implementation of AMMs MB-2a, MB-2b, and MB-ALT-8 would ensure that any adverse impacts to sensitive intertidal and subtidal habitats would be appropriately mitigated. Additionally, as described for terrestrial biological resources, this alternative may increase the pressure for backpassing events which could result in incremental increases to the severity of impacts described in Impact MB-5.

The reduced nourishment volumes may also result in an incremental decrease in impacts to down coast marine resources described in Impact MB-7 as a reduced volume of sand would be available for down coast transport to Zuma Beach, Point Dume State Beach, and other down coast beaches. Additionally, intertidal habitat areas and shoreline marine biological resources farther south may be indirectly affected by changes in sand supply and distribution through littoral drift. This may result in additional reductions to impacts to marine biological resources down coast. However, as 86 percent of the proposed nourishment volume would still be applied to Broad Beach under this alternative, this reduction in the severity of down coast transport impacts likely would be incremental for down coast marine biological resources. The reduced volume of sand and the absence of construction activities on the west end of Broad Beach would incrementally reduce short-term construction related impacts to marine biological resources identified for the Project in Impacts MB-3, MB-4, MB-5, and MB-6.

Recreation and Public Access: As the emergency revetment would be retained under this alternative, Alternative 9 would have similar impacts associated with recreation and public access described in REC-4. However, as described for the impacts to Marine Biological Resources under this alternative, impacts to rocky intertidal and other sensitive marine habitats would be reduced. The dune and beach profile, per the Project, at the western end of Broad Beach would be approximately 160 feet wide and would substantially cover the rocky intertidal areas, particularly the boulder field fronting 31412 Broad Beach Road. However, under this alternative the beach width at the western end would be reduced by approximately 50 percent and would leave rocky intertidal areas and the boulder field at least partially exposed in the intertidal and surf zone. This alternative would substantially reduce impacts to marine biological resources by reducing the width of the western end of Broad Beach, but would reduce recreation opportunities and public access to some degree.

Broad Beach west of the existing rock revetment is unique from the rest of Broad Beach, because of the rocky intertidal habitat and biological resources that exist at this location. A 2012 public survey of beachgoers at Broad Beach indicated that tidepooling was an attraction for some beachgoers. Under existing conditions, swimming and playing in the surf zone are attractive at the east end of Broad Beach, and less so at the far west end. Although lateral access would be limited at the west end of Broad Beach, this alternative would help minimize impacts to the existing rocky intertidal habitats while

still offering improved access for tidepooling as a recreation resource. The majority of Broad Beach would provide for enhanced opportunities for a full range of beach recreation within the proposed beach and dune areas.

The existing narrow intertidal beach would be expected to narrow more quickly over the 20 year Project life. SLR may also reduce public access during low tide conditions. Impacts to public access could be reduced by reducing the length of the narrow beach on the western end of broad beach; however, this would have corresponding impacts to marine habitats in this area. These impacts could also be reduced by increasing the size of the phased nourishment events. For example, phases one and two could each consist of 40,000 to 50,000 cy of sand which would increase the depth or size of the beach on the west end while still minimizing impacts to marine habitats to some extent. Regardless, under this alternative, impacts described for REC-3 pertaining to public access would be less beneficial than those described for the Project. Construction-related impacts from nourishment and backpassing operations would have similar impacts to those identified for the Project in Impacts REC-1 and REC-2.

Other Resource Areas: This alternative would have similar impacts to the Project in terms of its effects on scenic resources, environmental justice, utilities and service systems, and marine water quality. Impacts to traffic and parking, cultural, historic, and paleontological resources, public health and safety hazards, and noise would be incrementally reduced due to the decreased levels construction activity associated with the reduced sand volumes.

Table 4-12. Alternative 9 – Changes in Impact Severity

Resource Area	Relative Change in Impact Severity	Discussion
Scenic Resources	No Major Change in Adverse Impacts	Similar to the Project, permanent authorization of the revetment through a long-term lease and approval of CDPs would create the potential for long-term degradation of the visual environment of Broad Beach after nourishment activities end and natural coastal erosion causes the revetment to become exposed as described in Impact SR-1.
Cultural and Paleontological Resources	No Major Change in Adverse Impacts	There would be no appreciable difference in impacts relative to the Project, although construction-related Impacts identified in Impacts CR-2 and CR-3 may be incrementally reduced due to the reduced construction and hauling activities.
Noise	No Major Change in Adverse Impacts	There would be no appreciable difference in impacts relative to the Project. While there may be a reduced duration of nourishment due to reduced sand volume on the western end of Broad Beach, this reduction would be incremental at most.
Public Health and Safety Hazards	Incremental Reduction in Adverse Impacts	This alternative would result in a slight decrease in the adverse effects associated with Impact HAZ-2, as the duration of nourishment and the presence of heavy construction equipment may be reduced do to the reduced nourishment volume on the western end of Broad Beach. However, this reduction in the duration of nourishment would be incremental

Table 4-12. Alternative 9 – Changes in Impact Severity

Resource Area	Relative Change in Impact Severity	Discussion
		at most and would not substantially reduce Impact HAZ-2. Similar to the Project adverse effects under this alternative would be reduced through implementation of AMMs HAZ-2, HAZ-3a, and HAZ-3b.
Traffic and Parking	Incremental Reduction in Adverse Impacts	This alternative would require approximately 5,700 fewer heavy haul truck trips due to the reduced nourishment volume at the west end of Broad Beach, which would incrementally reduce traffic and congestion on the inland routes, PCH, and in the Zuma Beach parking lot, incrementally reducing the severity of the adverse effects associated with Impact TR-1, TR-3, and TR-4. These impacts would be further reduced through implementation of AMM TR-1.
Environmental Justice	No Major Change in Adverse Impacts	There would be no appreciable difference in impacts relative to the Project.
Utilities and Service Systems	No Major Change in Adverse Impacts	Under this alternative the revetment would be retained in place similar to the Project and impacts to utilities and service systems would remain similar to the Project. Potential impacts to septic systems on the western end of Broad Beach may be incrementally increased over the mid-term as there would be a reduced nourishment volume and footprint in this area; however, this would not be substantial as the entire beach would erode over the long-term exposing these areas both under this alternative and under the Project.
Marine Water Quality	Incremental Decrease in Adverse Impacts	This alternative would reduce turbidity impacts on the western end of Broad Beach identified in Impact MWQ-1 and corresponding impacts to marine biological resources identified in Impacts MWQ-2 and MWQ-4. Impact MWQ 3 would remain similar to the Project due to nourishment and retention of the existing revetment.