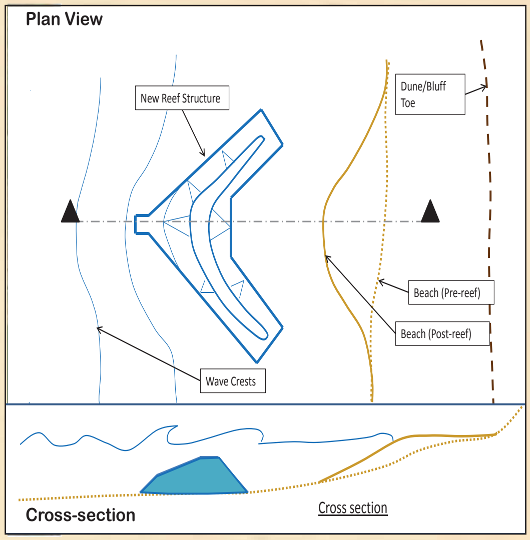
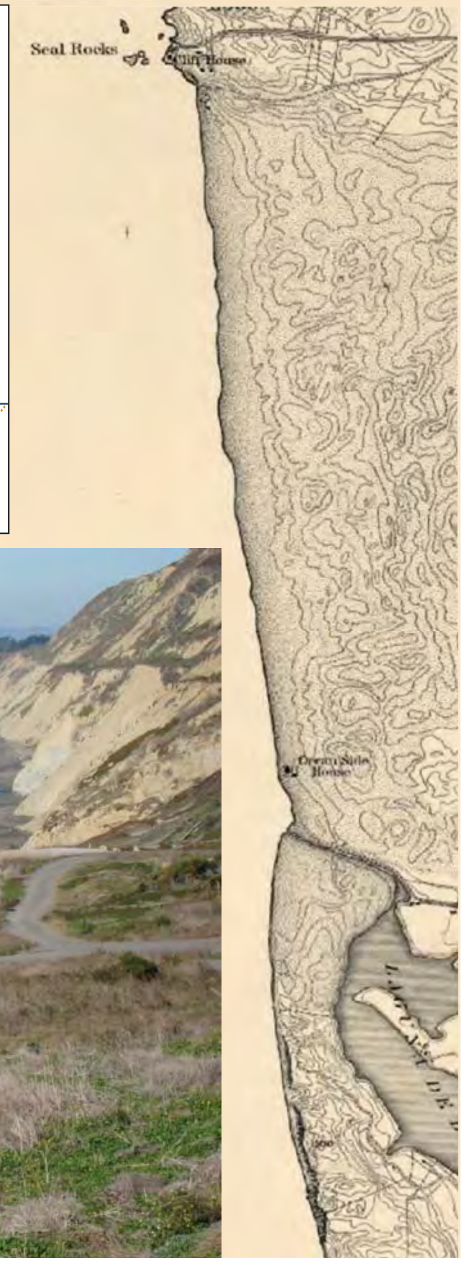
San Francisco Littoral Cell Coastal Regional Sediment Management Plan

Your Coast in 50 Years - A Sediment Management Workshop

Pre- Workshop Information Packet

FALL 2012





Coastal Sediment Management Workgroup

ABAG

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Your Coast in 50 Years

Pacifica, 1994

Ocean Beach, 2012

Welcome to a new era of living on our treasured coasts! We all as a society and as individuals look to the oceans and coastlines for many things: livelihoods, recreation, food, inspiration. Our places of residence, commerce and play have grown in fits and starts along the seashore through the decades – sometimes not truly in sustainable ways. With growing understanding and urgency about the threats from sea level rise, business as usual may not be the best option for the future of our coastal assets.

This information packet is meant to provide a fact-based synopsis about one strategy for our coastal zone: regional sediment management. There are elements related to a specific plan for the San Francisco-Daly City-Pacifica corridor as well as libraries describing some possible solutions for addressing erosion along the coast.

We encourage you to read through the information and bolster your understanding about the problem areas and available strategies. We hope you will use this packet to become acquainted with the language of sediment management to ultimately develop a workable vision for your, and our, coast in for the next generations.

Sincerely,

Doug George	Bob Battalio
Oceanographer/Project Manager, ESA PWA	Coastal Engineer/Project Director, ESA PWA

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Project Overview

A Coastal Regional Sediment Management Plan (CRSMP) is a guidance and policy document that discusses how Regional Sediment Management (RSM) can be applied in a rapid, cost-effective, and resource-protective manner. ESA PWA and the Association of Bay Area Governments (ABAG) are completing the CRSMP for a segment of the San Francisco Littoral Cell along the San Francisco and San Mateo Counties' Pacific coastline for the Coastal Sediment Management Workgroup (CSMW). The CSMW is a taskforce concerned with the adverse impacts of coastal erosion on coastal habitats; it is co-chaired by the U.S. Army Corps of Engineers and the California Natural Resources Agency. Along with other federal, state and local/regional entities, the CSMW is working to implement RSM to augment or restore natural processes.

Preparing a CRSMP entails specifying how governance, outreach and technical approaches can support beneficial use of sediment resources without causing environmental degradation or public nuisance. Because the study region is heavily urbanized and includes the entrance to San Francisco Bay, many components are needed to produce a valuable plan. Assessments of geological and geomorphic processes, habitats and species of concern (terrestrial and marine), infrastructure at risk, economic costs/benefits, public access, and policies that may influence sediment management must be made with existing data sets. In addition, the influence of climate change and sea level rise on sediment management strategies is considered to make the CRMSP useful for a long-term planning horizon (50 years). Also, community ownership of the CRMSP is encouraged by public meetings and a Stakeholder Advisory Group to ensure the plan is acceptable by local cities and counties.

Coastal Sediment Management Workgroup

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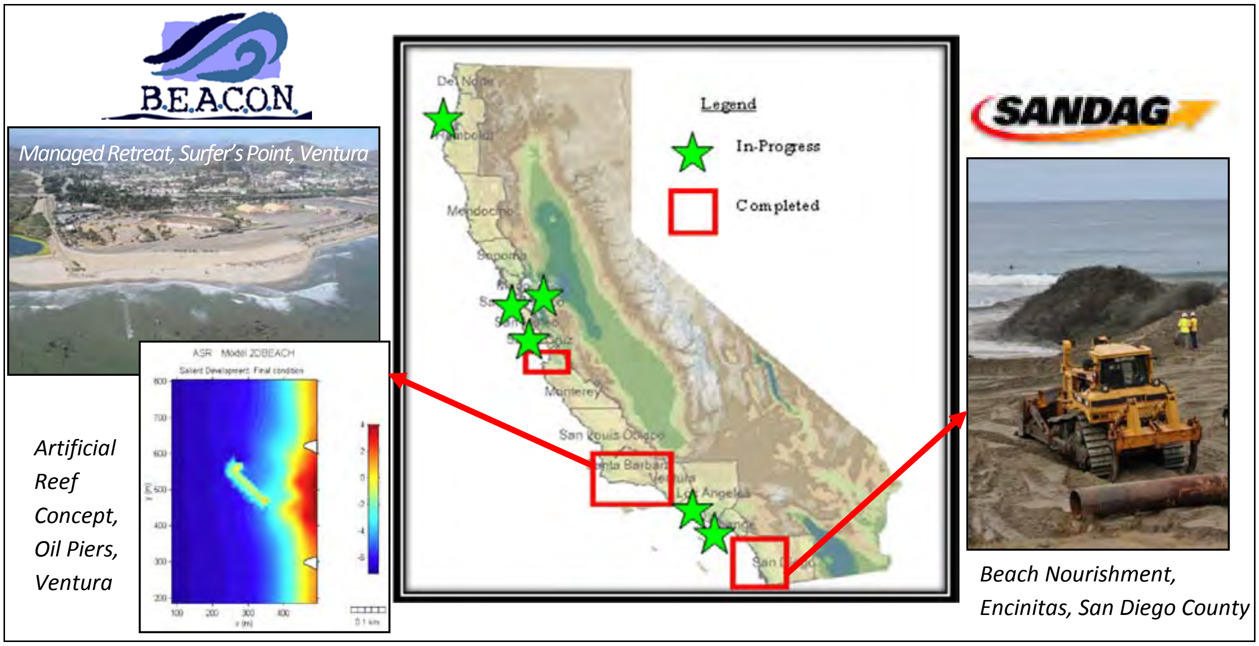
Moving from Plan to Projects: Example projects from two CRSMPs



Artificial Reef Concept, Oil Piers, Ventura

Beach Nourishment, Encinitas, San Diego County

The San Francisco Littoral Cell CRSMP is the latest plan to be developed in California under the guidance of the Coastal Sediment Management Workgroup (CSMW). Two regions in Southern California are implementing their CRSMPs – Santa Barbara and Ventura counties and San Diego County.

BEACON: The Beach Erosion Authority for Clean Oceans and Nourishment (BEACON) completed a CRSMP for Santa Barbara and Ventura counties in January 2009. Managed retreat and construction of artificial reefs are among the recommended projects. The Surfers' Point, Ventura, managed retreat project was implemented in 2011 after severe erosion of artificial fill had degraded public access and use, including the collapse of a significant portion of a bike path and parking lot. Approximately 1,800-linear-feet of shoreline was restored to more natural conditions using native materials, grading and planting that also maintained public access recreation opportunities. A multipurpose artificial reef is being investigated for the nearby Oil Piers, Ventura, to produce a stable beach in the lee of the structure. The predicted size of the newly formed salient will widen the beach by 300-360 ft at its widest point behind the reef and extend at least 1,300 ft alongshore. Other efforts by BEACON include working with flood control agencies to directly recover coarse grained upland sediment for use at beaches.

SANDAG: The San Diego Association of Governments (SANDAG) completed a CRSMP in April 2009 that called for extensive beach nourishment based on sand placements in 2001. Eight beaches from Imperial Beach to Oceanside received sand from offshore sites during a three month period in fall 2012. A unique funding structure was developed to implement this regional project (see Moving from Plan to Projects: Developing a Path and Funding Opportunities).

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Infrastructure, Coastal Armor, and Erosion Hazard Zones

Understanding the extensive coastal infrastructure is essential to determining what could be at risk from coastal erosion. This assessment helps target areas for actions related to sediment management that may mitigate loss of important roads, water networks and commercial or residential districts. This also identifies where existing strategies, such as seawalls, may be overwhelmed by sea level rise in the future. The following maps show an overview of each city and then most study reaches (segments of coast) within each jurisdiction. The maps combine the elements described below.

Infrastructure

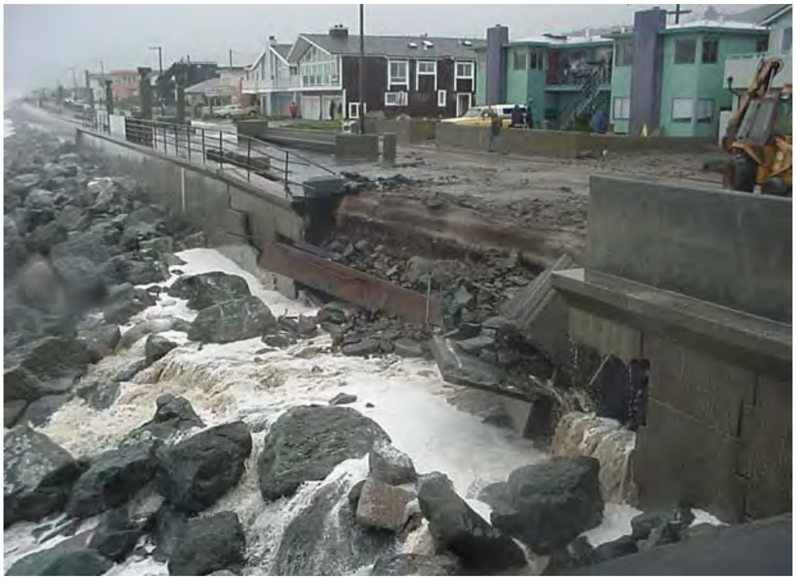
The Cities of San Francisco, Pacifica, and Daly City provided the pump station, outfall, and pipeline locations shown on the following maps. The cities have major storm or sewer outfalls in the planning area. Much of the pipeline system is at risk and has endured damages in the past from coastal erosion. The Bing basemap imagery depicts roads and buildings within each of the study reaches. Additional information from the National Park Service (e.g., coastal trails) and counties is in hand but not shown; it will be considered in the analysis, however.

Coastal Armor

Nearly all of the study reaches have some type of coastal protection structure. The condition of structures is highly variable, with some newly constructed and others in need of repair. This data layer was developed initially by the California Coastal Commission and updated by ESA PWA in fall 2011 (ESA PWA, 2012). Walls are depicted as lines while revetments, which are much more variable in width, are depicted as areas.

Seawalls, retaining walls, and revetments are the main shoreline protection structures that exist within the RSM planning area. These structures are typically built by public jurisdictions or private landowners to protect inland property and infrastructure from coastal erosion. The structures do not prevent erosion of the beaches seaward of them and beaches continue to narrow in front of most structures, as seen in the photographs below from Pacifica near Beach Boulevard.

The size of waves breaking on the structures increases as erosion removes the protective beach. This results in a progressive over-loading of the structures which leads to wall failure or reinforcement, and wave overtopping. Sea level rise will exacerbate this progressively increasing loading. This condition is expected to progress such that there will little to no beaches fronting coastal structures within the next few decades.

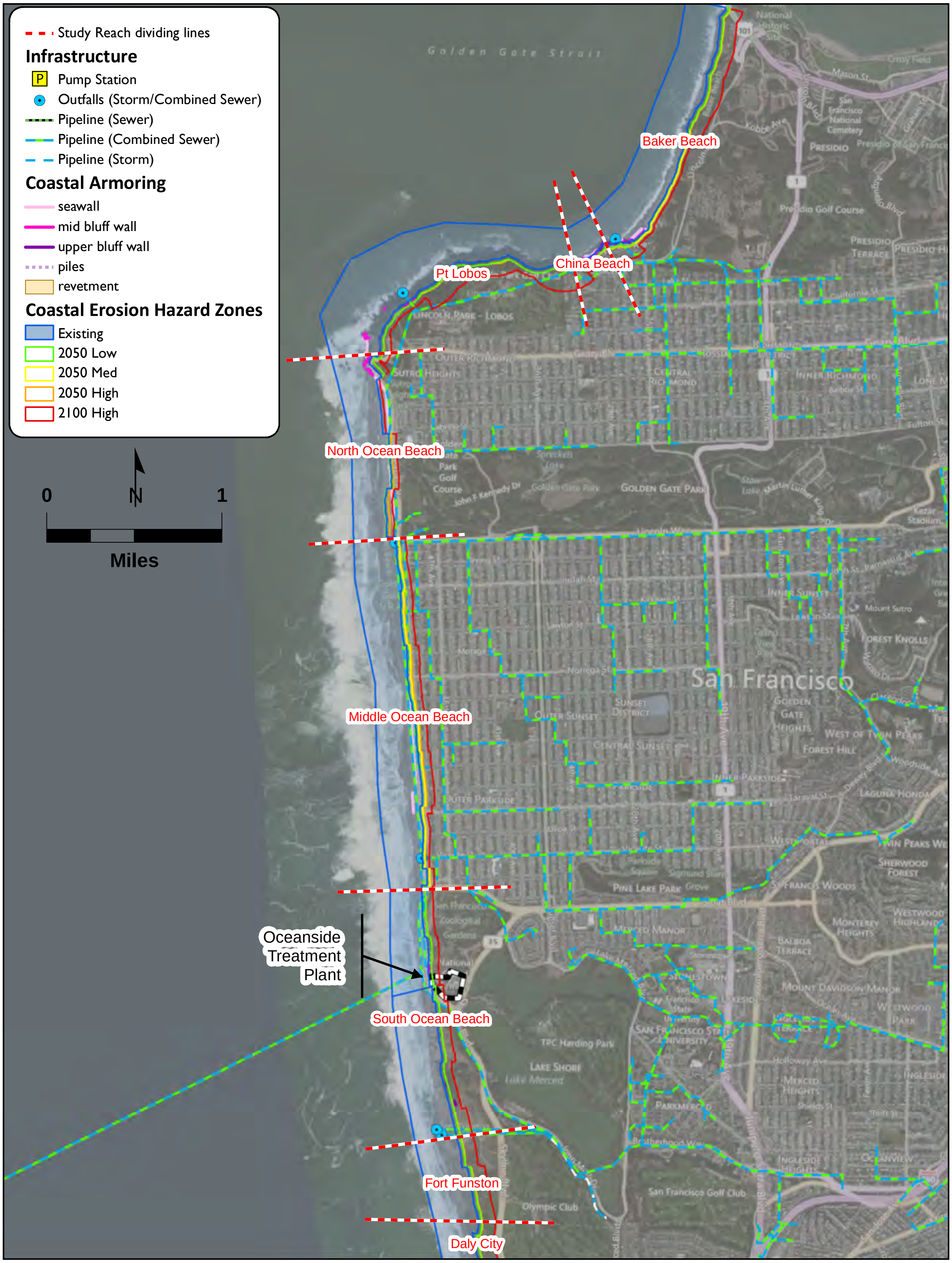


Seawall failure, Beach Boulevard, Pacifica, 2010

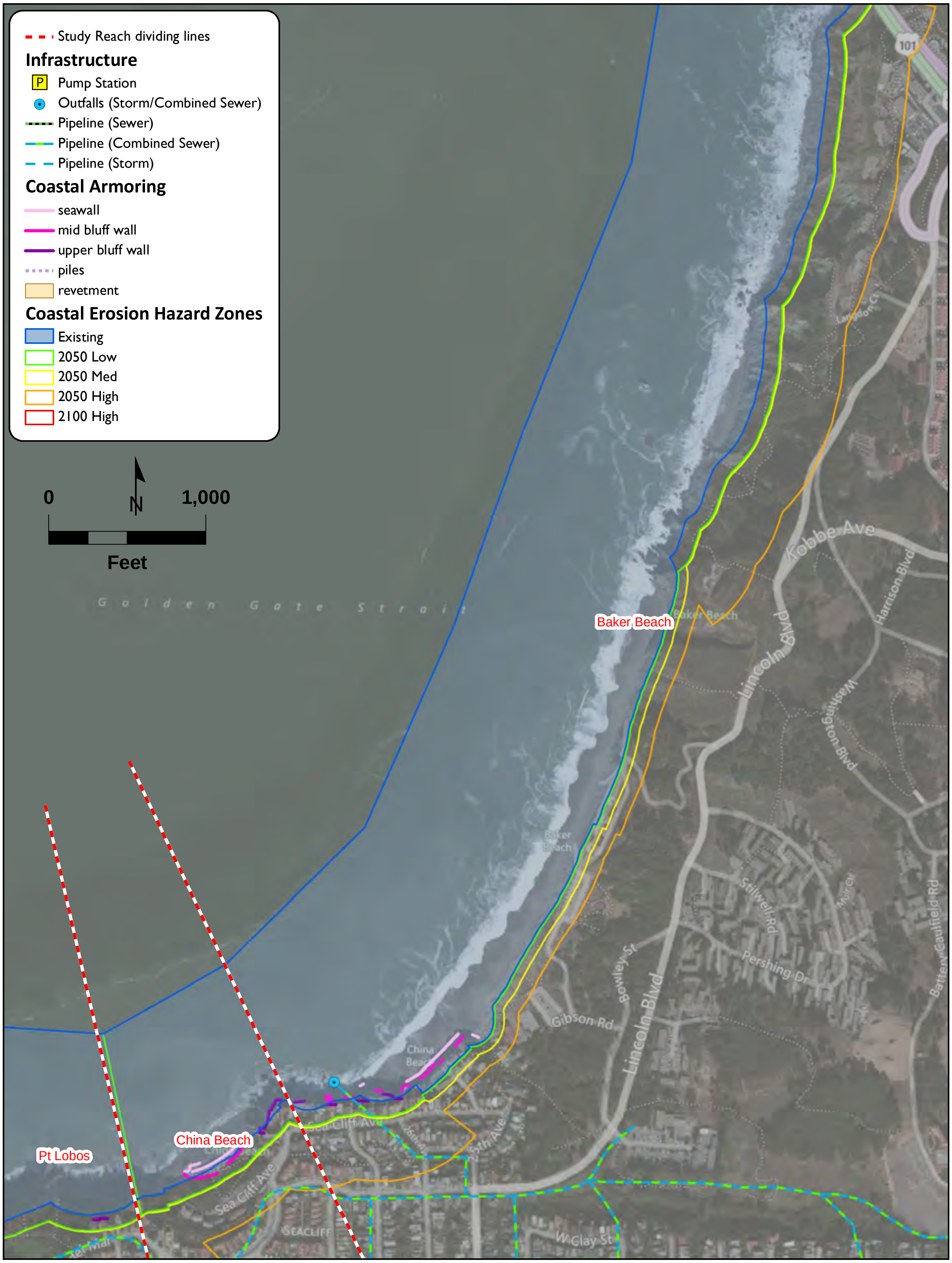
Coastal Erosion Hazard Zones

Future shoreline erosion hazard zones are included to show which stretches of coast will be most vulnerable to increased erosion due to sea level rise by 2050 and 2100. The zones incorporate three components of coastal erosion: retreat associated with sea level rise, erosion potentially caused by a 100-year wave event, and the historical shore erosion rates based on data since the 1950s. Full cliff erosion zones for southern San Francisco and Daly City are shown in a subsequent section (see Landslide Hazard Zones) and not displayed here. Historical erosion rates incorporate the effect of existing coastal armor but the benefit of the seawalls to prevent erosion and flooding has not been analyzed. The hazard zones are representative of the potential hazards if the armoring is not sufficient to prevent overtopping or is not maintained. Erosion estimates were made assuming no management actions are taken. As sea level rises, the ocean will reach higher land elevations more frequently. The sea level rise plus bigger storm waves and larger storm surge has a cumulative effect on the inundation distance or elevation. The resulting erosion can be much greater than that experienced recently. For more information about the methods used to develop these hazard zones see PWA et al 2009.

San Francisco: Overview



San Francisco: China and Baker Beaches



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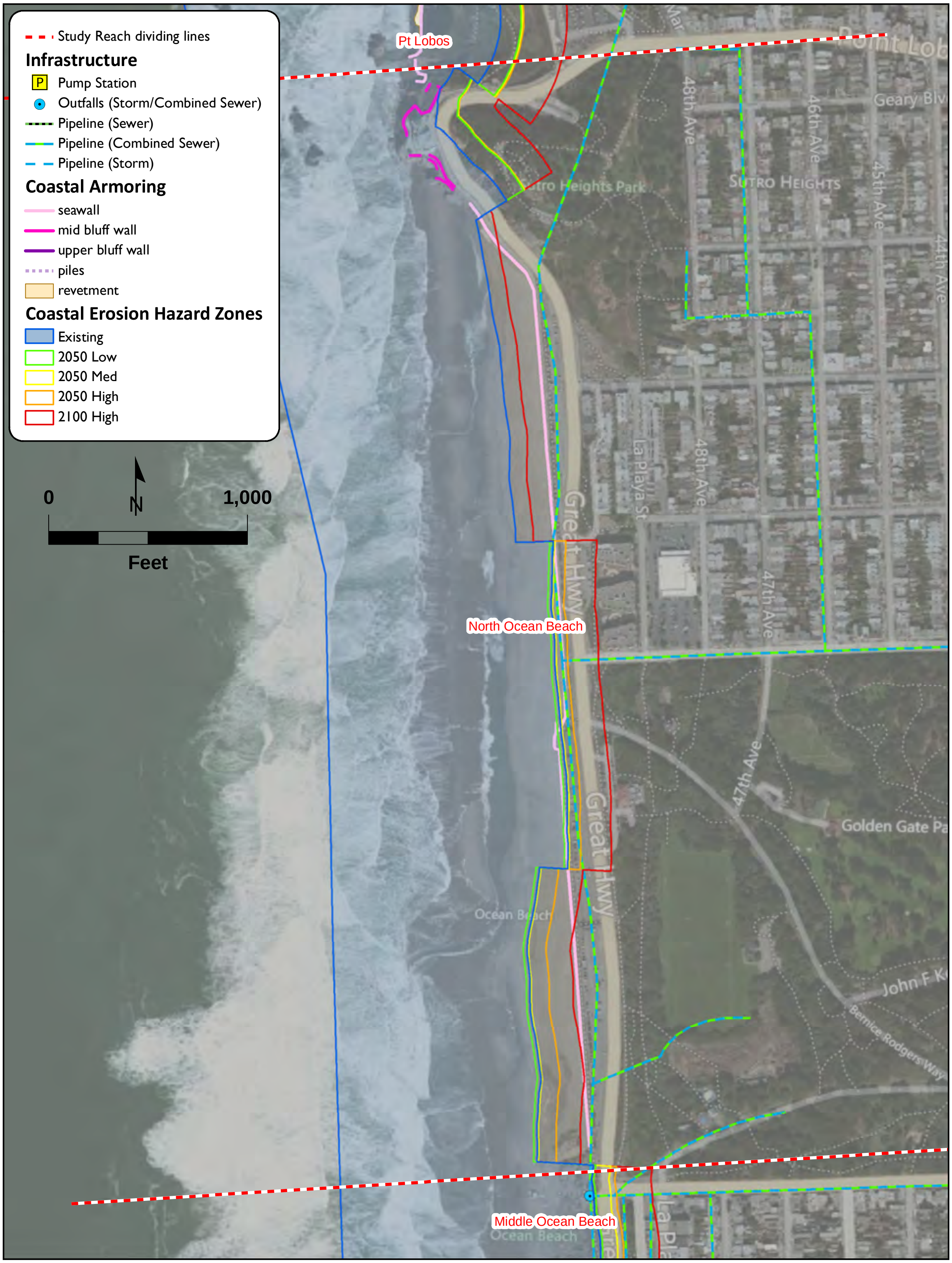
San Francisco: North Ocean Beach



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San Francisco: Middle Ocean Beach

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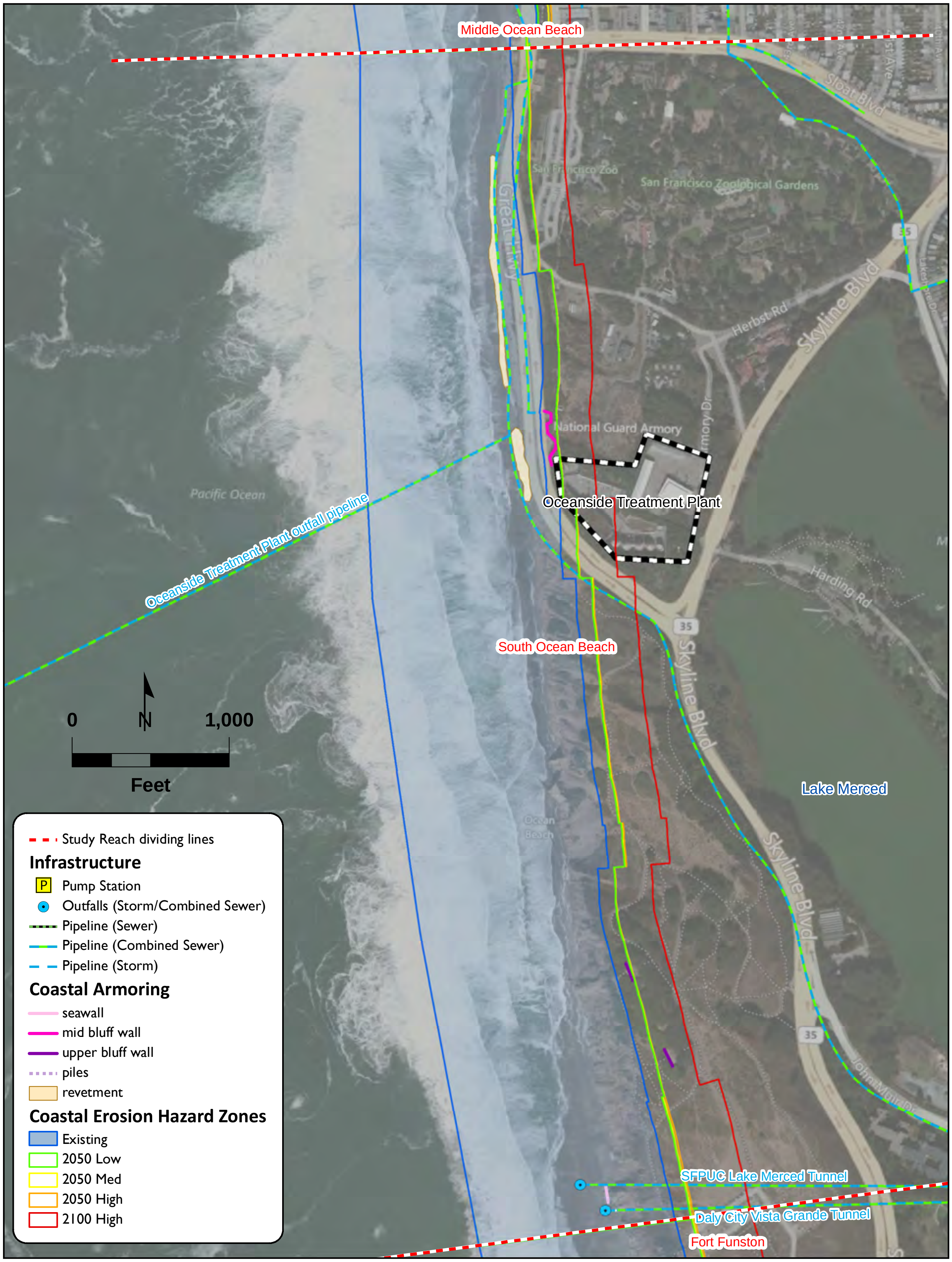
San Francisco: South Ocean Beach



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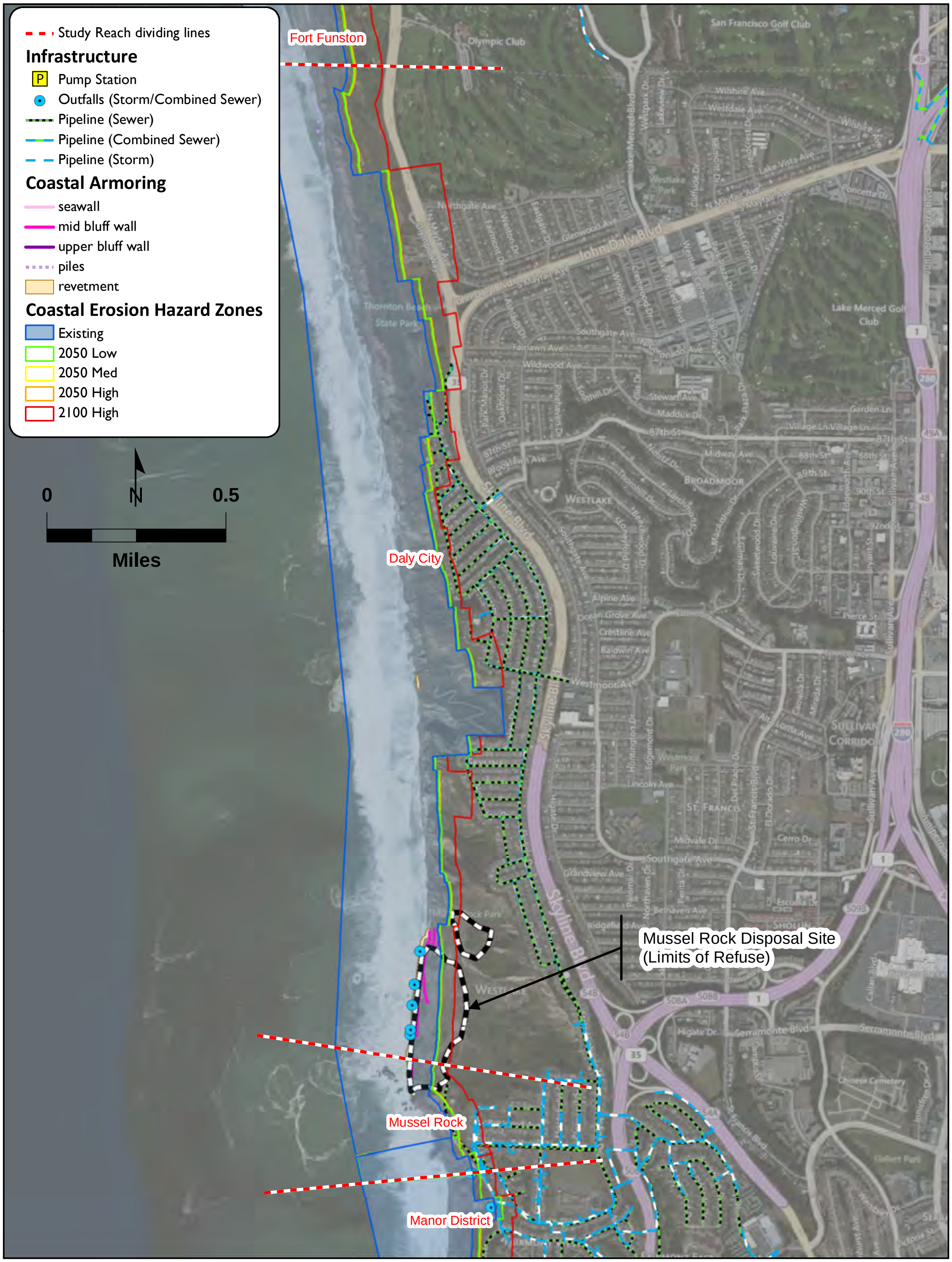
Daly City: Overview



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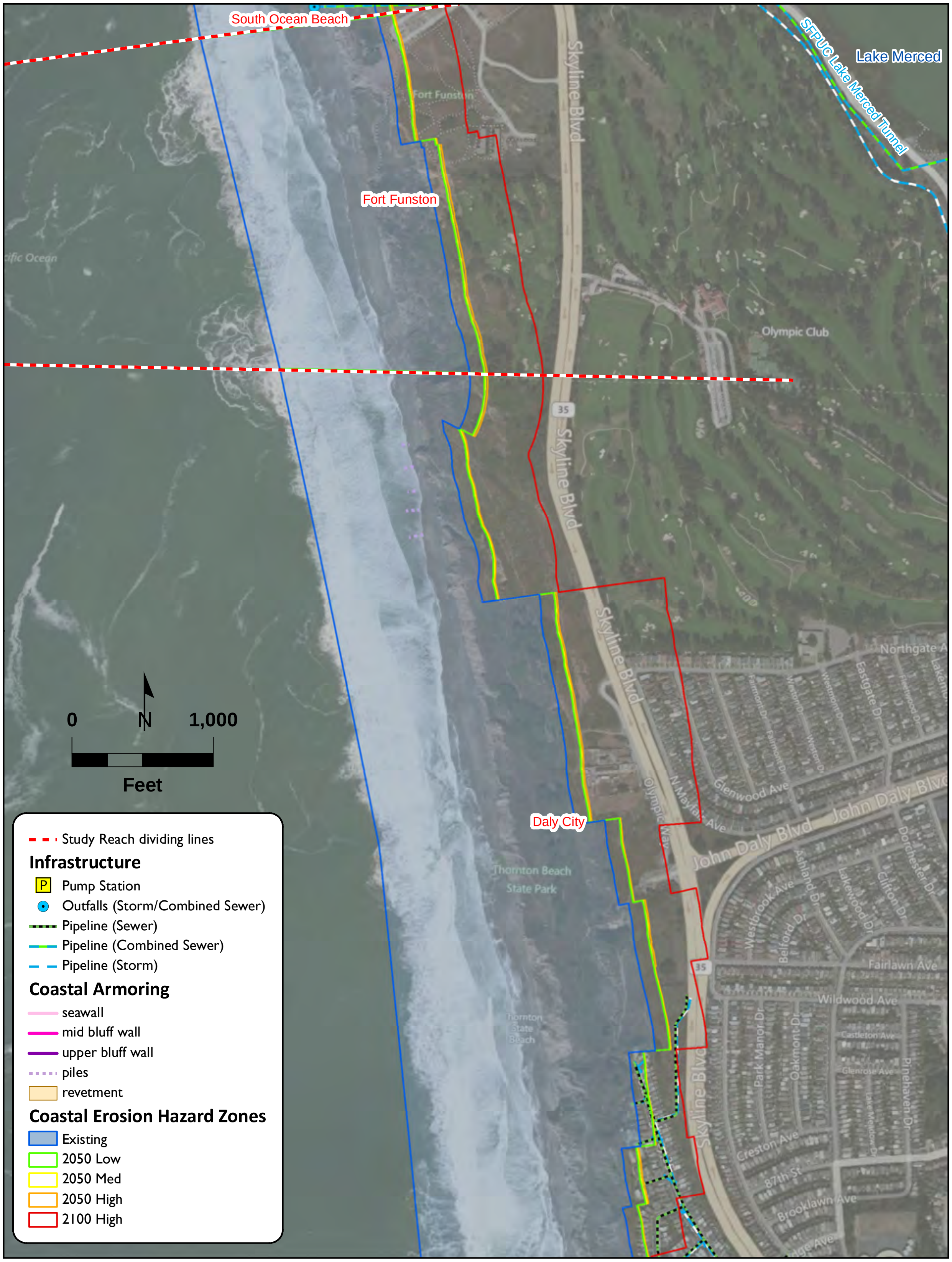
Daly City: North & Ft Funston



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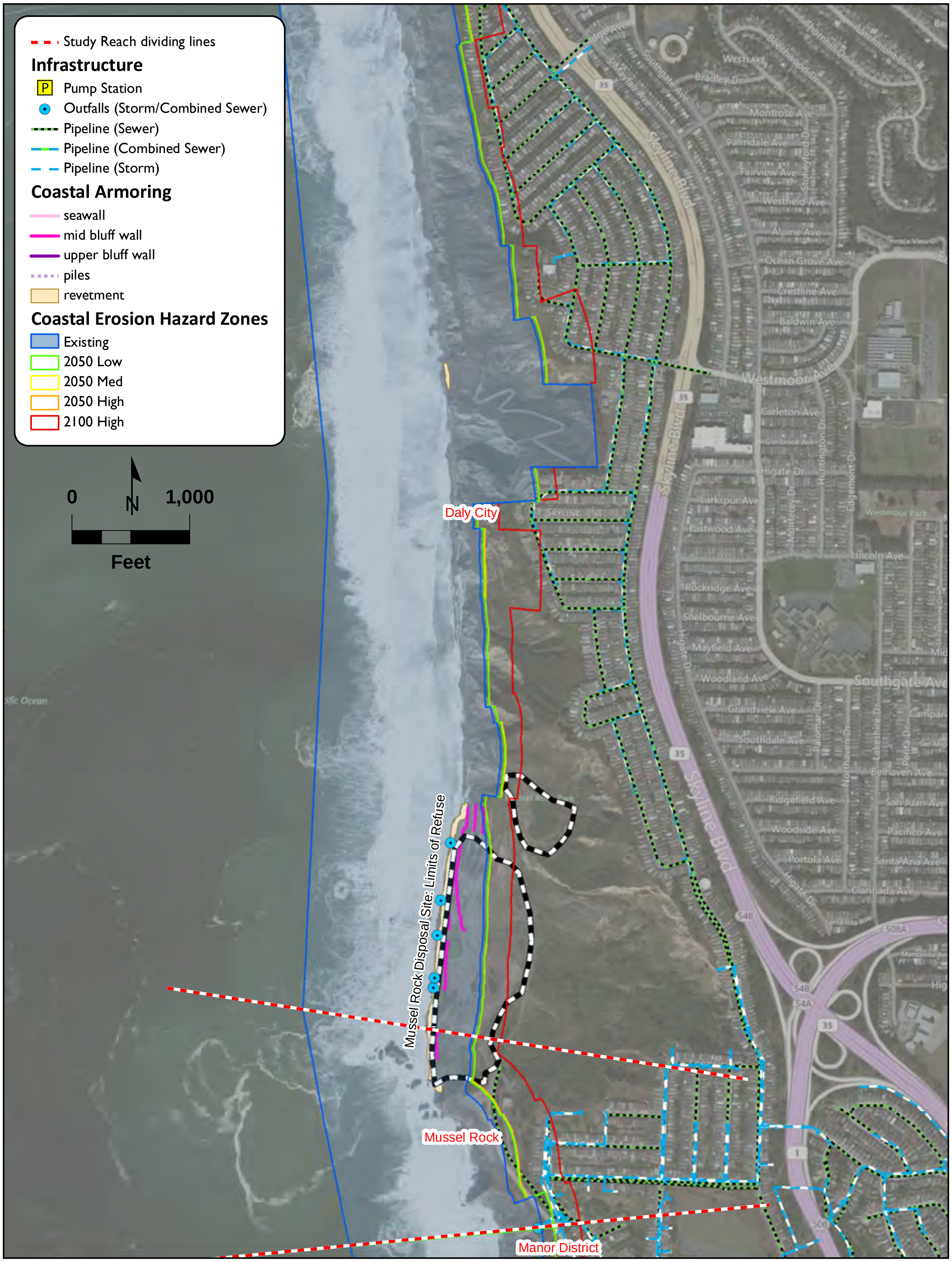
Daly City: South & Mussel Rock



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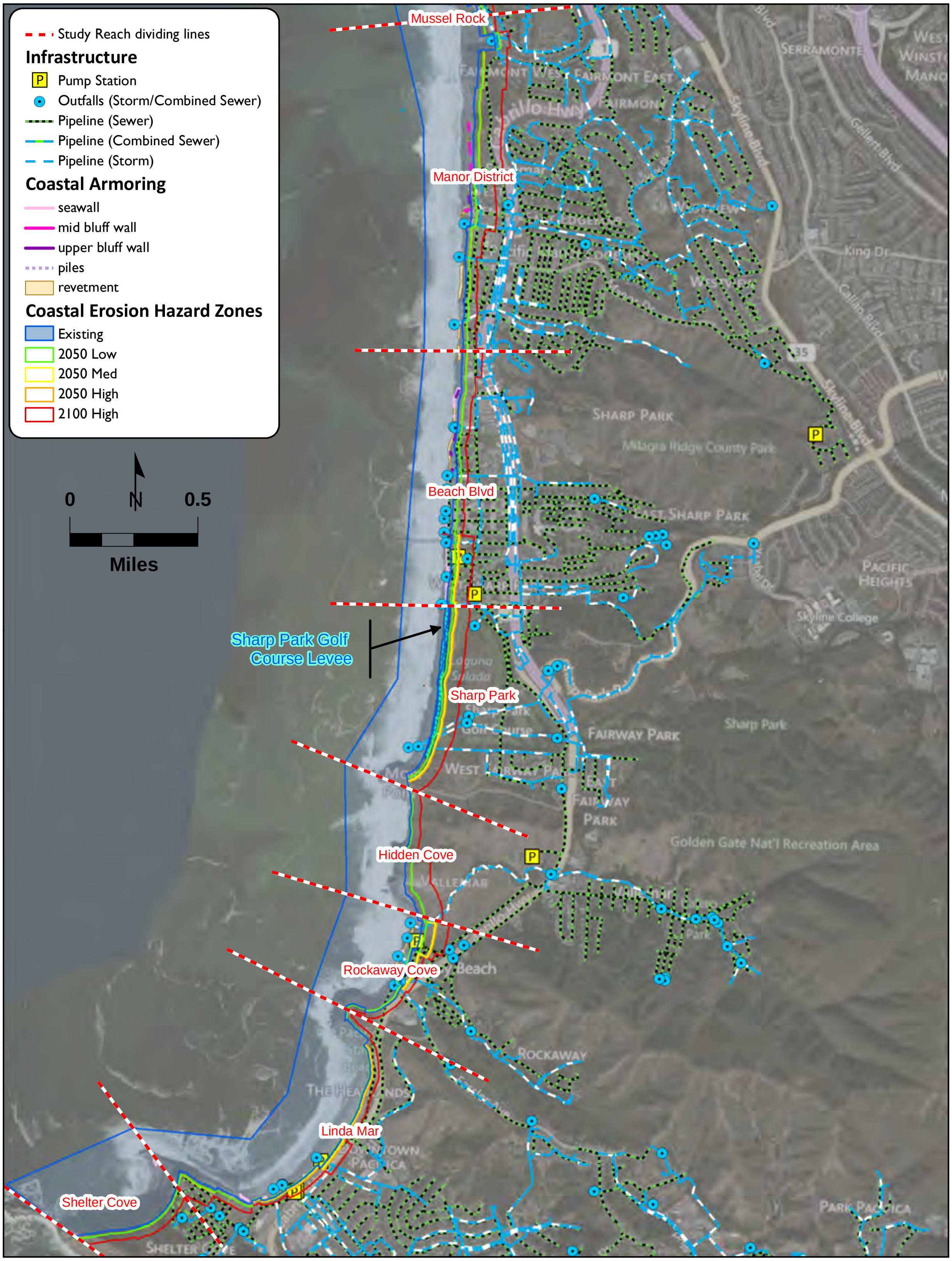
Pacifica: Overview



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Pacifica: Manor Beach

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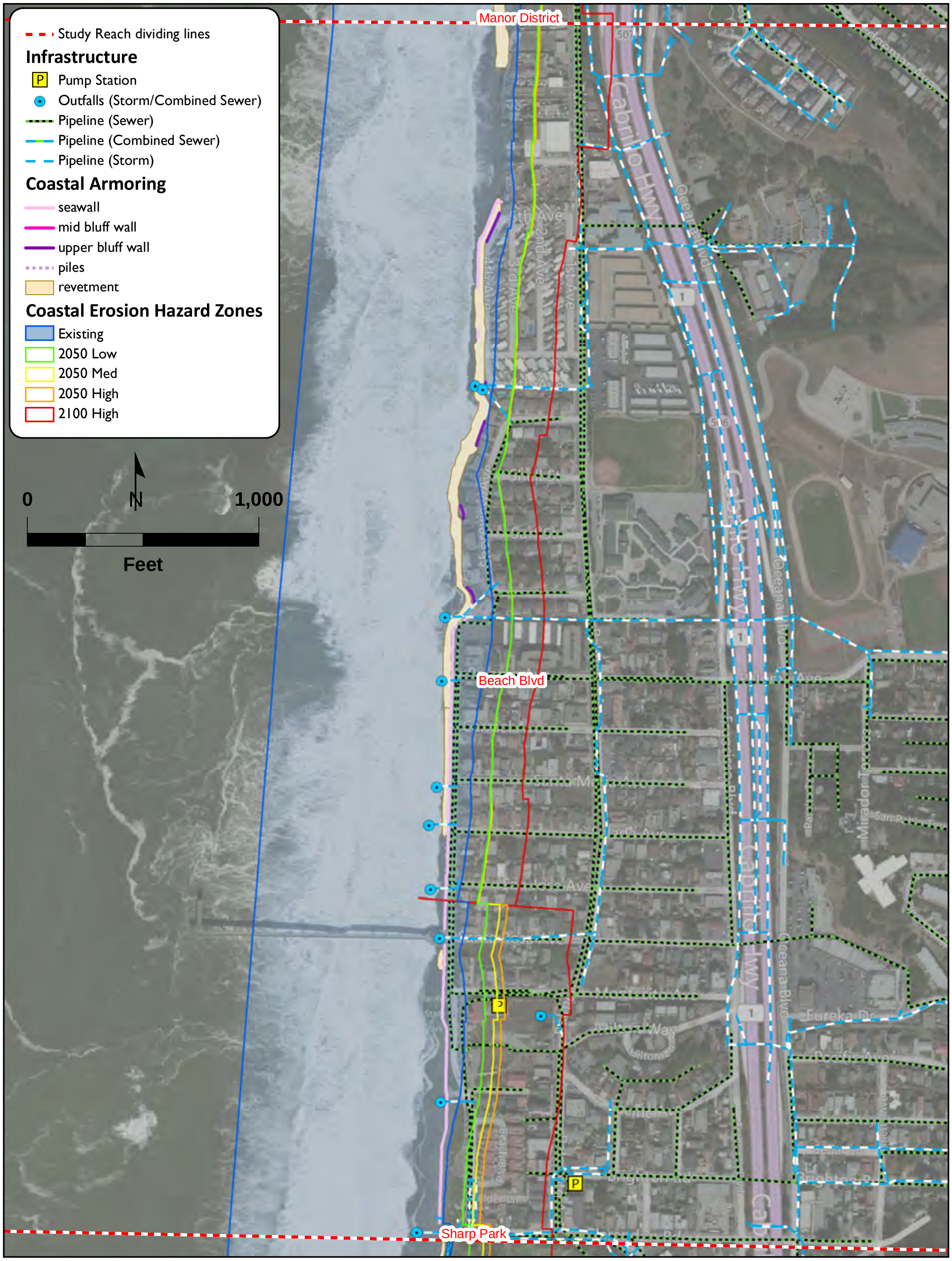
Pacifica: Beach Blvd.



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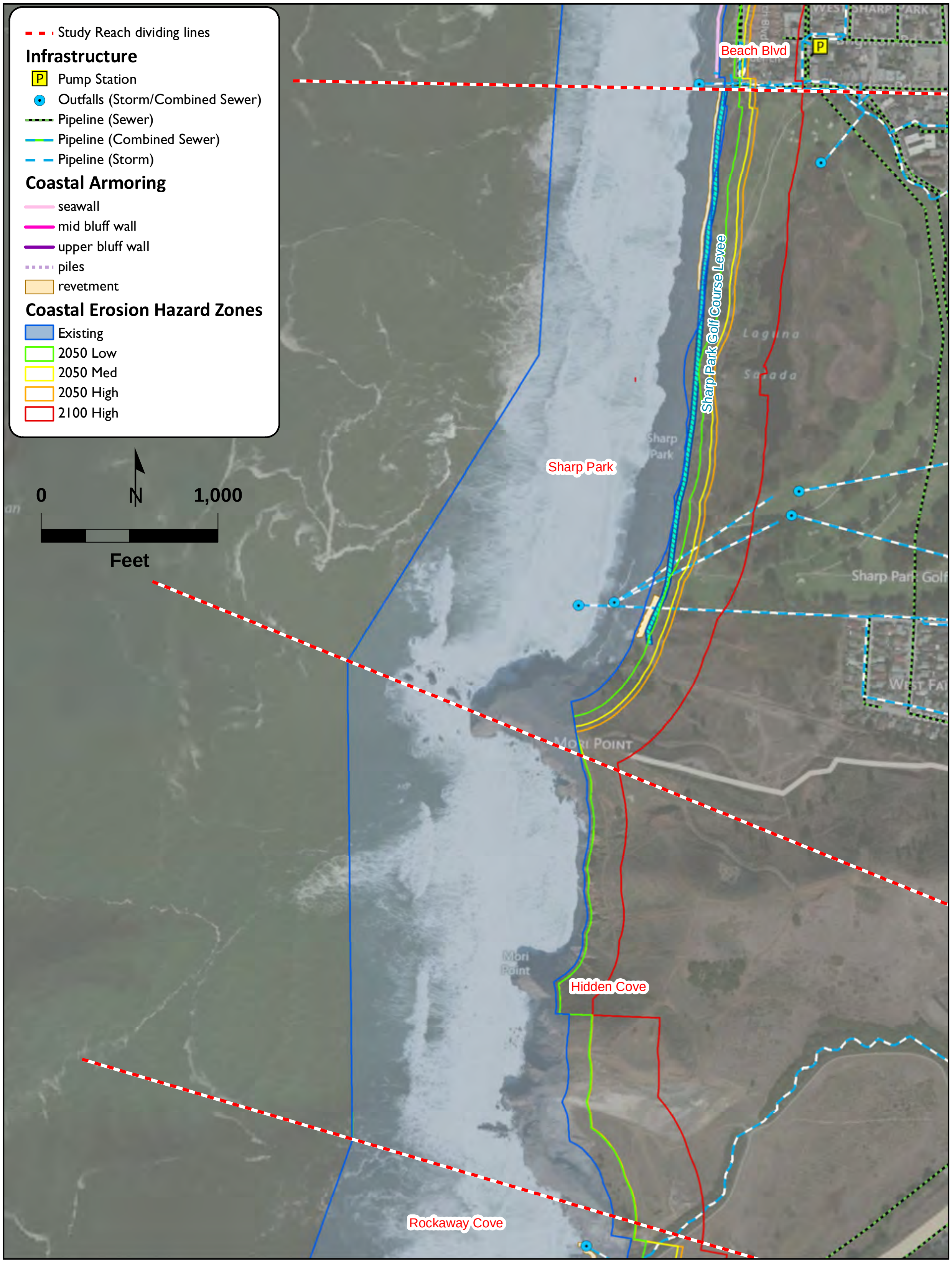
Pacifica: Hidden Cove, Sharp Park



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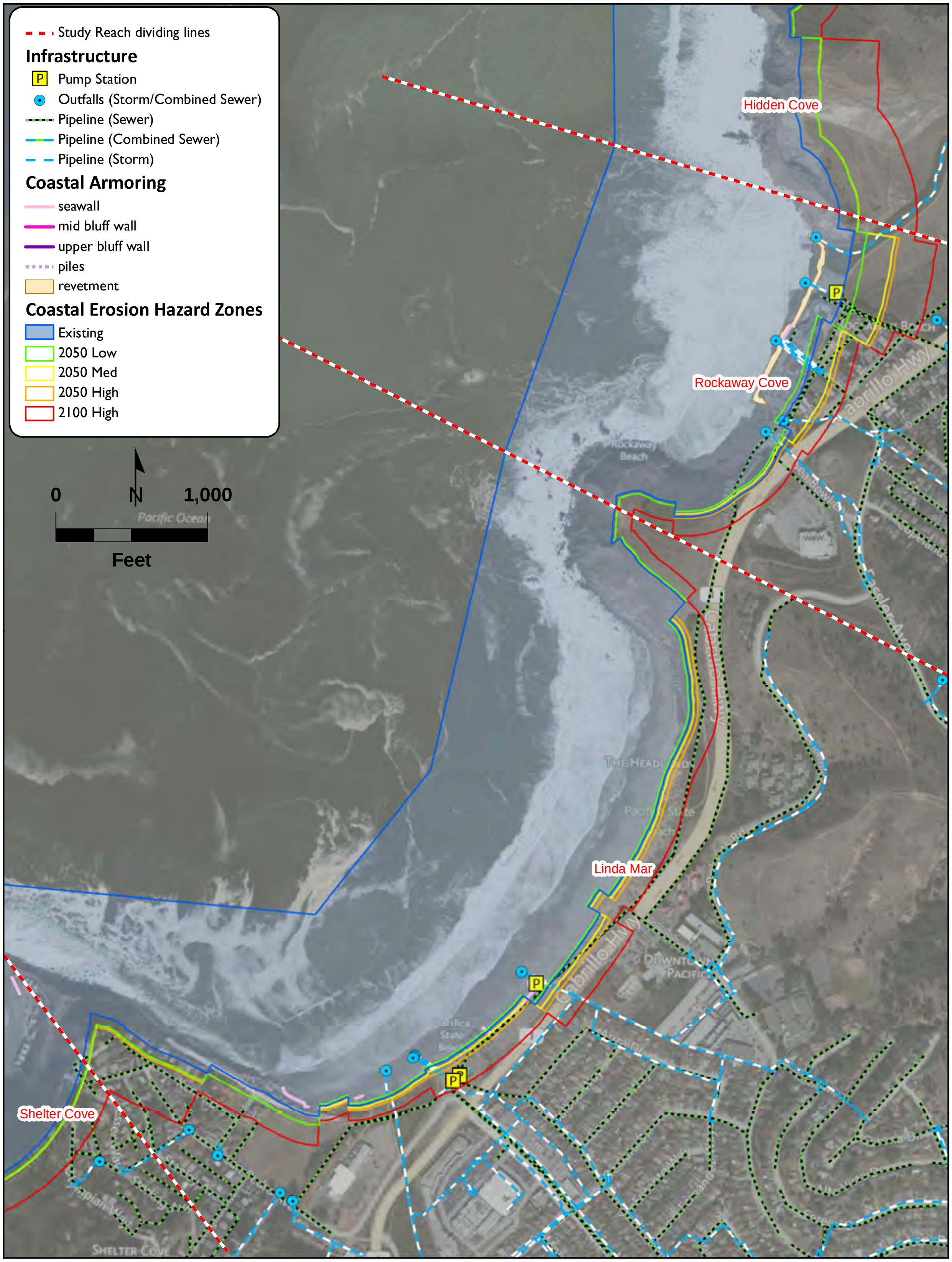
Pacifica: Linda Mar, Rockaway



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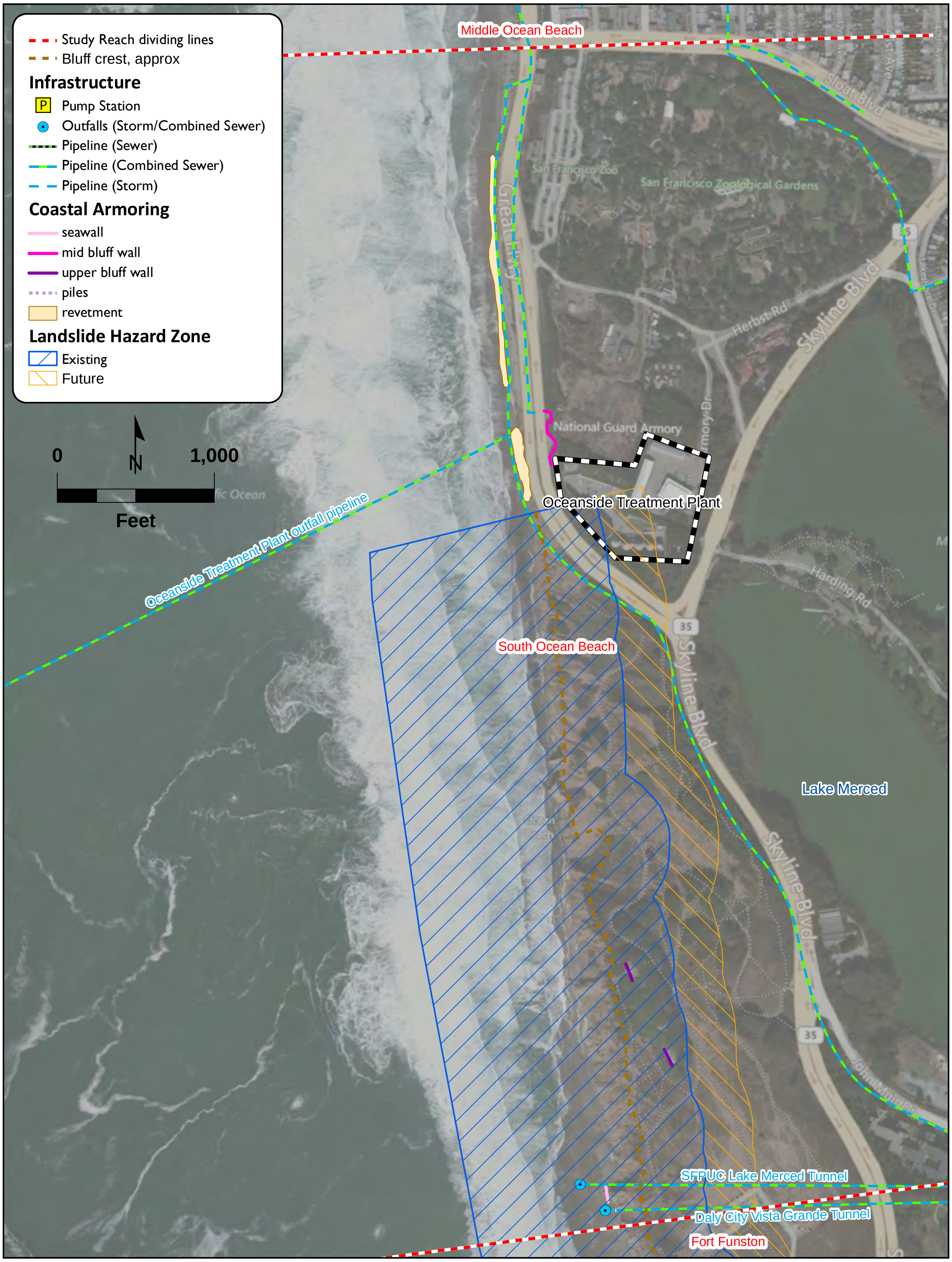
Landslide Hazard Zones

The geology along the cliff-backed shore from Fort Funston to Mussel Rock reflects eons of sea level fluctuations and the effect of the San Andreas Fault zone. The Merced and Colma Formations (a formation is a rock unit formed under similar conditions at about the same geologic time) combine to create the soaring cliffs with the Merced comprising most of the steep cliff face and the Colma as a thin sandy layer at the top. Geologists such as Sloan (2005) have identified that both formations are mainly sandstone, which is a sedimentary rock formed from pieces of older rocks. These formations are easily eroded because no substance has glued the sand grains together. The Merced was deposited from about 2 or 3 million years ago to about half a million years ago and the Colma during the most recent interglacial period, about 125,000 to 55,000 years ago. Activity from the San Andreas Fault has uplifted both formations to their present position above the sea. The weak bonds among the Merced and Colma rocks also make them susceptible to erosion from tectonic movement, but the cliffs are also undercut by wave action. During winter storms and swell conditions, waves can become big enough to cross the beach and attack the cliff bases. The normal coastal erosion is enhanced by these conditions. In addition, cliff top and bottom construction activities have further destabilized the cliffs. Soft rocks, waves, rain, the occasional earthquake, and construction all work together to bring the cliffs down.

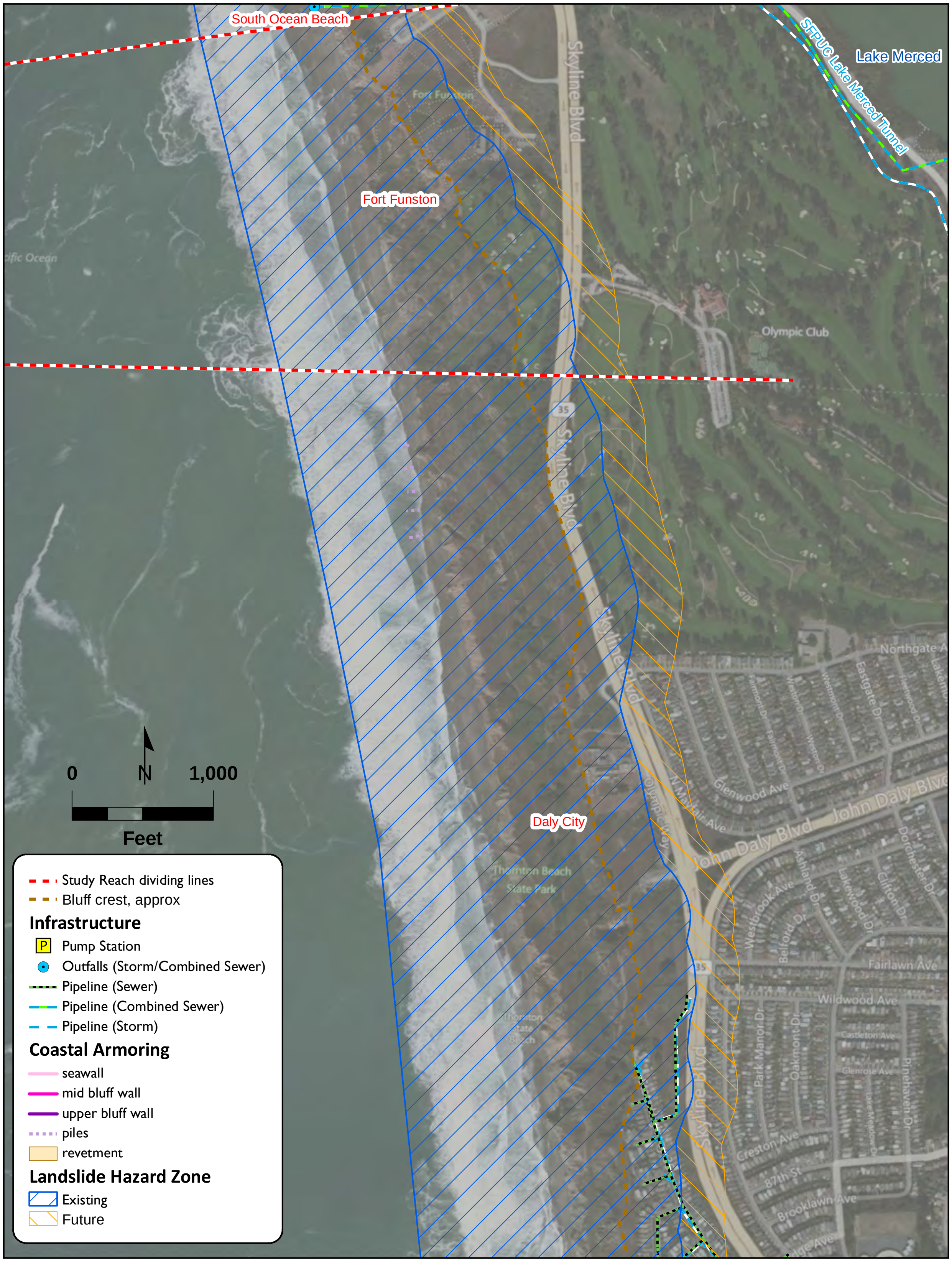
The cliffs fail in large blocks that are identifiable in cross-sections from the land to the ocean. To account for this failure mechanism, 10 representative transects (one for each shoreline study reach) were geomorphically interpreted to measure block failure widths. At least two block failures were identified on more than half the transects. Based on these measurements, block failure widths averaged 312 feet ± 77 feet. The total of the average and the standard deviation (389 feet) were added together to represent a factor of safety included to best represent the uncertainties in the method.

To delineate the landslide hazard zones, the active bluff edge was determined using a break in slope derived from topography gathered in 2009-2011 by the California Ocean Protection Council. This bluff edge was buffered by 389 feet and 701 feet to produce 3 regions representing the landslide related hazard zones. To the west of the bluff edge is the ACTIVE hazard zone, the first block failure width inland of the active bluff edge is the HIGH hazard zone and the second block failure width represents the MODERATE hazard zone. The following maps show the existing (ACTIVE) and future (HIGH) landslide hazard zones for southern San Francisco and Daly City.

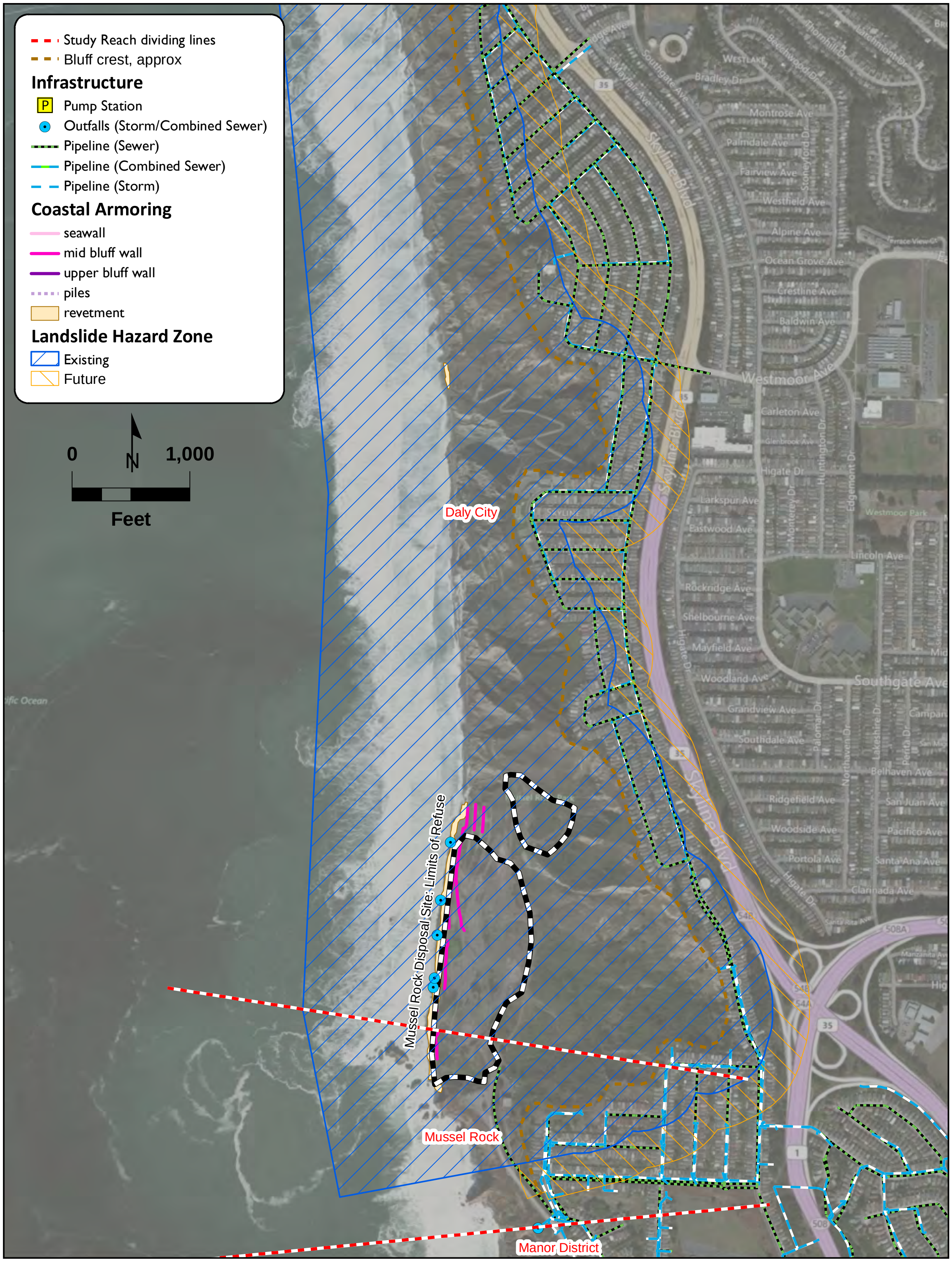
San Francisco: Landslide Hazard Zone, South Ocean Beach



Daly City: Landslide Hazard Zone, North and Fort Funston



Daly City: Landslide Hazard Zone, South



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Coastal Erosion Mitigation Alternatives

Development of residential, commercial and industrial zones in erosion-prone coastal regions over the previous century has increased the need for coastal protection measures. Traditionally, those measures have often been either engineered structures (seawalls, rock revetments, and groins) or placing sand in eroding areas. However, armoring or attempting to hold the shore in place through structures create a new set of problems, many of which are incompatible to maintain a natural beach system that supports the local tourism economy and coastal ecosystem. Generally, on a natural shore, as the shore erodes, beach width is maintained. However, when structures are built on an eroding shore, passive erosion occurs in which the beach in front of the structure becomes drowned over time as the adjacent shore continues to erode. This results in the structure projecting like a peninsula out into the ocean, which blocks lateral (alongshore) access. Identifying more sustainable approaches for preserving the beaches is a key objective of the regional sediment management plan and an overall goal for the CSMW. Several newer mitigation alternatives have been proposed throughout the world that enhance or sustain coastal processes and, as a result, beaches and their associated coastal development. While some development will require engineered structures, providing a suite of options encourages preservation of beach environments wherever possible.

To compare the mitigation alternatives fairly, the following section presents some traditional and non-traditional measures with standardized criteria. The criteria are based on efforts by the Southern Monterey Bay Coastal Erosion Workgroup and provide an assessment of impacts, costs, and effectiveness. Criteria are categorized as Technical and Impacts, as follows:

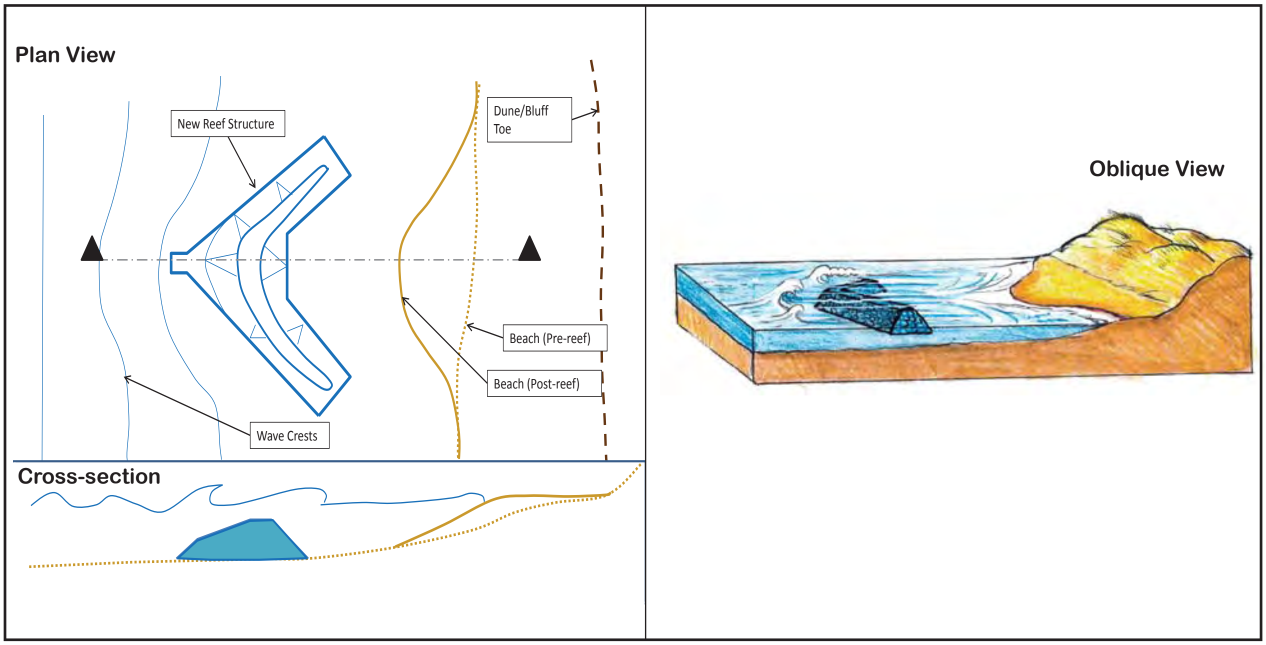
Technical

- Effectiveness – reducing threat to upland
- Effectiveness – maintaining beach width
- Resiliency – adaptable to future conditions
- Certainty of success – scientific certainty that measure will function as intended

Impacts

- Environmental
- Economic Costs – of implementation only
- Recreation
- Safety/Access
- Aesthetics
- Cumulative – if all oceanfront parcels received treatment

Artificial Reefs



Characteristics of Artificial Reefs

Reduce threat to structures	Yes
Maintain Beach Width	Yes – potentially widen behind structure
Economic Costs	High – depends on type and source of material, transportation, and placement costs. Ongoing monitoring and maintenance
Environmental Impacts	Potential impacts to offshore bottom species, promotion of non-native species, alters habitat types from sand to rock
Recreational	Potentially improves surfing and fishing
Safety and Public Access	Improves
Aesthetics	Minimal impacts if any below sea surface
Regulatory Viability	Uncertain
Adaptability to Future Conditions	Potentially – depends on rate of climate changes, ability to add material to increase crest of structure elevation
Cumulative Impacts	Conversion of sand bottom habitat to rock reef, increase in non-native species diversity and abundance
Certainty of Success	Mixed results, more certain in short term, uncertain in short to long term without placement of additional material or raising crest elevation

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Beach Nourishment

Photos courtesy of SANDAG

Characteristics of Beach Nourishment

Reduce threat to structures	Yes – depends on volume and duration that material remains in place
Maintain Beach Width	Widens
Economic Costs	Potentially high, depends on sediment sources, transportation costs, and placement methods
Environmental Impacts	Short term impacts with the severity depending on placement mechanisms and preexisting conditions
Recreational	Improves – after placement
Safety and Public Access	Depends on sediment characteristics, likely improves but potential short term impact to safety caused by alterations in breaking wave characteristics
Aesthetics	Depends on sediment characteristics
Regulatory Viability	Uncertain, may require Congressional modification of MBNMS Designation Document
Adaptability to Future Conditions	Yes, but periodic nourishments likely to be required
Cumulative Impacts	Depends on volumes, number and mechanisms of placements
Certainty of Success	Certain in immediate term, uncertain in short to long term without sand retention structures

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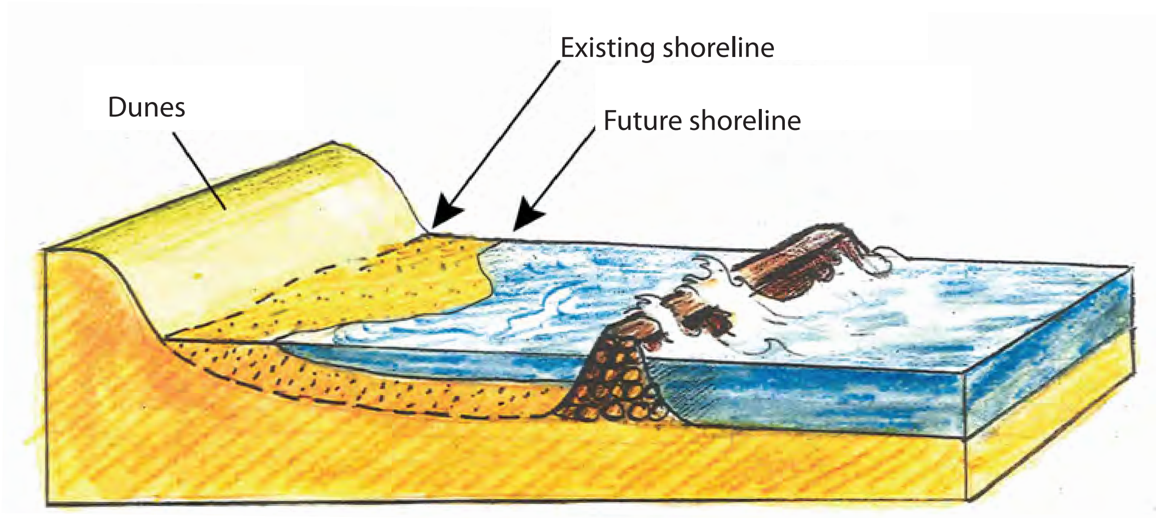
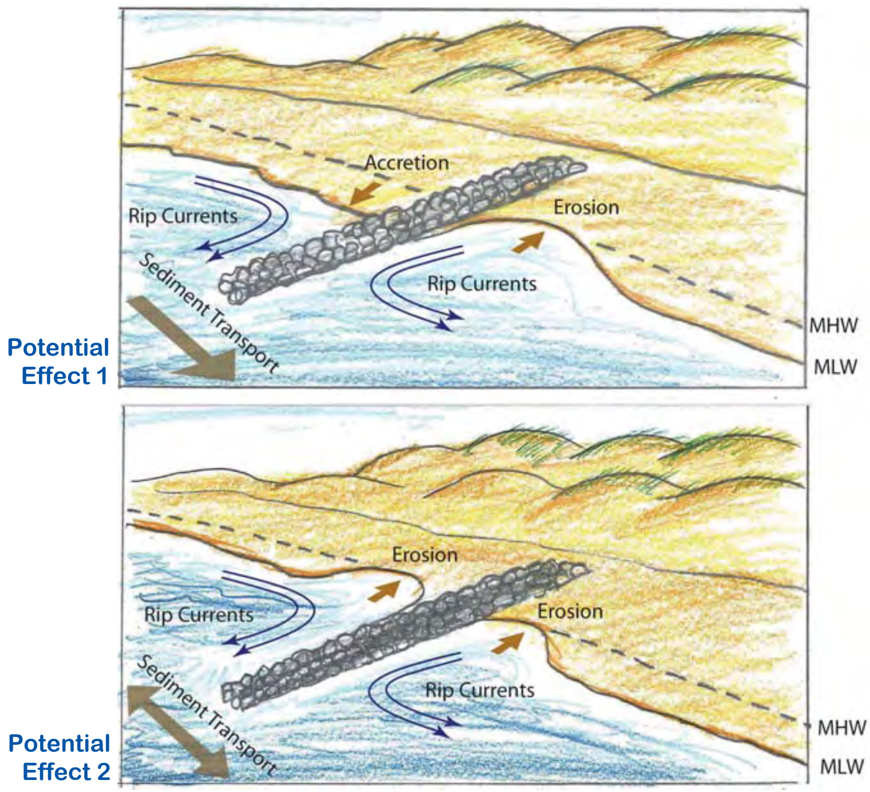
Breakwaters



Characteristics of Breakwaters

Reduce threat to structures	Yes
Maintain Beach Width	Yes to improves
Economic Costs	High
Environmental Impacts	Yes – sand to rock habitat, potential to become a sink of sediment until equilibrium is reached
Recreational	Benefits to beach recreation and potentially swimming and fishing, impacts to surfing and boating
Safety and Public Access	Reduces wave energy, promotes calmer waters
Aesthetics	Impacts
Regulatory Viability	Uncertain
Adaptability to Future Conditions	Eventually become submerged breakwater
Cumulative Impacts	Depends on scale of breakwater, a breakwater may also lead to additional structures
Certainty of Success	Certain

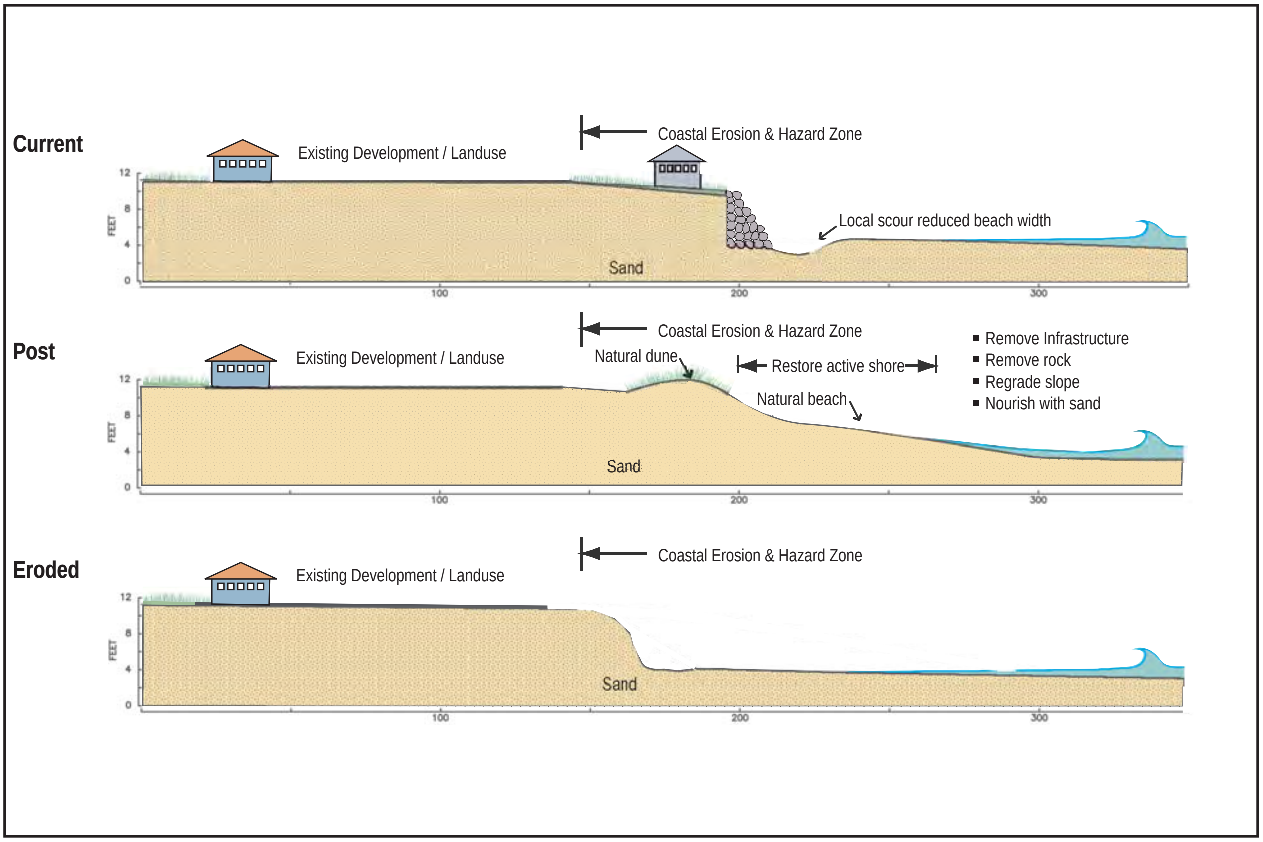
Groins



Characteristics of Groins

Reduce threat to structures	Yes generally in areas updrift of structure
Maintain Beach Width	Potentially improves updrift, narrows downdrift unless updrift is at full carrying capacity
Economic Costs	High
Environmental Impacts	Yes
Recreational	Potential benefits to beach width and surfing
Safety and Public Access	Impacts from rip current generation, and lateral access
Aesthetics	Impacts
Regulatory Viability	Uncertain
Adaptability to Future Conditions	Depends on rates of climate change, likely not in medium/long term
Cumulative Impacts	Likely downcoast erosion impacts. One groin usually leads to fields of groins, a reasonable expectation of long term buildout of groin field
Certainty of Success	For areas with mainly uni-directional transport, and with pre-filling of the accretion fillet: Certain in short term, less certain in medium/long term

Managed Retreat



Characteristics of Managed Retreat

Reduce threat to existing structures	No
Maintain Beach Width	Yes
Economic Costs	Variable, depends on site & parcel conditions
Environmental Impacts	No Generally reduces impacts by moving development away from sensitive coastal lands
Recreational	Yes
Safety and Public Access	Yes
Aesthetics	Yes
Adaptability to Future Conditions	Highly adaptable
Cumulative Impacts	None. Reduces impacts of development
Certainty of Success	Highly certain

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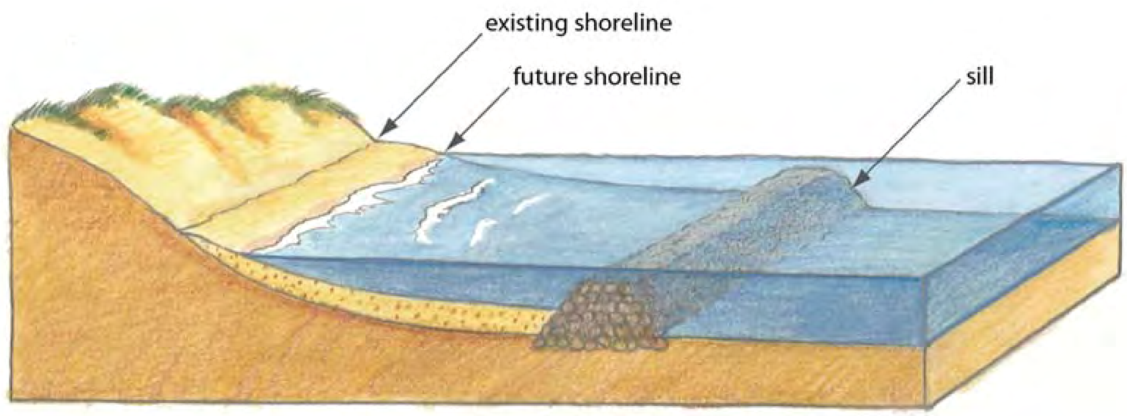
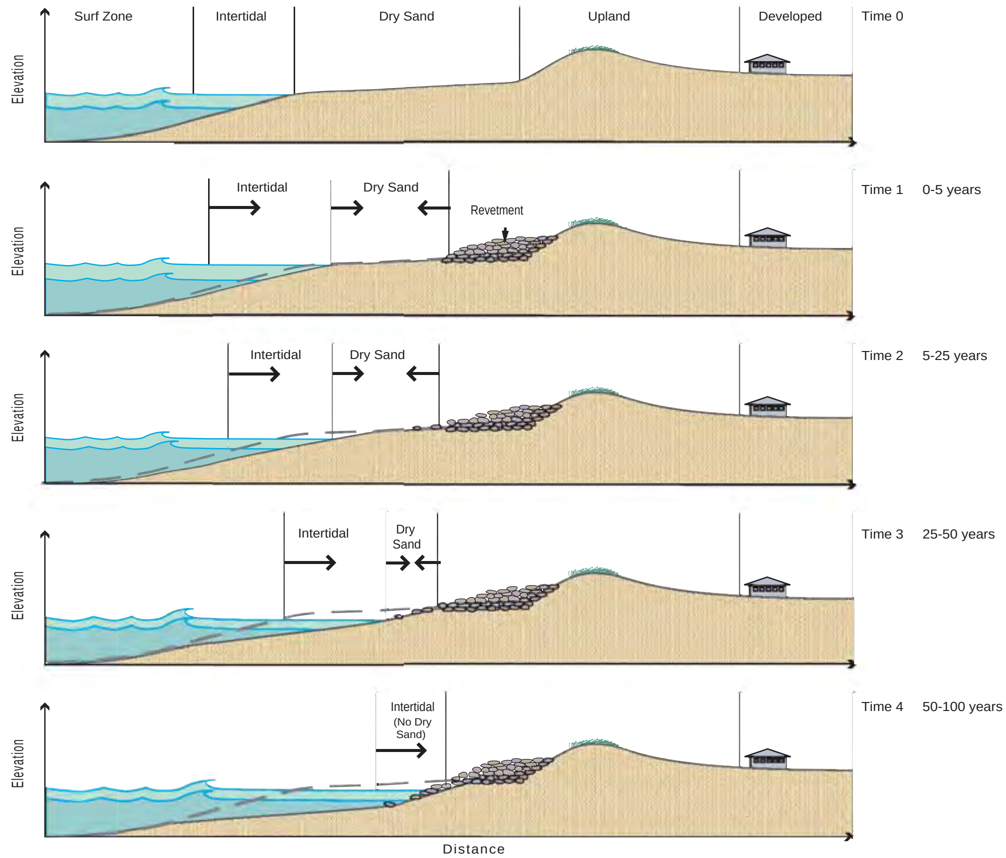
Perched Beach



Characteristics of Perched Beach

Reduce threat to structures	Yes behind toe structure, potential flanking erosion on adjacent parcels
Maintain Beach Width	Yes potentially widens
Economic Costs	High initial cost, ongoing maintenance
Environmental Impacts	Conversion of sand bottom to rocky reef
Recreational	Improves to maintains
Safety and Public Access	Improves lateral access, potential safety issue by alterations of breaking wave characteristics and deepwater offshore of toe structure
Aesthetics	Minimal impacts if any below sea surface
Regulatory Viability	Uncertain
Adaptability to Future Conditions	Adaptable until depth over sill increases and stops dissipating wave energy
Cumulative Impacts	Conversion of sand bottom habitats to rock reef
Certainty of Success	Low Wave Exposure: Somewhat certain in short term, less certain in medium/long term without improvement/repairs to sill structure High Wave Exposure: Uncertain.

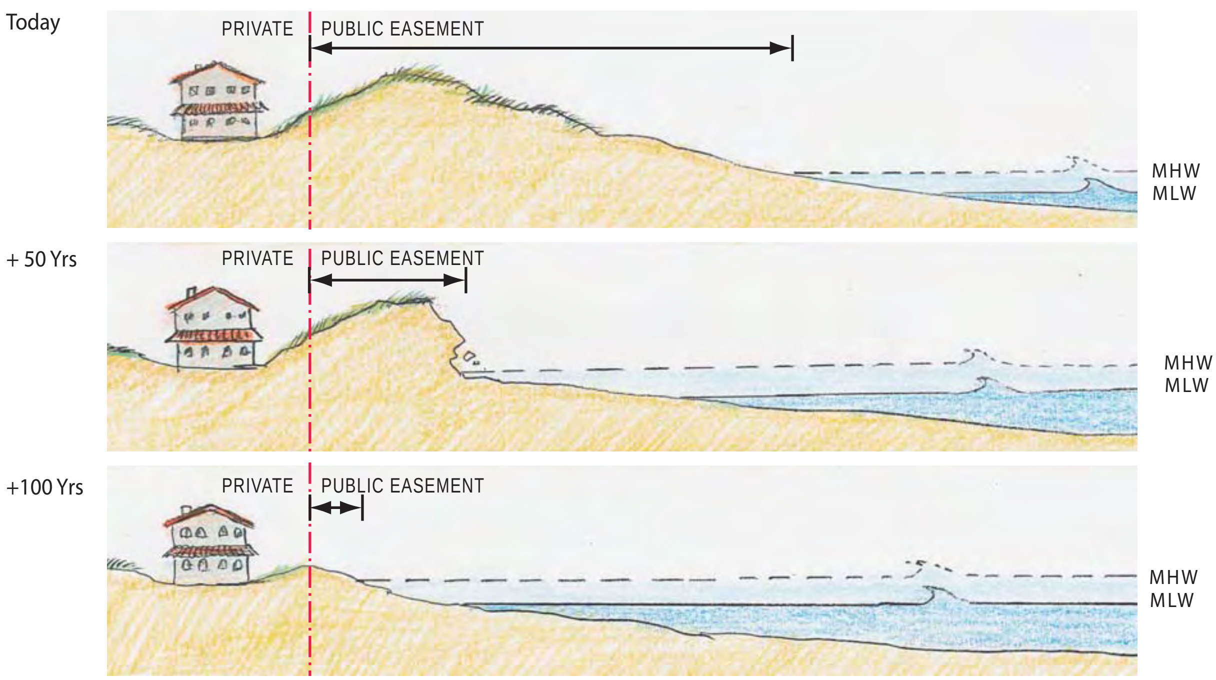
Revetments



Characteristics of Revetments

Reduce threat to structures	Yes in short to medium term
Maintain Beach Width	No – loss due to structure footprint and narrowing due to passive erosion
Economic Costs	High ($3,500-$10,000 per lineal foot of shore)
Environmental Impacts	Impacts to sandy beach habitats, shorebirds, potential flanking erosion to adjacent unprotected parcels
Recreational	Reduces beach widths over time
Safety and Public Access	Reduces
Aesthetics	Impact but partially mitigable with concrete contouring, texturing
Regulatory Viability	Probably, case-by-case analysis required
Adaptability to Future Conditions	No
Cumulative Impacts	Large cumulative impacts to recreation, and beach habitats
Certainty of Success	Certain in short term, less certain in medium/long term

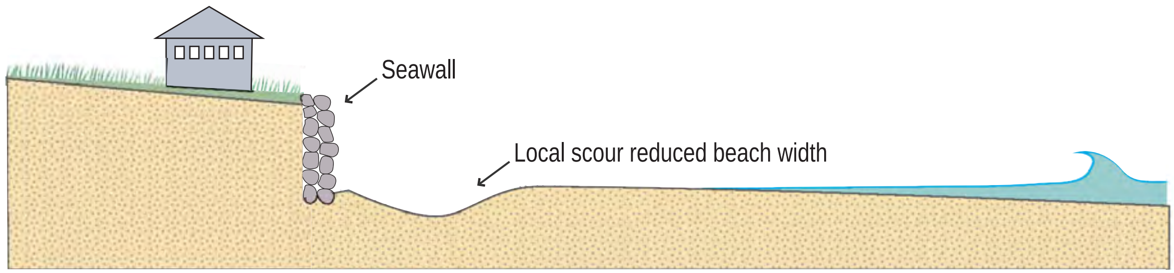
Rolling Easement



Characteristics of Rolling Easement

Reduce threat to structures	No
Economic Costs	Little to none
Maintain Beach Width	Yes
Environmental Impacts	No
Recreational	Yes
Safety and Public Access	Yes.
Aesthetics	Yes.
Adaptability to Future Conditions	Yes
Cumulative Impacts	None
Certainty of Success	Highly Certain

Seawalls



Characteristics of Seawalls

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Aesthetics	Impact but partially mitigable with concrete contouring, texturing
Regulatory Viability	Probably, case-by-case analysis required
Adaptability to Future Conditions	No
Cumulative Impacts	Large cumulative impacts to recreation, and beach habitats
Certainty of Success	Certain in short term, less certain in medium/long term

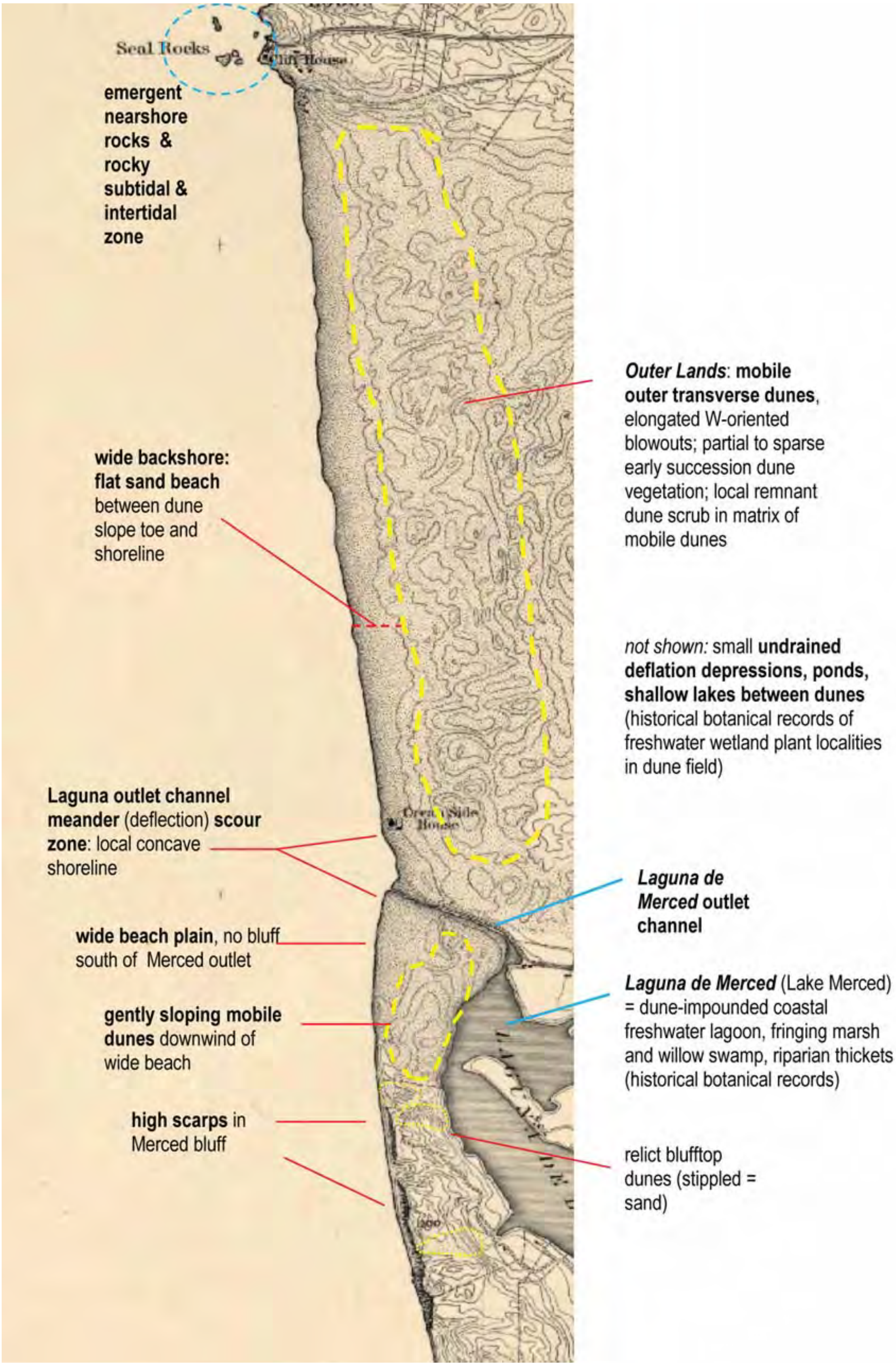
Historical Ecology

Protecting and enhancing the ecological resources along the shoreline is an essential component of regional sediment management plans. Actions, such as beach nourishment or managed retreat, can provide new accommodation space for species to reside and migrate through. Conversely, some structural actions, such as sea walls or revetments, can interrupt or fragment habitats. In the marine environment, artificial reefs built for sand retention can be designed to be multi-purpose structures that add rocky habitat where is none is currently present.

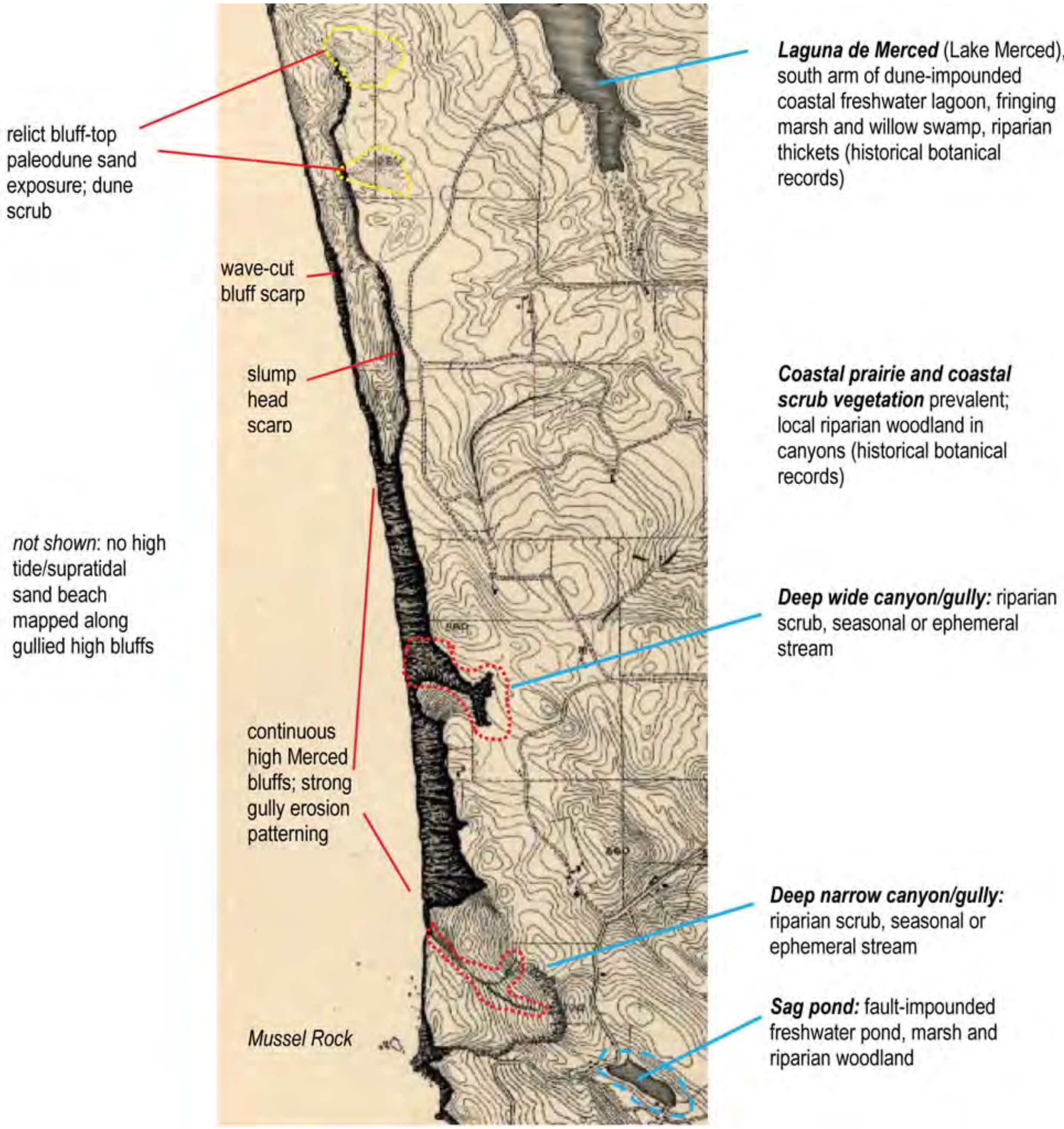
A baseline understanding of habitats and special status species is needed to assess how actions that are part of the regional sediment management plan will impact the ecology. However, with much of the coastline altered by human development, establishing a baseline for habitats and species with recent information reflects a degraded environment rather than one that is pristine. A longer-range perspective on ecology can be developed using historical terrestrial maps prior to modern human changes to the landscape. Interpreting contemporary habitat zones from those maps helps identify locations that could be restored or at least re-established under the regional sediment management plan.

The following section is an interpretation of habitats and probable species usage from topography maps (T-sheets) published in 1869 by the U.S. Coast Survey. Not all areas of the study area were mapped at that time so only segments that were completed are shown here. The topographic features and map symbols were combined with other features (soil types, rock and sediment outcrops, relict habitats and vegetation) and historical botanical records to determine location-specific habitats.

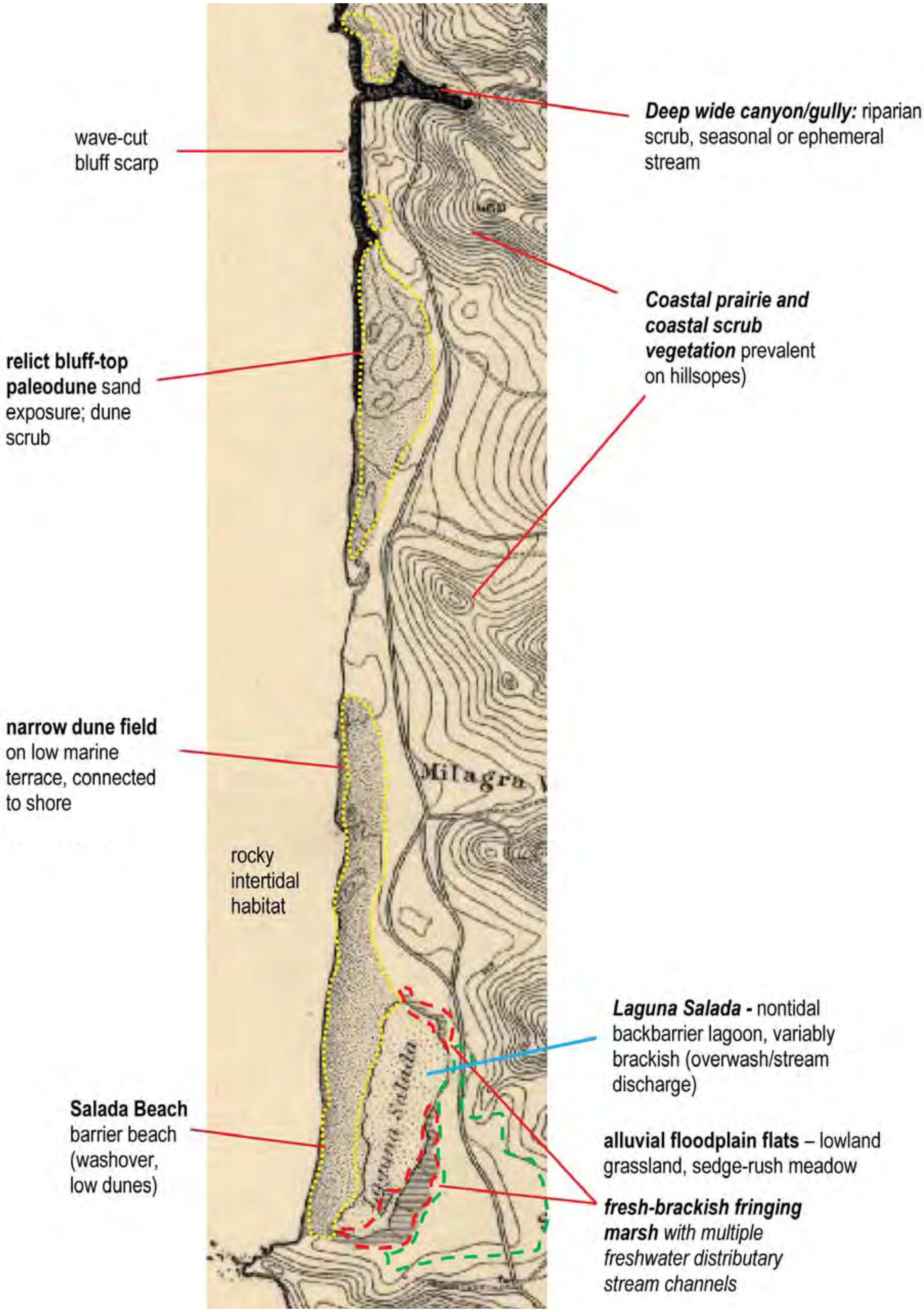
San Francisco: Historical Ecology, 1869



Daly City: Historical Ecology, 1869



Pacifica: Historical Ecology, 1869



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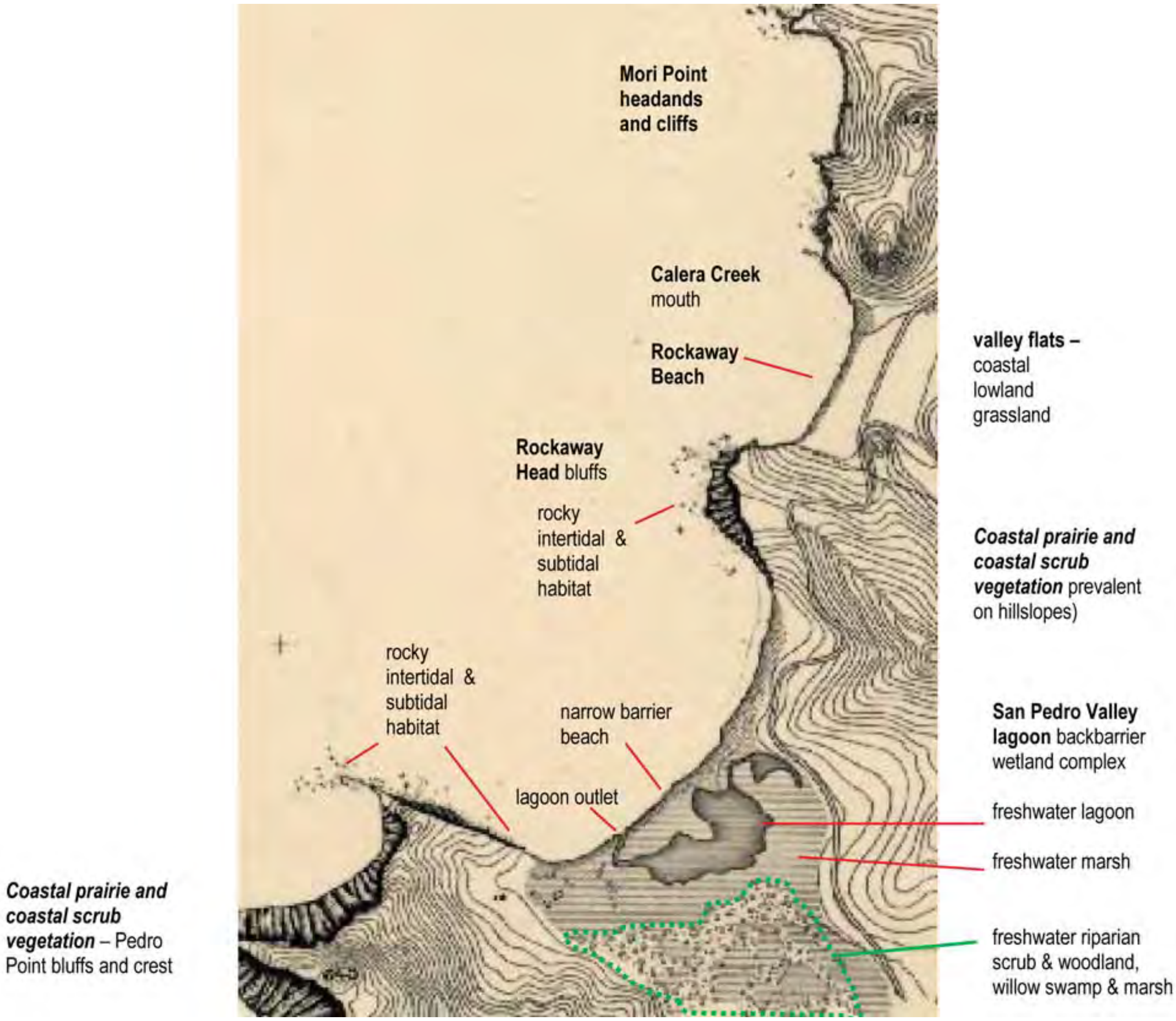


Economic Analysis

At a regional scale of analysis, the intention is not to determine exact costs and benefits for funding and approval purposes, but to determine the likely economic viability of proposed alternatives. If an alternative is likely to have a benefit to cost ratio greater than 1 (e.g., benefits are greater than costs) then it can be considered viable and appropriate for further investigation and development as part of a later regional planning process. The U.S. Army Corps of Engineers, or a State or local agency, may engage in a more rigorous benefit-cost analysis if/when they conduct a feasibility study for potential projects and could determine different benefit-cost ratios as a result.

Beach Nourishment

The recreational benefit analysis for beach nourishment is based on the number of visits to each beach and the value of each visit, which may vary with the type of recreation. Increasing beach width provides several recreational benefits: 1) numerous studies show that beach visitors generally prefer wider beaches up to 300 feet; 2) increasing beach width generally increases visitation; 3) at very crowded beaches, increasing beach width increases "carrying capacity" by increasing the amount of space per visitor.

It is also possible to conduct an economic impact analysis, which estimates the spending and tax revenue generated by beach tourism and recreation as well as the increased beach width from additional visitation generated by nourishment.

Infrastructure

The value of infrastructure (for example, pump stations or roads) is calculated using the best available cost of replacement estimates from public agencies, regulated utilities or engineers with expertise. In previous studies, trigger points (e.g., a critical beach width) were used to project when infrastructure would be lost. Although this is a simplification, this approach allows one to identify key risks since loss of infrastructure is generally triggered by an episodic coastal storm.

Ecology

Beaches also have ecological value, although this is often hard to quantify and even harder to estimate the economic value. However, there have been many new techniques and approaches tried in California, including those by the US Army Corps of Engineers, that will inform a qualitative discussion of beach ecological value.

Preliminary Information

The following table was compiled for the current study and represents a preliminary assessment of beach visitation, revenue generated and amenities. This information is being updated to better inform the economic analyses.

City	Attendance	Estimated Spending	Estimated State and Local Tax Revenue	Beach Amenities and Use	Ease of Access
San Francisco	645,000	$36,000,000	$1,200,000	Restrooms, showers, vendors. Walking, surfing, aerial sports.	7/10
Daly City	25,000	$1,500,000	$45,000	Walking, surfing.	4/10
Pacifica	253,000	$15,300,000	$455,000	Restrooms, showers, pier, vendors. Surfing, walking.	6/10

Example Scenarios: Ideas and Engagement

Scenarios will be developed for all critical erosion hazard zones identified in the regional sediment management plan to suggest projects for all three cities and federal landowners. The following are two example scenarios where coastal erosion mitigation alternatives are employed along a stretch of Pacifica for 2050.

Example Scenario 1: Beach Nourishment and Multi-purpose Reefs

This scenario envisions placing sand on the beaches to extend the current shoreline 100’ horizontally seaward. The beaches of Linda Mar and Rockaway Cove are bounded by naturally occurring headlands that assist in reducing, but not eliminating, the alongshore transport of sand away from the beaches. The beach nourishment could be repeated at intervals of a decade depending on the rate of natural sand removal by waves.

In addition, a multi-purpose reef could be constructed to further improve sand retention by reducing the wave action inside of Rockaway Cove. The reef would be designed to enhance recreational activities, such as surfing and fishing. The presence of the reef could allow for less frequent replenishment of the beach sand.

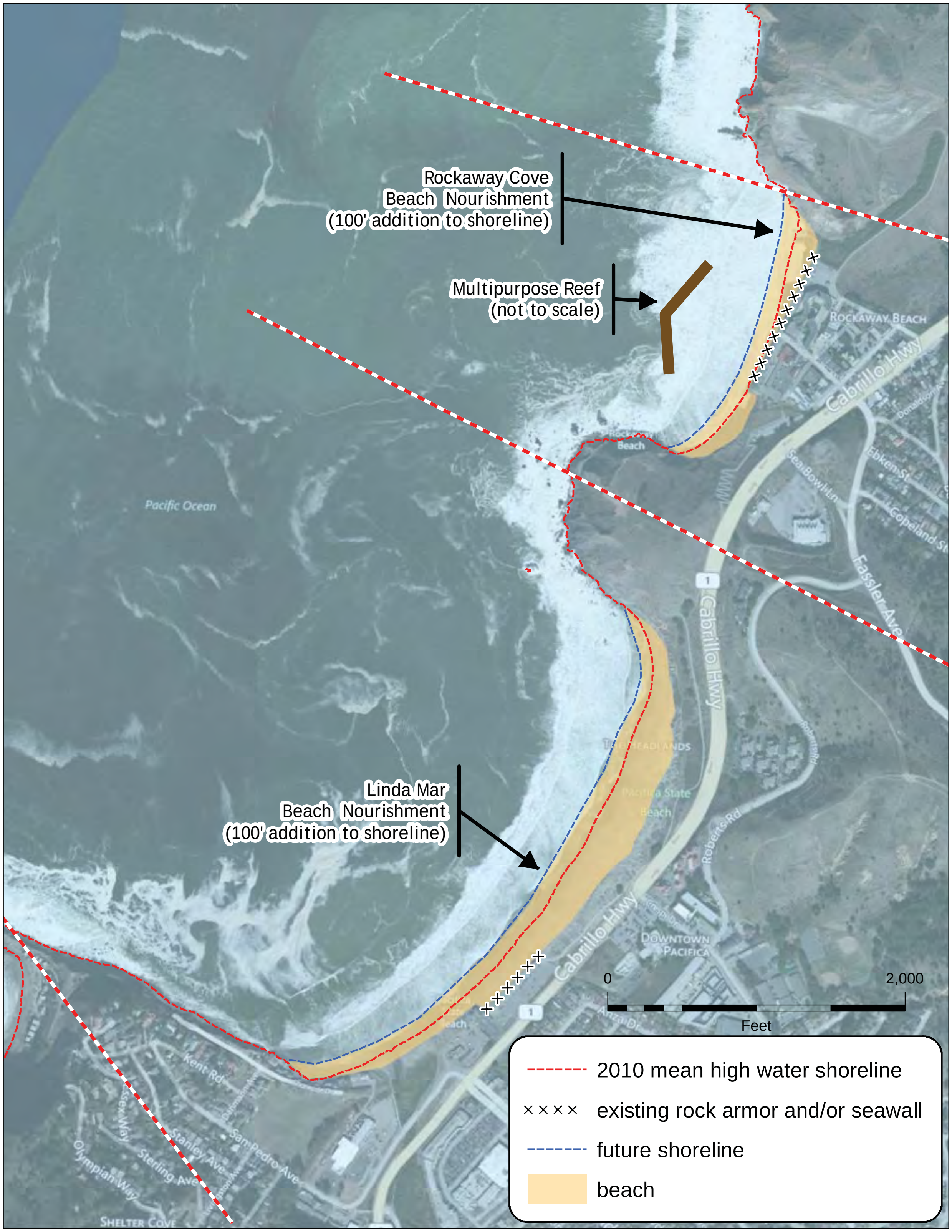
Example Scenario 2: Hybrid of Coastal Armor and Managed Retreat

This scenario along the Pacifica coast between Mussel Rock and Mori Point combines structures and managed retreat and builds on existing investments in coastal armor. Only publicly funded and recently permitted structures in north Pacifica are maintained and survive the next 50 years under this scenario. An alternative vision not shown is full armoring along all of north Pacifica but this would likely result in no beaches for the area.

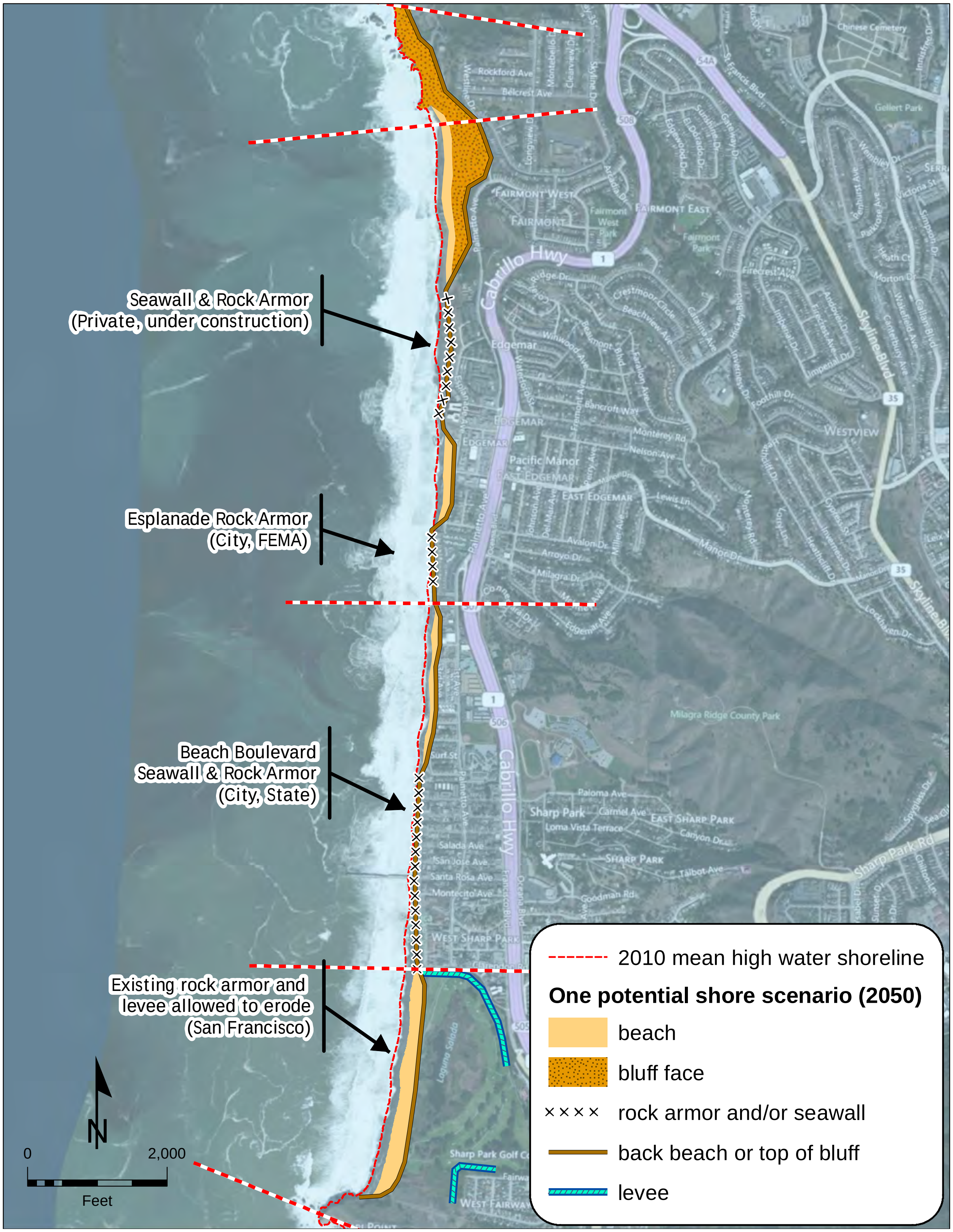
What’s Your Scenario for 50 Years?

The scenarios presented are ideas to help construct a sustainable vision for the future of all three cities’ beachfront zones. Other options can be explored at the workshop and given the knowledge and tools above, alternate ideas are requested to reflect the values of the community. Use the maps and erosion mitigation alternatives to develop scenarios that balance your needs and perspective for the coastline with which you interact.

Pacifica Example Scenario: Beach Nourishment & Reefs



Pacifica Example Scenario: Hybrid of Armor & Managed Retreat



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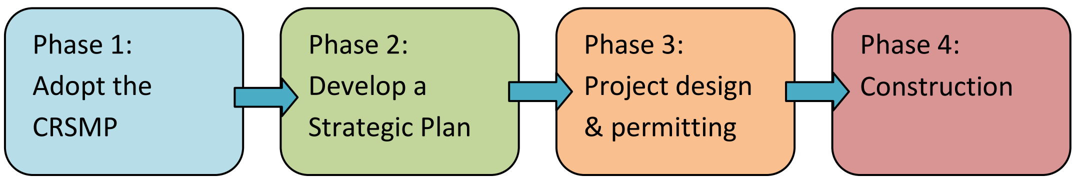
Moving from Plan to Projects: Developing a Path and Funding Opportunities

The completed California CRSMPs introduced earlier provide a useful look ahead to our region. The BEACON CRSMP plots a course from plan development to undertaking projects. The SANDAG CRSMP has resulted in sand placement/beach nourishment projects funded through collaborative approaches.

BEACON: The Beach Erosion Authority for Clean Oceans and Nourishment (BEACON) completed a CRSMP for Santa Barbara and Ventura counties in January 2009. BEACON's multi-phase regional sediment strategy is:



For more information:

- BEACON's CRSMP page: http://www.beacon.ca.gov/projects/016-CRSMP.htm

SANDAG: The San Diego Association of Governments (or SANDAG, comparable to ABAG, the Association of Bay Area Governments) completed a CRSMP in April 2009. In September 2012, SANDAG began construction on the Regional Beach Sand Project II (RBSP II) to replenish eight receiver sites with approximately 1.4 million cubic yards of sand from three offshore dredge sites. This grew from an earlier nourishment project in 2001. The total RBSP II cost will be approximately $29 million.

Funding:

- Department of Boating and Waterways awarded SANDAG about 82%, or $23.8 million
  - DBW funds may not be available in the future to support a project at the same level as the 2012 RBSP.
- Coastal cities (Imperial Beach, Solana Beach, Encinitas, Carlsbad, and Oceanside), helped provide the 15% required match
  - Encinitas and Solana Beach used money from accounts that were funded by transient occupancy taxes (TOTs) specifically targeting beach management.
  - Several cities withdrew funds from mitigation accounts created by SANDAG and the California Coastal Commission in 1996, to supplement their required 15 percent match and help meet cost overruns.
  - SANDAG is actively seeking additional funding sources for future projects that support the implementation of the Strategy and RSM Plan goals.

For more information:

- SANDAG CRSMP page: http://www.sandag.org/index.asp?projectid=330&fuseaction=projects.detail
- RBSP information: http://www.sandag.org/beachsand

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Moving from Plan to Projects: Potential Funding Sources

Several state and federal sources are available to fund beach nourishment on a case-by-case basis, depending on availability and legislative approval.

- California Coastal Commission
    - Beach Sand Mitigation Fund: permit conditions attached to the requests for shoreline armoring which require fees to go into a regional fund to pay for placement of sand on the beach within the same littoral cell area through offshore dredging or sand transport from inland sources. The program has limited funds that are for use as mitigation in the cell or sub-cell where the impacts occurred. There is no cost-share requirement, but funds must be used for a nourishment project, not planning or design.
- California Department of Boating and Waterways
    - Harbor and Watercraft Fund: provides funds to state agencies and local governments for construction of shoreline protective devices and beach nourishment on public beaches and park lands (State 75%, local match 25%)
- California Department of Parks and Recreation
    - Has invested in wetlands restoration which could be combined with a larger coastal project that includes beach environments
- California State Coastal Conservancy
    - Has funded purchase of coastal lands for public use and environmental enhancement (e.g. Esplanade, Linda Mar and several other locations in Pacifica).
- National Park Service
    - Has taken management of property and provided coastal access and environmental enhancement (e.g. Mori Point)
- US Army Corps of Engineers

There are multiple funding sources for studies in addition to the above sources for implementation (design, construction, land purchase, land management).

For more information: http://dbw.ca.gov/csmw/programs.aspx

References and Credits

ESA PWA, 2012. California Coastal Armoring Geodatabase – Design and Construction. Prepared for California Ocean Science Trust, California Coastal Commission and California Ocean Protection Council.

PWA, 2008. California Coastal Erosion Response to Sea Level Rise – Analysis and Mapping. Prepared for the Pacific Institute.

Sloan, D., 2005. Down to the Sea Again: A Real Cliff-Hanger in Daly City. *Bay Nature: Exploring Nature in the San Francisco Bay Area.* January-March 2005. Online journal. http://baynature.org/articles/jan-mar-2005/down-to-the-sea-again

Photos courtesy of:

Shelby Tucker, SANDAG
Bob Battalio, ESA PWA
Doug George, ESA PWA

Packet Preparers

Doug George, ESA PWA
Brad Evans, ESA PWA
Elena Vandebroek, ESA PWA
Bob Battalio, ESA PWA

Athena Honore, ABAG

Dr. Philip King, SFSU

Dr. Peter Baye, Annapolis Field Station

Packet Reviewers

Clif Davenport, CGS/CSMW
John Dingler, USACE