Coastal Resiliency

INTRODUCTION

The Coastal Resiliency Element identifies goals, objectives, policies, and implementation actions to ensure the City of Carpinteria (City) remains resilient to potential future risks associated with coastal hazards. Low-lying areas such as those within the Beach Neighborhood are subject to coastal flooding due to storm surges, wave attack, loss of sediment, and rising sea levels. Bluff erosion is also another serious local hazard affecting development and resources along the Carpinteria Bluffs. Climate change and sea level rise are projected to increase the likelihood and severity of these coastal hazards in the coming decades. In response, the City plans for the resiliency of the City's beaches and coastal resources, infrastructure, residences, and land uses from sea level rise impacts, including the benefits of open space planning to enhance climate resilience. The Coastal Resiliency Element addresses potential hazards and adaptation strategies for the City based on sea level rise and coastal hazards modeling. These hazards and related adaptation strategies are informed by other plans and studies of coastal hazards and resiliency strategies, including the Local Hazard Mitigation Plan and the Carpinteria Sea Level Rise Vulnerability Assessment and Adaptation Project (SLRVAAP).

Planning for coastal resiliency requires consideration of various adaptation methods and input from stakeholders to help shape City adaptation proposals. The City performs ongoing evaluation and monitoring of climate change projections and the probabilities of different sea level rise scenarios to best understand potential threats to the City. This

"Plan for and adapt to coastal hazard threats while protecting the assets that best define the community."

- **Public Commenter at Sea Level Rise Workshop, February 12, 2019**

is particularly important as the probability and timing of sea level rise can change over time due to factors influencing climate change. As a result, vulnerabilities in the City may evolve based on changes in worldwide GHG emissions and related changes in sea levels. By anticipating the potential intensity and timing of sea level rise-related hazards, the City will be able to employ a diverse range of flexible and effective strategies that will minimize risks to public facilities and private homes and businesses and minimize associated costs to the extent feasible. These strategies will also ensure that new development is sited and designed to minimize exposure to coastal hazards. The objectives and policies within this Element were developed to:

- Use science to guide decisions;
- Minimize coastal hazards through planning and development standards;
- Maximize protection of public access, recreation, and sensitive coastal resources; and,
- Maximize agency coordination and public participation.

The **Coastal Resiliency Element** addresses the following legislative requirements:

Coastal Act Chapter 3

Article 2 – Public Access

§30213

Article 4 – Marine Environment

§30233; §30235; §30236

Article 6 – Development

§30252; §30253; §30254

Article 8 – Sea Level Rise

§30270

California Planning Law

California Government Code (Gov. Code) §65302(g)

This law requires that General Plans include a vulnerability assessment to identify climate adaptation and resiliency strategies as well as adaptation and resiliency goals, policies, objectives, and feasible implementation actions for the protection of the community.

Issue Areas

The Coastal Resiliency Element addresses the following issue areas:

- **Coastal Flooding**, including potential projected flooding events from wave runup and overtopping of the beach and dunes from severe coastal storm events.
- **Tidal Inundation**, including the extent of possible non-storm-related inland flooding from predicted monthly high tides.
- **Coastal Erosion and Retreat**, including beach erosion and shoreline or bluff retreat and associated potential infrastructure damage from coastal processes that occur over time, which could increase based on sea level rise.
- **Adaptation**, including new and ongoing mitigation efforts to build the resiliency of public infrastructure, open space, private development, and the shoreline to avoid or lessen impacts from sea level rise.
- **Regional Collaboration** between the City and agencies and organizations, including the County of Santa Barbara, Beach Erosion Authority for Clean Oceans and Nourishment (BEACON), CCC, California Department of Transportation (Caltrans), Los Angeles – San Diego – San Luis Obispo Rail Corridor Agency (LOSSAN), U.S. Army Corps of Engineers (USACE), Union Pacific Railroad (UPRR), local jurisdictions, and special districts that are critical to addressing regional coastal hazards.

- **Environmental Justice** consideration during City planning processes, to meet the needs of vulnerable lower-income or disadvantaged communities, who may be less resilient than the community as a whole.
- **Coastal Hazard Monitoring**, including continuous consideration of the best available scientific methods and research, will allow the City to identify when and what actions must be taken to address coastal hazards.

Several issue areas and adaptation strategies discussed in this Element are also contained in other CLUP/General Plan Elements. The **Land Use Element** defines allowed land uses within the City relative to known hazards and constraints. Discussion of other potential hazards facing the City, including fluvial flooding, are addressed in the **Safety Element**. The **Open Space & Conservation Element** ensures the environmental resources of the City are preserved and managed sustainably. The **Healthy Community Element** addresses coastal public access, coastal recreation, and considerations for disadvantaged communities in the City.

Related Resources

To complement the Coastal Resiliency Element, the City recognizes several sources of information and guidance that will inform the implementation of City goals and policies related to climate-driven coastal planning and adaptation. The resources described below informed the development of this Element and the current assessment of vulnerabilities to coastal hazards now and in the future. As climate science and projected sea level rise estimates evolve, these resources and others may change the known vulnerabilities in the City and continue to inform local decision-making consistent with the policies of this Element.

Local Hazard Mitigation Plan

The City has a Local Hazard Mitigation Plan (LHMP) as an annex to the Santa Barbara County Multi-Jurisdictional Hazard Mitigation Plan (MJHMP). An LHMP assesses risks and vulnerabilities from natural or human-caused disasters, including coastal hazards (e.g., sea level rise, coastal flooding, coastal erosion), and identifies and prioritizes mitigation actions. The LHMP is subject to annual maintenance and implementation and must be updated every five years in compliance with the Disaster Mitigation Act (DMA) of 2000. Please refer to the LHMP for the current location, extent, probability, and severity of vulnerabilities to hazards (including coastal hazards) that affect the City.

Sea Level Rise Vulnerability Assessment and Adaptation Plan

In 2019, the City prepared the SLRVAAP which identified existing and future coastal hazards based on the best available scientifically driven sea level rise projections available at the time for future years 2030, 2060, and 2100. The SLRVAAP follows the steps outlined in the Sea-Level Rise Policy Guidance (CCC 2015) and the State of California Sea-Level Rise Guidance (California Ocean Protection Council [OPC] 2018) guidance for preparing local communities for sea level rise and an uncertain future. The SLRVAAP used the widely accepted National Research Council model to assess the City's vulnerability to sea level rise and future damage associated with increased coastal

hazards.[1] The National Research Council model projected that sea level rise could reach 1 foot by 2030 and up to 5 feet by 2100 (Table CR-1). However, as noted in this table, the probability of sea level rise occurring at these levels in these projected years is low, ranging from 0.5% for 1 feet of rise in 2030 to 2% for 5 feet of rise in 2100. Alternately, OPC had also developed a more extreme worst-case projection, known as the H++ scenario, which assumed an accelerated rate of increase up to 10 feet of sea level rise by 2100; however, this extreme scenario was not used as a basis for modeling in the SLRVAAP as there are no probabilities assigned to this occurring (Table CR-2). Both scenarios were based on assumptions regarding carbon emission rates and associated rates of ice melt and sea level rise which are subject to change and may accelerate, which supports a worst-case approach to possible sea level rise.

Table CR-1. 2019 Sea Level Rise Projections (Conservative Scenario)

Projected Year	Sea Level Rise (feet)	Probability of Occurring
2030	~1 ft	<0.5%
2060	~2 ft	~1%
2100	~5 ft	~2%

Source: OPC 2018. State of Sea-Level Rise Guidance 2018 Update; 2019 SLRVAAP

Table CR-2. H++ Scenario (Extreme Worst-Case Scenario)

Projected Year	Sea Level Rise (feet)	Probability of Occurring
2070	~5 ft	Not specified
2100	~10 ft	Not specified

Source: OPC 2018. State of Sea-Level Rise Guidance 2018 Update; 2019 SLRVAAP

State Sea Level Rise Guidance

The science surrounding global warming and sea level rise is ever-evolving, and new methodologies, assumptions, probability scenarios, and regional sea level rise projections are continually updated. For instance, in 2024, following the completion of the City's SLRVAAP, OPC released and adopted the State of California Sea-Level Rise Guidance: 2024 Science and Policy Update (OPC 2024), which updates and replaces the previous 2018 State of California Sea-Level Rise Guidance. The State of California Sea-Level Rise Guidance: 2024 Science and Policy Update adopts an updated sea level rise scenario framework presented in the 2022 Federal Sea-Level Rise Technical Report. These updated sea level rise scenarios consist of five California Sea Level Rise Scenarios ranging from 2020 to 2150. The median values (i.e., 50th percentile) for these updated sea level rise scenarios are depicted in Table CR-3 (OPC 2024).

[1] The National Research Council model was used in the regional County of Santa Barbara Coastal Resilience Project to map projections of existing and future coastal hazards. This sea level rise scenario is considered a high, though not worst-case scenario (which is the H++ scenario).

Table CR-3. 2024 Sea Level Rise Projections for Santa Barbara (feet)

Year	Low	Intermediate-Low	Intermediate	Intermediate-High	High
2020	0.1	0.2	0.2	0.2	0.2
2030	0.2	0.3	0.3	0.3	0.4
2040	0.3	0.4	0.4	0.5	0.6
2050	0.3	0.5	0.6	0.9	1.1
2060	0.4	0.6	0.9	1.4	1.8
2070	0.5	0.7	1.2	2.0	2.7
2080	0.5	0.9	1.6	2.8	3.8
2090	0.5	1.1	2.1	3.5	5.0
2100	0.6	1.2	2.8	4.5	6.3
2110	0.6	1.4	3.4	5.3	7.5
2120	0.7	1.5	4.0	6.0	8.6
2130	0.7	1.7	4.4	6.6	9.5
2140	0.7	1.9	4.9	7.1	10.4
2150	0.8	2.0	5.5	7.6	11.3

Source: OPC 2024. State of Sea-Level Rise Guidance 2024 Update.

COASTAL HAZARDS AND SEA LEVEL RISE

The City constructs an annual 1,300-foot long beach berm (raised sand along right edge of photo) fronting shoreline residences to minimize damage from winter storms.

Sea level rise rates depend primarily on the warming of the Earth's oceans and ice melt in response to increasing atmospheric carbon levels. The City's existing coastline is currently vulnerable to coastal hazards, which are projected to be exacerbated by sea level rise. Existing coastal hazards from severe storms cause beach and shoreline erosion and flooding from wave runup, particularly within the Beach Neighborhood. The Carpinteria Bluffs and Tar Pits Park are also subject to bluff retreat and erosion. Coastal hazards are intensified during the winter months when winter storms increase wave attack and erosion. Sediment flows from local and regional creeks during storm seasons have a beneficial effect on beach width, as watershed sediments are the primary sand source for the City's beaches. Natural sand supply is sometimes augmented by the County Flood Control District sediment disposal activities, which include sediment removed from the Carpinteria Salt Marsh and occasionally from foothill detention basins and deposited on the beach, often at Ash Avenue, widening the City's beach.

Rising sea levels alone are not the primary cause of potential damage to homes, businesses, public infrastructure, and natural resources. Rather, increasing frequency, severity, and duration of severe storms, tidal inundation, and coastal erosion as a result of climate change and sea level rise present the potential for increased risk to the City. Coastal hazards facing the City primarily include:

- **Coastal Flooding:** Flooding caused by wave runup and overtopping of the beach or winter beach berm from large storm events, which can be exacerbated by higher tides and El Niño events and increased by climate-induced sea level rise. The modeled aerial extent of such flooding may be affected or delayed by structures such as the large condominiums and apartments fronting the Beach Neighborhood or the large rock revetments that line the shoreline of the Sand Point Road and Sandyland Road neighborhoods in the unincorporated area.
- **Coastal Erosion:** Gradual erosion of beaches, dunes, or bluffs, caused by wave attack, weathering, and sea level rise, which can be worsened by improperly designed groins that interfere with the transport of sediment along the shoreline; in some cases, seawalls or rock revetments that project seaward-- such as several major upcoast revetments-- can also interfere with sand transport and exacerbate beach erosion. Further, projected erosion may be reduced or delayed by coastal armoring such as the 700 feet of rock revetment and concrete seawall below areas of the Carpinteria Bluffs or by actions undertaken by the UPRR to protect its rail tracks which lie landward of the Carpinteria Bluffs.
- **Tidal Inundation:** Tidal inundation of public infrastructure, homes, and other resources can result from predicted high tides of varying intensities. Tidal inundation currently periodically affects public roads, trails, beach access, and drainage systems surrounding the Carpinteria Salt Marsh. Developed areas in the Beach Neighborhood and on the southwestern edge of the City were constructed in low-lying areas that were historically wetlands, making these areas particularly vulnerable to projected sea level rise-induced increases in tidal inundation and coastal flooding.

The 1983 El Niño event resulted in major damage to beachfront homes along Carpinteria City Beach, near Ash Avenue. Without adaptation, future storms in combination with sea level rise could result in severe erosion of the beach and repeated damage to shoreline structures.

Historically large storms have caused coastal flooding and coastal erosion in the City, such as the 1983 El Nino season which caused extensive damage along the City's waterfront, particularly in the Beach Neighborhood. If sea level rise occurs as projected (5 feet by 2090-2140, depending on the sea level rise scenario), potential damage from coastal flooding, coastal erosion, and tidal inundation could escalate progressively. Vulnerable homes, commercial buildings, and infrastructure will need to be adapted to rising sea levels, tidal inundation, wave attacks, coastal erosion, and flooding. The UPRR is projected to be vulnerable to coastal erosion and bluff failure, particularly through the Carpinteria Bluffs. Similarly, habitats, coastal access points, and public trails within Tar Pits Park the City's Carpinteria Salt Marsh Nature Park, the adjacent Carpinteria Salt Marsh Reserve, and the Carpinteria Creek Estuary may require adaptation actions to maintain essential recreational access, habitats, and ecological function.

The City shoreline comprises sandy coastline fronting the apartments, condominiums, and single-family homes of the Beach Neighborhood to the west, and transitions to rugged bluffs to the east that support open space and recreational uses within Tar Pits Park and the Carpinteria Buffs Nature Preserve, as well as the blufftop alignment of the Union Pacific Railroad (UPRR). Photo Source: California Coastal Records Project.

VULNERABILITY ASSESSMENT

City Vulnerabilities to Coastal Hazards

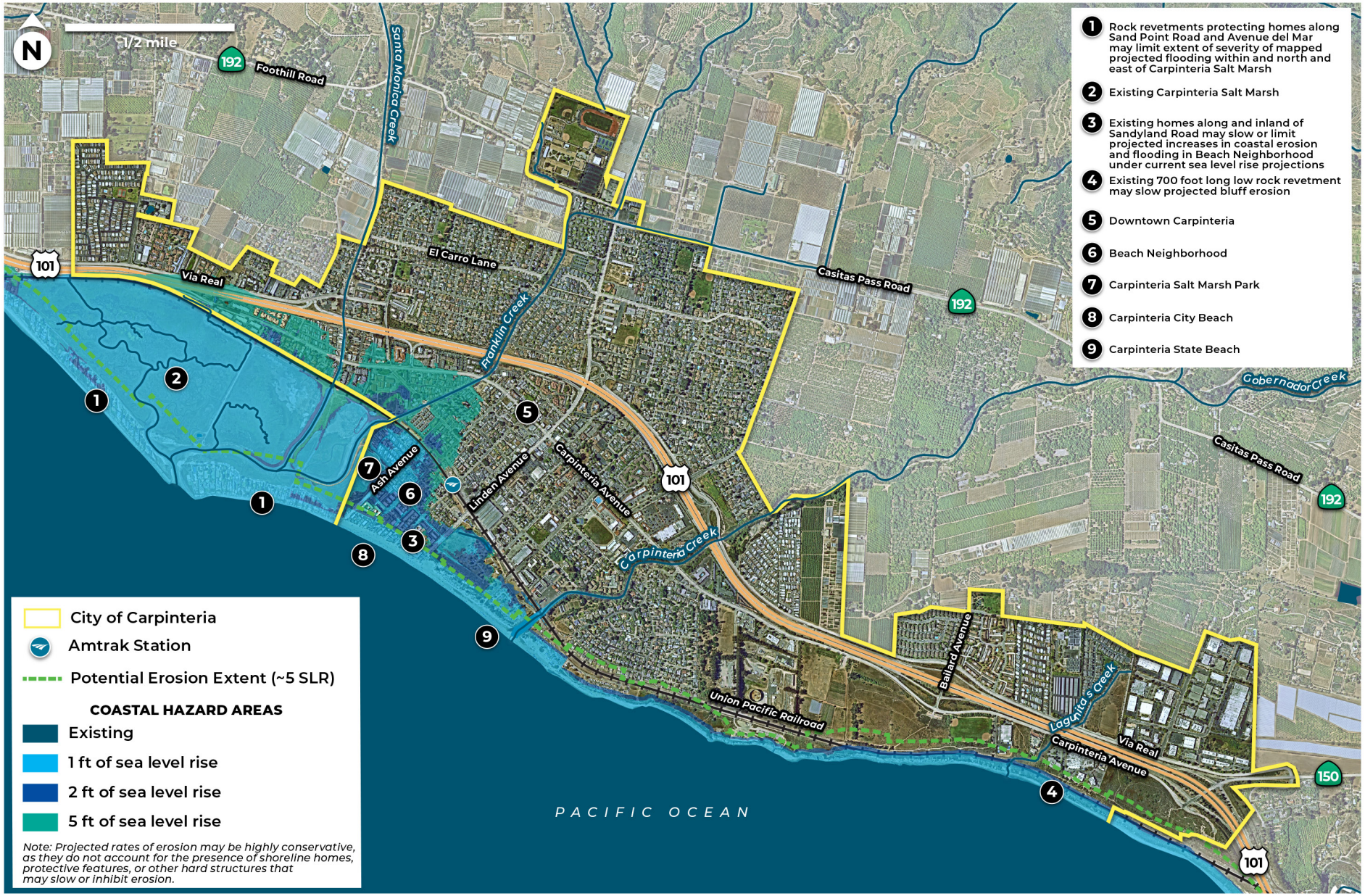
Examining coastal vulnerabilities is the first step in understanding the extent of potential damage from sea level rise and formulating effective adaptation strategies. Vulnerabilities in the City vary depending on when the public or private buildings, resources, or infrastructure may be affected, what projected sea level rise elevation would affect the resource, and which hazard type(s) may affect the resource. Potential vulnerabilities in the City include:

- **Existing Buildings:** Residences and businesses in certain neighborhoods of the City are currently vulnerable to structural damage and property loss due to coastal flooding and tidal inundation, which is projected to increase with sea level Rise. Multi-family units (apartments and condominiums) represent over 80 percent of vulnerable residential parcels in the City along the shoreline and within the Beach Neighborhood. Many of these units are short-term (less than 30 days) vacation rental properties that provide overnight coastal access accommodations for visitors and also generate significant transient occupancy tax revenue for the City. Also, residences and businesses and the Aliso School in the West Downtown neighborhood will be to tidal inundation and/ or coastal flooding should sea levels rise by 2 feet, although the timing, extent, and severity of such flooding could be affected by the rock revetments fronting the Carpinteria Salt Marsh.
- **Affordable Housing:** Affordable housing, including mobile homes, in low-lying areas is vulnerable to damage from coastal flooding and tidal inundation with sea level rise in the Beach Neighborhood and potentially over the longer term in the West Downtown Neighborhood.
- **Coastal Access and Trails:** Large storms currently damage public coastal access points to the beach and along the bluffs in Tar Pits Park due to cliff erosion, landward retreat, and coastal flooding, particularly when coinciding with monthly high tides.
- **State/City Beach Recreation:** Erosion and inundation of Carpinteria State Beach and Carpinteria City Beach could result in loss or inundation of sandy beach, and decreased beach visitation and recreation value.
- **State Park Campground:** Low-cost overnight accommodations in the campground are vulnerable to damage from coastal flooding, and over the long term, erosion may result in the permanent loss of Carpinteria State Beach, a coastal recreational area of statewide importance.
- **Beaches and Dunes:** The City's southern edge comprises the City and State Park beaches and State Park dunes, which are vulnerable to coastal flooding, erosion, and inundation, impacting coastal habitats and recreation.
- **Environmentally Sensitive Habitat Areas (ESHA):** Increases in coastal flooding could exacerbate erosion and inundation of beach and dune habitats, transition high marsh ESHA to mudflat or subtidal habitats, convert Carpinteria Creek riparian habitats to estuarine wetlands, erode coastal bluff scrub and other ESHA on the Carpinteria Bluffs, and more frequently submerge the Carpinteria Harbor Seal Rookery.

- **Railroad:** The UPRR rail corridor on the Carpinteria Bluffs is highly vulnerable to coastal erosion, although approximately 700 feet or 10% of this approximately 7,000 feet of shoreline is protected by rock revetment or a concrete seawall. Low-lying areas throughout Downtown and along the Carpinteria Salt Marsh Reserve are potentially vulnerable to coastal flooding and tidal inundation which is projected to increase with sea level rise.
- **U.S. 101:** U.S. 101 runs through the City, including approximately 1,500 linear feet that run through low-lying areas near the Carpinteria Salt Marsh Reserve, which could become vulnerable to coastal flooding and tidal inundation with 5 feet of sea level rise.
- **Public Infrastructure:** Sewer, water, and stormwater infrastructure is vulnerable to direct damage and adverse effects of flooding such as backflow and contamination.

Vulnerable residential dwellings, particularly in the Beach Neighborhood, exposed to flooding from wave runup could increase from 86 homes today, to 237 with 1 foot of sea level rise, and up to 1,090 with 5 feet of sea level rise.

Figure CR-1 depicts projections of what coastal hazards in the City are modeled to be with 1, 2, and 5 feet of sea level rise as projected in Table CR-1, as estimated by the 2019 SLRVAAP. However, when analyzing the extent of potential vulnerabilities and damage to the City, it is important to consider that sea level rise projections are a worst-case estimate of the National Research Council model and guidance from the 2018 State of California Sea-Level Rise Guidance with a relatively low probability of occurrence (0.5% to 2%); this approach to coastal hazards planning is similar to the approach used in floodplain management (e.g., planning for 100-year/1-percent probability floods). It is also important to note that modeling of sea level rise and potential erosion as part of the SLRVAAP has inherent limitations, particularly the inability to account for the effects of fixed hard structures on flooding or erosion. Thus, projected flooding inland of the Carpinteria Salt Marsh Reserve does not account for the presence of permanent rock revetments and homes along the Marsh shoreline (i.e., presumes absence). Similarly, erosion and flooding in the Beach Neighborhood do not account for the presence of shoreline homes and condominiums, which may slow or inhibit erosion and flooding unless such homes are destroyed or eventually removed. Further, projected erosion along the Carpinteria Bluffs may be slowed or avoided by 700 feet of revetment and seawall or actions by UPRR (e.g., installation of emergency rock revetments) to protect its rail tracks. For areas generally lacking hard structures with largely natural shorelines such as Carpinteria State Beach, Tar Pits Park, and much of the Carpinteria Bluffs, model projections may more accurately simulate projections of potential erosion and flooding.



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Carpinteria Coastal Hazards with Sea Level Rise (2100)

FIGURE CR-1

Projected Expansion of Coastal Hazards in the City

Sea level rise is projected to expand coastal hazard areas in the City, although the timing and severity of such increased hazards remain under study. If sea level rise proceeds as projected (5 feet by 2090-2140, depending on the sea level rise scenario), the potential for damage to homes, businesses, public infrastructure, and natural resources from coastal flooding, coastal erosion, and tidal inundation may worsen. With progressive increases in sea level, neighborhoods, businesses, and infrastructure may be placed in harm's way due to increased coastal flooding, coastal erosion, and tidal inundation.

Current projections of sea level rise (e.g., 5 feet by 2090-2140) have varying degrees of probability and are based on varying projections and modeling scenarios for global warming and sea level rise-inducing factors. Changes in GHG emission rates and other factors can accelerate or delay sea level rise, increasing the importance of monitoring to inform adaptations strategies.

Planning for Coastal Resiliency in 2100

Several areas of the City with differing vulnerabilities to sea level rise could be exposed to coastal hazards, including the Beach Neighborhood, the Carpinteria Bluffs, and the Carpinteria Salt Marsh Reserve. The City's lower income and minority populations are also disproportionately vulnerable to sea level rise impacts with associated environmental justice concerns. With 5 feet of sea level rise (currently projected to occur by 2090-2140, depending on the sea level rise scenario), coastal flooding during severe storms could expand in depth, and extend inland throughout the Beach Neighborhood and even potentially into the Downtown core along Linden Avenue. This could potentially affect areas inland of UPRR, possibly areas north of Carpinteria Salt Marsh and south of U.S. 101, and areas along Franklin Creek (Figure CR-1). Monthly high tides could reach inland to inundate the Beach Neighborhood and Carpinteria State Beach inland to the Tomol Interpretative Park, even in areas not directly connected to the ocean due to daylighting (surfacing) of groundwater, and due to tidal inundation and the backup of the storm drain system, assuming the currently low probability sea level rise rates proceed as projected. Based on the modeling results of the SLRVAAP, the rates of coastal bluff erosion are projected to increase from a current roughly 6-inch average annual rate to as much as 3 feet annually.[2] Such erosion could extend through the first row of parcels to the inland of Sandyland Road in the Beach Neighborhood if repeated damage to these structures leads to the removal of dozens of homes along the shoreline. In the central and eastern parts of the City, bluff erosion could impact the UPRR within Tar Pits Park and the Carpinteria Bluffs Nature Reserve, although UPRR may take action to protect its tracks, which would also slow erosion and provide some protection for landward uses. Over the longer term, if the bluffs erode as rapidly as projected and the UPRR is destroyed or relocated, sea level rise could begin to affect dwellings and infrastructure in the Concha Loma Neighborhood. If coastal bluff erosion proceeds as projected, it could potentially impact the City's recreational trails, sensitive habitats along the Carpinteria Bluffs, and existing structures although this would presume destruction of the UPRR tracks which lie seaward of most

[2] Bluff erosion rates combined conservative sea level rise projections with estimates of changes in bluff erosion rates based upon geologic data, the resilience of particular geological formations and their response to repeated more frequent wave attack.

of the Carpinteria Bluffs.[3] If sea level rise proceeds as projected (5 feet), by 2100 the combined effects of projected tidal inundation, coastal flooding, and monthly high tides could impact an estimated $651.1 million of property (2018 valuation) with $219.1 million in total flood damages to property from waves generated during a single severe storm and $439.9 million in property from coastal erosion alone.

Beach Neighborhood and Downtown Area

The low-lying Beach Neighborhood and portions of Downtown are vulnerable to potential future hazards, including beach erosion which could expose the Neighborhood to coastal flooding, wave attack and runup, and tidal inundation, due to its low-lying setting, proximity to the shoreline and Carpinteria Salt Marsh, and existing high groundwater. If sea level rise proceeds as projected, public infrastructure, homes, and businesses in the Beach Neighborhood would be increasingly exposed to coastal flooding, coastal erosion, and tidal inundation over time. Over the long term, projected hazards could extend landward of the UPRR to include the Downtown area west of Linden Avenue along Elm, Ash, and Holly Avenues. Based on modeling performed for the City's pending Living Shoreline Project, the City's current annual beach berm program may not be adequate to avoid such impacts.

With 5 feet of sea level rise (currently projected to occur by 2090-2140, depending on the sea level rise scenario), residential units, including affordable housing units, short-term rentals, and commercial structures, largely within the Beach Neighborhood as well as more limited numbers within West Downtown south of U.S. 101 and the Concha Loma Neighborhood (see below), could be impacted by coastal flooding, tidal inundation, and erosion with up to 5 feet of sea level rise. In the Beach Neighborhood, portions of Linden Avenue south of the UPRR, a bike route, sidewalks, and public coastal access points and parking spaces could be eroded or regularly flooded with 5 feet of sea level rise. Free public coastal access parking spaces, including approximately 30 at the terminus of Linden Avenue, and bicycle facilities on public streets could also be damaged or destroyed.

Carpinteria State Beach (a key source of low-cost overnight accommodations) is also included in the Beach Neighborhood and the majority of State Beach campground is low-lying former marshland fronted by low dunes, while the easternmost areas are located on a low bluff top. With 5 feet of sea level rise, 213 campsites would be damaged or destroyed by coastal erosion, coastal flooding, and tidal inundation. Additionally, almost 200 coastal access parking spaces, picnic grounds, and several restrooms could also be damaged or destroyed. This section of the coast could be severely eroded or inundated, impacting 1 million annual visitors to the City.

[3] Projected landward erosion in the Beach Neighborhood assumes that shoreline and inland structures would be damaged to such an extent over time that repair and replacement would no longer be feasible;, and removal may be required, allowing the shoreline to advance landward. As a long-range planning tool, the National Research Council model is not sophisticated enough to account for short- or long-term interference in erosion rates from fixed hard structures such as buildings, so damage projections below reflect current worst case estimates of sea level rise and coastal erosion, coastal flooding and tidal inundation.

Carpinteria Bluffs

For this discussion, Tar Pits Park, the Concha Loma Neighborhood, and all of the Carpinteria Bluffs have been grouped. Currently, coastal erosion from wave attacks, as well as some areas of uncontrolled runoff and deteriorated culverts, threaten both Tar Pits Park and the Carpinteria Bluffs. Approximately 700 feet of rock revetment and a seawall protect some landward infrastructure, light industrial buildings, segments of the Carpinteria Bluffs Trail, and natural habitats on research development industrial properties. However, most of this area is unarmored. The UPRR traverses this entire area and lies landward of Tarpits Park, the Pier and parking lots, and seaward of the Concha Loma Neighborhood. However, UPRR lies seaward of most of the Carpinteria Bluffs, including the former oil and gas facilities, the Carpinteria Bluffs Nature Reserve, Viola Park, research development industrial properties, the Rincon Bluffs Preserve, and the Rincon Gateway. This location is important as the UPRR frequently takes action along the coast to protect its tracks from damage from coastal erosion, often through the installation of rock revetments, seawalls, or other measures, and is generally not subject to the local agency or state permits. With 5 feet of sea level rise (currently projected to occur by 2090-2140, depending on the sea level rise scenario), and not accounting for existing coastal protection or any potential future actions taken by UPRR, accelerated bluff retreat is projected to cause substantial erosion in Tar Pits Park and the Carpinteria Bluffs, threatening over 2 miles of public trails and approximately 1.8 miles of the UPRR that traverses the bluffs. Bluff erosion rates are highly conservative and are projected to increase from 6 inches per year currently to approximately 1 to 3 feet per year, assuming 5 feet of sea level rise. If sea level rise-induced erosion proceeds as projected, more than two dozen residences within the Concha Loma Neighborhood, light industrial and office, oil and gas infrastructure, Casitas Pier, seaward portions of the Carpinteria Bluffs Nature Preserve and Viola Fields Park, and research development industrial properties), and seaward areas of the Rincon Bluffs Reserve and Rincon Gateway could be threatened, especially with higher end scenarios of 2 to 5 feet of sea level rise, including loss of as coastal sage and coastal bluff scrub communities. Sea level rise could also inundate, erode, and damage the Carpinteria Harbor Seal Rookery, which could displace the seals or limit their access to foraging and pupping areas.

Carpinteria Salt Marsh

The Carpinteria Salt Marsh, some adjacent areas such as the City's Carpinteria Salt Marsh Nature Park, and large areas of the West Downtown Neighborhood along Carpinteria Avenue and 7th Street would be potentially vulnerable to coastal flooding and tidal inundation hazards as rising seas inundate the salt marsh and move landward.[4] With 5 feet of sea level rise, approximately 70 acres of residential units north of the Carpinteria Salt Marsh, including mobile homes and affordable housing units, as well as segments of U.S. 101, UPRR, Carpinteria Avenue, Aliso Elementary School, the City's Salt Marsh Nature Park, and the Salt Marsh Trail may be subject to

[4] Again, due to limitations in modeling technology, these hazard projections are worst case and do not account for the mitigating effects of the large revetments that front the neighborhoods seaward of the salt marsh. If these revetments remain intact, rising seas would be constricted to passing through the existing 100 foot wide channel at the mouth of the salt marsh, constricting flows and potentially substantially reducing the mapped extent and severity of hazards from coastal flooding and tidal inundation.

flooding or tidal inundation with 5 feet of sea level rise. The Carpinteria Salt Marsh is also an important natural open space that improves climate resilience. With sea level rise, wetlands can absorb excess water, slowing wave action, and providing a buffer zone against coastal erosion, essentially acting as a "sponge" to help protect coastal communities from the impacts of rising sea levels; however, their effectiveness depends on the rate of sea level rise and the ability of the wetland ecosystem to adapt and migrate inland as needed. While the Carpinteria Salt Marsh provides a wetland buffer, its ability to migrate inland is limited by the U.S. 101 travel corridor.

Environmental Justice

The Beach and West Downtown Neighborhoods in the City which support minority and lower-income households are located near the salt marsh and shoreline and could be disproportionately impacted by sea level rise (refer to Figure HC-1). Sea level rise could also disproportionately affect elderly and transit-dependent populations. For instance, the loss of public transit facilities would negatively affect those without access to a vehicle, potentially hindering the ability to get to work and other activities. These populations would also be impacted by the loss of affordable housing in the West Downtown Neighborhood and Beach Neighborhood due to sea level rise. Further, such households may not be able to afford repeated repairs from coastal flooding or tidal inundation, increased insurance premiums, and/or major alterations to homes and businesses to increase resiliency, thereby potentially placing additional hardship on low-income households and businesses.

ADAPTATION APPROACHES

Planning how to adapt to the effects of sea level rise in the City involves identifying potential actions that the City could take to protect, accommodate, and adaptively manage vulnerable areas and resources. The outcome of a sea level rise adaption plan is the ongoing reduction of coastal hazards for City residents and visitors. A variety of cost-benefit tradeoffs exist between adaptation strategies, and the timing and nature of such strategies will in turn be affected by the rate and level of sea level rise and resultant increases in projected coastal erosion, coastal flooding, and tidal inundation. If sea level rise proceeds as projected (5 feet by 2090-2140, depending on sea level rise scenario), more rigorous measures and strategies will be required.

Since 1983, the City has constructed a seasonal winter beach berm to protect shoreline homes from coastal storms, which involves the construction of a sand berm along approximately 1,400 feet of City Beach to last through the winter storm season. The sand berm is constructed in the fall and demolished in the spring. This program has proven to be effective in buffering the Beach Neighborhood from storm damage and will continue as a seasonal adaptation strategy as sea level rise progresses. However, modeling for the pending Living Shoreline Project indicates that the winter beach berm could be breached or overtopped during future strong storms. Such breaches or overtopping events would only be further exacerbated by sea level rise. Additional adaptation strategies include the following:

Protection Strategies

Shoreline protection devices protect development in their current location without changes to the development itself. Protection devices can include rock revetments or seawalls; however, shoreline protection devices may in turn cause inundation and loss of beaches and intertidal habitats by fixing the shoreline in place as sea levels rise. To avoid the potential adverse tradeoffs of shoreline protection devices, more natural engineered structures may be appropriate, such as the installation of living shorelines with vegetated dunes underlain by cobbles, which buffer the shore from erosion using natural materials and processes.

Nourishment (Imported Sand) protects development and natural resources by reinforcing and building up the beach as a natural buffer against erosion and coastal flooding. In the City, imported sand sources include the Carpinteria Salt Marsh and detention basins in the foothills (e.g., Santa Monica Debris Basin). Programs to transport sediment from the Carpinteria Salt Marsh or foothill detention basins to the City or upcoast beaches would reduce vulnerabilities and improve resiliency from sea level rise. The County Flood Control & Water Conservation District (Flood Control) performs sediment disposal/nourishment on the City's Beach typically at Ash Avenue using heavy haul trucks to deposit such sediment. Refer also to the **Open Space & Conservation Element** for further discussion regarding sources of sediment for beach nourishment, existing nourishment activities, and policies promoting continued coordination with local agencies for re-nourishment activities to mimic historical natural processes and improve coastal resiliency.

Sand retention protects development and natural resources by installing structures such as groins or cobbles to slow the passage of sand downcoast. Sand retention is often used in combination with beach nourishment to prolong the retention of sand on the beach. Sand retention techniques commonly involve the installation of a structure and, as a result, can adversely impact downcoast beaches by interrupting sand transport if not accompanied by relatively regular beach renourishment. Well-planned sand retention may be key in improving resiliency while minimizing adverse consequences to downcoast beaches. As a complement to nourishment projects, sand retention may be an important tool in helping conserve California's beaches given increases in beach erosion projected to occur with sea level rise.

Accommodation strategies employ methods that modify existing development or ensure new developments or infrastructure are designed to decrease risks from coastal hazards. Accommodation strategies may be planning-based or structural. Planning strategies may include changes in land use plans and zoning ordinances to constrain or cluster new development in non-vulnerable areas. Structural strategies may include designing building foundations and infrastructure to withstand inundation and direct wave attacks such as elevating structures on pilings, placing non-habitable spaces (i.e., garages, storage) on lower floors, and installing flap gates on sewer outfalls to prevent backflow during flood events. This Coastal Resiliency Element includes policies and programs designed to help facilitate such accommodation strategies.

Managed retreat strategies gradually realign infrastructure and development away from an eroding or flooded shoreline, and limit new construction in such areas, including open space and

habitat areas. Within the City, with 5 feet of sea level rise, the most threatened homes and public facilities in the Beach Neighborhood could be moved landward if repeated frequent damage from storms, and continued repair is no longer feasible. Repetitive loss programs, acquisition and buy-out programs, and transfer of development rights programs can create incentives for relocation and shoreline retreat. To be effective, a managed retreat strategy must be implemented in a proactive, phased, and orderly manner to avoid expensive emergency responses or disproportionate hardship to property owners. Along the Carpinteria Bluffs, managed retreat could entail a major regional project, relocating the UPRR landward if repeated severe damage to the tracks makes maintenance in place no longer feasible. If a major managed retreat of public facilities or private structures is eventually required, it would require careful coordination with affected parties and local, state, and potentially federal agencies.

Hybrid strategies may combine several technologies and techniques in an overall shoreline management plan or a patchwork of approaches to target unique conditions along a diverse shoreline. For example, adaptation approaches along the low-lying developed Beach Neighborhood and most of Carpinteria State Beach may well be different from those employed along the bluff tops of Tar Pits Park and the Carpinteria Bluffs. A living shoreline dune system with sand retention as a near-term improvement may be combined with managed shoreline retreat in these low-lying areas as a long-term solution. In severely threatened areas of the Beach Neighborhood, shoreline protection either of natural techniques or structural may combine with structural reinforcements such as elevated building foundations. Within bluff-top areas, erosion control through culvert replacement and channeling runoff may be combined with bluff face revegetation with native species to slow erosion while coordinating with UPRR and other stakeholders about longer-term solutions. Hybrid strategies may provide the City and property owners with time to implement longer-term adaptation or managed retreat strategies. Such strategies could also help manage City beach habitats if the shoreline recedes over time as projected.

Do nothing or a policy of non-intervention is also considered an adaptation strategy, and often results in emergency response at the highest cost without consideration of the full range of tradeoffs and secondary impacts. This Coastal Resiliency Element includes policies and programs designed to avoid repeated emergency responses entailed in the do-nothing approach to minimize the high cost of repeated or continuous emergency actions and reduce interference with natural coastal processes.

Adaptation Strategies for the City

The City proposes to consider pursuing a range of adaptation strategies in response to projected coastal hazards that reflect community values and priorities, including maintaining the City's small beach town character and high quality of life, protecting public access to the beach and coastal recreational opportunities, working cooperatively with affected property owners, and protecting or adapting vulnerable neighborhoods and communities within the City's fiscal capabilities. The City proposes to focus sea level rise adaptation strategies within the potential coastal hazard areas as depicted in Figure CR-1, including, but not limited to, those in Table CR-4.

Table CR-4. Potential City Adaption Strategies

Adaptation Strategy	Description & Approach
Winter Storm Berm Program	▪ Continue the existing winter storm berm program as long as it remains viable or is replaced by a more viable approach.
Living Shoreline/ Dune Restoration	▪ Continue to explore the environmental impact and design of a vegetated dune system underlain by cobbles along the City Beach and potentially include the State Beach to protect development within the Beach Neighborhood and State Park.
Army Corps of Engineers Storm Damage and Shoreline Protection Feasibility Study	▪ Continue to coordinate with the USACE to conduct a sea level rise and coastal erosion feasibility study including consideration of the City's Dune and Shoreline Management and fund a mitigation strategy, with a portion of funding derived from the Santa Barbara Harbor to offset past construction impacts on sand supply. ▪ Minimize coastal erosion through beach nourishment and the use of cobble, using USACE funding.
BEACON Projects	▪ Collaborate with BEACON to optimize the maintenance of City and State beaches and protection of the City's shoreline from coastal hazards.
Sediment & Beach Nourishment	▪ Work with BEACON and Flood Control to establish long-term funded programs to regularly augment the existing sand supply along the beaches to broaden the range of sediment, including acceptable fines and cobbles to provide natural defenses for erosion protection. ▪ Pursue funding for and establish programs to enable opportunistic beach nourishment activities in coordination with Flood Control and BEACON, including transport of sediments from foothill detention basins, the Carpinteria Salt Marsh, and other beach-quality sediment sources.
Sand Retention Structures	▪ Work with BEACON, regulatory agencies, and community organizations to explore sand retention options to improve the resiliency of the City's shoreline, the longevity of beach nourishment projects, and mitigation of potential impacts to downcoast beaches. ▪ Consider more natural sand retention options such as enhancing existing points, use of cobbles, or a recreational pier, before more intrusive options such as groins or offshore breakwaters.

Table CR-4. Potential City Adaption Strategies (Continued)

Adaptation Strategy	Description & Approach
Stormwater Infrastructure Improvements	▪ Monitor storms and high tides to inform actions to minimize flooding within the Beach Neighborhood; pursue channel improvements along area creeks, or installation of pumps, and floodgates on culverts to reduce flooding from creeks, drains, and channels. ▪ Repair and improve culverts and drainages along Tarpits Park and the Carpinteria Bluffs to reduce bluff erosion and the formation of canyons and gullies on bluff faces.
Coastal Resiliency Overlay	▪ Establish policy and program framework for adaptation such as development standards for accommodation of sea level rise. ▪ Enact a Coastal Resiliency Overlay affecting properties within defined coastal hazard areas, which would provide additional adaptation options to property owners within the Overlay and requirements to design projects to avoid or accommodate sea level rise hazards.
Repetitive Loss Program	▪ In the long term, review the resiliency of structures and infrastructure that are subject to repetitive damage and consider the most appropriate adaptation measures.
UPRR/ LOSSAN Rail Corridor	▪ Coordinate with LOSSAN and UPRR on railroad improvements to adapt segments of the tracks to potential coastal flooding, and tidal inundation impacts within the Downtown and Beach Neighborhoods. ▪ Coordinate with LOSSAN and UPRR regarding appropriate measures to protect the railroad and slow erosion of the bluffs. Include revegetation of areas of Tar Pits Park as well as the Carpinteria Buffs in coordination using deep-rooted erosion-resistant native coastal bluff scrub vegetation.

Funding and Regional Collaboration

Strategies such as utility upgrades or relocation, beach nourishment, or adaptation of individual structures or infrastructure systems can be extremely expensive. While limited grant programs exist to support specific adaptation planning efforts or actions, substantial increases in funding from local, state, and federal sources will be required to implement robust adaptation strategies and measures if sea level rise proceeds as projected. Without regular dedicated sources of funding, the City will be challenged to plan for adaptation and integrate such measures into a realistic capital improvement program. Similarly, private property owners, particularly lower-income households, could benefit from easily accessible funding sources if such funding becomes available, to implement adaptation strategies, which may minimize costly emergency repairs. Adaptation planning will require regional and multi-jurisdictional coordination and funding. In particular, establishing regular funding mechanisms at the local, state, and federal levels to help

offset the costs of adaptation strategies is key to successful implementation, including permit streamlining for such measures.

MONITORING & TRIGGERS

Given the long-term nature of sea level rise hazards and the potential for changing probabilities based on changes in emissions, adaptation needs to be informed by monitoring. Triggers are indicators of when adaptive strategies are needed to address coastal hazard-related vulnerabilities and reduce or avoid impacts. Triggers serve as a catalyst to initiate planning, permitting, and/or implementation of adaptive measures, and are important for developing time-sensitive policies or actions. For this Element, the tipping point is when sea level rise could critically affect vulnerable assets, resources, or infrastructure.

Adaptation efforts can take several years or even decades to develop and implement, allowing the City time to plan, permit, finance, and/or implement the appropriate action before the tipping point is reached. For example, repairing decayed culverts and other measures to slow bluff erosion take both funding and time and major regional projects such as relocating a segment of railroad could take decades to plan and implement, along with extensive funding. Therefore, successful adaptation planning sets triggers sufficiently far in advance to allow associated adaptation measures to be implemented to reduce and eliminate risks before they become critical. Further, potential triggers need to be monitored and assessed to inform adaptation decisions. Triggers should be reevaluated and updated as needed to capture changes in projected sea level rise and advances in science and changing conditions.

Triggers for Adaption

Triggers for adaptive actions by the City may include:

- **Sea level rise elevation** – monitor sea level rise reports such as those from the State of California and the Scripps Institute of Oceanography, and National Oceanic and Atmospheric Administration tide gauges in the Santa Barbara Channel. Monitoring sea level, and the rate it is rising allows the City to implement further actions in advance of projected sea level rise impacts.
- **Beach width** – identify a measured width threshold to trigger actions like beach nourishment, such as when the beach width at the end of summer is less than 100 feet.
- **Future plans** – require long-range studies to identify when appropriate additional strategies must be completed (e.g., wastewater treatment upgrades or transportation planning).
- **Storm damage and frequency** – work with Flood Control, BEACON, and the USGS to monitor the frequency and severity of exposure of the City Beach and shoreline to wave action. Coordinate with these agencies to track and record coastal erosion and flooding, including the date, location, type, and severity to determine if the rate and frequency of erosion and flooding is increasing.
- **Property and infrastructure damage** – track damages to buildings and facilities, and the required extent of repairs (e.g., repair if under 30 percent, upgrade building standards if

damaged by more than 50 percent, or relocate if the structure has multiple damage claims more than 50 percent).

- **Bluff erosion and setbacks** – coordinate with USGS to determine existing bluff retreat rates and monitor the rate of bluff erosion as a trigger for adaptation measures. Consider relocation of threatened development or infrastructure.

Monitoring

Monitoring sea level rise, storm frequency, and storm damage helps to determine when to implement adaptation measures, allocating sufficient time for coordination, planning, permitting, engineering, and financing. Successful monitoring strategies will be required to have a certain lead time from initial concept to implementation that varies depending on the scale and type of strategy, and the amount of sea level rise that the strategy can accommodate. Once the strategies are prioritized, then conservative (worst-case) estimates of lead times before implementation will be developed. These lead times should then inform policy triggers that are monitored through measurable objectives to act as a catalyst for the planning process.

Goal

Reduce risks to life and property while increasing community and ecosystem resilience to sea level rise.

OBJECTIVES AND POLICIES

Objective CR-1: Monitor sea level rise and identify adaptation strategies and triggers based on the best available science and data recommended by Ocean Protection Council (OPC) and State agencies at the time.

Policies:

CR-1a. The City shall monitor, assess, and inform the public and City decision-makers about the effects of sea level rise on coastal resources, coastal access, public infrastructure and facilities, and existing development to make informed recommendations on adaptation and revise plans and policies as needed.

CR-1b. Implementation of City-wide sea level rise adaptation strategies shall be based upon observed evidence of physical changes in sea level rise, known as triggers, such as water surface elevation changes as measured at local Santa Barbara tide gauges, repeated frequent severe damage resulting from coastal hazards, and/or changes in storm frequency and intensity, and should be informed by a Sea Level Rise Monitoring Program.

CR-1c. The City shall work with local, regional, and state agencies to install and maintain a local tide gauge as part of the City's efforts to conduct sea level rise monitoring.

CR-1d. The City shall encourage USGS to continue to conduct the twice yearly (spring and fall) shoreline transect profile monitoring program to assist in monitoring future sea level rise and the overall health of the City's public beaches.

CR-1e. The City shall review and update at regular intervals, and at a minimum every ten years, a sea level rise vulnerability assessment to incorporate an emerging scientific understanding of sea level rise, potential changes to greenhouse gas emissions scenarios and sea level rise projections, and updated information on coastal hazards, as well as to consider regional approaches to coastal resiliency building and adaptation planning efforts. The City shall coordinate and collaborate with local, state, and federal agencies to ensure consistency between current sea level rise projections.

CR-1f. The City should coordinate with the California State Lands Commission, other state and federal agencies, other jurisdictions, academic and research institutions, and appropriate organizations to obtain mean high tide line survey data, document baseline data and monitor the movement of the shoreline and the public trust boundary.

CR-1g. The City shall coordinate with CCC at regular intervals to evaluate the CCC's retained permit jurisdiction based on the movement of the shoreline commensurate with sea level rise.

Implementation Actions:

1. *Establish and maintain a Sea Level Rise Monitoring Program which includes the following:*
    a. *Local tide gauge data;*
    b. *Long-term shoreline and beach profile data;*
    c. *Frequency, duration, and severity of coastal flooding and coastal erosion events; and*
    d. *Cost and extent of structure and infrastructure damages from coastal storm events, flooding, and tidal inundation.*

    Timing: Within 5 years of CLUP/General Plan adoption.
2. *Prepare, adopt, and amend the Local Coastal Program to include quantifiable triggers for use by the City in determining the optimal timing for implementation of Citywide sea level rise adaptation measures. To support the Local Coastal Program amendment, prepare a report that identifies and recommends feasible quantifiable triggers based upon updated sea level rise planning and policy guidance, data from the Sea Level Rise Monitoring Program, and other relevant sea level rise studies.*

    Timing: Within 5 years of CLUP/General Plan adoption.

Objective CR-2: Minimize the risk of damage and disruption from coastal hazards upon vital public infrastructure.

Policies:

CR-2a. To the extent feasible and based on available resources, the City should repair roadways and paths damaged from coastal flooding and/or retrofit existing roadway infrastructure over time to withstand sea level rise impacts through drainage improvements, use of resilient materials and construction methods, and/or elevation or relocation of key at-risk roadways and paths.

CR-2b. The City should proactively coordinate with Caltrans and local transportation agencies to implement adaptation measures, which may include the establishment of alternative transportation routes and facilities, to avoid coastal hazards and ensure continued circulation and public coastal access.

CR-2c. The City should coordinate with Caltrans and local agencies to develop a long-term adaptation strategy to address potential flooding or damage of U.S. 101 due to flooding or coastal hazards.

CR-2d. The City should coordinate with UPRR and LOSSAN to identify adaptation opportunities for rail infrastructure.

CR-2e. The City shall evaluate the condition of City-maintained stormwater drainage systems to reduce flooding and erosion damage and to identify opportunities for incorporating flood protection measures via capital stormwater projects capable of resolving flooding or erosion damage.

CR-2f. The City shall coordinate with various stakeholders, including the CSD and CVWD to ensure that new critical facilities, including the wastewater treatment plant, and other infrastructure are sited and designed to minimize risk from coastal hazards.

Implementation Actions:

3. *Establish a Transportation Infrastructure Monitoring Program to inventory and monitor damage to City transportation facilities and/or disruption of routes from coastal hazards and sea level rise. As part of the monitoring program, the City should prioritize facilities for adaptation based on risk and accessibility needs.*

   Timing: Within 5 years of CLUP/General Plan adoption.

4. *In collaboration with responsible entities, develop a Sea Level Rise Critical Infrastructure and Drainage Master Plan to be reviewed and approved by CCC as an amendment to the Local Coastal Program that identifies infrastructure, including stormwater, water supply, and wastewater infrastructure, that is potentially vulnerable to sea level rise hazards or may exacerbate flood and tidal*

inundation hazards, and that identifies adaptation options to address identified vulnerabilities.

Timing: Within 5 years of CLUP/General Plan adoption.

Objective CR-3: Maintain and enhance a wide, safe, sandy beach for habitat, recreation, and public coastal access for use by future generations; protect existing public infrastructure and facilities; and avoid the need for hard shoreline protection devices.

Policies:

CR-3a. Shoreline protective devices, including but not limited to shoreline armoring, such as seawalls, groins, breakwaters, and other such construction that alters natural shoreline processes, shall be prohibited unless consistent with the policies and provisions of the City's Local Coastal Program, non-structural protection alternatives are infeasible, there is no less environmentally damaging alternative, and no waiver of rights to a shoreline protective device (as described in Policy CR-3b) applies to the property. For the following policies under Objective CR-3, "existing structure" means a principal structure (e.g., residential dwelling or accessory dwelling unit) that was legally permitted and in existence before the effective date of the Coastal Act (January 1, 1977) and that has not subsequently undergone major redevelopment under Policy CR-4a and Policy CR-4b.

CR-3b. Shoreline protective devices shall be sited and designed to avoid adverse impacts on coastal resources, including the beach, rocky points, or intertidal areas, to the maximum extent feasible. Such impacts may include but are not limited to erosion or loss of sand supply, destruction of the rocky substrate, smothering of a significant number of organisms, loss of public access, loss of recreation facilities, or destruction or loss of coastal ecosystems. If there is no feasible alternative that avoids all impacts, then the alternative that would result in the fewest or least significant impacts shall be selected and unavoidable impacts to resources shall be mitigated. Mitigation shall not be used as a substitute for the selection of the least damaging alternative. Such devices shall avoid encroachment onto public trust lands and interference with the natural migration of the public trust lands boundary.

CR-3c. Shoreline protective devices shall only be authorized until the time when the existing principal structure that is protected by such a device:

a. Is no longer present;

b. No longer requires armoring; or,

c. Undergoes major redevelopment. For major redevelopment, any potential rights to future protection are terminated and removal of the shoreline protective device shall be required as part of the demolition and alteration of the structure being redeveloped.

CR-3d. Non-exempt repair and maintenance of existing, legally permitted shoreline protective devices may be permitted as repair and maintenance only if the activities do not result in an enlargement or extension of armoring. Repair and maintenance activities shall not result in a seaward encroachment of the shoreline protective device or substantial impairment of public trust resources. Repair and maintenance projects shall include measures to address and mitigate all coastal resource impacts that the repair and maintenance activities may cause, including for local sand supply, public views, and public recreational access. Replacement of 50 percent or more of the protective device shall not be considered repair and maintenance but instead constitutes a replacement structure subject to provisions applicable to new or replacement shoreline protective devices.

CR-3e. For coastal storm preparedness until other adaptation options are triggered, and with permit approval from the CCC and USACE, the City may continue to construct the winter sand berm on the City Beach in the fall and demolish the berm in spring, or other timing as required by the Coastal Development Permit.

CR-3f. The City shall support and facilitate the current USACE Carpinteria Shoreline Feasibility Study and examine other long-term solutions for beach nourishment and the establishment of a vegetated dune system at the City Beach and/or State Beach.

CR-3g. The City shall encourage the use of soft or natural shoreline protection methods, such as dune restoration, beach/sand nourishment, living shorelines, horizontal levees, and other "green" infrastructure as alternatives to hard shoreline protective devices. Soft shoreline protection devices shall be fully evaluated for coastal resource impacts and shall only be approved if found consistent with the Local Coastal Program policies related to shoreline protection. The City should consider how these options may need to change over time as the sea level rises.

CR-3h. Beach nourishment programs and/or projects shall be designed to minimize adverse impacts to beach, intertidal, and offshore resources with consideration of sourcing of material, nourishment location(s), method and timing of placement, water quality best management practices, and shall be subject to appropriate testing for grain size, shape, color, sorting, constituent materials, and contaminants. The use of a broad natural range of grain sizes, from fines to cobbles compatible with typical historically present material, should be considered to mimic natural processes. Programs and projects shall include comprehensive monitoring plans that address water quality, monitoring, avoidance of sensitive species and habitats during nourishment events, and post-event evaluation.

CR-3i. The City shall pursue the beneficial reuse of sediments removed from local flood control facilities for beach nourishment as a priority adaptation measure. In addition:

a. The City shall continue to support regional initiatives for the implementation of a comprehensive beach sand replenishment and retention program to protect the shoreline of the City and State Beach, and maintain and enhance public recreation, coastal access, and beach habitats;

b. The City shall continue to coordinate with appropriate responsible agencies, such as Flood Control, the University of California Reserve System, BEACON, USACE, and the Federal Emergency Management Agency (FEMA) to ensure that beach-compatible sediment, including suitable fines and cobbles, removed from local flood control facilities as part of ongoing maintenance is transported to area beaches and used for habitat enhancement, and sustainability of dune and marsh habitats; and

c. The City shall continue to work with appropriate responsible agencies, such as BEACON, Regional Water Quality Control Board, State Lands Commission, CCC, U.S. Environmental Protection Agency, and USACE to streamline permitting for beach nourishment projects.

Implementation Actions:

5. *Continue to plan for and pursue funding to support the implementation of a "living shoreline" project with a restored dune system, including the use of cobbles and restoration of coastal habitat along the Carpinteria shoreline, in coordination with regional and state agencies.*

   Timing: Within 2 years of CLUP/General Plan adoption.

Objective CR-4: Protect existing and future development and infrastructure from the adverse effects of coastal flooding and sea level rise.

Policies:

CR-4a. Require new development and major redevelopment to plan for coastal hazards and sea level rise.

CR-4b. To evaluate potential sea level rise impacts and adaptation planning, the planned/expected life of new development and major redevelopment shall be based on Table CR-5, consistent with CCC guidance.

Table CR-5. Proposed Expected Life of Development and Redevelopment

Type of Development	Life Expectancy[1]
Auxiliary Development or Amenity Structures (e.g., bicycle racks, parking lots)	5-25 years
Commercial or Industrial Development	75-100 years
Residential Development	75-100 years
Critical facilities (water supply, wastewater, transportation corridors) [2]	100-150 years

1. Life Expectancy is based on the Draft Residential Adaptation Policy Guidance, Model Policy A.2 approach to redevelopment and may be refined based on State guidance.
2. Critical facilities should consider the High scenario (9.5 feet by 2130) for sea level rise planning.

CR-4c. The Coastal Hazards Map, Figure CR-1, includes areas potentially subject to existing and future coastal hazards, that present potential risks to life and property where further site-specific study is needed to assess potential adverse impacts. Development and major redevelopment proposed in potential coastal hazard areas, including those mapped as potentially hazardous on the Coastal Hazards Map, Figure CR-1, shall be evaluated for potential coastal hazards at the site through completion of a site-specific Coastal Hazard Report. The Coastal Hazard Report shall use the best available science and data recommended by OPC and State agencies at the time, and shall analyze current and future threats to the structural integrity and safety of the proposed development over its expected life. Additionally, evaluation of coastal hazards may also be required at the discretion of the Community Development Director for development not identified in a potential hazard area on the Coastal Hazards Map.

CR-4d. New development and major redevelopment shall be sited and designed to avoid coastal hazards, considering predicted sea level rise over the anticipated life of the development. If hazards cannot be completely avoided, then development and major redevelopment shall be sited and designed to protect coastal resources, minimize risks to life and property to the maximum extent feasible, and identify triggers as necessary for the implementation of future adaptation measures. New development and major redevelopment shall assure stability and structural integrity of the development without reliance on seawalls or other shoreline protective devices that harm coastal resources including ESHA, public access, and recreation, nor contribute to erosion, geologic instability, or destruction of the site or surrounding area.

CR-4e. Subdivisions and lot line adjustments in areas subject to threats from sea level rise and coastal hazards shall only be permitted if the development of each created parcel can comply with all applicable hazard policies and standards of the Local Coastal Program, will not require shoreline protection, and will not adversely impact coastal resources or public access. A lot line adjustment may also be approved between existing legally created parcels where new development on the adjusted parcels can more closely conform to Local Coastal Program policies and provisions than development on the existing parcels. For this policy, the City shall use the "high" sea level rise scenario for a 100-year timeframe to analyze potential hazards to the development of parcels that are proposed to be created through subdivisions or lot line adjustments.

CR-4f. If it is infeasible for new development or major redevelopment to avoid flooding hazards, the development shall be designed to minimize risks from flooding, including as influenced by sea level rise, over the anticipated life of the development, and otherwise constructed using siting and design techniques that will limit damage caused by floods. Any siting and design alternatives shall ensure that the elevation of any structure(s) is consistent with visual resource protection policies of the LCP, and to ensure that access to utilities, including water, sewer, and roads, can continue over the anticipated life of the development.

CR-4g. New development and major redevelopment located in coastal hazardous areas shall be conditioned to require that it be removed, and the affected area restored to its pre-development natural conditions at the applicant/owner's expense if:

a. Any government agency with relevant authority and jurisdiction has ordered that the structure(s) is not to be occupied due to hazards, or be removed;

b. Essential services to the site can no longer feasibly be maintained (e.g., utilities, roads);

c. Removal is required under Local Coastal Program policies for sea level rise adaptation planning; or,

d. The development requires new and/or augmented shoreline protective devices that conflict with the Local Coastal Program or relevant Coastal Act policies.

CR-4h. As a condition of coastal permit approval for new development in an area subject to current or future hazards, applicants shall be required to acknowledge and agree, and private applicants must also record a deed restriction on the property to acknowledge and agree:

a. that the development is located in a hazardous area, or an area that may become hazardous in the future;

b. to assume the risks of injury and damage from such hazards in connection with the permitted development;

c. to unconditionally waive any claim of damage or liability against the City of Carpinteria, and the Coastal Commission, if permit is appealed, its officers, agents, and employees for injury or damage from such hazards;

d. to indemnify and hold harmless the City of Carpinteria, and the Coastal Commission, if permit is appealed, its officers, agents, and employees with respect to approval of the project against any and all liability, claims, demands, damages, costs (including costs and fees incurred in defense of such claims), expenses, and amounts paid in settlement arising from any injury or damage due to such hazards;

e. that they have no rights under Coastal Act Section 30235 and related LCP policies to shoreline armoring in the future;

f. that sea level rise could render it difficult or impossible to provide services to the site (e.g., maintenance of roadways, utilities, sewage or water systems), thereby constraining allowed uses of the site or rendering it uninhabitable;

g. that the boundary between public land (tidelands) and private land may shift with rising seas, the structure may eventually be located on public trust lands, and the development approval does not permit encroachment onto public trust land;

h. any future encroachment must be removed unless the Coastal Commission determines that the encroachment is legally permissible pursuant to the Coastal Act and authorizes it to remain, and any future encroachment would also be subject to the State Lands Commission's (or other trustee agency's) leasing approval; and

i. that the structure may be required to be removed or relocated and the site restored if it becomes unsafe or if removal is required pursuant to LCP policies.

Implementation Actions:

6. *Adopt a Zoning Ordinance Amendment to establish a Coastal Adaptation Overlay District that includes the following:*
    a. *Establishment of specific development standards and siting requirements (e.g., increased finished floor elevations, building heights, development setbacks, use of perimeter foundations, etc.) to accommodate sea level rise for uses in hazardous locations and to address potential regulatory takings.*
    b. *Disclosure requirements to future buyers of property of coastal hazard-related development standards and special requirements as a result of sea level rise-induced impacts, such as flooding, erosion, and inundation.*
        i. *Real estate disclosures of all coastal hazards that are identified in the City's Coastal Adaptation Overlay Zone shall be required in real estate transactions. Any site-specific analyses related to sea level rise and the terms and conditions of any applicable coastal development permits must also be disclosed in real estate transactions by the seller. The coastal hazard report and project conditions of approval shall be recorded as an informational notice as a requirement of any granted development permit.*
    c. *Requirement for an indemnification agreement between the City and applicants/property owners acknowledging coastal hazard risks and owner-assumption of damages resulting from development or major redevelopment proposed in the Coastal Adaptation Overlay Zone.*
    d. *Requirement for all projects within the Coastal Adaptation Overlay Zone to evaluate current and future coastal hazard risks based on best available science and unless exempt, to conduct a site-specific Coastal Hazards Report that shall include the following:*
        i. *Be prepared by a licensed civil engineer with expertise in coastal engineering and geomorphology or other suitably qualified professional;*
        ii. *Include analysis of the physical impacts from coastal hazards and sea level rise;*
        iii. *Describe current conditions at the site and projected future conditions at the site, accounting for sea level rise over the expected life of the development; at a minimum, the Intermediate-High SLR scenario (or similar based on best available science at the time of application) for the anticipated life of the project should be used for analyses of future conditions. Critical facilities should consider the High scenario for sea level rise planning,*
        iv. *Assess the safety of the proposed structure to withstand current and projected future hazards both with and without existing protective devices;*

v. *Identify any necessary adaptation measures that are required to be applied to the development to avoid or minimize impacts related to coastal hazards and sea level rise, and contain substantial evidence that the project site, with the identified adaptation measures, is suitable for the proposed development and that the development will adequately protect life and property from the identified hazards;*

vi. *Describe assumptions used in the analysis including calculations used to determine long-term erosion impacts and the elevation and inland extent of current and future flooding and wave runup;*

vii. *For development on a beach, dune, low bluff, or other shoreline property subject to coastal flooding, inundation, or erosion, the Report shall include a detailed wave uprush and impact report and analysis; and/or*

viii. *For blufftop development, the report shall include a detailed analysis of erosion risks.*

e. Requirement for *City* conditions of approval for new development and major redevelopment within the Coastal Adaptation Overlay Zone to reflect the recommendations of site-specific coastal hazard and sea level rise reports.

Timing: Within 5 years of CLUP/General Plan adoption.

7. *Develop a Repetitive Loss Program to eliminate or reduce property damage, impacts on coastal resources, and community disruption caused by repeated flooding or storm damage. A Repetitive Loss Structure is a structure that has suffered damage and filed FEMA claims or coastal development permits or exemption applications for residences damaged beyond 50% on three or more occasions during a rolling 10-year period.*

   Timing: Within 5 years of CLUP/General Plan adoption.

8. *Develop a program framework for potential managed retreat in the long term (e.g., 2060 and beyond) for strategic locations and with extensive public involvement. Development and future implementation of the program should be triggered by observed evidence of physical changes in sea level rise as measured at local Santa Barbara tide gauges, repeated frequent severe damage resulting from coastal hazards, and/or changes in storm frequency and intensity.*

   Timing: Within 10 years of CLUP/General Plan adoption.

Objective CR-5: Improve regional collaboration and coordination with federal, state, and local agencies to protect coastal resources and critical infrastructure, inform the community of potential risks, and pursue funding for coastal adaptation planning.

Policies:

CR-5a. The City should continue to educate the public about the potential impacts of sea level rise and shoreline hazards. The City should pursue various methods to notify and educate owners, residents, tenants, and potential future owners of property located in areas potentially subject to shoreline hazards and the accelerated impact of sea level rise on those hazards.

CR-5b. The City shall continue to actively coordinate with regional partners and local, state, and federal agencies to promote regional coastal resiliency building and adaptation strategies and pursue long-term funding programs and cost-sharing agreements to facilitate program implementation for adaptation strategies, including but not limited to:

a. Periodic nourishment of beaches;

b. Living shoreline strategies including habitat restoration and enhancements;

c. Flood control strategies;

d. Pilot adaptation projects;

e. Regional infrastructure improvements including highways, rail, and utilities;

f. Green streets and infrastructure that increase sea level rise resilience; and

g. Sea level rise program and project planning.

CR-5c. The City should work with state and federal legislators to advocate for legislation that requires CPUC and UPRR to coordinate with local jurisdictions on sea level rise and adaptation planning.

CR-5d. The City shall coordinate with special districts and utility purveyors on adaptation planning for critical facilities and public services to plan for resiliency for the community.

CR-5e. The City shall continue to coordinate with the Carpinteria Unified School District and the Office of the State Architect on sea level rise risks and adaptation planning and initiate a joint study to further investigate hazard risks and adaptation strategies for Aliso Elementary School.

Objective CR-6: Prioritize social equity, environmental justice, and the needs of vulnerable communities in coastal adaptation planning and coastal resiliency projects.

Policies:

CR-6a. The City shall prioritize adaptation projects and programs that address the social and economic needs of vulnerable populations, such as maintenance of low-cost recreation and public access to the coast, low-cost visitor accommodations within the City (particularly at Carpinteria State Beach), affordable housing, and local jobs.

CR-6b. The City shall consider environmental justice concerns in the analysis of adaptation measures and alternative project designs, and ensure that all communities, including low-income and underserved, are meaningfully involved throughout the decision-making and planning process.

CR-6c. The City shall pursue opportunities to increase the resiliency of critical transportation infrastructure used by transit-dependent populations to avoid isolation and economic loss.

Objective CR-7: Evaluate approaches to coastal adaptation weighing benefits to costs, economic impacts, and appropriate use of public funds.

Policies:

CR-7a. The City should conduct a cost-benefit or similar analysis of sea level rise adaptation projects and programs before implementation to assess feasibility and to inform decision-making, including environmental justice concerns.

CR-7b. The City shall actively continue to seek state and federal funding for expedited implementation of priority adaptation strategies.

CR-7c. The City should identify, evaluate, and pursue all feasible potential sources of revenue for funding implementation of the City's adaptation strategies and programs as contained in the CLUP/General Plan. In compliance with applicable laws, the costs of the programs shall be allocated and shared in proportion to the benefits realized by affected parties. Potential sources of funding may include, but are not limited to:

a. Regional sediment management and opportunistic sand funding sources;

b. City-assessed sand mitigation fees, which may be expended for living shoreline, nourishment, and sand retention projects;

c. Environmental mitigation fees paid by third parties (such as developers, utility companies, and Caltrans);

d. Expansion of existing Assessment District No. 5 or formation of a Coastal Hazard Abatement District or Geologic Hazard Abatement District;

e. Creation of an Economic Infrastructure Financing District that allows property tax revenues to be devoted to fund infrastructure adaptation;

f. City fees directly related to actual costs incurred by the City for the processing and issuance of permits, the use of City facilities and staff, and reasonable third-party costs;

g. Government grants (e.g., Federal Land and Water Conservation Fund, Army Corps of Engineers, Coastal Conservancy, State Tidelands Oil Revenue Fund, Oceanside Harbor mitigation fund, State Parks Bond, Open Space Bond Act, Park Land Bond Act, Hazard Mitigation Funds, etc.);

h. Bond financing;

i. Dedicated increases in the transient occupancy tax; sales tax; or establishment of a special tax; and/or,

j. Establishment of an assessing entity, as subject to applicable state laws, with such funds utilized solely to benefit those properties.

CR-7d. The City shall establish an Adaptation Account which will serve as the primary account where all funds generated under the Coastal Resiliency Element of the CLUP/General Plan will be held. The City should invest the Adaptation Account funds and expend them for purposes including:

a. Sand replenishment and sand retention studies and projects;

b. Living shoreline or nature-based "green" protection strategies;

c. Sea level rise monitoring, including updating the most recent mean high tide line (MHTL) survey and collection of coastal storm data;

d. Implementation of the Coastal Adaptation Overlay Zone;

e. Preparation of other shoreline surveys and monitoring programs;

f. Opportunistic beach nourishment programs and development of stockpile locations;

g. Repair and maintenance of a living shoreline;

h. Public recreation improvements;

i. Repair and replacement of beach access infrastructure;

j. Managed retreat strategies; and,

k. Other City identified strategies.

The City may use the funds in the Adaptation Account, as authorized by applicable law and subject to the restrictions of any terms of the funding sources.

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