CHAPTER 1

Planning for Sea-Level Rise in Del Mar

1.1 About the City of Del Mar

Del Mar is a beach city in San Diego County, California. Del Mar is Spanish for "of the sea" or "by the sea," which reflects its location on the coast of the Pacific Ocean (Figure 1.1). The city has a total area of 1.8 square miles (4.7 km^2). 1.7 square miles (4.4 km^2) of it is land and 0.1 square miles (0.26 km^2) of it (3.94%) is water. At the southern edge of Del Mar is the Los Penasquitos Lagoon. Del Mar's climate is considered Mediterranean-subtropical with warm, dry summers and mild, humid winters, and is considered one of the most desirable climates in the United States. Temperatures exceed 85 °F (29 °C) only on a few occasions throughout the year and rarely drop below 41 °F (5 °C). The average yearly temperature in Del Mar is approximately 65 °F (18 °C).

1.2 Planning Process and Goals

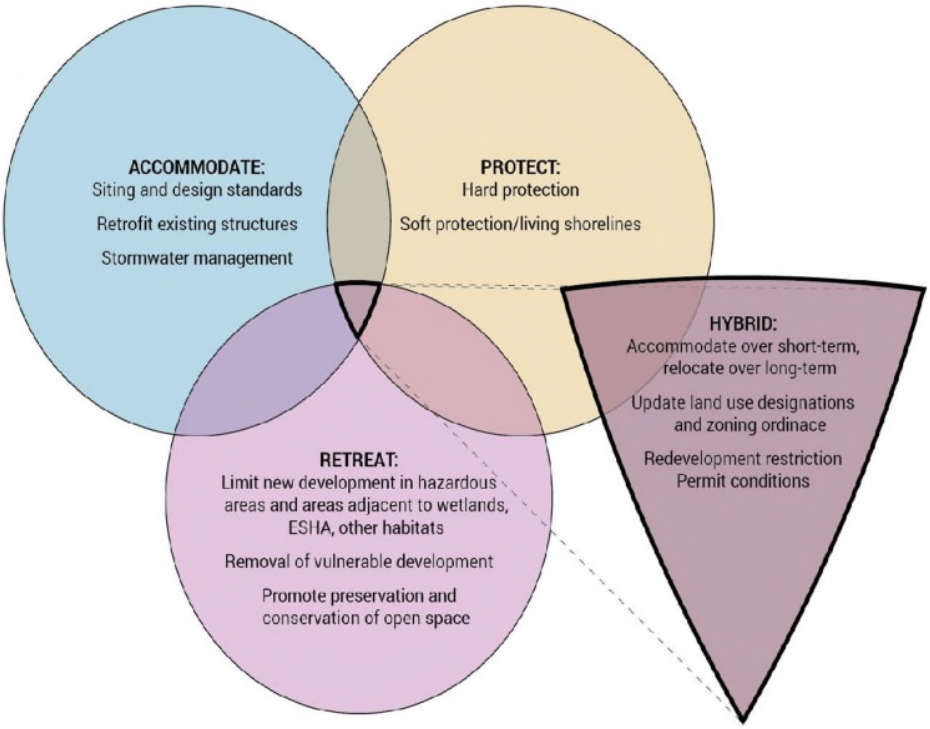
Sea level rise is increasing the risk to coastal communities from storms, flooding, and erosion. In response to the increased risk from these coastal hazards, one of the California Coastal Commission's priority goals is to coordinate with local governments, such as the City of Del Mar (City), to complete a Local Coastal Program (LCP) amendment that addresses sea level rise impacts. An updated LCP can help cities address new coastal management challenges resulting from sea level rise and climate change.

This planning process includes identifying how and where to apply different adaptation mechanisms based on Coastal Act requirements, other relevant laws and policies, acceptable levels of risk, and community priorities. By planning ahead, communities can reduce the risk of costly damage from coastal hazards, can ensure the coastal economy continues to thrive, and can protect coastal habitats, public access and recreation, and other coastal resources for current and future generations. Adaptation strategies should be chosen based on the specific risks and vulnerabilities of a particular region or project site, in the context of applicable Coastal Act and LCP requirements.

Consistent with the California Coastal Commission Sea-Level Rise Policy Guidance and current environmental practice, the Adaptation Plan includes hybrids between these approaches, nature based or green infrastructure solutions, and measures that incorporate environmental considerations, rather than focusing on single-purpose solutions to protection, such as traditional shoreline armoring. Figure 1.2 illustrates the Adaptation Plan with examples of sea-level rise adaptation options.

Figure 1.1
Del Mar Map

Figure 1.2
Examples of Protection, Accommodation, and Retreat Adaptation Strategies



1.3 Amending Del Mar's Local Coastal Program

The California Coastal Act requires local governments in the state's Coastal Zone to create and implement Local Coastal Programs (LCPs). Given that a majority of Del Mar lies within the Coastal Zone, the City's LCP is an integral component of many planning processes. Each local government's LCP consists of a Coastal Land Use Plan (referred to as LUP or General Plan) and an Implementation Plan (Zoning Code). Using the California Coastal Act, the California Coastal Commission (CCC) and local governments manage coastal development, including addressing the challenges presented by coastal hazards like storms, flooding, and erosion.

Sea level rise and a changing climate threaten many coastal resources, presenting new management challenges to coastal cities. In response to the increased risk from these coastal hazards, one of the CCC priority goals is to coordinate with local governments, such as the City of Del Mar (City), to complete a LCP amendment that addresses sea level rise impacts.

The purpose of this report is to complete some of the steps outlined in the CCC's Sea Level Rise Policy Guidance document. These steps include the following:

Step 1. Establish the Projected Sea Level Rise Ranges

The rate of sea-level rise is projected to accelerate in the future. Table 1 includes

projected future sea-level rise from the National Research Council (NRC) study Sea-Level Rise for the Coasts of California, Oregon, and Washington (NRC 2012) for the mid-range and the high-range sea-level. The rate of sea-level rise is projected to accelerate in the future. Table 1-1 includes projected future sea-level rise from the National Research Council (NRC) study Sea-Level Rise for the Coasts of California, Oregon, and Washington (NRC 2012) for the mid-range and the high-range sea-level rise scenarios.

The mid-range sea-level rise projections are based on reducing fossil fuel use, with a balance between fossil fuels and alternative energy sources; whereas the high-range sea-level rise projections assume intensive fossil fuel use will continue in the future. The NRC sea-level rise projections are considered “best available science” for/by the State of California.

The Del Mar Adaptation Plan acknowledges that the processes causing sea-level rise and the science of projecting sea-level rise are inherently uncertain. For example, the rate of sea-level rise is highly dependent on whether global greenhouse gas emissions will continue to increase or whether global emissions will be reduced. The rate of sea-level rise could be higher, or lower, than the above projections. Given the uncertainties, the Adaptation Plan is therefore not tied to specific timeframes or years, but rather uses thresholds based on amounts of sea-level rise of up to 5.5 ft and responses to climate change , such as flood frequency and erosion.

Table 1.1
Sea level rise scenarios used in this Study

	2030	**2050**	**2070**	**2100**
Low SLR	2in	5in		17in (1.4 ft)
Mid SLR	5 in	12 in	20 in (1.7 ft)	37 in (3.1 ft)
High SLR	12 in	24 in	38 in (3.2 ft)	66 in (5.5 ft)

Step 2. Identify Potential Impacts from Sea Level Rise

Based on available modeling from SPAWAR and USGS (CoSMoS 1.0 and 3.0 preliminary), the potential hazards for the City were identified including storm induced dune erosion, coastal flooding from wave run-up, and tidal inundation. Given the boundaries and setting of the City, the most dominant hazards are the following: coastal flooding associated with major wave events, river flooding and coastal erosion.

Step 3. Assess the Risks and Vulnerabilities to Coastal Resources and Development

The following sectors were determined to experience some form of existing or future

risk and related vulnerability to sea level rise (e.g., bluff erosion and/or coastal flooding):

A. Land Use
B. Roads
C. Public Transportation
D. Wastewater
E. Storm water
F. Schools and Parks
G. Hazardous Materials
H. Other Utilities (e.g. water, electricity, gas)

Per the City of Del Mar's Coastal Hazards, Vulnerability, and Risk Assessment (ESA 2016,http://www.delmar.ca.us/DocumentCenter/View/2455), the City of Del Mar is currently vulnerable to river and coastal flooding and erosion, with significant damages in the recent past(late 1970s to present). Along the Del Mar bluffs (Figure 1), the cliff top has retreated to a point where it is a safety concern for the LOSSAN (Los Angeles-San Diego-San Luis Obispo) railroad along the bluff top, and the San Diego Association of Governments (SANDAG) and North County Transit District (NCTD) have responded by installing multiple bluff stabilization projects.

With future climate change and sea-level rise, the City of Del Mar's current vulnerabilities are projected to increase in both frequency and intensity, resulting in increased damage to much of Del Mar including low-lying areas and areas near coastal bluffs:

- The beach above high tide will be lost to erosion with approximately 1 to 2 ft of sea-level rise, at which point beach erosion and coastal storms will threaten sea wall integrity, affecting the City's North Beach District.
- Bluffs will erode and impact the LOSSAN railroad as well as the South Beach and South Bluff Districts; or, if the railroad were to be armored with a seawall, little to no beach will exist.
- San Dieguito River flooding will inundate the City's North Beach and Valley Districts, including the Del Mar Fairgrounds, more frequently and with greater depths.

The increased future sea-level rise and hazards will impact coastal resources and assets in Del Mar, including properties, roads and bridges, infrastructure, emergency services, coastal access, and San Dieguito River lagoon wetland habitats. The Coastal Hazards, Vulnerability, and Risk Assessment (ESA 2016, http://www.delmar.ca.us/DocumentCenter/View/2455) includes additional details, analysis, and discussion of Del Mar's vulnerabilities to sea-level rise.

Step 4. Identify Adaptation Measures

The Del Mar Sea-Level Rise Adaptation Plan serves as the City of Del Mar's long-range

planning guide to address future sea-level rise and its effects on storm surge and coastal flooding and erosion. This Adaptation Plan will provide the basis for developing new sea-level rise policies that will be integrated into the City's LCP via a LCP Amendment.

Preparation of the Adaptation Plan is funded by the City and a planning grant awarded to the City by the Ocean Protection Council and administered by the California Coastal Commission. This Adaptation Plan follows the California Coastal Commission's (2015) *Sea Level Rise Policy Guidance* for addressing sea-level rise in LCPs. Additional information on the City's sea-level rise LCP Amendment is available at: http://www.delmar.ca.us/sealevelrise.

The Adaptation Plan is consistent with the California Coastal Act and relevant City and State policy, plans, and guidelines (Section 2).

1.4 Del Mar's Sea-Level Rise Stakeholder Technical Advisory Committee (STAC)

The City established the Sea- Level Rise Stakeholder Technical Advisory Committee (STAC) to provide oversight and ensure the LCP amendment process is open, inclusive, and develops consensus amongst the many stakeholders involved. (For more details on the STAC, see: http://www.delmar.ca.us/499/Sea-Level-Rise-Stakeholder-Committee.) STAC developed the following guiding principles for the development of the Adaptation Plan:

- Limit the risk of extreme coastal and river flooding and damage to less than approximately a 5% chance of occurring in a given year.
- Maintain a walkable beach for recreational use and economic benefit, and to reduce flooding.
- Maintain continuous horizontal coastal access and vertical water access points to North and South Beach.
- Maintain continuous coastal access from North Beach to South Beach.
- Maintain San Dieguito Lagoon wetland habitat functions.

1.5 Summary of the Adaptation Plan

The Adaptation Plan includes the following components and adaptation measures to reduce risks associated with future sea-level rise.

- **Public Facilities, Infrastructure and Beaches:** high priority sea-level rise adaptation measures for the City to begin planning for now include:
    - Relocating the City of Del Mar Fire Station
    - Relocating the City of Del Mar Public Works Yard
    - Flood-proofing the sewer lift station along San Dieguito Drive
    - Beach sand retention, replenishment, and management
- **San Dieguito Lagoon wetland adaptation:**

    - Conversion of vegetated wetland to mudflat and open water habitats with sea-level rise could be partially accommodated and offset by allowing and facilitating the conversion of higher elevation area to tidal wetland habitat, such as the tern nesting island, adjacent upland habitats, and upstream riparian habitats.
    - Placement of sediment to raise the elevation of the wetlands (e.g., "spraying" material dredged from the River channel as a thin layer of sediment across the vegetated marshplain) has the potential to reduce or slow wetland habitat conversion.
    - Wetland expansion/restoration can create new wetlands with higher elevation areas that are more resilient to sea-level rise; wetland restoration is compatible with partial retreat and construction of "living" levees to reduce flood risks along the River.
- **San Dieguito River flooding adaptation**:
    - San Dieguito River channel dredging and Lake Hodges reservoir management have potential to reduce river flood risks in the near- to mid-term.
    - A hybrid approach with restoration of developed area adjacent to the River to expand the San Dieguito Lagoon wetland floodplain and construction of new levees between the wetlands and development can provide longer-term flood risk reduction; "living" levees can be designed to incorporate restored wetland transition and upland habitats that improve wetland resiliency to sea-level rise.
    - As an alternative to levees, structures can be raised in the mid-term and, if appropriate, removed in the long-term; this would apply to sections of the North Beach District and Del Mar Fairgrounds due to the extent of the River floodplain.
    - If Lake Hodges reservoir management is not possible, the timeframe for other measures may be sooner.
- **Bluff/beach erosion adaptation**:
    - Beach nourishment and installation of access paths down the bluffs (e.g., stairways) in conjunction with authorized pedestrian crossings at railroad under- or over-passes may provide some near-term reduction in bluff erosion; investigating whether landscape irrigation in City neighborhoods east of the bluffs is contributing increased groundwater flow and associated erosion and the potential to reduce irrigation affects may also be beneficial.
    - Relocating the LOSSAN railroad will allow for continued landward bluff erosion, and thereby maintain a beach below the bluff and provide access along the bluff top.
    - Removal of bluff top sewer lines, drainage ditches, and fiber optic cables will eventually be required as the bluff continues to recede inland.
- **Beach coastal (ocean) flooding and beach erosion adaptation:**
    - Beach and dune nourishment may provide near-term protection, but their effectiveness is likely to decrease over time with higher amounts and rates of sea-level rise.
    - Redevelopment policies and regulations can be developed for the LCP Amendment to make feasible the option of raising private buildings in the near-term and over time.

- Sand retention measures such as groins or artificial reef may help maintain the beach, but would likely introduce need for additional mitigation and interfere with surfing resources.
- Raising/improving the existing sea wall and revetments (i.e., “holding the line”) would reduce flood risks with sea-level rise, but may lead to beach loss over time, especially without beach nourishment. Beach loss adjacent to sea walls and revetments could lead to conflicts with Coastal Act prohibitions against protection in perpetuity.
- Raising City infrastructure including buildings, utilities, and roads will likely be required to accommodate the increase in flood risk with sea-level rise.

1.6 Purpose of the Adaptation Plan

This Adaptation Plan will provide the basis for developing new sea-level rise policies that will be integrated into the City’s Local Coastal Program (LCP) via a LCP Amendment. This report provides technical analysis using flood risk and shoreline change modeling. Preparation of the Adaptation Plan has been funded by the City and a planning grant awarded to the City by the Ocean Protection Council and administered by the California Coastal Commission. This Adaptation Plan follows the CCC’s (2015) *Sea Level Rise Policy Guidance* for addressing sea-level rise in LCPs. Additional information on the City’s sea-level rise LCP Amendment is available at: http://www.delmar.ca.us/sealevelrise.

This project will inform the City’s long-term effort to address a range of coastal and climate change hazards in planning and regulatory processes. This information will assist the City in making informed decisions regarding land use and development standards from the project level to the plan and policy level.

The guiding principles behind the Adaptation Plan seek to minimize risks to Del Mar’s assets, including property and infrastructure, and to protect Del Mar’s coastal resources, which, as defined by the California Coastal Act, include coastal development and hazards; public access and recreation; coastal habitats; Environmentally Sensitive Habitat Areas and wetlands; water quality and supply; archaeology and paleontological resources; and scenic and visual resources. A key coastal resource is the sandy beach, both for public enjoyment and community wellbeing, but also for ecosystem services such as storm damage protection.

Consistent with the California Coastal Commission Sea-Level Rise Policy Guidance and current environmental practice, the Adaptation Plan includes hybrids between these approaches, nature based or green infrastructure solutions, and multi-objective measures that incorporate environmental considerations, rather than focusing on single-purpose solutions to protection, such as traditional shoreline armoring.

1.7 Definitions

Adaptation: means anticipating the adverse effects of climate change and taking appropriate action to prevent or minimize the vulnerabilities and reduce the fiscal impacts.

Coastal Erosion: erosion of the coast caused by wave attack.

Coastal Flooding: flooding along the coast caused during a large storm wave event and typically includes wave uprush with momentum that can cause damages.

Economic Benefits: can be measured in two ways – market and non-market benefits. Market benefits are measured using market values. For example, to value a private residence one would use the market price of the home. Many of the benefits in this study are non-market benefits. Economists have developed a number of techniques to measure benefits when the price is set at zero. For example, beaches are free in California, but numerous studies indicate that visitors are willing to pay to go to the beach. This willingness to pay is non-market value. Our study incorporates the literature on non-market valuation to measure these changes.

Economic Costs: are measured similarly and can be market or non-market. In many cases in this study, costs are measured as replacement or repair costs. For example, this study measured the costs of roads at replacement cost.

Economic Impacts: measure the spending and economic activity resulting from a policy change. This study estimates the changes in spending from changes in beach recreation caused by changes in beach width.

Fiscal Impacts: measure not only tax revenue impacts, but also changes in costs to a city from a policy change. For example, if increased beach recreation requires increased public safety/lifeguards, a fiscal impact analysis would also incorporate these changes.

Tidal Inundation: flooding caused during predictable high tides that occur with some regularity.

Net Benefits: estimate the economic benefits minus the economic costs. Typically, these net benefits are discounted over time.

Nuisance Flooding: recurring flooding caused by high tides and potentially exacerbated with stormwater or precipitation.

Planning Horizon: The planning horizon is the future time that forecasts of climate impacts are made and the time that an organization will look into the future when preparing a strategic plan.

Tax Revenue Impact: measures the changes in taxes as a result of a policy change. This study estimate changes in sales taxes and transient occupancy taxes (TOTs) resulting from changes in beach tourism/recreation.

Vulnerability Assessment and Sector Profiles: A vulnerability assessment is the process of identifying, quantifying, and prioritizing (or ranking) the vulnerabilities in a system. There are a variety of vulnerable “sectors” within the City, ranging from building structures, stormwater, beach accesses, wastewater, and transportation.