PUBLIC REVIEW DRAFT

Imperial Beach
COMMUNITY RESILIENCE PLAN

MAY 10, 2024

Imperial Beach
COMMUNITY RESILIENCE PLAN

Prepared by

GHD | Nexus planning & research | citythinkers URBAN DESIGN + PLANNING

Funded by

National Fish and Wildlife Foundation (NFWF) | NOAA | Imperial Beach

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OVERVIEW

The City of Imperial Beach completed a Sea Level Rise Vulnerability Assessment (Assessment) in 2016. The Assessment identified hazards the City currently experiences related to tidal inundation and flooding that may be further exacerbated in the future by sea level rise. According to the study, significant impacts are projected to start occurring with a 1.6 foot increase in sea level rise should the City not implement any coastal flooding adaptation strategies.

While it is known that Imperial Beach experiences wave and tidal flooding, coastal erosion, and high groundwater during high tides and storm events, even with the efforts taken with addressing sea level rise such as the Bayshore Bikeway Resiliency Project, Imperial Beach is still at the early phase of understanding and identifying coastal resilience needs for our community. This is largely due to hurdles associated with determining the feasibility of adaptation projects that can increase the City's resiliency.

One of the consistent roadblocks that is difficult to address are the constraints to implementation and establishment of a baseline. The goal of the Community Resilience Plan (CRP) is to identify, through community engagement and technical analyses, sea level rise adaptation solutions that provide multiple benefits, including environment conservation, preservation of public access, economic sustainability, and the protection of the City's vulnerable disadvantaged communities.

This report presents the results of a year-long process to explore the opportunities and constraints to planning and development of coastal flooding adaptation strategies. This document summarizes community engagement and the sea level rise science that informed the development of specific coastal flooding adaptation strategies. A monitoring and implementation plan provides a blue print for the appropriate manner to measure and respond to projected sea level rise. Combined, the information provided is intended to help the City of Imperial Beach become more resilient.

1. INTRODUCTION

Imperial Beach's unique low-lying geography and physical setting (i.e., being surrounded on three sides by water) are critical to understanding its coastal resiliency challenges and opportunities. The City's most important natural attributes are its beaches and open spaces, which are highly valued by residents and visitors, and are vital to the City's economy. However, the City currently experiences coastal flooding in these valuable areas of the community. Seacoast Drive, 7th Street, and Grove Avenue all struggle to drain water during periods of coincident high tides, heavy rains, or big surf. Projected sea level rise threatens to exacerbate coastal flooding over time and has the potential to overwhelm large areas of the City should appropriate measures not be taken.

The uncertainty surrounding the timing and impact of this climate-induced hazard looms in the background at a time when the City is in a renaissance. With an influx of new developments and a community visioning process underway, this is the perfect opportunity to identifying, planning, and implementing coastal adaptation strategies through this Community Resilience Plan (CRP)

Proactively addressing future coastal impacts will protect the community and the environment, inform a blueprint for infrastructure investment, and reduce the uncertainty around development and investment thereby leading to long-term economic sustainability.

The City has already taken great steps to address these vulnerabilities though the preparation of a sea level rise vulnerability assessment in 2016 and most recently through the development of a novel, coastal resiliency project on the bayside called the Bayshore Bikeway Resiliency Project.

GOALS OF THE COMMUNITY RESILIENCE PLAN

Development of the CRP is a clear next step following the sea level rise vulnerability assessment and pilot projects with the following goals:

- Provide a holistic framework to plan, monitor, and implement sea level rise adaptation strategies that will protect the entire community from projected future flooding.
- Prioritize infrastructure investment in the City.
- Identification of areas where City development rules and regulations may assist in resiliency.
- Inform the development of policies and actions for the Local Coastal Program Work Plan.
- As the City embarks on a community-wide visioning process, the CRP can help to guide that effort, aligning adaptation pathways with community vision.

To support the development of the Community Resilience Plan, the City of Imperial Beach was awarded a $250,000 grant from the National Fish & Wildlife Foundation and the National Oceanic and Atmospheric Administration. Through State and Federal funding mechanisms, the City of Imperial Beach is proactively addressing natural hazards of concern such as coastal flooding.

PUBLIC REVIEW DRAFT

2. COMMUNITY ENGAGEMENT

The primary focus of the NFWF grant is to address coastal flooding. However, the City believes all outreach is an opportunity to gain feedback from the community on how to improve the quality of living for all. Promoting a Resilient & Thriving Awareness Campaign, the Project team engaged with Imperial Beach communities members from June 2023 to January 2024. The intent was to gain their input on how the city can be more resilient and thrive in the areas of government, community, economy, and environment (as further described in Figure 1).

Resilient & Thriving

Resilient: Having the ability to recover quickly and to adapt to future conditions. This can mean improved emergency communications, forming closer community bonds, or planning for disasters.

Thrive: Planning for future conditions such as a natural disaster also provides opportunities to make Imperial Beach better. This can mean more parks, better transportation, safer streets, and clean water.

Figure 1: Resilient & Thrive

Community Engagement Opportunities

Numerous opportunities were provided for the Imperial Beach community to follow the progress of this Project and participate in its design and development. The goals, desired outcomes, marketing, summary of events and feedback are further described herewithin. Engagement activities consisted of the following:

1. **Workshops:** Planned and facilitated in-person workshops at diverse locations and times;
2. **Pop-up Events:** Staffed booths at local and regional recreational and community events; and
3. **Surveys:** Performed in-person, intercept surveys at locations near the Project site and provided on-line surveys accessed directly through the project website.

In-Person Workshops
- Saturday, January 20th, 2024 - Imperial Beach Public Library

Pop-Up Events
- National Night Out: August 1st, 2023 - Veterans Park
- Farmer's Market: August 17th, 2023 - Veterans Park
- Bike the Bay: August 27th, 2023 - Bikeway Village
- Summer Movies in the Park: September 2, 2023 - Veterans Park
- Farmer's Market: September 16th, 2023 - Veterans Park
- Farmer's Market: December 16th, 2023 - Veterans Park

Figure 2: Outreach at Farmer's Market in Veterans Park, December 16, 2023

Outreach Marketing Efforts

The Project team used a variety of direct marketing and digital media to reach and inform the local and regional community and agency stakeholders.

Website

The Project website www.IBCommunityResilience.com provides the public with a one-stop-shop for information on all project components, a schedule of activities, as well as materials, and public notices. The website integrates an ESRI Storymap to guide the user through the Project (www.ibcommunityresilience.com/resilientthrive)

The Imperial Beach City website provides up-to-date information on the project's progress and links directly to the Project website: www.imperialbeachca.gov/646/Imperial-Beach-Community-Resilience-Plan

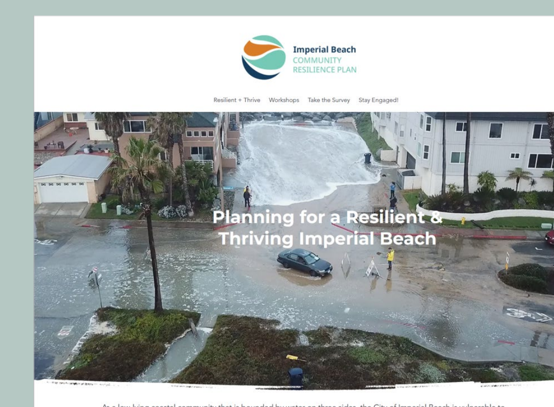


Figure 3. Website and Storymap

Social Media

Social media including Facebook, Nextdoor, and LinkedIn were used to share information with the public.

Direct Mail and Eblasts

Eblasts are sent out via email to the entire contact database to inform community members of the pop-ups and workshops.

Figure 4. Example Flyers

Community Response: Resilient & Thrive Campaign

Feedback collected from the community informs the design process of the Community Resilience Plan. The following are the most commonly heard comments organized by topic during the Resilient & Thrive Campaign:

Community	City Action/Response
Need more dog-poop bag stations and signage about the rules	Coordinating with Public Works on assessing areas and opportunities for more signage and poop-bags
Address homeless issue	Have created a Housing Division within recent years and through a partnership with the Regional Taskforce on Homelessness (RTFH) have a created a grant funded position of Community Outreach Worker (COW) who directly works with unsheltered population
Concern over too much low income/high density development	The City is always focused on meeting the needs of the community and maintaining a classic Southern California small beach town atmosphere to the residents. With the changing State Laws, there is a push for more housing, but the City is seeking to implement improvement projects to maximize community needs and benefit, as seen by the projects proposed within the IB CRP
Provide more affordable housing	The city has recently updated the IBMC to enable affordable housing density bonuses consistent with State Law
More parks	BBRP - Joint Use Park - and always seeking opportunities to add more park space
Adult classes/programs for families with disabled adults	Parks, Recreation, and Community Services Department is expanding its programmatic efforts
More youth recreation programs	Parks, Recreation, and Community Services Department is expanding its programmatic efforts
Community pool with pool pass	In conjunction with Mar Vista High School, the H.S. pool has been made as an amenity availble to the public on a limited basis
Tennis courts + pickle ball	The City is assessing the ability to accommodate these requests and is proactively searching for a feasible location for a pickleball court.
More community meeting spaces	The City is looking in to opportunities to enhance existing facilities to meet this need.
Food insecurity, Access to more affordable food/ vouchers, focus on seniors	The City is currently in the process of building a community garden directly adjacent to the St. James plaza (affordable senior housing facility) to address this need.
More parking for the disabled	The City on an ongoing basis works with private developers for new developemnts and the Public Works Department to assess existing right of way needs to provide accessible parking.
Provide Imperial Beach shuttle service within community	The City has been working on obtaining funding to supplement this type of service.
Develop bicycle master plan	In 2008, the City adopted a Bicycle Transportation Plan. With increased staff capacity and funding, the City can work on updating this document.
Need street calming on Rainbow. Too dangerous with all the traffic.	The City is currently working on the Palm Avenue Complete Multimodal Corridor project, to provide complete street enhancements to this corridor, enhancing safety for all users.
Improved transportation for seniors	The City working in conjunction with regional planning agencies to identify better ways to improve transportation for the entire community and is proactively seeking grant funding opportunities.
More parking at the beach	The City completed a Coastal Parking Analysis and will be implementing identified strategies to alleviate parking impacts around the beach area.

Government	City Action/Response
Improve public health and safety for community	Received the feedback. Public health and safety are always a high priority for the City. The City recently released the MyImperialBeach app for residents to report issues to the City.
More code enforcement	The City recently released the MyImperialBeach app for residents to report issues to the City and code enforcement can respond.
Remove graffiti	The City recently released the MyImperialBeach app for residents to report issues to the City including graffiti which the City can respond to.
Need police to stop all the bikes at pier and 9th	Safety is always a high priority.
Clean up trash at bus stops at IB Blvd and Ebony	Received the feedback. The City recently released the MyImperialBeach app for residents to report issues to the City.
Better recycle material management	Received the feedback. The City recently released the MyImperialBeach app for residents to report issues to the City. Additionally, the City has an Environmental and Natural Resources Department who can further assess recycling needs.
Red paint on curbs for no park areas	Public Works can assess the red striping for the City and respond to ensure all needs are met.
Add more motorcycle parking	The City completed a Coastal Parking Analysis and will be implementing identified strategies to alleviate parking impacts around the beach area
Fix sidewalk on South Seacoast Dr.	IB CRP project has identified an adaptation pathway and project to address this need.
Be responsive to IB Boulevard improvements	Maintenance is an ongoing priority. If issued with landscaping arise, the City recently released the MyImperialBeach app for residents to report issues to the City.
Keep post office open	Noted and understand the concern. The City supports the post office operations.
Emergency shelters for the unhoused	The City adopted an ordinance to allow for permanent supportive housing and low barrier navigation center as required by State Law.

Economy	City Action/Response
Employment opportunities that allow people to afford to live in IB	The City is always seeking to enhance the commercial corridors within the City with active commercial uses that will enhance the economic vitality of the City and promote employment opportunities for the community.
Clean up ocean water so beach is open (Top Comment)	The City is an agreement and support of increasing and enhancing water quiality and is taking actionable steps to facilitate the improvement.
Better pier management so it is safe	The City is coordinating with our partner, the Port of San Diego to enhance Pier management and safety.
Pickleball courts at Seacoast and Date St	The City is assessing the ability to accommodate these requests and is proactively searching for a feasible location for a pickleball court.
Add skatepark near pier	Received the feedback.

Environment	City Action/Response
Increase natural spaces in IB	The City is supporting enhancing natural spaces in IB through projects such as the BBRP and the IB CRP.
Focus on recycling more water.	Feedback received.
Support bioswales. Want to see more of them.	Stormwater infratructure and green infrstructure is incoroporated in new CIP projects and promoted within developments.
Improve water quality (Top Comment Overall)	The City is an agreement and support of increasing and enhancing water quiality and is taking actionable steps to facilitate the improvement.
Add multi-use resilient landscapes	Noted and received. Resilient landscape pallete is a priority for all improvement projects.

Community Response: Coastal Flooding Adaptation Strategies

Workshops and pop-up events were intended to obtain community feedback on the proposed conceptual coastal flood protection strategies and public access enhancements. Feedback collected from the community informs the planning process for the CRP and identifies priorities for the City of Imperial Beach. The community was asked three specific questions:

1. How do you like to enjoy this space?
2. Do you support the proposed solutions (coastal flood protection)? Are there other solutions you'd like to see considered?
3. How can public access and recreation be improved in this area?

The following are summarized community responses by Planning Area or Segment.

Segment 1: San Diego Bay

Residents appreciated the integration of public access nodes with the bikeway and the focus on public health and safety.

Segment 2: North Beach

Multiple residents voiced their support for extending the existing groins to the permitted conditions. There was concern about the impact to waves for surfing.

Segment 3: South Beach

Coastal Flood Protection Strategies

- Add sand to the beach (i.e., beach sand nourishment)
- Extend cobble south of Seacoast Drive

Public Access Enhancements

- Add new play areas
- Add fitness equipment and signage
- Provide more ways to explore
- Add a picnic area/green space to south Seacoast Drive
- Provide lighting at street ends
- No shade structures
- No cement

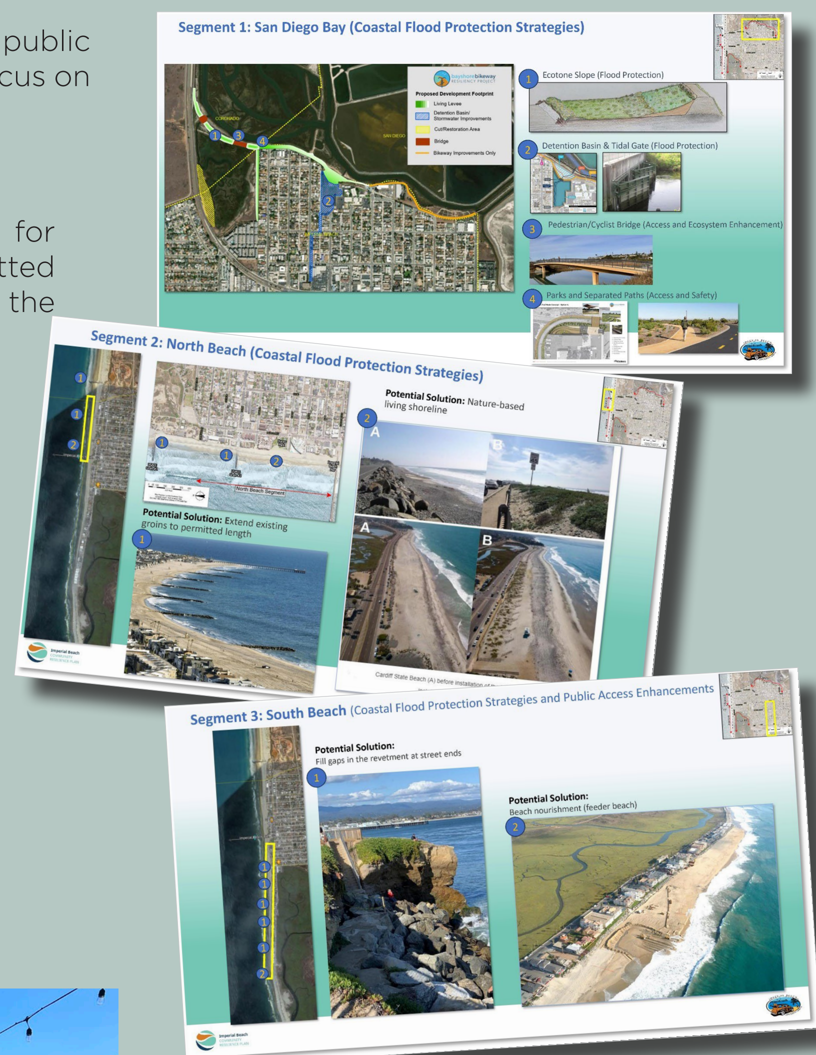


Figure 6. Informational Boards for Workshops

Figure 5: Bike the Bay Pop-Up on August 27, 2023

Segment 4: Estuary

Coastal Flood Protection Strategies

- Multiple individuals support the Boardwalk concept along South Seacoast Drive
- Need a wider walkway to accommodate bikes and dogwalkers

Public Access Enhancements

- No reduction in parking
- Consider parking passes for residential occupants
- Remove sand from the street end
- Keep same aesthetic as Imperial Beach Blvd

Wayfinding

- Add color-coded or glow-in-the-dark signage
- Add more wayfinding signage that includes commercial businesses
- Signs telling people not to remove rocks from the beach
- Add a touchscreen at 13th Street, pier, grocery outlet
- Use CityMyIB app to advertise events

Figure 7. Informational Boards for Workshops

Figure 8: Workshop at IB Public Library on January 20, 2024

3. RESILIENCY IN IMPERIAL BEACH

What is Resiliency for Imperial Beach?

The City of Imperial Beach community is affected by a variety of natural and man-made hazards. The primary hazards affecting the community include effects from climate change and pollution of the environment. Increasing temperatures, rising sea-levels, and degraded water quality have direct impacts on public health and infrastructure and will continue to affect people's livelihoods and the local economy.

While the focus of the Community Resilience Plan is on coastal flooding, the City of Imperial Beach is also prioritizing water quality and extreme heat events as further discussed below:

Water Quality

Transboundary pollution flowing from Mexico into the Tijuana River or coastal tributaries create severe impacts to water quality, public health, and environment of San Diego border region. Pollutants that are not captured in Mexico are frequently carried by stormwater runoff or fugitive wastewater from areas in the City of Tijuana across the border and into natural areas in the U.S., including important ecological sites such as the Tijuana River National Estuarine Reserve and Border Field State Park. Contaminated flows in the Tijuana River can reach upwards of hundreds of millions of gallons per day during severe events.

To learn on the most recent developments please go to: Imperial Beach Sewage

Extreme Heat

Climate change is leading to more frequent, more severe, and longer-lasting episodes of extreme heat in California, posing a greater danger to Californians. Heat kills more people directly than any other weather-related hazard. According to Cal-Adapt, the number of Extreme Heat Days per year when daily maximum temperature is above 90.4 °F under a High Emissions (RCP 8.5) Scenario will increase from 2 per year to over 22 by 2070.

Coastal Hazards

The City of Imperial Beach faces various threats from coastal hazards that may be exacerbated in the future due to sea level rise (SLR). For Imperial Beach to achieve resilience, the City needs to assess current and future threats, and identify appropriate strategies that can be implemented to allow the protection from hazards, ability to respond and recover from impacts, and provide a pathway for the City to continue to thrive.

To properly develop resilience solutions and strategies for Imperial Beach, it is critical for a target goal of impacts and vulnerabilities to be selected. Based on the ever evolving state of climate change and sea level rise science (see Sea Level Rise Science on page 16), this CRP has identified 3.5 ft of SLR (as compared to baseline of 2000) as an appropriate target for planning purposes.

The City's 2016 Sea Level Rise Vulnerability Assessment identified significant impacts are anticipated to occur with 1.6 ft of SLR should the City not implement any adaptation strategies. With the draft updated State SLR Guidance (OPC 2024), 1.6 ft is anticipated to occur closer to mid-century with 3.5 ft anticipated close to late-century. This CRP presents an opportunity for the City to identify hazards, develop projects, and plan for resilience through envisioning the coastline of the future.

3.5 ft of SLR represents a reasonable, and conservative approach to planning for resilience. This target follows the State's SLR Principles and provides guidance on to approach selecting and evaluating potential projects and pathways to pursue. This target supports the goal of the CRP in creating an adaptation management and monitoring plan to address flooding impacts, encourage nature-based solutions, and adequately addresses the needs of residents currently experiencing flooding or those projected to be substantially impacted by future coastal flooding.

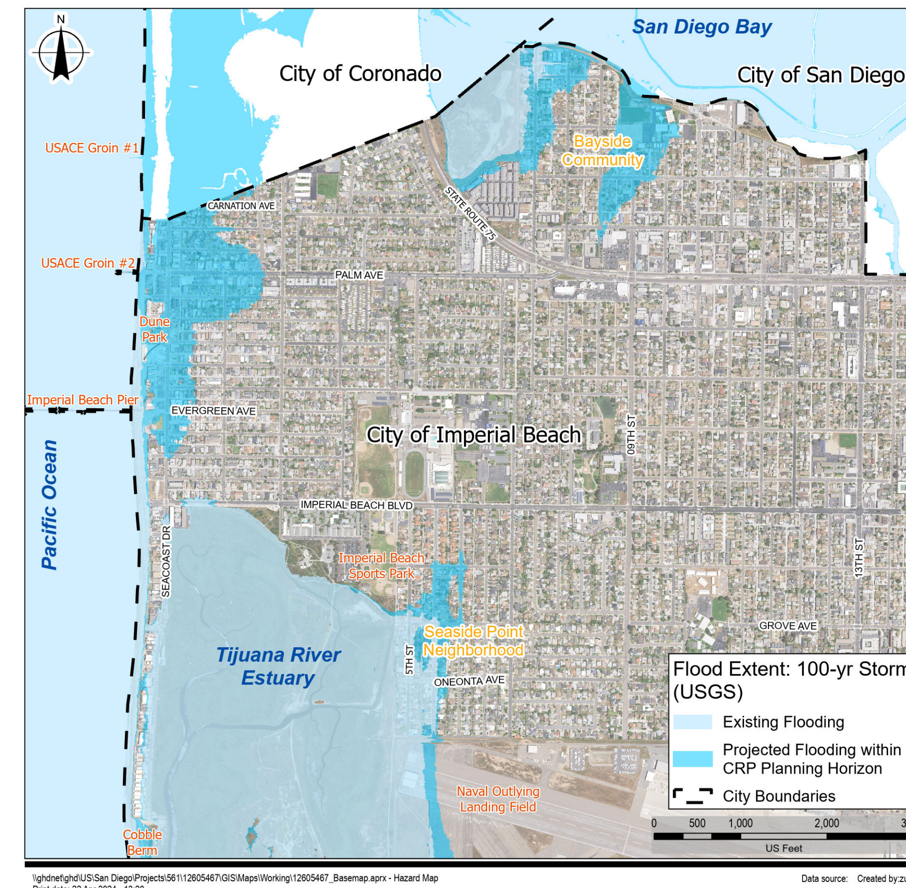


Figure 9. Predicted Coastal Flooding During a 100 Year Storm Event and Sea Level Rise

Sea Level Rise Science

SLR trends are trackable through established tide gauges with the closest gauge to the City shown in Figure 10. The historic mean relative sea level trend is 2.23 millimeters/year based on monthly mean sea level data from 1906 to 2023 which is equivalent to a change of 0.73 feet in 100 years.

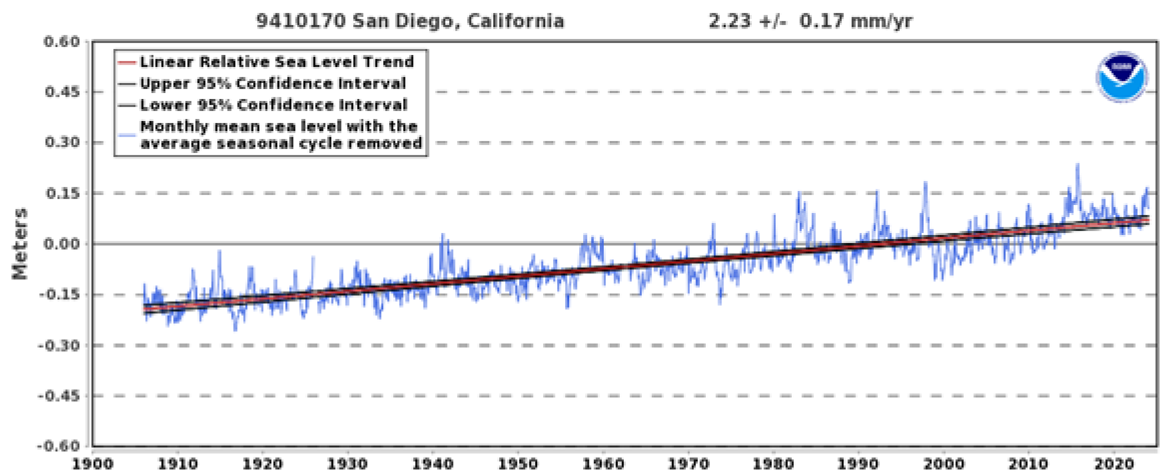


Figure 10. Historic mean relative sea level trend from 1906-2023 relative to the 1993 baseline (NOAA 2024).

SLR projections for California are provided by the Ocean Protection Council (OPC). A draft State of California Sea Level Rise Guidance was released in early 2024 to update the previous guidance from 2018. The updated draft includes five scenarios (Low, Intermediate-Low, Intermediate, Intermediate-High, and High). These correspond to average global SLR magnitudes and do not have probabilities attached to them like the 2018 OPC scenarios. Instead, the latest scenarios are based on the 'plausibility' of occurring. Plausible ranges of SLR means the credible and reasonable range of future sea level rise supported by published, peer-reviewed publications and the consensus assessment of the Intergovernmental Panel on Climate Change Assessment Report 6 (IPCC AR6).

Figure 11 shows a comparison of the SLR scenarios between 2018 and 2024 projections for the NOAA San Diego tide gauge. The SLR scenarios projected in the 2024 guidance have a much smaller range of values than the 2018 guidance until 2050, showing more confidence in mid-century projections. In the mid-term (2050-2100), the range of possible sea level rise expands with the range becoming increasingly larger over the long-term (towards 2100 and beyond). The medium-high risk aversion scenario (from the 2018 guidance) was previously commonly used as a design consideration for infrastructure, and the H++ scenario was an extreme scenario used for critical infrastructure. However, due to the updates in the science, the 2018 medium-high risk aversion scenario is higher than every scenario in the new projections, and the H++ scenario was removed due to its implausibility.

Sea Level Rise Science (continued)

The new scenarios, as described in OPC's 2024 draft guidance, are as follows:

- **Low:** The scenario is on the lower bounding edge of plausibility given current warming and sea level trajectories, and current societal and policy momentum.
- **Intermediate-low:** A reasonable estimate of the lower bound of most likely sea level rise in 2100
- **Intermediate:** Based on sea level observations and current estimates of future warming, a reasonable estimate of the upper bound of most likely sea level rise in 2100.
- **Intermediate-high:** Intermediate-to-high future emissions and high warming; this scenario is heavily reflective of a world where rapid ice sheet loss processes are contributing to sea level rise.
- **High:** High future emissions and high warming with large potential contributions from rapid ice-sheet loss processes; given the reliance on sea level contributions for processes in which there is currently low confidence in their understanding, a statement on the likelihood of reaching this scenario is not possible.

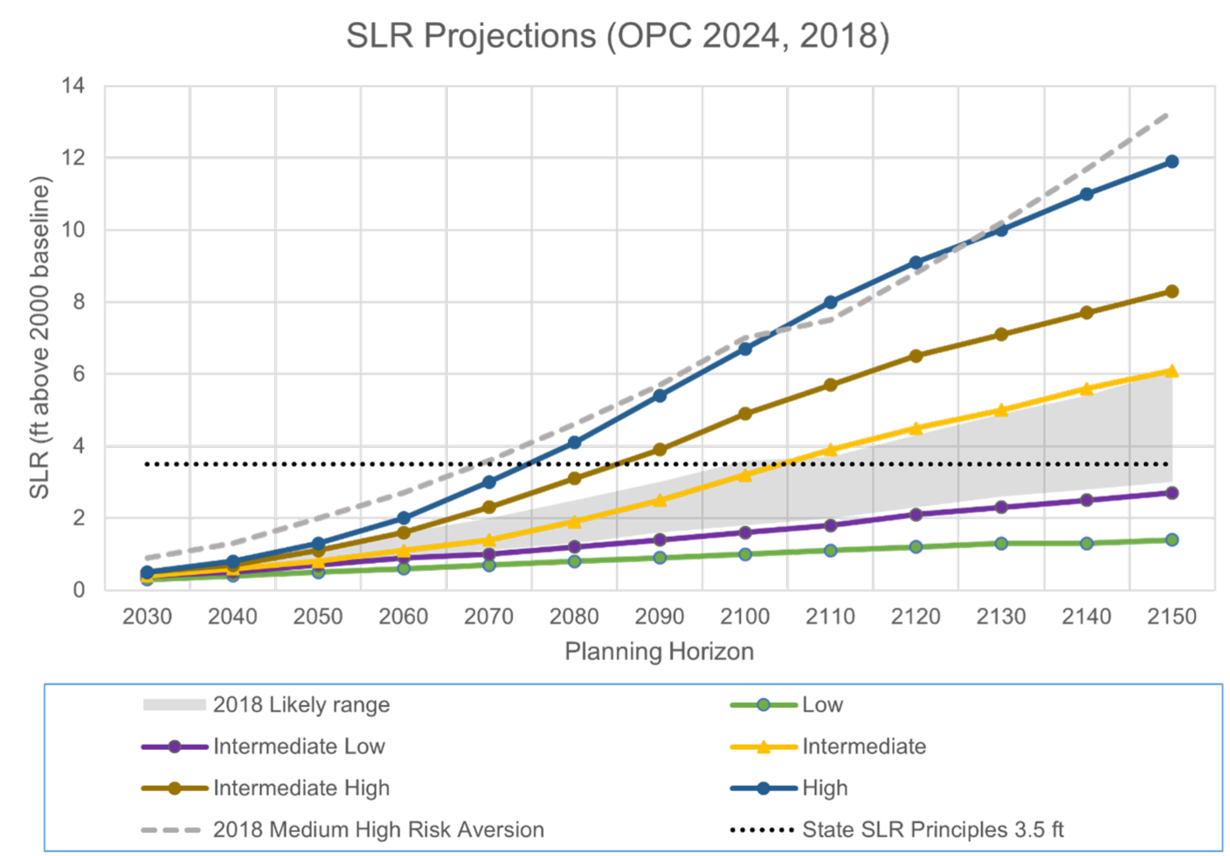


Figure 11.. Sea level rise projections for the San Diego tide gauge (adapted from OPC 2024, 2018).

4. COASTAL FLOODING ADAPTATION STRATEGIES

What Strategies Were Considered
There are several options to consider how to address the impacts and risks of projected future coastal hazards. Generally, four main categories make up the strategies to consider: protect, accommodate, and relocate. These strategies are described as follows:

Protect: Prioritize existing alignment and certain uses through engineered efforts that may limit some access, uses, or habitat.

Accommodate: Minor retrofitting of existing structures (e.g., increase elevation) with a focus on repair and maintenance as impacts are realized. The level of use or service may need to be adjusted as status of assets change.

Relocate: Realign or relocate assets out of hazard areas and limit new development in these areas.

Hybrid: Blend protective elements using natural materials and proven structural designs while incorporating social and environmental considerations.

Sometimes a combination these options (a hybrid approach) is necessary initially or over time (a phased adaptation approach) to balance social, environmental, and economical need in a coastal resiliency project.

It is important to note that there are tradeoffs associated with every category and adaptation alternative. For example, strategies with more physical protection often also provide social benefits and preserved use but may compromise environmental aspects. Conversely, strategies that prioritize environmental features may not provide long-term resilience but can offer natural aesthetics and can represent community values.

Why were these strategies developed and selected?
After an inventory of City assets and reviewing their vulnerability to coastal hazards, several strategies were developed focused on the identified goal of the Resilience Plan to create strategies to address flooding impacts, encourage nature-based solutions, and adequately addresses the needs of residents that currently experience flooding or are projected to be substantially impacted by future coastal flooding.

Strategies were developed to meet minimum requirements that included:
- Illustrated various multi-benefit strategies for the shoreline with consideration of existing infrastructure and the surrounding natural habitat in order to adapt to projected SLR
- Incorporated equitable policies to ensure broad utility and to build capacity to enable planning of future adaptation projects, strategies and other activities
- Designed with adaptive pathway approach in mind where implemented strategies would be monitoring, repaired and maintained, and modified (and/or separate strategy explored) when necessary
- Achieved resilience up to 3.5 ft of sea level rise
- Prioritized and incorporated nature-based elements where appropriate and feasible
- Assumed substantial financial investment within a reasonable range

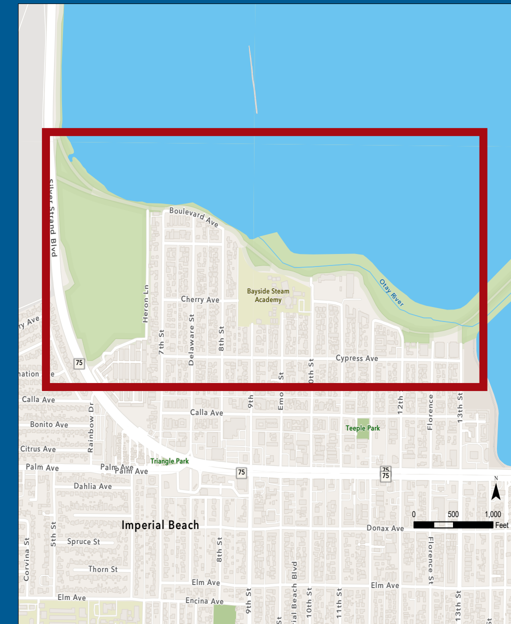
Planning Areas
Four neighborhoods, identified by "segment", in Figure 12 face coastal and tidal flooding impacts:
- The Bayside Neighborhood (Segment 1) will be impacted from future flooding from San Diego Bay primarily near the north end of 7th and 8th Streets and areas around the Bayside Elementary School.
- North Beach Segment (Segment 2) consists of the Carnation Avenue Neighborhood andis currently impacted by flooding resulting from wave overtopping from the Pacific Ocean.
- South Beach (Segment 3) is currently impacted by flooding as a result of waves from the Pacific Ocean overtopping the street ends. These impacts will increase in frequency and severity with SLR.
- The Estuary Segment (Segment 4) is comprised of the Seaside Point Neighborhood and South Seacoast Drive. This segment currently floods during high tidal water levels that results in estuary waters entering the stormdrain system and flooding the streets. These impacts will increase in frequency and severity with SLR.

Potential adaptation strategies (starting on page 20) are organized by "Segment" as illustrated in Figure 12.

Figure 12. Planning Areas by Segment

Segment 1: Bayside

ECOTONE SLOPE + MULTI-PURPOSE DETENTION BASIN



SITE BACKGROUND

Surrounding the City's northern boundary, the Bayside segment is approximately one mile of shoreline along the San Diego Bay from SR-75 to 13th Street. The Bayshore Bikeway, a 17-mile Class 1 facility, that nearly encircles the San Diego Bay, is the first line of infrastructure along this shoreline. Behind it is a low lying urbanized coastal environment, consisting of a residential community, the Bayside Elementary School, the City Public Works Yard, and commercial infrastructure.

KEY CONSIDERATIONS

- Stable and environmentally sensitive shoreline.
- Existing coastal hazards within this segment primarily consist of nuisance flooding due to issues with storm drainage (i.e. undersized stormdrains with flat grades) and low invert elevations that allow tidal waters from the Bay to back up into the City.
- Tidal flooding and inundation along this segment becomes widespread with 3.5 feet of SLR due to the low-lying nature of the shoreline and coastal development.

OPPORTUNITIES

- Improve active transportation and public use of existing developed corridor.
- Use developed corridor to provide flood resiliency to the Bayside Community.
- Provide transitional habitat areas to improve the resiliency of marsh habitat.
- The Bayshore Bikeway corridor is the first line of public infrastructure between the Bay and the City.

ADAPTATION FEATURES

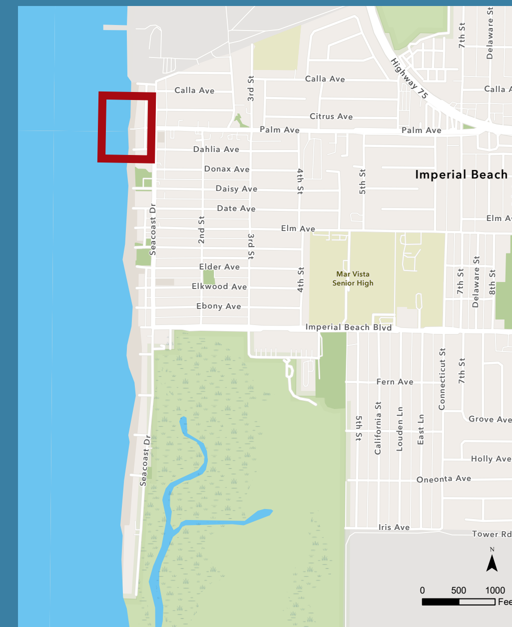
- The Bayshore Bikeway Project plans to build resilience into this segment from SLR up to 3.5 feet through raising the bikeway and multi-use path on a living levee. The levee would provide ecotone slopes, which would provide room for marsh habitats to transition over time as water levels increase in the Bay.
- Stormwater improvements in the vicinity of Bayside Elementary to provide additional capacity to an undersized storm drain system. The improvements would also limit tidal waters from the bay from backing up into the storm drain system during high tides – as it does currently.

Figure 13. Bayshore Bikeway Resiliency Project Development Footprint

Figure 14. Rendering of the Proposed Living Levee and Bikeway Improvements at 7th

Segment 2: North Beach

DUNES PARK LIVING SHORELINE



SITE BACKGROUND

Consists of approximately 0.4 miles of open-coast shoreline from the City's northern boundary at Carnation Ave. to the Imperial Beach Pier. This segment consists of sandy beach backed by a variety of coastal development, including private residences, hotels, and a City park, and a commercial zone. These sites are protected through a series of inconsistent (in terms of design and being a continuous line of defense) private and public shoreline protection structures (i.e. revetment and seawalls). This segment of shoreline also consists of sand retention structure that helps to hold sandy shoreline.

KEY CONSIDERATIONS

- Relatively stable sandy beach
- Inconsistent public and private shoreline protection
- Due to the inconsistent shoreline protection, coastal flooding during periods of large waves and high tides.

OPPORTUNITIES

- Adequate beach space exists fronting Dunes Park to test a nature-based shoreline protection solution (see Figures 16 through 18).

ADAPTATION FEATURES

- Add dunes fronting the Dunes Park to pilot a nature-based shoreline protection technique on the open coast of the City (see Figures 16 through 18).

Figure 16. Living Shoreline

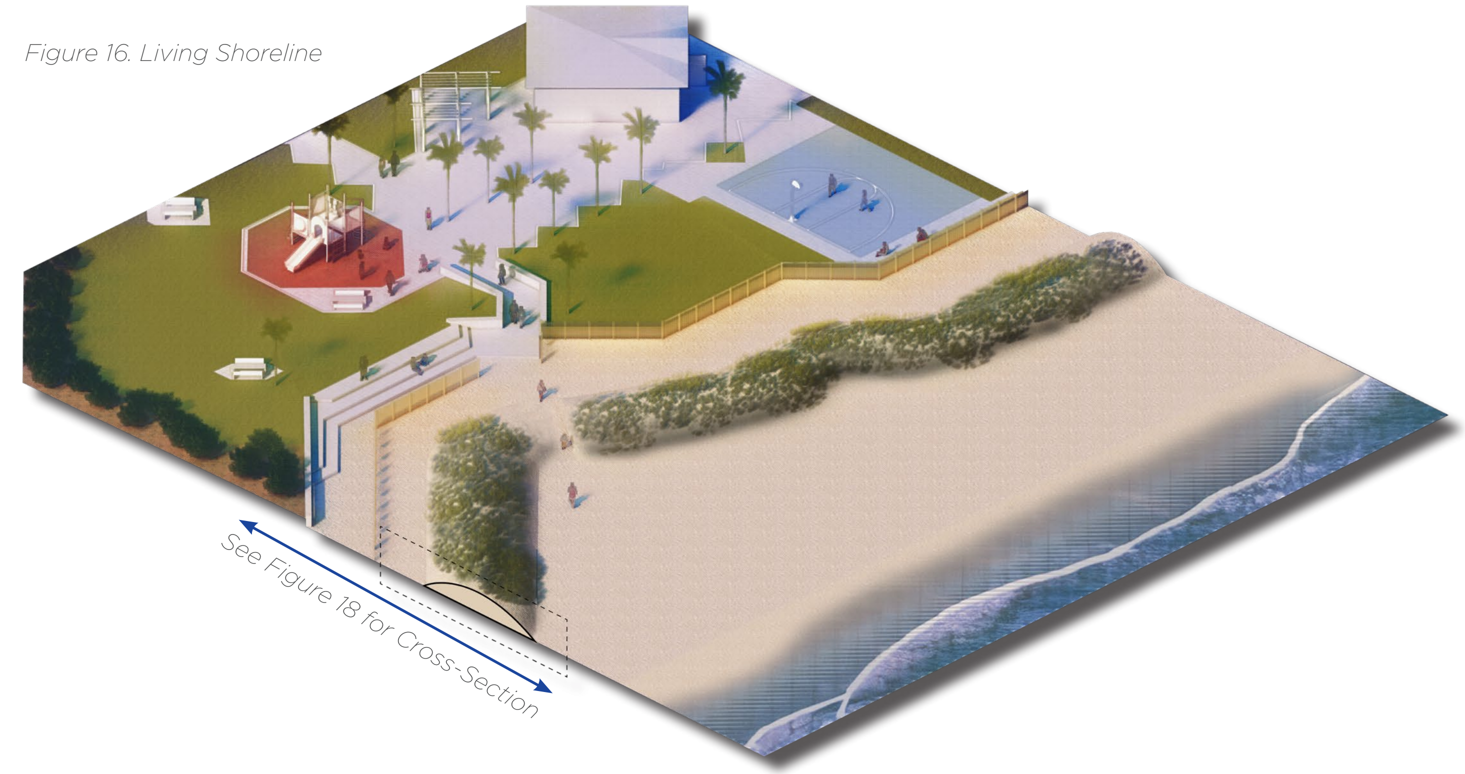


Figure 17. Concept - Living Shoreline

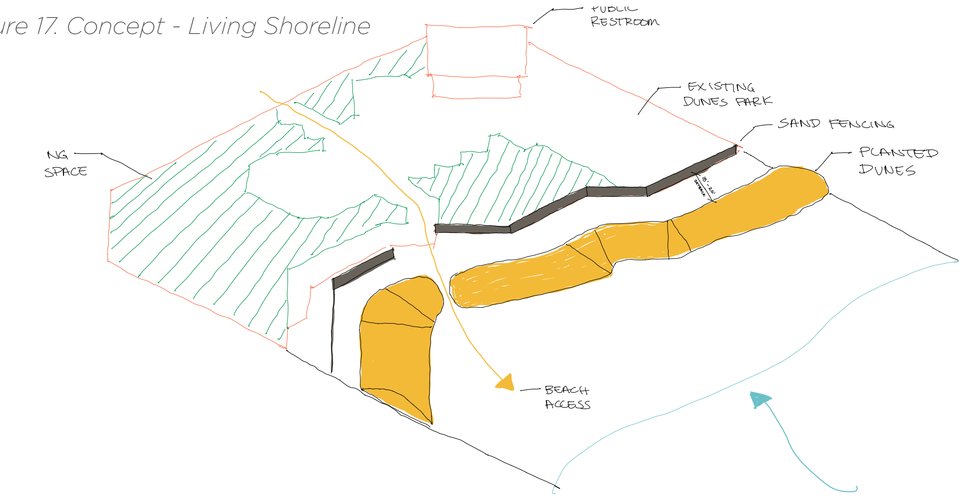
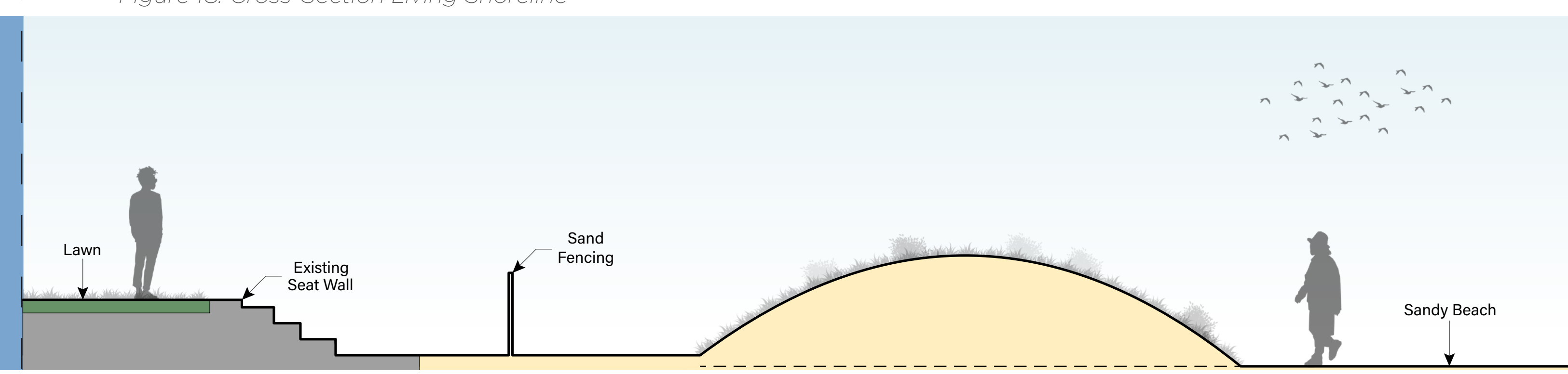
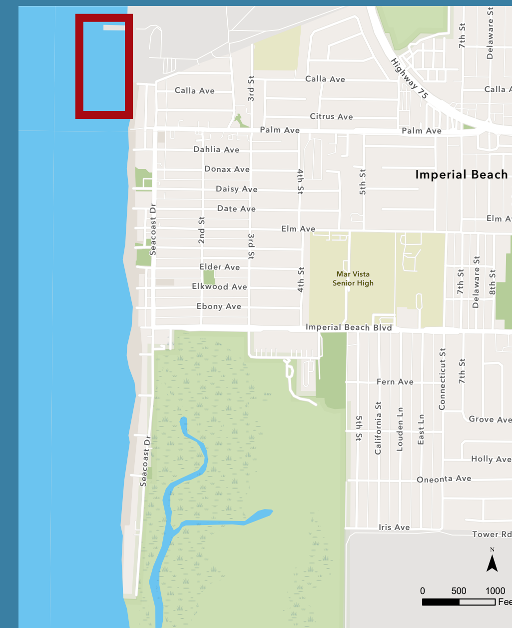


Figure 18. Cross-Section Living Shoreline



Segment 2: North Beach

REHABILITATE GROIN



SITE BACKGROUND

Consists of approximately 0.4 miles of open-coast shoreline from the City's northern boundary at Carnation Ave. to the Imperial Beach Pier. This segment consists of sandy beach backed by a variety of coastal development, including private residences, hotels, and a City park, and a commercial zone. These sites are protected through a series of inconsistent (in terms of design and being a continuous line of defense) private and public shoreline protection structures (i.e. revetment and seawalls). This segment of shoreline also consists of sand retention structure that helps to hold sandy shoreline. A rock groin, constructed in 1961 by the U.S. Army Corps of Engineers to a length of 400 feet, lies directly in front of Palm Ave.

KEY CONSIDERATIONS

- Relatively stable sandy beach.
- Palm Ave groin was built by the USACE and later relinquished to the City.
- Due to the inconsistent shoreline protection along Segment 2, coastal flooding during periods of large waves and high tides results in coastal flooding.

OPPORTUNITIES

- Palm Ave groin was damaged from its built condition, it is now approximately 120 feet shorter. An opportunity exists to repair, rehabilitate or modify structure. This structure, in combination with beach nourishment, would help stabilize the beaches in the City.

ADAPTATION FEATURES

- Repair/rehabilitate the Palm Ave Groin to its authorized length of 400 feet by adding rock to restore lines and grades of as-built design for the seaward most 120 linear feet of the groin.

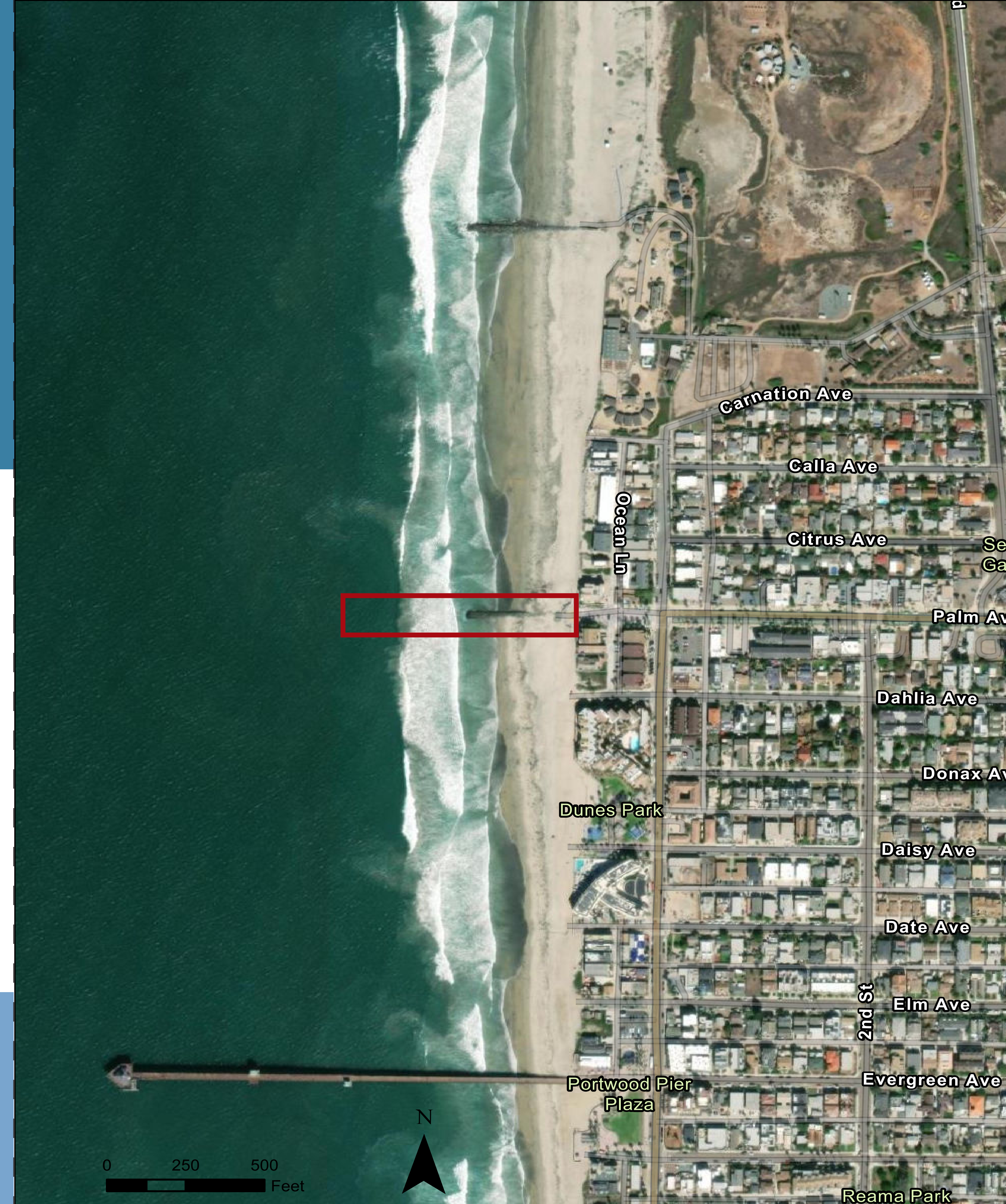
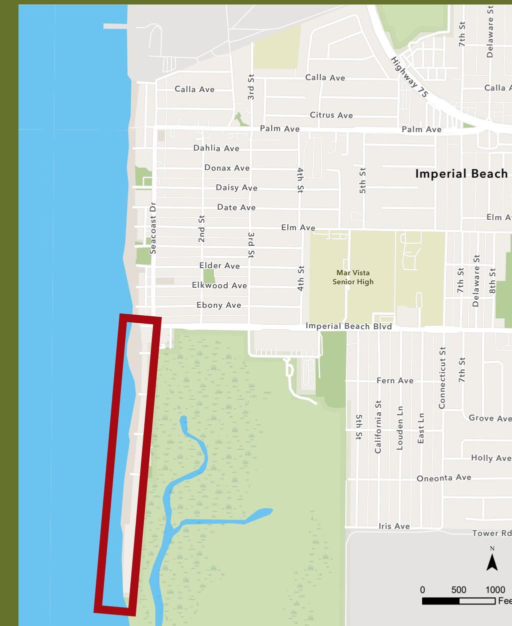


Figure 15. Imperial Beach groin

Segment 3: South Beach
STREET ENDS



SITE BACKGROUND

The South Beach segment consists of narrow sandy beach backed primarily by private residences and one City park adjacent to the pier (Portwood Pier Plaza). The backshore is protected through a series of inconsistent (in terms of design and being a continuous line of defense) shoreline protection structures (i.e. rock revetments and seawalls). There are several gaps in shoreline protection at the City street ends along this segment that serve as coastal accessways.

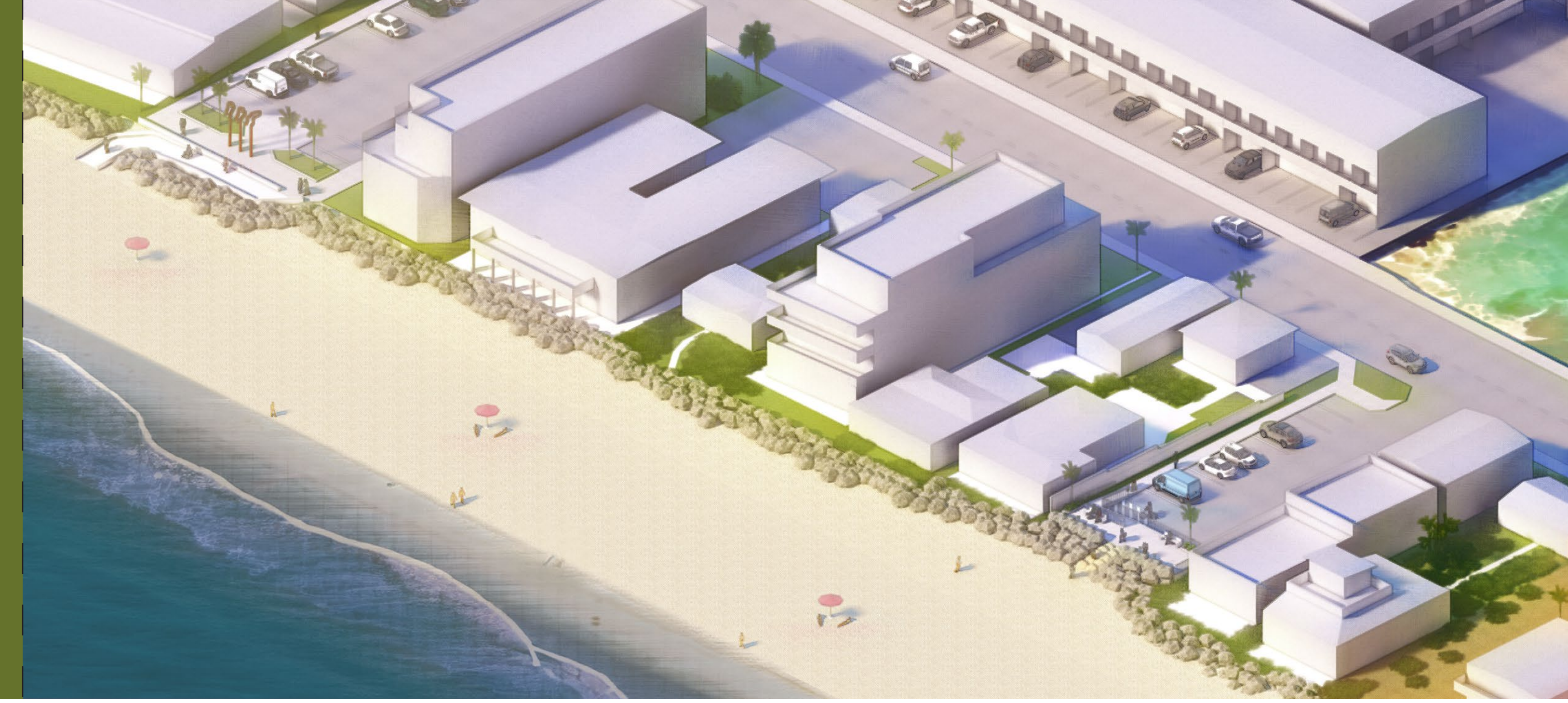


Figure 19. Street Ends along Seacoast Drive

KEY CONSIDERATIONS

- Narrow sandy beach (widest at the pier and progressively narrows to the south).
- Frequent flooding of Seacoast Drive as a result of wave overtopping at the street ends.
- Inconsistent public and private shoreline protection.
- This segment of the City is prone to flooding as a result of large waves and high tides. These conditions drive water and sand through gaps in the shoreline protection system at the street ends several times a year. This hazards will increase in intensity and severity with SLR.

OPPORTUNITIES

- Street ends could be improved to provide continuous erosion and flood protection while enhancing coastal accessways (visually and through the addition of amenities).

Figure 20. Street Ends - Winter Conditions

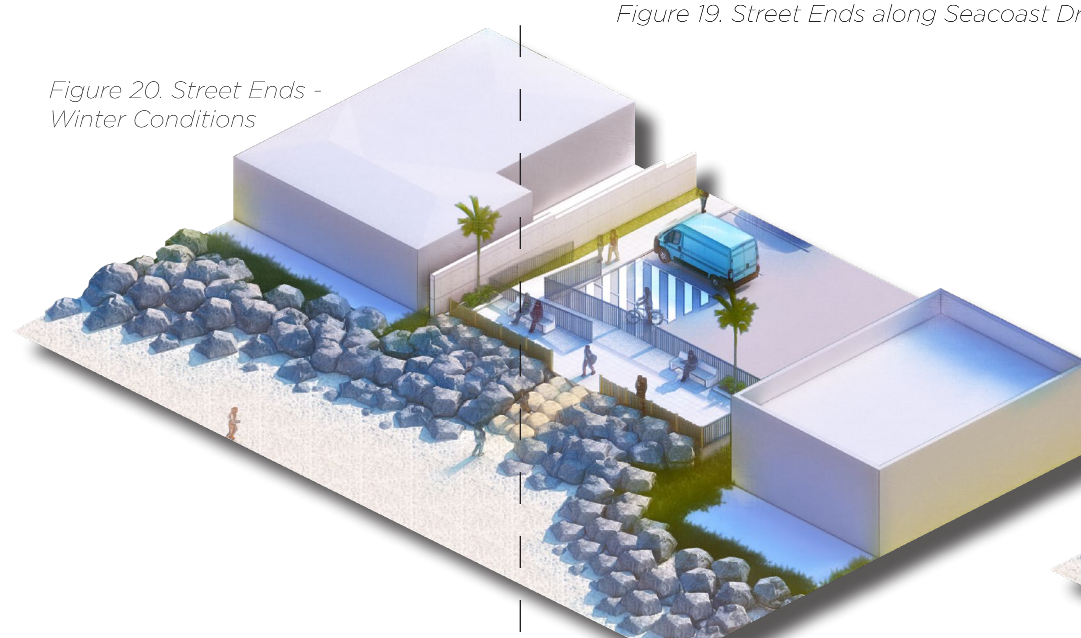
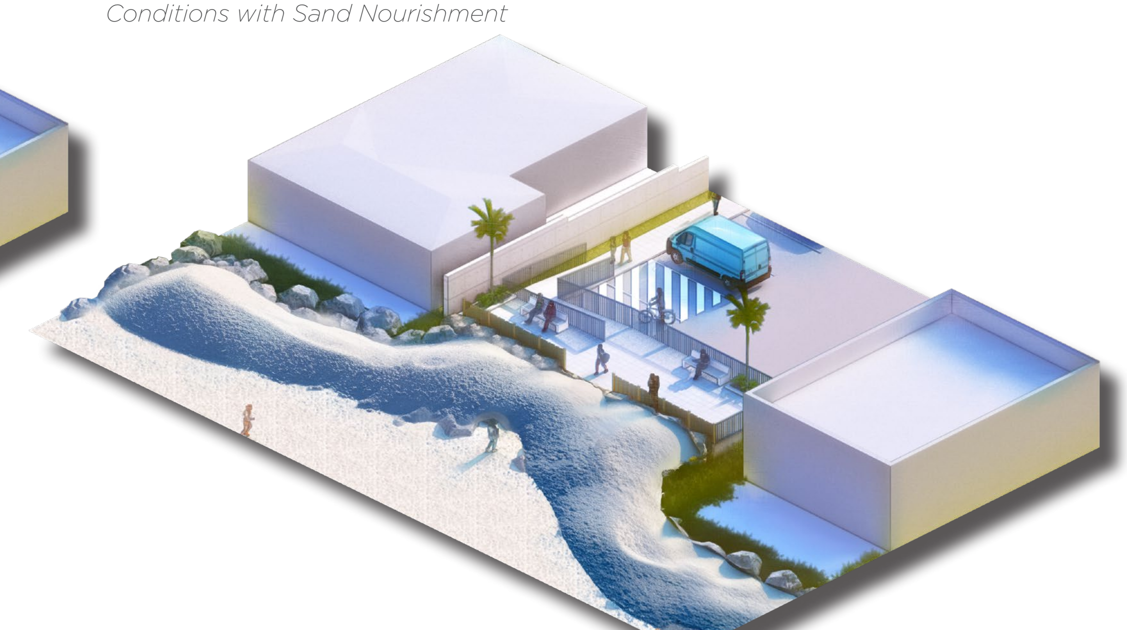


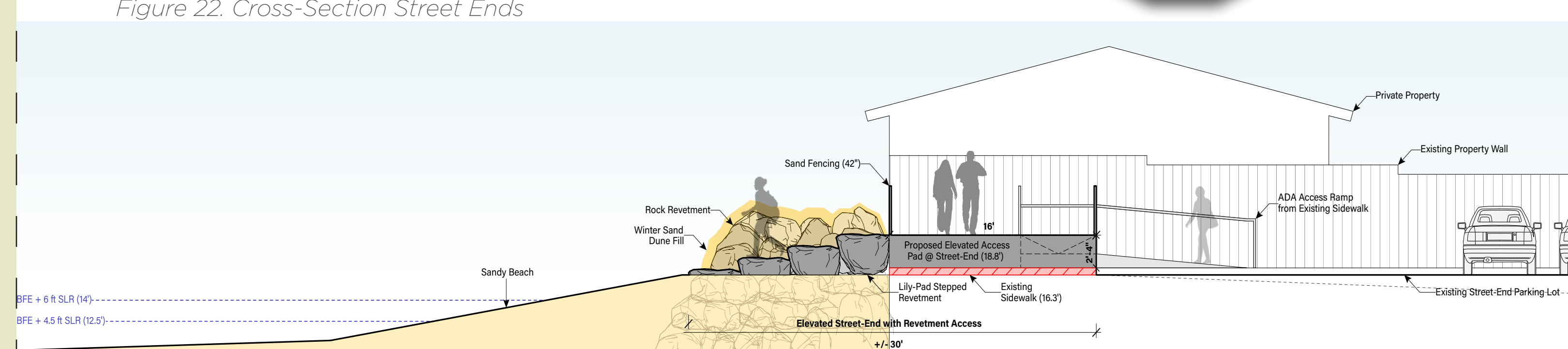
Figure 21. Street Ends - Summer Conditions with Sand Nourishment



ADAPTATION FEATURES

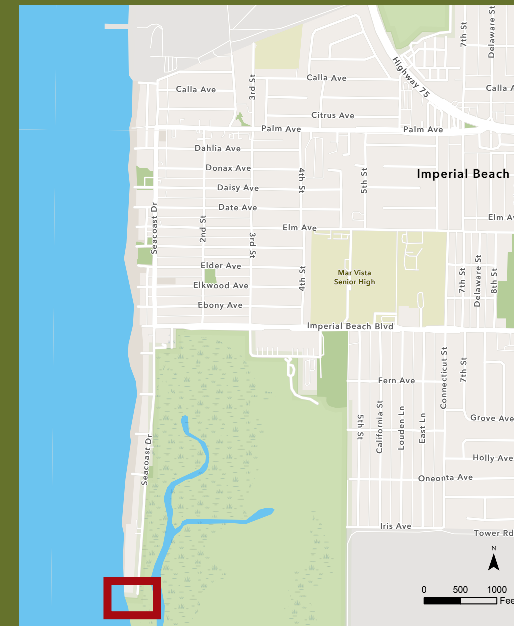
- Improve coastal accessways by filling shoreline protection gaps to provide a consistent line of protection as illustrated in Figure 19 and Figure 21.
    - Gaps would be filled with a rock revetment that would conform to adjacent private rock revetments on both sides.
    - The rock revetment would be buried with sand to allow to public access over this feature (see Figure 20 and Figure 21).
    - In the eroded beach condition (winter), public access across the rock revetment would be gained through a "lily pad" feature through the revetment (see Figure 20). The lily pad walkway would be a series of specifically placed rocks that allow for a stepped passage through the revetment.
    - During summer months, the "lily pad" can be covered with beach sand to provide a uniform dune look and cover the rock revetment (see Figure 21).

Figure 22. Cross-Section Street Ends



Segment 3: South Beach

STREET END FLOOD PROTECTION at SOUTHERN TERMINUS of SEACOAST DRIVE



SITE BACKGROUND

The South Beach segment consists of narrow sandy beach backed primarily by private residences and one City park adjacent to the pier (Portwood Pier Plaza).

Directly south of the end of Seacoast Drive lies an access point to the North Beach Trail along an existing cobble berm with an elevation of approximately 20 feet (NAVD88). This cobble berm was built by the USFWS to stablize the mouth of the estuary by preventing overwash and exchange between the estuary and ocean at this location. The cobble berm stops before reaching the south Seacoast Drive street end in order to allow for lifeguard access to the beach.

KEY CONSIDERATIONS

- Area of significant overwash (water and sand) during large wave events. Water collects/ponds at cul-de-sac.
- Area is used for lifeguard access to southern beaches. Rock revetments along the shoreline to the north limit lateral access to lifeguard vehicles during eroded beach conditions or large waves.
- Area of interest and high public use: beach users, bird watchers and hikers use this access point.

OPPORTUNITIES

- North Beach Trail is on top of an existing cobble berm. The cobble berm was constructed by the USFWS to control the Tijuana River mouth and serves as an example of the flood protection that could be provided by this feature.
- Existing rip rap exists along the end of South Seacoast Drive cul-de-sac. The existing rip rap footprint could be used to fortify this structure to add resilience.
- The cobble berm would meet the ecotone slope or multi-use path floodwall concept of Segment 4 to provide continuous protection. A low spot between these two features would allow overwash water to be retained and infiltrated within a small basin or conveyed into the estuary (see Figures 23 through 25).

ADAPTATION FEATURES

- North Beach Trail gap to be filled through an extension of the existing cobble berm and improvements to the existing rock revetment at the end of Seacoast Drive (see Figures 23 through 25).
- Shoreline protection system will aim to balance the needs of lifeguard vehicular access with flood protection goals (see Figures 23 through 25).

Figure 23. Cobble Berm + Ecotone Slope

Figure 24. Concept - Cobble Berm + Ecotone Slope

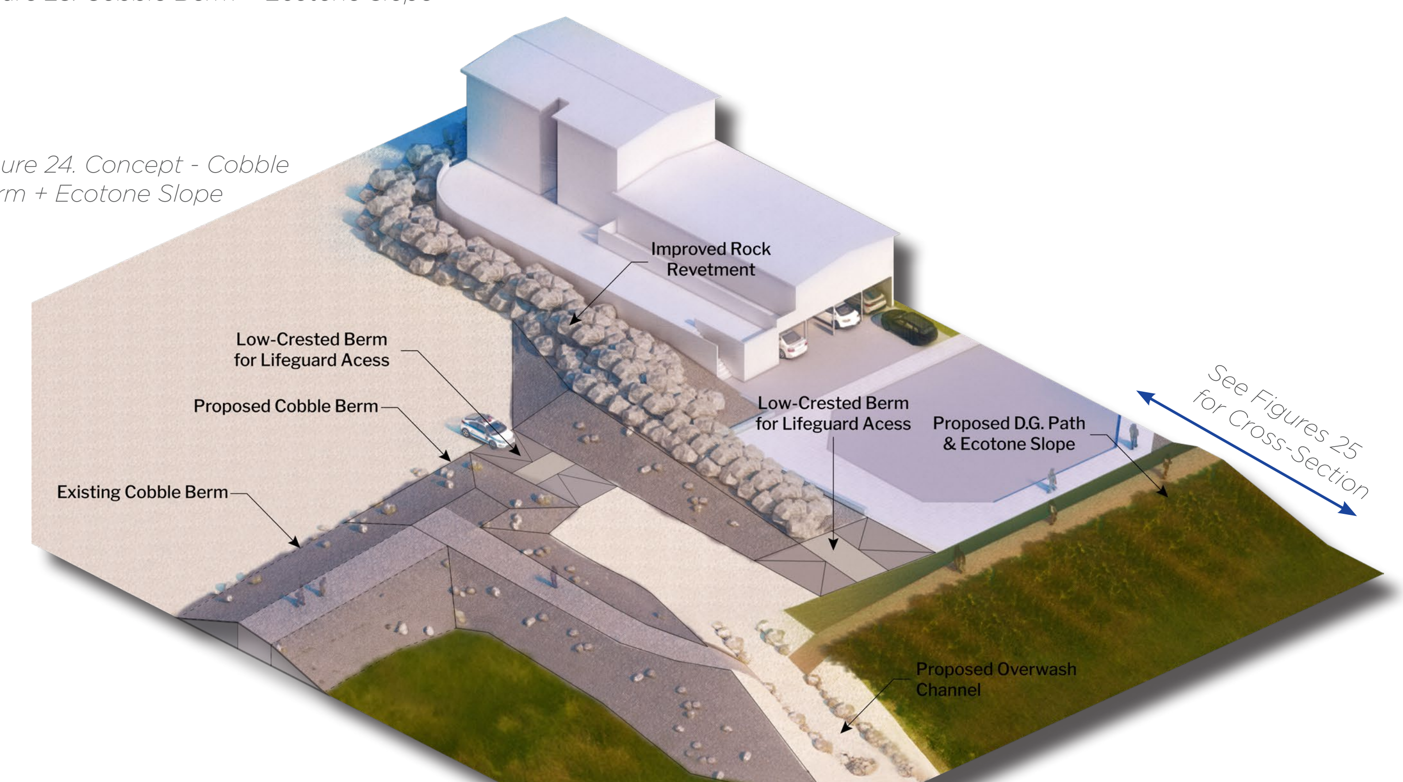
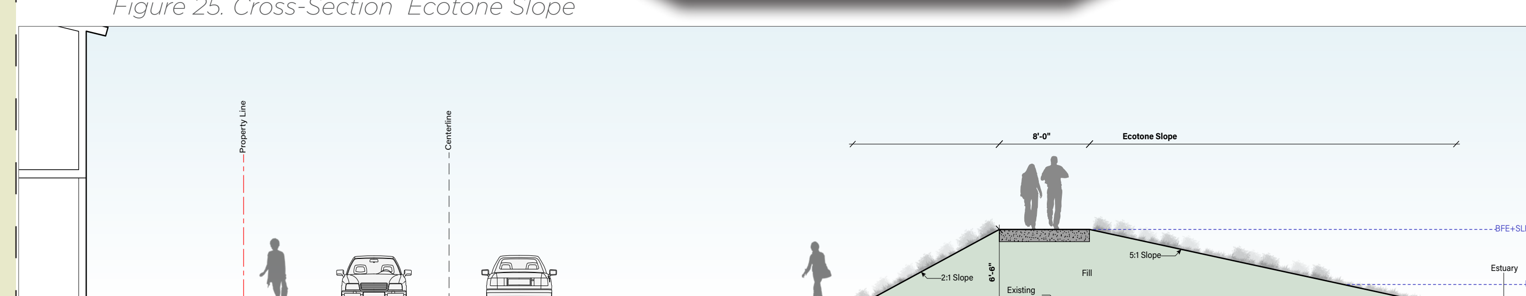


Figure 25. Cross-Section Ecotone Slope

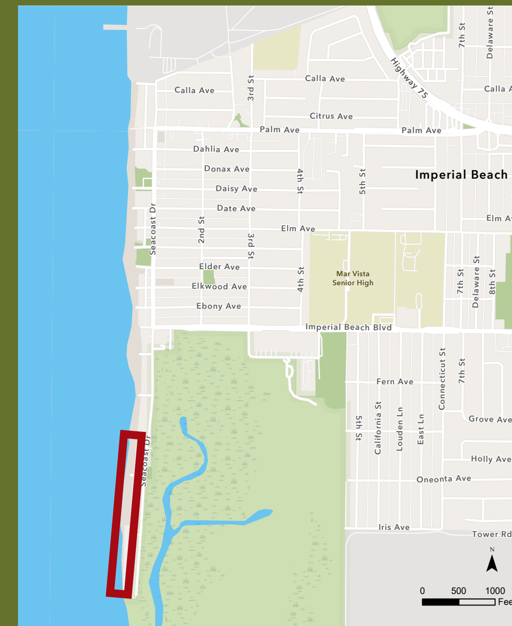


Segment 3: South Beach
FEEDER BEACH

SITE BACKGROUND

The South Beach segment consists of narrow sandy beach backed primarily by private residences and one City park adjacent to the pier (Portwood Pier Plaza). The backshore is protected through a series of inconsistent (in terms of design and being a continuous line of defense) shoreline protection structures (i.e. rock revetments and seawalls).

This segment has been used in the past as a receiving beach for regional beach nourishment projects and programs, like the Sand Compatibility and Opportunistic Use Program (SCOUP). The site was selected due to the erosive beach conditions and because of the ability for this beach to feed or supply sand to the rest of the beaches in the City.



KEY CONSIDERATIONS

- Narrow sandy beach (widest at the pier and progressively narrows to the south).
- Inconsistent public and private shoreline protection.
- This segment of the City is prone to flooding as a result of large waves and high tides. These conditions drive water and sand through gaps in the shoreline protection system at the street ends several times a year. This hazards will increase infrequency and intensity with SLR.

OPPORTUNITIES

- Environmental clearances and monitoring data from prior nourishment projects and programs could be leveraged to establish a "feeder beach" for frequent sand placement within this segment. This feeder beach could supply sand to City beaches to the north (see Figure 26).

ADAPTATION FEATURES

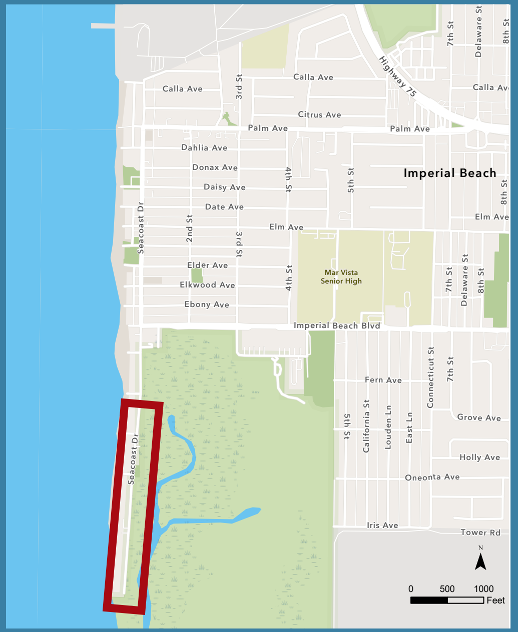
- Designate a feeder beach to receive frequent sand placement within this segment. Establishment of the feeder beach would seek programmatic environmental clearances to allow for frequent sand placement as compatible sand becomes available (see Figure 27).

Figure 26. Feeder Beach Location

Figure 27. Beach Nourishment in Imperial Beach in 2012 as part of SANDAG's Regional Beach Sand Project II

Segment 4: South Seacoast Drive

ELEVATED WALKWAY with FLOODWALL



SITE BACKGROUND

Segment 4 consists of approximately 1.5 miles of shoreline around the perimeter of the Tijuana River Estuary from Seacoast Drive on the western side to Iris Ave on the east. The backshore of this shoreline segment is public infrastructure (South Seacoast Drive roadway), private residences, the Tijuana Slough National Wildlife Refuge facility, the Imperial Beach Sports Park, and existing nature trails (i.e. McCoy Trail). Due to a rich diversity of endangered, threatened, migratory, and native species and their habitats, the Tijuana Estuary along this shoreline is a National Wildlife Refuge managed by the U.S. Fish and Wildlife Service.

KEY CONSIDERATIONS

- This segment is prone to flooding as a result of tidal and fluvial flood water levels overtopping low lying areas of coastal development and nuisance flooding in areas where tidal waters back up into stormwater outfalls.
- High estuary water levels currently result in flooding of southernmost Seacoast Drive during high tides several times a year. Sensitive environmental areas exist along the shoreline in this entire segment.

OPPORTUNITIES

- The mobility along Seacoast Drive could be improved through widened multi-use paths and dedicated bike lanes. The street is actively used by joggers, cyclists, and pedestrians (see Figure 28 and Figure 29).

ADAPTATION FEATURES

An elevated walkway with floodwall or ecotone slope along the boundary between Seacoast Drive and the estuary would provide flood protection to this coastal area from estuary tidal waters.

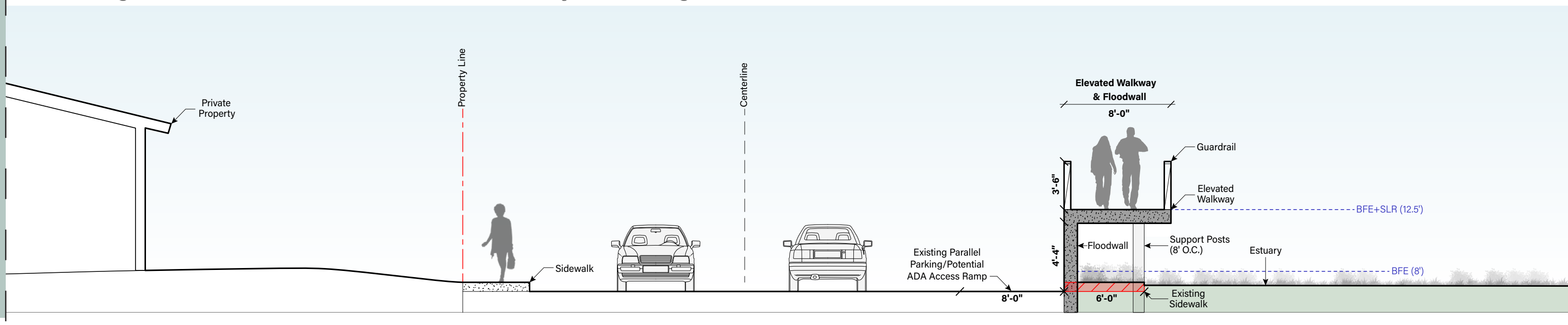
Proposed design features:

- The walkway is proposed between the southern end of Seacoast Drive to Imperial Beach Boulevard, approximately 3,800 linear feet.
- The 8-foot wide walkway could either be on support piles, cantilevered or on compacted fill or a hybrid of these options along its length.
- At the southernmost end the walkway would be approximately 6 feet above existing grade.
- This would lower to about 2 feet above grade as the walkway approached Imperial Beach Boulevard.

Figure 28. Elevated Walkway & Ecotone Slope

Figure 29. Elevated Walkway with Integrated Floodwall

Figure 30. Cross Section: Elevated Walkway with Integrated Floodwall

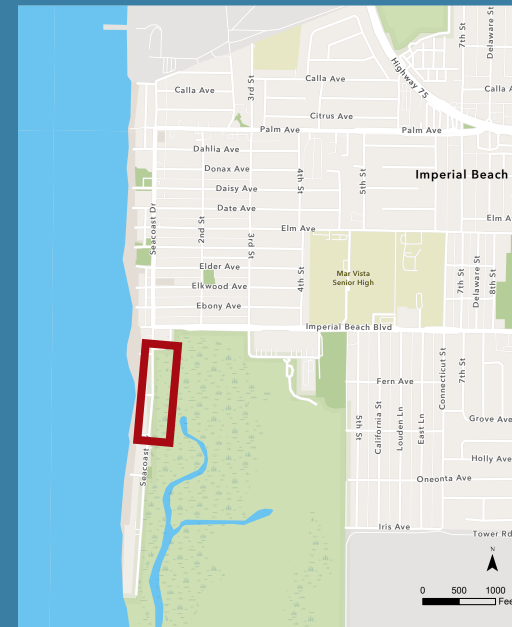


Segment 4: South Seacoast Drive

ECOTONE SLOPE

SITE BACKGROUND

Segment 4 consists of approximately 1.5 miles of shoreline around the perimeter of the Tijuana River Estuary from Seacoast Drive on the western side to Iris Ave on the east. The backshore of this shoreline segment is public infrastructure (South Seacoast Drive roadway), private residences, the Tijuana Slough National Wildlife Refuge facility, the Imperial Beach Sports Park, and existing nature trails (i.e. McCoy Trail). Due to a rich diversity of endangered, threatened, migratory, and native species and their habitats, the Tijuana Estuary along this shoreline is a National Wildlife Refuge managed by the U.S. Fish and Wildlife Service.



KEY CONSIDERATIONS

- Sensitive environmental areas exist along the shoreline in this entire segment. These habitat areas are managed by the USFWS.
- The southernmost end of Seacoast Drive is flooded several times a year as a result of tidal water levels from the estuary overtopping the roadway.
- This segment is prone to flooding as a result of tidal and fluvial flood water levels overtopping low lying areas of coastal development and nuisance flooding in areas where tidal waters back up into stormwater outfalls.

OPPORTUNITIES

- The mobility along Seacoast Drive could be improved through widened multi-use paths and dedicated bike lanes. The street is actively used by joggers, cyclists, and pedestrians (see Figure 31 and Figure 32).

ADAPTATION FEATURES

- An elevated walkway with floodwall or ecotone slope along the boundary between Seacoast Drive and the estuary would provide flood protection to this coastal area from estuary tidal waters. The ecotone slope could accompany the supported pile, cantilever or compacted fill walkway concept. The ecotone is proposed at a 5:1 (H:V) slope to provide a diversity of marsh habitat types in the existing condition and as sea levels rise.

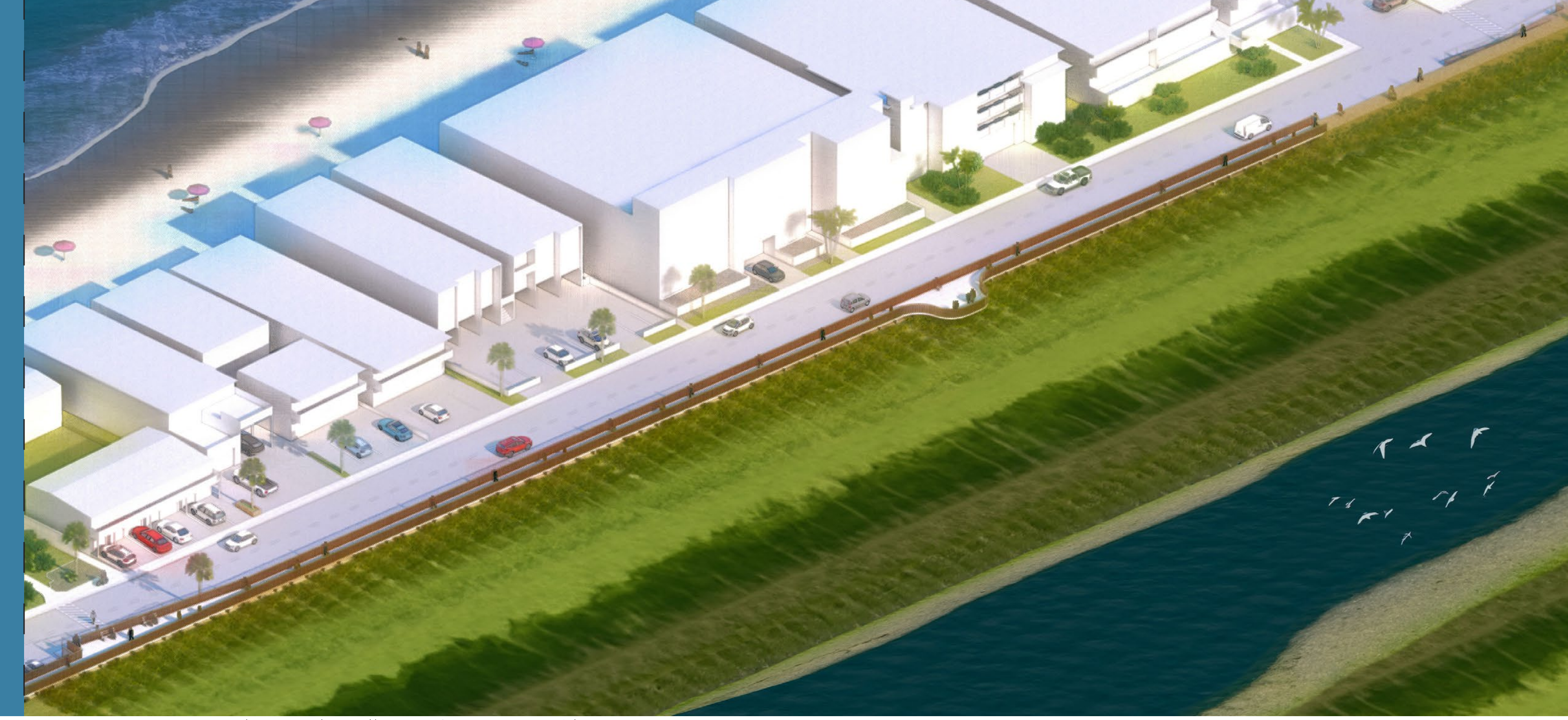
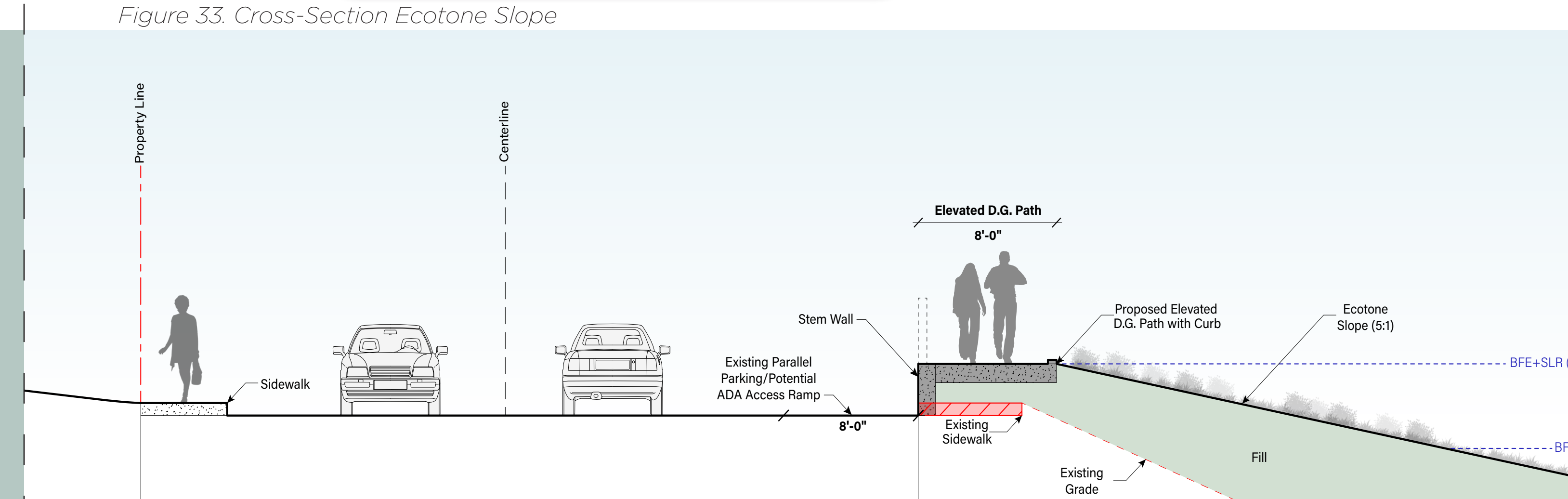


Figure 31. Elevated Walkway & Ecotone Slope

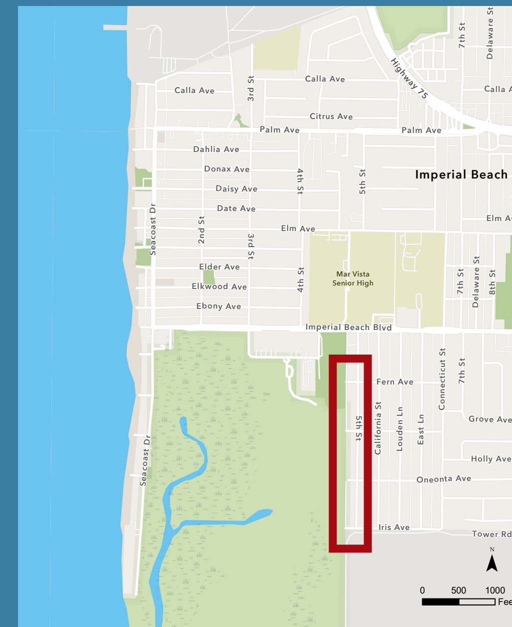
Figure 32. Ecotone Slope

Figure 33. Cross-Section Ecotone Slope



Segment 4: Seaside Point Neighborhood

ECOTONE SLOPE



SITE BACKGROUND

Segment 4 consists of approximately 1.5 miles of shoreline around the perimeter of the Tijuana River Estuary from Seacoast Drive on the western side to Iris Ave on the east. The backshore of this shoreline segment is public infrastructure (South Seacoast Drive roadway), private residences, the Tijuana Slough National Wildlife Refuge facility, the Imperial Beach Sports Park, and existing nature trails (i.e. McCoy Trail). Due to a rich diversity of endangered, threatened, migratory, and native species and their habitats, the Tijuana Estuary along this shoreline is a National Wildlife Refuge managed by the U.S. Fish and Wildlife Service.

KEY CONSIDERATIONS

- Sensitive environmental areas exist along the shoreline in this entire segment. These habitat areas are managed by the USFWS.
- Tidal waters back up into stormdrains in the Seaside Point Neighborhood and along Seacoast Drive.
- This segment is prone to flooding as a result of tidal and fluvial flood water levels overtopping low lying areas of coastal development and nuisance flooding in areas where tidal waters back up into stormwater outfalls.

OPPORTUNITIES

- The existing McCoy Trail along the utility corridor between the Seaside Point Neighborhood is a developed space that could offer an opportunity for a resiliency project with lessened environmental impacts.

ADAPTATION FEATURES

- A raised pathway and ecotone slope along the utility corridor and trail between the Seaside Point Neighborhood and the estuary would provide flood protection to the community from tidal waters and sea level rise. The stormdrains in this neighborhood would also be improved with flap gates to prevent tidal waters from backing up into the stormdrain system (see Figure 34 and Figure 35).

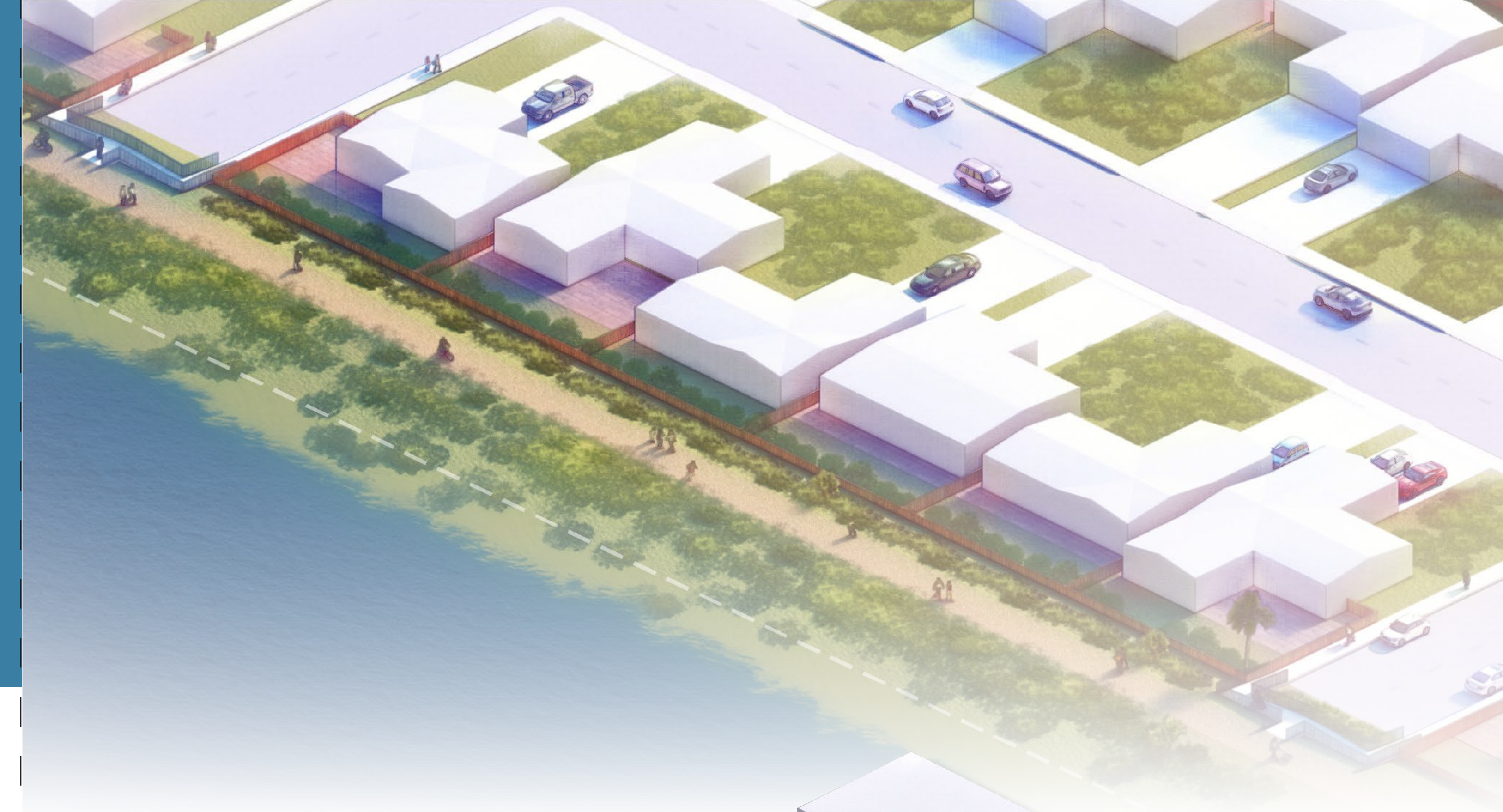


Figure 34. Ecotone Slope

Figure 35. Ecotone Slope

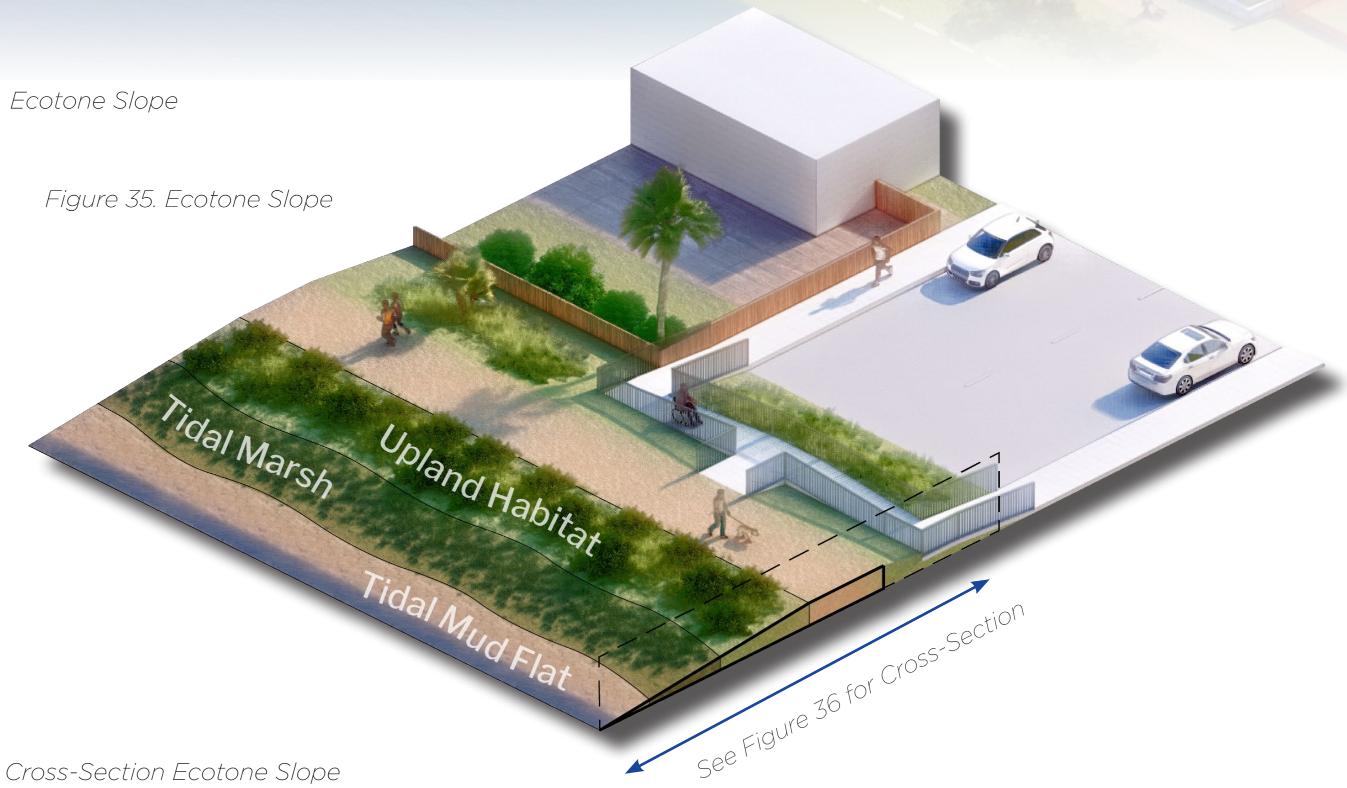
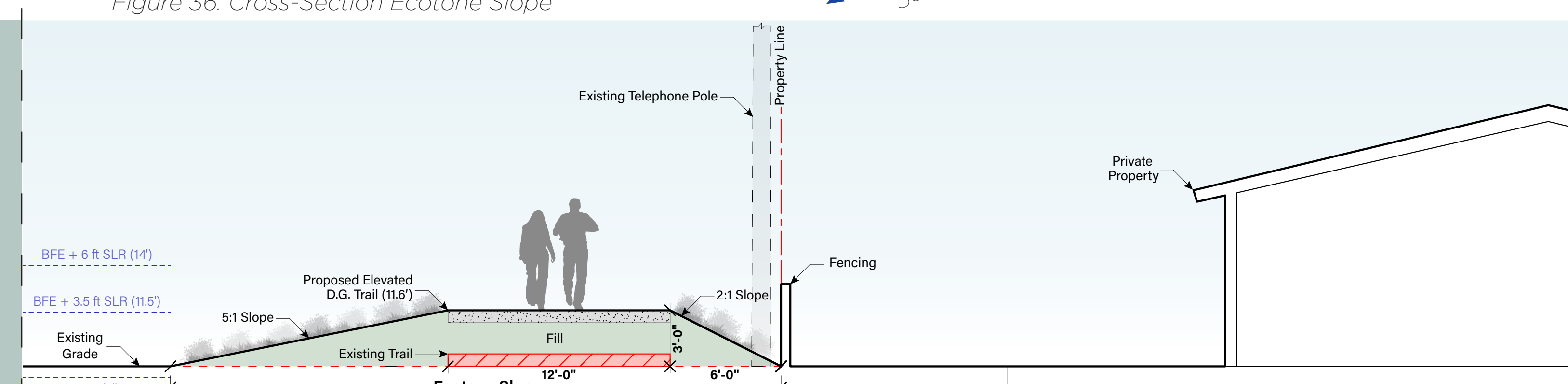


Figure 36. Cross-Section Ecotone Slope



5. NEXT STEPS

Imperial Beach
COMMUNITY
RESILIENCE PLAN

The next steps for implementing the CRP adaptation strategies include conducting more detailed feasibility analyses, garnering regulatory agency support, assessing benefit-cost relationships of proposed elements, and collaboration with local stakeholders. Upon implementation of the CRP adapation strategies, the City of Imperial Beach would be more resilient to projected sea level rise flooding in the mid-term with an adaptive management plan to address long-term flooding caused by climate change.

Appendix A
DRAFT Monitoring & Implementation Program
Community Resilience Plan

City of Imperial Beach

May 10, 2024

→ **The Power of Commitment**

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Abbreviations

Term	Definition
Bikeway	Bayshore Bikeway
City	City of Imperial Beach
MIP	Monitoring and Implementation Program
NERR	National Estuarine Research Reserve
OBFP	Opportunistic Beach Fill Program
RBSP	Regional Beach Sand Projects
Resilience Plan	Imperial Beach Community Resilience Plan
SIO	Scripps Institution of Oceanography
SLR	sea level rise
SWMP	System-Wide Monitoring Program
TRNERR	Tijuana River National Estuarine Research Reserve
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service

Introduction

Situated on a low-lying coastal strip and surrounded by water on three sides, the City of Imperial Beach (City) is particularly susceptible to natural hazards such as coastal flooding. These hazards pose a significant threat to the daily lives of the community, local businesses, City services, and vital infrastructure. In response to these challenges, the City is developing an Imperial Beach Community Resilience Plan (Resilience Plan). The aim of the Resilience Plan is to identify potential adaptation strategies and solutions to mitigate these hazards and bolster the City's resilience. A key component of the Resilience Plan is this report, the Monitoring and Implementation Program (MIP). This MIP outlines a management approach that leverages observations to track impacts over time, assess the performance of implemented adaptation strategies, and inform ongoing management and decision-making processes. The primary objective of this MIP is to establish monitoring activities that can provide a cost-effective understanding of the physical changes occurring along the City's shoreline over time due to sea level rise (SLR) and coastal hazards such as flooding, inundation, and erosion. The City's Sea Level Rise Area Adaptation Strategy Checklist, included as part of the City's 2022 LCP IP Update, is a tool developed to help inform monitoring SLR impacts and determine case-by-case strategies to improve resiliency. Recognizing that SLR may have different impacts on different areas of the City, the checklist outlined how observations could be collected and evaluated to be used to maintain up-to-date information on vulnerabilities for the various segments of the City's shoreline. This MIP builds off the steps outlined by the checklist by identifying potential metrics, methodology, and frequency of data collection. A framework for the timely deployment of adaptation strategies was developed with physical or observational thresholds identified that can signal when a transition from one strategy to another may be necessary. Recognizing the interplay and feedback loop between implementation and monitoring, this plan integrates both elements to present adaptive pathways, potential thresholds, and a monitoring framework. It is important to note that specific project level designs are still in the conceptual phase at the time of this program's development. Consequently, this MIP will require revisions to accommodate any design changes that may arise as concepts are refined and further engineering and environmental evaluations are conducted.

Community Resilience Plan Goals and Objectives

The goal of the overarching Resilience Plan is to develop strategies to address flooding and erosion impacts, encourage nature-based solutions, and adequately address the needs of residents that currently experience flooding or are projected to be substantially impacted by future coastal flooding. To meet this goal, the objectives of the Resilience Plan include:

- Data collection to gain a better understanding of the existing constraints, including surveying the coastal areas to determine property lines and locations of existing structures;
- Illustrate various multi-benefit strategies for the shoreline with consideration of existing infrastructure and the surrounding natural habitat in order to adapt to projected SLR;
- Develop equitable policies to ensure broad utility and to build capacity to enable planning of future adaptation projects, strategies and other activities;
- Establish a baseline and monitoring program to understand how the City's shoreline is physically changing over time;
- Create an implementation plan with a framework for when adaptation strategies could be deployed; and
- Engage the community to gain feedback on the proposed adaptation strategies and policies.

Planning Areas

To assist with better addressing specific hazards and developing appropriate adaptation strategies, the Resilience Plan is divided into four planning areas based on common backshore characteristics and limits of coastal hazards. This division of the City's shoreline into segments is also appropriate for outlining adaptive management activities and a monitoring framework. These planning areas are as follows and are shown graphically in Figure 1**Error! Reference source not found.**:

- Segment 1: Bayside – Surrounding the City's northern boundary, this segment is approximately one mile of shoreline along the San Diego Bay, for which the Bayshore Bikeway (Bikeway) is the primary feature from SR-75 to 13th Street. This Bikeway occupies the first line of infrastructure along this reach with an assortment of low-lying features behind it, including private residences, the Bayside Elementary School, the City Public Works Yard, and the Bikeway Village. The existing shoreline is lined with sensitive marsh habitat managed by the U.S. Fish and Wildlife Service (USFWS).
- Segment 2: North Beach – Stretching along the City's Pacific Ocean shoreline from the pier to the northern City limit, Segment 2 consists of approximately 0.4 miles of open-coast shoreline from Carnation Avenue to the Imperial Beach Pier. This segment consists of a relatively stable sandy beach backed by a series of inconsistent revetment and seawalls that protect the existing developments and infrastructure. Also, a groin constructed by the U.S. Army Corps of Engineers (USACE) directly in front of Palm Avenue has aided in stabilizing the beach in this area.
- Segment 3: South Beach – Encompassing the City's Pacific Ocean shoreline from the pier to the southern City limit, Segment 3 consists of approximately 0.9 miles of open-coast shoreline from the Imperial Beach Pier to the south end of Seacoast Drive. The existing shoreline is composed of a dynamic sand and cobble beach backed with a series of revetments that vary in design and condition. Prior Regional Beach Sand Projects (RBSP) have implemented beach nourishment within this segment. Wave energy is intensified at the southern end of the segment as a result of wave focusing on the Tijuana Slough delta.
- Segment 4: Estuary – Surrounding the southern portion of the City adjacent to the Tijuana River Estuary, Segment 4 consists of approximately 1.5 miles of shoreline around the perimeter of the estuary from Seacoast Drive to Iris Avenue. The existing shoreline is lined with sensitive marsh habitat managed by the USFWS. Fronting the estuary lies public infrastructure (e.g., South Seacoast Drive), private residences, the Tijuana Estuary Center, the Imperial Beach Sports Park, and the estuary's existing McCoy Trail.

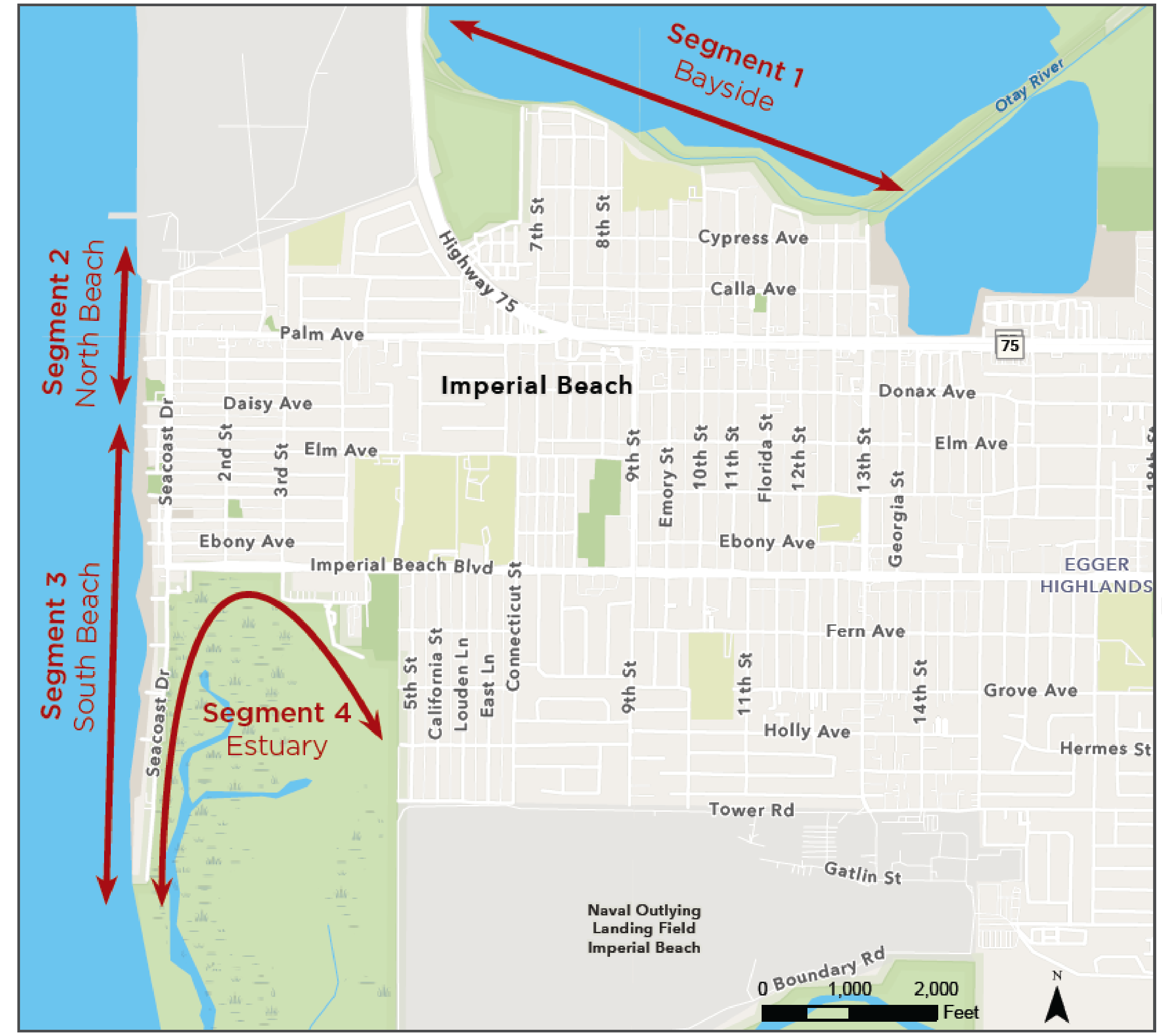


Figure 1. Community Resilience Planning Areas

Adaptation Pathways

This section presents potential adaptive pathways for each of the four project segments. Each of the pathways presented begins with Phase 1, which is considered the first strategy, or suite of strategies, implemented. This assumption is appropriate to assist with the City planning on a longer time horizon for projects to provide resilience in the near term, to 2050, while recognizing the need for longer term planning horizons. The pathways presented within this plan then propose future phases (i.e., concept projects or management actions) and the thresholds that would signal the City to begin planning or implementing that future phase. Understanding that each management action may require several years to implement, approximate lead times were incorporated into the pathways. These lead times were derived based upon analogous projects that have been implemented in the City and best judgement based on similar coastal projects in California.

Segment 1: Bayside

The Bayshore Bikeway Resiliency Project is currently being developed in Segment 1, which has plans for construction in 2026. Project highlights are shown in Figure 2 and include elevating the Bikeway to protect the Bayside Community from coastal hazards, including up to 3.5 feet of SLR. The Bikeway would be graded with ecotone slopes to provide transitional marsh habitat along the bayside. Phase 1 of the Bayshore Bikeway Resiliency Project would also include stormwater improvements in the vicinity of Bayside Elementary to provide additional capacity to an undersized storm drain system. The improvements would also limit tidal waters from the bay from backing up into the storm drain system during high tides – as it does currently. While this segment does not have impending impacts that require a resilience project, the Bayshore Bikeway Resiliency Project is an opportunistic pilot project that can provide multiple benefits to this portion of the City for the anticipated planning horizon.

To address future higher projections of SLR, future phases could consider modifying the project to accommodate even higher bay water levels. Two main strategies are being considered to address these future hazards:

1. Elevating the Bikeway and integrating an ecotone slope; and
2. Construction of a floodwall or seat wall along the bay side of the Bikeway.

A phased approach for implementing these concepts is provided below in Table 1.

Table 1. Segment 1 - Adaptive Management Pathways and Monitoring Thresholds

Phase	Threshold	Concept	Assumed Lead Time to Implement Phase
Phase 1	No threshold required to begin planning and implementation of the proposed coastal resiliency strategies	Bayshore Bikeway Resiliency Project to elevate path, construction of ecotone slope, and living levee	Estimated implementation in 2026
Phase 2	Overtopping/flooding of Bikeway exceeds 5 times over a 12 month period	Increase Bikeway elevation **OR** Construct floodwall	5-7 years

Implementation of Phase 2 may require additional design considerations based on the observed impacts of the project from flooding and desired level of protection and resilience. Primarily, Phase 2 would look to decrease inundation and flooding vulnerabilities by adding elevation to the Bikeway or through structural protection, such as a floodwall. Cross sections illustrating options for Phase 2 are provided in Figure 3.

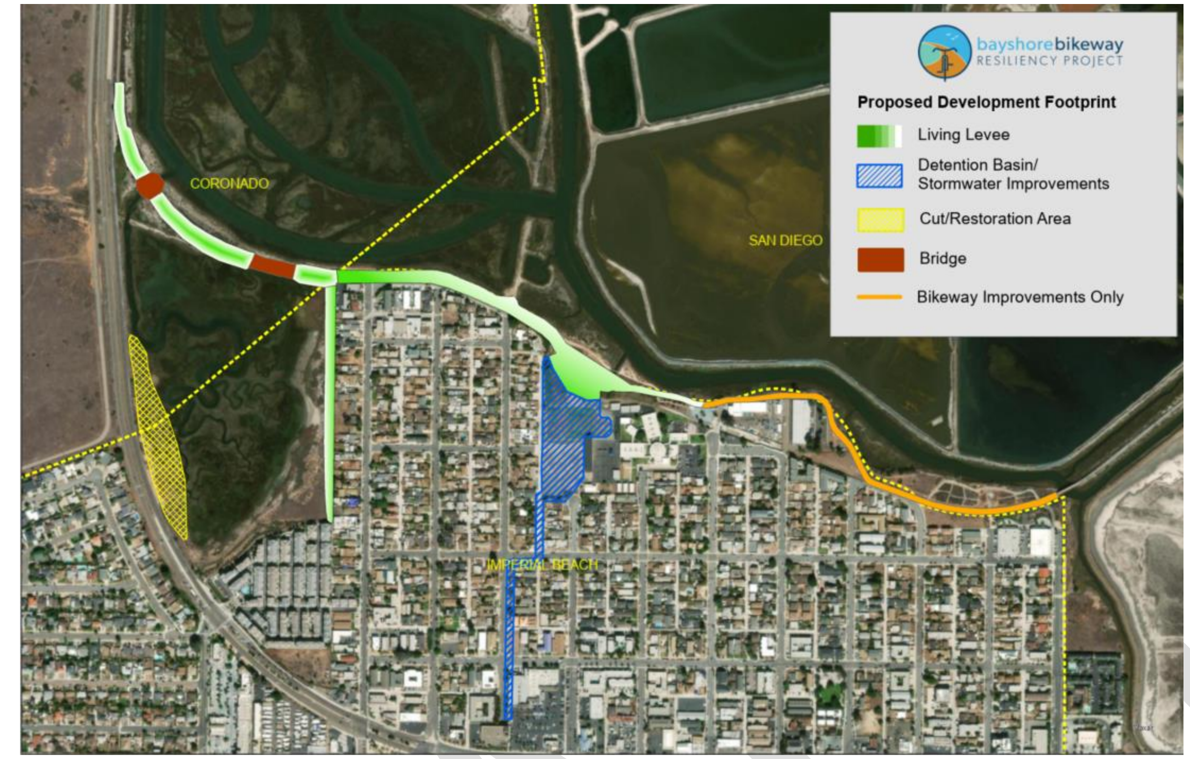


Figure 2. Bayshore Bikeway Resiliency Project Proposed Development Footprint Representing Phase 1 Adaptation for Segment 1

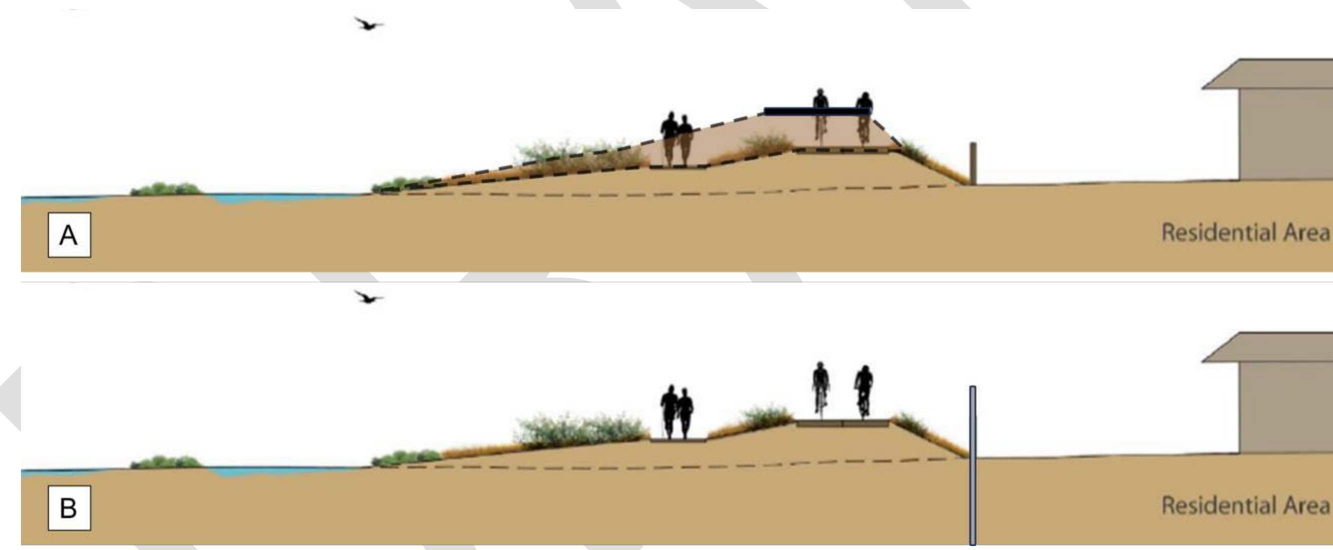


Figure 3. Conceptual Adaptation Concept Options for Phase 2 of Segment 1 where the (A) Bikeway is Increased in Elevation through an Ecotone Slope, or (B) a Floodwall is Added to Reduce Flood Impacts

Segment 2: North Beach

Initial assessments of coastal hazards along the North Beach segment indicated it to be the least vulnerable to coastal hazards of the four segments. This is likely due to the stability of the beach in this area. However, residential development and community infrastructure is low-lying and is prone to flooding under relatively small amounts of SLR and high wave events. Additionally, while several shoreline protective features exist along the segment, only a handful are engineered seawalls, many at the northern end of the segment appear to be unengineered rip rap. Gaps and inconsistencies in these protective features can provide flood pathways to the community behind them.

Based on these vulnerabilities and the opportunities identified in City owned areas, three main strategies are being considered for the North Beach segment:

1. Increasing elevation of accessways and fill in gaps to match adjacent shoreline properties;
2. Creating dunes at appropriate backshore locations; and
3. Rehabilitating the existing groin at Palm Avenue.

A phased approach for implementing these concepts is provided below in Table 2Table 1.

Table 2. Segment 2 - Adaptive Management Pathways and Monitoring Thresholds

Phase	Threshold	Concept	Assumed Lead Time to Implement Phase
Phase 1	Overtopping/ flooding of coastal accessways exceeds 5 times over a 12 month period	-Raise elevations and fill in gaps along accessways to match adjacent shoreline -Implement engineered dune at Dune Park and/or passive dune at appropriate location(s)	2-5 years
Phase 2	Beach width continuously recedes to less than 20 ft consistently over a 24-month period	-Rehabilitate Palm Ave groin to as-built length -Continued support of beach nourishment activities in Segment 3	5-10 years

Inconsistencies in elevation at public accessways with adjacent shoreline properties and protection features can provide vulnerabilities to flooding. The initial Phase 1 activities include increasing the elevation of these accessways to match the adjacent features. By filling the gaps along the shoreline, greater resilience and protection from flooding can be achieved across this segment. Phase 1 also includes consideration for implementing dunes at appropriate locations. Not only can these features provide further flood protection through nature-based solutions that can be integrated with existing recreation activities and enhancing habitat elements, but they may also help offset the impact associated with increased shoreline protection at street ends. For example, Dune Park currently has sand fencing to support trapping windblown sand and offers a great opportunity for designing a nature-based project where a vegetated dune feature could be implemented to provide multiple benefits, including flood protection and coastal resilience (Figure 4). Other areas in this segment could be explored for possible dune features such as Dahlia Avenue and Elm Avenue. These two areas represent opportunities where a hybrid approach could be pursued where revetment is buried and covered with a vegetated dune. This hybrid strategy would provide the confidence of an armored flood protection while gaining the aesthetic and recreational benefits of a softer approach. While engineered dunes are likely the preferred approach to achieve coastal resilience goals, recent examples of passive dune projects, such as those implemented at Borderfield State Park and South Ponto State Beach, highlight opportunities for relatively low-cost, and effective dune creation efforts that could be explored further. It is important to highlight that these dune-related strategies will require regular maintenance as sand can be eroded during storm events (large waves). While a flood-based threshold is provided to signal implementing Phase 1 adaptation elements, pursuing dunes at appropriate locations could be an opportunistic strategy for the City to consider. Given the availability of nature-based focused coastal resilience grant funding from state and federal sources, this is potentially a ripe opportunity for the City to implement an adaptation project prior to realizing impacts.

Figure 4. Conceptual Rendering of Vegetated Dune at Dune Park

A longer term strategy in Phase 2 could consider rehabilitating the southern groin off Palm Avenue, which would act to stabilize beach sand both in between the two existing groins as well as some distance south of the structures. Rehabilitation of the groin to its as-built length would help stabilize sediment from longshore transport and support wider localized beach widths. While this is a potential strategy to consider, it does present regulatory, political, and fiscal considerations. While rehabilitating the groin to its as-built length would provide short- to mid-term benefits, at high to extreme levels of SLR the groin likely will provide a reduced ability to stabilize the beach. Coordination with the USACE would be critical to determine if this strategy would be feasible. Additionally, while the groin is an existing feature, sand retention structures can be controversial in that they have the potential to impact downdrift beaches should they be designed to capture too much sand or if their operation is not coupled with a properly designed beach nourishment / sediment management program.

Segment 3: South Beach

Due to the South Beach segment consisting primarily of private residencies, most of the shoreline is protected with unengineered rip rap, seawalls, and engineered revetment. Like Segment 1, gaps and inconsistencies in these protective features can provide flood pathways to the community behind them and present vulnerabilities across the shoreline. Segment 3 of the City is prone to flooding and overtopping events promulgating into street ends and roadways during high tides and storm events at today's sea level. These hazards and their impacts will only worsen as sea levels rise. An important factor to consider is that while the pervasiveness of shoreline protective features along this segment limits the amount of erosion observable, these structures themselves contribute to the reduction of usable beach space, both through the physical space they occupy and through localized scour along the toe of the structures.

Based on these vulnerabilities and the opportunities identified in City owned areas, two main strategies are being considered for the South Beach segment:

1. Increasing elevation of accessways, street ends, and filling in gaps to match adjacent shoreline properties; and
2. Designating South Beach as a receiving beach for sand for the City.

A phased approach for implementing these concepts is provided below in Table 3Table 1.

Table 3. Segment 3 - Adaptive Management Pathways and Monitoring Thresholds

Phase	Threshold	Concept	Assumed Lead Time to Implement Phase
Phase 1	No threshold required to begin planning and implementation of these coastal resiliency strategies	-Raise elevations and fill in gaps at street ends and accessways to match with adjacent shoreline protection -Pursue beach nourishment activities (e.g., RBSP III)	2-5 years
Phase 2	Flooding/ overtopping of street ends 5 times over 12 month period	-Consider more frequent beach nourishment	3-7 years

Adaptation strategies being conceived for Segment 3 in Phase 1 focus on filling gaps in elevation and shoreline protective features at the City / Port owned street-end beach access points. This could be done by importing armor stone, cobble, sand, or a combination of materials and providing a stairway or slopped access down to the beach, as shown in Figure 5. Providing an elevated access point will limit wave runup and overtopping into streets and roadways, which would further result in reducing maintenance burdens that contribute to overwhelming stormwater infrastructure.

Figure 5. Conceptual Rending of Improved Street End Accessway

As shown in Figure 6, an extended cobble berm can be constructed at the south end of Seacoast Drive, south of the road, along with a floodwall along the estuary side to avoid waves overtopping into the street, which currently happens during sizable wave events. This concept would utilize an overwash fan type feature where ocean water could flow to a small natural detention basin to percolate. This would avoid the water and sand going straight into the Tijuana River Estuary or Seacoast Drive.

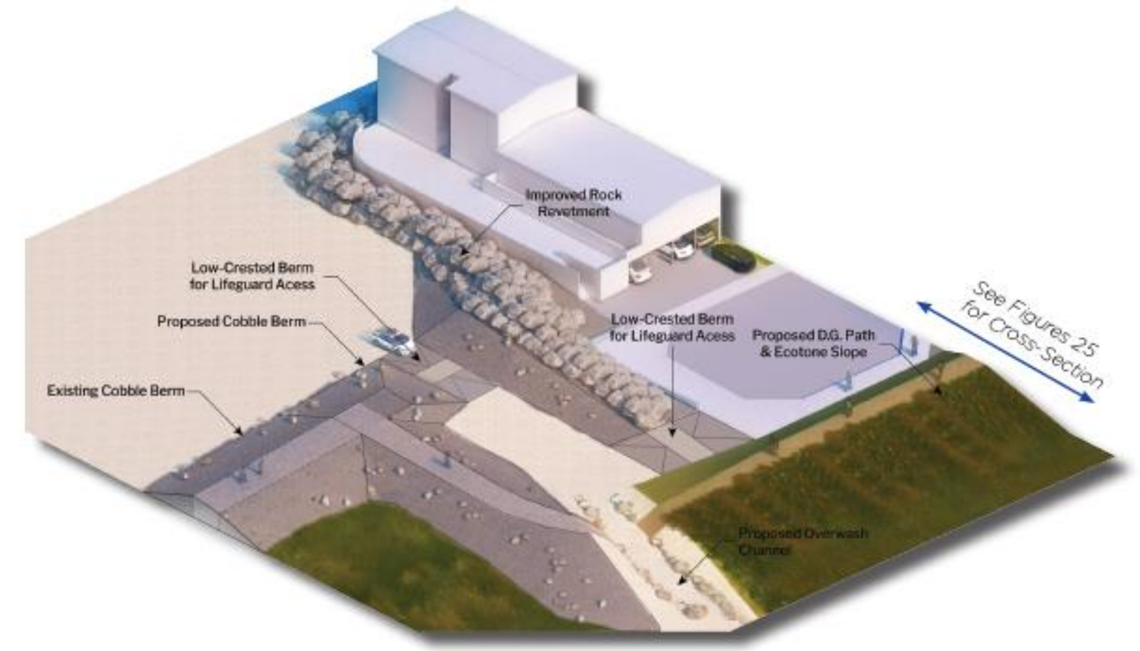


Figure 6. Conceptual Rendering of Extended Cobble Berm, Elevated Boardwalk, and Floodwall at the End of Seacoast Drive

Complimentary to filling in the gaps and street ends, Phase 1 includes designating South Beach as the receiving beach for the City. Since net longshore transport is predominately northerly in the City (i.e., sand generally moves south to north), placement of sand in this location will benefit the whole City. Designation of the beach entails a multitude of parallel efforts that increases the frequency and volume of sand being delivered to the beach. The first recommended action under this strategy is the continued participation in SANDAG's RBSP program, which is a regional beach nourishment program. Other considerations in this strategy are to advocate for a programmatic approach for RBSP projects, reinstate the City's Opportunistic Beach Fill Program (OBFP), which utilizes beach compatible sand from upland development of restoration projects, and/or consideration of a City led beach nourishment project.

Segment 4: Estuary

The primary coastal hazards for Segment 4 are coastal and fluvial flooding via the Tijuana River Estuary and stormwater nuisance flooding during high tides. It should be noted that Seacoast Drive is exposed to waves; however, Segment 4 focuses on the hazards associated with the estuary and Tijuana River. Wave impacts along Seacoast Drive are addressed in Segment 3. The existing development around the perimeter of the estuary varies in elevation along Seacoast Drive and along the Seaside Point neighborhood. There are many low-lying areas that are vulnerable to high tides under existing conditions, and many more that would be exposed with SLR. The areas identified as the most vulnerable to coastal flooding include Seacoast Drive, Imperial Beach Drive, and the eastern perimeter-boundary of the estuary (i.e., Seaside Point neighborhood) (Figure 7). However, the entire Tijuana River Estuary perimeter within Segment 4 is exposed to the effects of coastal flooding with SLR.

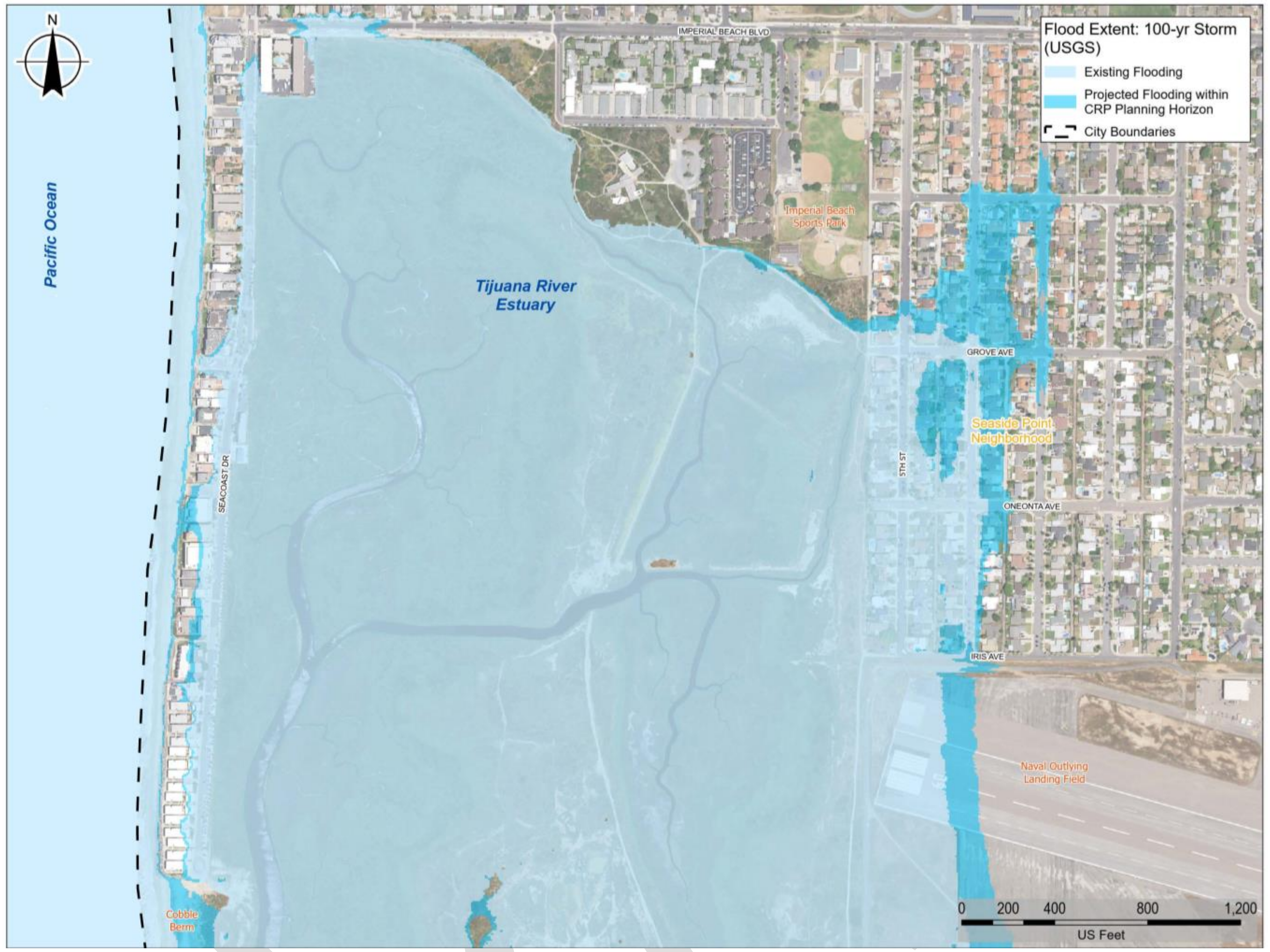


Figure 7. Segment 4 Flood Vulnerabilities including Seacoast Drive (left), Imperial Beach Boulevard (top), and Seaside Point Neighborhood (right)

Based on the vulnerabilities and the opportunities identified in City owned areas, three main strategies are being considered for the Segment 4:

1. Elevating sidewalks, trails, and the perimeter of certain roads through living levees, boardwalks, and floodwalls;
2. Improving existing stormwater infrastructure inside the estuary at the bend in Grove Avenue to treat stormwater and prevent water from backing into the community; and
3. Converting Iris Avenue and Oneonta Avenue street ends into an integrated elevated parklet with the estuary trail.

A phased approach for implementing these concepts is provided below in Table 4Table 1.

Table 4. Segment 4 - Adaptive Management Pathways and Monitoring Thresholds

Phase	Threshold	Concept	Assumed Lead Time to Implement Phase
Phase 1	Flooding/ overtopping of street, trails, paths 5 times over 12-month period	- Construct elevated walkway with integrated floodwall on the east side of Seacoast Drive - Raise sidewalk along low-lying section of Imperial Beach Boulevard - Elevate trail path fronting Tijuana Estuary Visitor Center and Imperial Beach Sport Park - Construct living levee with trail path fronting Seaside Point neighborhood and convert street ends (terminating at the estuary) to open space connection points - Construct stormwater wet ponds and control structure inside the estuary at the bend in Grove Avenue	7-10 years
Phase 2	Flooding/ overtopping of street, trails, paths 5 times over 12-month period	- Raise floodwall along Seacoast Drive - Elevate trail path fronting Tijuana Estuary Visitor Center and Imperial Beach Sport Park - Elevate living levee trail path fronting the westside of Seaside Point neighborhood	5-7 years
Phase 3	Flooding/ overtopping of street, trails, paths 5 times over 12-month period	- Add floodwall along estuary side of elevated boardwalk - Add floodwall along living levee trail path	5 years

Phase 1 for Segment 4 proposes the construction of an elevated boardwalk and floodwall along the east side of Seacoast Drive that transitions to an ecotone slope naturalized pathway on the north end of the segment, towards Imperial Beach Boulevard (Figure 8 and Figure 9). These strategies are designed to protect the roadway from flooding caused by elevated water levels in the estuary while also providing a formalized recreational amenity that is adequately separated from the roadway and enhances the community's connections north to south and with the estuary. The floodwall on the southern portion would be designed to be resilient to SLR and high tides from the Tijuana River Estuary based on the anticipated needs of the community. In addition to flood protection, these strategies aim to increase integration and create connectivity between downtown Imperial Beach and the full length of Seacoast Drive.

Figure 8. Conceptual Rendering of Boardwalk and Flood Wall that Transitions to Ecotone Slope Path along Seacoast Drive

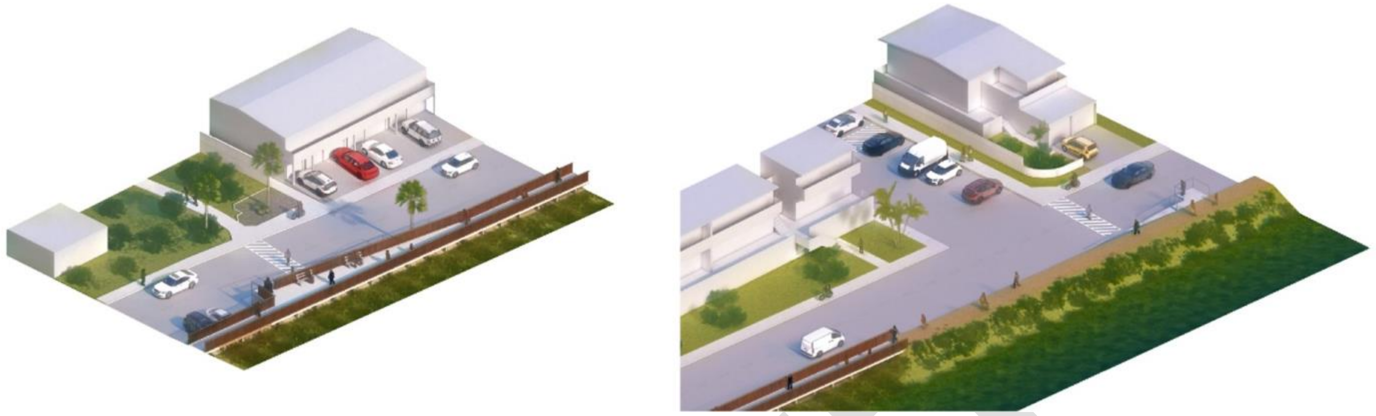


Figure 9. Conceptual Rendering of Seacoast Drive Boardwalk and Floodwall (left) and Ecotone Slope Path (right) that Integrates with Existing Transportation and Recreation Elements in the Community

On the northern and eastern boundary of the estuary, the existing sidewalks and trails along the estuary could be raised to reduce the likelihood of wave overtopping or flooding. Phase 1 incorporates raising the naturalized pathways within the estuary (parallel to Imperial Beach Boulevard) to the same elevation as the adjacent existing sidewalks (e.g., Imperial Beach Boulevard) they are already connected to. This would serve to reduce the impact that elevated water levels may have on these features while preserving the existing aesthetics and avoid major restructuring or realignment of these paths. Fronting the Seaside Point neighborhood, the existing trail and utility corridor (parallel to 5th Street) could be utilized to construct a living levee with an elevated multi-use trail and a shallow ecotone slope supportive of marsh edge and transitional habitat (Figure 10 and Figure 11). The construction of these features would reduce the vulnerability of this low-lying residential community to existing and projected future coastal flood hazards.

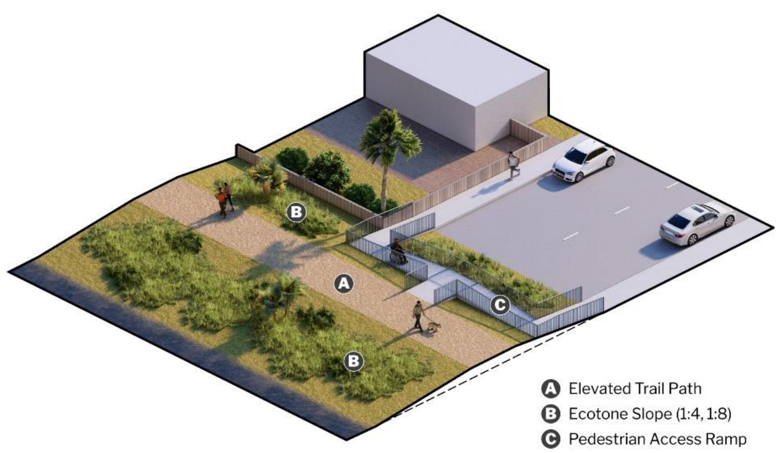


Figure 10. Conceptual Rendering of Elevated Trail Path and Ecotone Slope for Estuary Area Parallel to 5th Street

Figure 11. Plan View of Conceptual Elevated Trail and Ecotone Slope with the Street Ends of Iris Avenue and Oneonta Avenue Converted to Parks

Phase 1 would also seek to address the existing stormwater infrastructure vulnerabilities within the estuary at the bend in Grove Avenue, which can be improved through the development of a stormwater wet pond and control structure (Figure 12). Currently, this storm drain outlet in the estuary is uncontrolled, allowing tidal water to back up into the storm drain system. This results in water bubbling up in storm drain inlets in the neighborhoods during non-storm conditions (i.e., high tide events) and during storm conditions (i.e., rain events). The tidal water then backs up in the underground pipelines, reducing the carrying capacity of the storm drain system. In turn, this causes increased duration and intensity of flooding in the City because the water is not allowed to drain. The addition of stormwater improvements would treat stormwater and prevent flooding in the community.

Figure 12. Plan View for Conceptual Stormwater Wet Ponds and Control Structure

An option for Phase 1 in Segment 4 is the conversion of the Iris Avenue and Oneonta Avenue street ends into an open space area. The open space area would act as a park connector from the Seaside Point neighborhood to the estuary and trails (Figure 11). These street end park features could allow for an integrated green-gray solution to blend the elevation difference from the street to meet the proposed raised nature trail.

Phase 2 builds upon Phase 1 to extend flood protection of the enhanced boardwalk, trail, sidewalks, and paths through additional elevation. This includes raising the proposed floodwall along the east side of Seacoast Drive.

Phase 3 would address even higher levels of SLR and flooding by adding protective elements across the segment. A floodwall could be implemented along the estuary side of the elevated boardwalk, preventing flood impacts. This phase would also include adding a seawall along the living levee trail path fronting the Seaside Point neighborhood.

Monitoring Framework

The City understands the importance of monitoring data to make informed decisions. Coordinated monitoring efforts will be vital for the City to track the performance of implemented projects, detect changes in coastal conditions, generate a record of hazard impacts and maintenance activities, and inform future management strategies and adaptive pathways. Fortunately, the City can leverage existing monitoring efforts such as those performed by Scripps Institution of Oceanography (SIO), SANDAG, and the Tijuana River National Estuarine Research Reserve (TRNERR). The City has also identified key monitoring metrics that can support SLR adaptation decision making through its 2022 LCP Implementation Plan Update. The monitoring framework included in this MIP builds off these prior efforts and provides guidance on ways to simplify additional data collection needs, prioritize core metrics, and offer a cost-effective approach to catalogue observations over time.

Existing Monitoring Efforts

SIO: Flood Frequency

SIO researchers have supported better flood identification and pioneered flood forecasting techniques in Imperial Beach; thus, it is very appropriate to leverage their tools going forward. Using combined tidal conditions (predictions and observations) and wave modeling outputs, SIO has been able to determine and validate flood elevation thresholds (e.g., mild and moderate) at five different locations across the City including: Palm Avenue, Cortez Avenue, Descanso Avenue, Encanto Avenue, and the southern end of Seacoast Drive. This information is available on an SIO website, https://siocpg.ucsd.edu/data-products/coastal-focus-sites/ch-imperial-beach/ib-flood-forecast/ (Figure 13) and automated emails are generated and sent to City staff in anticipation of forecasted flood events. As flood elevations are reached, they should be tracked and catalogued by the City to determine when a threshold has been met.

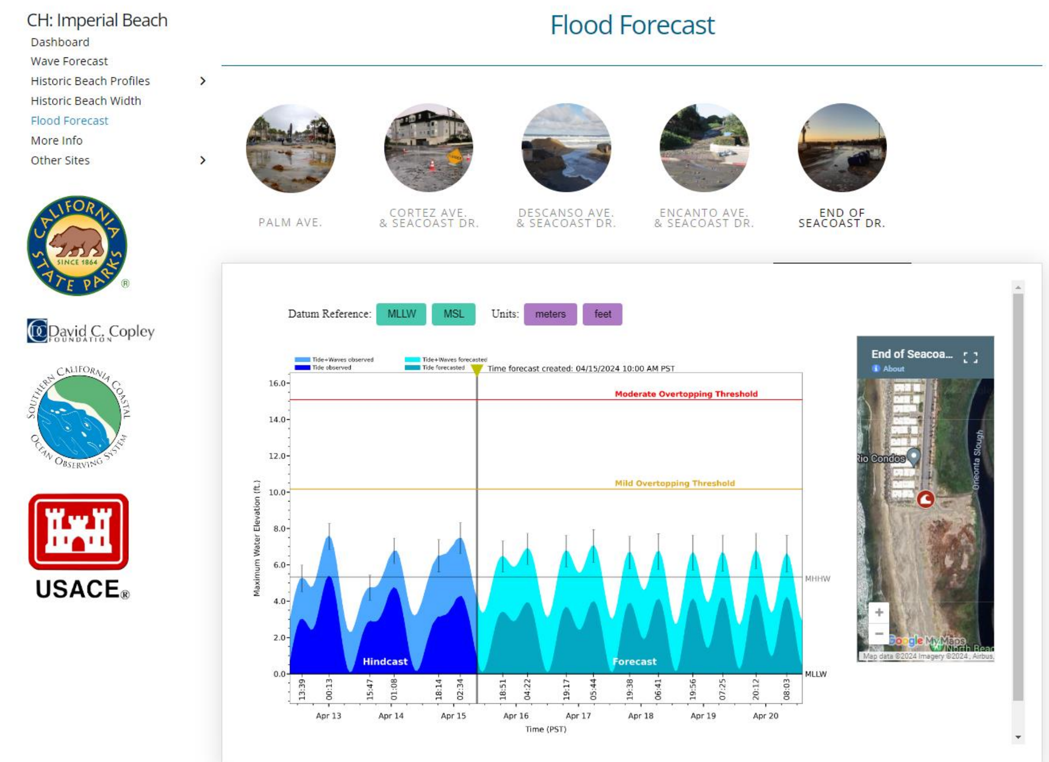


Figure 13. Example of Flood Forecast for the End of Seacoast Drive

TRNERR: Water Levels

TRNERR has managed the monitoring program of the Tijuana River Estuary since the implementation of the System-Wide Monitoring Program (SWMP) by the NOAA National Estuarine Research Reserve (NERR) in 1996. These monitoring efforts were conducted through the deployment of data loggers to capture water level data in the Tijuana River Estuary and San Diego South Bay (Figure 14). The data logger in the estuary (Station TJROSWQ) was established along the Oneonta Slough near Seacoast Drive in January 1996. The South Bay logger (Station TJRSBWQ) was established at the north end of the former salt Pond 10 in January 2008. These stations provide archived and real time local water level data. These public data resources can be leveraged to provide relevant extreme water level data to the City to track potential flood impacts from the estuary and bay. These datasets are also available in existing data access webpages managed by either TRNERR[1] or the NERR Centralized Data Management Office[2]. These webpages could be linked through a City website to provide further accessibility to this information.

[1] **https://tijuanariver.trnerr.org/OSLevels.html**;
[2]: **http://www.nerrsdata.org**

Figure 14. TRNERR SWMP Water Level Stations in (A) Tijuana River Estuary and (B) San Diego South Bay Pond 10

SANDAG and SIO: Shoreline Change

As a component of the SANDAG regional shoreline monitoring, semi-annual (i.e., twice a year) shoreline transect monitoring currently occurs in the spring and fall throughout the County of San Diego with five of these transects lying along the City of Imperial Beach[3]. Although based on data needs, only four of these transects are currently included in the SANDAG monitoring program. These transect surveys are intended to understand the seasonal and long-term changes of beach width and nearshore volume along each profile. This provides an understanding of the natural sediment processes on the City's beaches and how management efforts contribute to these shoreline changes. The continued participation in this effort allows City staff to make evidence-based decisions concerning the beach width thresholds presented in the adaptation pathways.

Shoreline change monitoring efforts are supplemented by the SIO Coastal Processes Group through their existing quarterly 'jumbo' beach and offshore surveys and monthly truck LiDAR beach surveys. The datasets extend back to 2009 and provide another comprehensive source of shoreline changes across Imperial Beach. Based on this data, historic beach widths for the open coastline of Imperial Beach are averaged over sections of the City from the Imperial Beach Pier to Camp Surf, the Pier to the end of Seacoast Drive, and south of the end of Seacoast Drive to the river mouth. Beach profiles are also provided for Palm Avenue, Cortez Avenue, Descanso Avenue, Encanto Avenue, and the end of Seacoast Drive. This data is available on SIO's website and could be linked through a City webpage. This data would further support City decisions for identifying thresholds, planning adaptation projects, and phasing.

Monitoring Plan Overview

Based off the 2016 Sea Level Rise Area Adaptation Strategy Checklist and focused upon the thresholds identified within the adaptive pathways for each project segment, a streamlined monitoring framework was developed with potential methods and data collection presented in Table 5 and outlined below by metric.

[3] Coastal Frontiers Corporation. 2023. SANDAG 2022 Regional Beach Monitoring Program Annual Report.

Table 5. Potential Monitoring Activities to Inform Proposed Adaptive Pathways

Metric	Monitoring Method	Lead	Frequency	Purpose
Flood Open Coast	Flood elevation thresholds (e.g., mild and moderate) are determined and tracked using combined tide and wave observations	SIO City	Continuous Extreme Events	Inform thresholds for Segments 2 and 3
Flood Bay/ Estuary	Water level elevation thresholds (e.g., highest observed, extreme events) are determined and observations tracked	TRNERR City	Continuous Extreme Events	Inform thresholds for Segments 1 and 4
Beach Erosion	Beach profile surveys (back beach to depth of closure) Subaerial beach surveys via photogrammetry or LiDAR	SANDAG SIO	Semi-annual Surveys Extreme Events	Inform thresholds for Segments 2 and 3
Maintenance Costs	Financial tracking of cleanup and repair activities	City	Annual	Inform future cost-benefit analysis and adaptation planning City-wide
Armoring Integrity	Structural condition inspection	City	Annual Post Extreme Events	Inform future cost-benefit analysis and adaptation planning

Flooding

Given the multiple pathways of flood vulnerability across the City, monitoring strategies are provided based on type of flooding source including bay, estuary, and open coast. Based on the current frequency of extreme flooding and overtopping observations, significant flooding thresholds were defined as the flooding of street ends, trails, and paths on at least five occasions over a 12-month period. The specific elevation to define a flood threshold will need to be determined and validated so that objective determination and tracking can be performed by the proposed monitoring methods below. In Segment 2, for example, SIO currently has mild and moderate overtopping elevations determined at the western end of Palm Avenue. Thus, the City could track the number of times the moderate flood level is reached to determine when the threshold (i.e., five times in a 12-month period) is reached to indicate the City should begin planning an adaptation project to fill in the gap and raise the elevation of that accessway.

Bay/Estuary Flooding

Using the existing water level gauges and monitoring in both the Tijuana River Estuary and San Diego Bay, flooding impacts can be tied to water level. This will allow the City to monitor and then determine when the water level exceeds that defined threshold. Additionally, further low-tech components can be integrated along public accessways to help the community observe water level changes over time. This could be implemented through landscape architectural designs (e.g., flags, signage, art, pavers, etc.) along the bikeway or trails that use a tiered color scheme to help identify water level fluctuations.

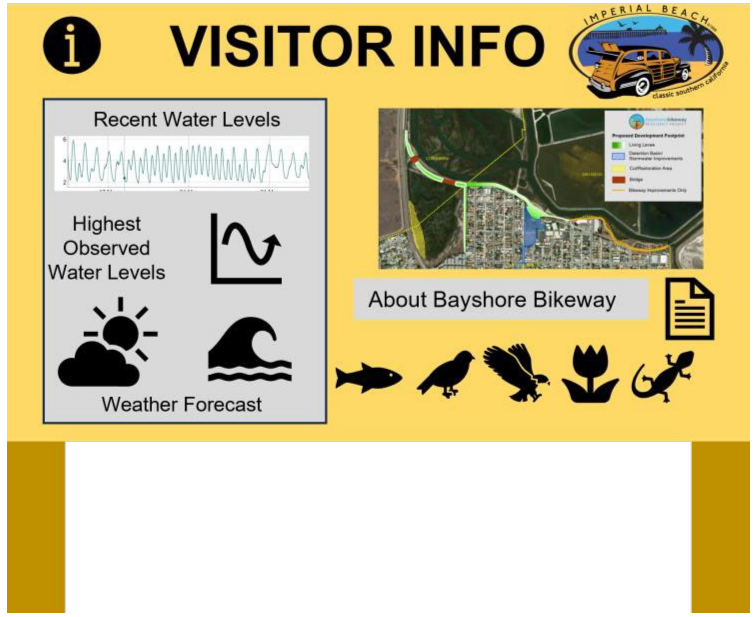
Open Coast Flooding

This metric consists of partnering with SIO to use combined tidal conditions (predictions and observations) and wave modeling outputs to track determined flood thresholds. Currently, SIO implements this system at five different locations across the City where current flood elevations have been determined including: Palm Avenue, Cortez Avenue, Descanso Avenue, Encanto Avenue, and the end of Seacoast Drive. As adaptations strategies are implemented, such as closing the gaps at a vulnerable street end, new appropriate elevations of flooding (e.g., mild, moderate) will need to be determined. These updated elevations can then be folded into the proposed methods and assist with informing when future phases of adaptation pathways may be necessary.

Beach Erosion

Given the dynamic nature of the shoreline conditions along the open coast, long-term monitoring of the beach is necessary to make informed decisions. Fortunately, there is a robust amount of historical data from existing shoreline monitoring programs that can be leveraged. As beach monitoring continues to occur from SANDAG and SIO, it will be necessary for the City to continue to receive annual reports on beach trends that can inform adaptive management pathways, such as more frequent beach nourishment activities.

Digital Bulletin Board Concept to Display
Current and Extreme Water Levels and other Interpretive Information



To further assist with identifying impacts and communicating these vulnerabilities to the public, interactive community boards could be added along the Bayshore Bikeway and at certain gathering points along the estuary trail network where real-time water level data could be displayed, as well as how it compares to extreme observations.

Citizen Science

The proposed monitoring programs can be further supplemented through anecdotal site observations and photos. To support efforts of maintaining a walkable beach, except during extreme tidal or storm events, City staff can record periods of inaccessibility by the public. This could serve as a complimentary data source to track shifting usability as beach conditions change. To reduce staff time needed for these observations, the beach can be documented through the installation of CoastSnap stations that rely on public participation to capture photos of the coastline. These could be located along the Imperial Beach Pier looking north and south to provide a full characterization of the City's shoreline. This allows photos across different seasonal and tidal conditions to be easily recorded and collected. While public accessibility is not a formal metric, the accessibility and usability of the beach is anticipated to change with increased water levels. These changes can be documented via site observations, closure tracking of key pieces of infrastructure (e.g., accessways) or through big data sources which can show usage patterns derived from cell phone data.

Maintenance Costs

Compiling ongoing cost data related to flooding events will inform trends in City expenditures and resources. These costs can include operation and maintenance of infrastructure, capital / renewal in response to events, and staffing requirements. The information will contribute to the City's financial understanding of the severity of public infrastructure and private property damage attributable to specific events. Understanding the escalating costs of coastal flooding events may help the City assign appropriate cost thresholds for the maintenance of flooding adaptation strategies. This information can support the justification for the project implementation and phasing adaptation over time. It is recommended City staff keep a ledger on annual expenditures for storm event cleanup and repair costs from various departments. This data can highlight the need for projects and provide necessary information for potential grant funding opportunities that often require a benefit-cost analysis component.

Armoring Integrity

Once projects that utilize hard armoring are implemented, such as closing gaps in accessways, it will be advantageous to monitor these features on a regular basis to track performance and any maintenance requirements. While it is anticipated that monitoring will be a requirement of permit conditions for these types of projects, at this time armoring integrity is not tied to a specific threshold in any segment. This monitoring would focus on identifying any shifting stability of the features as they are exposed to wave forces. It is also recommended that a coastal engineer or a civil / structural engineer with experience with coastal structures inspect the structure annually to assess its condition.

Conclusion

This Monitoring and Implementation Program presents potential flood resilience adaptive pathways for the City of Imperial Beach to pursue across four segments of the City's shoreline. Thresholds of coastal hazard impacts (e.g., flooding over time, beach width) are identified as points that would signal the City to begin planning and implementation of future, phased management actions along an adaptive pathway for a given asset. These adaptive pathways identify future, phased management actions that can be taken once coastal hazard impacts are observed to meet certain thresholds, helping the City planning for both the near-term (2050) and beyond.

The adaptive pathways for the four project segments are:

<u>Segment 1 - Bayside</u>: Phase 1 focuses on the creation of the Bikeway and ecotone slope to raise elevation and reduce flood impacts. Phase 2 further increases elevation of the ecotone slope and Bikeway and the consideration of incorporating a floodwall or seat wall along the estuary edge of the Bikeway.

<u>Segment 2- North Beach</u>: Phase 1 increases elevation of accessways as well as fills in any gaps to match adjacent shoreline properties. Phase 1 incorporates dunes where appropriate to further increase resilience and offer softer, nature-based solutions for flood protection. Phase 2 would also leverage the existing built environment and consider rehabilitation of the groin at Palm Avenue to its as-built condition.

<u>Segment 3: South Beach</u>: Phase 1 focuses on increasing the elevation of accessways and street ends and filling in gaps to match adjacent shoreline properties. Phase 1 also entails the designation of a feeder beach for nourishment projects that would supply sand to the rest of the City's ocean shoreline. Phase 2 would increase either the frequency and/or magnitude of beach through additional nourishment.

<u>Segment 4- Estuary</u>: Phase 1 would elevate sidewalks, trails, and the perimeter of certain roads through living levees, boardwalks, and floodwalls. It would also improve existing stormwater infrastructure inside the estuary and adjacent to Grove Avenue to treat stormwater and prevent water from backing up into the community. The Iris Avenue and Oneonta Avenue street ends present opportunities to be converted into integrated elevated parks that connect with the estuary trail. Phase 2 would raise the elevation of the protective elements along Seacoast Drive and Seaside Point neighborhood. Phase 3 would add additional flood protection though a floodwall along the elevated boardwalk on Seacoast Drive and a floodwall along the living levee trail path.

A monitoring framework was developed that leverages the existing mechanisms from external regional agencies and local partners across the City's shoreline, Tijuana River Estuary, and San Diego Bay. The proposed monitoring metrics focus on flooding, but also consider erosion, maintenance costs, and armoring integrity. The monitoring framework included in this plan builds off prior efforts and provides guidance on ways to simplify additional data collection needs, prioritize core metrics, and hopes to offer a cost-effective approach to catalogue observations over time. Given that project level designs are still in the conceptual phase, this MIP will require revisions to accommodate any design changes that may arise as concepts are refined and further engineering and environmental evaluations are conducted.

The Power of Commitment