



MEMORANDUM

October 11, 2022

TO: MEMBERS, PORT COMMISSION
Hon. Willie Adams, President
Hon. Kimberly Brandon, Vice President
Hon. John Burton
Hon. Gail Gilman
Hon. Steven Lee

FROM: Elaine Forbes 
Executive Director

SUBJECT: Informational presentation on the Draft Waterfront Adaptation Strategies

DIRECTOR'S RECOMMENDATION: Information Only – No Action Required

EXECUTIVE SUMMARY

The Port of San Francisco, in partnership with the U.S. Army Corps of Engineers and San Francisco city agencies, has developed seven Draft Waterfront Adaptation Strategies (Alternatives) (“Strategies”) based on over five years of public engagement.

This is an impactful moment for the City as we plan for the future and address risk now. San Francisco needs a vision for how we will adapt to sea level rise. The Draft Strategies are a key milestone. From these seven strategies we will identify a preferred approach to reduce flood risks from sea level rise and extreme storms and provide an opportunity to invest in and bring public benefits to San Francisco’s waterfront.

The Port of San Francisco's treasured waterfront is vulnerable to hazards, including urgent seismic risk and increasing flood risks from sea level rise. The Waterfront Resilience Program (“Program” or “WRP”) works to ensure the waterfront, and its critical regional and citywide assets, are resilient to hazards - and increasingly accessible to everyone it serves.

Since 2018, the WRP has achieved several key milestones towards developing a more resilient waterfront, including: completion of the Multi-Hazard Risk Assessment (MHRA),

launch of the U.S. Army Corps of Engineers (USACE) San Francisco Waterfront Coastal Flood Study (the “Port/USACE Flood Study” or “Flood Study”), development of Draft WRP program goals, development of seismic and flood measures, and identification of early projects for the Embarcadero Seawall.

Today’s presentation will describe the seven Draft Strategies. The Strategies are options to be evaluated that reduce flood and seismic risk along the waterfront. Following this presentation, the Strategies will be presented to the public for feedback and will be evaluated across a range of technical measures with a goal of reaching a Draft Waterfront Adaptation Plan (Tentatively Selected Plan) (“Draft Plan”) by summer 2023.

STRATEGIC OBJECTIVES

The Port’s Waterfront Resilience Program supports the goals of the Port’s Strategic Plan as follows:

Engagement

By leading an inclusive stakeholder process to develop a shared vision, principles and goals for the Waterfront Resilience Program and Flood Study and using multiple avenues for public involvement in the development and evaluation of Draft Waterfront Adaptation Strategies.

Equity

By developing a program-wide equity strategy and evaluating Draft Waterfront Adaptation Strategies through an equity lens to ensure that benefits accrue to, and burdens are minimized for Black, Indigenous, People of Color (BIPOC) communities, and by increasing the proportion of funds spent on contract services performed by LBE firms.

Resiliency

By leading the City’s efforts to address threats from earthquakes and flood risk through research and infrastructure improvements to the entire Port shoreline and adjoining buildings and other infrastructure.

Evolution

By developing adaptation options with a long-time horizon, developing strategies to adapt the waterfront and its uses over time, and recognizing that decisions made today influence the options available to future generations who will be addressing different environmental and social conditions.

Sustainability

By incorporating nature-based features into the Draft Waterfront Adaptation Strategies to enhance the quality of the Bay water and habitat with the improvements.

Productivity and Economic Recovery

Through wise investment of Proposition A Seawall Earthquake Safety Bonds and other Port and public funding sources, and by developing strategies to defend or floodproof Port maritime and industrial facilities to extend their useful life and reduce their risk from coastal flooding and sea level rise.

WATERFRONT HAZARDS

San Francisco faces earthquake and coastal flood risks today. These risks will increase in the future as sea levels rise and extreme storms become more frequent, threatening buildings, small businesses, popular attractions and open spaces, jobs, and critical services such as BART, Muni, and the wastewater system. To defend San Francisco from current and future flood risks, there is a need to adapt the shoreline to address up to 7 feet of sea level rise that is projected by 2100. Any effort aimed at long-term sea level rise resilience should also strengthen the waterfront against the urgent earthquake risk we face today.

San Francisco could start experiencing potentially costly coastal floods and seismic damages today. A major earthquake can strike at any time. To access federal and state funding opportunities, San Francisco needs to make key decisions now about how to adapt the waterfront and protect critical assets from flooding and earthquakes.

What happens along the San Francisco Waterfront impacts San Franciscans in every corner of the city. The scale of change necessary provides a once in a generation opportunity to not only defend our waterfront from flood and earthquake risks, but also to rejuvenate the waterfront, improve the City's connection to the Bay, and bring benefits such as more open space, enhanced mobility, increased safety, healthier natural systems, and jobs.

In addition to coastal flooding, the waterfront and inland areas impacted by sea level rise may also face stormwater and emergent groundwater hazards that threaten public infrastructure and private homes and businesses. Any adaptation strategies that increase shoreline resilience to coastal flooding will need to consider these other flood sources as well.

The Port is working to ensure that all resilience strategies developed create opportunities for San Francisco's historically underserved communities to engage in decision making and benefit directly through inclusive public engagement, job opportunities, and community improvements such as new open space, waterfront access, and improved mobility. Historically underserved communities, particularly in the southeast, are often hit first and worst by climate hazards such as storm and coastal flooding, impacting jobs, housing, and access to and from the community.

USACE WATERFRONT COASTAL FLOOD STUDY

The Port is collaborating with the U.S. Army Corps of Engineers (USACE) on a general investigation of flood risks to the Port's entire 7½ mile jurisdiction (the "USACE San Francisco Waterfront Coastal Flood Study" or "Flood Study"). The Flood Study is a planning-level feasibility study that will analyze coastal flood risk through 2100, identify

and evaluate adaptation strategies, conduct robust public engagement to inform the development of Revised Draft Strategies and the Draft Plan, and recommend a Final Plan based on qualitative and quantitative criteria by 2025. The Port Commission approved a Feasibility Cost-Sharing Agreement for the Flood Study on October 12, 2021.

Federal funding for flood risk mitigation is administered through USACE, making them an important partner for local and regional resilience planning. The Port is pleased to have the flood risk reduction expertise of the USACE staff in developing a Draft Waterfront Adaptation Plan (Tentatively Selected Plan) through a robust and inclusive community process that will reduce risk and include economic, social, and environmental benefits to serve the City of San Francisco.

Goals of the Flood Study are to better understand current and future flood risk, identify flood protection solutions, engage the public to identify priorities, and create opportunities for funding for flood risk reduction projects. The Flood Study assesses benefits and costs of various alternatives to determine the best plan, considering economic, social, and environmental benefits and impacts.

The Port of San Francisco's community-affirmed vision and principles for its resilience work through the Waterfront Resilience Program include broader goals. Principles include inspiring an adaptable waterfront that improves the health of the Bay, ensuring public access to the waterfront, providing opportunities for diverse families, businesses, and neighborhoods to thrive - and much more.

DRAFT WATERFRONT ADAPTATION STRATEGIES - PROCESS

Over the last nine months, the Port has worked closely with partner City agencies, USACE, resource and regulatory agencies, and community stakeholders to develop seven Draft Waterfront Adaptation Strategies.

The Draft Waterfront Adaptation Strategies are different ways for the City to create a resilient, sustainable, and equitable waterfront for the next 100 years. The Strategies are options to reduce flood and seismic risk along the Port's entire waterfront jurisdiction, from Heron's Head Park to Fisherman's Wharf, through a combination of phased large and small projects, new policies, such as flood defenses, structure elevation, floodproofing, city infrastructure adaptations (e.g., wastewater and stormwater management, transportation system), flood-resilient building codes, and land use changes.

The Strategies are a combination of construction projects and policy changes that will guide decisions about:

- Where, when, and how high to build flood defenses
- How and when to adapt key buildings and infrastructure to ensure continued operations of City services
- How to incorporate nature-based and ecological features

- Recommendations for policy changes that will best defend public and private lands, preserve and grow housing and jobs, and create recreational opportunities, waterfront access, and improved Bay habitat

To work with the schedule set out by the Flood Study Agreement, the program team will develop strategies and select a preferred plan through the following steps (see Figure 1: Draft Waterfront Adaptation Strategies Development Schedule):

1. **Develop Strategies (Spring/Summer 2022):** Develop Draft Waterfront Adaptation Strategies to bring to public and stakeholder engagement in fall 2022.
2. **Evaluate and Select (Fall/Winter 2022-2023):** Evaluate the Draft Strategies through qualitative and quantitative tools. Conduct robust public outreach and engagement to get public feedback on the Draft Strategies. Based on evaluation and public feedback, develop Revised Draft Waterfront Adaptation Strategies.
3. **Refine and Endorse (Spring/Summer 2023):** Through continued public engagement and evaluation, develop and select a Draft Waterfront Adaptation Plan (Tentatively Selected Plan) (“Draft Plan”) from the Revised Draft Waterfront Adaptation Strategies evaluated in this process.

Figure 1: Schedule through Selection of Draft Waterfront Adaptation Plan



Following selection of the Draft Plan, we will refine the plan and conduct environmental review (NEPA/CEQA) and additional public outreach and engagement. The Draft Plan will go through local and USACE review and approvals to create a Final Waterfront Adaptation Plan (Recommended Plan) by Flood Study completion in 2025.

Provided that the plan meets federal requirements that the benefits of the plan exceed its costs, USACE will present the Final Plan to the U.S. Congress for potential federal funding. If the Congress approves the Final Plan, Congress will fund up to 65% of the resulting project, providing potentially billions of dollars in federal investment in San Francisco’s waterfront.

This funding could also improve shoreline stability where USACE would fund coastal flood defenses and provide other community benefits that are part of a cost-effective

plan. The Port and City have goals to further improve seismic resilience and provide other public benefits that will not be eligible for USACE funding.

The Final Plan recommended to Congress in 2025 may differ from the Port and the City's preferences to address a higher rate of sea level rise and include additional community and seismic benefits. The additional cost of these benefits will not be cost-shared with USACE – San Francisco will need to identify funding for 100% of the cost differential between the Recommended Plan and the Locally Preferred Plan.

COMMUNITY ENGAGEMENT

The Draft Waterfront Adaptation Strategies development process builds off 5+ years of public outreach and engagement. Since 2017, the WRP has connected with tens of thousands of San Franciscans through community meetings, event tabling, waterfront boat, bike, and walking tours, mixers, online engagement like surveys and mapping exercises, and much more. Community input has helped the WRP develop its guiding vision, principles, goals, and evaluation criteria. The community has also shared what waterfront assets are key priorities as the WRP takes action to reduce seismic and flood risks.

Community feedback has strongly affirmed the Port's key focus on life safety and disaster response. The WRP heard "put people first" loud and clear. The assets and services most prioritized: housing, disaster recovery facilities, utilities, and businesses. Community members also shared a key focus on protecting transportation assets.

In developing the Draft Strategies for public review, the Port conducted additional outreach and engagement, including a city-wide survey and focus groups with leaders of community-based organizations ("CBOs") and Port Advisory Committee members. The survey presented five examples of how other cities made changes to address the flood risks they faced. The survey reached nearly 1,000 people across the waterfront and city and feedback indicated an openness to explore the many types of adaptation approaches (including more transformative options), a desire to preserve and expand the connection between the City and the waterfront, and concerns about feasibility, cost, and disruption impacts. Community members were interested in learning specifics about where along the waterfront each precedent could/would be used.

We held five focus group meetings since mid-August to get feedback on the Draft Adaptation Strategies along with how best to communicate such complex material. Feedback from focus group attendees was integral to updating our communications strategies, including simplifying content, clarifying what happens in 2040 and 2090, and focusing on each Strategy's challenges and opportunities.

Key themes that arose from the survey and focus groups were consistent with WRP community feedback to-date, including:

- Increasing space for open space / parks /diversity of uses
- Prioritizing nature / habitat
- Prioritizing accessibility to the waterfront
- Limiting disconnection with the waterfront

- Mitigating displacement / equity concerns
- Aesthetic concerns

Additional key themes for future communications and engagement include:

- Feasibility (political, geographical, maintenance and otherwise)
- Clarifications on cost and length of construction time and disruption to neighborhoods
- Exploration of workforce impacts and job creation possibilities
- City-wide response to sea level rise – communicating what happens beyond the Port’s jurisdiction

Beginning in fall 2022, we will be sharing and inviting public feedback on the Draft Strategies to inform development of the Draft Plan. The goals for this phase of outreach are:

- Share the Draft Strategies through accessible and inviting language, graphics/illustrations, and presentations to communicate waterfront hazards. Show how community feedback to date has informed the development of the Draft Strategies and present the range of options for addressing risks.
- Gather public input on key components of the Draft Strategies to help guide the Planning Team’s work in developing Revised Draft Strategies, in combination with technical evaluation, by Spring 2023, and the Draft Plan by Summer 2023.
- Prioritize outreach in the Central and Southern Waterfront neighborhoods (zip codes 94107, 94110, 94124, 94134) as well as to historically underrepresented groups.
- Continue engagement of CBOs who have been part of previous WRP outreach while also encouraging participation from those who may be sharing input for the first time.

We will be engaging the public using a variety of traditional and innovative public outreach and engagement methods, including:

- Digital Survey via StoryMaps
- Community Workshops (digital and in-person)
- CBO Presentations via Focus Group Participants
- Walking Tours
- Waterfront Community Mixer in District 10
- Community Partner Feedback Conversations
- A public education campaign via earned media, social media, community presentations, and web content.

DRAFT WATERFRONT ADAPTATION STRATEGIES

The Port, working with City agencies and USACE, have developed seven Draft Waterfront Adaptation Strategies (Alternatives). Each strategy varies in how it is applied to different parts of the waterfront. The Draft Strategies include:

- **Strategy A NO ACTION:** Takes no actions to reduce flood risks beyond projects that are already approved.

- **Strategy B NONSTRUCTURAL OPTION:** Moves people and assets away from the risk, uses nonstructural measures (such as floodproofing) to reduce risks, and allows water to go where it wants rather than constructing traditional structural solutions.
- **Strategy C LOWER SEA LEVEL RISE:** Adapts the shoreline to withstand 1.5' of sea level rise by 2040 using a combination of structural and nonstructural measures.
- **Strategy D LOWER SEA LEVEL RISE - ADAPTABLE:** Adapts the shoreline to withstand 1.5' of sea level rise by 2040, with the possibility of building higher by 2090.
- **Strategy E HOLD THE LINE:** Preserves a waterfront that looks and functions much as it does today by adapting the shoreline.
- **Strategy F MANAGE THE WATER:** Creates an active system for managing flooding by heavily relying on machinery.
- **Strategy G ALIGN WITH WATERSHEDS:** Advances shoreline adaptation while working with natural inland flooding patterns to floodproof some buildings and infrastructure and move others away from highest risk areas.

See Exhibit B for full descriptions of the Draft Strategies.

Figure 2. Sea Level Rise Adaptation Level by Strategy

Strategies		Sea Level Rise (SLR) Level		
		+1.5'	+3.5'	+7'
Strategy A	No Action			
Strategy B	Nonstructural Option	✓	✓	✓
Strategy C	Lower Projected Sea Level Rise	✓		
Strategy D		✓	✓	
Strategy E	Higher Projected Sea Level Rise	✓	✓	✓
Strategy F		✓	✓	✓
Strategy G		✓	✓	✓

The seven Draft Waterfront Adaptation Strategies use different approaches to reduce the flood risk and increase flood resilience, while managing the complex combination of coastal, stormwater, and rising groundwater hazards. While each strategy is different, all strategies aim to:

- Reduce the risks from sea level rise and coastal flooding
- Improve life safety outcomes and the City's disaster response capabilities

- Bring other public benefits
- Consider storm surge and wave action associated with extreme storms

The Draft Strategies represent different approaches to addressing the same risks and to identify a cost-effective approach to risk reduction. The intent is not to choose one - rather, it is to use the best ideas from all of them to create a Draft Waterfront Adaptation Plan.

The Draft Strategies use sea level rise projections through the end of the century, which are based on global climate modeling. We do not know exactly what will happen in 2040 and 2090 because a lot depends on the earth's response to a warming climate and our global ability to reduce greenhouse gas emissions. Most global climate models are closely aligned until mid-century. By the end of the century, sea level rise projections are less certain, creating a range of future sea level rise projections to consider.

Strategy A (No Action) represents a baseline for comparison to evaluate the costs and benefits of all other strategies. This strategy is needed to set the benchmark for comparison of costs, benefits, and environmental and social impacts, as well as policy evaluation for the Draft Waterfront Adaptation Strategies.

Strategy B moves people and assets away from the risk, uses nonstructural measures (such as floodproofing) to reduce risks and allows water to go where it wants rather than constructing traditional structural solutions. In Strategy B, buildings and critical city systems could be floodproofed, raised in place, or relocated so that they are not damaged when flood waters enter the area.

Two strategies (Strategies C and D) address lower rates of sea level rise than is typically considered for local and State projects to understand the risks, costs, and benefits of a smaller scale of intervention.

- Strategies C and D use a lower projected rate of sea level rise - assuming 1.5 feet of sea level rise could occur by 2100.
- Strategies C and D adapt to 1.5 feet of sea level rise in 2040, and Strategy D provides the ability to adapt to 3.5 feet of sea level rise if a higher rate of sea level rise occurs.
- Strategies C and D propose less change and adaptation across the waterfront. They adapt the shoreline to lower rates of sea level rise to address all flooding risk associated with that lower projection.

Three strategies (Strategies E, F, and G) use a higher projected rate of sea level rise, consistent with State and local guidance, to understand the risks, costs, and benefits of protecting to a higher rate of sea level rise.

- Strategies E, F, and G assume sea levels could rise between 3.5 feet and 7 feet by 2100 - they adapt to 3.5 feet in 2040 and can be adapted for up to 7 feet if even higher rates of sea level rise occur.
- Strategies E, F, and G propose more change and adaptation across the waterfront. They adapt the shoreline to higher rates of sea level rise to address all flooding risk associated with that higher projection.

All Draft Strategies are shown at two timeframes – 2040 and 2090. The choices we make to adapt the waterfront for 2040 will open different adaptation pathways to prepare for 2090. These dates are for planning purposes only – once a Draft Plan is selected, we will develop more detailed implementation pathways and timeframes.

The Port is starting with a range of strategies, some more transformative than others, so we can devise the best plan. We are seeking deep public engagement to help create the Revised Draft Strategies and the Draft Plan by summer 2023.

NEXT STEPS

Draft Waterfront Adaptation Strategies are ready for public feedback now and the Port and USACE will be gathering feedback on these now through early 2023. The Port and USACE are evaluating all these strategies to understand their costs and benefits. Each will be developed to a greater level of design and engineering detail to more accurately capture the benefits and cost of each strategy.

Additionally, staff will conduct detailed race and social equity assessment to center community voices, ensure that benefits accrue, and burdens are minimized to BIPOC (Black, Indigenous, and People of Color) communities, and that the preferred strategy considers community input. The equity assessment will develop a framework to comprehensively consider the equity implications of each strategy, in terms of how they benefit and burden BIPOC and other communities of concern (such as seniors, youth, LGBTQ populations, and people with disabilities). The Project Team has been developing the draft equity evaluation framework in collaboration with an Equity Working Group made up of a breadth of equity practitioners from the Port, City Agency leadership, and Consultant team.

Based on this evaluation and public feedback, we will present Revised Draft Waterfront Adaptation Strategies (Alternatives) (“Revised Draft Strategies”) in spring 2023 for additional public feedback. From the set of Revised Draft Strategies, we will select a Draft Waterfront Adaptation Plan (Tentatively Selected Plan) that will be further developed and go through environmental review (NEPA/CEQA review) through 2025.

Today staff seeks to inform and get initial feedback from the Port Commission about the Draft Strategies and the public engagement process. We are excited to release the Draft Waterfront Adaptation Strategies and advance them to a Draft Waterfront Adaptation Plan, in collaboration with our City and Federal partners, to meet the Port Commission’s goals under the Port’s Strategic Plan and to ensure the waterfront is resilient to flood and other hazards.

Prepared for: Brad Benson, Waterfront Resilience Director
Prepared by: Adam Varat, Deputy Waterfront Resilience Program
Manager – Planning

Exhibits

Exhibit A: Waterfront Resilience Program Background and Work to Date

Exhibit B: Summary Fact Sheets of Draft Waterfront Adaptation Strategies

Exhibit A: Waterfront Resilience Program Background and Work to Date

The Port of San Francisco's treasured waterfront is vulnerable to hazards, including urgent seismic risk and increasing flood risks from sea level rise. To protect this resource - from the iconic landmarks, cultural and art destinations, and beautiful open spaces connected to the Bay, to the diverse maritime industries and businesses, and key emergency, transportation and utility infrastructure, the Port has established the Waterfront Resilience Program ("Program" or "WRP"). The Program works to ensure the waterfront, and its critical regional and citywide assets, are resilient to hazards - and increasingly accessible to everyone it serves.

In 2018, the San Francisco Board of Supervisors proposed Proposition A Seawall Earthquake Safety Bonds. San Francisco voters approved this bond with a margin of 83-17% at the November 6, 2018 election. At the time, the Port and the City acknowledged that Proposition A was a vital down payment to address seismic and flood risks along the waterfront.

In 2020, the Port released the results of the Embarcadero Seawall Multi-Hazard Risk Assessment (MHRA) to examine the impacts to Port, City, regional and privately-owned assets and infrastructure from a variety of potential seismic and flood events for the 3 miles of Embarcadero Seawall, from Fisherman's Wharf to Mission Creek. The MHRA was presented to the Port Commission on September 22, 2020¹.

The WRP has developed 23 early projects to address the most urgent earthquake safety, disaster response, and coastal flood risks within the Embarcadero Seawall portion of the waterfront. The program team present these early projects to the Port Commission on December 14, 2021². These early projects are near-term investments such as seismic retrofits, improvements to disaster response facilities, shoreline stability and near-term flood risk reduction projects. Early projects can be delivered with Proposition A funding, federal and state grants, investments by long-term tenants or through public-private partnerships, City agencies capital programs, and the Port through its Capital Improvement Program.

WRP staff presented an update on Embarcadero Early Projects at the September 13, 2022, Port Commission meeting. Six projects have completed Needs Assessment Reports and are starting Alternatives Analysis, the second of three pre-design steps used in the Program. Recommendations to advance first projects into detailed design are expected in 2023 and construction is expected to start before the end of 2024.

The Port completed an Initial Southern Waterfront Earthquake Assessment, which compiled existing information, highlighted information gaps, and identified potential

¹ September 22, 2020 Staff Report:

<https://sfport.com/meetings/san-francisco-port-commission-september-22-2020>

² December 14, 2021 Staff Report:

<https://sfport.com/meetings/san-francisco-port-commission-december-14-2021>

seismic hazards and vulnerabilities based upon limited analysis and professional judgment. The findings of the Initial Southern Waterfront Earthquake Assessment were presented to the Port Commission in September 2022, along with next steps that include two projects that begin to address seismic hazards in the southern waterfront. Findings from this assessment have also informed the development of Adaptation Strategies in the southern waterfront.

Exhibit B: Summary Fact Sheets of Draft Waterfront Adaptation Strategies

Draft Waterfront Adaptation Strategies

The Port of San Francisco, in partnership with the U.S. Army Corps of Engineers and San Francisco city agencies, has developed seven Draft Waterfront Adaptation Strategies based on over five years of public engagement. Draft Adaptation Strategies are ready for public feedback, with a goal of reaching a Draft Waterfront Adaptation Plan (Tentatively Selected Plan) by summer 2023. Learn more at sfport.com/wrp/waterfront-adaptation.

Overview of All Seven Draft Waterfront Adaptation Strategies

Adaptation Strategies are different ways for the City to create a resilient, sustainable, and equitable waterfront for the next 100 years. Each one is a combination of construction projects and policy changes that will guide such decisions as where, when, and how high to build flood defense and how and when to adapt key buildings and infrastructure to ensure continued operations of City services.

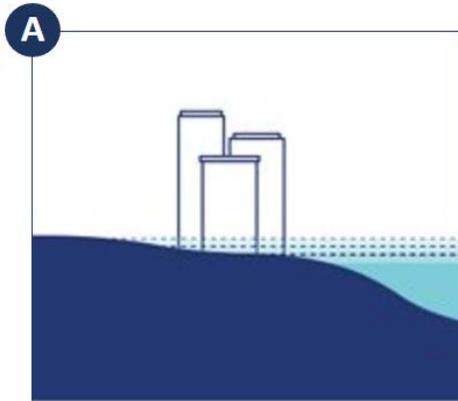
Draft Waterfront Adaptation Strategy Summary				
Strategies		+1.5' Sea Level Rise	+3.5' Sea Level Rise	+7' Sea Level Rise
A – No Action	No Action			
B – Nonstructural Option	Nonstructural Option	✓	✓	✓
C – Lower Sea Level Rise	Lower Projected Sea Level Rise	✓		
D – Lower Sea Level Rise – Adaptable		✓	✓	
E – Hold the Line	Higher Projected Sea Level Rise	✓	✓	✓
F – Manage the Water		✓	✓	✓
G – Align with Watersheds		✓	✓	✓

The Port Wants to Hear from You!

Public feedback on the Draft Waterfront Adaptation Strategies will support inform further strategy development, with a goal of reaching a Draft Waterfront Adaptation Plan (Tentatively Selected Plan) by summer 2023.

There is no single approach to adaptation that will meet the needs of San Francisco along the entire waterfront. The different risks, topography, and historic development of the waterfront means that we will need to use a combination of approaches. The intent is not to choose one but to use the best ideas from all of them to create a Draft Waterfront Adaptation Plan.

Visit sfport.com/wrp/our-waterfront for more information about upcoming community events.



Strategy A – No Action

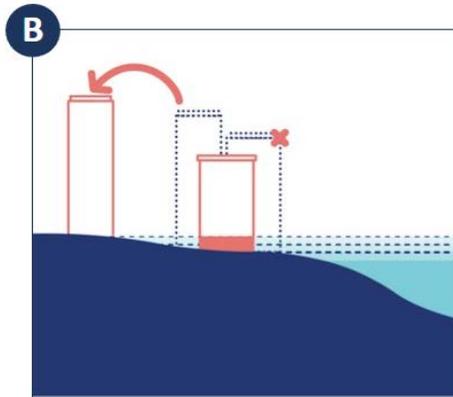
Strategy A represents a baseline for comparison to evaluate the costs and benefits of all other strategies. This strategy is needed to set the benchmark for comparison of costs, benefits, and environmental and social impacts, as well as policy evaluation for the Draft Waterfront Adaptation Strategies.

Taking no action would not reduce the risk of coastal flooding that could begin to cause economic damages and interruptions to private property and public assets and impact transportation corridors, the performance of wastewater and stormwater system, and the stability of the electrical grid. Our coastal modeling shows the potential for significant and unacceptable flood damages beginning as early as 2030 with no action.

A Future with No Action

Many areas of the shoreline would be overtopped by frequent “high tide flooding” in the absence of large storms. This would occur first in the water months when King Tides – the year’s highest tides – could flood roadways causing road and transit closures. In the long-term, low-lying areas would be subjected to more prolonged flooding, damage, and disruption. Eventually low-lying areas could be flooded every day by the rise and fall of the Bay tides. Over time, this is projected to result in lower quality of life, lowered property values, and the displacement of businesses, jobs, and homes.

Some public and private projects that are already underway or are planned for the future would address sea level rise in those areas (such as Mission Rock and Pier 70 or Islais Creek/3rd Street Bridge), but these are targeted efforts that address a very small portion of a much larger problem. A No Action strategy highlights why it is important to begin addressing flooding concerns now through adaptation planning, to reduce the risk of these impacts occurring.



Strategy B – Nonstructural Option

In Strategy B, buildings and critical city systems could be floodproofed, raised in place, or relocated so that they are not damaged when flood waters enter the area. As sea levels rise over time, areas of the city that could flood frequently may be good candidates for managed retreat where people and assets are moved out of harm's way to avoid recurring damage and disruption.

Strategy B includes actions to accommodate floodwaters within the city while reducing the likelihood of damage and severity of disruption. This strategy would provide federal and local funding to assist property owners and the city to floodproof, modify, or remove buildings and infrastructure to reduce the risk of flood damages as sea levels rise.

A Future with the Nonstructural Option

As sea levels rise over the next century, changing flood risks would be monitored and evaluated. As flood risks change:

Areas of the city with a higher risk of flooding may be managed for responsible retreat.

Buildings and critical city systems with a lower risk of flooding will be flood-proofed or modified to reduce the potential for flood damage when flooded.

Areas of retreat could be adapted with nature-based features to reduce flood risks for more inland areas, such as reducing the intensity of wave hazards. Inland areas of the city may include policy changes to allow increased housing density and business relocations to allow businesses, jobs, and people to remain in San Francisco. Essential utilities, such as wastewater, water, and the electric grid would be relocated or modified to continue providing service for the inland areas of the city. Major transportation and transit corridors could be elevated on causeways to reduce the potential for disruption.

Although new construction and utility relocations would consider seismic risks, consistent with state and local building codes, the seismic risks associated with the aging Embarcadero Seawall and other shoreline infrastructure would not be comprehensively addressed. However, seismic risks will be reduced in areas of retreat.

Examples of Nonstructural Options



Warning systems



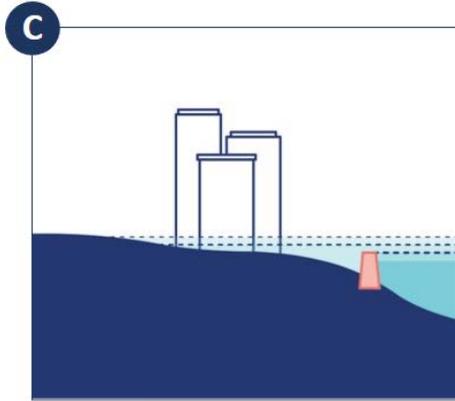
Floodproofing



Raise structure in place



Buyouts



Strategy C – Lower Sea Level Rise

Strategy C addresses lower rates of sea level rise than is typically considered for local and state projects in order to understand the costs and benefits of a smaller scale of interventions.

Strategy C addresses flooding in all areas where 1.5 feet of sea level rise introduces coastal flood risks. These areas are typically in the lowest lying areas along the waterfront, including Fisherman’s Wharf, Ferry Building area, Mission Creek, Terry Francois Blvd, Warm Water Cover, Islais Creek, and Piers 80-90.

Some areas of the shoreline would include nature-based solutions and natural features that can reduce flood risks, while also enhancing Bay ecology and habitat. This strategy would only involve one construction period, so future actions to adapt to a higher rate of sea level rise would need to go through the planning and approvals process if needed.

The flood defense measures would not be adaptable to higher rates of sea level rise. Foundations would not be sized to support a future adaptation construction period. Measures such as floodwalls would be prioritized as they are less expensive and easier to implement if future adaptability is not required. Although the floodwalls would consider seismic risks, consistent with state and local building codes, the seismic risks associated with the aging Embarcadero Seawall and other shoreline infrastructure would not be comprehensively addressed.

Strategy C Flood Defenses in 2040



Strategy C 2040 Flood Defenses Across the Waterfront

Islais Creek / Bayview

- Raise creek shorelines in the lowest-lying locations to defend against 1.5 feet of sea level rise
- Enhance public access and wildlife habitat along the northern, inner shoreline of Islais Creek.
- Raise the southern facing Piers 80 and 96 edges and use deployable flood defense structures to maintain maritime access and uses.

Mission Creek / Mission Bay

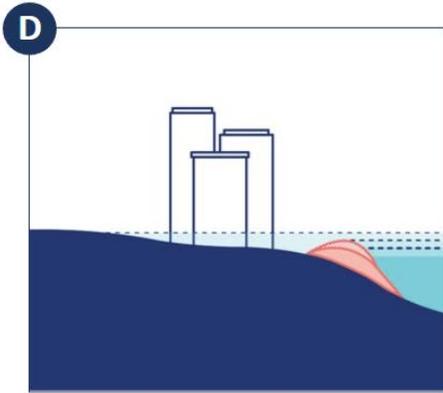
- Raise creek shorelines to defend against 1.5 feet of sea level rise
- Enhance public access and wildlife habitat along the southern shoreline of Mission Creek.
- Raise the bay shoreline and use deployable flood defense structures to maintain maritime access and uses at limited locations between planned development projects.

Embarcadero

- Raise the bay shoreline and use deployable flood defense structures to protect against 1.5 feet of sea level rise from the Bay Bridge to Pier 7, and near Pier 45. Deployable structures will maintain maritime access and uses at some locations.

Strategy C Flood Defenses in 2090

No long-term actions are included. The flood defense measures would not be adaptable to higher rates of sea level rise; so future actions to adapt to a higher rate of sea level rise would need to go through the planning and approvals process if needed.



Strategy D – Lower Sea Level Rise

Strategy D addresses lower rates of sea level rise than is typically considered for local and state projects in order to understand the costs and benefits of a smaller scale of interventions. Strategy D addresses the lowest-lying areas of risk, but the flood risk reduction actions are designed to be adaptable to a higher rate of sea level rise in the future. The flood risk reduction actions consider opportunities to enhance waterfront access and open space, maintaining Bay views and waterfront access.

Some areas of the shoreline would include nature-based solutions and natural features that can reduce flood risks, while also enhancing Bay ecology and habitat. This strategy addresses some earthquake risks in the areas with actions, but the seismic risks associated with the aging Embarcadero Seawall and other shoreline infrastructure would not be more comprehensively addressed until the adaptation phase closer to 2090. This strategy could include raising some roadways, bridges (e.g., Third Street), and rail lines by 2090.

Strategy D Flood Defenses in 2040



Strategy D 2040 Flood Defenses Across the Waterfront

Islais Creek / Bayview

- Raise creek shorelines in the lowest-lying locations to defend against 1.5 feet of sea level rise
- Enhance public access and wildlife habitat along the northern, inner shoreline of Islais Creek.
- Raise the southern facing Piers 80 and 96 edges to maintain maritime uses.

Mission Creek / Mission Bay

- Raise creek shorelines to defend against 1.5 feet of sea level rise
- Enhance public access and wildlife habitat along the southern shoreline of Mission Creek.
- Raise the bay shoreline and maintain maritime access and uses at limited locations between planned development projects.

Embarcadero

- Raise bay shoreline to defend against up to 3.5 feet of sea level rise at limited locations, including from the Bay Bridge to Pier 7, and near Pier 45. Deployable structures will maintain maritime access and uses at some locations.

Strategy D Flood Defenses in 2090



Strategy D 2090 Flood Defenses Across the Waterfront

Islais Creek / Bayview

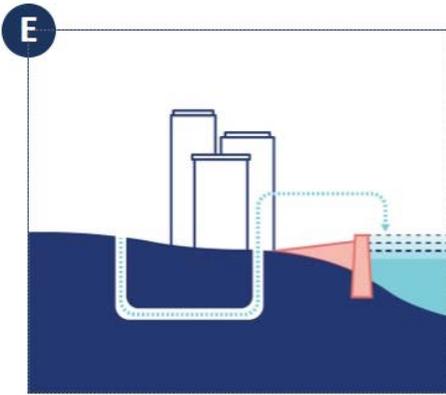
- In the long term, 2090 and beyond, implementation of Strategy D in Islais Creek / Bayview, would raise the shoreline protections to defend against up to 3.5 feet of sea level rise and include additional shoreline protection structures to provide shoreline wide flood protection.

Mission Creek / Mission Bay

- In the long term, 2090 and beyond, implementation of Strategy D in Mission Creek / Mission Bay, would raise the shoreline protections to defend against up to 3.5 feet of sea level rise.

Embarcadero

- In the long term, 2090 and beyond, implementation of Strategy D in the Embarcadero, would include additional shoreline protections to protect the remaining shoreline area against up to 3.5 feet of sea level rise.

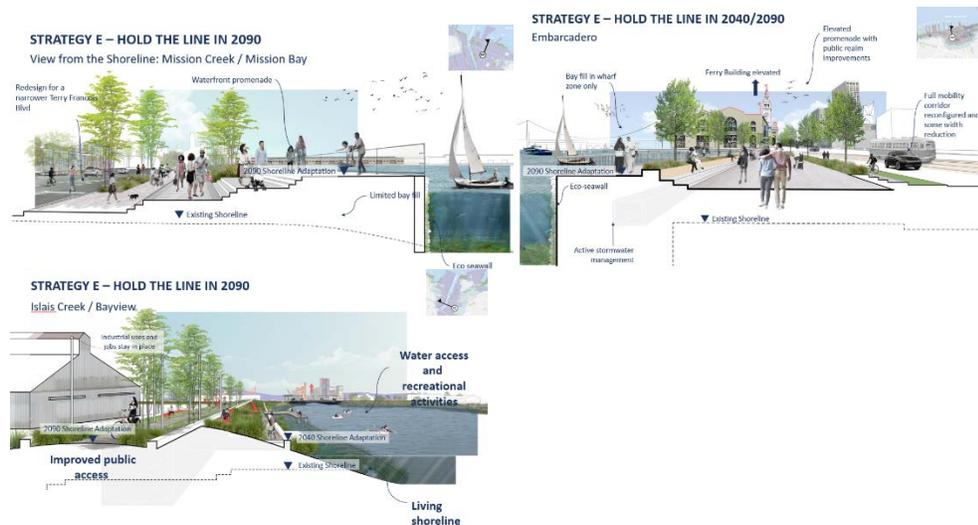


Strategy E – Hold the Line

Strategy E preserves a waterfront that looks and functions much as it does today by adapting the shoreline. This strategy addresses the flood risk associated with 3.5 feet of sea level rise in 2040 and up to 7 feet in 2090.

This strategy includes raising some roadways, bridges (e.g. Third Street), and rail lines and adding targeted areas of bay fill in constrained ideas. It relies primarily on the construction of engineered shoreline flood defense structures along the current shoreline alignments. It also incorporates large and numerous stormwater pump stations to reduce the risks of inland stormwater flooding.

This strategy emphasizes the public’s feedback that the waterfront be preserved as close to how it is today, minimizing the visible changes people might see.



The strategy considers opportunities to enhance waterfront access and open space, including maintaining Bay views and waterfront access. Nature-based solutions and natural features would be maximized along the shoreline, including features that reduce flood risk, and features that can enhance Bay ecology and habitat.

Strategy E Flood Defenses in 2040



Strategy E 2040 Flood Defenses Across the Waterfront

Islais Creek / Bayview

- Raise the bay and creek shorelines to defend against 3.5 feet of sea level rise.
- Enhance public access and wildlife habitat along the inner portion of Islais Creek.
- Build infrastructure to pump away stormwater and groundwater flooding.
- Raise bridges, roads, and transit connecting to Third and Illinois Streets over the creek to 7 feet of sea level rise.

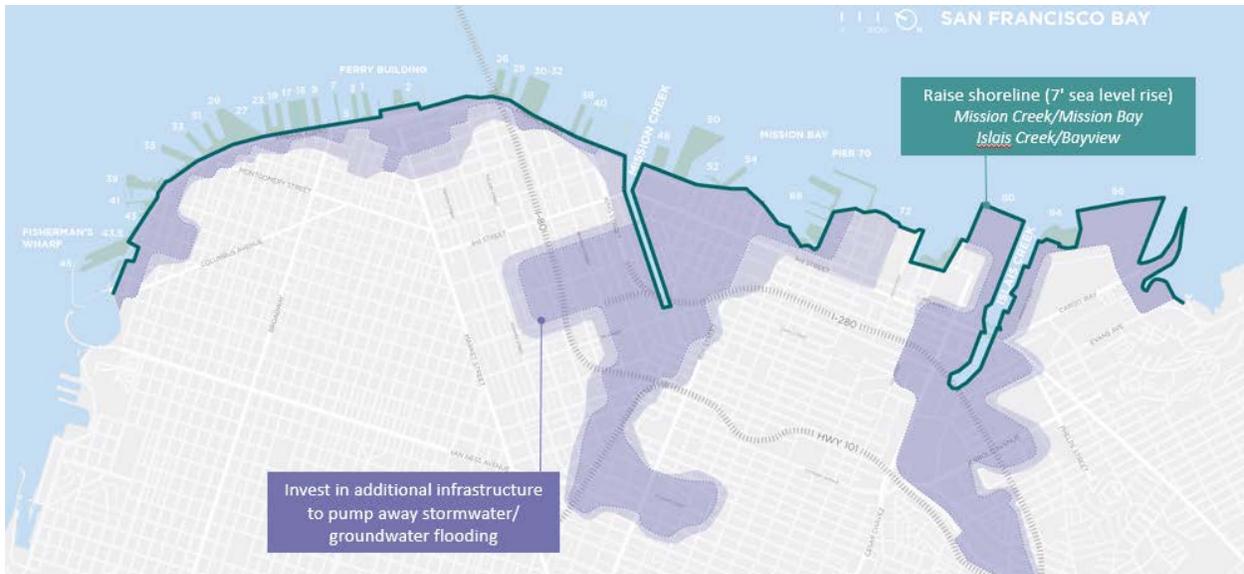
Mission Creek / Mission Bay

- Elevate the bay and creek shorelines to defend against 3.5 feet of sea level rise.
- Buildings and infrastructure would be kept in place. These changes would require raising the historic bridges on Third and Fourth Streets over Mission Creek, as well as connected roads and rail lines.
- Strategy E would include construction of pump stations at the mouth of Mission Creek to manage stormwater and groundwater flooding. This new infrastructure would require ongoing maintenance.

Embarcadero

- Build a coastal flood defense system to defend against 7 feet of sea level rise.
- Elevate the Ferry Building and Embarcadero promenade. Fully redesign the Embarcadero roadway to meet the elevated promenade.
- Add targeted bay fill in the wharf zone only.
- Along the Embarcadero, because of difficulty and disruption of a major construction project, shoreline adaptations would build to be adaptable to up to 7 feet of sea level rise in 2040, so it wouldn't need to be rebuilt again later. Additional adaptations could be made if needed.
- Build pump stations to manage stormwater and groundwater flooding.

Strategy E Flood Defenses in 2090



Strategy E 2090 Flood Defenses Across the Waterfront

Islais Creek / Bayview

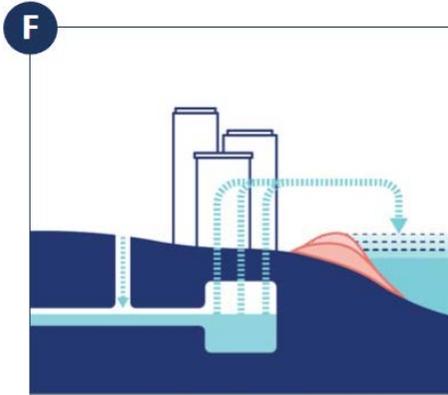
- Raise the shoreline protections higher to defend against up to 7 feet of sea level rise.
- Invest in additional infrastructure to pump away stormwater and groundwater flooding.
- Buildings and infrastructure would be kept in place, including Port operations and jobs. This would require building significant new infrastructure including pump stations to manage stormwater and groundwater to reduce flooding within the city. This new infrastructure would require ongoing maintenance.
- Both raising the roadway and connected transportation network and building new stormwater infrastructure would require significant cost and construction in addition to the cost of the flood defense infrastructure.

Mission Creek / Mission Bay

- In the long term, 2090 and beyond, implementation of Strategy E in Mission Creek / Mission Bay, would raise the shoreline protections to defend for up to 7 feet of sea level rise.

Embarcadero

- Shoreline adaptations would be built to defend against up to 7 feet of sea level rise in 2040, so no long-term actions would be needed.



Strategy F – Manage the Water

Strategy F creates an active system for managing flooding by heavily relying on machinery. This strategy addresses the flood risk associated with 3.5 feet of sea level rise in 2040 and up to 7 feet in 2090.

Strategy F would transform some parts of the waterfront to enable active flood response management via some land use changes and shoreline alignments and through construction of tide gates on Mission and Islais creeks. New tide gates and Mission and Islais creeks would keep coastal floodwaters out, creating engineered lagoons with pumps that could hold stormwater and groundwater to actively manage water. By 2090, Strategy F would require floodproofing and accommodation on industrial and commercial land uses east of Illinois Street. No residential uses are changed. These areas would require flood monitoring and warning systems.

This strategy emphasizes the public’s feedback that we develop innovative solutions to comprehensively plan for future flooding due to climate change. Nature-based solutions and natural features would be maximized along the shoreline, including features that can reduce flood risks, and features that can enhance Bay ecology and habitat.



Strategy F Flood Defenses in 2040



Strategy F 2040 Flood Defenses Across the Waterfront

Islais Creek / Bayview

- Elevate bay shorelines to defend against 3.5 feet of sea level rise.
- Construct a tide gate across Islais Creek east of Illinois Street to defend against up to 7 feet of sea level rise and manage flooding. Tide gates are structures across a waterway that can be closed to reduce flood risk during storm events or extreme high tides. It would be built east of Illinois Street bridge to limit coastal flooding and create a lagoon to capture stormwater and prevent stormwater and groundwater flooding. The water level in this constructed lagoon could be lowered ahead of major storms, to make room for stormwater and prevent flooding.
- The tide gate would mean that the roads, bridges, and shoreline edges of the inner portion of Islais Creek would not have to be raised.
- Port operations and working lands would be raised and adapted to 3.5' of sea level rise. Buildings and infrastructure would be kept in place, including Port operations and jobs.

Mission Creek / Mission Bay

- Elevate the bay shoreline to defend against 3.5 feet of sea level rise.
- Construct a tide gate across Mission Creek east of Third Street to defend against up to 7 feet of sea level rise and manage flooding. Tide gates are structures across a waterway that can be closed to reduce flood risk during storm events or extreme high tides. It would be built east of the Third Street Bridge (Lefty O'Doul Bridge) to limit coastal flooding and create a lagoon to capture stormwater and prevent stormwater and groundwater flooding.
- The tide gate would mean the roads, bridges, and shoreline edges of the inner portion of Mission Creek would not have to be raised.

Embarcadero

- Build a coastal flood defense system to defend against 7 feet of sea level rise.
- Strategy F would maintain the Ferry Building at its existing location and elevation, as the shoreline would be elevated bayward of the Ferry Building.

- Strategy F would include a generous pedestrian promenade on two levels and would not require roadway narrowing on the Embarcadero.
- Reconfigure northbound lanes only of the Embarcadero roadway to meet the elevated promenade.
- The shorelines would be extended into the Bay with some bay fill to provide adaptation space, make room for sewer infrastructure and limit impacts to the roadway.
- Build pump stations to manage stormwater and groundwater flooding.

Strategy F Flood Defenses in 2090



Strategy F 2090 Flood Defenses Across the Waterfront

Islais Creek / Bayview

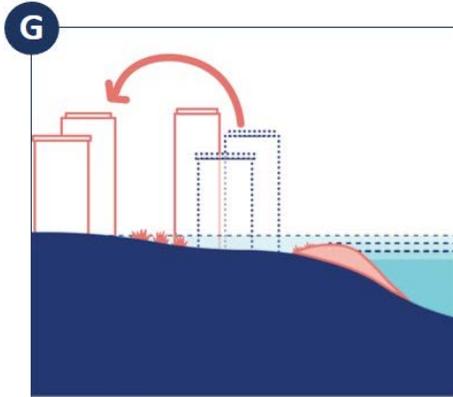
- Build coastal flood defense along Illinois Street and Amador Way, connecting to the tide gate, to defend against 7 feet of sea level rise.
- Raise and adapt Port working lands and vulnerable industrial zones to withstand 7 feet of sea level rise.

Mission Creek / Mission Bay

- Build a coastal flood defense along Illinois Street and Terry Francois Boulevard, connecting to the tide gate, to defend against 7 feet of sea level rise.
- As land in Mission Bay subsides and sea levels rise, it would become a neighborhood below sea level. A flood management district would be created that includes canals, basins, and pumping for stormwater and groundwater. The district would manage tidal gates and lagoons to minimize coastal and stormwater flooding to the district.

Embarcadero

- Shoreline adaptations would be built to defend against up to 7 feet of sea level rise in 2040, so no long-term actions would be needed.

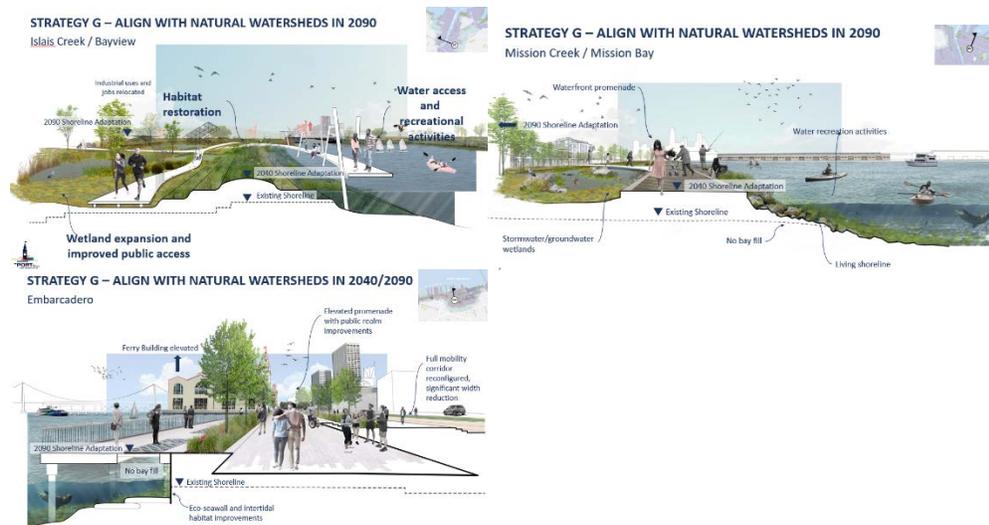


Strategy G – Align with Watersheds

Strategy G advances shoreline adaptation while working with natural inland flooding patterns to floodproof some buildings and infrastructure and move others away from the highest risk areas. This strategy addresses the flood risk associated with 3.5 feet of sea level rise in 2040 and up to 7 feet in 2090.

Strategy G would be the most transformative to parts of the waterfront over the long term. It would enable the City to rely more on natural drainage rather than large pumping systems. For several decades, it would mostly defend the existing shoreline, except on Port working land which would be adapted to flooding. This strategy emphasizes the public’s feedback that we work with nature to address past environmental harms. This approach would begin to restore historic natural watersheds at the creeks.

Over the long term, it would establish new open spaces and wetlands, but would require relocating or adapting some buildings and jobs. It would entail big changes to transportation infrastructure and have a substantial construction impact but provide a wider breadth of adaptation options for future generations.



Strategy G Flood Defenses in 2040



Strategy G 2040 Flood Defenses Across the Waterfront

Islais Creek / Bayview

- Elevate the bay and creek shorelines to defend against 3.5 feet of sea level rise.
- Consolidate Port operations inland and adapt to flooding, connecting to water via piers, allowing improved shoreline open space and habitat.
- Raise bridges, roads, and transit connecting to Third and Illinois Streets over the creek channel.
- This strategy requires developing a comprehensive set of land use tools and policies to gradually vacate this zone, which could include voluntary buyouts, rezoning, grants, loans and incentives, and transfer of development rights.

Mission Creek / Mission Bay

- Elevate the bay shorelines to defend against 3.5 feet of sea level rise.
- Raise bridges, roads, and transit connecting to Third and Fourth Streets over the creek.

Embarcadero

- Build a coastal flood defense system at the existing shoreline to defend against 7 feet of sea level rise.
- Reconfigure the Embarcadero roadway. This strategy would require no bay fill, but have the most impact on the Embarcadero Roadway, requiring a reduction in width.
- Raise the Ferry Building at its existing location.
- Provide a moderate sized pedestrian promenade.
- Build pump stations to manage stormwater and groundwater flooding.

Strategy G Flood Defenses in 2090



Strategy G 2090 Flood Defenses Across the Waterfront

Islais Creek / Bayview

- Over several decades, gradually vacate limited areas near Islais Creek Channel (no residential areas impacted).
- Although no residential areas would be affected, the equity implications of relocating industrial uses and the jobs they support must be addressed.
- Widen and extend the creek channel Westward beyond I-280.
- In vacated areas, establish floodable open space zone that provides recreation, stormwater infiltration and improved habitat.
- Rezone nearby areas to support industrial jobs at higher densities.
- Invest in public access improvement along the creek with natural areas and recreational spaces.
- Provide protection for up to 7 feet of sea level rise at outer edge of floodable zone.

Mission Creek / Mission Bay

- Allow water to come into the Mission Bay area as sea levels rise to 7 feet or more. Mission Bay would be transformed to a floodable district, with significant changes to all urban systems. Housing would not be relocated or removed but will need accommodations to deal with flooding and access.
- Manage streets and open spaces as floodable natural areas.
- Flood-proof or elevate buildings and infrastructure.
- Connect buildings with elevated walking and biking paths.
- Elevate transit on causeway or locate underground.

Embarcadero

- Shoreline adaptations would be built to defend against up to 7 feet of sea level rise in 2040, so no long-term actions would be needed.