

An aerial photograph of a waterfront industrial area. A tall, narrow building is the central focus, covered in a vibrant, multi-colored mural featuring geometric patterns and shapes in red, blue, yellow, and green. To the left, a body of water is visible with a large ship and industrial cranes. To the right, there are several large, multi-story industrial buildings, some with corrugated metal roofs and others with concrete facades. The sky is clear and blue.

# SAN FRANCISCO WATERFRONT FLOOD STUDY

S.F. Board of Supervisors  
Land Use & Transportation

*March 25, 2024*



Waterfront Resilience Program

# AGENDA

- 1 Waterfront Risks and Hazards**
- 2 San Francisco Waterfront Flood Study & Draft Plan**
- 3 Next Steps**



US Army Corps  
of Engineers



An aerial photograph of an industrial waterfront facility. A prominent feature is a tall, narrow concrete structure covered in a vibrant, multi-colored mural of geometric patterns and shapes. To the left, a body of water is visible with a large ship and several cranes. To the right, there are various industrial buildings, including a large white structure with many windows and a corrugated metal building. The sky is clear and blue.

# 1 SF Waterfront Flood Study & Waterfront Risks and Hazards

# WHAT IS THE FLOOD STUDY?

- The **Flood Study** analyzes **coastal flood risk** and the effects of **sea level rise** to the San Francisco waterfront along the Port's 7.5-mile jurisdiction over the next 100 years.
- The **Draft Plan** will inform subsequent stages of funding and design to develop targeted construction projects.
- The proposed solutions are estimated to cost **\$13.5 billion** (high-level, preliminary cost estimate) and, if approved by Congress, the Federal government may pay **65% of the cost**.
- The Flood Study is led by the **U.S. Army Corps of Engineers (USACE)** in collaboration with the **City of San Francisco**.



San Francisco Waterfront

San Francisco  
Planning

ONESF  
Building Our Future



San Francisco  
Water Power Sewer



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# WHAT'S AT RISK?

## Potential Sea Level Rise by 2100

San Francisco's waterfront location makes it ***vulnerable to coastal flooding*** due to ***sea level rise***

Without a Federal project, modeling shows:

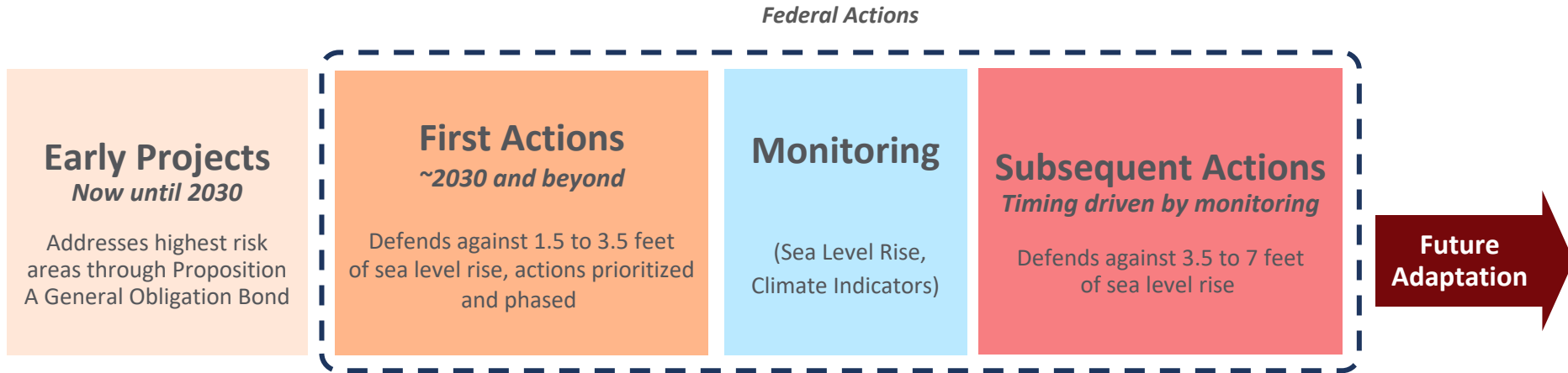
- By 2050, ***100 to 500 structures*** and ***assets*** will be vulnerable to flooding
- By 2140, damages could amount up to ***\$23 billion***



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# ADAPTATION ACTIONS OVER TIME



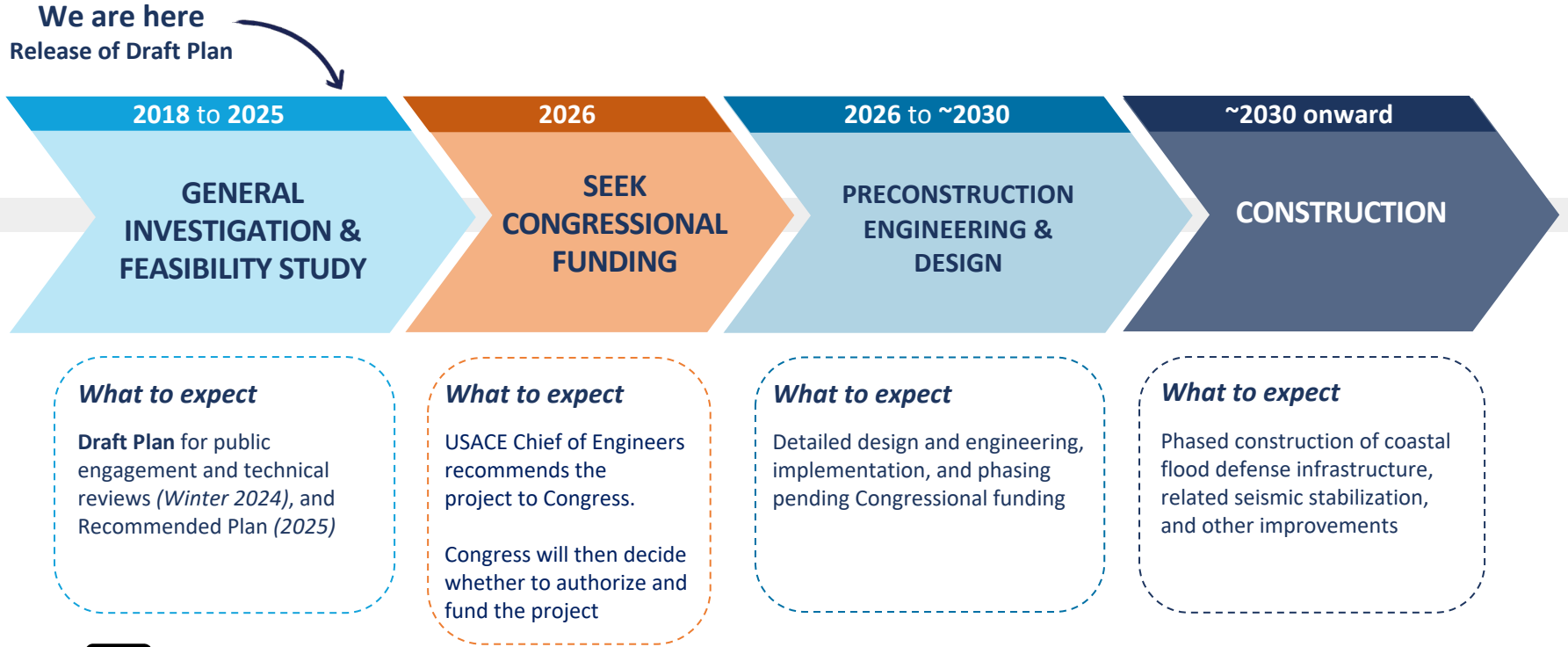
## COST BENEFIT ANALYSIS THAT ELEVATES EQUITY

Four categories of analysis:

- + National Economic Development (including damages prevented)
- + Regional economic impacts (including jobs)
- + Environmental quality, consequences, and compliance
- + **Other social effects (including impacts to vulnerable populations)**

*Note: Dates are approximate and subject to change. Projects will occur in phases which will extend over decades.*

# WHERE ARE WE IN THE FLOOD STUDY PROCESS?



# 3 Draft Plan

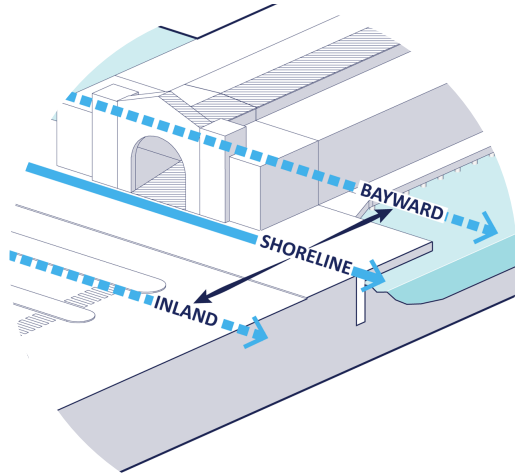


Waterfront Resilience Program  
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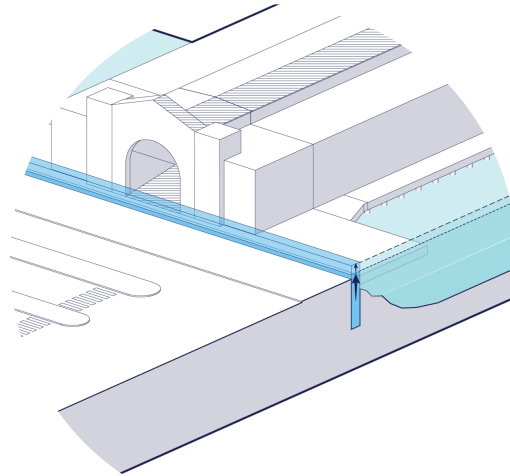


# WHAT IS IN THE DRAFT PLAN?

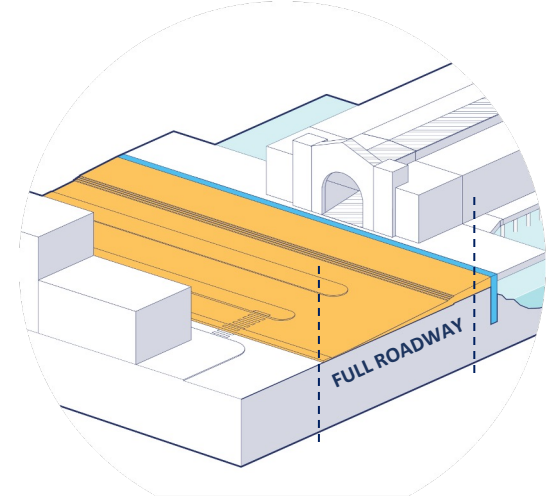
*Where* to build flood defenses



*How high* to build flood defenses



*How much space* to use

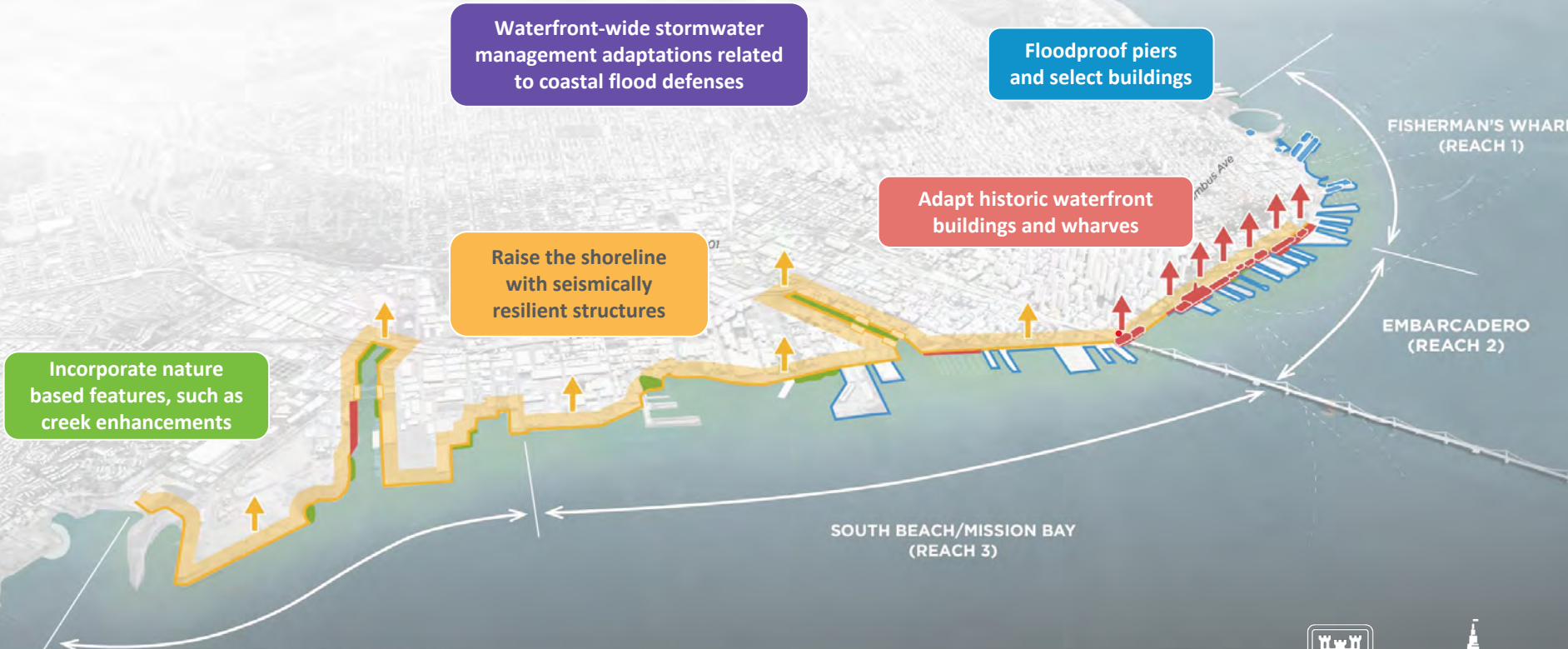


...and How flood defenses can **be adapted** in the future

**What is not being decided now:** The Draft Plan **does not include** detailed designs for flood defenses, the Embarcadero Historic District, waterfront streets, open spaces, and infrastructure, timing and sequencing of construction, and a funding plan.

These will be developed at a later stage of the process with public input.

# THE DRAFT PLAN



Incorporate nature based features, such as creek enhancements

Raise the shoreline with seismically resilient structures

Waterfront-wide stormwater management adaptations related to coastal flood defenses

Adapt historic waterfront buildings and wharves

Floodproof piers and select buildings

ISLAIS CREEK/BAYVIEW (REACH 4)

SOUTH BEACH/MISSION BAY (REACH 3)

EMBARCADERO (REACH 2)

FISHERMAN'S WHARF (REACH 1)

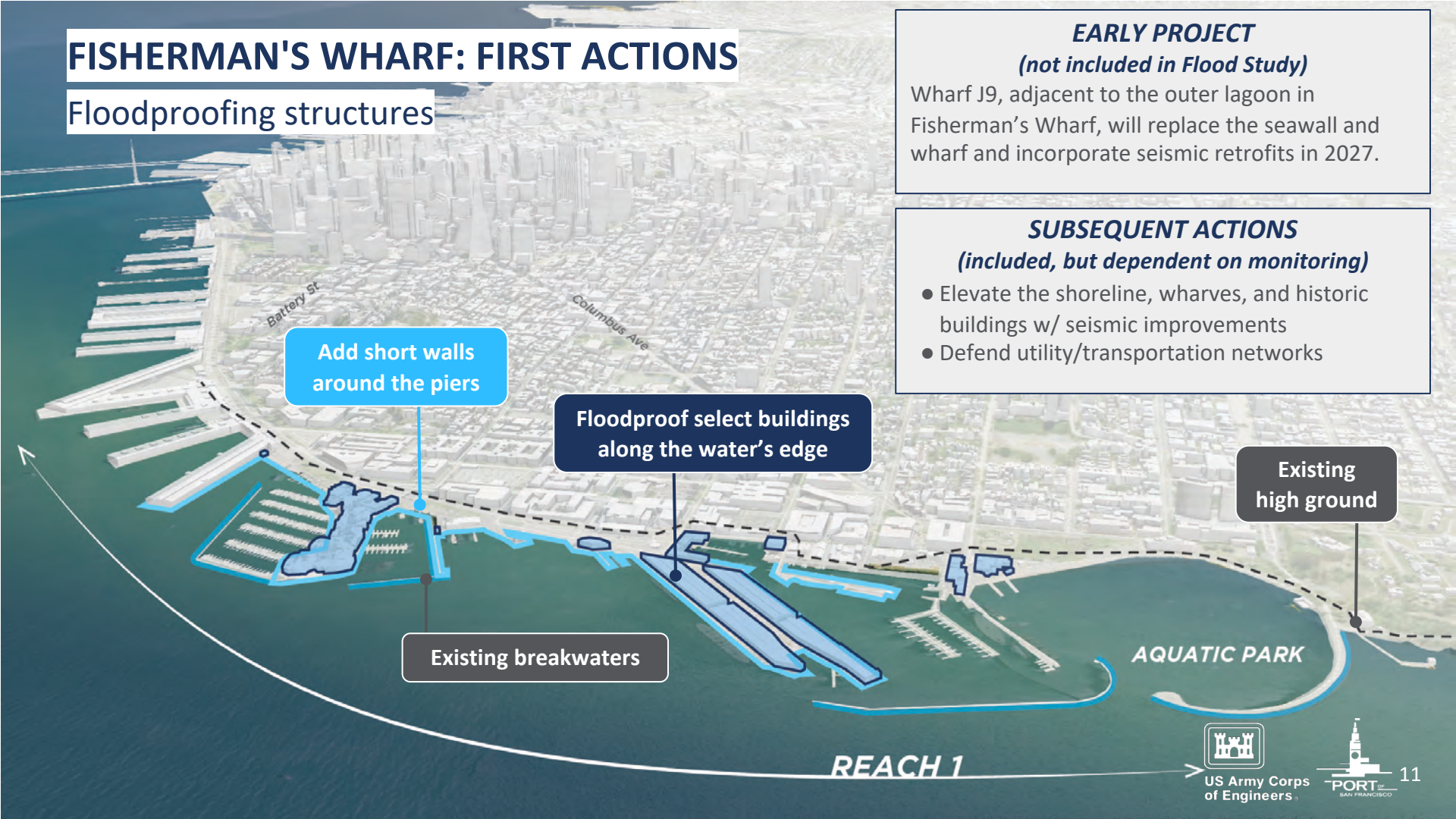


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# FISHERMAN'S WHARF: FIRST ACTIONS

## Floodproofing structures



### EARLY PROJECT

*(not included in Flood Study)*

Wharf J9, adjacent to the outer lagoon in Fisherman's Wharf, will replace the seawall and wharf and incorporate seismic retrofits in 2027.

### SUBSEQUENT ACTIONS

*(included, but dependent on monitoring)*

- Elevate the shoreline, wharves, and historic buildings w/ seismic improvements
- Defend utility/transportation networks

Add short walls around the piers

Floodproof select buildings along the water's edge

Existing high ground

Existing breakwaters

AQUATIC PARK

REACH 1



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# EMBARCADERO: FIRST ACTIONS

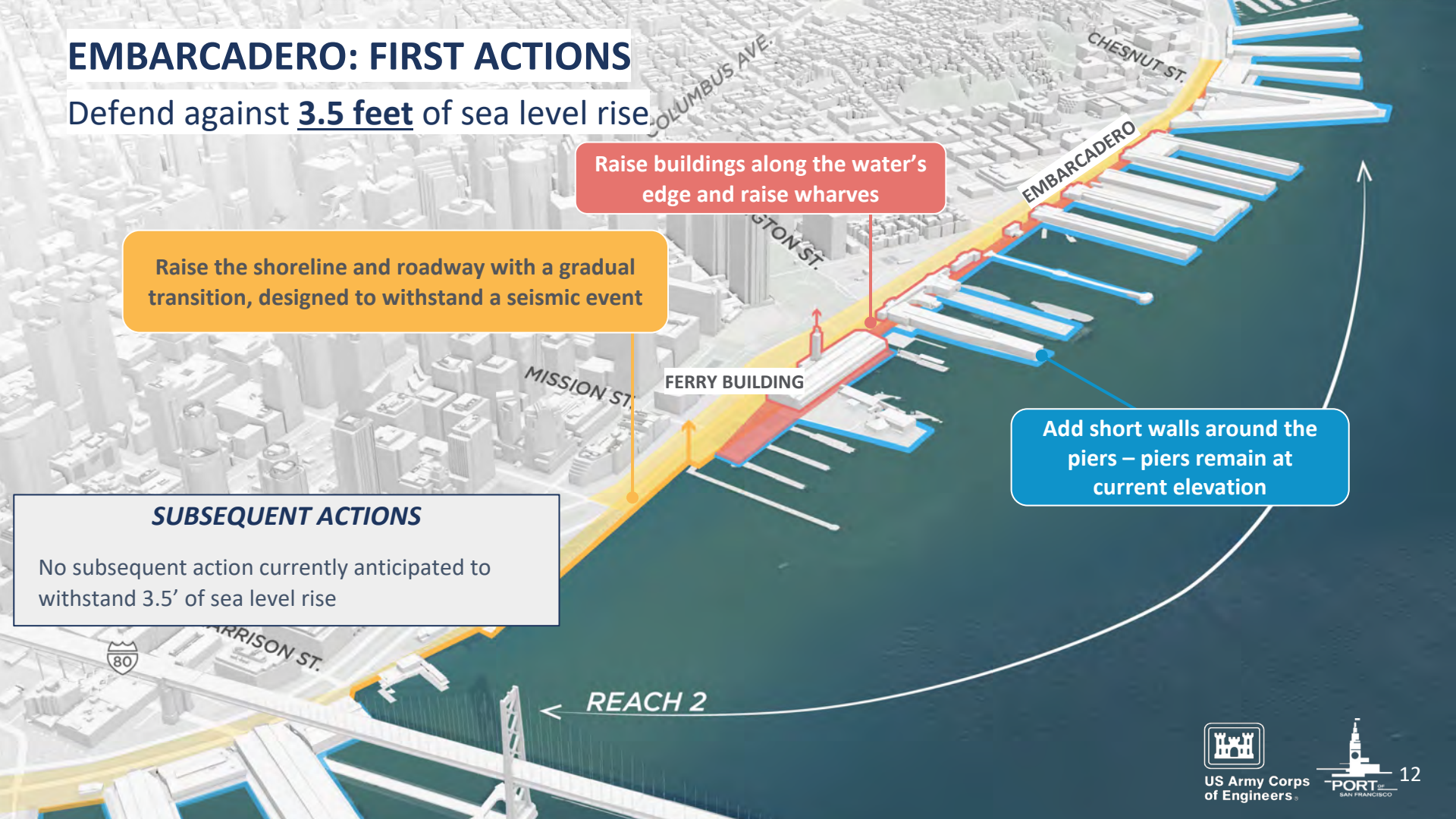
Defend against **3.5 feet** of sea level rise

Raise buildings along the water's edge and raise wharves

Raise the shoreline and roadway with a gradual transition, designed to withstand a seismic event

Add short walls around the piers – piers remain at current elevation

**SUBSEQUENT ACTIONS**  
No subsequent action currently anticipated to withstand 3.5' of sea level rise



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# ACTIONS EXPLAINED

## Elevate buildings and wharves

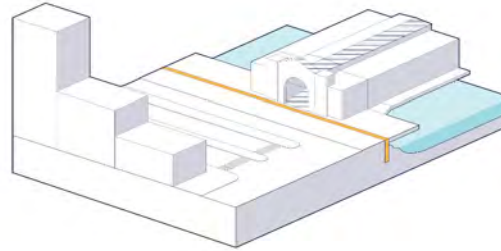
Elevate buildings and wharves along the water's edge, including the Ferry Building and historic bulkhead buildings. Enhance seismic stability for wharves and buildings.

## Add short walls around piers

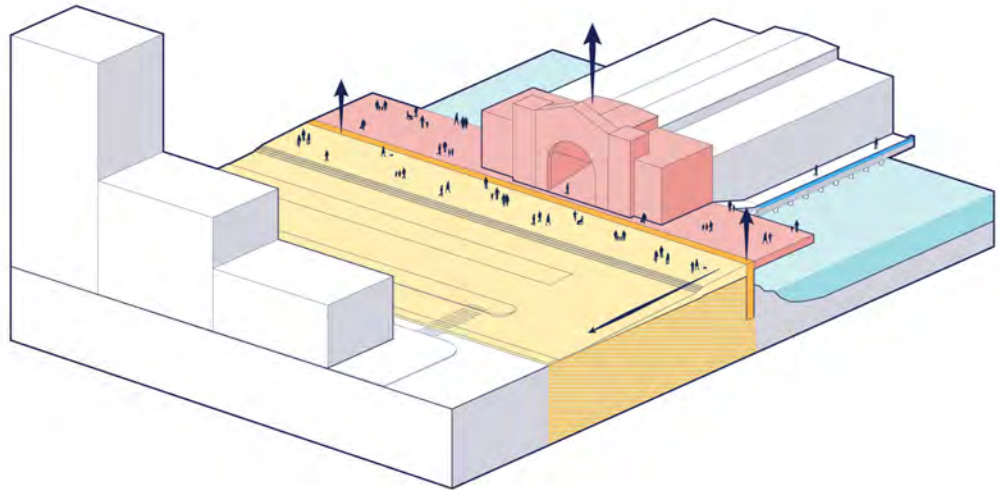
Build up to two-foot walls around piers to manage flood risks and defend against intermittent high water.



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*Current condition*



*Future condition*

# SOUTH BEACH / MISSION BAY: FIRST ACTIONS

Elevate the shoreline to defend against **1.5 feet** of sea level rise

New park and development projects will adapt their sites to sea level rise

MISSION BAY

Berms/levees + nature-based features

Closure structures on bridges

Piers and wharves not elevated; add short walls around the piers

Ground improvements to ensure flood defenses withstand a seismic event

SOUTH BEACH

Elevated shoreline

## SUBSEQUENT ACTIONS

*(included, but dependent on monitoring)*

Elevate shoreline to withstand 3.5' of Sea Level Rise and add nature based features

REACH 3



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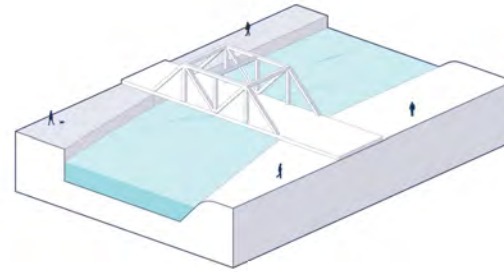


# ACTIONS EXPLAINED

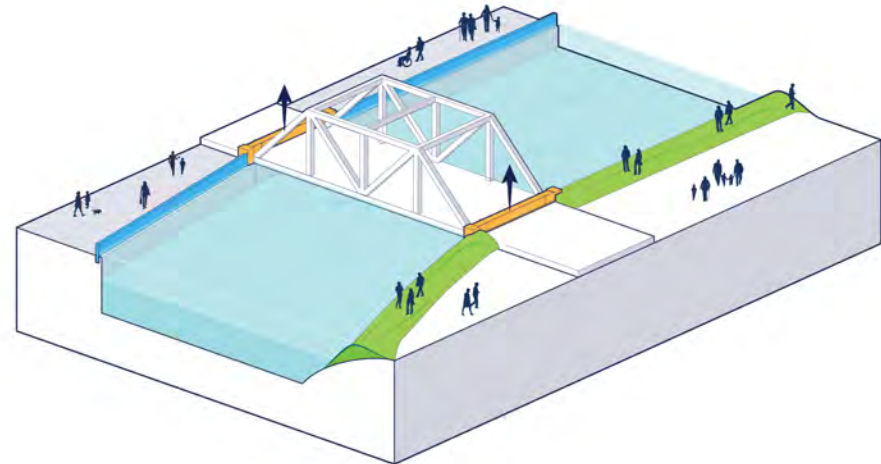
## Closure structure on bridges

Closure structures on Third and Fourth Street Bridges will close gaps in the elevated shoreline to prevent flooding.

It is anticipated that these closures would be infrequent (less than once a year) and used in anticipation of a large storm or tide event.



*Current condition*

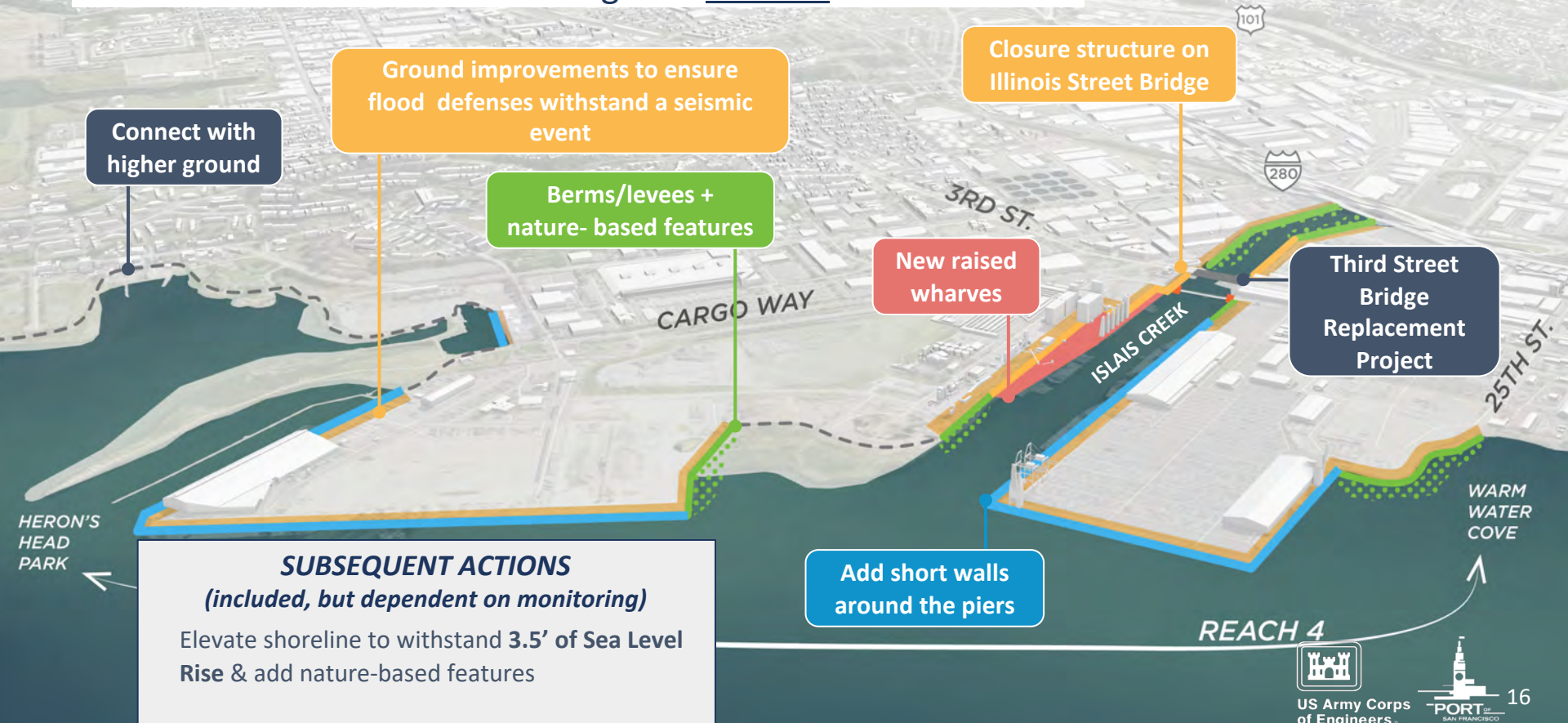


*Future condition*



# ISLAIS CREEK / BAYVIEW: FIRST ACTIONS

Elevate the shoreline to defend against **1.5 feet** of sea level rise

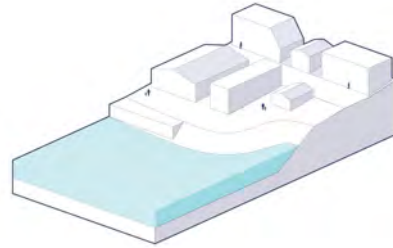




# ACTIONS EXPLAINED

## Berms/levees + nature-based features

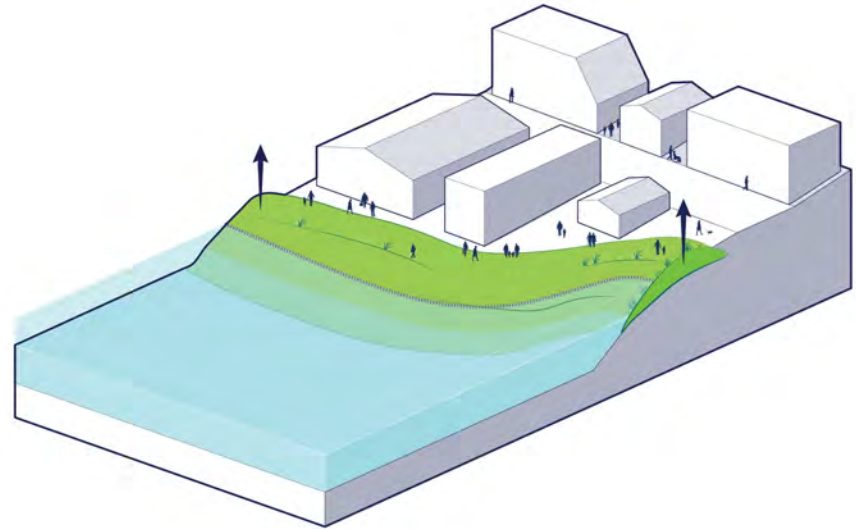
Berms/levees are areas of raised ground that can help prevent flooding while maintaining waterfront access. They can include public space, such as walking or biking paths, and incorporate vegetation that support habitats.



*Current condition*



*Berm/levee*



*Future condition*

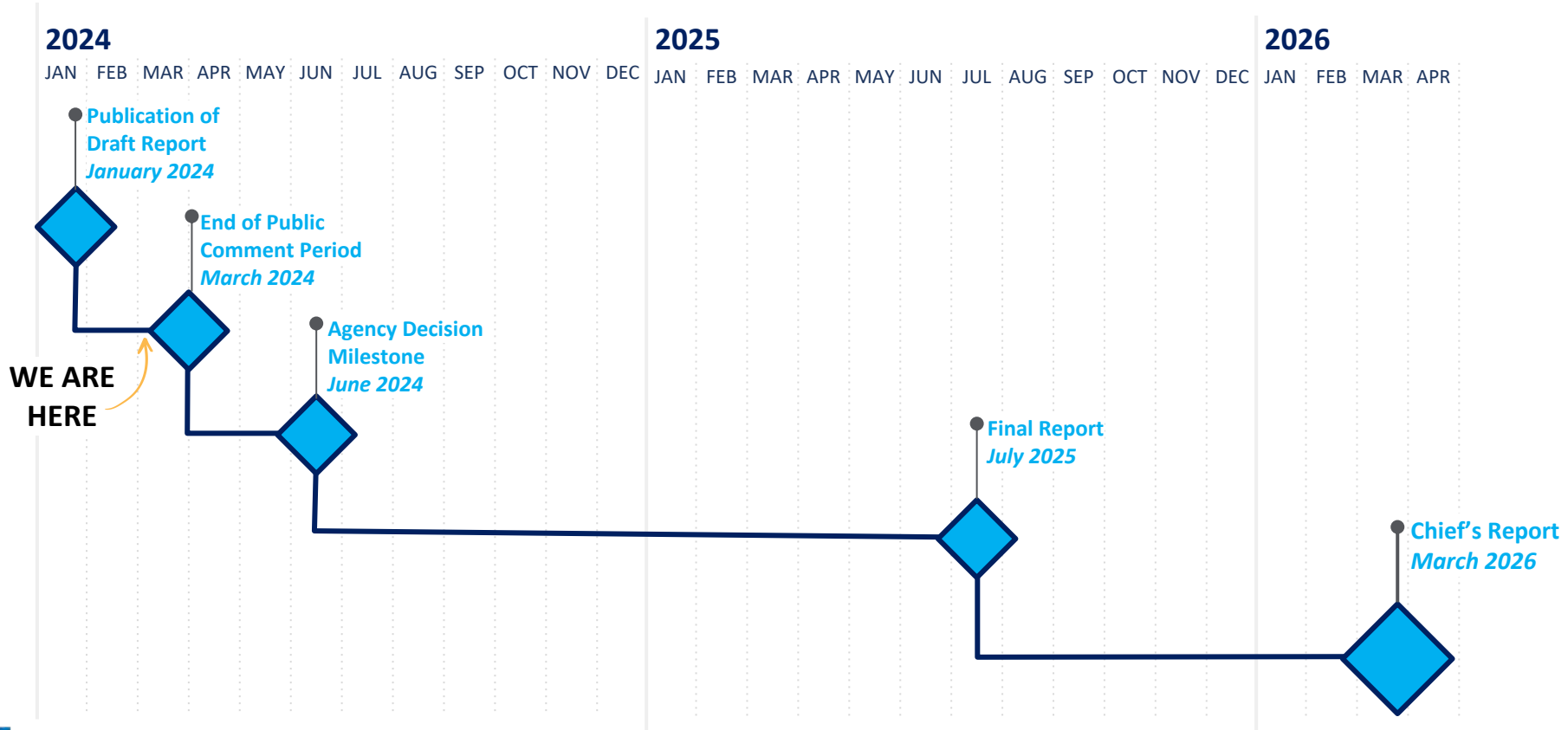


## 4 Next Steps



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# DRAFT SCHEDULE TO COMPLETE SF FLOOD STUDY



WE ARE  
HERE

# OUTSTANDING ISSUES

The Flood Study establishes *federal interest* in the project. By design, it analyzes a project at a less detailed level than is typical. City and USACE staff are continuing to examine refinements and changes to the Plan.

URBAN DESIGN

YOSEMITE SLOUGH

INLAND DRAINAGE &  
COMBINED SEWER

ENGINEERING WITH  
NATURE

TRANSPORTATION

ENVIRONMENTAL  
CONTAMINATION

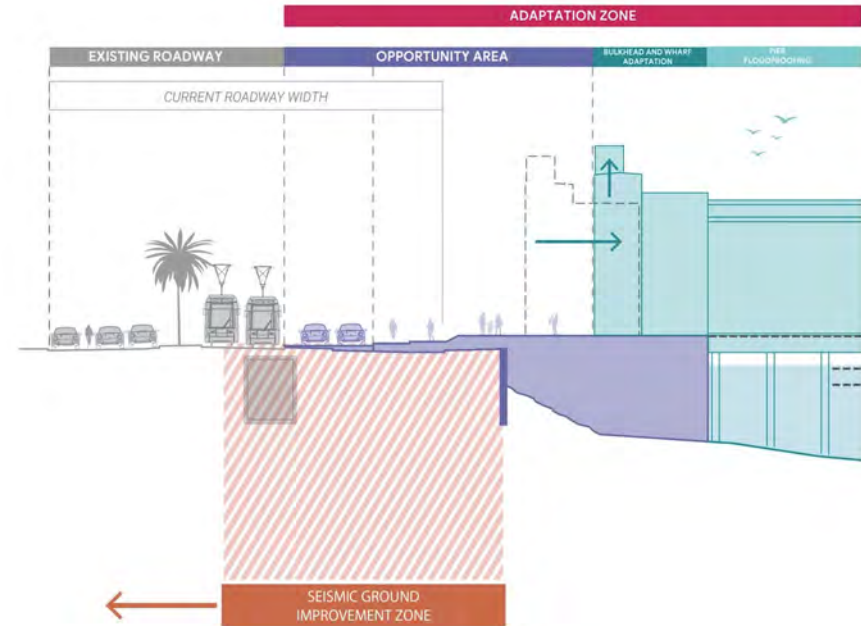
HISTORIC DISTRICT

**Cost-shared** Draft Plan changes need to be justified by:  
**reduced costs, increased benefits and/or decreased impacts**

## URBAN DESIGN

*Recommend flexibility for moving bayward in constrained areas of the Embarcadero if needed to accommodate waterfront access and public space needs and/or avoid impacts to key infrastructure*

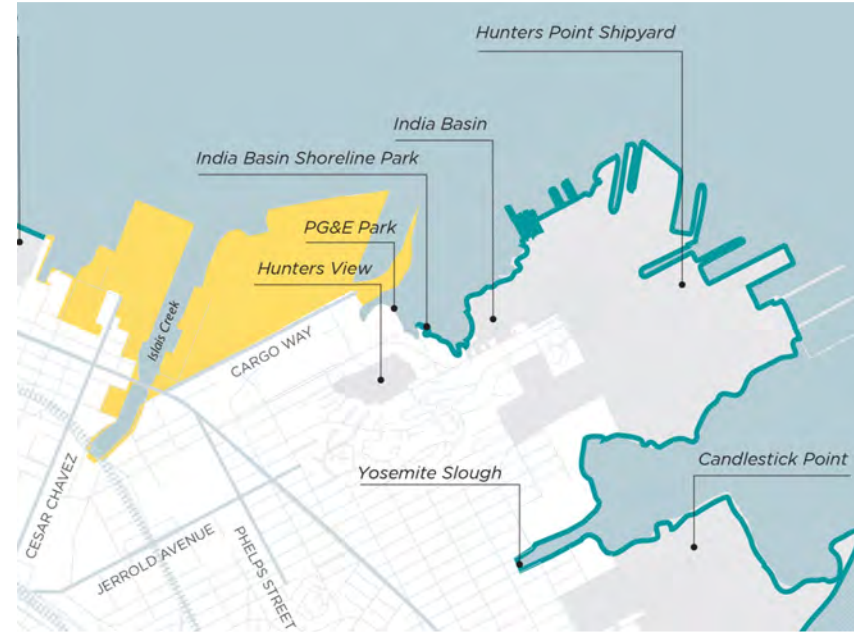
**Timing:** Evaluate in the Design Phase, after Project authorization by Congress (projected in 2026)



# YOSEMITE SLOUGH

*Desire to secure additional funding later for Yosemite Slough Adaptation Plan led by Planning with a CA Office of Planning and Research grant, responding to Bayview community concern to improve resiliency for area south of project boundary*

**Approvals and Timing:** Requires approval by the Assistant Secretary of the Army. Congressional authorization in 2028 or later



## INLAND DRAINAGE & COMBINED SEWER

*Recommend additional work to determine how combined flooding including inland drainage and combined sewer needs will be addressed*

### **Issues:**

- *Stormwater management*
- *Groundwater rise*
- *Sea level rise impacts to the SFPUC combined sewer*

**Approvals and Timing:** *Requires approval by the Assistant Secretary of the Army; most work would occur in the Design Phase*



Utility Infrastructure

# ENGINEERING WITH NATURE

*Recommend including Engineering with Nature features everywhere they can be reasonably incorporated*

**Issues:** *Team has direction to add EWN except in shaded areas and active maritime zones*

**Approvals and Timing:** *Nature-based adaptation features will continue to be optimized during the Study and in the Design Phase*





# TRANSPORTATION - BRIDGES

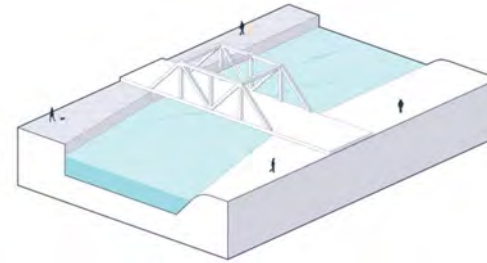
*Recommend examining the SFMTA proposal to replace bridges in lieu of closure*

***Approvals and Timing:*** Consider in the Design Phase. USACE must determine that costs, benefits and impacts justify this change. Opportunity to engage with other Federal funding agencies

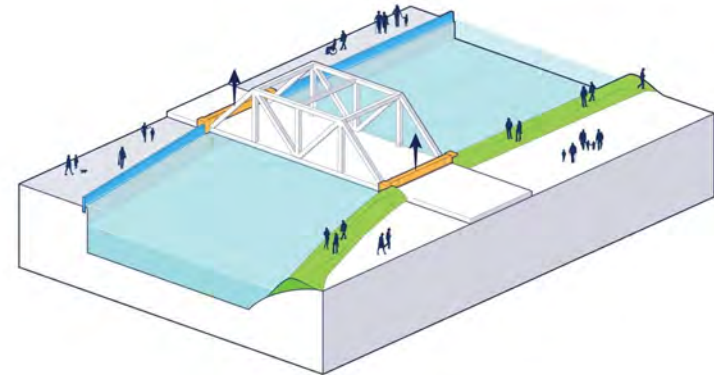
PLAN REFINEMENT

PLAN CHANGE

BETTERMENT



*Current condition*



*Proposed future condition in Draft Plan*

# ENVIRONMENTAL CONTAMINATION

*Evaluate contamination, assess risk of mobilization, and develop options and responsible parties for remedial actions*

## **Issues:**

- *Catalogue prior investigations of contaminated sites on Port property; new investigations planned for the creeks*
- *Sea level rise-induced groundwater rise mobilizing contaminants*
- *Remedial actions*

**Approvals and Timing:** *Requires approval by the Assistant Secretary of the Army; most work would occur in the Design Phase*

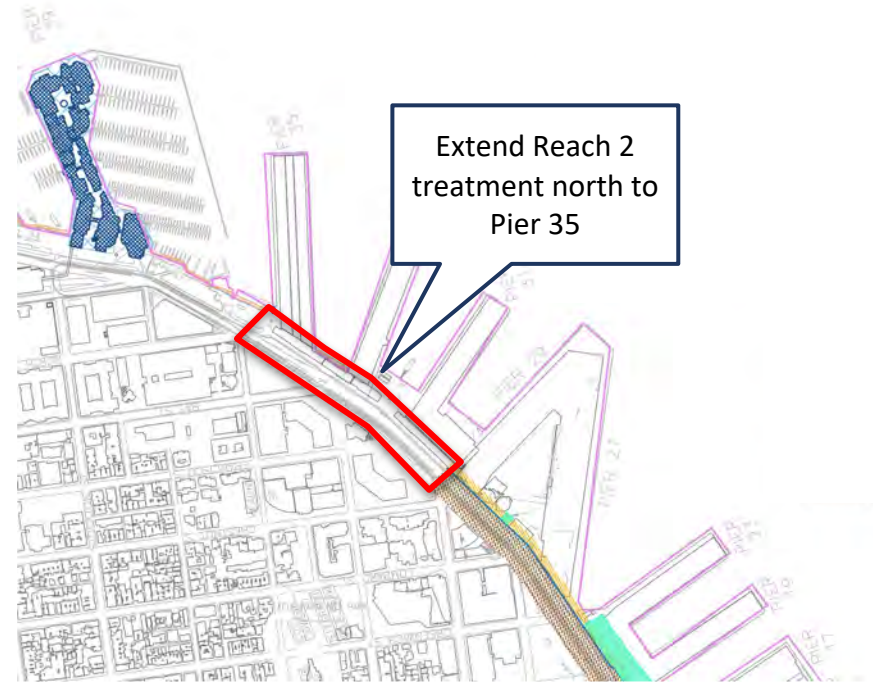
## **Hazardous Materials**

USACE regulations require that hazardous materials are removed or made safe before construction projects can begin. Working with USACE, the Port has identified and assessed past and recent efforts to clean up contaminated areas within the project area. This assessment also considered the potential risks posed by rising groundwater due to sea level rise. In the next phase, the City and USACE are working together to make sure the draft plan protects people and the environment from hazardous materials.

## HISTORIC DISTRICT & CRITICAL INFRASTRUCTURE

*Recommend extending Reach 2 treatment of the Embarcadero to the north to Pier 35 including improvements to facilities that connect North Point Wet Weather Facility to the Bay outfalls*

***Approvals and Timing:*** USACE must determine that costs, benefits and impacts justify this change. This change could occur now.



## PUBLIC ENGAGEMENT

- 4 in person community workshops in English hosted along the waterfront
- 1 in person community workshop in Spanish
- 1 in person community workshop in Chinese
- 4 in person walking tours hosted along the waterfront
- 12+ Port Tenant webinars and 2 community webinars
- 20+ presentations to Community Based Organizations
- Presentations to Bay Conservation and Development Commission, CA State Lands, Planning, Historic Preservation Commission, SFMTA, SFPUC, SFUSD Climate Fellows, Youth Commission
- Engagement via StoryMaps, social media, newsletters

## HOW TO PROVIDE COMMENT

There are several ways that you can comment through **March 29, 2024**:

- Share written comments via email: [SFWFRS@usace.army.mil](mailto:SFWFRS@usace.army.mil)
- Share written comments via mail: U.S. Army Corps of Engineers, Tulsa District ATTN: RPEC-SFWS, 2488 E 81st St., Tulsa, OK 74137
- Share written comments online: learn more and comment online at [sfport.com/wrp](https://sfport.com/wrp)



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To stay in touch, please sign up for the Port of SF's Waterfront Resilience Program **eNewsletter and mailing list** by visiting [sfport.com](https://sfport.com) and clicking the Signup for e-newsletter in the footer and selecting Waterfront Resilience Program from the list in the form provided.

A photograph of two children riding bicycles on a dirt path. The child in the foreground is wearing a red and white jersey and a yellow helmet. The child in the background is wearing a dark jersey with the number 30 and a dark helmet. In the background, a large ship is visible in the water under a clear blue sky. The path is surrounded by dry grass and a few trees.

# Thank you

U.S. Army Corps of Engineers | [SFWFRS@usace.army.mil](mailto:SFWFRS@usace.army.mil)  
Port of SF Waterfront Resilience Program | [wrp@sfport.com](http://wrp@sfport.com)

