

SAN FRANCISCO WATERFRONT FLOOD STUDY

Draft Report and Public Feedback

January 26 – March 29, 2024



Waterfront Resilience Program



US Army Corps
of Engineers®

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 in order 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
Flood Study

San Francisco
Planning

ONESF
Building Our Future



San Francisco
Water Power Sewer



Pier 14

The original Pier 14, built in the early 1900's, was part of a busy cargo waterfront.

To its north were 10 ferry slips serving the Ferry Building, where 100,000 ferry riders would pass through each day.



After the 1906 earthquake and fire, Pier 14 was used for unloading lumber and other materials to rebuild San Francisco.

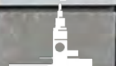


At nearly the same location as the original, the new Pier 14 Public Pier serves as a waterfront for various San Francisco waterfront activities.

Art Agnos, Mayor of San Francisco from 1988 to 1997, first announced the idea of the waterfront through a proposal to the City with its waterfront. On December 18, 2003, the Port Commission designated Pier 14 to Art Agnos, in recognition of his vision and actions to revitalize the San Francisco waterfront.



US Army Corps of Engineers



PORT OF SAN FRANCISCO





LAND ACKNOWLEDGEMENT

The Port of San Francisco acknowledges that we are on the ***unceded ancestral homeland of the Ramaytush Ohlone*** who are the original inhabitants of the San Francisco Peninsula.

As the indigenous stewards of this land and in accordance with their traditions, the Ramaytush Ohlone have never ceded, lost nor forgotten their responsibilities as the ***caretakers of this place***, as well as for all peoples who reside in their traditional territory.

As guests, we recognize that we benefit from living and working on their traditional homeland.

We wish to ***pay our respects*** by acknowledging the Ancestors, Elders and Relatives of the Ramaytush Community and by ***affirming their sovereign rights as First Peoples***.



US Army Corps
of Engineers®



PORT
SAN FRANCISCO

WHERE TO GET MORE INFORMATION

The information in this presentation is a summary of what you can find in the Draft Integrated Feasibility Report and Environmental Impact Statement found at <https://www.swt.usace.army.mil/>.



StoryMap Hub

ArcGIS StoryMaps is a web-based interactive application that includes maps in the context of narrative text and other multimedia content



US Army Corps
of Engineers

YOUR FEEDBACK IS IMPORTANT TO US AND THE PROCESS

USACE and the City are seeking public comment on the Draft Integrated Feasibility Report and Environmental Impact Statement through **March 29, 2024**.

USACE Public NEPA Workshops:

South Beach / Mission Bay:	Monday, February 26, 5:30-7:30, ATwater Tavern
Islais Creek / Bayview:	Tuesday, February 27, 5:30-7:30 PM, Southeast Community Center
Fisherman's Wharf:	Wednesday, February 28, 5:30-7:30 PM, Aquarium of the Bay
Embarcadero:	Thursday, February 29, 5:30-7:30 PM, Exploratorium

Provide written comments:

- Email: SFWFRS@usace.army.mil
- Mail: U.S. Army Corps of Engineers, Tulsa District ATTN: RPEC-SFWS, 2488 E 81st St., Tulsa, OK 74137
- Online: sfport.com/wrp



US Army Corps
of Engineers®

AGENDA

- 1 Waterfront Risks and Hazards**
- 2 San Francisco Waterfront Flood Study**
- 3 The Draft Plan**
- 4 Public Comment**



1 Waterfront Risks and Hazards



US Army Corps
of Engineers

SAN FRANCISCO IS AN ICONIC, BELOVED WATERFRONT CITY



US Army Corps
of Engineers®

WHAT'S AT RISK?

Flood Risk Today



San Francisco's waterfront faces urgent flood risks **today**

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***

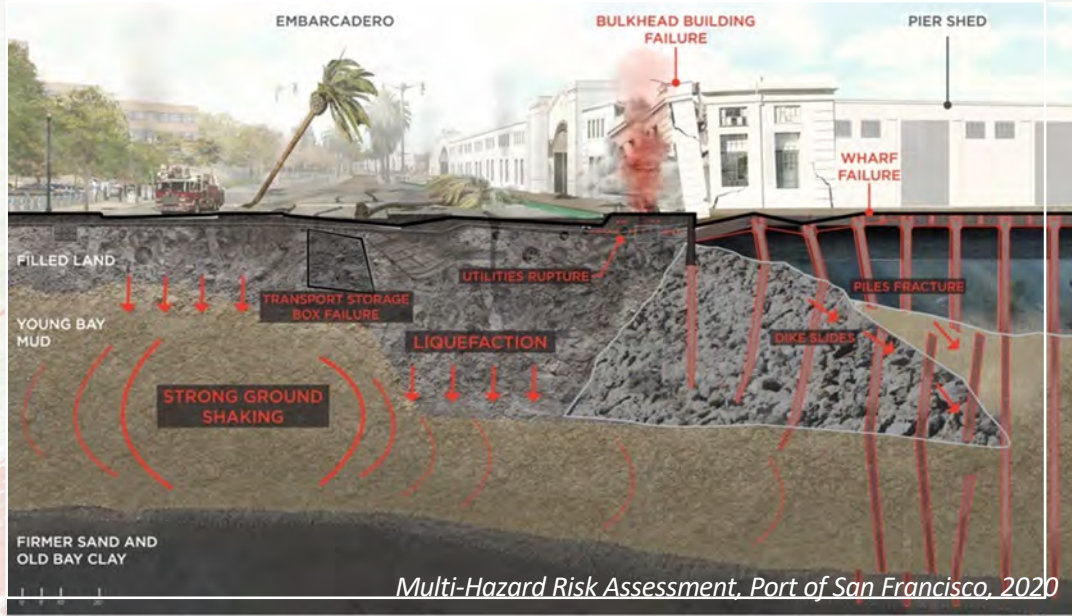
Without a Federal project, modeling shows:

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



WHAT'S AT RISK?

Seismic Hazard



Up to **40,000** people could be at risk on Port property if an earthquake occurs during the day



HOW SAN FRANCISCO IS ADDRESSING THOSE RISKS

San Mateo County

Ocean Beach Adaptation

The *San Francisco Waterfront Flood Study* is one of several adaptation efforts by City and Federal agencies to address risks and build resilience

Northern Waterfront Adaptation

Southern Waterfront Adaptation

San Francisco Waterfront Flood Study



US Army Corps
of Engineers



2 San Francisco Waterfront Flood Study



US Army Corps
of Engineers

WHERE ARE WE IN THE FLOOD STUDY PROCESS?

We are here
Release of Draft Plan



What to expect

Draft Plan for public engagement and technical reviews (*Winter 2024*), and Recommended Plan (*2025*)

What to expect

USACE Chief of Engineers recommends the project to Congress.

Congress will then decide whether to authorize and fund the project

What to expect

Detailed design and engineering, implementation, and phasing pending Congressional funding

What to expect

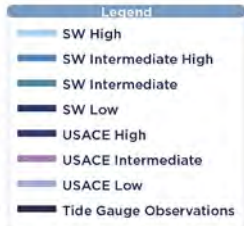
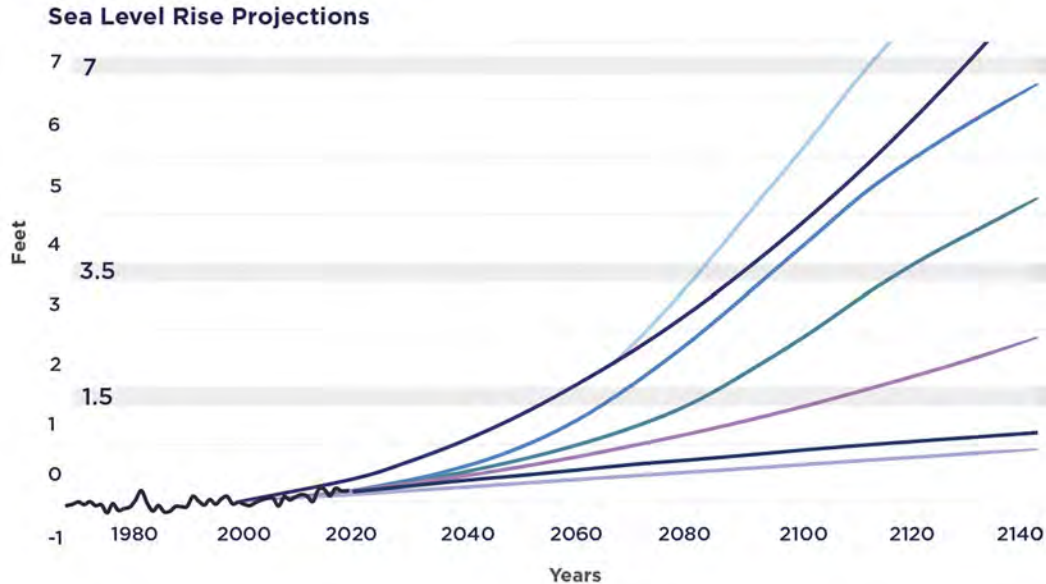
Phased construction of coastal flood defense infrastructure, related seismic stabilization, and other improvements

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

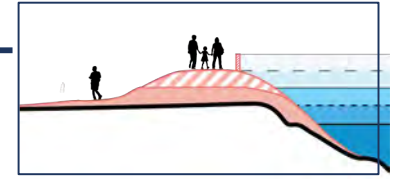


US Army Corps
of Engineers

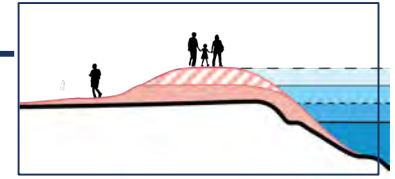
CONSIDERATIONS OF SEA LEVEL RISE IN PLANNING



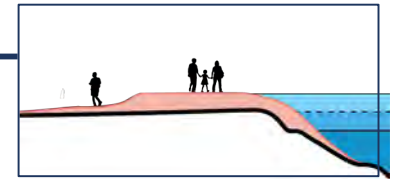
7 Feet Sea Level Rise



3.5 Feet Sea Level Rise

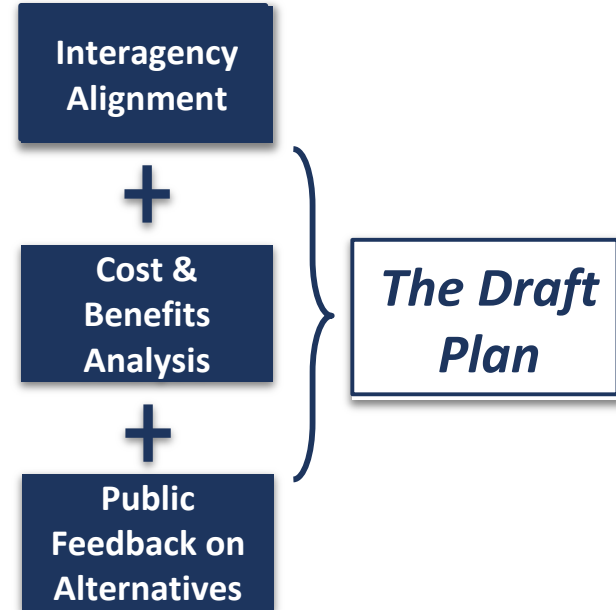


1.5 Feet Sea Level Rise



The Flood Study manages **uncertainty** by considering the risks, scale, cost, timing, and adaptability of the flood defense system across a range of sea level rise scenarios. Modeling includes typical Bay storms.

GETTING TO THE DRAFT PLAN



KEY FEEDBACK THAT HELPED SHAPE THE DRAFT PLAN

Focus on life safety & emergency response

Put people first

Prioritize housing, disaster recovery facilities, utilities, transportation and businesses

Expand (and maintain) the City's connection to the waterfront

Prioritize nature and healing the Bay

Consider racial and social equity and environmental justice



A COMPREHENSIVE COST BENEFIT ANALYSIS THAT ELEVATES EQUITY

Historically, plan selection maximizes NED national economic benefits. This plan incorporates analysis across four categories:

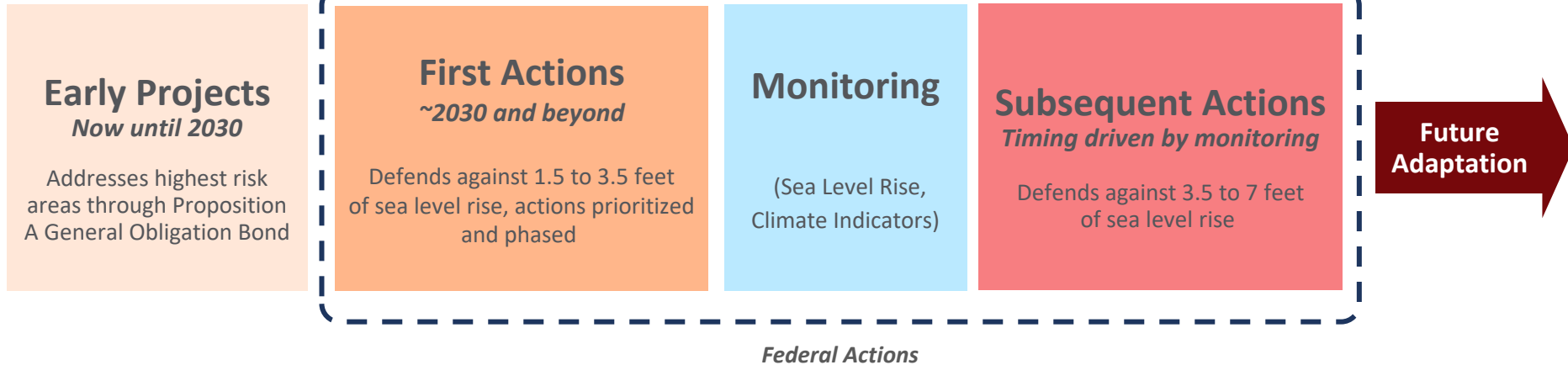
- + National Economic Development (including damages prevented, cost of construction)
- + Regional economic impacts (including jobs)
- + Environmental quality, consequences, and compliance (including pollution)
- + **Other social effects (including disproportionate effects on vulnerable populations)**



*Other Social Effects (USACE Analysis)
data included in Alternative Selection*

MONITORING AND ADAPTATION ACTIONS OVER TIME

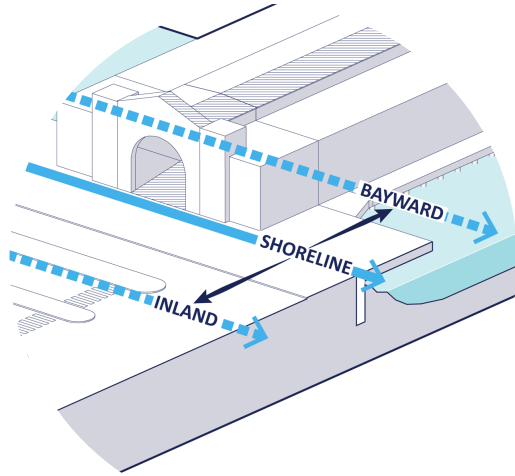
The Draft Plan



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

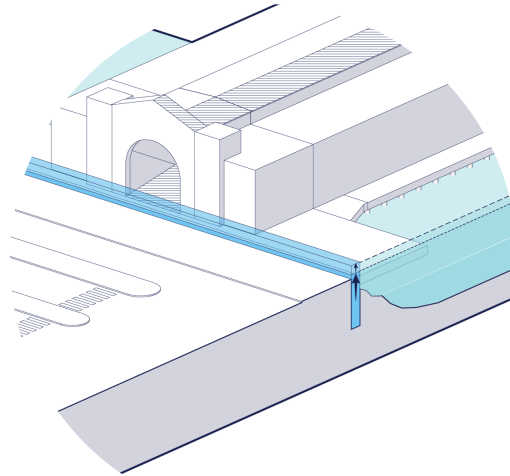
WHAT IS IN THE DRAFT PLAN?

Where to build flood defenses



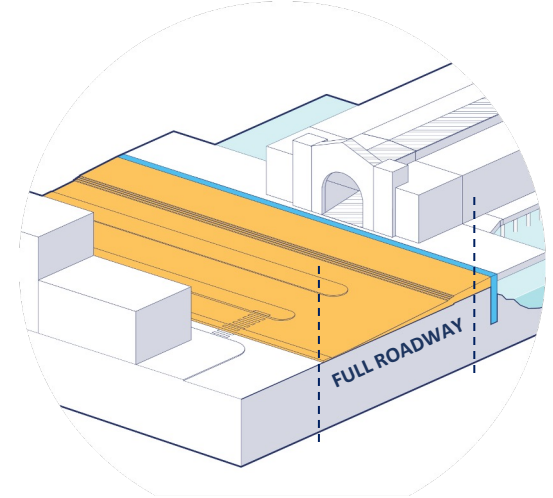
Have we located the flood defenses in the right place?

How high to build flood defenses



Should we invest in higher levels of flood defense first, or adapt in multiple phases?

How much space to use



More space provides more flexibility but is associated with more disruption. Less space means more abrupt grade changes.

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

What's not being decided at this stage?

The Draft Plan **does not include** the following:

- Detailed designs for flood defenses
- Designs for waterfront streets, open spaces, and infrastructure (including pumping stations)
- Timing and sequencing of construction
- Funding plan

These elements will be developed during later project phases with the public, USACE and City Agencies.

The Draft Plan is not:

- A re-design for the future waterfront
- A plan for the Embarcadero Historic District, the Ferry Building and public plazas and roadway, and creek and shoreline amenities

Project plans and implementation strategies will leverage other opportunities, align with other public and private projects, and reflect what the City can afford given other capital obligations

ENVIRONMENTAL REVIEW

Environmental consequences of the **Draft Plan** and a high-level comparison of the environmental consequences for each of the Alternatives have been assessed as described in the **National Environmental Policy Act (NEPA)** Environmental Impact Statement.

Multiple laws, executive orders, and policies, such as the Endangered Species Act (ESA), Clean Water Act, and National Historic Preservation Act (NHPA), are considered during the NEPA process.

California Environmental Quality Act (CEQA) to be done at a later date



HOW WERE ENVIRONMENTAL IMPACTS ANALYZED?

- Approximately 50 resources assessed
- Alternatives are compared to existing conditions
- Incorporates resource agency input
- Assessed by an impact rating criteria

Unavoidable Impacts from Draft Plan

- 8.0 acres of Bay Fill and loss of subtidal habitat requires mitigation
- Long-term disruption to transportation corridors and noise disturbances from construction

Resource	Bay fill	Levee	Bridge raise	Road raising	Vertical wall	Bulkhead wall/Seawall	Cantilever wall	Pile supported	Sheetpile wall	T-wall	Elevated promenades	Wharf	Deployable flood gate	Tide gate	Shoreline extension	Ecological Armoring*	Embankment shoreline*	Naturalized shoreline*	Vertical shoreline*	Marsh*	Coarse beach*	Ecotone levee*	
Commercial and Recreational Fisheries	Y	N	Y	N	N	Y	Y	N	Y	N	N	Y	Y	Y	Y	Y+	Y+	Y+	Y+	Y+	Y+	Y+	N
Macroinvertebrates	Y	N	Y	N	N	Y	Y	N	Y	N	N	Y	Y	Y	Y	Y+	N	N	Y+	Y+	Y+	Y+	N
Terrestrial vegetation	N	Y	Y	Y	Y	N	N	Y	N	Y	Y	N	Y	Y	Y	N	Y+	Y+	N	Y	N	Y+	Y+
T&E Species - Terrestrial	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y+	Y+	Y	Y+	Y+	Y+	Y+
T&E Species - Aquatic	Y	Y	Y	N	N	Y	Y	N	Y	N	N	Y	Y	Y	Y	Y+	N	N	Y+	Y+	Y+	Y+	N
State listed species	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y+	Y+	Y+	Y+	Y+	Y+	Y+
Designated Critical Habitat	Y	N	Y	N	N	Y	Y	N	Y	N	N	Y	Y	Y	Y	Y+	N	N	Y+	Y+	Y+	Y+	N

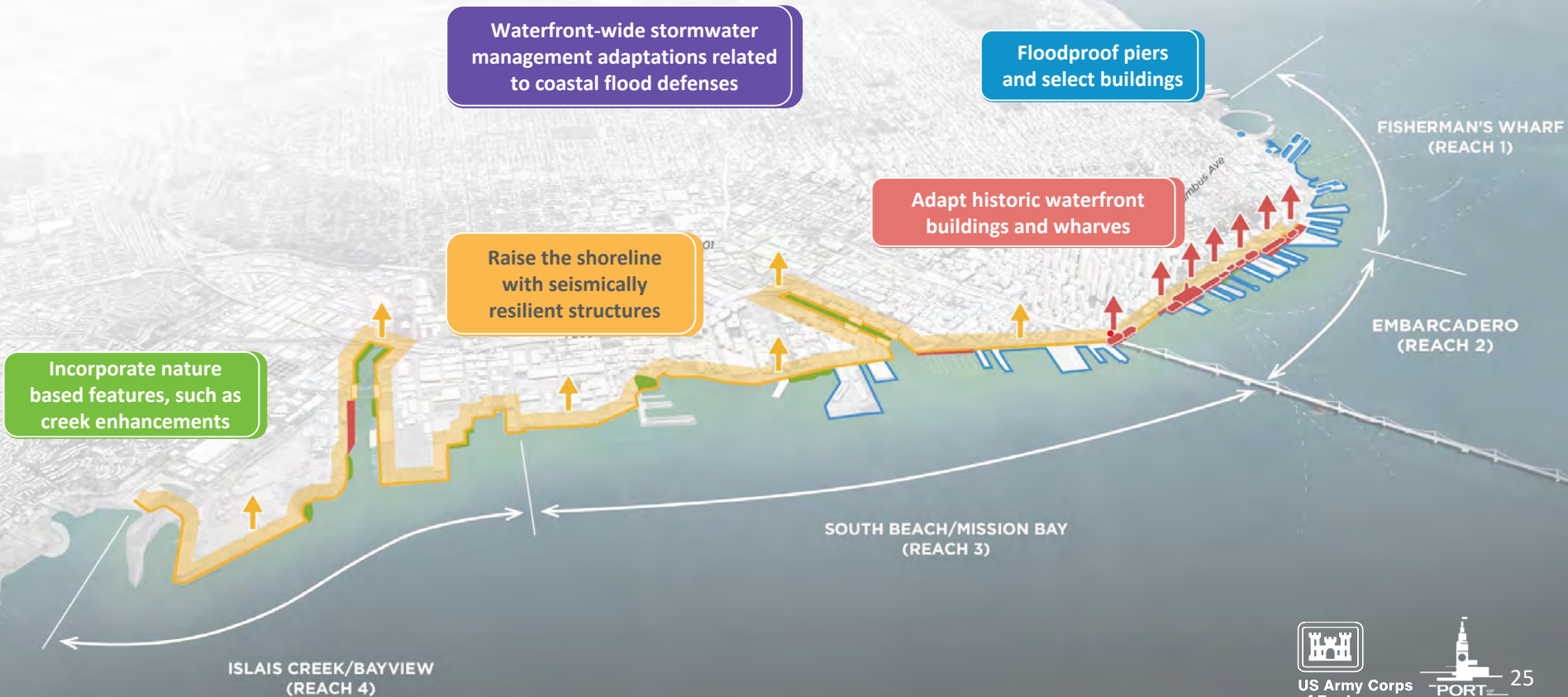
Y: Potential to adversely impact the resource N: Not anticipated to adversely impact the resource
 +: Beneficial impact
 This is only a subset of the complete table.

3 The Draft Plan



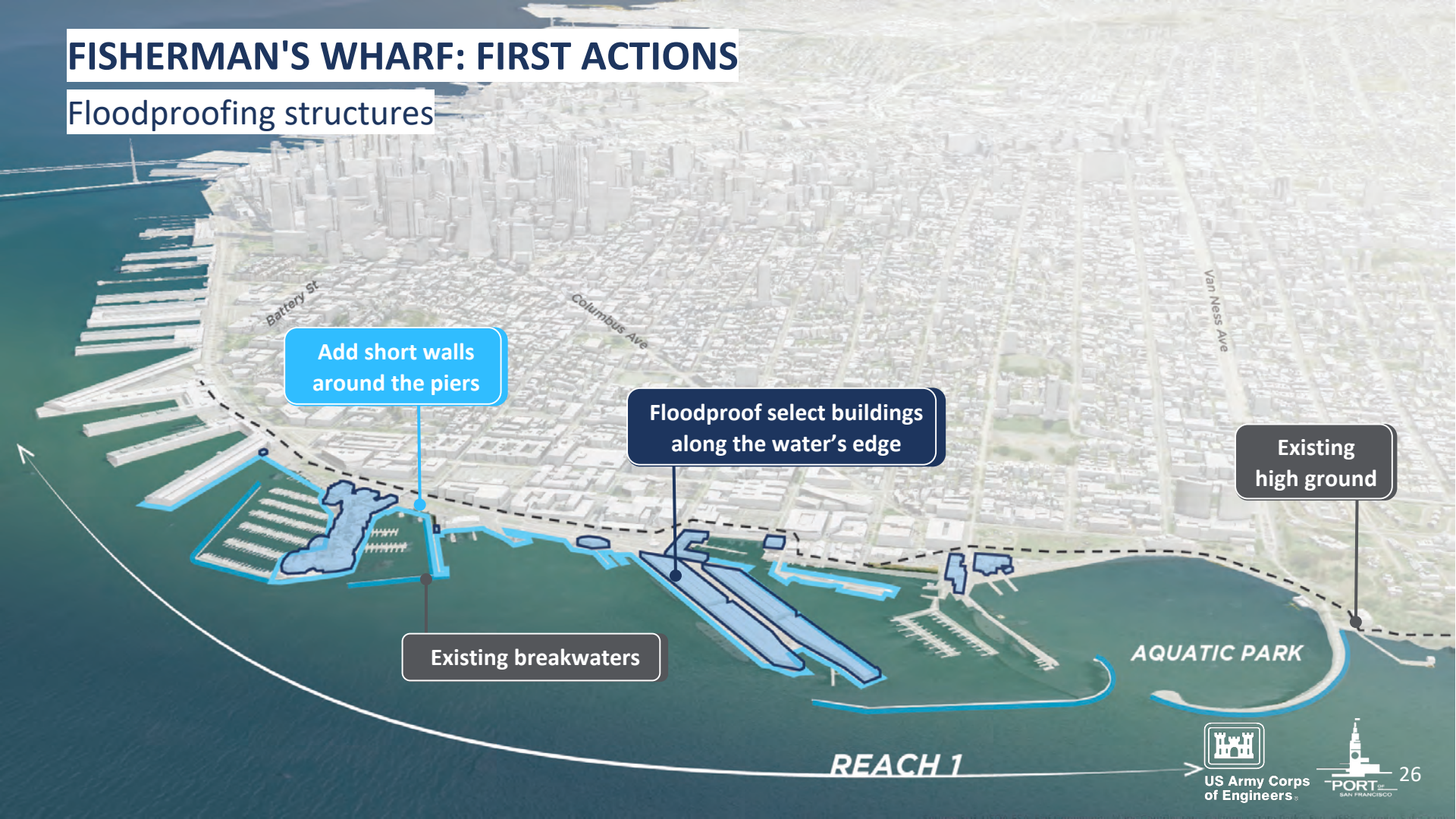
US Army Corps
of Engineers

THE DRAFT PLAN



FISHERMAN'S WHARF: FIRST ACTIONS

Floodproofing structures



Add short walls around the piers

Floodproof select buildings along the water's edge

Existing high ground

Existing breakwaters

AQUATIC PARK

REACH 1



US Army Corps of Engineers



FISHERMAN'S WHARF SUMMARY TABLE

1ST ACTIONS

Coastal Flood Defense



Floodproofing to withstand **near-term flood risk**

Seismic Resilience of Flood Defenses



Partially addressed outside Flood Study. Draft Plan does not include seismic ground improvements given no new flood defense structure in Reach 1.

Connection to the Waterfront



Visual and physical connections **maintained**, with 2' walls along piers

Asset and System Defense



At-risk buildings are defended. Transit and utility networks do not have near term risk

Nature-Based Features



No feasible options that also maintain maritime function in this geography

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
- Seismic ground improvements.
- Defend utility/transportation networks

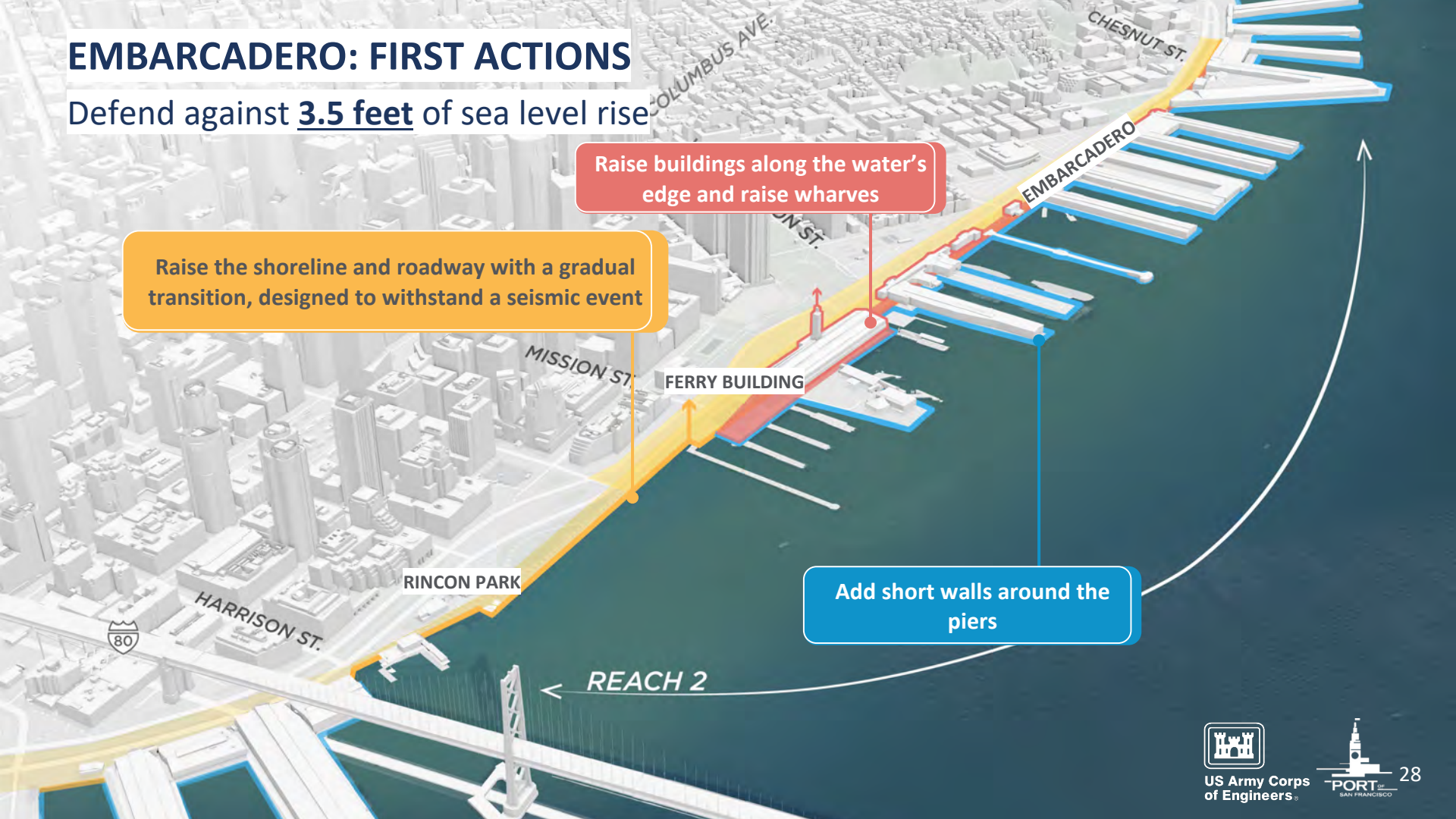
EMBARCADERO: FIRST ACTIONS

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

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

Raise buildings along the water's edge and raise wharves

Add short walls around the piers



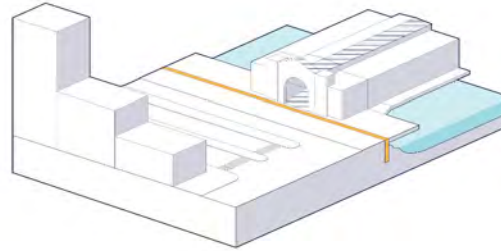
ACTIONS EXPLAINED

Elevate buildings and wharves

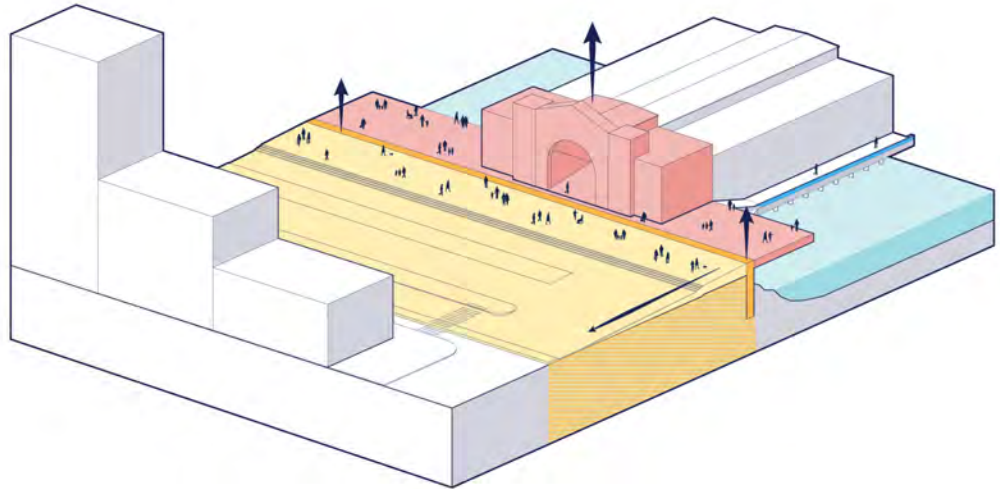
Elevate buildings and wharves along the water's edge, including the Ferry Building and historic bulkhead buildings. Enhance seismic stability for wharves and buildings.

Add short walls around piers

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



Current condition



Future condition

EMBARCADERO SUMMARY TABLE

1ST ACTIONS

Coastal Flood
Defense



Elevated shoreline to withstand **3.5'** of
Sea Level Rise

Seismic Resilience of
Flood Defenses



Ground improvements under roadway
and structural improvements on wharf
and bulkhead buildings

Connection to the
Waterfront



Visual and physical connections
maintained, with 2' walls along piers

Asset and System
Defense



Transit and utility networks are **defended**

Nature-Based
Features



Included as optional elements

EARLY PROJECT

(not included in Flood Study)

Piers 9 & 15 Seawall Earthquake Safety Projects will retrofit the bulkhead walls and wharves, Downtown Coastal Resilience Project will improve flood defenses and earthquake resilience in the Ferry Building area where flood risk exists today.

SUBSEQUENT ACTIONS

(included, but dependent on monitoring)

- No subsequent action currently anticipated to be needed to withstand 3.5' of sea level rise – subject to change depending on actual rate of sea level rise



US Army Corps
of Engineers®



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

Berms/levees + nature-based features

Closure structures on bridges

Add short walls around the piers

Ground improvements to ensure flood defenses withstand a seismic event

Elevated shoreline

REACH 3 →



US Army Corps of Engineers

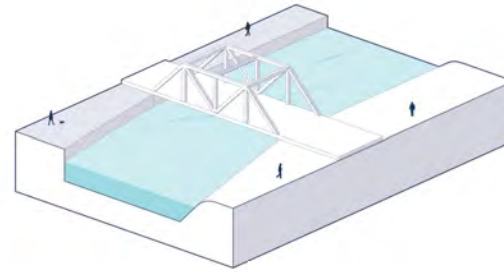


ACTIONS EXPLAINED

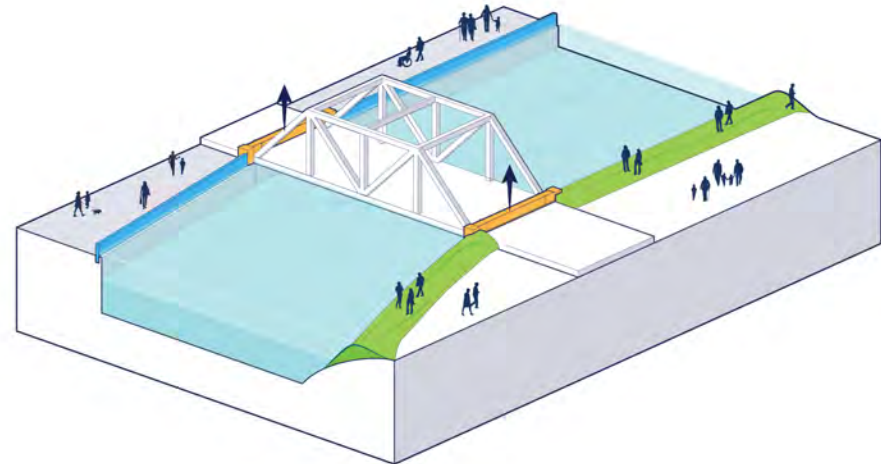
Closure structure on bridges

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

SOUTH BEACH / MISSION BAY SUMMARY TABLE

1ST ACTIONS

Coastal Flood Defense



Elevated shoreline to withstand **1.5'** of Sea Level Rise

Seismic Resilience of Flood Defenses



Ground improvements under roadways, shoreline promenades, and open spaces

Connection to the Waterfront



Visual and physical connections **maintained**, opportunities to access water on berms/levees

Asset and System Defense



Transit and utility networks are **defended**, bridges remain in place

Nature-Based Features



Berms/levees with naturalized shorelines along Mission Bay **and creek enhancements** along Mission Creek

EARLY PROJECT

(not included in Flood Study)

- Pier 50 Earthquake Improvement Project – Seismic risk assessment of existing pier and shed structures
- Pier 24 ½ to Pier 28 ½ Seawall Earthquake Safety Project – stabilizing vulnerable portions of the wall and wharf substructures supporting the Promenade

SUBSEQUENT ACTIONS

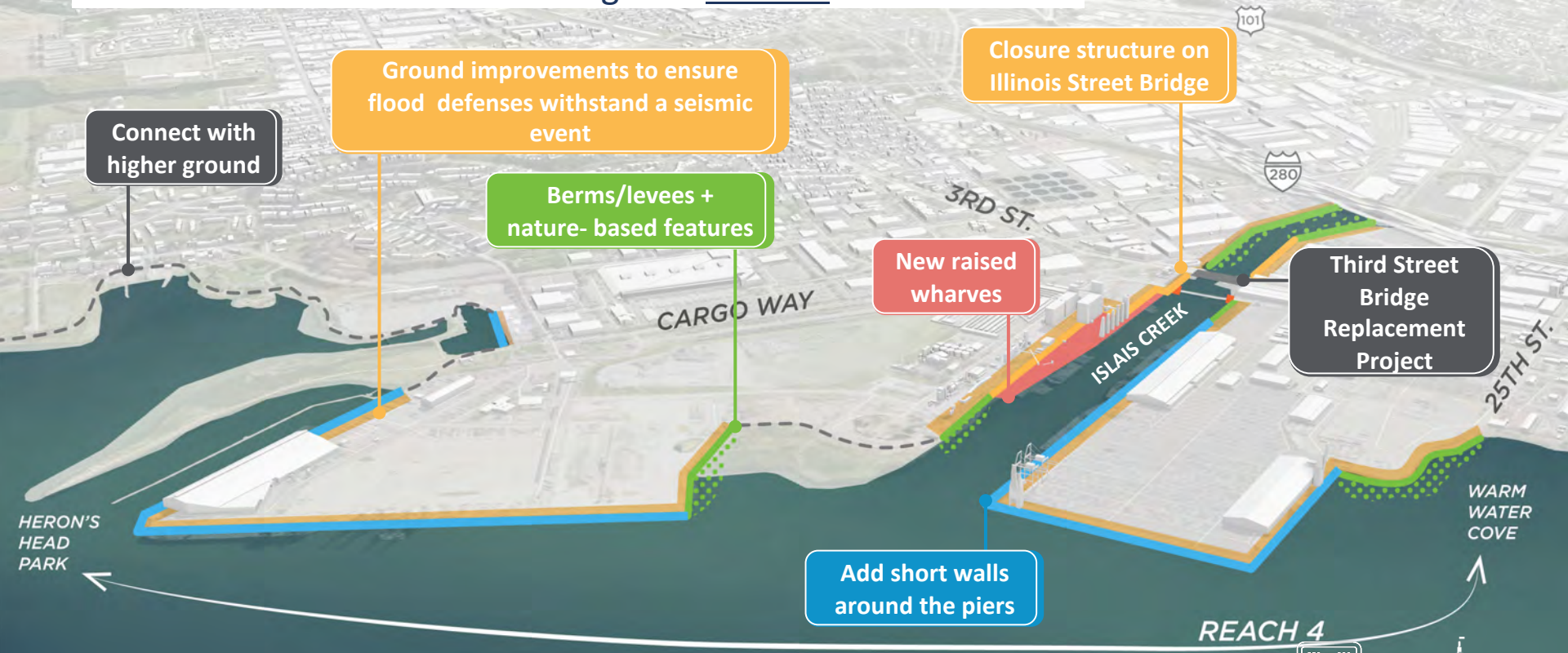
(included, but dependent on monitoring)

- Elevate shoreline to withstand **3.5'** of Sea Level Rise
- Incorporate additional nature based features along the creek and Bay shoreline



ISLAIS CREEK / BAYVIEW: FIRST ACTIONS

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



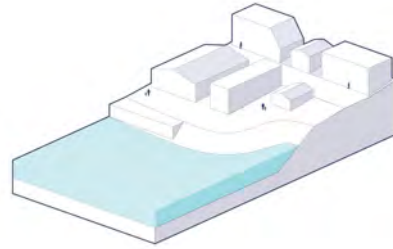
US Army Corps of Engineers



ACTIONS EXPLAINED

Berms/levees + nature-based features

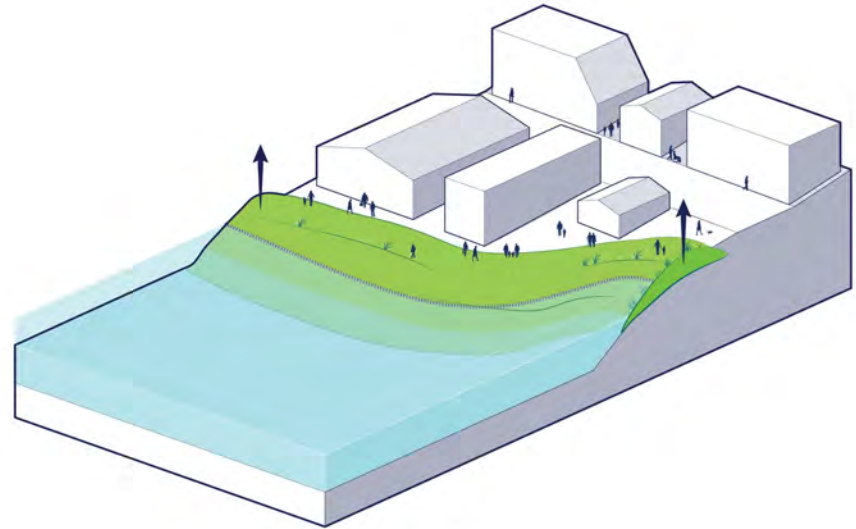
Berms/levees are areas of raised ground that can help prevent flooding while maintaining waterfront access. They can include public space, such as walking or biking paths, and incorporate vegetation that support habitats.



Current condition



Berm/levee



Future condition

ISLAIS CREEK / BAYVIEW SUMMARY TABLE

1ST ACTIONS

Coastal Flood Defense



Elevated shoreline to withstand **1.5'** of Sea Level Rise

Seismic Resilience of Flood Defenses



Ground improvements under roadways and shoreline promenades/open spaces

Connection to the Waterfront



Visual and physical connections **maintained**, opportunities to access water on berms/levees

Asset and System Defense



Transit and utility networks are **defended**, bridges remain in place

Nature-Based Features



Habitat enhancements along Islais Creek, Pier 94 wetlands, and Warm Water Cove

EARLY PROJECT (not included in Flood Study)

SF Public Works Third Street Bridge rehabilitation project

SUBSEQUENT ACTIONS (included, but dependent on monitoring)

- Elevate shoreline to withstand **3.5'** of Sea Level Rise
- Incorporate additional nature-based features along the creek and Bay shoreline



4 Next Steps



US Army Corps
of Engineers

WE WANT TO HEAR FROM YOU

Next Steps:

- Engage with BCDC staff and members of the Resource Agency Working Group to solicit comments on the USACE Report and Draft Plan
- Engage with the California State Lands Commission (2/26)
- Continue Port of San Francisco participation in the BCDC Regional Shoreline Adaptation Plan and related regional adaptation planning efforts



A CATALYST FOR A MORE RESILIENT SAN FRANCISCO

This is a once-in-a-century opportunity to:



Defend communities, assets, and infrastructure equitably against coastal flooding



Improve earthquake safety related to flood defense projects



Invest in a great public waterfront along with flood defense projects



Safeguard resilient transit and utility networks



Secure funding through collaboration with the Federal government



Adapt historic and cultural resources to climate change



US Army Corps
of Engineers



Thank you

U.S. Army Corps of Engineers | SFWFRS@usace.army.mil
Port of SF Waterfront Resilience Program | wrp@sfport.com



US Army Corps
of Engineers.