



WATERFRONT RESILIENCE PROGRAM

Northern Advisory Committee

November 18, 2020



TODAY'S AGENDA

Presentation Overview



- Overview of the Program
- Key findings from the Embarcadero Seawall Multi-Hazard Risk Assessment (MHRA)
- Introduction to “measures” or strategies for addressing risk along the Embarcadero waterfront
- Key priorities from community and stakeholder engagement
- Describe next steps to develop Proposition A projects
- Describe USACE Flood Study


WATERFRONT RESILIENCE PROGRAM EFFORTS

Program and City Resilience Projects and Efforts



WATERFRONT RESILIENCE PROGRAM

Goal Statement

An aerial photograph of San Francisco at dusk. The city skyline is illuminated with lights, and the Golden Gate Bridge is visible on the right. The waterfront area is prominent, showing various piers and structures. The sky is a mix of orange and blue, with some clouds. The overall scene is a panoramic view of the city and its harbor.

The Port's Waterfront Resilience Program will take actions to **reduce seismic and climate change risks** that support a safe, equitable, sustainable, and vibrant waterfront.

WATERFRONT RESILIENCE PROGRAM DRAFT PRINCIPLES

Affirmed through robust community engagement

- **Prioritize** life safety and emergency response
- **Advance** equity throughout the Waterfront Resilience Program, including through community and stakeholder engagement, planning, contracting, jobs and decision-making
- **Enhance** and sustain economic and ecological opportunities
- **Inspire** an adaptable waterfront that:
 - Improves the health of the Bay
 - Ensures public access to the waterfront and historic places and an inviting waterfront for all
 - Protects and preserves historic and maritime resources
 - Provides opportunities for diverse families, businesses, and neighborhoods to thrive
- **Lead** a transparent, innovative, collaborative, and adaptive Resilience Program



WATERFRONT RESILIENCE PROGRAM

Adaptation Framework



STRENGTHEN ELEMENT

Objective: Immediately implement highest priority disaster response and life safety projects along the Embarcadero Seawall.



ADAPT ELEMENT

Objective: Reduce remaining seismic and increasing flood risks, respond to changing priorities, and provide a framework for the Port to adapt over time.



ENVISION ELEMENT

Objective: Develop visions that can respond to higher water levels, changes in priorities and science, and a waterfront that is resilient to 2100 and beyond.

EMBARCADERO SEAWALL PROGRAM

Program Overview



- **Project Area:** Fisherman's Wharf to Mission Creek
- **Timing:** 2017 to 2021 project planning followed by implementation / construction
- **Focus:** Seismic and flood risk associated with the Embarcadero Seawall
- **Funding:** \$425 million General Obligation Bond passed in November 2018

EMBARCADERO SEAWALL PROGRAM SCHEDULE

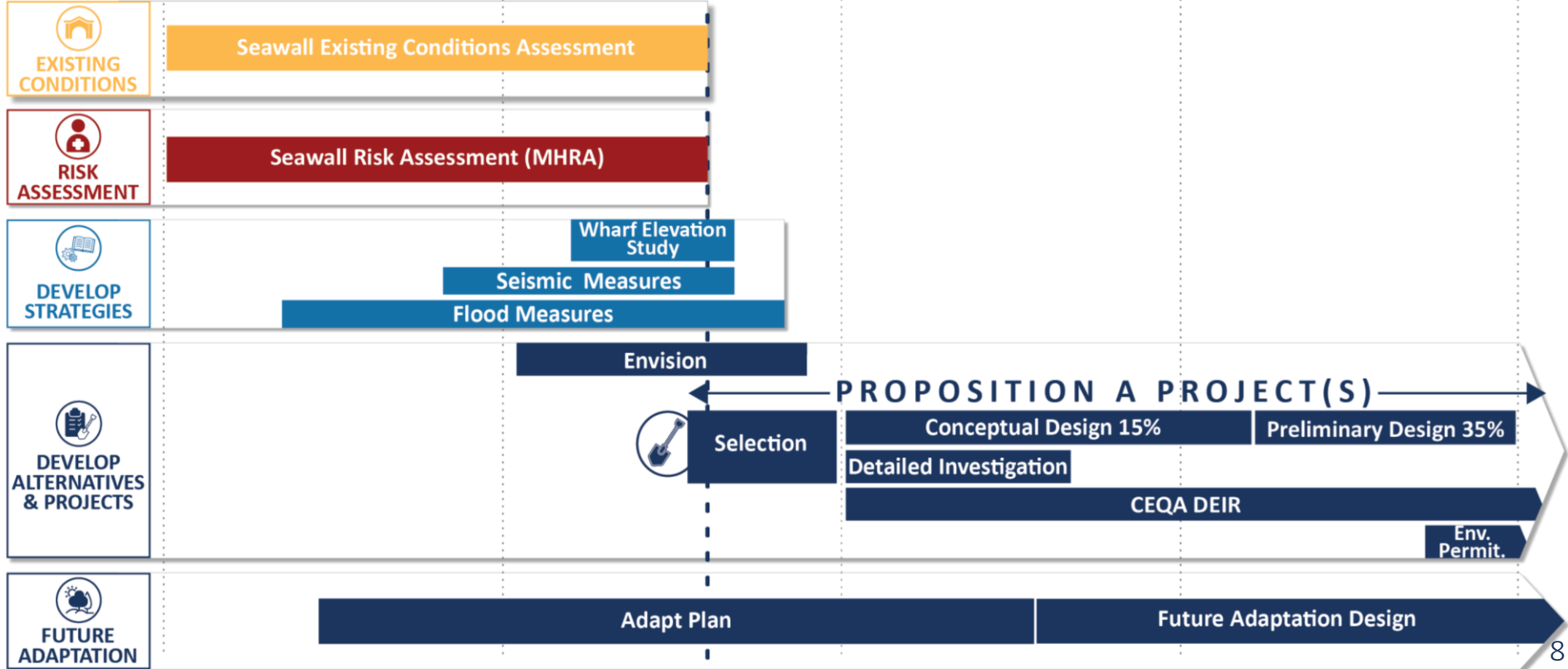
September 2020

2019

2020

2021

2022





What have we learned?

Key Findings from the Multi-Hazard
Risk Assessment (MHRA)

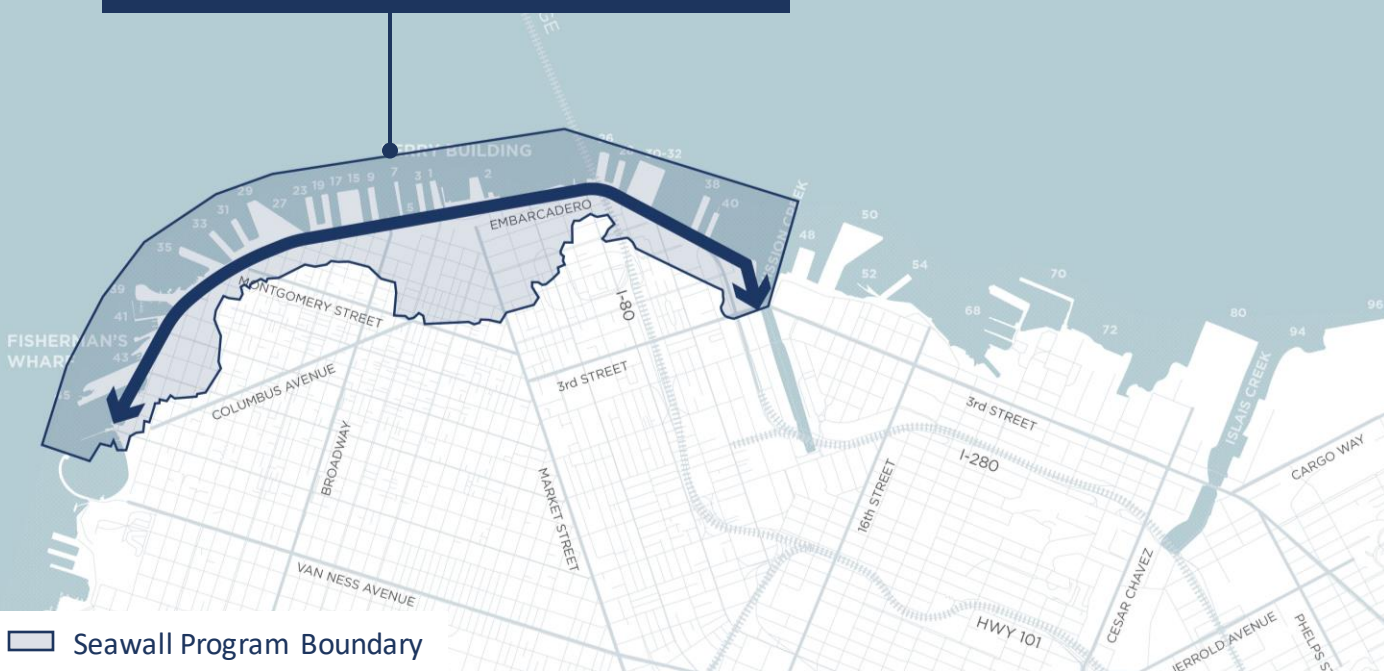


WHAT IS THE MULTI-HAZARD RISK ASSESSMENT (MHRA)?

Proposition A Required a Detailed Safety Assessment of the Embarcadero

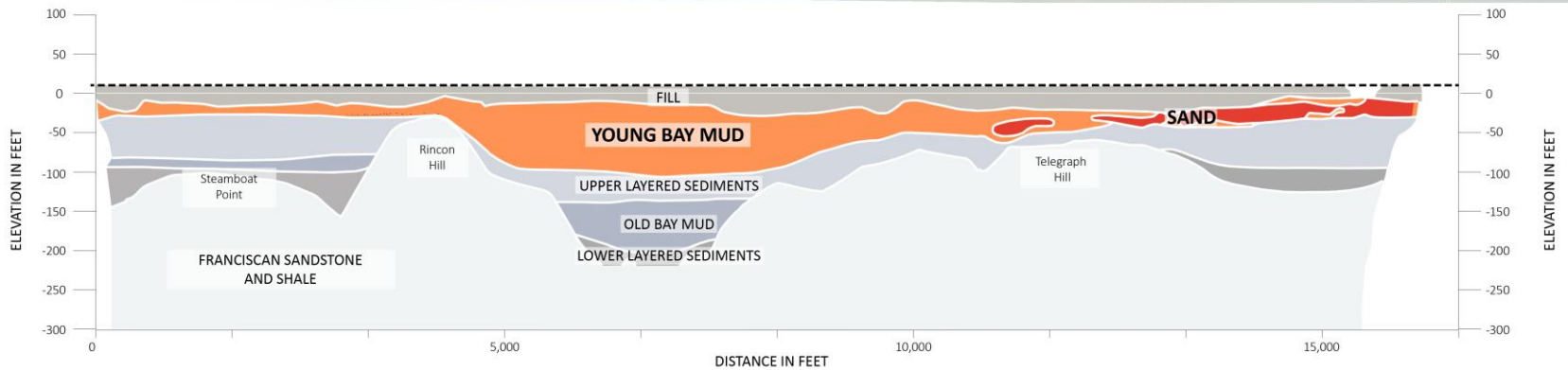
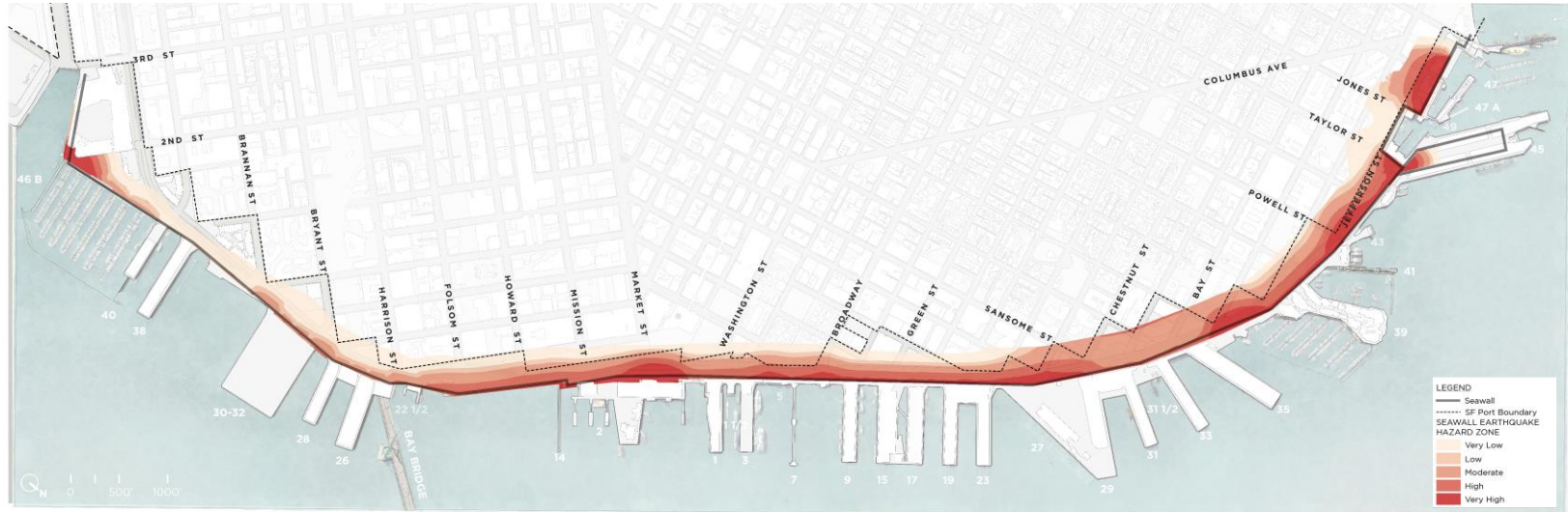
Refined investigation of flood and seismic hazards along the Embarcadero Seawall, from Fisherman's Wharf to Mission Creek

SAN FRANCISCO BAY



- Range of seismic hazards assessed within Embarcadero Seawall area
- Range of flood hazard scenarios assessed including impacts to critical City infrastructure
- Methodology: Bored holes and used lasers to uncover what is happening under the Bay and worked closely with agency partners to understand impacts to assets and services that the City and the region rely upon

SEAWALL EARTHQUAKE HAZARD ZONE



HAZARDS AND CONSEQUENCES

MHRA Key Findings

Up to **\$30 billion** cost of damages and disruption from **combined seismic and flood risk by 2100**



Lower lateral spread risk south of Bay Bridge



Ferry Building Area:
Significant seismic risk



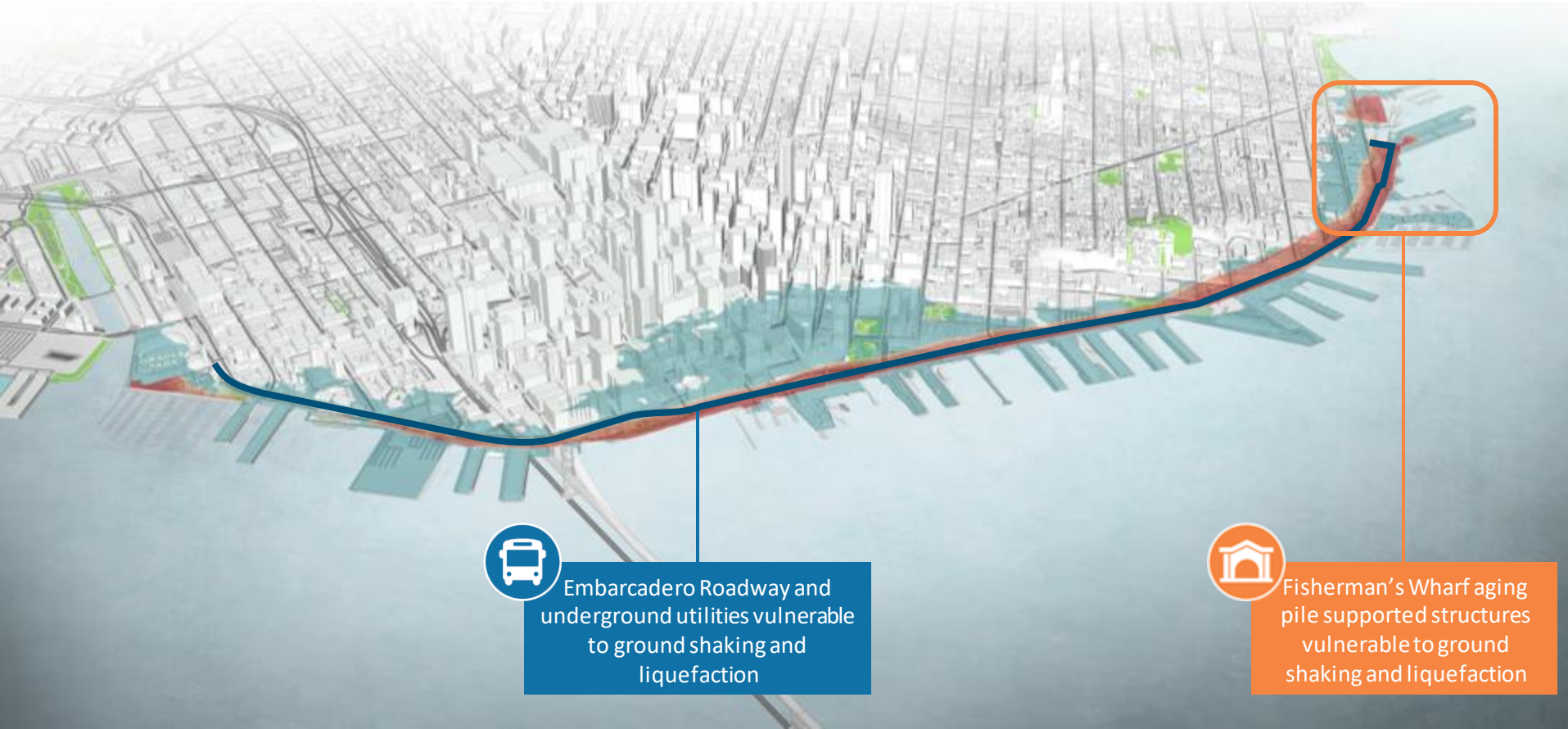
Entire Embarcadero:
Significant flood risk
between 2 and 3 feet
of sea level rise



Bulkhead wharves
and buildings at
greatest seismic risk

OTHER EARTHQUAKE HAZARDS AND CONSEQUENCES

MHRA Key Findings



Embarcadero Roadway and underground utilities vulnerable to ground shaking and liquefaction



Fisherman's Wharf aging pile supported structures vulnerable to ground shaking and liquefaction

EXISTING SHORELINE

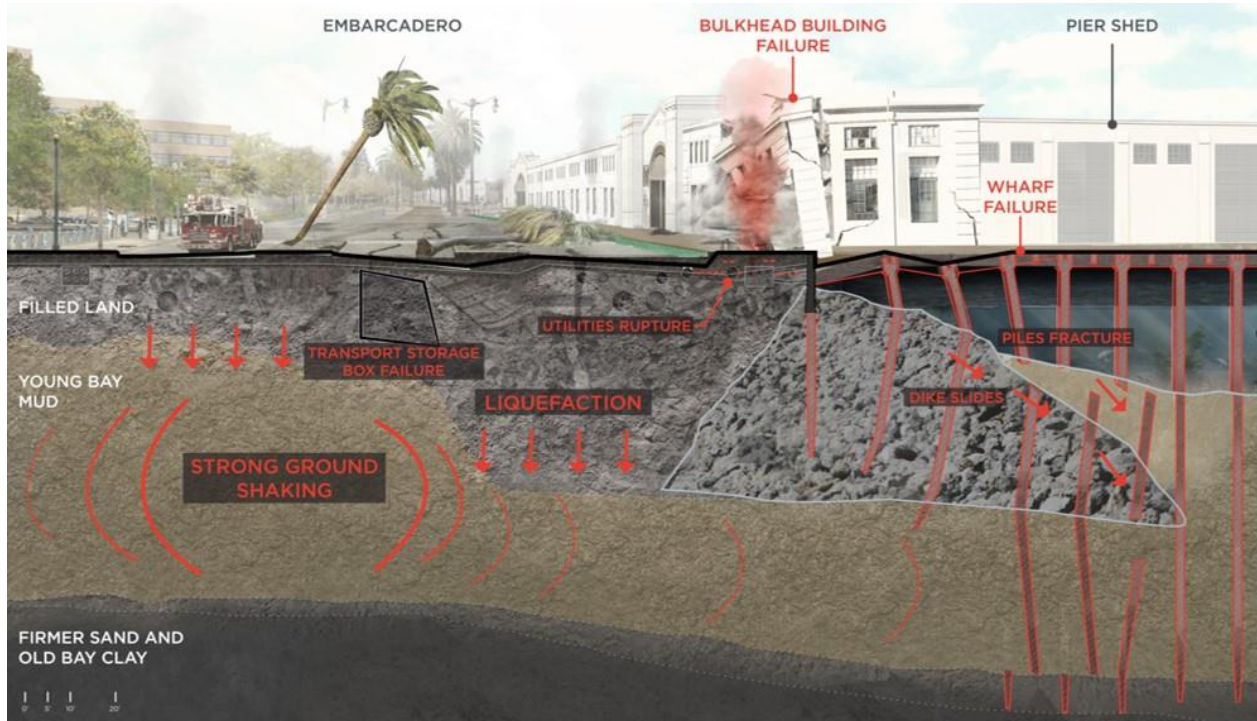
Critical Components of the Waterfront



- Seawall and Bulkhead Wharves are the city's flood protection and are highly vulnerable to seismic events

BULKHEAD WHARF EARTHQUAKE HAZARDS

MHRA Key Findings



Liquefaction induced lateral spreading at Port de Port-au-Prince



Lateral spreading cause by 1906 earthquake in San Francisco

BULKHEAD WHARF

WHARF TODAY AT CURRENT WATER LEVEL



WHARF TODAY WITH WATER LEVEL SURGE



Wharf is a current protection measure
– King Tide conditions today

LOCATIONS OF INTEREST



Seismic Measures Development

Introducing improvements or “measures” for consideration along the Embarcadero

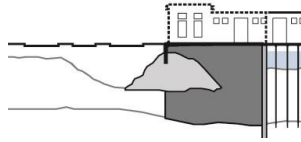


EMBARCADERO SEAWALL SEISMIC MEASURES

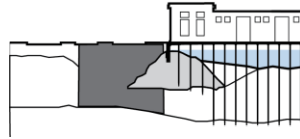
Draft seismic improvements under consideration by the Port

Seismic Measures

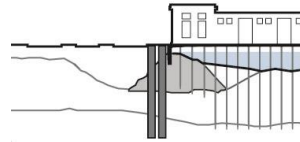
Shoreline
Stabilization



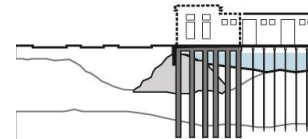
Nearshore
Buttress



Landside
Buttress

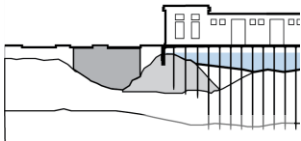


Drilled Shafts

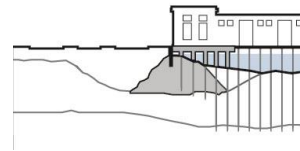


Super Bulkhead
Wharf

Targeted
Measures



Liquefaction
Mitigation



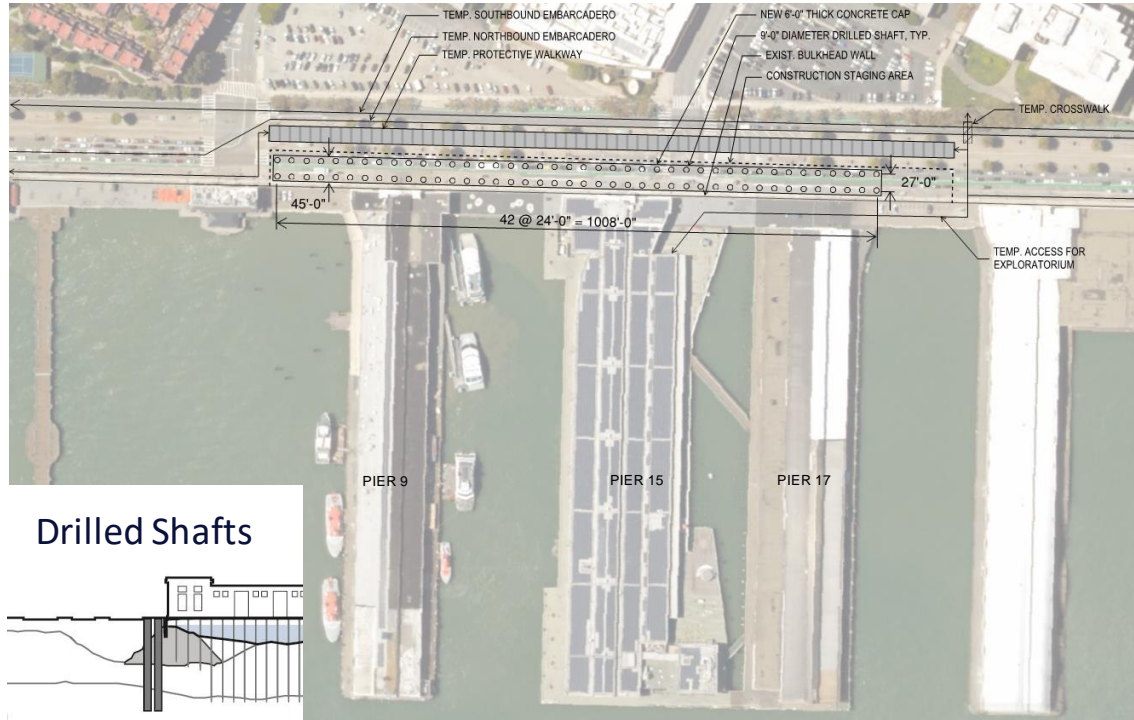
Bulkhead
Wharf Retrofits

For each seismic measure:

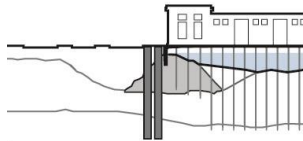
- Preliminary Engineering
- Cost Estimates
- Construction Production Rates
- Construction Impacts
- Feasibility
- Adaptation for Sea Level Rise

SEAWALL SEISMIC MEASURES DEVELOPMENT

Example Measure Construction Process

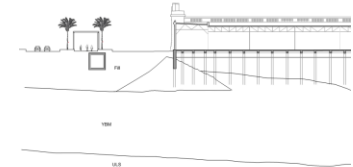


Drilled Shafts

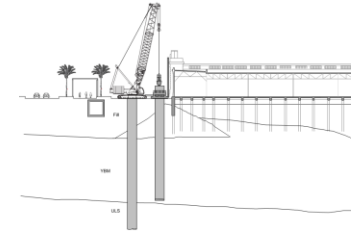


Construction Stages

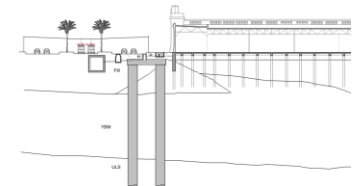
Remove / relocate utilities:



Close northbound lanes, reroute traffic, install concrete shafts:



Place slab, restore Embarcadero:



USACE Flood Study



USACE FLOOD RESILIENCY STUDY

Overview and Key Highlights



- Port is local sponsor, seeking assistance since 2012
- Local and Federal Expertise
- ~5 years (subject to waiver), 50/50 cost share
- Assess flooding under five sea level rise curves, including 3 USACE curves (low, medium, high) and two additional State of California curves
- Robust community and stakeholder input
- If USACE finds a Federal interest and Congress authorizes a Project:
 - Design/construction of project cost-shared 65% Federal, 35% Local

USACE FLOOD RESILIENCY STUDY PROCESS

Develop, evaluate, refine, and narrow alternatives under consideration

1 Future Without Project (FWOP) - **in process**
(flood damages and consequences)

Detailed Economic Analysis

- National Economic Development (NED) Account
- Regional Economic Development (RED) Account
- Other Social Effects (OSE)
- Environmental Quality

2 Problems, Opportunities, Objectives, Constraints, and Considerations (POOCCs)

3 Iterative Multi Step Alternative Formulation

- Initial Array
- Focused Array – **We Are Here**
- Final Array

4 National Economic Development (NED) Plan / Locally Preferred Plan (LPP)

5 Tentatively Selected Plan (TSP)

6 Feasibility Report and National Environmental Policy Act (NEPA)

FUTURE WITHOUT PROJECT (FWOP) CONDITION

Purpose

1

Flood events will cause damages and impacts felt throughout the city, region and beyond as sea level rises

2

The Flood Resiliency Study will quantify damages and impacts to determine the level of "Federal Interest"

3

Future Without Project (FWOP) is which all Federal actions are measured

4

Account for all projects taken by the Port or City in advance of a Federal project which will impact flood risk (i.e. Mission Rock, Pier 70, Potrero Point)

5

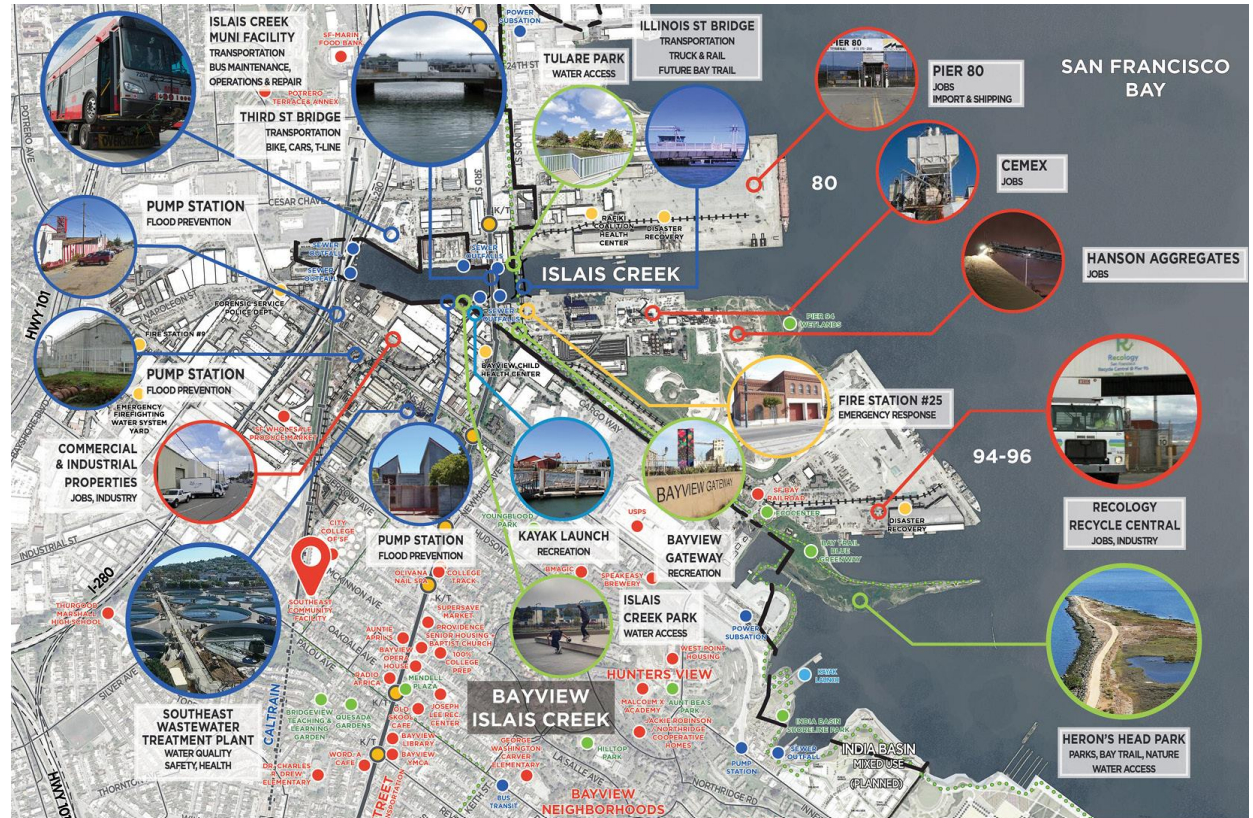
There is a high likelihood of Federal investment to prevent future damages when the cost of mitigation actions are less than the potential damage

COMPILE ROBUST INVENTORY OF ASSETS

FWOP – Step 1

Collaborated with City partners, Port tenants and other stakeholders to:

- Assign value to physical infrastructure
- Estimate impact of disruption and downtime for businesses and services
- Evaluate vulnerability of each asset to flood risk based on water depth
- Compile exhaustive database of all assets within the flood plain for use in the planning model



COMPILE ROBUST INVENTORY OF ASSETS

FWOP – Step 1

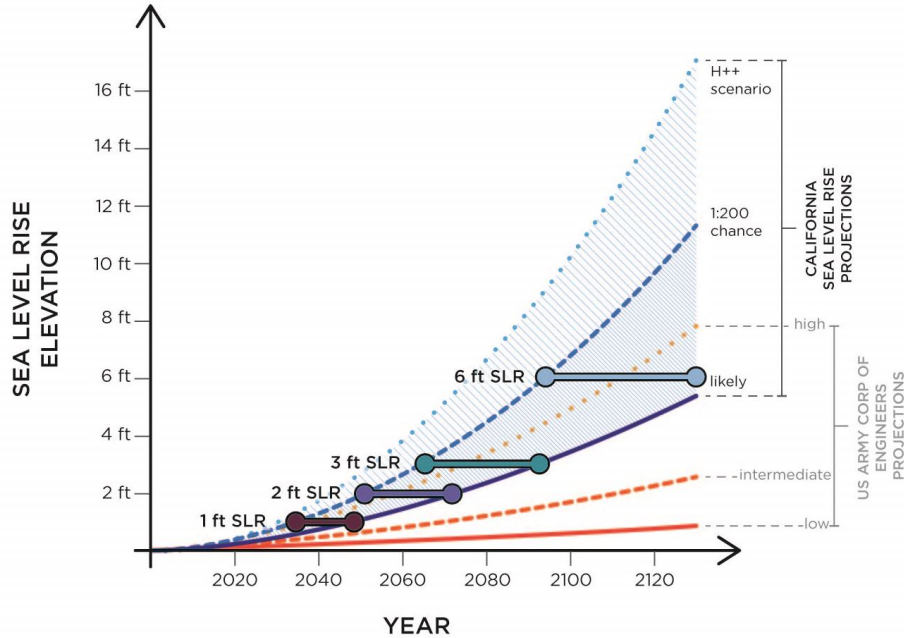


Assets at risk include more than:

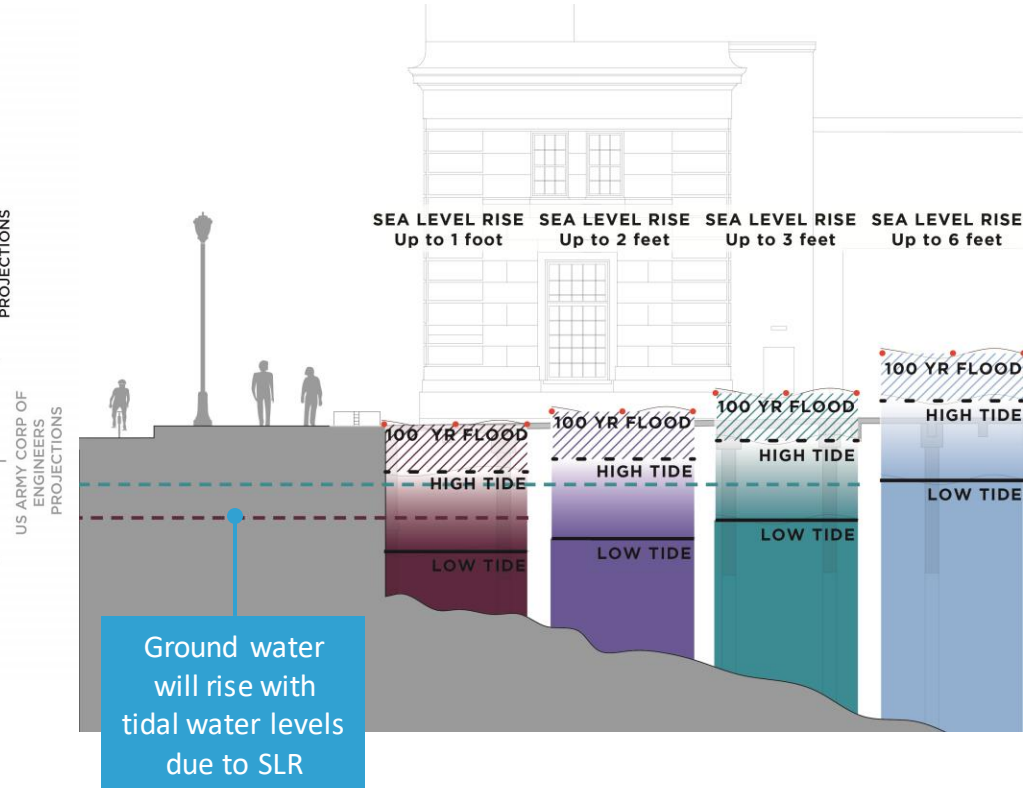
- 40 miles of roadway
- 25 miles of muni & cable car track
- 5 miles of freight railway
- 6 fire stations
- Dozens of other critical facilities
- 11,000 jobs
- 360,000 regional commuters
- 2,600 residential and commercial buildings
- 13,500 residents, 58% people of color
- Wastewater functions for 580,000 residents

DETERMINE FLOOD SCENARIOS

FWOP – Step 2

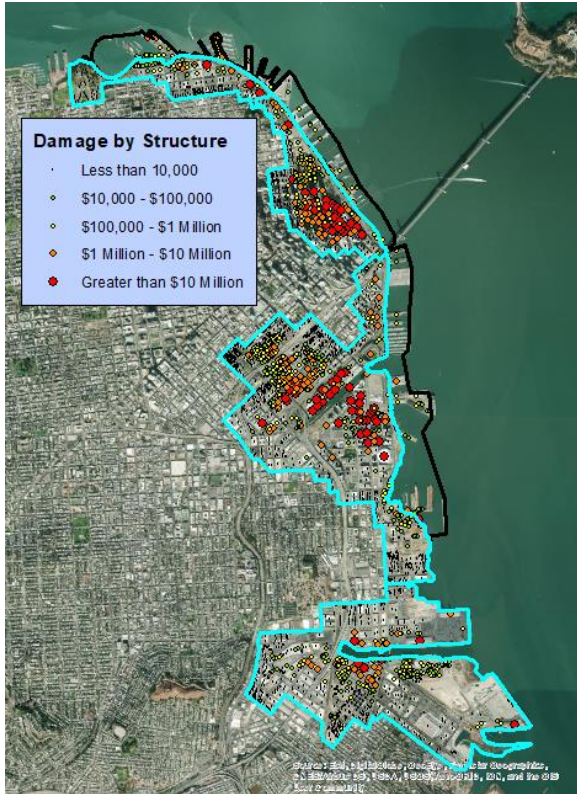


State of CA – Updated 2018; USACE – Updated 2013



PLANNING MODEL TO ANALYZE FWOP DAMAGES

FWOP – Step 3



Coastal Flood Scenarios



Robust Asset Inventory



Planning Model
(Economic Damages)

*DRAFT – work in progress

USACE Flood Study Focused Array



USACE FLOOD RESILIENCY STUDY AREA

Subareas support community prioritization and evaluation of conditions/ measures



PROBLEMS, OPPORTUNITIES, OBJECTIVES, CONSTRAINTS AND CONSIDERATIONS

Subarea Scale "POOCCs"

Problems, Opportunities, Objectives, Constraints, and Considerations
Fisherman's Wharf
Subarea 1-2

Subarea Description



Subarea 1-2: Fisherman's Wharf

J area for the sea lions and the Aquarium of the Bay. Pier 39 and the Blue & Gold Fleet, which provides sightseeing boat to end a water taxi dock. Many restaurants, stores, and additional California's top visitor serving destinations. Additional facilities: Outriggers, Pier 39 garage (Seawall) Lot 311), the Port harbor a variety of commercial stores, fish processing, and industrial! Pier 45 docks historic vessels, including the Jeremiah O'Brien remains a key maritime asset with modern fish processing ope with active berths along Dredg B and C. Shed C and the drop in a 4-alarm fire on May 23, 2020. Pier 45 is also home to the Pier 49, located near the base of Pier 45, includes the Fisherm restaurants, including The Droitto, Alidor's, and Terantino's at Street Pier and Pier 45 is home to Somer's restaurant, and a White Fleet terminal and Francisco Orso Restaurant at Pier 4 include a ferry terminal for the San Francisco Bay Ferry, which Many of the tourist destinations, shoreline access areas, and a San Francisco Bay Trail, a regional trail system that is designed estuary through all nine counties. There is also a Bay Area War E2 Launch Accessible Transfer System that connects to woodpe in and out of the water. The system also includes launch roller to pit, slide over, or drop down into a kayak or canoe, as well as Area Water Trail boat launch are storage racks with room to 2 short-term use to explore Pier 39.

Problems, Opportunities, Objectives, Constraints, and C
Ferry Building
Subarea 2-2

Subarea Description



Subarea 2-2: Ferry Building

to loss of jobs, tourism, and the revenues, causing significant economi and those who cannot work remotely would be most impacted. This i due to COVID-19.

The subarea's one-mile shoreline is entirely engineered and includes Embarcadero Sewall and historic piers.

Landmarks of this subarea include the Central Embarcadero Historic I National Register. In 2016, it was named one of America's 11 most on-Historic Preservation. This annual list identifies the nation's architecturally important degree. Loss or damage of the Ferry Building, the adjacent impact the area's historic district, affecting tourism and potentially in Pier 17 was rehabilitated and serves as the Port of San Francisco headq a Baywide History interpretive walk through the bulkhead building and be used for public functions. The bulkheads of Piers 1, 5, 3, and 5 have Baywide History interpretive walk, and office space. Pier 3 is an open-p public access. The Pier 24 Annex houses the Pier 24 Photography art 1 Across from the Ferry Building, Embarcadero Plaza, with its Valencian, between the City and the Bay. It connects the Embarcadero and Marin

Problems, Opportunities, Objectives, Constraints, and Considerations
Islais Creek
Subarea 4-2

Subarea Description



Subarea 4-2: Islais Creek

Islais Creek (Subarea 4-2) covers a large portion of the neighborhoods surrounding Islais Creek. It includes the industrial zone surrounding the western portion of Islais Creek, Islais Creek Channel, and the northern section of the Bayview Hunters Point neighborhood north of Palou Avenue.

The area contains several key infrastructure assets, including the Southeast Wastewater Treatment Plant, as well as multiple transportation storage, maintenance, and operation facilities that serve the entire city.

The Southeast Wastewater Treatment Plant is San Francisco's largest wastewater facility. It is responsible for treating flows from the City's Bayside in addition to minor flows from Daly City and Brisbane. The Southeast Treatment Plant operates 24 hours a day; the plant includes the Marina, Financial District, South of Market Area, Mission, Hunters Point, and Visitation Valley.

More than 80 percent of the total annual wastewater flow from the city is processed by the Southeast Treatment Plant. Wastewater and stormwater are transported through a network of transport and storage facilities, sewers, and high-capacity pump stations prior to reaching the Southeast Treatment Plant. Treated wastewater and stormwater is discharged to the Bay through an offshore outfall near Pier 80.

Disaster response assets, such as fire stations and hydrants of the Emergency Firefighting Water System (EFWS), also known as the Auxiliary Water Supply System or AWSS), are in the subarea. The EFWS is supplied by the local potable water system and saltwater from San Francisco Bay and distributed via a separate pipe network from the potable water systems.

The subarea contains the northern portion of the 3rd Street neighborhood commercial district. Third Street, including the Muni T-Third Light Rail Line (Muni T-Line), is a critical north-south transportation route for Bayview residents. Third Street and the Muni T-Line cross Islais Creek along the Third Street Bridge. The Illinois Street Bridge primary serves to provide railroad and heavy truck access to Piers 90-96, while also relieving congestion on Third Street. Illinois Street Bridge and the Illinois Street Bridge are also part of the City's disaster response system.

Within the Islais Creek inlet, the shoreline is primarily engineered, but small strips of natural shoreline are located between the inlet and the inland developed areas. Some of these areas are designated as parks with public shoreline and trail access.

The City received funding from Caltrans to develop strategies to address sea level rise and coastal flooding adjacent to Islais Creek through the Islais Creek Adaptation Strategy. The project will develop near-term resilience measures, mid-term adaptation, and a long-range vision for the Islais Creek shoreline that protects transportation infrastructure, enhances shoreline access and habitat, and increases community resilience in adjoining neighborhoods. Islais Creek is also included in the Port and U.S. Army Corps of Engineers Flood Study, which is analyzing flood risks along San Francisco's bayside shoreline.

The Islais Creek channel is also part of the Port of San Francisco Piers 80-96 Maritime Eco-Industrial Strategy (Maritime Eco-Industrial Center), which is generally bounded by 25th Street on the north, Illinois Street on the west and Cargo Way on the south. The Port defines the Maritime Eco-Industrial Center as an area that co-locates maritime industrial uses to enable

- Longer, more detailed document required by USACE effort to inform subarea scale alternatives development
- Informed by City department meetings, events and advisory group discussions, community manager, and policies and direct review and input from Port staff



Waterfront Resilience Program | POOCC | Subarea 1-2 Fisherman's Wharf | Page 1 of 7

² The San Francisco Bay Trail. Available at <http://baytrail.org/>

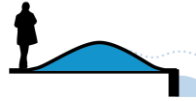


Waterfront Resilience Program | POOCC | Subarea 4-2 Islais Creek | Page 1 of 7

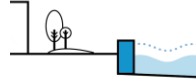
FLOOD MEASURES

Draft flood improvements under consideration by the Port

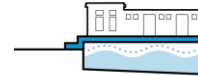
Physical



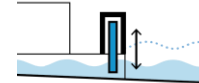
Levees



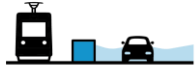
Seawalls



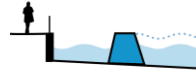
Raised Marine Structures



Tide Gates



Floodwalls



Breakwaters



Building Adaptations



Deployables

Ecological



Ecological Marine Structures



Ecological Features



Aquatic Habitat



Ecological Shorelines

Stakeholder Engagement

A community-driven process



COMMUNITY & STAKEHOLDER ENGAGEMENT OVERVIEW

Ongoing Engagement

The Port is proud to work with a diverse group of LBE, WBE, and MBE subcontractors to plan and execute engagement, which has included:

- Connected with thousands of San Francisco residents at City wide neighborhood events
- Community meeting series in three waterfront geographies
- Casual "mixers" to engage key stakeholders and interested public
- Digital engagement
- Youth engagement
- Public housing engagement
- Over 100 presentations to neighborhood, business, community, and CAC groups along the waterfront and citywide
- Targeted Port tenant engagement
- Press

STAKEHOLDER ENGAGEMENT HIGHLIGHTS

Ongoing engagement with City departments, local and regional agencies, resource agencies, and more

Problems, Opportunities, Objectives, Constraints, and Considerations
Fisherman's Wharf
 Subarea 1-2



Subarea Description
 Fisherman's Wharf (Subarea 1-2) includes Fisherman's Wharf, an active fishing industry and popular tourist area that features:

Problems, Opportunities, Objectives, Constraints, and Considerations
Ferry Building
 Subarea 2-2



Subarea Description
 Ferry Building (Subarea 2-2) includes the iconic Ferry Building, an important pier, the city's downtown ferry terminals, and portions of San Francisco's Financial District. It is an important neighborhood and a major transit hub.

Problems, Opportunities, Objectives, Constraints, and Considerations
Islais Creek
 Subarea 4-2



Subarea Description
 Islais Creek (Subarea 4-2) covers a large portion of the neighborhood surrounding Islais Creek. It includes the existing levee surrounding the western portion of Islais Creek, Islais Creek Channel, and the northern portion of the Bayview Hunters Point neighborhood, east of Palms Avenue.

Problems, Opportunities, Objectives, Constraints, and Considerations
San Francisco Bay
 Subarea 5-2




Subarea Description
 San Francisco Bay (Subarea 5-2) includes the city's waterfront, including the city's downtown, the city's major ports, and the city's major waterfront parks. It is an important area for the city's economy and recreation.

Wharfmark Resilience Program | FPOCC | Subarea 4-2 Islais Creek | Page 3 of 7

Measure Profile
New Seawall Bayward
 Flood Adaptation Measure



PHYSICAL INFRASTRUCTURE



SHORELINE LOCATION


DESIGN LIFE
 100+ years

COASTAL FLOOD HAZARD


MEASURES COMPATIBLE
 Flood

Measure Profile
Locks
 Flood Adaptation Measure



PHYSICAL INFRASTRUCTURE



SHORELINE LOCATION


DESIGN LIFE
 100+ years

COASTAL FLOOD HAZARD


MEASURES COMPATIBLE
 Flood

Measure Profile
Earthen Levee
 Flood Adaptation Measure



PHYSICAL INFRASTRUCTURE


SHORELINE LOCATION


DESIGN LIFE
 100+ years

COASTAL FLOOD HAZARD


MEASURES COMPATIBLE
 Flood

PHYSICAL INFRASTRUCTURE



SHORELINE LOCATION


DESIGN LIFE
 100+ years

COASTAL FLOOD HAZARD


MEASURES COMPATIBLE
 Flood

PHYSICAL INFRASTRUCTURE


SHORELINE LOCATION


DESIGN LIFE
 100+ years

COASTAL FLOOD HAZARD


MEASURES COMPATIBLE
 Flood

PHYSICAL INFRASTRUCTURE


SHORELINE LOCATION


DESIGN LIFE
 100+ years

COASTAL FLOOD HAZARD


MEASURES COMPATIBLE
 Flood

Wharfmark Resilience Program | Measure Profile | Page 1 of 3

- The **Interagency Coordinating Team**, which is convened jointly by USACE and Port staff, enables each agency to partner in the Study
- A **Cooperation and Participating Resource Agency Working Group (RAWG)** was established consisting of representatives from the USACE, the Port, and the various State and Federal agencies concerned with the study area

COMMUNITY MEETINGS

Feedback via digital meetings on seismic and flood risk reduction measures

What we heard:

1b AQUATIC PARK + FISHERMAN'S WHARF SUBAREAS

FACILITATORS: BRAD BENSON + LAUREN WONG

REPORT OUT NOTES

1. What are the most important considerations for evaluating measures?

ADAPTABILITY COST: EFFECTIVE DESIGN LIFE ABLE TO BE REPLACED

ECOLOGICAL FEATURES (COMBOS WITH STRUCTURAL) LONG TERM SKULUTION NEEDED TOO

2. Which concerns do you have about any of the measures?

ASSET LEGEND

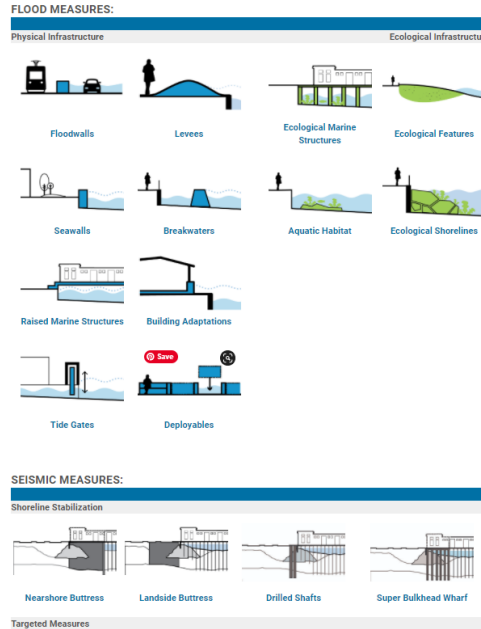
REPORT OUT REPRESENTATIVE

	DESIGN LIFE	ADAPTABILITY	IMPACT ON THE WATERFRONT	COST	COMPATIBLE MEASURES
FLOOD MEASURES					
1 LEVELS	75+ years	Low	Major Intervention	\$\$\$\$\$	Nearshore Buttress, Bulkhead Wharf Retrofit, Ecological Features
2 SEAWALLS	50-100 years	Varies	Major Intervention	\$\$\$	Nearshore Buttress, Drilled Shafts, Ecological Shorelines
3 RAISED MARINE STRUCTURES	50+ years	Medium	Major Intervention	\$\$\$\$\$	Drilled Shafts, Ecological Features
4 FLOODWALLS	30-50 years	Low	Minor Intervention	\$\$	Bulkhead Wharf Retrofit, Drilled Shafts
ECO/INFRA					
5 ECOLOGICAL FEATURES	10-50+ years	Medium-High	Minor Intervention	S*	All Flood Measures and Seismic Measures
6 ECOLOGICAL SHORELINES	Decades	Medium-High	Typically Minor Intervention	S*	All Flood Measures and Seismic Measures
SEISMIC MEASURES					
7 NEARSHORE BUTTRESS	100+ years	Very High	Major Waterside Intervention	\$\$\$\$\$	Stress, Seawalls, Ecological Features
8 DRILLED SHAFTS	75+ years	Medium	Moderate Landside Intervention	\$\$\$	Raised Marine Structures, Floodwalls, Seawalls
9 BULKHEAD WHARF RETROFIT	30 years	Low	Minor Waterside Intervention	\$\$	Levels, Floodwalls, Ecological Features
SMC + EMERGENCY PREPAREDNESS					
10 EMERGENCY PREPAREDNESS			No physical concept	\$	All Flood Measures and Seismic Measures

- Understanding of the challenges of applying measures
- Balancing near- and long-term risk
- Interest in preserving historic resources
- Focus on Bay ecology and health
- Desire to preserve and enhance access to and along the waterfront
- Interest in exploring alternative modes of transport

DIGITAL ENGAGEMENT HIGHLIGHTS

Feedback via Waterfront Resilience Story Maps and a Measures Explorer



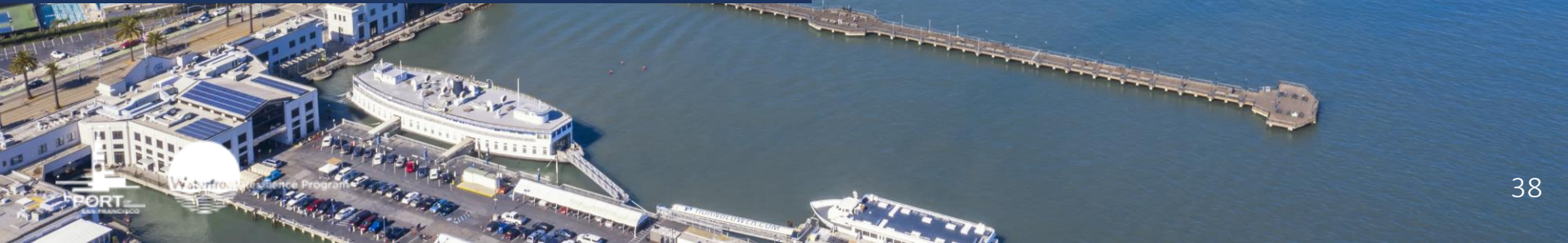
<https://www.sfportresilience.com/planning-for-our-future>

- To date, there have been more than **100K page visits** across all Measure Explorer and Story Maps pages
- The top three measures with the most page views: **Levees, Floodwalls, Seawalls**
- The top three Story Maps with the most pages views: **South Beach, Aquatic Park, Fisherman's Wharf**
- The top three themes with the most page views: **Open Space, Transportation, Maritime**



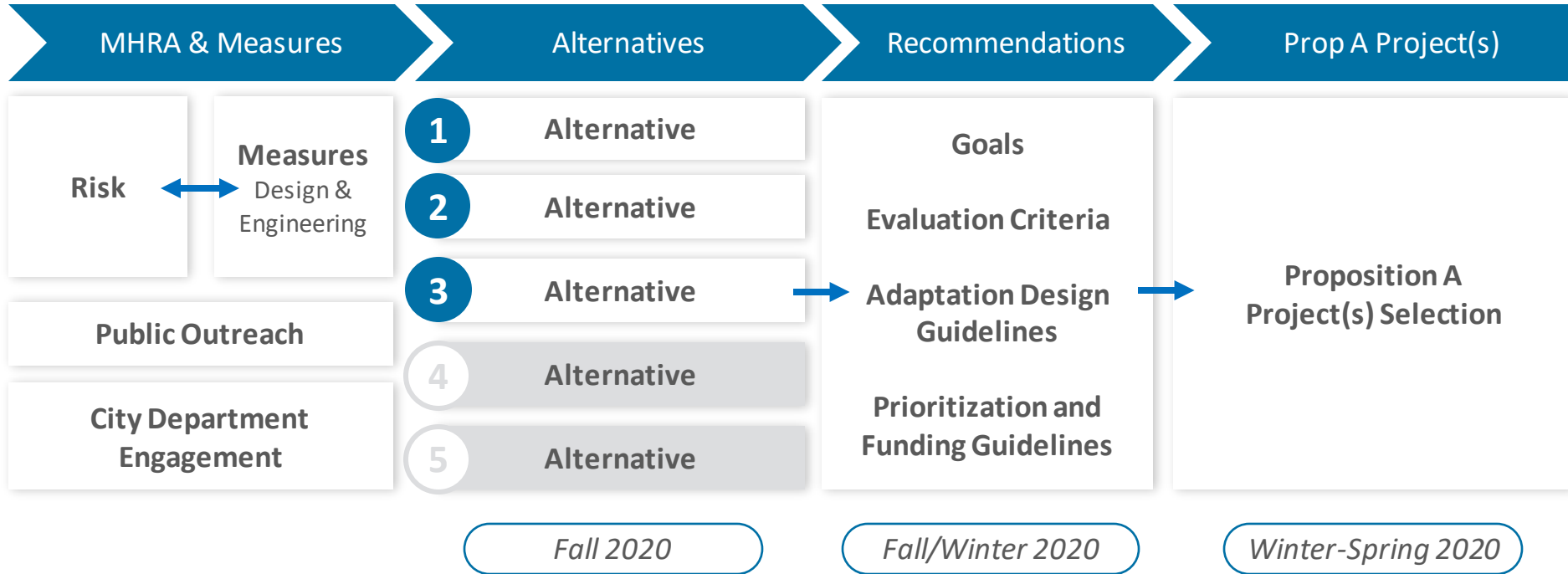
Next Steps

What's Next for the Embarcadero Seawall Program and the USACE Flood Resiliency Study



ALTERNATIVES DEVELOPMENT

Embarcadero Seawall Program Proposition A Project Selection



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. They are riding away from the camera towards the ocean under a clear blue sky. A large dark blue semi-transparent box is overlaid on the left side of the image, containing text.

Thank You!

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