TODAY’S AGENDA
Presentation Overview

• Understanding the Risks
  • What we're facing

• Waterfront Resilience Program
  • What we're doing

• Range of Possibilities
  • What we're considering

• Draft Waterfront Adaptation Strategies

• Next Steps
TODAY’S AGENDA
Committee Questions

- Do the strategies address the current and future hazards we're facing?
- What are the implications of the strategies on key City capital assets and infrastructure?
- What investments would be required with each strategy to continue to operate City infrastructure systems?
- What opportunities do you see to use this project to advance infrastructure goals?
The Port of San Francisco has developed seven high-level Draft Waterfront Adaptation Strategies through a collaborative interagency process and over five years of public engagement.

The draft Strategies are ready for public feedback, with a goal of reaching a Draft Waterfront Adaptation Plan by Summer 2023.
DRAFT WATERFRONT ADAPTATION STRATEGIES

Port-led, City of San Francisco Agencies, and USACE Partnered in Development Process
The Port and U.S. Army Corps of Engineers (USACE) are conducting a *waterfront coastal flood study* for San Francisco, which could result in *significant federal funding for flood risk reduction*.

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 community benefits that will not be eligible for USACE funding.
Understanding the Risks

What We're Facing
RISING TO THE CHALLENGE
San Francisco Faces Urgent Seismic, Coastal, and Inland Flood Risks Today

SEISMIC RISKS
San Francisco, 1906

COASTAL FLOODING
Recology

INLAND FLOODING
The Embarcadero

Islais Creek outfall and Marin St.
WATERFRONT WIDE EARTHQUAKE HAZARDS

Very High Earthquake “Liquefaction” Risk

Liquefaction occurs when water-saturated sediment (like sand) temporarily loses strength and acts as a fluid.

Various levels of lateral spreading risk along the shoreline.

Source: USGS, Open-File Report 2006-1037 Version 1.1, Maps of Quaternary Deposits and Liquefaction Susceptibility in the Central San Francisco Bay Region, California
COASTAL AND INLAND FLOOD RISK

Different Geographic Impacts
COASTAL AND INLAND FLOODING

Existing conditions
COASTAL AND INLAND FLOOD RISK

Sea levels rise
Raise shoreline to defend against sea level rise
Groundwater and stormwater flooding behind raised shoreline
Pumping reduces flooding behind raised shoreline
COASTAL AND INLAND FLOOD RISK

Two related forms of flooding

INLAND FLOOD ZONE

COASTAL FLOOD ZONE
COASTAL AND INLAND FLOOD RISK

Shift based on the location of flood protection
Any solution endorsed by the City of San Francisco will aim to address all three risks: seismic risks, coastal flooding and inland flooding.
Waterfront Resilience Program

What We're Doing
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.
PROGRAM AREA

Focus is Conceptual-Level Strategies Within the Port’s Jurisdiction

Areas addressed through additional City planning efforts and projects
OTHER CITY ADAPTATION PROJECTS
Outside Port jurisdiction
Range of Possible Solutions

What We're Considering
DRAFT WATERFRONT ADAPTATION STRATEGIES

Key Components

Coastal Flood Defense
Location + Height
And area of elevation change

Physical Changes
Such as earthquake-resilient berms, floodproofing, and nature-based features

Policy Changes
Such as resilient codes, warning systems, and land use changes
Driving Questions

**What if...**
- we **did not adapt** to mitigate the risks?
- we adapted by **floodproofing** and **moving** buildings and assets, **without** coastal flood structures?
- we address flooding **at a lower rate** of sea level rise?
- we address flooding **at a higher rate** of sea level rise, **as recommended by CA and SF guidance**?

USACE SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY
Draft Waterfront Adaptation Strategies

**What if...**
- **we did not adapt** to mitigate the risks?
- **we adapted by floodproofing and moving** buildings and assets, *without* coastal flood structures?
- **we address flooding at a lower rate of sea level rise?**
- **we address flooding at a higher rate of sea level rise, as recommended by CA and SF guidance?**

**USACE SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY**

**STRATEGY A**
**STRATEGY B**
**STRATEGY C**
**STRATEGY D**
**STRATEGY E**
**STRATEGY F**
**STRATEGY G**
THE ROLE OF COMMUNITY FEEDBACK
Pathway to the Draft Waterfront Adaptation Plan

Assessment + Feedback
- Public and Community Input
- Technical Evaluation
- Regulatory Standards

Waterfront Adaptation Plan (Tentatively Selected Plan)
Draft Waterfront Adaptation Strategies
TIME HORIZONS

- TODAY
  - Early Projects

- 2040
  - Mid Term Adaptation

- 2090
  - Long Term Adaptation
SEA LEVEL RISE

- 7' of sea level rise
  - Meets CA State and City of SF Guidance

- 3.5' of sea level rise
- 1.5' of sea level rise

Strategies:
- Strategy A
- B*
- C
- D
- E
- F
- G

*Strategy involves phased floodproofing and relocation of assets

Adaptable to
Initially built to
What if... we did not adapt to mitigate the risks?

What if... we adapted by floodproofing and moving buildings and assets, without coastal flood structures?

What if... we address flooding at a lower rate of sea level rise?

What if... we address flooding at a higher rate of sea level rise, as recommended by CA and SF guidance?
This strategy 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 B – NONSTRUCTURAL OPTION

Examples

- **Warning systems**
- **Floodproofing**
- **Raise structure in place**
- **Buyouts**
Adapts the shoreline to withstand 1.5’ of sea level rise by 2040 using a combination of structural and nonstructural measures.
STRATEGY C – LOWER SEA LEVEL RISE

Address flooding in lowest lying areas along the waterfront (1.5' sea level rise)

Build infrastructure to pump away stormwater/groundwater flooding

Tie into Planned / Proposed Developments

NOTE: ALL DRAWINGS FOR FEASIBILITY STUDY ONLY. NOT A PROPOSED DESIGN.
Adapts the shoreline to withstand 1.5’ of sea level rise by 2040, with the possibility of building higher by 2090.
STRATEGY D – LOWER SEA LEVEL RISE – ADAPTABLE

2040

Address flooding in lowest lying areas along the waterfront (1.5' sea level rise)

Raise shoreline around the Ferry Building (3.5' sea level rise)

Tie into Planned / Proposed Developments

Build infrastructure to pump away stormwater/groundwater flooding

NOTE: ALL DRAWINGS FOR FEASIBILITY STUDY ONLY. NOT A PROPOSED DESIGN.
NOTE: ALL DRAWINGS FOR FEASIBILITY STUDY ONLY. NOT A PROPOSED DESIGN.

Invest in additional infrastructure to pump away stormwater/groundwater flooding

Raise bridges and connected roads/transit (3.5' sea level rise)

Raise remaining shoreline (3.5' sea level rise)
What if... we did not adapt to mitigate the risks?

What if... we adapted by floodproofing and moving buildings and assets, without coastal flood structures?

What if... we address flooding at a lower rate of sea level rise?

What if... we address flooding at a higher rate of sea level rise, as recommended by CA and SF guidance?

**Focused on Strategies E, F, and G**
Preserves a waterfront that looks and functions much as it does today by adapting the shoreline.
STRATEGY E – HIGHER SEA LEVEL RISE – HOLD THE LINE

2040

Raise shoreline (7' sea level rise)  
Embarcadero

Raise shoreline (3.5' sea level rise)  
Mission Creek/Mission Bay  
Islais Creek/Bayview

Build infrastructure to pump away stormwater/groundwater flooding

Raise bridges and connected roads/transit (7' sea level rise)
STRATEGY E – HIGHER SEA LEVEL RISE – HOLD THE LINE

2090

Invest in additional infrastructure to pump away stormwater/groundwater flooding

Raise shoreline (7' sea level rise)
Mission Creek/Mission Bay
Islands Creek/Bayview
STRATEGY E – HIGHER SEA LEVEL RISE – HOLD THE LINE

Islais Creek / Bayview in 2090

2090 Shoreline Adaptation

Industrial uses and jobs stay in place

Improved public access

Water access and recreational activities

Existing Shoreline

Living shoreline

2040 Shoreline Adaptation
STRATEGY E – HIGHER SEA LEVEL RISE – HOLD THE LINE

Mission Creek / Mission Bay in 2090

Redesign for a narrower Terry Francois Blvd

Waterfront promenade

Existing Shoreline

2090 Shoreline Adaptation

Limited bay fill

Eco seawall
STRATEGY E – HIGHER SEA LEVEL RISE – HOLD THE LINE

Embarcadero in 2090

- Existing Shoreline
- Bay fill in wharf zone only
- Ferry Building elevated
- Elevated promenade with public realm improvements
- Eco-seawall
- Active stormwater management
- 2090 Shoreline Adaptation
- Full mobility corridor reconfigured and some width reduction
STRATEGY F – HIGHER SEA LEVEL RISE – MANAGE THE WATER

Creates an active system for managing flooding by heavily relying on machinery.
STRATEGY F – HIGHER SEA LEVEL RISE – MANAGE THE WATER

2040

- **Raise shoreline (7’ sea level rise)**
  - Embarcadero

- **Construct tide gates (7’ sea level rise)**
  - keeping roads, bridges in place

- **Build infrastructure to pump away stormwater/groundwater flooding**

- **Raise shoreline (3.5’ sea level rise)**
  - Mission Creek/Mission Bay
  - Islais Creek/Bayview

- **Adapt Port working lands to flooding (3.5’ sea level rise)**
CANALS, BASINS, AND PUMPING NEEDED FOR STORMWATER/GROUNDWATER FLOODING

RAISE SHORELINE (7’ SEA LEVEL RISE)
Mission Creek/Mission Bay
Islais Creek/Bayview

ADAPT PORT WORKING LANDS AND INDUSTRIAL ZONES FOR FLOODING (7’ SEA LEVEL RISE)
STRATEGY F – HIGHER SEA LEVEL RISE – MANAGE THE WATER
Islais Creek / Bayview in 2090

Industrial uses and jobs stay in place

Improved public access

Water access and recreational activities

Eco seawall

2040 and 2090 Coastal Defense at Existing Shoreline
STRATEGY F – HIGHER SEA LEVEL RISE – MANAGE THE WATER

Mission Creek / Mission Bay in 2090

Redesign for a narrower Terry Francois Blvd

Waterfront promenade

Existing Shoreline

2090 Shoreline Adaptation

2040 Shoreline Adaptation

Bay fill

Living shoreline
STRATEGY F – HIGHER SEA LEVEL RISE – MANAGE THE WATER

Embarcadero in 2090

- Elevated bayward promenade with public realm improvements
- Ferry Building stays in place
- Limited impacts to mobility corridor
- Most bay fill
- 2090 Shoreline Adaptation
- Habitat terraces
- Active stormwater management
- 2040 Shoreline Adaptation
- Existing Shoreline
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.
STRATEGY G – HIGHER SEA LEVEL RISE – ALIGN WITH WATERSHEDS

2040

- Raise shoreline (7' sea level rise) Embarcadero
- Build infrastructure to pump away stormwater/groundwater flooding
- Raise bridges and connected roads/transit (3.5' sea level rise)
- Adapt Port working lands to flooding (3.5' sea level rise)
- Raise shoreline (3.5' sea level rise) Mission Creek/Mission Bay Islais Creek/Bayview

Coastal Flood Defense
Coastal Adaptation Zone
Inland Adaptation Zone
STRATEGY G – HIGHER SEA LEVEL RISE – ALIGN WITH WATERSHEDS

2090

Mission Bay transformed to a floodable district, with significant changes to all urban systems

Raise shoreline (7’ sea level rise)
Mission Creek/Mission Bay
Islais Creek/Bayview

Adapt Port working lands and industrial zones for flooding (7’ sea level rise)

Widen Islais Creek – new open spaces and wetlands
STRATEGY G – HIGHER SEA LEVEL RISE – ALIGN WITH WATERSHEDS

Islais Creek / Bayview in 2090

- Habitat restoration
- Water access and recreational activities
- Wetland expansion and improved public access
- Industrial uses and jobs relocated

2090 Shoreline Adaptation

2040 Shoreline Adaptation

Existing Shoreline
STRAATEGY G – HIGHER SEA LEVEL RISE – ALIGN WITH WATERSHEDS

Mission Creek / Mission Bay in 2090

- Waterfront promenade
- Stormwater/groundwater wetlands
- Existing Shoreline
- No bay fill
- Living shoreline
- 2040 Shoreline Adaptation
- Water recreation activities
- 2090 Shoreline Adaptation
**STRATEGY G – HIGHER SEA LEVEL RISE – ALIGN WITH WATERSHEDS**

Embarcadero in 2090

- **Ferry Building elevated**
- **No bay fill**
- **Elevated promenade with public realm improvements**
- **Full mobility corridor reconfigured, significant width reduction**
- **Eco-seawall and intertidal habitat improvements**
**DRAFT WATERFRONT ADAPTATION STRATEGIES DEVELOPMENT SCHEDULE**

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**DEVELOP**

7 Draft Waterfront Adaptation Strategies (Alternatives)

**EVALUATE + SELECT**

**FINALIZE**

Revised Draft Strategies (Tentatively Selected Plan)

**COMMUNITY ENGAGEMENT**
JOIN THE CONVERSATION

Different Options for Engaging

• Join us at an upcoming meeting – online or digital
• Forward the digital engagement tool to your friends and colleagues
• Join us at the upcoming Waterfront Community Mixer
• More information here: sfport.com/wrp
Thank You

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