

Port of San Francisco Draft Waterfront Adaptation Strategies

Storms, Flooding & Sea Level Rise Defense
Conference - Propeller Club of Northern California

November 9, 2022



Waterfront Resilience Program



PORT OF

SAN FRANCISCO

DRAFT WATERFRONT ADAPTATION STRATEGIES



Port of SF has developed 7 high-level Draft Waterfront Adaptation Strategies with over five years of public engagement.

We have a goal of reaching a Draft Waterfront Adaptation Plan by Summer 2023.



RISING TO THE CHALLENGE

San Francisco Faces Urgent Seismic, Coastal, and Inland Flood Risks Today

SEISMIC RISKS



San Francisco, 1906



Marina, 1989

COASTAL FLOODING

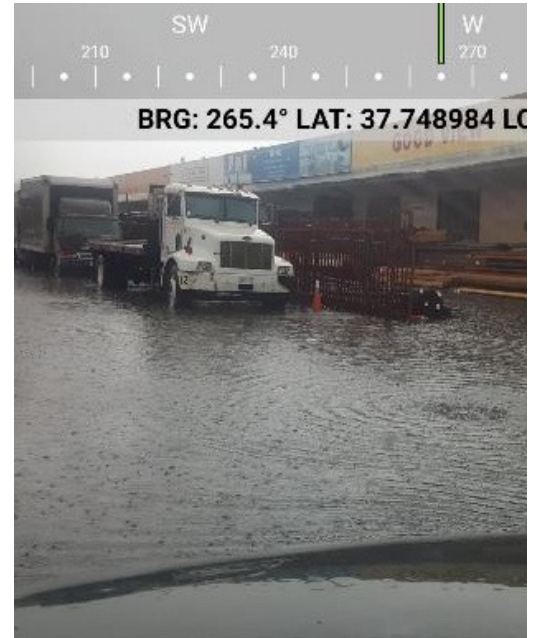


Recology



The Embarcadero

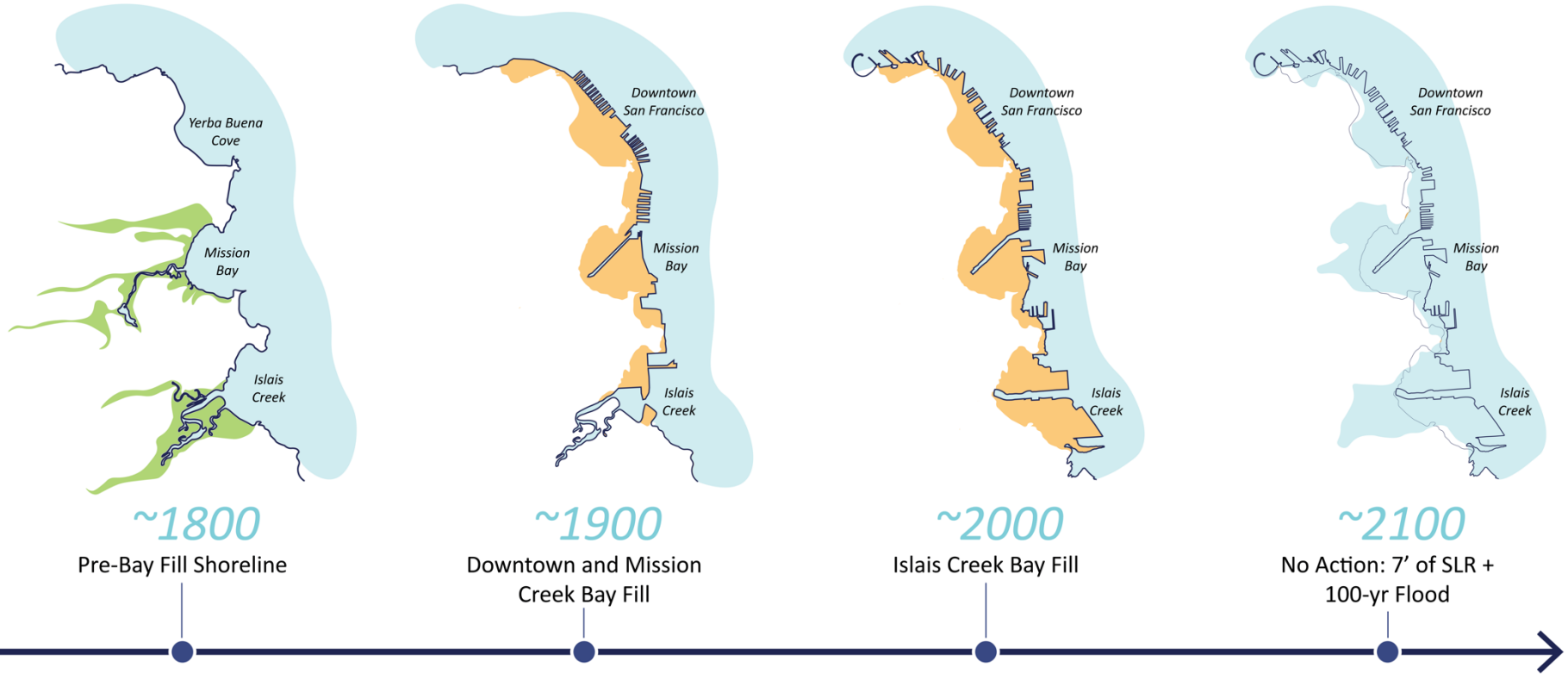
INLAND FLOODING



Islais Creek outfall and Marin St.

HISTORIC SHORELINE + BAY FILL

From the 1800s



~1800

Pre-Bay Fill Shoreline

~1900

Downtown and Mission
Creek Bay Fill

~2000

Islais Creek Bay Fill

~2100

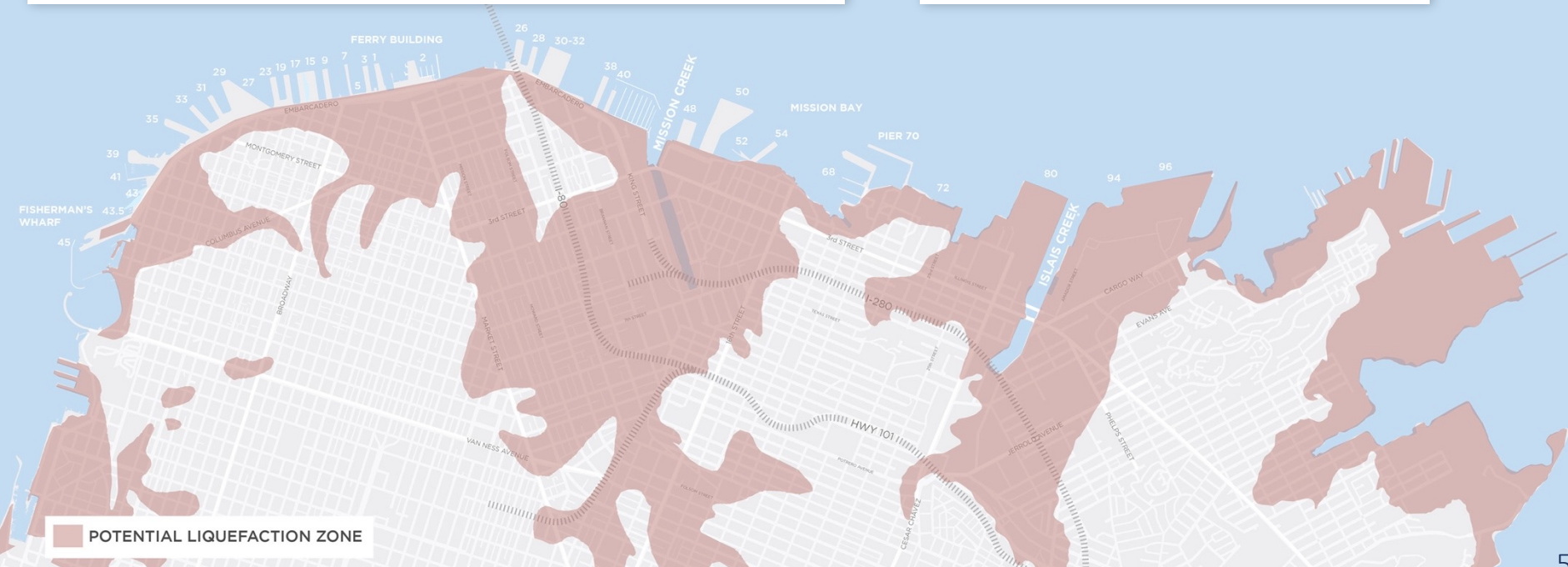
No Action: 7' of SLR +
100-yr Flood

WATERFRONT WIDE EARTHQUAKE HAZARDS

Very High Earthquake “Liquefaction” Risk

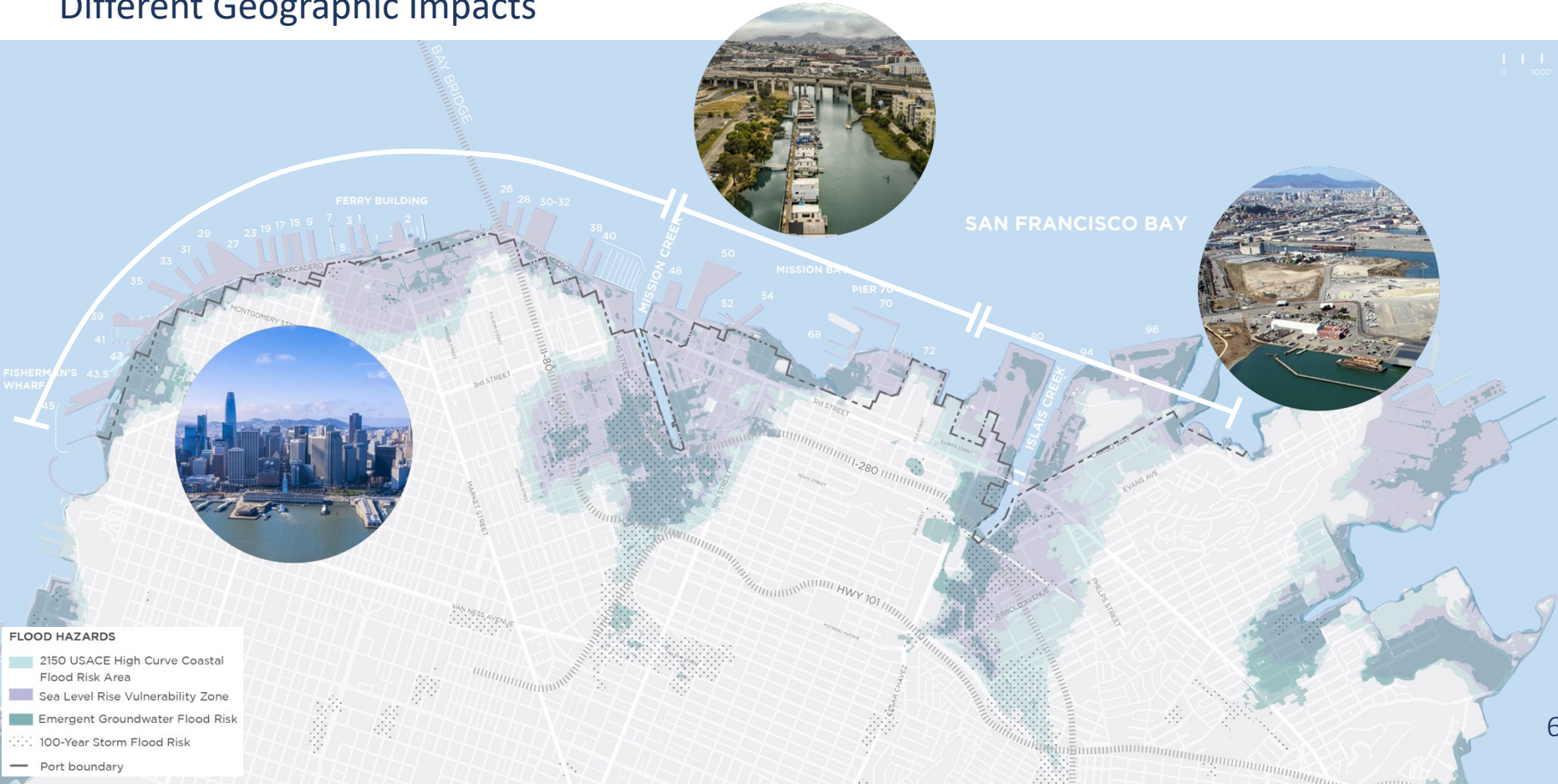
Liquefaction occurs when water-saturated sediment (like sand) temporarily loses strength and acts as a fluid

Various levels of lateral spreading risk along the shoreline



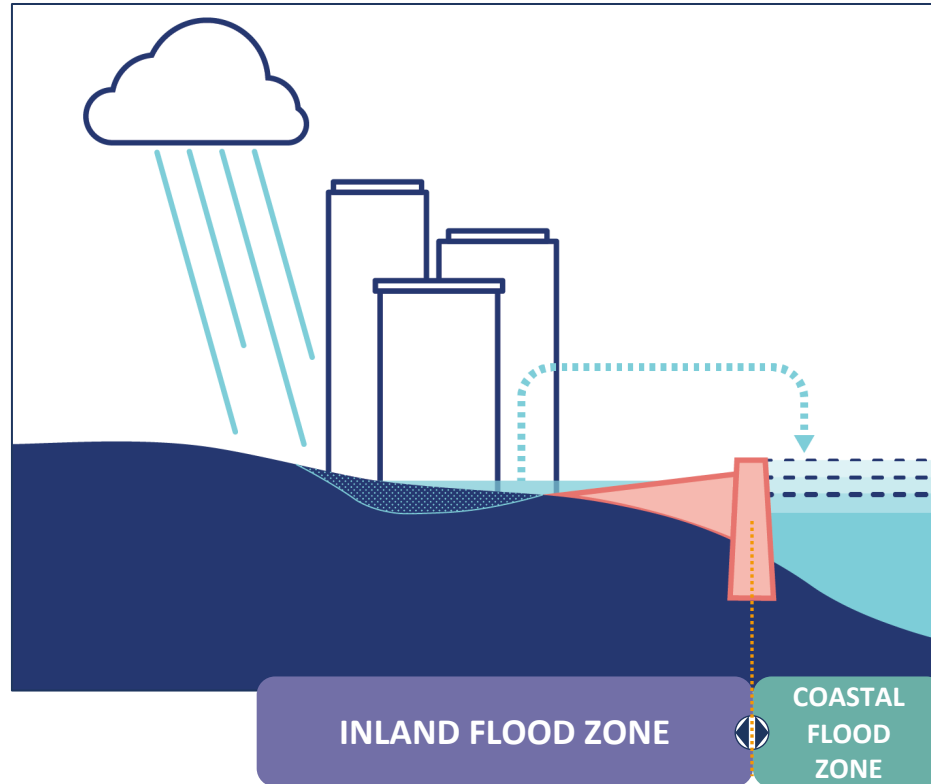
COASTAL AND INLAND FLOOD RISK

Different Geographic Impacts



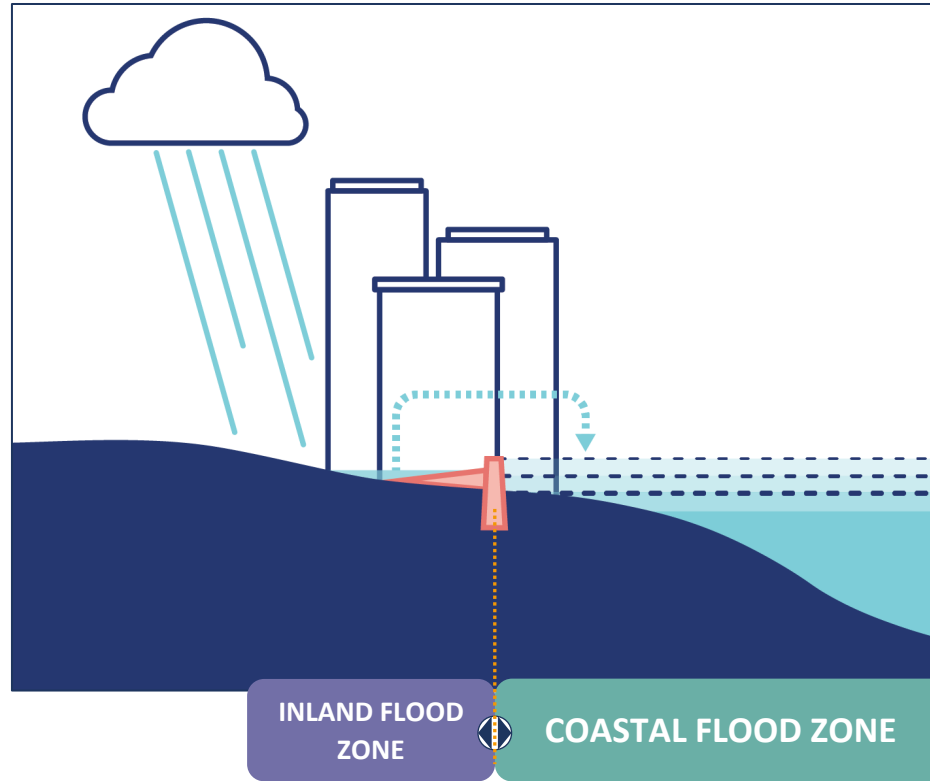
- FLOOD HAZARDS**
- 2150 USACE High Curve Coastal Flood Risk Area
 - Sea Level Rise Vulnerability Zone
 - Emergent Groundwater Flood Risk
 - 100-Year Storm Flood Risk
 - Port boundary

COASTAL AND INLAND FLOOD RISK



Two related forms of flooding

COASTAL AND INLAND FLOOD RISK

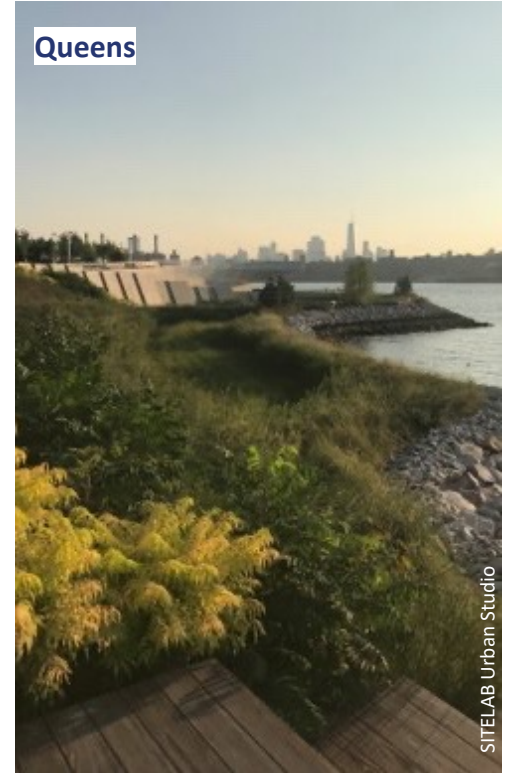


Shift based on the location of flood protection

Any solution endorsed by the City of San Francisco will aim to address **all three risks**:
seismic risks, **coastal flooding** and **inland flooding**.

PUBLIC PRIORITIES - NATURE BASED SOLUTIONS

Prioritize Nature and Healing the Bay



PUBLIC PRIORITIES - PUBLIC SPACES

Expand Open Spaces and the City's Connection to the Waterfront



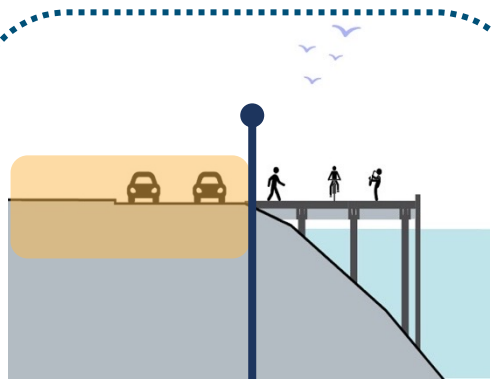
PUBLIC PRIORITIES - EQUITY

Center Racial and Social Equity and Environmental Justice

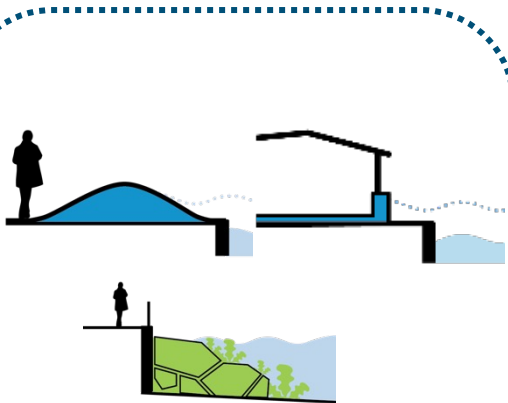


DRAFT WATERFRONT ADAPTATION STRATEGIES

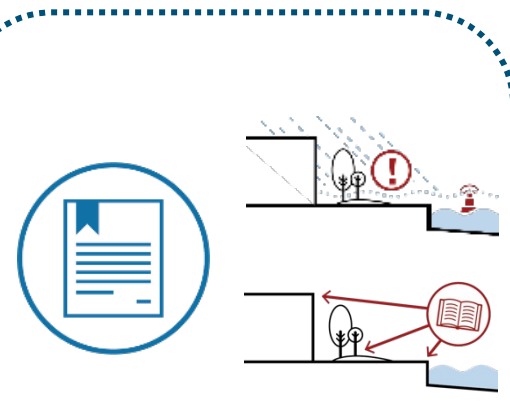
Key Components



**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*

USACE SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY

Draft Waterfront Adaptation Strategies

What if...
we **did not adapt**
to mitigate the
risks?

STRATEGY A

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

STRATEGY B

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

STRATEGY C

STRATEGY D

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

STRATEGY E

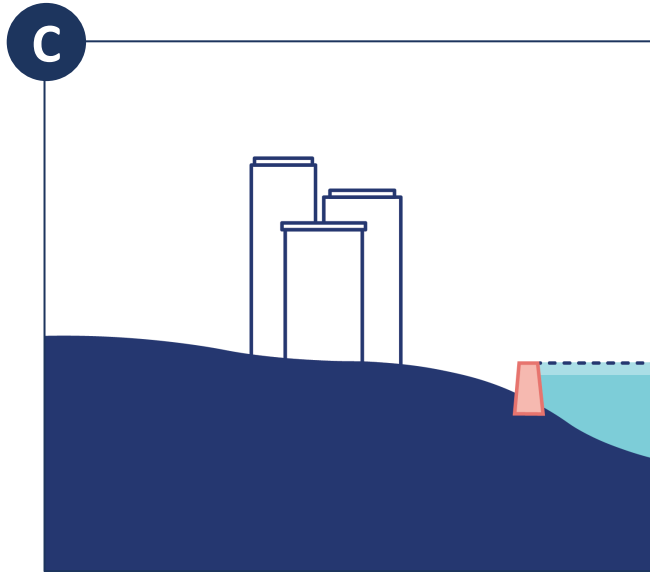
STRATEGY F

STRATEGY G

TIME HORIZONS

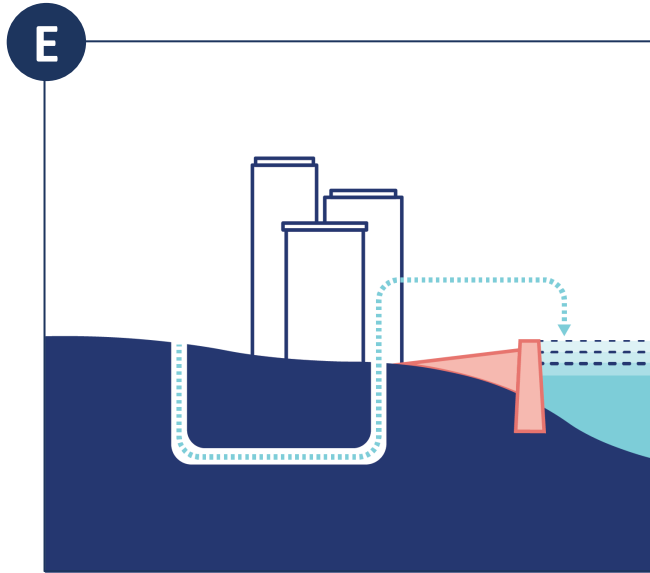


STRATEGY C – LOWER SEA LEVEL RISE



Adapts the shoreline to withstand 1.5' of sea level rise by 2040 using a combination of structural and nonstructural measures

STRATEGY E – HIGHER SEA LEVEL RISE – HOLD THE LINE



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

- Coastal Flood Defense
- Coastal Adaptation Zone
- Inland Adaptation Zone

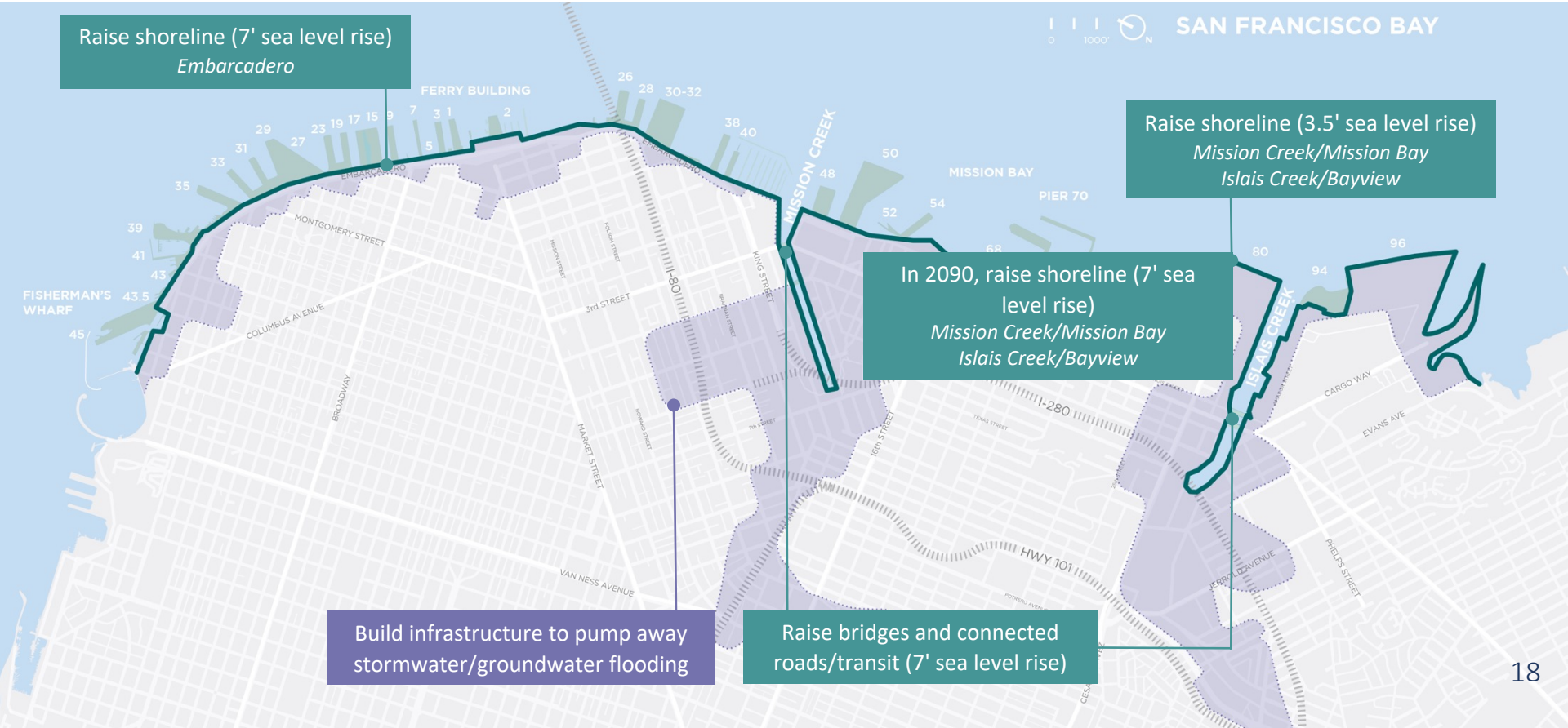
Raise shoreline (7' sea level rise)
Embarcadero

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

In 2090, raise shoreline (7' 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

Islais Creek / Bayview in 2090



Industrial uses and jobs stay in place

Water access and recreational activities

2090 Shoreline Adaptation

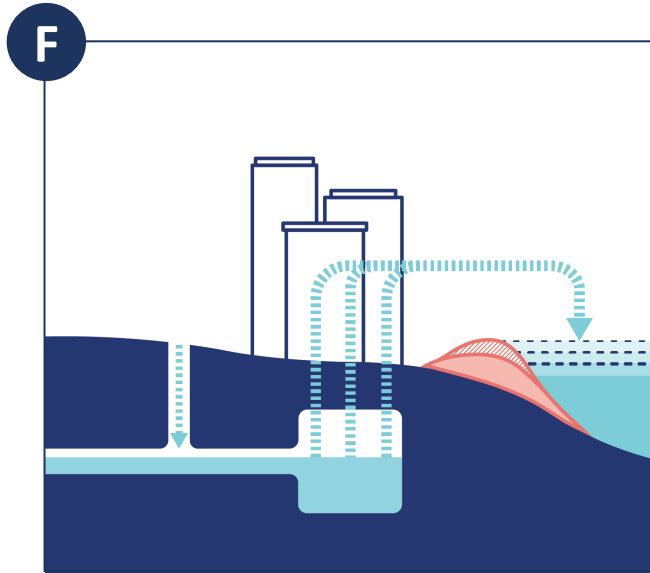
2040 Shoreline Adaptation

Improved public access

Existing Shoreline

Living shoreline

STRATEGY F – HIGHER SEA LEVEL RISE – MANAGE THE WATER

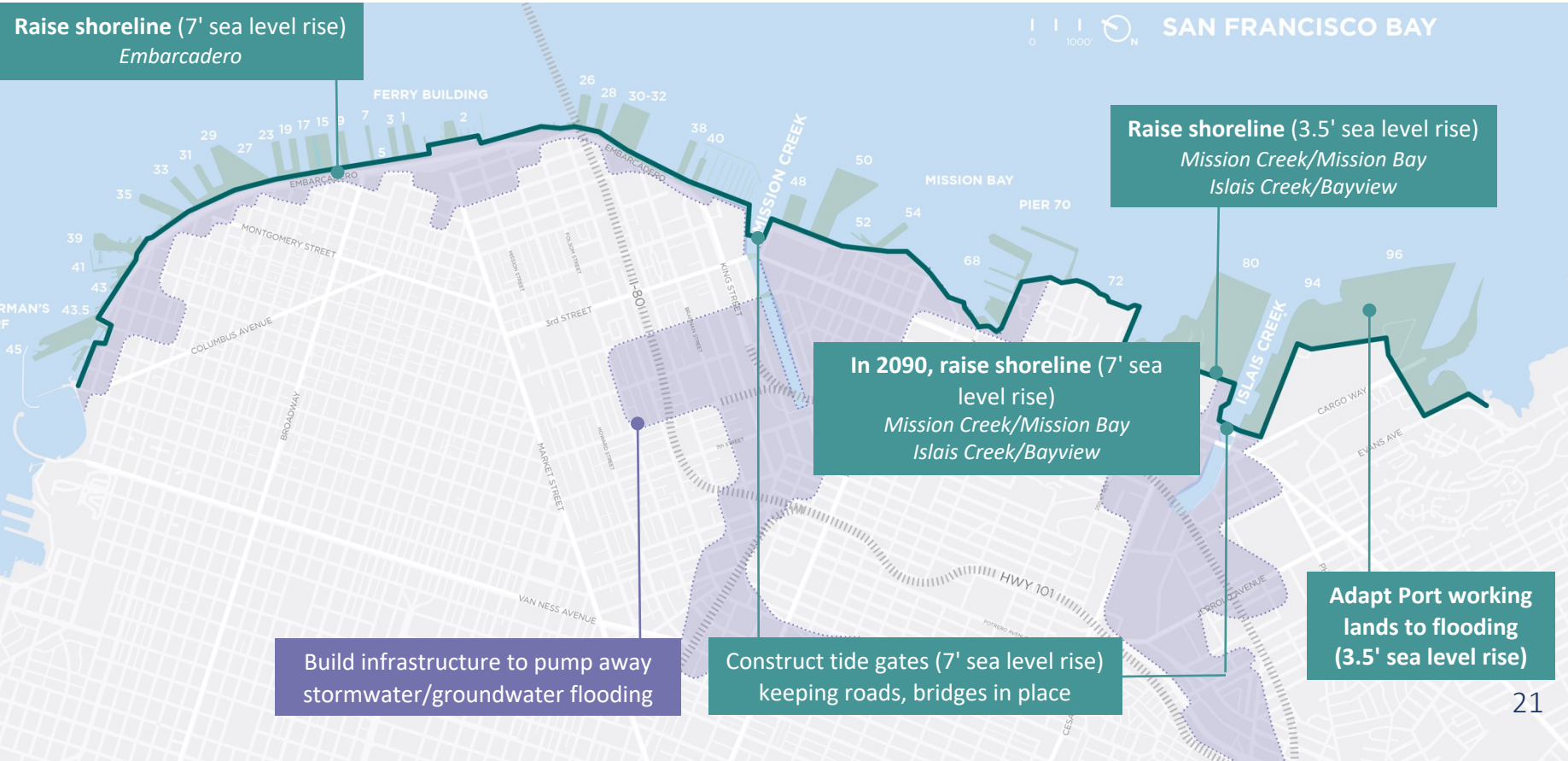


Creates an active system for managing flooding by heavily relying on machinery

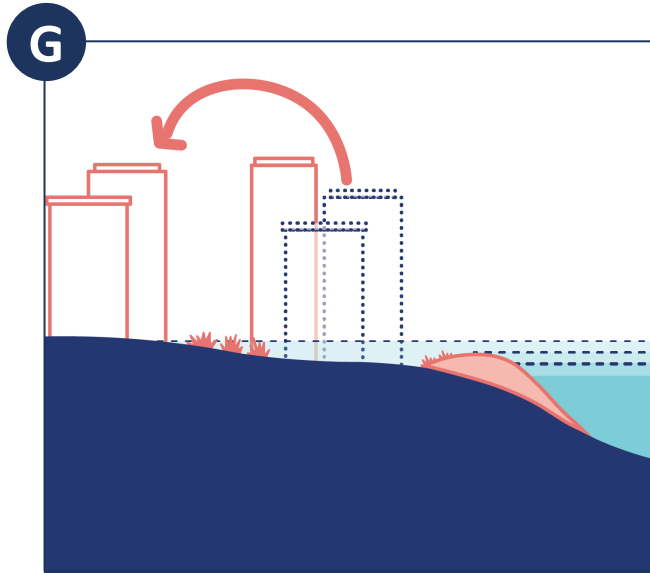
STRATEGY F – HIGHER SEA LEVEL RISE – MANAGE THE WATER

2040

- Coastal Flood Defense
- Coastal Adaptation Zone
- Inland Adaptation Zone



STRATEGY G – HIGHER SEA LEVEL RISE – ALIGN WITH WATERSHEDS



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

- Coastal Flood Defense
- Coastal Adaptation Zone
- Inland Adaptation Zone

Raise shoreline (7' sea level rise)
Embarcadero

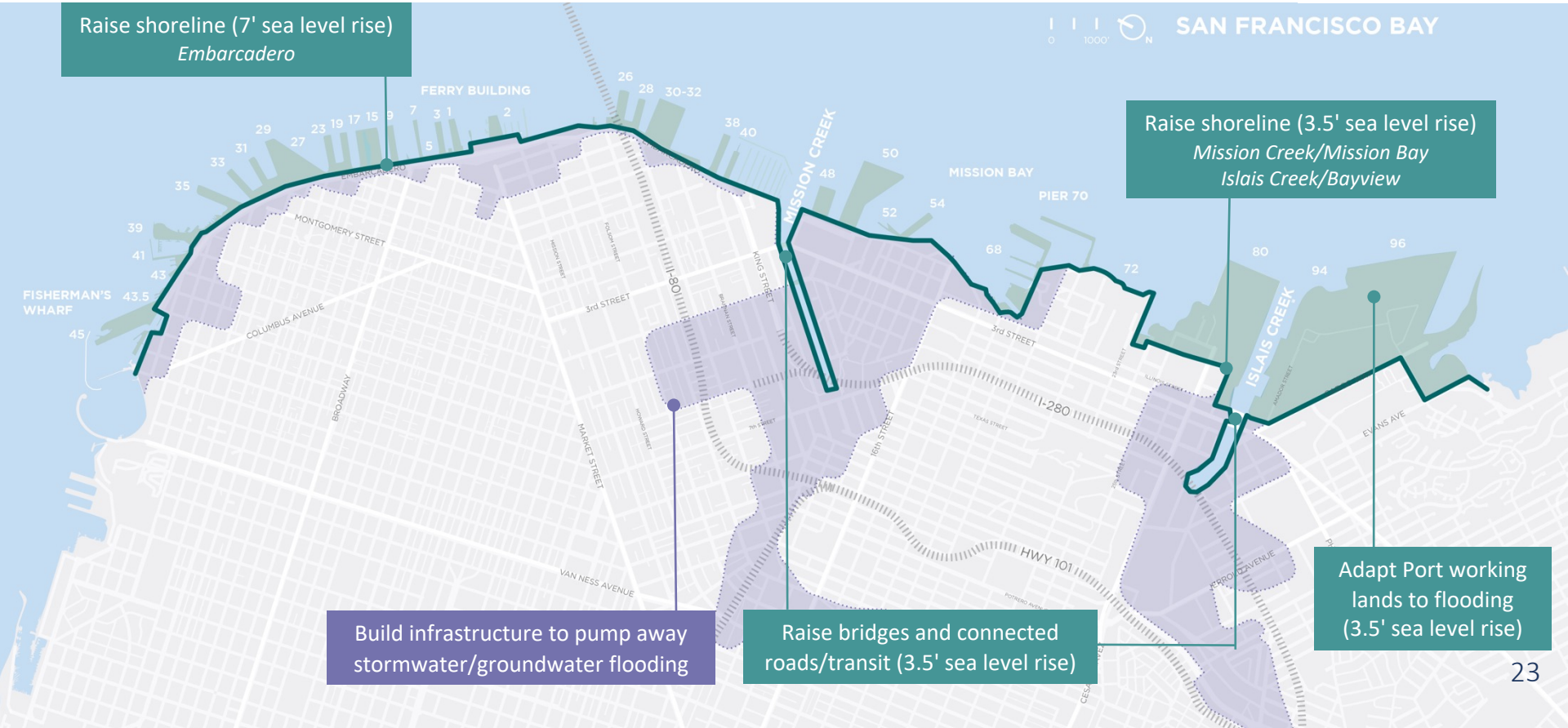
0 1000' N SAN FRANCISCO BAY

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 (3.5' sea level rise)

Adapt Port working
lands to flooding
(3.5' sea level rise)

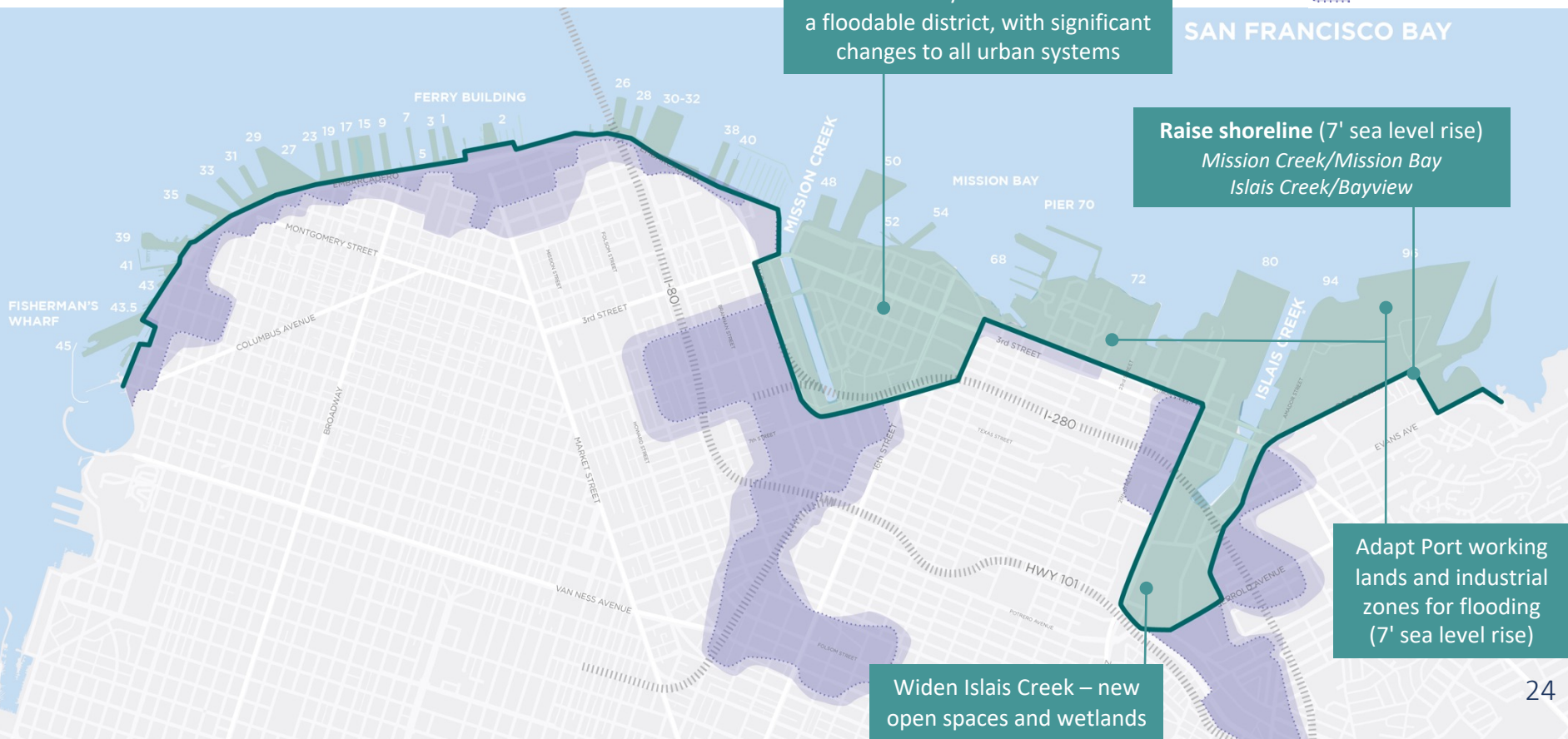


STRATEGY G – HIGHER SEA LEVEL RISE – ALIGN WITH WATERSHEDS

2090

- Coastal Flood Defense
- Coastal Adaptation Zone
- Inland Adaptation Zone

SAN FRANCISCO BAY



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



FUNDING



US Army Corps
of Engineers®



FEMA



How can we best coordinate with federal agencies with distinct mission areas, when adaptation requires coordinated action affecting multiple infrastructure systems?

- How is coordination working across federal agencies?
- Benefit cost and OMB 7% discount rate reform
 - Common benefit cost approach across federal agencies?
 - Single program benefit-cost analysis to support all project applications related to that program?
- Grant guidelines that exclude projects if other funding is available or limit uses of funds
- Coordinated federal agency review of mega-projects?

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 black jersey with the number 30 and a black helmet. In the background, a large ship is visible in a harbor under a clear blue sky. The path is surrounded by dry grass and a few trees.

Thank You

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