Oakland Alameda Adaptation Committee Workshop

May 20th, 2024

Agenda

1. **Welcome – Keta Price & Danielle Mieler**
   - OAAC Introduction
   - Workshop ground rules
2. **Oakland Alameda Adaptation Projects Overview – Jamie Phillips, CMG**
3. **Climate Science & Concepts – Dr. Kris May, Pathways Climate Institute**
   - Climate Science & Coastal Flooding
   - Rising Groundwater & Inland Flooding
   - Compound Flooding
4. **OAAC Long-term Adaptation Planning Framework –**

   Dr. Kris May, Pathways Climate Institute and Jamie Phillips, CMG
   - Adaptation Pathways Concept
   - Adaptation Toolkit
   - Small-group breakout session
5. **Closing and Thank You!**

Oakland Alameda Adaptation Committee – OAAC

OAAC – Process and Projects

- **Oakland Alameda Adaptation Committee (OAAC)**
- **Mission:**
  - A coalition of shoreline communities, agencies and stakeholders working to coordinate flood and sea level rise adaptation projects, protect and restore water quality, habitat and community resilience for the Oakland Alameda sub-region
- **Process**
  - Streamlines efforts
  - Helps seek funding
  - Informs Hazard Mitigation and Adaptation Plans

Input Opportunities

- **Community Partners**
  - Leading community engagement
  - Greenbelt Alliance, Ninth Root, REAP Climate Center, Hood Planning Group and CASA
- **First Round of Outreach (May-July 2024)**
- **May 20 Workshop:**
  - What sea level rise means for Oakland and Alameda
  - How sea level rise impacts groundwater and stormwater systems
  - General tools to make our communities more resilient and transformative

Ground Rules

- Engage in active listening
- Seek first to understand, not to be understood
- No one or two individuals should dominate the conversation
- Engage in your realm of experience and expertise, and respect and engage others in theirs
- Take ownership for positive outcomes
- No bad ideas – let's make this a "yes, and…" space

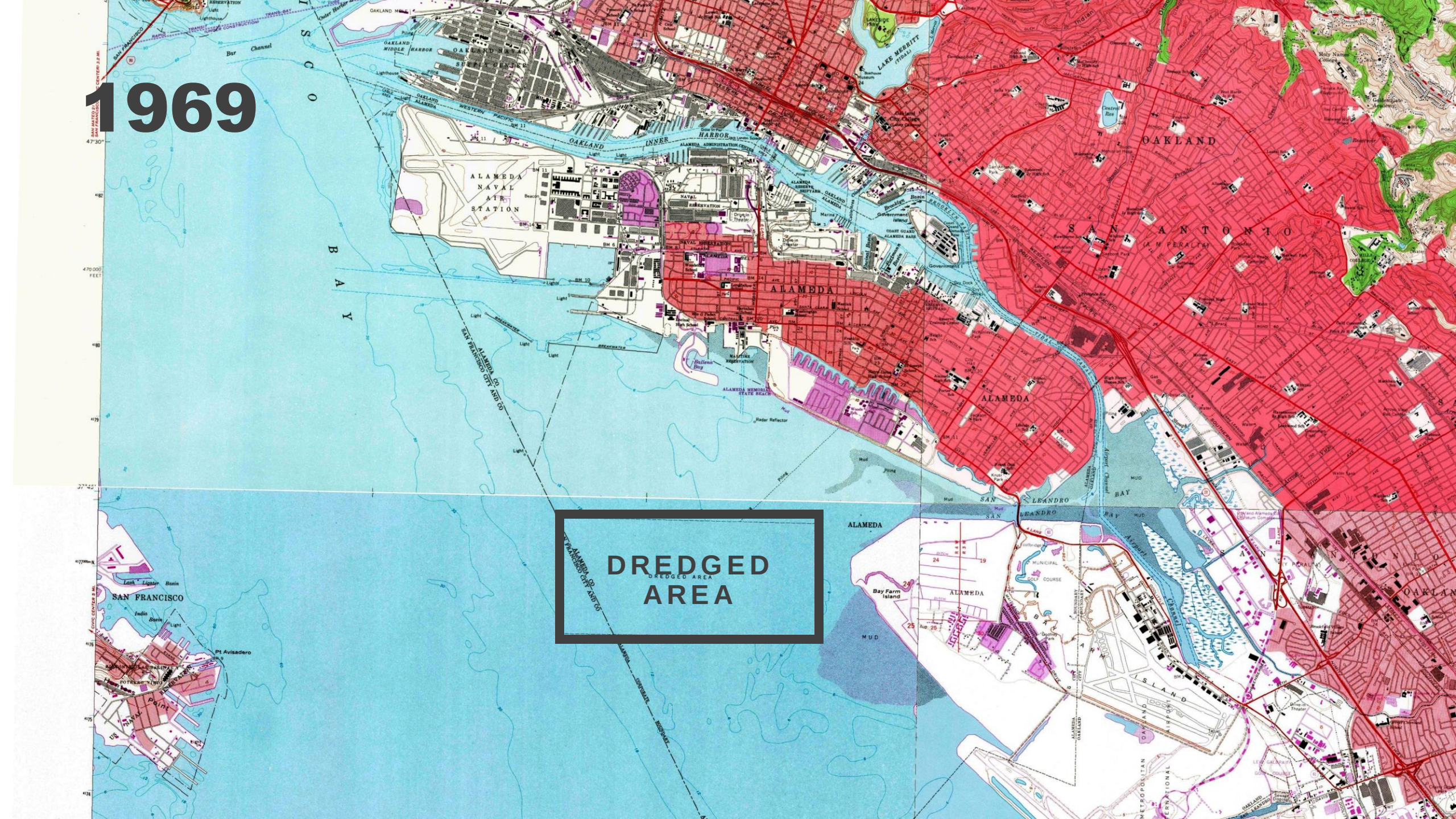
Where do you work, live and play?

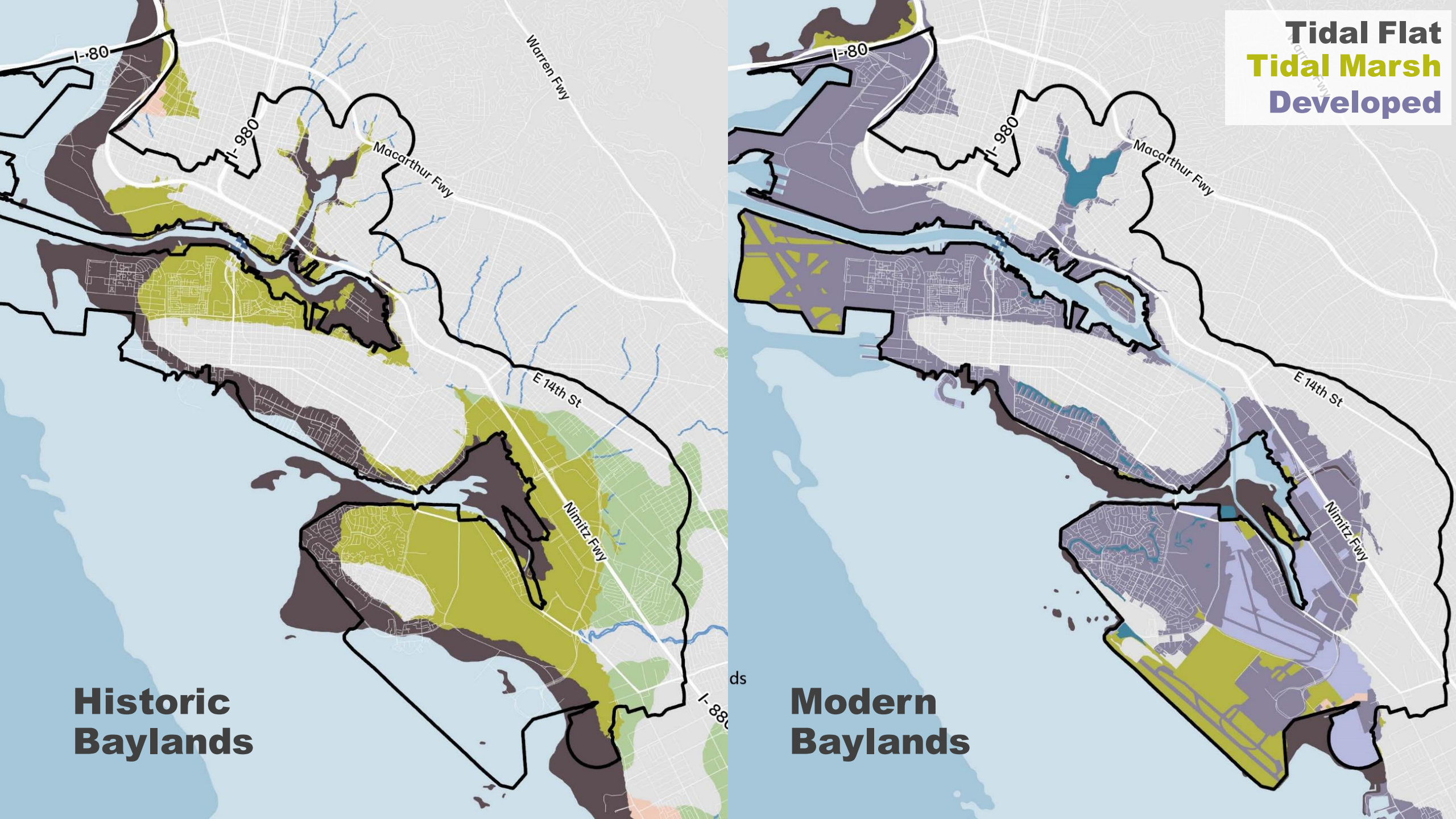
Add your responses into the chat!

OAAC ADAPT Introduction

Jamie Phillips, CMG


1895
Gibbon Pt.
LIGHT
Deep Water Channel
S.P.R.R. NARROW GAUGE
San Antonio Creek
S.P.R.R. LIVERMORE LINE
Lake Merritt
OAKLAND
Indian Gulch
Oakland Harbor
ALAMEDA
Fruitvale
Rincon Pt.
Steamboat Pt.
Mission Rock
Potrero Pt.
BOUNDARY LINE
Hunter Point
Avisadero Pt.
SAN LEANDRO BAY
San Leandro Bay
Bay Farm Island
SOUTHERN
San Leandro
Fitchburg
East Creek

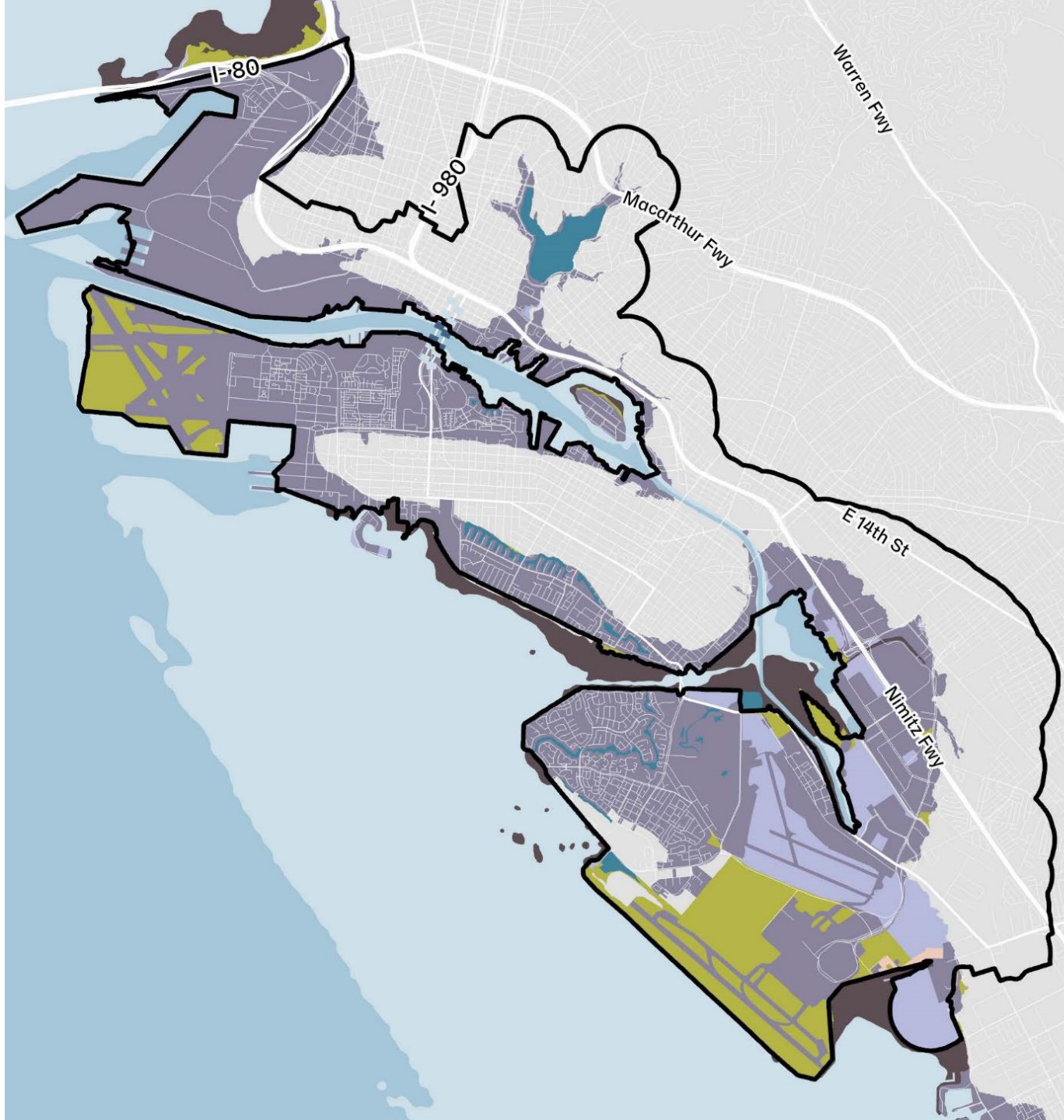

1969
DREDGED AREA
DREDGED AREA
SAN FRANCISCO
ALAMEDA
OAKLAND
SAN ANTONIO
ALAMEDA NAVAL AIR STATION
OAKLAND INNER HARBOR
SAN FRANCISCO BAY
SAN LEANDRO BAY
Bay Farm Island
Pt Avisadero


Tidal Flat
Tidal Marsh
Developed
I-80
I-980
Macarthur Fwy
Warren Fwy
E 14th St
Nimitz Fwy
Historic Baylands
Modern Baylands

OAAC Subregional Goals

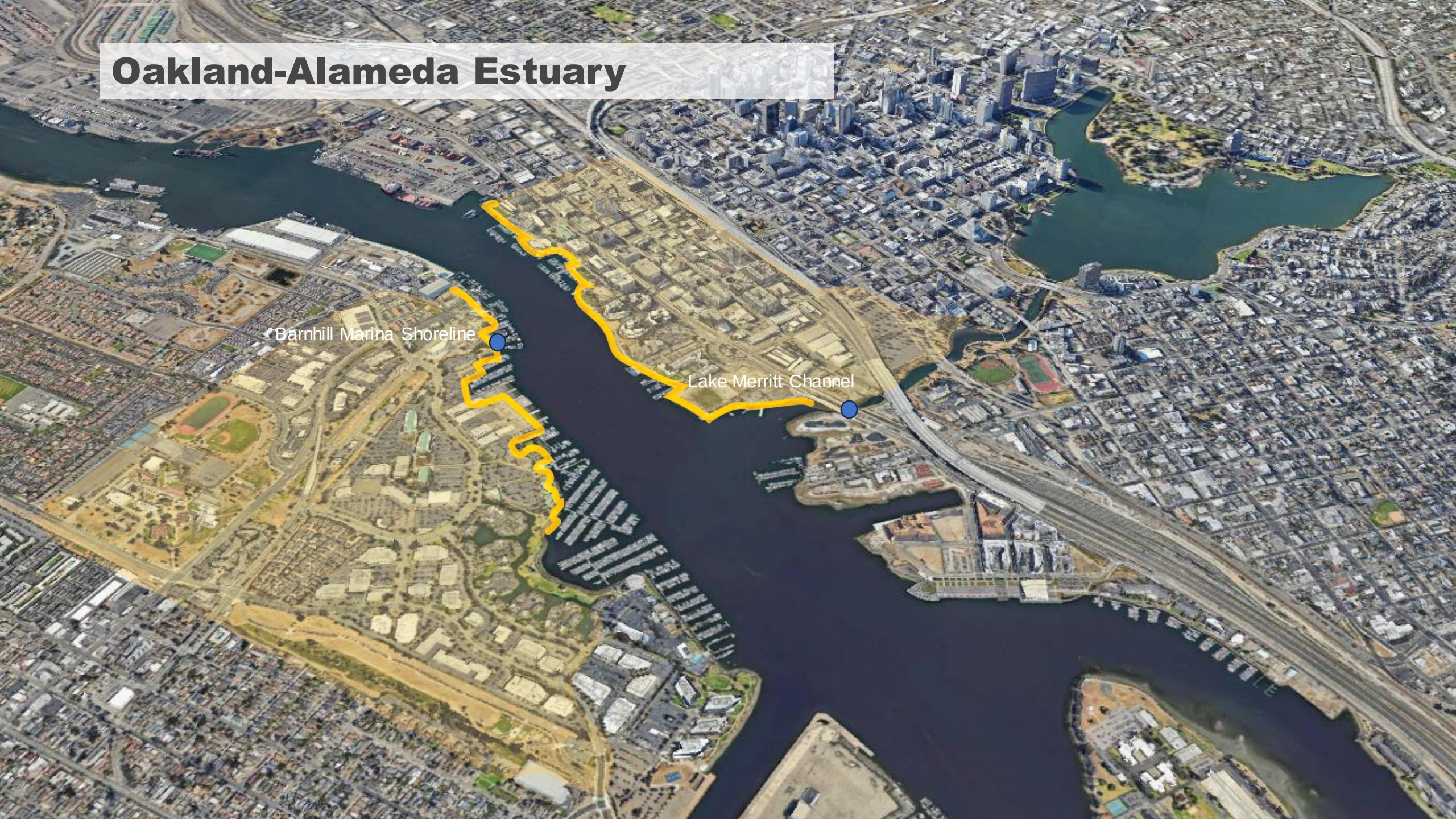
1. **Protect** Oakland-Alameda sub-region from the negative effects of expected sea level, inland flooding, and groundwater rise and liquefaction
2. Identify and develop opportunities for **multi-benefit** adaptations strategies
3. Avoid negatively affecting **neighboring subregions** through protection and adaptation measures
4. Utilize an **adaptation pathways** approach to address different SLR thresholds and time horizons. Identify near, mid, and long-term adaptation strategies
5. Enhance **transportation**, **recreation** corridors, **bay access**, and the San Francisco **Bay Trail**
6. Preserve and increase **open space** where possible.
7. Improve subtidal, intertidal, transitional, and upland habitat with **nature-based solutions**
8. Improve **air quality**

Subregional Long-term Adaptation Project Area

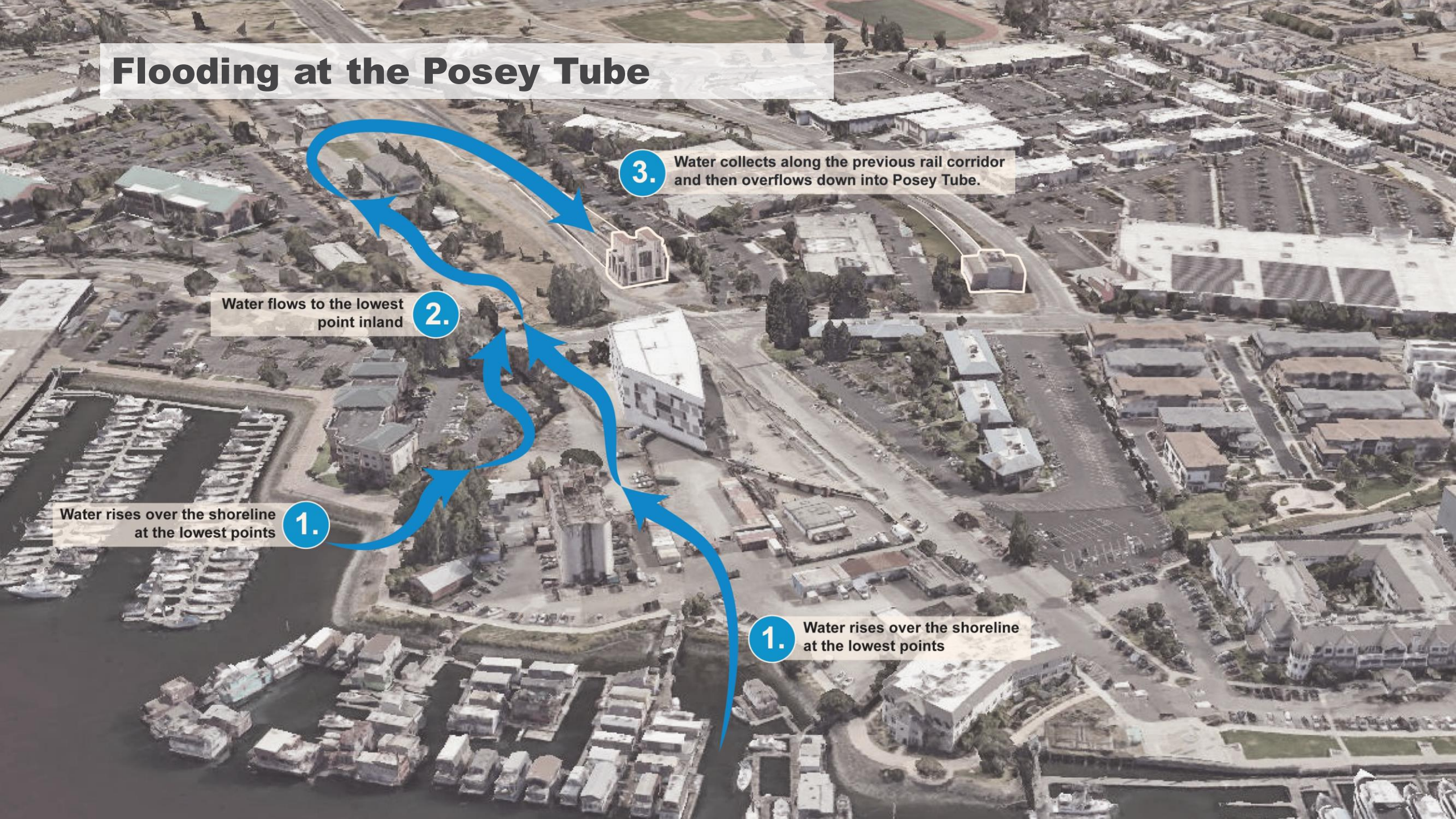



Bay Farm Island
Oakland Airport
Doolittle Drive
San Leandro Bay
Veteran's Court
Lagoon outfall

Oakland-Alameda Estuary



Flooding at the Posey Tube



OAAC Adapt – Project specific sea level rise criteria

Near Term

2080
35 to 50-year adaptation project lifespan

2 feet of sea level rise

Protect to elevation +14.0

Long Term

2100+
Build upon near term project

5 feet of sea level rise

Protect to elevation +17.0

OAAC Adapt Engagement Timeline

Climate Science and Analysis

Spring 2024

- Develop vision, goals and planning principles
- Analyze existing conditions
- Coastal flooding science

Draft Adaptation Pathways and Alternatives

Summer and Fall 2024

- Gather input on preliminary alternatives exploring near–term ideas.
- Adaptation pathways and long-term adaptation ideas

Alternatives Synthesis

Fall 2024 and Spring 2025

- Develop final concepts based on community and stakeholder review

Part 1: Climate Science

Kris May, Pathways Climate Institute

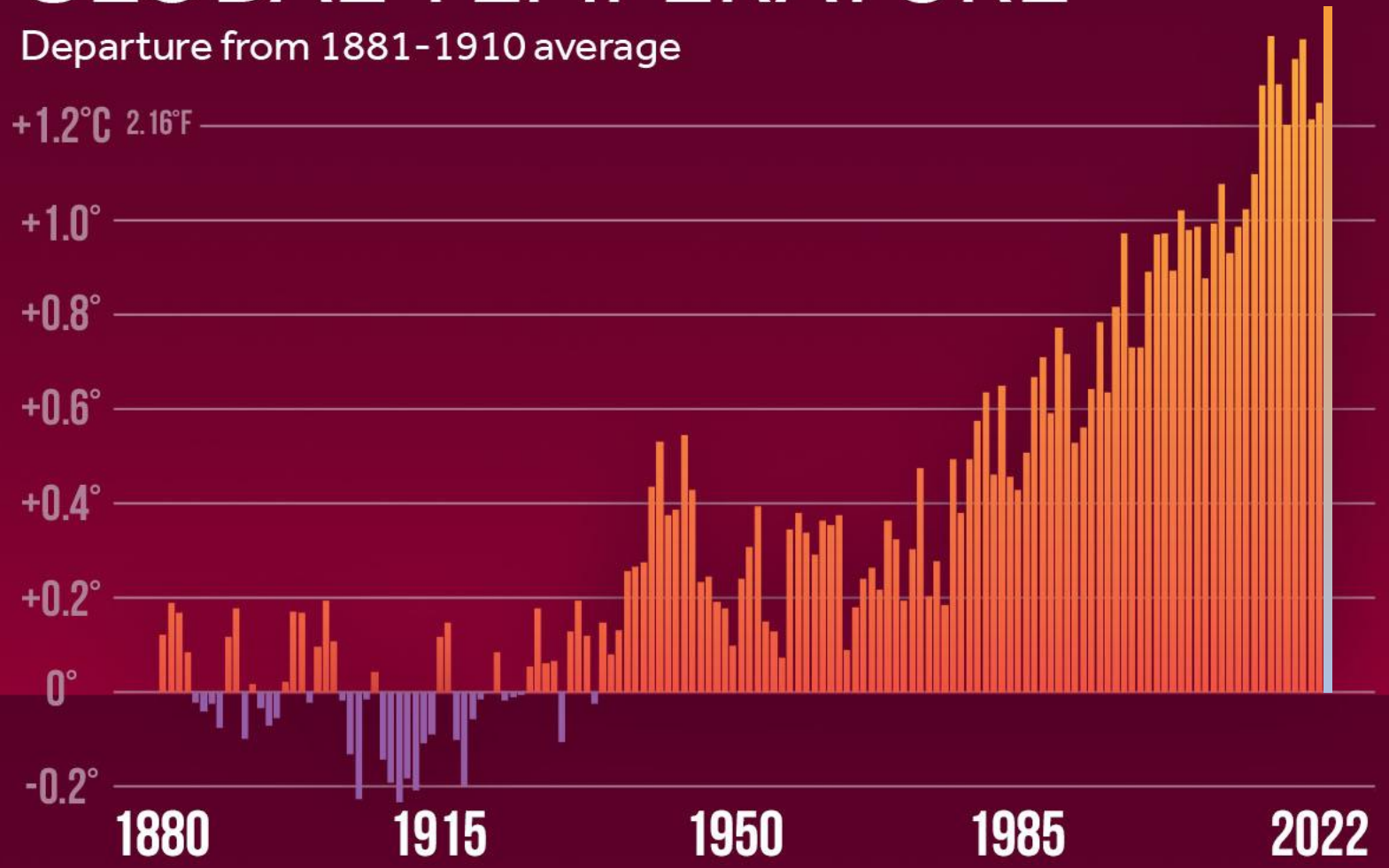
1. Sea Level Rise
2. Rising Groundwater Inland Flooding
3. Compound Flooding

Our Climate is Changing

Bay Trail near Bay Bridge Touchdown

GLOBAL TEMPERATURE

Departure from 1881-1910 average

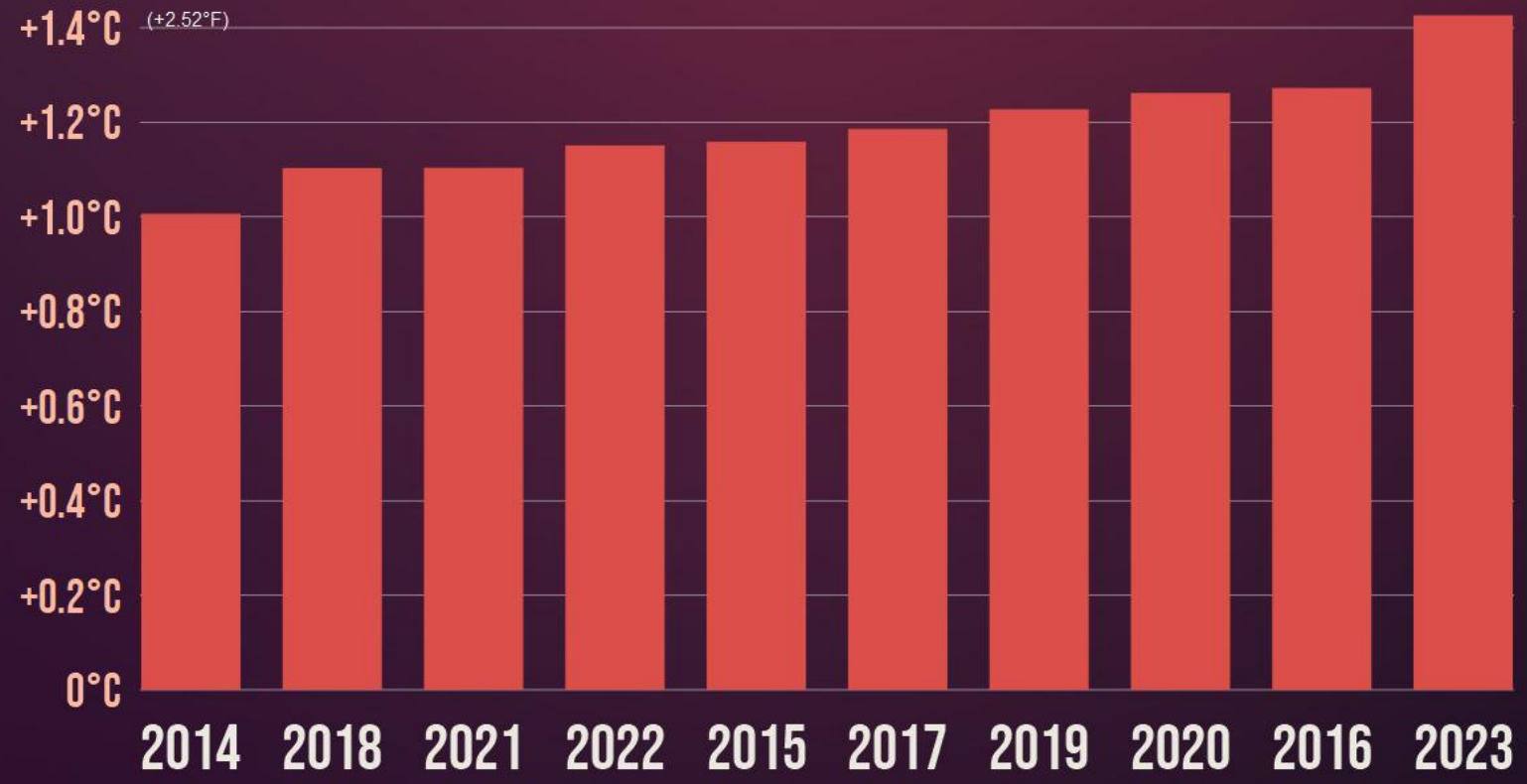


2023 Hottest Year on Record

Source: NASA GISS & NOAA NCEI global temperature anomalies averaged and adjusted to early industrial baseline (1881-1910). Data as of 1/12/2023.

CLIMATE CENTRAL

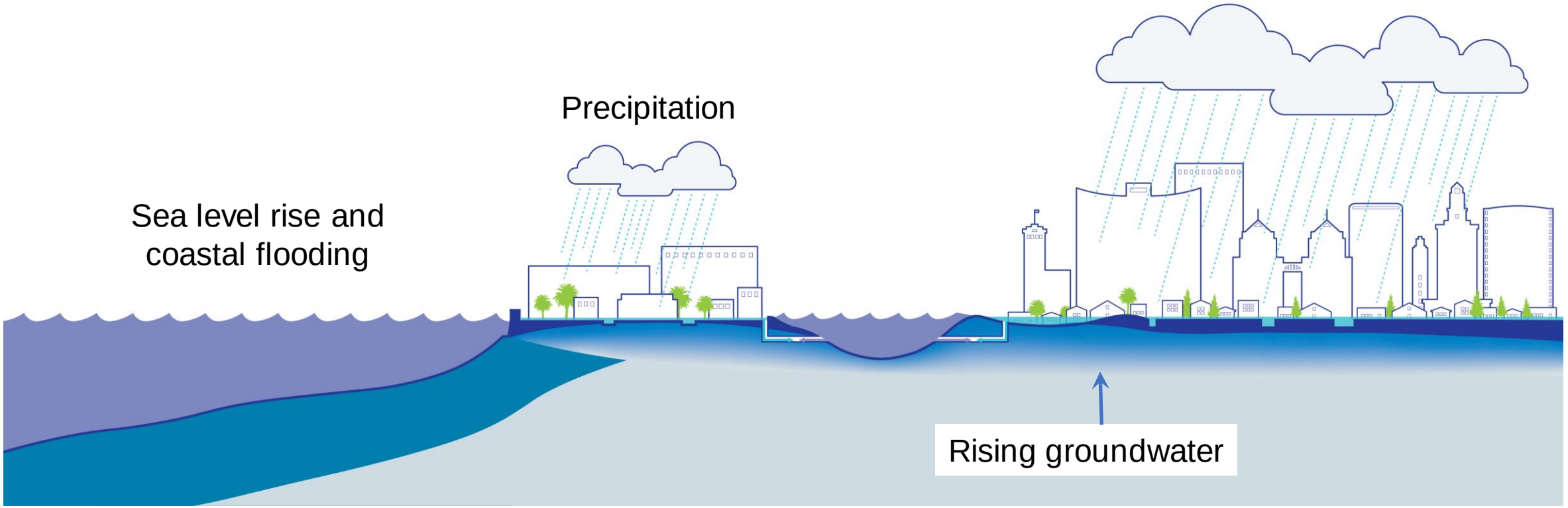
10 HOTTEST GLOBAL YEARS ON RECORD



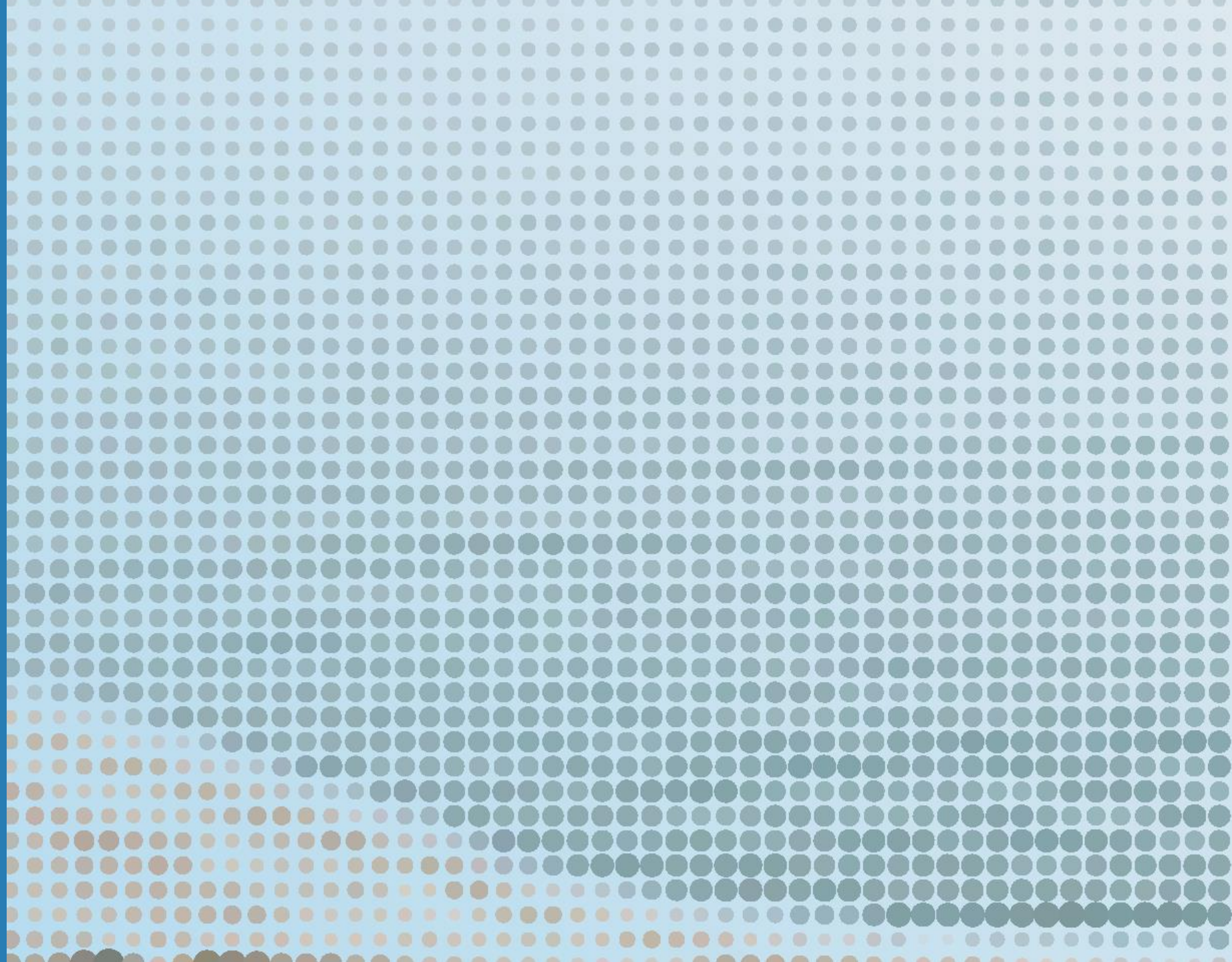
Global temperature anomalies (°C) averaged and adjusted to early industrial baseline (1881-1910).
Data as of 1/12/2024.
Source: NASA GISS & NOAA NCEI

CLIMATE CENTRAL

Rising temperatures impact the entire water cycle



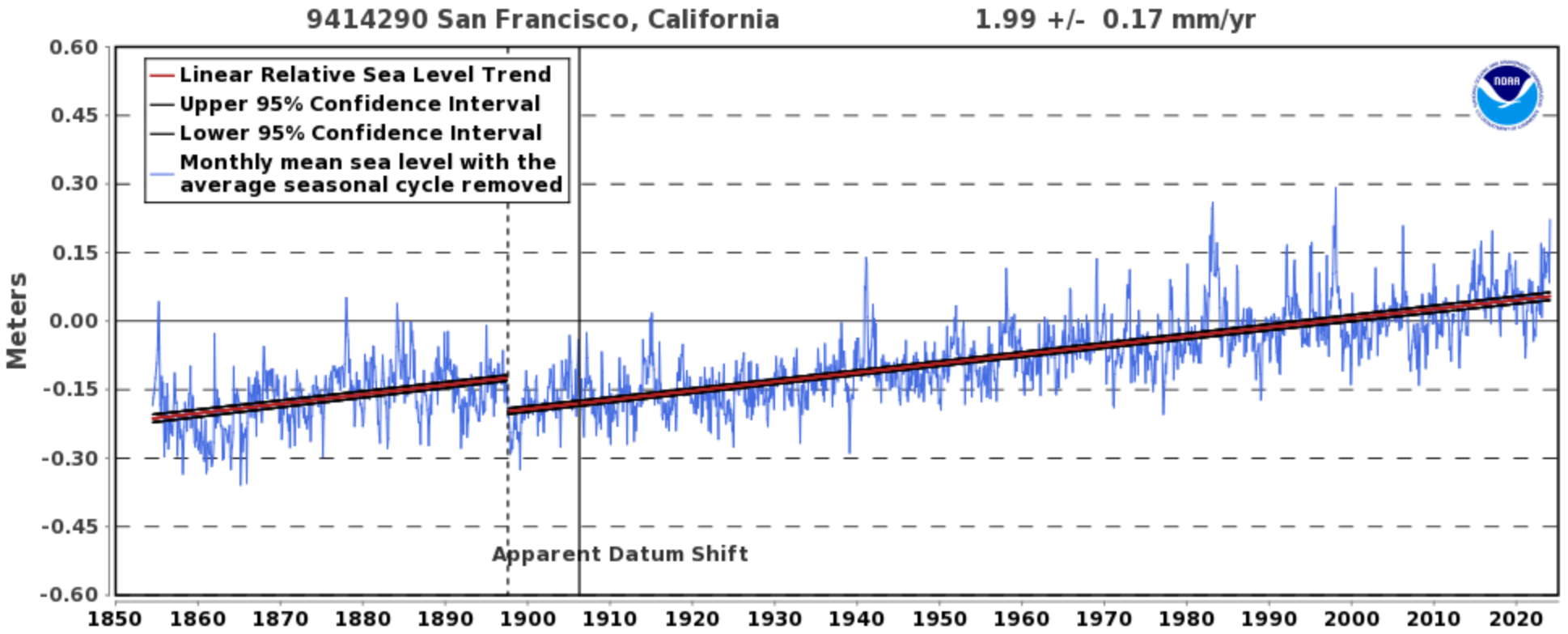
Sea level rise and coastal flooding



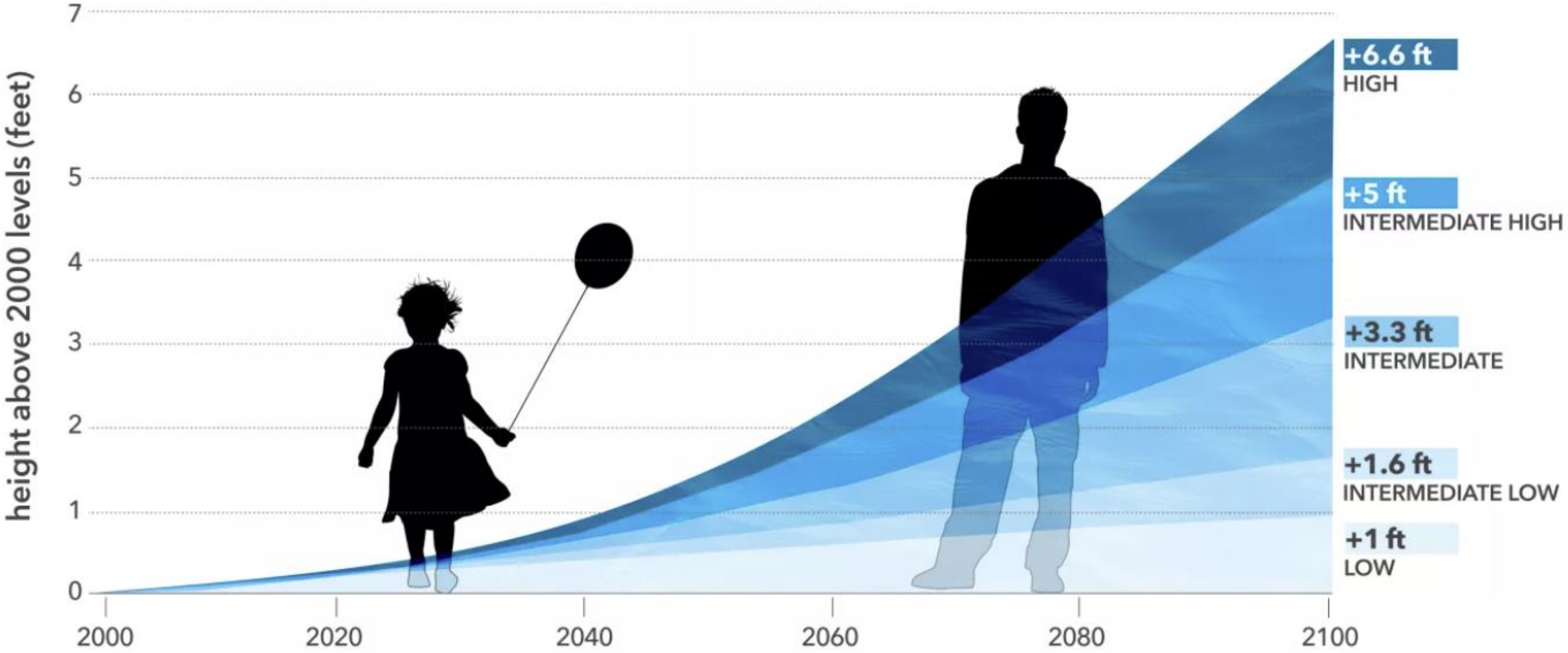
What is sea level rise?

Sea levels rise as the total volume of ocean water increases:

- **As temperatures increase, water expands, raising the surface of the ocean and Bay**
- **Melting glaciers and polar ice sheets also increase the volume of ocean water**



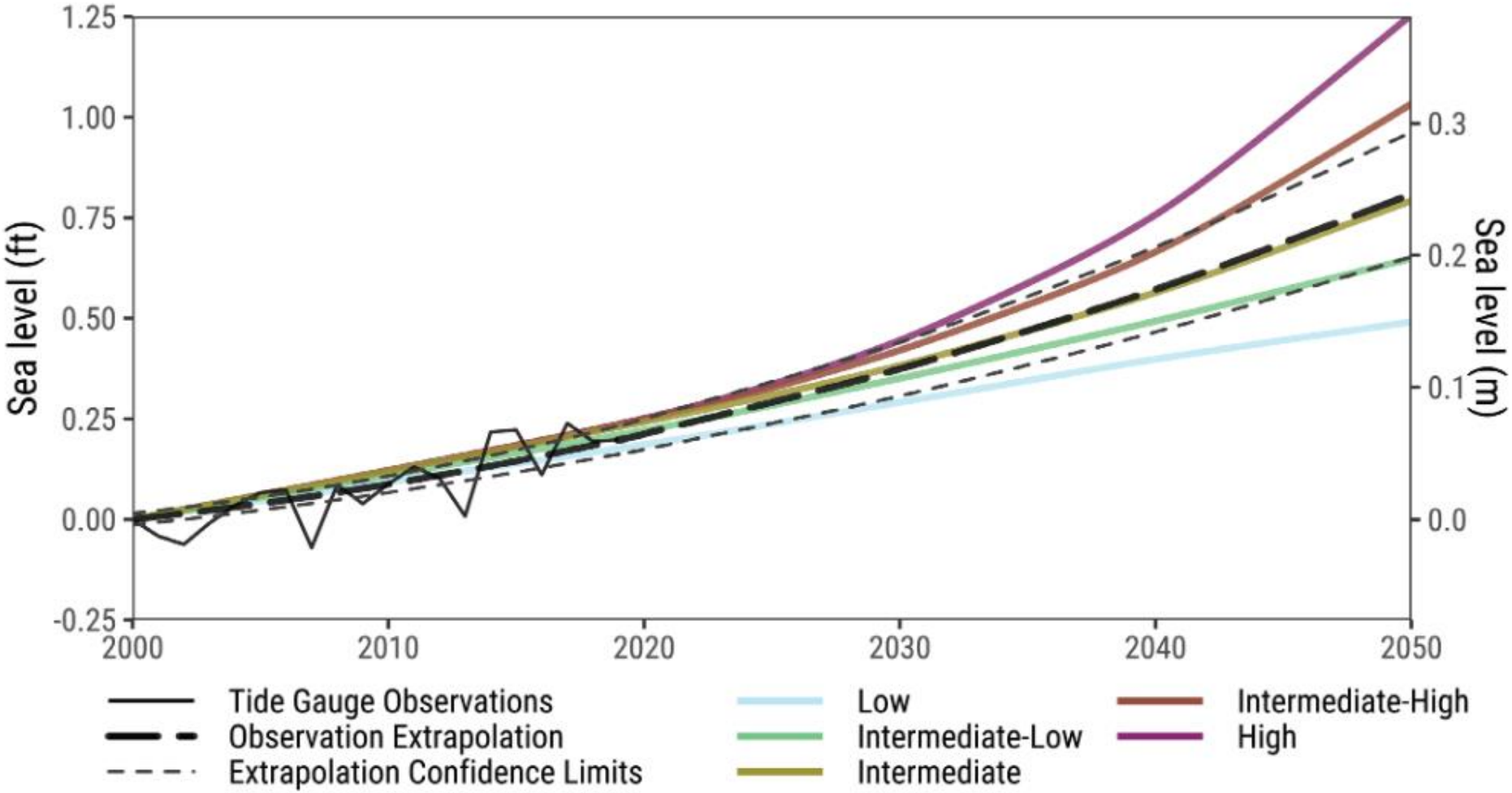
Projected Global Sea Level Rise to the Year 2100



Source: climate.gov

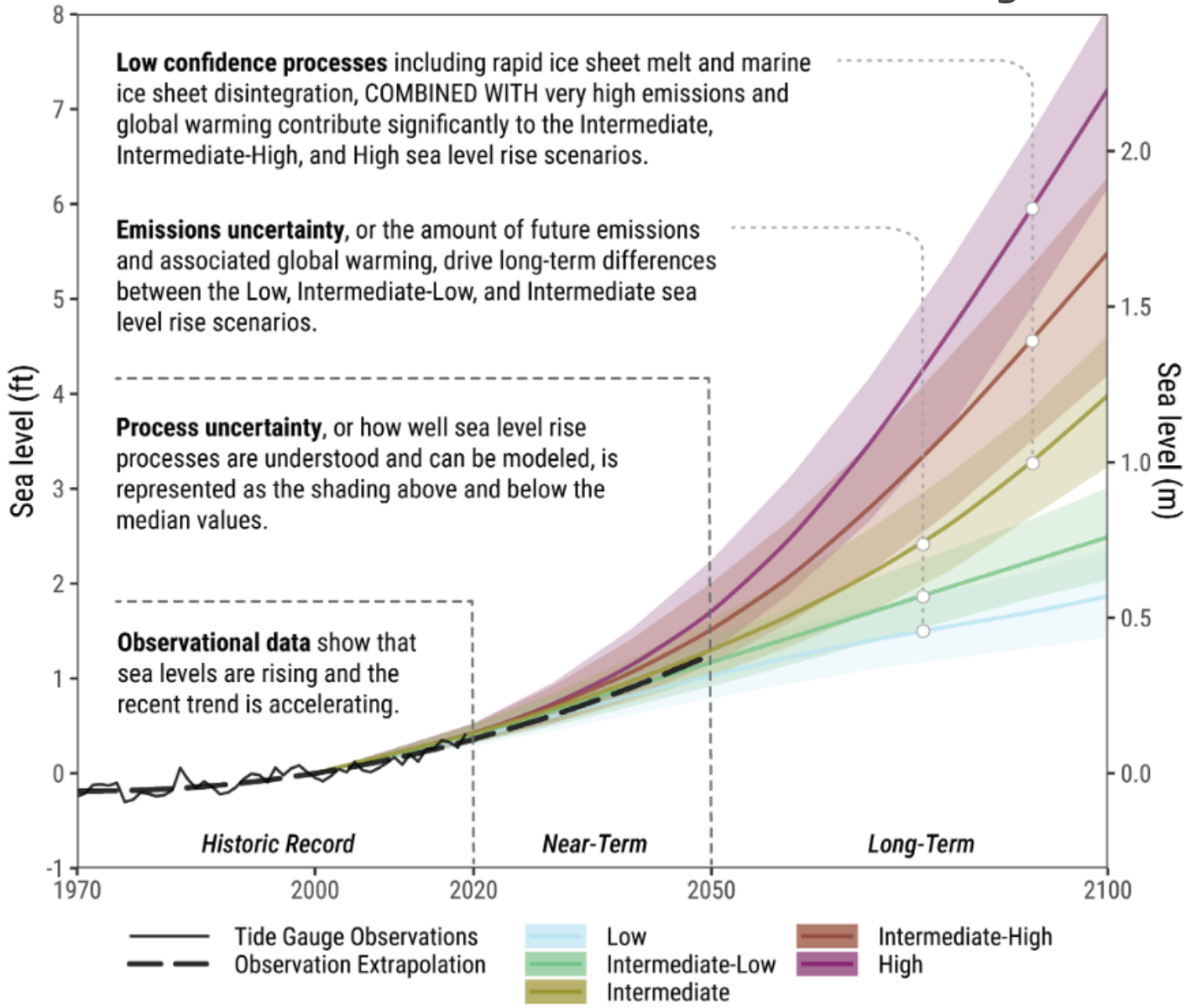
California Sea Level Rise

Observation-based Extrapolation trending with Intermediate Curve



https://oceanservice.noaa.gov/hazards/sealevelrise/sealevelrise-tech-report-sections.html

Future Sea Level Rise Uncertainty



- **3.3 feet by 2100** (Intermediate, Likely)
- **6.6 feet by 2100** (Plausible, High Impact, but Low Confidence – assumes both high emissions and rapid ice sheet melt)

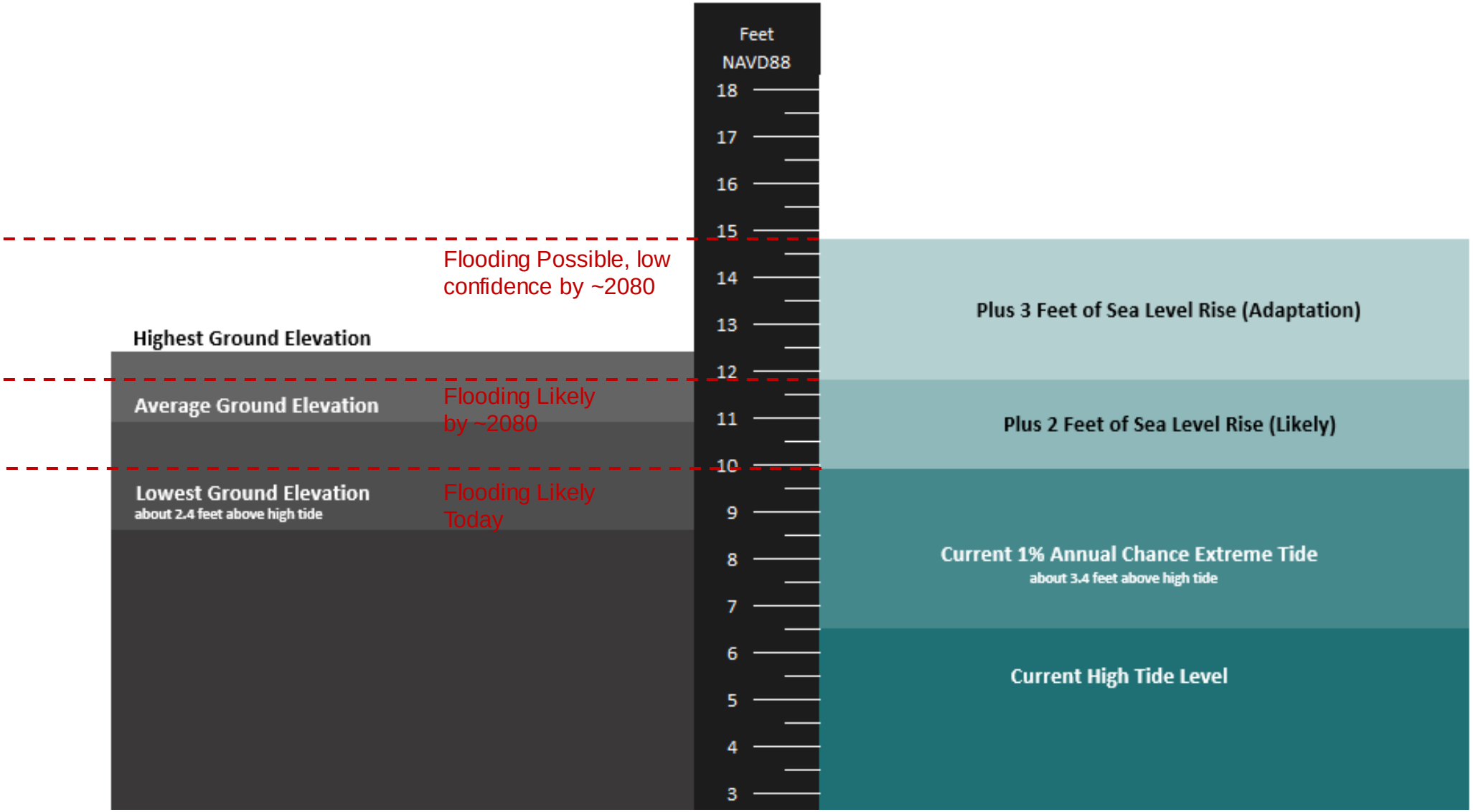
https://oceanservice.noaa.gov/hazards/sealevelrise/sealevelrise-tech-report-sections.html

Bay Farm Island near Veterans Court and the Harbor Bay Club

Embarcadero West Bridge over Lake Merritt Channel

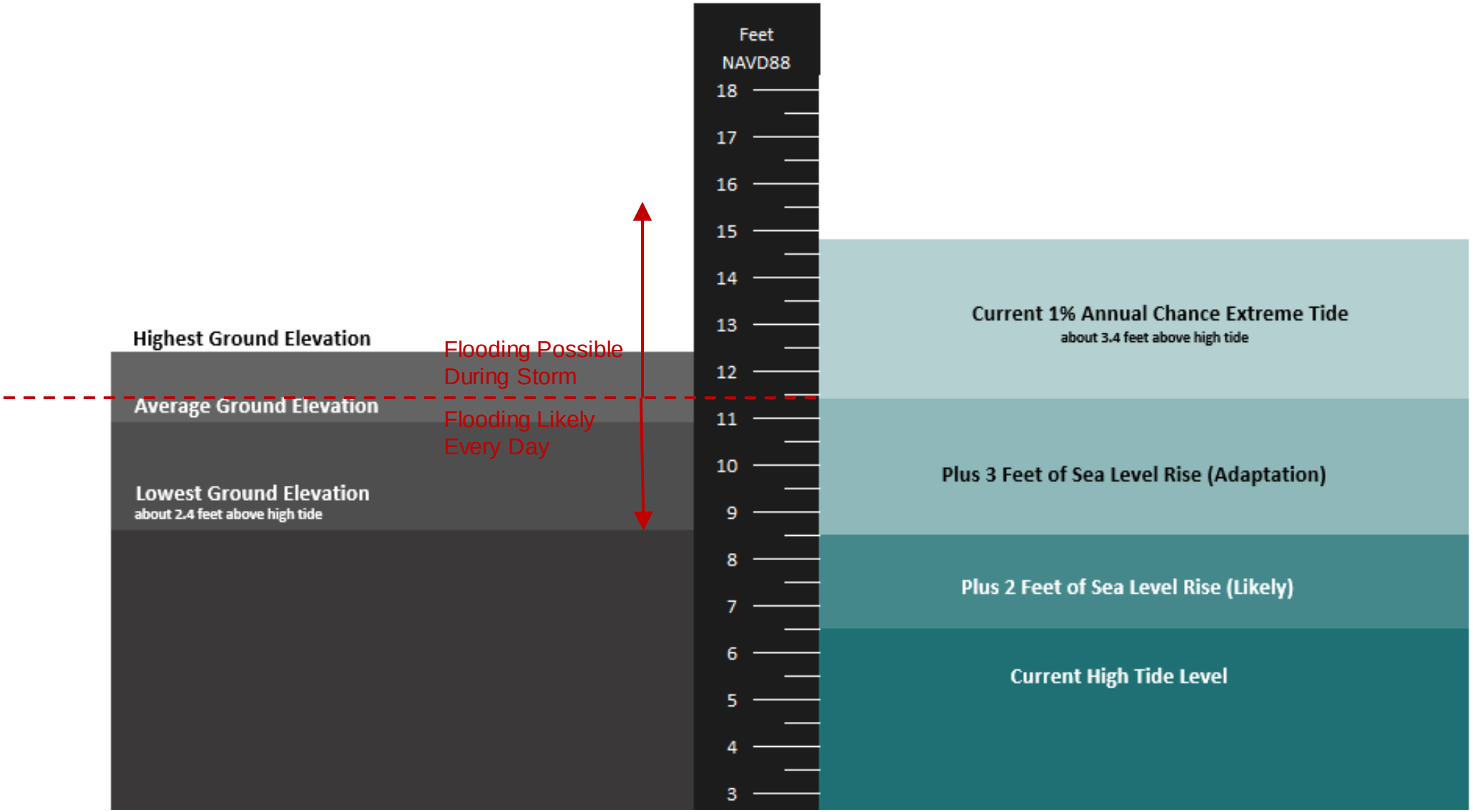
Flood Management Elevation Targets

northern Bay Farm Island (example near term, 30 to 50-year design life)



Flood Management Elevation Targets

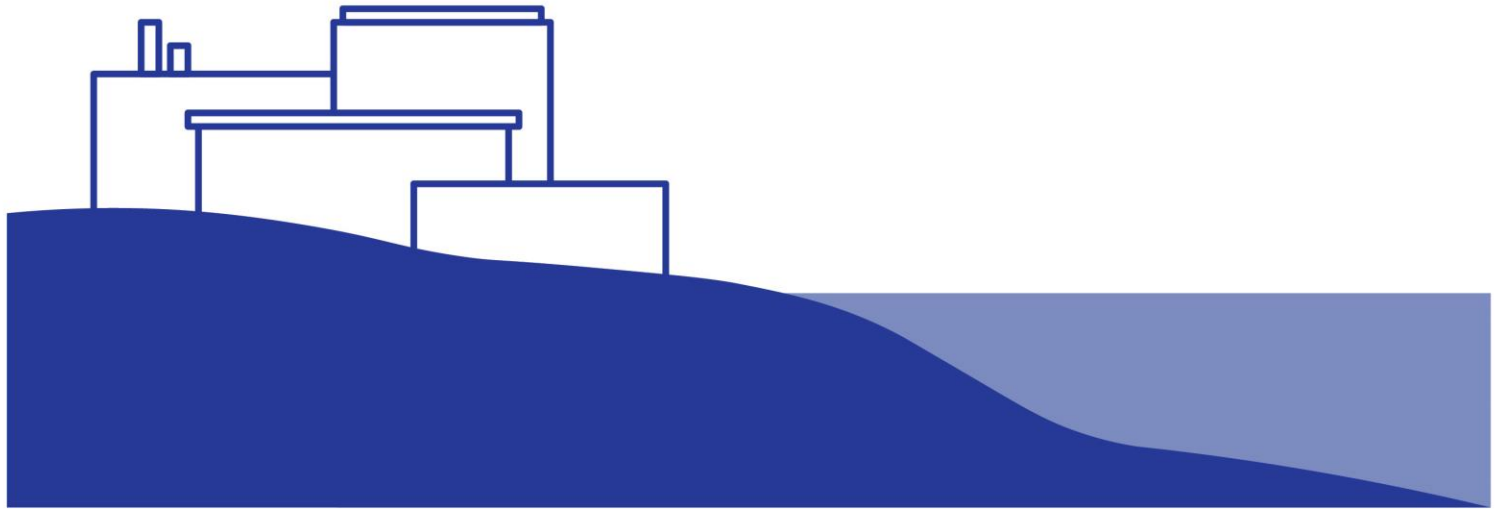
northern Bay Farm Island (with 5 feet of sea level rise)




Feet
NAVD88
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
36” of Sea Level Rise
24” of Sea Level Rise
1% Annual Chance Extreme Tide
January 2024 King Tide Event

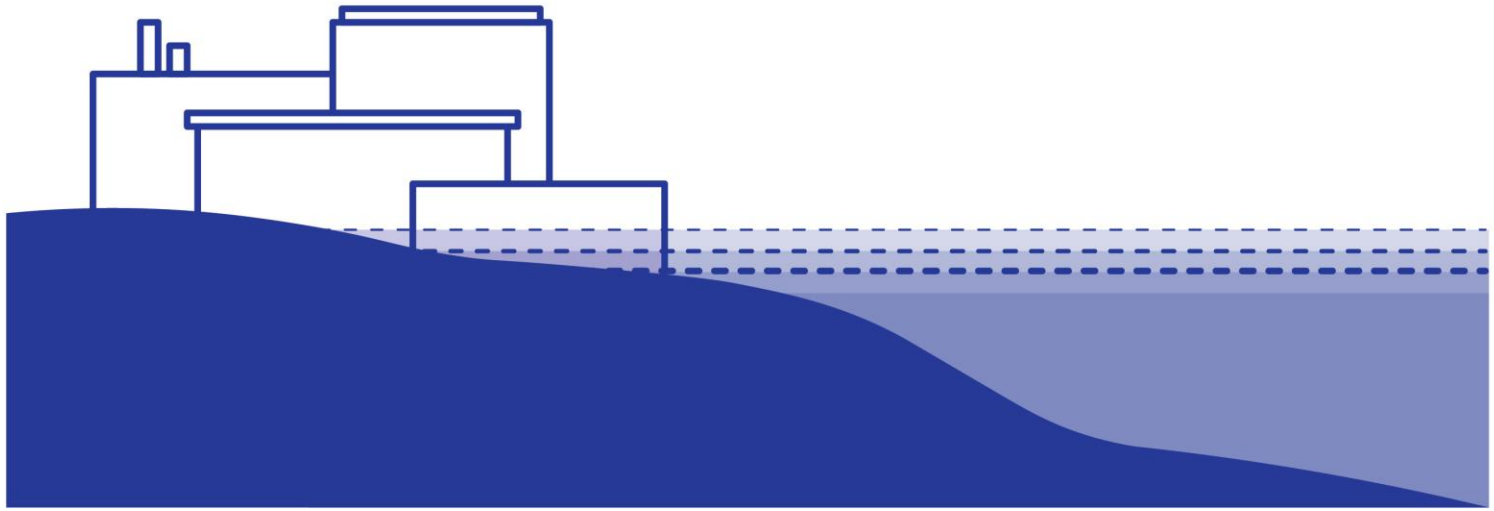
Coastal and Inland Flood Risk

Imagine this is the city's shoreline today



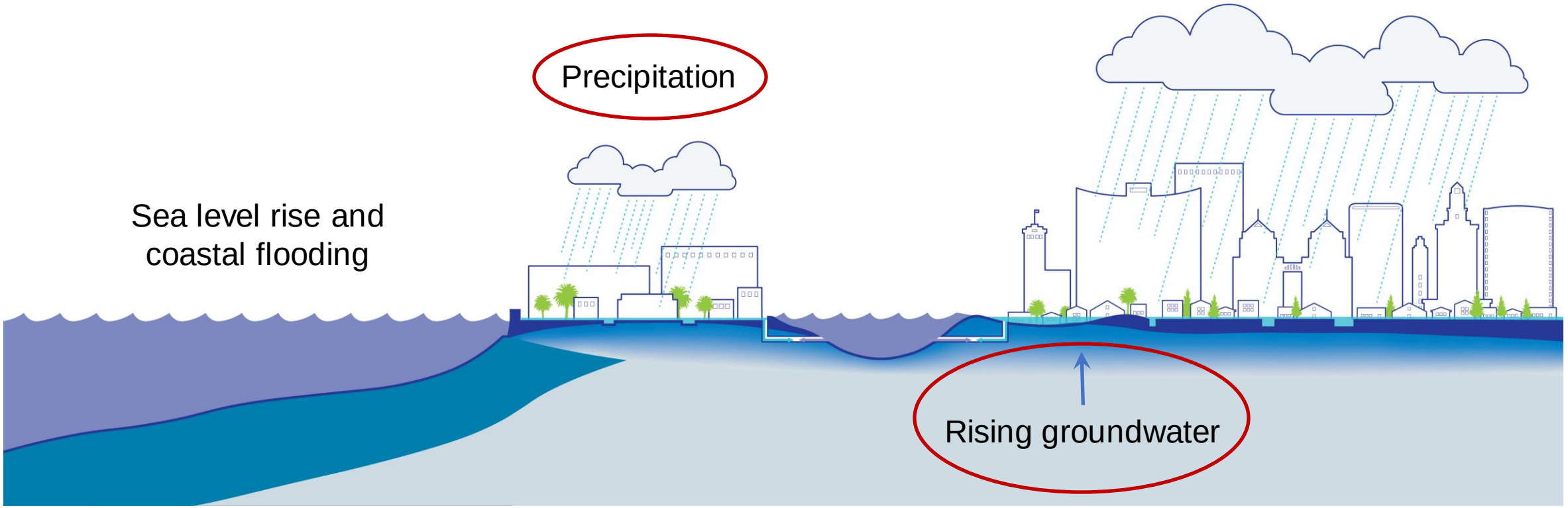
Coastal and Inland Flood Risk

Rising sea levels will cause coastal flooding



Inland Flooding

Rising temperatures impact the entire water cycle



The intensity of rainfall events is increasing

Precipitation % Change

		10-yr	100-yr
2050	3-hr	21.6%	25.8%
	24-hr	17.9%	22.1%
2060	3-hr	27.8%	32.7%
	24-hr	22.2%	26.8%
2070	3-hr	33.7%	39.3%
	24-hr	25.9%	31.2%
2080	3-hr	40.7%	47.1%
	24-hr	30.7%	36.6%
2090	3-hr	49.6%	56.9%
	24-hr	37.1%	43.7%
2100	3-hr	59.0%	67.2%
	24-hr	43.6%	51.0%

San Francisco Bay Area Domain SSP5-8.5

https://sfpuc.org/about-us/reports/san-francisco-bay-area-precipitation-warmer-world

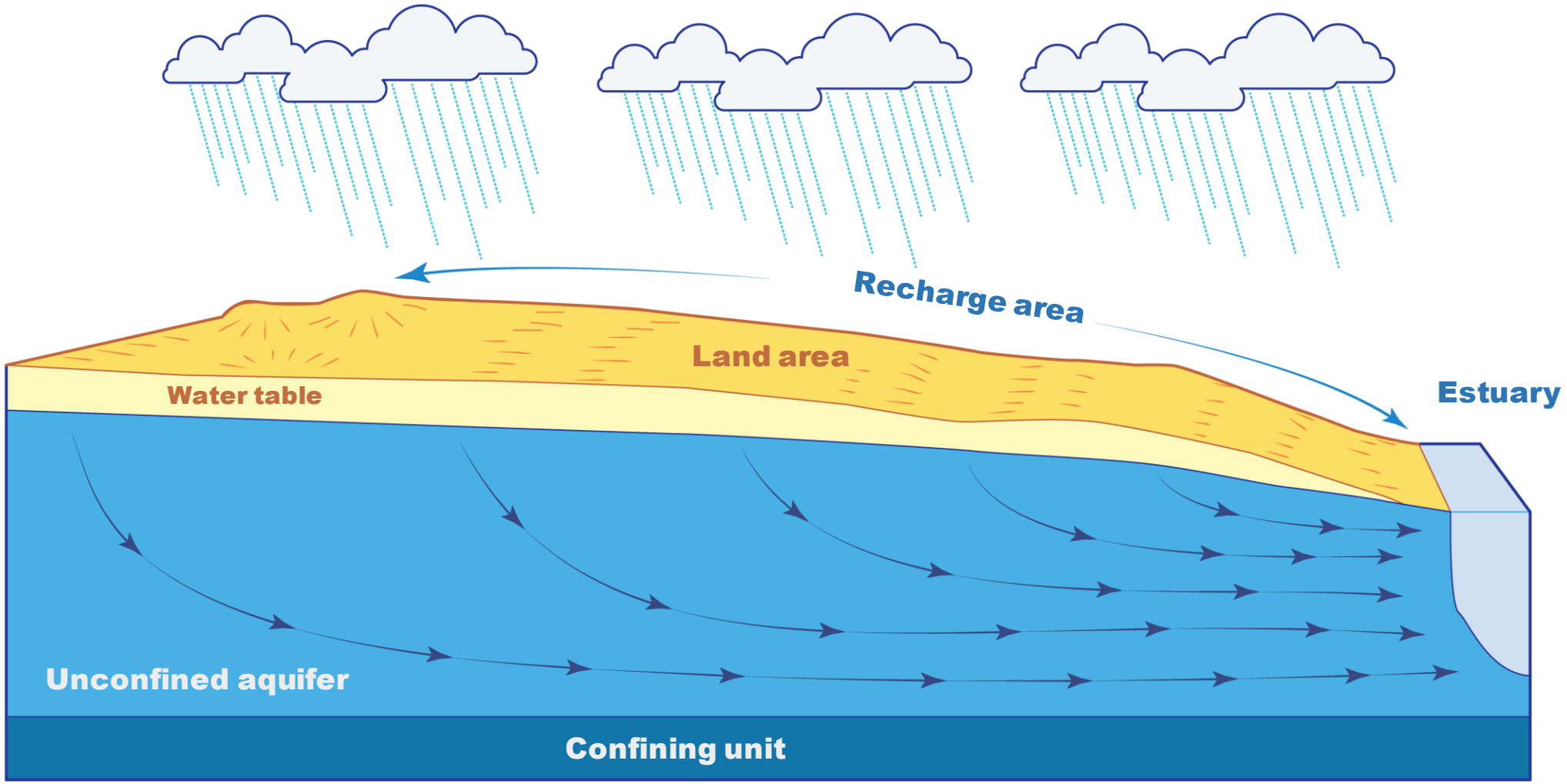
Extreme Rainfall Can Cause Localized Flooding

Fernside Road, Alameda (Jan 1, 2023)

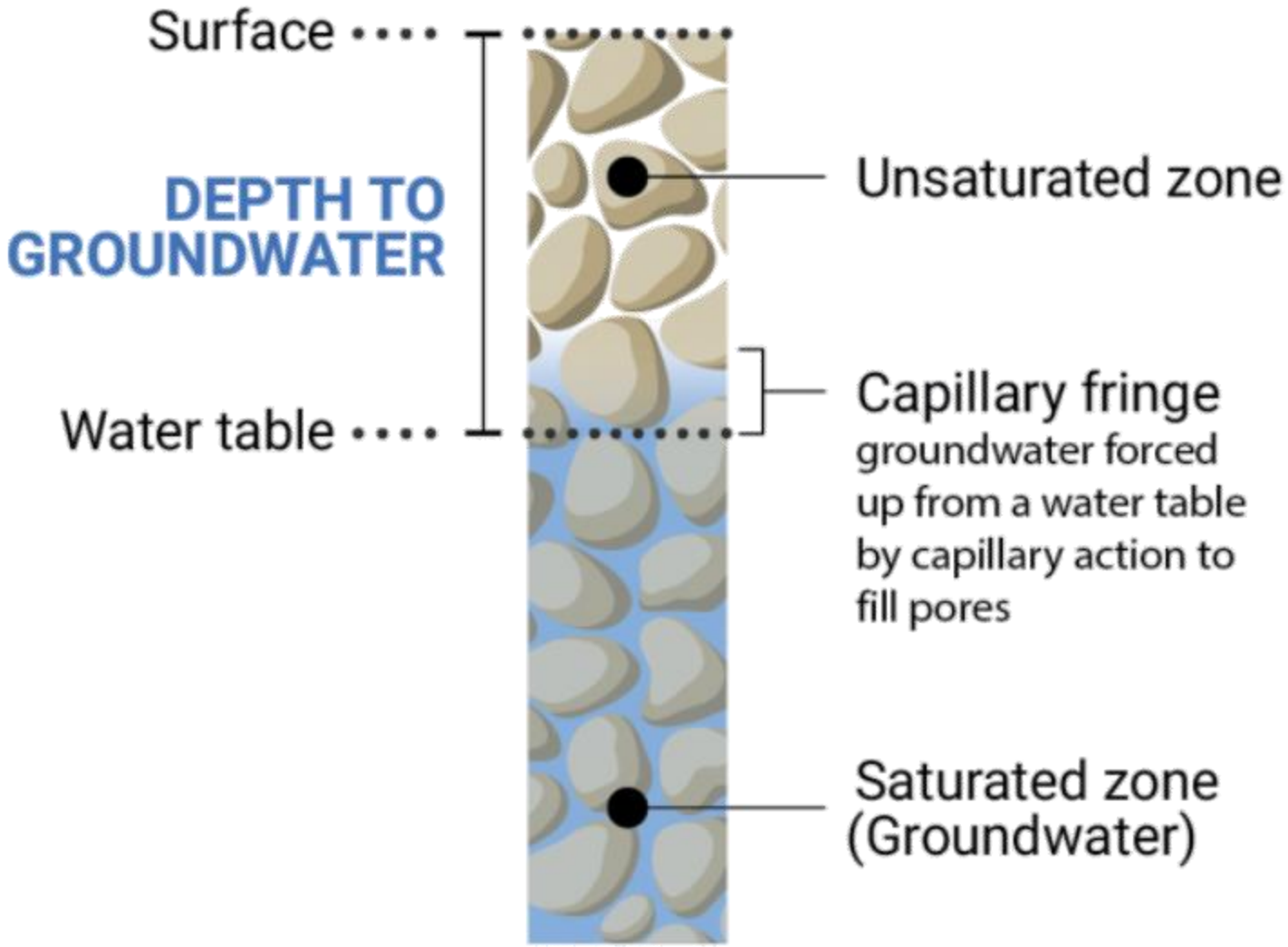
I-880, Oakland (Feb 14, 2019)

Dec 31, 2022, Tayfun Coskun/Anadolu Agency/Getty Images

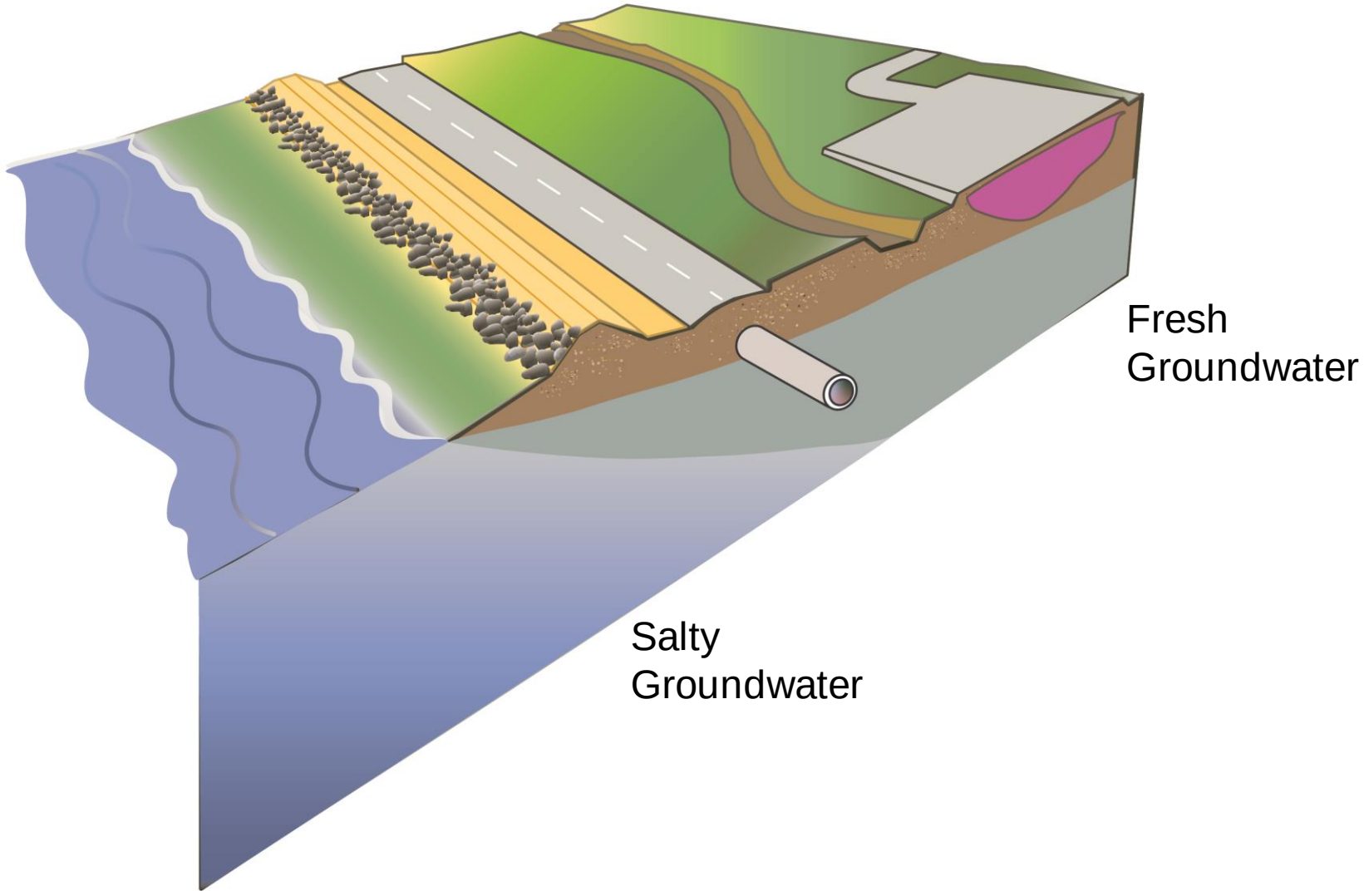
Rising Groundwater Exacerbates Inland Flooding and Infrastructure Deterioration



What is Groundwater?

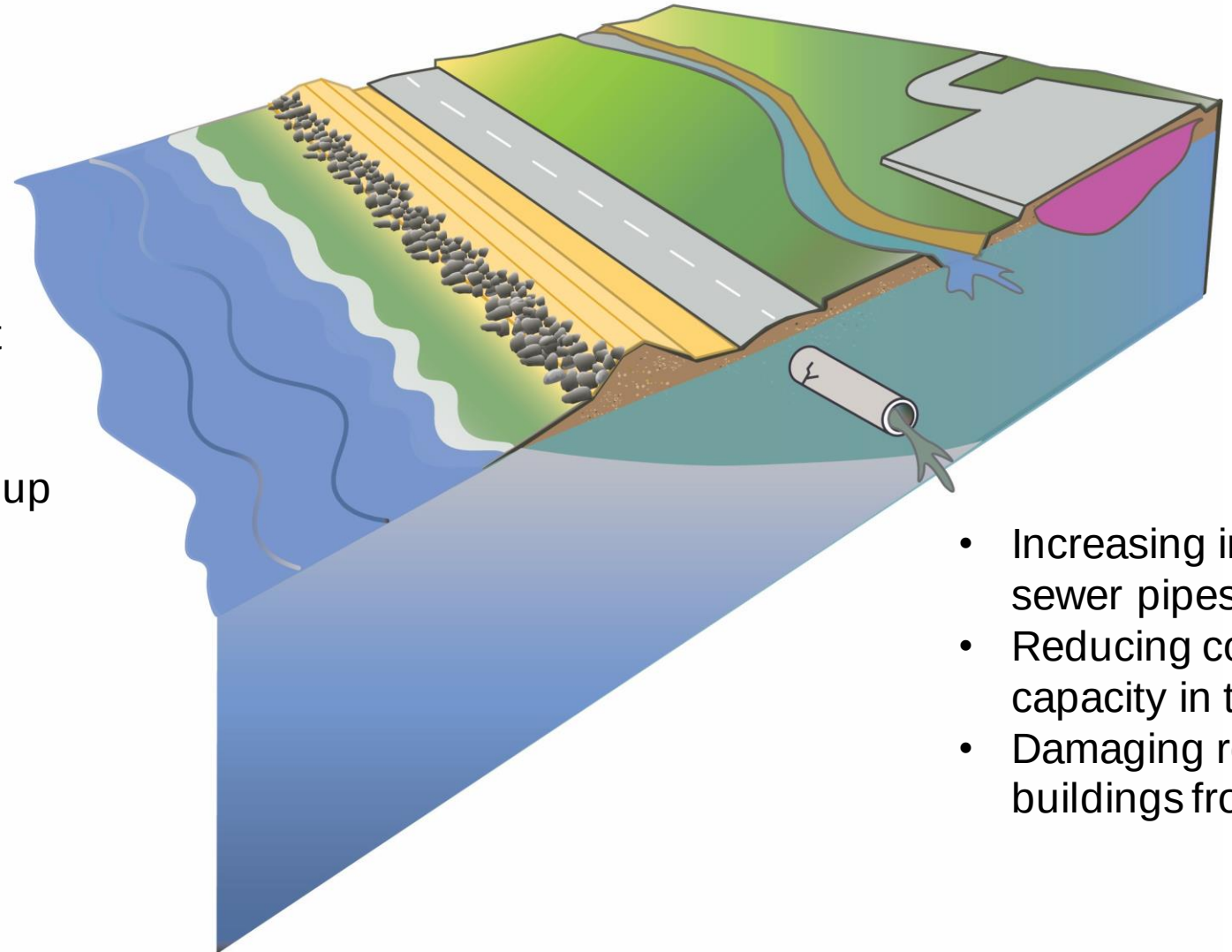


Sea Level Rise is also Increasing Groundwater Tables



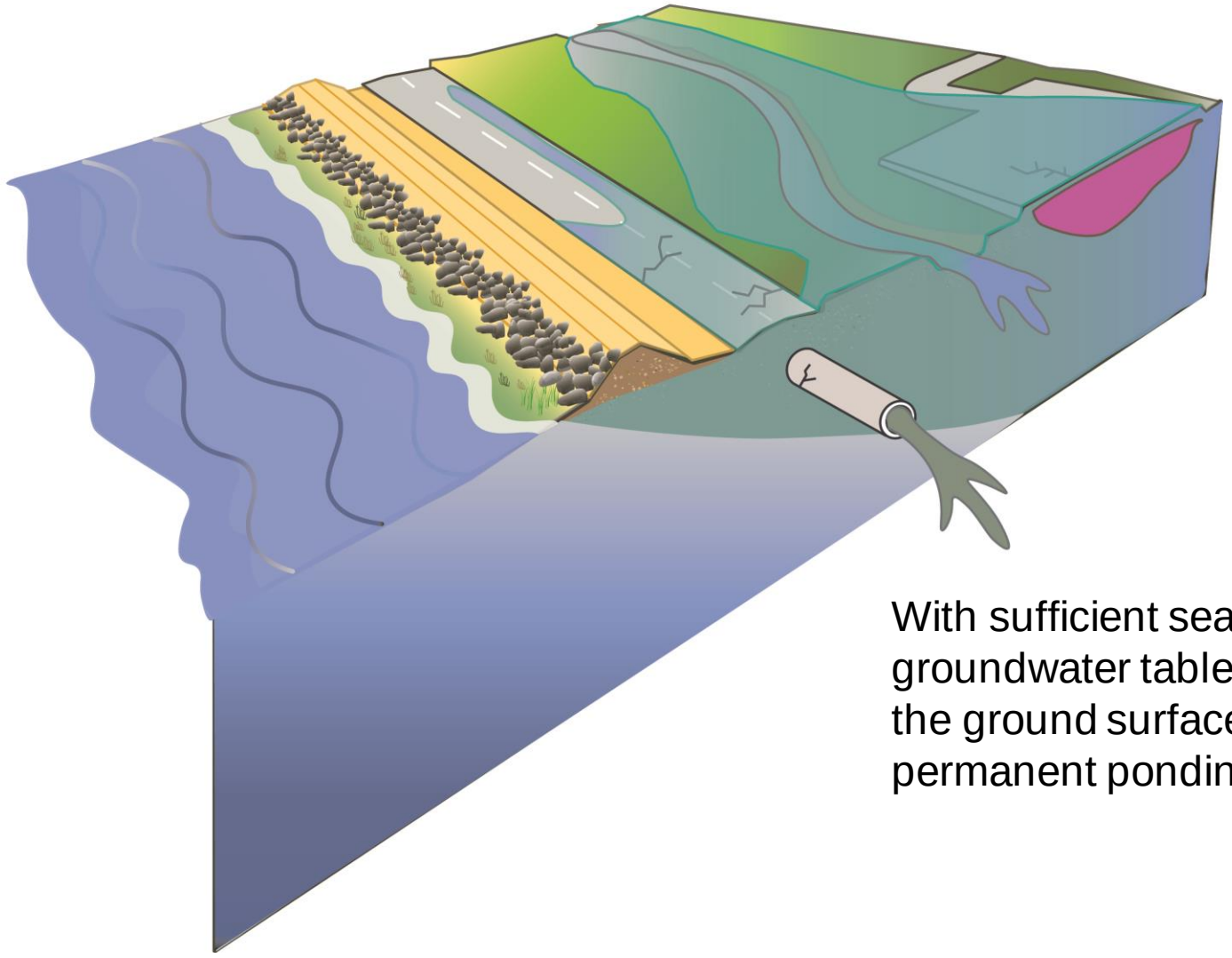
Sea Level Rise is also Increasing Groundwater Tables

As the Bay rises, it pushes the fresher shallow groundwater table up

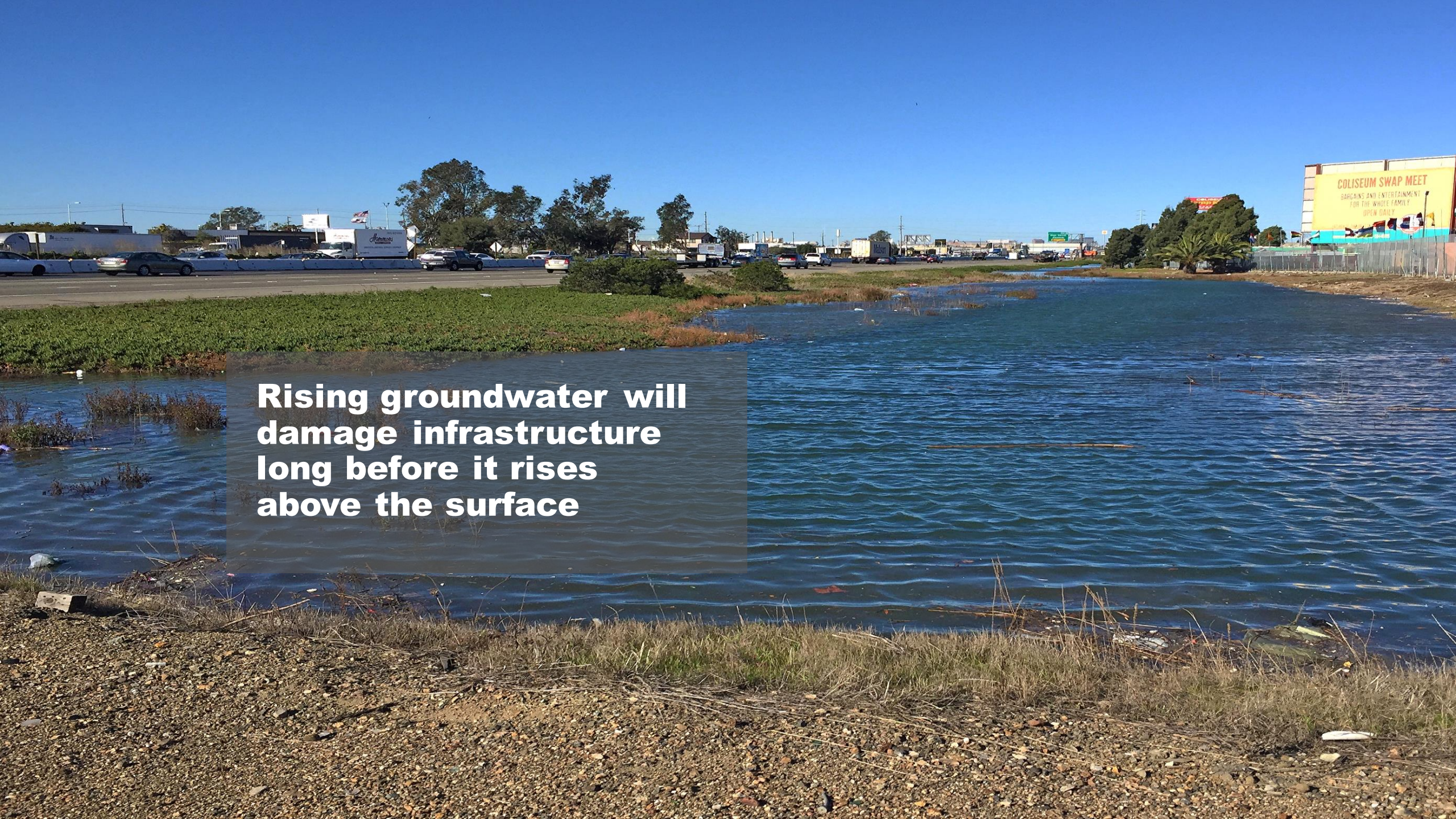


- Increasing infiltration into sewer pipes
- Reducing conveyance capacity in tributaries
- Damaging roadways and buildings from below

Sea Level Rise is also Increasing Groundwater Tables



With sufficient sea level rise, the groundwater table can rise above the ground surface causing permanent ponding

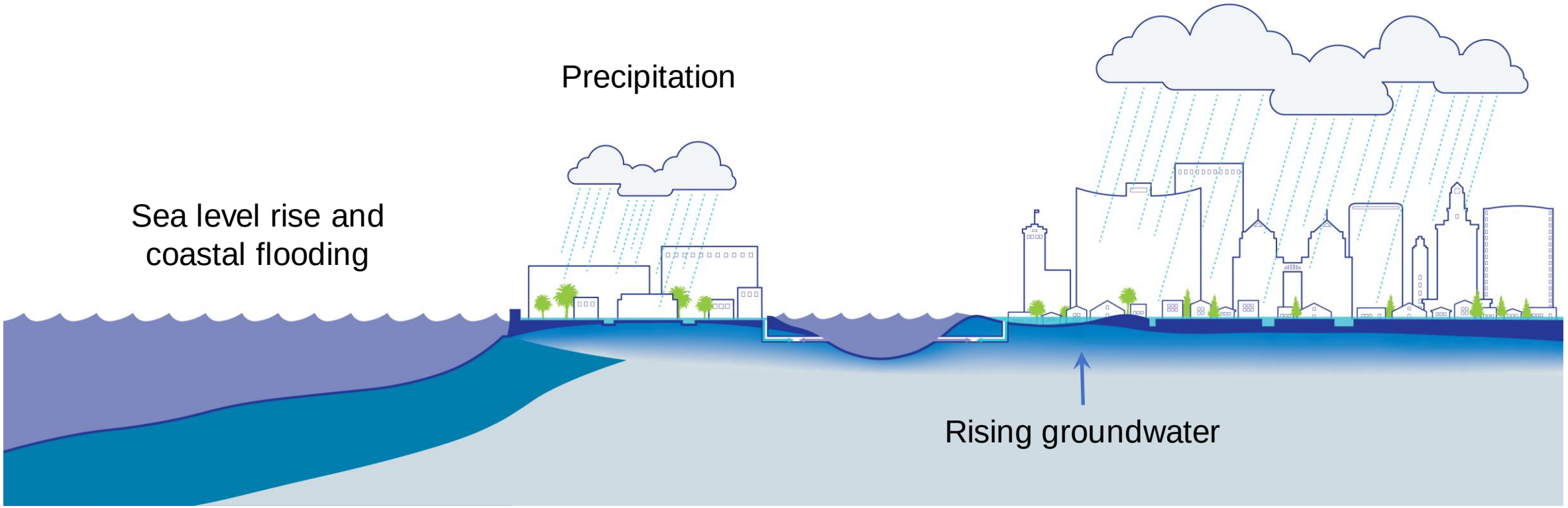


Rising groundwater will damage infrastructure long before it rises above the surface

Low-lying areas near the bay shore built on fill are at the greatest risk of:

- **Sea level rise driven coastal flooding**
- **Rainfall-driven flooding**
- **Rising and emergent groundwater**

Water is the most powerful substance on earth



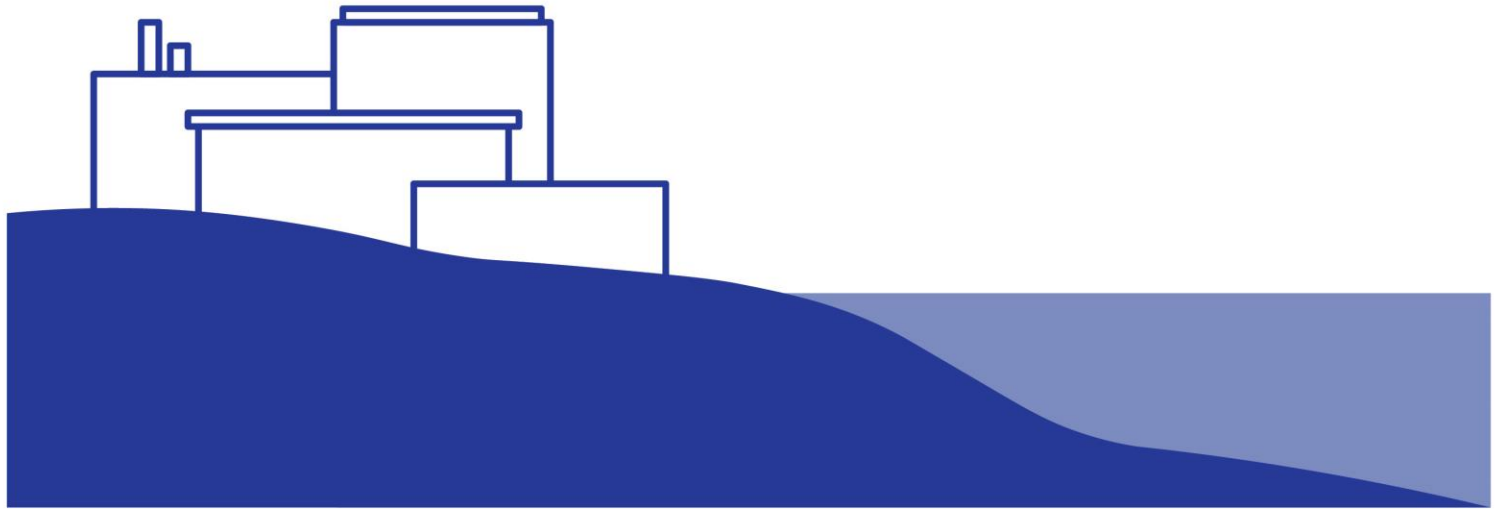
Compound Flooding

When Multiple Hazards Happen Together or in Back-to-Back Events

Photo Credit: Chayna Girling

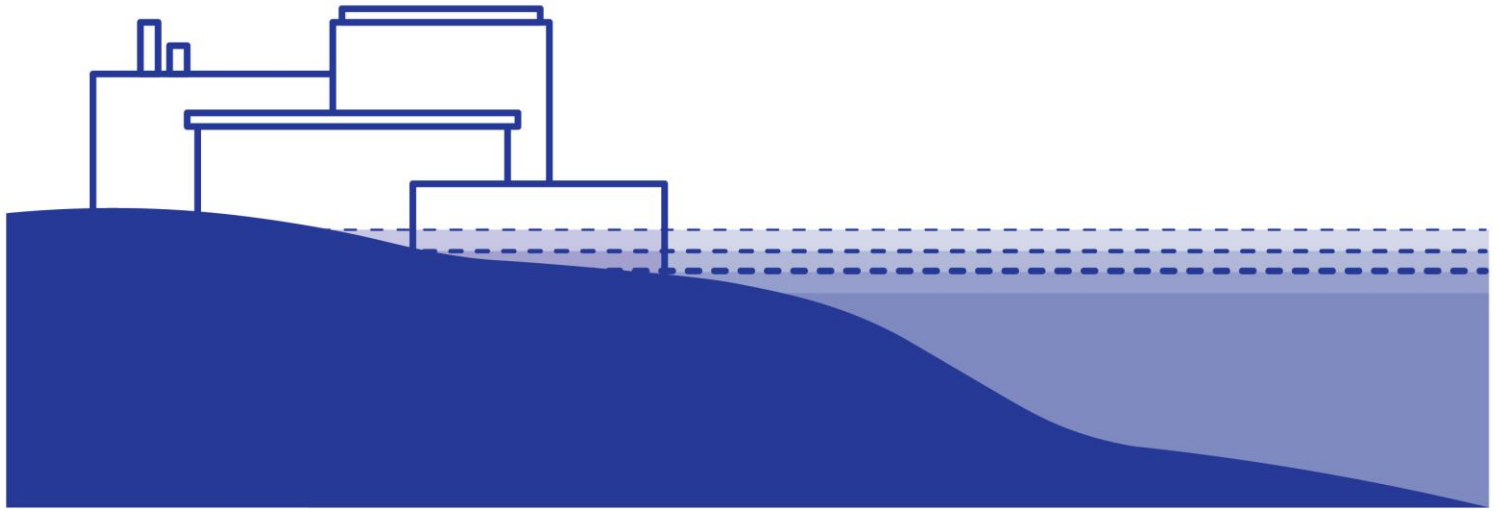
Coastal and Inland Flood Risk

Imagine this is the city's shoreline today



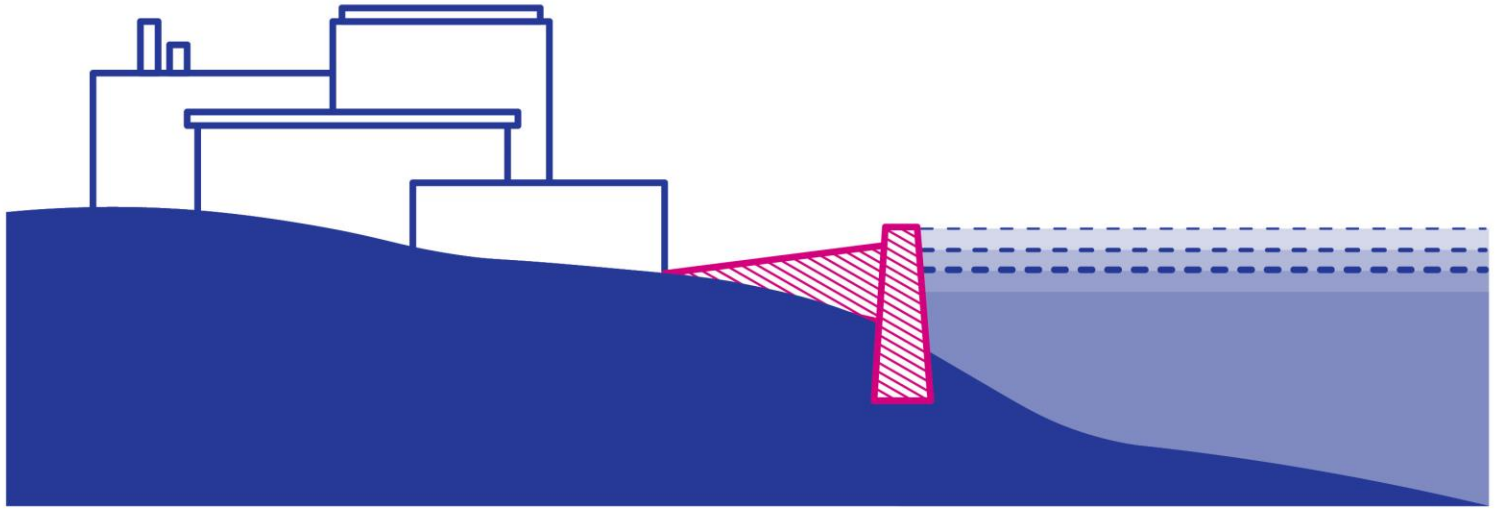
Coastal and Inland Flood Risk

Rising sea levels will increase the likelihood and frequency of coastal flooding



Coastal and Inland Flood Risk

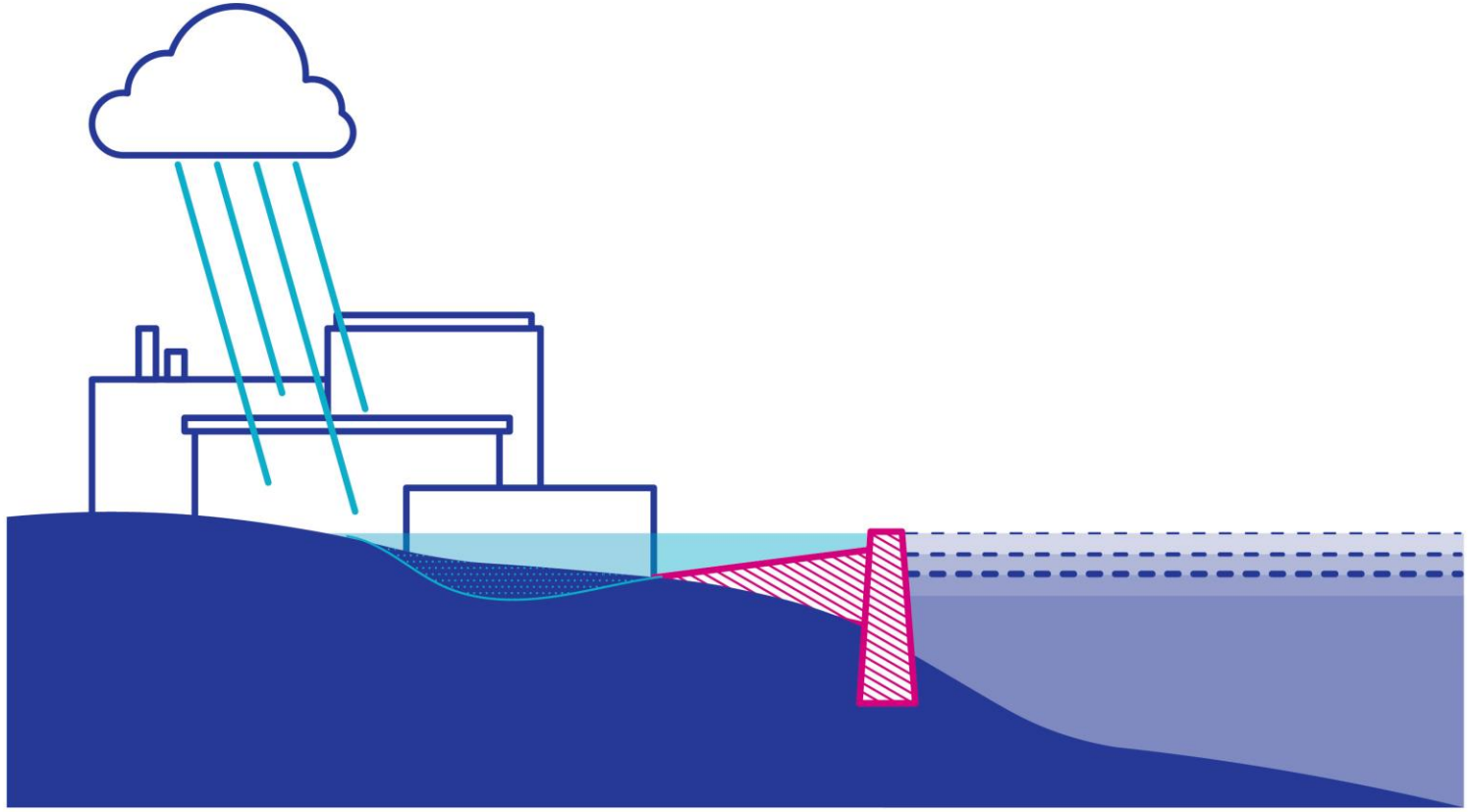
To defend against coastal flooding, we can raise the shoreline



Coastal and Inland Flood Risk

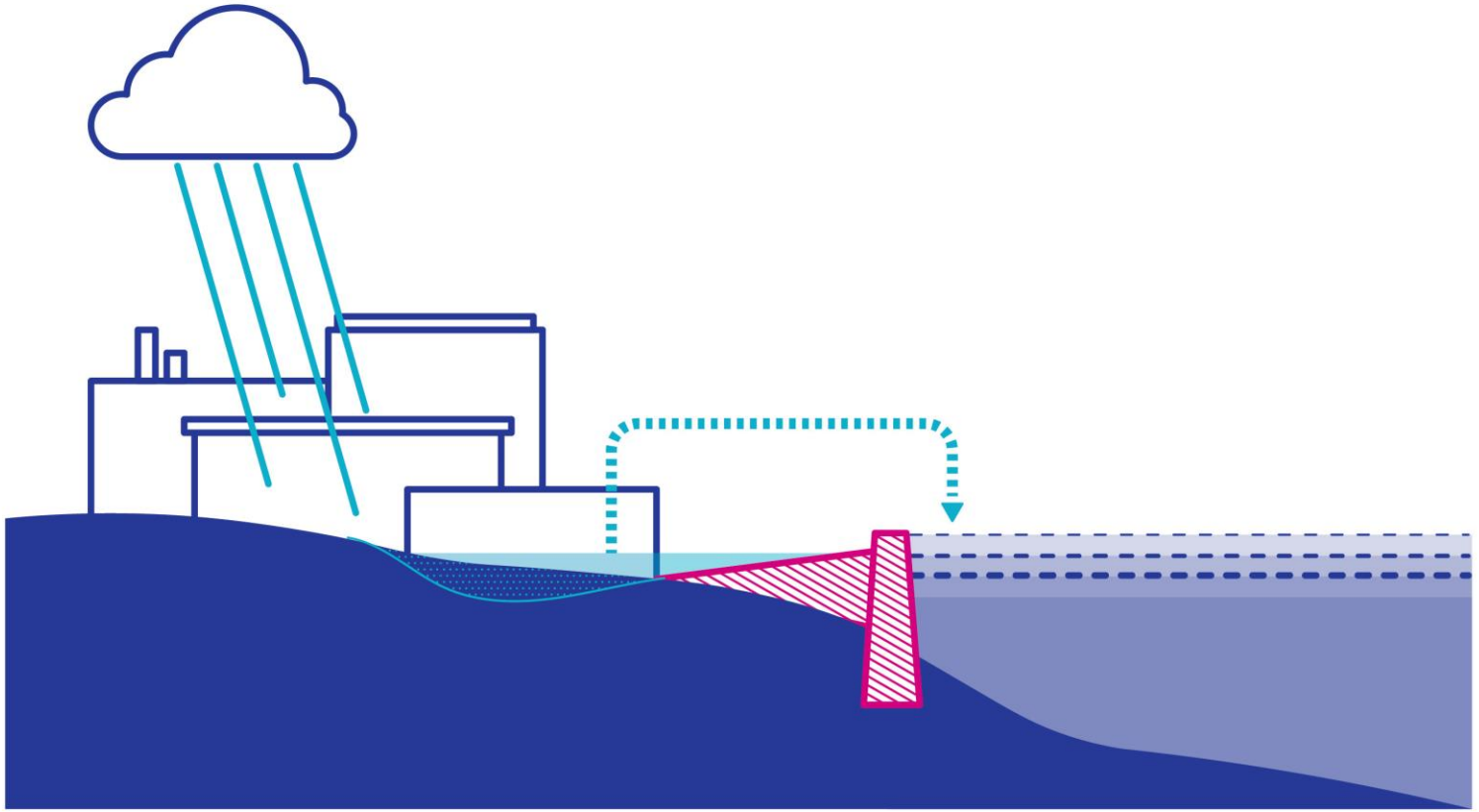
But that creates another problem:

inland flooding occurs behind the raised shoreline when it rains and the groundwater table rises



Coastal and Inland Flood Risk

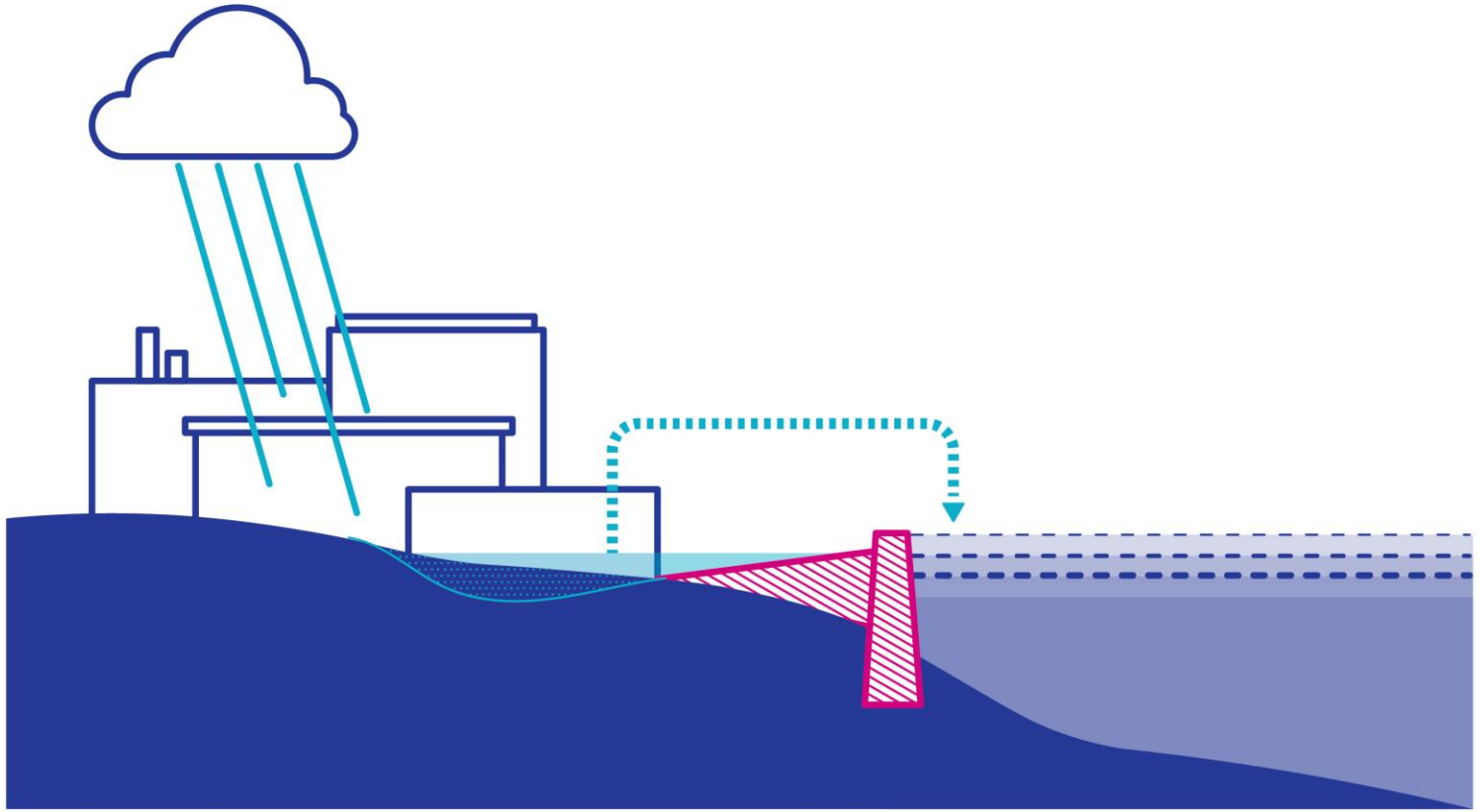
Inland flooding can be addressed by pumping the inland floodwater back into the Bay



Coastal and Inland Flood Risk

This creates two interconnected forms of flooding:

a “coastal flood zone” and an “inland flood zone”



What flood hazard concerns you the most?

Add your responses into the chat

Part 2: Responses to a Changing Climate

Dr. Kris May, Pathways Climate Institute &
Jamie Phillips, CMG

Seawall at Jack London District

Levee with Seawall and the Bay Trail

Foster City Shoreline Protection Levee with Seawall and Bay Trail

Tide Gate and Pump Station

Northern Bay Farm Island Lagoon Tide Gate and Pump

Levee and Waterfront Park

Alameda Point at Seaplane Lagoon


Levee and Waterfront Park

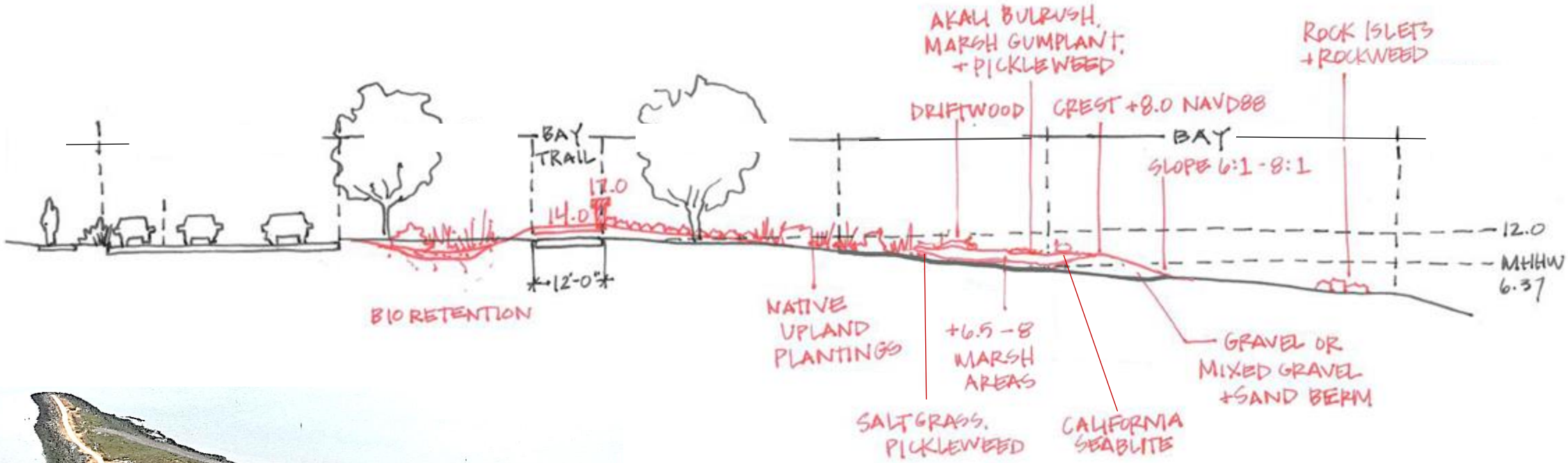
Waterfront Park with Water Access

Waterfront Park with beach access and rocky intertidal habitat

Crane Cove Park, San Francisco

Levee and Tidal Marsh

Heron’s Head Park Tidal Marsh Restoration and Access



Heron's Head Park Tidal Marsh Restoration and Access

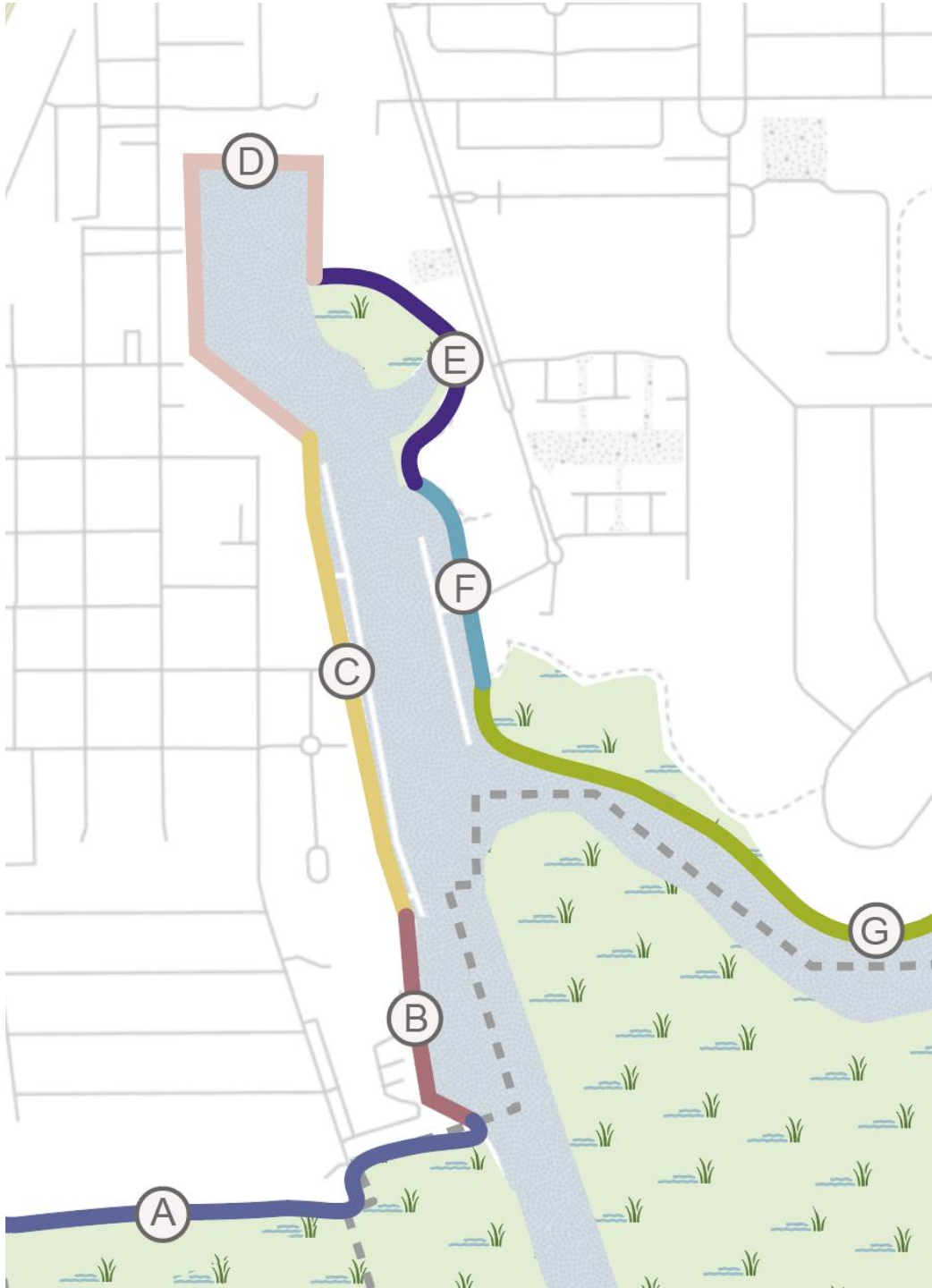
What are Adaptation Pathways?

- Support planning under **uncertainty**. How much our climate will warm over the next 100 years is **uncertain**, which makes planning hard.
- The biggest part of that uncertainty is us, **humans**, and how quickly we act to reduce greenhouse gas emissions.
- We **cannot** sit and **wait** to achieve greater certainty of the future
- **Adaptation pathways** allows us to make **incremental adaptation decisions** and **actions** over time
  - Developing a **long-term plan** that considers the **higher end projections** of what is **plausible** in the future
  - Identifying **near-term actions** that address both **existing risks** and **likely projections** of the future
  - Identifying **triggers** and/or **thresholds** for **additional actions** over time
  - Identifying **decision points**, or actions that **change** the **adaptation trajectory**

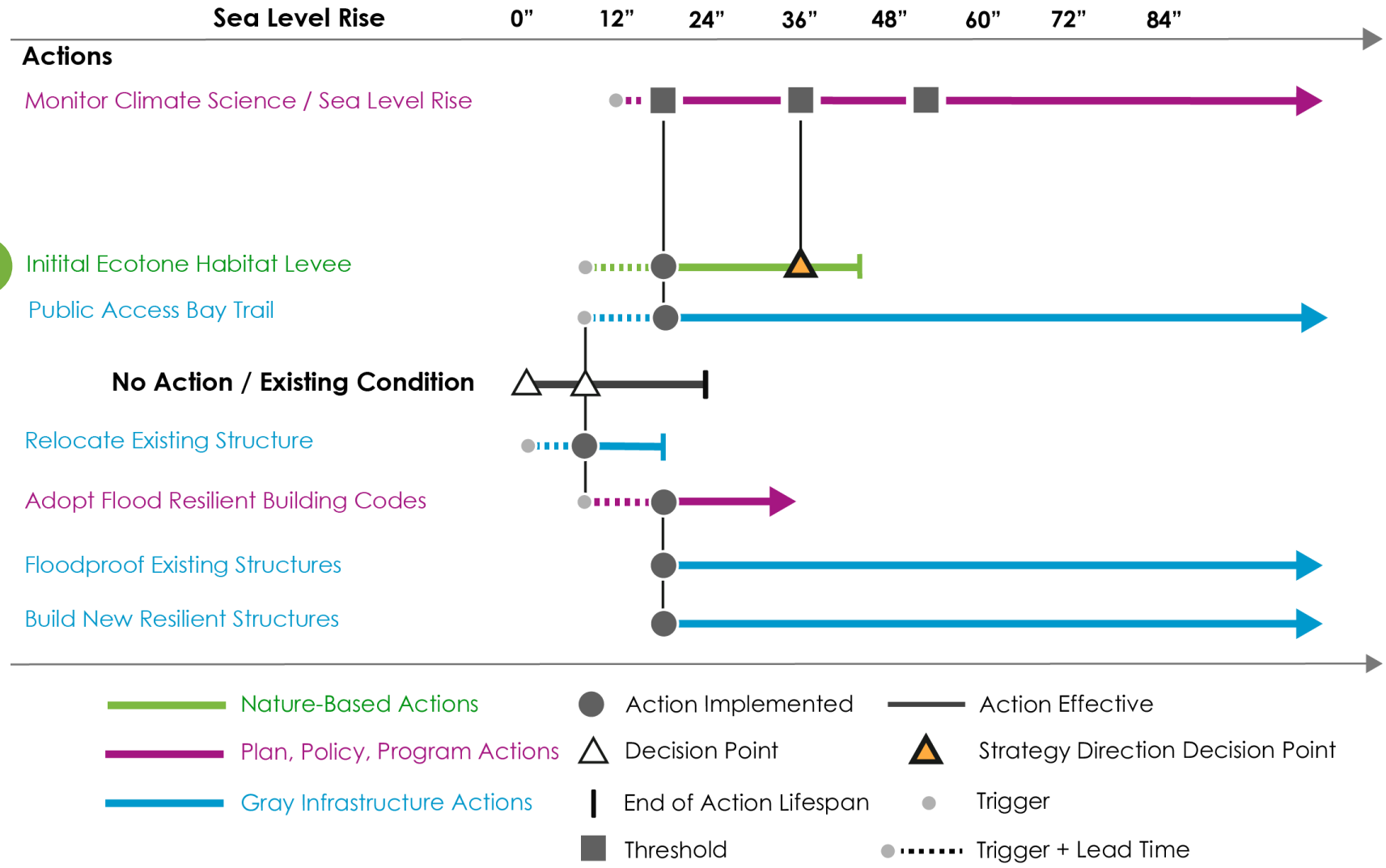
Shoreline Reaches

Evaluate shoreline adaptation options

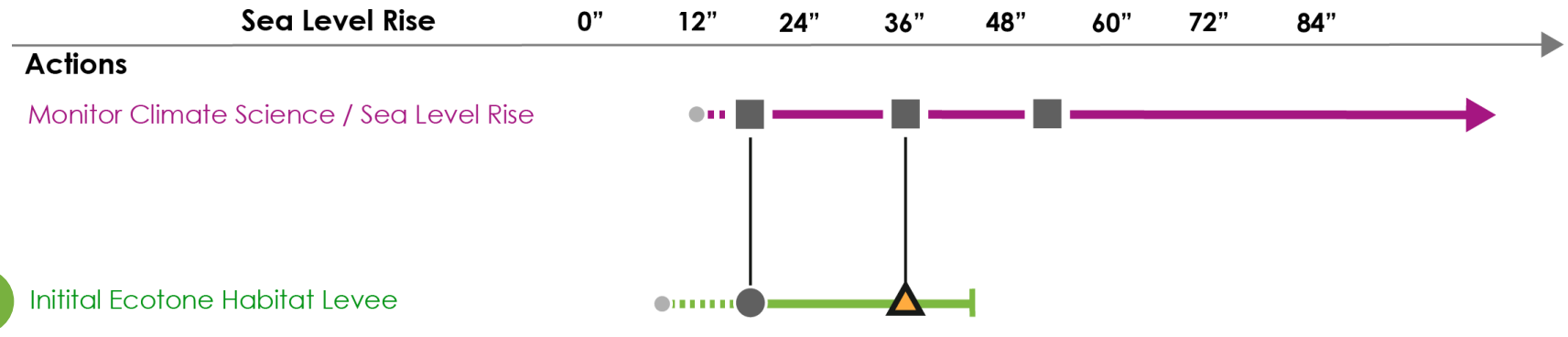
- Shoreline type / characteristics
- Height / elevation
- Existing and future hazards
- Outboard maritime use
- Inland land use / population
- Habitat connectivity
- Habitat opportunities
- Space constraints
- etc.

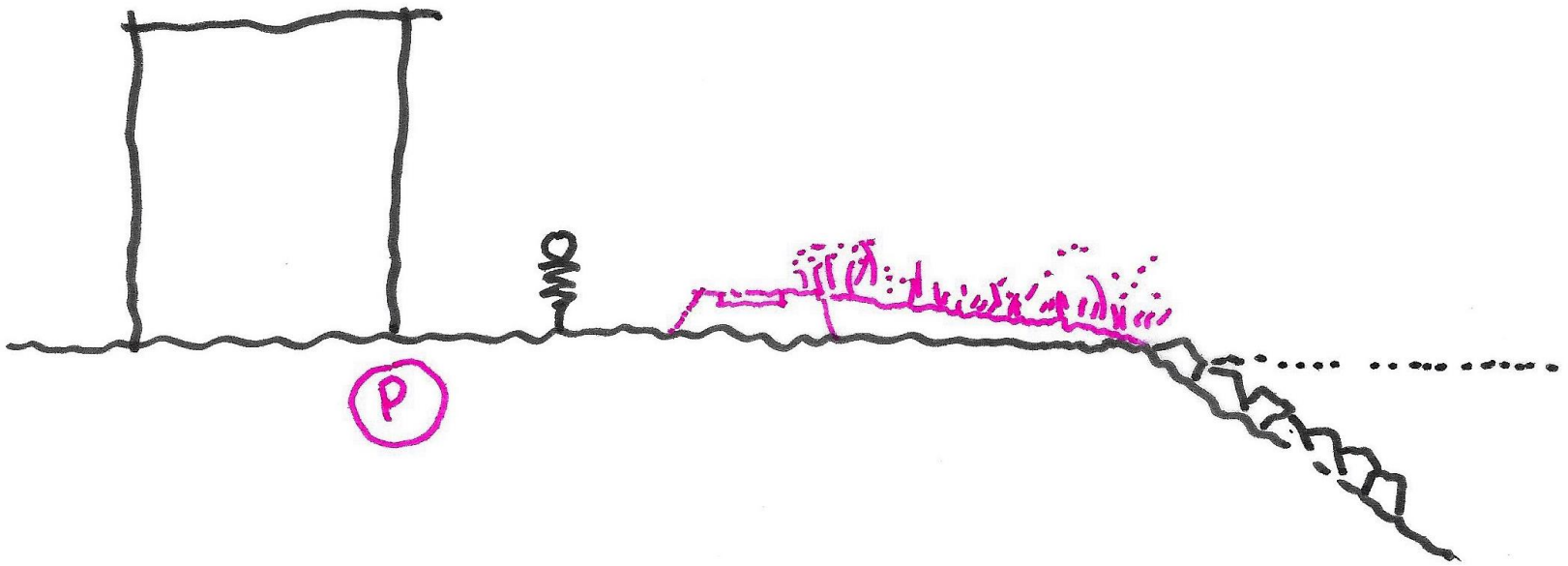


Example Adaptation Pathway Step 1

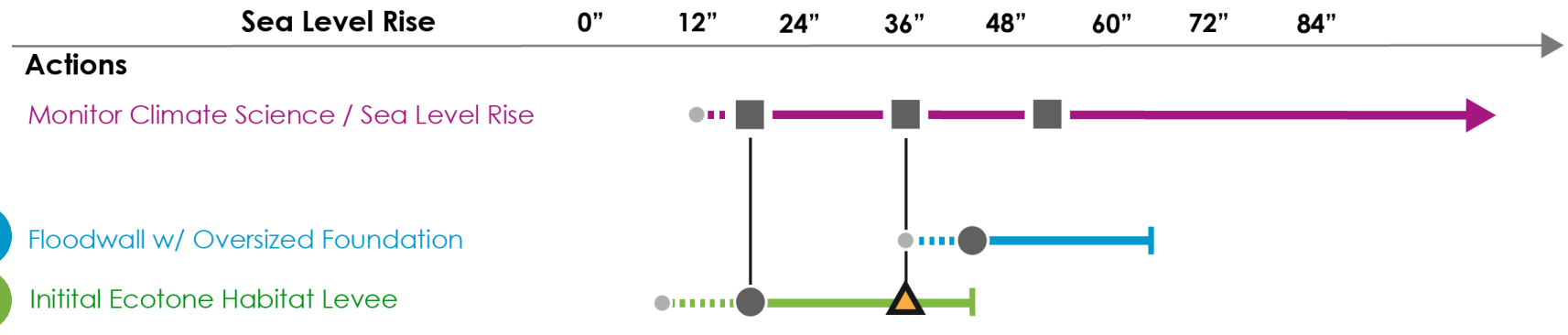


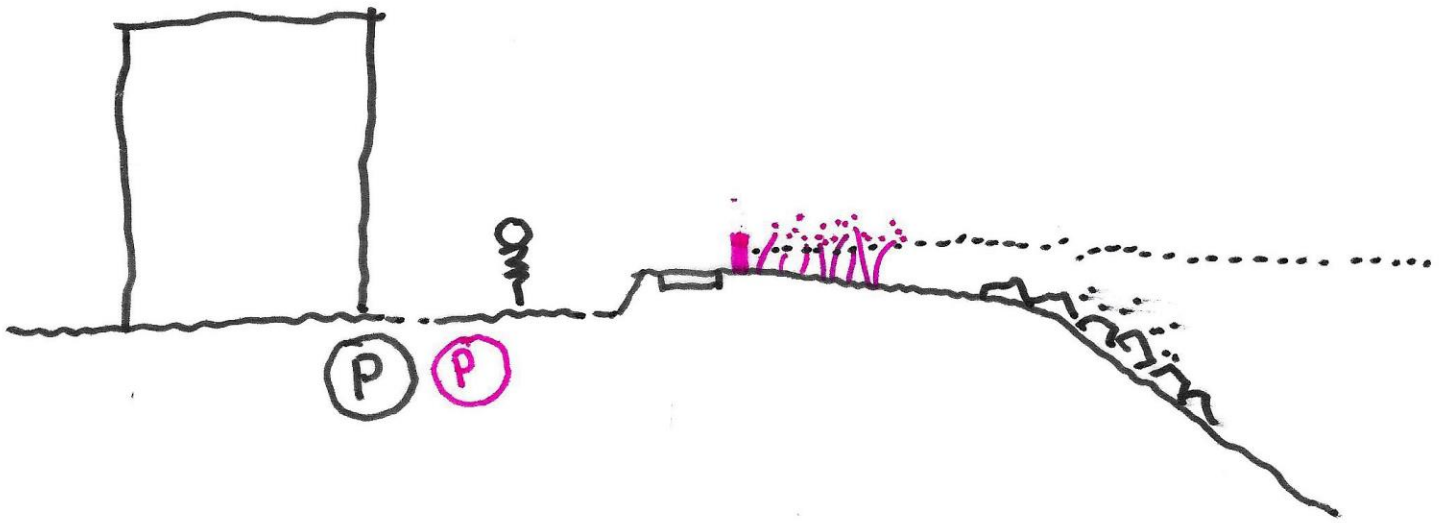
Example Adaptation Pathway Step 1



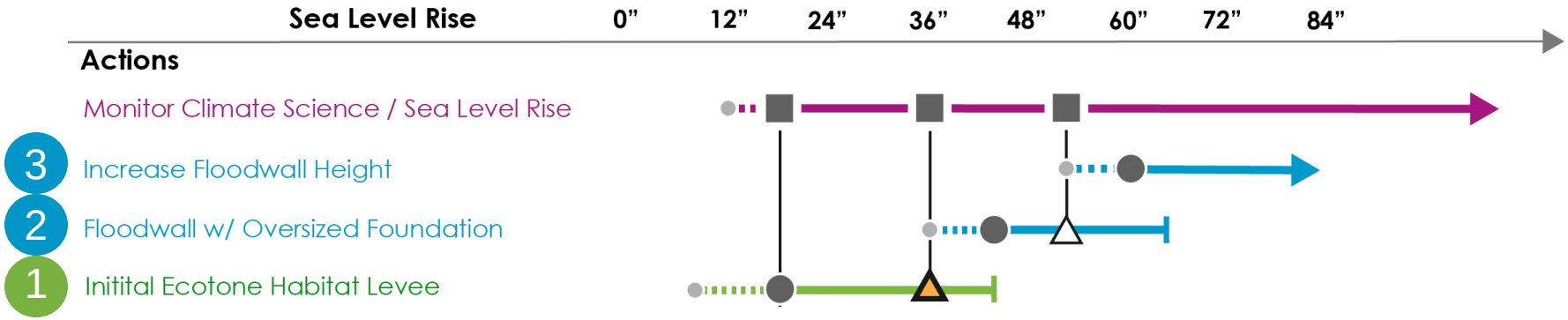


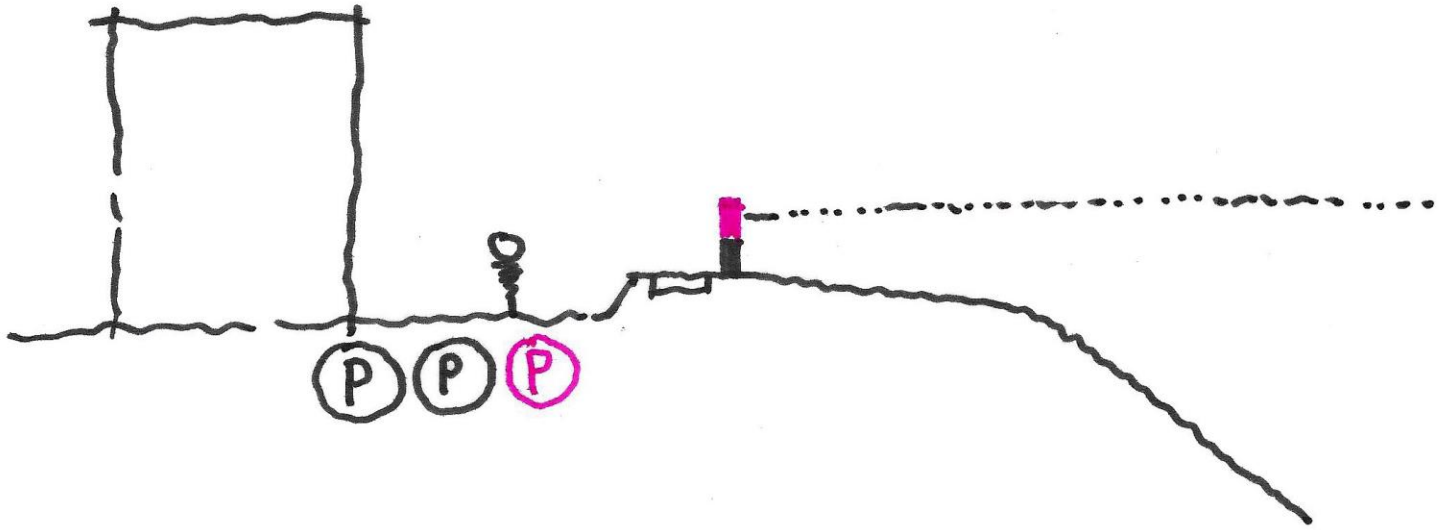
Example Adaptation Pathway Step 2 (Structural)



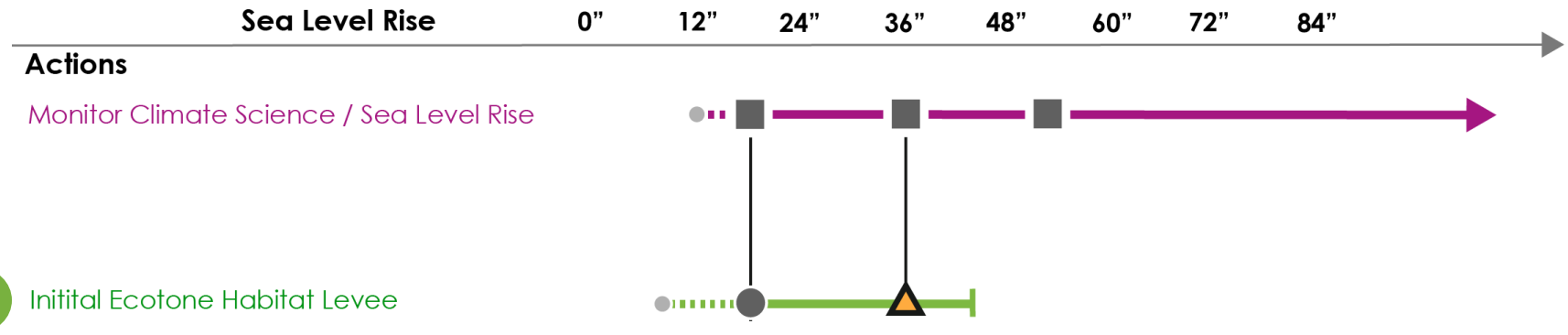


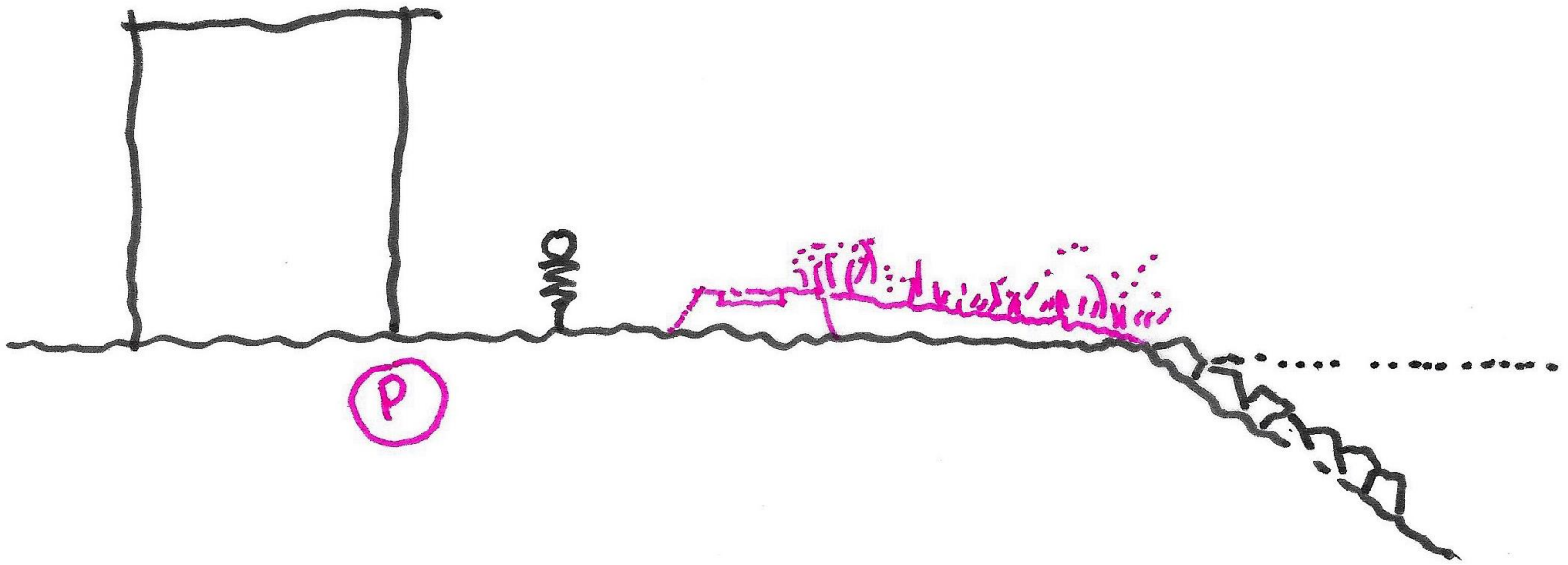
Example Adaptation Pathway Step 3 (Structural)



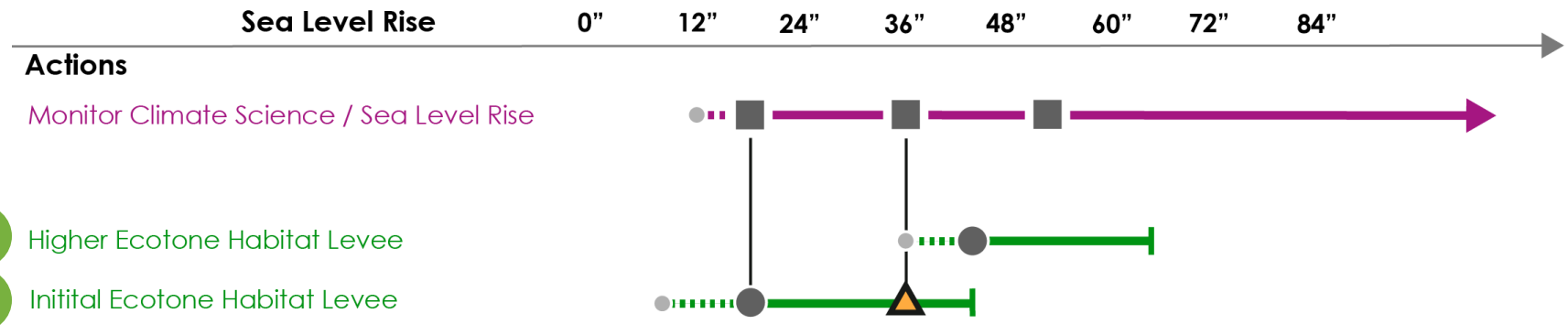


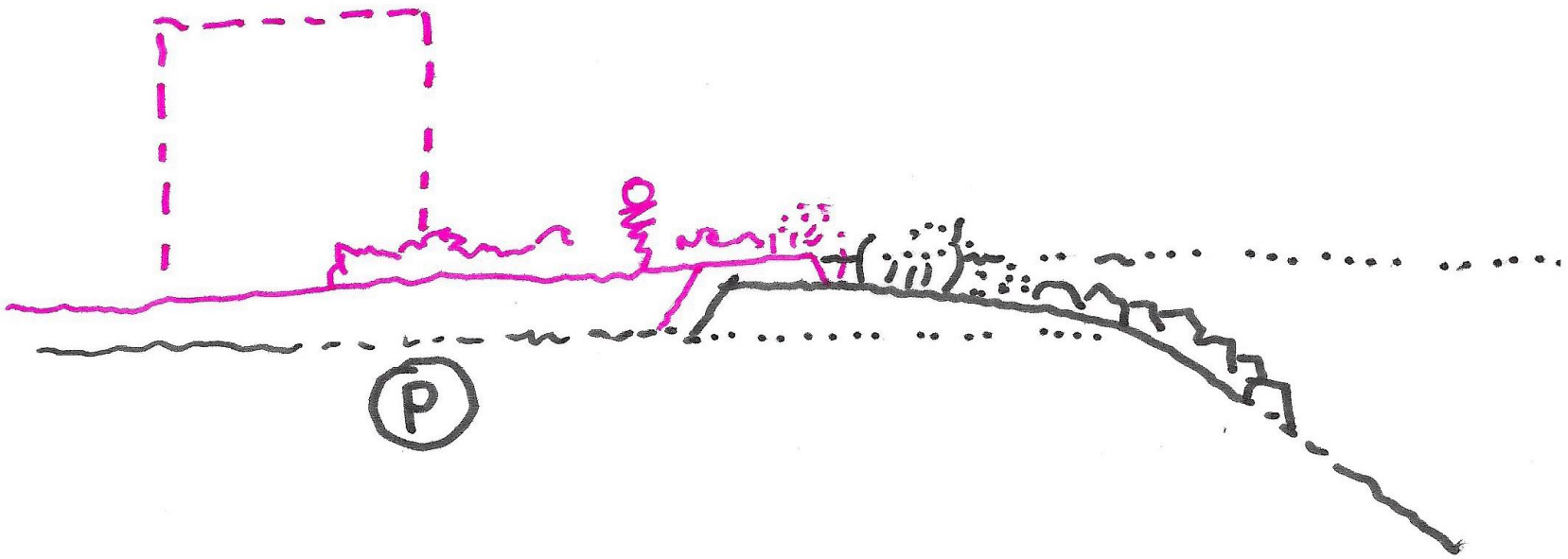
Example Adaptation Pathway Step 1



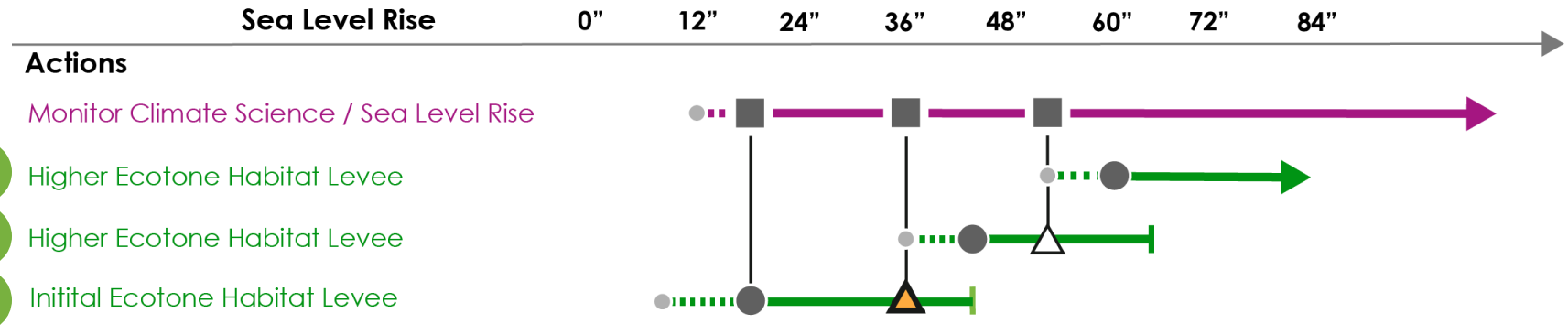


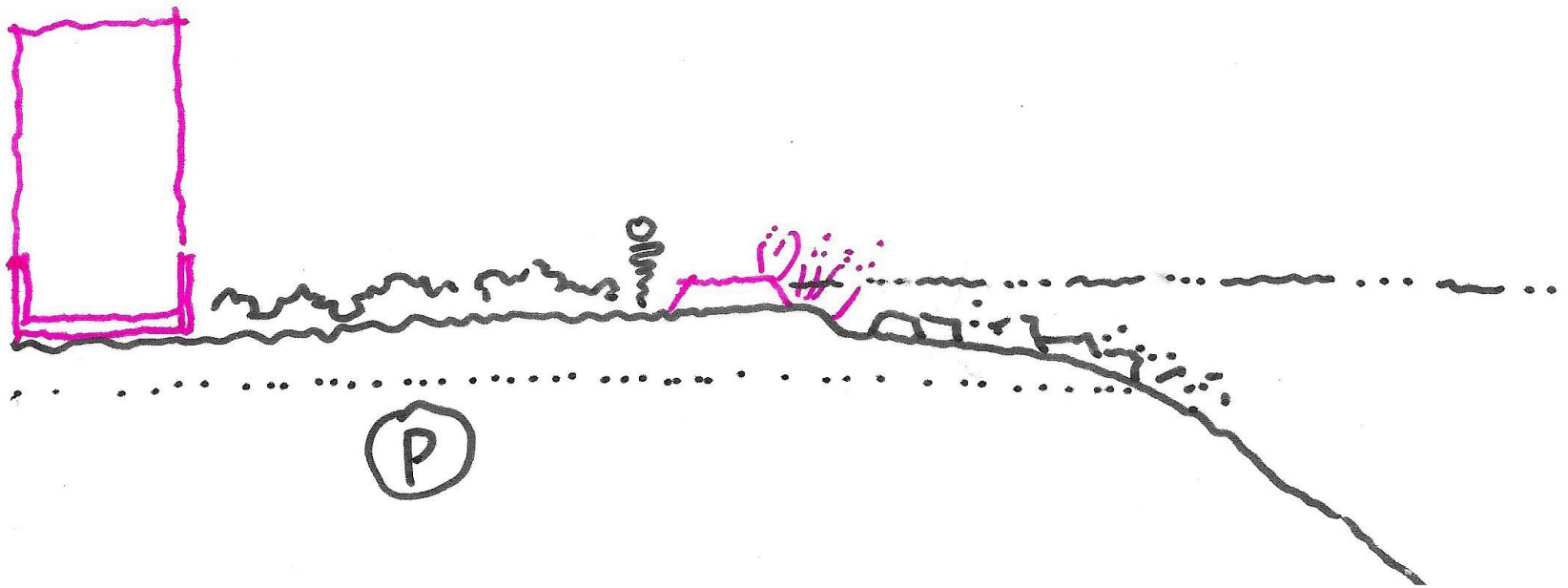
Example Adaptation Pathway Step 2 (Nature Based)



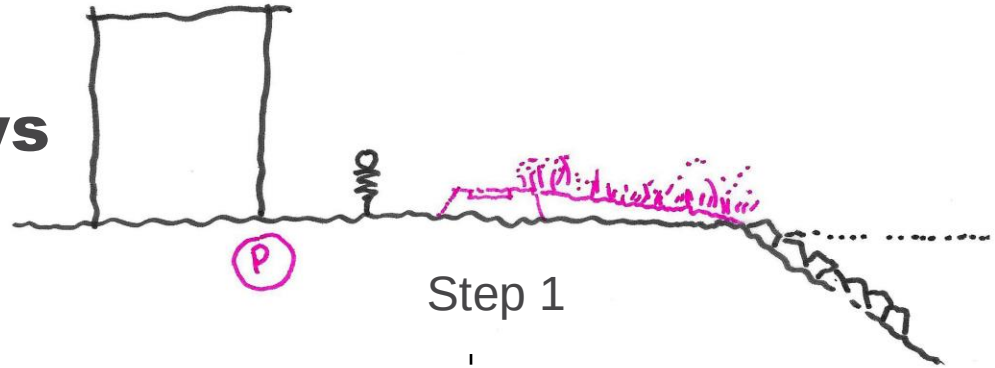


Example Adaptation Pathway Step 3 (Nature Based)

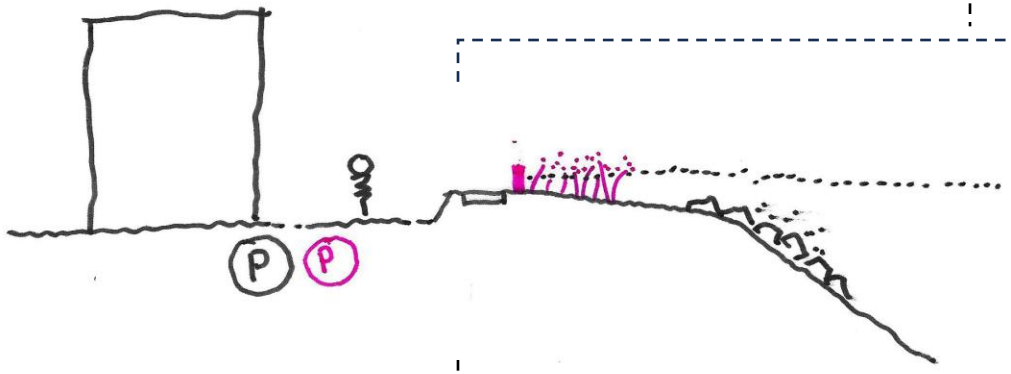




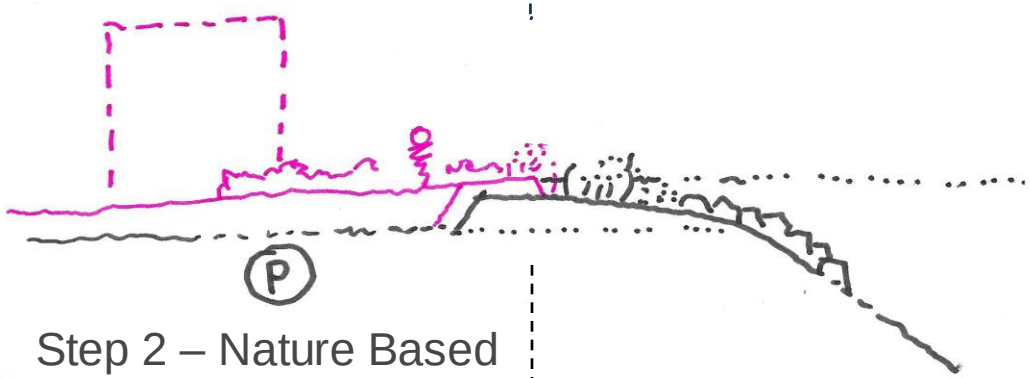
Adaptation Pathways



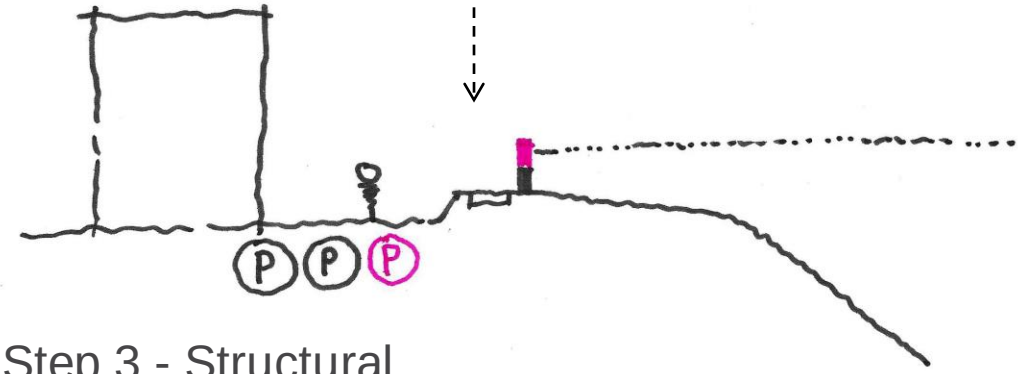
Step 1



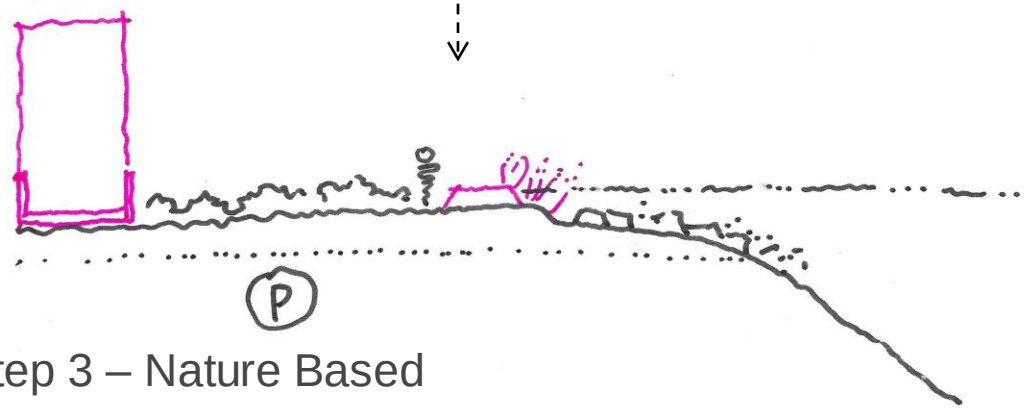
Step 2 - Structural



Step 2 – Nature Based



Step 3 - Structural

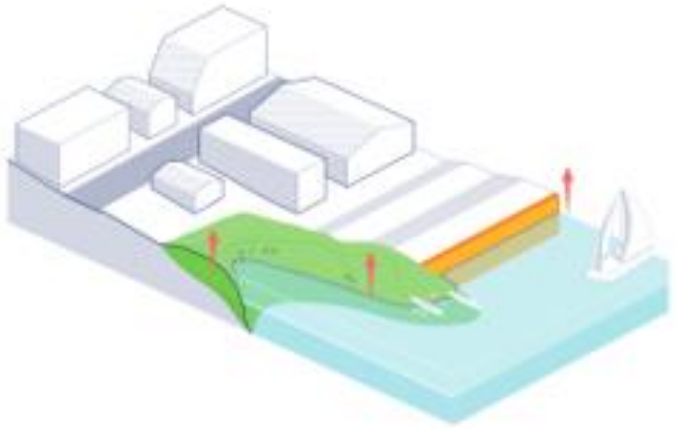


Step 3 – Nature Based

Adaptation Pathways

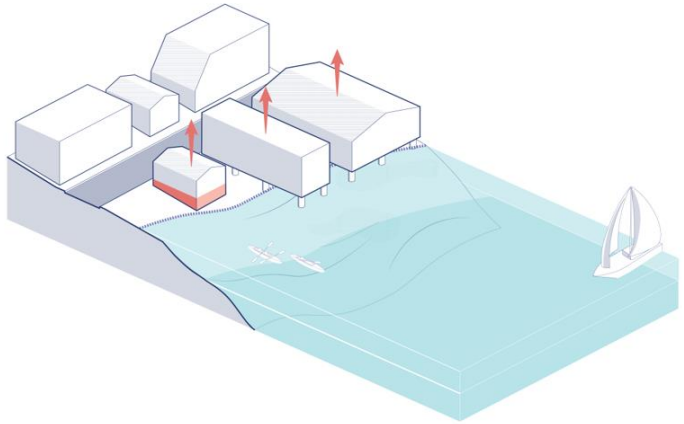
- **Near-term actions** are more certain, although we will need to prioritize where we start.
- Future actions on the Adaptation Pathway can be more conceptual – identifying options for future decision-making
  - Identify water level thresholds and **decision points**, or actions, that **change** the **adaptation trajectory**
  - Include **options** that require land-use change or acquisitions
  - Consider **trade-offs** between **green** and **gray** solutions
  - Help set the tone and scale for future adaptation
  - Encourage **dialog** with the public and stakeholders to support **transparent**, and **equity-centered**, decision making

“Traditional” Approaches to Reduce Coastal Flood Risk



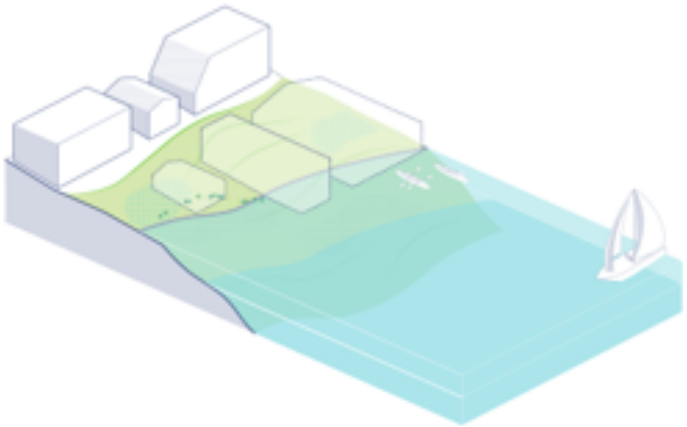
Protect

Keep coastal water out, stay in place



Accommodate

Let coastal water in, stay in place



Retreat or Avoid

Move out of the area over time

Port of San Francisco Waterfront Resilience Program Port Commission Meeting June 2022
https://sfport.com/files/2022-07/WRP%20Update%20on%20Adaptation%20Strategies%20Process%20to%20Port%20Commission%20-%206.14.22.pdf

Spectrum of Change

Resistance **Resilience** **Transformation**

Peterson St-Laurent, G., Oakes, L.E., Cross, M. et al. R–R–T (resistance–resilience–transformation) typology reveals differential conservation approaches across ecosystems and time. Commun Biol 4, 39 (2021). https://doi.org/10.1038/s42003-020-01556-2

Which adaptation ideas are you excited about seeing in your community?

Add your responses into the chat!

Breakout Discussion Groups

Where do you work, live and play?

What flood hazard concerns you the most?

Which adaptation ideas are you excited about seeing in your community?

Thank You