

Welcome! The Webinar will begin shortly



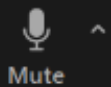
Sustainability and Climate Action Plan Ad Hoc Committee

January 13, 2022

cityofpaloalto.org/ClimateAction

Acting Now for a Resilient Future

Click on Q&A anytime during the presentation to ask questions



Mute



Chat



Raise Hand



Q&A

Leave

- **Recap of December 2021 S/CAP Ad Hoc Meeting**
- **Climate Impacts**
 - Impacts of Wildfires
 - Marshall Burke and Michael Wara, Woods Institute for the Environment, Stanford University
 - Wildfire Protection Programs Update
 - Overview of Sea Level Rise
 - Jeremy Lowe, San Francisco Estuary Institute
 - Sea Level Rise Vulnerability Assessment
- **Discussion**





- 24 Questions, covering the following themes:
 - How can the City encourage active transportation (walking, biking, transit)?
 - How can the City make bicycling safer?
 - What assumptions are the City making about commuters?
 - Have you studied land use and housing preferences?
- 24 Comments, covering the following themes:
 - Provide viable alternatives to driving
 - Safety is biggest barrier to more people biking
 - Apply lessons learned from Safe Routes to Schools to all residents
 - S/CAP needs to be brought into every major decision City Council makes
 - The city needs both affordable and mixed-income housing



Marshall Burke

Associate Professor, Department of Earth System Science
deputy director, Center on Food Security and the Environment
center fellow, Freeman Spogli Institute for International Studies
Stanford University

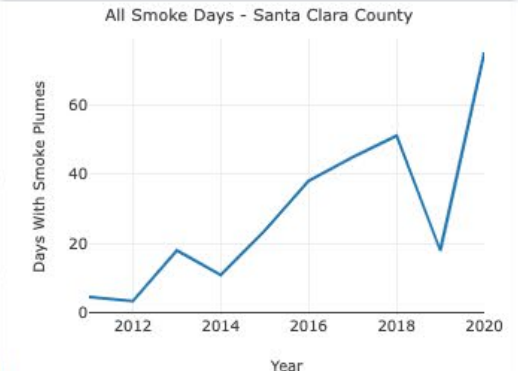
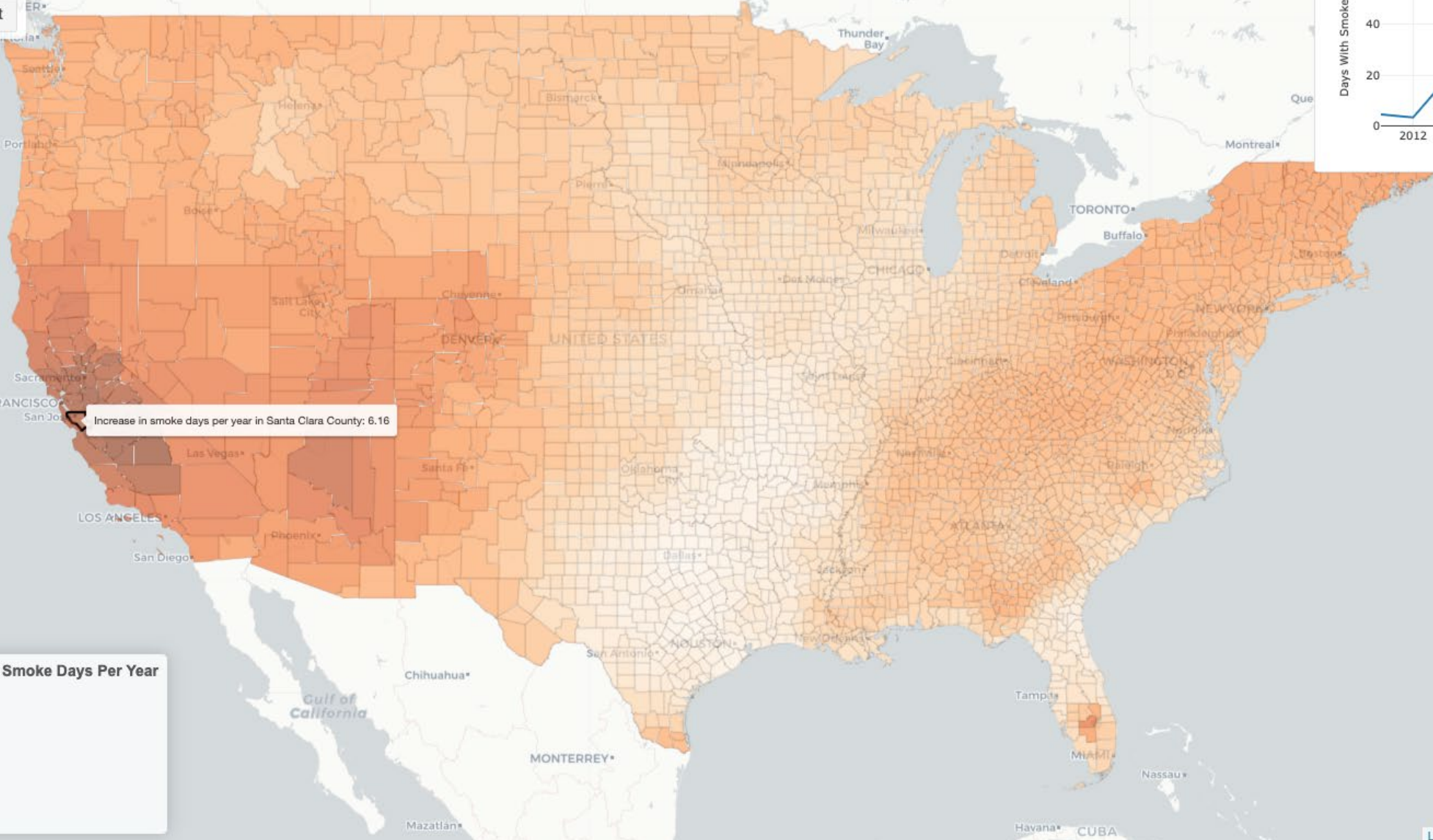
Michael Wara

Director, Climate and Energy Policy Program
senior research scholar, Woods Institute for the Environment
Stanford University

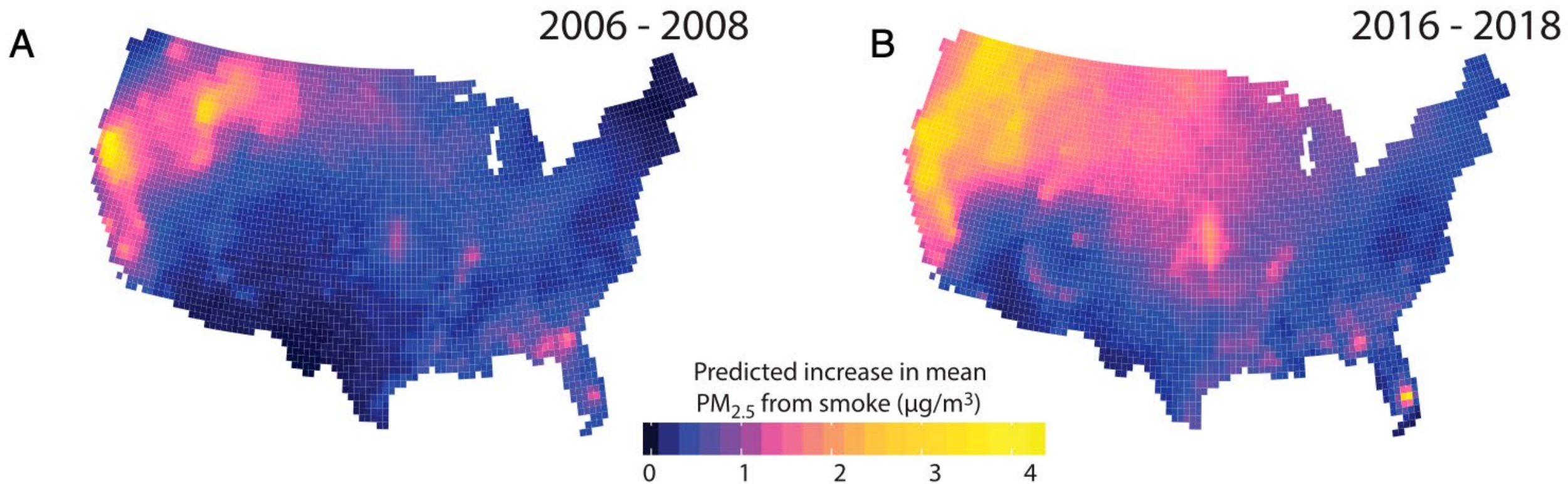
1. Dramatic increase in ambient smoke exposures over last 15 years

+
-

Reset Plot



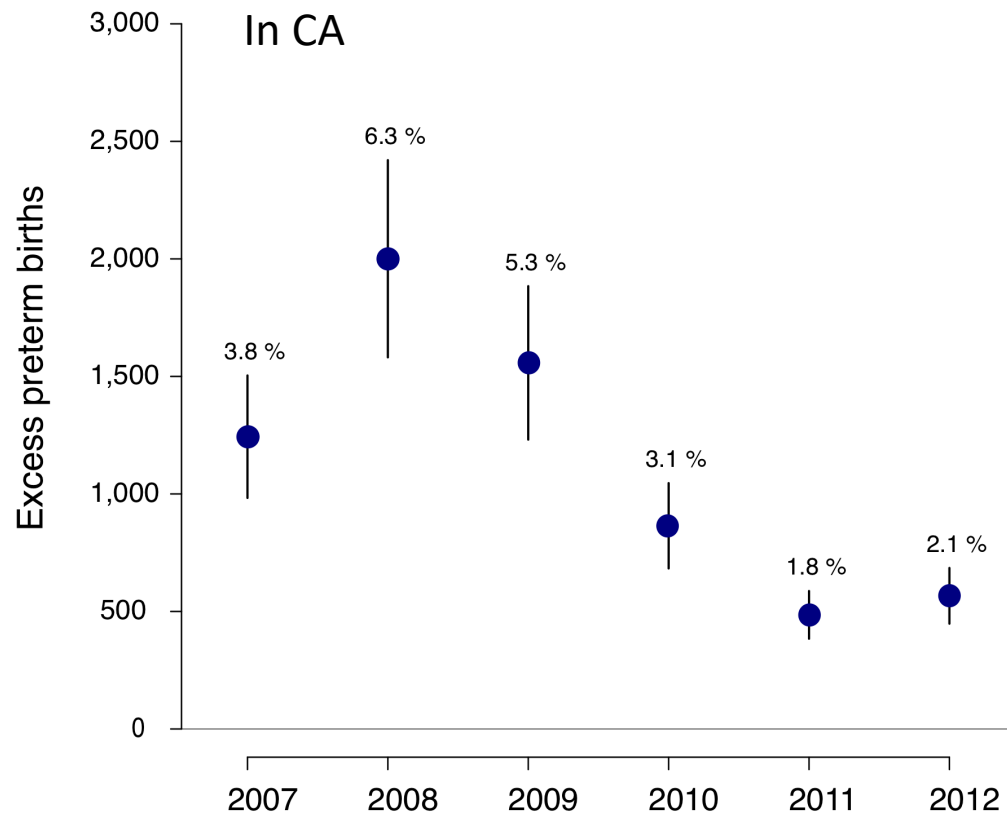
1. Dramatic increase in ambient smoke exposures over last 15 years



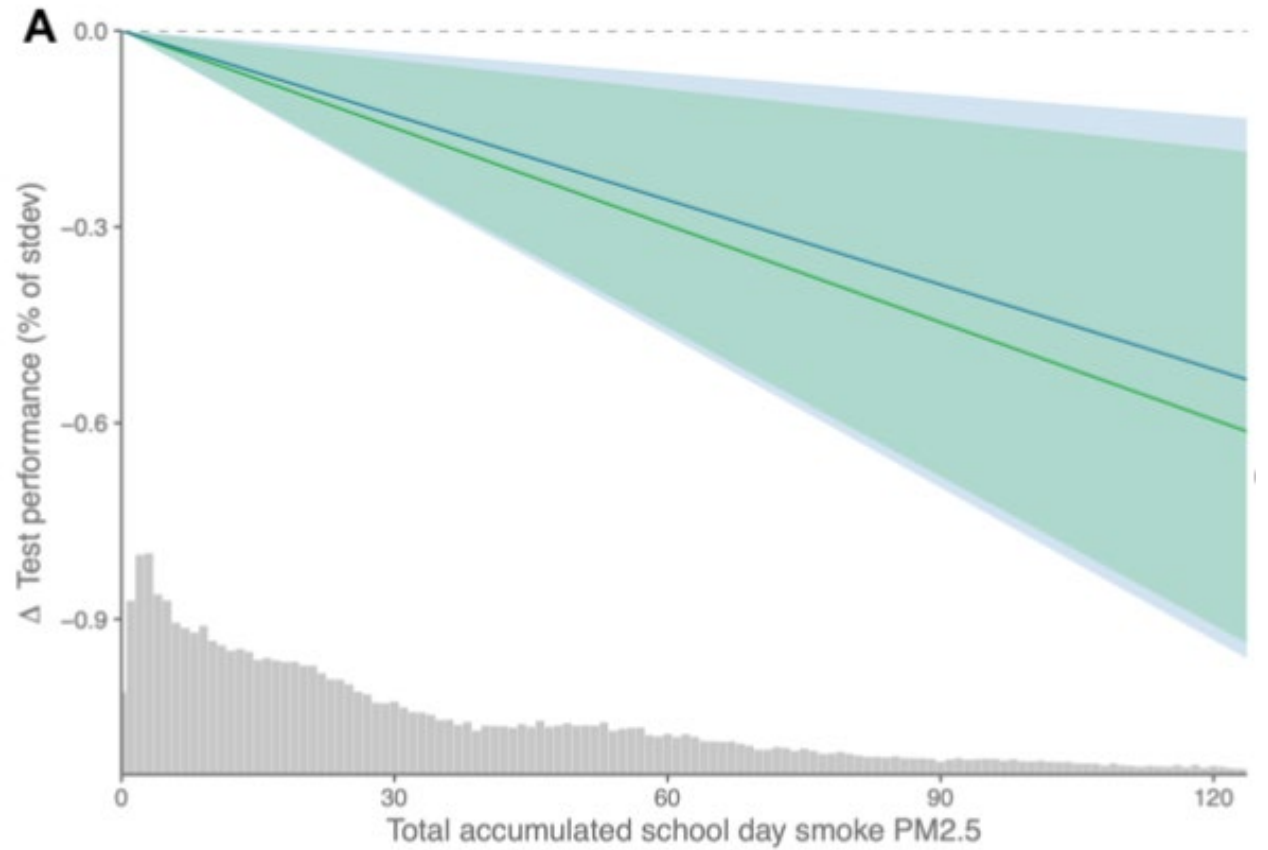
Smoke now half of *annual* air pollution in most of northern CA!

2. Large negative consequences that extend beyond health

a. Excess preterm births by year

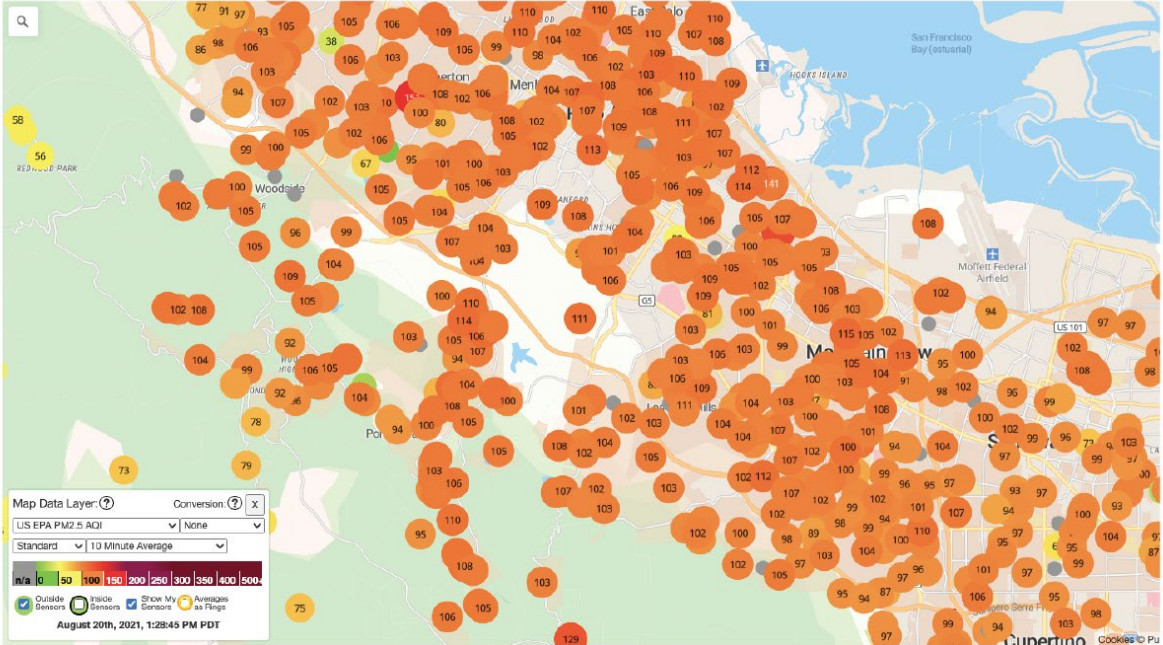


Smoke exposures and standardized test scores

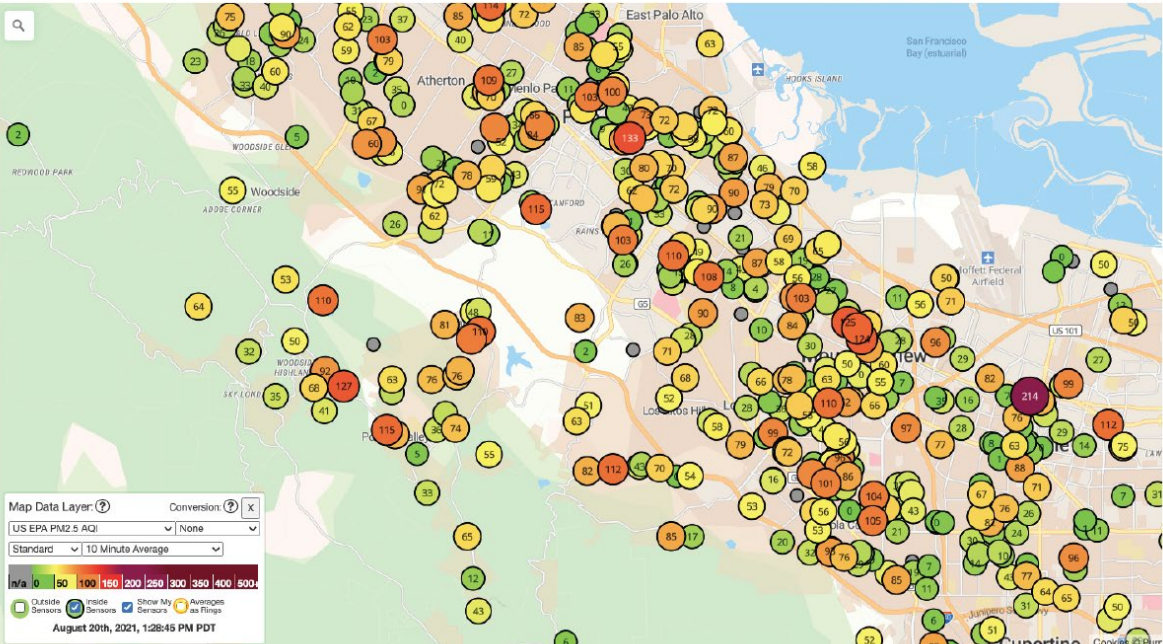


3. Dramatic variation in smoke infiltration into residential environments

Outdoor PM2.5 on a bad day

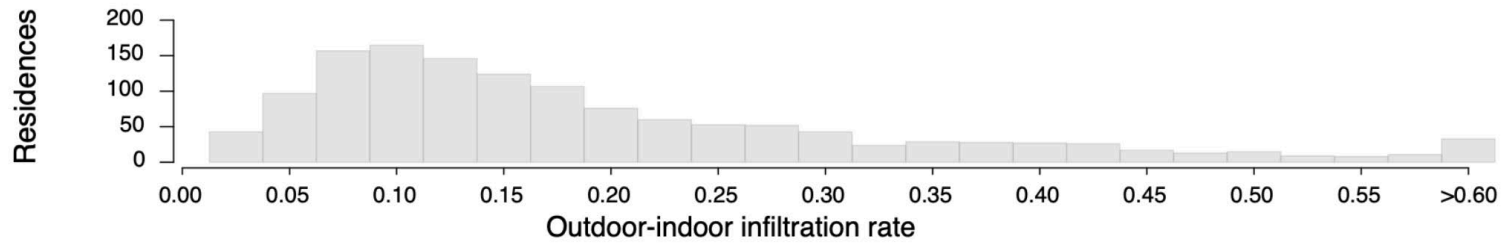


Indoor PM2.5 on a bad day



3. Dramatic variation in smoke infiltration into residential environments

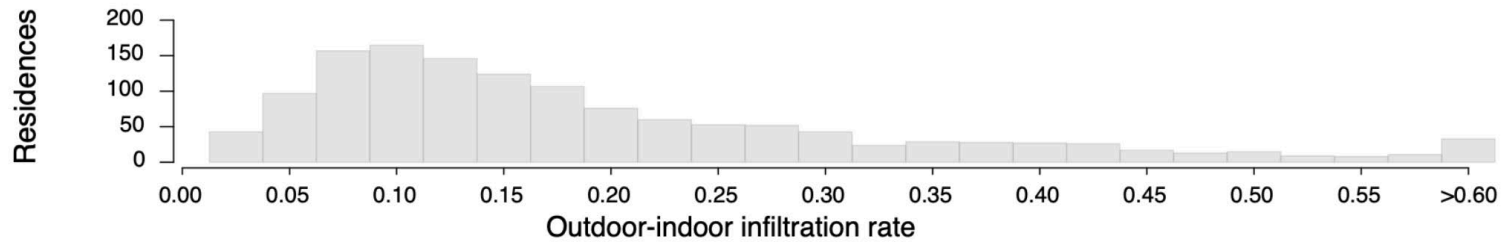
How much indoor PM goes up by, per unit increase in outdoor PM



10x differences across the sample!!!

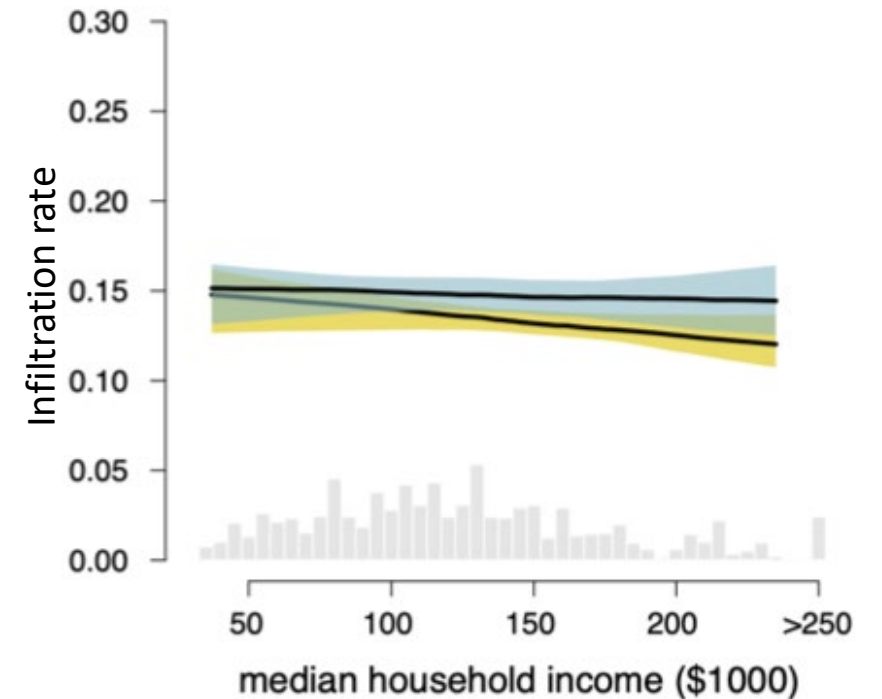
3. Dramatic variation in smoke infiltration into residential environments

How much indoor PM goes up by, per unit increase in outdoor PM



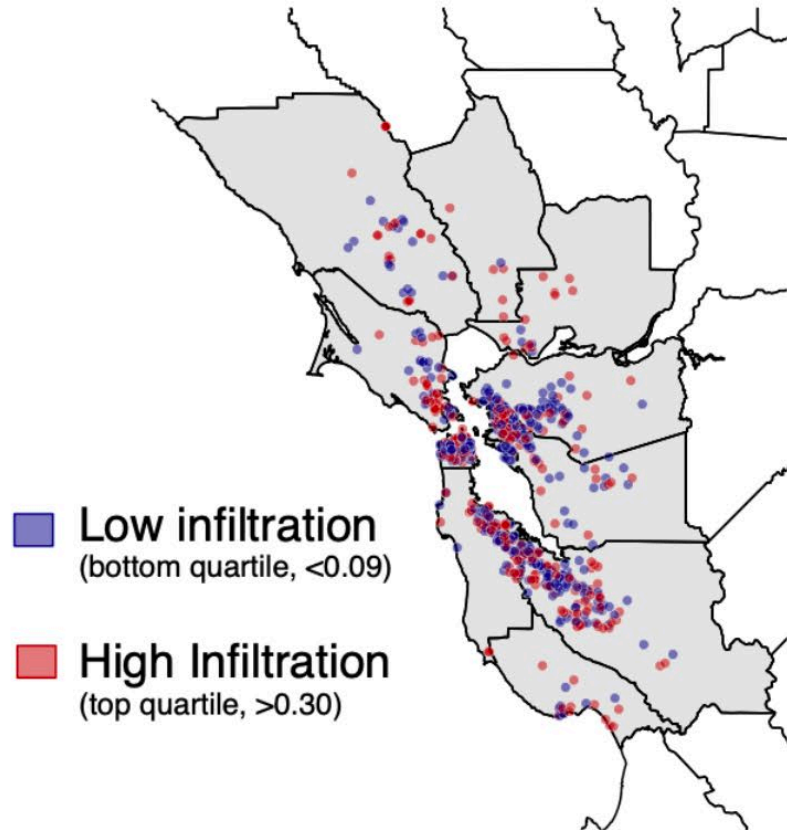
10x differences across the sample!!!

Surprisingly uncorrelated with household income:

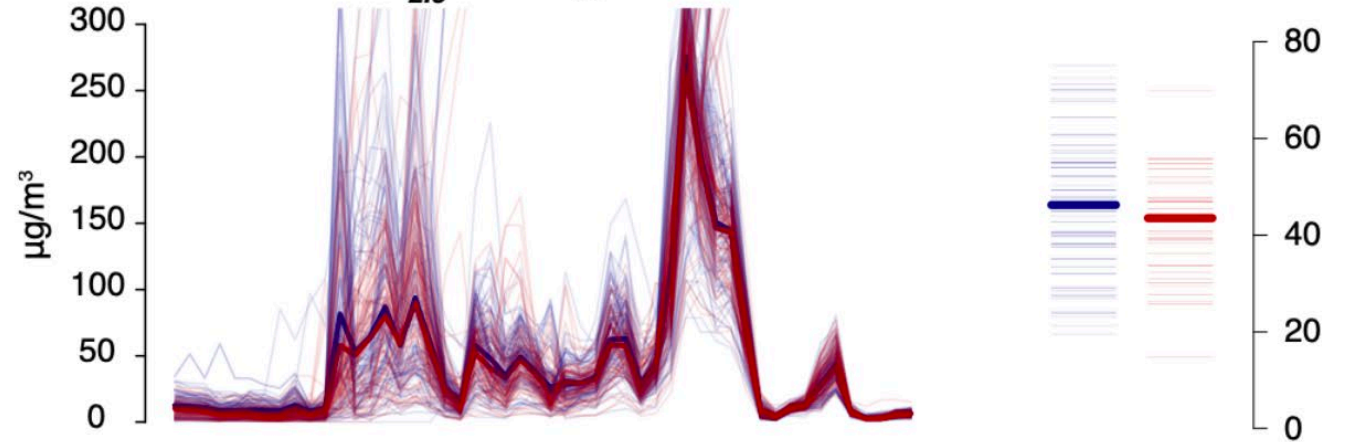


3. Dramatic variation in smoke infiltration into residential environments

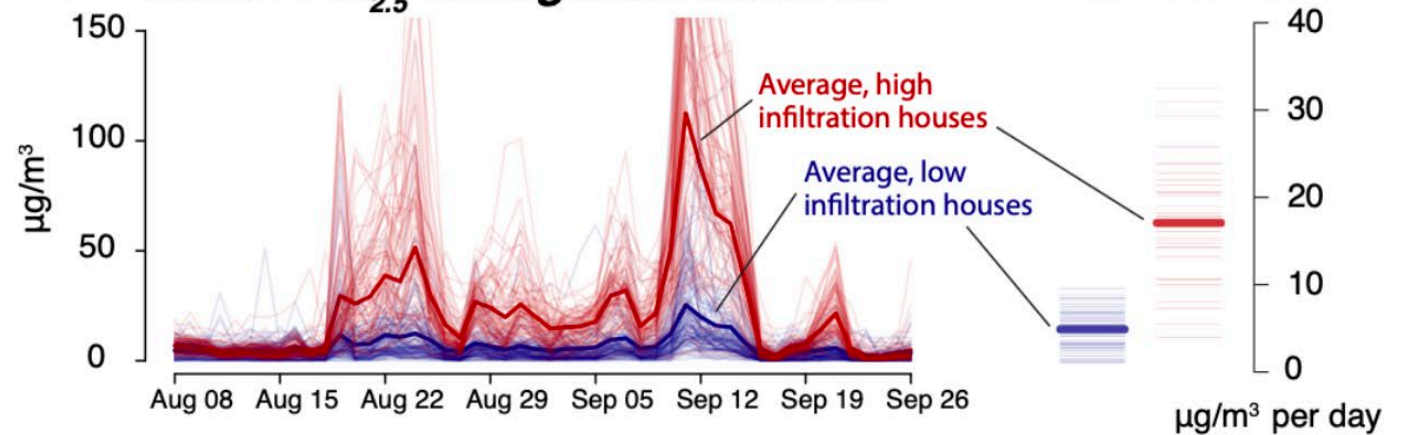
d Infiltration in the Bay Area



e Outdoor $PM_{2.5}$ during 2020 wildfires Average Outdoor Exposure



f Indoor $PM_{2.5}$ during 2020 wildfires Average Indoor Exposure



>20x difference in cumulated indoor exposures!

4. Simple technologies could have a huge impact



For measuring exposures



For limiting exposures





- Wildfire Threats and Risks

- Geographic Area: Wildfire Urban Interface (WUI)
- Rated as a medium risk in the City’s Local Hazard Mitigation Plan (LHMP)



- Mitigation Activities

- Vegetation management / fuel treatments
- Electrical line clearance and undergrounding
- Defensible space: harden homes and create zones



- Preparedness

- Interagency coordination
- Situational Awareness
- Ready, Set, Go



Wildfire Protection Programs Update



- Local Hazard Mitigate Plan / Foothills Fire Mitigation Plan

<https://www.cityofpaloalto.org/Departments/Emergency-Services/Plans-and-Information>



- WUI building code

https://www.cityofpaloalto.org/files/assets/public/development-services/building-division/residential-guidelines/inspections/wildland-urban-interface_2019-01-09.pdf



- City Staff Reports:

- 12315: Information Report – Foothills Fire Mitigation and Safety Improvement Strategies
- 11950: Palo Alto Foothills Rebuild (Project EL-21001)
- 13479: Study Session – Foothills Fire Mitigation Strategies
- 13774: Foothills Fire Mitigation and Safety Improvement Strategies, follow up report (1/24/2022)

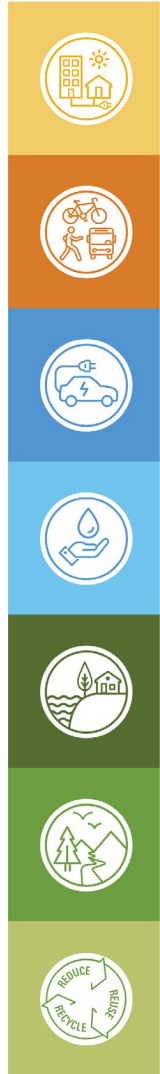


- Alert Wildfire Camera Network: Alertwildfire.org

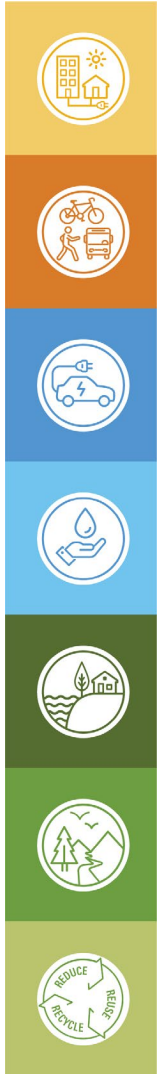


- Wildfire Preparation: cityofpaloalto.org/wildfire

Questions and Comments from S/CAP Ad Hoc



Sea Level Rise



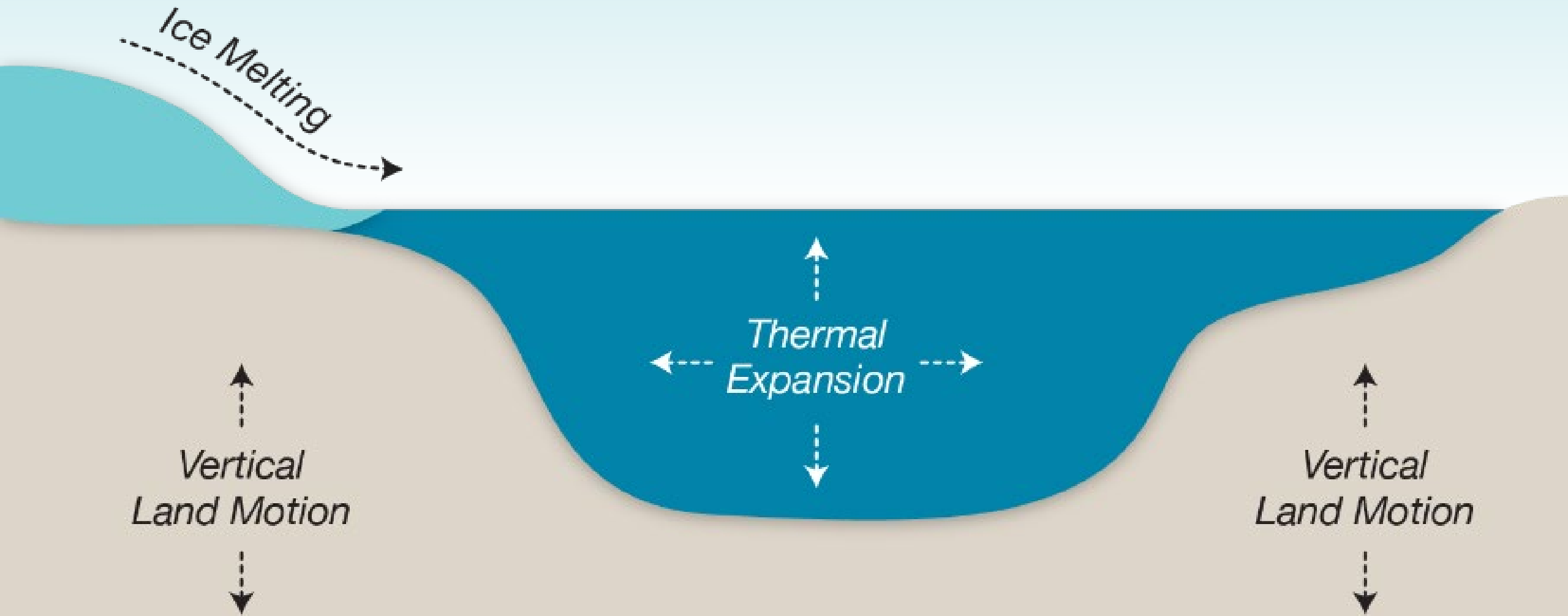
An aerial photograph of a coastal estuary. The water is a mix of brown and blue, with intricate patterns of marshes and channels. In the background, a city with a large airport is visible. The text is overlaid on the image.

Overview of Sea Level Rise

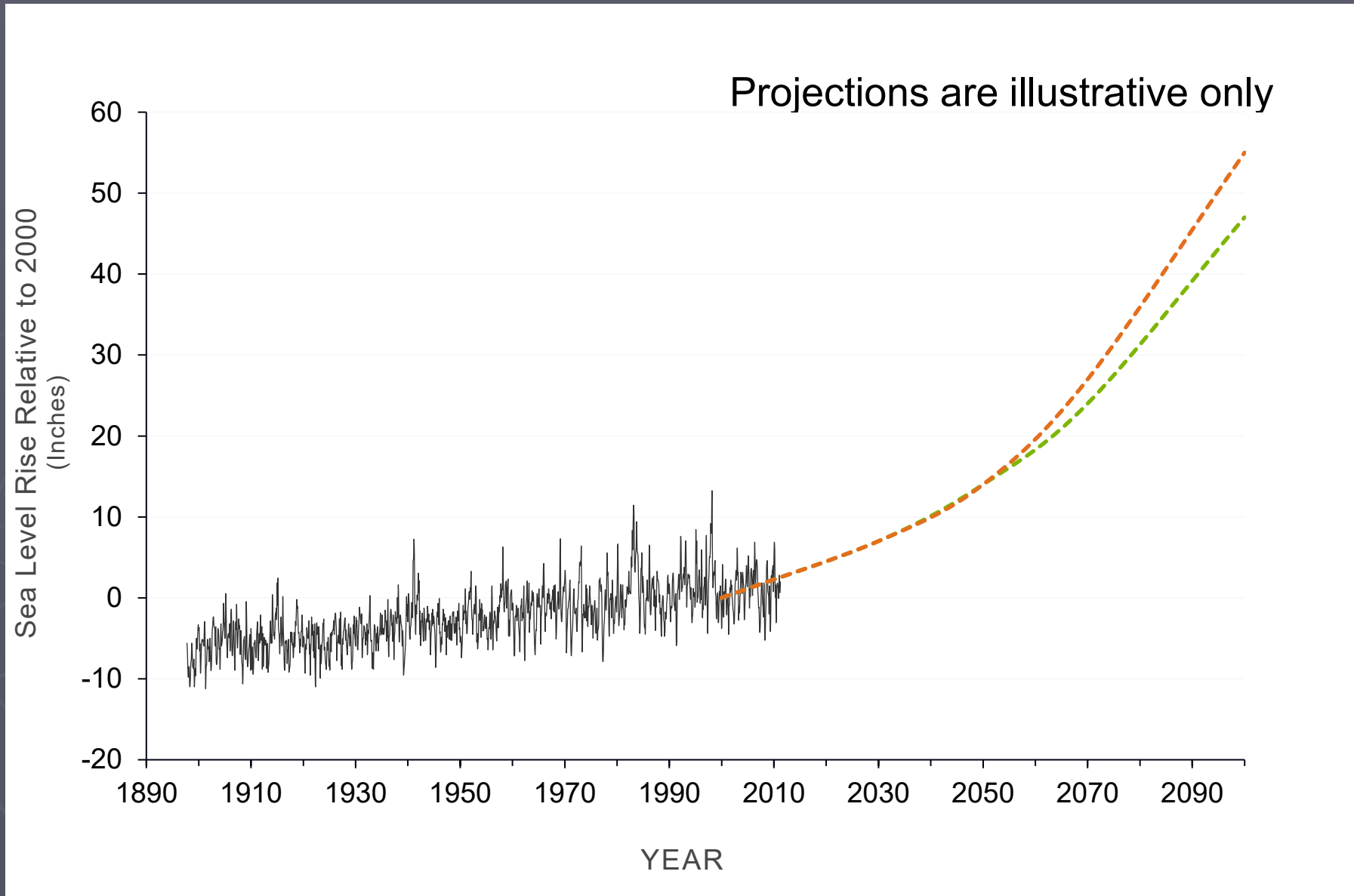
Sustainability and Climate Action Plan Ad Hoc Committee
January 13, 2022

Jeremy Lowe, San Francisco Estuary Institute

Drivers of Sea Level Rise



Sea Level: Today and Tomorrow

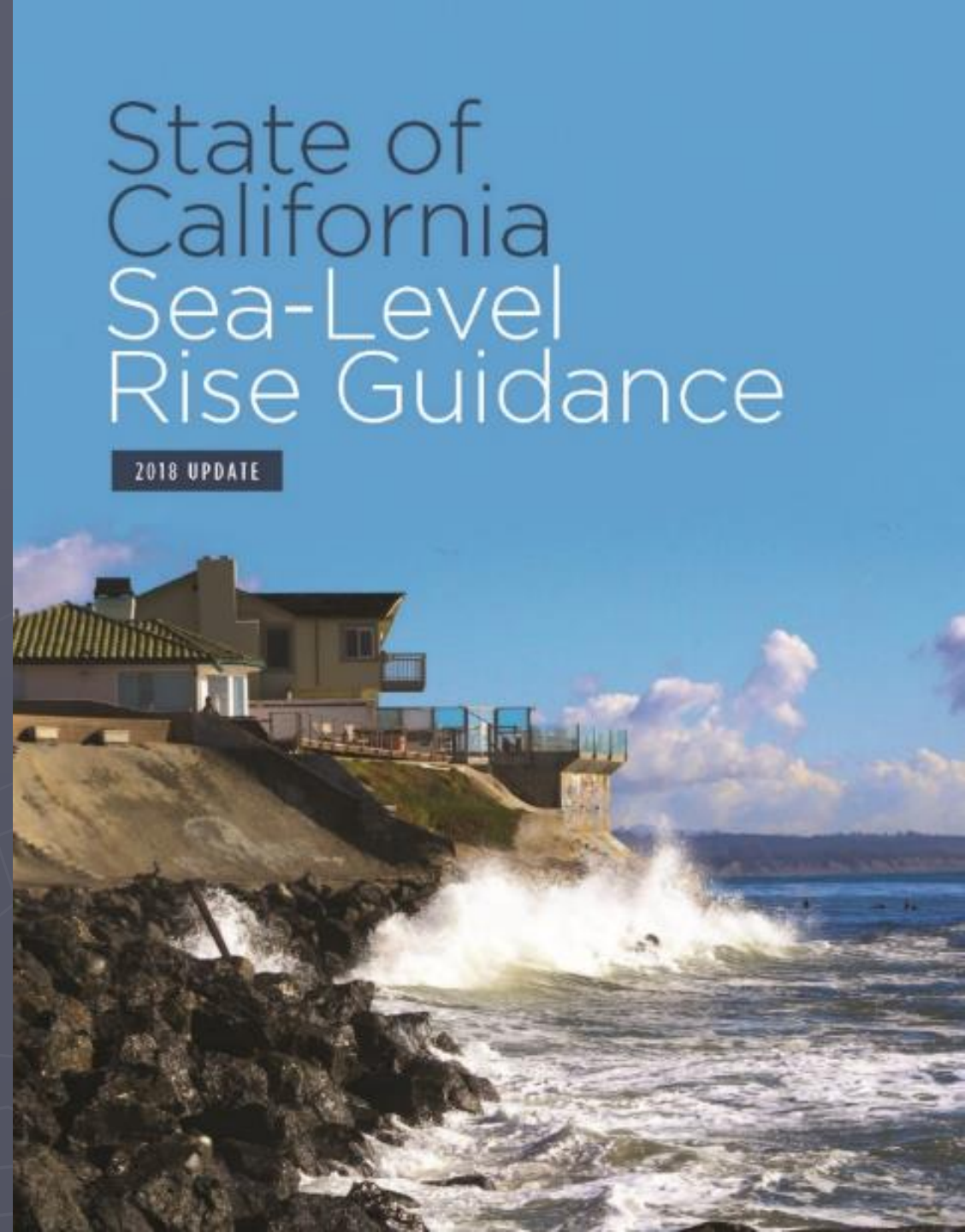


Source: ESA

Information on Sea-Level Rise

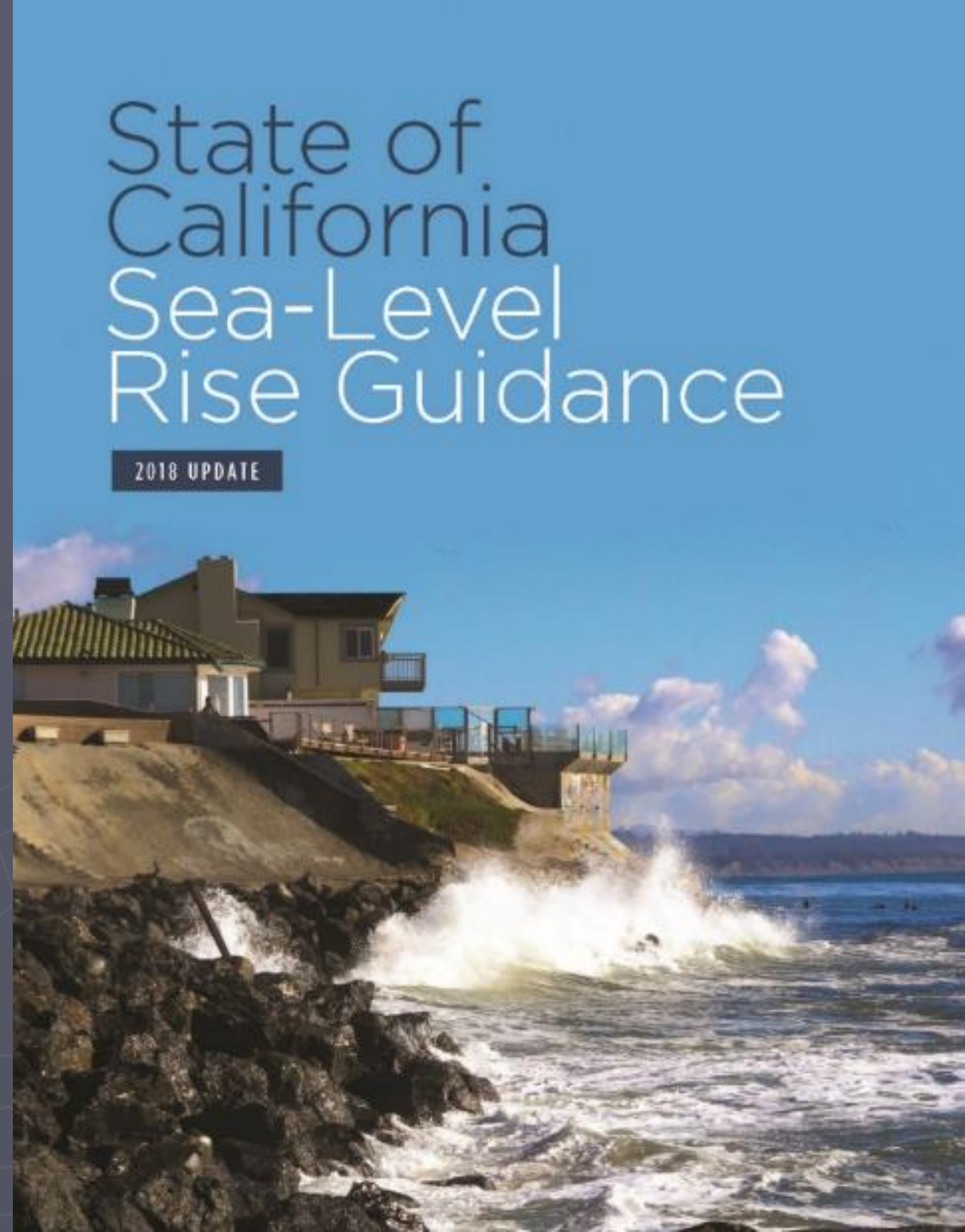
- 2017 - California OPC Science Advisory Team Working Group reviewed the latest research.
- 2018 - Updated SLR guidance document for the State (California OPC 2018).
- Latest peer-reviewed projections of SLR.
- Scenario selection using a risk-based approach.
- Planning approaches for critical assets, natural habitats, and public access.

www.opc.ca.gov/opc-climate-change-program/

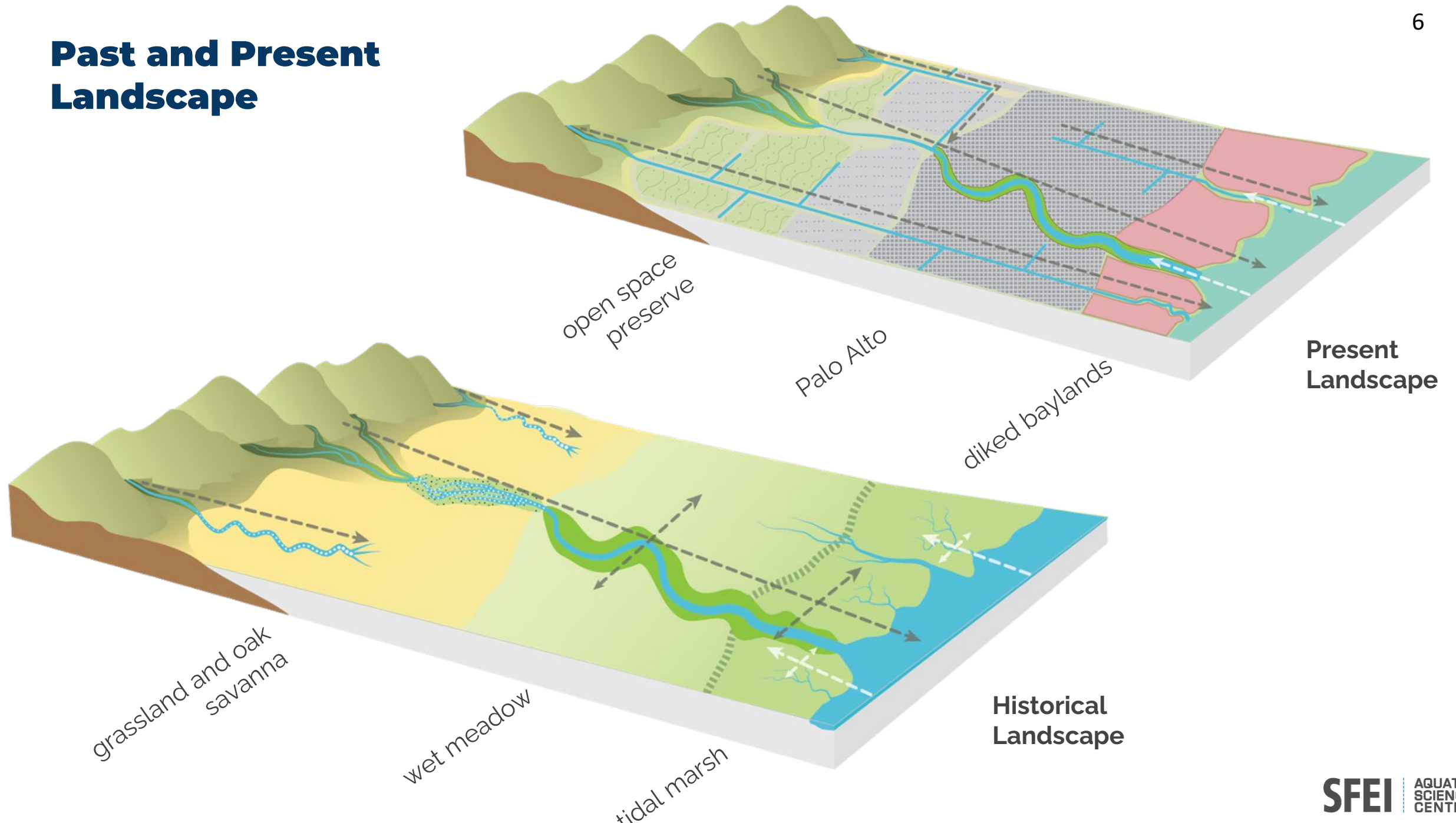


Information on Sea-Level Rise

- Sea level in the Bay Area has risen over 8 inches in the last 100 years.
- Projection of 1-in-200 chance sea level rise:
 - 24 inches by 2050
 - 66 to 84 inches by 2100
- Two values are given for 2100 reflecting high and low emission scenarios.
- At least 6 feet of sea level rise is inevitable over the next several centuries.



Past and Present Landscape



grassland and oak savanna

wet meadow

tidal marsh

open space preserve

Palo Alto

diked baylands

Present Landscape

Historical Landscape

What is Protecting Us?



Photo: ESA

Same Levee – New Year's Eve 2005



Photo: Mark Taylor

Creeks Backup Due to High Bay Levels

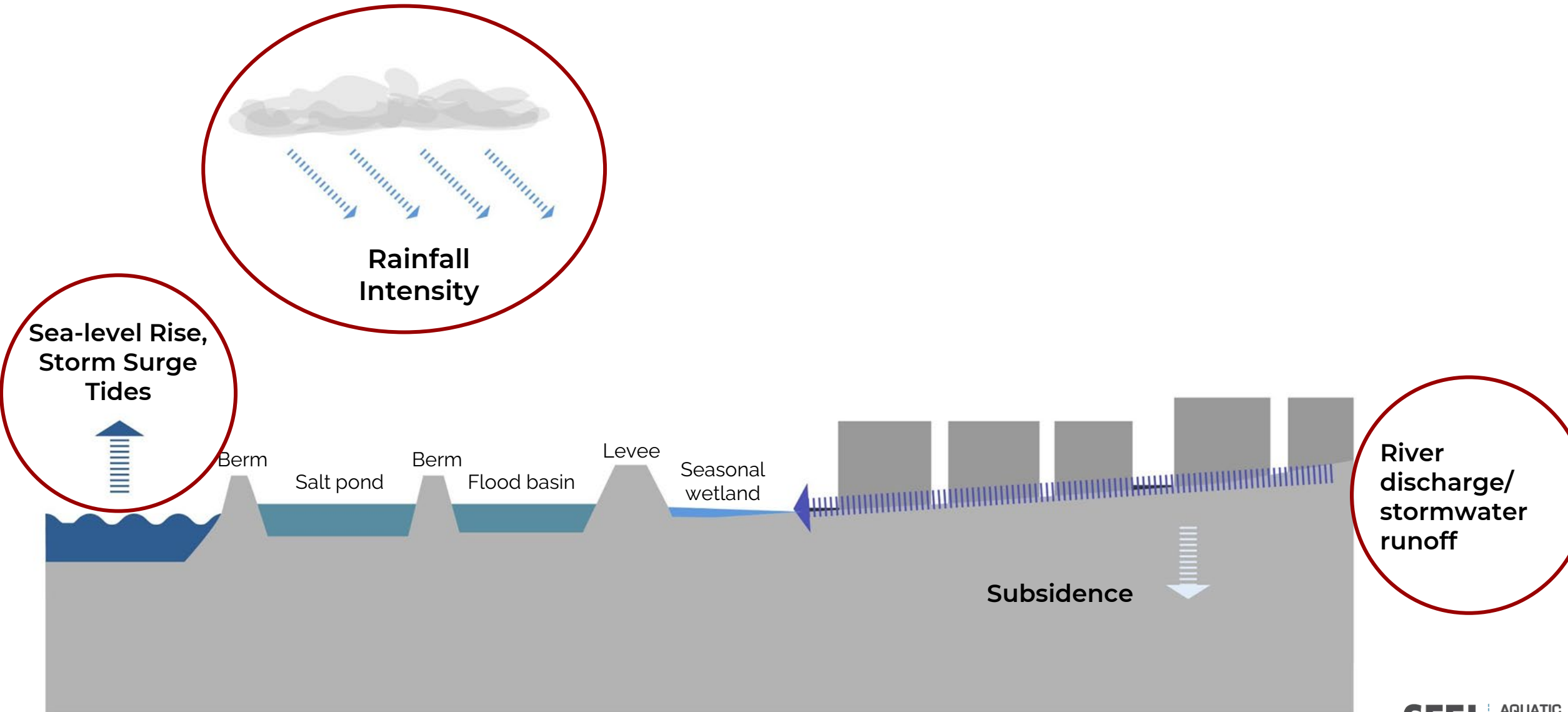


Photo: Mike Lowery

Palo Alto Shoreline



Sources of surface flooding



Sea-level Rise,
Storm Surge
Tides

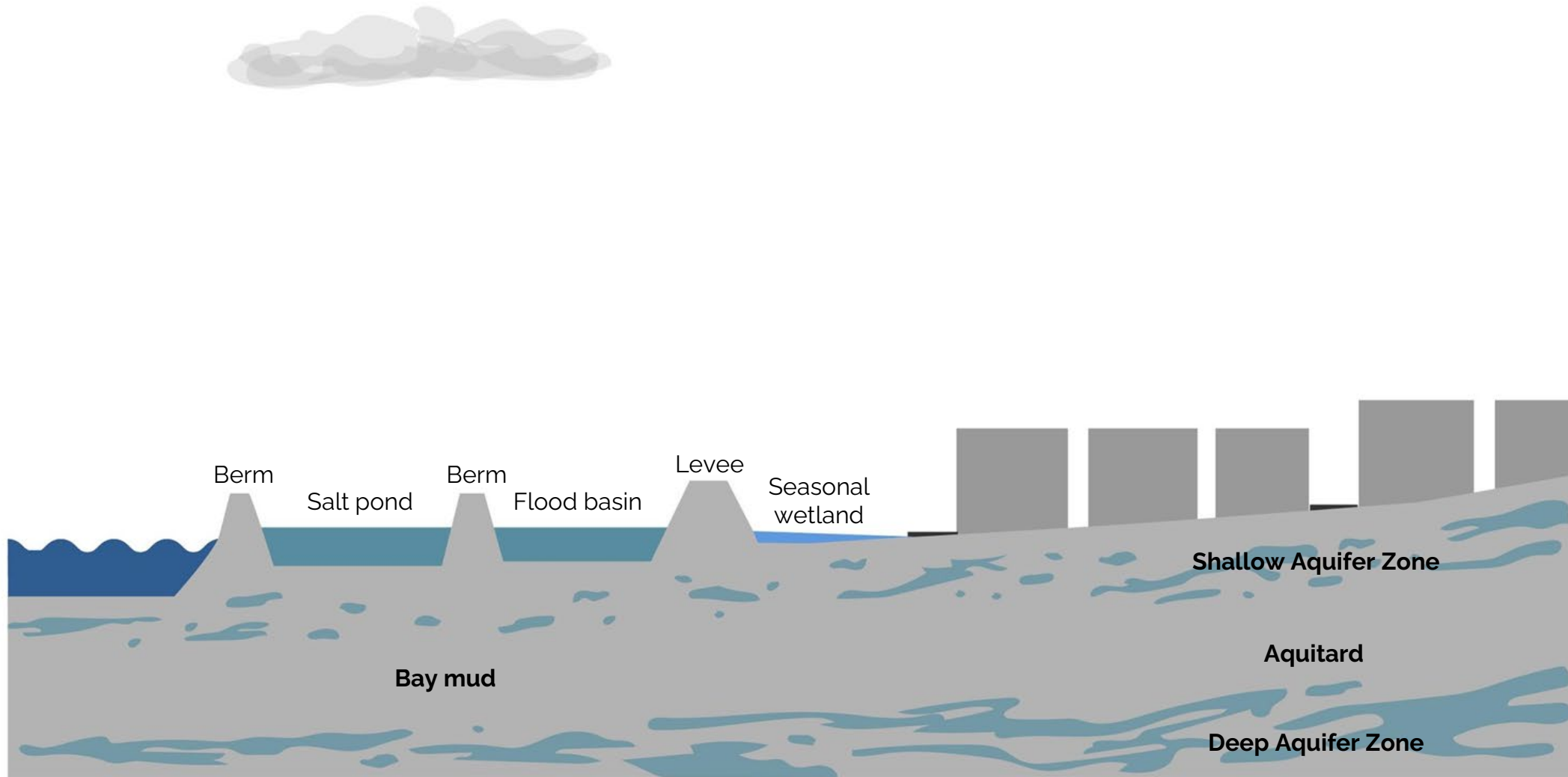
Rainfall
Intensity

River
discharge/
stormwater
runoff

Subsidence

Diagrammatic only: not to scale

Groundwater



Diagrammatic only: not to scale

Horizontal Levee



Tidal salt

Levee

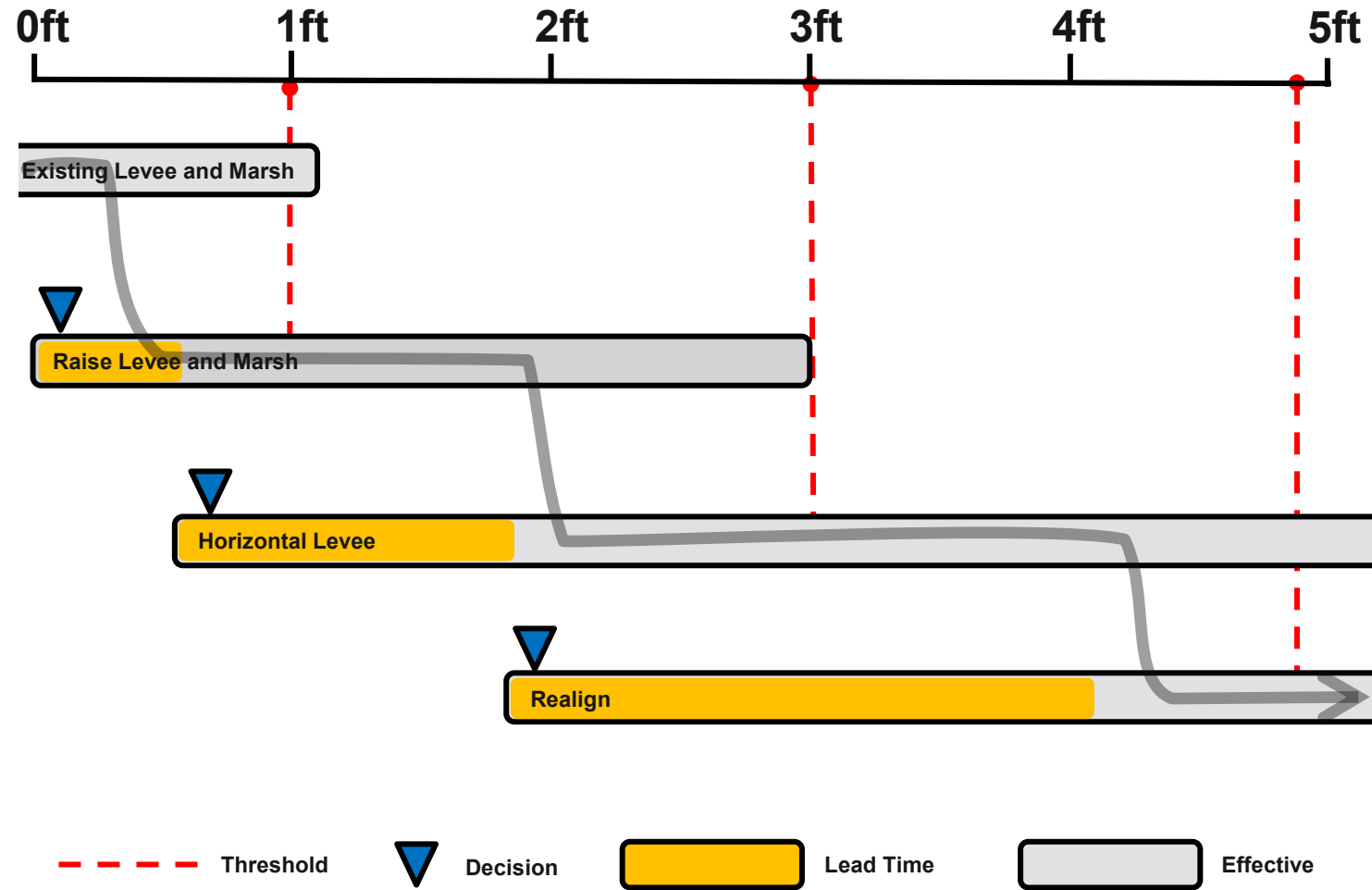
r Baye

ary District

SAFER/Shoreline II Levee Project and South Bay Salt Ponds Project



Adaptation Pathways





Palo Alto Sea Level Rise Vulnerability Assessment and Adaptation Plan

Sea Level Rise Adaptation Plan Development



Vulnerability Assessment examines asset exposure to 12-84” of sea level rise with:

- Daily high tides
- 100-year storm tides
- Shallow and emergent groundwater changes
- Report discussion focuses on 36” sea level rise because that is a turning point if no additional action is taken
- 36” near end of century (2070-2100) and will continue to increase after 2100



City and Community Facilities and Residential Parcels



Emergency Services



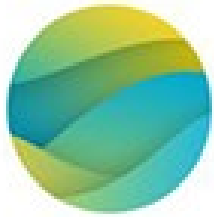
Transportation



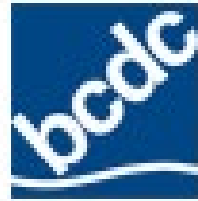
Natural Resources, Trees & Open Space



Utilities and Flood Management



OCEAN
PROTECTION
COUNCIL



SAN FRANCISCO BAY
CONSERVATION & DEVELOPMENT
COMMISSION



AECOM



pathways
CLIMATE INSTITUTE

SFEI | AQUATIC
SCIENCE
CENTER
SAN FRANCISCO ESTUARY INSTITUTE & THE AQUATIC SCIENCE CENTER



CITY OF
**PALO
ALTO**

*Groundwater work peer review by
Dr. Kristina Hill, UC Berkeley*

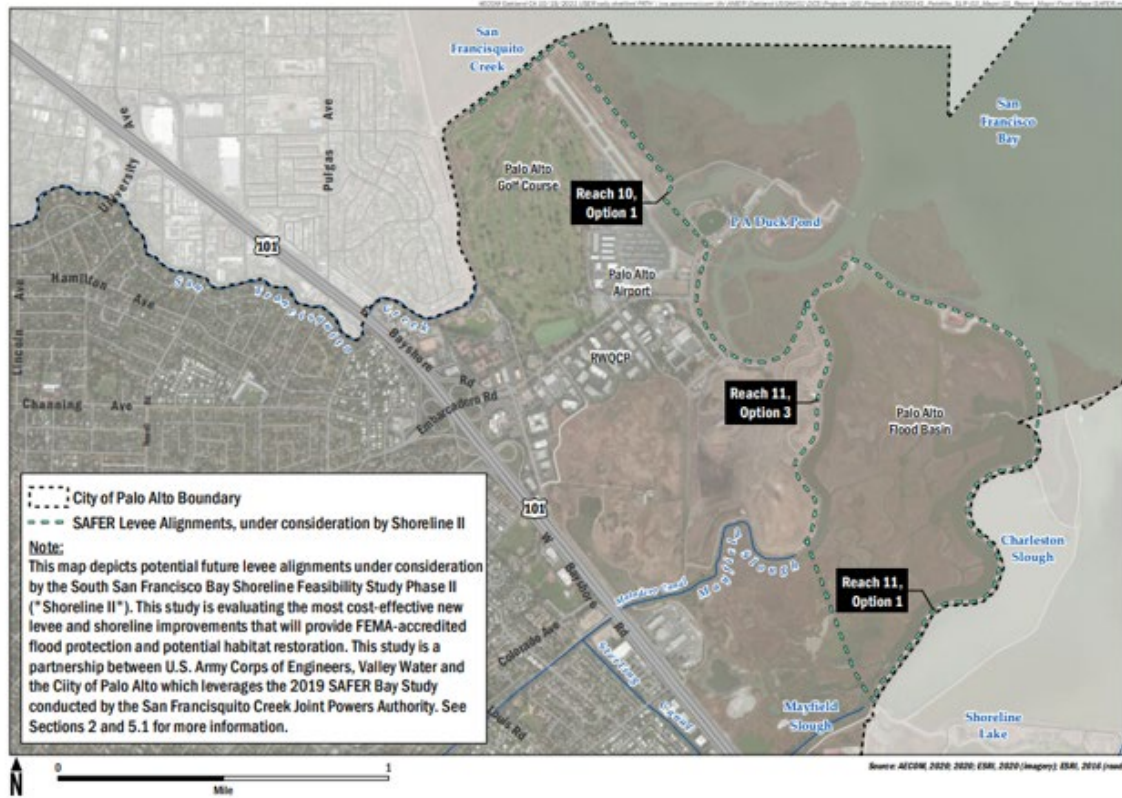
San Francisquito Creek “Downstream Project”

Construction completed: Fall 2018
Partnership with San Francisquito Creek Joint
Powers Authority Agencies



Shoreline II Levee Improvements

- Fall 2024: Feasibility study completion
- 2029: Construction begins
- 2039: Construction completed
- Project partners: Valley Water, USACE, Coastal Conservancy, City of Palo Alto



Palo Alto Flood Basin Tide Gate Structure Replacement Project

- Construction starts: 2023
- Construction completed: 2027
- Project partners: Valley Water, City of Palo Alto



Palo Alto Horizontal Levee Pilot Project

Construction starts: Fall 2023
Construction completed: Fall 2025

San Francisco Bay

Flood Basin

Palo Alto Baylands

Palo Alto Airport

Embarcadero Road



Byxbee Park

Regional Water Quality Control Plant

Other Adaptations Efforts



Elevated power distribution equipment at the RWQCP



SEA LEVEL RISE: ELEMENTARY SCHOOL

These lessons were created in partnership with the Regional Water Quality Control Plant



Salt Marsh Harvest Mouse

Grade: K-2nd

NGSS: ESS3.A: Natural Resources

In this activity, a teacher will guide students through slides about a local endangered species, the salt marsh harvest mouse. Students will complete activities on a printable "field guide" page or foldable book as they learn about this fascinating animal and what it might take to ensure its future survival.

[ACCESS LESSON](#)



Changing Shorelines

Grade: 4th

NGSS: LS4.D: Biodiversity and Humans

Students will compare a series of local shoreline maps, using recognizable features to help them deepen their understanding of the past, present and future of the salt marsh habitat around the San Francisco Bay. They will learn how humans have played a role in that change and discuss why it matters now and for the future.

[ACCESS LESSON](#)



The Future of our Shores

Grade: 5th

NGSS: ESS3.C: Human Impacts on Earth Systems

Students will learn about sea level rise and its underlying causes by analyzing climate data. They will then focus on local sea level rise projections, evaluate what local features are at risk, and create a project highlighting a potential solution to create a better future for our shores.

[ACCESS LESSON](#)

Sea Level Rise School Curricula

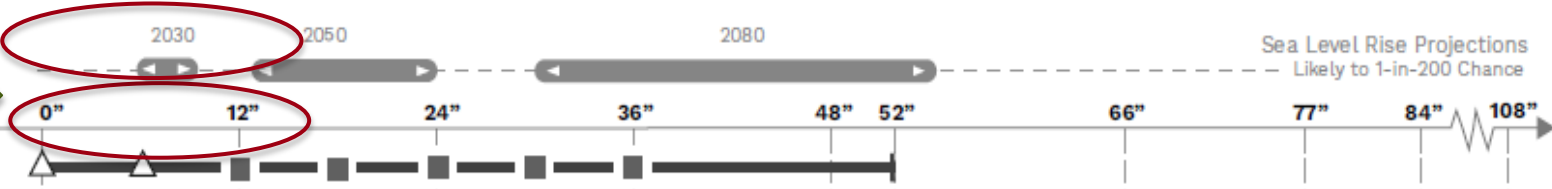
Sea Level Rise Adaption Plan Goals

1. Preserve and Expand Habitat
2. Protect City and Community Assets and Private Property

Adaptation Strategies

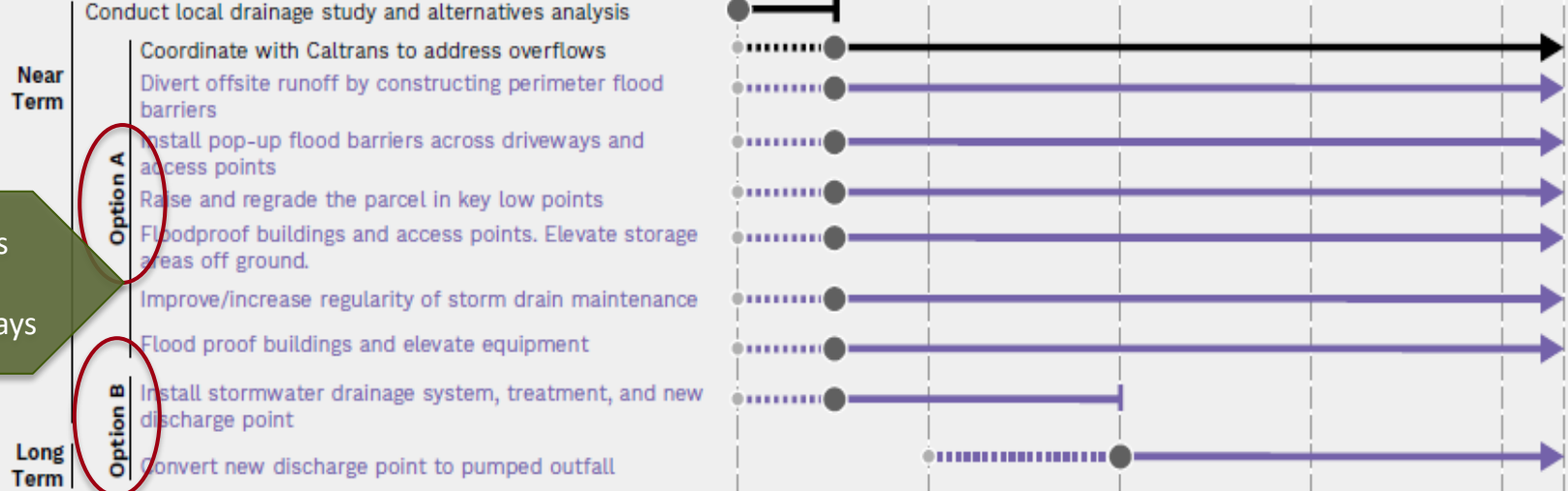
- a) **Protect** - keep Bay water out (e.g., levee and tide gate)
- b) **Adapt** existing infrastructure (e.g., water proofing and raising structures)
- c) **Prepare for Possible Retreat after 2050** (e.g., consider options for assets outboard of levee)

When we need to start planning based on sea level and year.

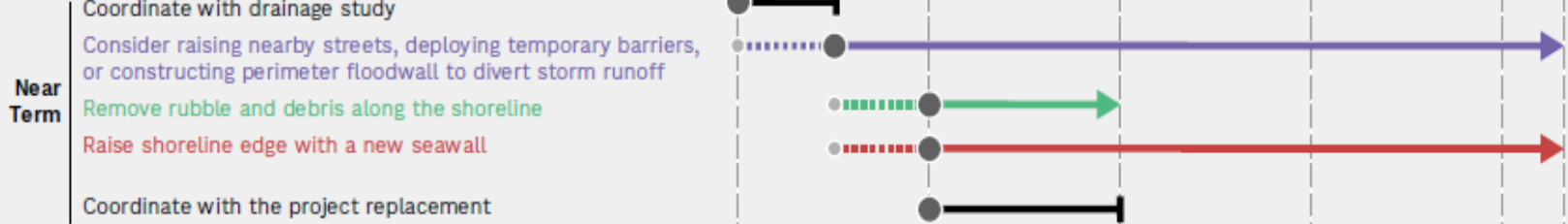


NO ACTION / EXISTING CONDITION

1 Address inland flooding



2 Protect Assets



LEGEND

- ▬ Coastal Defense Actions
- ▬ Planning Actions
- ▬ Nature-Based Actions
- ▬ Stormwater Actions
- Threshold
- Trigger
- Trigger + Lead Time
- Action Implemented
- △ Decision Point
- △ Strategic Decision Point
- ↗ Alternative Action
- ▬ Action Effective
- ⊥ End of Action Lifespan
- ➔ Action continues

Adaptation actions sequenced into adaptation pathways



Palo Alto
Sea Level Rise
Vulnerability Assessment

Attachment A Shallow Groundwater Assessment and Maps

Prepared for:
City of Palo Alto

November 2021

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Excerpt of City/Community/Residential Property Exposure to Daily High Tide and Storm Tides

Table 10. City and Community Facilities and Residential Parcels: Sea Level Rise Exposure Summary from Daily High-Tide Inundation or 100-Year Storm-Tide Flooding

Asset	Water Level	+0-inch SLR	+12-inch SLR	+24-inch SLR	+36-inch SLR	+ 48-inch SLR	+66-inch SLR	+84-inch SLR
CITY FACILITIES								
Lucy Evans Baylands Nature Center	HT	—	✓	✓	✓	✓	✓	✓
	ST	✓	✓	✓	✓	✓	✓	✓
Animal Shelter	HT	—	—	—	✓	✓	✓	✓
	ST	✓	✓	✓	✓	✓	✓	✓
Municipal Services Center	HT	—	—	—	✓	✓	✓	✓
	ST	✓	✓	✓	✓	✓	✓	✓
Utility Control Center	HT	—	—	—	✓	✓	✓	✓
	ST	✓	✓	✓	✓	✓	✓	✓
Baylands Ranger Station	HT	—	—	—	✓	✓	✓	✓
	ST	✓	✓	✓	✓	✓	✓	✓
Former ITT Property	HT	—	—	—	✓	✓	✓	✓
	ST	✓	✓	✓	✓	✓	✓	✓
Libraries	HT	—	—	—	—	—	—	—
	ST	—	—	—	—	—	Mitchell Park	Mitchell Park
Boat Launch	HT	—	—	—	—	✓	✓	✓
	ST	✓	✓	✓	✓	✓	✓	✓

Excerpt of City/Community/Residential Property Exposure to Shallow and Emergent Groundwater

Table 11. City and Community Facilities and Residential Parcels: Sea Level Rise Exposure Summary from Emergent Groundwater Flooding or a High Shallow Groundwater Table

Asset	Water Level	+0-inch SLR	+12-inch SLR	+24-inch SLR	+36-inch SLR	+ 48-inch SLR	+66-inch SLR	+84-inch SLR
CITY FACILITIES								
Lucy Evans Baylands Nature Center	EG	—	—	—	—	—	✓	✓
	HG	✓	✓	✓	✓	✓	—	—
Animal Shelter	EG	—	—	—	—	—	—	—
	HG	—	—	—	—	✓	✓	✓
Municipal Services Center	EG	—	—	—	—	—	—	—
	HG	—	—	—	—	✓	✓	✓
Utility Control Center	EG	—	—	—	—	—	—	—
	HG	—	—	—	—	✓	✓	✓
Baylands Ranger Station	EG	—	—	—	—	—	—	✓
	HG	—	✓	✓	✓	✓	✓	—
Former ITT Property	EG	—	—	—	✓	✓	✓	✓
	HG	—	✓	✓	—	—	—	—
Libraries	EG	—	—	—	—	Mitchell Park	Mitchell Park	Mitchell Park
	HG	—	Mitchell Park Library	Mitchell Park Library	Mitchell Park Library	—	—	—
Cubberley Community Center	EG	—	—	—	—	—	—	✓
	HG	—	✓	✓	✓	✓	✓	—



East Palo Alto

MIDTOWN

PALO VERDE

ST. CLAIRE GARDENS

CHARLESTON GARDENS

FAIRMEADOW

Current conditions



East Palo Alto

MIDTOWN

PALO VERDE

ST. CLAIRE GARDENS

CHARLESTON GARDENS

FAIRMEADOW

Daily high tide with 36 inches sea level rise (c. 2070-2100)



East Palo Alto

MIDTOWN

PALO VERDE

ST. CLAIRE GARDENS

CHARLESTON GARDENS

FAIRMEADOW

Daily high tide with 36 inches sea level rise (c. 2070-2100)



City/Community Residential Facilities located inland of US 101,

- 2,630 residential parcels
- Two schools (Palo Verde Elementary and Ohlone)
- Two senior/disability centers (Palo Alto Housing Corporation and Alta Torre)

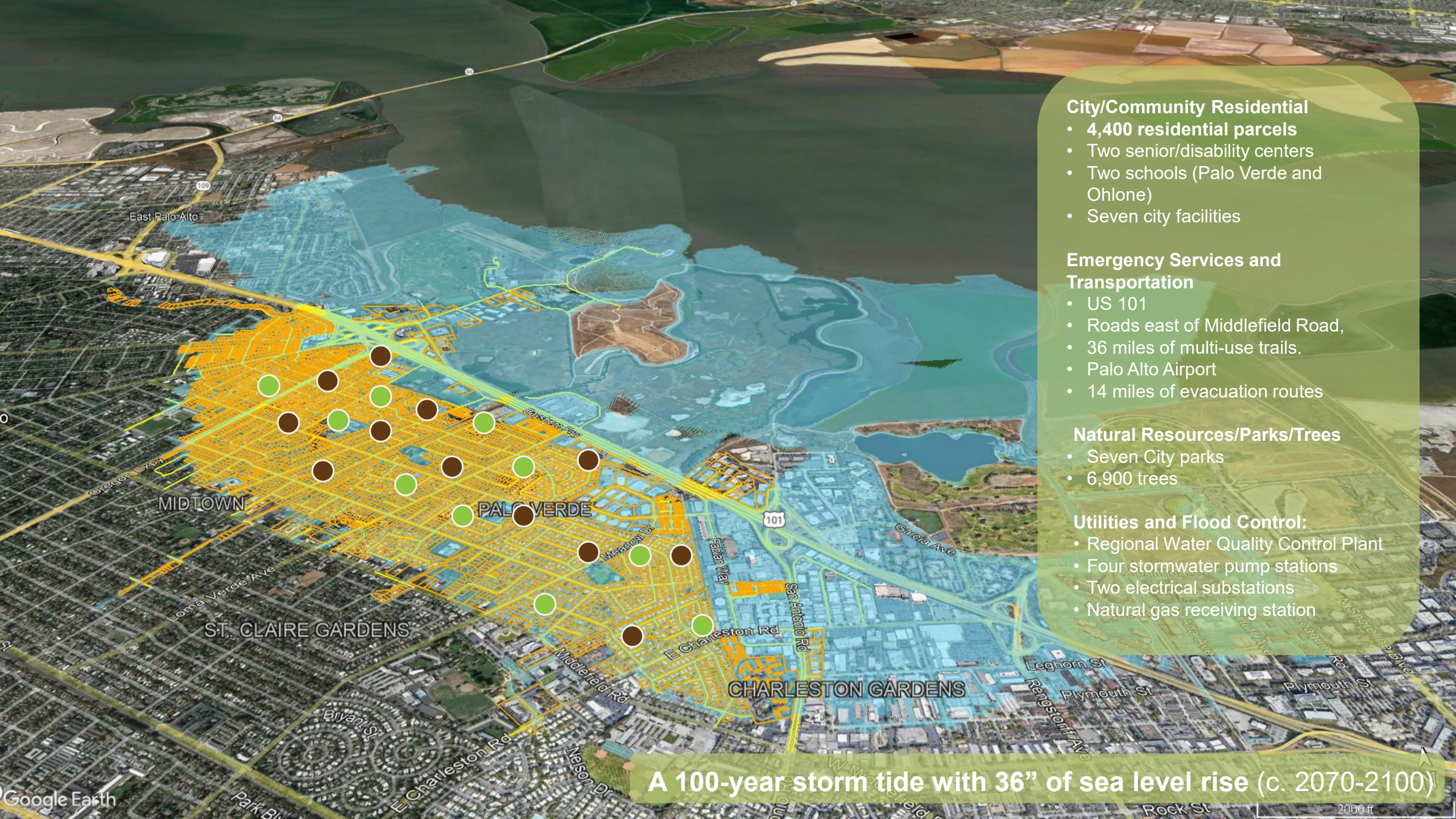
Natural Resources

- Marshes permanently inundated Transition some tidal marsh areas to a different habitat
- 4,700 trees
- 90% of golf course
- Five parks: Baylands Athletic Fields, Greer, Seale, Ramos, Baylands Preserve, and Bixbee Park

Utilities and Flood Control

- Regional Water Quality Control Plant
- Four stormwater pump stations
- Two electrical substations
- Natural gas receiving station
- 14 miles of Fiber Optic network
- 35 miles drinking water
- 37 miles sewer
- 2 pump stations (SFC and Matadero)
- 2.5 miles of levee
- 14 miles of Fiber Optic network

Daily high tide with 36 inches sea level rise (c. 2070-2100)



City/Community Residential

- 4,400 residential parcels
- Two senior/disability centers
- Two schools (Palo Verde and Ohlone)
- Seven city facilities

Emergency Services and Transportation

- US 101
- Roads east of Middlefield Road,
- 36 miles of multi-use trails.
- Palo Alto Airport
- 14 miles of evacuation routes

Natural Resources/Parks/Trees

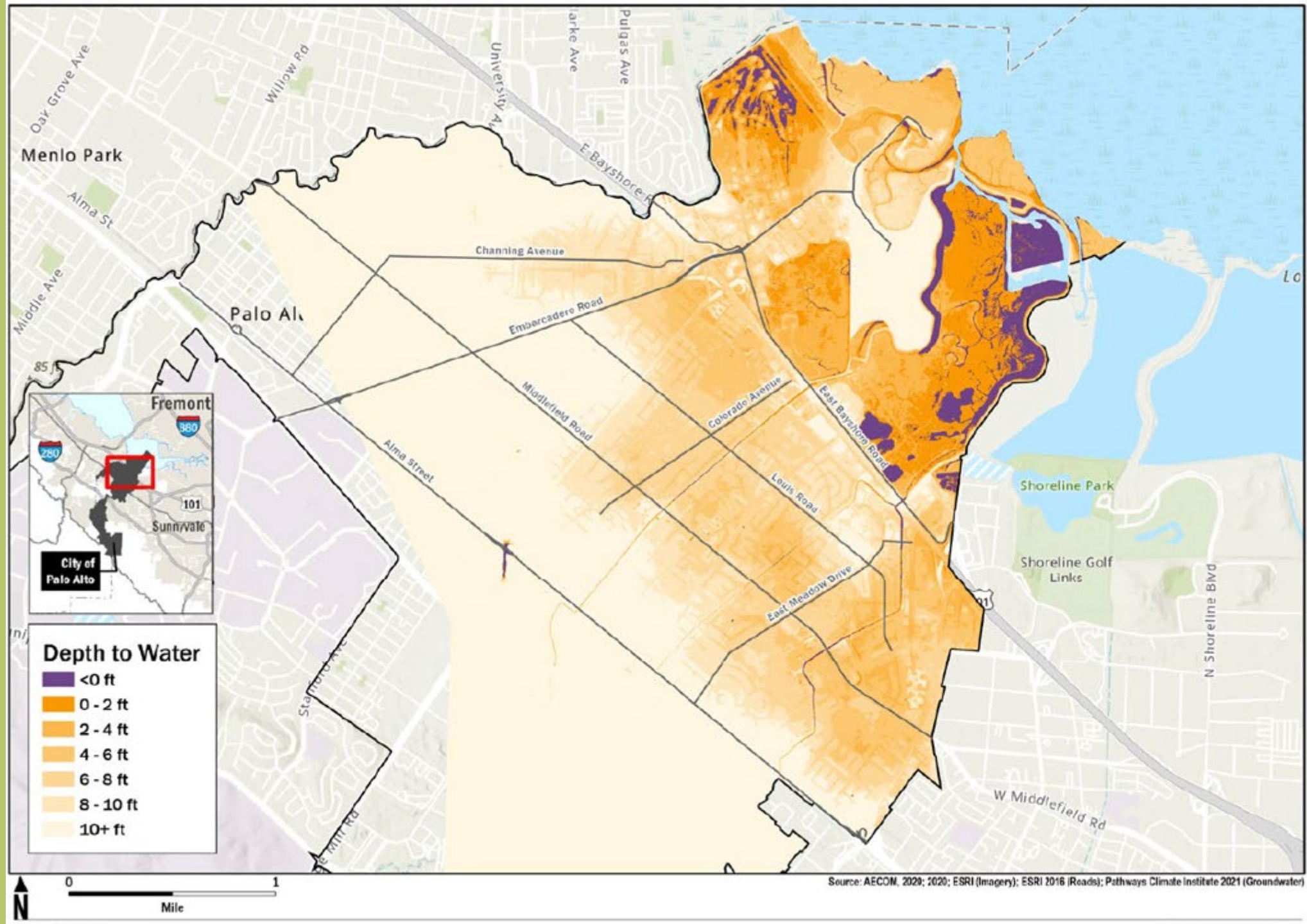
- Seven City parks
- 6,900 trees

Utilities and Flood Control:

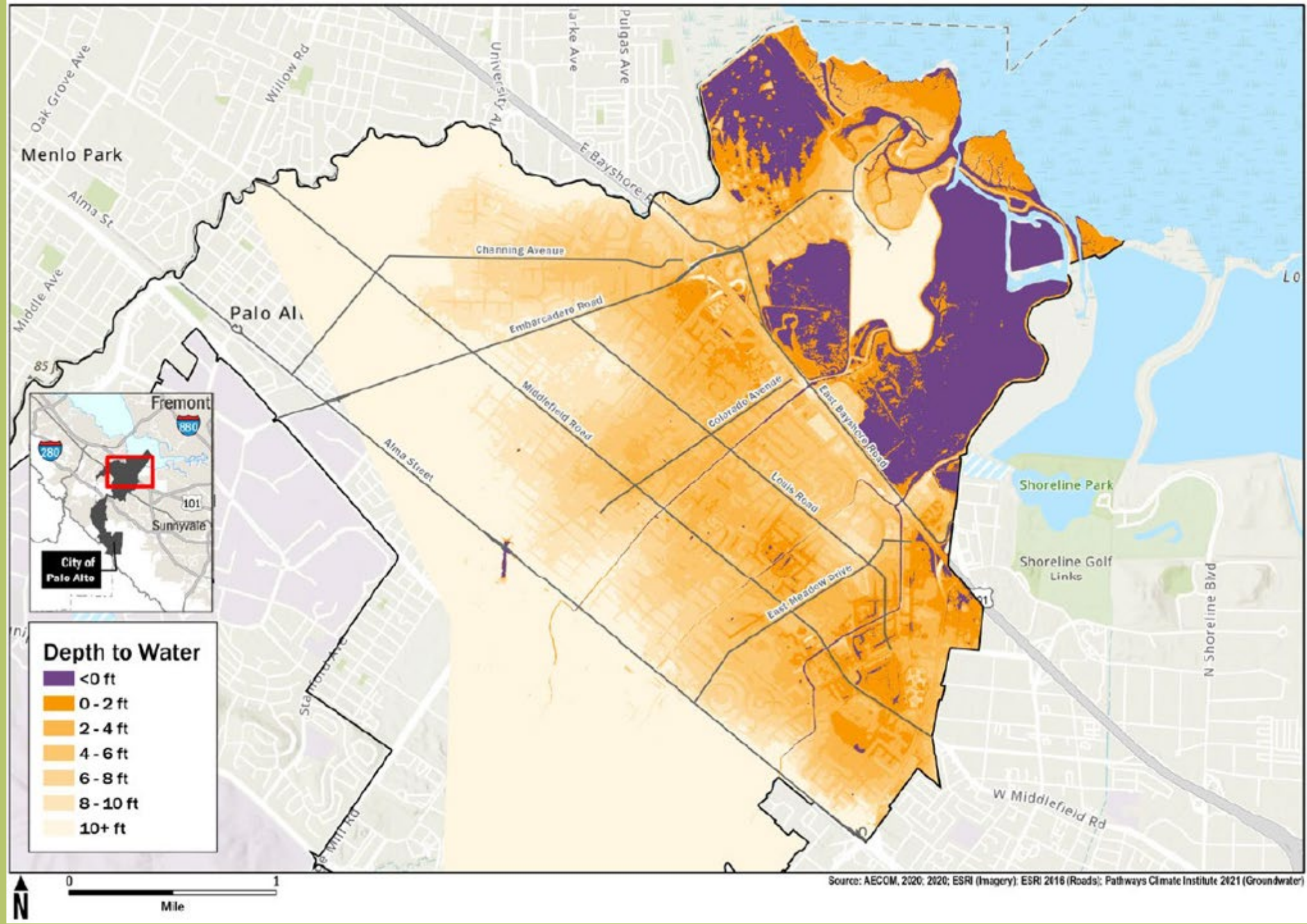
- Regional Water Quality Control Plant
- Four stormwater pump stations
- Two electrical substations
- Natural gas receiving station

A 100-year storm tide with 36" of sea level rise (c. 2070-2100)

2021 Depth to Groundwater



Depth to Groundwater with 36" Sea Level Rise



1) **Protect** City and habitat (keep water out from above and below)

2) **Adapt** City and habitat (increase resilience to water)

3) **Consider retreat needs after 2050**

1) Protect City and habitat (keep water out from above and below)

- Continue with levee and tide gate improvement plans
- Increase groundwater monitoring and expand groundwater waterproofing
- Continue habitat restoration in Bay, creeks and upland areas to absorb and slow water
- Develop a SLR Plan in 2022 for redundant protection and to address additional specific asset concerns

2) Adapt City and habitat (increase resilience to water)

3) Consider retreat needs after 2050

1) Protect City from SLR inundation and changing groundwater conditions:

2) Adapt natural and built assets to increase resilience:

- Update design criteria/building codes to assume three feet higher groundwater and SLR
- Assume higher-risk SLR scenarios for critical infrastructure design
- Install backflow prevention and convert stormwater outfalls to pumped outfalls
- Design for adaptability
- Enhance City's flood and emergency response capabilities
- Incentivize green infrastructure to reduce peak stormwater flows
- Convert portions of Baylands trails to raised boardwalks

3) Consider retreat needs after 2050:

1) Protect City from SLR inundation and changing groundwater conditions:

2) Adapt natural and built assets to increase resilience:

3) Consider retreat needs after 2050:

- Possible relocation of assets outside of levees
- Transition Baylands upland areas to transitional wetland/upland habitat

Next Steps

Sign up for report release and meeting information at cityofpaloalto.org/sealevelrise.



Milestone	Completed
1. Complete groundwater peer review and release Sea Level Rise and Groundwater Vulnerability Assessment	Q1, 2022
2. Public/staff/Commission meetings for SLR Adaptation Plan Development	Throughout 2022
3. Council approval of SLR Adaptation Plan	Q1, 2023
4. Implement Plan and develop related tools and public education	Ongoing after Council approval
5. Update SLR Adaptation Plan with SCAP and revised Ocean Protection Council guidelines.	Every five years, but with annual workplans.

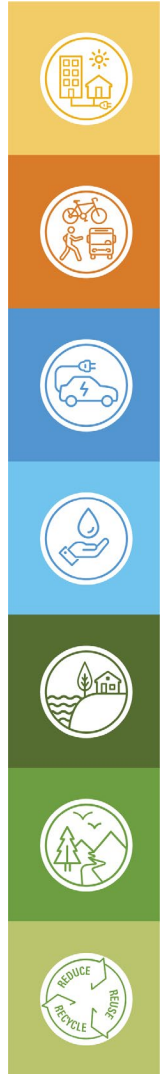


Thank you

www.cityofpaloalto.org/sealevelrise



Questions and Comments from S/CAP Ad Hoc





SUSTAINABILITY & CLIMATE ACTION PLAN

Thank You!

Please submit questions or comments to
sustainability@cityofpaloalto.org

Acting Now for a Resilient Future



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