Bay Area Regional Collaborative

375 Beale Street
Suite 700
San Francisco, Caliofornia
94105

Meeting Agenda - Final

Bay Area Regional Collaborative

Cindy Chavez, Supervisor, County of Santa Clara - Chair
Amy Worth, Councilmember, City of Orinda - Vice Chair

Friday, January 24, 2020 | **10:00 AM** | **Board Room - 1st Floor**

Bay Area Regional Collaborative
Governing Board

The BARC Governing Board may act on any item on the agenda.
The meeting is scheduled to begin at 10:00 a.m.
Agenda, roster, and webcast available at https://barc.ca.gov
For information, contact Clerk of the Board at (415) 820-7913.

Governing Board Members
ABAG—Jesse Arreguin, Scott Haggerty, Julie Pierce, David Rabbitt
BAAQMD—Cindy Chavez, David Hudson, Nathan Miley, Rod Sinks
BCDC—John Gioia, Anne Halsted, Dave Pine, Brad Wagenknecht, Zack Wasserman
MTC—Nick Josefowitz, Jake Mackenzie, Jim Spering, Amy Worth
CalSTA (Non-voting)—Tony Tavares, Dina El-Tawansy (Alternate)

1. Call to Order / Pledge of Allegiance / Roll Call / Confirm Quorum

2. Governing Board Member Annoucements

Information

3. Vice Chair's Report

3. 20-0193 Vice Chair's Report

Action: Information

Presenter: Amy Worth

4. Consent Calendar

4.a. 20-0194 Approval of Governing Board Minutes of November 15, 2019

Action: Approval

Presenter: Clerk of the Board

Attachments: Item 04a Minutes 20191115 Draft.pdf

5. BARC Member Agency Executive Director Updates

5.a.i. 20-0203 San Francisco Bay Regional Water Quality Control Board

Action: Information

Presenter: Michael Montgomery

5.a.ii. 20-0195 San Francisco Bay Regional Water Quality Control Board: Presentation on Water Board Policy Update: Wetlands and Climate Change

Action: Information

Presenter: Michael Montgomery

Attachments: Item 05aii Handout RWQCB Climate Change.pdf

Item 05aii Presentation Water Board Policy Update 2019-0110.pdf

5.b. 20-0199 California State Coastal Conservancy

Action: Information

Presenter: Sam Schuchat

5.c. 20-0200 Association of Bay Area Governments and Metropolitan Transportation Commission

Action: Information

Presenter: Therese W. McMillan

5.d. 20-0201 Bay Area Air Quality Management District

Action: Information

Presenter: Jack Broadbent

5.e. 20-0202 San Francisco Bay Conservation and Development Commission

Action: Information

Presenter: Larry Goldzband

6. Bay Area Regional Efforts to Address Flooding and Sea Level Rise

6.a. 20-0204 State Legislative Perspective on Need for Regional Climate Adaptation Strategy

Action: Information

Presenter: The Honorable Bill Quirk, California State Assemblymember

6.b. 20-0196 Recommendations for Regional Approach to Flood Risk Management and Sea Level Rise

Action: Approval

Presenter: Allison Brooks

Attachments: Item 06b 1 Memo Flood Risk Management and SLR.pdf

Item 06b 2 Presentation Risk Management FINAL.pdf

Item 06b 3 Report LAO Preparing Rising Seas.pdf

6.c. 20-0197 Adapting to Rising Tides Bay Area: Operationalizing the Findings

Action: Information

Presenter: Dana Brechwald

Attachments: Item 06c Presentation BCDC ART Adaptation Guidance.pdf

6.d. 20-0198 Plan Bay Area 2050 Update: Environment Element Draft Blueprint

Action: Information

Presenter: Dave Vautin and Rachael Hartofelis

Attachments: Item 06d 1 Memo PBA 2050 Blueprint Environment Element v2.pdf

Item 06d 2 Presentation PBA 2050 Blueprint Environment Element.pdf

7. Public Comment

Information

8. Adjournment / Next Meeting

The next BARC Governing Board meeting is on March 20, 2020.

The Governing Board may take action on any item listed in the agenda.

This meeting is scheduled to end promptly at 12:00 p.m. Agenda items not considered by that time may be deferred.

The public is encouraged to comment on agenda items by completing a request-to-speak card and giving it to BARC staff or the chairperson.

Although a quorum of the Governing Board may be in attendance at this meeting, the Governing Board may take action only on those matters delegated to it. The Governing Board may not take any action as the Bay Area Regional Collaborative Governing Board unless this meeting has been previously noticed as a Bay Area Regional Collaborative Governing Board meeting.

375 Beale Street, Suite 800
San Francisco, CA 94105

Metropolitan Transportation Commission

Bay Area Regional Collaborative

Legislation Details (With Text)

File #:	20-0193	**Version:**	1	**Name:**	
Type:	Report			**Status:**	Informational
File created:	1/15/2020			**In control:**	Bay Area Regional Collaborative
On agenda:	1/24/2020			**Final action:**	
Title:	Vice Chair's Report				
Sponsors:					
Indexes:					
Code sections:					
Attachments:					

Date	Ver.	Action By	Action	Result

Vice Chair's Report

Amy Worth

Information

Bay Area
Regional
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Metropolitan Transportation Commission

375 Beale Street, Suite 800
San Francisco, CA 94105

Legislation Details (With Text)

File #:	20-0194	**Version:**	1	**Name:**	
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File created:	1/15/2020			**In control:**	Bay Area Regional Collaborative
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Title:	Approval of Governing Board Minutes of November 15, 2019				
Sponsors:					
Indexes:					
Code sections:					
Attachments:	Item 04a Minutes 20191115 Draft.pdf				

Date	Ver.	Action By	Action	Result

Approval of Governing Board Minutes of November 15, 2019

Clerk of the Board

Approval

375 Beale Street
Suite 700
San Francisco, Caliofornia
94105

Meeting Minutes - Draft

Bay Area Regional Collaborative

Cindy Chavez, Supervisor, County of Santa Clara - Chair
Amy Worth, Councilmember, City of Orinda - Vice Chair

Friday, November 15, 2019 | **9:00 AM** | **Board Room - 1st Floor**

Bay Area Regional Collaborative
Governing Board

The BARC Governing Board may act on any item on the agenda.
The meeting is scheduled to begin at 9:00 a.m.
Agenda, roster, and webcast available at https://barc.ca.gov
For information, contact Clerk of the Board at (415) 820-7913.

Governing Board Members
ABAG—Jesse Arreguin, Scott Haggerty, Julie Pierce, David Rabbitt
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BCDC—John Gioia, Anne Halsted, Dave Pine, Brad Wagenknecht, Zack Wasserman
MTC—Nick Josefowicz, Jake Mackenzie, Jim Spering, Amy Worth
CalSTA (Non-voting)—Tony Tavares, Doanh Nguyen (Alternate)

1. Call to Order / Pledge of Allegiance / Roll Call / Confirm Quorum

Chair Chavez called the meeting to order at about 9:05 a.m. Quorum was present.

Present: 13 - Arreguin, Chavez, Gioia, Haggerty, Halsted, Hudson, Josefowitz, Pierce, Sinks, Spering, Wagenknecht, Worth, and Schuchat

Absent: 5 - Mackenzie, Miley, Pine, Rabbitt, and Wasserman

2. Governing Board Member Annoucements

There were no Governing Board member announcements.

3. Chair's Report

There was no Chair's Report.

The following items were taken next in order: Item 4, Item 5, and Item 8.b.

4. Consent Calendar

Upon the motion by Worth and second by Halsted, the BARC Governing Board approved the Consent Calendar, including the minutes of September 20, 2019, the Memorandum of Understanding between the Metropolitan Transportation Commission and the Bay Area Regional Collaborative, and the Regional Water Quality Control Board joining as a non-voting BARC member. The motion passed unanimously by the following vote:

Aye: 11 - Chavez, Gioia, Haggerty, Halsted, Hudson, Josefowitz, Pierce, Sinks, Spering, Worth and Schuchat

Absent: 7 - Arreguin, Mackenzie, Miley, Pine, Rabbitt, Wagenknecht and Wasserman

4.a. 19-1304 Approval of Governing Board Minutes of September 20, 2019

4.b. 19-1306 Approval of Memorandum of Understanding between the Metropolitan Transportation Commission and the Bay Area Regional Collaborative

4.c. 19-1307 Approval of San Francisco Bay Regional Water Quality Control Board Joining as Non-voting BARC Member

5. Meeting Schedule

Arreguin and Wagenknecht joined the meeting.

5.a. 19-1308 Approval of BARC 2020 Meeting Schedule

Upon the motion by Worth and second by Spering the BARC 2020 hybrid meeting schedule was approved. The motion passed unanimously by the following vote:

Aye: 13 - Arreguin, Chavez, Gioia, Haggerty, Halsted, Hudson, Josefowitz, Pierce, Sinks, Spering, Wagenknecht, Worth and Schuchat

Absent: 5 - Mackenzie, Miley, Pine, Rabbitt and Wasserman

6. Adapting to Rising Tides Bay Area

6.a. 19-1311 Presentation on Adapting to Rising Tides Bay Area Findings

Dana Brechwald gave the report.

7. AB 617 West Oakland Community Action Plan

7.a. 19-1310 Report on AB 617 West Oakland Community Action Plan

Henry Hilken introduced Margaret Gordon and Jake Howard who gave the report.

8. BARC Executive Director's Report

8.a. 19-1309 BARC Executive Director's Report

Allison Brooks gave the report.

8.b. 19-1305 Approval of BARC 2020-22 Work Plan

Allison Brooks gave the report.

Upon the motion by Hudson and second by Haggerty, the BARC 2020-22 Work Plan was approved. The motion passed unanimously by the following vote:

Aye: 13 - Arreguin, Chavez, Gioia, Haggerty, Halsted, Hudson, Josefowitz, Pierce, Sinks, Spering, Wagenknecht, Worth and Schuchat

Absent: 5 - Mackenzie, Miley, Pine, Rabbitt and Wasserman

9. BARC Member Agency Executive Director Updates

9.a. 19-1313 Association of Bay Area Governments and Metropolitan Transportation Commission

Therese W. McMIllan gave the report.

9.b. 19-1314 Bay Area Air Quality Management District

Jack Broadbent gave the report.

9.c. 19-1315 San Francisco Bay Conservation and Development Commission

Larry Goldzband gave the report.

9.d. 19-1316 California State Coastal Conservancy

Sam Schuchat gave the report.

9.e. 19-1317 San Francisco Bay Regional Water Quality Control Board: Presentation on Wetland Fill Policy Challenges and Future Regulatory Options--Findings and Recommendations

Michael Montgomery gave the report.

10. Public Comment

There was no public comment.

11. Adjournment / Next Meeting

Chair Chavez adjourned the meeting at about 11:04 a.m. The next meeting of the BARC Governing Board is on January 24, 2020.

Bay Area
Regional
Collaborative

Metropolitan Transportation Commission

375 Beale Street, Suite 800
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Legislation Details (With Text)

File #:	20-0203	**Version:**	1	**Name:**	
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Title:	San Francisco Bay Regional Water Quality Control Board				
Sponsors:					
Indexes:					
Code sections:					
Attachments:					

Date	Ver.	Action By	Action	Result

San Francisco Bay Regional Water Quality Control Board

Michael Montgomery

Information

375 Beale Street, Suite 800
San Francisco, CA 94105

Metropolitan Transportation Commission

Bay Area Regional Collaborative

Legislation Details (With Text)

File #:	20-0195	**Version:**	1	**Name:**	
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File created:	1/15/2020			**In control:**	Bay Area Regional Collaborative
On agenda:	1/24/2020			**Final action:**	
Title:	San Francisco Bay Regional Water Quality Control Board: Presentation on Water Board Policy Update: Wetlands and Climate Change				
Sponsors:					
Indexes:					
Code sections:					
Attachments:	Item 05aii Handout RWQCB Climate Change.pdf Item 05aii Presentation Water Board Policy Update 2019-0110.pdf				

Date	Ver.	Action By	Action	Result

San Francisco Bay Regional Water Quality Control Board: Presentation on Water Board Policy Update: Wetlands and Climate Change

Michael Montgomery

Information

Executive Summary

The San Francisco Bay Regional Water Quality Control Board (Regional Water Board) proposes to develop an amendment to the Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan) to address the threats posed by climate change to water quality and beneficial uses. The Regional Water Board is proposing to amend the Basin Plan because it is critical that our policies and decisions influence climate change adaptation projects to improve beneficial uses of the San Francisco Bay (Bay). The proposed Basin Plan Amendment (BPA) will use the latest science to maximize the use of nature-based solutions (often called “green infrastructure”) to protect vulnerable shorelines from sea level rise.

Motivation

Increasing concentrations of greenhouse gases and resultant climate changes are driving rising sea levels within the San Francisco Bay region. The region will likely experience an acceleration in the rate of relative sea level rise (SLR); increases in the frequency, intensity, and duration of storms; shifts in the seasonal timing and volume of rainfall; changes in Delta outflows; and impacts to the physical and ecological conditions and processes that support the diversity and resilience of shoreline habitats.

The Bay’s tidal marshes and flats (mudflats), which are critical to water quality and the health of the Bay, are especially threatened by SLR and decreases in suspended sediment entering the Bay from creeks, streams, and rivers, which drain to the Bay. Modeling demonstrates that these factors could drown most of the Bay’s tidal marshes by 2100, convert vast areas of mudflats to open water, and make it more challenging, if not impossible, to achieve habitat restoration goals. Furthermore, these large-scale changes will permanently impact beneficial uses of the Bay, such as wildlife habitat, preservation of rare and endangered species, fish migration and spawning, recreation, and commercial fishing.

Climate change and SLR threaten critical shoreline infrastructure and low-lying communities through increased risk of flooding and erosion. Where development has encroached upon natural shorelines, traditional solutions employed to control erosion and flooding have relied on levees, seawalls, and rock revetments (often called “grey infrastructure”). Grey infrastructure solutions provide minimal benefits to water quality and beneficial uses and often negatively impact natural Bay features, such as mudflats, wetlands, and beaches. In contrast, green infrastructure solutions rely on mudflats, wetlands, and beaches to reduce erosion and flooding risks by working with nature.

Our Role

The Regional Water Board is charged with protecting, enhancing, and restoring the beneficial uses in the Bay, its tributaries, and its nearshore environments. Our regulatory authority is derived from provisions of the federal Clean Water Act, the state Porter-Cologne Water Quality Control Act, and policies in the Basin Plan. Our authority extends to regulation of activities that might affect wetlands, such as wetland fill, dredging of navigation and flood control channels, and the beneficial reuse of dredged sediment by issuing permits for such activities. While our permitting decisions incorporate the California Wetlands Conservation Policy (commonly known

as “No Net Loss”), our Basin Plan currently does not consider the threats to the Bay’s wetlands and nearshore habitats by climate change and SLR. Additionally, the Basin Plan does not address how planning and permitting decisions can address these threats and support water quality and beneficial uses of the Bay in the long-term and at a regional scale.

The Basin Plan Amendment

A BPA to incorporate these recommendations and address climate change and wetland fill will likely include both non-regulatory and regulatory elements:

Non-Regulatory Elements

Non-regulatory elements of the proposed BPA will include:

- A narrative explaining the impacts to water quality and beneficial uses of the Bay associated with a changing climate and SLR.
- References to the 2015 Goals Report, the U.S. Fish and Wildlife Service’s *Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California* (USFWS 2013), *Rising Seas in California* (OPC 2017), and the *State of California Sea Level Rise Guidance* (OPC 2018).
- An updated list of tidal wetland restoration sites that are currently being restored, as well as those currently planned for restoration (e.g. South Bay and Napa-Sonoma salt ponds, Hamilton, Sears Point, etc.).
- Support for a regional approach to tidal wetland monitoring, such as the Wetland Regional Monitoring Program currently being developed by the Regional Water Board and its partners.

Regulatory Elements

Regulatory elements of the proposed BPA will include:

- Documentation of the threats that climate change poses to the Bay’s tidal wetlands and adjacent habitats, and their beneficial uses, including but not limited to threats from SLR, changes in freshwater inputs, and changes in regional sediment supplies.
- Identification of preferred strategies for climate change adaptation, emphasizing the roles that natural and nature-based processes can play while integrating feasible solutions that maximize Bay-wide water quality and related habitat benefits.
- Clarification of the regulatory framework to be considered for project that convert waters of the State from one type to another (e.g., seasonal wetland to tidal wetland).
- Clarification of how the “No Net Loss” policy will be applied to Bay margin wetland restoration projects, especially in consideration of losses in acreage, functions and values associated with SLR projections.
- Identification of instances where fill in waters of the State may be considered beneficial, or otherwise may not trigger a requirement for compensatory mitigation. Restoration elements to be considered could include:

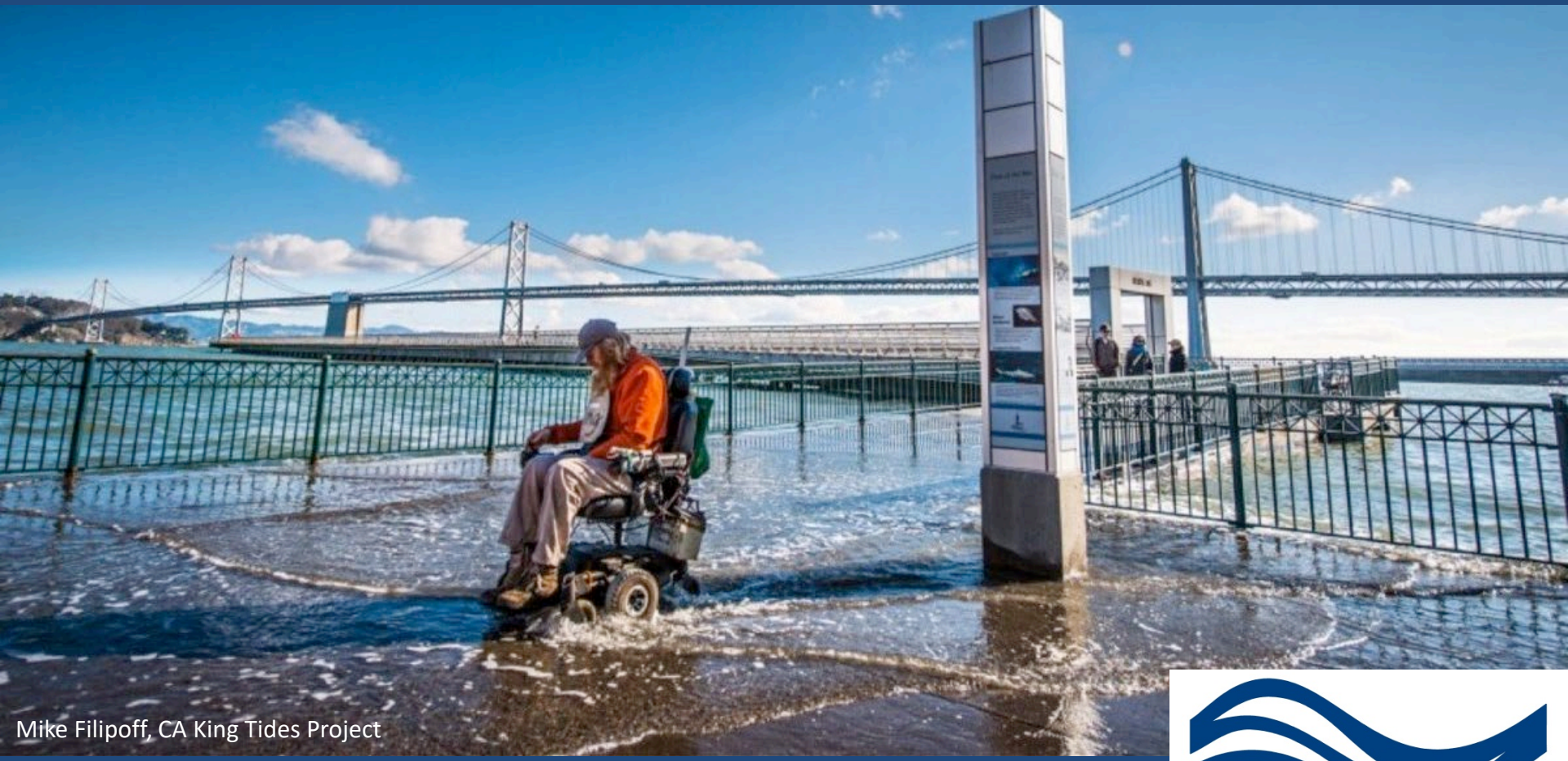
    - Horizontal/ecotone levees;
    - New/enhanced estuarine-terrestrial transition zones in baylands in places where they are currently absent or impacted by shoreline hardening, current or historic land uses, or other anthropogenic impacts;
    - Living shorelines, beaches, and hybrid coastal infrastructure; and
    - Strategic sediment placement to raise elevations in restoring and subsided bayland.
- Clarification that avoidance and minimization in the context of Bay fill includes evaluating opportunities for incorporating the upland/landward edge of the Bay in any alternatives analysis completed consistent with Clean Water Act Section 404(b)(1) guidelines, and identification of approaches for how projects should consider facilitating the upslope transgression of tidal wetlands as sea levels rise.
- Identification of the benefits of "complete" tidal wetland systems consistent with the definition in the 2015 Baylands Goals update.
- A framework for how the Regional Water Board will consider temporal tradeoffs and uncertainties in wetland restoration to avoid and minimize fill impacts in waters/wetlands.
- A framework for evaluating mitigation on a regional, sub-regional (Suisun, North Bay, Central Bay, South Bay, Lower South Bay), or operational landscape unite (OLU) basis, rather than project-by-project, and clarifying expectations for the role mitigation banks may play.
- Emphasis on the expectation that projects consider and appropriately address project-related indirect and cumulative impacts to waters.
- References to existing technical guidance on natural and nature-based features, including "living shorelines," and emphasis on the role that nature-based infrastructure can play in avoiding and reducing impacts.

Collaborative Approach

The Regional Water Board will develop the BPA through a collaborative public process and in coordination with our partner resource and regulatory agencies, many of which are implementing their own climate change-focused policy updates.

One venue for collaborating on policy development is the Bay Restoration Regional Integration Team (BRRIT). The BRRIT is a newly formed regulatory team that brings together staff from the Regional Water Board, U.S. Army Corps of Engineers, Bay Conservation and Development Commission (BCDC), National Marine Fisheries Service, U.S. Fish and Wildlife Service, and the California Department of Fish and Wildlife to streamline permitting for projects funded through the San Francisco Bay Restoration Authority. Regional Water Board staff will also continue to collaborate with BCDC staff on related initiatives including but not limited to BCDC's new Bay Plan Amendment for Fill for Habitat Projects, which was approved by BCDC on October 3, 2019. Lastly, Regional Water Board staff will hold a series of public meetings to solicit input from interested parties.

Water Board Policy Update: Wetlands and Climate Change



Mike Filipoff, CA King Tides Project

Xavier Fernandez

Planning Division Chief

SF Bay Regional Water Quality Control Board

CALIFORNIA Water Boards

STATE WATER RESOURCES CONTROL BOARD

REGIONAL WATER QUALITY CONTROL BOARDS

Climate Change Threats

- More frequent and severe droughts and floods
- Sea level rise
- Coastal flooding, overtopping, erosion
  - Higher groundwater tables
  - Drowning of tidal marshes

Photo: Christina Toms

Bothin Marsh, Mill Valley

What the Water Board Is Doing

1. Collaborating with partners
2. Planning and permitting projects
3. Amending our Basin Plan

Photo: CA King Tides Project

Arrowhead Marsh, Oakland

SF Bay Basin Plan

- Master policy document
- Designates beneficial uses
- Assigns water quality objectives
- Describes implementation plans & policies
  - Chapter 4.23: Wetland Protection & Management

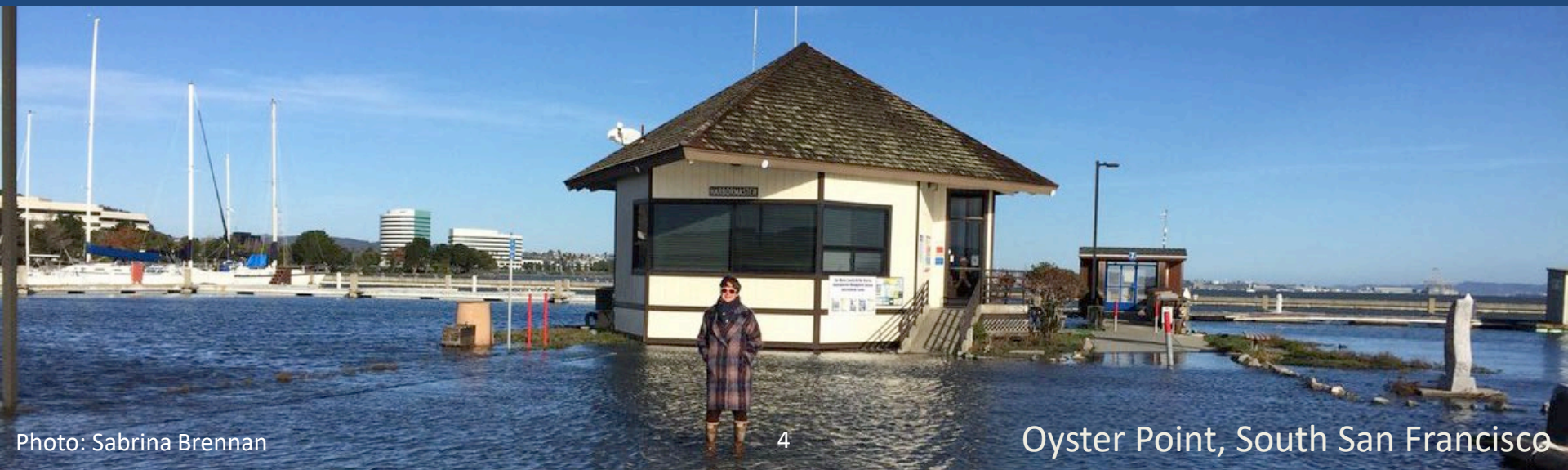


Photo: Sabrina Brennan

Oyster Point, South San Francisco

Key Beneficial Uses of San Francisco Baylands + Shorelines

- Estuarine habitats – mudflats, tidal fresh, brackish, and salt marshes
- Habitat for wildlife, including rare and special-status species
- Recreation, commercial fisheries, shellfish harvesting

Graphics: Baylands Goals 2015

Key Water Board Authorities

- Placement of fill in wetlands and waters
- Dredging and beneficial reuse

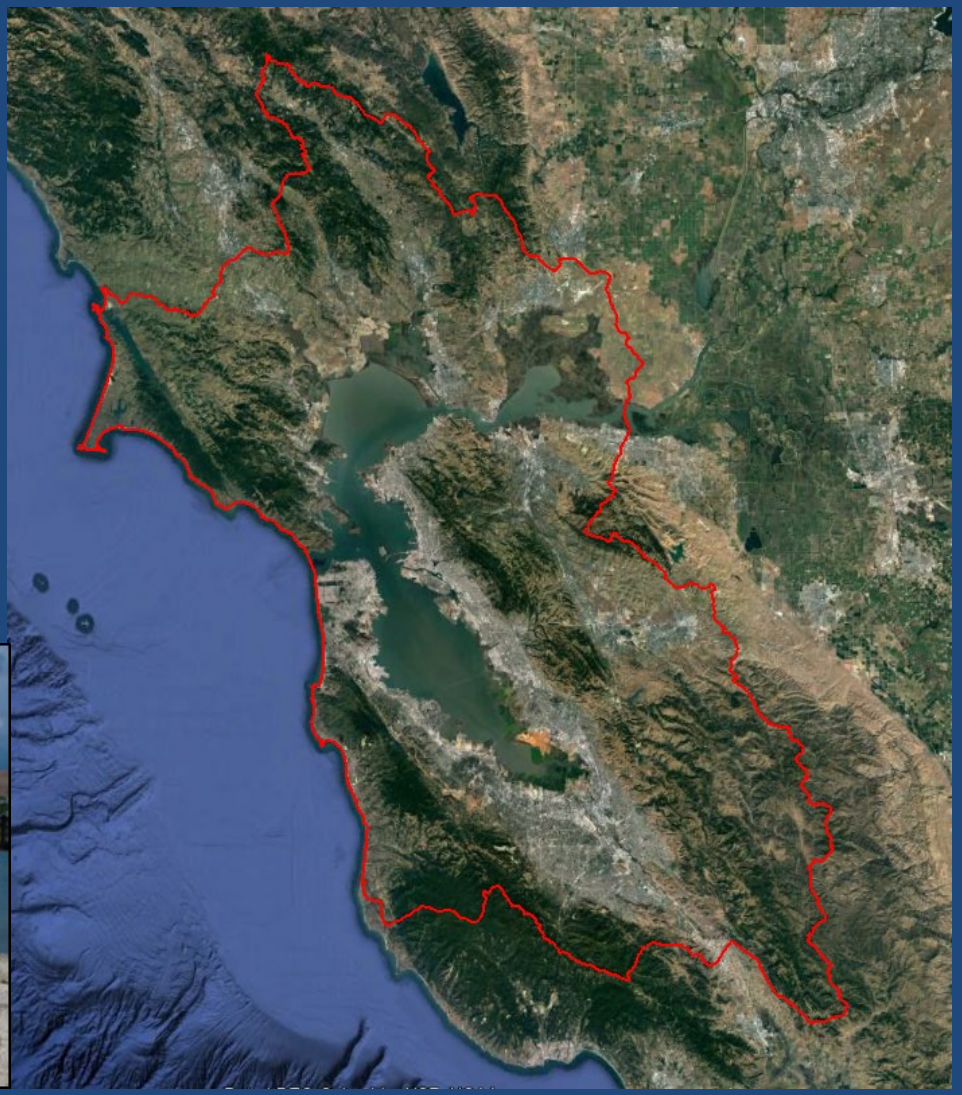


Photo: Stuart Siegel, Graphic: Christina Toms

CA Wetlands Conservation Policy

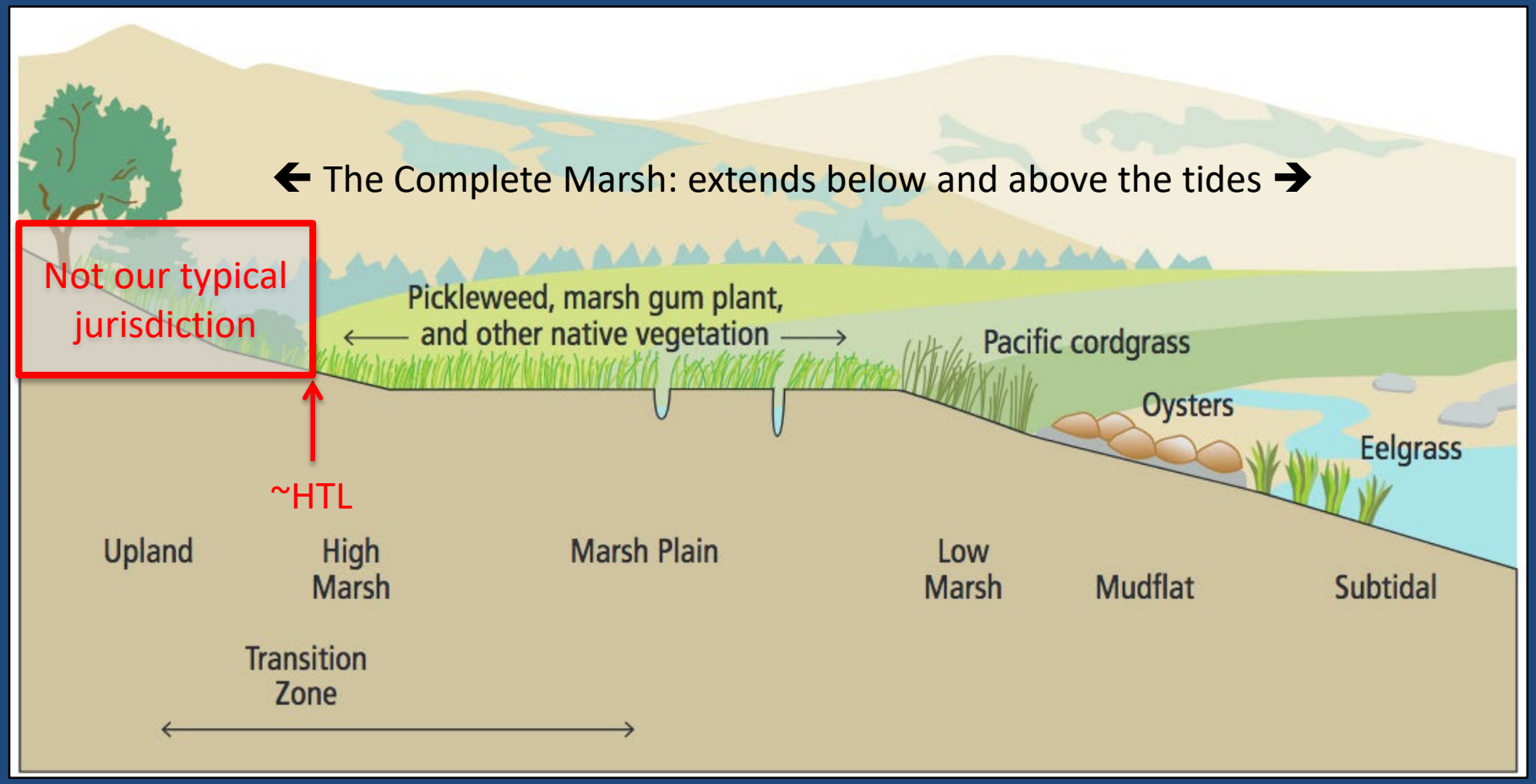
- "No Net Loss"
- Ensures no overall net loss and a long-term net gain in wetlands acreage, functions, and values
- Emphasizes regional restoration goals, planning, and strategies

Photo: Christina Toms

Hill Slough, Suisun Marsh

The Complete Tidal Marsh

- Important habitats above the high tide line (HTL)



Graphic: BEHGU

Proposed Basin Plan Amendment

San Pedro Road, China Camp State Park

Cindy Pavlinac Photo

Key Regulatory Opportunities

1. Document threats that climate change poses to Bay habitats and beneficial uses
2. Identify benefits of “complete” baylands
3. Identify preferred strategies for SLR adaptation: Baylands Goals, Adaptation Atlas

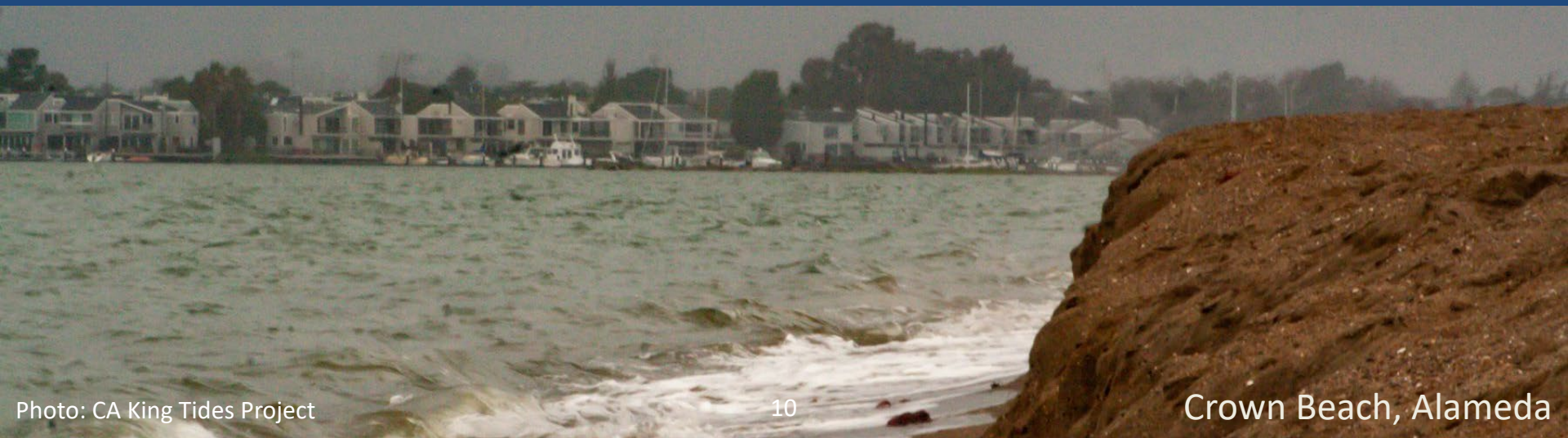


Photo: CA King Tides Project

Crown Beach, Alameda

Key Regulatory Opportunities

4. Clarify how we will apply “No Net Loss” for
   - Horizontal and ecotone levees
   - Living shorelines, beaches, dunes, and nature-based (hybrid green-grey) infrastructure
   - Strategic/thin-lift sediment placement
   - Enhanced high tide refugia in marshes

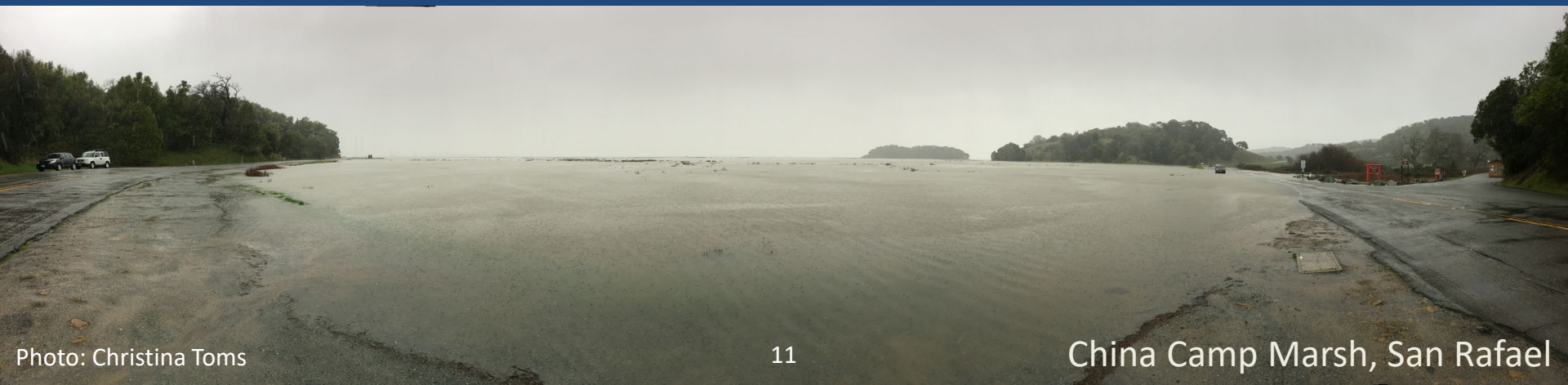


Photo: Christina Toms

China Camp Marsh, San Rafael

Key Regulatory Opportunities

5. Clarify acceptable wetland type conversions
6. Incentivize landward alignments of shoreline protection, movement of natural shorelines
7. Develop framework to address temporal and spatial tradeoffs and uncertainties
8. Address indirect and cumulative impacts

Photo: Christina Toms

Sonoma Baylands

Key Regulatory Opportunities

9. Minimize shoreline hardening
10. Evaluate mitigation on a regional basis
11. Support regional tidal wetland monitoring

Photo: CA King Tides Project

San Francisco Embarcadero

DRAFT - December 4, 2018

SAN FRANCISCO BAY SHORELINE Adaptation Atlas

Working with Nature to Plan for Sea Level Rise

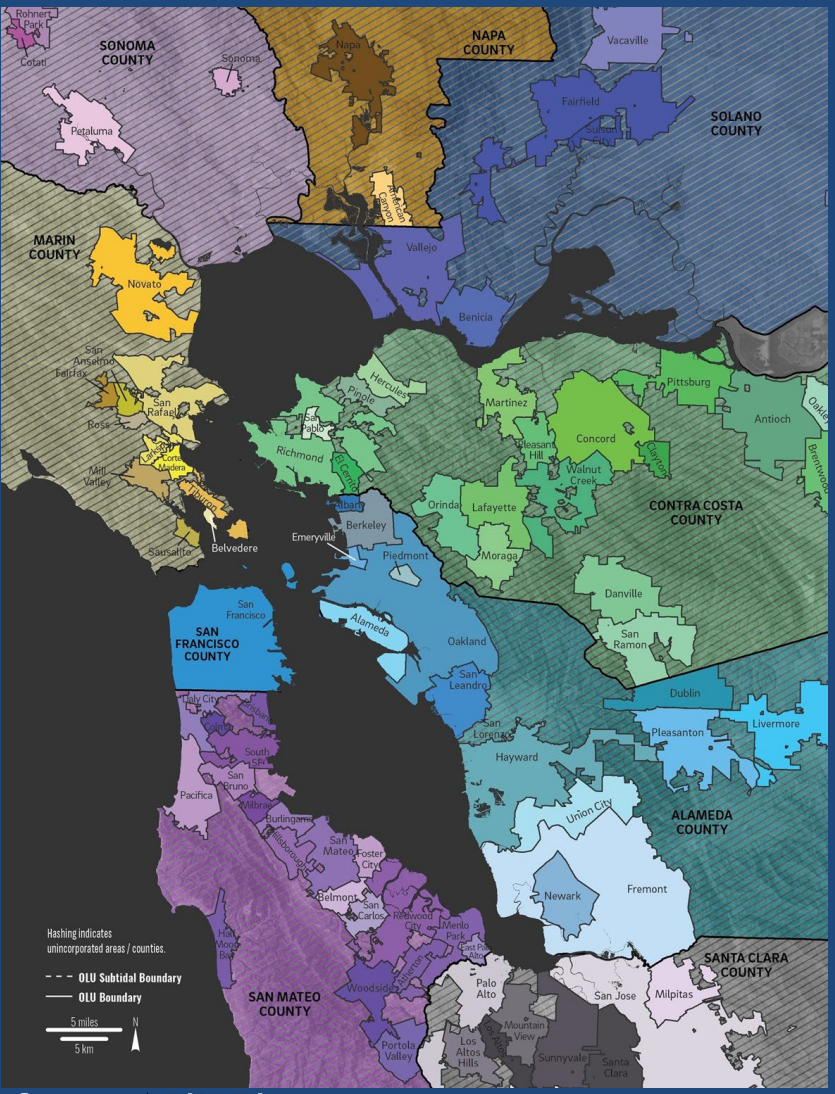
USING OPERATIONAL LANDSCAPE UNITS

Scale of Natural Processes

Physical and ecological processes that govern the shoreline happen at the Bay scale.

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

Traditional Jurisdictions



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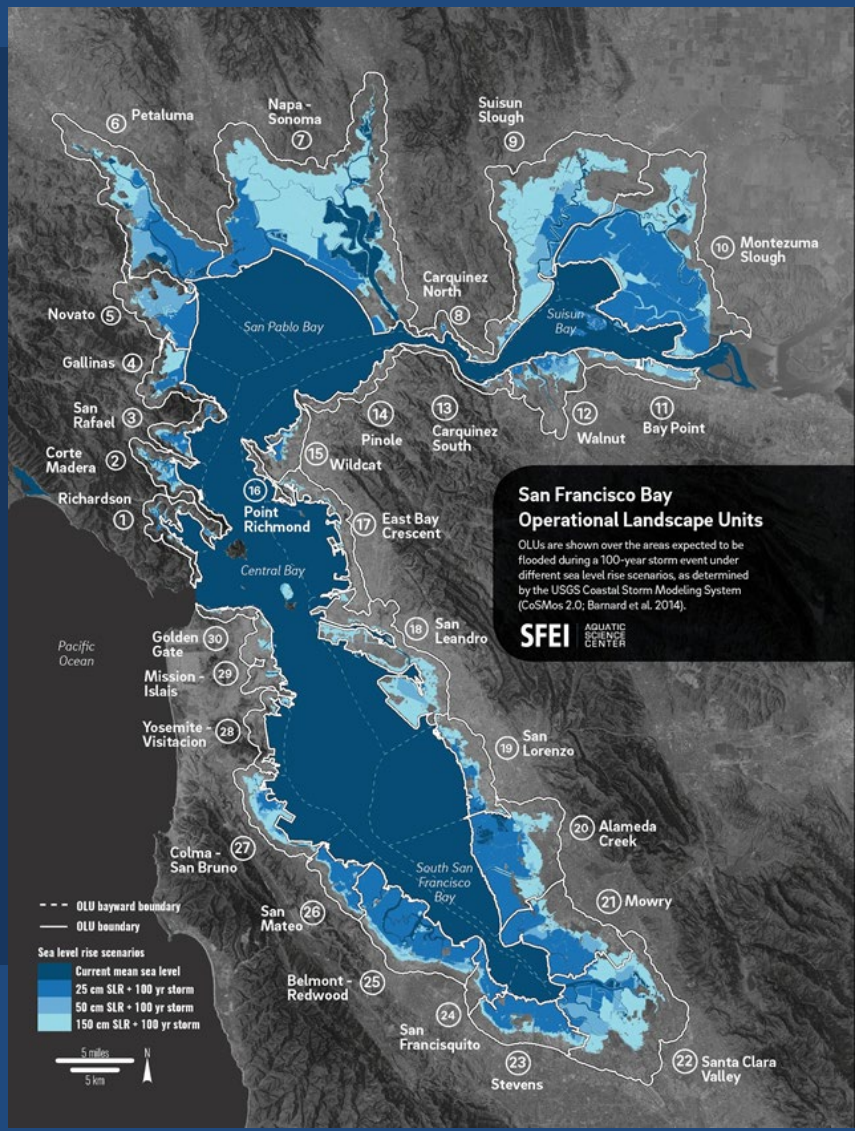
Nature's Boundaries

Operational Landscape Units

Areas with shared geophysical and land use characteristics *suited for a particular suite of nature-based measures*.



Basin Plan Amendment: Next Steps

- Climate change + wetlands policy staff report: http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/climate_change/

- 2020-2021: Develop Basin Plan Amendment
  - Staff writing + review, stakeholder engagement, CEQA, Board adoption, sign-off by EPA and CA Office of Administrative Law

Photo: Erik Grijalva

Amtrak Capitol Corridor, Suisun

Questions?

xavier.fernandez@waterboards.ca.gov

Photo: CA King Tides Project

Alviso Marina County Park

Bay Area
Regional
Collaborative

Metropolitan Transportation Commission

375 Beale Street, Suite 800
San Francisco, CA 94105

Legislation Details (With Text)

File #:	20-0199	**Version:**	1	**Name:**	
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Title:	California State Coastal Conservancy				
Sponsors:					
Indexes:					
Code sections:					
Attachments:					

Date	Ver.	Action By	Action	Result

California State Coastal Conservancy

Sam Schuchat

Information

375 Beale Street, Suite 800
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Metropolitan Transportation Commission

Bay Area Regional Collaborative

Legislation Details (With Text)

File #:	20-0200	**Version:**	1	**Name:**	
Type:	Report			**Status:**	Informational
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Title:	Association of Bay Area Governments and Metropolitan Transportation Commission				
Sponsors:					
Indexes:					
Code sections:					
Attachments:					

Date	Ver.	Action By	Action	Result

Association of Bay Area Governments and Metropolitan Transportation Commission

Therese W. McMillan

Information

375 Beale Street, Suite 800
San Francisco, CA 94105

Metropolitan Transportation Commission

Bay Area Regional Collaborative

Legislation Details (With Text)

File #:	20-0201	**Version:**	1	**Name:**	
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On agenda:	1/24/2020			**Final action:**	
Title:	Bay Area Air Quality Management District				
Sponsors:					
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Date	Ver.	Action By	Action	Result

Bay Area Air Quality Management District

Jack Broadbent

Information

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375 Beale Street, Suite 800
San Francisco, CA 94105

Legislation Details (With Text)

File #:	20-0202	**Version:**	1	**Name:**	
Type:	Report			**Status:**	Informational
File created:	1/15/2020			**In control:**	Bay Area Regional Collaborative
On agenda:	1/24/2020			**Final action:**	
Title:	San Francisco Bay Conservation and Development Commission				
Sponsors:					
Indexes:					
Code sections:					
Attachments:					

Date	Ver.	Action By	Action	Result

San Francisco Bay Conservation and Development Commission

Larry Goldzband

Information

375 Beale Street, Suite 800
San Francisco, CA 94105

Metropolitan Transportation Commission

Bay Area Regional Collaborative

Legislation Details (With Text)

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Sponsors:					
Indexes:					
Code sections:					
Attachments:					

Date	Ver.	Action By	Action	Result

State Legislative Perspective on Need for Regional Climate Adaptation Strategy

The Honorable Bill Quirk, California State Assemblymember

Information

375 Beale Street, Suite 800
San Francisco, CA 94105

Metropolitan Transportation Commission

Bay Area Regional Collaborative

Legislation Details (With Text)

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Sponsors:					
Indexes:					
Code sections:					
Attachments:	Item 06b 1 Memo Flood Risk Management and SLR.pdf Item 06b 2 Presentation Risk Management FINAL.pdf Item 06b 3 Report LAO Preparing Rising Seas.pdf				

Date	Ver.	Action By	Action	Result

Recommendations for Regional Approach to Flood Risk Management and Sea Level Rise

Allison Brooks

Approval

Bay Area
Regional
Collaborative

DATE: January 24, 2020

TO: BARC Governing Board

FROM: Allison Brooks, BARC Executive Director

RE: *Recommendations for Regional Approach to Flood Risk Management and Sea Level Rise*

In December 2019, the California Legislative Analyst's Office (LAO) released a report entitled *Preparing for Rising Seas: How the State Can Help Support Local Coastal Adaptation.* The report was a response to legislative interest in the role that the State can play in managing sea-level rise (SLR) and was useful in providing an initial overview of the threats and challenges of SLR to coastal communities. The report also highlighted the complicated intersection of SLR with other important state priorities, such as increasing the supply of affordable housing in coastal communities threatened by increased flooding and SLR, and provided some recommendations for supporting local adaptation efforts.

A less fully developed area of the report was the role of regional agencies in managing climate adaptation. While there is mention of the need for greater regional-scale coordination and shared learning among key stakeholders, and a recommendation for appropriated resources to support some level of staff to enable such coordination, the report does not adequately describe a framework by which regional agencies can bolster climate adaptation efforts at the local and regional scale to accomplish shared goals and performance metrics in adapting to climate change. We have established such a framework for climate mitigation, with clearly defined roles for regional agencies. We need a similar framework for managing climate change impacts. Coordination alone will no longer be sufficient.

This memo and accompanying presentation propose that the BARC member agencies adopt a risk-management approach in reducing the risks to our communities posed by flooding and sea level rise. A similar framework is already used for hazards such as earthquakes and is well suited to uncertain risks like flooding and SLR, which require a range of strategies to bring down the costs to local communities. Adopting a risk-management framework that assigns roles and responsibilities for key stakeholders to collectively reduce risk are critical next steps the BARC member agencies can support to put the Bay Area on a path towards resilience.

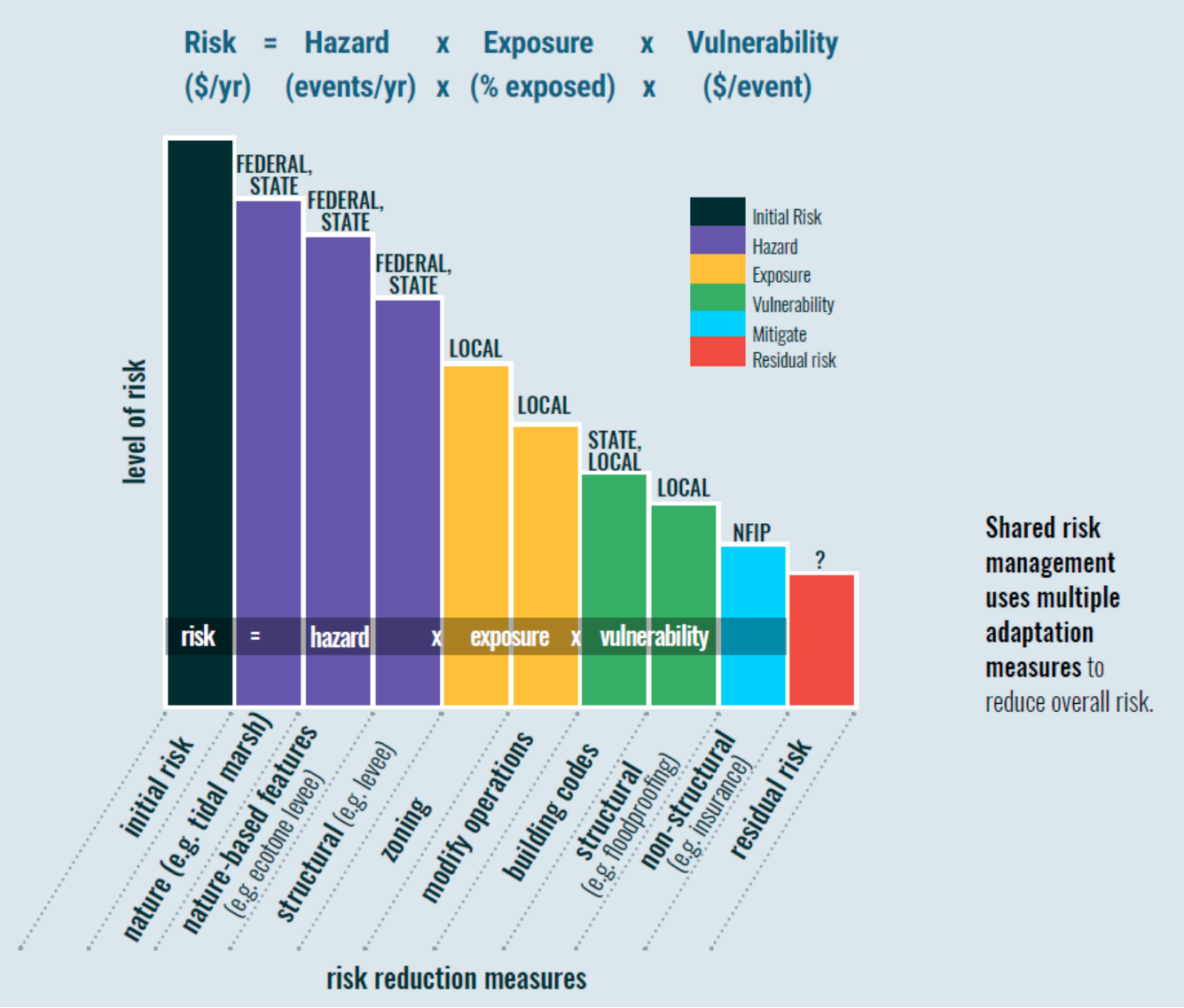
The Value of a Flood Risk Management Approach

A fundamental feature of a flood-risk management approach is the concept of buying down risk. This is a very different approach than the current state of practice for flood management, which is to apply a default 100-year storm (1% probability of occurring) design level of protection across the board. This methodology essentially assigns the same level of protection to both a densely populated urban area with large immovable structures and a low-density rural area. In contrast, a risk-management approach

requires us to answer a number of preliminary questions so that we can adequately understand the problem we are trying to solve for and ultimately make both informed land use decisions and sufficient investments in protection to reduce our risk. These questions include:

What are we trying to protect, and why?
How much risk are we willing to accept, and for how long?
How do we pay for the cost of protection and can we afford it?
When does protecting a local asset become untenable?

The answers to these questions are based on a variety of factors ranging from societal and cultural values to economics. Many of them are inherently political in nature, and cannot be determined solely through science and engineering. Although we will not be able to eliminate risk entirely, or in a universally agreed-upon way, starting with a risk management framework ensures we are asking the right questions from the outset and wisely using the resources we have in across the region and in line with our shared values.



Source: Jeremy Lowe, San Francisco Estuary Institute (SFEI)

The chart above depicts the way in which multiple adaptation measures can be combined to reduce overall risk in a risk management model. The black bar represents the initial level of risk that is present in the absence of any risk reduction measures. The different-colored sets of bars represent measures that can be undertaken to reduce the three factors that come together to comprise risk: hazard, exposure, and vulnerability. Each of these three factors are reduced through different sets of measures. As risk reduction measures are implemented by the appropriate stakeholder(s), the *initial risk* level is brought down to an *acceptable level* of risk. This framework demonstrates that risk is comprised of components that are shared across different stakeholders at different levels of government. This chart also shows that the reduction of flood risk does not only occur through costly infrastructure projects, but also through a variety of land use and property-specific actions, such as re-zoning flood-prone regions, updating building codes, floodproofing homes, and changes to insurance policies. Risk reduction is not solely dependent on building levees, and the cost of any measure should be based on what we are trying to protect.

A Regional Framework is an essential starting point for equipping the Bay Area to use a risk management approach like the one outlined above. Similar to the way in which we approach climate mitigation, we must have a shared set of guidelines and metrics that allow us to select and evaluate possible risk reduction actions. A Regional Framework would lay out agreed-upon guiding principles, establish clear roles and responsibilities of agencies to share risk effectively, ensure the appropriate allocation of resources to support local action at various phases (e.g., planning, implementation), and advance projects that best achieve the desired level of risk reduction. To ensure progress and accountability, the framework would track the performance of risk-sharing at the regional scale, using Plan Bay Area as a vehicle.

As the forum shared by the agencies who hold much of the regulatory and planning authority to establish and carry out a shared regional flood risk framework, BARC is an important venue for beginning this work. BARC staff look forward to discussing these issues with the Governing Board and Member Agencies.

Applying a Risk Management Framework to Prepare for Flooding & Sea Level Rise

Allison Brooks, Bay Area Regional Collaborative (BARC) & Jeremy Lowe, San Francisco Estuary Institute (SFEI)

BARC Governing Board, January 24, 2020

To Be Discussed:

1) Limitations to current practice of flood risk management
2) Understanding the problem we are trying to solve for
3) Value of adopting a risk-management approach to flooding and sea level rise, along with other hazards
4) Discussion questions

We have goals for mitigation, It's time for goals for adaptation

We know:

- **We can't buy our way out of disasters anymore, there are just too many** - What are the up-front investments needed to reduce the risk to an affordable level & make our quality of life better in the process (parks, marshes, natural system) - multi-benefit
- **This can't just be a city by city approach** - we need some regional cohesion, guidance, a strategic plan of attack
- **This is fundamentally a land use issue -** As stated in the recent Legislative Analyst Office (LAO) Report on Preparing for Rising Seas:

  > "The degree of SLR that is predicted over the next century clearly will affect land use decisions and create additional challenges for local governments - and the state - as they seek to expand housing options for Californians in coastal regions"

- **While climate adaptation is an emerging issue, there are existing multi-faceted approaches to managing risk that we can apply.**

The Missing Middle - What is the problem are we solving for?

"Interviewees who were able to gather the necessary information to complete vulnerability assessments... were unclear how to determine what specifically they should do next." LAO report 2019

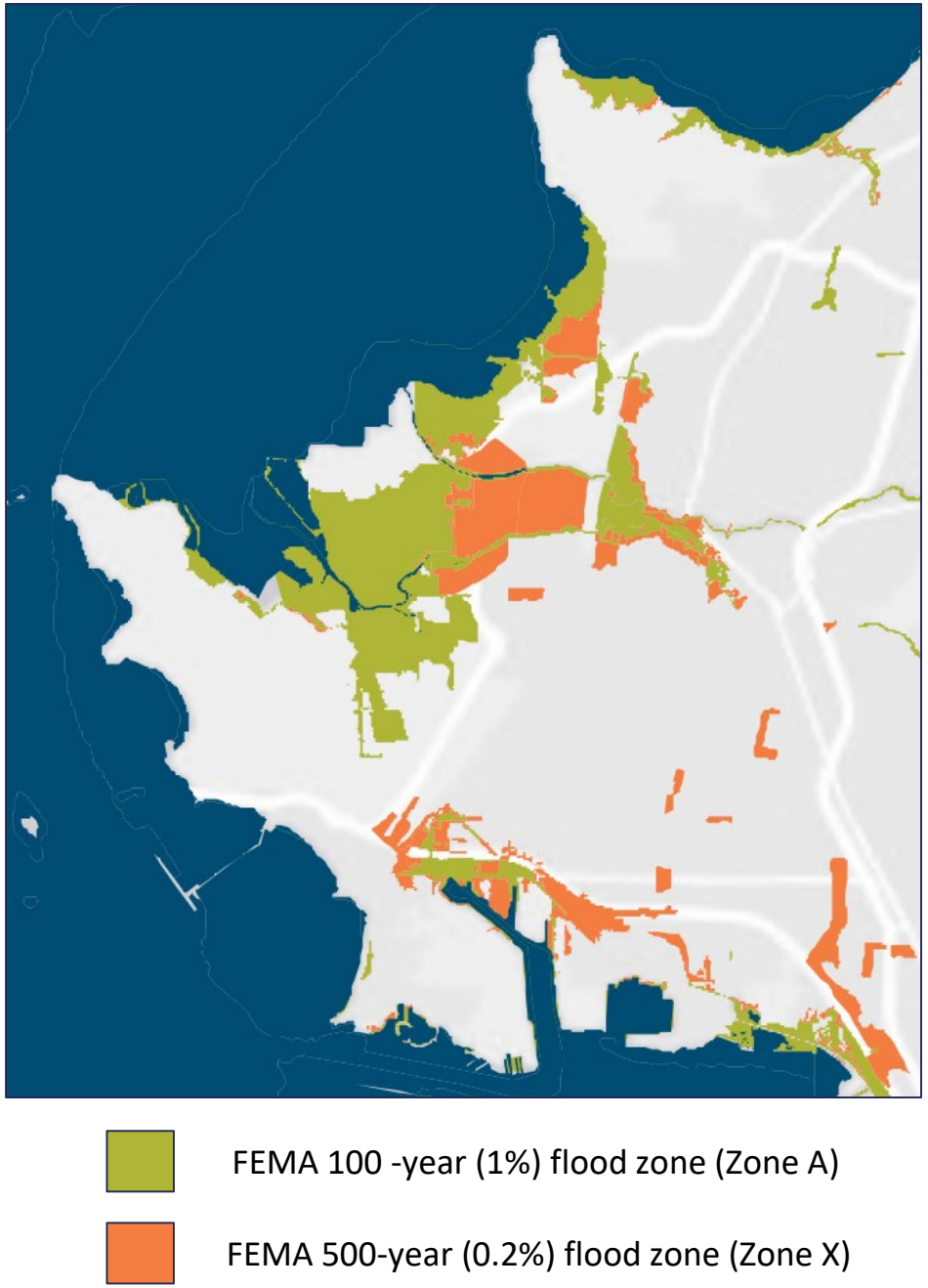
1. Vulnerability studies show we have problems.
2. We have lots of "solutions" to the problem – gray, green, hybrid etc.
3. To get from #1 to #2 we need to define the problem:

What is the level of protection needed based on value of assets in specific locations. What are the full range of strategies needed to manage risk?

LAO report focuses on 1 and 2, ignores 3.

Current State of Practice

- The current practice of flood risk management is most often to provide 100-year (1%) flood protection.
- “There is no solid basis of evidence, however, to justify a default 1% design level of flood protection especially given scientific projections that future flooding will be more frequent and intense due to climate change.” (BCDC ART 2017).
- A default 1% design level does not represent an attempt to achieve optimal balancing of risks and benefits:
  - e.g. why provide the same level of flood risk reduction for both a densely populated urban area with large immovable structures and a low-density rural area with less value in harm’s way?



Let’s Define the Problem

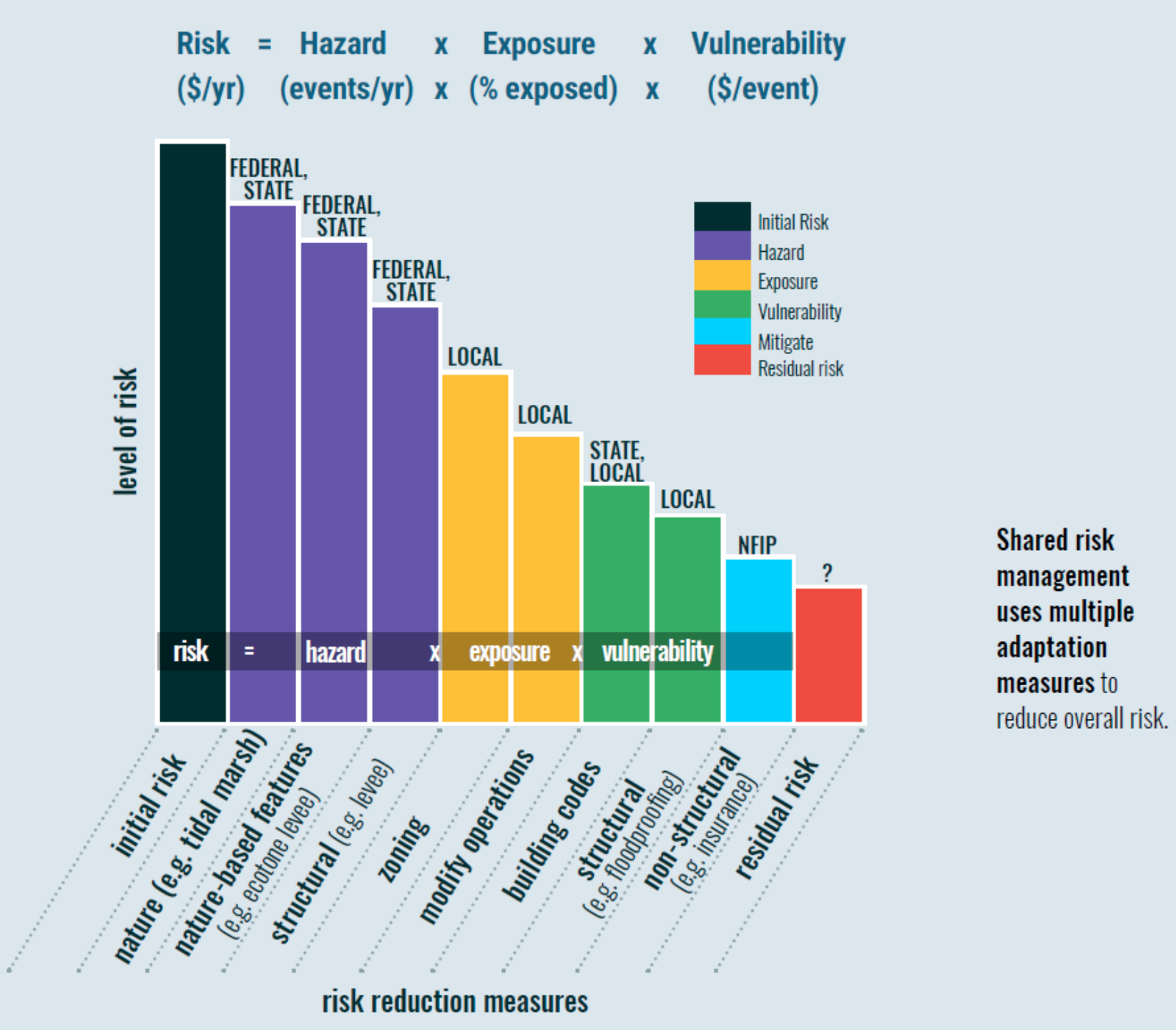
Questions We Need to Ask Ourselves:

- What are we trying to protect? Why?
- How much flood risk are we willing to accept? For how long?
- How do we pay for the cost of protection? Can we afford it?
- When does protecting a location/asset become untenable?

These are questions based on societal values and priorities, economics, and are inherently political in nature. They can’t be decided by scientists and engineers.

Moving to a Flood Risk Management Model - *Sharing Risk*

- Need to manage exposure and vulnerability as well as the hazard
- Sharing risk using a combination of risk reduction measures.
- Goal is to reduce initial risk to an acceptable residual risk by managing the cumulative reduction in hazard and exposure and vulnerability.



Shared risk management uses multiple adaptation measures to reduce overall risk.

Hazard

Coastal Storm

None Annual 20-year 100-year

Sea Level Rise (cm)

0 25 50 75 100 150 200

Location

Select All Clear All

- Marin County
- Napa County
- Orange County
- San Diego County
- San Francisco County
- San Luis Obispo County
- San Mateo County

Exposure

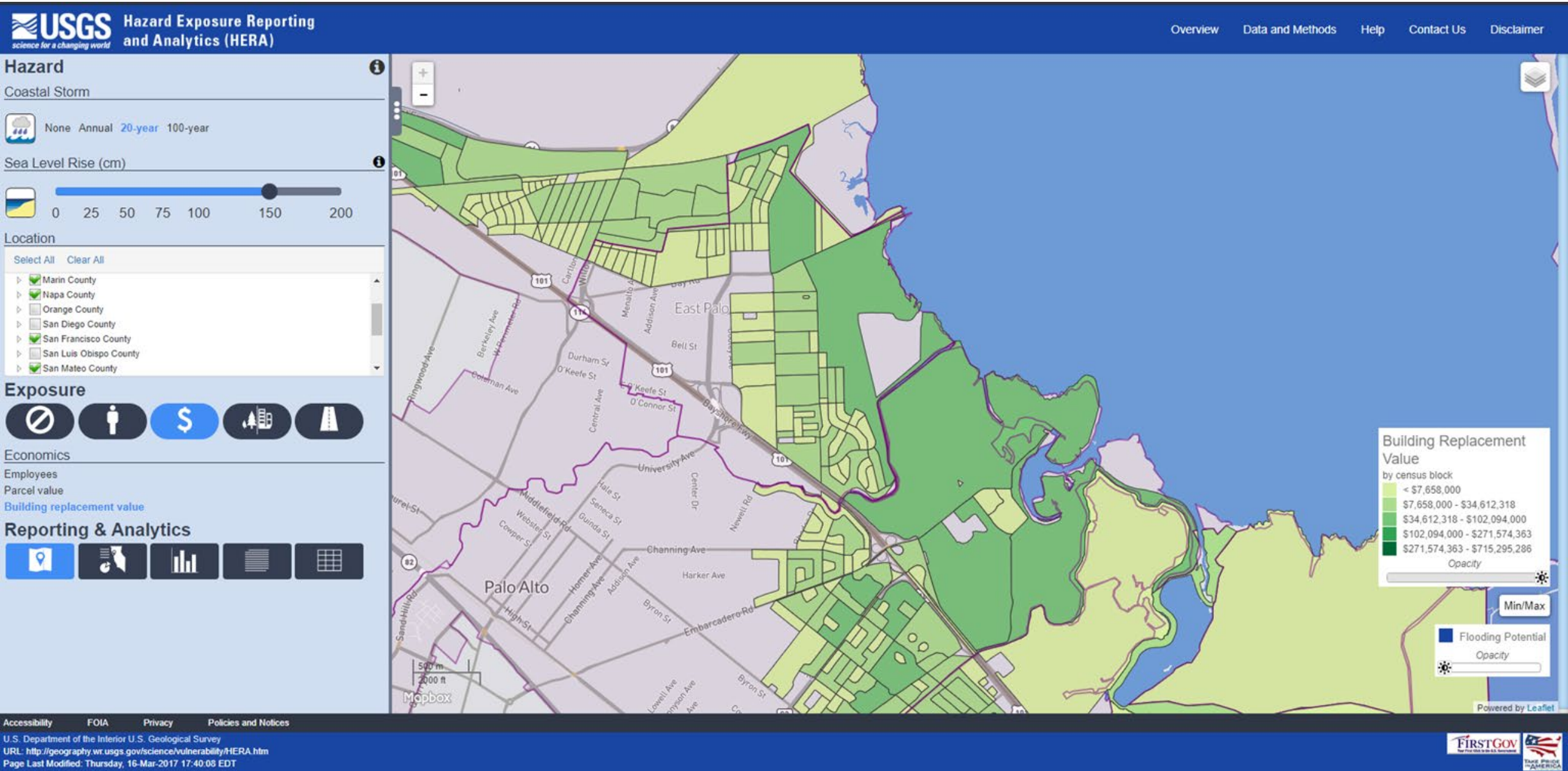
Economics

Employees

Parcel value

Building replacement value

Reporting & Analytics


USGS
science for a changing world
Hazard Exposure Reporting and Analytics (HERA)
Overview
Data and Methods
Help
Contact Us
Disclaimer
Hazard
Coastal Storm
None Annual 20-year 100-year
Sea Level Rise (cm)
0 25 50 75 100 150 200
Location
Select All Clear All
Marin County
Napa County
Orange County
San Diego County
San Francisco County
San Luis Obispo County
San Mateo County
Exposure
Economics
Employees
Parcel value
Building replacement value
Reporting & Analytics
East Palo
Palo Alto
Building Replacement Value
by census block
< $7,658,000
$7,658,000 - $34,612,318
$34,612,318 - $102,094,000
$102,094,000 - $271,574,363
$271,574,363 - $715,295,286
Opacity
Min/Max
Flooding Potential
Opacity
Powered by Leaflet
Accessibility
FOIA
Privacy
Policies and Notices
U.S. Department of the Interior U.S. Geological Survey
URL: http://geography.wr.usgs.gov/science/vulnerability/HERA.htm
Page Last Modified: Thursday, 16-Mar-2017 17:40:08 EDT

Hazard

Coastal Storm

None Annual 20-year 100-year

Sea Level Rise (cm)

0 25 50 75 100 150 200

Location

Select All Clear All

- San Mateo County
- Santa Barbara County
- Santa Clara County
- Solano County
- Sonoma County
- Ventura County

Exposure

Economics

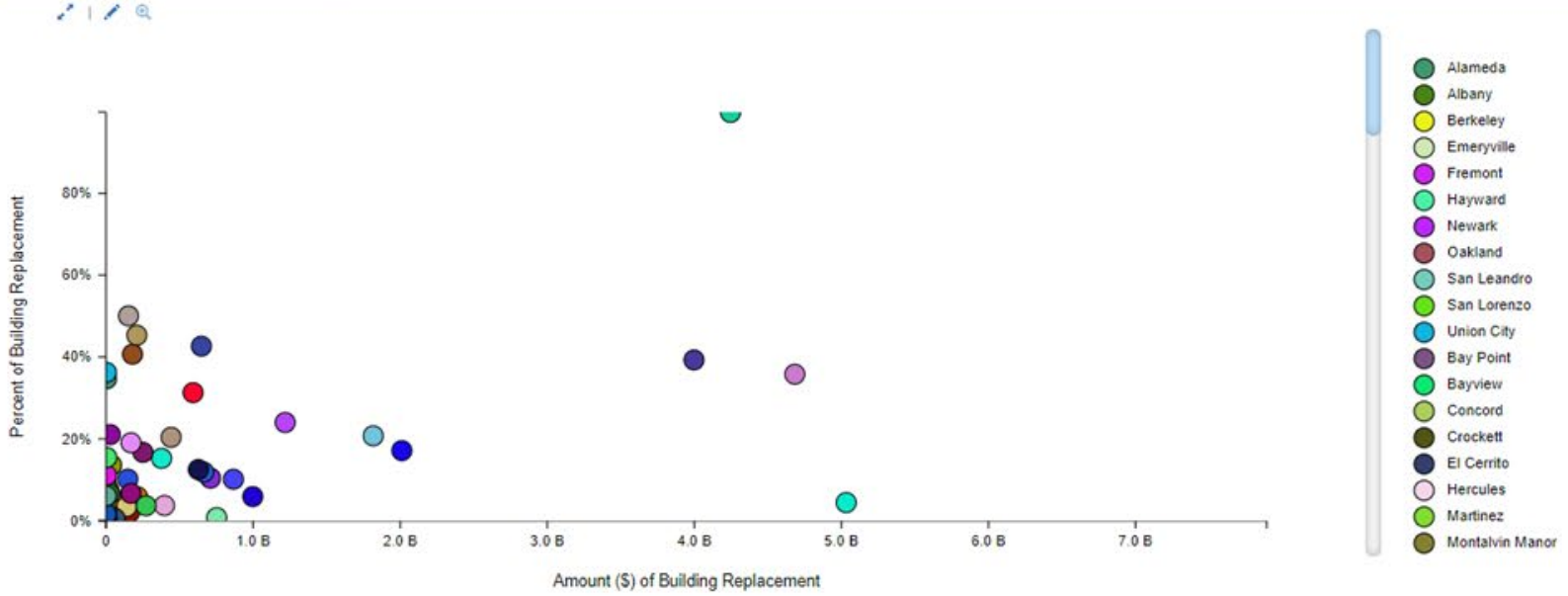
Employees
Parcel value
Building replacement value

Reporting & Analytics

Printer Friendly

Amount (dollars) and percent of community building replacement in hazard zones

Assuming 20-yr coastal storm with 150 cm of sea level rise



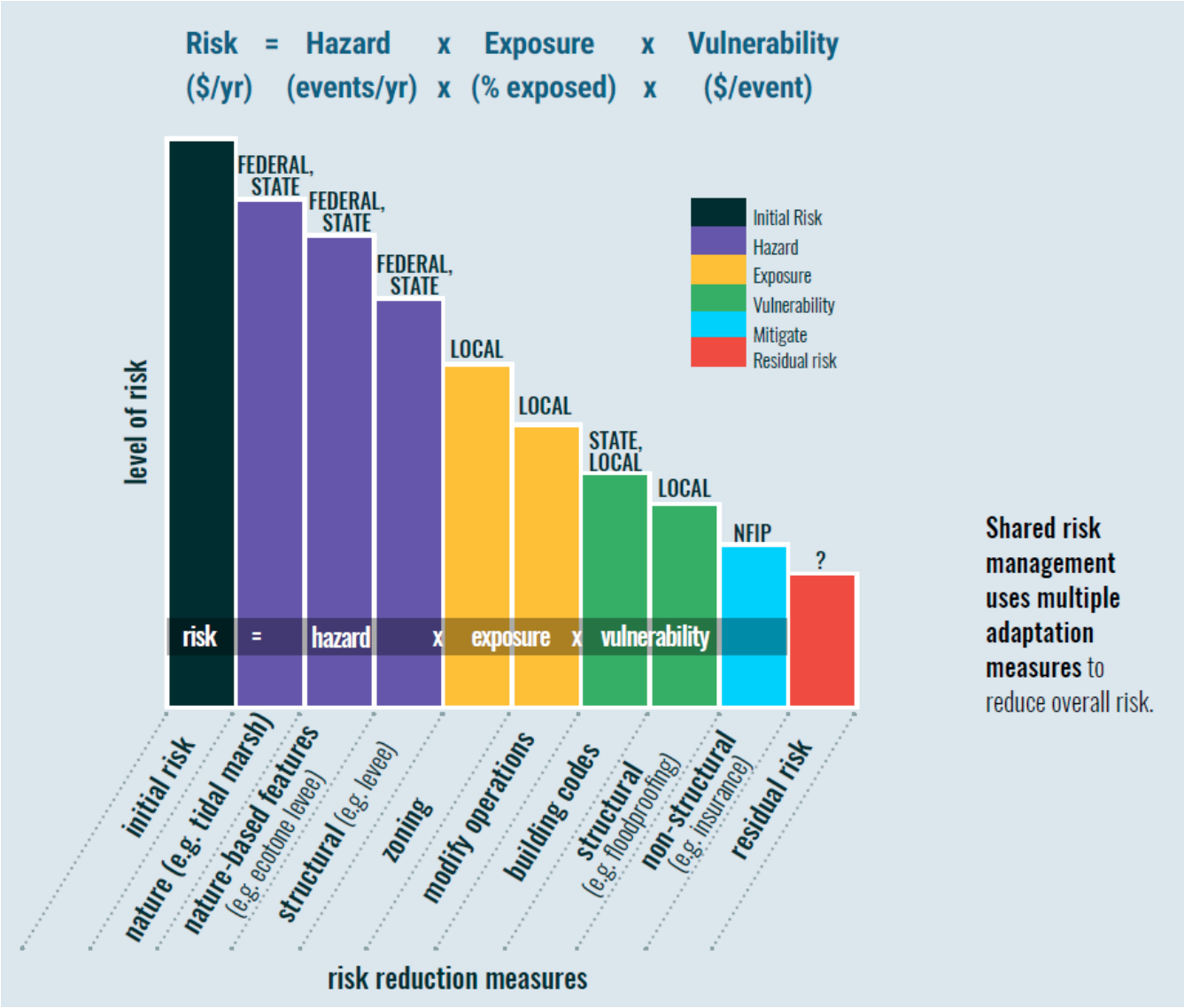
Amount (dollars) of building replacement in hazard zones and sea level rise projections

Assuming 20-yr coastal storm with 150 cm of sea level rise

Getting Clear on Roles and Responsibilities

A Regional Framework to manage flooding and Sea Level Rise can:

- Make sure we are asking the right questions
- Establish clear roles and responsibilities of appropriate agencies and organizations in each activity area to share risk
- Ensure resources are allocated to appropriate agencies and organizations to execute roles and responsibilities.
- Advance projects at local and/or sub-regional level that achieve desired risk reduction
- Track performance of risk sharing at the regional scale in Plan Bay Area



2020 Climate Bond Proposals

2020 Climate Bond Funding Comparison Chart			
	SB 45 (Allen) (millions)	AB 352 (Garcia) (millions)	Governor's Budget* (millions)
Resiliency/Climate Risk Reduction	**$4,129**	**$2,965**	**$4,750**
Wildfire, flood, drought and other natural disaster prevention and community resilience	$1,619	$ 1,250	
Safe drinking water and protecting water supply and water quality from climate risks	$1,170	$925	
Fish and wildlife protection from climate risks	$520	$475	
Agricultural land protection from climate risks	$190	$100	
Protecting coastal lands, waters, natural resources, and wildlife from climate risks	$630	$215	

*Governor's Budget directs 80% of funds to mitigate near-term risks (wildfire, floods and drought). The remaining 20% is reserved for reducing longer-term risks related to sea level rise and extreme heat. Includes $ for resiliency planning and demonstration projects to protect critical infrastructure.

For Discussion:

1. Can we agree that this risk-management approach is workable as a region? Do you agree we are on the right track?

1. How can we best organize ourselves to:
   - Continue to strengthen & integrate resiliency in Plan Bay Area
   - Develop Guiding Principles
   - Agree on Roles & Responsibilities of key stakeholders
   - Establish Work Groups to build out each activity area (columns)
   - Inform legislative programs to support framework

Preparing for Rising Seas: How the State Can Help Support Local Coastal Adaptation Efforts

LAO

GABRIEL PETEK
LEGISLATIVE ANALYST
DECEMBER 2019

Cover Photo: The cover image of high tides along the Embarcadero in San Francisco was taken by Dave Rauenbuehler, @daver6 via Flickr.

Table of Contents

Executive Summary

Important for Coastal Communities to Begin Preparing for Sea-Level Rise (SLR)

California Faces the Threat of Extensive and Expensive SLR Impacts. California's coast could experience SLR ranging from about half of 1 foot by 2030 up to about 7 feet by 2100. Periodic events like storms and high tides will produce even higher water levels and increase the risk of flooding. Rising seas will also erode coastal cliffs, dunes, and beaches which will affect shorefront structures and recreation.

Most Responsibility for SLR Preparation Lies With Local Governments, However, the State Has a Vested Interest in Ensuring the Coast Is Prepared. Most of the development along the coast is owned by either private entities or local governments—not the state. Additionally, most land use policies and decisions are made by local governments, and they are most knowledgeable about their communities. Local governments will need to grapple with which existing infrastructure, properties, and natural resources to try to protect from the rising tides; which to modify or move; and which may be unavoidably affected. However, given the statewide risks, the state can play an important role in encouraging and supporting local efforts and helping to alleviate some of the challenges local governments face.

Many Coastal Communities Are Only in the Early Stages of Preparing for SLR. The progress of SLR preparation across the state's coastal communities has been slow. Moreover, few coastal communities have yet begun implementing projects to respond to the threat of rising seas. Coastal communities must increase both the extent and pace of SLR preparation efforts if California is to avoid the most severe, costly, and disruptive impacts in the coming decades.

Delaying SLR Preparations Will Result in Lost Opportunities and Higher Costs. Planning ahead means adaptation actions can be strategic and phased, helps "buy time" before more extreme responses are needed, provides opportunities to test approaches and learn what works best, and may make overall adaptation efforts more affordable and improve their odds for success. The next decade represents a crucial time period for taking action to prepare for SLR.

Local Adaptation Efforts Face Several Key Challenges

Funding Constraints Hinder Both Planning and Projects. Local governments cite funding limitations as their primary barrier to making progress on coastal adaptation efforts.

Limited Local Government Capacity Restricts Their Ability to Take Action. The novelty of the climate adaptation field makes it hard for local governments to locate and hire individuals with appropriate experience and expertise.

Adaptation Activities Are Constrained by a Lack of Key Information. Local governments cite a need for additional data and technical assistance to help inform their adaptation decisions.

Few Forums for Shared Planning and Decision-Making Impede Cross-Jurisdictional Collaboration. Even though the interrelated effects of SLR make cross-jurisdictional planning essential, local governments lack formal and strategic ways to learn from each other or make decisions together about coastal adaptation issues.

Responding to SLR Is Not Yet a Priority for Many Local Residents or Elected Officials. Because many California residents are not yet aware of how and when SLR might affect their communities, coastal adaptation actions are not a high priority for them to request from their local governments.

Protracted Process for Attaining Project Permits Delays Adaptation Progress. Achieving regulatory approval for coastal adaptation projects is complicated and takes a long time.

LAO Recommendations for Supporting Local Adaptation Efforts

While our recommendations represent incremental steps that will not be sufficient to address all the anticipated impacts of SLR, they represent prerequisites along the path to more robust statewide preparation.

Foster Regional-Scale Adaptation

- Establish and assist regional climate adaptation collaborative groups to plan together and learn from each other regarding how to respond to the effects of climate change.
- Encourage development of regional coastal adaptation plans to address key risks that SLR poses to the region, as well as strategies the region will take to address them.
- Support implementation of regional adaptation efforts by contributing funding towards construction of projects identified in regional plans.

Support Local Planning and Adaptation Projects

- Increase assistance for cities and counties to conduct vulnerability assessments, adaptation plans, and detailed plans for specific projects.
- Support coastal adaptation projects with widespread benefits such as those that pilot new techniques, protect public resources, reduce damage to critical infrastructure, or address the needs of vulnerable communities.
- Facilitate post-construction monitoring of state-funded demonstration projects to learn more about which adaptation strategies are effective.

Provide Information, Assistance, and Support

- Establish the California Climate Adaptation Center and Regional Support Network to provide technical support and information to local governments on adapting to climate change impacts.
- Develop a standardized methodology and template that local governments can use to conduct economic analyses of SLR risks and adaptation strategies.
- Direct the California Natural Resources Agency to review and report back regarding how regulatory permitting processes can be made more efficient.

Enhance Public Awareness of SLR Risks and Impacts

- Require coastal flooding disclosures for real estate transactions to spread public awareness about SLR and allow Californians to make informed decisions about the risks of purchasing certain coastal properties.
- Require that state-funded adaptation plans and projects include robust public engagement efforts to help develop societal awareness about SLR, build acceptance for adaptation steps, and ensure the needs of vulnerable communities are addressed.
- Direct state departments to conduct a public awareness campaign about the threats posed by SLR to develop public engagement in and urgency for taking action.

INTRODUCTION

State's Climate Change Response Will Require Both Mitigation and Adaptation. In recent years, California has taken steps to limit the effects of climate change by enacting policies and programs to reduce emissions of greenhouse gases. While these efforts—if combined with similar global initiatives—ultimately may constrain the total amount of warming the planet experiences, scientists are conclusive that some degree of climate change already is inevitable. The changing climate will have several consequential effects on California over the coming decades. Indeed, such impacts have already begun. In recent years, the state experienced a severe drought, multiple serious wildfires, and periods of record-breaking heat, all of which scientists suggest likely are harbingers of future conditions. In addition to these more episodic events, science has shown that the changing climate will result in a gradual and permanent rise in global sea levels. Given the significant natural resources, public infrastructure, housing, and commerce located along California's 840 miles of coastline, the certainty of rising seas poses a serious and costly threat. As such, in the coming years the state will need to broaden its focus from efforts to *mitigate* the effects of climate change to also undertake initiatives centered on how communities can *adapt* to the approaching impacts.

Report Responds to Increasing Legislative Interest in Climate Adaptation. This report responds to increasing legislative interest in determining how the state can best prepare for the impacts of climate change, including sea-level rise (SLR). In recent years, the Legislature has held several hearings on SLR and coastal adaptation, formed two related select committees, and deliberated multiple legislative proposals on these topics. In addition, the Governor and some legislative members have indicated interest in placing a new general obligation bond on the 2020 ballot for voter approval that would provide funding for climate adaptation activities.

Report Focuses on How State Can Support Local Coastal Adaptation Efforts. Although the risk presented by SLR is an issue of statewide importance, most of the work to prepare for and respond to these changes has to take place at the local level. This is because most of the development along the coast is owned by either private entities or local governments—not the state. Additionally, most land use policies and decisions are made by local governments, and they are most knowledgeable about the needs and specific circumstances facing their communities. However, the state can play an important role in encouraging and supporting local efforts and helping to alleviate some of the challenges that local governments face in preparing for SLR. Given the importance of protecting the state's residents, economy, and natural resources from considerable damages, this report focuses on how the Legislature can help support and expedite progress in preparing for rising seas at the local level. (While the state will also need to take action to prepare for potential impacts to assets for which it has primary responsibility—like coastal highways and state parks—consideration of those steps is outside the scope of this report.) This focus and our recommendations represent a continuation of the state's long-standing role in facilitating and incentivizing implementation of state objectives at the local level. While adopting our recommended actions will not be sufficient to address all the projected impacts of SLR, they represent important incremental steps towards greater preparation across the state.

Findings Informed by Extensive Interviews and Research. The findings and recommendations presented in this report are informed by interviews we conducted with over 100 individuals. These interviewees represented local governments from across the state, academic researchers, community groups, nongovernmental organizations, federal agencies, and state departments. We also reviewed relevant reports and academic literature, including several statewide surveys conducted on the topics of coastal adaptation, climate change preparation, and local government planning. The resources we reference within the report are listed in the "Appendix."

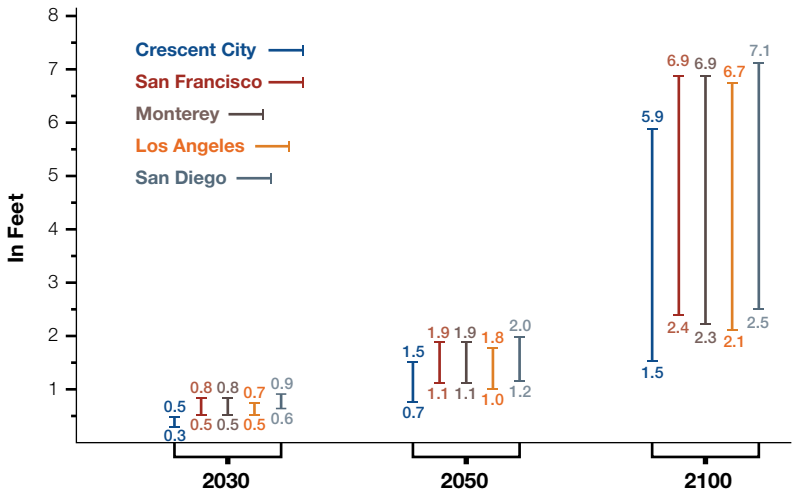
CALIFORNIA FACES THREAT OF RISING SEAS AND TIDES

Coast Will Experience Encroaching Seas in Coming Decades. Climate scientists have developed a consensus that one of the effects of a warming planet is that global sea levels will rise. The degree and timing of SLR, however, is still uncertain, and depends in part, upon whether global greenhouse gas emissions and temperatures continue to increase. **Figure 1** displays recent scientific guidance compiled by the state for how sea levels may rise in various coastal areas of California in the coming decades. As shown, the magnitude of SLR is projected to be about half of 1 foot in 2030 and as much as 7 feet by 2100. The estimates shown in the figure represent the range between how sea levels might rise across the state under two different climate change scenarios. The bottom end of the range reflects the lower bound of a "likely" scenario (with a projected 66 percent chance of occurring). The top end reflects the upper bound of a higher risk and more impactful scenario (with a projected 1-in-200 chance of occurring). As shown, the range between these scenarios is greater in 2100, reflecting the increased level of uncertainty about the degree of climate change impacts the planet will experience further in the future.

Figure 2 displays a detailed map of how current SLR projections translate into potential flooding in the San Francisco (SF) Bay Area. The map shows flooding projected to occur with 2 feet of SLR combined with a ten-year storm surge (that is, the temporary flood effects from a storm that has a one-in-ten likelihood of occurring in a given year). This combination of events would result in a total water level of over 4 feet. As shown, under this scenario—and given existing shoreline protections and conditions—many portions of the SF Bay shoreline would become inundated. For example, as highlighted in the map, this would result in severe flooding for Foster City, the Oakland International Airport, and the toll plaza for the SF Bay Bridge in Oakland. This combination of SLR and storm is well within the range of possibilities that could occur within the next 50 years. Combining a significantly high-tide event with SLR would result in even more severe flooding across the region than that shown in this map.

Figure 1

Range of Sea-Level Rise Projections for the California Coast[a]



[a] Estimates represent the range between "likely" scenarios with a 66 percent chance of occurring and scenarios with a 1-in-200 chance of occurring. Range does not include estimates associated with "extreme" scenarios incorporating the effects of potential ice loss from the West Antarctic Ice Sheet, which are significantly higher.

From the *State of California Sea-Level Rise Guidance Document* published by the California Natural Resources Agency and the California Ocean Protection Council.

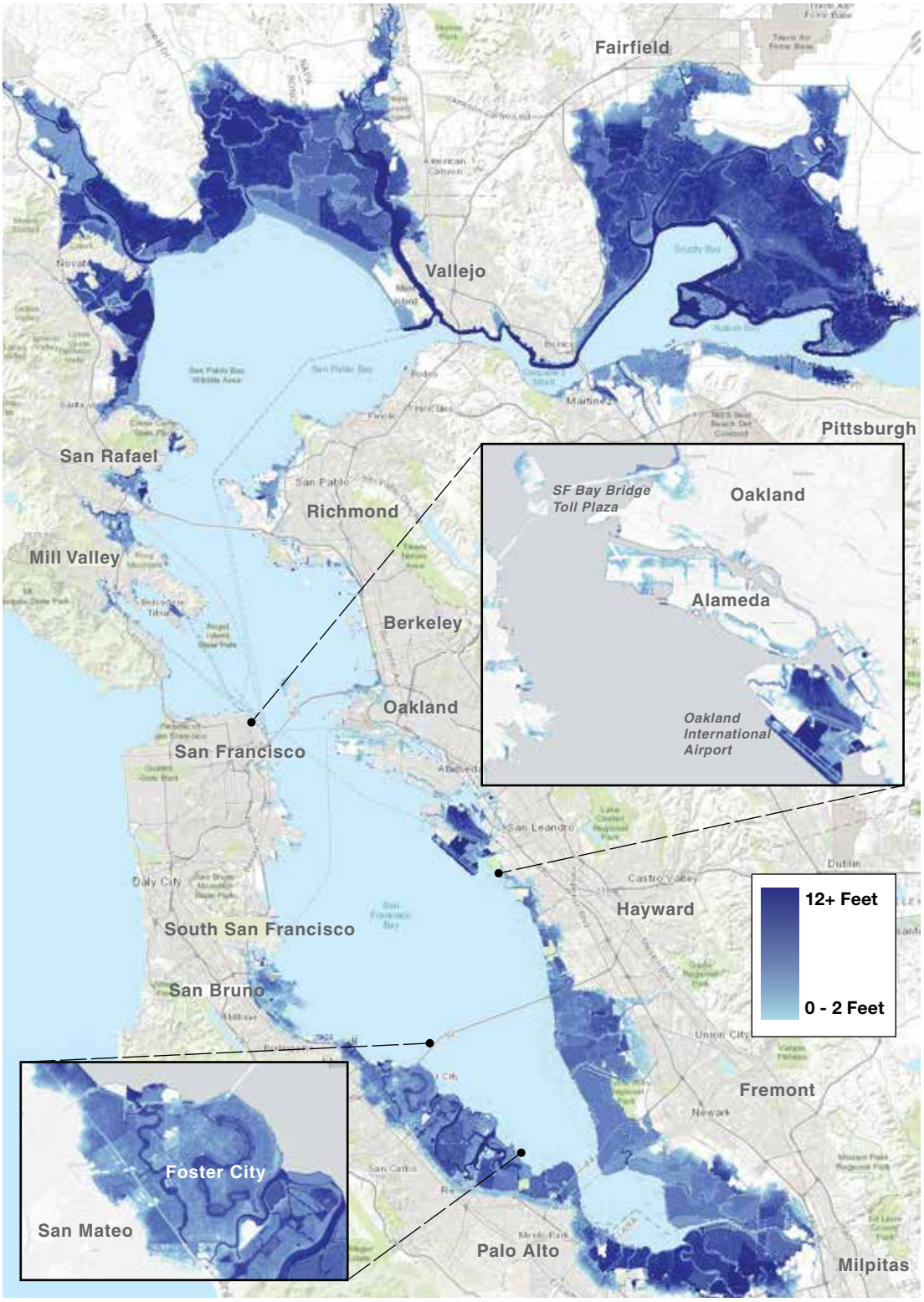
LAO

Storms and Future Climate Impacts Could Raise Water Levels Further. Although they would have substantial impacts, the SLR scenarios displayed in Figure 1 likely *understate* the increase in water levels that coastal communities will actually experience in the

Figure 2

Potential Impacts of Sea-Level Rise (SLR) and Flooding in the San Francisco Bay Area

Predicted Shoreline Flooding With 2 Feet of SLR and a Ten-Year Storm Surge[a]



[a] A ten-year storm surge represents the temporary flood effects from a storm that has a one-in-ten likelihood of occuring in a given year.

Map courtesy of the San Francisco Bay Conservation and Development Commission's Adapting to Rising Tides Bay Shoreline Flood Explorer.

SF = San Francisco

coming decades. This is because climate change is projected to contribute to more frequent and extreme storms, and the estimates shown in Figure 1 do not incorporate potential increases in sea levels caused by storm surges, exceptionally high "king tides," or El Niño events. These periodic events could produce notably higher water levels than SLR alone. Moreover, the data displayed in the figure do not include significantly higher estimates associated with "extreme" scenarios that incorporate the effects of potential ice loss from the West Antarctic Ice Sheet. The likelihood of these severe scenarios occurring is still uncertain, but possible. If there is considerable loss in the polar ice sheets, scientists estimate that San Francisco could experience over 10 feet of SLR by 2100.

SLR Impacts Have Potential to Be Extensive and Expensive. The potential changes in sea levels and coastal storms will impact both human and natural resources along the coast. These events will increase the risk of flooding and inundation of buildings, infrastructure, wetlands, and groundwater basins. A 2015 economic assessment by the Risky Business Project estimated that if current global greenhouse gas emission trends continue, between $8 billion and $10 billion of existing property in California is likely to be underwater by 2050, with an additional $6 billion to $10 billion at risk during high tide. A recent study by researchers from the U.S. Geological Survey (USGS) estimates that by 2100, roughly 6 feet of SLR and recurring annual storms could impact over 480,000 California residents (based on 2010 census data) and $119 billion in property value (in 2010 dollars). When adding the potential impacts of a 100-year storm, these estimates increase to 600,000 people and over $150 billion of property value.

Rising seas will also erode coastal cliffs, dunes, and beaches—affecting shorefront infrastructure, houses, businesses, and recreation. The state's *Safeguarding California Plan* cites that for every foot of SLR, 50 to 100 feet of beach width could be lost. Moreover, a recent scientific study by USGS researchers predicted that under scenarios of 3 to 6 feet of SLR—and absent actions to mitigate such impacts—up to two-thirds of Southern California beaches may become completely eroded by the year 2100. Such a loss would impact not only Californians' access to and enjoyment of key public resources, but also beach-dependent local economies. While no entity has completed a comprehensive economic assessment of beach-related recreation across the state, a 2016 report by the Center for the Blue Economy estimated that California's ocean economy—including tourism, recreation, and marine transportation—is valued at over $44 billion per year.

SLR Impacts Could Have Fiscal Implications at Both Local and State Levels. The potential impacts of SLR also could have negative impacts on the economy and tax base—both locally and statewide—if significant damage occurs to certain key coastal infrastructure and other assets. These include ports, airports, railway lines, beaches and parks used for recreation, and high-technology companies located along the SF Bay. Furthermore, if property values fall considerably from the increased risk and frequency of coastal flooding, over time this will affect the annual revenues upon which those local governments depend. To the degree local property tax revenues drop, this also could affect the state budget because the California Constitution requires that losses in certain local property tax revenues used to support local schools be backfilled by the state's General Fund.

SLR Threatens Vulnerable Populations. Not all of the assets threatened by SLR are expensive homes and affluent communities. In contrast, many communities with more vulnerable populations also face the risk of more frequent flooding. Such populations include renters (who are less able to prepare their residences for flood events), individuals not proficient in English (who may not be able to access critical information about potential SLR impacts), residents with no vehicle (who may find it more difficult to evacuate), and residents with lower incomes (who have fewer resources upon which to rely to prepare for, respond to, and recover from flood events). For example, a 2012 study conducted by the SF Bay Conservation and Development Commission's (BCDC) Adapting to Rising Tides Project found that SF Bay Area locations at risk of inundation from SLR included more than 9,000 renter-occupied households,

over 2,500 linguistically isolated households, over 2,000 households with no vehicle, and over 15,500 individuals living in households earning less than 200 percent of the federal poverty level.

COASTAL ADAPTATION ACTIVITIES CAN HELP LESSEN SLR IMPACTS

While the estimates cited above highlight the potential damages, costs, and disruption that SLR could cause, strategies for moderating such impacts exist.

Three Primary Options Exist for Adapting to SLR. The state, coastal communities, and private property owners essentially have three categories of strategies for responding to the threat that SLR poses to assets such as buildings, other infrastructure, beaches, and wetlands. As shown in **Figure 3** (on page 8), they can (1) build hard or soft barriers to try to stop or buffer the encroaching water and **protect** the assets from flooding, (2) modify the assets so that they can **accommodate** regular or periodic flooding, or (3) **relocate** assets from the potential flood zone by moving them to higher ground or further inland. Each of these options comes with trade-offs, as discussed in the figure, and not all strategies will work in every situation. Communities and residents are understandably reluctant to relocate existing properties, as this will be disruptive, expensive, and in some cases not logistically possible. Armoring much of the coast to protect most assets, however, also is not practical. Not only would such an approach be prohibitively expensive and have decreasing effectiveness over the years as more intense wave action migrates inland, it also would disrupt natural erosion processes such that it would cause much of the sand on the state's beaches to disappear.

Selecting which combination of SLR adaptation approaches to use in a particular location is an involved process necessitating scientific research, locally specific information, public and stakeholder input and support, both high-level and detailed planning, and—in many cases—additional funding. Local governments planning for SLR are also balancing other—and sometimes competing—land use objectives. As we discuss in the box on page 9, SLR presents particular challenges for coastal jurisdictions—and the state—seeking to expand the supply of housing units.

Undertaking Coastal Adaptation Activities Likely Less Costly Than Avoiding Action. The types of adaptation efforts described in Figure 3 can not only help mitigate disruptive SLR impacts, in many cases they also make sense from a fiscal perspective. That is, while such activities might require up-front investments, the costs of failing to adequately prepare for the impacts of SLR likely would cost even more. Recent research found a strong benefit-to-cost ratio for undertaking mitigation projects ahead of disasters compared to spending on disaster response and recovery. Specifically, a Federal Emergency Management Agency (FEMA)-sponsored study by the National Institute of Building Sciences found that for every $1 the federal government invested in various types of pre-disaster mitigation activities in recent years, it avoided public and private losses totaling $6. Designing new structures to be more resilient to natural hazards was also found to be financially advantageous. For example, in the case of riverine flooding, the study estimates that for every extra $1 spent to build new buildings higher out of the floodplain than international building codes require, $5 in flood damage-related costs was avoided. While the study was based on retrospective data on other types of disasters and did not consider future SLR-related coastal flooding, similar principles likely apply. That is, investing in adaptation activities that will help to mitigate significant flooding, damage, disruption, and erosion that will otherwise occur from SLR is almost certainly a less costly approach overall compared to not taking such actions.

Figure 3

Three Key Strategies for Adapting to Sea-Level Rise (SLR)

PROTECT

Place hard or soft barrier between development and the sea to reduce exposure to flooding or erosion. Hard protection ("armoring") consists of constructing physical structures to keep water back, such as seawalls, groins, revetments, and levees. Soft protection consists of efforts to enhance natural infrastructure's ability to buffer against the water, such as building up sand dunes, adding sand to beaches, and expanding wetlands.

ADVANTAGES

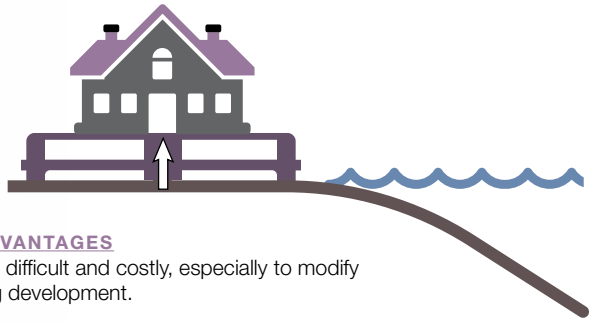
Can allow existing development and infrastructure to remain in place. Can be less costly than other alternatives.

DISADVANTAGES

Hard protection can contribute to beach erosion and increased flooding in adjacent areas. Soft protection likely will become a less viable strategy once sea levels rise to the higher stages of projected levels.

ACCOMODATE

Modify or design development in ways that will withstand SLR without damage, such as by elevating buildings or infrastructure, floodproofing structures, and building on floating structures.



ADVANTAGES

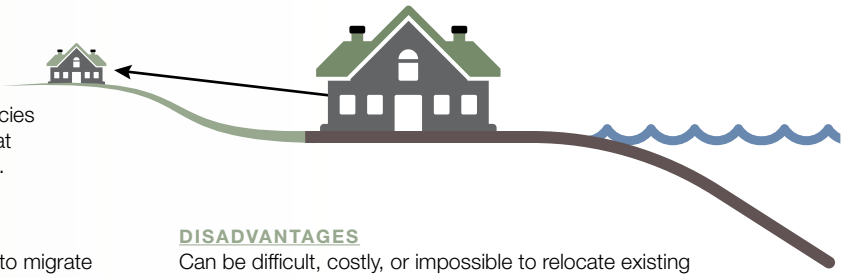
Can allow existing development and infrastructure to remain in place once modified. Can allow for new development in areas that may face flooding in the future.

DISADVANTAGES

Can be difficult and costly, especially to modify existing development.

RELOCATE

Remove or move existing development to less risky areas and limit the construction of new development in vulnerable areas. This could include physically moving an asset or facility that is at risk, or adopting zoning policies that prohibit new development or require that it be "set back" from potential hazard zones.



ADVANTAGES

Can provide space for beach and wetlands to migrate inland as water rises. Ensures development locations are/will be safe from flooding.

DISADVANTAGES

Can be difficult, costly, or impossible to relocate existing development. Renders certain parcels of land unavailable for development.

LAO

SLR Complicates State's Housing Objectives

The potential impacts of sea-level rise (SLR) create complications for a different state and local priority—increasing housing availability and affordability. California faces a serious housing shortage, and the state's coastal areas are experiencing the most acute population growth, high housing costs, and demand for more affordable housing. Our office has estimated that on top of the 100,000 to 140,000 housing units typically built in the state each year, California probably would have to build as many as 100,000 additional units annually—almost exclusively in its coastal communities—to seriously mitigate housing affordability problems. In recent years, the state has implemented a number of measures intended to encourage local governments to build more housing, including providing additional funding and instituting new penalties for jurisdictions that fail to comply with state housing laws.

Flooding caused by SLR poses two serious impediments to coastal jurisdictions seeking to meet these state housing objectives. First, over the coming decades some existing housing units along the coast will experience regular flooding and become uninhabitable. Second, some parcels of land that do not currently contain housing—and therefore may seem like apt locations for new development—also face the likelihood of flooding in future years. While local governments may be reluctant to adopt policies restricting development on these parcels given their current viability, the future hazards make them risky locations to construct new housing. Certain adaptation strategies described in Figure 3 could help to safeguard some existing properties and land parcels from the effects of SLR—including protecting them through armoring, or building or retrofitting structures such that they can accommodate flooding. As described in the figure, however, these strategies come with trade-offs, including costs and effects on adjacent areas. The degree of SLR that is predicted over the next century clearly will affect land use decisions and create additional challenges for local governments—and the state—as they seek to expand housing options for Californians in coastal regions.

LOCAL RESPONSES TO SLR WILL BE KEY TO STATEWIDE PREPAREDNESS

Most Responsibility for SLR Preparation Lies With Local Governments . . . Most of the development along the coast is owned by either private entities or local governments—not the state. Additionally, most land use policies and decisions are made at the local level, and local governments are most familiar with the specific circumstances facing their communities. As such, responsibility to prepare for and respond to the impacts of SLR lies primarily with the affected local communities. Deciding how to confront these challenges and implement the strategies described in Figure 3 will be both difficult and costly. Local governments will need to grapple with which existing infrastructure, properties, and natural resources to try to protect from the rising tides; which to modify or move; and which may be unavoidably affected.

. . . However, the State Has a Vested Interest in Ensuring the Coast Is Prepared. As discussed in more detail later in this report, the 1976 California Coastal Act grants the state special jurisdiction over land use decisions along the coast. Specifically, unlike other areas of California, along certain portions of the coast the state possesses the authority to regulate activities that change the intensity of use of land, with the intended goal of balancing development with protecting the environment and public access. This authority, combined with a motivation to minimize costly and traumatic damage for residents

and their property, creates a strong rationale and incentive for the state to help ensure that local jurisdictions plan for and take action to adapt to SLR. Californians could experience serious public health and safety impacts if local governments do not take proper steps to prepare for how SLR will affect certain coastal infrastructure. Such impacts include threats to drinking water (from impacts to coastal groundwater aquifers and water treatment plants, and damage to levees in the Sacramento San Joaquin Delta), sewage treatment, local transportation infrastructure, and other essential facilities such as hospitals and schools. Moreover, the state is charged with overseeing natural resources on behalf of the public trust and, thus, is responsible for ensuring the preservation of public access to the coast and the health of coastal wetlands, wildlife, and habitats. As discussed earlier, SLR damages also would have fiscal implications, which the state will want to try to minimize.

CALIFORNIA IS IN BEGINNING STAGES OF PREPARING FOR SEA-LEVEL RISE

In this section we discuss how the state, federal, and local governments currently are engaged in preparing to adapt to the impacts of SLR.

State-Level Efforts

Multiple State Departments Have SLR-Related Responsibilites. As summarized in **Figure 4**, a number of state departments are engaged in efforts to prepare for and respond to the impacts of SLR. Additionally, senior-level staff from each of the departments shown in the figure—together with representatives from the Delta Stewardship Council—meet periodically to discuss statewide policy and priorities through a Sea-Level Rise Leadership Team they have formed. Besides the activities described in the figure, many state departments also are taking initial steps to assess how SLR will impact the state facilities and essential services for which they are responsible. Such steps were spurred by Governor Schwarzenegger's Executive Order S-13-08 (which in 2008 directed state agencies to begin planning for SLR and climate impacts), and several iterations of the *Safeguarding California Plan* (which was compiled by the California Natural Resources Agency [CNRA] and serves as the roadmap for steps that state agencies and departments should take to respond to the changing climate). One department managing significant state assets that are at risk from SLR is the California Department of Transportation (Caltrans), which manages state highways along the coast. Another is the Department of Water Resources, which manages the State Water Project, a water conveyance system that is highly dependent on the integrity of the levees in the Sacramento San Joaquin Delta to successfully move drinking water from the northern to the southern part of the state.

Additional Departments May Have More Involvement With SLR Adaptation in the Future. Two state departments not shown in Figure 4 that have had limited involvement with SLR activities thus far but may have increased roles in the future are the Strategic Growth Council (SGC) and California Office of Emergency Services (CalOES). Currently, SGC administers several state programs that are primarily designed to reduce greenhouse gas emissions, and its engagement on SLR-related issues has been relatively limited. As the state expands its focus beyond climate change *mitigation* into a greater emphasis on *adaptation*, however, the Legislature may choose to task SGC with additional responsibilities given the Council's experience in managing climate-related programs. Additionally, CalOES directs disaster preparedness and response activities in California, including overseeing local disaster mitigation planning efforts and administering associated federal programs and funding. Correspondingly, as California communities increase preparation for and begin to experience the impacts of SLR, CalOES likely will play a role in supporting such efforts.

State Has Been Engaged in SLR Planning, Data Collection, and Information Dissemination. The state has published a number of reports in recent years concerning SLR projections and steps the state and local governments might take to respond. Among these is the *State of California Sea-Level Rise Guidance Document*, which was initially adopted in 2010 and most recently updated in 2018. This document—developed by the Ocean Protection Council (OPC) in coordination with other partner agencies—provides (1) a synthesis of the best available science on SLR projections and rates for California, (2) a stepwise approach for state agencies and local governments to evaluate those projections and related hazard information in their decision-making, and (3) preferred coastal adaptation approaches. Other SLR-related plans and reports the state has released in recent years include several iterations of the aforementioned *Safeguarding California Plan* (each of which consists of multiple companion reports), four *California Climate Change Assessment* reports (also encompassing multiple companion reports), the *California State Hazard Mitigation Plan*, and *Paying It Forward: The Path Toward Climate-Safe Infrastructure in California*.

Additionally, pursuant to Chapter 606 of 2015 (SB 246, Wieckowski), the Governor's Office of Planning and Research (OPR) operates the Integrated Climate Adaptation and Resilience Program. This program is intended to develop a cohesive and coordinated response to the impacts of climate change across the state and has two components. First, a Technical Advisory Council helps OPR and the state improve and coordinate climate adaptation activities. Second, OPR has created a searchable online public database of adaptation and resilience resources—known as the State Adaptation Clearinghouse—including some related to SLR and coastal adaptation. The

Figure 4

State Departments With Major Sea-Level Rise (SLR) Related Responsibilities

Department	Primary SLR-Related Responsibilities
California Coastal Commission	Regulates the use of land and water in the coastal zone, excluding the San Francisco (SF) Bay Area. (The coastal zone generally extends 1,000 yards inland from the mean high tide line.) Reviews and approves Local Coastal Programs (LCPs)—plans that guide development in the coastal zone. Maintains permitting authority over proposed projects in areas in the coastal zone with no approved LCP and for state-managed lands such as state parks.
SF Bay Conservation and Development Commission	Reviews and issues regulatory permits for projects that would fill or extract materials from the SF Bay, and works to preserve public access along the bay's shore. Participates in the SF Bay Area's multiagency regional effort to address the impacts of SLR on shoreline communities and assets. Administers the Adapting to Rising Tides Program to support SLR-related planning and projects in the SF Bay Area.
Ocean Protection Council	Allocates grants for SLR and coastal adaptation projects and research. Conducts and distributes data and information to help local jurisdictions and state departments plan for SLR, including developing the *State of California Sea-Level Rise Guidance Document.*
State Coastal Conservancy	Allocates grants for and undertakes projects to preserve, protect, and restore the resources of the California coast and the SF Bay Area. Provides grants for planning and projects through its Climate Ready Program to increase the resilience of coastal communities and ecosystems to climate change impacts such as SLR.
State Lands Commission	Stewards sovereign state lands, including those located between the ordinary high water mark of tidal waters and the boundary between state and federal waters three miles offshore. Monitors sovereign state lands the Legislature has delegated to local municipalities to manage in trust for the people of California.
Governor's Office of Planning and Research	Administers the Integrated Climate Adaptation and Resilience Program, which includes a web-based clearinghouse that compiles information about climate change adaptation research and projects, including those related to SLR.
Department of Parks and Recreation	Owns and manages more than one-quarter of California's coastline. Responsible for protecting and conserving these beaches, wetlands, and other coastal resources on behalf of the public.

Clearinghouse includes resources such as local plans, educational materials, policy guidance, data, research, and case studies.

State departments have undertaken certain other initiatives to support SLR-related activities around the state, some of which are mentioned in Figure 4. For example, BCDC has developed the Adapting to Rising Tides Program which provides adaptation planning support, guidance, tools, and information to SF Bay Area agencies and organizations. BCDC has also developed detailed maps of how potential future flooding might impact the SF Bay region. The State Coastal Conservancy (SCC) has developed additional SLR resources and helps to coordinate the California Coastal Resilience Network, which presents monthly webinars on coastal adaptation. OPC has undertaken several initiatives, including a recently enacted contract to conduct a relatively small-scale public awareness campaign about the risks associated with SLR.

State Has Provided Limited Funding for Coastal Planning and Projects. In addition to undertaking state-level planning and research, the state has also provided some limited funding for SLR planning and projects. **Figure 5** summarizes the funding appropriated by the Legislature for coastal adaptation activities over the past five years (2014-15 through 2019-20), totaling $67 million. These funds have been provided from a variety of sources. The Legislature has utilized bonds as the largest source of funding for these coastal adaptation activities ($26 million), followed by the Environmental License Plate Fund ($17.5 million) and the Greenhouse Gas Reduction Fund ($14.8 million). Much of this funding has been or will be used for grants to local governments and nongovernmental organizations for planning and projects, including through SCC's Climate Ready Program. The totals shown in the figure include $25 million for OPC and nearly $4 million for SCC appropriated in the *2018-19 Budget Act* that can be used for coastal adaptation projects, some of which likely has not yet been allocated for specific projects. In addition, a portion of the funds have been used for state department staff to undertake activities that assist local governments, such as staff support from BCDC and the Coastal Commission for local planning efforts.

In addition to the funding specifically for coastal adaptation shown in Figure 5, some other state funds have supported related work in recent years. This includes a program run by the Division of Boating and Waterways within the Department of Parks and Recreation (State Parks) that allocates grants for local beach erosion control and sand replenishment projects. Some other funding has been provided through sub-grants from other state departments. For example, both BCDC and some local governments have received funding from Caltrans for coastal adaptation planning and projects that involve transportation infrastructure. Some of BCDC's work supporting adaptation planning in the SF Bay Area has also been supported by some small grants from the Delta Stewardship Council, and SCC has received grants from the California Department of Fish and Wildlife for wetlands restoration projects.

Figure 5

Summary of Recent State Funding for Coastal Adaptation

2014-15 Through 2019-20 (In Millions)

Department	Primary Uses	Amount
Ocean Protection Council	Grants for adaptation projects, statewide research projects.	$34.6
State Coastal Conservancy	Grants for sea-level rise planning, grants for adaptation projects.	15.4
California Coastal Commission	Grants for local adaptation planning and to update Local Coastal Programs, staff support for those local planning efforts.	14.0
San Francisco Bay Conservation and Development Commission	Regulatory review of adaptation projects, grants for sea-level rise planning, staff support for regional planning efforts.	3.3
Total		**$67.3**

Federal-Level Efforts

Federal Government Has Supported Some Coastal Adaptation Activities in California. In general, the federal government's role in preparing for SLR in California has largely been to support the state and local agencies by providing technical assistance, scientific research and information, and some limited

funding. The primary federal agencies engaged in SLR-related activities in California are the National Oceanic and Atmospheric Administration (NOAA) and USGS. As discussed in the nearby box, FEMA has not had much involvement in coastal adaptation activities thus far, but likely will play a larger role in the future.

NOAA Provides Technical Assistance and Some Funding. NOAA works collaboratively with the state to implement the federal Coastal Zone Management Act and help protect coastal resources. Significant SLR-related initiatives that NOAA is undertaking in California include providing training on coastal adaptation planning, developing tools (including the "Sea Level Rise Viewer" that provides detailed digital maps of potential SLR flooding), and collaborating on data collection initiatives. In addition, NOAA annually provides funding to the three state departments designated to help implement the Coastal Zone Management Act—the Coastal Commission, BCDC, and SCC. Between 2016 and 2019, NOAA allocated a total of about $11 million to these three departments for their ongoing coastal management activities, of which about $1.8 million was explicitly for SLR-related projects and policy development. NOAA has also provided some specific one-time grants to state departments and local governments for SLR-response initiatives in California, including $690,000 to San Diego County for a coastal resiliency project described below.

USGS Provides Scientific Research and SLR Modeling. Unlike NOAA, USGS does not give out grants to the state or local agencies; rather,

Role of FEMA in Coastal Adaptation

FEMA Helps Communities Prepare for and Respond to Disasters. The Federal Emergency Management Agency (FEMA) works with the California Office of Emergency Services (CalOES) to help prepare for and recover from disasters. Therefore, like CalOES, FEMA likely will play a role in supporting the state's coastal communities as they get ready for and respond to sea-level rise (SLR) impacts. Such efforts could include providing federal disaster mitigation funding for projects designed to reduce the future impacts of SLR. After a state experiences a federally declared disaster, FEMA provides it with funding to undertake activities intended to lessen the impacts of future disasters through the Hazard Mitigation Grant Program. For example, in 2018 (after experiencing several wildfire disasters) California received over $500 million in disaster mitigation funding from FEMA. The state also received close to $500 million in 2017, when federal disasters were declared after wildfires and severe storms.

FEMA Funds Could Be Used for Coastal Adaptation Projects. While the Legislature could help identify priorities for the use of such funds, thus far it has deferred to CalOES to select which areas of focus and specific projects to support—subject to approval from FEMA—when the state receives disaster mitigation funds. In general, CalOES has opted to use such funds to prevent future disasters of the type that recently occurred. For example, it plans to use essentially all of the 2018 funding on wildfire mitigation projects. However, this is not a FEMA-imposed requirement. While FEMA does have some requirements around how disaster mitigation funds must be used—including that funded projects meet its cost-benefit analysis parameters—it allows these funds to be used to help lessen the potential impacts of many types of disasters, not just those that a state recently experienced. As such, the state could use FEMA pre-disaster funds for coastal adaptation projects to mitigate future SLR-related flooding—even if FEMA provides the funds after the state experiences wildfire-related disasters. CalOES indicates it plans to use about $50 million from the 2017 allocation of federal disaster mitigation funds for coastal projects. In general, however, this has not been a primary area of focus for such funds thus far.

USGS undertakes scientific research, which those agencies can then utilize. The largest SLR-related activity in which USGS is engaged in California is development of the Coastal Storm Modeling System (CoSMoS). This is a dynamic modeling approach that integrates predictions for (1) future SLR, (2) future coastal storms, and (3) long-term evolving coastal trends such as erosion to beaches and bluffs. Because it forecasts the potential interactions of these multiple events and impacts, this tool—which USGS has already completed for most of the state—allows for more detailed local predictions of future coastal flooding than models which only predict SLR. (The state has also contributed some funding to help develop CoSMoS.) In addition to developing CoSMoS, USGS is engaged in various other scientific research endeavors that relate to SLR, including monitoring coastal erosion and groundwater hazards, sea-floor mapping, and the Hazard Exposure Reporting and Analytics project that assesses the potential socioeconomic impacts of SLR within California's coastal communities.

Local-Level Efforts

Local Governments Can Undertake Multiple Steps to Prepare for SLR. While the magnitude and timing of SLR still are unknown, many of California's coastal communities have begun preparing for what level of risk they face and how they might respond over the coming decades. **Figure 6** highlights the key steps in this process. As shown, the first step for local governments typically is to conduct an assessment to ascertain how their residents, infrastructure, and services might be affected under different SLR scenarios. Next, they develop a high-level adaptation plan for how they might address those identified vulnerabilities. Subsequently, they begin to undertake the three stages of actually applying adaptation strategies to mitigate those risks—developing detailed plans, constructing projects, and undertaking ongoing monitoring and modifications to ensure effectiveness. While in many cases communities may undertake adaptation *projects*—such as building up sand dunes or restoring wetlands to serve as a wave buffer, or relocating infrastructure out of flood zones—they also may implement new policies as part of their adaptation strategies. These could include imposing limits on (1) where and when hard armoring may be used (in order to prevent the erosion of beaches), (2) new development, or (3) rebuilding in certain coastal areas.

The process described in Figure 6 represents a deliberate, strategic approach to undertaking coastal adaptation. However, state law does not require that local governments progress sequentially through the steps described in the figure—nor, indeed, that they undertake each step at all. (As noted earlier, Coastal Commission staff does encourage local governments that are updating their Local Coastal Programs [LCPs] to undertake SLR vulnerability assessments.) Local governments could opt to skip the first several proactive planning steps of this process and instead implement response activities on a reactive basis once they begin to experience SLR impacts. As we discuss later, however, to the degree local communities avoid undertaking proactive risk assessment and planning activities in the near term, they may lose some opportunities for minimizing damage and disruptive SLR impacts in future years.

Many Coastal Communities Have Begun Preparing for SLR, but Only in Early Stages. Data suggest that many communities around the state have begun to prepare for the effects of climate change. For example, OPR's statewide *Annual Planning Survey* found in 2018 that 60 percent of responding cities and counties have plans or strategies to adapt to the impacts of climate change. (This survey did not ask about SLR specifically.) However, a closer look at the status of adaptation planning around the state suggests that even for those jurisdictions that are beginning to address the impacts of climate change, the majority of coastal jurisdictions still are only in the initial stages of the SLR preparation process displayed in Figure 6. Specifically, a recent statewide survey called the *2016 California Coastal Adaptation Needs Assessment Survey*—conducted as part of *California's Fourth Climate Change Assessment*—asked coastal professionals about the current status of their adaptation work. Respondents included representatives from the local, state, and federal levels of government, as well as private

consultants and nongovernmental organizations. About one-third of respondents indicated they were primarily engaged in detecting and gathering information—such as by conducting vulnerability assessments. About half of respondents said they were developing adaptation and project plans—the second and third steps of the adaptation process shown in Figure 6. Only 16 percent indicated that they had transitioned to implementing and monitoring projects and policies. While these responses show slight progress compared to a similar survey conducted in 2011—in which a larger share reported they were still assessing their climate risks—the results show that few communities are yet ready to begin *implementing* SLR adaptation projects.

Moreover, the fact that most of the survey respondents indicated that they are engaged in *some* phase of adaptation work is not representative of the whole state, as highlighted by the OPR survey data. That is, this survey's responses seemingly over-represented coastal professionals who are engaging in adaptation work and under-represented those communities that have not yet begun this type of work. That even within this skewed sample group so few respondents indicated they are implementing projects underlines how much preparation work remains to be undertaken statewide.

Several Types of SLR Planning Efforts Underway at Local Level. While some local governments are undertaking SLR vulnerability assessments and adaptation plans on their own initiative, such efforts are also prompted by three key statutory requirements. First, as described in the box on the next page, the 1976 California Coastal Act encouraged coastal communities to develop LCPs, which include policies to govern new and existing development along the coast and protect coastal resources in accordance with

Figure 6

Key Steps for Local Governments to Prepare for Sea-Level Rise (SLR)

Conduct Vulnerability Assessment
Develop understanding of how SLR might affect the local jurisdiction. Model various SLR inundation scenarios and assess the potential exposure and impacts to key assets (such as infrastructure, property, and natural resources) and local services (such as drinking water and emergency response).

Develop Adaptation Plan
Based on assessed vulnerabilities, determine specific strategies that can be undertaken to reduce the amount of risk and damage the community will experience from SLR. Identify overall approach and priorities, policies, potential projects, and time lines.

Develop Detailed Project Plans and Policies
Develop specific implementation plans for adaptation projects including engineering design, environmental permitting, costs, funding sources, deadlines, and anticipated performance measures. Research and draft new policies and solicit public feedback.

Implement Adaptation Projects and Policies
Construct projects. Adopt and enforce policies.

Monitor and Evaluate Effectiveness of Projects and Policies
Conduct multiyear monitoring to assess how well projects and policies are meeting anticipated objectives as conditions change and whether modifications may be necessary to maintain or improve outcomes.

LAO

State Has Special Jurisdiction Over Land Use Decisions in the Coastal Zone

Enacted in 1976, the California Coastal Act gives the state a unique role in planning and regulating the use of land and water along the coast. Specifically, within the coastal zone—unlike other areas of California—the state possesses the authority to regulate the construction of buildings, divisions of land, and activities that change the intensity of use of land or public access to coastal waters. (The land covered by the coastal zone is specifically delineated in statute and varies in width from several hundred feet in highly urbanized areas up to five miles in certain rural areas, and excludes the San Francisco Bay Area.) The basic goals of the Coastal Act are to balance development along the coast with protecting the environment and public access. The Act includes specific policies that address issues such as shoreline public access and recreation, habitat protection, landform alteration, industrial uses, water quality, transportation, development design, ports, and public works. The Coastal Act tasks the California Coastal Commission with implementing these laws and protecting coastal resources. As such, entities seeking to undertake development activities within the coastal zone must first attain a coastal development permit from the Coastal Commission. (In general, local governments make decisions about land use outside the coastal zone.)

The Coastal Commission may delegate some permitting authority to the 76 cities and counties along the coast if they develop plans—known as Local Coastal Programs (LCPs)—to guide development in the coastal zone. The LCPs specify the appropriate location, type, and scale of new or changed uses of land and water, as well as measures to implement land use policies (such as zoning ordinances). The Coastal Commission reviews and approves ("certifies") these plans to ensure they protect coastal resources in ways that are consistent with the goals and policies of the Coastal Act. Local governments have incentives to complete certified LCPs, as they can then handle development decisions themselves (although stakeholders can appeal such decisions to the Coastal Commission). In contrast, any project undertaken in the coastal zone in communities without certified LCPs must attain a permit from the Coastal Commission. To date, nearly 90 percent of the applicable geographic area is covered by a certified LCP.

state law. Since most LCPs were developed around 30 years ago—before the need to account for the potential effects of climate change—some coastal communities are beginning to work on updates to address SLR. The Coastal Commission reports that 39 jurisdictions are in the process of updating their LCPs for SLR, including 30 that have completed vulnerability assessments. (Coastal Commission staff encourages using SLR vulnerability assessments to inform LCP updates.) Thus far, only three local governments have completed all stages of updating their LCPs for SLR and had them certified by the Coastal Commission. As shown earlier in Figure 5, state funding grants have partially supported these efforts. Specifically, the Coastal Commission reports that between 2013 and September 2019, it provided 50 grants totaling nearly $7 million to 37 local jurisdictions for SLR-related LCP updates.

Second, Chapter 608 of 2015 (SB 379, Jackson) requires communities to update the safety element of their General Plans to address the risks posed by climate change no later than 2022. Data suggest that local jurisdictions still are in the process of working to meet this requirement. Specifically, about 30 percent of the cities and counties that responded to OPR's 2018 survey reported that they have addressed climate adaptation in their adopted General Plan policies.

Third, Chapter 592 of 2013 (AB 691, Muratsuchi) required certain coastal cities and special districts to conduct an assessment of how they propose to address SLR on the granted public trust coastal lands for which they are responsible. (These are sovereign state lands for which the Legislature has delegated management to local municipalities for specified uses, such as piers, ports, harbors, airports, and recreation.) For each applicable jurisdiction, these assessments must include: (1) an inventory of public trust assets that are vulnerable to SLR; (2) how SLR may impact those assets in the short, medium, and long term; (3) an evaluation of the financial costs associated with those SLR impacts—including for nonmarket asset values such as recreation and ecosystem services; and (4) a description of how potential SLR adaptation strategies could address the identified vulnerabilities and a proposed time frame for implementing such measures. The State Lands Commission is in the process of reviewing these reports, which had to be submitted by July 2019.

Some Examples of Regional Collaboration on SLR Planning Exist, but Efforts Are Limited. Because the effects of SLR do not stop at the city border or county line, local jurisdictions would benefit from working together with their neighbors on a regional basis to collaborate on plans for addressing the interrelated impacts. While some regional collaborative efforts have been initiated across the state, these initiatives still are emerging and uneven. Perhaps the largest effort consists of seven regional groups that have formed in various areas of the state to work on climate change adaptation issues—including but not limited to SLR—as highlighted in **Figure 7**. The Local Government Commission and OPR help facilitate a network for these groups to communicate, known as the Alliance of Regional Collaboratives for Climate Adaptation (ARCCA). However, these regional groups have experienced varying levels of participation and activity. Most of the groups meet only intermittently to informally share information, none has worked on developing a regional SLR or climate adaptation plan, and typically, they do not have permanent dedicated funding or staff. In some cases, local jurisdictions are only eligible to participate in their region's collaborative if they are willing and able to pay an annual administrative fee. As such, not all cities and counties located within the regions encompassed by these ARCCA groups are active participants that benefit from the potential collaboration. (Orange County is the only coastal county not encompassed by any of the ARRCA regional collaboratives.)

The SF Bay Area has made the most progress on multicounty regional SLR collaborative efforts. In a survey of SF Bay Area stakeholders conducted by University of California (UC), Davis, researchers in the fall of 2018, close to 60 percent of respondents reported that they had shared information about SLR with other organizations in the last year, and about 45 percent said that they had engaged in some joint SLR planning with other organizations. Moreover, in 2016, voters in the nine-county region passed Measure AA, establishing the SF Bay Restoration Authority and imposing a parcel tax that is projected to raise about $25 million annually for 20 years to fund projects to protect and restore the bay. To support this effort, the Authority has established—and funded—the "SF Bay Restoration Regulatory Integration Team," which is intended to expedite and simplify the permitting process

Figure 7

Groups Participating in the Alliance of Regional Collaboratives for Climate Adaptation

- ✓ Bay Area Climate Adaptation Network
- ✓ Capital Region Climate Readiness Collaborative
- ✓ Central Coast Climate Collaborative
- ✓ Los Angeles Regional Collaborative for Climate Action and Sustainability
- ✓ North Coast Resource Partnership
- ✓ San Diego Regional Climate Collaborative
- ✓ Sierra Climate Adaptation and Mitigation Partnership

for wetland restoration and flood management projects. Additionally, BCDC is initiating efforts to coordinate the development of a "Regional Adaptation Plan" for the SF Bay Area.

Other limited examples of regional collaboration related to SLR exist around the state at the county level. For example, some counties have conducted vulnerability assessments and adaptation planning specifically to address the threat of SLR across the jurisdictions within their counties. These include Marin and San Mateo. San Mateo County also just received statutory approval to reconstitute an existing special flood district to specifically address the anticipated impacts of SLR across the county. Additionally, San Diego County undertook a three-year initiative (funded by grants from NOAA and SCC) called the "Resilient Coastlines Project of Greater San Diego" to coordinate several local SLR initiatives, gather scientific information on a regional basis, develop tools and resources, and connect community members and scientific experts to work together.

In an effort to help encourage regional climate adaptation efforts, the Legislature recently passed Chapter 377 of 2018 (SB 1072, Leyva). This legislation creates a program to assist under-resourced communities in developing the capacity to access grant funding for climate change mitigation and adaptation projects. SGC will administer the program, and still is in the process of determining its structure, selection criteria, and funding sources.

STRONG CASE EXISTS FOR LOCAL GOVERNMENTS TO ACCELERATE ADAPTATION ACTIVITIES

The relatively limited progress that local governments have made in preparing for SLR may not seem overly concerning, given that most of the intense impacts of SLR still are decades in the future. However, waiting too long to initiate adaptation efforts likely will make executing an effective response more difficult and costly. Taking action ahead of when sea levels are projected to significantly encroach on the coast would enable local governments to benefit in several important ways, as summarized in **Figure 8** and discussed below.

Planning Ahead Means Adaptation Actions Can Be Strategic and Phased. Time allows cities and counties to (1) be strategic, phased, and

Figure 8

Benefits of Taking Action Early to Prepare for Sea-Level Rise (SLR)

- ✓ ***Planning Ahead Means Adaptation Actions Can Be Strategic and Phased.*** Early planning can allow coastal communities to adopt a phased approach that undertakes escalating actions when certain predetermined conditions or "triggers" are reached.
- ✓ ***Undertaking Near-Term Actions Can "Buy Time" Before More Intensive Responses Are Needed.*** Putting certain adaptation projects and strategies in place now can help postpone and extend the period before which subsequent, more difficult-to-implement actions are needed.
- ✓ ***Early Implementation Provides the Opportunity to Test Approaches and Learn What Works Best.*** Acting to implement adaptation strategies in the near term will provide the opportunity to monitor, evaluate, and revise them in the coming years before SLR threats become more pressing.
- ✓ ***Taking Action Earlier May Make Overall Adaptation Efforts More Affordable.*** Undertaking a multiyear, multistep strategic plan for coastal adaptation can allow local governments to spread costs over a longer period of time.
- ✓ ***Coming Decade Represents a Key Window for SLR Preparation.*** Some adaptation strategies—such as fortifying certain tidal marshes—may not be effective against SLR unless they are implemented before sea levels rise to higher levels.

thoughtful about which approaches will work best for their communities; (2) gather community input; and (3) implement projects and policies that may take many years to put into effect. Planning ahead can allow coastal communities to adopt a phased approach for when it will undertake escalating actions that is dependent upon when certain predetermined conditions or "triggers" are reached. For example, such a strategy might state that the community will relocate its wastewater treatment plant once sea levels are observed to have risen by 1 foot locally, and that in the meantime, stakeholders will identify a new location for the plant, develop detailed project plans, and acquire funding so they are ready to implement the project once the identified threshold has been reached. A phased approach based on defined triggers can also help address community concerns that a local government might be acting "prematurely" to address SLR and thereby affecting their property values unnecessarily. The *State of California Sea-Level Rise Guidance Document* encourages coastal communities to utilize "adaptation pathways" with multiyear, progressive steps—but such an approach requires time to develop and implement.

Undertaking Certain Near-Term Actions Can "Buy Time" Before More Intensive Responses Are Needed. Putting certain adaptation projects and strategies in place now can help postpone and extend the period before which subsequent, more difficult-to-implement actions are needed. For example, building up wetlands or sand dunes in certain areas could help buffer the effects of SLR and coastal storms and protect the development behind them for the coming few decades. Even if such a strategy would have decreasing effectiveness once sea levels rise to higher levels, implementing such a project in the near term could delay the date at which the buildings begin to regularly flood and need to be relocated or elevated.

Early Implementation Provides Opportunity to Test Approaches and Learn What Works Best. Near-term action allows for time to test theories and determine the most effective approaches. Because SLR poses a unique set of challenges, many uncertainties exist around which potential adaptation strategies might be most effective. For example, scientists are unsure of how successful wetland restoration projects will be at buffering the force of waves during more severe coastal storms. Acting to implement adaptation strategies in the near term will provide the opportunity to monitor, evaluate, and revise them in the coming years. This can help the state and local governments ascertain which types of approaches will be best for particular locations and/or for widespread application as SLR threats become more pressing.

Taking Action Earlier May Make Overall Adaptation Efforts More Affordable. Undertaking a multiyear, multistep strategic plan for coastal adaptation can allow local governments to spread costs over a longer period of time and thereby make them more affordable. A multiyear financing approach—such as utilizing bonds—for large projects also provides the opportunity for costs to be borne by both current and future taxpayers, which is reasonable since such projects are intended to provide benefits over many years. Moreover, if local governments take the opportunity to test out SLR response approaches, they and other coastal communities can learn "best practices" from those pilot projects and likely will be able to replicate similar approaches in more efficient, cost-effective ways in the future.

Coming Decade Represents Key Window for SLR Preparation. Experts suggest the next ten or so years represent a crucial time period for taking action to prepare for SLR. After that point, sea levels may already have risen by around 1 foot in many locations, as shown earlier in Figure 1. Once sea levels have risen to higher levels, the planning window narrows and options for how local governments can respond become more limited. For example, a comprehensive scientific study of the SF Bay, *The Baylands and Climate Change*, suggests tidal marshes that are established by 2030 are more likely to flourish and provide wave-buffering benefits. After that point, marshes may not have sufficient time to develop and fortify—by building up sediment and growing plants—and will instead become submerged. Coastal communities that delay SLR response activities until coastal flooding is more imminent lose opportunities to implement proactive, incremental, and ground-tested adaptation responses. Instead, they will be forced into a more reactive mode with the need to address the threat immediately.

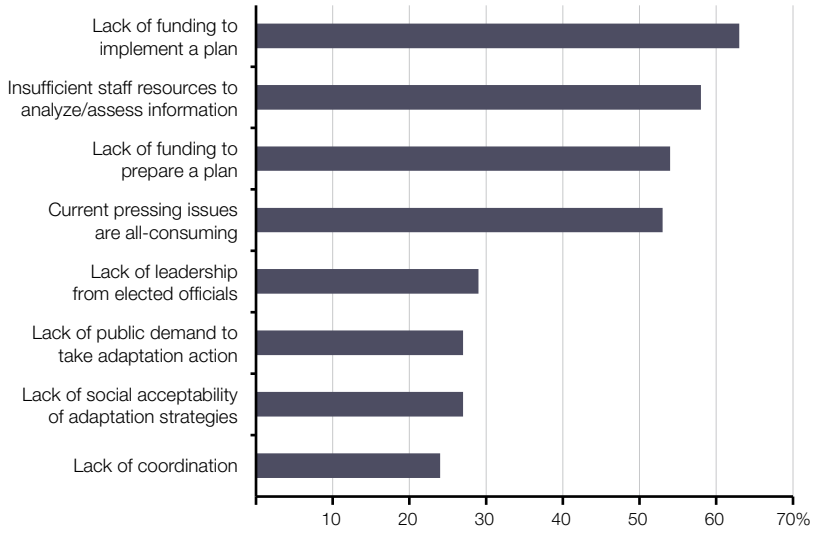
LOCAL ADAPTATION EFFORTS FACE KEY CHALLENGES

Despite the significant threats posed by the projected changes in the coming years and the compelling reasons to take action soon, most local governments still are only in the early stages of preparing for SLR, as discussed earlier. Data suggest that local governments' progress in adapting to the impacts of SLR is constrained by a number of key challenges. For example, **Figure 9** displays the top eight barriers that coastal professionals identified in the *2016 California Coastal Adaptation Needs Assessment Survey* as being "big hurdles" in their adaptation efforts. The academic literature on coastal adaptation and the many interviews we conducted in researching this report identified some additional common obstacles. **Figure 10** summarizes our compilation of key challenges, which we describe in more detail in this section.

Figure 9

Survey Results Highlight Significant Barriers to Coastal Adaptation

Percent of Coastal Professionals Indicating Barrier Is a Big Hurdle



From: S. Moser, J. Finzi Hart, A. Newton Mann, N. Sadrpour, P. Grifman (Susanne Moser Research & Consulting and U.S. Geological Survey), 2018. "Growing Effort, Growing Challenge: Findings From the 2016 California Coastal Adaptation Needs Assessment Survey." *California's Fourth Climate Change Assessment*.

LAO

Funding Constraints Hinder Both Planning and Projects

Local Governments Cite Funding Limitations as Primary Barrier to Making Progress on Coastal Adaptation Efforts. Funding for both coastal adaptation project implementation and planning are paramount concerns for local governments seeking to prepare for SLR. These funding challenges were identified in nearly all of the interviews we conducted in researching this report, and also are reflected as the first and third most cited hurdles, respectively, in the survey data displayed in Figure 9. A different statewide survey conducted in 2017 asked local government representatives specifically which adaptation-related activities they needed funding to conduct over the coming five years. (This survey did not ask about SLR or coastal adaptation specifically.) The responses are displayed in **Figure 11** on page 22. As shown, comparatively lower—but still significant—proportions of respondents indicate the need for funding to conduct initial assessment and planning activities, with a much higher share needing funding to implement and evaluate projects. That survey also asked local governments whether they had yet acquired the necessary funds to undertake the identified adaptation activities—fewer than 2 percent responded affirmatively. About 32 percent of respondents indicated they had secured *some* funding, whereas about two-thirds responded they had secured *none* of the needed funding.

Responses from our interviewees and both of the above surveys appear to align with the trends cited earlier—that

many but not all communities have made headway in beginning to plan for climate change impacts (which is why comparatively fewer cite the need for planning funds), but few have moved into enacting those plans. Moreover, these data suggest that funding is a primary contributor to that lack of progress. The expressed need for funding likely is a result of constraints on available local funding as well as on funding from state, private, or federal sources.

Limited Local Funding Faces Many Competing Priorities. Even though responsibility for addressing SLR lies primarily with local governments, our interviews indicated that they struggle to identify local funding sources they can dedicate to preparation activities. This is echoed by the *2016 California Coastal Adaptation Needs Assessment Survey*, with respondents indicating that only about one-third of the funding currently supporting their adaptation activities comes from local sources. One chief explanation for these responses is that allocating funding from existing sources to respond to a large, long-term, uncertain threat such as SLR is difficult when local governments have to balance such expenditures against many other immediate short-term priorities. Such priorities might include housing shortages, homelessness, schools, aging infrastructure, and other climate-related impacts such as increased wildfires. (Competing funding commitments likely also are factors for the 53 percent of survey respondents shown in Figure 9 who cite the challenge of facing many other pressing, all-consuming issues as a big hurdle in addressing SLR.) Additionally, California local governments' ability to generate new revenues for activities is constrained by certain constitutional limitations, including Proposition 13 (1978, which limits increases in local property taxes) and Proposition 218 (1996, which requires meeting a two-thirds local voter threshold in order to raise certain local taxes and fees). Moreover, local revenues available for adaptation activities may be further constrained in the future *by* SLR. This

Figure 10

Local Adaptation Efforts Face Key Challenges

- ***Funding Constraints Hinder Both Planning and Projects.*** Local governments cite funding limitations as their primary barrier to making progress on coastal adaptation efforts. This is largely because local funding faces many competing priorities and constraints, and only limited amounts of adaptation funding have been available from other sources.
- ***Limited Local Government Capacity Restricts Their Ability to Take Action.*** The novelty of the climate adaptation field makes it hard for local governments to locate and hire individuals with appropriate experience and expertise to plan for the impacts of sea-level rise (SLR). These capacity limitations are particularly challenging for small and disadvantaged communities.
- ***Adaptation Activities Are Constrained by a Lack of Key Information.*** Local governments cite a need for additional data and technical assistance to help inform their adaptation decisions, especially around the costs, trade-offs, and potential economic implications of SLR impacts. The novelty of coastal adaptation efforts means that this type of information is even more in demand—and limited.
- ***Few Forums for Shared Planning and Decision-Making Impede Cross-Jurisdictional Collaboration.*** Even though the interrelated effects of SLR make cross-jurisdictional planning essential, local governments lack forums and resources for discussing and planning for SLR on a regional basis.
- ***Responding to SLR Is Not Yet a Priority for Many Local Residents or Elected Officials.*** Because many California residents are not yet aware of how SLR might affect their communities or consider the threat as being far off in the future, coastal adaption actions are not a high priority for them. This makes it difficult for local elected officials or government staff to champion unpopular SLR response actions.
- ***Protracted Process for Attaining Project Permits Delays Adaptation Progress.*** Achieving approval for coastal adaptation projects is complicated and takes a long time, in part because they represent a new challenge for the existing environmental regulatory system. This is particularly problematic because coastal communities face a pressing need to make progress on preparing for SLR before its impacts become more widespread.

is because existing property values in some areas of the coast likely will decrease if those buildings become or are at risk of becoming flooded, thereby over time affecting the property tax revenues generated for the local jurisdiction.

Only Limited Amounts of Adaptation Funding Have Been Available From Other Sources. Local government respondents to the *2016 California Coastal Adaptation Needs Assessment Survey* indicated that while local sources have provided one-third of their coastal adaptation funding thus far, state funds provided the largest share—45 percent. As shown earlier in Figure 5, however, these funds have been relatively modest. Nevertheless, these findings highlight the important role that state resources have played in encouraging the coastal adaptation activities that have occurred to date. Responses to the aforementioned survey indicate that funding they have received for their adaptation activities from other sources are even more limited—10 percent from foundations or other private sources and 9 percent from the federal government.

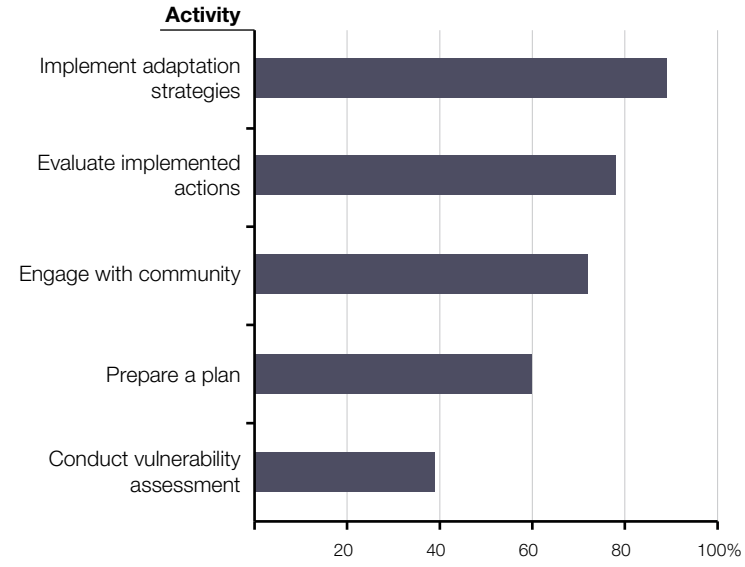
Limited Local Government Capacity Restricts Ability to Take Action

Local Governments Lack Sufficient Staff and Technical Expertise to Address SLR. Inadequate internal capacity to undertake adaptation planning and projects is also a significant barrier to local governments' SLR preparation efforts. We heard this frustration expressed repeatedly in our interviews, with local government staff indicating they need to address adaptation planning activities in addition to their primary job responsibilities. Additionally, local government interviewees indicated that staffing constraints often mean that they do not have the capacity to complete the work necessary to compile successful grant applications for the funding that the state offers for adaptation planning and projects—thereby compounding their challenges in making progress on coastal adaptation efforts. In OPR's *2018 Annual Planning Survey*, 60 percent of responding cities and counties indicated they had very little or no staffing and technical capacity to address climate change or adaptation. These findings are mirrored in the survey responses highlighted in Figure 9. Specifically, insufficient staff resources to analyze and assess information was the second most commonly cited hurdle to coastal adaptation efforts, cited by 58 percent of respondents. Interestingly, some progress to address these capacity issues appears to have been made in recent years, as a comparatively higher percentage of coastal professionals responding to the 2011 version of the same coastal needs assessment survey indicated insufficient staff resources as

Figure 11

Local Governments Express Need for Funding to Advance Adaptation Activities

Survey Respondents Indicating Need For Funding for Adaptation Activity in Next Five Years (2017)



From: S. Moser, J.A. Ekstrom, J. Kim, S. Heitsch (Susanne Moser Research & Consulting, Department of Water Resources, Local Government Commission and ICF), 2018. "Adaptation Finance Challenges: Characteristic Patterns Facing California Local Governments and Ways to Overcome Them." *California's Fourth Climate Change Assessment.* California Natural Resources Agency.

being a big hurdle—67 percent compared to 58 percent in the 2016 survey.

Adaptation Expertise Is Not Widespread. A couple of key factors may explain these capacity challenges. The first is a direct result of the funding constraints noted earlier—limited funds often translate to a limited ability to hire a sufficient cadre of qualified staff. Additionally, because climate adaptation is a new field, local governments find it hard to locate individuals with appropriate scientific, engineering, and legal experience and expertise to know how to plan for the impacts of SLR, even if they could manage to secure the funds to hire more staff. The *2016 California Coastal Adaptation Needs Assessment Survey* report states that "most coastal practitioners are still essentially learning about adaptation 'on the job' rather than through formal training opportunities." Specifically, the survey found that only about 40 percent of local government respondents indicated that they had received *any* formal training in adaptation.

Small and Disadvantaged Communities Particularly Challenged by Capacity Limitations. Our research indicates the challenges associated with limited government capacity to address climate adaptation needs are especially pronounced for smaller communities and those whose residents have a lower average income and/or lower property values. These communities often have smaller government administrations and fewer financial, business, philanthropic, and community resources upon which to draw. As such, these communities likely find it even harder than their larger and better-resourced neighbors to hire and maintain experienced staff dedicated to adaptation work—which in turn also makes it even more challenging to compete for limited grant funding. This raises an important social equity concern about how adequate preparation for SLR may be influenced by the relative size and wealth of a particular community.

Adaptation Activities Constrained by Lack of Key Information

Local Governments Cite a Need for Additional Data to Help Inform Adaptation Decisions. In the interviews we conducted in preparing this report, one of the most frequently cited obstacles to coastal adaptation was a lack of information to help guide decision-making. Specifically, local entities expressed uncertainty about how to proceed with SLR preparation because they are unsure about details such as:

- ***Trade-Offs of Adaptation Options.*** Data and examples that might help inform which adaptation options might be most appropriate for their community and what factors to consider when making those decisions.
- ***Cost of Adaptation Options.*** Rough estimates for how much different options might cost to implement and what factors influence those costs.
- ***Economic Implications of Adaptation Options and SLR Impacts.*** The potential economic impacts of implementing various adaptation options, including the "no action" alternative.
- ***Locally Specific SLR Projections.*** Specialized estimates and maps for how exactly SLR and coastal storms might affect specific locations, neighborhoods, infrastructure, and resources in their communities.
- ***Legal Clarifications.*** A legal analysis clarifying the responsibilities—and liabilities—local governments face with regard to SLR, particularly related to how potential changes in the mean high-tide line, land use policies, and city services might affect private properties.

The first four information priorities were also cited by city and county respondents to the *2016 California Coastal Adaptation Needs Assessment Survey* when asked which types of information they perceive as most useful for assessing the risks from climate change to local coastal resources. Specifically, about 75 percent rated information on the trade-offs of adaptation as very useful, and a similar percentage said the same about information on the costs of adaptation (representing the top two responses to the question). The usefulness of economic and community vulnerability assessments each were rated as very useful by about 60 percent of respondents. (The survey did not ask about legal information.)

The lack of information on the potential economic impacts that SLR might have on the community was raised repeatedly throughout the interviews we conducted for this report. Even for the local governments that have conducted initial SLR planning activities, few vulnerability assessments include these types of considerations. Similarly, only a handful of completed adaptation plans across the state include an analysis of the economic trade-offs of employing potential adaptation strategies. For example, this could include evaluating and comparing the short- and long-term costs and benefits of approaches like building seawalls, adding sand to beaches, restoring wetlands, and relocating infrastructure. Feedback from our interviewees suggests they have not undertaken these types of analyses because they are complicated and expensive to conduct, with few examples available to serve as models. Yet without an understanding of the economic implications associated with SLR or the costs and benefits of the steps they could take to address those impacts, local governments are constrained in determining the best path forward.

Novelty of Coastal Adaptation Efforts Means Information Is Even More in Demand—and Limited. Interviewees who were able to gather the necessary information to complete vulnerability assessments and high-level adaptation plans indicated that they were unclear how to determine what specifically they should do next. That the coastal adaptation field is so new is a large contributor to this information gap. These uncharted waters present a double challenge—local governments have never undertaken such work before and therefore are urgently in need of guidance, examples, and data to help them make these novel decisions. However, such information is not widely available because few others have undertaken such work either.

Technical Assistance Not Widely Available. Interviewees cited a lack of—and desire for—entities to which they might be able to turn for advice, technical assistance, comparison data, and real-world examples to help inform their adaptation decisions. As noted earlier, OPR created the Adaptation Clearinghouse, which provides an online database of resources for adaptation planning and projects. Our interviews and available research, however, suggest use of this website is not yet widespread. This is due both to a lack of awareness about the resource, and also because users find it overwhelming and difficult to navigate. Rather, local entities express a desire for (1) models and planning templates they can recreate or modify to meet their local circumstances, and (2) experts they can call upon to discuss and help address their specific needs. The Clearinghouse has only limited examples that meet the first need and does not have staff available to address the second. Some entities have provided technical assistance for coastal adaptation efforts within their regions—such as the Adapting to Rising Tides Program administered by BCDC in the SF Bay Area and the University of Southern California Sea Grant program in Los Angeles—but these resources are not available statewide.

Few Forums for Shared Planning and Decision-Making Impede Cross-Jurisdictional Collaboration

Local Governments Lack Robust Forums for Discussing and Planning for SLR on a Regional Basis. Local governments across California lack formal and strategic ways to learn from each other, share information, or make decisions together about coastal adaptation issues. As noted earlier, while some regional collaborative efforts are underway across the state, such initiatives are largely informal, they lack funding and staff, and their level of activity and participation vary by region. Moreover, with the exception of a couple of countywide plans, no region has yet developed a coordinated plan for how it will address SLR impacts on a regional basis. This lack of coordination was frequently mentioned as a significant concern by the individuals we interviewed, and was highlighted as a big hurdle by about one-quarter of survey respondents in Figure 9. When UC Davis researchers surveyed stakeholders in the SF Bay Area about the largest barriers they face in working collaboratively with other stakeholders on SLR issues, the most common response was the lack of an overarching regional plan to address SLR.

Cross-Jurisdictional Planning Is Challenging. Distinctions across local governments—including bureaucratic and administrative differences, as well as varying interests and priorities—always make cross-jurisdictional planning and coordination difficult. Interviewees indicated that addressing the needs of their own jurisdictions already presents a challenge, and the prospect of incorporating those of their neighbors into their planning efforts feels like an overwhelming task. Moreover, they expressed concerns that regional planning efforts might prioritize the requests of other jurisdictions over their own—especially if their city is small or wields comparatively less political influence—and also that finding common ground around adaptation actions could be difficult. Finally, interviewees stated that regional collaboration would require additional staff time—particularly to organize and attend forums for such discussions to take place—and their resources already face constraints.

Interrelated Effects of SLR Make Cross-Jurisdictional Planning Essential. Given these complications, the lack of collaborative efforts around SLR is not surprising. However, the widespread impacts of SLR make coordinated regional planning fundamental to effective preparation—and the lack of such efforts is therefore particularly concerning. Local jurisdictions planning on their own will not be able to address the SLR impacts that might have substantial impacts on their own community but are dependent upon their neighbors taking action. For example, residents of one city may be precluded from getting to and from their homes or work or from accessing emergency services if a key transportation thoroughfare floods in a neighboring city. Moreover, SLR response actions taken by one jurisdiction could have significant effects on their neighboring cities. For example, if one city decides to construct hard armoring structures—such as seawalls—to protect structures along much of its coastline, the ensuing erosion processes could remove most of the sand from the beaches in a neighboring city. These interconnected SLR impacts increase the importance of coordination, shared input, and joint planning. Even multi-jurisdictional planning efforts might be insufficient to adequately address future SLR impacts if they fail to include key landowners and stakeholders—such as utilities, railroads, Caltrans, State Parks, refineries, and ports—who will be necessary participants in making future land use decisions for the region.

Responding to SLR Is Not Yet a Priority for Many Local Residents or Elected Officials

Many California Residents Do Not See Need for Immediate Action to Address SLR. Two of the barriers cited in the survey data shown in Figure 9 relate to public perceptions about the risk of SLR—the lack of public demand to take adaptation action and the lack of social acceptability of adaptation strategies. These dynamics were echoed in many of the interviews we conducted in preparing this report, and have been on display in some high-profile community mobilization efforts against proposed SLR adaptation actions in certain coastal communities in recent months.

Much of the public lack of engagement about or resistance to coastal adaptation efforts seems to stem from two key factors. First, many California residents are generally unaware of projections about how SLR might impact them. Few communities have undertaken public awareness campaigns about SLR or broadly disseminated maps of areas that are projected to flood in the coming years. Moreover, potential SLR coastal flooding is not currently required to be disclosed during real estate transactions—in contrast with the risks associated with forest fires, earthquakes, or floods. (Existing flood risk notifications are based on historical flood events and therefore do not take potential SLR impacts into account.) California law requires that these potential hazards be disclosed to prospective property buyers. Because residents may not know about SLR predictions or see many obvious SLR-related impacts happening now, coastal adaptation actions likely are not a high priority for them to request from their local governments—especially compared to more current pressing concerns. Second, even many coastal residents who have some awareness that sea levels are projected to rise likely view the threat of SLR as being far off in the future. They therefore feel that for their local governments to take SLR

response actions that might affect their property values or lifestyle in the near future is premature and inappropriate—even if those actions are only planning for what future adaptation responses *might* be. For example, several coastal communities that drafted adaptation plans mentioning the possibility of relocating infrastructure in the future before it becomes flooded (sometimes referred to as "managed retreat") have faced vociferous public backlash—largely because of residents' concerns that such changes might impact their own properties now or in the future.

Local Elected Officials Currently Face Disincentives to Champion Unpopular SLR Response Actions. Resistance against taking aggressive action on SLR now is also demonstrated in the attitudes and actions of many local government leaders. As shown in Figure 9, 29 percent of the survey respondents identify the lack of leadership from elected officials as a big hurdle to making progress on coastal adaptation activities. This dearth of enthusiasm about adaptation may be somewhat predictable, as local officials typically try to reflect the priorities of their constituents. Additionally, the most intense impacts of SLR likely will not manifest for at least a decade—and perhaps multiple decades—into the future. Many current public officials may be disinclined to face the backlash and potential political consequences from enacting unpopular policies now when the evidence for and benefits of taking those actions may not be experienced until long after they are out of office. A lack of public support also makes it difficult for local governing entities to advance proposals for raising additional revenues—such as through new fees or taxes—to undertake adaptation projects now. Moreover, local officials may be reluctant to undertake any adaptation actions or policies that would limit future development or reduce existing property values in fear of restricting or reducing the local revenues on which they currently rely to provide government services.

Despite these disincentives, reluctance to champion coastal adaptation efforts is not a universal position across California's cities and counties. Rather, as noted earlier, many California cities and counties are making some progress on SLR preparation activities, and examples exist of local elected officials around the state taking a leadership role in such efforts.

Protracted Process for Attaining Project Permits Delays Adaptation Progress

Several coastal professionals with whom we spoke in preparing this report reported that the lengthy process for attaining approvals from state and federal agencies to implement adaptation projects is a significant barrier to getting more projects underway.

Achieving Approval for Coastal Adaptation Projects Is Complicated and Takes a Long Time. As with any development project along the coast or SF Bay, adaptation projects must go through a review and approval process and attain permits from numerous state and federal agencies to ensure they are not causing undue harm to the environment. Although such projects often differ from traditional construction and infrastructure projects in that they may be nature-based (such as sand dune or wetland restoration projects), they are not exempt from the standard environmental review process. Agencies that typically must grant regulatory approvals for coastal adaptation projects include the U.S. Army Corps of Engineers, the U.S. Fish and Wildlife Service, NOAA National Marine Fisheries Service, the Regional Water Quality Control Board, the California Department of Fish and Wildlife, the Coastal Commission (for projects in the coastal zone), and BCDC (for projects along the SF Bay). These agencies review potential projects to ascertain how they might affect fish and wildlife and their habitats, water quality, and public access to the shoreline.

In general, project proponents must submit separate permit applications (and associated fees) to each of the applicable agencies, each of which then undertakes its own independent review on its own time line. In addition, each regulatory reviewer typically imposes its own permit requirements, such as requiring activities to help mitigate any anticipated environmental impacts. Because these reviews are conducted independently from each other, in some cases one agency may impose

permit conditions that can duplicate or even contradict those required by a different agency. For example, while federal and state fish and wildlife agencies work to minimize project impacts on at-risk species, BCDC seeks to maximize public access to the bay shore. These goals can be in direct conflict, as imposing permit requirements to add public access infrastructure and increase human visitors can negatively impact wildlife. In such cases, the project proponents must negotiate between the agencies to develop a set of project requirements that they are capable of implementing. Due to the delays associated with these myriad reviews and ensuing requirements, SCC estimates that attaining permits for a typical adaptation project can take at least one year from when such applications are submitted. As discussed below, this protracted time line is particularly problematic for coastal adaptation efforts given the relatively narrow window for implementing certain types of projects.

SLR and Coastal Adaptation Projects Represent New Challenge for Existing Environmental Regulatory System. In general, the existing set of regulatory requirements for coastal projects was established several decades ago to protect against environmental damage that might be caused by development along the coast or SF Bay. Most of these requirements were developed long before SLR became a concern, and as such did not contemplate the types of adaptation projects currently being proposed or the coming challenges such projects are intended to address. For example, BCDC has long had policies against allowing sediment to be dumped or added within tidal waters to avoid filling in the SF Bay, which was a significant concern in the 1960s that led to BCDC's creation and underlying statutory authority. However, many bay shore adaptation projects require the addition of sediment to build up existing tidal marshes and wetlands to enable them (and the wildlife that live there) to withstand higher water levels and waves. This disconnect has led to problems and delays with attaining BCDC's approval for proposed wetland restoration projects in recent years. (As noted later, BCDC recently modified its Bay Fill policy to address this concern.)

Similarly, to protect coastal resources the Coastal Commission has a rigorous process for evaluating and permitting coastal development—such as hotels, houses, parking lots, or water treatment plants—that has historically posed a *risk* to such resources. The Coastal Commission's regulatory review structure has not typically been faced with how to evaluate natural infrastructure projects that are intended to make the coastline more resilient and that can *benefit* the environment—such as "living shoreline" projects that add sand and plants to the shore to buffer wave action and enhance coastal habitats. (Certain other types of adaptation projects, such as relocating a road or infrastructure inland, however, may more closely resemble traditional development projects.) Because existing regulatory review policies were not developed to evaluate these new types of projects, they can face increased scrutiny, requirements, and delays compared to more traditional and familiar projects (such as adding piles of rocks to the shore to armor the coast ahead of a storm). The increased rigor, complication, and time for these reviews can in turn create disincentives for coastal communities to attempt innovative or nature-based approaches.

Permitting Approach Is Particularly Problematic for Climate Adaptation Projects. Complaints that the environmental permitting system is complicated and protracted are not unique to coastal adaptation projects. Such criticism has often been raised by proponents of many types of projects, including for traditional types of construction and development as well as nature-based projects such as those that restore streams or remove dead trees and dense underbrush from forests. However, such issues raise particular concerns for coastal adaptation projects for two key reasons. First, coastal communities face a pressing need to make progress on preparing for SLR before its impacts become more widespread, and this need will become increasingly urgent in the coming years as sea levels continue to rise. As discussed earlier, the next decade represents a crucial time period for implementing certain types of projects—such as enhancing coastal marshes—before rising water levels preclude their effectiveness. As such, coastal

communities cannot afford to wait at least a year to attain approvals for each project—nor, collectively, can the state, if it wants to improve SLR preparedness levels across California. Second, the state should be encouraging a wide complement of potential approaches to address SLR, including innovative natural infrastructure projects that provide environmental benefits. As discussed, the current regulatory review regime may be having the opposite effect.

While some limited examples of efforts to address these issues exist, they do not apply to coastal adaptation projects statewide. For example, as noted earlier, the SF Bay Area has created the regional SF Bay Restoration Regulatory Integration Team to expedite and simplify the permitting process for certain projects. This team is coordinating permit review and requirements across all the applicable state and federal agencies, however only for SF Bay Area wetland projects funded with local Measure AA funds. Additionally, CNRA has formed a work group to look into ways to coordinate and expedite regulatory review processes, but thus far that effort is limited to permits for forest health projects and does not apply to coastal adaptation.

STATE CAN HELP EXPEDITE LOCAL SLR ADAPTATION EFFORTS

As discussed earlier, the state has a strong interest in helping to ensure that local governments take sufficient actions to mitigate the potential economic, environmental, and public health risks associated with SLR. Moreover, given that delaying adaptation work can result in missed opportunities and higher costs, a strong case exists for the state to help remove barriers at the local level in order to expedite such work.

State Can Play Key Role in Supporting Local Adaptation Efforts. Coastal communities must increase both the extent and pace of SLR preparation efforts if California is to avoid severe, costly, disruptive, and harmful impacts in the coming decades. The state has neither the capacity nor the authority to assume primary responsibility for planning, developing policies, or implementing response activities across California's many coastal communities. Furthermore, local governments are most attuned to the particular needs and circumstances facing their communities. However, this does not mean the state should avoid *any* involvement in coastal adaptation activities—the statewide risks and potential impacts of inadequate preparation are too great. The state can play an important role in encouraging and supporting local efforts and helping to alleviate some of the challenges local governments face. For example, the state can use its over-arching position to help facilitate coordination across jurisdictions and take advantage of economies of scale by collecting and disseminating helpful information statewide. The state can also take action to ensure public trust resources like beaches, wetlands, and coastal access are preserved. Additionally, the state can help ensure that local adaptation efforts adequately address the needs of vulnerable communities that might not have the political or financial resources to guarantee they receive sufficient preparation and protection.

State Cannot Bear Majority of Costs of SLR Preparation . . . The state does not have the fiscal resources to fund most of the coastal adaptation activities that ultimately will be needed to prepare for SLR. Nor would expecting statewide taxpayers to fully subsidize such activities be appropriate, given that most coastal properties and infrastructure are owned by and primarily benefit local governments or private entities. Local governments have the primary responsibility for planning, authorizing, maintaining, and operating their local infrastructure, and they—and their residents—correspondingly should pay the costs associated with those activities, including how their infrastructure may need to be modified for SLR. As is the case with most local infrastructure costs—including construction and maintenance of water and sewer systems, roads and transportation

systems, and school facilities—the bulk of funding for climate adaptation activities will need to come from local sources.

. . . However, State Investments Can Help Spur Other Actions. Because of the state interest in ensuring that coastal communities are adequately prepared, however, the state has made and will want to continue making some contributions to assist local governments in their SLR adaptation efforts. State dollars can serve as "seed money" that help to spur adaptation project planning efforts for which local governments cannot generate sufficient impetus or funding to get started on their own. Local governments report they often find obtaining local funding sources—such as new dedicated taxes, bonds, or loans—easier when they are requesting the monies to construct specific projects, in contrast to planning activities. As such, state funds play a particularly important role in helping support these initial stages of adaptation work. State funds can also be a key factor enabling the construction of adaptation projects, pairing with local funds to help partially offset what still will be significant upfront costs for local governments. This is consistent with the role the state has played as a contributing funder for many other types of local infrastructure projects. For example, the state frequently funds portions of local water supply and transportation projects, and contributes to the construction of local public school buildings. State funds could be especially important for large regional adaptation projects (which are more difficult and complicated to implement) and projects in economically disadvantaged communities (which often face additional challenges in generating local funding).

RECOMMENDATIONS FOR LEGISLATIVE STEPS

LAO Recommendations Intended to Help Address Key Local Barriers, Help Expedite Adaptation Progress. While effectively preparing for and responding to SLR will be a difficult task for local governments, the threat is on its way. Consequently, the challenges local jurisdictions face will become significantly greater if they do not make additional progress in the coming years. We believe the Legislature can play an important role in helping to increase the types, pace, and scale of coastal adaptation efforts around the state. In this section, we make several recommendations for how the Legislature can help alleviate some of the key barriers to coastal adaptation that local governments are experiencing. Figure 12 summarizes our recommendations, which we discuss in more detail below.

Figure 12

Summary of LAO Recommendations to Support and Enhance Coastal Adaptation Efforts

✓ **Foster Regional-Scale Adaptation**
- Establish and assist regional climate adaptation collaborative groups.
- Encourage development of regional coastal adaptation plans.
- Support implementation of regional adaptation efforts.

✓ **Support Local Planning and Adaptation Projects**
- Increase assistance for cities and counties to plan for sea-level rise (SLR).
- Support coastal adaptation projects with widespread benefits.
- Facilitate monitoring of state-funded demonstration projects.

✓ **Provide Information, Assistance, and Support**
- Establish the California Climate Adaptation Center and Regional Support Network.
- Develop a standard methodology for economic analyses of SLR risks and responses.
- Require a review of how regulatory permitting processes can be made more efficient.

✓ **Enhance Public Awareness of SLR Risks and Impacts**
- Require coastal flooding disclosures for real estate transactions.
- Require that state-funded adaptation plans and projects include robust public engagement.
- Direct state departments to conduct public awareness campaign about threats posed by SLR.

Foster Regional-Scale Adaptation

More widespread collaboration and planning for the inter-jurisdictional effects of SLR not only will help contribute to greater statewide coastal preparedness, it can also help address coastal communities' challenges with limited funding, information, and capacity. We have three recommendations for how the Legislature can foster adaptation efforts at the regional scale.

Establish and Assist Regional Climate Adaptation Collaborative Groups. We recommend the Legislature support climate adaptation work at a regional scale. Specifically, we recommend establishing collaborative groups in several regions across the state to plan together and learn from each other regarding how to respond to the effects of climate change. These groups can help build on some of the nascent collaborative efforts on climate adaptation that are already underway in some regions but help make them more consistent, sustainable, and available across all areas of the state.

By sharing information and resources, such groups have the potential to address many of the adaptation barriers identified by coastal professionals. They can help with coordinating how to respond to cross-jurisdictional climate impacts, creating efficiencies and economies of scale, and building capacity through shared learning and pooling of resources. Participants should primarily include representatives from local governments, but the groups should also create a forum for them to liaison with other key planning partners such as community-based organizations, state agencies, and utilities.

While collaboration will be particularly helpful for SLR preparation because of the cross-jurisdictional effects of coastal flooding, we believe limiting the scope of these groups solely to coastal regions and issues would be a missed opportunity. Local governments must confront and plan to address multiple climate-related challenges, including an increased risk of wildfires, droughts, and incidents of extreme heat. Working with and learning from regional neighbors will be not only helpful but essential in all of these interrelated efforts.

In implementing this recommendation, the Legislature will want to carefully consider how to define and delineate regions, how many regions to fund, and which entities should serve as the fiscal and administrative agents for the groups. These collaborative groups should be large enough to encompass impacts that will affect the whole region and take advantage of economies of scale, but not so large that they inevitably overlook important issues, concerns, and constituents specific to the region. Moreover, they should consider natural processes that will impact participants similarly (such as tidal impacts and sand migration patterns) around which regional planning makes particular sense. Based on existing regional models and feedback we solicited in researching this report, we think the state should look to fund around 10 or 12 collaborative groups. Because of its experience administering climate mitigation programs and its current work establishing a regional program pursuant to SB 1072 (as mentioned on page 18), we recommend the Legislature direct SGC to administer this program, including developing criteria for selecting regions and regional leads, soliciting applications, and choosing the collaborative leads for each region. The seven existing ARCCA groups highlighted in Figure 7 on page 17 may be appropriate entities to lead this effort in some regions because of their previous work and relationships, but this may not be the case in all areas of the state. Moreover, not all counties are covered by the existing ARCCA groups.

In order to sustain the regional groups on an ongoing basis, we recommend providing them with an annual appropriation. The amount of state funding to provide to each region should be sufficient to support a couple staff members, administrative costs, and regular opportunities to plan and share information together (such as meetings and conferences)—perhaps around $500,000 per region annually. The overall cost to the state will depend upon how many regions the Legislature chooses to fund. This level of consistent base funding should make certain the groups can be sustained, however it will not be sufficient to fund all of their activities. To ensure local buy-in and accountability that the groups' work remains helpful

and relevant to them, collaborative participants should also be expected to contribute to the groups' costs and operations. These contributions could include in-kind staff time and involvement as well as a physical location to house the staff and group's operations.

Encourage Development of Regional Coastal Adaptation Plans. In addition to establishing and sustaining forums for regional collaboration around climate issues, we also recommend the Legislature support those groups in developing coastal adaptation plans. These plans should address key vulnerabilities and risks that SLR poses to the region, as well as adaptation strategies the region will take to address them. We envision such a regional plan as distinct from planning efforts occurring at the individual city and county levels in that it would focus on more broad, interconnected, cross-jurisdictional issues that would be outside the scope of single-jurisdiction plans and projects. Additionally, we view these plans as an opportunity to incentivize the region to work together to help address the needs of under-resourced communities that might not be able to adequately prepare if left to plan their own, as well as public trust resources which benefit all local constituents. The plans should not be simply a collection of unrelated vulnerabilities and projects compiled by the region but rather should be focused on issues that have cross-jurisdictional importance. To ensure this emphasis, we recommend the Legislature require that these plans be focused on three categories of regional issues:

- ***Interrelated natural effects*** such as erosion and sand migration patterns, as well as wetlands that buffer wave action.
- ***Interrelated human impacts*** such as addressing potential flooding in important transportation corridors and for important infrastructure that affect multiple jurisdictions.
- ***Key regional priorities*** such as addressing the needs of vulnerable communities, preserving public access to the shoreline, and protecting natural resources such as beaches and coastal habitats.

Because these regional coastal adaptation plans would be coordinated and developed by the regional collaborative groups described above, we similarly recommend the Legislature task SGC with their administration. We recommend the Legislature direct SGC to develop criteria for what the plans should include (pursuant to priorities specified in legislation), what types of entities should be included in the development process, as well as a process for reviewing and approving the plans once they have been developed to ensure they meet the required elements. We recommend the Legislature appropriate funding for grants that SGC would allocate to the regional collaborative groups to support the development of these plans. The state has provided funding for regional plans in other sectors that can serve as models for these coastal adaptation plans. These include regional transportation plans, integrated regional water management plans, and sustainable communities strategies. Based on these examples, we estimate that a few million dollars per region is a reasonable amount to provide for plan development. Assuming the state establishes between six and eight collaborative groups that encompass the coast, adopting this recommendation would have an overall one-time cost of $15 million to $30 million. This amount likely would not be sufficient to cover all costs for these planning efforts, but we believe expecting that local governments contribute a share of the costs is reasonable.

While the state's regions face a number of climate-related challenges for which they have to prepare, we recommend focusing state support for this initial planning effort on coastal adaptation. Because of its cross-jurisdictional impacts and imminence, we think SLR is a fitting issue for the state to select for a pilot regional adaptation planning initiative. As such, only the regional collaborative groups containing coastal counties would be eligible for this proposed planning grant. Limiting the exercise in this way can help participating cities and counties undertake and accomplish the work more quickly compared to if they had to also address potential regional impacts from wildfires, droughts, and heat. (The state should not prohibit regional collaborative groups from widening the scope of their adaptation plans should they wish to do so, but should only provide funding for a targeted coastal focus.) If this regional

planning exercise proves to be productive and effective, the Legislature could consider funding similar efforts to address other climate threats in the future.

In areas where planning efforts already are underway, regional coastal adaptation plans can build upon and connect work that has already been undertaken by individual cities and counties, help fill in gaps, and focus the emphasis on issues of regional importance. In other areas of the state where fewer planning efforts have yet been undertaken, more initial research and planning will be needed. Additionally, an overall regional plan could encompass sub-regional plans and projects based on what makes the most sense for the region. For example, the adaptation plan for the SF Bay Area may be divided into a set of interrelated strategies for the North Bay that differ from those developed for the East Bay.

Consistent with many other local planning efforts—including LCPs—we do not propose making the development of regional coastal adaptation plans a required state mandate. Even if the Legislature were to make these planning efforts optional, we believe most jurisdictions and regions would participate. This is because coastal communities already have a rationale to seek to avoid the potential damages and disruption from SLR; the state providing a forum, structure, and funding to undertake regional planning can help remove barriers and facilitate those communities taking essential steps to meet those objectives. Additionally, implementing our recommendation to provide future project funding that is contingent upon the development of these plans—as discussed next—would provide incentives for cities and counties to participate in these regional efforts.

Support Implementation of Regional Adaptation Efforts. Once they have developed coastal adaptation plans, we recommend the Legislature provide some funding to help regions begin implementing the projects identified in those plans. Because of its experience in allocating grants for coastal projects, we recommend the Legislature task SCC with administering this program. As noted earlier, the need for funding to undertake projects is a primary barrier for coastal communities seeking to prepare for SLR. The state making a commitment to help assist in the funding of projects—even if it might be appropriated across multiple years—will help incentivize participants to spend time on collaborative planning. State contributions for implementing larger-scale, multiyear coastal adaptation projects will be particularly important because such projects likely will be more logistically complicated and expensive to undertake if multiple jurisdictions are involved. As discussed earlier, we recommend the state require that local governments also acquire funding contributions from other sources for these projects.

Estimating an appropriate range of funding for the state to provide for coastal adaptation projects is difficult until regional plans and priorities are developed and submitted. However, stakeholders whom we interviewed for this report emphasized that having some certainty that project implementation funding will be available and forthcoming from the state will be a critical factor for ensuring robust participation by local governments in the planning process. Given the magnitude of the threats posed by SLR, regional projects could easily cost billions of dollars. Because local governments likely will not be ready to spend these funds for a few years—until after they complete regional plans and initial project design work—the Legislature could select an initial target amount to plan to set aside now and revisit that amount as plans and project proposals are developed, particularly in the context of its other spending priorities. For example, if the Legislature is considering asking voters to approve a new general obligation bond for climate adaptation in the coming years, it could reserve a portion of these funds for regional coastal adaptation projects.

Support Local Planning and Adaptation Projects

Not all SLR preparation efforts are appropriate to undertake at the regional scale. Individual cities and counties also will need to address anticipated impacts within their own jurisdictions that do not have a regional impact. Moreover, communities around the state share the need to learn more about which types of coastal adaptation strategies

are most effective. We have three recommendations to help achieve these objectives.

Increase Assistance for Cities and Counties to Plan for SLR. While some SLR impacts would be covered by our proposed regional planning effort, this would not preclude the need for cities and counties to plan for how they will address their more localized vulnerabilities. We recommend the Legislature provide additional support for individual jurisdictions to continue to plan for the effects of SLR. Specifically, we recommend the Legislature appropriate funding to SCC for a grant program that would offset a portion of local governments' costs for conducting vulnerability assessments, adaptation plans, and detailed plans for specific projects. This would continue previous efforts funded through SCC's Climate Ready Program. The funding would help communities that have not yet completed the initial steps of the SLR planning process. Moreover, even cities and counties that have completed vulnerability assessments and adaptation plans report a need for financial assistance in developing detailed project plans and feasibility studies, and in proceeding through the environmental permitting process—activities for which obtaining private financing is often more difficult.

Based on indications from previous rounds of Climate Ready Program grant funding, we find that roughly $5 million per year for the next five years would be reasonable to help local governments make additional progress in SLR planning. After five years the Legislature can reassess the need to continue providing these planning funds, or whether by that point the local demand for funding has largely shifted from planning to project implementation. These planning funds would be in addition to the $1.5 million per year in ongoing Greenhouse Gas Reduction Fund monies the Coastal Commission currently uses to support local governments in planning for SLR and updating their LCPs. (The Coastal Commission uses half of these funds for local grants and half for staff support.)

Support Coastal Adaptation Projects With Widespread Benefits. In addition to planning funds, we also recommend the Legislature support local jurisdictions in undertaking coastal adaptation projects. As discussed, project implementation funding is the most significant barrier to adaptation progress cited by coastal professionals, and state funding plays a crucial role in helping to spur investments from other sources. However, limited state funding should not be used to benefit a small number of private property owners, but rather be targeted for projects with widespread benefits. To this end, we recommend the Legislature appropriate funding explicitly to support these types of projects. Specifically, we recommend the Legislature provide funding to SCC to administer a competitive grant program for coastal adaptation projects that fall under at least one of the following four categories:

- ***Pilot Demonstration Projects to Test Adaptation Strategies.*** Such projects should be designed to experiment with innovative approaches, learn about which strategies are—or are not—most effective in different conditions, and include methods for disseminating lessons learned to other jurisdictions.
- ***Projects With Broad Public Benefits.*** Such projects should protect public resources such as beaches, wetlands, shoreline access, and fish and wildlife habitat.
- ***Projects for Critical Infrastructure.*** Such projects should demonstrate that they address significant risks to public health and safety by reducing potential damage to public infrastructure such as water treatment plants or highways.
- ***Projects Addressing the Needs of Vulnerable Communities.*** Such projects should benefit communities in which a large proportion of residents have comparatively low incomes and therefore likely would not otherwise be able to undertake adequate SLR preparation.

Facilitate Monitoring of State-Funded Demonstration Projects. We recommend the Legislature facilitate some multiyear monitoring, evaluation, and future modification—or "adaptive management"—of coastal adaptation projects. Specifically, we recommend that state grants provided for construction of coastal adaptation projects intended to pilot new approaches—as

described above—also include sufficient funding to conduct several years of post-construction follow-up activities. The Legislature can direct SCC to design adaptation project grant awards to support these additional costs.

In order to verify which types of coastal adaptation projects are most effective, project implementers will need to continue to observe and potentially modify them after construction is completed. While ongoing monitoring and adaptive management is recommended for any type of project—especially those that are nature-based—such practices are particularly essential for coastal adaptation projects for two reasons. First, because of the unprecedented challenge that SLR presents, many response strategies will necessarily be new and untested. Second, conditions will shift as sea levels rise, potentially affecting the project's original design and performance. These uncertainties add to the need to monitor the project to evaluate whether modifications are necessary in the coming years.

In most cases, when the state provides grant funding for capital projects, responsibility for undertaking—and paying for—post-construction activities such as maintenance and monitoring falls to the grantees. Because of the oft-mentioned fiscal constraints local governments face, however, such activities do not always take place at a robust level. For these coastal adaptation projects, we believe a strong rationale exists for the state to help support such costs and ensure that meaningful scientific monitoring and adaptive management occur. This is because of the statewide usefulness of learning lessons from new and innovative coastal adaptation projects, as well as the importance to the public of ensuring their ultimate success in mitigating SLR impacts. We believe that the state helping to fund such follow-up work will ensure that it takes place and thereby help to inform the quality and amount of knowledge about effective adaptation strategies across the state. That, in turn, can help address the need that local governments cite for additional information about the trade-offs of coastal adaptation strategies. Post-construction follow-up activities can help answer the key questions of "how well does the strategy work, does it last, and how can we make it work better?" To this end, we recommend the state require that as a condition of receiving state funding, local grantees must submit regular project reports to SCC summarizing project performance and lessons learned. SCC could then disseminate this information through the aforementioned regional climate collaborative groups and the California Climate Adaptation Center and support network we propose below.

While the amount needed for these follow-up activities will vary by project, a rough guideline might be about 10 percent of the amount provided for construction. For example, if SCC allocated a grant of $10 million to construct a living shoreline project, it might then also provide an additional $1 million to be used over several years for monitoring and adaptive management. This proportional approach likely will not cover all of the associated costs. As with project construction costs, state funding can help enable and enhance monitoring efforts, but project proponents should be expected to help pay the full costs of post-construction activities.

In addition to project-specific follow-up activities, we recommend the Legislature allow SCC to use a portion of adaptation project funds to conduct—or award grants for another entity to conduct—large-scale scientific monitoring on coastal conditions. For example, this could include tracking changes in beach width along a whole region of coastline—rather than each jurisdiction or project grantee having to conduct such monitoring for its own portion of beach. Such larger scale monitoring not only could take advantage of economies of scale, it also could allow for analyses across different locations to test the effectiveness of strategies employed in one area as compared to those in another.

Implementing this recommendation need not require a separate appropriation from the Legislature. However, the Legislature should consider these post-construction costs when determining the overall amount it wants to appropriate for coastal adaptation.

Provide Information, Assistance, and Support

As discussed earlier, local governments are struggling with how to determine next steps in preparing for SLR and seeking tools to help make such decisions. The state is uniquely positioned to take advantage of economies of scale, centralized communication forums and expertise, and state-level authority to help support local adaptation efforts. We have three specific recommendations to help advance these objectives.

Establish California Climate Adaptation Center and Regional Support Network. We recommend the Legislature establish a system for providing technical support and information to local governments on adapting to climate change impacts. The goal of this system would be to connect practitioners undertaking adaptation work with state policy and guidance, useable scientific information, and technical assistance that is both easily accessible and applicable. This system would seek to address local governments' frequently expressed need for "a *person* to call" to answer their questions and provide real-world advice, guidance, expertise, and examples of how to proceed with adaptation work. Because of the many climate-related challenges facing local governments, we recommend this effort not be limited to coastal adaptation and the threat of SLR but rather be designed to support a broad array of climate adaptation efforts.

Specifically, we recommend the Legislature establish the California Climate Adaptation Center with funding for a staff of roughly 20 employees. We estimate this would cost a few million dollars annually. We recommend that about half of these employees be located in a central location—such as Sacramento—and represent expertise in several disciplines essential to adaptation work. For example, these could include experts in planning, engineering, land use law, finance, and community outreach. The remaining staff could be located in regional locations—ideally co-located with staff from our proposed regional climate collaborative groups—so they can be an easily accessible and familiar "go-to" resource for nearby local governments. These regional staff should seek to develop robust relationships at the local level and be engaged in local planning and collaborative meetings and efforts. Regional-based staff should work together with Center-based staff as a network to share information and best practices across the state, disseminate updates and guidance from various state agencies *to* local governments, as well as provide feedback *from* local governments back to state policymakers about challenges and needs at the local level. The Center should also be charged with establishing formal partnerships with the state's universities and coastal researchers to help provide a bridge between local governments and the latest scientific information. Because of its work overseeing the Integrated Climate Adaptation and Resilience Program, we recommend the Center be housed under OPR as an expansion of that effort. As discussed earlier, that program is intended to develop a cohesive and coordinated response to the impacts of climate change across the state.

Develop Standard Methodology for Economic Analyses of SLR Risks and Responses. We recommend the Legislature require OPC to contract for development of a standardized methodology and template for conducting economic analyses of SLR risks and adaptation strategies. This template can serve as a model for local governments to use in conducting their own analyses to assess their local risks and the best options for taking action. It should guide local governments on *how* to undertake such an analysis, as well as include a database of pre-populated statewide data (such as employment data by sector) which local governments can download in lieu having to search for it on their own. In addition to traditional market-based factors, this methodology should provide a framework for how local governments might assign value to nonmarket factors such as ecosystem services and maintaining—or losing—local beaches. Moreover, it should help local governments in evaluating the economic implications of a no action alternative to help them truly assess the trade-offs of potential adaptation steps they might be considering.

Providing such a tool for local governments across the state to use would achieve three

important goals. First, the availability of such a tool likely would lead to more local governments conducting in-depth analyses of how SLR might impact their communities. This increased awareness can in turn help spur additional preparation efforts across the state and make sure such efforts are more data driven and cost effective. Second, the state completing this activity can take advantage of economies of scale and save taxpayers the costs of many individual local governments having to develop or pay the full costs of such work on their own. While local governments still will incur some costs to undertake a customized local economic assessment, their expenses will be lower since they will not have to start "from scratch." Third, a consistent methodology would allow the state to compare and compile data across jurisdictions that conduct such analyses to get a sense of statewide economic risk and inform how future state investments should be targeted.

Understanding the costs and benefits of various adaptation approaches—including the implications of avoiding taking action—is essential input for local governments weighing the trade-offs of how they should proceed. Moreover, such information will be key for them to explain and defend their decisions to local constituents—especially when such decisions might be politically unpopular.

In order to support the development of a standardized methodology and template, we estimate that OPC would need roughly $1 million in one-time funding. A handful of examples of such economic analyses exist that can serve as models for developing a statewide template, including those conducted for San Diego County, the City of Imperial Beach, and the five-state Mid-Atlantic region along the east coast of the U.S.

Require Review of How Regulatory Permitting Processes Can Be Made More Efficient. We recommend the Legislature direct CNRA to explore and implement options for a more coordinated and efficient regulatory review process for coastal adaptation projects, and to report back to the Legislature on suggestions for improvement. This would be similar to the work the agency is undertaking to help simplify and expedite the permitting process for forest health projects. CNRA might identify ways to improve current processes without changes to statute or additional resources, such as by directing departments to consult with each other during their permit review process and to coordinate the conditions and requirements they impose on project proponents. CNRA's review might also reveal that changes to current law or regulations are needed to address existing permit complications. For example, BCDC recently revised its policies to allow for the placement of increased amounts of sediment along the shore of the SF Bay for projects that will restore and enhance the natural habitat. Additionally, CNRA should look at the degree to which additional funding might be necessary to help expedite review and implementation of coastal adaptation projects. The agency should also evaluate the example of the SF Bay Restoration Regulatory Integration Team to see if similar practices could and should be replicated in other regions of the state.

The state's environmental permitting system is designed to protect valuable public trust resources. We are not recommending these important protections be repealed, removed, or ignored. However, the current protracted review process is both causing undue delays for implementing coastal adaptation projects and inhibiting innovative approaches that need to be tried and tested. Because the state has a vested interest in local governments making progress in preparing for SLR and avoiding potential damage—and in them taking such action soon—we recommend reducing regulatory obstacles that currently prevent them from doing so.

Implementing this recommendation will not have any upfront costs for the state. CNRA's review, however, could conclude that significantly expediting permit review time lines would require hiring additional state department staff. The Legislature could then decide if a compelling case exists that departments cannot implement CNRA's suggested changes within existing resources and whether to provide additional funding to improve permitting processes.

Enhance Public Awareness of SLR Risks and Impacts

Coastal communities cite the lack of support for—and, in some cases, direct resistance to—coastal adaptation activities from the public and locally elected leaders as a key barrier to SLR preparation. This is primarily due to a lack of public awareness about coming threats and the need to address SLR. As such, we offer three recommendations for how the state can help build such awareness.

Require Coastal Flooding Disclosures for Real Estate Transactions. We recommend the Legislature adopt legislation requiring that the sale of coastal properties in areas at risk of flooding from SRL be accompanied by a "Vulnerable Coastal Property Statement." This would help to ensure that buyers are aware of the risks posed by SRL and other coastal hazards. Instituting such a requirement would be comparable to the real estate disclosures currently required for properties at risk of forest fires, earthquakes, or other types of flooding. Requiring this information would help spread awareness about SLR among the public and allow Californians to make informed decisions about the risk they are assuming before purchasing coastal properties.

Implementing this recommendation would necessitate the state determining how to define which areas—and encompassed properties—should be designated as "vulnerable" and require disclosures. Moreover, the state would have to decide which time lines and assumptions to make in selecting from the many potential SLR scenarios that scientists have developed. Several tools exist that could be utilized to draw these maps, including the CoSMoS system developed by USGS that incorporates coastal erosion trends. We recommend the Legislature direct OPC to assemble a technical advisory committee to help determine the best approach for implementing this recommendation, including a process for how often the maps should be updated to reflect updated projections.

While uncertainty exists around the degree and time line for SLR, this is no different from the natural hazards for which the state already requires real estate disclosures. The state has already determined that despite the inherent uncertainty, alerting purchasers when a property faces a *potential* risk of future damage from earthquakes, fires, or floods is important public policy. The same rationale applies to potential—and, in some areas, probable—coastal flooding. Indeed, the case for coastal disclosures is arguably even stronger since the certainty of some amount of SLR occurring is greater than that associated with threats such as earthquakes.

We acknowledge that implementing this recommendation has the potential to impact local property tax revenues if such disclosures result in a reduction in the market value of affected coastal properties. Specifically, if a property sells for a lower price than it otherwise would have because of the buyers' heightened awareness of SLR-related flood risks, the local governments would receive less local property tax revenue than if it sold for a higher price. As noted earlier, to the degree local property tax revenues drop, this also could affect the state budget. This is because the California Constitution requires that decreases in certain local property tax revenues used to support local schools be backfilled by the state's General Fund. Despite these potential implications, we believe a strong case still exists for the state to facilitate greater public awareness about the risks that buyers are assuming when purchasing certain coastal properties. Moreover, the value of properties that experience flooding when sea levels reach higher levels will eventually decrease regardless of whether or not the state requires disclosure warnings.

Require That State-Funded Adaptation Plans and Projects Include Robust Public Engagement. If the Legislature opts to establish new grant programs to support coastal adaptation planning and projects at the regional and local levels, we recommend it ensure public outreach and engagement are key components of those programs. Specifically, in the statutes it adopts to create these programs, we recommend directing implementing departments—such as SGC and SCC—to include meaningful public involvement requirements in the criteria they develop for adaptation planning and project

grant programs. We also recommend requiring that the administering departments validate the adequacy of the public engagement efforts that were undertaken by grant recipients before approving final plans and grant awards. That is, final approval of plans and grants by the state should be contingent upon the grantee showing evidence that it met state requirements for public engagement.

Outreach to and participation of the public will be essential to both regional and single-jurisdiction planning processes to help develop societal awareness about SLR and climate risks and to build acceptance for the adaptation steps that will be undertaken. Moreover, to ensure the needs of vulnerable communities are included and accurately reflected in the plans and proposed projects, undertaking broad-based outreach efforts in coordination with community-based organizations is important.

Direct State Departments to Conduct Public Awareness Campaign About Threats Posed by SLR. We recommend the Legislature direct state departments to intensify their efforts to increase public awareness of the time lines, risks, and options for addressing SLR. This should include developing resources which local governments can use in their own local public education efforts, such as templates for social media campaigns, posters and signs, and easily customizable inundation maps. While certain state departments have developed some resources—such as reports, fact sheets, and webinars—most are not widely disseminated and many are not particularly user-friendly. For example, many documents contain technical scientific language and do not clearly explain how SLR will affect California residents' daily lives in the coming years.

We believe that state-level efforts to educate the public about SLR can help local governments in several ways. Among the most important potential benefits would be to help the public better understand the potential risks associated with SLR and develop a sense of engagement in and urgency for taking action. Not only could this reduce the active public *resistance* that some local governments are encountering in their SLR preparation activities, it could foster an atmosphere of organized *support* and advocacy for such efforts. Moreover, greater awareness could build encouragement for—and pressure on—local officials to take action. Another key advantage of undertaking such a campaign on a statewide basis is that it would preclude the need for each individual coastal community to develop such materials and strategies on its own, thereby saving taxpayer money.

We recommend the Legislature direct state departments to focus on increasing public awareness and disseminating information within their existing resources by making it a priority within their regular operations. This could include BCDC, SCC, and the Coastal Commission dedicating a small portion of the annual funding that they receive from NOAA to implement the federal Coastal Management Act towards expanding public awareness activities. Additionally, OPC reports that it recently entered a contract for roughly $200,000 to initiate a public awareness campaign about SLR, which is a positive step in this effort. We recommend the Legislature request regular updates from OPC on the progress and perceived effectiveness of this campaign and what additional steps might be merited—including, potentially, expanding the scope and reach of this work. The Legislature can then evaluate whether additional appropriations might be merited in the future to make these efforts more widespread and effective. The "Save Our Water" water conservation campaign that the state undertook during the recent statewide drought can serve as an example of this type of effort, however that was a more expansive and expensive initiative than what we are recommending here.

FUNDING OPTIONS FOR IMPLEMENTING RECOMMENDATIONS

Multiple Funding Options Available. Given the relatively limited level of state involvement and funding in supporting local coastal adaptation efforts thus far, many of our recommended actions—unsurprisingly—would result in additional costs. We do not identify specific funding sources for each activity, as the Legislature has multiple options upon which it could rely.

Some of the costs associated with our recommendations could be significant, such as if the state opts to play a large role in supporting and expanding implementation of coastal adaptation projects. The state would need to rely on funding sources that can support significant—multimillion dollar—levels of spending for such projects, such as the General Fund or the Greenhouse Gas Reduction Fund. Other recommended actions, however, encompass more modest steps that are intended to help support local governments in their preparation efforts. For these activities—such as supporting regional climate collaborative groups or developing a template for undertaking economic analyses—the Legislature also has the option of using funding sources that are able to support smaller, less-costly expenditures. Such sources include the Environmental License Plate Fund, which provides roughly $50 million annually from the sale of license plates for environmental programs and projects. The state has used this fund to support some coastal activities in the past. Additionally, over $30 million remains unappropriated that voters authorized for coastal restoration and adaptation activities via Proposition 68, the 2018 natural resources bond. The Legislature could direct these resources for implementing some of our recommendations—particularly for supporting adaptation projects. As noted earlier, the Legislature is also contemplating proposals to ask voters to approve a new general obligation bond targeted for climate adaptation activities, which would obligate future General Fund dollars to repay the bond.

Both State and Local Governments Could Look to Alternative Funding Sources to Support Adaptation Activities. In addition to the funding sources upon which the state has historically relied for coastal activities—the General Fund, general obligation bonds, the Greenhouse Gas Reduction Fund, and the Environmental License Plate Fund—the Legislature could also prioritize other existing sources to increase support for coastal adaptation activities. For example, the Legislature could direct CalOES to use a portion of the federal funds the state often receives from FEMA through the Hazard Mitigation Grant Program for these purposes. As discussed earlier, the state receives significant amounts of these funds in years after it experiences federally declared disasters. The Legislature historically has deferred to CalOES on how to utilize these funds, and with a few limited exceptions, thus far the department has not targeted coastal adaptation projects as a priority area of focus. The Legislature could also direct Caltrans and the California Transportation Commission to place a greater priority on SLR adaptation projects in its use of transportation funds along the coast.

Similarly, local governments likely also will need to identify funding sources to support intensified climate adaptation efforts. This could include designing adaptation projects that allow them to take advantage of other available funding sources such as those targeted for transportation, recreation, or water system infrastructure maintenance and replacement projects. For example, if a local government already has plans to upgrade an aged water treatment plant using rate-payer funding, it could incorporate features that would make the project more resilient to future SLR, such as by elevating or moving key components of the facility.

Local governments could also pass new taxes, fees, or bonds at the local level. A few examples of such strategies have already been approved by local voters. These include Measure AA in the nine-county SF Bay Area (which imposed a new parcel tax to be used for shoreline restoration projects), Proposition A in the City of San Francisco (which authorized a $425 million local general obligation bond to repair and improve the Embarcadero seawall), and Measure W in Los Angeles (which imposed a parcel

tax to be used for stormwater capture projects that improve water quality and may also increase water supply in the face of climate change and increased droughts).

Larger Fiscal Context of Implementing LAO Recommendations. For all of the state funding sources we have identified as options for implementing our recommendations—both large and comparatively smaller—the Legislature already faces many competing priorities. Directing funding to implement our recommended actions and support local governments in their coastal adaptation efforts would mean less funding available from any of these sources for other state expenditures. As with all its budgetary decisions, the Legislature will have to balance its multiple priorities. While spending on coastal adaptation now to prevent higher disaster response and recovery costs in the future makes sense, this is not the only pressing issue facing the state and its budgetary resources. For example, the Legislature has also set important goals for addressing housing and homelessness, paying down unfunded pension obligations, and expanding access to child care and health care—all of which could create pressures for additional state funding. Moreover, multiple indicators suggest an economic slowdown could be on the horizon, which would constrain state revenues and further complicate the Legislature's budget decisions. The same types of fiscal trade-offs also exist at the local level.

We note, however, the coming decade is a key period for escalating the pace and scale of adaptation progress. As discussed, taking action soon will allow coastal communities—and the state—to be more strategic about phasing in responses to SLR, and to learn what approaches work best before the risk of severe flooding becomes imminent. We believe that this sense of urgency and the costly implications of failing to adequately prepare for SLR merit consideration of our recommendations alongside other state priorities, especially while the state is still in a strong fiscal position.

CONCLUSION

Recommended Actions Represent Next Step in What Will Be a Multiyear, Multistage Process. The overall goals of our recommendations are to prompt more widespread progress in local coastal preparation efforts. We believe implementing our recommended steps would help build partnerships and capacity at the local level that will both extend adaptation activities to more coastal communities and assist those that are already engaged in planning efforts to transition into implementing policies and projects. While these are incremental steps that will not be sufficient to address all the anticipated impacts of SLR, they represent prerequisites along the path to more robust statewide preparation. Specifically, in order to adequately address the potential impacts of SLR and avoid costly damage and disruption, local governments must first establish collaborative cross-jurisdictional relationships, strengthen their knowledge base about which strategies work (and which do not), and increase public awareness about the coming threats. The Legislature assisting them in these tasks in the near term will help lay the groundwork for local governments to tackle the more difficult—and costly—decisions and actions in future years as floodwaters become more imminent.

Given the scope of this report, we developed our recommendations specifically to expedite coastal adaptation progress at the local level. Yet we believe adopting our suggested actions could help facilitate state-level adaptation efforts as well. Specifically, several of our recommendations also would benefit the state departments responsible for preparing state-owned assets—such as highways and parks—for the impacts of climate change and SLR. For example, state department actions could be informed and improved by the expertise housed within our proposed California Climate Adaptation Center. Similarly, state departments that need to evaluate the potential economic impacts of SLR on state assets could avoid incurring some additional costs if they could rely on a state-developed standardized methodology to conduct such analyses.

Additional Issues Will Need Legislative Attention in Future Years. This report is meant to be a preliminary step at looking at how the Legislature can help address the specific climate challenge of SLR. Additional activities and investments will be needed as coastal impacts become more pressing and prevalent in the future. We knowingly did not address certain issues within this report, either because they were too complex for us to study in detail within our time frame or because they fell outside of the scope we identified for this report. In order for local governments and the state to effectively tackle the coming challenges presented by SLR and other climate risks, however, the Legislature will need to confront some of these difficult topics in the coming years. These include:

- ***Clarifying Uncertain Legal Questions.*** At some point, statutory clarification likely will be needed to address some unprecedented legal issues. These include questions about when and where seawalls can be built and fortified, given the associated trade-offs between protecting the assets behind them and the resulting erosion of nearby beaches.
- ***Defining Statewide Priorities and Responsibilities.*** As threats become more pressing, the Legislature may want to set statewide priorities and expectations for responding to SLR. For example, it will have to weigh whether the state should step in to compel local jurisdictions to protect health and safety and public resources if they fail to adequately prepare for coastal flooding or if they plan to implement actions that will have negative impacts on beaches. The Legislature may also consider establishing statewide decision-making guidelines for which types of resources and facilities should be protected and which might have to be abandoned as sea levels rise.
- ***Rethinking How and Where We Build.*** As water levels rise and areas of the coast begin to experience regular flooding, it will constrain where new development can take place, and some existing properties will have to be renovated or relocated. These challenges will be particularly difficult given the state's existing housing shortage, and therefore an effective response will require thorough and strategic state-level planning and guidance. The Legislature may want to consider how to help local governments confront land use decisions complicated by SLR, including how to facilitate and encourage needed relocations, whether to place restrictions on rebuilding after a flood event, and how to support innovative and resilient approaches to building and development.
- ***Responding to Changes in Insurance Markets.*** As has started to occur in areas of high wildfire risk, the cost and availability of property insurance in coastal communities likely will change as the risk of SLR-related flooding increases. The Legislature may want to determine what role the state should play to support California residents and business owners when property insurance becomes unaffordable or unavailable for some existing properties.
- ***Addressing Additional Climate-Related Risks and Challenges.*** Clearly, SLR is not the only way that the effects of climate change will impact California. The Legislature will also need to determine how to prepare—and help local governments to prepare—for other challenges such as increases in intense heat events, droughts, wildfires, and inland flooding from severe storms.

Further legislative involvement in addressing these issues will be important—particularly when statutory changes are needed to clarify and resolve issues, offer guidance, or provide funding. The Legislature has many avenues through which to engage in these topics, including holding policy and select committee hearings, proposing and participating in robust deliberation over legislation, and requesting research and input from experts within state departments and universities. While the challenges facing the state's coastline are daunting, the science is clear—sea levels are rising. The impacts these coming changes ultimately will have on California's residents, economy, and natural resources will depend directly upon the actions that local governments and the state take to prepare in the coming years.

AN LAO REPORT

LEGISLATIVE ANALYST'S OFFICE

APPENDIX

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Adapting to Rising Tides Bay Area: Operationalizing the Findings

Dana Brechwald

Information

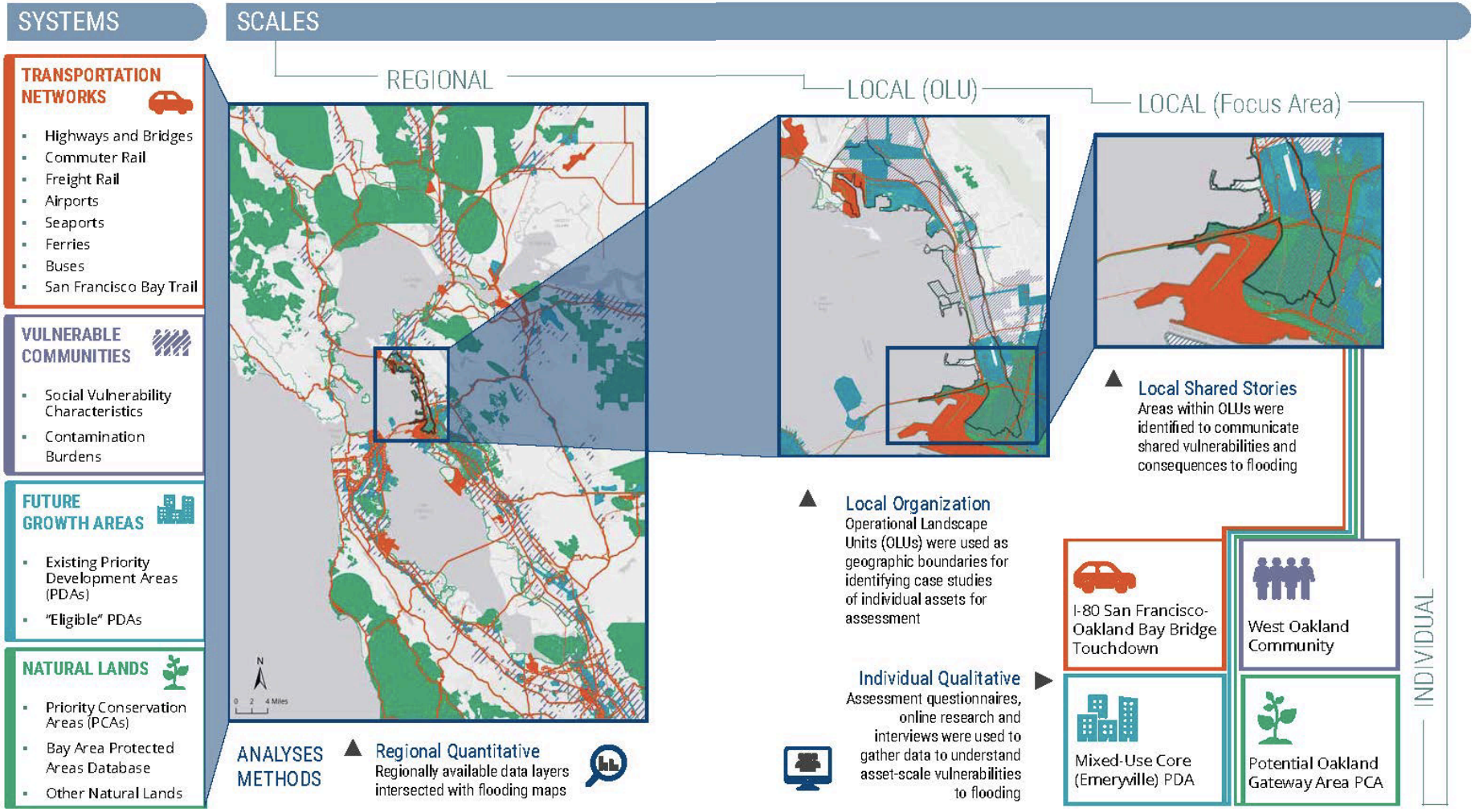
Adapting to Rising Tides
Adaptation Guidance

Developing tools to link vulnerability to reduced risk

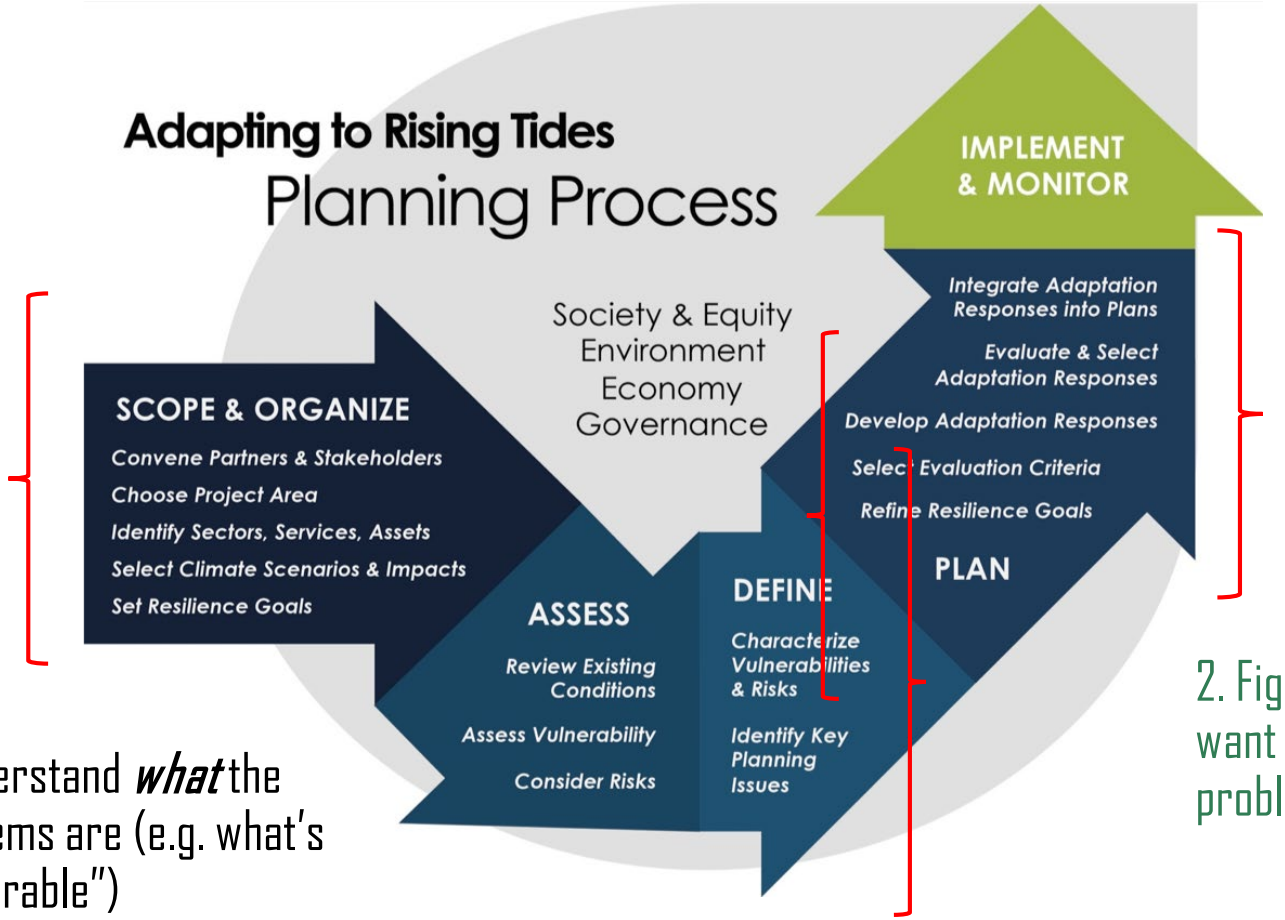
BARC Governing Board

1/24/2019

ART Bay Area Systems and Scales



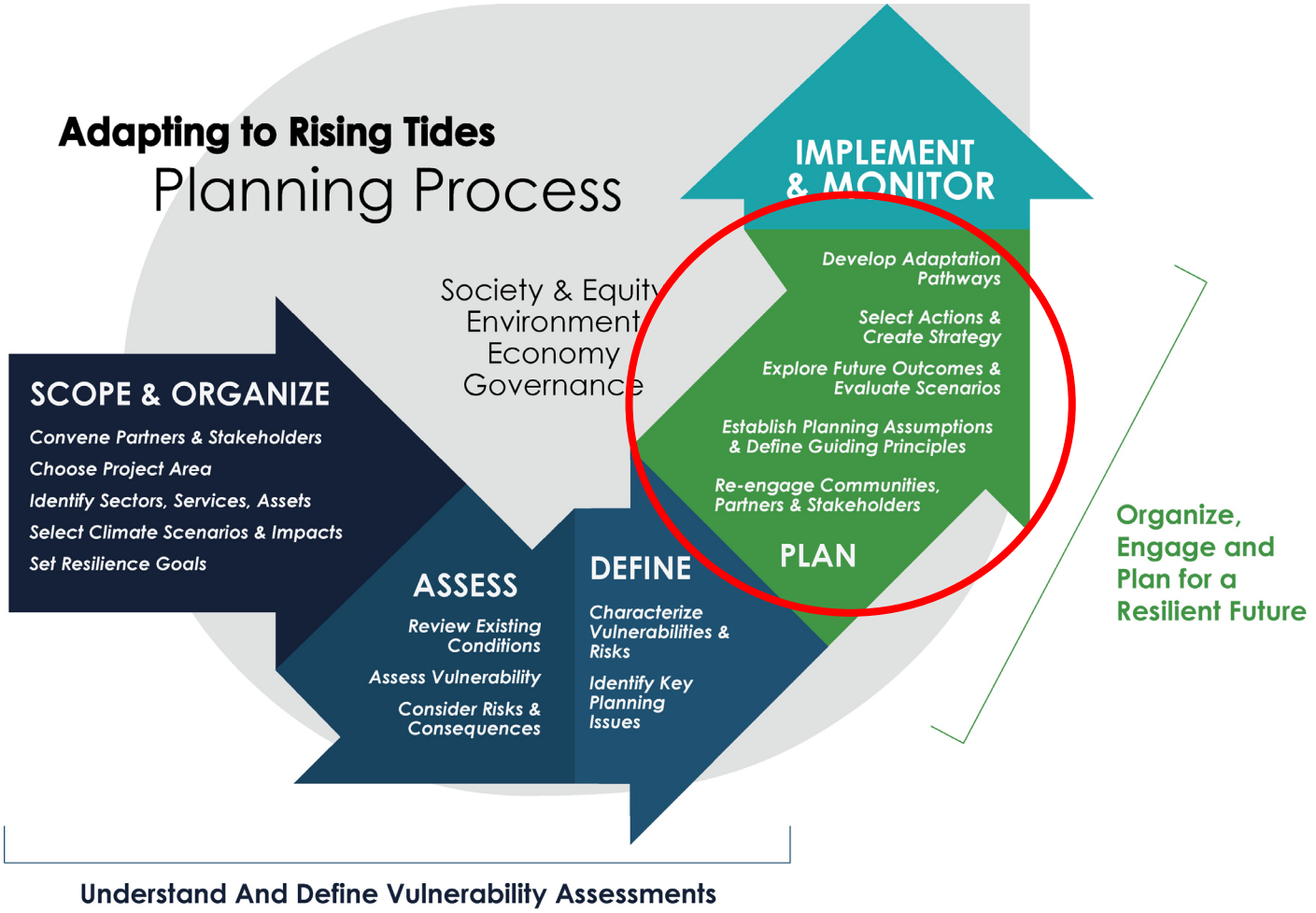
The ART Process



1. Understand ***what*** the problems are (e.g. what's "vulnerable")

2. Figure out ***how*** you want to solve the problems identified

Expanded ART Process



Goals of Adaptation Guidance

- ✓ Provides a series of steps to translate vulnerability assessments into interconnected adaptation actions based on a collaborative vision of risk reduction
- ✓ Help users understand how to decide how actions work together to reduce risk on multiple fronts to create a comprehensive "suite" of actions
- ✓ Get users thinking about how actions sequence over time, taking uncertainty into account – what actions they can or should take today to begin preparing for adaptation even if "impacts" may occur later (adaptation pathways)?
- ✓ Encourage best practices regarding community engagement and the need for planning to be more inclusive for local solutions
- ✓ Provide a toolkit that emphasizes land use, capacity building, program creation, and funding/financing, not just built projects

1. RE-ENGAGE WITH COMMUNITIES AND RELEVANT STAKEHOLDERS

+

2. IDENTIFY APPROPRIATE IMPLEMENTING PARTNERS

3. ESTABLISH PLANNING ASSUMPTIONS (including barriers & opportunities)

4. **COLLECTIVELY DEFINE GUIDING PRINCIPLES FOR RESILIENCE**

5. **EXPLORE FUTURE OUTCOMES - WHAT COULD THE SHORELINE LOOK LIKE?**

Conceptual example of scenario planning with different colors representing different future scenarios

- PROTECT
- AVOID OR RETREAT
- ADAPT
- PREPARE

6. **SELECT ACTIONS AND CREATE A STRATEGY FOR PREFERRED SCENARIOS**

- CAPACITY BUILDING
- PLANS AND POLICIES
- PROGRAMS AND OPERATIONS
- FUNDING AND FINANCING
- BUILD A PROJECT

7. **EVALUATE STRATEGIES (A SUITE ACTIONS) TO UNDERSTAND BENEFITS AND TRADEOFFS**

- FEASIBILITY
- SOCIAL BENEFITS
- ECONOMIC BENEFITS
- ENVIRONMENTAL IMPROVEMENTS
- GOVERANCE
- DISASTER LIFECYCLE
- REGIONAL OR NEIGHBORING IMPACTS

1. RE-ENGAGE WITH COMMUNITIES AND RELEVANT STAKEHOLDERS

+

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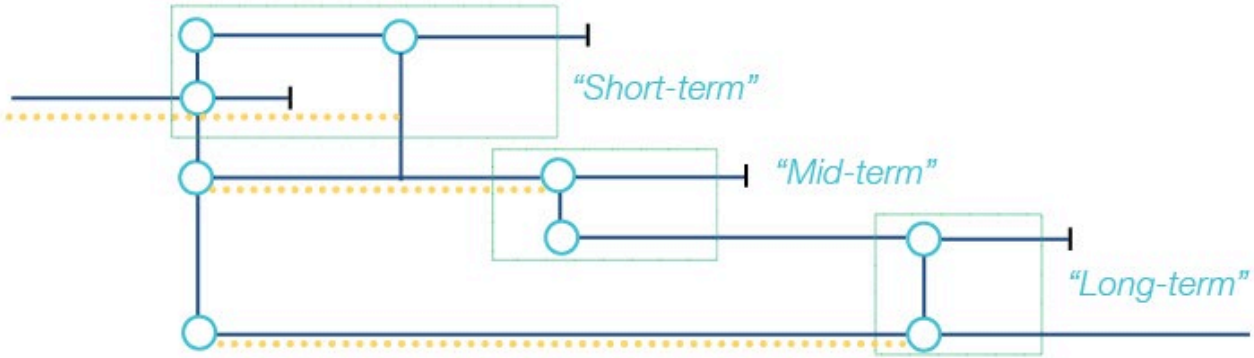
- GOVERANCE
- DISASTER LIFECYCLE
- REGIONAL OR NEIGHBORING IMPACTS

8. PUT THE PIECES TOGETHER TO CREATE ADAPTATION PATHWAYS

STRATEGY OPTIONS	*TIMELINE, TOTAL WATER LEVELS, OR NEAR, MID, LONG-TERM*
*Action **1** for Strategy **A***	
*Action **2** for Strategy **A***	
*Action **3** for Strategy **B***	
*Action **4** for Strategy **C***	
*Action **5** for Strategy **C***	



How does this coordinate with other guidance?

In effort to improve coordination among other groups doing similar work, we scheduled meetings and participated in ongoing efforts:

- ✓ SFEI/Point Blue - Adaptation Framework
- ✓ CalOES – APG 2.0 Public Webinars (3)
- ✓ OPC – Sea Level Rise Potential Adaptation Guidance
- ✓ BCDC's Climate Change Policies Implementation Team
- ✓ BayCAN – South Bay Meeting
- ✓ SB1 Adaptation Planning/East Palo Alto Parent Academy
- ✓ San Mateo Climate Collaborative – Sea Level Rise Task Force

Adaptation Catalogue

- ✓ Comprehensive catalog of actions you can take to reduce risk and advance adaptation
- ✓ Includes a wide range of tools – not just built flood control projects
- ✓ Covers all types of approaches: adapt, protect, avoid or retreat, and prepare
- ✓ Designed to work in "packages," not standalone
- ✓ Pulls from many existing sources, including CSCC, Adaptation Atlas, and past ART projects

Next Steps

- ✓ Will publish in Spring/Summer 2020:
  - Guidance Document
  - Worksheets/templates
  - Adaptation Catalogue

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Plan Bay Area 2050 Update: Environment Element Draft Blueprint

Dave Vautin and Rachael Hartofelis

Information

Plan Bay Area 2050 Draft Blueprint: Update on the Environment Element

Subject: Overview of the environmental strategies under consideration for inclusion in the Plan Bay Area 2050 Draft Blueprint.

Background: The Plan Bay Area 2050 Draft Blueprint includes four elements: Transportation, Housing, the Economy, and the Environment. For the Environment element of the Draft Blueprint, strategies will be integrated to address topic areas including reducing greenhouse gases, mitigating climate and natural hazard risks, and conserving key natural and agricultural lands. These issues and their associated strategies link to and are thought of as an integrated Blueprint alongside complementary transportation, housing and economic strategies.

This document introduces the three environmental topical areas and the Draft Blueprint strategies proposed to achieve improved regional outcomes. The proposed strategies each have a brief strategy description for both Blueprint Basic (which assumes no new future regional revenue measures) and Blueprint Plus (which assumes robust new futures regional revenue measures), as well as findings from Horizon analysis.

Strategies: Building on Plan Bay Area 2040 and Horizon, staff are recommending the study of four environmental strategies in the Draft Blueprint:

Reduce Transportation-Related Greenhouse Gas (GHG) Emissions

1. **Expand the Climate Initiatives Program** captures additional GHG reductions from Plan Bay Area 2040 strategies that comprise MTC's Climate Initiatives Program, as well as new strategies under consideration such as increased electrification requirements for transportation network companies.

Note: *additional GHG reductions will be achieved through a combination of transportation, housing, and economic strategies to be showcased later in January.*

Conserve Agricultural Lands and Open Space

2. **Keep Current Urban Growth Boundaries in Place** continues to be recommended in the Draft Blueprint; this strategy has been a part of both prior versions of Plan Bay Area.

Address Climate and Hazard Impacts

3. **Adapt to Sea Level Rise** to reduce regional climate impacts. Three Horizon sea level rise strategies will be merged into this single strategy for the Draft Blueprint, contingent on funding availability in Blueprint Basic.
4. **Modernize Existing Buildings with Seismic, Wildfire, Drought, and Energy Retrofits** to preserve existing housing. The strategy aims to make

existing homes healthier and safer while also reducing the carbon and water footprint of the Bay Area's aging homes, contingent upon New Revenues available in Blueprint Plus.

Next Steps: Staff recommend the study of four environmental strategies in the Draft Blueprint. Staff will continue to explore how the strategies reduce greenfield development, address climate and hazard impacts, and reduce transportation-related emissions. Working with stakeholders, staff will also develop possible funding measures to support the more expansive and costly strategies included in the Draft Blueprint Plus.

Attachments: Attachment A: Description of Environmental Strategies Proposed for Inclusion in the Draft Blueprint
Attachment B: Plan Bay Area 2050 and the Bay Conservation and Development Commission's ART Bay Area initiative
Attachment C: Presentation

Attachment A

Reduce Transportation-Related Greenhouse Gas (GHG) Emissions

Transportation emissions represent the largest source of greenhouse gas emissions in California. There are over 170 million miles driven in the Bay Area each day, an average of nearly 25 vehicle miles traveled (VMT) per person. Most of these vehicles are conventional gasoline cars, emitting carbon dioxide and other air pollutants with each mile driven.

Through legislation and executive order, the State has established goals to reduce GHG emissions 40 percent below 1990 levels by 2030 and become carbon neutral by 2045. To support this goal, SB 375, the Sustainable Communities and Climate Protection Act of 2008, requires the State to establish GHG emission reduction goals for each metropolitan region in California. Under SB 375, MTC is charged with developing a plan to reduce per-capita GHG emissions from cars and light-duty trucks by 19 percent compared to 2005 levels by 2035. To achieve this goal, Plan Bay Area 2050 will have to prioritize strategies that accommodate growth while reducing dependence on automobiles.

While such strategies were not specifically studied in Horizon, many other complementary strategies for transportation, housing, and the economy were evaluated to understand how these could complement the Climate Initiatives Program (discussed on the following page). These included:

- Allowing diverse housing in Priority Development Areas
- Allowing diverse housing in Transit Rich Areas
- Streamlining development in all growth areas
- Expanding public transit networks
- Building a complete micromobility network
- Implementing Vision Zero speed reduction measures
- Applying tolls based on time-of-day and vehicle occupancy on all freeways

These strategies helped to support significant reductions in GHG emissions in Futures Round 2.

In Horizon, individual projects and policy strategies were not developed and analyzed solely for GHG emission reductions. Because reducing GHG emissions is a priority of the regional planning process, many strategies considered in Horizon – from transportation investments to land use policies – were considered for their impact on travel behavior and emissions. At the series of recent "pop-up" workshops, 90 percent of all comments were in support of the strategies. Future committee items will inform which strategies advance into the draft Blueprint for the transportation, housing and economy elements, which will ultimately complement the strategy listed below.

Strategy – Expand the Climate Initiatives Program

Staff expect that the GHG reduction achieved by strategies from the Transportation, Housing, and Economy elements alone will fall short of the 19 per-capita reduction target, even as new strategies continue to be

integrated to make the Plan more sustainable than ever. Similar to past Plans, staff anticipate closing most or all of the remaining gap with an expanded Climate Initiatives Program.

A number of policies and investments that can reduce GHG emissions are currently not able to be analyzed in the regional land use and travel models because the models are not sensitive enough to capture every type of strategy. Instead, separate calculation methodologies are developed for these policies and programs. Because they are analyzed outside of the standard regional models, the strategies are referred to as "off-model" strategies. These off-model strategies make up the Climate Initiatives Program, the set of activities to help the region meet its SB 375 GHG reduction targets. The Plan Bay Area 2050 Climate Initiatives Program is expected to include most strategies from Plan Bay Area 2040, as well as several new strategies:

- Bikeshare
- Bike Infrastructure
- Carshare
- Commuter Benefits Ordinance
- Employer Shuttles
- Trip Caps
- Vanpool
- Regional EV Charger Network
- Feebate Program Implementation
- Vehicle Buyback Program
- Mobility-as-a-Service *(potential new strategy)*
- Electric TNC Requirement *(potential new strategy)*

The performance of these strategies, in combination with updated land use and transportation strategies, will be assessed as the Blueprint is developed for Plan Bay Area 2050 and compared to the GHG reduction targets. Depending on the assessment, additional policy commitments may be required to reach the 2035 target established by the State.

Conserve Agriculture and Open Space

The San Francisco Bay Area is exceptional in its natural beauty, biologically diverse landscapes and waters, bountiful farms and ranchlands, and world-class parks, trails and open spaces. Vibrant natural and working lands are essential to the high quality of life, health, and prosperity of the region. These natural and working landscapes and their rich biodiversity also form the region's life support system by purifying, storing, and conveying water, producing food, sequestering carbon, and much more.

Protection of natural and working lands has been a regional priority in recent decades, resulting in approximately 28 percent (1.3 million acres) of Bay Area lands under some form of land use protection. Despite these efforts, every year urban development continues to move outward, onto previously undeveloped lands. Pressures for greenfield development are already immense and with two million additional residents anticipated by 2040, conserving natural and working lands will only become more challenging. The healthier and more connected these natural and working lands remain, the better able they

will be to provide benefits to people and wildlife while withstanding the effects of population increases and climate change in the coming decades. Meeting this challenge will require bold action.

Strategy – Keep Current Urban Growth Boundaries in Place

Maintaining urban growth boundaries (UGBs) was the core conservation strategy in Plan Bay Area 2040 and Horizon. Expanding urban development outward has negative environmental impacts and increases the amount of public infrastructure required to be built and maintained into the future. With the exception of San Francisco, all counties in the Bay Area protect open space and agricultural lands by county-wide land use measures, such as urban service areas, environmental corridors, slope/density restrictions, stream conservation areas, or riparian buffers. Additionally, some cities have UGBs to limit sprawl and protect agricultural land. Generally, this means that if a project falls outside a UGB, there are regulatory measures in place to aid local jurisdictions in land protection.

Blueprint Basic: Using urban growth boundaries, confine new development within areas of existing development or areas otherwise suitable for growth, as established by local jurisdictions.

Blueprint Plus:

same as Blueprint Basic.

No funding required

Horizon Analysis: With this strategy in place, the projected greenfield development from 2020 to 2050 would be 33 to 47 times less than the recent 2000 peak. The reason there is still some greenfield development is that counties and cities have identified limited greenfield areas within the current set of UGBs that are built out during the planning timeframe. In Horizon and in Plan Bay Area 2040, MTC and ABAG use the regional land use model to assert that no growth occurs outside the UGBs. This assertion assumes that UGBs on their own are a strong enough strategy to prevent development beyond the boundary. However, the general growth measures that are in place vary in effectiveness and enforcement. Given the effectiveness of the UGBs in recent years at constraining greenfield development, no strengthened Blueprint Plus measure is currently recommended. ABAG and MTC staff will work with conservation stakeholders to continue to find ways to strengthen UGBs as a means to prevent sprawl onto important agricultural and habitat lands.

Address Climate and Hazard Impacts

In recent years, shocks and stresses have impacted the daily lives of residents - wildfires have destroyed over 10,000 homes in the region, power shut offs have left communities in the dark, and transportation networks have struggled to deal with increasing floods. Many communities have already faced these hazards, raising funds for both mitigation and adaptation. Yet the future holds even more uncertainty - within the next 30 years, there's an estimated 72 percent chance of a 6.7 or greater earthquake hitting the area. Sea level rise is expected to impact the region on a timeline that keeps inching closer. Additionally, climate change has exacerbated the risk of wildfires, as well as other extreme weather impacts.

Without regional resilience efforts, hundreds of thousands of jobs and housing units could be displaced, and key infrastructure rendered unusable by delays or closures. Some hazards, such as earthquakes and wildfires, can be particularly troubling, as they quickly exacerbate the regions housing crisis. A resilient approach is critical to moving forward. The Bay Area has taken steps in a number of communities, but piecemeal efforts have left critical vulnerabilities within the region that the following Blueprint strategies seek to address. By focusing on both sea level rise adaptation and home retrofits, the region can look to 2050 with a foundation of resilient strategies on which to build.

Strategy – Adapt to Sea Level Rise

With no protective measures, even just 1 foot of additional sea level rise will flood key highways, homes and jobs, and many of the Bay Area's marsh ecosystems. The impacts grow larger with each additional foot of sea level rise.

Blueprint Basic: Using forecasted revenues from existing sources like the Army Corps of Engineers and FEMA, the region could protect portions of the Bay Area's shoreline. With limited existing funds the strategy would prioritize resources on areas of high benefits and low costs. Some areas would be assumed to flood as seas rise. ***Funding: $2 billion***

Blueprint Plus: With new revenues, the region could more fully adapt to sea level rise. Most Bay Area communities and transportation facilities could be protected; this may include protecting SR-37, provided equity mitigation strategies are identified. ***Funding: $20 billion***

Horizon Analysis: In Horizon, sea level rise adaptation was studied through three separate strategies: partial adaptation to sea level rise, full adaptation to sea level rise, and adaptation of the SR-37 corridor.

In partial adaptation, protective and adaptive approaches were focused in areas with the most significant impacts. These impacts included areas with existing communities, sensitive ecosystems, key transportation systems, or areas planned for future growth. Horizon analysis found that a partial, or more limited adaptation approach, could prevent flooding under a 3-foot scenario of up to 100,000 housing units, between 100,000-200,000 jobs, and many critical infrastructure assets, such as major highways. However, many communities were not fully protected under this strategy, and crucial connective infrastructure like SR 37 went unprotected. The Draft Blueprint Basic relies on only a portion of the "partial adaptation" Horizon strategy because existing forecasted revenues were less than anticipated. The adaptation for Blueprint Basic is therefore expected to protect fewer homes, jobs, marsh ecosystems and transportation assets than what was analyzed in the partial Horizon strategy.

Horizon also studied a strategy that more fully adapted the region to sea level rise, and a strategy that specifically adapted State Route 37 (SR-37) and the surrounding ecosystems. More fully adapting to sea level rise protected more communities, and expanded wetland restoration efforts. Adapting SR-37 to sea level rise would maintain a critical east-west highway corridor, preserving much faster travel times than any alternative, and opening up a regionally significant opportunity to restore over 15,000 acres of historic marsh. The Blueprint Plus could integrate all three Horizon sea level rise strategies, provided equity mitigation strategies are identified for SR-37. At the January 7th RAWG workshop, staff will continue to work with stakeholders to answer two key questions: How much adaptation should be funded?

Strategy – Modernize Existing Buildings with Seismic, Wildfire, Drought and Energy Retrofits

Many older buildings built before modern codes are at a greater risk of damage in earthquakes and wildfires and do not meet current standards for energy and water efficiency. A significant earthquake or fire could create even greater pressure on the tight Bay Area housing market by reducing the available housing stock. New buildings are already required to use water and energy efficiently – improvements to existing buildings will further reduce the region's environmental footprint.

Blueprint Basic: Due to a lack of substantial existing funding, the strategy as included in the Blueprint would only entail a continuation of ad-hoc upgrades. The strategy would have a very limited effect on the quality of existing Bay Area homes. ***Funding: <$1 billion***

Blueprint Plus: With new revenues, expand the local adoption of building ordinances and companion retrofit incentives to bring existing buildings up to higher standards. Align $20 billion in new funding split evenly between seismic, wildfire, drought, and energy upgrades. Provide subsides up to 50 percent to offset the burden of multifamily and single-family building retrofits. ***Funding: $20 billion***

Horizon Analysis: The Bay Area has made efforts to retrofit the existing housing stock, but many of these efforts are geographically localized, or siloed within specific focuses. This Blueprint Plus strategy imagines a broad effort to modernize Bay Area housing, providing upgrades that work in tandem to make safer, more efficient homes. As studied in Horizon, the Blueprint Plus strategy would provide incentives for earthquake, wildfire, energy, and water retrofit upgrades for older homes constructed before modern codes. It accounts for a 50 percent subsidy to reduce the burden of retrofits on tenants and homeowners. This strategy is only recommended for inclusion in the Draft Blueprint Plus, with the addition of new revenues to support the measure.

Horizon analysis has shown that this strategy – when fully funded - could reduce residential earthquake risk for over 500,000 households -- in the modeled scenario with a magnitude 7.0 Hayward earthquake, the strategy saved 50,000 homes and sped up regional recovery. The strategy would support wildfire mitigation measures for over 275,000 at-risk homes in the region, focusing on proven measures like structure hardening and defensible space. The energy and water efficiency measures would reduce carbon emission by roughly 2 million tons, and water use by 12 billion gallons annually.

The Horizon analysis highlighted the benefits of mitigation. Moving forward, it is important to consider the impact of up-front costs or variable subsidy rates, especially for lower income residents. Additionally, even when funded as a Blueprint Plus strategy, this is not a catch-all fix, as retrofits only reduce a home's risk. Insurance and land use policies are also key to mitigating risk for wildfires, earthquakes and flooding. Additionally, water and energy efficiency retrofits within this strategy tend to address low hanging fruit, and the next step for many communities may end up trickier.

Attachment B

Attachment B

Regional Planning: Plan Bay Area 2050 and ART Bay Area

In 2016, ART Bay Area was developed as a collaborative effort between MTC/ABAG, BARC, and BCDC, helping the region to understand sea level rise vulnerability and regional risk. Its analysis has informed the modeling efforts of Horizon, while creating regional agreement on processes and data. With the onset of Plan Bay Area 2050, the assessments provided by ART Bay Area are especially beneficial. A shared understanding of the region's vulnerability helps Plan Bay Area 2050 create a robust framework for MTC's entrance into sea level rise planning, and supports a more unified vision on regional risk. The collaborative relationship of these agencies has led to mutually beneficial planning efforts, and helps to institutionalize resilience planning within the Bay Area.

Plan Bay Area 2050 Draft Blueprint: Update on Environment Element

BARC Governing Board

January 24, 2020

What is Plan Bay Area?

- The regional plan is **a blueprint for growth and infrastructure for the next 30 years.**
- The regional plan is **updated every four years**, with this major update due in 2021.
- The regional plan is a reflection of **the shared priorities of the diverse nine-county San Francisco Bay Area.**
- The regional plan is **fiscally-constrained**, even as it aspires to tackle the Bay Area's big challenges with specific strategies.
- The regional plan is **not an expenditure plan**; it is focused on setting priorities and over the long term and looking holistically across "silos".

Plan BayArea 2040

HORIZON

PLAN BAY AREA 2050

Spring 2015 to July 2017

February 2018 to October 2019

September 2019 to June 2021

High-performing strategies and projects from *Horizon* – those that are resilient to uncertainties – **will be recommended for inclusion in the Plan Bay Area 2050 Blueprint.**

Vision for Plan Bay Area 2050

To ensure by the year 2050 that the Bay Area is **affordable**, **connected**, **diverse**, **healthy** and **vibrant** for all.

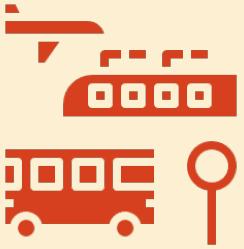
HORIZON → PLAN BAY AREA 2050

Similar to *Horizon*, ***Plan Bay Area 2050*** **is integrating four core topic areas,** as we work to create a long-range integrated regional vision for the next 30 years.

Cross-Cutting Issues

Equity

Resilience



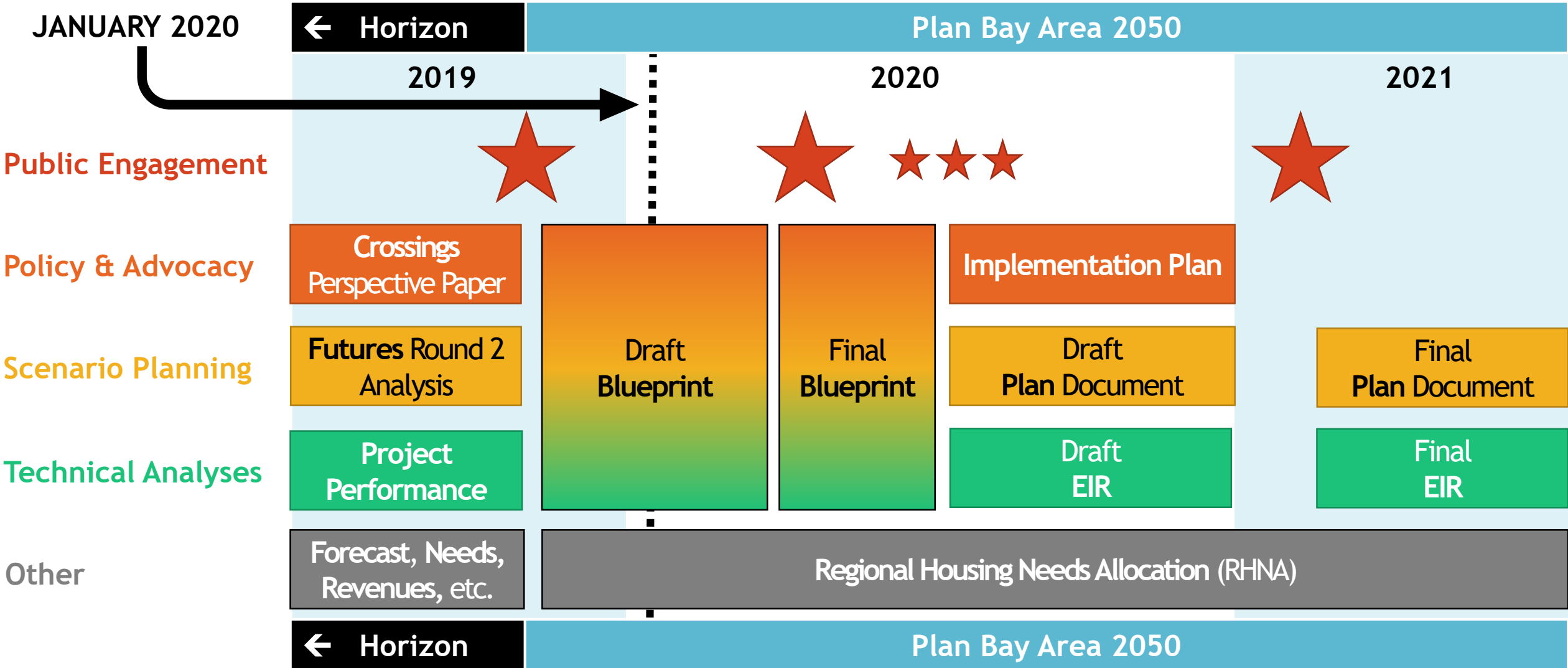
Transportation

Environment

Housing

Economy

Plan Bay Area 2050 Schedule



The Draft Blueprint will integrate complementary strategies to achieve improved regional outcomes.

Plan Bay Area 2050 Blueprint

- **Transportation** Investments & Strategies
- **Housing** Geographies & Strategies
- **Economic** Geographies & Strategies
- **Environmental** Strategies

Three Topics to Think About…

- **EQUITY.**

  Plan Bay Area 2040 performed **much better on environmental goals than on equity goals**; in concert with the **Equity Platform** effort, staff proposes to **prioritize equity to a significantly greater degree** this cycle.

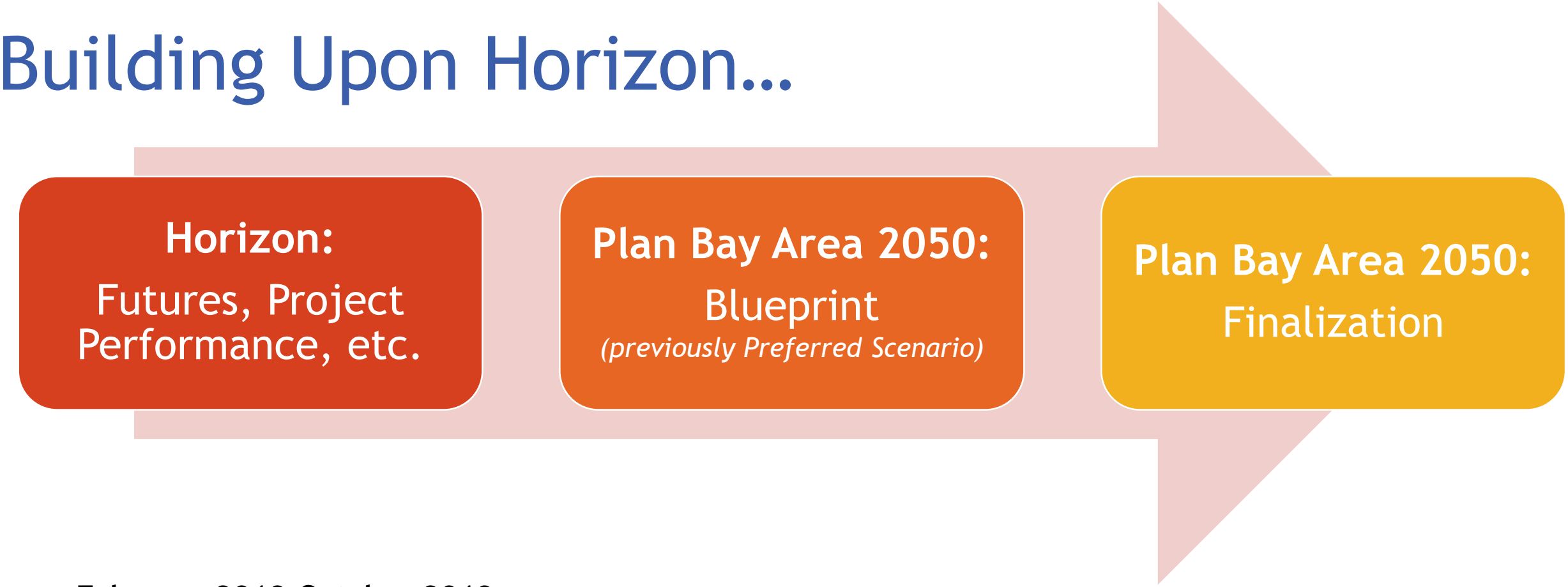
- **GREENHOUSE GASES.**

  The new **19 percent per-capita greenhouse gas emissions reduction target** will require **ambitious strategies** going far beyond *Plan Bay Area 2040*; adopting a Plan that does not achieve the target puts the region's access to state funding sources at risk post-2021.

- **NEW REVENUES.**

  The Blueprint may be able to **incorporate significant new revenues** that could fund transportation, housing, economic, and/or environmental strategies.

Building Upon Horizon…

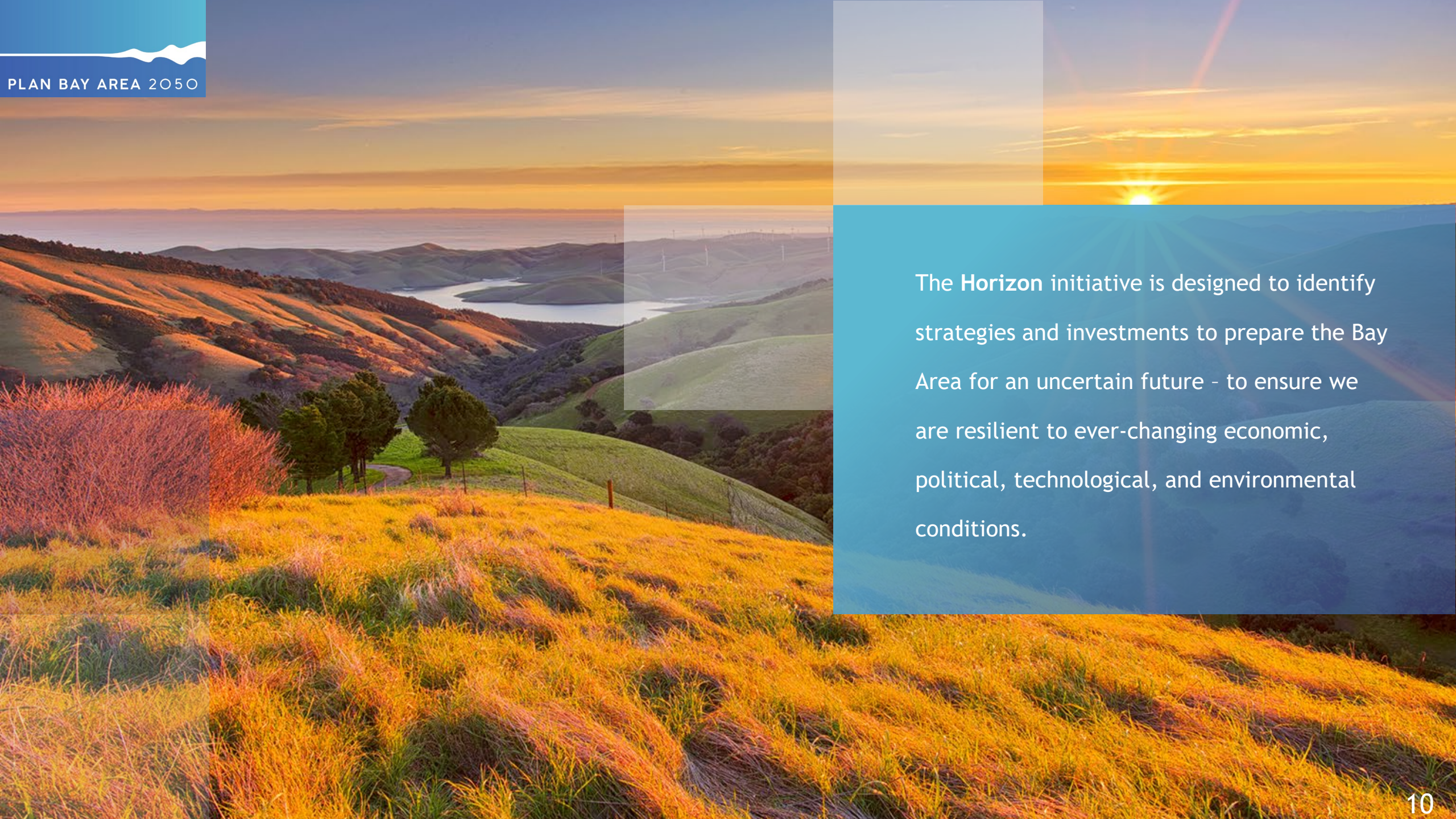


February 2018-October 2019
Robust scenario planning, project evaluation, and policy analyses

September 2019-Summer 2020
Selection of resilient and equitable strategies to create a more comprehensive regional plan

Summer 2020-Summer 2021
Development of shorter-range Implementation Plan + environmental analysis

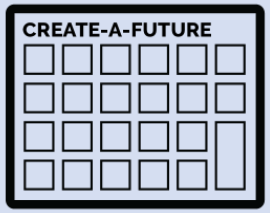
PLAN BAY AREA 2050



The **Horizon** initiative is designed to identify strategies and investments to prepare the Bay Area for an uncertain future – to ensure we are resilient to ever-changing economic, political, technological, and environmental conditions.

Futures Process

OUTREACH

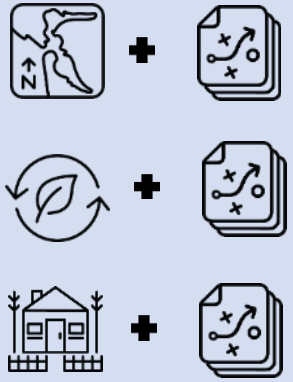


ROUND 1 ANALYSIS

Current Strategies

REPORT

OUTREACH



ROUND 2 ANALYSIS

New Strategies

REPORT

Three Futures – "What If?" Scenarios

A

Rising Tides, Falling Fortunes

What if... the federal government cuts spending and reduces regulations, leaving more policy decisions to states and regions?

B

Clean and Green

What if... new technologies and a national carbon tax enabled greater telecommuting and distributed job centers?

C

Back to the Future

What if... an economic boom and new transportation options spur a new wave of development?

35 Strategies Analyzed

Strategies were designed to support these nine priority areas, based on the Futures Interim Report findings. While new revenues were assumed in all Futures, fiscal constraint did mean that some strategies were omitted from Rising Tides, Falling Fortunes.

Improve Economic Mobility

Shift the Location of Jobs

Spur Housing Production

Retain & Expand Affordable Housing

Improve Access, Speed, and Reliability of Transportation

Prioritize Active Modes

Price Transportation Services

Reduce the Environment's Impact on Us

Reduce Our Impact on the Environment

Futures Round 2: Environmental Strategies Recommended from *Horizon*

Reduce the Environment's Impact on Us

Adapt to Sea Level Rise. Fund a set of protective and adaptive systems to prevent flooding in areas expected to have the most significant impacts from climate change.

Modernize Existing Buildings with Seismic, Wildfire, Drought, and Energy Retrofits. Subsidize 50 percent of common earthquake, wildfire, energy and water retrofit strategies for residential structures.

Reduce Our Impact on the Environment

Expand Climate Initiatives Program. Increase funding for programs targeted to reduce greenhouse gas emissions, building upon existing initiatives such as bikeshare and electrification incentives.

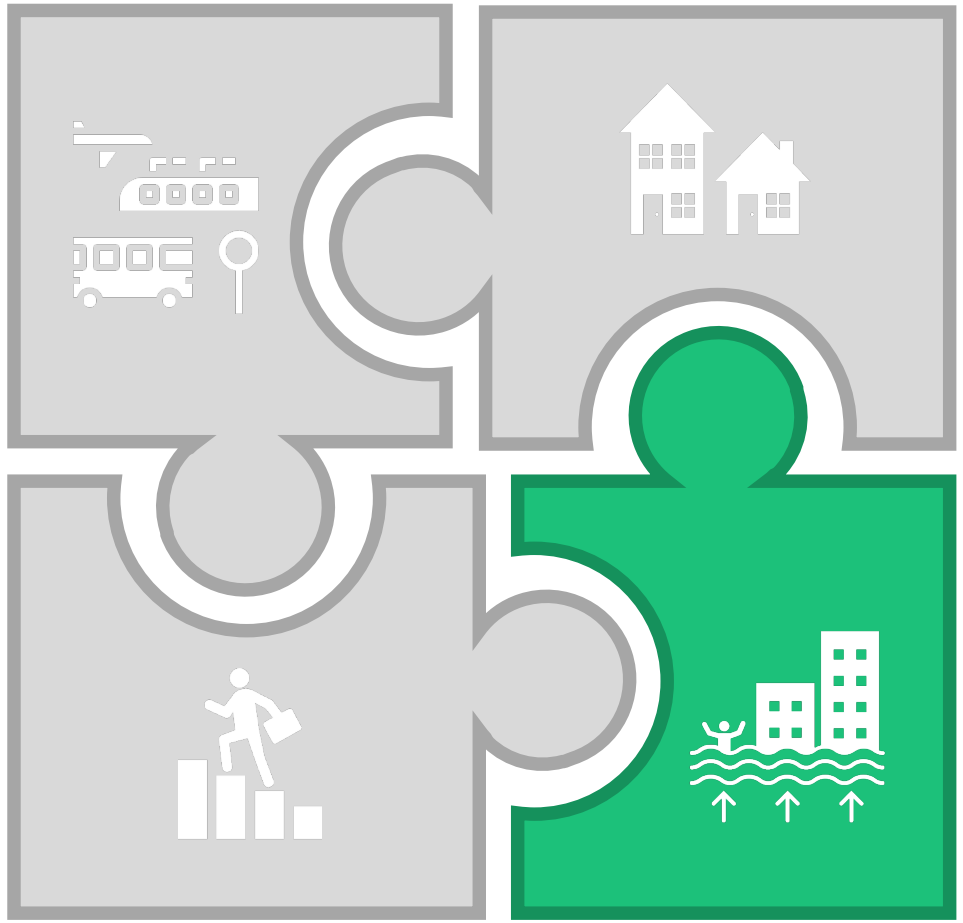
Keep Current Urban Growth Boundaries in Place. Maintain existing urban growth boundaries to restrict urban development on greenfields, continuing the Bay Area's recent commitment to reducing sprawl and protecting agricultural lands.

Additional Strategies Evaluated - Require Further Refinements

Purchase Disaster Recovery Financing

Plan Bay Area 2050 Blueprint: **Environment Element**

Today we will focus on a critical plan component — the environment.



Reduce Transportation GHG Emissions

1. Expand the Climate Initiatives Program

   Also: *Achieve additional GHG reductions from Transportation, Housing, and Economy strategies*

Conserve Agriculture Lands and Open Space

2. Keep Current Urban Growth Boundaries in Place

Address Climate and Hazard Impacts

3. Adapt to Sea Level Rise
4. Modernize Existing Buildings with Seismic, Wildfire, Drought and Energy Retrofits

The Role of "New Revenues"

Plan Bay Area 2050 **Blueprint Basic**
Includes available revenues from Needs & Revenue assessments, but does not include New Revenues from future regional measures

Plan Bay Area 2050 **Blueprint Plus**
Includes available revenues from Needs & Revenue assessments + additional New Revenues distributed to one or more topic areas of the Plan

This approach will provide more flexibility over the next year, should the MTC/ABAG boards wish to integrate new revenues to create a more aspirational Plan.

Either could be adopted as the Preferred Alternative in 2020 or 2021.

PLAN BAY AREA 2050

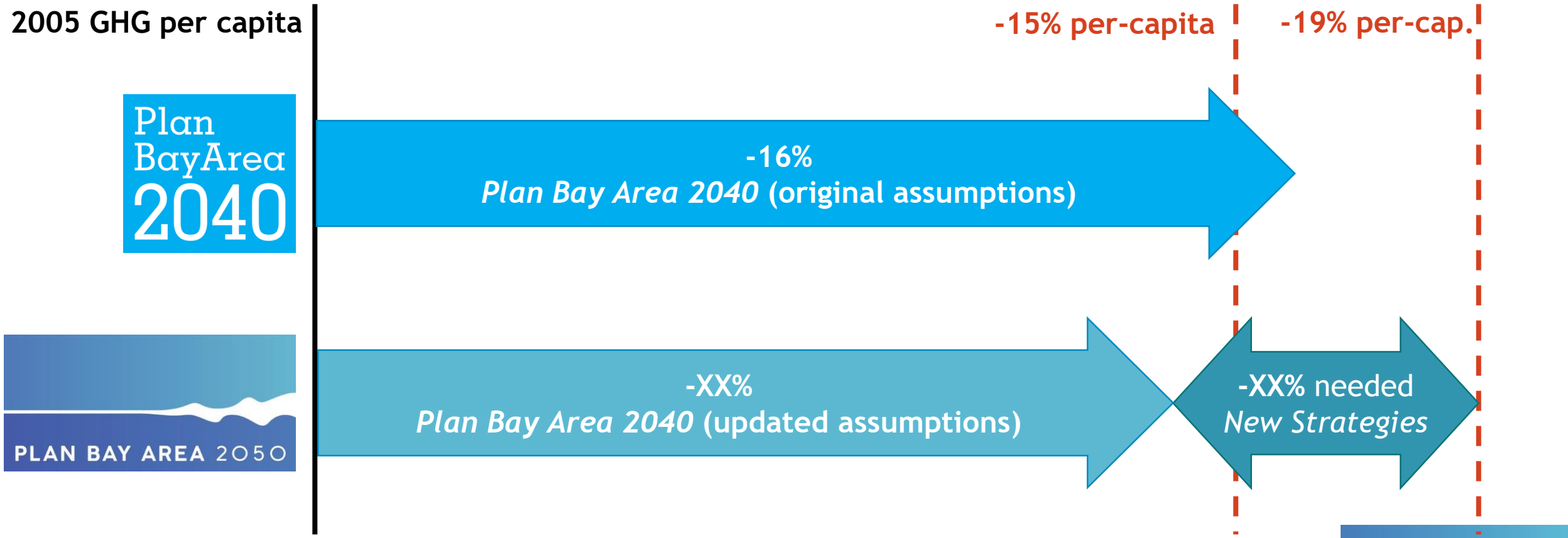
What Questions Will the Environment Element of the Plan Address?

- How do we equitably mitigate the GHG impacts of our travel choices within the region?
- How do we limit urban sprawl to protect agricultural lands and open space?
- How do we adapt to hazards and climate change?

	Draft Blueprint *Basic*	Draft Blueprint *Plus*
	Base set of strategies that can be funded with existing revenues.	*Expanded set of strategies supported with the inclusion of new revenues.*
Advance GHG Reduction Strategies	✓ *TBD based on GHG target gap[1]*	✓ *TBD based on GHG target gap[1]*
Keep Current Urban Growth Boundaries in Place	✓ *No cost*	✓ *No cost*
Adapt to Sea Level Rise	~ *$2 billion[2]*	✓ *$20 billion[2]*
Modernize Existing Buildings with Seismic, Wildfire, Drought and Energy Retrofits	~ *<$1 billion[2]*	✓ *$20 billion[2]*

[1] In Plan Bay Area 2040, the additional GHG reduction strategies needed to achieve the GHG target cost more than $500 million.
[2] Based on draft Resilience Needs & Revenue Assessment released at the December Joint MTC Planning & ABAG Administrative Committee.

Horizon Finding – Meeting or exceeding the Plan Bay Area 2050 19 percent per-capita reduction target for transportation-related GHG emissions will require bolder strategies.



Advance GHG Reduction Strategies

Blueprint *Basic*:

In Plan Bay Area 2040, a package of strategies helped the region achieve the GHG reduction target. These strategies make up MTC's Climate Initiatives Program, which includes investments in transportation demand management (TDM) strategies and electric vehicle and charging incentive programs.

$TBD based on GHG gap

Blueprint *Plus*:

The Blueprint *Plus* will include many of the same strategies in the *Basic* version; however, if the additional strategies included in the Blueprint *Plus* reduce GHG emissions, this might be a rare example of where the *Plus* version is actually cheaper than the *Basic* version.

$TBD based on GHG gap

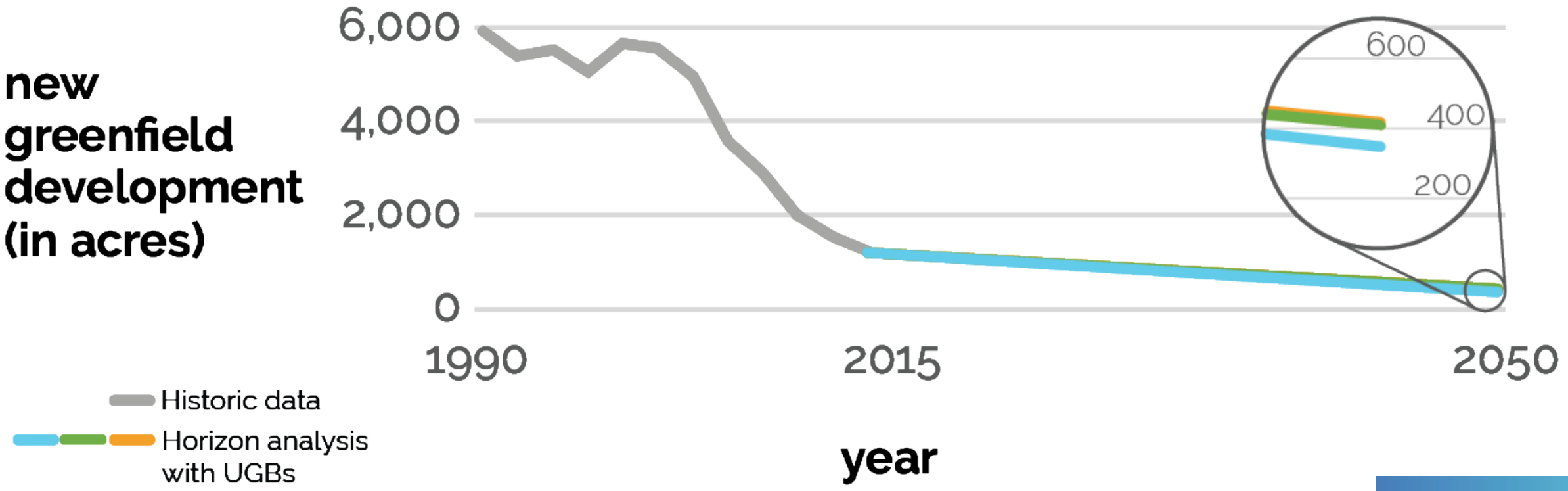
- *Regional Equity Working Group participants recommended that MTC's GHG reduction strategies target Communities of Concern and households with fewer resources.*

Integrated Strategies Part of MTC's Climate Initiatives Program

- Bikeshare
- Bike Infrastructure
- Carshare
- Commuter Benefits Ordinance
- Employer Shuttles
- Trip Caps
- Vanpools
- Regional EV Charger Network
- Clean Vehicle Feebate
- Vehicle Buyback Program
- Mobility-as-a-Service *(potential new strategy)*
- TNC ZEV Requirement *(potential new strategy)*

Horizon Finding - Past efforts to curb greenfield development from urbanization have been effective. Preserving existing urban growth boundaries should remain a key strategy.

Horizon Analysis - Acres of greenfield development annually - historic and projected



Keep Urban Growth Boundaries

Blueprint *Basic*:

Using urban growth boundaries, confine new development within areas of existing development or areas otherwise suitable for growth, as established by local jurisdictions.

No cost

Blueprint *Plus*:

Same as Blueprint Basic

No cost

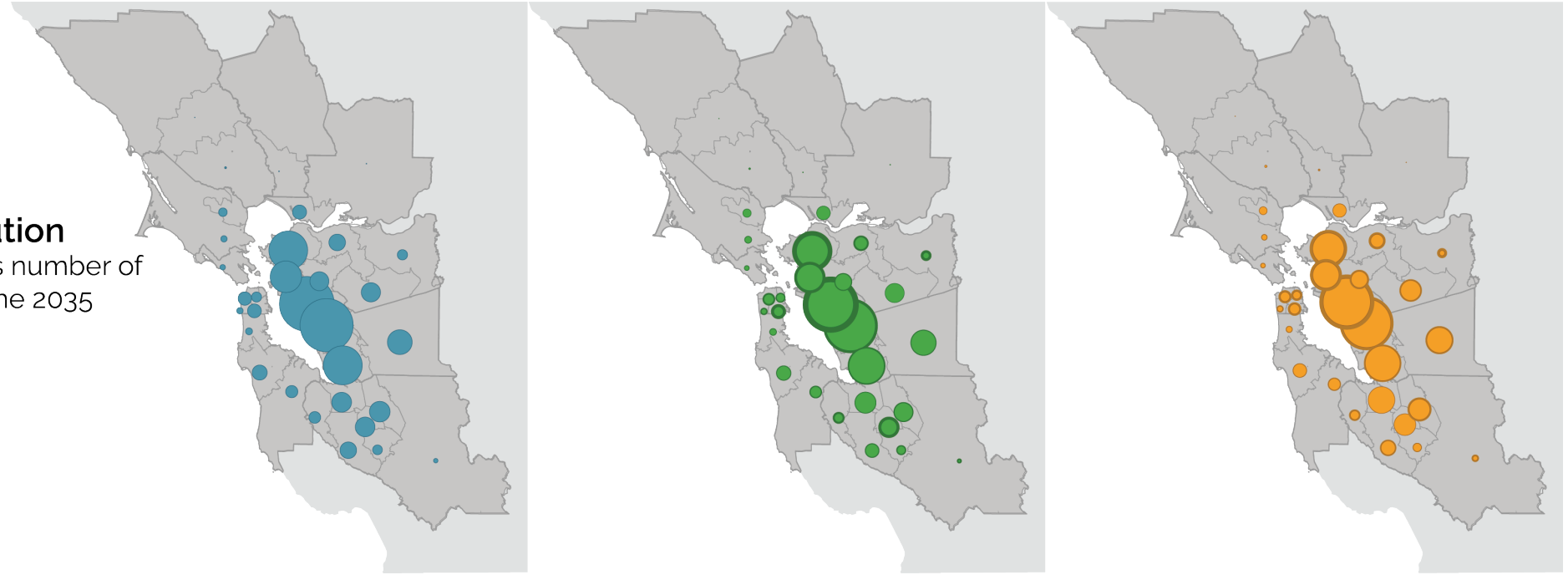
- *Over 93% of comments approved of restricting new development to within the urban growth boundary.*
- *"Maintaining urban growth boundaries is a bare minimum 'must have' and even this could be difficult." - Pop-up Comment*

Horizon Finding - Unmitigated climate and hazard impacts would result in significant damage; adaptation and hazard mitigation measures reduce impacts.

Rising Tides, Falling Fortunes
2035 earthquake
no retrofit in Round 2

Clean and Green
2035 earthquake
with retrofit in round 2

Back to the Future
2035 earthquake
with retrofit in round 2



Damage Distribution
circle area represents number of damaged homes in the 2035 M7.0 earthquake

- 500
- 5,000
- 50,000

Dark color shows Round 1 damage, lighter color shows Round 2 damage.

Retrofit Existing Buildings

Blueprint *Basic*:

Due to a lack of existing funding, the strategy would only entail a continuation of ad-hoc seismic, wildfire, water and energy upgrades. The strategy would have a very limited effect on the quality of existing Bay Area homes.

$ <1 Billion

Blueprint *Plus*:

With new revenues, pair ordinance adoption and retrofit incentives to bring existing buildings up to higher seismic, wildfire, water and energy. Offer 50% subsidies to offset the cost of multi- and single-family home retrofits.

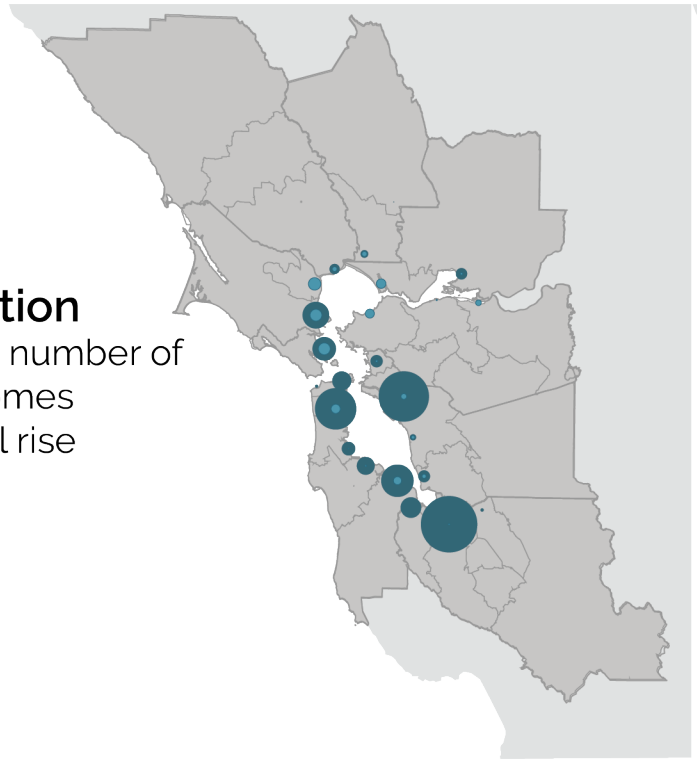
$20 Billion

- *This was one of the most popular strategies in the Mayor of Bayville game, and it had the strongest pop-up support (97%).*
- *"Offer incentives to homeowners in the form of tax credits to encourage more retrofits." – Pop-up Comment*

Horizon Finding - Unmitigated impacts from sea level rise and natural disasters resulted in significant damage across the region.

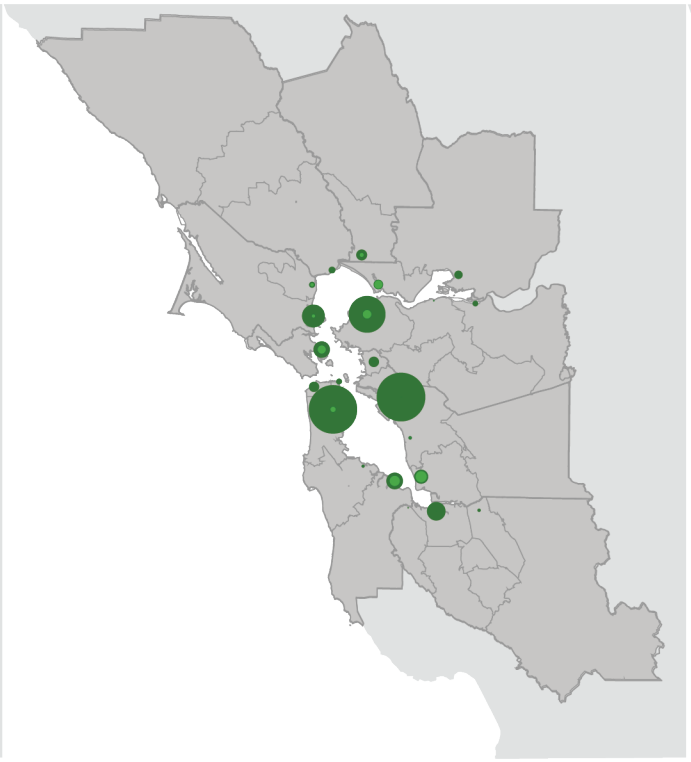
Rising Tides, Falling Fortunes
3 feet of sea level rise by 2050

with partial adaptation in Round 2



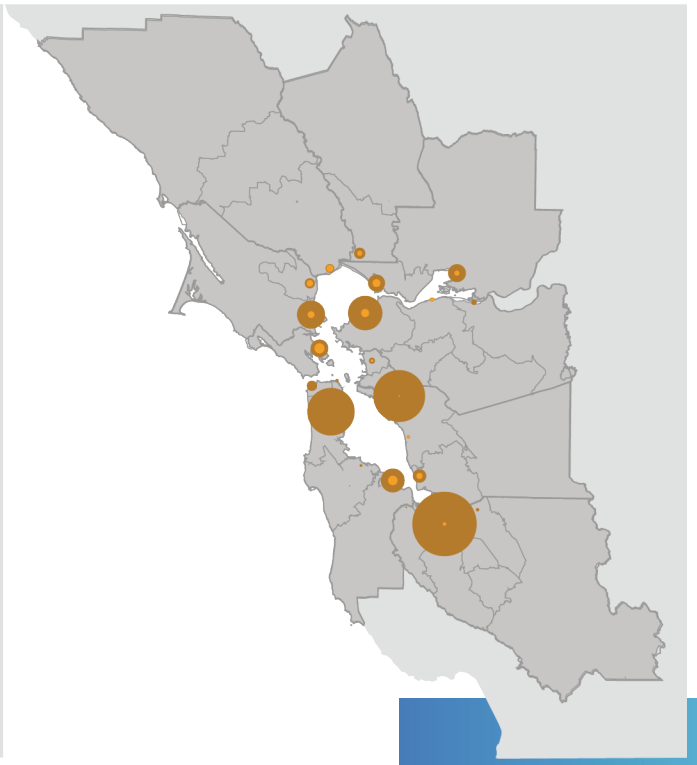
Clean and Green
1 foot of sea level rise by 2050

with "full" adaptation in round 2



Back to the Future
2 feet of sea level rise by 2050

with "full" adaptation in round 2

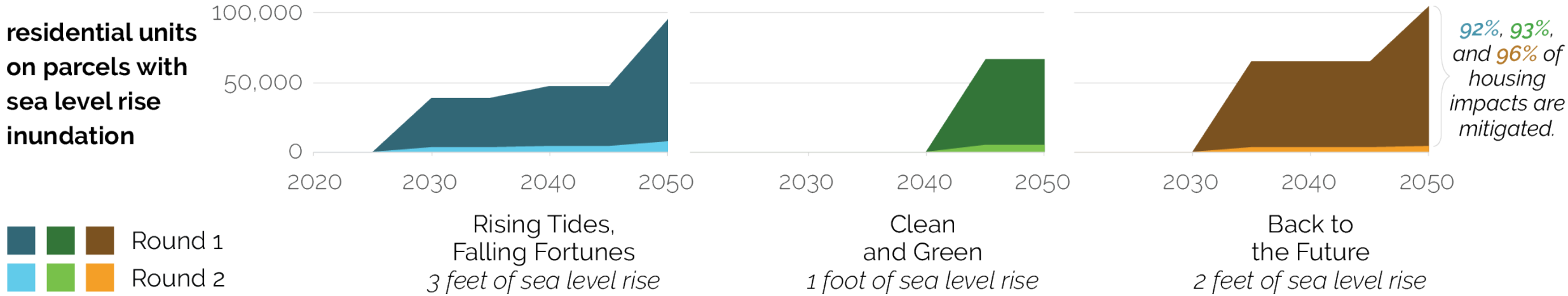


Damage Distribution
circle area represents number of existing and future homes damaged by sea level rise

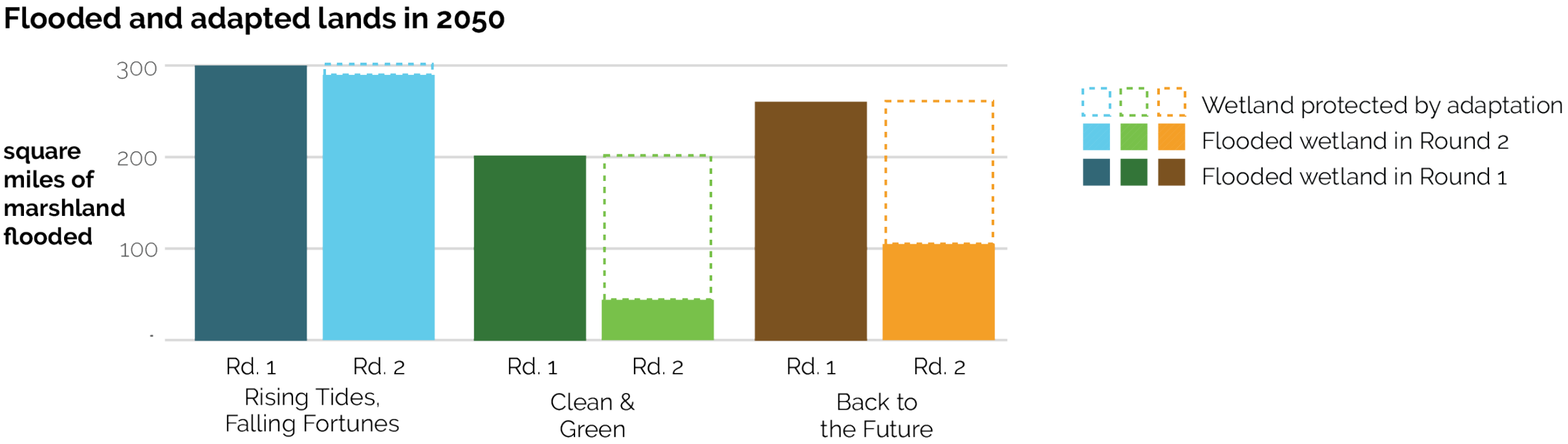
- 500
- 5,000
- 50,000

Horizon Finding – Adaptation strategies boosted our region's resilience.

Residential sea level rise impacts in Futures round 1 (without adaptation) and round 2 (with adaptation)



Horizon Finding - Climate change adaptation will be an equally important strategy to curb the loss of natural lands in the region.



Adapt to Sea Level Rise

Blueprint *Basic*:

With forecasted revenues, the region could protect portions its most vulnerable shoreline. Strategies would prioritize on areas of low costs and high benefits, such as for key infrastructure or growth areas.

$ 2 Billion

Blueprint *Plus*:

With new revenues, the region could more fully adapt to sea level rise. Most Bay Area communities and transportation facilities could be protected; this may include protecting SR-37, provided equity mitigation strategies are identified.

$20 Billion

- *Over 90% of pop-up comments approved investing in sea level rise adaptation.*
- *"The best offense is a good defense. Investing in prevention is much better than retroactively trying to fix things." - Mayor of Bayville Comment*

The Draft Blueprint aims to package complementary strategies; the Environment strategies will be made stronger when paired together with Transportation, Housing, and Economy strategies.

- **Transportation** investments need to align with the sea level rise adaptation strategy, given that not all assets may be able to protected without New Revenues.
- **Housing** preservation policies targeting affordability should align with existing building upgrades for health and safety, in order to minimize displacement risk.
- **Economic** strategies should consider how employers can assist in addressing commute-related GHG reductions, in part by encouraging growth in lower-VMT locations.

Agency Collaboration

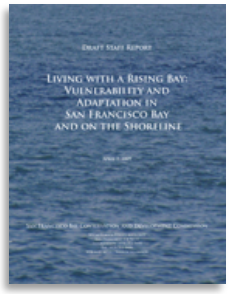
Bay Conservation and Development Commission

California state planning and regulatory agency with regional authority over the San Francisco Bay, the Bay's shoreline band, and the Suisun Marsh

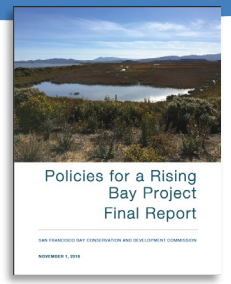
Adapting to Rising Tides

A regional program to lead and support efforts that increase the resilience of San Francisco Bay Area communities to sea level rise and storm events

Climate Change Planning



2011 Climate Change Policies



2015-16 Policies for a Rising Bay

2017 Raising the Bar on Regional Resilience

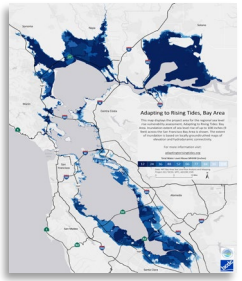
PLAN BAY AREA 2050

2018 - 21 Horizon/ Plan Bay Area 2050

ART Program Established **2012**

BCDC Commissioner SLR Workshops **2016-17**

ART Bay Area **2016 -19**



PLAN BAY AREA 2050

Linking ART Bay Area and Plan Bay Area

Horizon Futures Planning

2018-2019

- Multi-topic broad regional stakeholder-driven initiative
- Used divergent scenario planning to study the effects of 1', 2', and 3' of inundation, not just on the region today, but with growth out to 2050.
- Outcomes
  - Integrated sea level rise into land use and travel models.
  - Incorporated a single high-level sea level rise adaptation strategy for consideration in Plan Bay Area.

ART Bay Area

2017-2019

- Sea level rise-focused regional stakeholder-driven initiative
- Studied the sea level rise impacts on future growth, vulnerable communities, ecosystem, and transportation systems across 10 water levels.
- Outcomes
  - Data on exposure and consequence for 30+ regional systems
  - Qualitative analysis of 30+ local "hot spots"
  - Identification of 8 regional-level common planning issues
  - 80+ adaptation strategies for local, regional, and state consideration

Linking ART Bay Area and Plan Bay Area

Plan Bay Area 2050

through summer 2021

- Build a 1.0 framework to incorporate sea level rise into regional planning and modeling.
- Develop a 1.0 regional level revenue and need assessment for sea level rise adaptation.
- Develop clear and actionable next steps for how MTC/ABAG can partner to advance adaptation from 2021-2025.

Regional Shoreline Adaptation Strategy

through summer 2020

- Establish Guiding Principles for local and regional adaptation planning
- Establish consensus around a coordinated regional Action Platform to support local and regional adaptation

PLAN BAY AREA 2050

What's Next?

January 2020

Answer key environmental questions in advance of the February committee meeting.

- Are these the right strategies to include in the Environment element of the Plan Blueprint?
- How might we weave equity more substantially into the strategies?
- How might we fund these efforts?

February 2020

Finalize the strategies to test in the Draft Blueprint.

- At the February committee meeting, staff will present the full package of strategies proposed for the Draft Blueprint *Basic* and Draft Blueprint *Plus*.

Spring 2020

Share feedback on the Draft Blueprint results.

- Staff will present on the regional outcomes resulting from the Draft Blueprint *Basic* and Draft Blueprint *Plus* at committees and public workshops in spring 2020.
- Further refinements to all strategies can be made at this time in advance of the Final Blueprint.