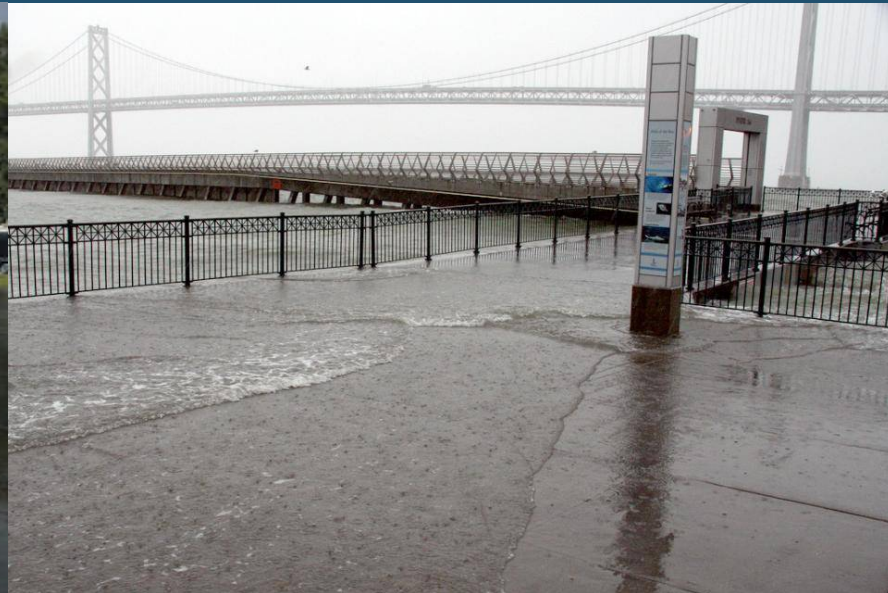


Sea Level Rise Adaptation in the San Francisco Bay Area

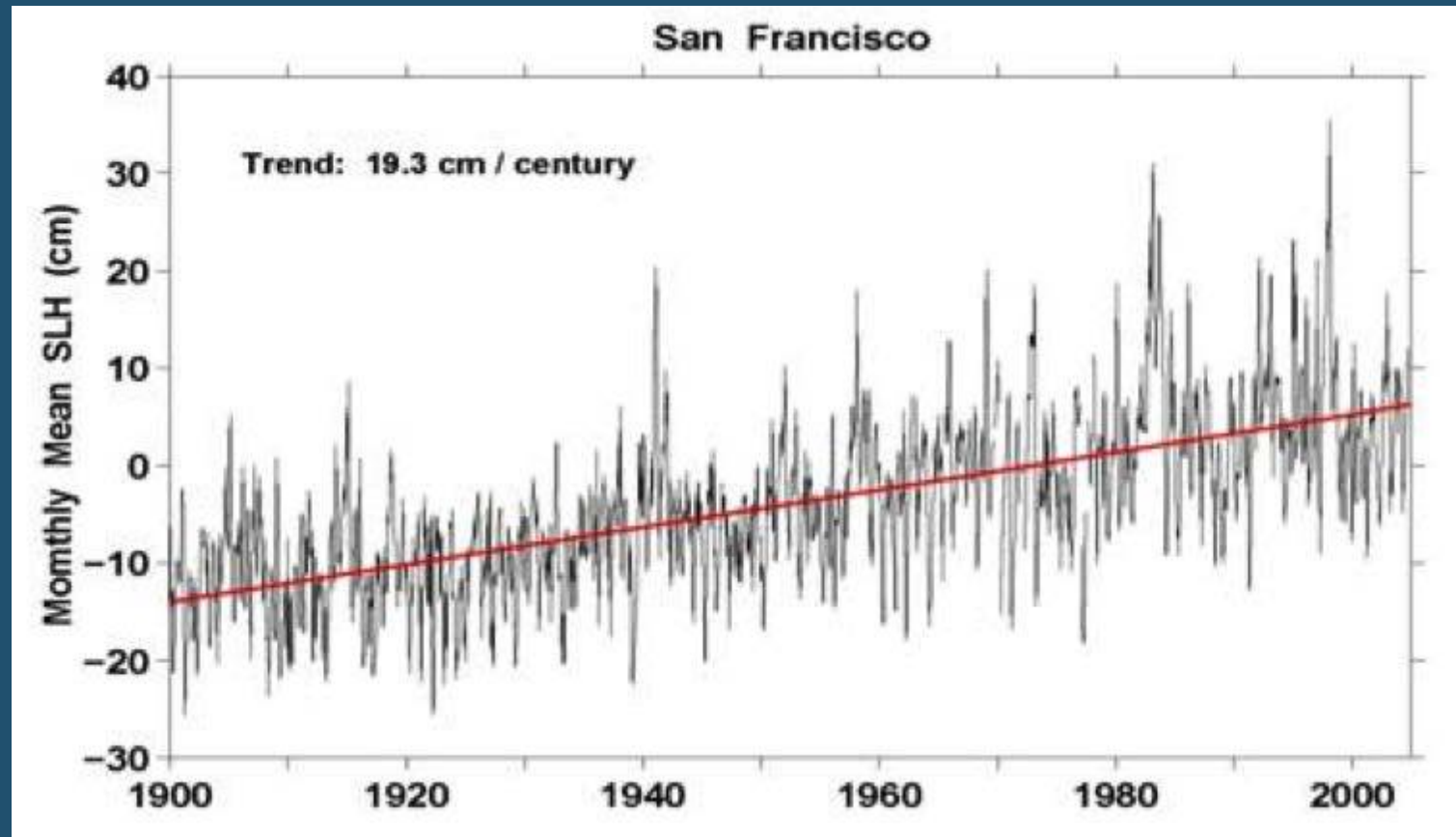
San Francisco Bay Conservation and Development Commission



Bay Area Flooding



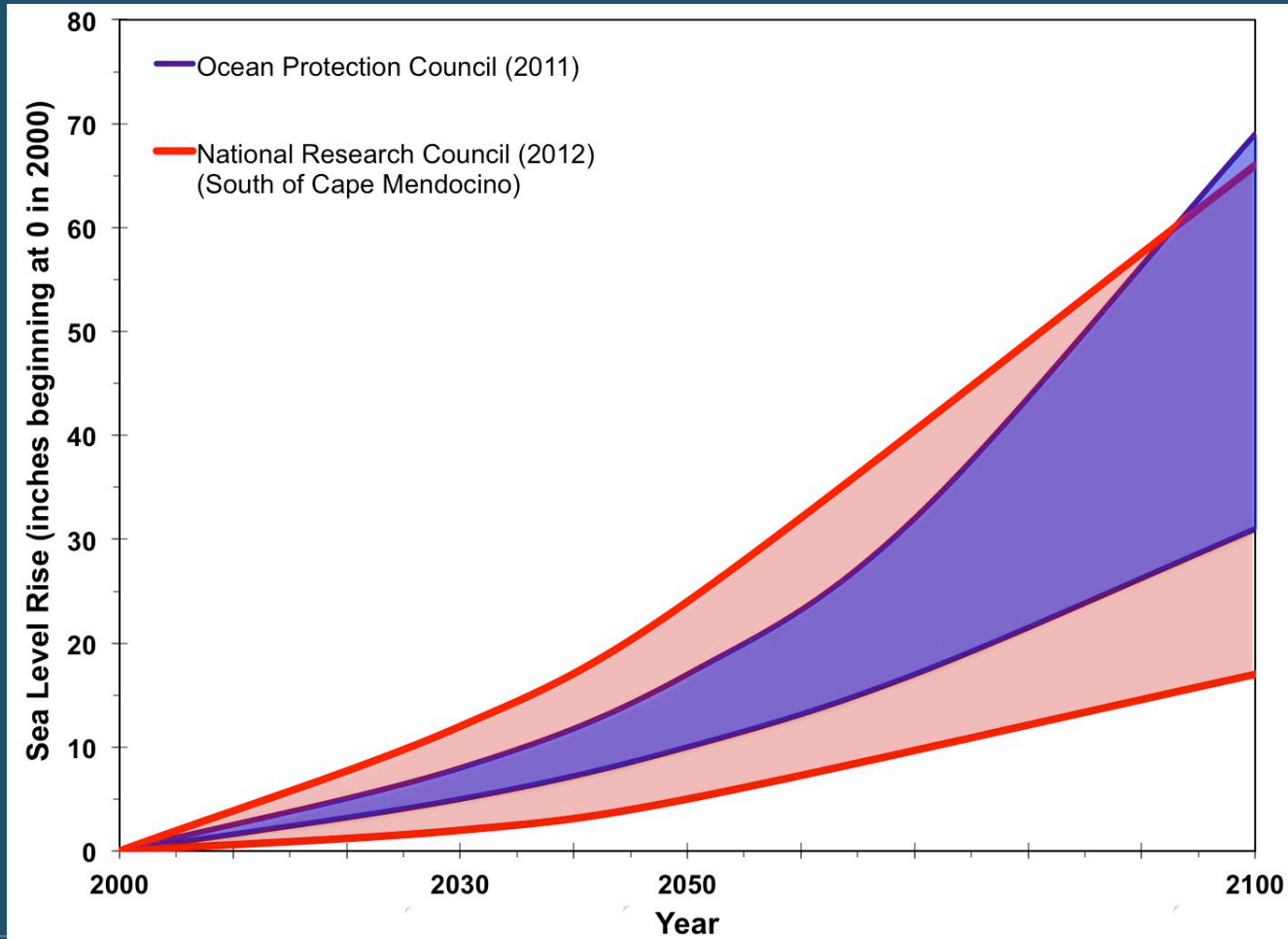
San Francisco-observed sea level with trend of 19.3 cm (0.63 feet) per century



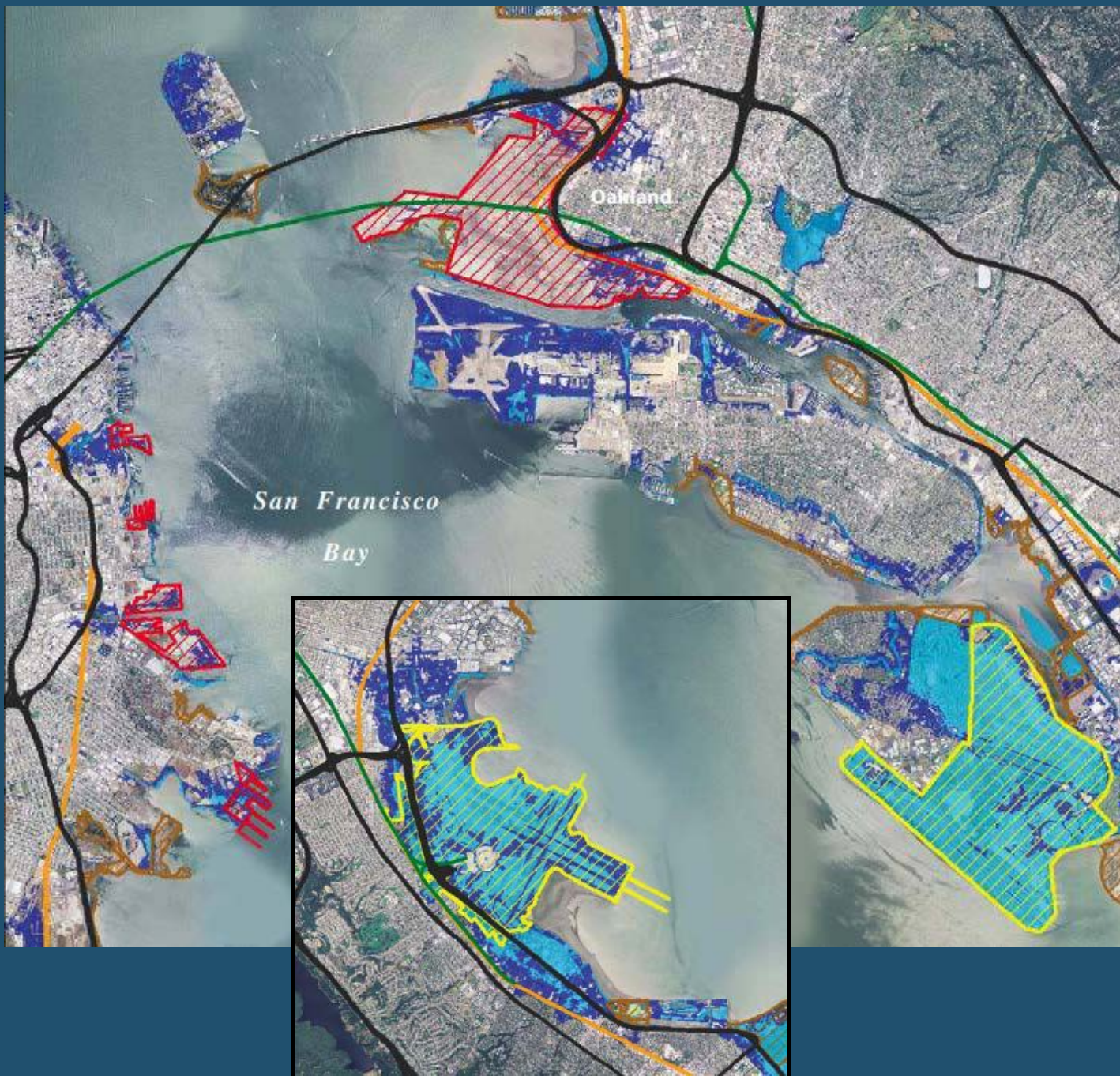
Source: California Climate Action Team Report 2006

Challenge: Urgency

Climate Drivers



Specific Vulnerabilities



San Francisco Bay Plan

San Francisco Bay Conservation
and
Development Commission



The
Adapting to Rising Tides
Project



San Francisco Bay Conservation
and Development Commission

ART Project Goal

Increase the preparedness and resilience of Bay Area communities to sea level rise and other climate change impacts while protecting ecosystem and community services.



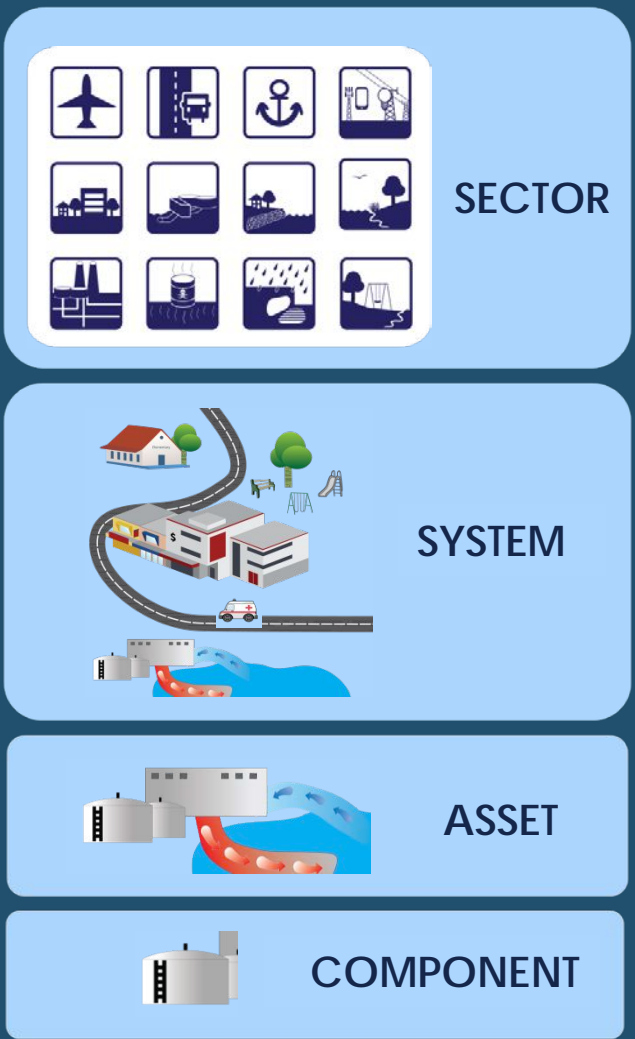
ART Objectives

- ❖ Create a framework for adaptation planning that benefits others in the region
- ❖ Provide “road tested” adaptation tools, processes and resources
- ❖ Identify how adaptation planning can be scaled up and scaled down
- ❖ Integrate economy, environment, social equity, and governance consistently and equally into adaptation planning
- ❖ Make the process easier, faster and more efficient for others



Scales of the ART Project

Multiple Geographic and Asset Scales



ART Asset Categories

- Airport
- Community land use, facilities, services
- Contaminated lands
- Energy, pipelines and telecom
- Hazardous material sites
- Ground transportation
- Parks and recreation
- Natural shorelines
- Seaport
- Stormwater
- Structural shorelines
- Wastewater



ART Collaborations

Active and engaged **Working Group** plus Communication and Technical Subcommittees

ABAG

Alameda County (AC)

AC Public Works

AC Community Development

AC Public Health Department

AC Transportation Commission

BART

Bay Institute

Bay Trail

CA Coastal Conservancy

Capitol Corridor JPA

City of Alameda

City of Emeryville

City of Hayward

City of Oakland

City of San Leandro

City of Union City

East Bay Dischargers Authority

East Bay Municipal Utility District

East Bay Regional Park District

H.A.R.D.

Pacific Institute

PG&E

Port of Oakland

San Francisco Estuary Institute

San Francisco Estuary Partnership



ART Planning Process

Adapting to Rising Tides Planning Process

SCOPE & ORGANIZE

- Choose Project Area*
- Convene Partners & Stakeholders*
- Set Resilience Goals*
- Select Climate Scenarios & Impacts*
- Identify Sectors, Services, Assets*

Society & Equity
Environment
Economy
Governance

ASSESS

- Review Existing Conditions*
- Assess Vulnerability*
- Consider Risks*

DEFINE

- Characterize Vulnerabilities & Risks*
- Identify Key Planning Issues*

PLAN

- Develop Adaptation Responses*
- Select Evaluation Criteria*
- Refine Resilience Goals*


IMPLEMENT & MONITOR

- Integrate Adaptation Responses into Plans*
- Evaluate & Select Adaptation Responses*

The ART Assessment

- ✧ Describes the existing conditions in the ART subregion
- ✧ Identifies the underlying causes and components of vulnerability and risk
- ✧ Summarizes the key planning issues in the subregion

Adapting to Rising Tides





DRAFT

EXISTING CONDITIONS AND STRESSORS REPORT

PREPARED BY:


SAN FRANCISCO BAY CONSERVATION AND DEVELOPMENT COMMISSION

JANUARY 2012



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Adapting to Rising Tides



Vulnerability & Risk Assessment Report
September, 2012

SAN FRANCISCO BAY CONSERVATION AND DEVELOPMENT COMMISSION
50 California Street, Suite 2600 San Francisco, CA 94111
Information: (415) 352-3600 Fax: (415) 352-3606
Web site: <http://www.bcdc.ca.gov>

Adapting to Rising Tides



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Project Reports

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REPORTS AT A GLANCE

COMING SOON: Vulnerability and Risk Assessment Briefing Book

Addressing Social Vulnerability and Equity in Climate Change Adaptation Planning

Transportation Risk Assessment: Briefing Book

Transportation Risk Assessment: Technical Report

Assessing Climate Change Vulnerability and Risk

Existing Conditions and Stressors Report

Climate Impacts Statement

Vulnerability and Risk Assessment

[Vulnerability and Risk Assessment Report](#)

This report presents the methods, data and findings of the Adapting to Rising Tides (ART) assessment. This assessment identified the underlying causes and components of vulnerability and risk of shoreline and community assets in the ART project area to future sea level rise and storm events.

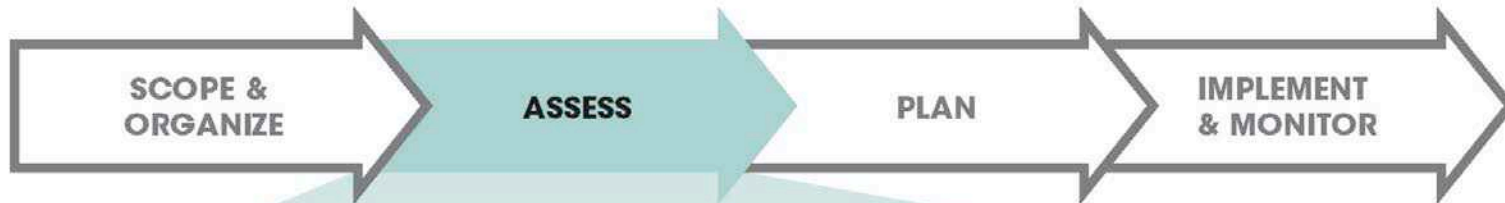
[Addressing Social Vulnerability and Equity in Climate Change Adaptation Planning](#)

The ART Project assessment integrates issues of social vulnerability and equity to provide a more accurate picture of the consequences of sea level rise and storm impacts, and to facilitate the development of equitable adaptation strategies. This white paper, prepared by NOAA Coastal Management Fellow, Heidi Nutters, summarizes the available literature and case studies, and describes the approach taken in the ART Project to address equity and the findings from the assessment.

[Transportation Risk Assessment Reports](#)

BCDC, MTC and Caltrans conducted a risk assessment in the Adapting to Rising Tides subregion of [Impacts on transportation infrastructure](#) from projected sea level rise. Sponsored by the Federal Highway Administration (FHWA), this pilot project tested and refined the FHWA's conceptual model for assessing impacts of global climate change on transportation networks nationwide.

ART Assessment



RESILIENCE

Existing Conditions

Asset Inventory:

Identify community assets (e.g., land uses infrastructure, etc) to be assessed

Assess Existing Conditions:

Choose metrics to characterize assets
Use metrics to assess existing conditions and stressors of assets

Vulnerability

Exposure:

Extent to which an asset experiences an impact

Sensitivity:

Degree to which an asset is impaired by an impact

Adaptive Capacity:

Inherent ability of an asset to accommodate or adjust to an impact to maintain its primary functions

Risk

Likelihood:

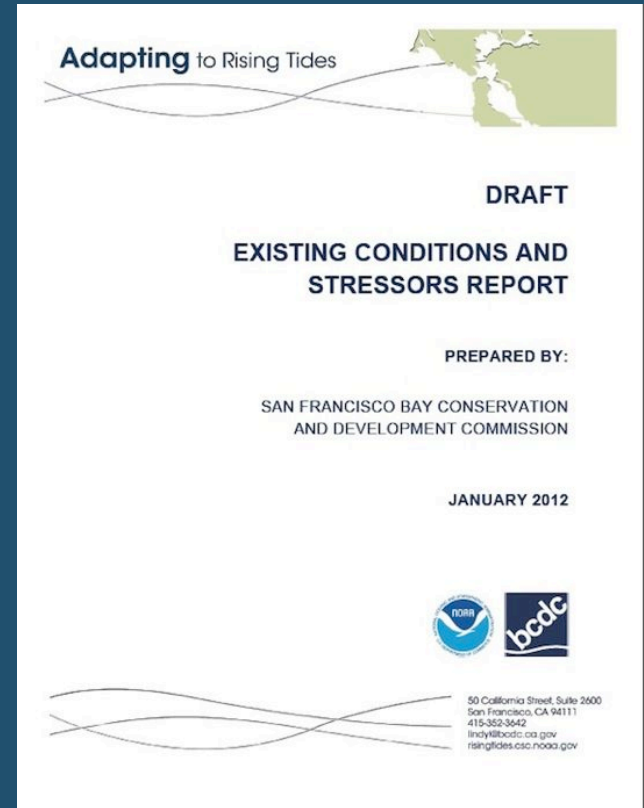
Chance or probability of an impact occurring

Consequence:

Magnitude of social, economic, governance and environmental effects if an impact does occur

Understanding Existing Conditions

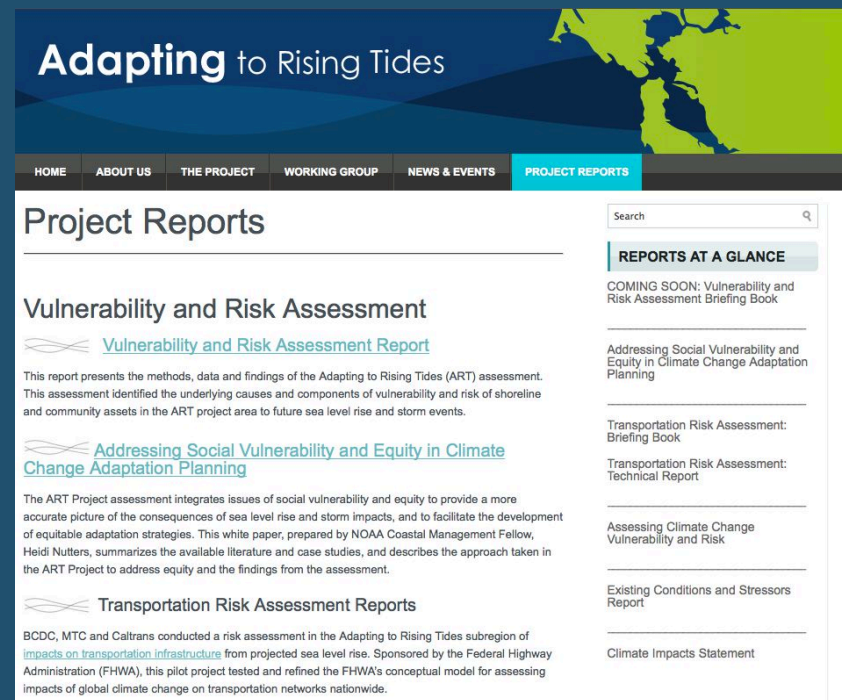
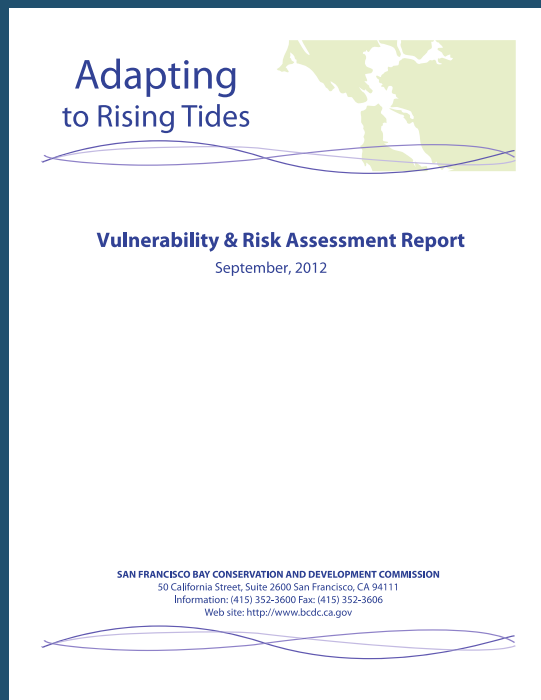
- Developed metrics to describe asset function, condition, management status, community and economic value
- Created an asset inventory populated with available data
- Summarized findings in an *Existing Conditions and Stressors Report*



ART V&R Report

Vulnerability & Risk Assessment Report

- Identifies the underlying causes and components of vulnerability and risk
- Presents methods, data and findings of the assessment



ART Issue Papers

Additional analysis conducted on several challenging issues:

- ✧ Vulnerability and Risk Approaches
- ✧ Equity
- ✧ Governance

ADAPTING TO RISING TIDES WHITE PAPER
JUNE 2012

**ADDRESSING SOCIAL
VULNERABILITY
AND EQUITY IN
CLIMATE CHANGE
ADAPTATION PLANNING**



Adapting to Rising Tides

Assessing Climate Change Vulnerability & Risk
STAFF REPORT
December, 2011

SAN FRANCISCO BAY CONSERVATION AND DEVELOPMENT COMMISSION
50 California Street, Suite 2600 San Francisco, CA 94111
Information: (415) 352-3600 Fax: (415) 352-3606
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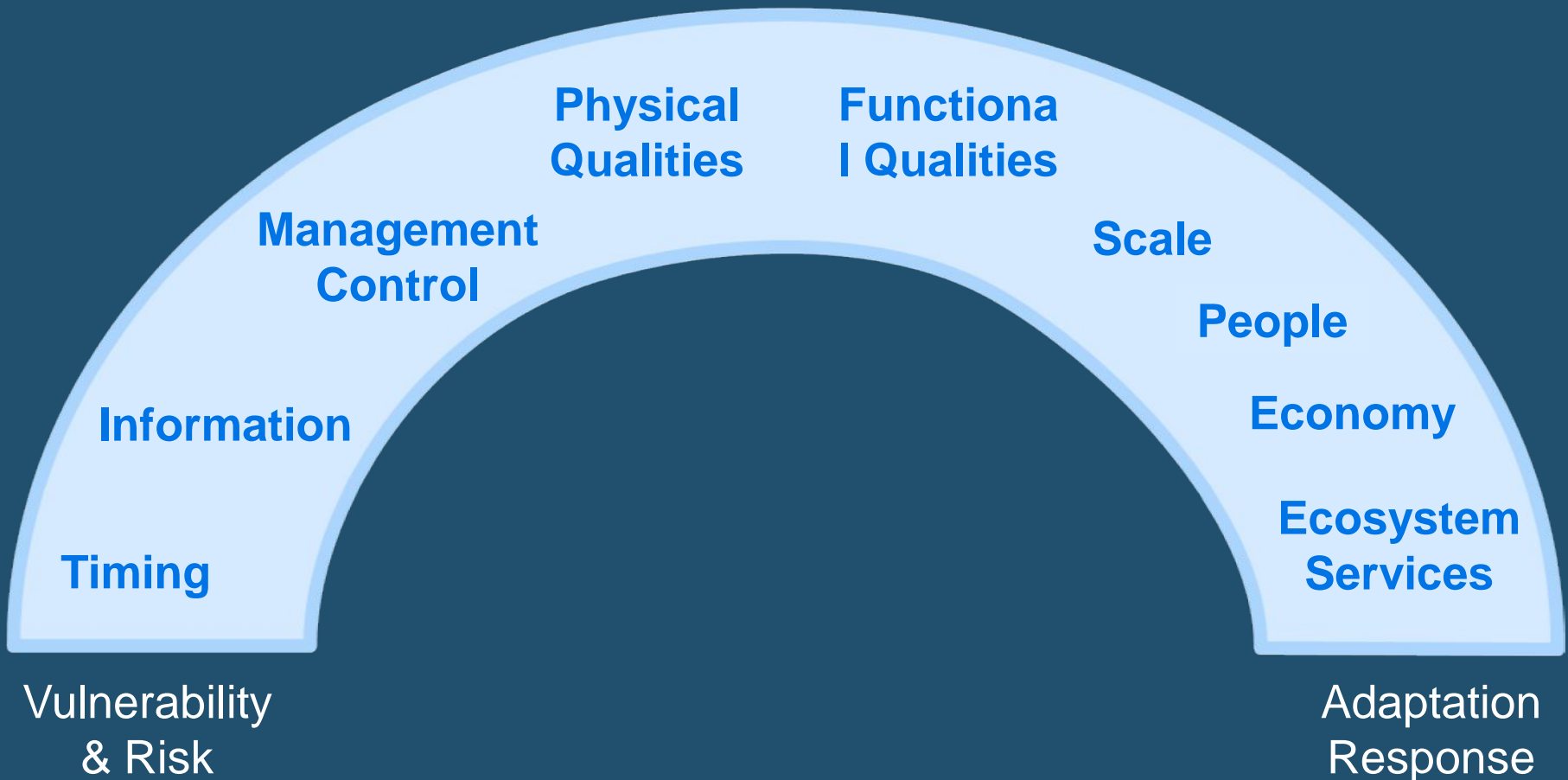
*Governance
is broader than the
organizations and mechanisms for
decision-making that make up a government.*

*It also accounts for the role that civil
society plays in making decisions and
setting priorities and the process by which
citizens interact with governments.*

*Citizen participation,
the capacity of public institutions,
and the ability to coordinate and
partner with the private sector
and civic institutions are all
part of governance.*

Defining Vulnerability & Risk

ART Classification – used to characterize and communicate vulnerabilities and risk to make it easier to identify key issues and develop robust adaptation responses



ART Define Step Report

Synthesizing Vulnerability & Risk: The Define Report

- Defines the Define Step
- Summarizes subregional vulnerabilities
- Identifies key planning issues



Developing an Adaptation Response



The ART approach:

- ✧ Connect actions directly to assessment outcomes
- ✧ Present a number of possible actions
- ✧ Characterize actions by type, priority, and implementation scale
- ✧ Identify possible implementation partners and processes

ART Adaptation Response

Overarching Adaptation Response

Adapting to Rising Tides

Information Vulnerability

Vulnerability O4: There is a limited understanding of how dynamic baylands habitats such as tidal marshes, intertidal mudflats, and subtidal areas will respond to accelerating sea level rise, or how these habitats will be affected by shoreline adaptation responses (e.g., structural solutions such as levees) that may change tide, wave or sediment conditions.

Action Number	Action	Action Type	Process	Possible Actors	Action Characterization
O4.1	Establish and support a regional research agenda to advance the understanding of how baylands will respond to accelerating sea level rise in light of declining sediment supply and limited space to migrate inland	Evaluation, Coordination	New Initiative	EBRPD, HARD, ACFCWCD, SCC, DFW, BCDC, RWQCB, Port, USACE, USFWS, FEMA, City, County, CBOs, Private Sector, SFBRA	Unlocking, Regional, High Priority
O4.2	Research and test restoration and management actions that will improve baylands resilience	Evaluation	Project Planning and Design	EBRPD, HARD, ACFCWCD, SCC, DFW, BCDC, RWQCB, Port, USACE, USFWS, FEMA, City, County, CBOs, Private Sector, SFBRA	Unlocking, Regional, High Priority
O4.3	Develop and implement a Regional Sediment Management Plan for the Bay	Coordination, Policy Development	Long-range Planning, New Initiative	CSMW, BCDC, USEPA, USACE, RWQCB, LTMS stakeholders, USFWS, NOAA, City DPW, Flood Control Agencies, Private Sector	Unlocking, Multi-benefit, Regional, High Priority

ART Adaptation Response

Transportation Adaptation Response

Adapting to Rising Tides

Functional Vulnerability

Vulnerability T7 (continued): The rail system lacks redundancy, and fixed stations and maintenance yards serve long, linear lengths of track. The interconnected nature of rail and the lack of redundancy mean that damage at any point in the system can disrupt commuter and goods movement system-wide, causing significant economic effects in the region, particularly if there is a loss of service to the seaport or airport. Repair or relocation of rail infrastructure may require significant investment to ensure public safety and security.

Action Number	Action	Action Type	Process	Possible Actors	Action Characterization
T7.3	Develop or update Continuity of Operations Plans (COOPs) to include sea level rise and storm events, and work with other regional transportation providers to identify alternative facilities and services to provide continuity of operations during an emergency	Program/operation	Emergency and Hazard Planning, Operations	MTC, Caltrans, BART, AC Transit, County, Cities, CMA, CCJPA, UP, WETA, Private Sector, CBOs	Multi-benefit, Regional
T7.4	Develop design standards for new infrastructure and capital improvements investments that will protect critical elements from sea level and groundwater rise	Policy Development	Codes and Standards, Capital Planning, Long range Planning	UP, Amtrak, Caltrans, CCJPA, Cities, Counties	Do It Yourself, Unlocking, Local, Regional
T7.5	Install manual, remote control, or automatic temporary barriers or waterproof closures to protect at- or below-grade critical elements such as station entrances, tunnels, maintenance facilities, asset storage areas, and rail alignments	Program/operation	Capital Planning, Operations, Codes and Standards, Project Planning and Design	UP, Amtrak, Caltrans, CCJPA, Cities, Counties	Do It Yourself, Unlocking, Local, Regional

ART Subregional Findings

Population Characteristics

- ✧ Certain characteristics make community members more vulnerable
- ✧ Possible Actions: increase community and neighborhood resilience through partnerships with community based organizations
- ✧ ART Program: Partnership with ABAG to analyze regional population vulnerabilities



ART Project to Program

Partnering on sector specific assessments:

- ✧ East Bay Regional Park District shoreline parks
- ✧ Transportation assets at three locations:
 - Bay Bridge touchdown
 - Coliseum
 - Hayward/San Mateo Bridge



ART Project to Program

Providing assistance to efforts of others:

- ✧ Southern Marin County
- ✧ San Francisco's Mission Bay neighborhood
- ✧ Capital Corridor rail hot spots assessment

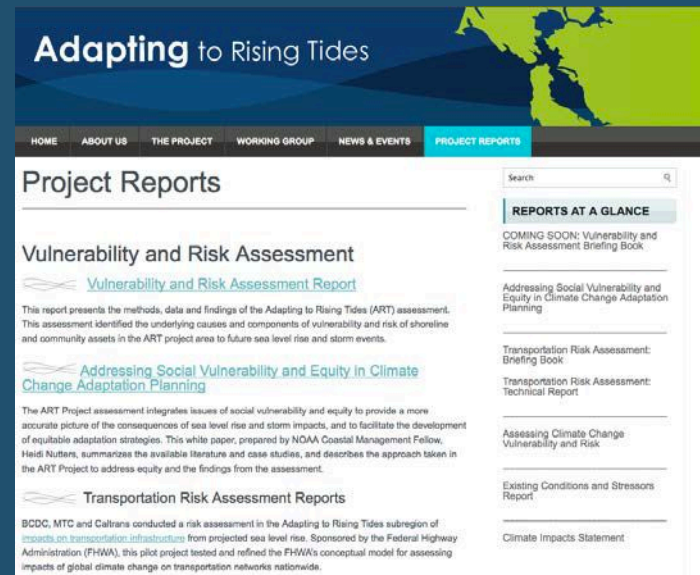
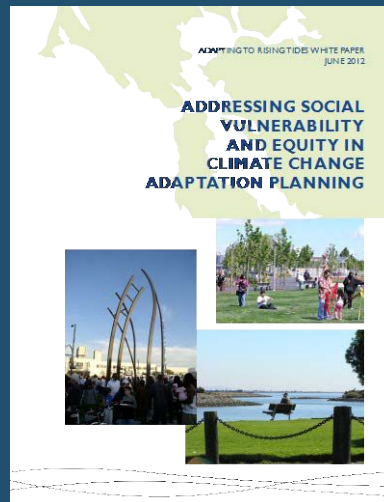


ART Project to Program

Adapting to Rising Tides Portfolio and Help Desk

✧ Process tools, resources, lessons learned, recommendation and guidance

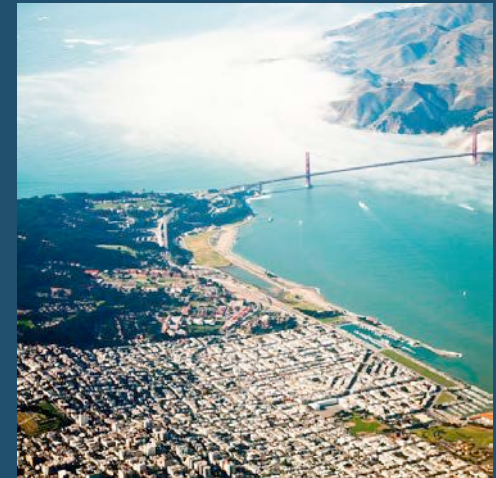
✧ Staff available to keep information and resources current and provide assistance



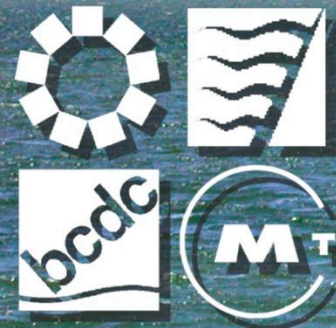
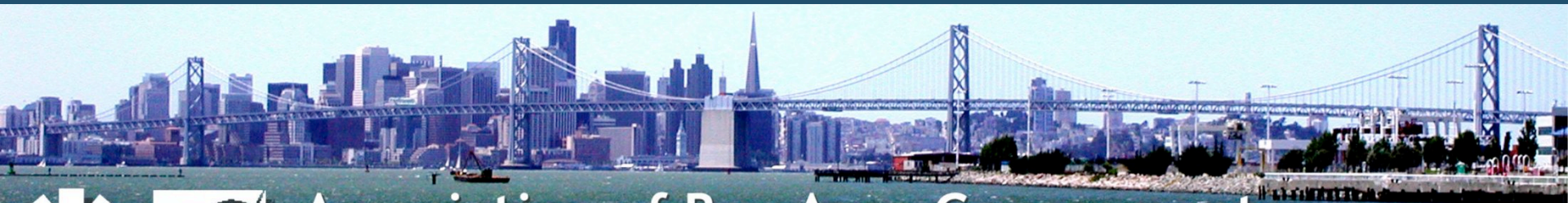
ART Project and Program

Regional Efforts:

- ✧ Housing and Community Multiple Hazard Risk Assessment
- ✧ Resilient Shorelines Initiative
- ✧ SF Bay Area Sentinel Site Cooperative



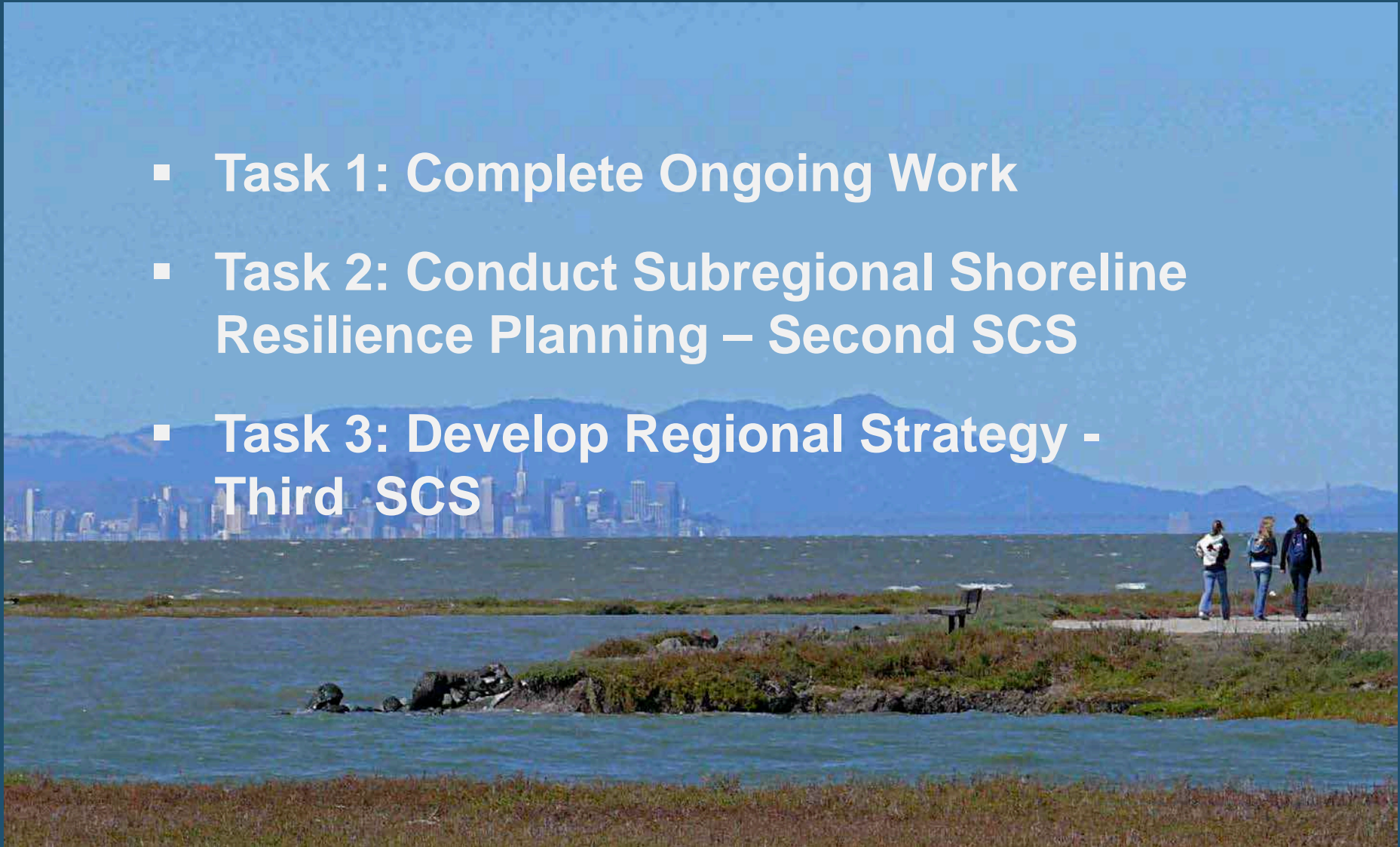
The Resilient Shorelines Project



Association of Bay Area Governments
Bay Area Air Quality Management District
Bay Conservation and Development Commission
Metropolitan Transportation Commission

JPC Adopted Work Plan

- **Task 1: Complete Ongoing Work**
- **Task 2: Conduct Subregional Shoreline Resilience Planning – Second SCS**
- **Task 3: Develop Regional Strategy - Third SCS**



Collaborations

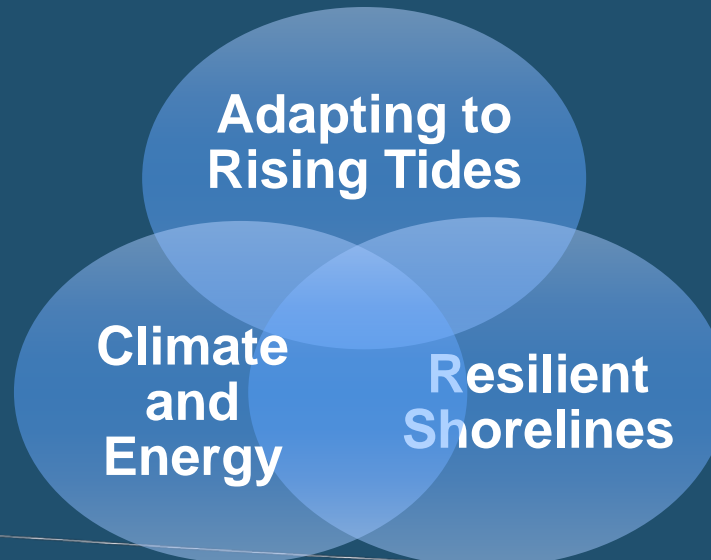
Bay Area Ecosystems Climate Change Consortium (BAECCC)

Promoting Nature-based Resilience solutions to Climate Change



Joint Policy Committee

- Integrate Regional Governance to Facilitate Collaborations
- Regional Resilience Strategy that integrates sea level rise and other climate impacts



SPUR Ocean Beach Master Plan



**Figure 0-2:
Ocean Beach Master Plan Illustrative**

The Ocean Beach Master Plan responds to desired outcomes within the beach's three reaches (i.e.—improved access, restored ecological health, a sense of history) by providing a series of recommendations that support them through a diverse array of strategies.



OUR COAST—OUR FUTURE

Goal

Provide Bay Area coastal managers and planners with science-based, decision-support tools to plan for and respond to SLR and storm hazards along the region's outer coast.

Objectives

Model vulnerabilities to SLR & storm hazards

Assess stakeholder info needs

Map vulnerabilities at appropriate scale for management action

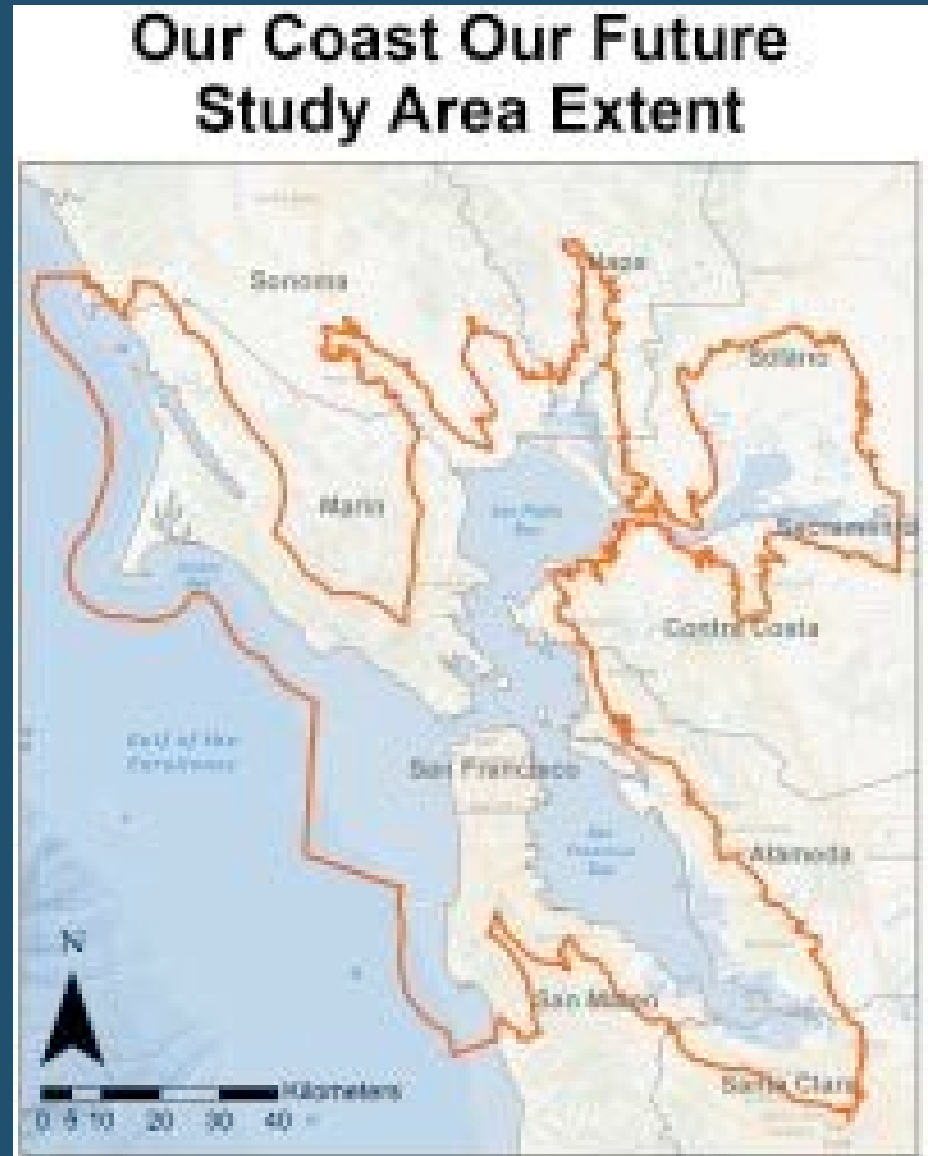
Develop web-based decision support tools to interpret data in context of management decisions

www.prbo.org/ocof



**Model vulnerabilities
from sea level rise
and storm hazards**

**Provide
stakeholders with a
variety of
information and
planning tools**



Regional Projects

SILICON VALLEY 2.0

- Evaluate the exposure of community assets
- Examine the potential consequences to the economy, society, and environment
- Develop preemptive adaptation



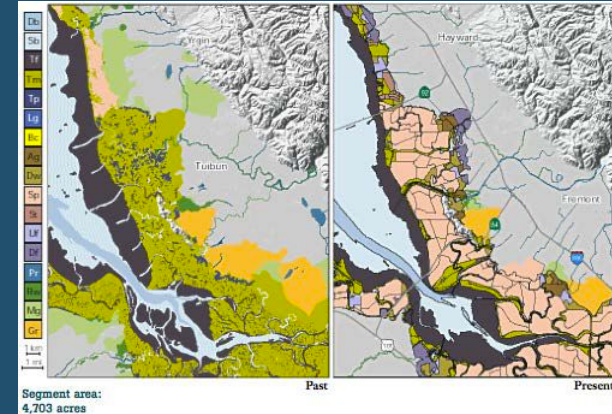
Managing Complexity: Collaboration

Baylands Goals



South Bay Salt Pond Restoration Project

Restoring the Wild Heart of the South Bay



South San Francisco Bay Shoreline Study

Alviso Ponds & Santa Clara County Interim Feasibility Study

Other Participating Agencies: US Fish & Wildlife Service; California Department of Fish & Game; Alameda County Flood Control District





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Thank You

