



METROPOLITAN
TRANSPORTATION
COMMISSION

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Memorandum

TO: Planning Committee

DATE: December 5, 2014

FR: Deputy Executive Director, Policy

W.I. 1414

RE: Climate Change Adaptation Pilot Project

Background

Plan Bay Area identified climate change adaptation as a multi-agency priority to address in advance of the 2017 update of the Plan. A number of regional and subregional efforts are underway throughout the region focused on climate change adaptation and specifically the effects of projected sea level rise. Many of these projects are part of the Bay Conservation and Development Corporation's (BCDC) Adapting to Rising Tides initiative.

MTC has partnered with BCDC on two pilot projects focused on the vulnerability and risk of transportation assets and potential adaptation strategies. This memo and the accompanying presentation summarize the second pilot, which is wrapping up this month and will inform future sea level rise adaptation planning for transportation assets in the region.

Climate Change Adaptation Pilot

In March 2013, MTC, in partnership with the BCDC, Caltrans District 4, and BART, was awarded a \$300,000 grant from the Federal Highway Administration for a pilot study to assess climate change and extreme weather vulnerability and adaptation options for transportation infrastructure. This project leverages the previous vulnerability and risk analysis, *Adapting to Rising Tides (ART): Transportation Vulnerability and Risk Assessment Pilot Project (Phase 1)*, also funded by FHWA and undertaken by MTC, Caltrans and BCDC and released in November 2011. The final report for the Phase 2 pilot will be finalized and submitted to FHWA in December 2014.

Scope

Phase 1 focused on a subregion of Alameda County and identified the vulnerability and risk of transportation assets from sea level rise and extreme weather. The current project continues that work and begins to identify high-level adaptation options and implementation strategies in three focus areas within the Phase I subregion. Each focus area has critical transportation assets, which are the focus of the study, and adjacent assets (other regional or community assets) that are considered in relation to any secondary impacts caused or benefits provided by potential adaptation strategies. The three focus areas that were selected for analysis include:

1. The West Oakland/Emeryville/Bay Bridge Peninsula;
2. The Oakland Coliseum Area; and
3. The State Route 92 Corridor.

Project Goals and Objectives

Project Goals and Objectives

The key objectives of the pilot project are as follows:

- A refined understanding of vulnerability and risk for the core transportation assets in three focus areas within the Alameda County sub-region
- A refined understanding of sea level rise and storm event exposure in the three focus areas by analyzing the extent, depth, and duration of inundation caused by overtopping of specific shoreline segments
- High-level climate adaptation options on three scales: 1) the core transportation assets alone; 2) the core transportation assets with key adjacent assets; and 3) each focus area as a whole
- Five refined representative adaptation options with specific and detailed actions including identification of timing, responsible parties, and methods for implementation

Next Steps

The final report will be released this month. This pilot project is one of many studies and planning initiatives underway throughout the region that will inform the climate change and sea level rise element of the 2017 update of Plan Bay Area. MTC will continue to work with partners to advance sea level rise vulnerability and risk analysis and adaptation planning, particularly as related to transportation infrastructure. This will include partnering with Caltrans to advance specific analysis and planning for the region's toll bridges, systematically evaluating the sea level rise studies underway throughout the region to identify key knowledge gaps, and identifying transportation infrastructure throughout the region at greatest risk and beginning to develop adaptation strategies to address those risks and vulnerabilities.



Alix Bockelman

Attachment

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Climate Change Adaptation Pilot Project

December 12, 2014



Climate Change Initiatives Throughout the Region

Regional Studies

- Plan Bay Area EIR
- Adapting to Rising Tides Program
- Resilient Shorelines Partnership
- Our Coast Our Future Tool
- Housing and Community Risk Project

SR-37 Sea Level Rise Analysis

Solano County:
• City of Benicia Study

Contra Costa County:
• County-wide Sea Level Rise Study

Alameda County:
• FHWA Phase 1 & 2 Studies
• ART Subregional Project
• Hayward Shoreline Resilience Study
• ART Shoreline Vulnerability Study
• Oakland / Alameda Resilience Study
• BART FTA Study

San Francisco County:
• SFPUC Sewer System Improvement Program

San Mateo County:
• County-wide Study
• SFO Study

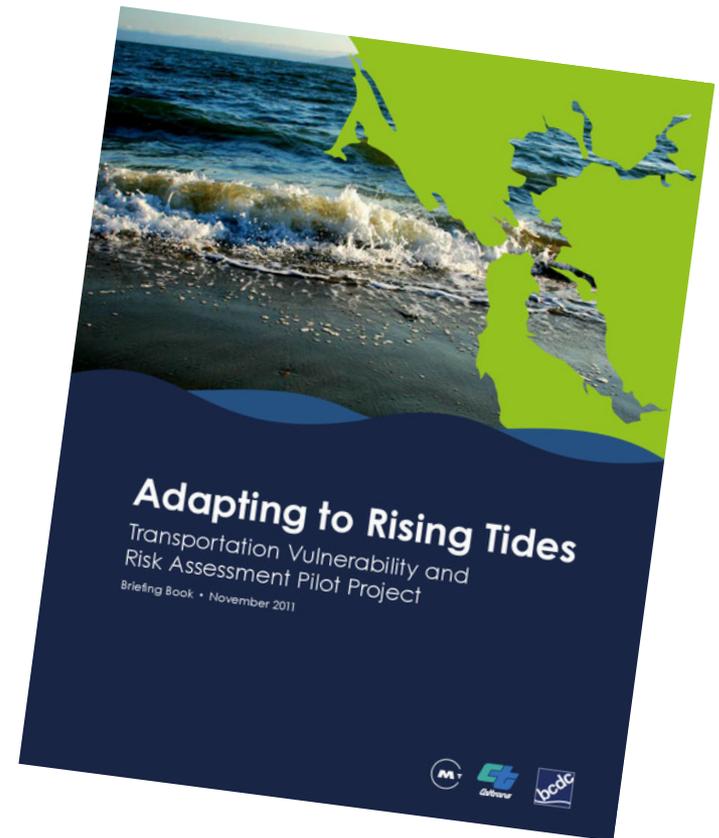
Santa Clara County:
• Silicon Valley 2.0

Other Local Studies

- CTP Guidelines
- Specific Plans/Climate Action Plans
- 100 Resilient Cities

FHWA Phase 1 Pilot

- Alameda County subregion selected for study area through competitive process
- Project management team included MTC, BCDC and Caltrans
- Conducted a vulnerability and risk analysis for study area
- Identified vulnerable / at-risk infrastructure



FHWA Phase 2 Project Objectives

- A refined understanding of vulnerability and risk for the core transportation assets
- A refined understanding of SLR and storm event exposure
- High-level climate adaptation options
- Five refined adaptation options
- A suite of evaluation criteria to evaluate the adaptation options



Extreme Weather and Sea Level Rise

- Extreme weather events are expected to occur more frequently
- Today's floods will be the future's high tides
- Areas that currently flood every 10 to 20 years will flood much more frequently



Sea Level Rise and Extreme Tide Matrix



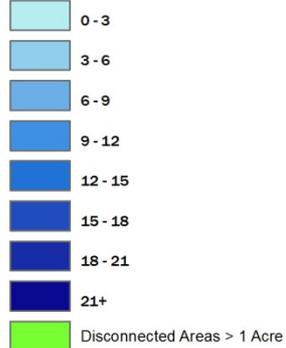
Sea Level Rise	Water Level above MHHW	Extreme Tide (Storm Surge) Levels						
		1-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
0"	0	12	19	23	27	33	37	42
+6"	6	18	25	29	33	39	43	48
+12"	12	24	31	35	39	45	49	54
+18"	18	30	37	41	45	51	55	60
+24"	24	36	43	47	51	57	61	66
+30"	30	42	49	53	57	63	67	72
+36"	36	48	55	59	63	69	73	78
+42"	42	54	61	65	69	75	79	84
+48"	48	60	67	71	75	81	85	90
+54"	54	66	73	77	81	87	91	96
+60"	60	72	79	83	87	93	97	102

Bay Bridge Focus Area: 36" SLR

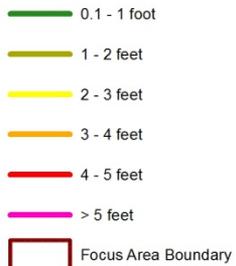


MHHW + 36" SLR Scenario

FEET



Shoreline Overtopping Potential - 36" SLR



MHHW 36" SLR
(*permanent inundation*)

OR

24" SLR + 1-yr tide

18" SLR + 2-yr tide

12" SLR + 5-yr tide

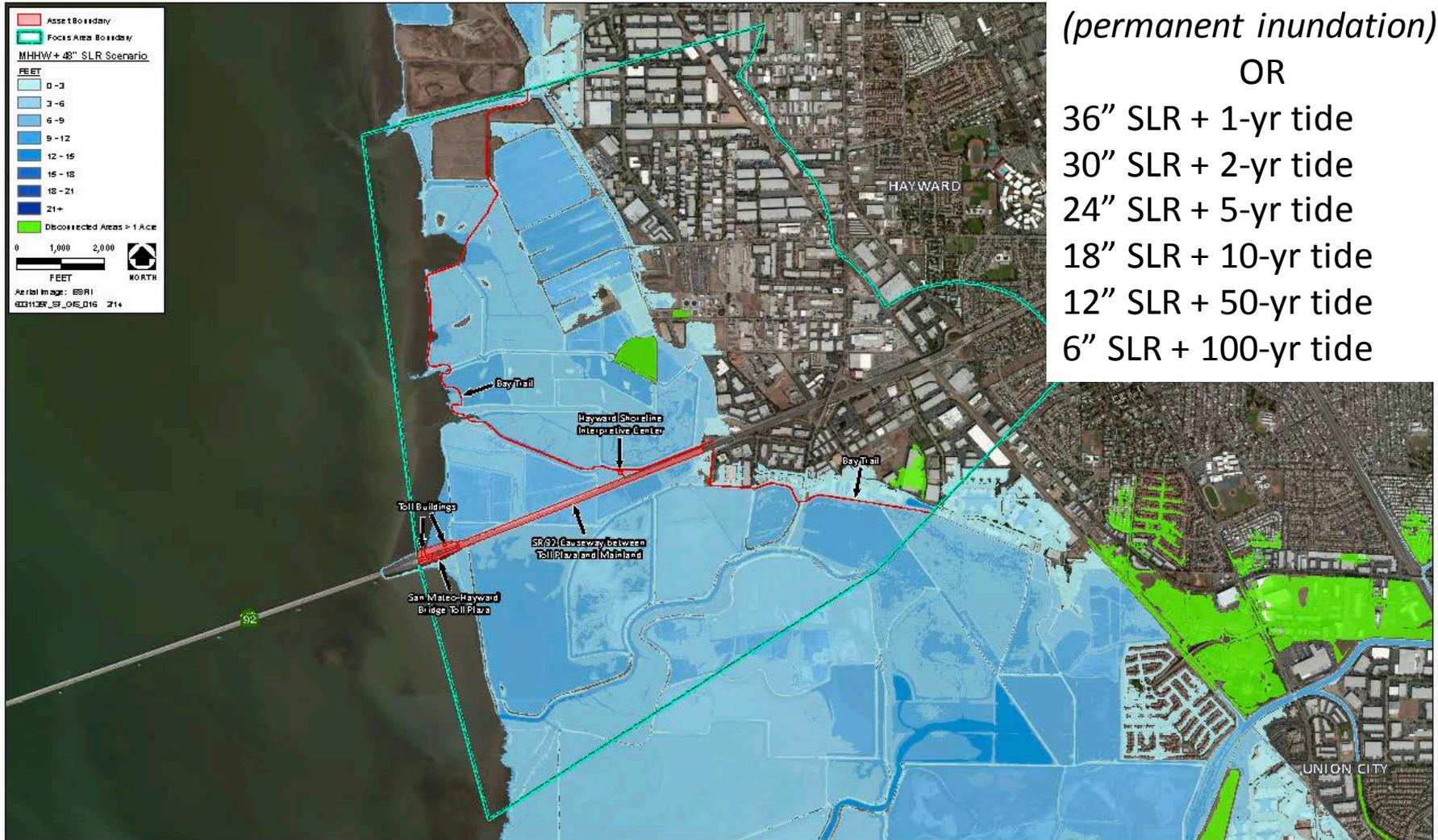
6" SLR + 10-yr tide

0" SLR + 50-yr tide

(*flooding, temporary inundation*)



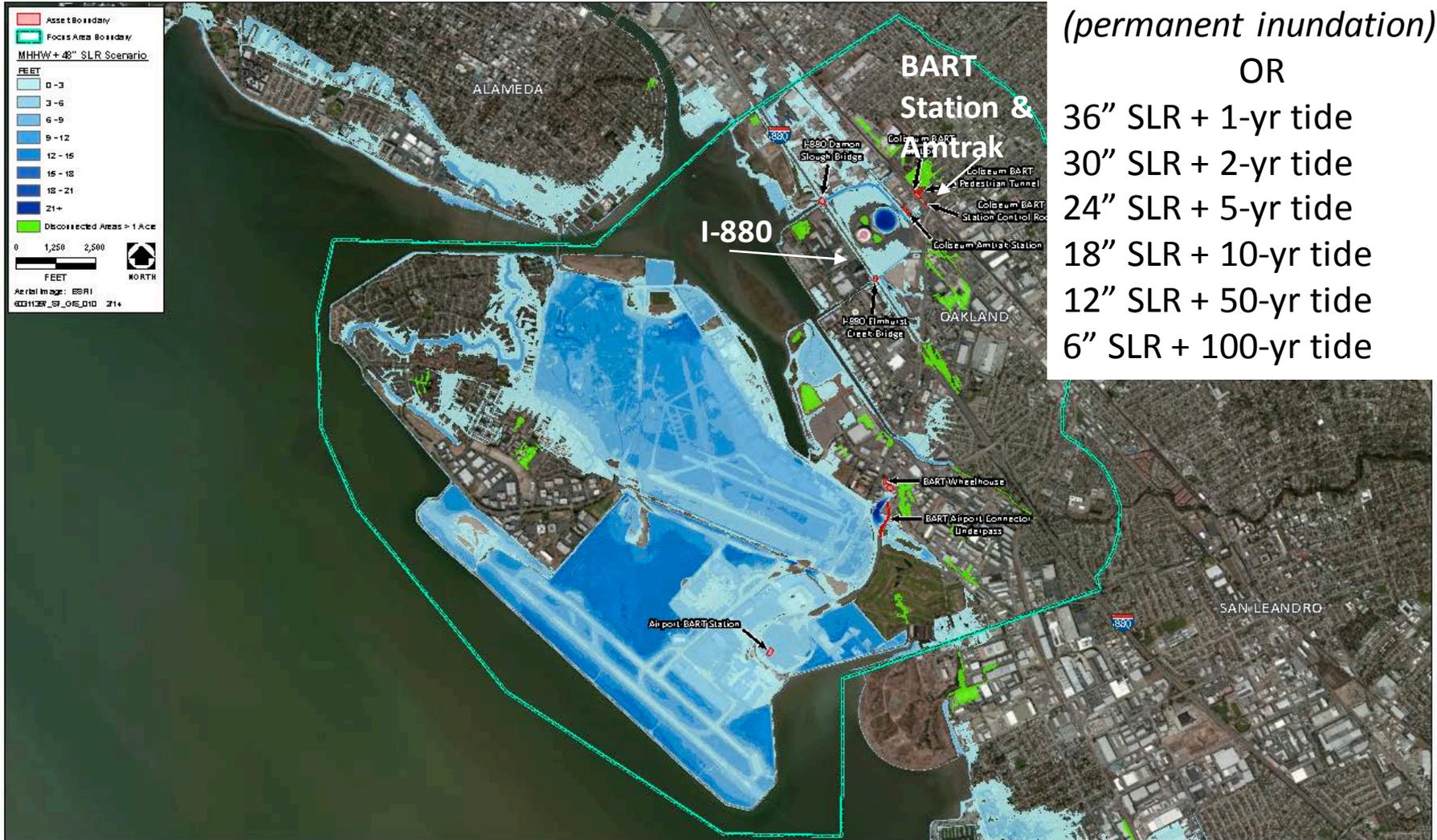
Hayward Focus Area: 48" SLR



MHHW 48" SLR
(permanent inundation)
OR
36" SLR + 1-yr tide
30" SLR + 2-yr tide
24" SLR + 5-yr tide
18" SLR + 10-yr tide
12" SLR + 50-yr tide
6" SLR + 100-yr tide

Source: AECOM 2014

Coliseum Focus Area: 48" SLR

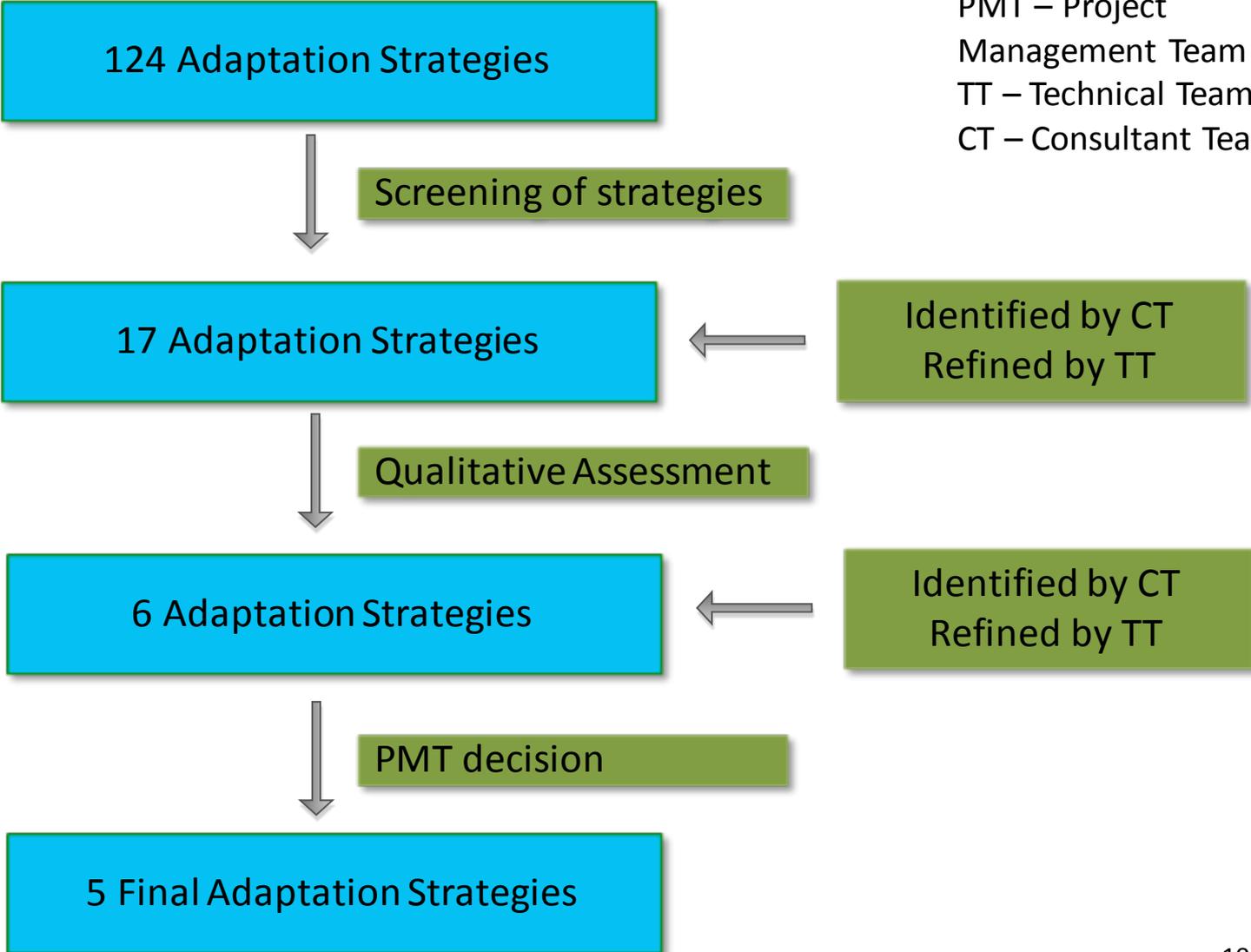


Source: AECOM 2014

Inundation Mapping Focus Areas - Oakland Airport/Coliseum

Process leading up to final strategy selection

PMT – Project Management Team
TT – Technical Team
CT – Consultant Team



List of 5 adaptation strategies



1. Levee Radio Beach
2. Breakwater Offshore Radio Beach
3. Damon Slough Levee
4. SR-92 Drainage Study
5. Mainstreaming Climate Change into Transportation Agencies

Levee + Breakwater Offshore Radio Beach



Total Estimated Project Costs

Levee: \approx \$5 million

Offshore Breakwater: \approx \$10.8 million

Total Estimated Daily Avoided Costs to the Region: \approx \$15 million

Damon Slough Levee



Total Estimated Project Cost: \approx \$2.7 million

Total Estimated Daily Avoided Costs to the Region: \approx \$8.1 million

SR-92 Drainage Study



- Total Estimated Project Cost : \$140,000 to \$250,000
- Drainage studies could be conducted for other assets, such as the Bay Bridge

Mainstreaming Climate Change into Transportation Agencies

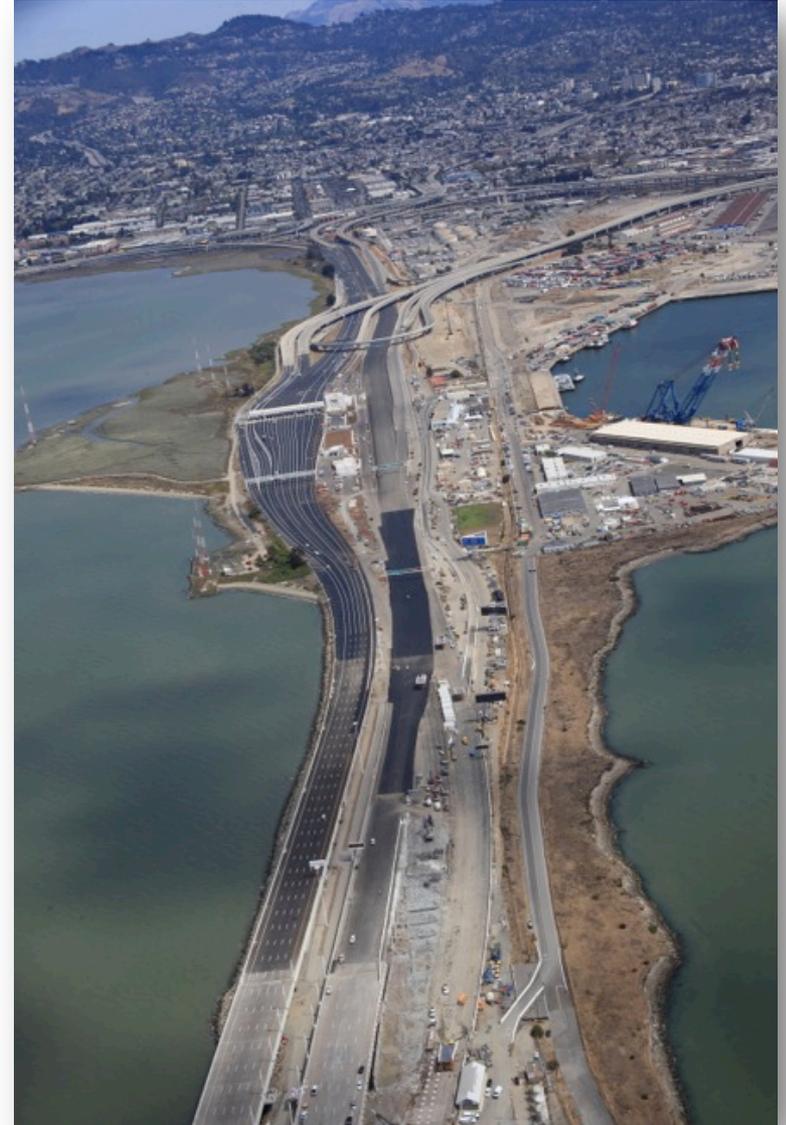


- Broad guidance for integrating adaptation planning and analysis into agency practices
- Replicable by other agencies, a framework agencies can expand upon/enrich
- Leverage guidance from federal agencies, Caltrans, BART, etc.
- Emphasize BART and Caltrans examples, illustratively



Findings

- Multi-agency and multi-asset partnerships are important
- Solutions that provide multiple benefits are possible
- Refined SLR mapping helped portray current and future risk
- Lack of accessible and quality information
- Lack of clear authority on multi-jurisdictional issues
- Lack of clear champion to advocate for implementation of solutions
- Lack of funding



Next Steps



Near Term/Asset Specific

- Conduct a detailed survey of all toll bridge assets
- Create a Bay Bridge focus group to advance adaptation strategies
- Conduct Drainage Study for SR 92
- Document ongoing initiatives in the region and identify gaps for additional analysis

Longer Term/Ongoing

- Integrate SLR into 2017 Plan Bay Area
 - Regional hot spot analysis to identify vulnerability and risk for multi-asset transportation infrastructure regionwide, building off of existing initiatives
 - Identify high priority assets for adaptation planning and implementation
- Advocacy / Legislation