SURVIVING THE STORM

March 4, 2016

North Bay Watershed Association

BAY AREA COUNCIL ECONOMIC INSTITUTE

ABOUT THE BAY AREA COUNCIL

- Founded 1945
- 300+ Largest Employers in Region
- Housing
- Transportation
- Water
- Workforce Development
- 21st Century Infrastructure

PARTNERS:

AECOM

THE Brattle GROUP

Gensler

Bay Area FLOOD PROTECTION AGENCIES Association

Coastal Conservancy

GORDON AND BETTY MOORE FOUNDATION

BAY AREA COUNCIL ECONOMIC INSTITUTE

GLOBAL MEGA STORMS:

New Orleans 2006

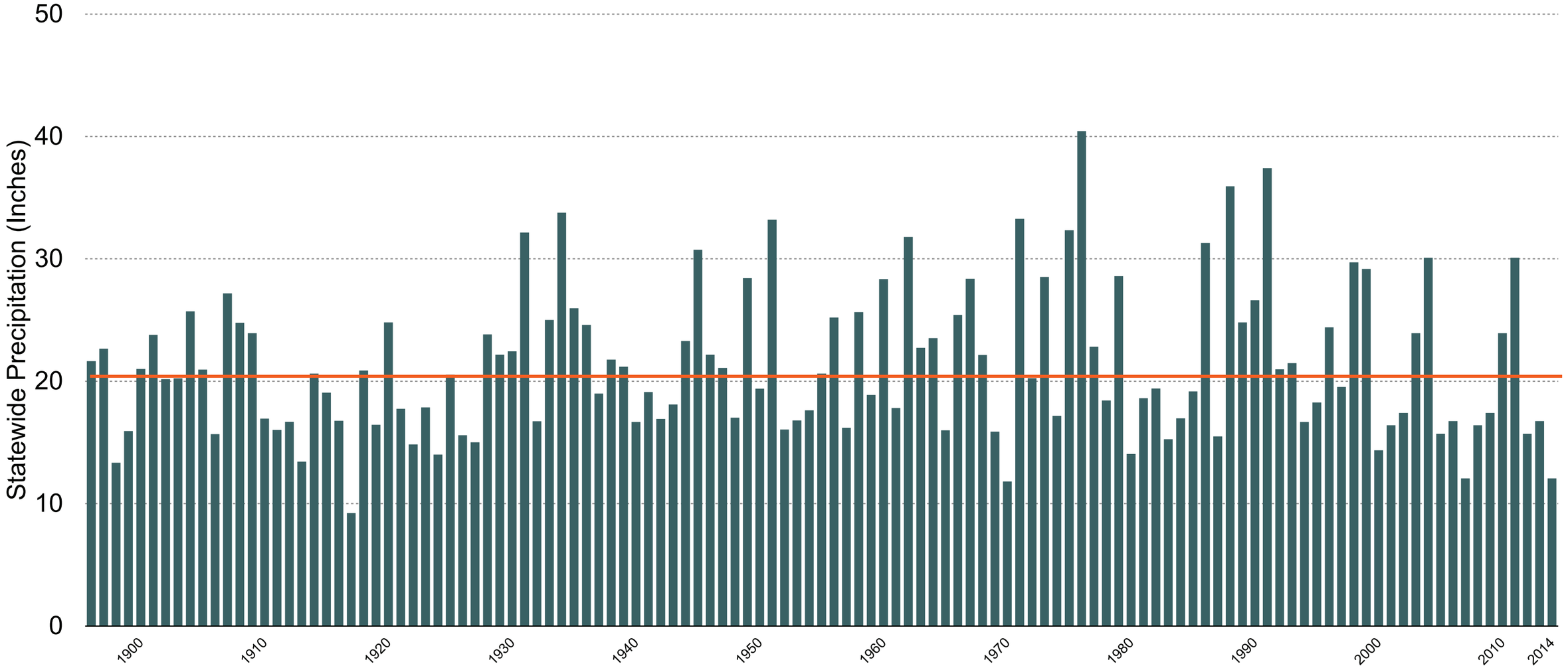
New Jersey 2012

Philippines 2013

Today, how **vulnerable** is the **Bay Area** to an **extreme storm**?

BAY AREA COUNCIL ECONOMIC INSTITUTE

CALIFORNIA'S HISTORIC ANNUAL PRECIPITATION:



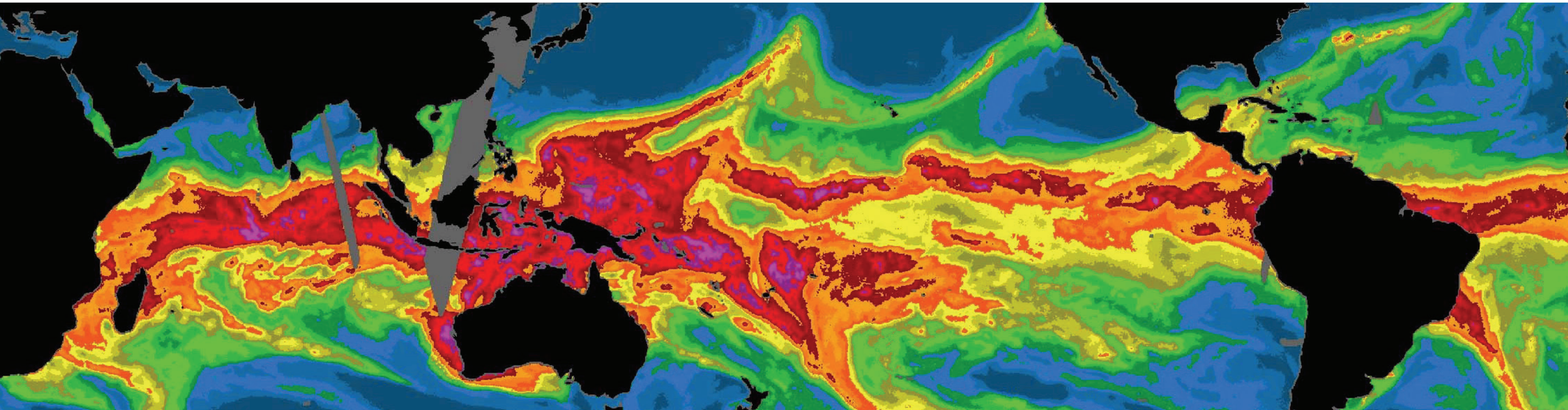
BAY AREA COUNCIL ECONOMIC INSTITUTE

ATMOSPHERIC RIVERS: CALIFORNIA'S EXTREME STORM

Prolonged Precipitation

Strong Winds

Elevated Tides



EXTREME RAINFALL EVENTS IN THE BAY AREA

How often?

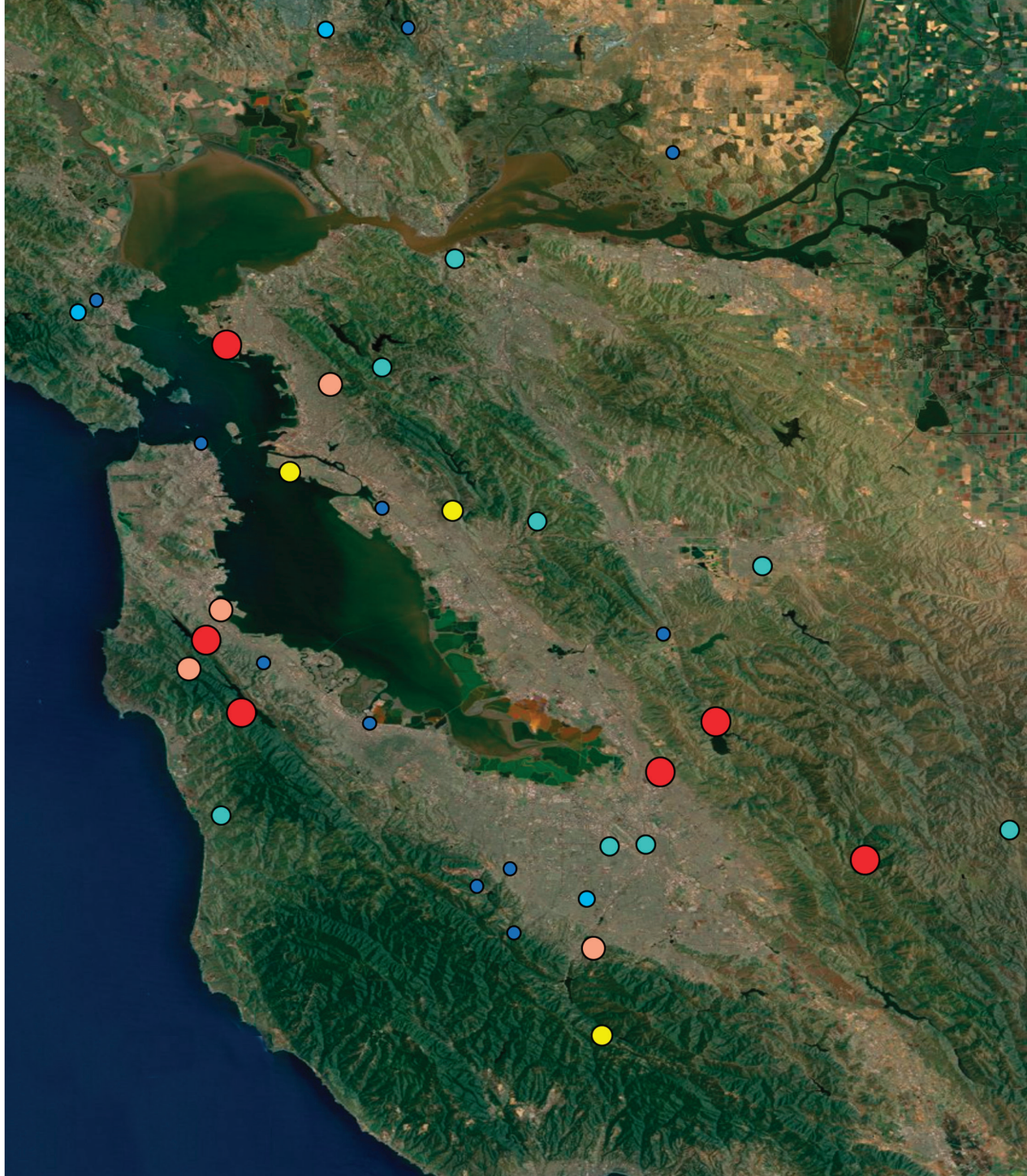
Legend

Return Period (max)

- 100 - 200
- 200 - 400
- 400 - 600
- 600 - 800
- 800 - 1000
- 1000+

(All locations shown on this map had at least 50 years of measured precipitation data.)

Source: Rainfall Depth-Duration-Frequency data from California Department of Water Resources, Engineering Meteorology.



BAY AREA COUNCIL ECONOMIC INSTITUTE

GREAT FLOOD OF 1862:

CALIFORNIA DEPENDS ON BAY AREA ECONOMY

California Personal Income Tax (PIT) Base Varies Regionally
2013 Data, Residents' Tax Returns

Region	Per Capita PIT Assessed	Total Tax Assessed (Billions)	Total Adjusted Gross Income (Billions)	Average Effective Tax Rate	Population (Millions)
San Francisco/Oakland/San Jose MSAs	$3,119	$19.9	$314.3	6.3%	6.38
Orange County	1,724	5.3	102.0	5.2%	3.10
Ventura County	1,360	1.1	25.2	4.5%	0.84
San Diego County	1,355	4.3	91.0	4.7%	3.18
Los Angeles County	1,345	13.5	267.3	5.0%	10.01
Central Coast[a]	1,208	1.7	36.6	4.6%	1.40
Napa, Solano, and Sonoma Counties	1,187	1.3	29.4	4.3%	1.05
Sacramento MSA	964	2.1	54.9	3.9%	2.20
North State[b]	542	0.7	20.9	3.2%	1.22
San Joaquin Valley[c]	541	2.2	67.0	3.3%	4.07
Riverside and San Bernardino Counties	530	2.3	77.5	3.0%	4.34
Other residents[d]	--	1.3	23.6	5.6%	--
Total	$1,460	$55.7	$1,109.5	5.0%	38.16


Clearlake
Lower Lake
Cloverdale
Middletown
Healdsburg
Calistoga
Windsor
NAPA
SONOMA
Guerneville
Saint Helena
Forestville
Santa Rosa
Sebastopol
Rohnert Park
Boyes Hot Springs
Sonoma
Napa
Petaluma
Fairfield
SOLANO
Vacaville
Dixon
Travis Field
Winters
Davis
Woodland
YOLO
West Sacramento
Sacramento
Carmichael
Rio Linda
Elk Grove
Vallejo
MARIN
San Rafael
Richmond
Concord
Pleasant Hill
Walnut Creek
Berkeley
Lafayette
CONTRA COSTA
Orinda
Moraga
Alamo
Oakland
San Francisco
Alameda
San Ramon
SAN FRANCISCO
Daly City
South San Francisco
Pacifica
Castro Valley
Dublin
Hayward
Livermore
ALAMEDA
Union City
Fremont
San Mateo
El Granada
Half Moon Bay
SAN MATEO
Milpitas
Santa Clara
San Jose
Cupertino
SANTA CLARA
Ben Lomond
SANTA CRUZ
Scotts Valley
Santa Cruz
Aptos
Watsonville
Tracy

BAY AREA AT RISK

355,000 residents, **$46.2 billion** in structures and contents are located in the region's 100-year floodplain

BAY AREA COUNCIL ECONOMIC INSTITUTE

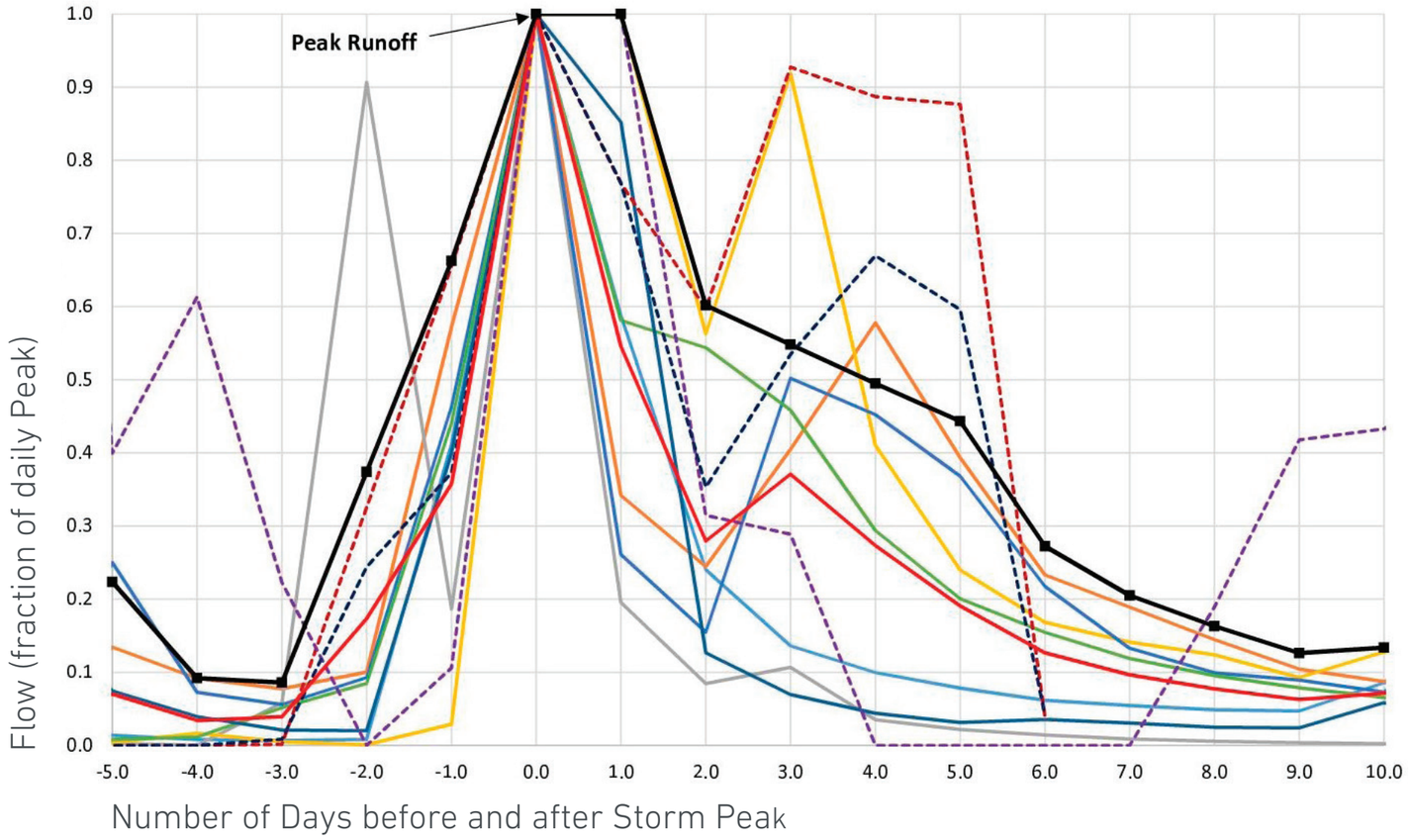
STORM SUMMARY

- Approximate 150 year return period
- Up to 12 inches of rain over 4 to 7 days*
- Elevated creek and river flows lasting over one week; peak flood flows last one day
- High tide in the Bay based on maximum observed tide which occurred in January 1983
- Area inundated by flood waters based on computer analysis of flood flows and a review of FEMA flood maps and other flood studies

*Varies by sub region, i.e., North Bay, East Bay, San Francisco, Peninsula, and South Bay

BAY AREA COUNCIL ECONOMIC INSTITUTE

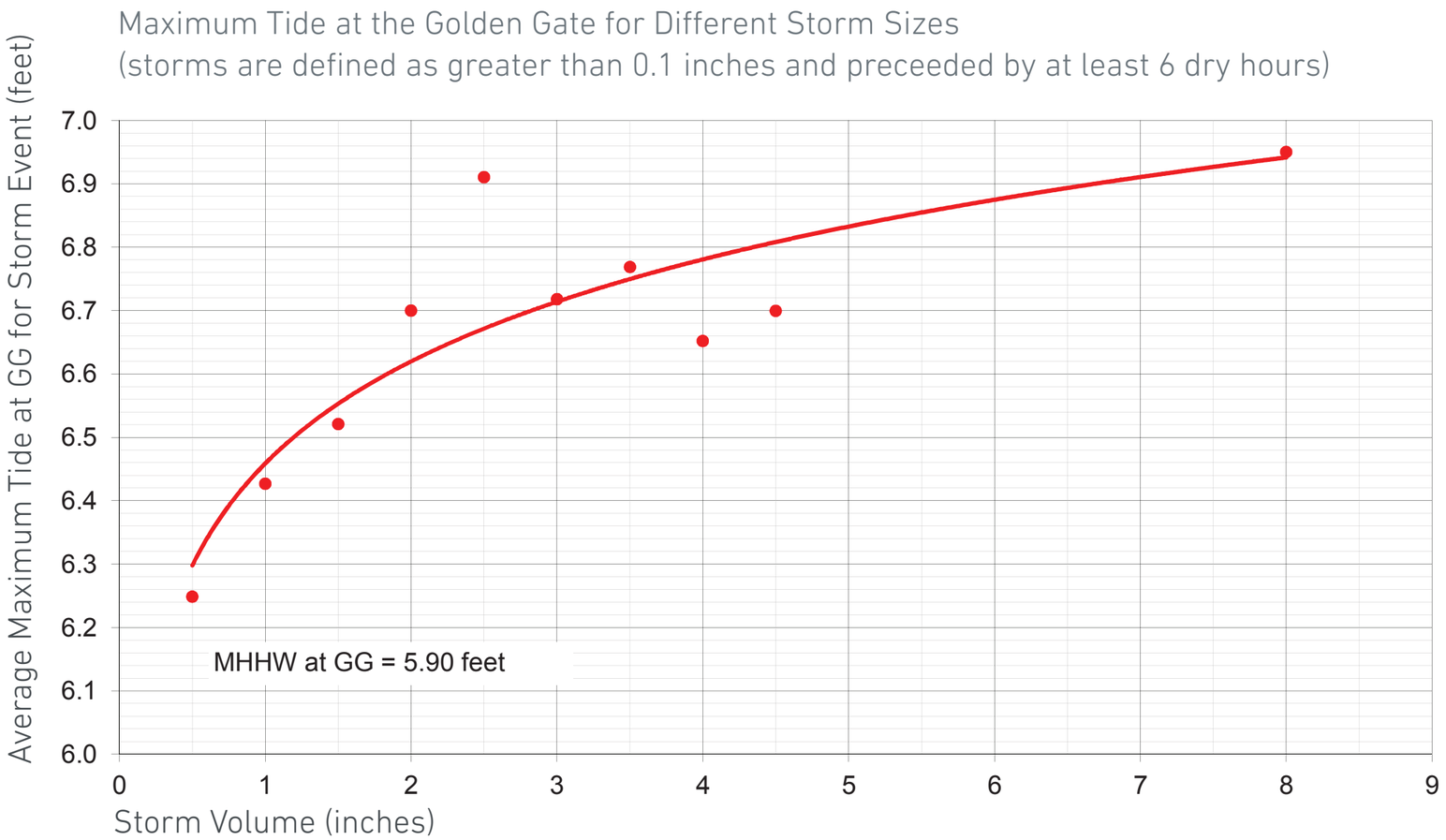
BAY AREA EXTREME STORM AND FLOOD ANALYSIS



Source: USGS Water Resources data

BAY AREA COUNCIL ECONOMIC INSTITUTE

GOLDEN GATE AVERAGE MAXIMUM HIGH TIDE



Source: NOAA North American Vertical Datum of 1988

BAY AREA COUNCIL ECONOMIC INSTITUTE

SUMMARY OF DAMAGES BAY AREA
(MILLIONS OF DOLLARS)

Damage Category	Estimated Damages
Structural damages	$5,932
Content damages	$4,180
Air transportation delay damages	$86
Road transportation delay damages	$78
Electricity service interruption costs	$125
Total	**$10,401**

Source: Analysis by The Brattle Group

BAY AREA COUNCIL ECONOMIC INSTITUTE

STRUCTURAL & CONTENT DAMAGES
(MILLIONS OF DOLLARS)

County Name	Structural Damages [1]	Content Damages [2]	Structural and Contents Damages [3]=[1]+[2]
Alameda	$394	$345	$739
Contra Costra	$448	$310	$758
Marin	$715	$487	$1,202
Napa	$22	$14	$36
San Francisco	$0	$5	$5
San Mateo	$680	$412	$1,092
Santa Clara	$3,586	$2,553	$6,140
Solano	$84	$52	$137
Sonoma	$2	$1	$3
Total	**$5,932**	**$4,180**	**$10,112**

Source: Analysis by The Brattle Group

COST OF INACTION

DOES NOT INCLUDE:

> highway or airport repair costs,

> loss of life,

> potentially catastrophic effects of levee failure in the Sacramento-San Joaquin Delta,

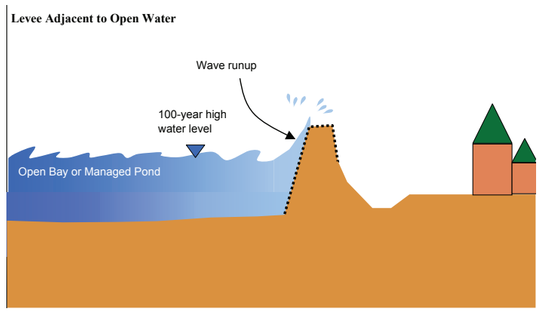
> flood-related damage to communications facilities

Will be exacerbated by sea-level rise

California is vulnerable to storms larger than the one modeled

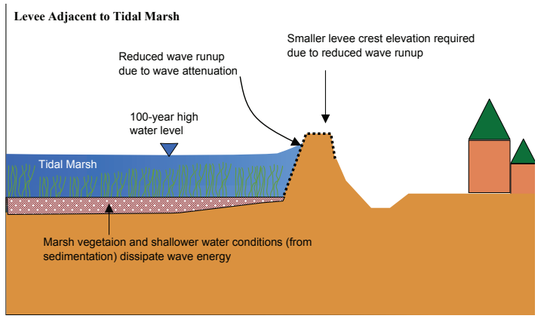
BAY AREA COUNCIL ECONOMIC INSTITUTE

BAY



Traditional Levee without Wetlands (Grey Infrastructure)

Source: South Bay Salt Pond Restoration Project

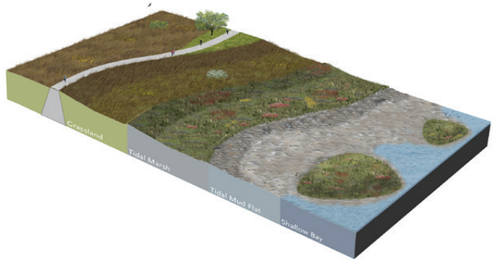


Traditional Levee with Wetlands (Green + Grey Infrastructure)

Source: South Bay Salt Pond Restoration Project

Seawalls (Grey Infrastructure)

Source: Dave Rauenbuehler



Horizontal Levee (Green + Grey Infrastructure)

Source: The City of San Jose

RIVER / CREEKS

Bioswale (Green Infrastructure)

Source: SFPUC

Storage Tunnels (Grey Infrastructure)

Source: SFPUC

Green Streets (Green Infrastructure)

Source: SFPUC

BAY AREA COUNCIL ECONOMIC INSTITUTE

GENERAL RECOMMENDATIONS

Infrastructure

Support the development of cost-effective structural and non-structural strategies, tailored to the region's variety of local environments, to reduce flood risk.

Funding

Identify new and expand existing local, regional, state and federal funding for flood infrastructure investment.

Prioritization

Identify and prioritize projects necessary to protect key economic assets such as transport, power, water, wastewater, employment centers, and communications infrastructure.

Also: Local , Regional, State and Federal Recommendations

Planning

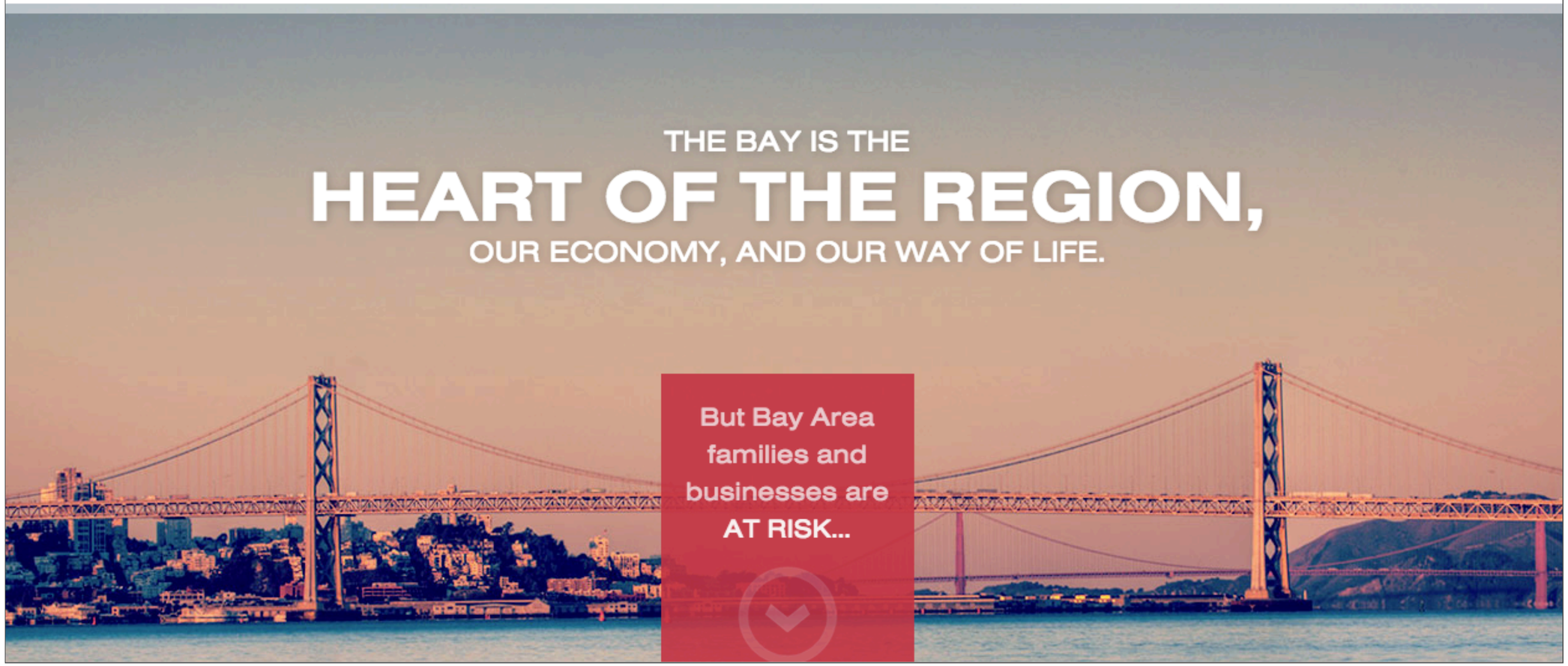
- Incorporate community resilience to extreme storms into Hazard Mitigation and General Plans.
- Identify ways to leverage new development under regional growth plans to provide local flood protection and reduce economic vulnerability.
- Incorporate climate change predictions, including sea-level rise and changes in rainfall, into flood risk analyses.

Early Warnings

Support development of accurate weather and flood forecasting, particularly for lead time on atmospheric rivers.

OUR BAY ON THE BRINK

FLOOD RISK | POLLUTION & CONTAMINATED FISH | THE SOLUTION



BAYAREA COUNCIL

SAVE THE BAY

SILICON VALLEY LEADERSHIP GROUP

YES on AA

CLEAN AND HEALTHY BAY

BAYAREA COUNCIL

SAVE THE BAY

SILICON VALLEY LEADERSHIP GROUP

BAY AREA COUNCIL ECONOMIC INSTITUTE

View Report:
bayareacouncil.org/issues-initiatives/

Education Campaign:
ourbayonthebrink.com

Yes on Measure AA:
http://peopleforacleanandhealthybay.org/