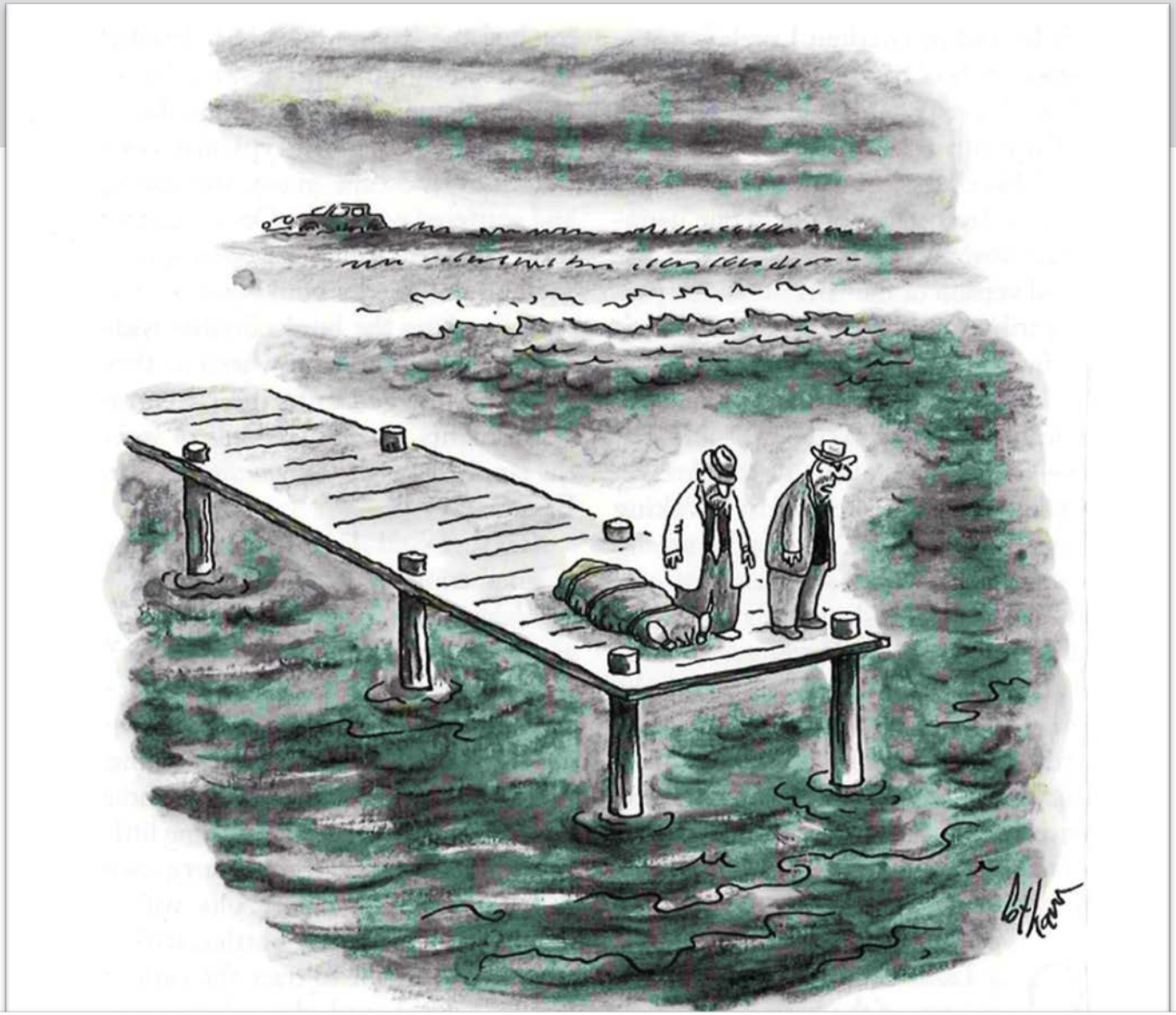
Identifying and Adapting to Sea-level Rise Vulnerabilities

Matt Brennan, PhD, PE

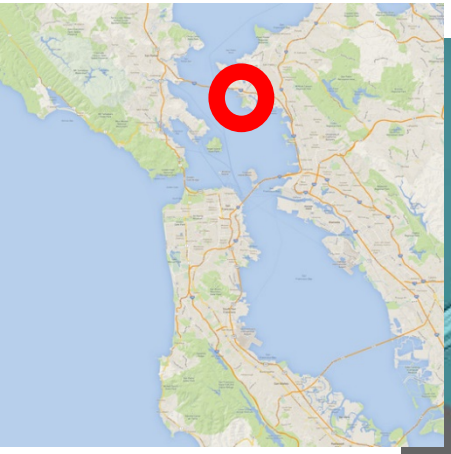
mbrennan@esassoc.com

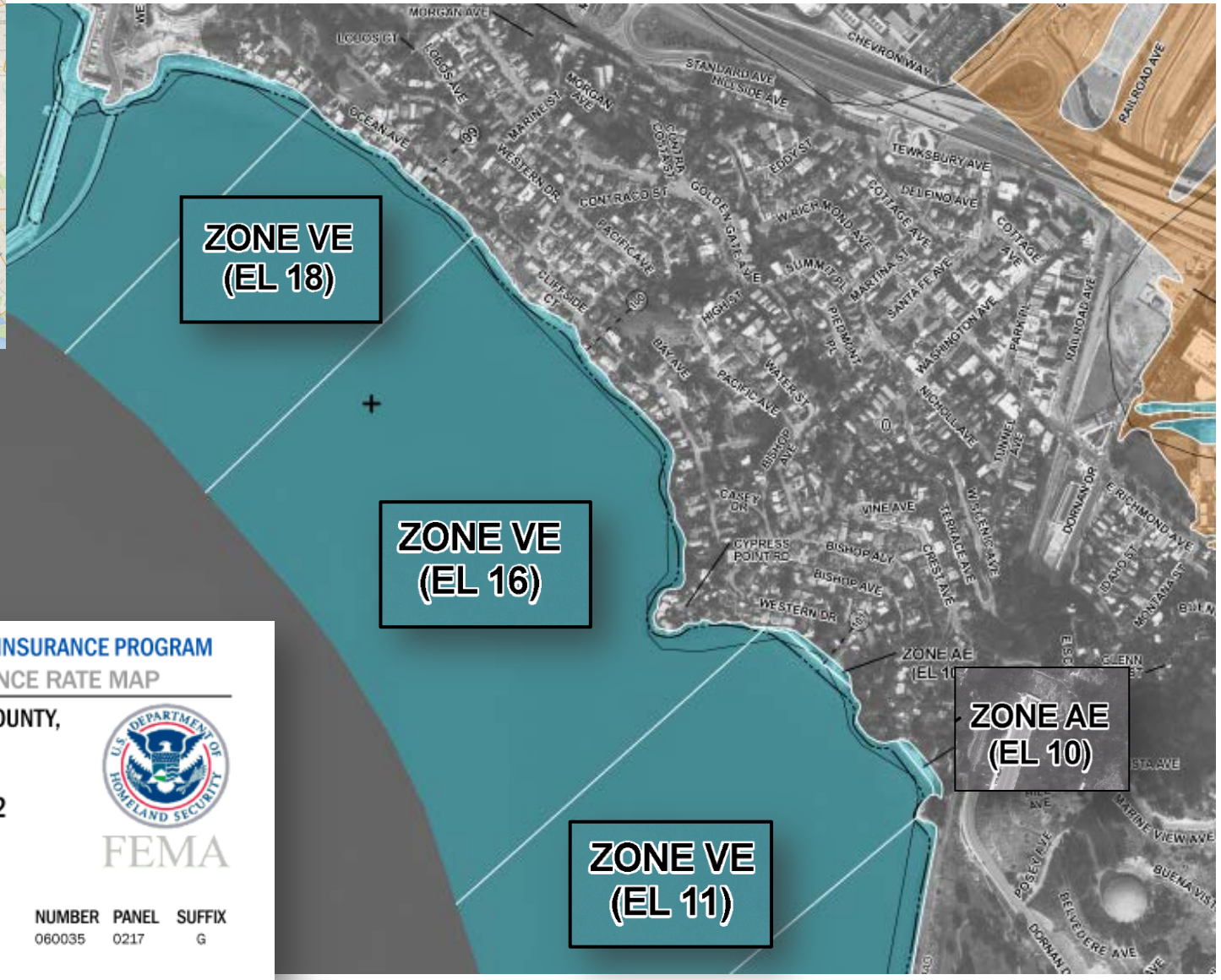
AEP – May 20th, 2017



"I've been dumping bodies here for years, and it seems to me that the sea level is rising."

FEMA Flood Maps – Now with Waves!





NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

CONTRA COSTA COUNTY, CALIFORNIA

and Incorporated Areas

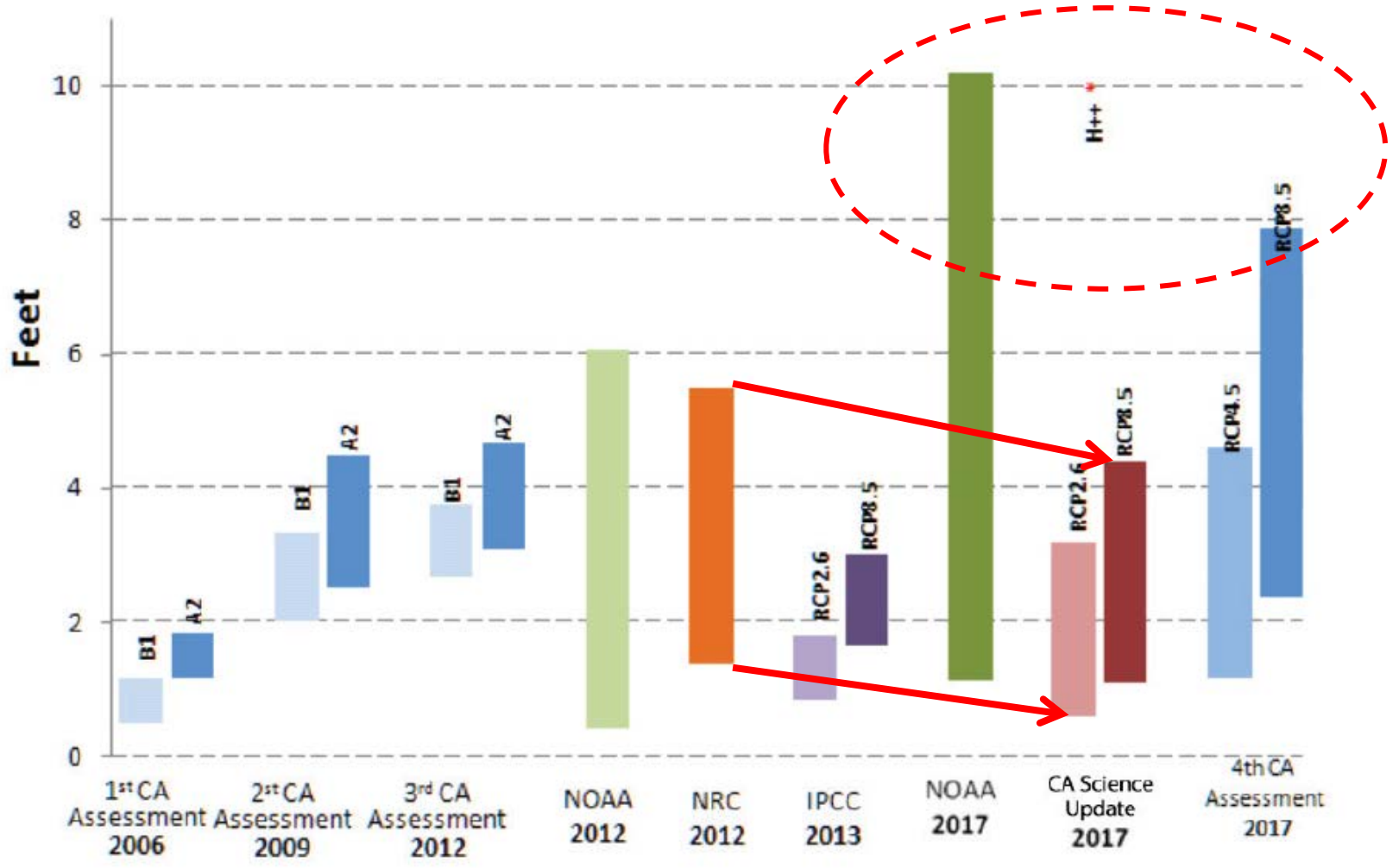
PANEL 217 OF 602

FEMA

Panel Contains:

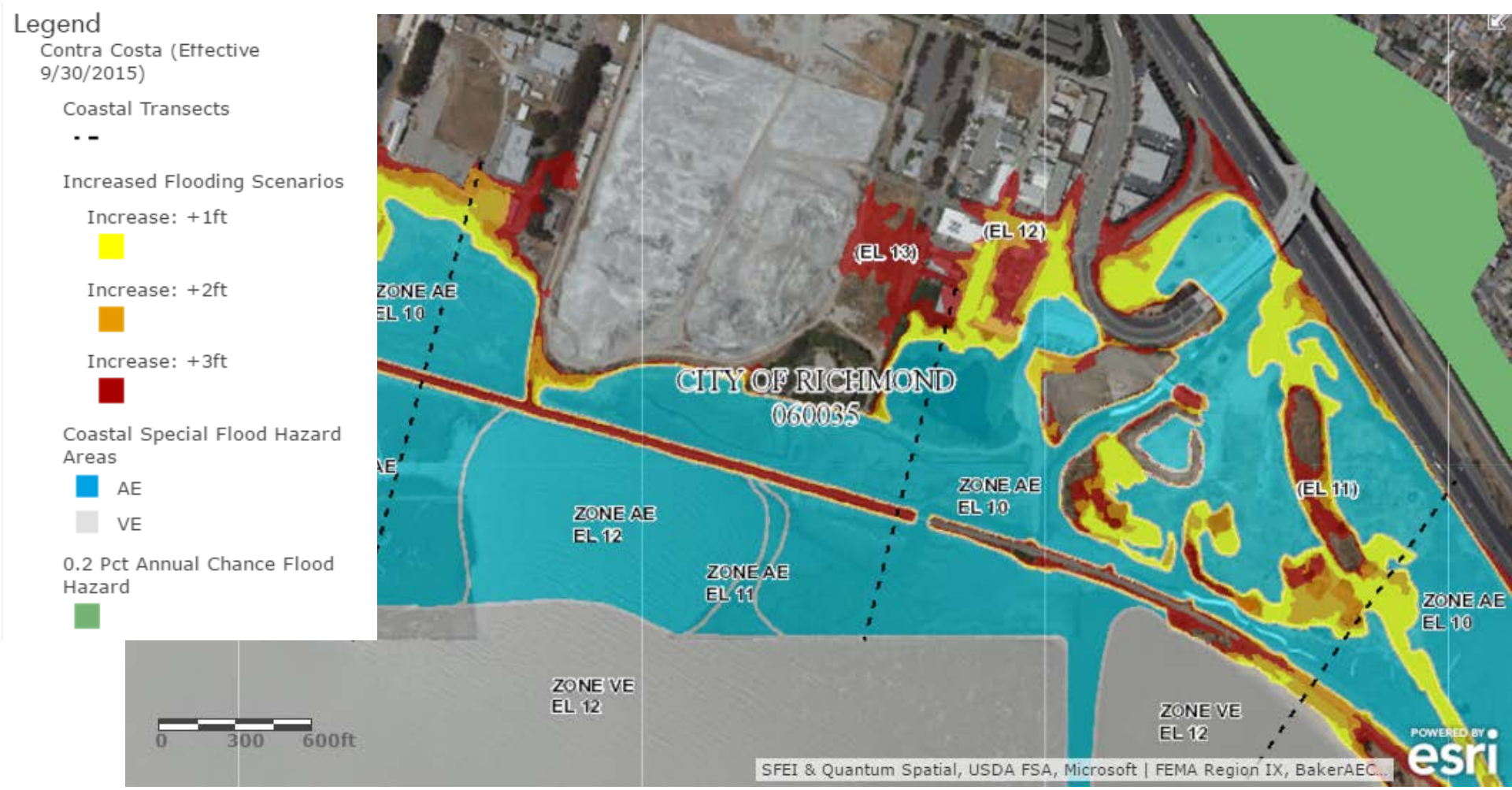
COMMUNITY	NUMBER	PANEL	SUFFIX
RICHMOND, CITY OF	060035	0217	G

Evolution of Sea-Level Rise Projections

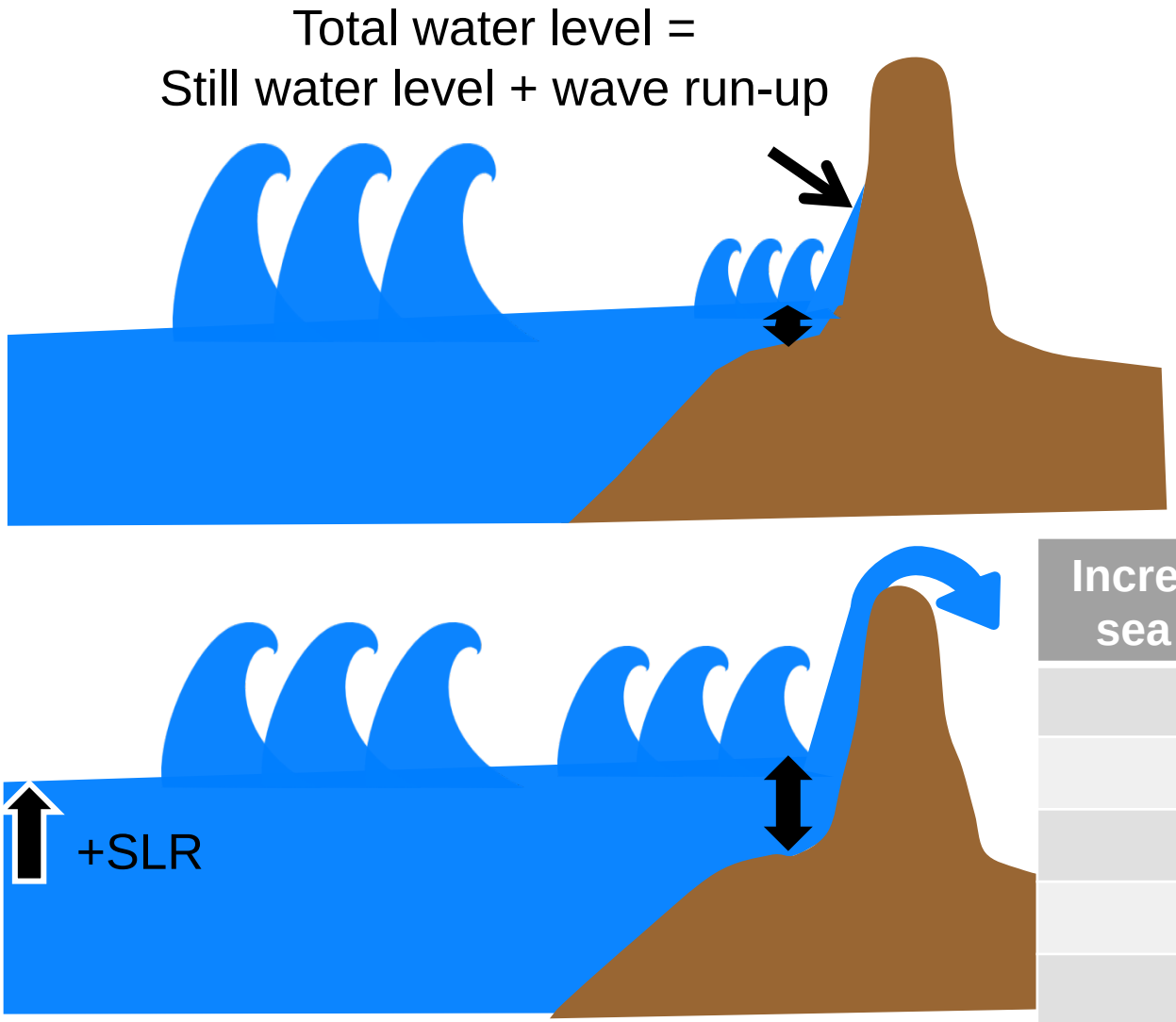


Source: Griggs et al. 2017. Rising Seas in California: An Update on Sea-Level Rise Science.

FEMA + Sea-Level Rise



Wave Run-up Can May Faster Than Sea-Level Rise



Increase in sea level	Increase in total water level
1	2.2
2	4.3
3	6.3
4	9.6
5.5	12.9

Source: FEMA

Coastal Erosion: Sea-level Rise Accelerated Hazard

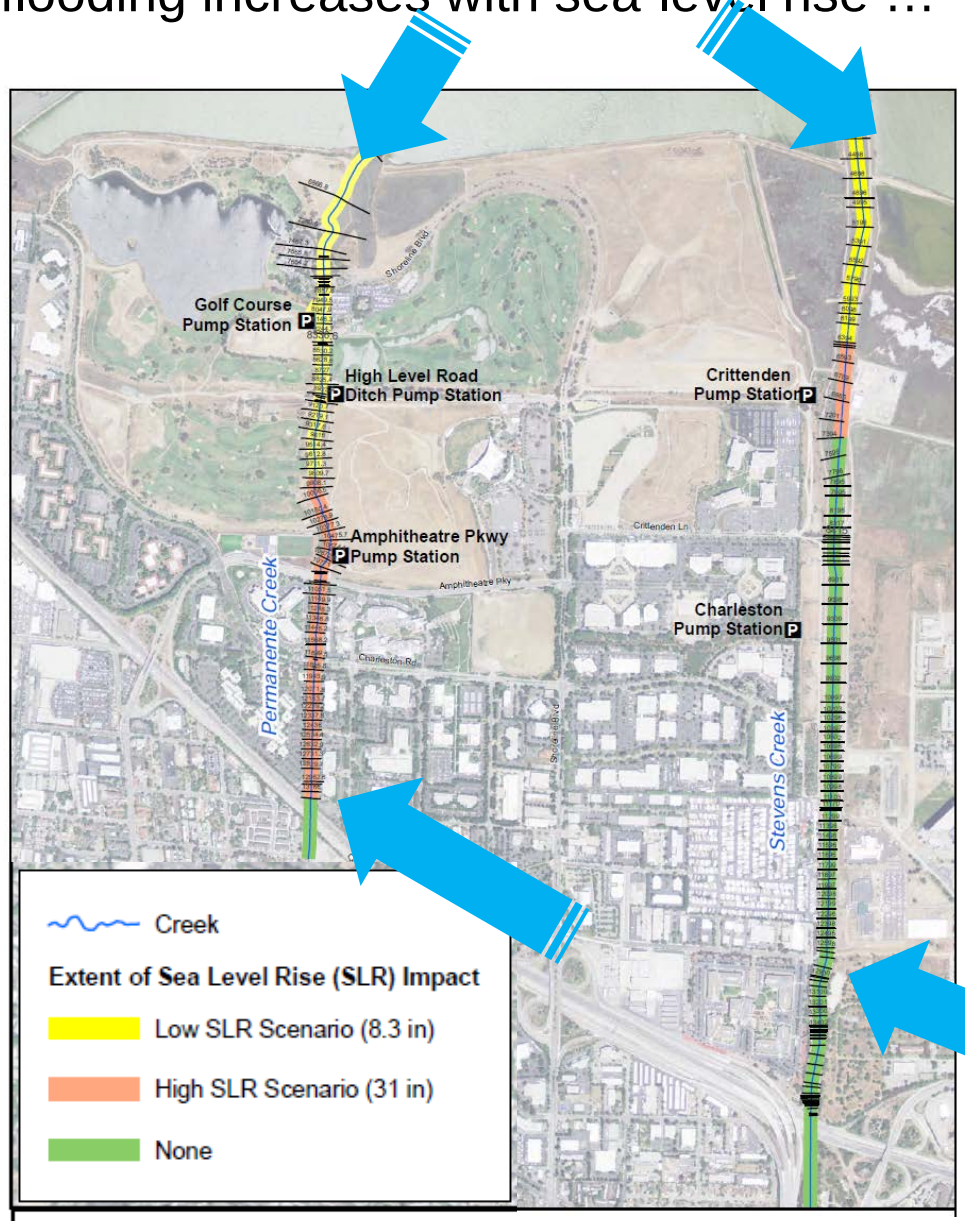
Effective FEMA DFIRM published 2008

Estimated – ESA PWA, potential erosion by 2100, published 2009

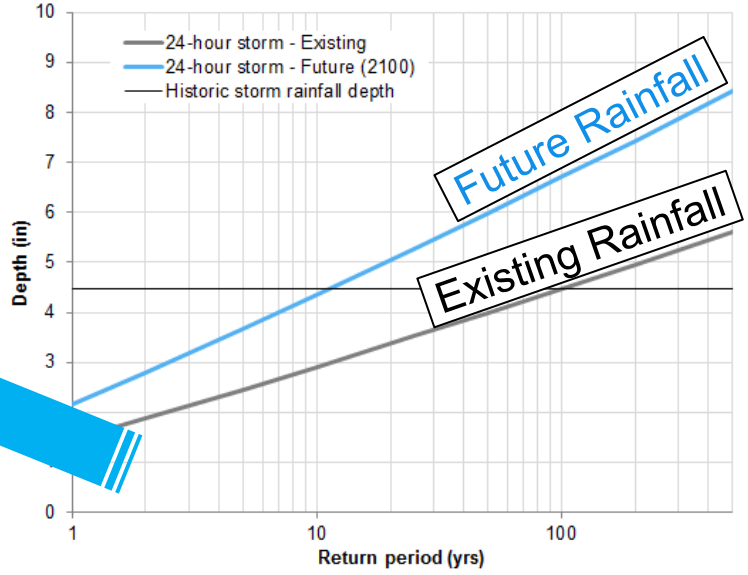
2010 - Buildings uninhabitable

Climate Change, Precipitation, and Creek Flooding

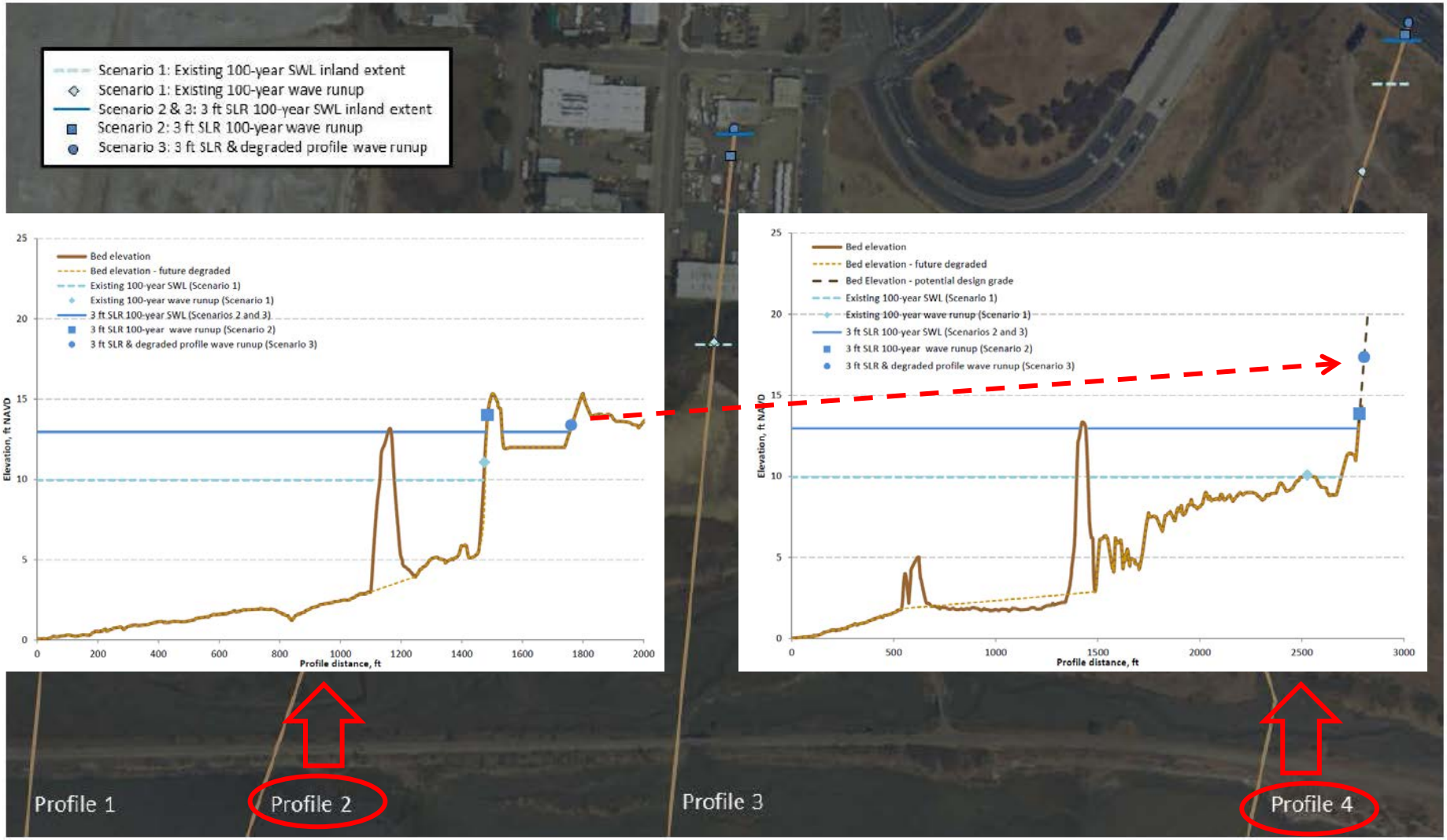
Bay flooding increases with sea-level rise …



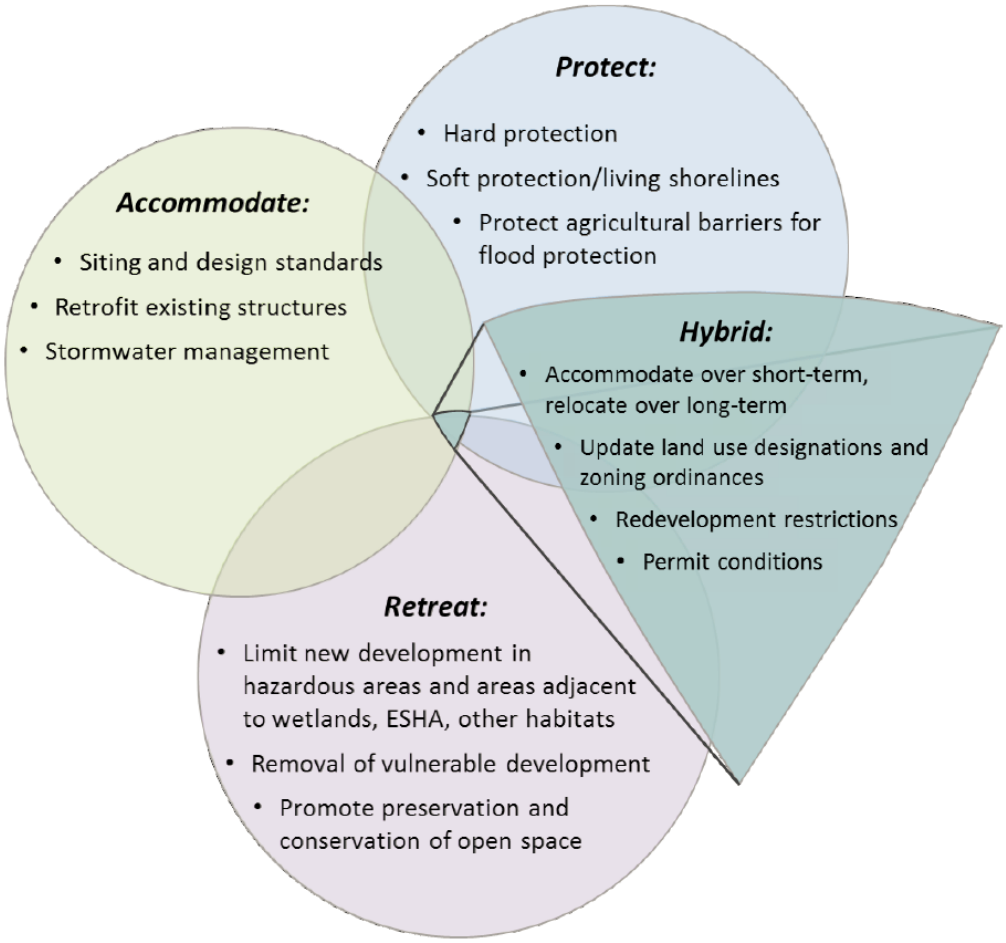
… and so might precipitation & creek flooding!

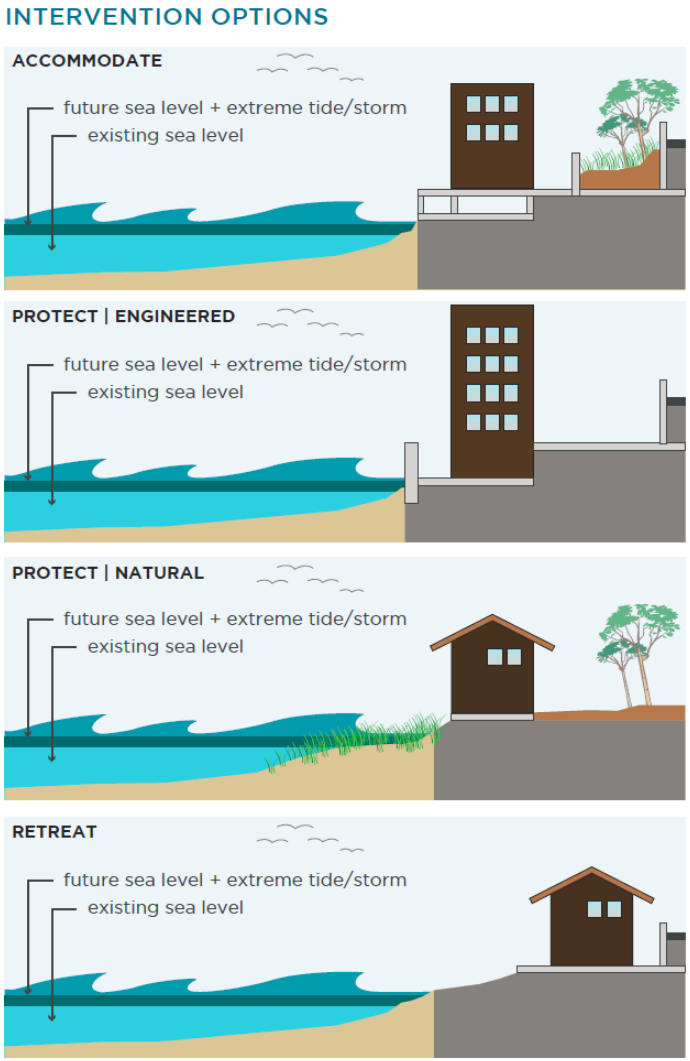


Different Shorelines Face Different Hazards



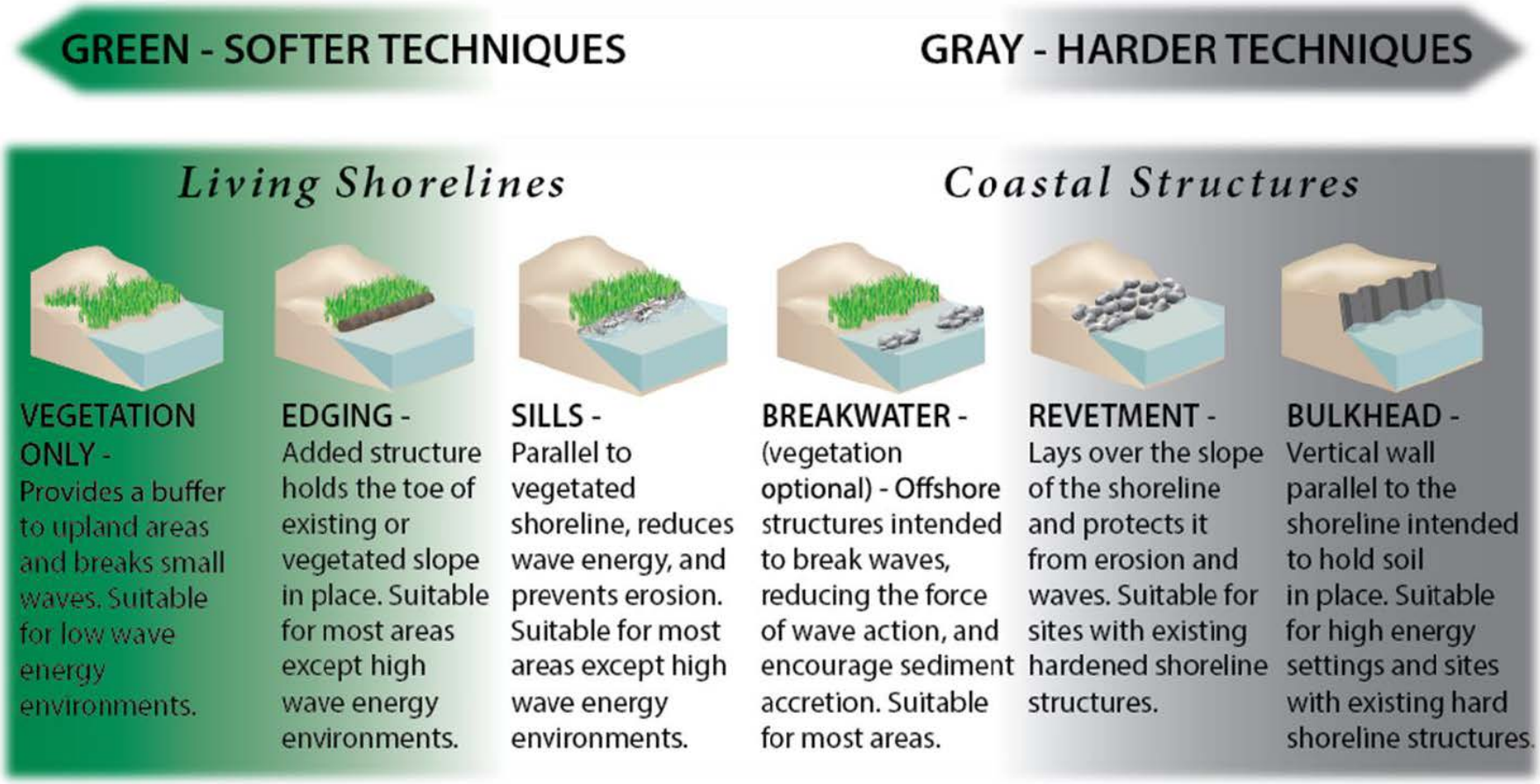
Approaches to Adaptation





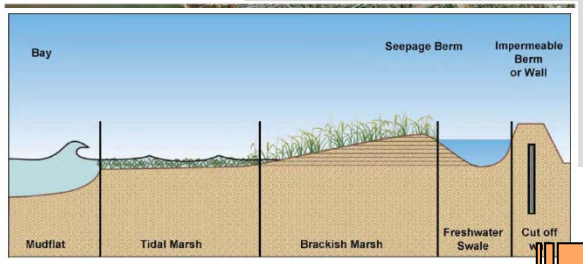
CA Coastal Commission SLR Guidance

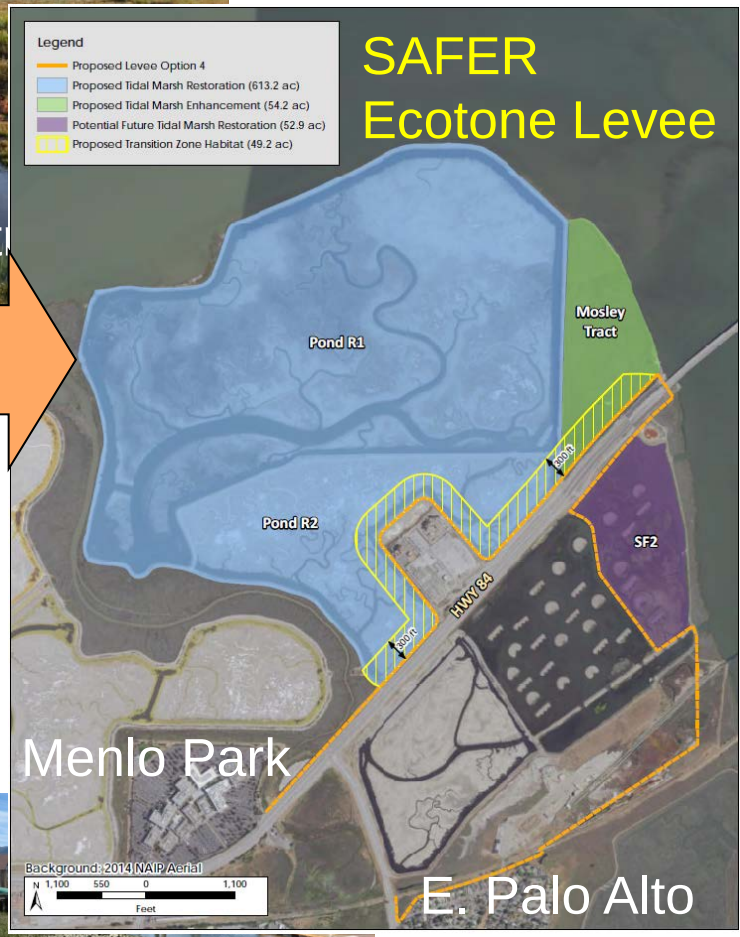
Protecting with Green & Gray

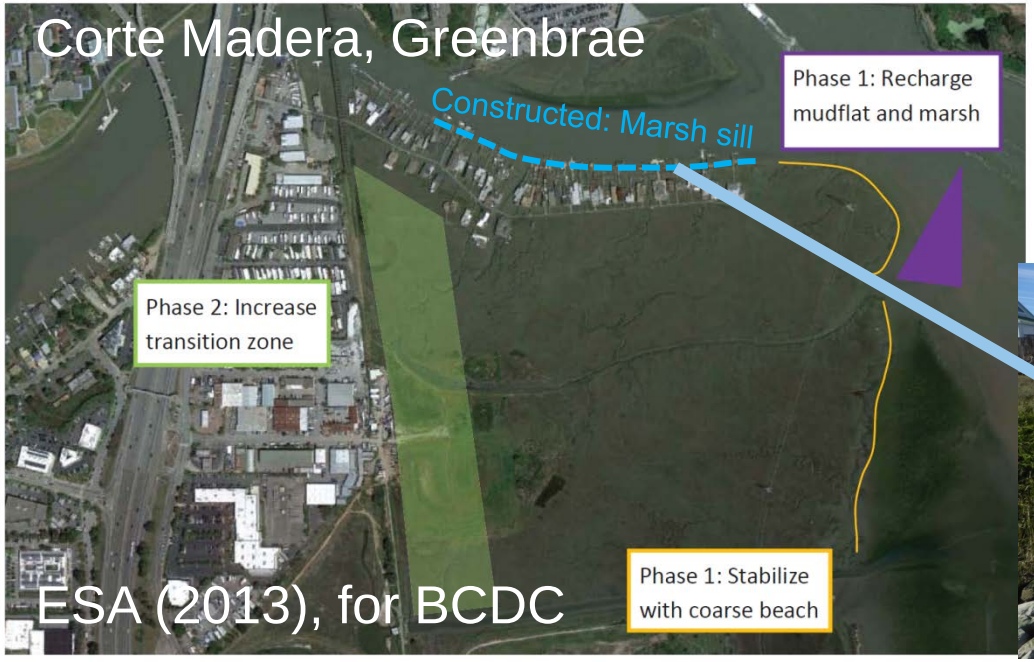


- NOAA Living Shoreline report, 2015.

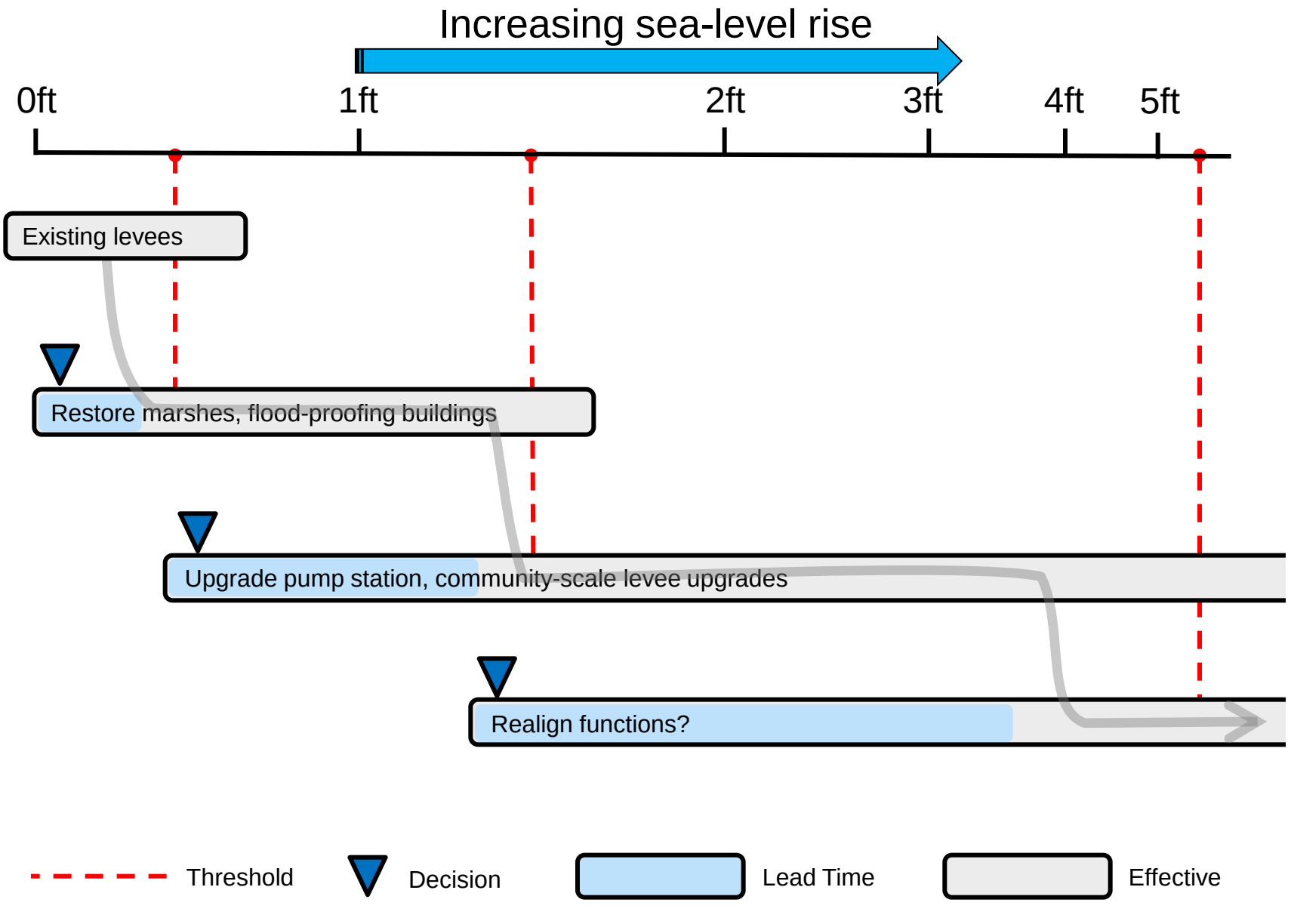
Example of Green/Gray Hybrids







Intentional & Phased Adaptation Planning



Where to Learn More

- At AEP 2017:
  - Ocean Beach MP: Multi-Objective Adaptation to Sea Level Rise along San Francisco's Pacific Ocean Shore
    - Friday, May 19 @ 9-10:30am
  - Sea Level Rise Mapping: The Past, the Present, and the Future
    - Saturday, May 20 @ 1:45-3:15pm
- State
  - OPC
    - www.opc.ca.gov/climate-change
  - California Coastal Commission
    - www.coastal.ca.gov/climate/slrguidance.html
- Bay Area
  - Bay Conservation & Development Commission
    - www.adaptingtorisingtides.org