

HUMBOLDT BAY SEA LEVEL RISE ADAPTATION PLANNING PROJECT

Adaption Planning Working Group

Meeting

August 27, 2014


- State Coastal Conservancy
- Coastal Ecosystems Institute of Northern California
- Humboldt Bay Harbor, Recreation, and Conservation District
- Humboldt County Public Works Department
- Northern Hydrology and Engineering
- Trinity Associates

Humboldt Bay Sea Level Rise Adaptation Planning Project

The goal of the project is to support informed decision-making and encourage a unified, consistent regional adaptation strategies to address the hazards associated with sea level rise in the Humboldt Bay region.

AGENDA

- 1. Introductions/Announcements**
- 2. Regional Assets at Risk by 2.0 meters of RSLR**
- 3. Highway 101 Case Study in VA and AS**
- 4. Regional Adaptation Strategies**

The background of the slide is a close-up photograph of water with numerous small, concentric ripples. The water is a light blue color, and the ripples create a textured, shimmering effect across the entire surface.

Introductions and Stakeholder Updates/Announcements



Humboldt Bay

Harbor, Recreation & Conservation District

[Home](#)

[Divisions](#)

[Commission](#)

[I Want To](#)

[Contact](#)

Humboldt Bay Sea Level Rise Adaptation Planning Project

Recent Updates:

[June 2014 Meeting Presentation](#)

April 2014 Inundation Maps: [Zip file download](#)

[April 2014 Meeting Presentation \(pdf file\)](#)

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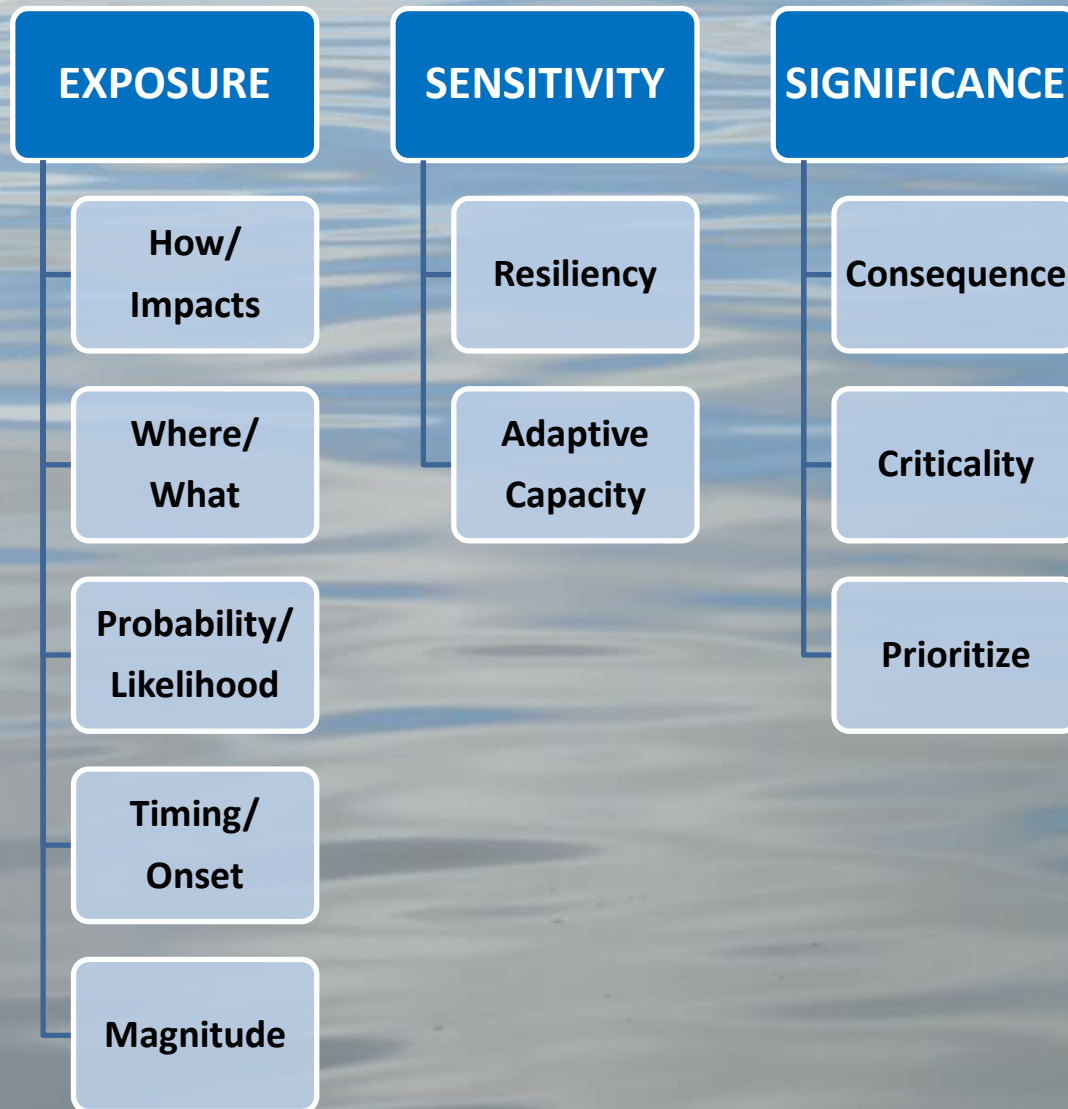
[Agency List](#)

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ADAPTATION PLANNING PROCESS FOR SEA LEVEL RISE

Plan for Change, Prepare for Extreme Events

VULNERABILITY ASSESSMENT



BASIC ADAPTATION STRATEGY PRINCIPAL

We cannot manage or protect the shoreline parcel by parcel or jurisdiction by jurisdiction, we need to address entire hydrologic units and the entirety of Humboldt Bay.



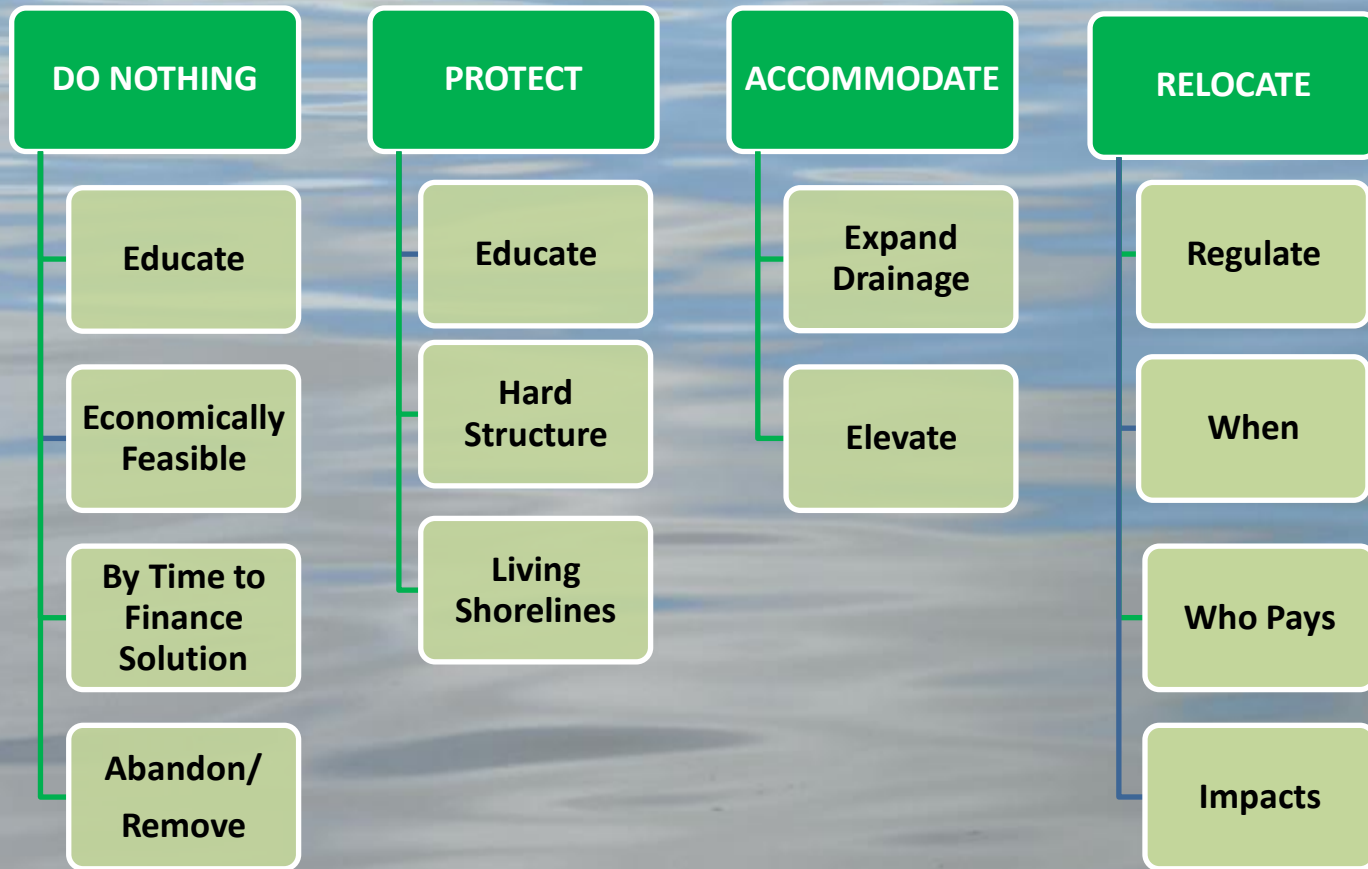
Eureka Slough Sub-Units

An aerial photograph of a coastal area with a large body of water, Eureka Slough, highlighted in blue. The slough is divided into two main sections by a narrow channel. The upper section is labeled 'Fay Slough Sub-Unit' and the lower section is labeled 'Freshwater Slough Sub-Unit'. The surrounding area includes a city grid on the left, a large body of water at the top, and a mix of greenery and urban development on the right and bottom.

Fay Slough Sub-Unit

Freshwater Slough Sub-Unit

ADAPTATION STRATEGIES

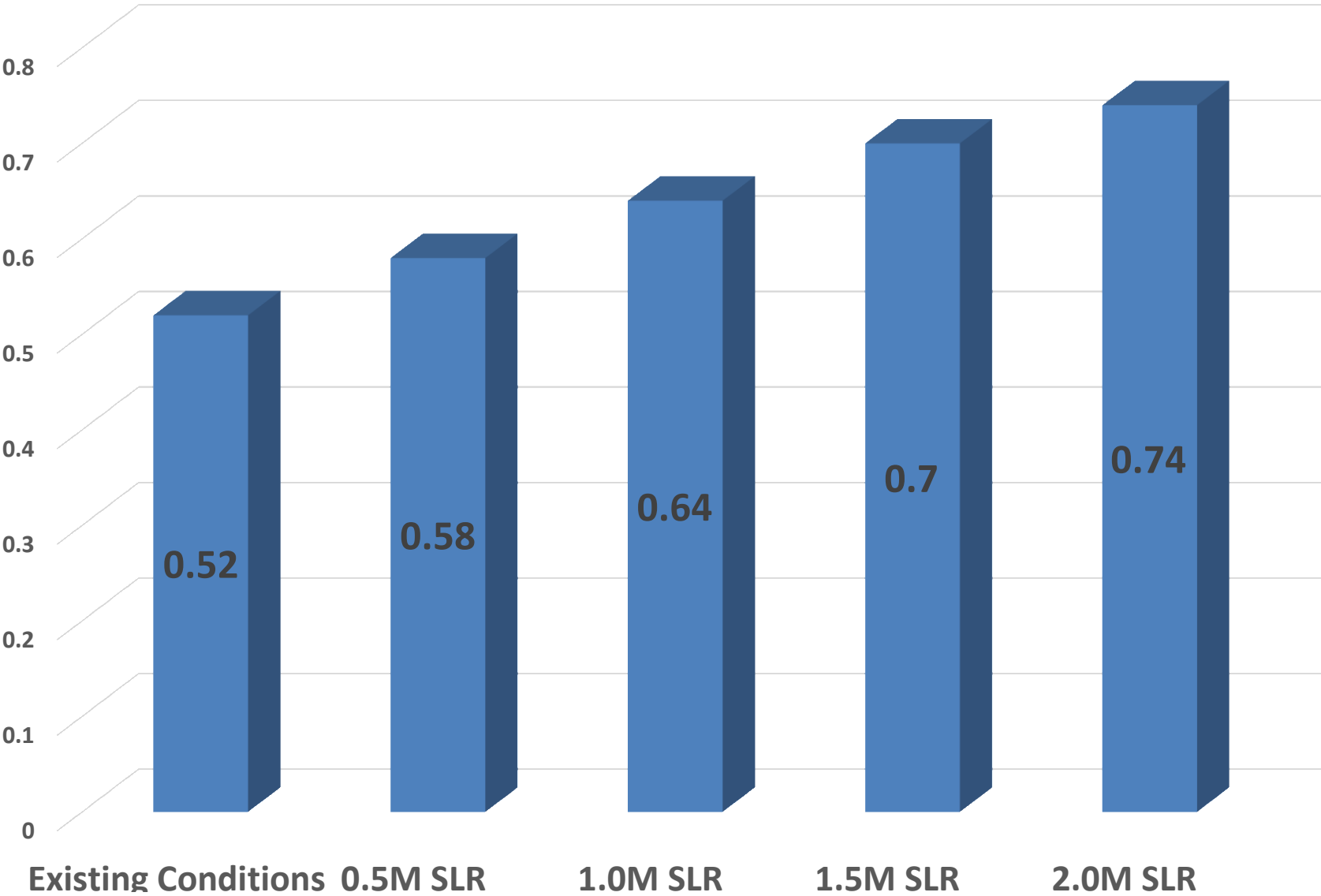


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Regional Assets at Risk

2.0 Meters of RSLR

Percent Increase in Bay Footprint as a Result of Shoreline Failure and Sea Level Rise



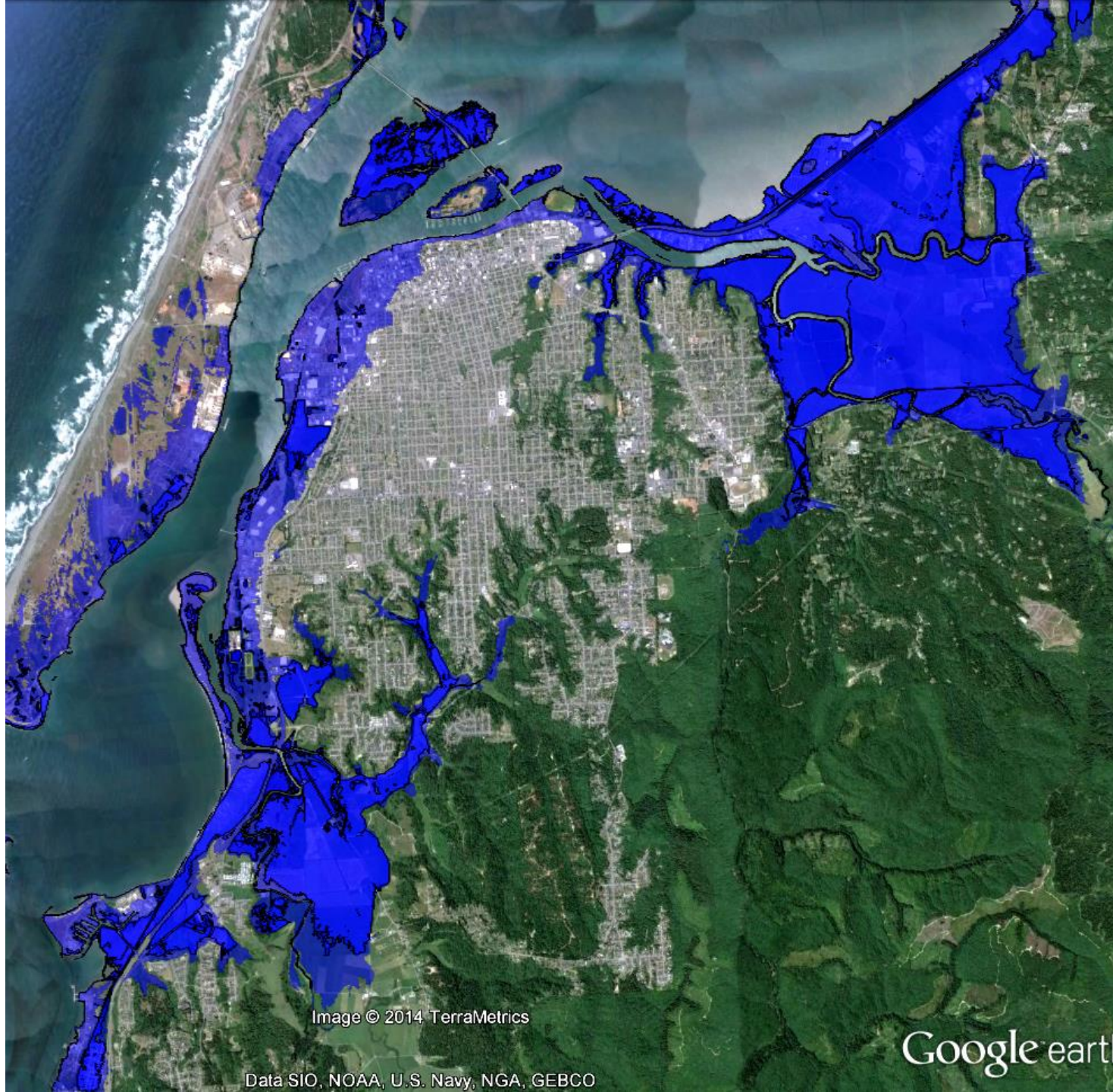


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Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Google earth



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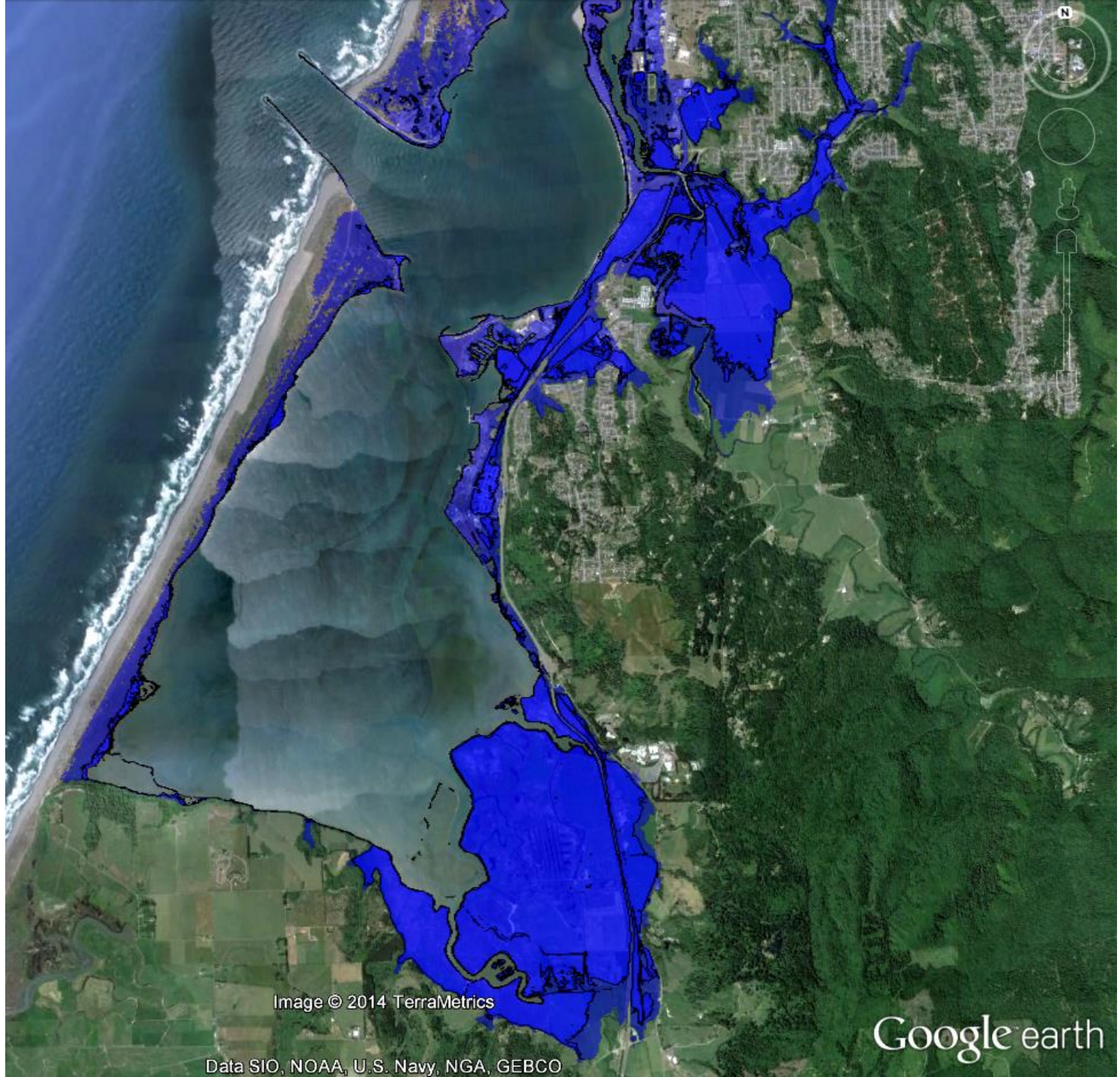
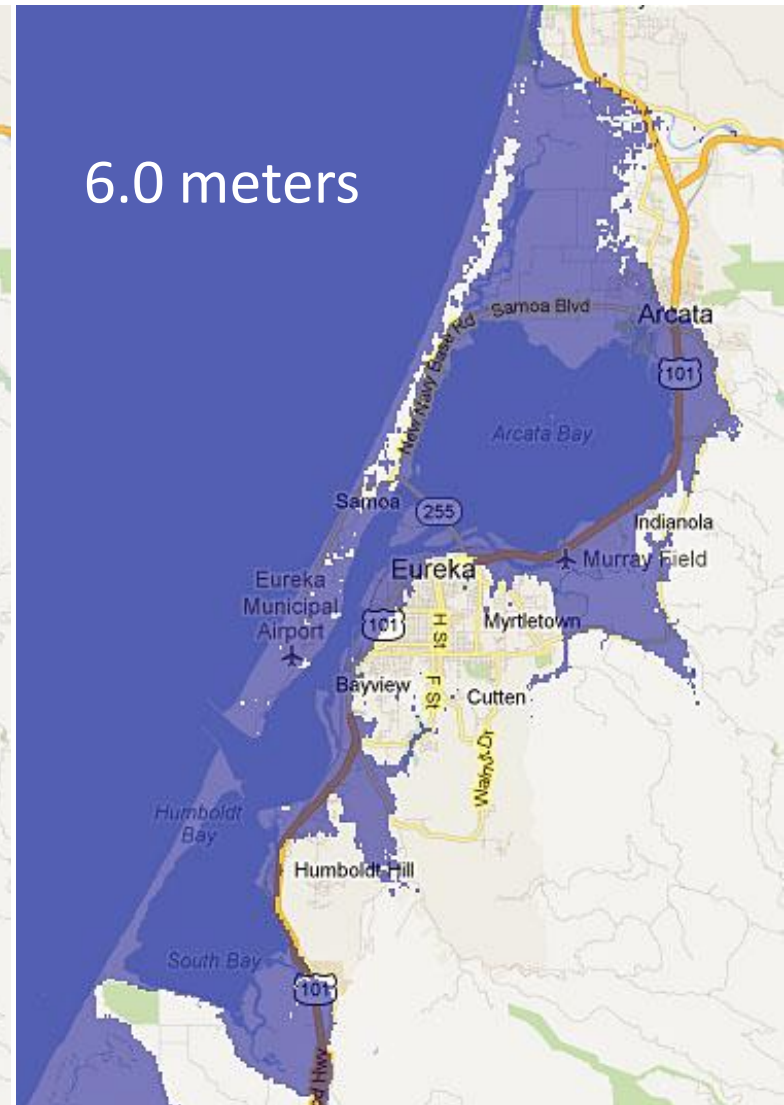
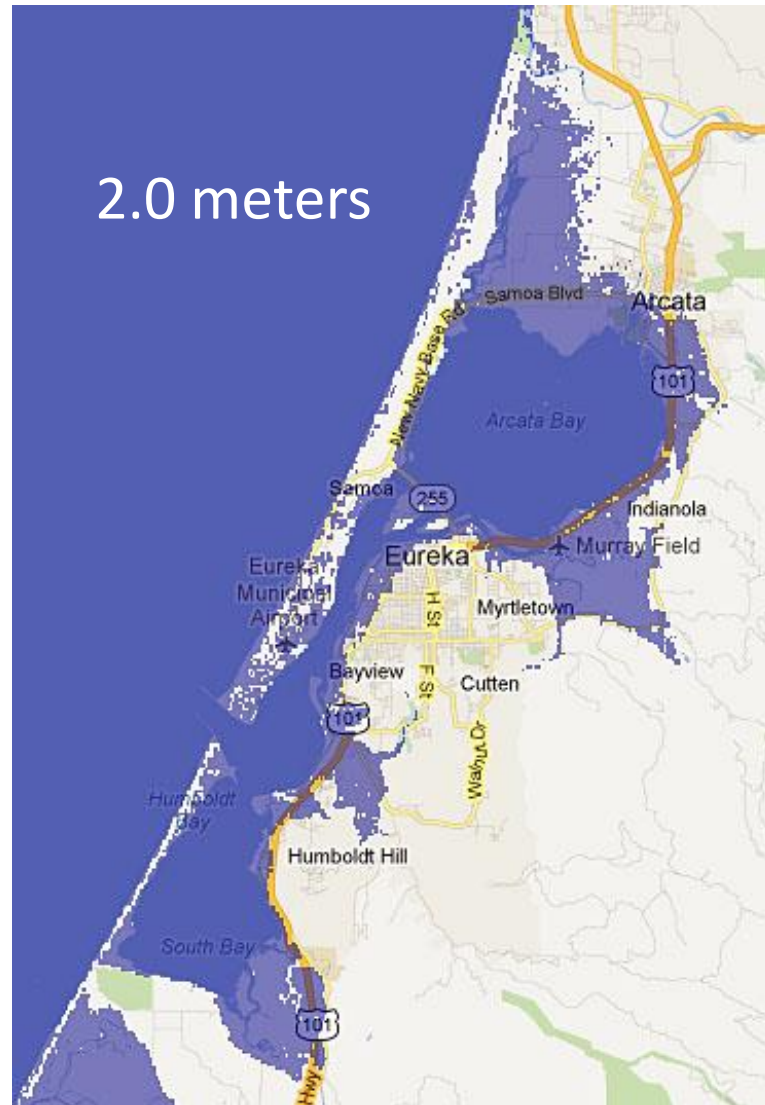


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Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Google earth

Long-Term Sea Level Rise



CRITICAL ASSETS AT RISK-2.0 meters RSLR

- **Transportation System:**
 - Highway 101 and 255,
 - local streets and roads
- **Utilities:**
 - Transmission Lines: water, sewer, gas, and electrical
 - Infrastructure: Eureka and Arcata WWTF
 - PG&E Power Plant
 - Chevron Fuel Depot
- **Communities:**
 - Manila,
 - Fairhaven,
 - King Salmon,
 - Fields Landing
- **Navigation:**
 - North and South Jetties,
 - MRS-Mad River Connection,
 - Eureka and Woodley Island Marinas
 - Coast Guard Station
- **Cultural Resources:**
 - Tuluwat World Renewal Ceremonial Site

2.0 Meters of Relative Sea Level Rise: Critical Assets Inundated		
Mad River Slough	Asset Category	Consequence
HBMWD Waterline trellises over Mad River Slough	Infrastructure	High
HBMWD Waterlines west of North Ma-le'I Dunes Rd and East to Bay School Rd.	Infrastructure	High
Area between Lower Mad River and Mad River Slough west of Hammond Bridge		High
Arcata Bay		
Highway 255 north of Vance Ave to Manila	Transportation-State	High
NCRA south of Samoa Blvd (except Brainards Point) to Eureka Slough	Transportation-State	High
PG&E Electric Transmission Towers from Ma-le'I Dunes Rd east to Bracut	Infrastructure	High
Arcata waste water treatment facility and marsh wildlife area	Infrastructure	High
Highway 101 south of Hwy 255 to off-ramps to Eureka Slough Bridge	Transportation-State	High
Dike on Arcata Bay at Gannon Slough	Infrastructure	High
City of Eureka's 2 water lines traversing Bayside bottom	Infrastructure	High
PG&E Gas lines parallel to Hwy 101 from Gannon Slough south	Infrastructure	High
PG&E Gas lines that traverse Bayside bottom land south of Bayside Cutoff	Infrastructure	High
Eureka Slough		
Dikes on north bank of Eureka and Fay Sloughs	Infrastructure	High
Highway 101 south of Bracut to Eureka Slough bridges	Transportation-State	High
HCSD Sewer lines and lift stations in 2nd Slough	Infrastructure	High
City of Eureka's water line trellis over Freshwater Slough bottom	Infrastructure	High
City of Eureka's 2 water lines traversing Eureka Slough bottom	Infrastructure	High
PG&E Gas lines that traverse Eureka Slough bottom	Infrastructure	High
PG&E Electric Transmission Towers traversing Eureka-Fay-Freshwater Slough bottom	Infrastructure	High
Eureka Bay		
Highway 101 north of King Salmon Ave to south Broadway	Transportation-State	High
Highway 101 north of Wabash Ave to E St.	Transportation-State	High
Highway 101 east of V St. to Eureka Slough Bridges	Transportation-State	High
NCRA from Eureka Slough Bridge to King Salmon	Transportation-State	High
Eureka waterfront from Eureka Slough bridge to Elk River Slough bridge	Commercial	High
Commercial and public docks from Samoa Bridge to Truesdale St.	Infrastructure	High
Commercial and residential areas from X St east, north of waterfront Dr. and 1st St. and		

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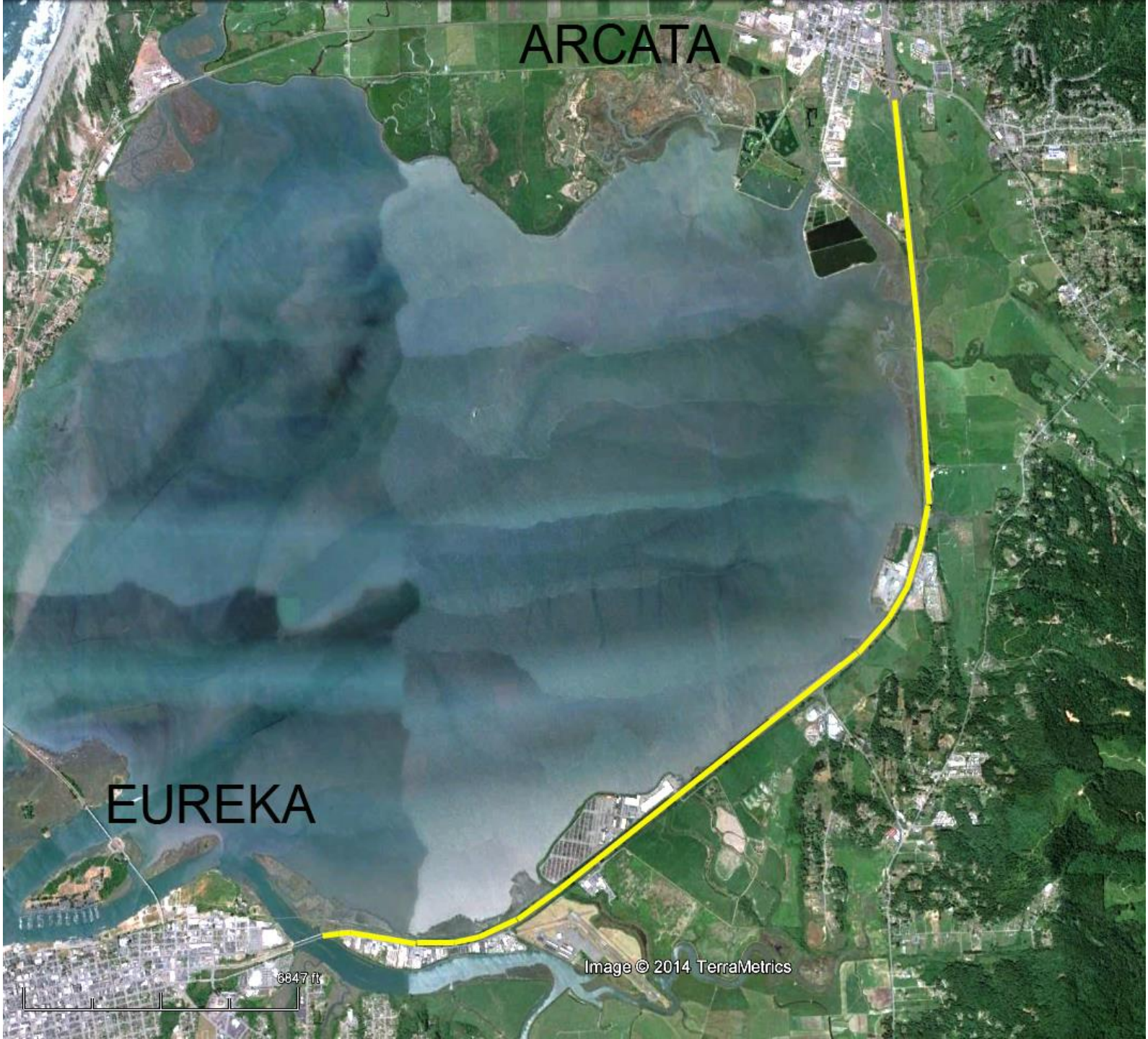
Highway 101 Case Study: Tidal Inundation and Flooding Impacts

ARCATA

EUREKA

6947 ft

Image © 2014 TerraMetrics



EUREKA

KING SALMON

4158 ft

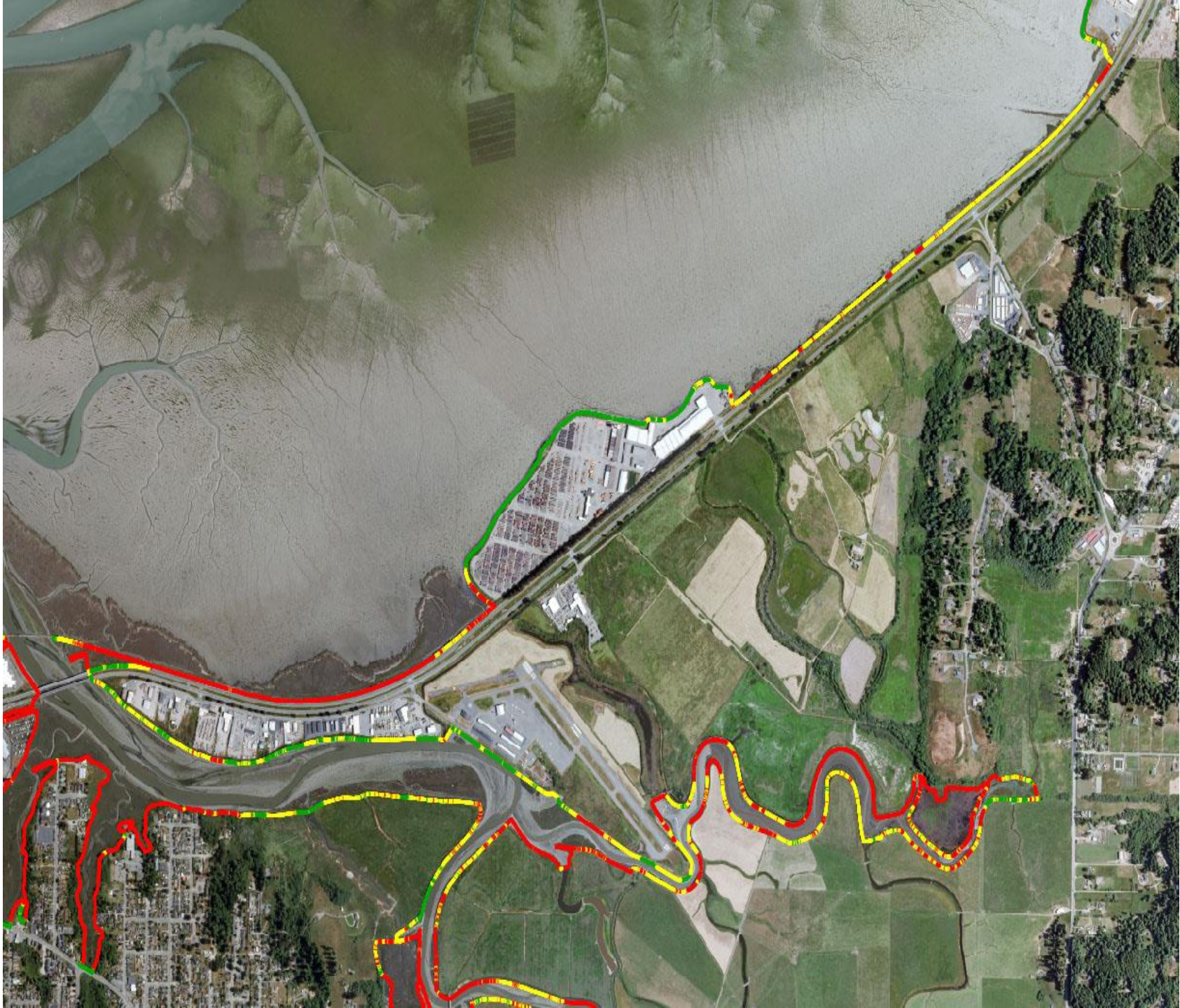


SOUTH BAY

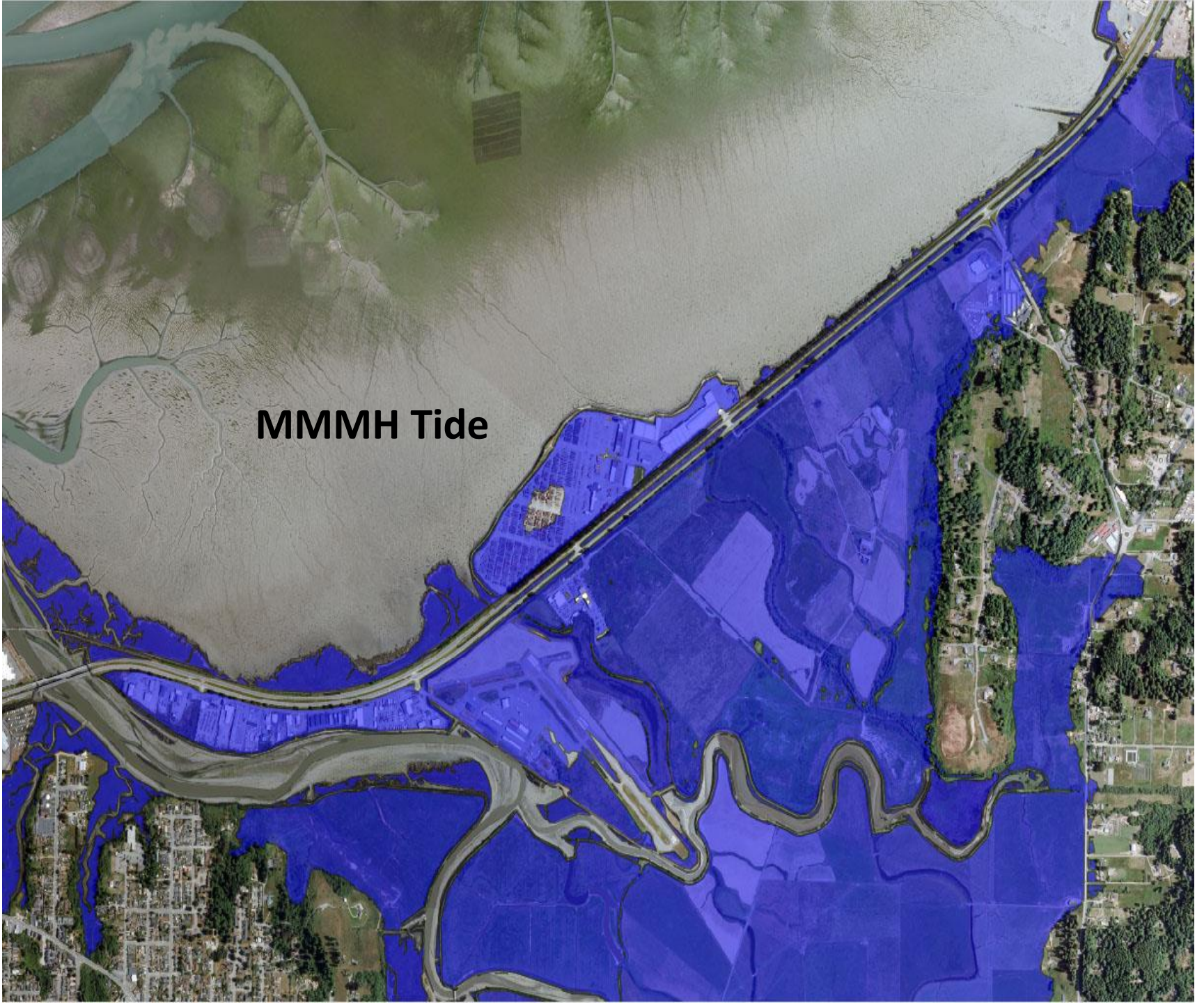
4148 ft



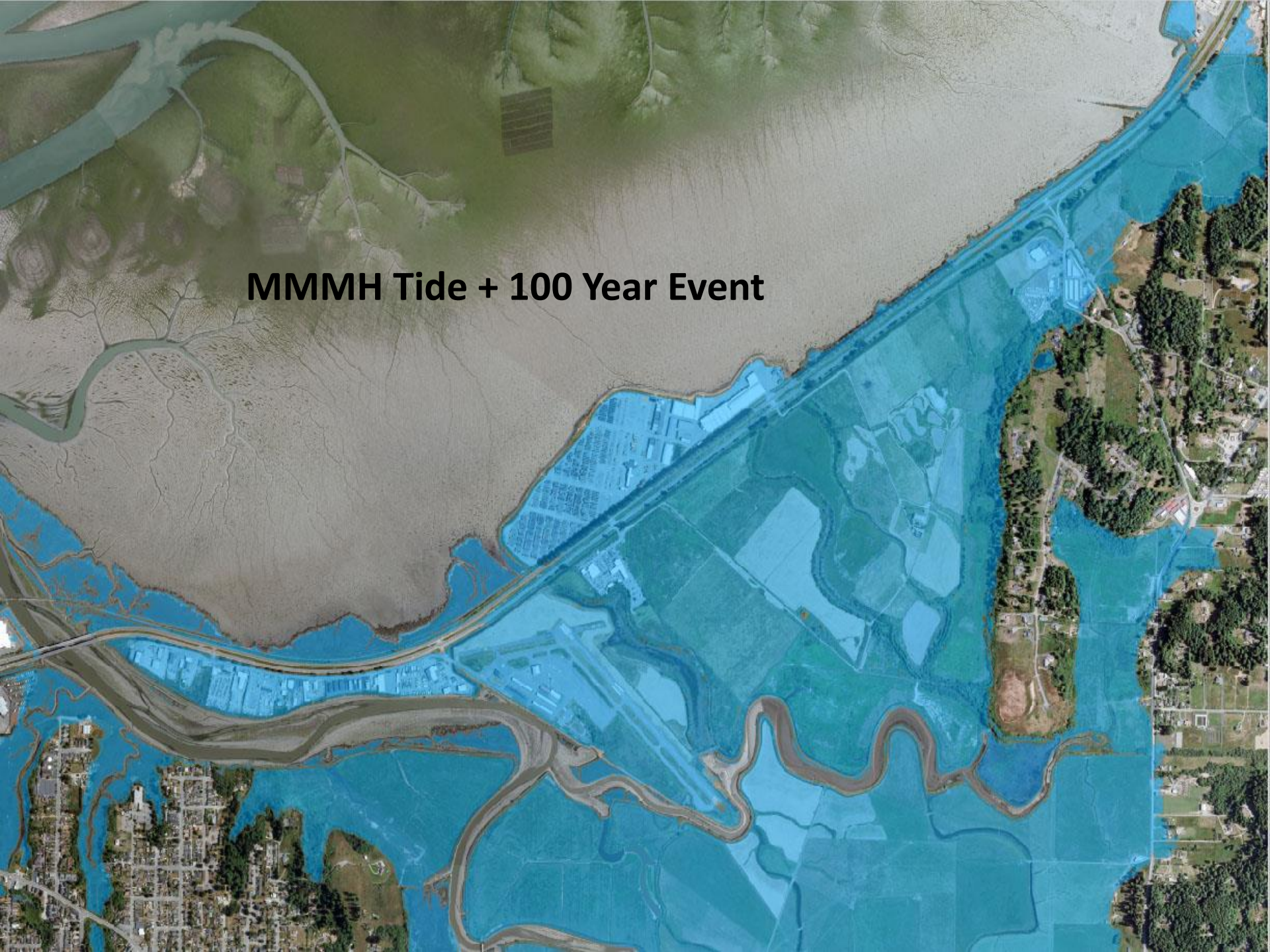




MMMH Tide

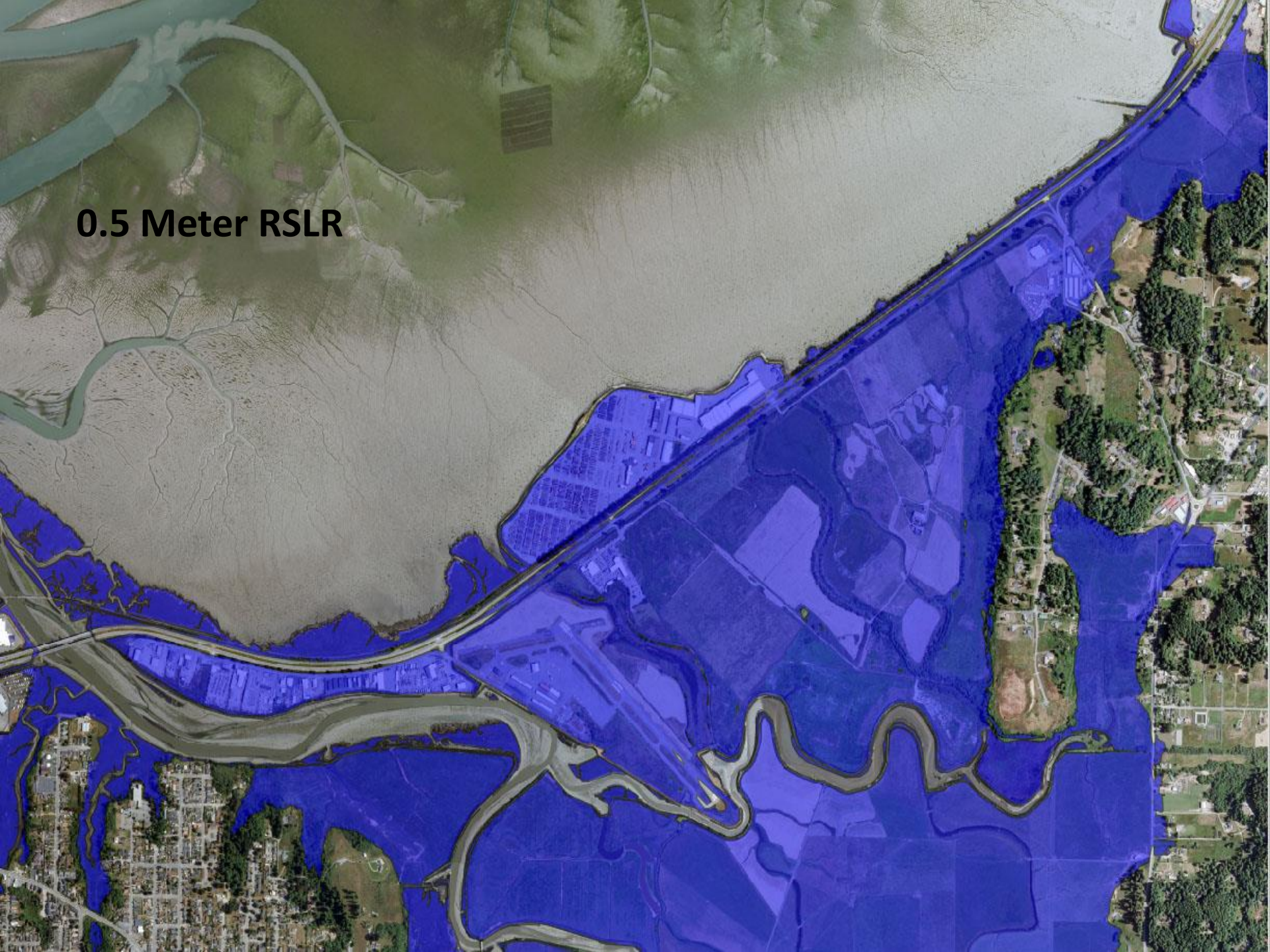


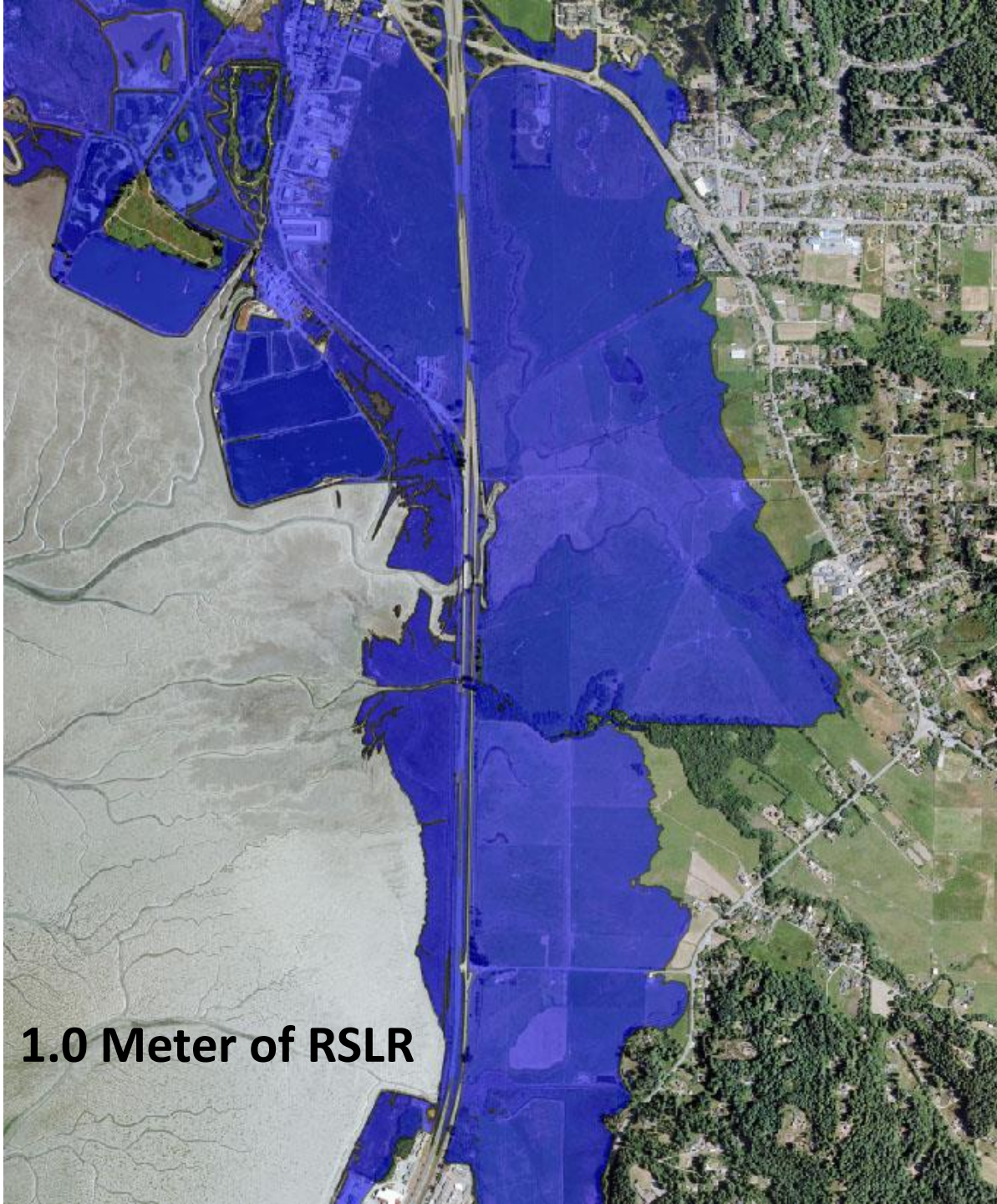
MMMh Tide + 100 Year Event



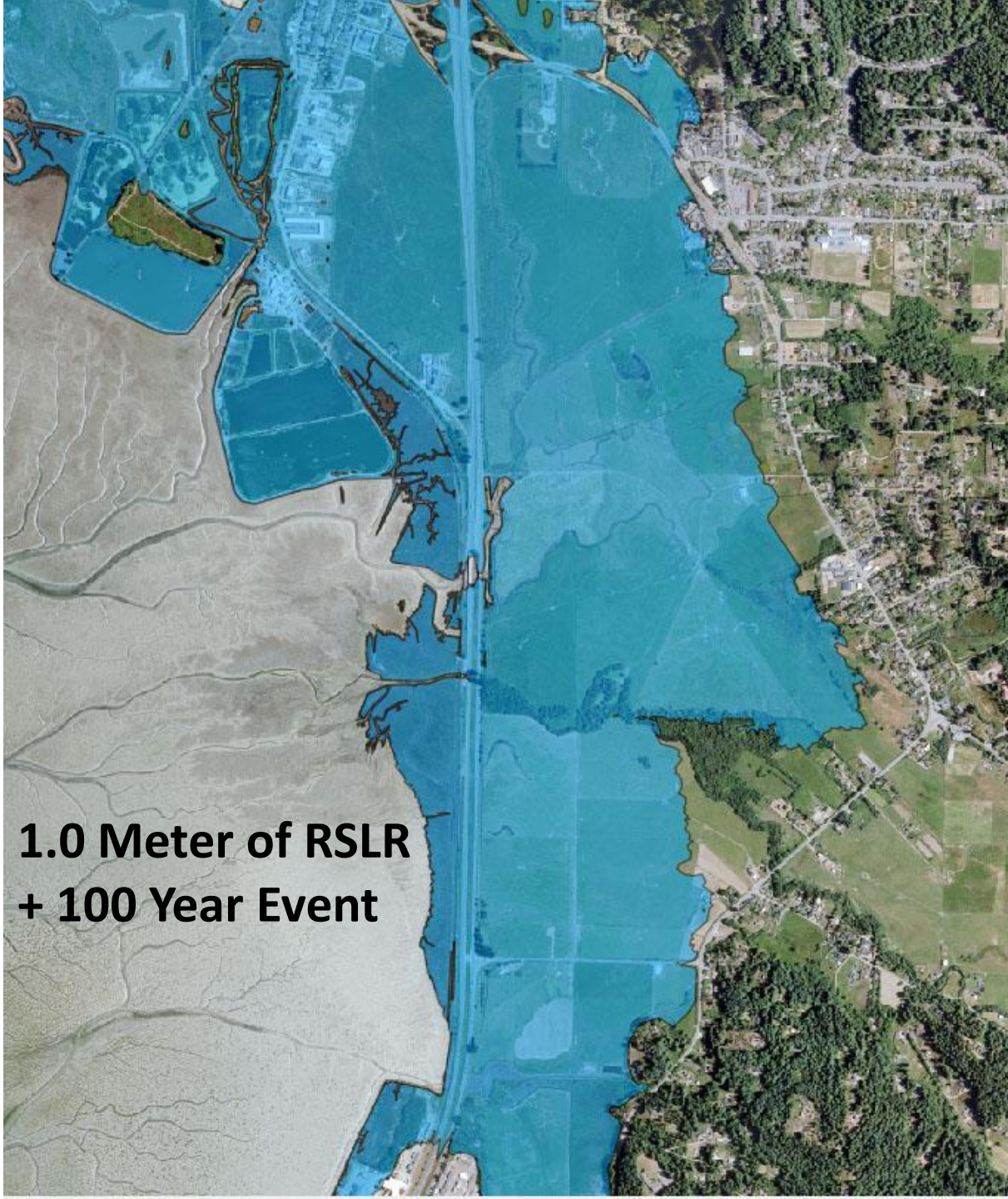


0.5 Meter RSLR





1.0 Meter of RSLR



**1.0 Meter of RSLR
+ 100 Year Event**

Highway 101 Inundation

MMMH Tide

- South Bay = Partially Inundated
- Elk River Slough = Causeway
- Arcata Bay = Causeway

0.5 Meters RSLR

- South Bay = Inundated
- Arcata Bay/Lower Reach = Inundated

1.0 Meters RSLR

- Elk River Slough = Inundated
- Arcata Bay/Upper Reach = Partially Inundated

1.5 Meters RSLR

- Arcata Bay/Upper Reach = Inundated

The background of the slide is a close-up photograph of water with gentle ripples, creating a textured pattern of light and dark blue-grey tones.

REGIONAL ADAPTATION STRATEGIES: 2014-2050 & 2050-2100

Plan for Change, Prepare for Extreme Events

RSLR Estimations

- **Near-term: 2014-2030 = 7 inches**
 - **Short-term: 2030-2050 = 13 inches**
 - **Mid-term: 2050-2075 = 24 inches**
 - **Long-term: 2075-2100 = 39 inches**
- ❖ **100 year event = 18 inches**

EDUCATION

Education is an important component of any adaptation strategy to employ:

- We need to convey what areas on Humboldt Bay are vulnerable under existing tidal conditions and extreme events, as well as with sea level rise.**
- It is important to identify what properties, infrastructures, or services are at risk as soon as appropriate vulnerability data and maps are available.**
- Need to rate asset criticality to prioritize adaptation strategies and measures**

DO NOTHING

2014-2050:

MMMh Tide

- South Bay = Partially Inundated
- Elk River Slough = Causeway
- Arcata Bay = Causeway

0.5 Meters RSLR

- South Bay = Inundated
- Arcata Bay/Lower Reach = Inundated

2050-2100:

1.0 Meters RSLR

- Elk River Slough = Inundated
- Arcata Bay/Upper Reach = Partially Inundated

1.5 Meters RSLR

- Arcata Bay/Upper Reach = Inundated

PROTECT

2014 to 2050 versus 2050 to 2100

- Raise Roadway Surface/Expand Road Base: 3.7 miles Lower AB
- Raise Roadway Surface/Expand Road Base: 2.2 miles Upper AB
- Enhance Existing Vulnerable Shoreline Structures: 5.5 miles AB
 - Living Shoreline and/or Harden Structures
- Enhance Existing Protective Shoreline Structures: 11.26 miles AB
 - Living Shoreline and/or Harden Structures
- Construct New Levees to Create Utility Corridor: 11.78 miles AB
 - Living Shoreline and/or Harden Structures

ACCOMMODATE

Increase Drainage Capacity versus Elevate

2014-2050:

0.5 Meters RSLR

- South Bay = Inundated
- Arcata Bay/Lower Reach = Inundated

2050-2100:

1.0 Meters RSLR

- Elk River Slough = Inundated

1.5 Meters RSLR

- Arcata Bay/Upper Reach = Inundated

RELOCATE

Phased Approach versus Bay-Wide

2014-2050:

0.5 Meters RSLR

- South Bay = Inundated
- Arcata Bay/Lower Reach = Inundated

2050-2100:

1.0 Meters RSLR

- Elk River Slough = Inundated
- Arcata Bay/Upper Reach = Partially Inundated

1.5 Meters RSLR

- Arcata Bay/Upper Reach = Inundated

Magnitude of Social/Environmental Consequences & Costs

RELOCATION: When/How to Finance

- **Critical Infrastructure: Utilities, Transportation, Fuel, Communications, and Dikes/Levees**
- **Land Uses: Urban-Residential, Commercial, Industrial, and Public Facilities; Rural-Agriculture, Utilities and Transportation**
- **Property: Public and Private**
- **Resources: Cultural, Historical, Natural and Coastal**

Assessment Criteria for Adaptation Strategies

- **Total Capital Investment**
- **Equivalent Annual Cost**
- **Implementation Timeline**
- **Usable Life**
- **Level of Performance/Effectiveness**
- **Flexibility**
- **Environmental Considerations**
- **Social Considerations**

REGULATIONS

- California Coastal Act
- Endangered Species Act
- Clean Water Act

2013-2015

APWG Meeting Schedule:

<u>2013</u>	<u>2014</u>	<u>2015</u>
2/27	2/26	01/07
4/24	4/30	
(7/15)	6/25	
8/28	8/27	
10/30	10/29	