

# Hwy 37 Adaptation to Rising Seas

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State Water Resources Control Board  
[www.waterboards.ca.gov](http://www.waterboards.ca.gov)

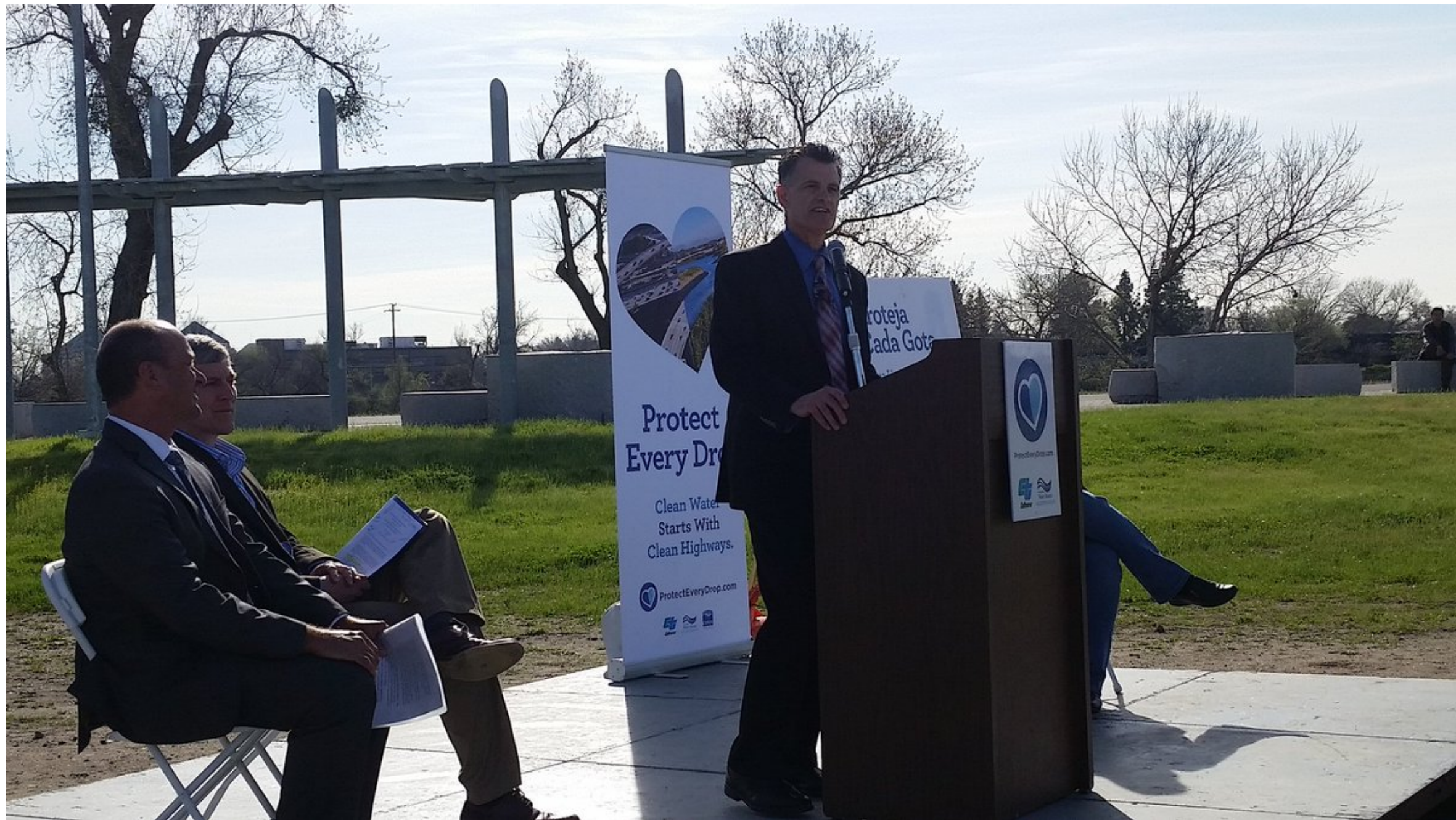
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# Overview

- Hwy 37: State-wide Significance
- Transportation, Flood, Climate Adaptation, Ecosystem Restoration
- Existing Setting: Degradation of Tidal Marsh System and Public Ownership of Inland Marshes
- Regulatory Considerations
- Forward Thinking

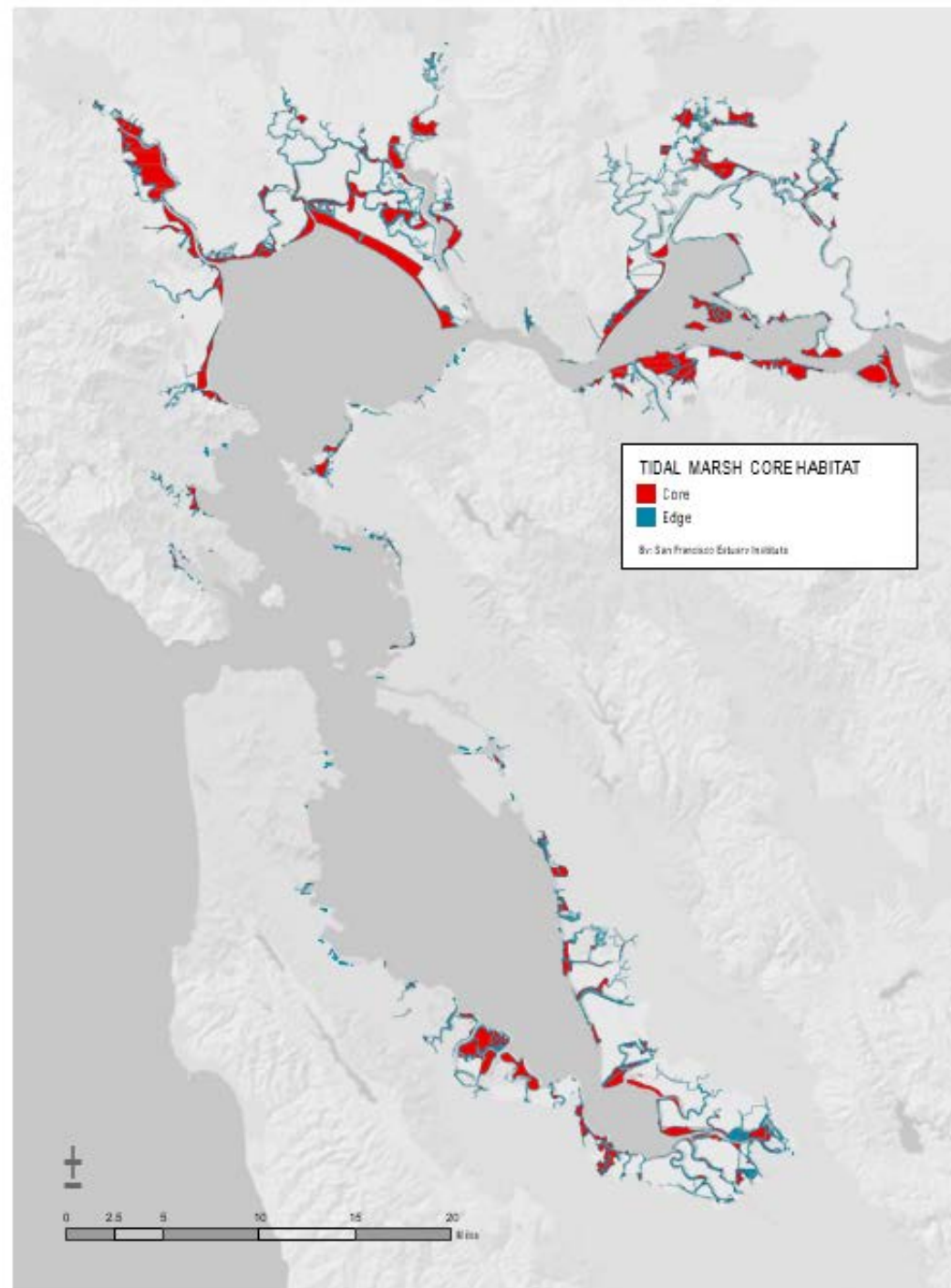




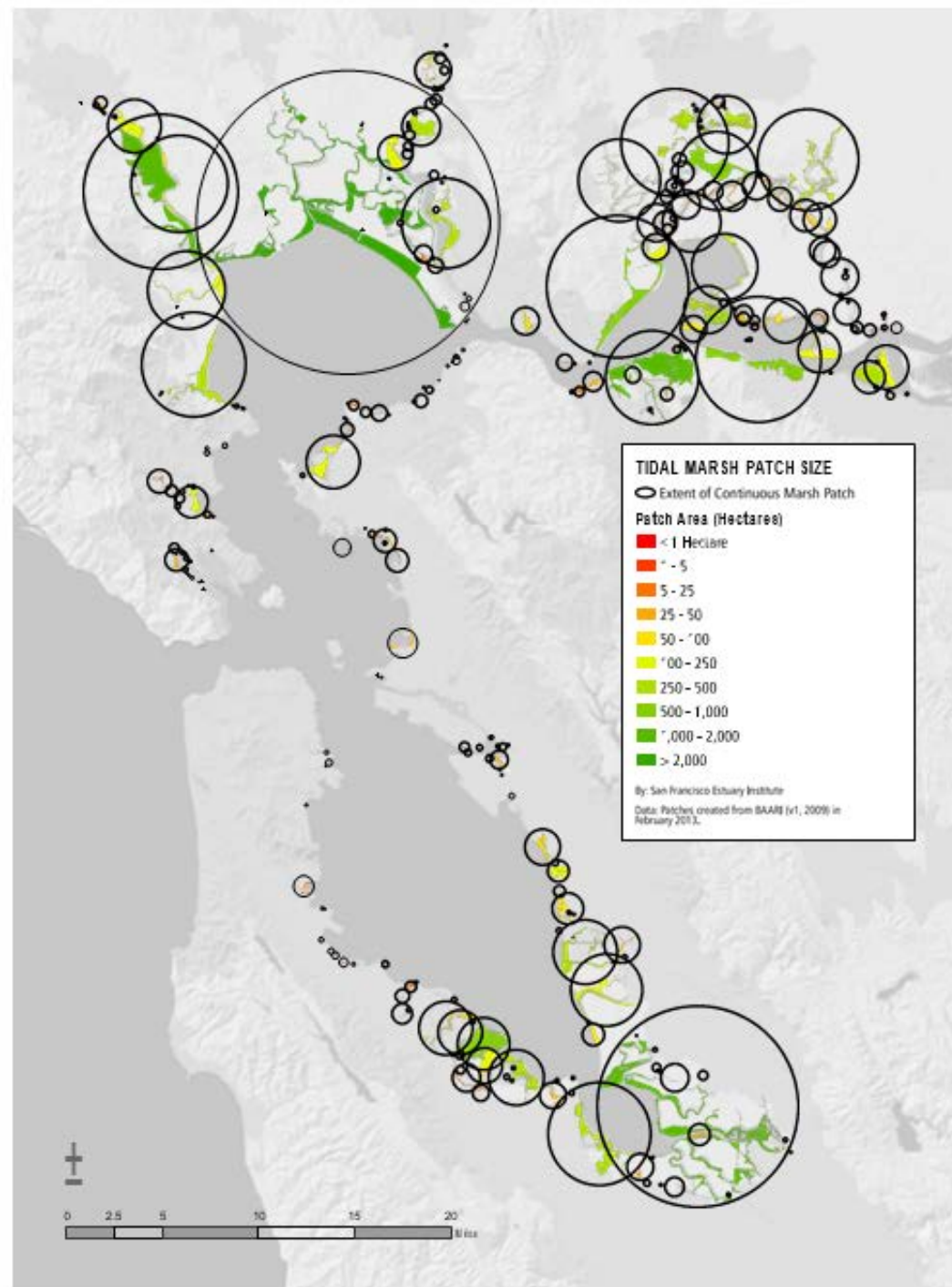
# Existing Setting: Degradation of Water Resources

- Water Quality Effects of Current Highway
  - Stagnation, pH (and Ammonia Toxicity), Low DO, Harmful Algal Blooms, Odors, Methylation of Mercury, Toxics, Lost Opportunities for Productivity
- Ecological Effects of Current Highway
  - Corridor interruption, lack of channel complexity and evolution
- Flood Effects of the Current Highway – barrier to flood attenuation
- What would the Water Do without a Highway?
  - High point that periodically floods, refreshing adjacent systems that are now isolated and degraded.
  - How can we mimic this in the design?
  - “Let Nature do the Heavy Lifting”





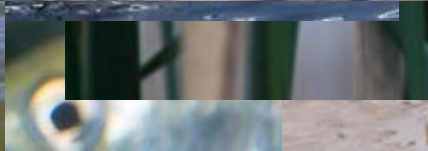
San Francisco Estuary  
Institute, 2009



San Francisco Estuary  
Institute, 2009



# Tidal Marshes have Value





# In the news ... again & again



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### Highway 37 may finally stop flooding under new CHP plan

February 13, 2017 | Michael Bodley  
Highway 37 may finally stop flooding under new CHP plan. By Michael Bodley. Highway ... KPIX. Highway 37 closed because of flooding near Highway 101 in Novato, Calif. on February 9th, 2017. John ...

### Highway 37 in Novato closed in both directions due to flooding

February 8, 2017 | Amy Graff  
Highway 37 in Novato closed in both directions due to flooding. Amy Graff. Highway 37 in Novato is underwater again. The stretch of road between Atherton Ave. and Hwy 101 is closed to traffic in both directions. ...

### Highway 37 closed in Novato due to flooding

January 22, 2017 | Katie Dowd  
Highway 37 closed in Novato due to flooding. Katie Dowd. No stranger to flooding in recent weeks, Highway 37 is closed again Sunday morning due to heavy flooding. State Route ...

### Section of Hwy. 37 in Novato reopens week after flooding

January 17, 2017 | Michael Bodley  
By Michael Bodley. A stretch of Highway 37 near Highway 101 in Novato that had been closed for about a week due to flooding was completely reopened Tuesday morning, according to the California Highway Patrol. ...

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### In demand but increasingly swamped, Highway 37 has no easy fixes

February 13, 2017 | Peter Fimrite  
... shut down for much of last week, has been closed for about three weeks this winter because of flooding. The soggy blockages have raised aggravation levels among tens of thousands of commuters who use Highway 37 each day ...

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# Critical infrastructure is eroding

## Tolay Lagoon/Hwy 37

This shows the approximate movement of the erosion front on the Tolay Lagoon levee (E end of lagoon) between 2/2013 and 1/2017.



1/14/2017



11/10/2015



1/2/2015



2/5/2013



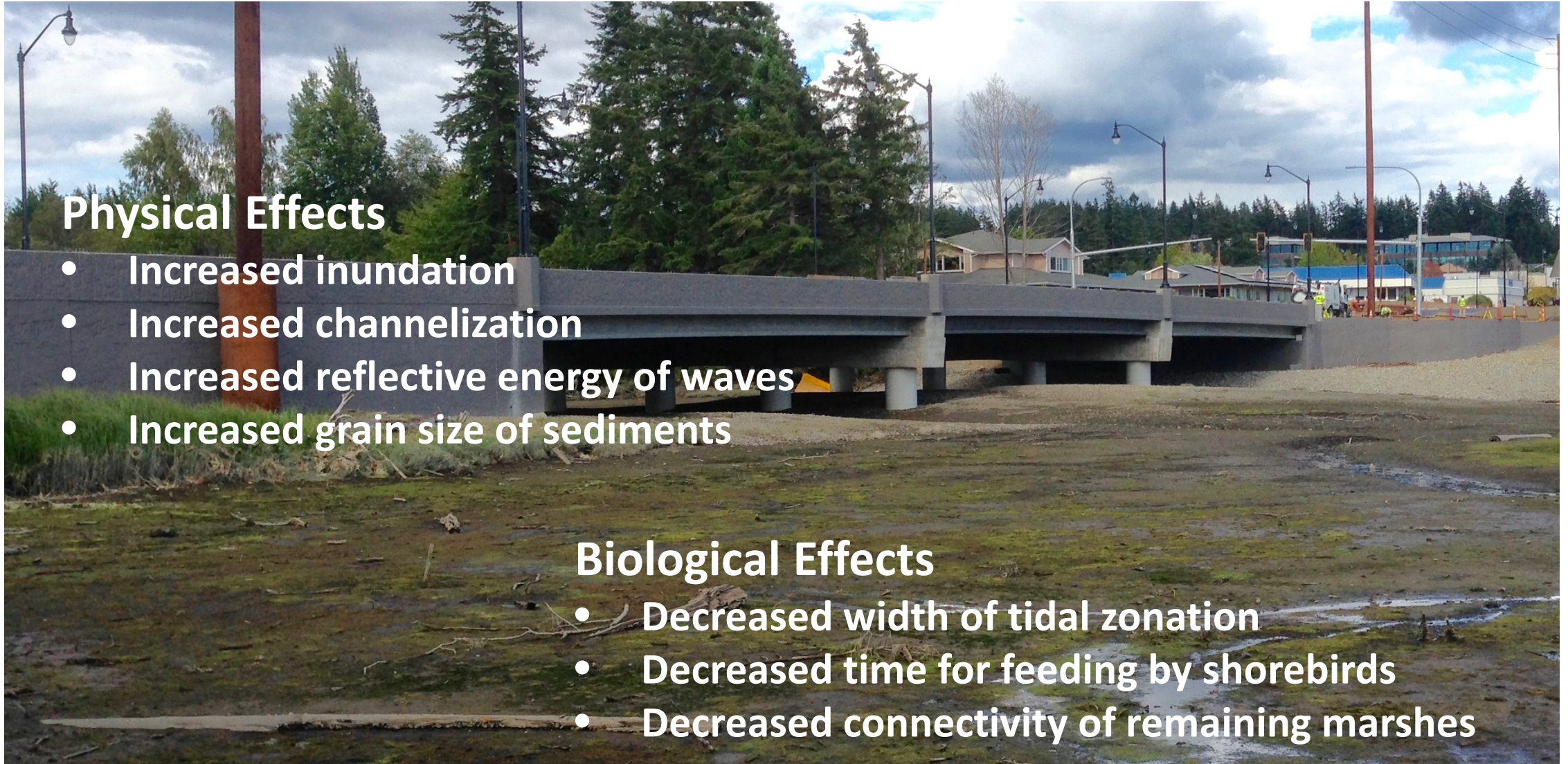
# Mechanisms: Armoring Effects on Marsh Adaptation to Sea Level Rise

## Physical Effects

- Increased inundation
- Increased channelization
- Increased reflective energy of waves
- Increased grain size of sediments

## Biological Effects

- Decreased width of tidal zonation
- Decreased time for feeding by shorebirds
- Decreased connectivity of remaining marshes





# Regulatory and Engineering Considerations

- Regulatory Requirements: Clean Water Act 404(b)1 Guidelines – Avoid Fill, then minimize, only then mitigate
  - Where would you get the Fill? Where would you mitigate?
  - Why not design a “self-mitigating” project?
- Engineering Considerations- Wetlands Fill Challenges
  - Bay mud environment, liquefaction
  - Culverts concentrate flows and cause scour, and eventually fail from sediment or erosion.
  - Backwaters along levee/berm with high residence time and WQ Problems, sediment accumulation

# Forward-Thinking

Consider alternatives with approaches that maintain transportation function, not just the structure.

Focus on enhancing the environment of the North Bay through environmentally sensitive design.

Economic benefits of regional flood capacity enhancement – help fund this infrastructure package

Be ready with partners and funding packages when opportunities arise! (*Measure AA – minor role, if any*)



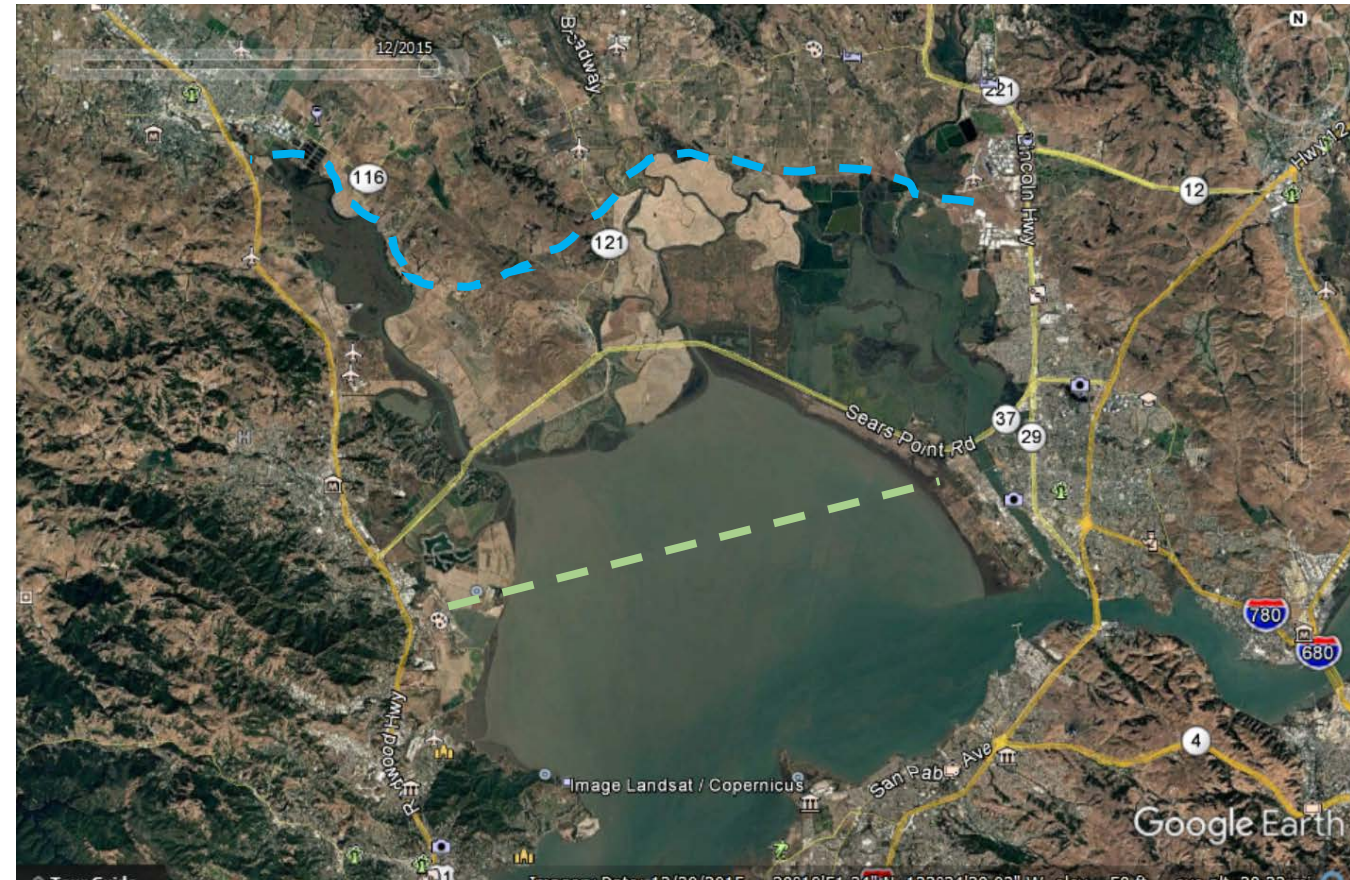
# Developing Resilient Landscapes



Preserving structures

Preserving function

*“keep the big picture in mind of the North Bay economies, communities, ecosystems”*



# Suggested Next Steps

- Consider a Broad Project Definition: *Transportation, Water Resources, Ecosystem Restoration, Regional Flood Management*
- Include Water Specialists on the Design Team
  - Design *with* Nature (bridge) vs. *against* (berm)
  - ASCE perspective: Project that “bridges” the transportation and water “tracks”
- Regional Partnership: Upfront Engagement of Regulatory & Resource Agencies

