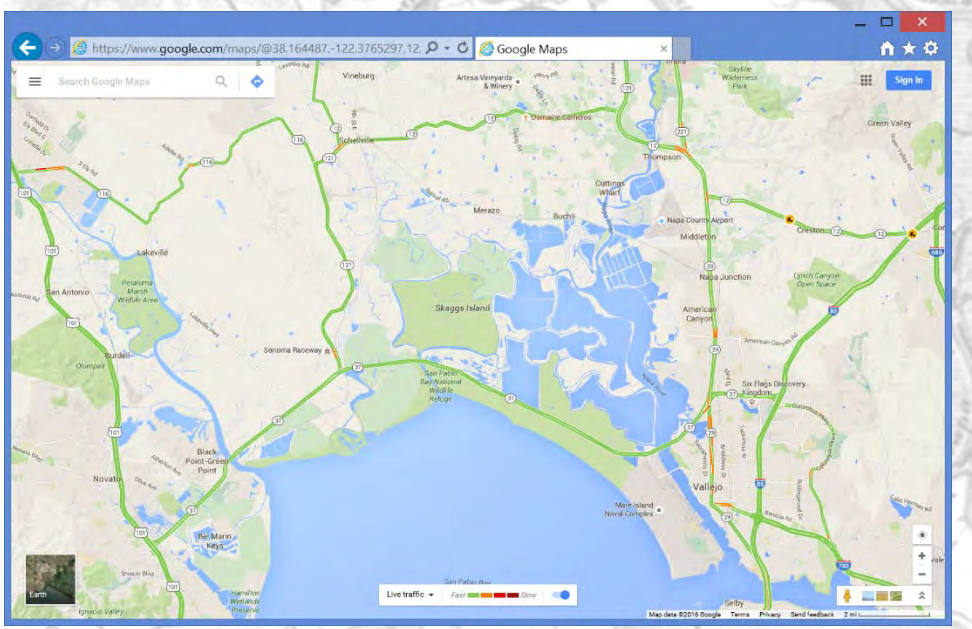
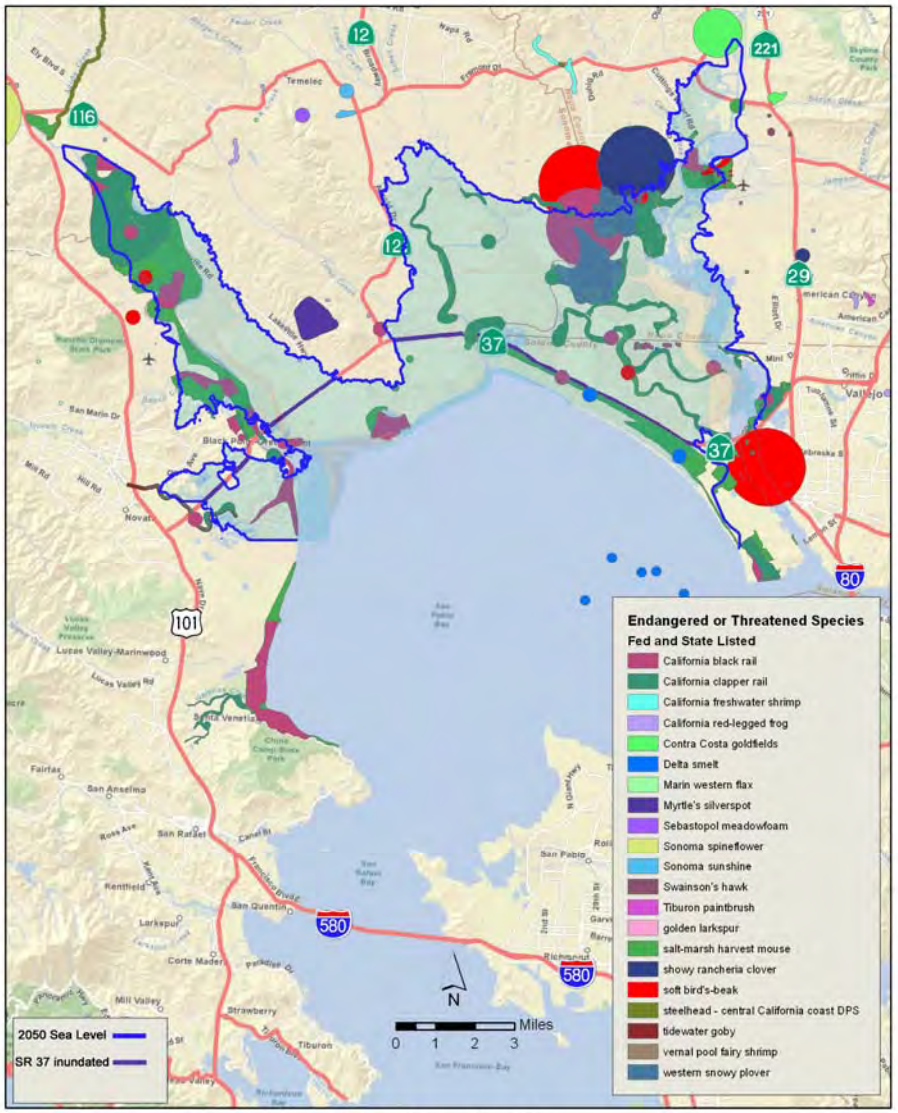
State Route 37 Integrated Traffic, Infrastructure and Sea Level Rise Analysis



Fraser Shilling, Co-Director
Road Ecology Center
University of California, Davis



Listed Species Map

Project Overview

Project Overview

Technical tasks complete

Reports finalized and online (http://hwy37.ucdavis.edu)

Project presented/published with Transportation Research Board

Stakeholder process temporarily paused

Project Overview

Project Includes:

Predicting when shoreline ecosystems and infrastructure will be affected by SLR and storms

Assessing vulnerability of highway segments

Proposes adaptive measures that could be taken (including potential cost)

Evaluates benefits and impacts of different scenarios

Stakeholder process to provide expert input and political investment in outcomes

Project Overview

Project Does Not Include:

Dealing with elevation data accuracy and bedrock depth

Consideration of bridges or tunnels across Bay proper

Moving of 37 to another alignment

Impacts of private-party toll-road option

Comprehensive economic or fiscal benefits/cost analysis

Comprehensive environmental impacts assessment

Funding the project as a public toll road or using solar or tide power generation on bridge structure

Why the Urgency?

- What we think we know
- What we don't know, but has significant consequences

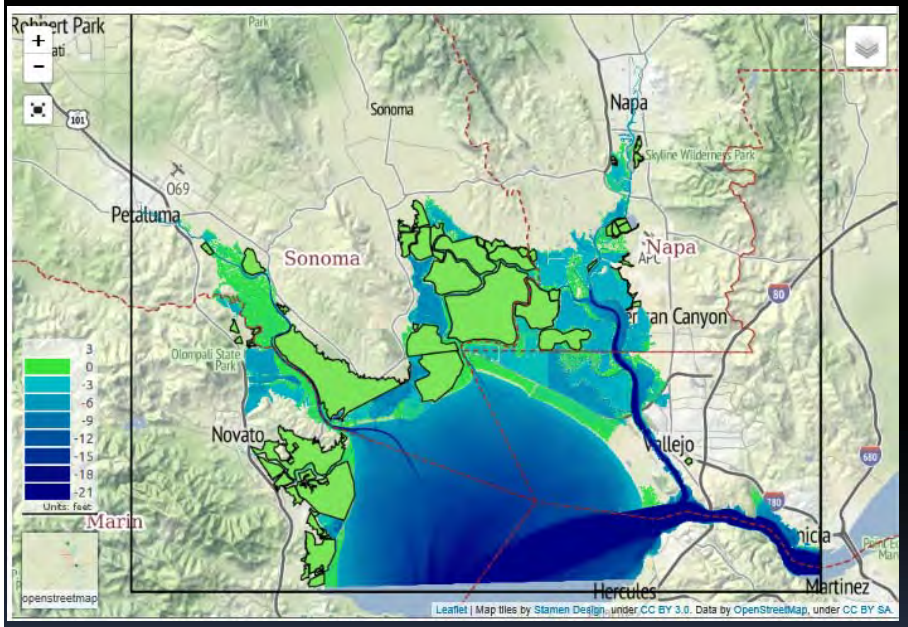
Why the Urgency?

- What we think we know

SLR Inundation

Website: http://hwy37.ucdavis.edu/maps

12″



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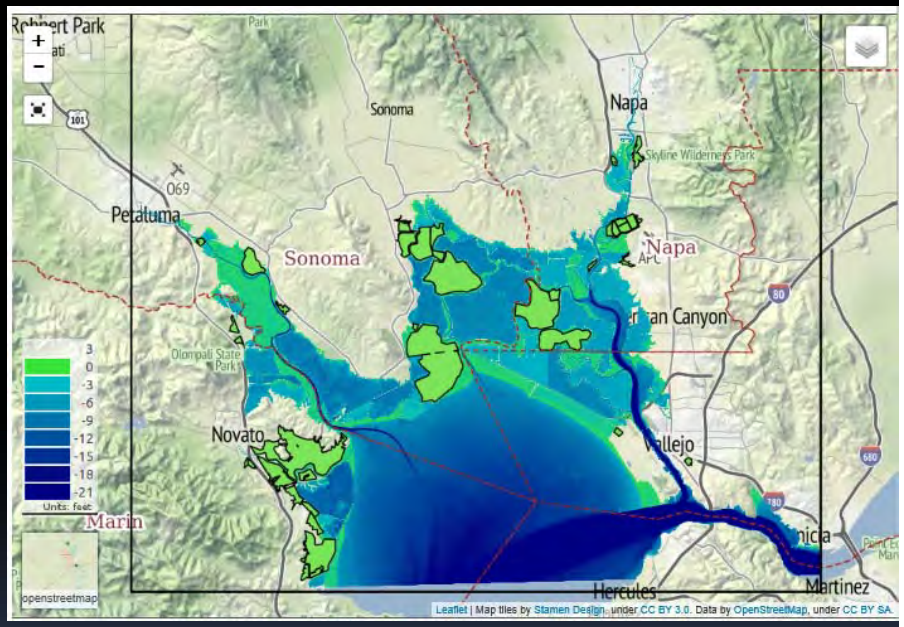
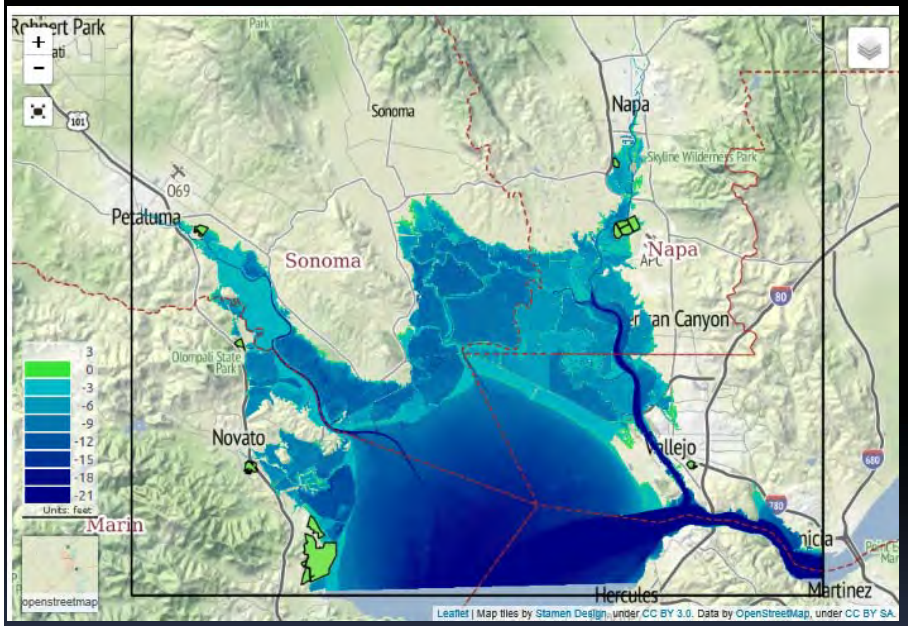


Storm Inundation

Website: http://hwy37.ucdavis.edu/maps

0" SLR + 100 yr storm



66" (SLR)

SLR: Overtopping

Website: http://hwy37.ucdavis.edu/maps

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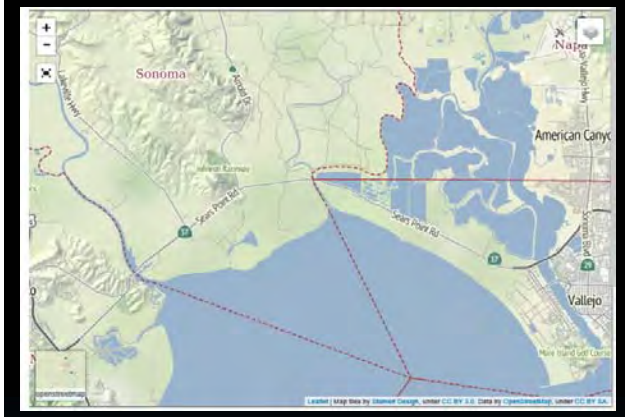

24″

36″

What we don't know, but has significant consequences

Timing: Actual berm, levee and highway elevations

LiDAR from 2010

Possible reflectance from vegetation on berms/levees

Timing & $: Highway continuously sinking (Caltrans Maintenance)

$: Depth to bedrock/pier foundation

etc.....

What we don't know, but has significant consequences

http://hwy37.ucdavis.edu/maps

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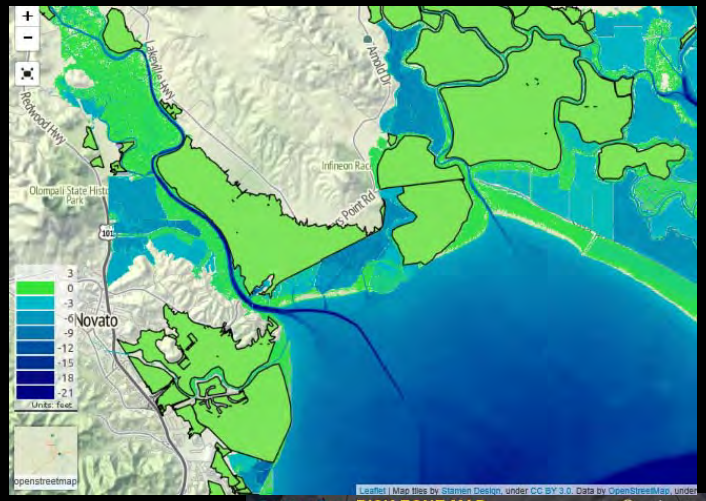

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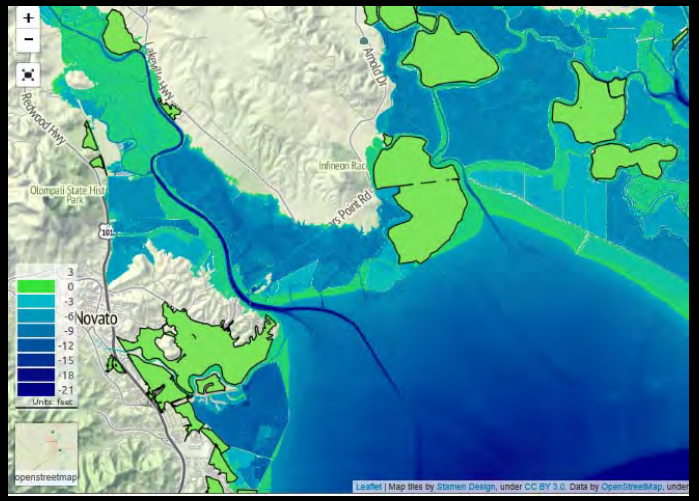

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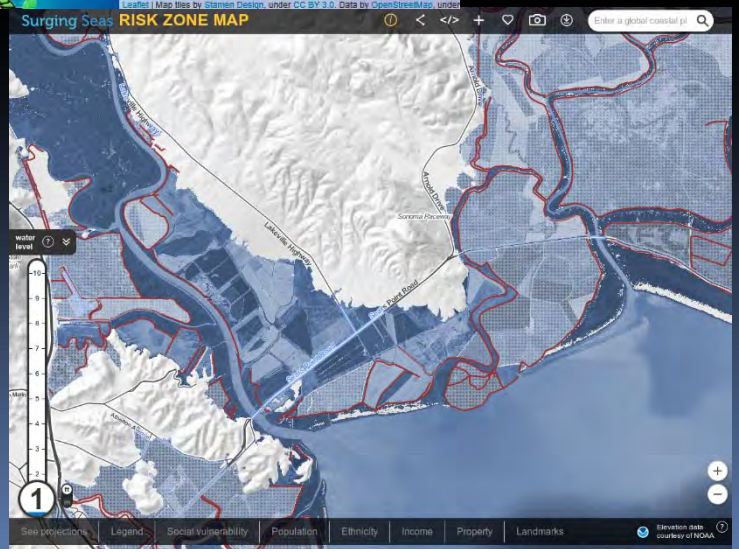


http://ss2.climatecentral.org

When is 12” vs. 24” SLR

- Highest: 12” by 2030; 24” by 2050 (NRC)

- Sea levels are >8” higher than expected this winter because of El Nino
- With 4” of SLR + El Nino = 12” (next El Nino)
- One large storm + El Nino could flood Marina to Lakeville (this or next El Nino)

Tolay Lagoon at Xmas King Tide

6.7’ event
12/24/2015

Tolay Lagoon earlier that year

6.69’ event
1/21/2015

Tolay Lagoon at Xmas King Tide

6.7’ event (12/24/2015) Difference between measured and predicted = 10”

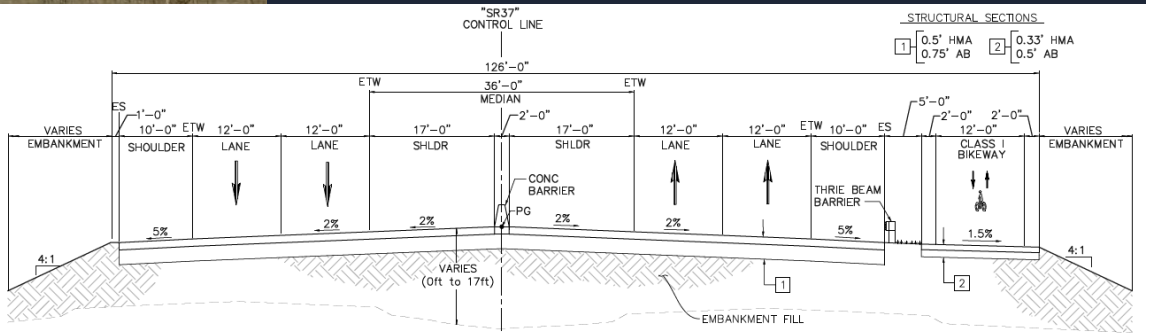
6.69’ event (1/21/2015) Difference between measured and predicted = 4”

How do we adapt?

- Vertically
- Horizontally

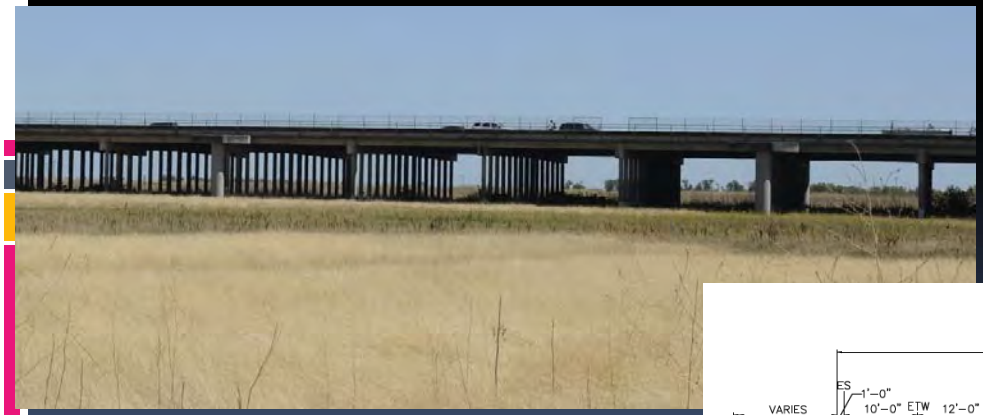
Adaptive Structural Scenarios

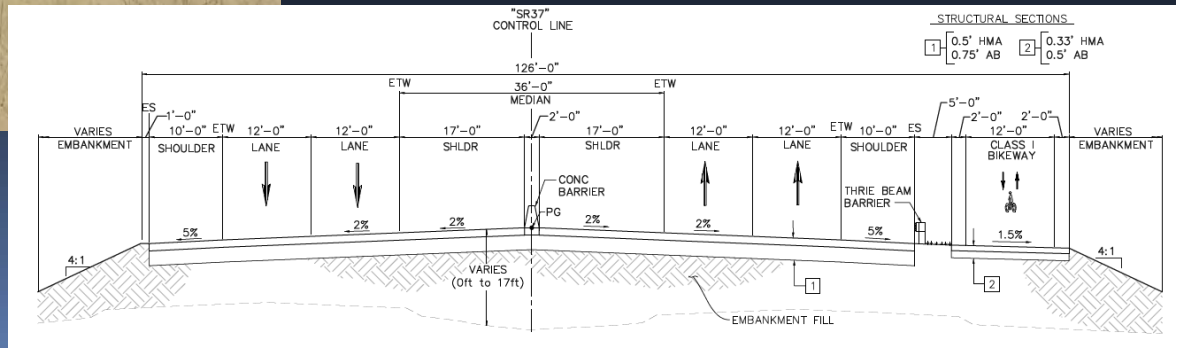
- Berm/Embankment
- Causeway (over land)
- Mixture of berm/causeway (e.g., berm segment C, causeway segment B)



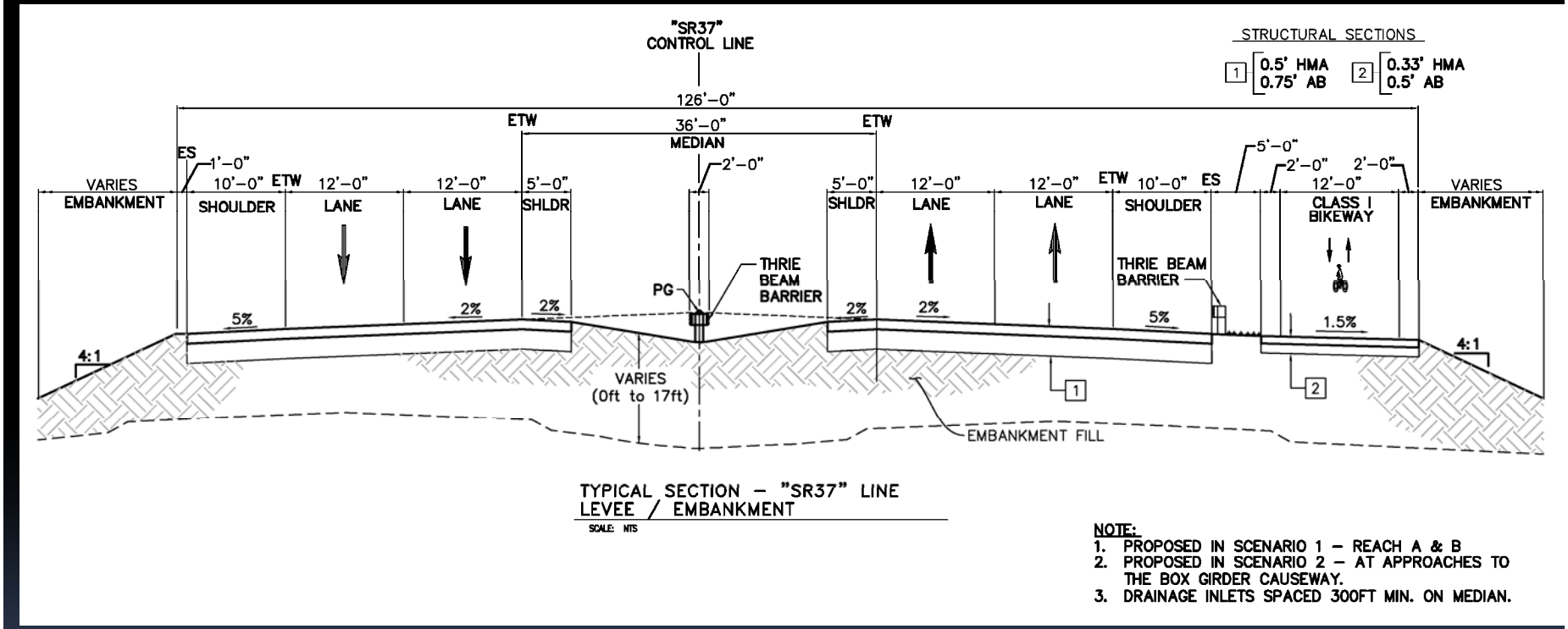
Adaptive Structural Scenarios

- Cost
- Capacity
- Environmental/community benefits/impacts





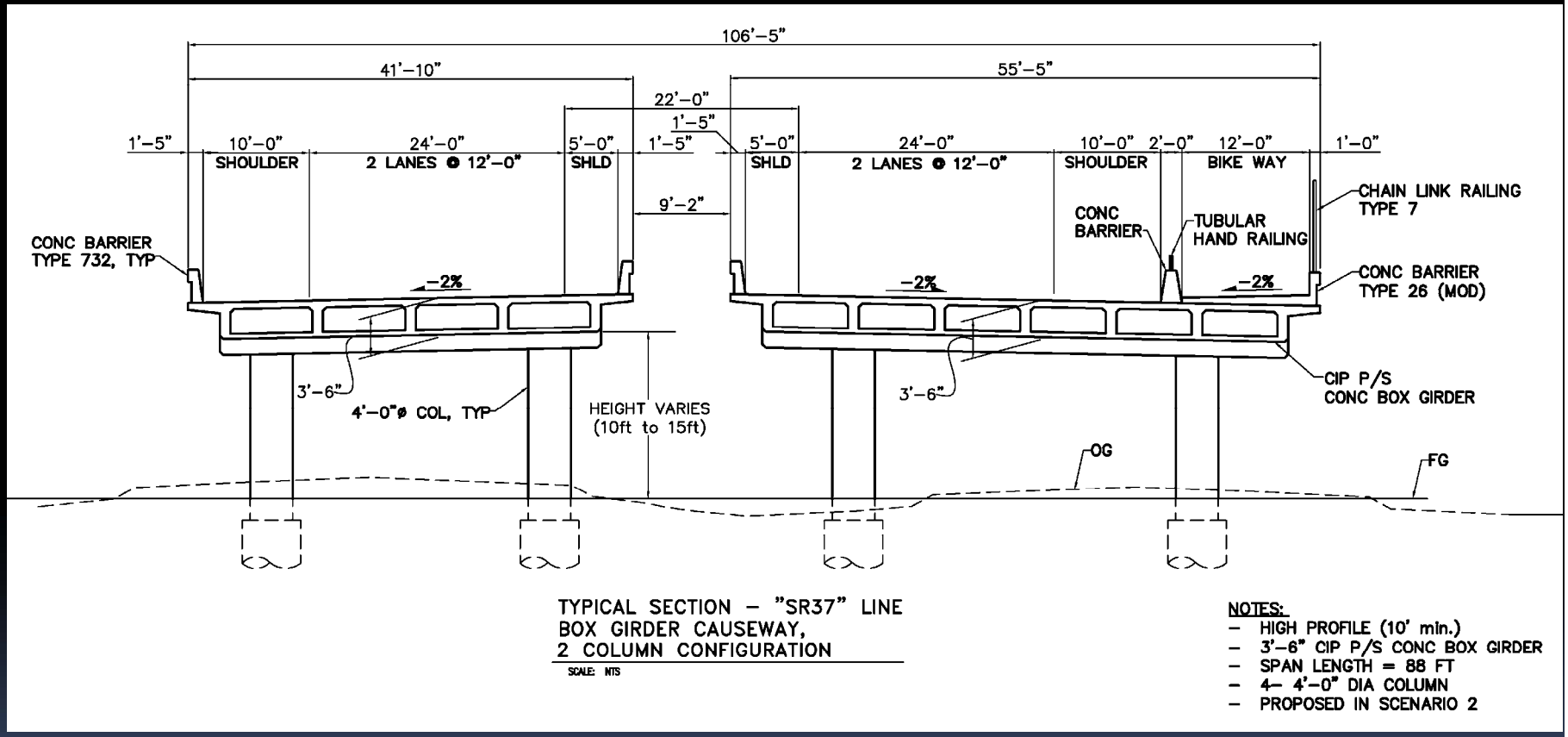
Adaptive Designs: Berm



Two lanes w/ shoulder
12 ft wide bikeway
Height of fill varies

Adaptive Designs: Berm

Adaptive Designs: Box-girder



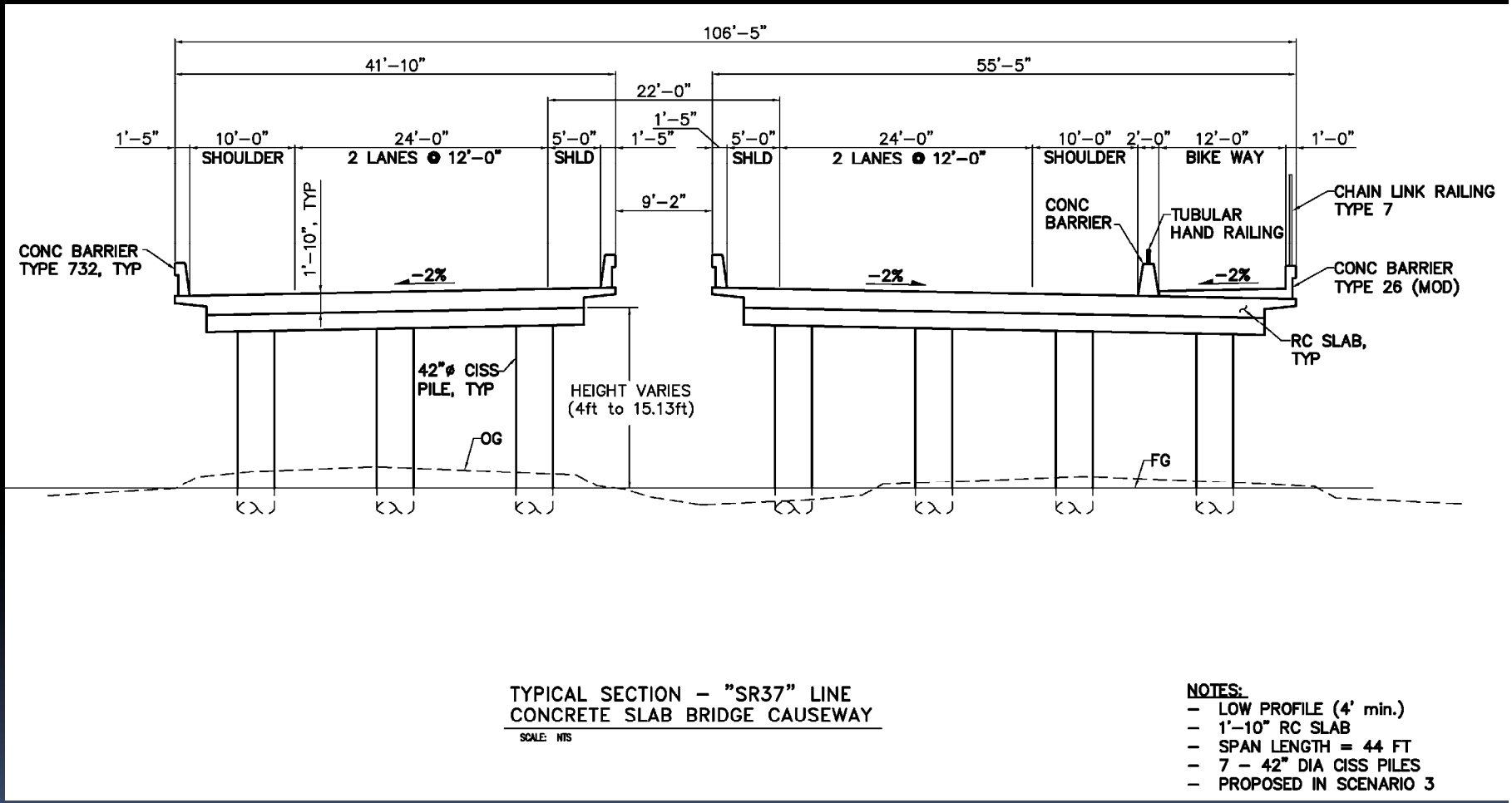
3.5 ft deep box girder

88 ft span length, 4.0 ft diameter columns

Two lanes w/ shoulder, 12 ft wide bikeway

Adaptive Designs: Box-girder

Adaptive Designs: Slab bridge



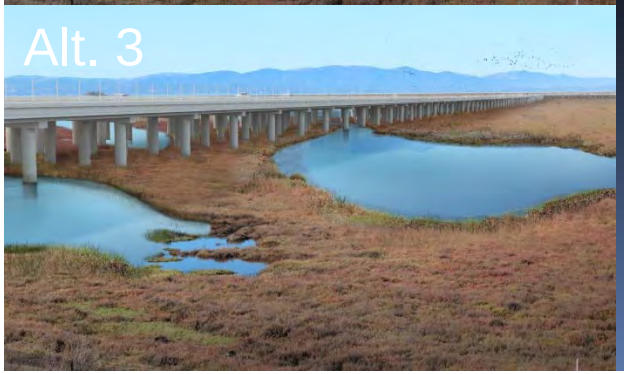
TYPICAL SECTION – "SR37" LINE
CONCRETE SLAB BRIDGE CAUSEWAY
SCALE: NTS

NOTES:
- LOW PROFILE (4' min.)
- 1'–10" RC SLAB
- SPAN LENGTH = 44 FT
- 7 – 42" DIA CISS PILES
- PROPOSED IN SCENARIO 3

22" thick slab, 44 ft span length, 3.5 ft diameter columns
Two lanes w/ shoulder, 12 ft wide bikeway

Adaptive Designs: Slab bridge

Cost Estimate Comparison



REACH	ALTERNATIVE		
	1 - Berm/ Embankment	2 - Box Girder Causeway	3 - Slab Bridge Causeway
A	$460	$1,400	$1,300
B	$650	$2,500	$2,200
C	$150	$400	$340
TOTAL	$1,260	$4,300	$3,840

($ in millions)

Project Overview and Web Resources

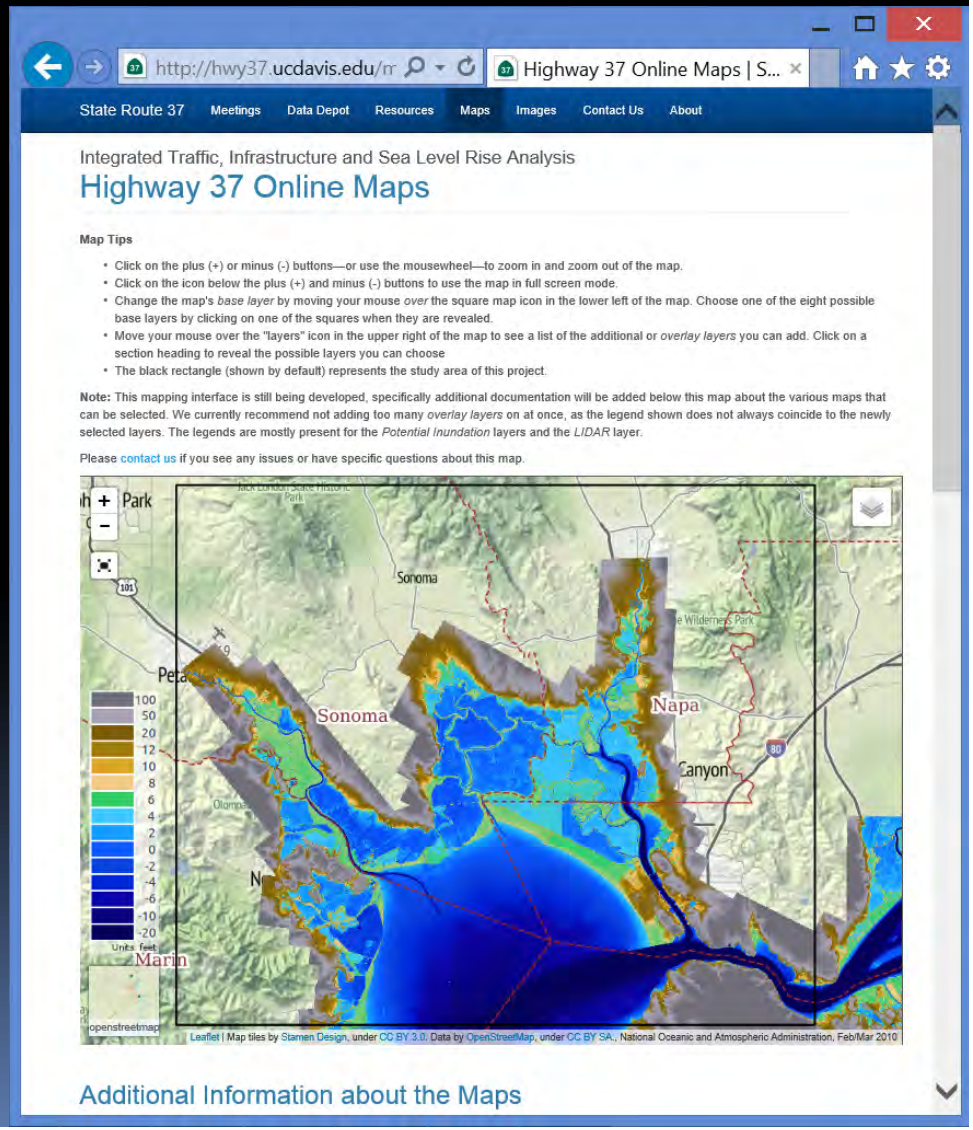
Website

http://hwy37.ucdavis.edu

Reports, agendas/minutes, map tool

Web Resources

Website: http://hwy37.ucdavis.edu/maps



What do we do next?

Meta-analyses of the determinants and outcomes of belief in climate change

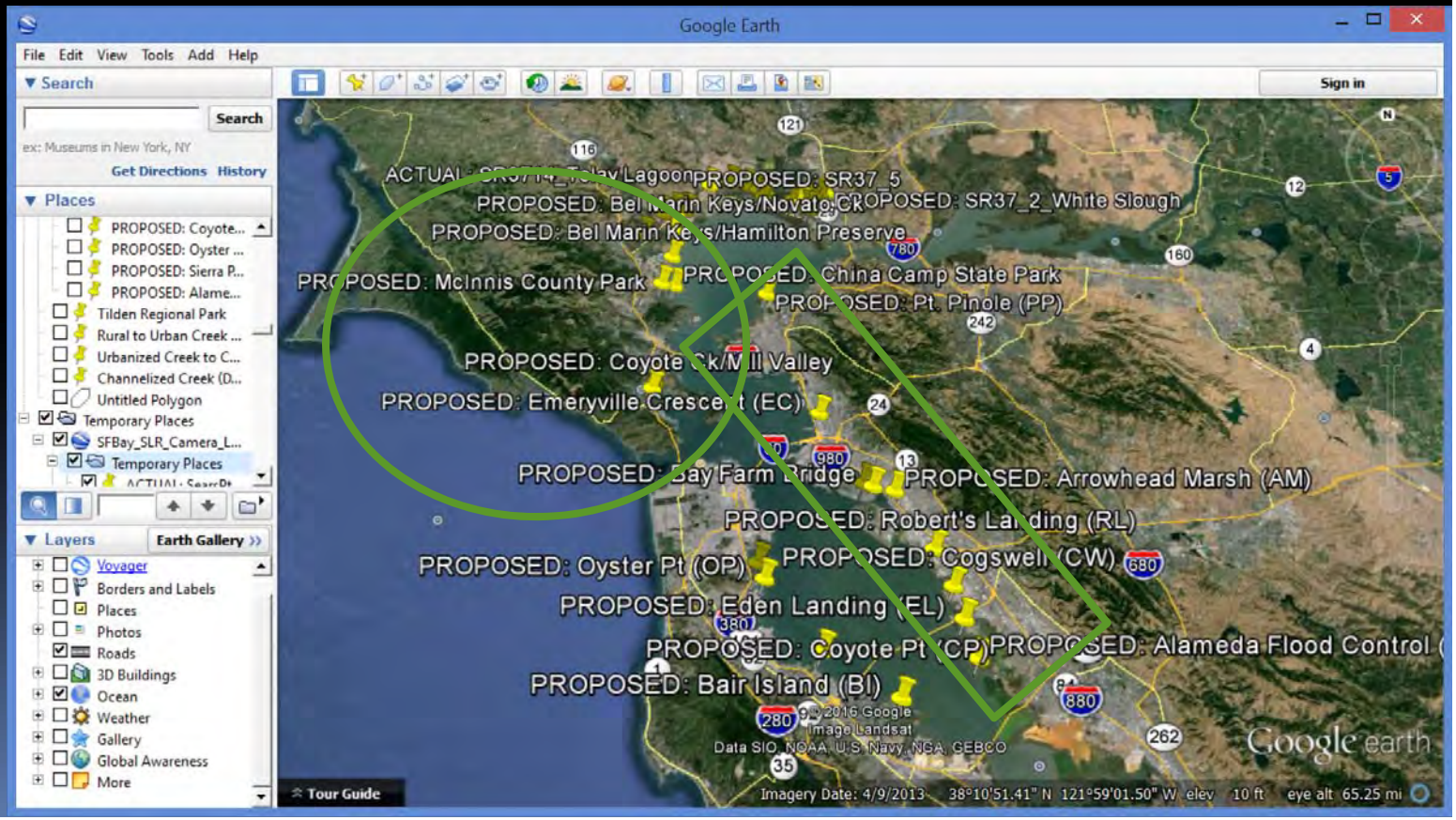
First, many intuitively appealing variables (such as education, sex, subjective knowledge, and experience of extreme weather events) were overshadowed in predictive power by values, ideologies, worldviews and political orientation. Second, climate change beliefs have only a small to moderate effect on the extent to which people are willing to act in climate-friendly ways. (Hornsey et al., 2016; Nature Climate Change)

PID, EIR/S

Studies: 1) Depth to bedrock, 2) actual berm/levee elevations, 3) stay in front of the curve nationally, 4) consider ALL options, 5) monitor shoreline/infrastructure

New Study: Sea Level Rise Monitoring

http://sealevelrisemonitor.org



More Information

http://hwy37.ucdavis.edu

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