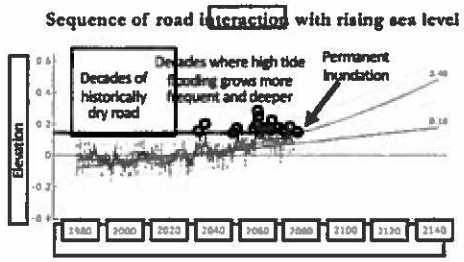
Climate Change and Transportation

1. Coastal Erosion
   a) Undermining
   b) Move or raise?
2. Storm Drain Backflow
   a) Pump stations
   b) One-way valves
   c) Tamp storage until low tide
3. Groundwater inundation
   a) Road bed degradation
   b) Raise
   c) Store
   d) Pump
4. Rain bombs
   a) Handling drainage throughout the watershed
   b) Storage
   c) Diversion
5. Heat Waves
   1. Black-outs, loss of traffic control
   2. Road surface
   3. Emergency vehicles
6. El Nino
   1. Twice as frequent, stronger
   2. Record setting: heat, rain, erosion, tides, hurricanes

The greatest hazard with SLR is high tide flooding



Planning Principles

- Adaptive Design
- Design for extremes *(end member events will become more commonplace: rain, drought, king tides, storms, heat events)*
- Develop action plan *(timing + funding + actions)*
- Interagency Coordination *(all hands on deck)*
- Design for high tide and groundwater flooding *(less focus on GMSL)*
- Design for the community – not just the road

Coastal roads are threatened by erosion on every island

A $15 Billion Price Tag To Protect Hawaii Highways From Climate Change

Hawaii will need **$15 billion** to protect highways from sea level rise.

$7.5 million for every mile of road that must either be raised, pushed back or relocated in the next 50 to 100 years.

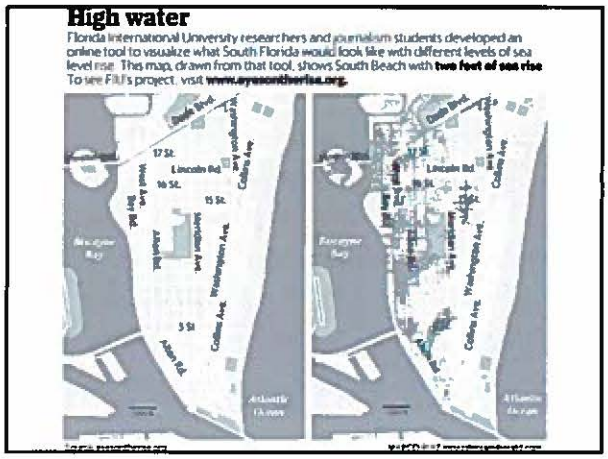
$40 million for every mile of bridge.

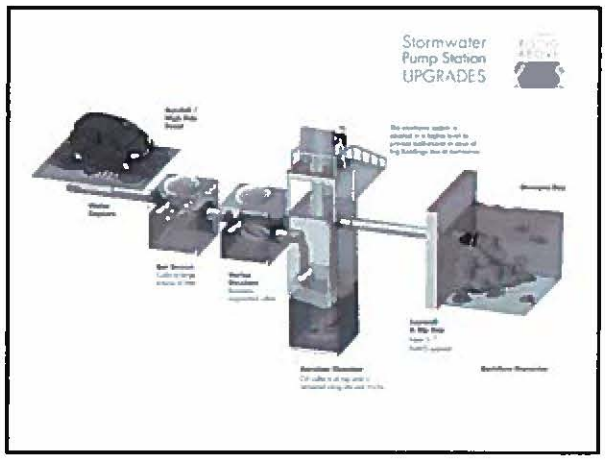
Groundwater inundation

Waikiki

Miami Beach

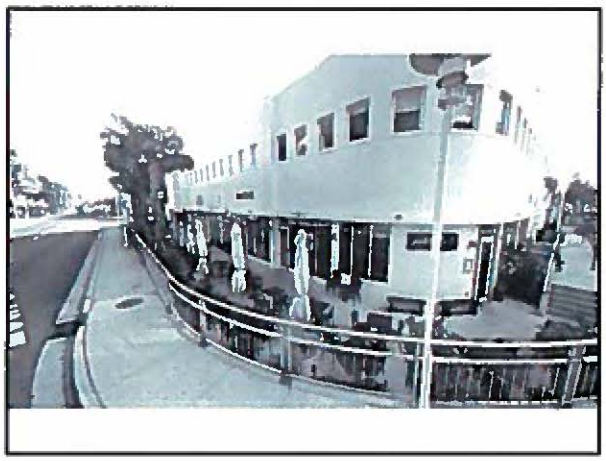
Miami Beach

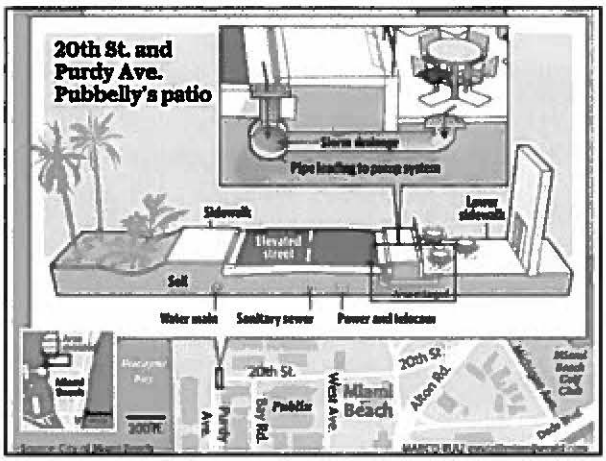


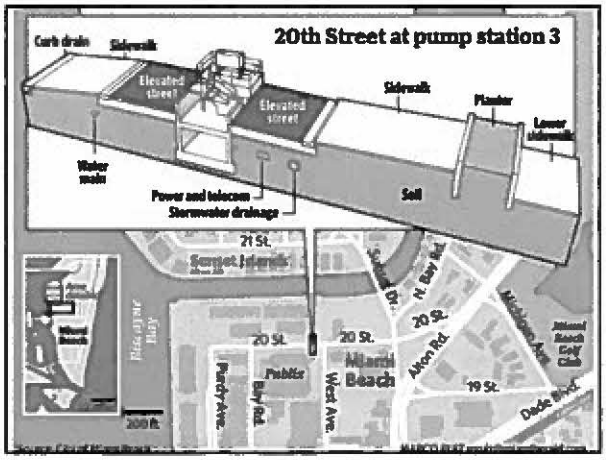


Miami is raising roads by 2 ft

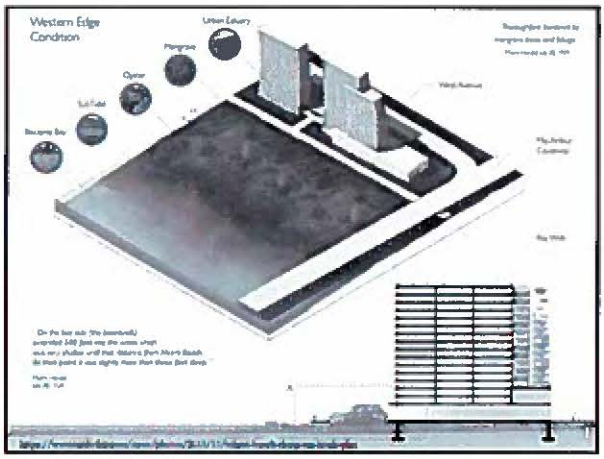
Construction workers raise the height of the street and sidewalks; Miami

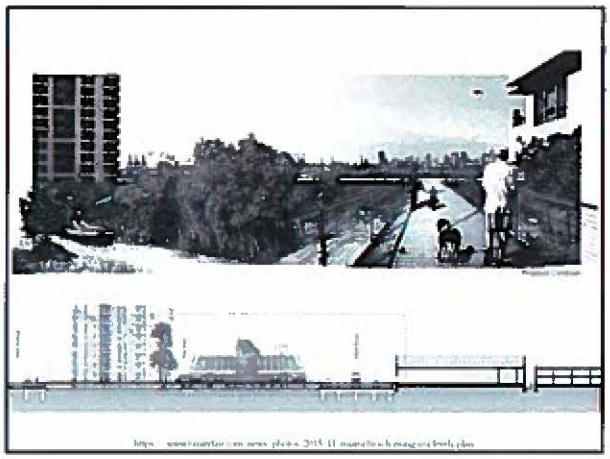


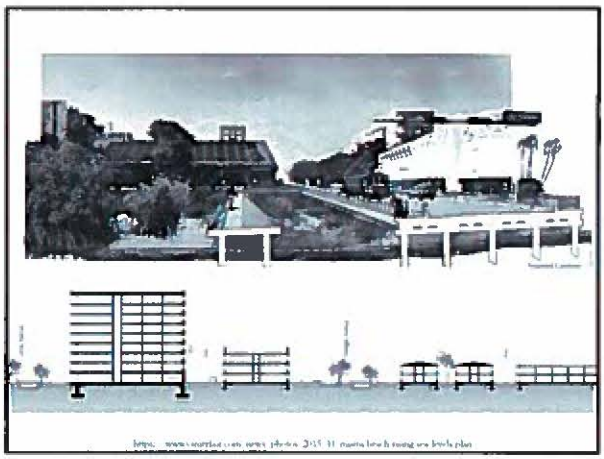


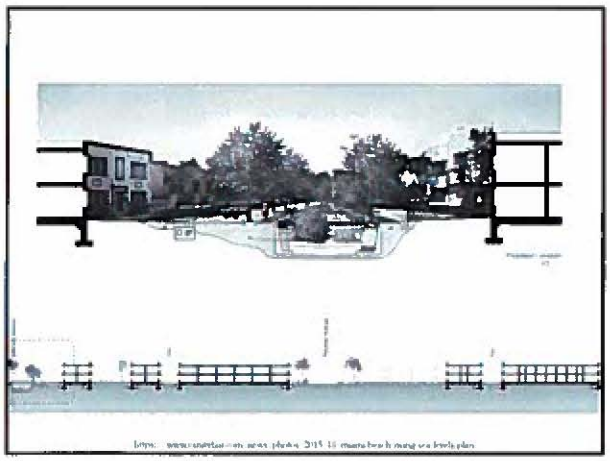


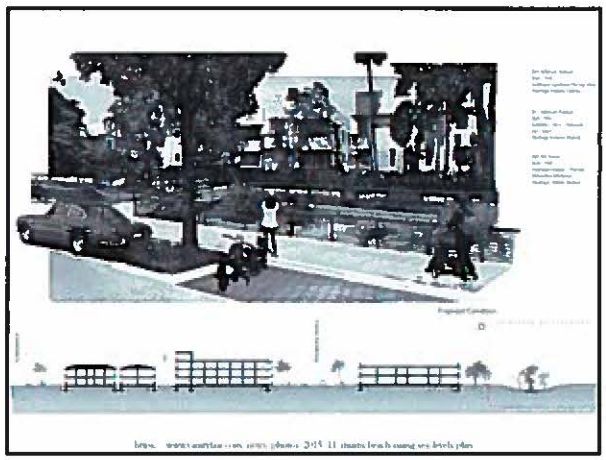
80 pump stations, $2-3 million each,
79,000 gal/minute

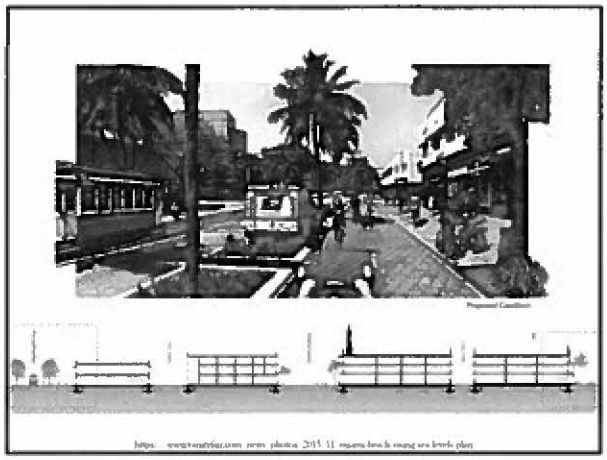

Western Edge
Condition
Urban Estuary
Mangrove
Oyster
Salt Tube
Bacterial Bay
West Avenue
Pile Arrival Causeway
Bay Walk

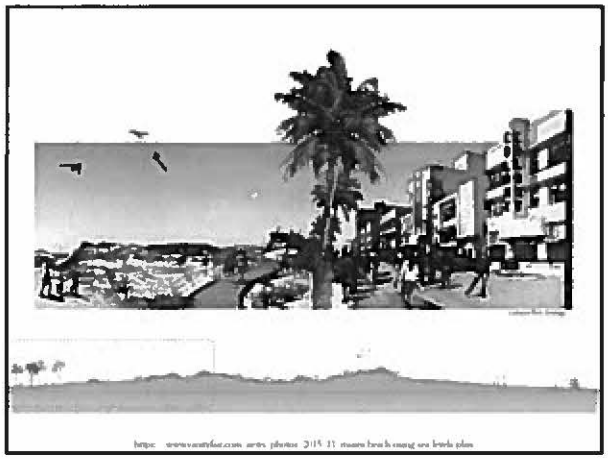


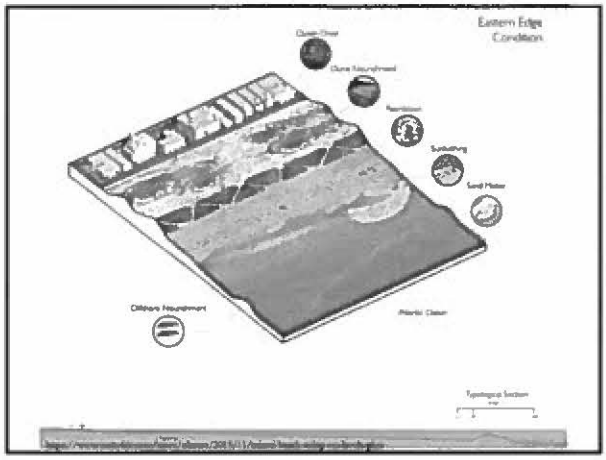


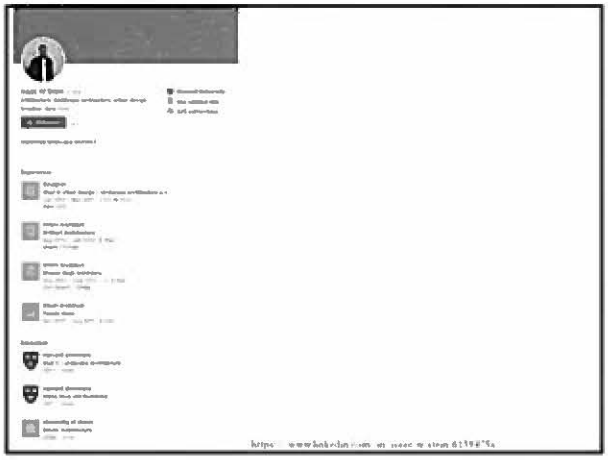


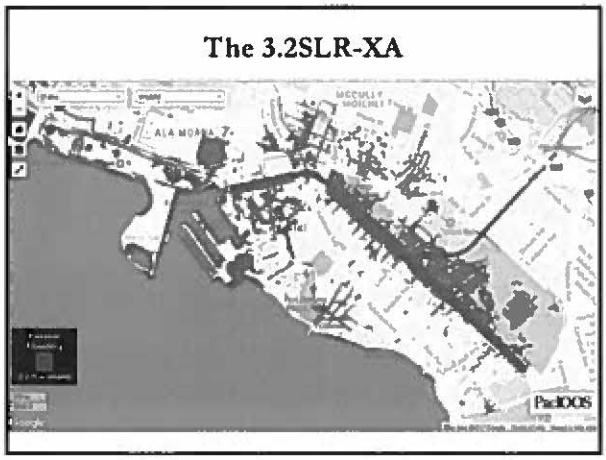


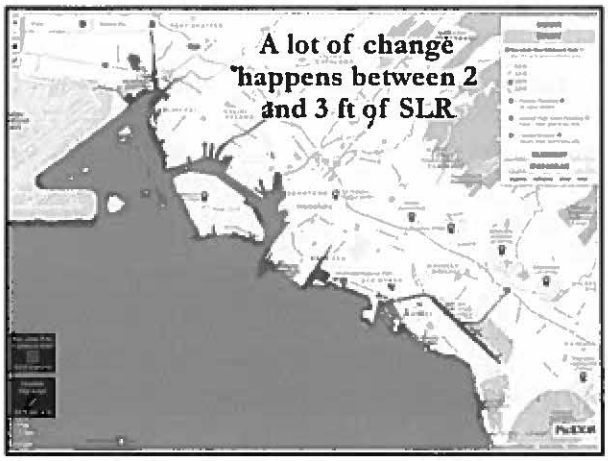


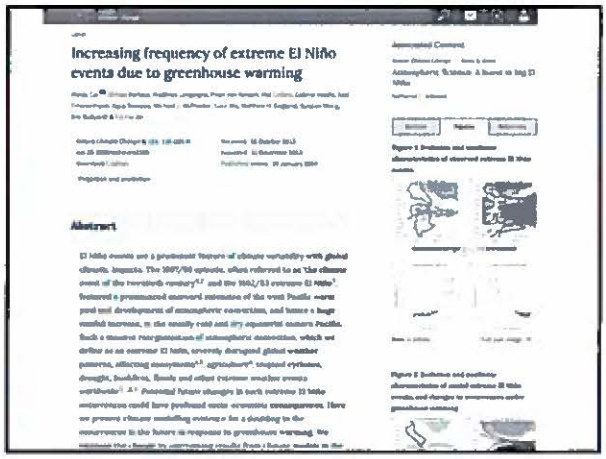



Eastern Edge
Condition




The 3.2SLR-XA
PacIOOS

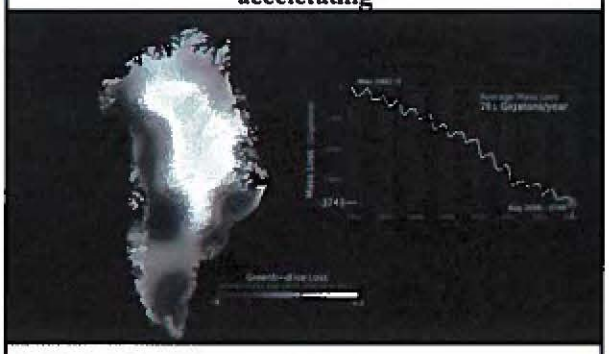

A lot of change
happens between 2
and 3 ft of SLR



Moving a road can catalyze a community to retreat.

Changing a fleet can incentivize rental cars to move to ecars

Ice is melting – 600 billion tons each year and accelerating



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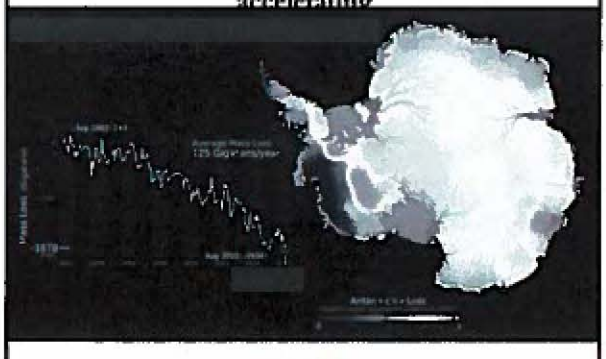
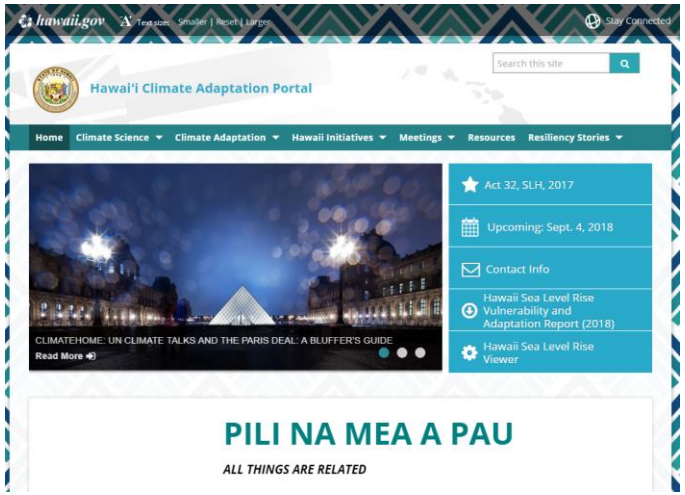


Sea Level Rise : Hawai‘i Sea Level Rise Viewer

view full-screen map

cursor: 23.4884°, -158.5657°

http://www.pacioos.hawaii.edu/shoreline/slr-hawaii/



climateadaptation.Hawaii.gov