


SOUTH MOLOKAI SHORELINE EROSION MANAGEMENT PLAN

Nancy McPherson – Department of Hawaiian Home Lands
Nancy.m.mcpherson@hawaii.gov
John Summers - Planning Consultants Hawaii, LLC
jsummers@planningconsultantshawaii.com
Thorne Abbott - Coastal Planners, LLC
Coastalplanners@gmail.com
 808-344-1595

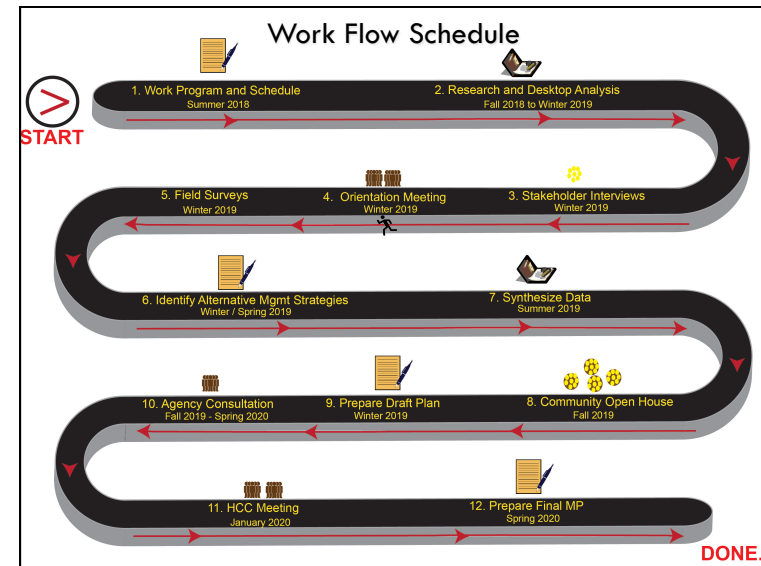
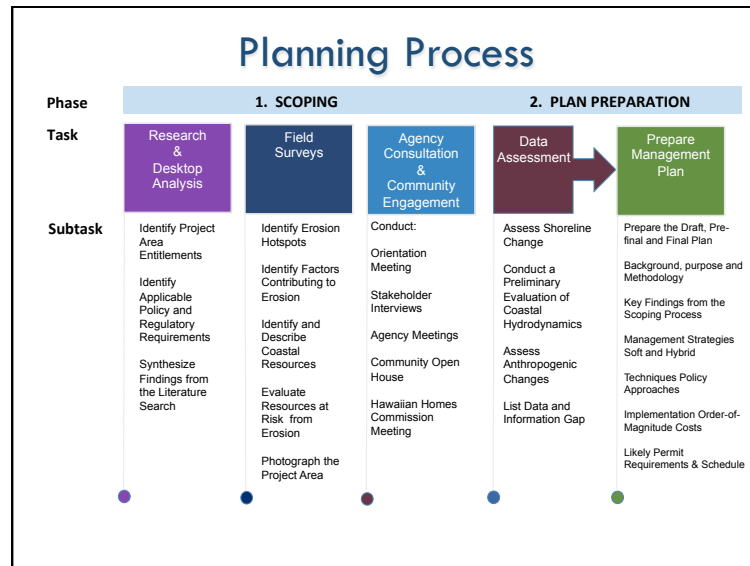
January 2019

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 Tara Owens - University of Hawaii Sea Grant Program
 James Buika - County of Maui Planning Department



Study Purpose

1. Enable DHHL to proactively plan for and manage shoreline erosion;
2. Investigate the causes of shoreline erosion, and likely future progression;
3. Identify effective and sustainable shoreline erosion management strategies; and
4. Educate the community as to the causes of shoreline erosion and appropriate management responses.

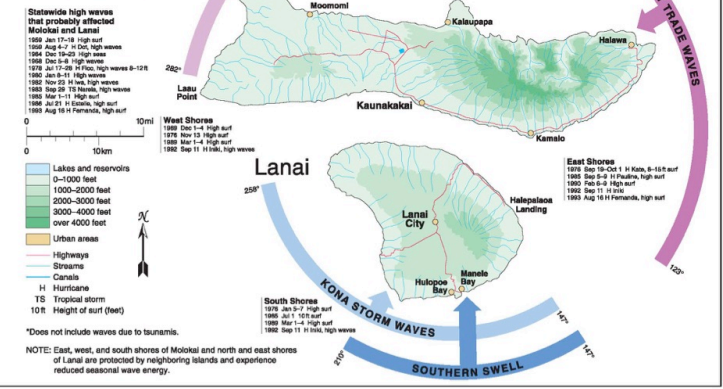


Study Area



Molokai and Lanai

Damaging high waves* and high waves due to hurricanes

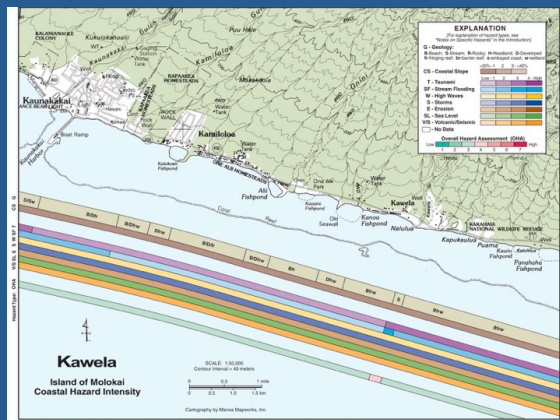


Natural Hazards Exposure

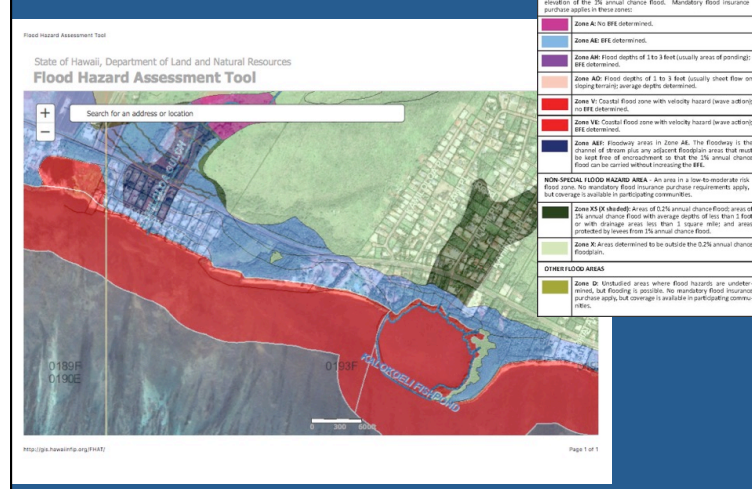
Kawela:

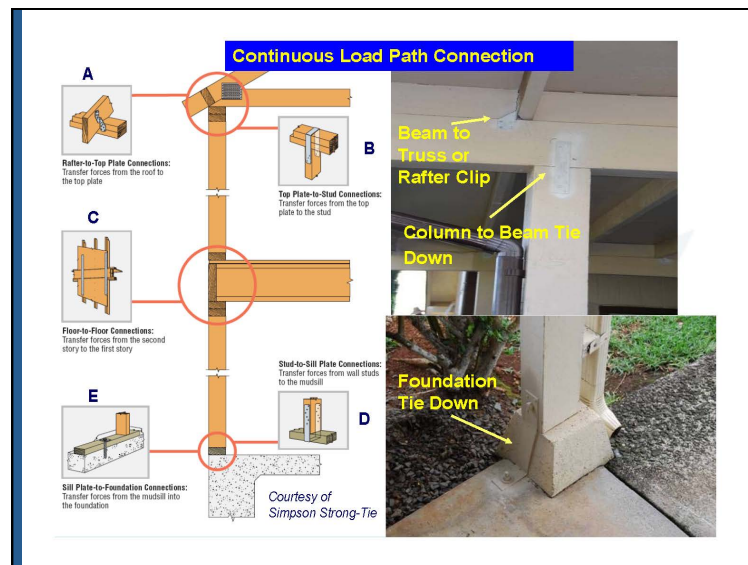
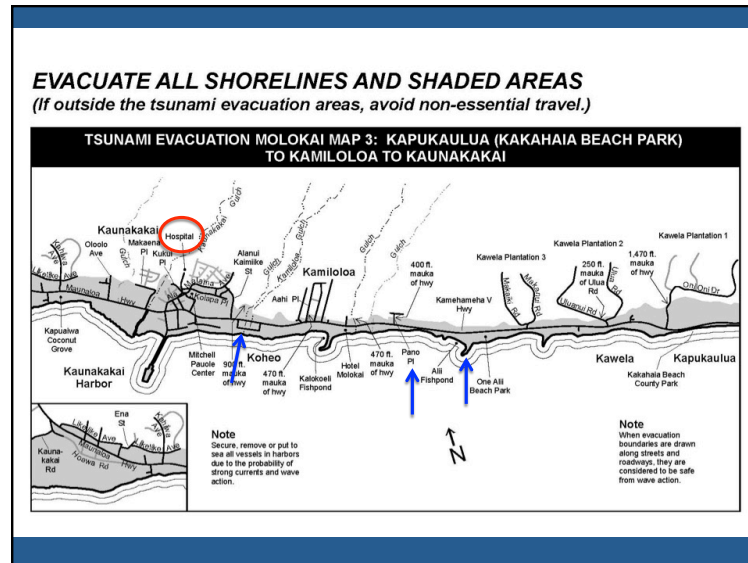
- 2 Tsunami
- 1-2 Stream Flooding
- 2 Big Waves
- 3 Storms
- 2 Erosion
- 3 Sea Level
- 3 Seismic

Rankings:
1 = Low Hazard
4 = High Hazard



FLOOD PRONE AREAS





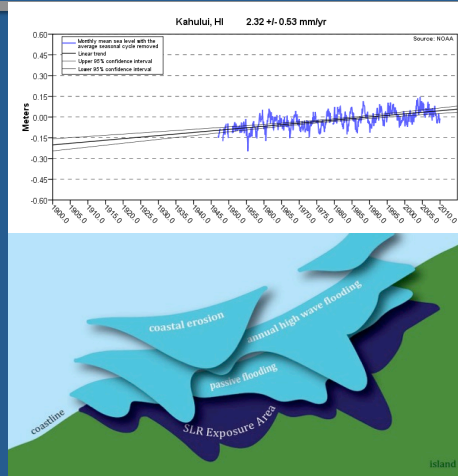
SEA LEVEL RISE

1950-2010

Tide gauge in
Kahului Harbor
indicates rising tides

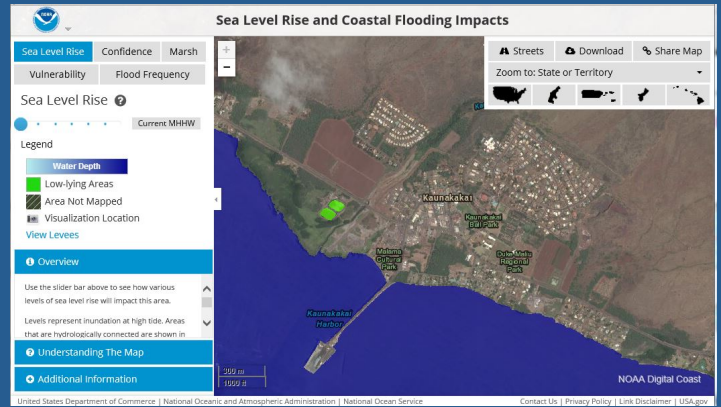
Risk model combines

- + Coastal Erosion
- + High Wave Events
- + Flooding
- = Sea Level Rise
Exposure Area



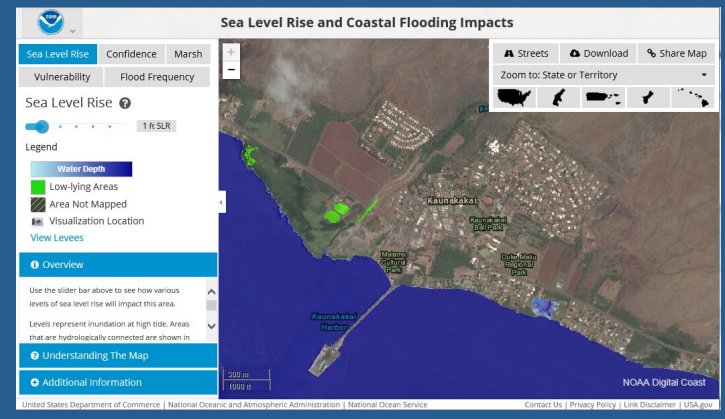
NOAA DIGITAL COAST SLR VIEWER

Sea Level: **+0 ft MHHW**



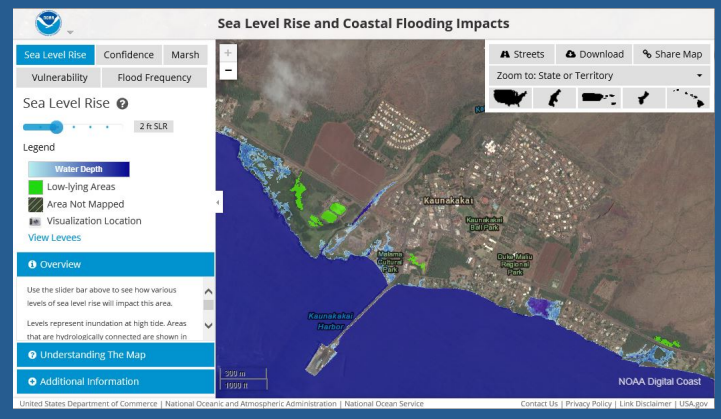
NOAA DIGITAL COAST SLR VIEWER

Sea Level: **+1 ft MHHW**



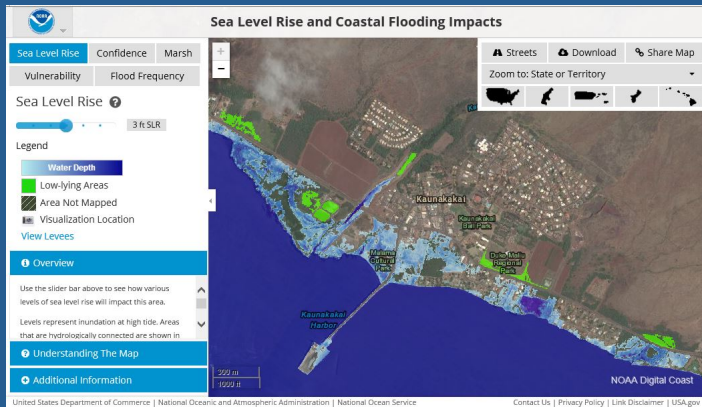
NOAA DIGITAL COAST SLR VIEWER

Sea Level: **+2 ft MHHW**



NOAA DIGITAL COAST SLR VIEWER

Sea Level: **+3 ft MHHW**



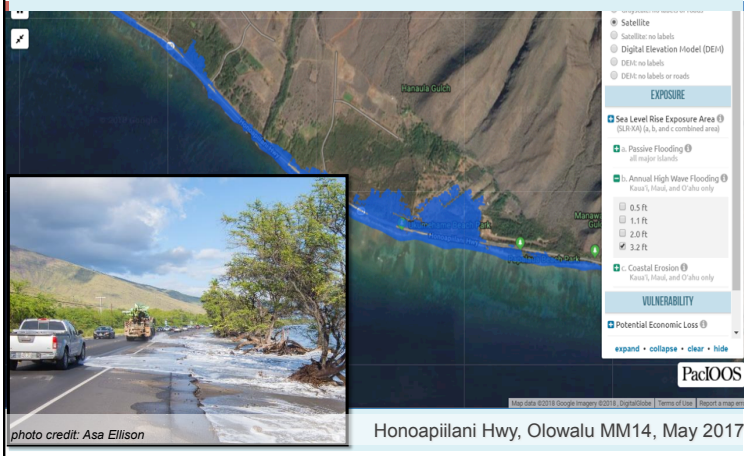
SEA LEVEL RISE IMPACTS IN HAWAII

- Increased rain storms = FLOODING
- Silt runoff and bleaching impacts on REEFS
- Salt intrusion to WETLANDS
- Coastal erosion leading to seawalls = BEACH LOSS
- Wave overtopping = CLOSED ROADS
- Vulnerable INFRASTRUCTURE
 - Kamehameha Highway
 - Fire Station
 - Fuel Tank Farm

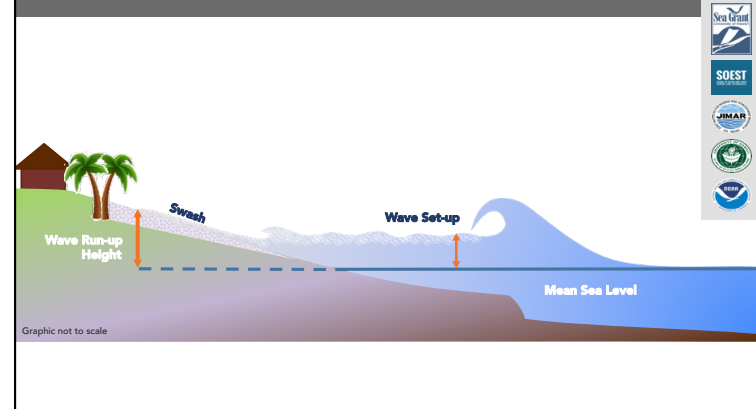


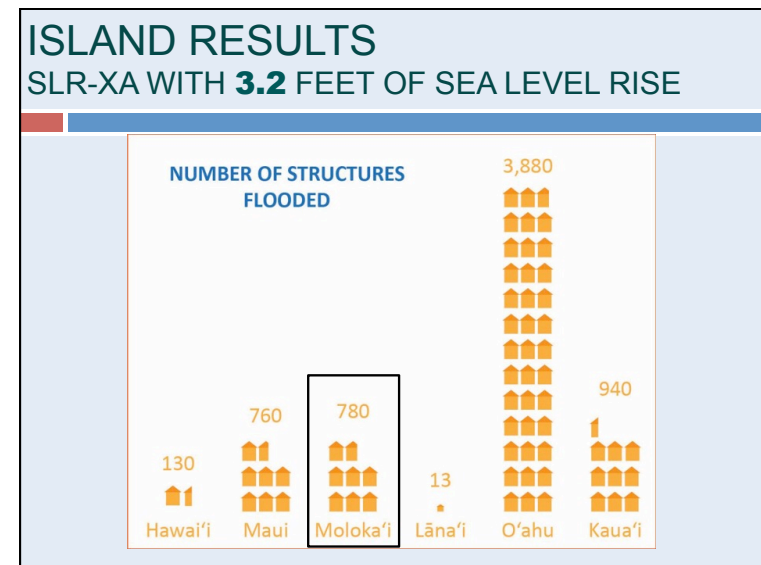
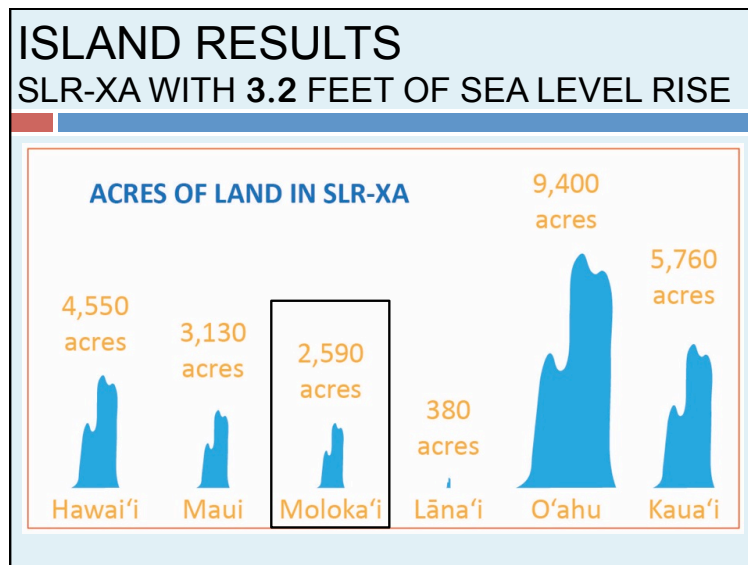
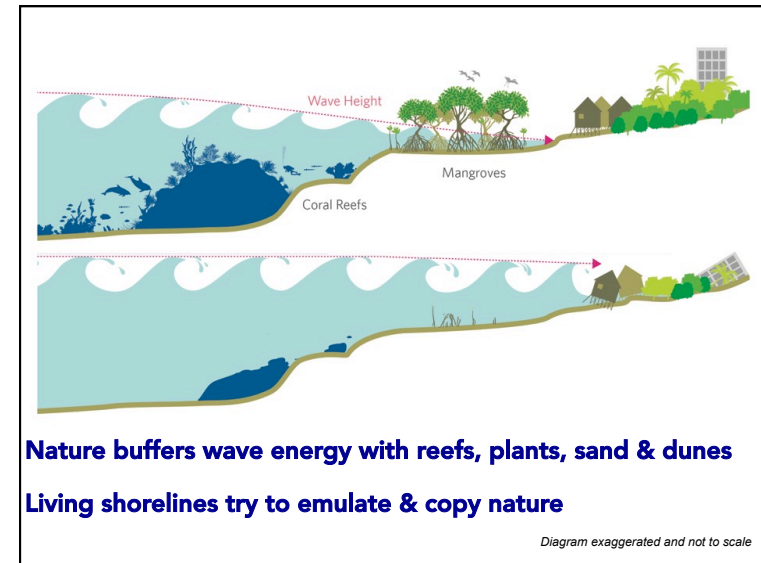
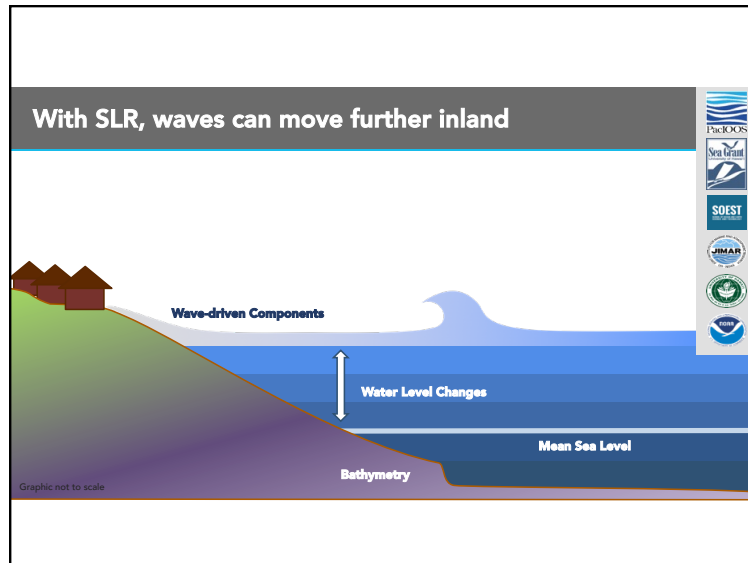
A GLIMPSE OF THE FUTURE

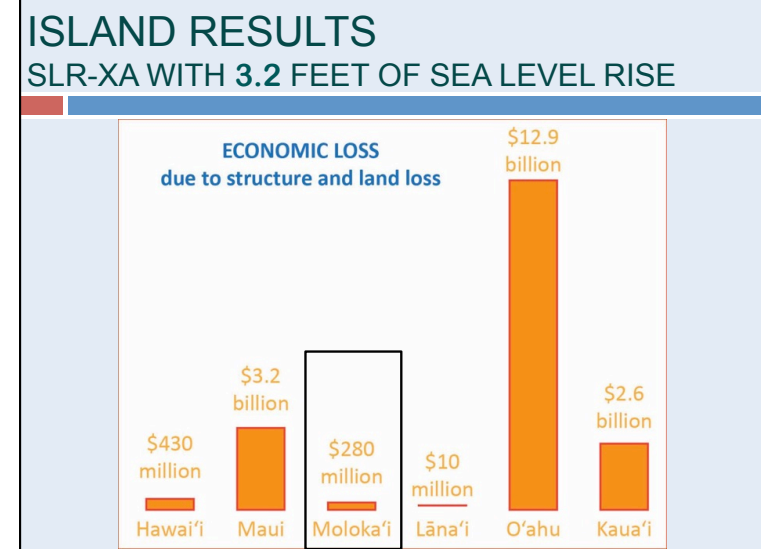
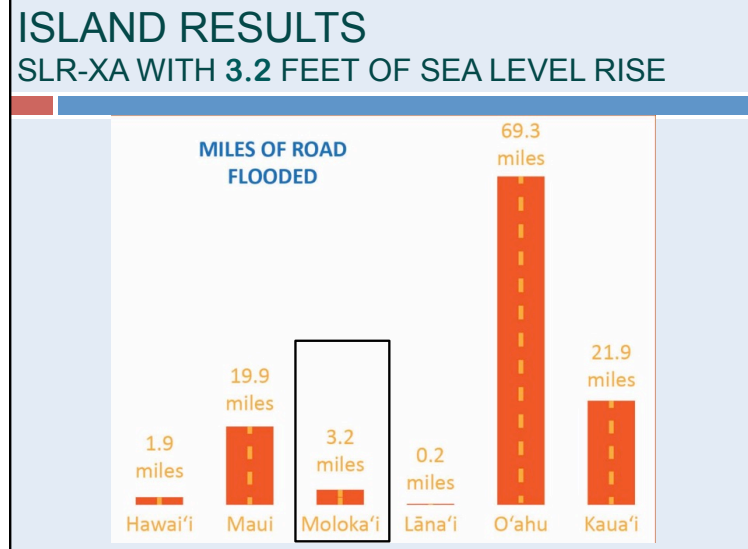
Today's King Tide = Tomorrow's Average Water Level



Today waves break offshore along the edge of the reef





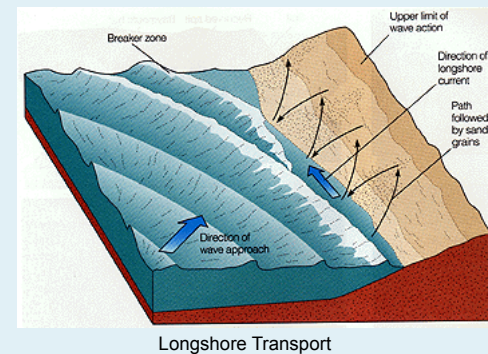


COASTAL EROSION

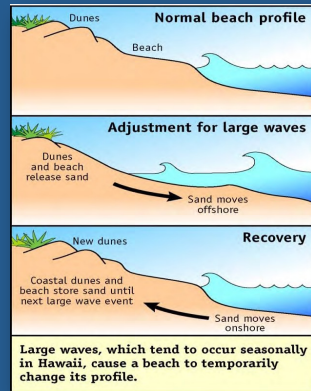
Combination of Causes:

1. Sediment transport hindered or interrupted
2. Currents & seasonal wave conditions move sand
3. Storms move sand quickly (episodic erosion)
4. Sea-Level Rise (chronic erosion)
5. Shore armoring (seawalls)

How does sand, silt, pebbles, and rocks move along the coastline?



Changing Beach Face or Profile

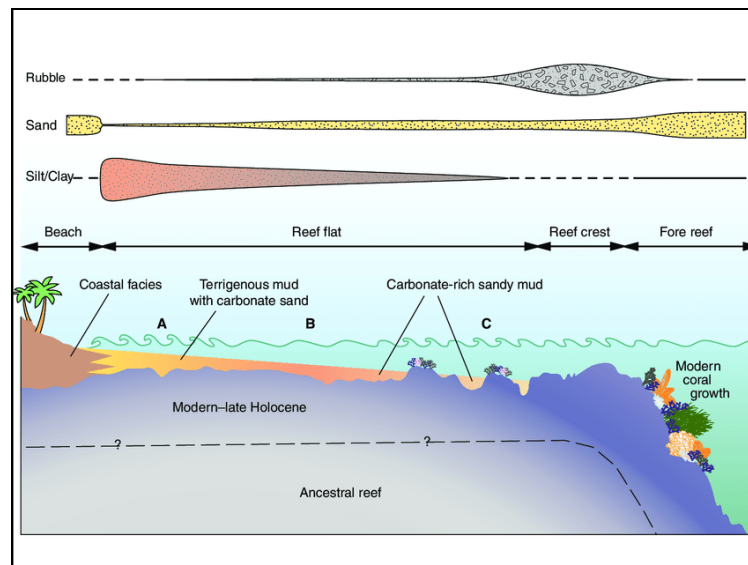
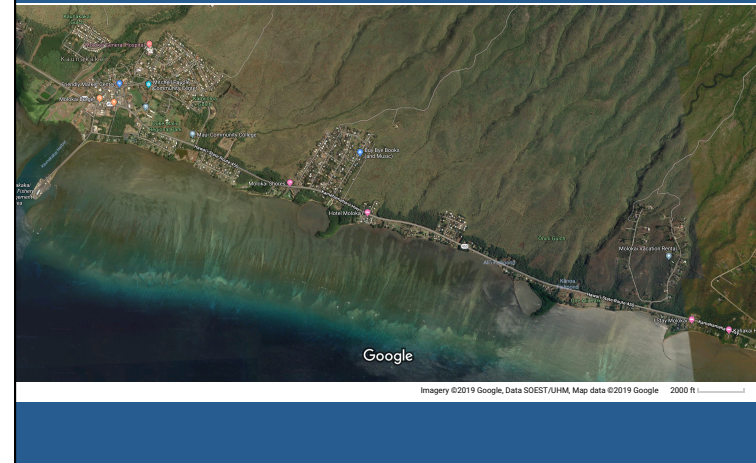


Big waves can eat into sand dunes and back shore areas to redistribute sand seaward and replenish the beach

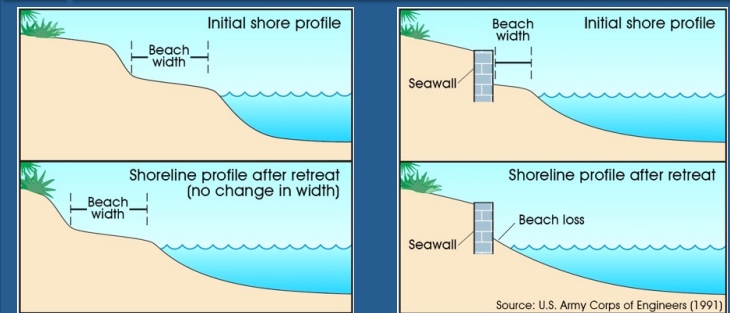
The extra sand makes the nearshore shallower so that the waves break further offshore

Normal currents push the sand back up to be held and captured by dune or back shore vegetation

SEDIMENT TRANSPORT



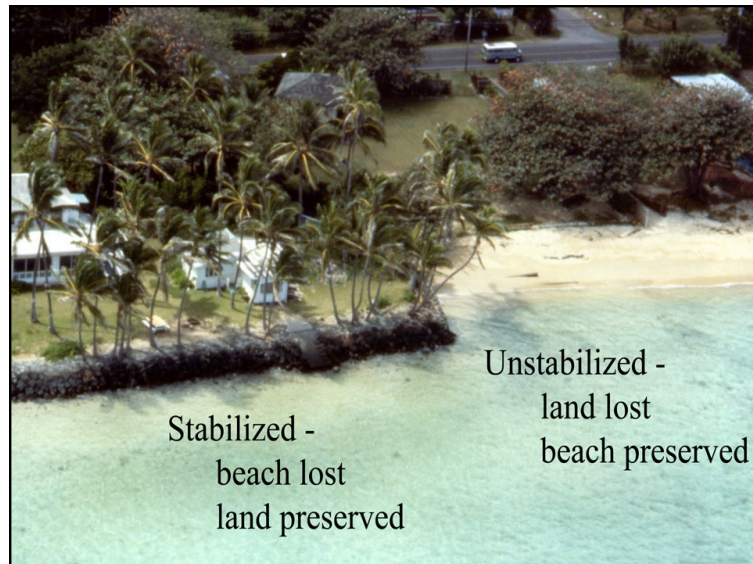
HUMAN IMPACTS: ARMORING



Beaches on chronically eroding shores can maintain their natural width as they slowly retreat landward.

Beach loss eventually occurs in front of a seawall where there is chronic erosion.

Often Causes a Domino Effect



EROSION RESPONSE OPTIONS

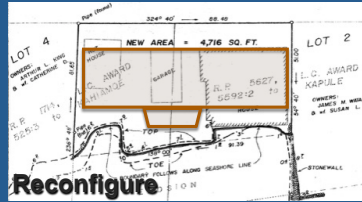
Retrofit

Rebuild to code

Armor

Elevate

EROSION RESPONSE OPTIONS

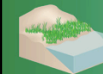


EROSION RESPONSE OPTIONS

GREEN - SOFTER TECHNIQUES

GRAY - HARDER TECHNIQUES

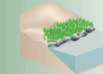
Living Shorelines



VEGETATION ONLY - Provides a buffer to upland areas and breaks small waves. Suitable only for low wave energy environments.



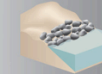
EDGING - Added structure holds the toe of existing or vegetated slope in place.



SILLS - Parallel to existing or vegetated shoreline, reduces wave energy, and prevents erosion. Suitable for most areas except high wave energy environments.



BREAKWATER - (vegetation optional) - Offshore structures intended to break waves, reducing the force of wave action, and encourage sediment accretion. Suitable for most areas.



REVETMENT - Lays over the slope of the shoreline and protects it from erosion and waves. Suitable for sites with pre-existing hardened shoreline structures.



BULKHEAD - Vertical wall parallel to the shoreline intended to hold soil in place. Suitable for areas highly vulnerable to storm surge and wave forces.

Source: <https://www.fisheries.noaa.gov/insight/understanding-living-shorelines>



Beach and Land Erosion at Project Beach Looking East, 22 August 2006 - before geotube groins.



Beach and Land Erosion Causing Pollution at Project Beach, 4 August 2009 - before geotube groins

Stable Road, 2006 & 2009 (before restoration)



Stable Road, 2017: 5 years after nourishment & groins

