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Description:	March 28, 2017 Workshop
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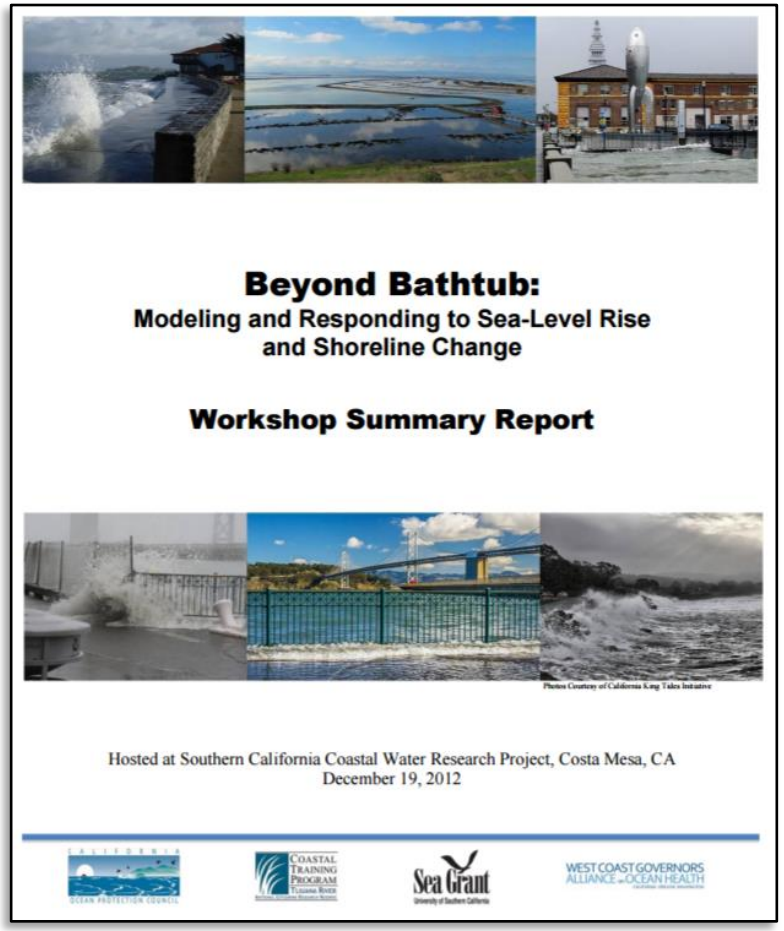
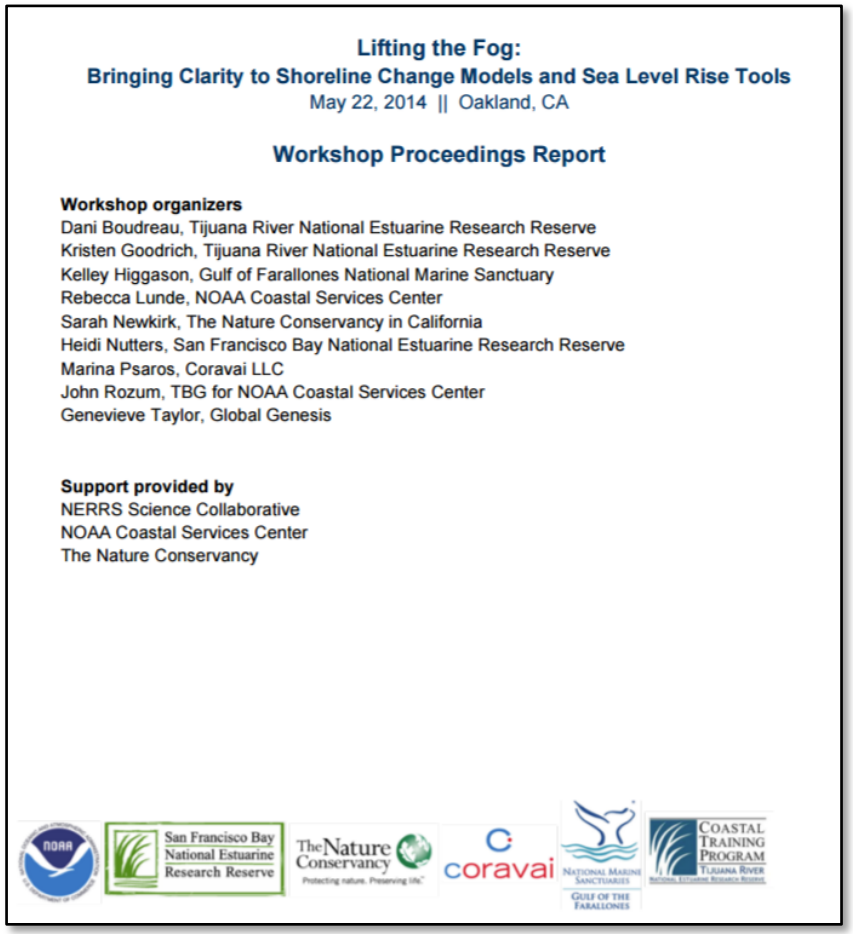
Past efforts to communicate model complexities



Beyond Bathtub:
Modeling and Responding to Sea-Level Rise and Shoreline Change

Workshop Summary Report

Hosted at Southern California Coastal Water Research Project, Costa Mesa, CA
December 19, 2012



Lifting the Fog:
Bringing Clarity to Shoreline Change Models and Sea Level Rise Tools
May 22, 2014 || Oakland, CA

Workshop Proceedings Report

Workshop organizers
Dani Boudreau, Tijuana River National Estuarine Research Reserve
Kristen Goodrich, Tijuana River National Estuarine Research Reserve
Kelley Higgason, Gulf of Farallones National Marine Sanctuary
Rebecca Lunde, NOAA Coastal Services Center
Sarah Newkirk, The Nature Conservancy in California
Heidi Nutters, San Francisco Bay National Estuarine Research Reserve
Marina Psaros, Coravai LLC
John Rozum, TBG for NOAA Coastal Services Center
Genevieve Taylor, Global Genesis

Support provided by
NERRS Science Collaborative
NOAA Coastal Services Center
The Nature Conservancy

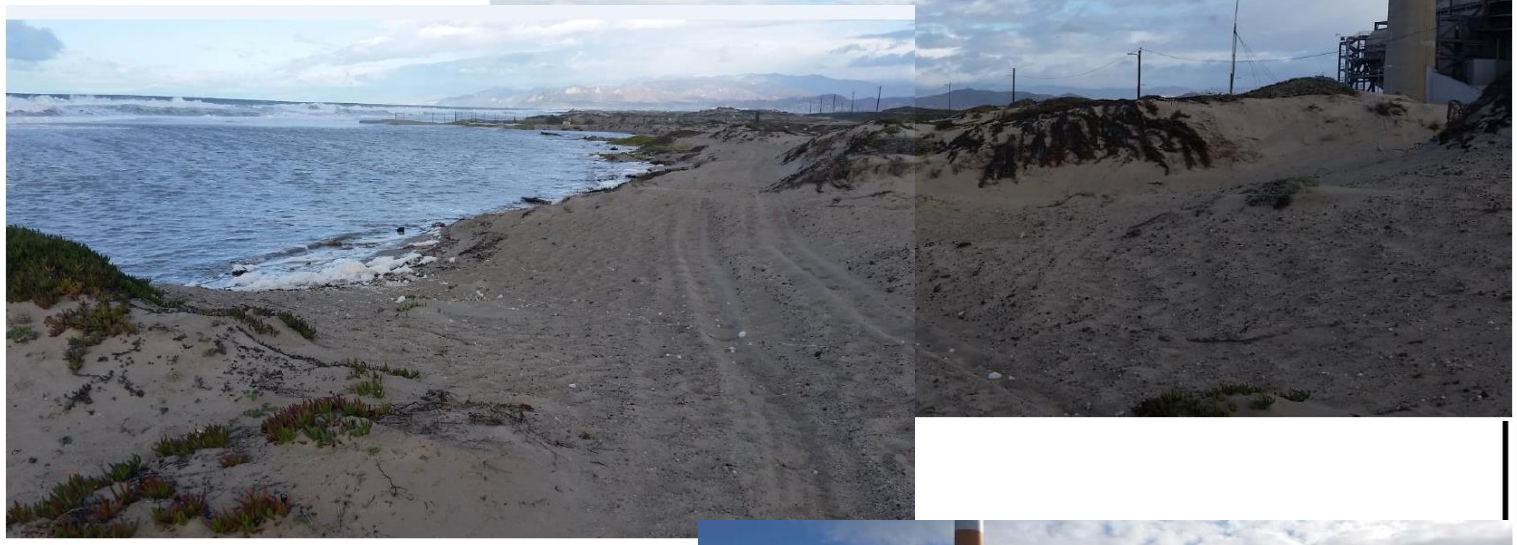
"All models are wrong and some of them are useful"

Nuances and subtleties between the models are difficult to discern especially without complete documentation, there has been NO systematic evaluation comparing the models. Proposed in 2010 by Barnard and Revell

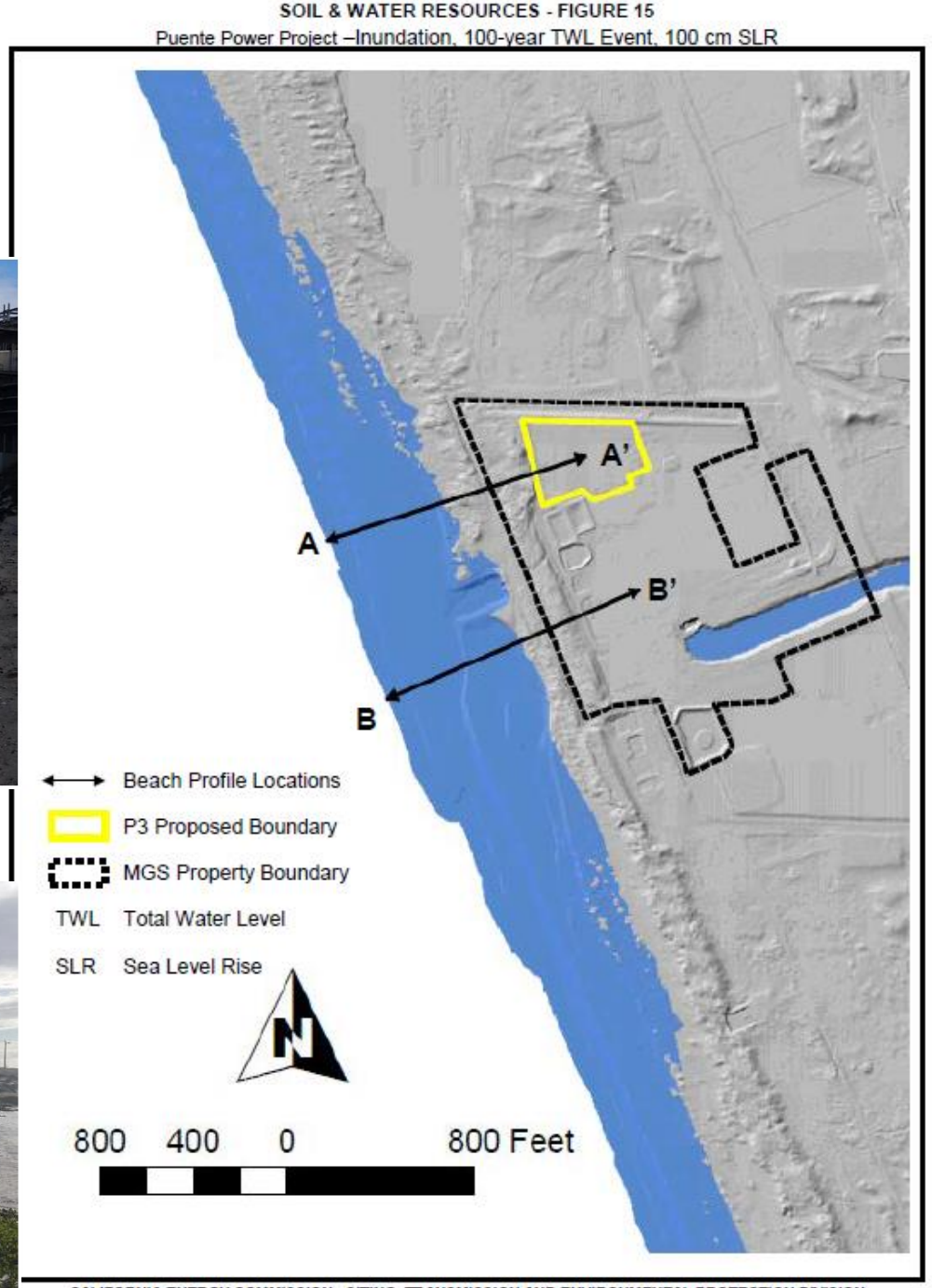
City of Oxnard Perspective

- To evaluate existing hazards, the FSA relied on the PRELIMINARY FEMA maps without discussing the specific methods or calculations used in the analyses.
- To evaluate future hazards, the FSA relied solely on PRELIMINARY COSMOS data without technical documentation. Basis was that it modeled SLR and storm events
- The City has relied on the Coastal Resilience Ventura model results which had been reviewed by local jurisdictions but which the FSA dismissed as a worst case scenario.
- Multiple comments submitted during CPUC and PSA processes and comment periods were ignored in the final FSA
- The City is following State of CA guidance to plan to adapt to sea level rise and trying to remove infrastructure and development from hazardous locations. Utility and Transportation infrastructure are often the adaptation bottlenecks and so the next 30 to 60 years of development and redevelopment must rely on the land use decision made in the 1960s. To rebuild energy infrastructure in this location is **Maladaptation**.

Preliminary COSMOS map 100 year Event & 1m of SLR



December 11, 2015



Waves – USGS COSMOS

COSMOS – from new tech methods for Los Angeles

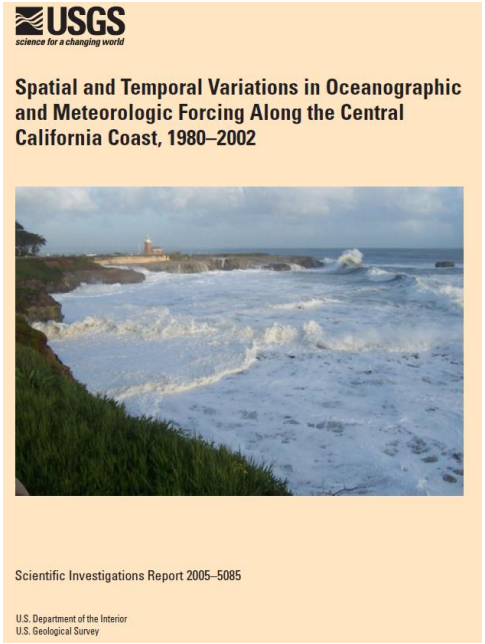
Based on complicated wave modeling of Global Climate Models

100 year offshore wave

22.3 feet (6.8m) at 18 seconds

Nearshore waves transformed using SWAN

- USGS 2005 analysis of buoy records for offshore Central CA within Tier 1 wave grid
- 100 year offshore wave
- 38.3 feet (11.7m)
- 2 year offshore wave
- 25 feet (7.6m)



Note that this represents different buoy locations, but wave direction affecting Mandalay must come through the Santa Barbara Channel. Unclear on Final Ventura methods in COSMOS

Waves - FEMA

FEMA –Interim Data Submittal #3 – Appendix D

Based on wind reanalysis to develop a 50 year hindcast

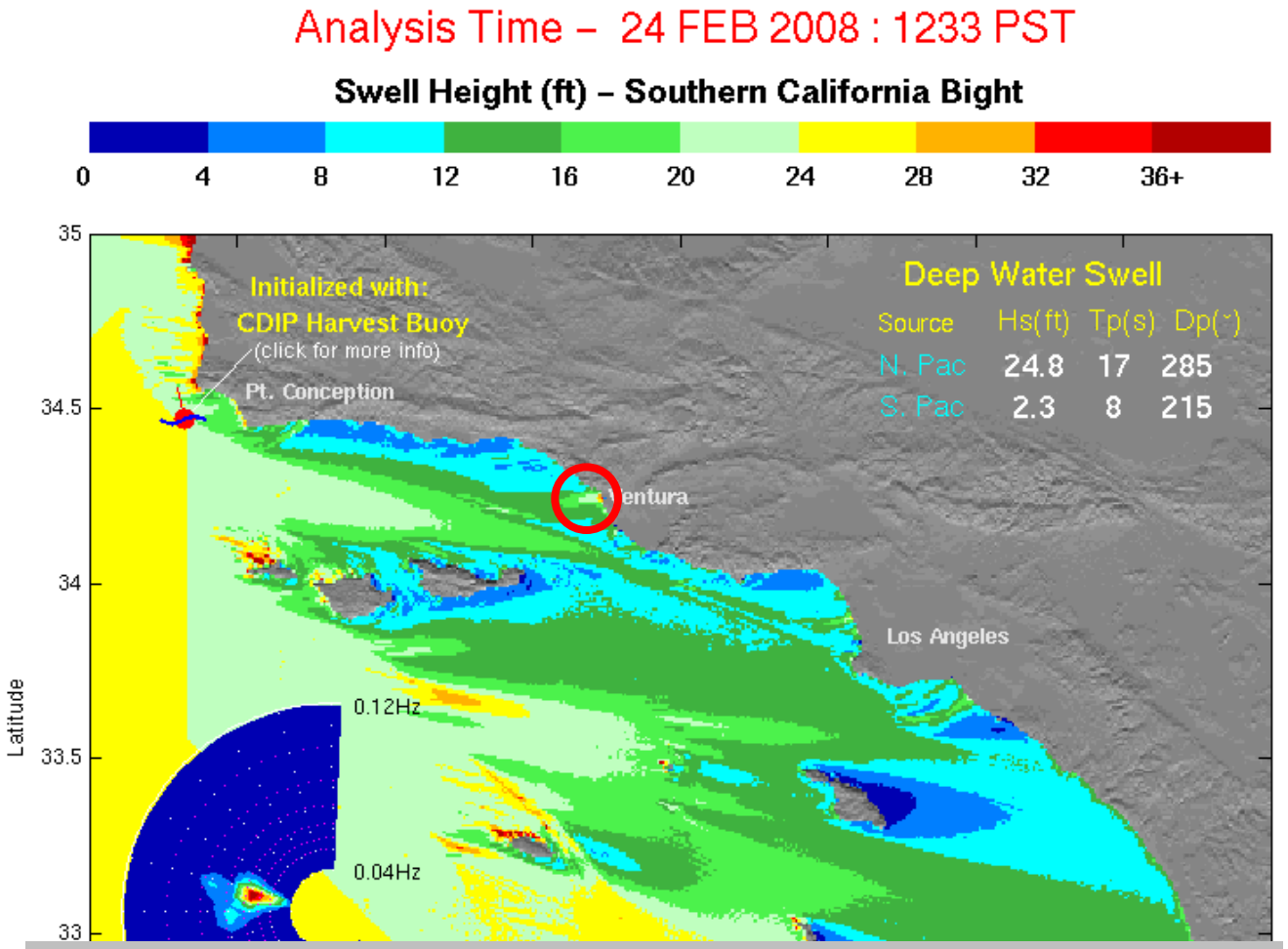
Transformed waves using proprietary CDIP model paid for by CA DBW and ACOE (*same model as right figure*)

Transformed waves that determine the preliminary BFE (1% annual chance TWL) used

20.7 feet at 14 seconds providing a maximum wave run up elevation of 20.1 feet using Stockdon

Uses a beach slope of .09 using slope of .10 yields run up of 21 feet.

Note: FEMA does not include dune erosion at the site or sea level rise



Since 2006, without transformations there have been 11 dates where offshore waves have been over 22 feet – averaging a 100 year event 1x per year for the last 11 years.

With focused transformations as seen above wave heights greater than 30'!

Preliminary COSMOS

- No long term dune erosion from sea leve
  - (only storm erosion from a single 100 year even
- Coastal flooding and shoreline evolution (COAST) not integrated
- COSMOS Coast assumes 1995 to 2011 training period is sufficient (accretion at site = 1.1681m = 3.8325 feet/year)
- Coastal flooding defined as 2min inundation duration NOT max run up as per FEMA guidelines.

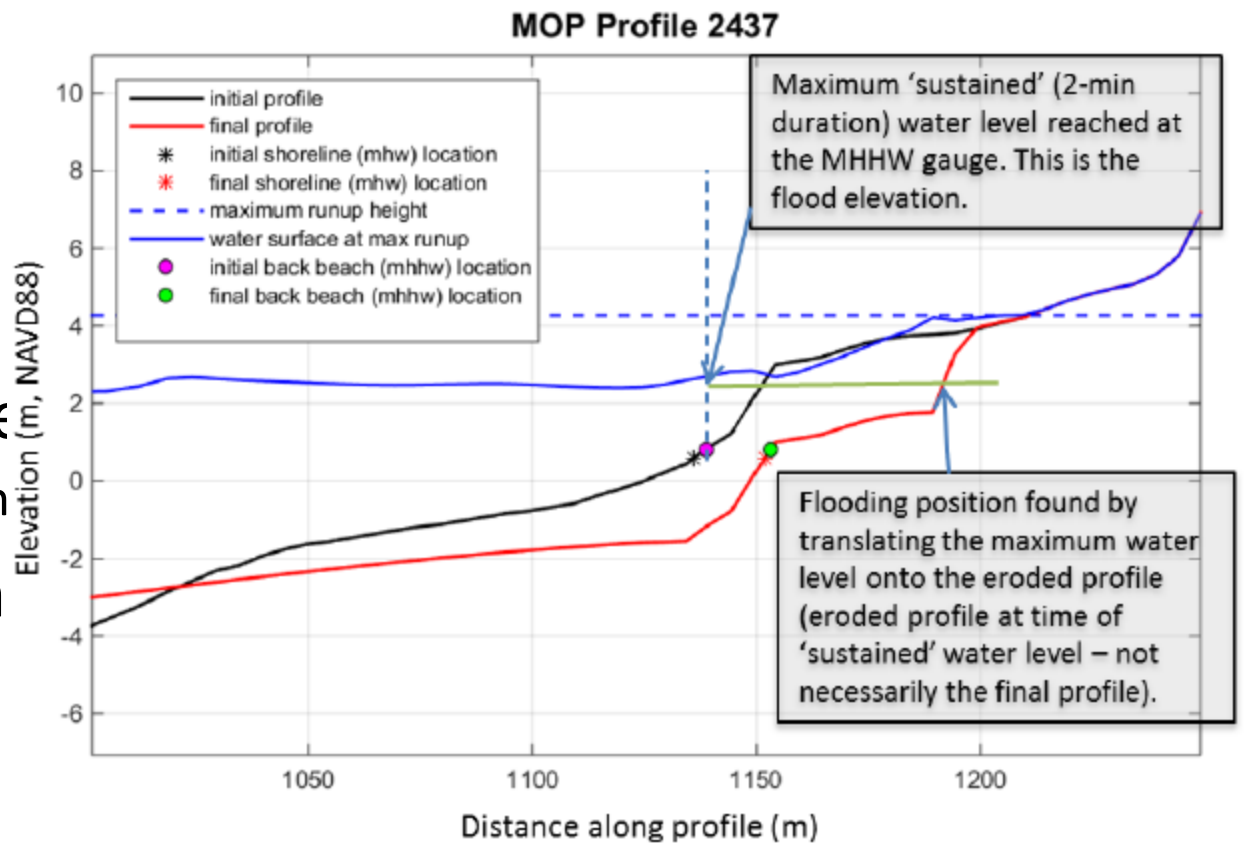


Illustration of method used to determine the flood extent at XBeach cross-shore profile models.

Difference in 2 minute inundation elevation versus maximum wave run up elevation in this example is ~6.6feet (~2m). A wave running up the beach 6 feet deep is capable of causing damage

Final COSMOS 3.0

1982-83 El Nino

Cosmos Flood Innundation - Baseline_100Y)
Cosmos Maximum Innundation - Baseline_100Y)
SPAWAR (Baseline_100Y)

0 0.175 0.35 0.7 Miles

Globe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coastal Resilience Ventura

- Shoreline change driven by 20 year buoy record appended as per Ruggiero et al 2011.
- SWAN wave transformation
- Stockdon wave run up formulation and converted to TWL exceedance curves to drive model, no time series dependence
- Long term recession of dune based on shoreface beach slope
- No sediment supply changes from dredging
- Includes long term shoreline change as a proxy for sediment budget
- Potential storm erosion calculated using modified Komar and Allen as per FEMA mapping guidelines using storm of unlimited duration.
- Assumes flooding occurs with storm of record 1983 event 25 feet 22 seconds
- Flooding integrated with long term erosion in 10 year time steps
- Model results peer reviewed by local experts and local jurisdictions as well as verified by available historical photos

Mandalay Combined Hazards 2060

The Nature Conservancy
Protecting nature. Preserving life.

Revell Coastal

- 25.3inches of sea level rise with coastal erosion and flooding
- 16.1inches of sea level rise with coastal erosion and flooding
- 7.4inches of sea level rise with coastal erosion and flooding

1:9,475

0 0.075 0.15 0.3 mi

0 0.125 0.25 0.5 km

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and

Hazard mapping from ESA PWA 2013

Summary

- City would like to acknowledge all models be considered
- A site specific assessment should be conducted by the applicant
- CEC should consider the regional community needs to respond to State guidance to avoid development in hazardous areas