Thinking Ahead:
Incorporating Climate Change into Aquatic Ecosystem Restoration Planning for the Ala Wai Watershed Project

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NCER

US Army Corps of Engineers
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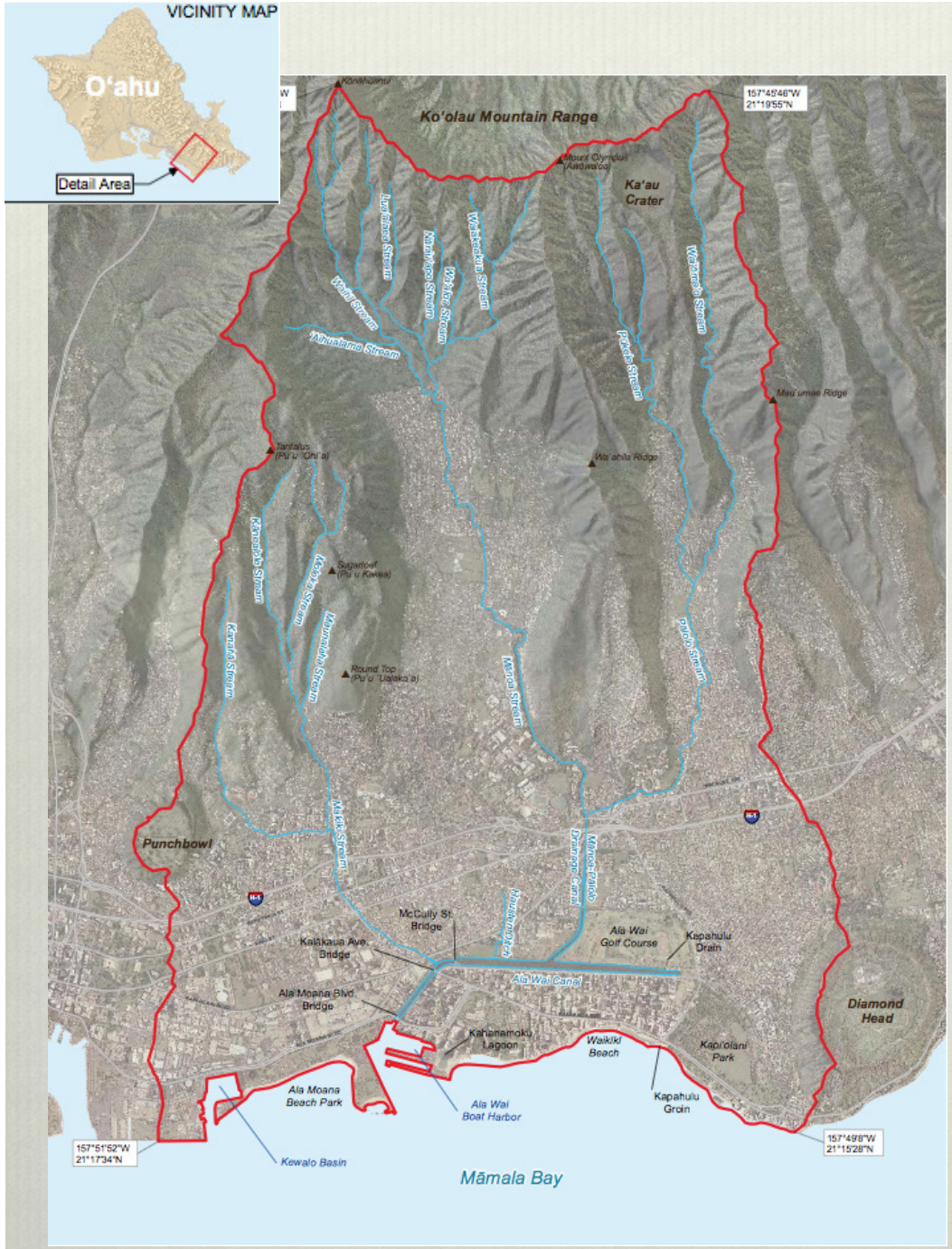
Outline

- Ala Wai Watershed Project Background
- Hawaii Climate Change Issues
- Climate Change Strategies For Ecosystem Restoration
- Application of Strategies to the Ala Wai Watershed



Ala Wai Watershed

Population:

- 160,000 residents
- 71,000 visitors/day

Size:

- 19 square miles
- Highest Point: 3100ft

Economic Base:

- 8% Gross State Product – $3.6B
- 11% Civilian Jobs in State
- 12% State & County Tax Revenue
- 1,600 businesses
- 38 Schools and 2 Universities

Streams & Waterways:

- 3 Perennial Streams & 2 Canals
- 1 Marine Protected Area
- Base flow: 8,000 cfs
- Flood Duration: 40-50 min








Problems

Potential Flood Damage:

- 3,000 properties within 100 yr floodplain
- $311 million in damages

Aquatic Ecosystem Degradation:

- Degraded stream habitat
- Increased sediment & erosion
- Invasive species
- Loss of 2,000 acres of coastal wetlands
- Degraded coral habitat

Water Quality: Impaired

- Trash
- Pesticides
- Nutrients

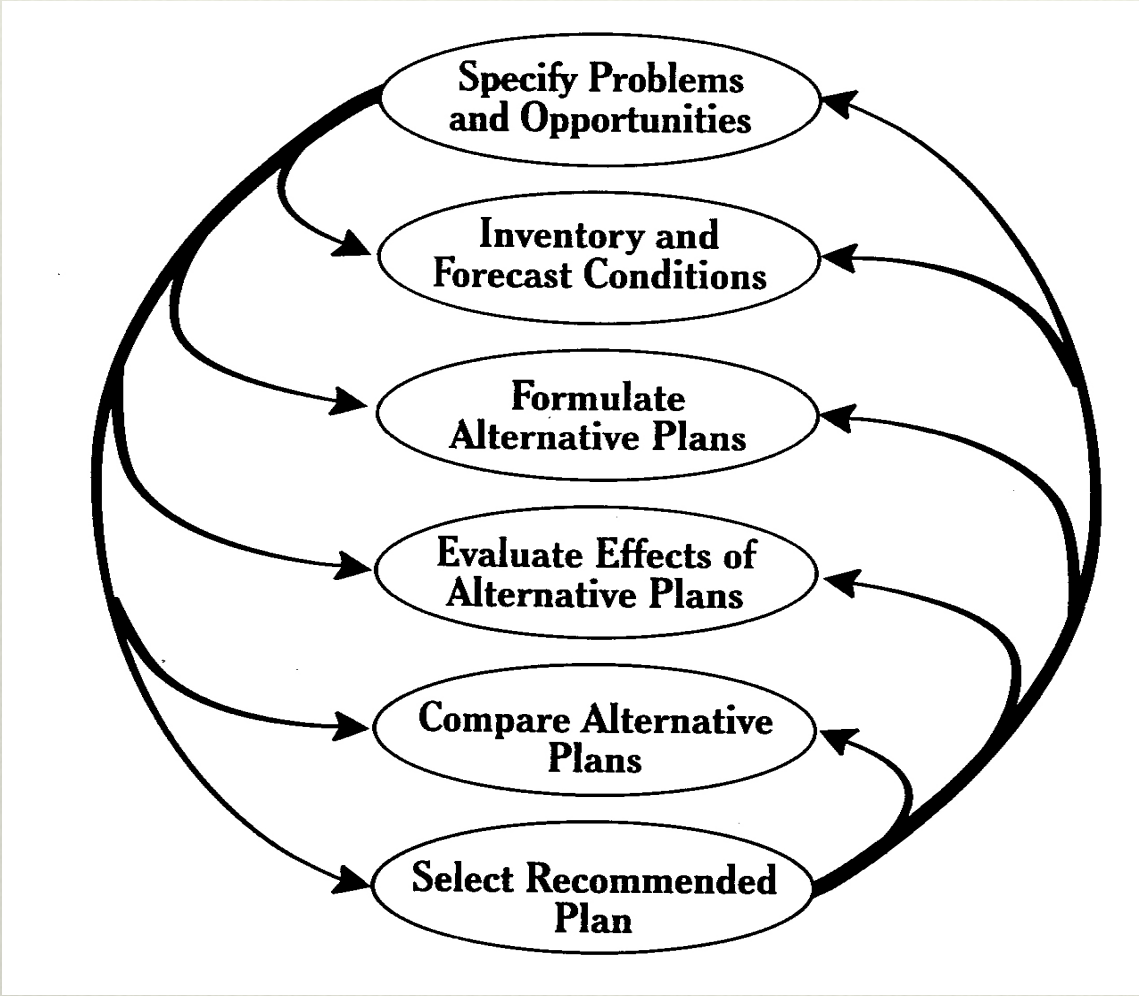
Ala Wai Project Goals & Objectives

Improve the overall quality of the Ala Wai watershed, from the crest of the Ko'olau Mountains to the nearshore waters, with a focus on reducing flood hazards and restoring aquatic ecosystem function.

- Flood Risk Management
- Aquatic Ecosystem Restoration
- Water Quality Improvement
- Maximize Recreational Opportunities
- Water Supply Enhancement

- Sponsors: USACE, State of Hawaii Department of Land & Natural Resources (DLNR), City & County of Honolulu Environmental Services (ENV).

Ala Wai Watershed Project Schedule



MILESTONES

◄ Project Initiation – June 2003

- Manoa Flood 2004
- Amendment 2006

◄Feasibility Scoping Meeting June 2011

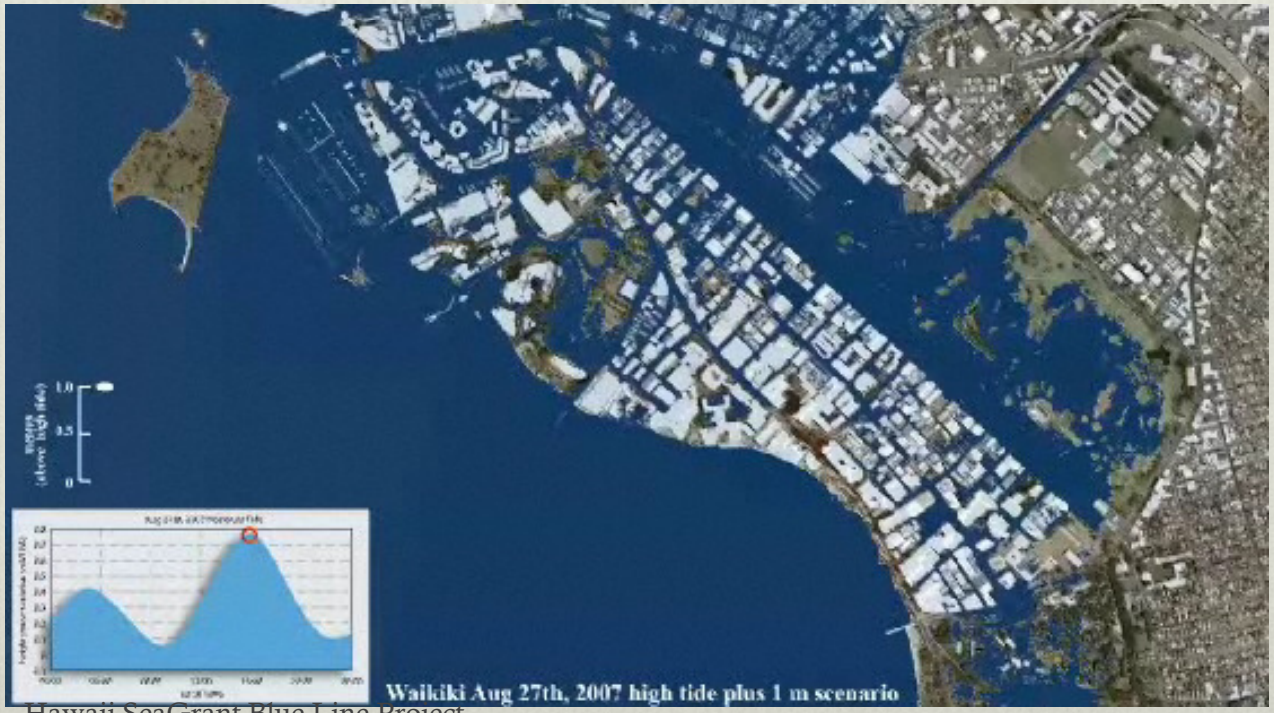
◄ Alternatives Formulation Briefing Report – Fall 2012

◄ Draft Feasibility Report & EIS Winter 2013

◄ Final Feasibility/ EIS – Fall 2013

Hawaii Climate Change Issues

- Sea Level Rise: 0.08-0.68m (0.5-1.4m in 2100)
- Amount of Rainfall: Decrease 5-10%
- Rainfall Frequency: 12% increase in heavy events, Decrease in light events
- Rainfall Intensity: 5% annual flood increase in intensity by 10-25%



Hawaii Climate Change Issues

- Groundwater: Decline in Groundwater Recharge
- Coral Reefs: 20% decrease due to bleaching and ocean acidification
- Species Diversity: Increase in Species Extinction (400 federally listed species)
- Unique Tropical Habitats: Decline due to very sensitive to changes in microclimates.
- Native Birds: Increase in Avian malaria, primary threat.
- Invasive Species: Expansion due to high tolerance for a wide range of climatic conditions


Amakihi (J. Jeffrey)


I'iwi (USFS)


Akepa (AAAS)

Hawaii Climate Change Issues

Kirbati Island (Greenpeace)

- Population: Increase from Climate Change Refugees
- Infrastructure: Increase coastal retreat will increase pressure on utilities, resources, pollution, waste disposal and housing.
- Food Security: Decrease in subsistence farming and fishing and increased dependence on imports and decreasing food security.
- Tourism: Increased hazard to tourism facilities from coastal erosion
- Water Supply: 34% increase in demand on Oahu

Climate Change Strategies Literature Review - Objective

- Identify methods to address climate change for watershed-based aquatic ecosystem restoration during the planning process.

Courtesy of hawaiipictures.com

Common Themes

- Understand the Local Impacts and Interactions.
- Acknowledge the Uncertainties.
- Let Go of the Past.
- Commit to the Long-Term
- Plan for Surprises – Adapt, Adapt, Adapt
- One Size Does Not Fit All

Understand Local Impacts & Interactions

- Not Just Temperature/Hydrology
- Impact changes to…
  - Growing seasons
  - Shifts in habitat
  - Water quality
  - Habitat connectivity
  - Species tolerance and adaptability
  - Human population impacts

HawaiianTrails.net

Ala Wai Watershed Application:

- Expert panels help develop local scenarios
- Incorporating new information/research from Statewide

Acknowledge the Uncertainties

- Uncertainty in Present Day & Future Species Distributions.
- Model Multiple Scenarios.
- *Be Conservative with High Risk Approaches. Be Liberal with Low Risk/No Harm Approaches* – M.A. Palmer. 2008.
- *Developing a culture that rewards risk taking would enhance the speed of adaptation to climate change challenges*. – B. Griffith, 2009.

Ala Wai Watershed Application

- Communicate Risk & Uncertainty of Management Measures
- Leaning on State of Hawaii CZM/Seagrant Climate Change Communication Initiatives

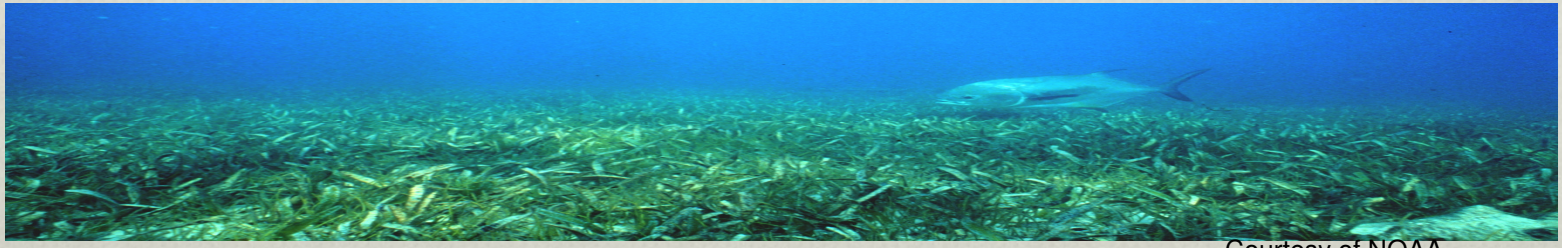
Let Go of the Past

- Stochastic Planning for Process and Function Needed.
  - Designing to Historic Conditions not possible.
  - Designing to Reference Sites may be too Static.

- *Ecological restoration can be viewed as an attempt to shift ecosystem composition, structure, and function to within a range that is more desirable than current conditions*. – M.A. Palmer. 2009

Ala Wai Watershed Application:

- Focus on replacing lost functions.
- Developed watershed limits flexibility for shifting habitats



Courtesy of NOAA

Commit to the Long Term

- Monitoring time-frame in decades.
- Apply a scientific method with consistent standards.
- Monitoring for the full array of climate consideration.
- *With the constantly changing conditions brought about by global climate change, the definition of ecosystem preservation must have a significantly enhanced conception of time dimension*. - K. Frederick, et al. 1997.

Ala Wai Watershed Application

- No strong champion for long term monitoring.
- Facilitating potential collaboration with UH Center for Conservation Biology.

One Size Does Not Fit All

- Multiple Interactions need Multiple Approaches
- Strategies (P. Halpin 1997)
  - Redundancy
  - Habitat Diversity
  - Buffer Zone Flexibility
  - Landscape Connectivity
  - Habitat Maintenance
  - Adaptive Management

Courtesy of NRCS

Ala Wai Watershed Application:

- Multiple approaches for redundancy and connectivity proposed.
- Diversity of habitat and buffer flexibility constrained by development

Plan For Surprises- Adapt, Adapt, Adapt

- Experimental Field Testing.
- Flexibility in Design.
- Structural Solutions as a Last Resort - Inflexible.
- Consider Artificial Supplementation when Necessary.
- Integrate Scientific Research into Planning Process.
- Interdisciplinary Approaches Necessary.

Ala Wai Watershed Application:

- Phased construction to allow for adaptation.
- Altered watershed will require structural solutions.
- Engaging University to champion research.

TNC – Washington State Program
Lessons from Business

- Component Redundancy
  - Boeing – Multiple Engines
  - TNC – Multiple Similar Habitats

- Functional Redundancy
  - Microsoft – Several Options to Open a File
  - TNC – Several Species to Provide Same Function

- Increased Connectivity
  - Starbucks – Coffee at Every Corner
  - TNC – Functional Corridors

Photo Courtesy of Robert Barger