

# HAWAII REGIONAL SEDIMENT MANAGEMENT

KAUAI  
Workshop  
January 20, 2011

Kauai Veteran's Center  
Kihei, HI



US Army Corps  
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State of Hawaii Department of Land and Natural Resources

US Army Corps of Engineers, Honolulu District





# AGENDA

1300 - 1310	Welcome and Introductions	Conger Conant
1310 - 1330	Regional Sediment Management Overview	Smith
1330 - 1500	Kauai RSM	
	Waves Climate	Podoski
	Shoreline Change	Miller-Owens
	Offshore Sand Sources	Miller-Owens
	Region Sediment Budget	Sloop
	Regional Sediment Management Plan	Sloop
1500 - 1515	Break	
1515 - 1615	Poipu Region: Potential RSM Projects	Sloop
	Federal Perspective	Smith
	State Perspective	Conger
	General Discussion	All
1615 - 1630	Break	
1630 - 1725	Kekaha Region: Potential RSM Projects	Sloop
	Federal Perspective	Podoski
	State Perspective	Conger
	General Discussion	All
1725 - 1730	Wrap-up and Adjourn	Conger Conant

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# REGIONAL SEDIMENT MANAGEMENT OVERVIEW

Thomas D. Smith, P.E.  
Honolulu District



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# NATIONAL REGIONAL SEDIMENT MANAGEMENT PROGRAM



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# REGIONAL SEDIMENT MANAGEMENT

An integrated approach that takes a holistic view of coastal, estuary, and river sediments on a regional scale in the planning and maintenance of water resource projects to achieve balanced and sustainable systems.



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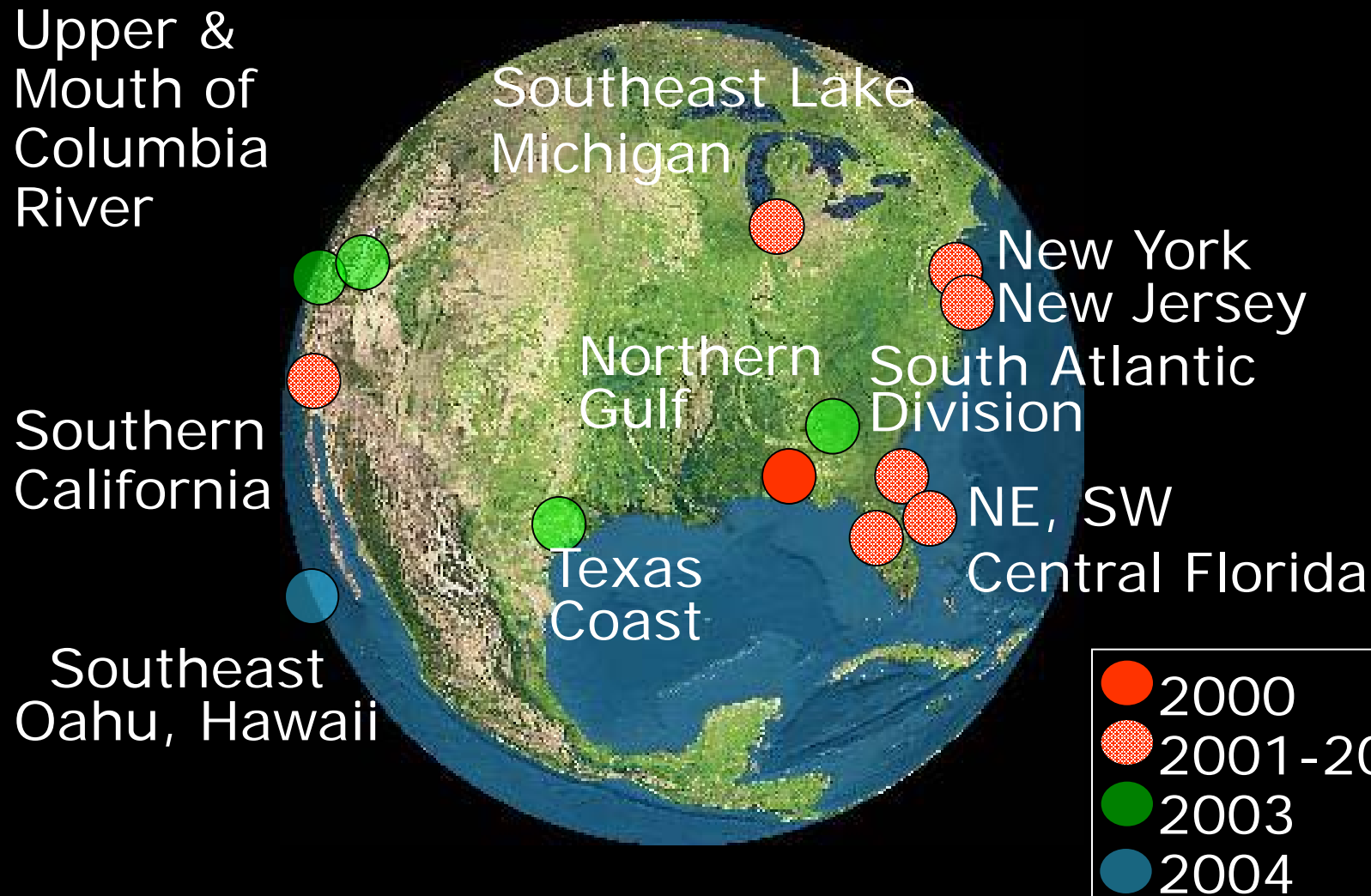
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# NATIONAL RSM PROGRAM





# SOUTHEAST OAHU RSM

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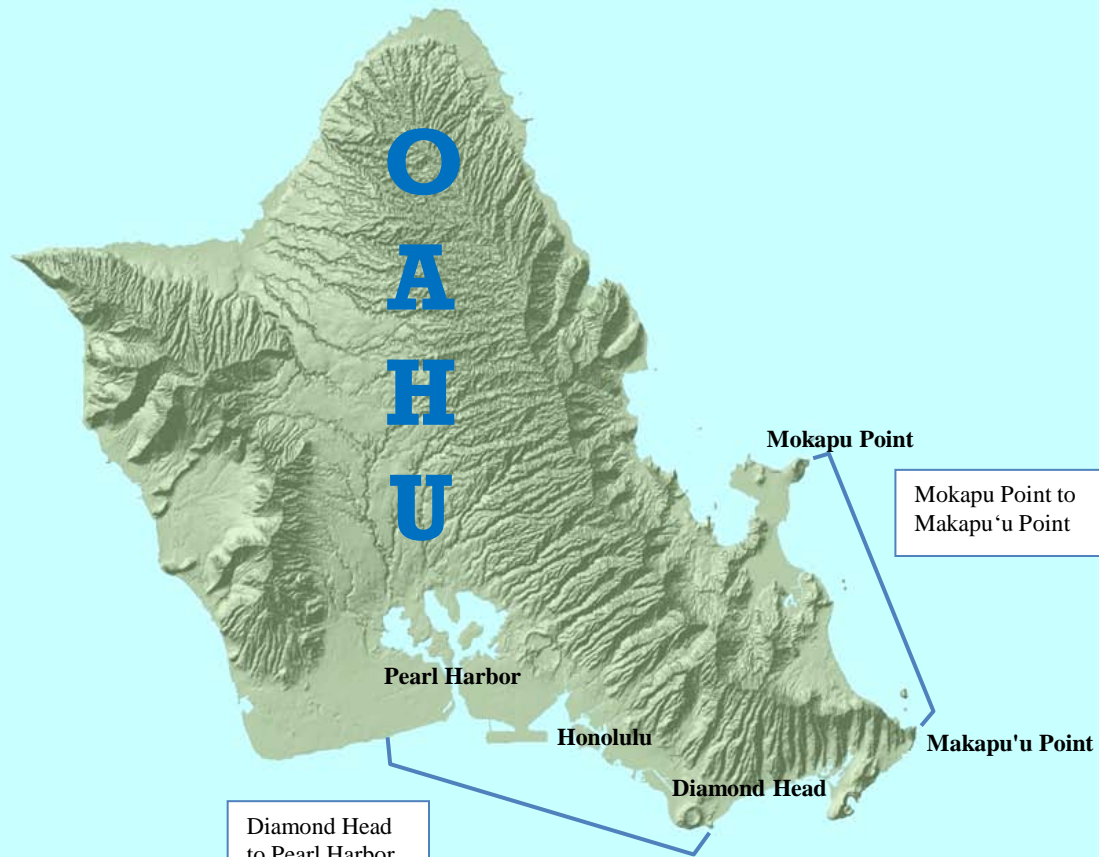
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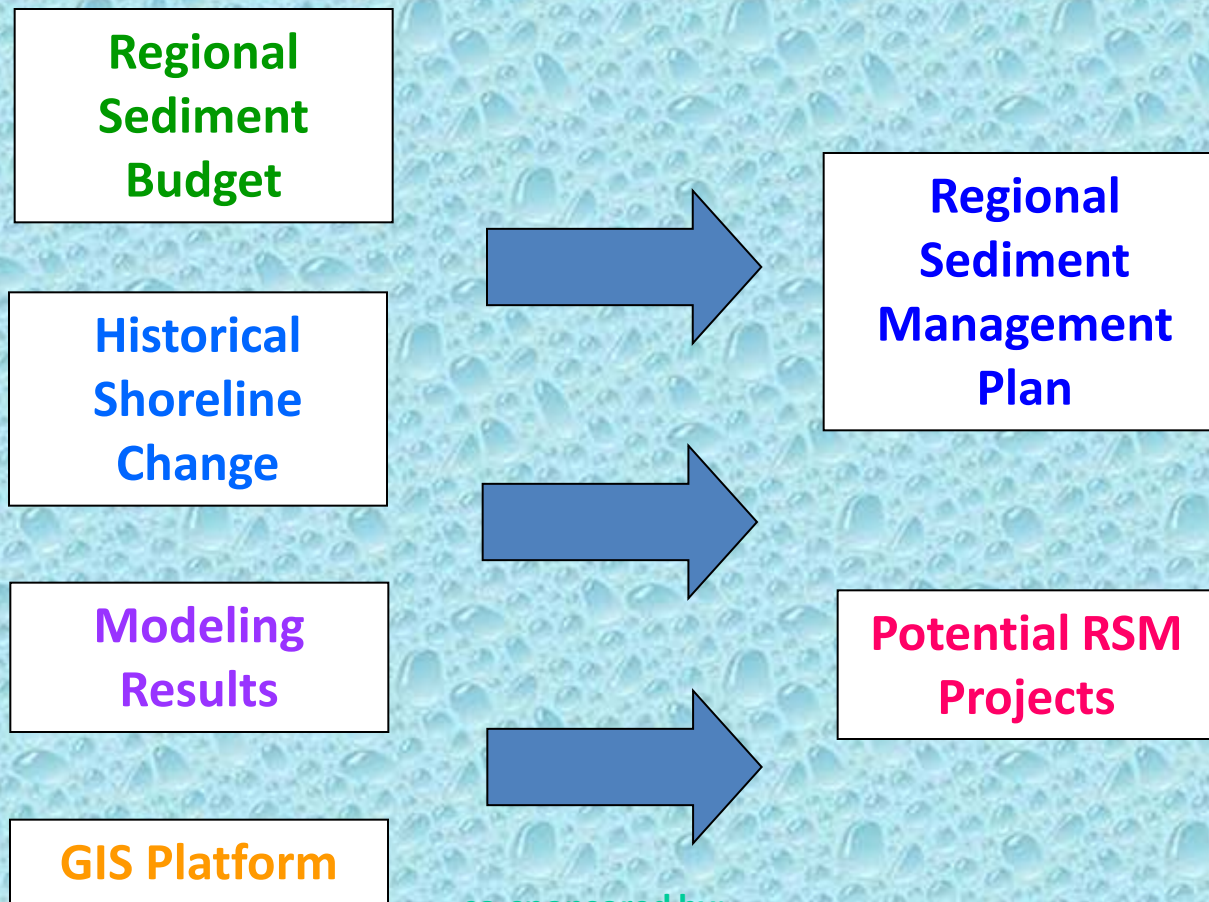


# SOUTHEAST OAHU RSM REGIONS





# FINAL PRODUCTS



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# MOKAPU POINT TO MAKAPUU POINT

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# Southeast Oahu

## RSM

- **Location:** Mokapu Point to the north through Makapuu Point to the south.
- **Purpose:** Optimize use of sediment resources.
- **Issues:**
  - Complex sediment transport pathways.
  - Large percentage of critically eroded shorelines.
  - Large percentage of armored shorelines.
  - Economical sand sources yet to be identified.
- **Goal:** Increase understanding of littoral processes with the goal of preserving and restoring beaches in the region with potential application elsewhere.



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# MAKAPUU BEACH



September 2005



January 2008



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# OFFSHORE SAND SOURCE INVESTIGATION

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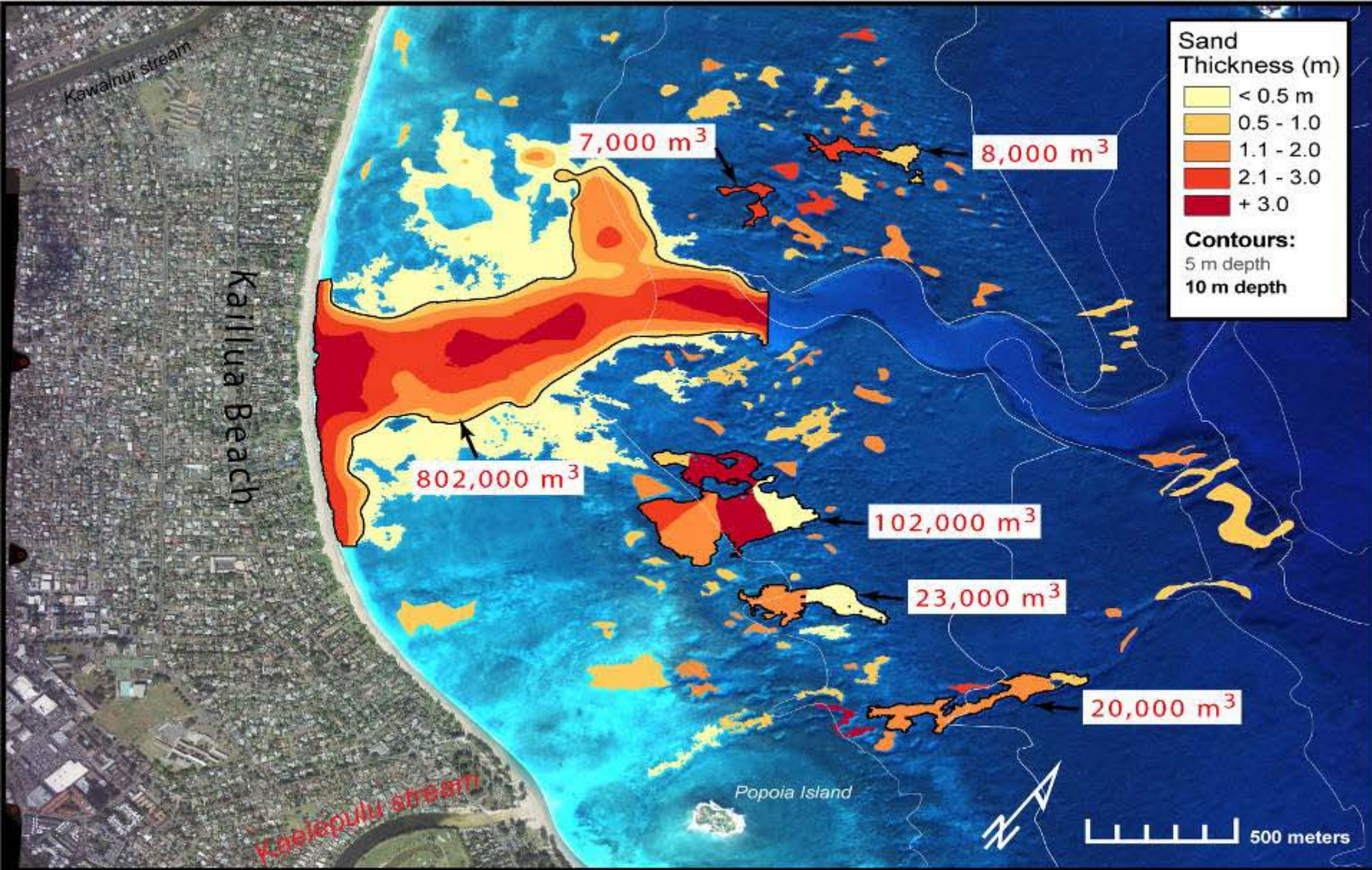
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# KAILUA BAY



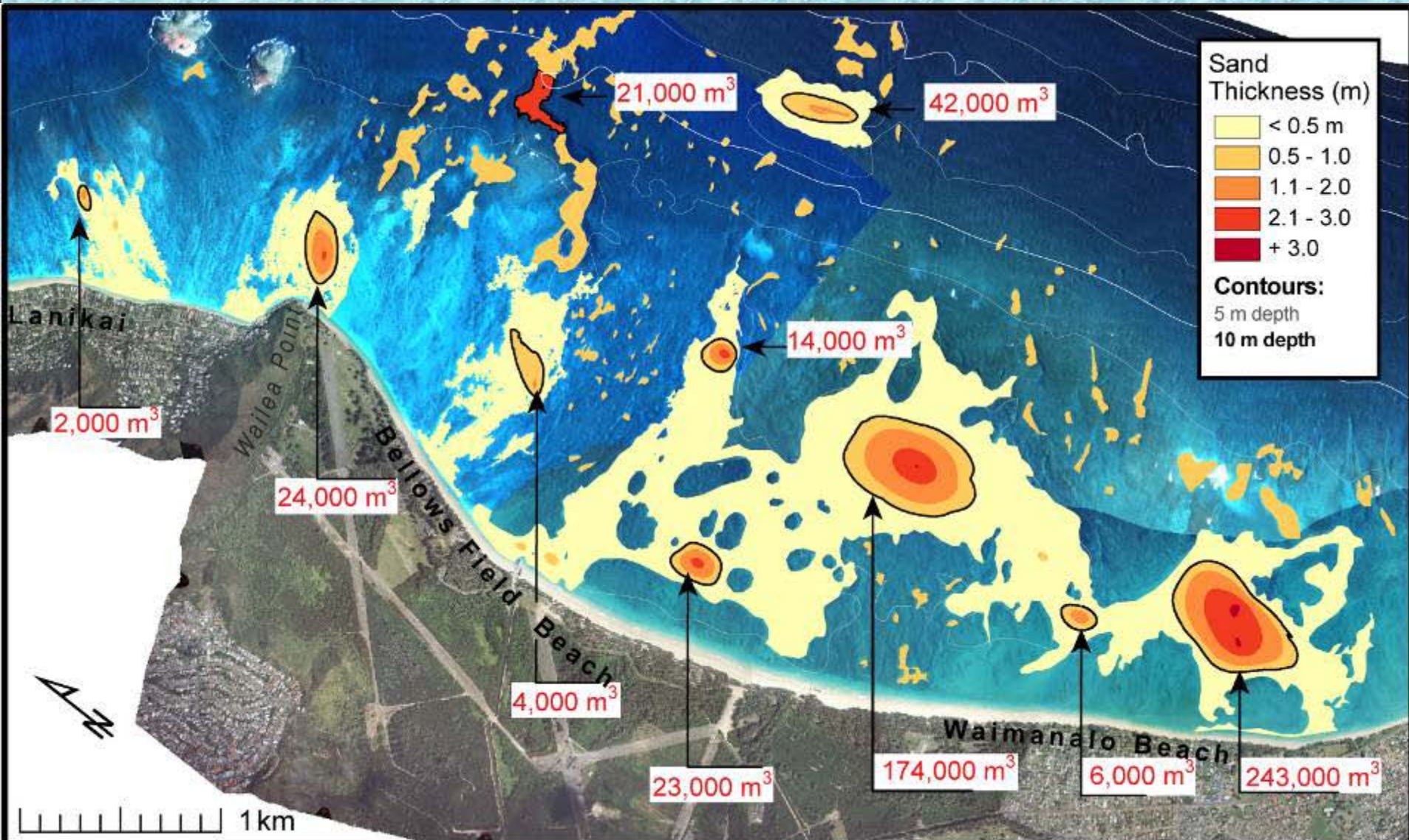




# OFFSHORE SAND



## NORTH BELLOWS & SOUTH LANIKAI





# WAILEA POINT SEDIMENT TREND ANALYSIS

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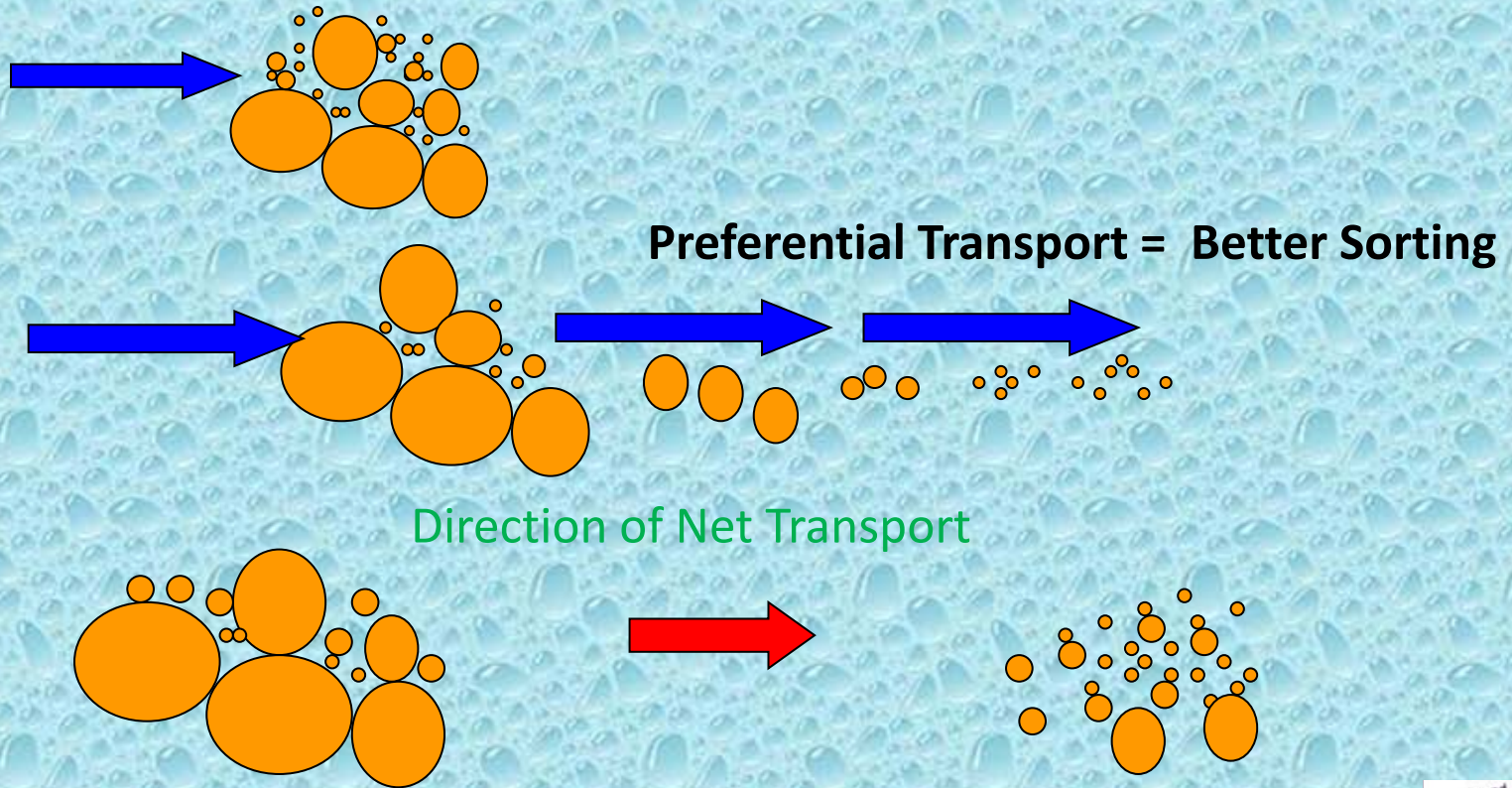




# WAILEA POINT S.T.A. ANALYSIS



Sediment becomes better sorted in the direction of transport.



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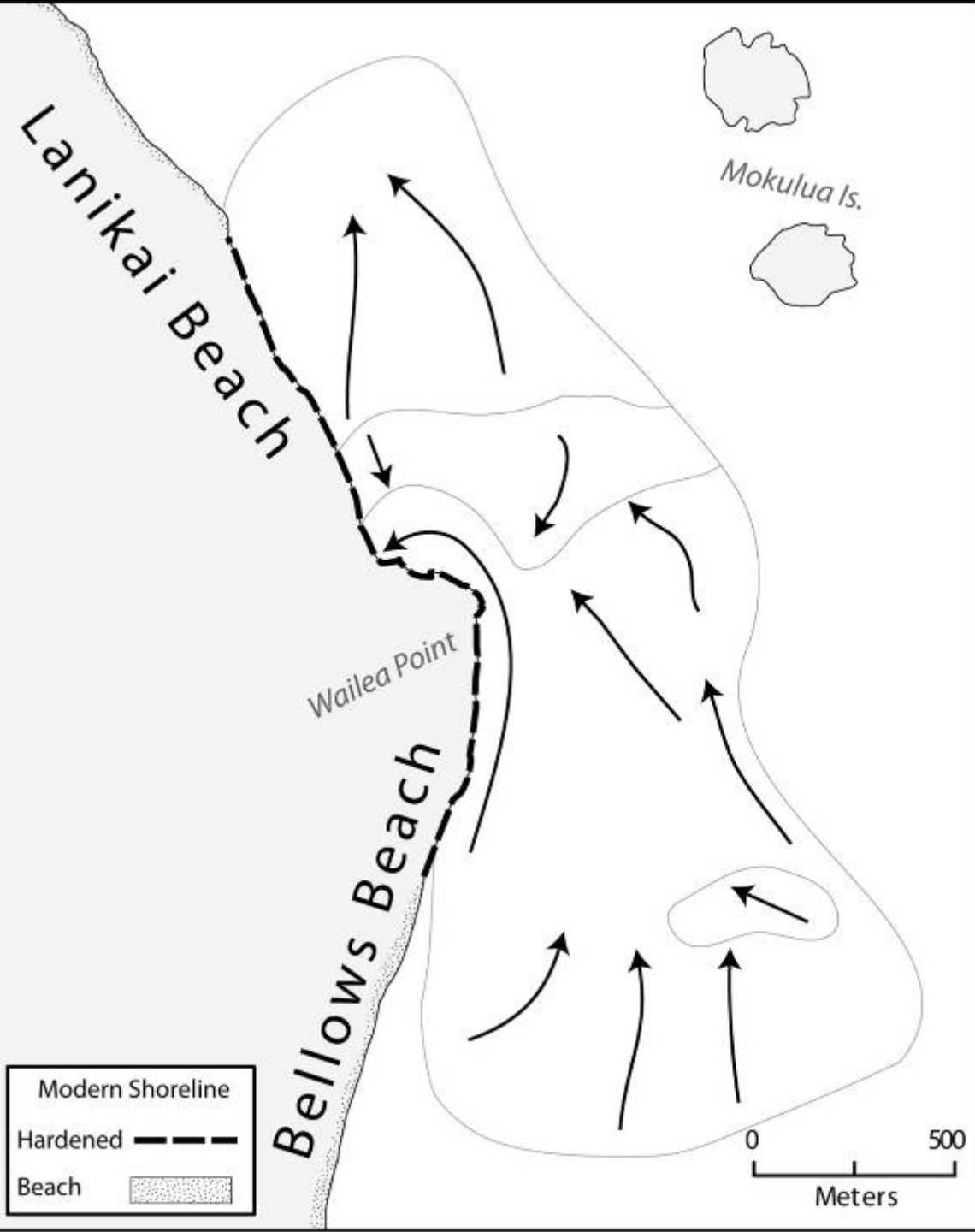
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# Gao-Collins Method Results

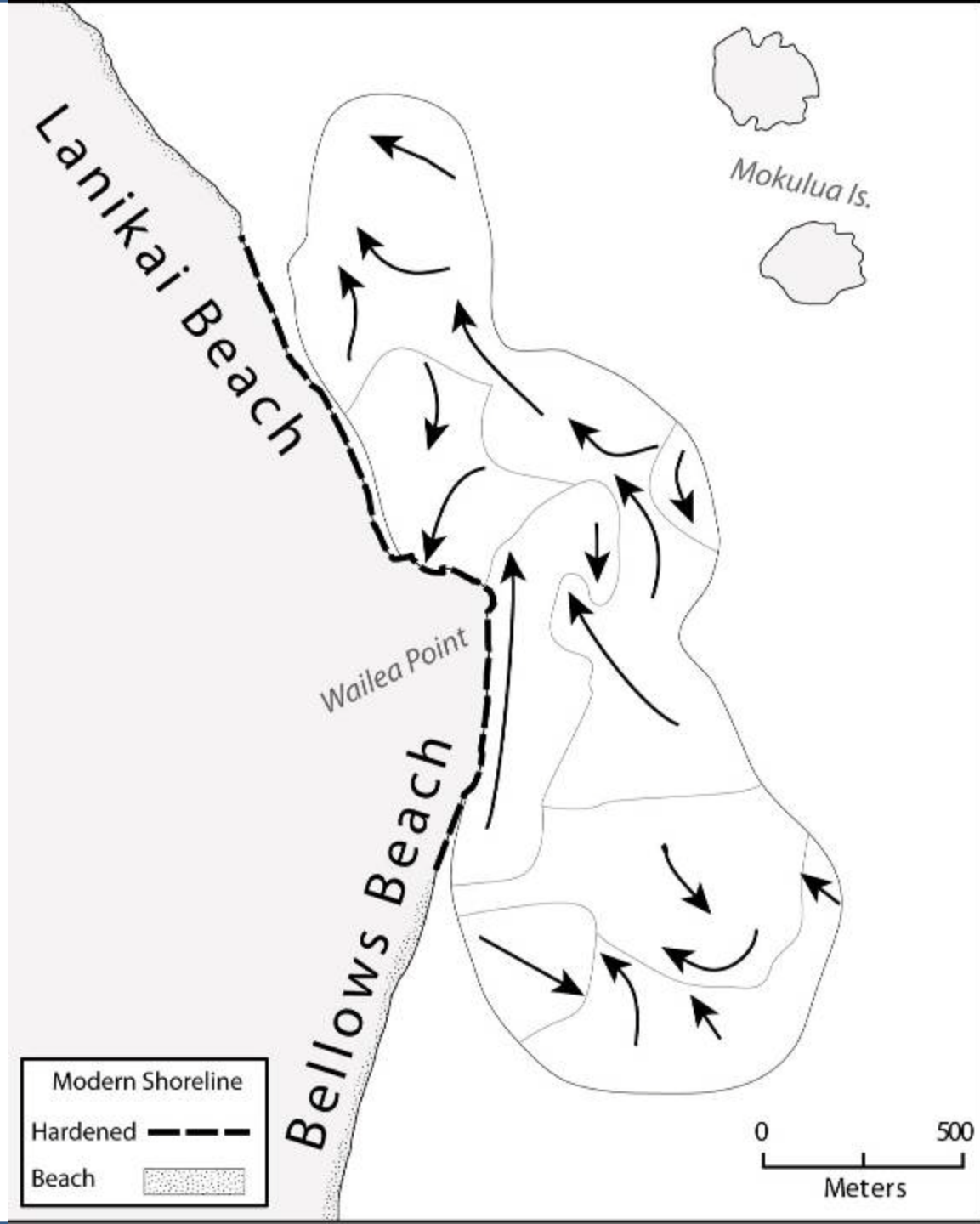
Gao and Collins  
(1992)





# Roux Method Results

Roux (1994)

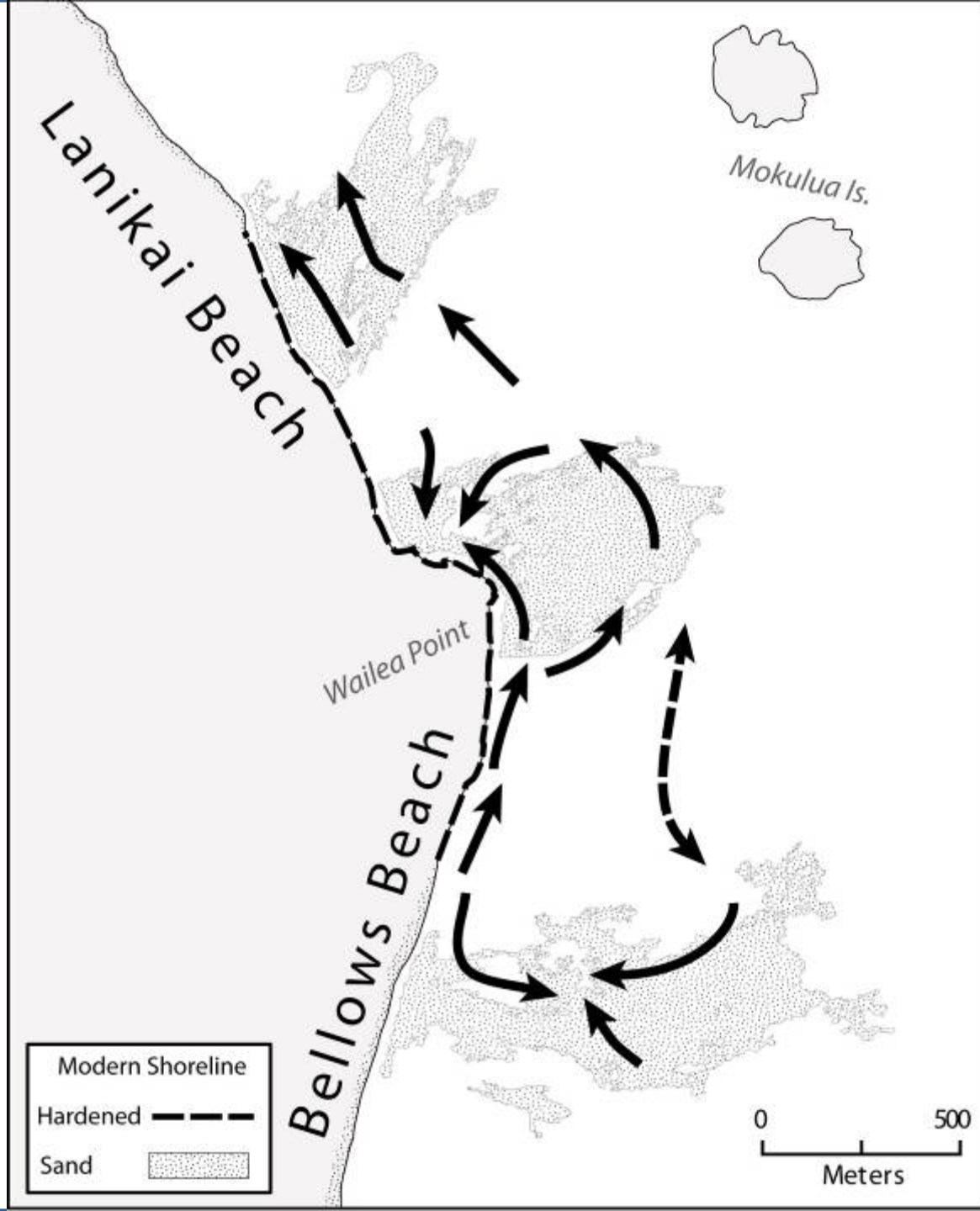




## Combine Results

Northward transport

Indicates Lanikai has historically received sand from Bellows Beach.







# WAILEA POINT S.T.A. ANALYSIS



## METHODOLOGY

Historical Analysis

DELPH3D Modeling

Sediment Trend Analysis

## RESULTS

1950s: Bellows acts as a source for accretion in South Lanikai

1970s: Revetments stabilize Bellows → South Lanikai erodes

1970-Present: Lanikai net transport to north without replenishment



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# REGIONAL SEDIMENT BUDGET



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# Waimanalo, Oahu, Hawaii

634400m E 157°42'10" W  
 UTM coordinates  
 2360700m N 157°42'10" W  
 Latitude/Longitude coordinates



Bellows Field Beach Park



## AREA DESCRIPTION

Waimanalo Beach is located on the southeast shore of Oahu. The study area (transects 236 - 378) extends 1.7 miles from Bellows Field Beach Park in the north to Kaiyona Beach Park in the south. The coast in this area is exposed to consistent easterly tradewind waves and large seasonal swell during the winter months. The inner shelf and shoreline are protected from large, long period swell by the fringing reef.

Overall, Waimanalo Beach is accreting or stable, with an average rate  $0.12 \pm 0.18$  ft/yr. Previous studies (Hwang, 1981 and Sea Engineering, 1988) accretion in the north of Waimanalo Beach and erosion in much of the south.

For more information see: <http://www.soest.hawaii.edu/asp/coasts/oaahu/index.asp>

Hwang, D., 1981, Beach Changes on Oahu as Revealed by Aerial Photographs, State of Hawaii, Department of Planning and Economic Development, Urban and Regional Planning Program.

Sea Engineering, 1988, Oahu Shoreline Study Part 1 Data on Beach Changes. Prepared for City and County of Honolulu.

Shoreline Change Rate (ft/yr)

## SHORELINE CHANGE RATES

- Accretion Rate
- Erosion Rate

Historical shoreline positions are measured every 66 ft along the shoreline. These sites are denoted by yellow shore-perpendicular transects. Changes in the position of the shorelines through time are used to calculate shoreline change rates (ft/yr) at each transect location.

Annual shoreline change rates are shown on the shore-parallel graph. Red bars on the graph indicate a trend of beach erosion, while blue bars indicate a trend of accretion. Approximately every fifth transect and bar of the graph is numbered. Where necessary, transects have been purposely deleted to maintain consistent along-shore spacing. As a result transect numbering is not consecutive everywhere.

The EX method is used to calculate shoreline change rates for the study area. The rates are smoothed along shore using a 1-3-5-3-1 technique to normalize rate differences on adjacent transects. For more information on erosion rate methods and results see: <http://www.soest.hawaii.edu/asp/coasts/oaahu/index.asp>

## HISTORICAL SHORELINES

- 1911 T-sheet
- 1927
- 1928 T-sheet
- Nov 1949
- Jul 1951
- Nov 1962
- May 1963
- Feb 1967
- Apr 1975
- Feb 1988
- Aug 1996
- Dec 2005
- Erosion rate measurement locations (shore normal transects)

Historical beach positions, color coded by year, are determined using orthorectified and georeferenced aerial photographs and National Ocean Survey (NOS) topographic survey charts. The low water mark is used as the historical shoreline, or shoreline change reference feature (SCRF).

Movement of the SCRF along shore-normal transects (spaced every 66 ft) is used to calculate erosion rates.

Waimanalo Bay Beach Park

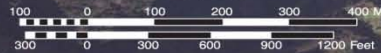
Kaliyona Highway

Kaliyona Beach Park

Oahu

Waimanalo

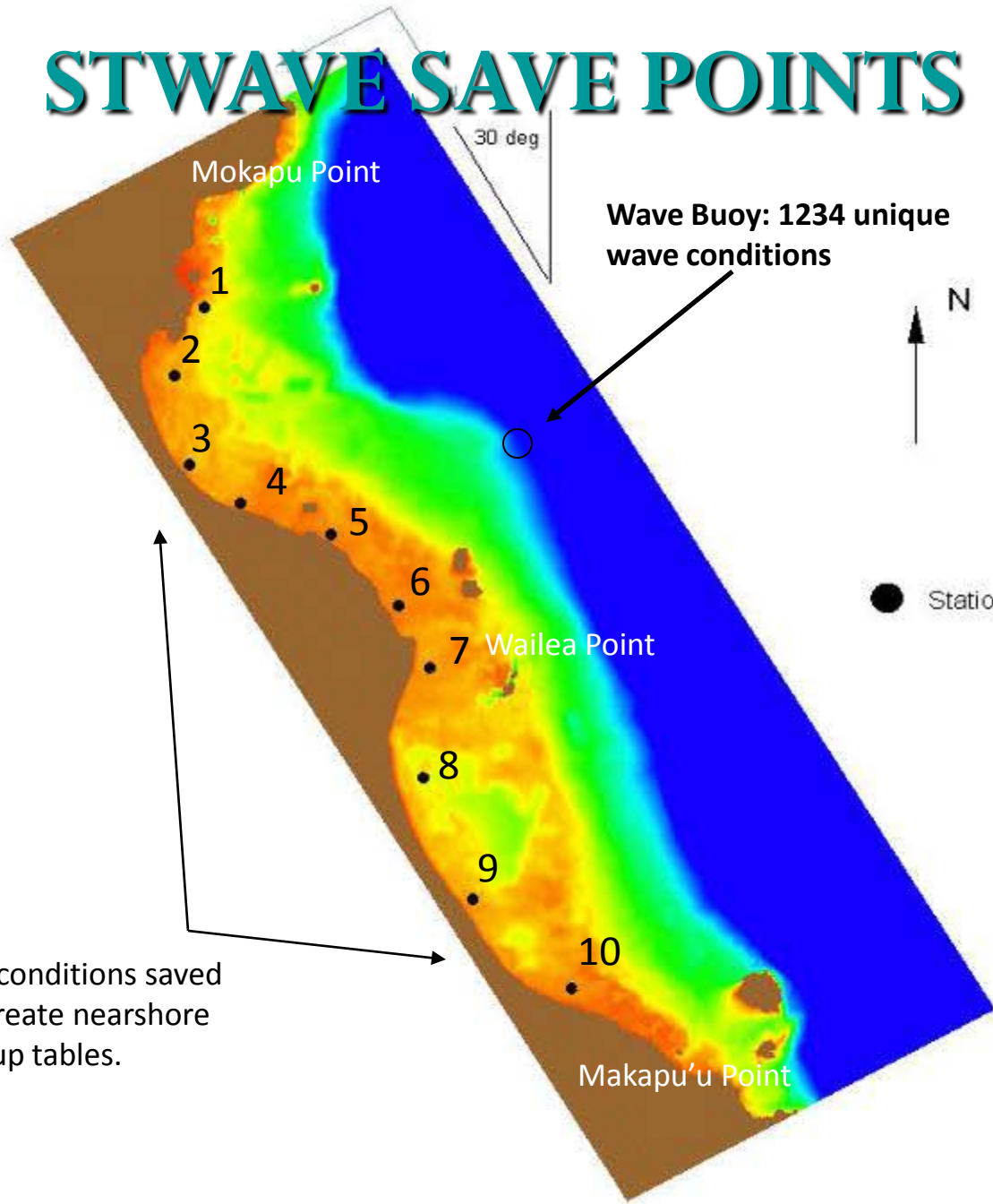
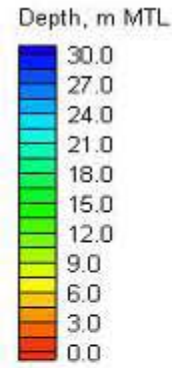
Scale 1:3000



Charles Fletcher, Bradley Romine, Matthew Barboe, Siang-Chyn Lim, Amanda Vinson  
 University of Hawaii Coastal Geology Group  
 School of Ocean and Earth Science and Technology  
 1680 East West Rd., Honolulu, HI 96822, U.S.A.  
<http://www.soest.hawaii.edu/asp/coasts/oaahu/>



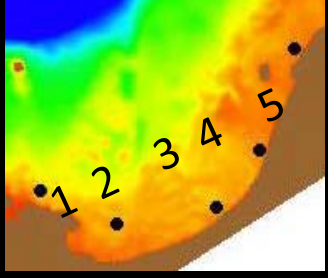
# STWAVE SAVE POINTS



1234 nearshore conditions saved at 10 points to create nearshore time series lookup tables.



# Kailua Bay, Oahu, Hawaii Smoothed Rates

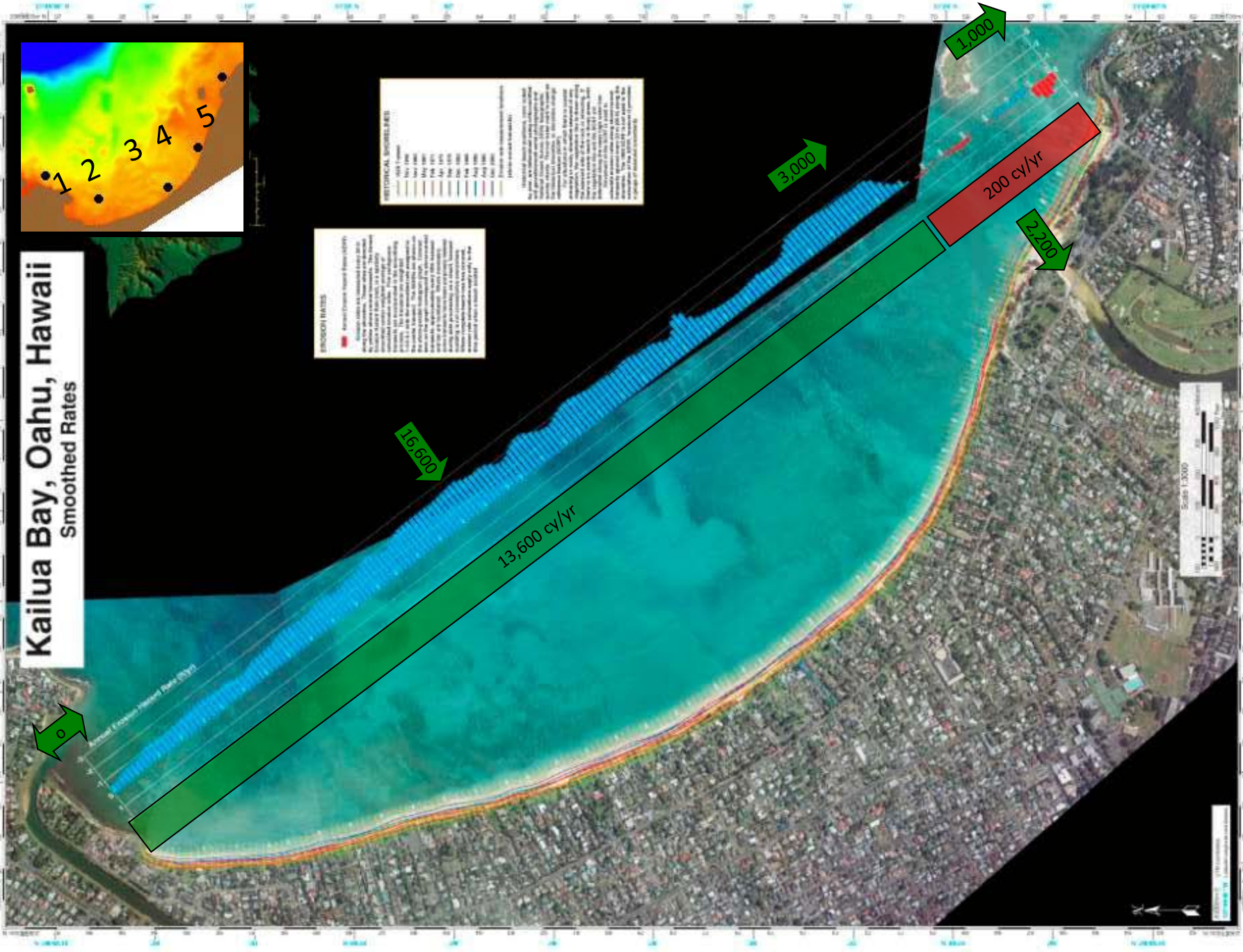


**SMOOTHED RATES**

Recent research reports from various sources indicate that the amount of sediment entering the ocean from the Kailua Bay watershed is significantly higher than the amount of sediment that is currently being removed from the bay. This is due to a combination of factors, including increased urbanization, deforestation, and erosion. The amount of sediment entering the bay is estimated to be between 10,000 and 15,000 cubic yards per year, while the amount being removed is estimated to be between 2,000 and 3,000 cubic yards per year. This results in a net accumulation of sediment in the bay, which can lead to increased turbidity, reduced water quality, and potential impacts on marine life.

**HYDROLOGICAL SURVEILANCE**

May 1988  
 May 1989  
 May 1990  
 May 1991  
 May 1992  
 May 1993  
 May 1994  
 May 1995  
 May 1996  
 May 1997  
 May 1998  
 May 1999  
 May 2000  
 May 2001  
 May 2002  
 May 2003  
 May 2004  
 May 2005  
 May 2006  
 May 2007  
 May 2008  
 May 2009  
 May 2010  
 May 2011  
 May 2012  
 May 2013  
 May 2014  
 May 2015  
 May 2016  
 May 2017  
 May 2018  
 May 2019  
 May 2020  
 May 2021  
 May 2022



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# Lanikai, Oahu, Hawaii

## Smoothed Erosion Rates

**EROSION RATES**

**Accretion:**

- Blue line: Annual Erosion Hazard Rates (AEHR)

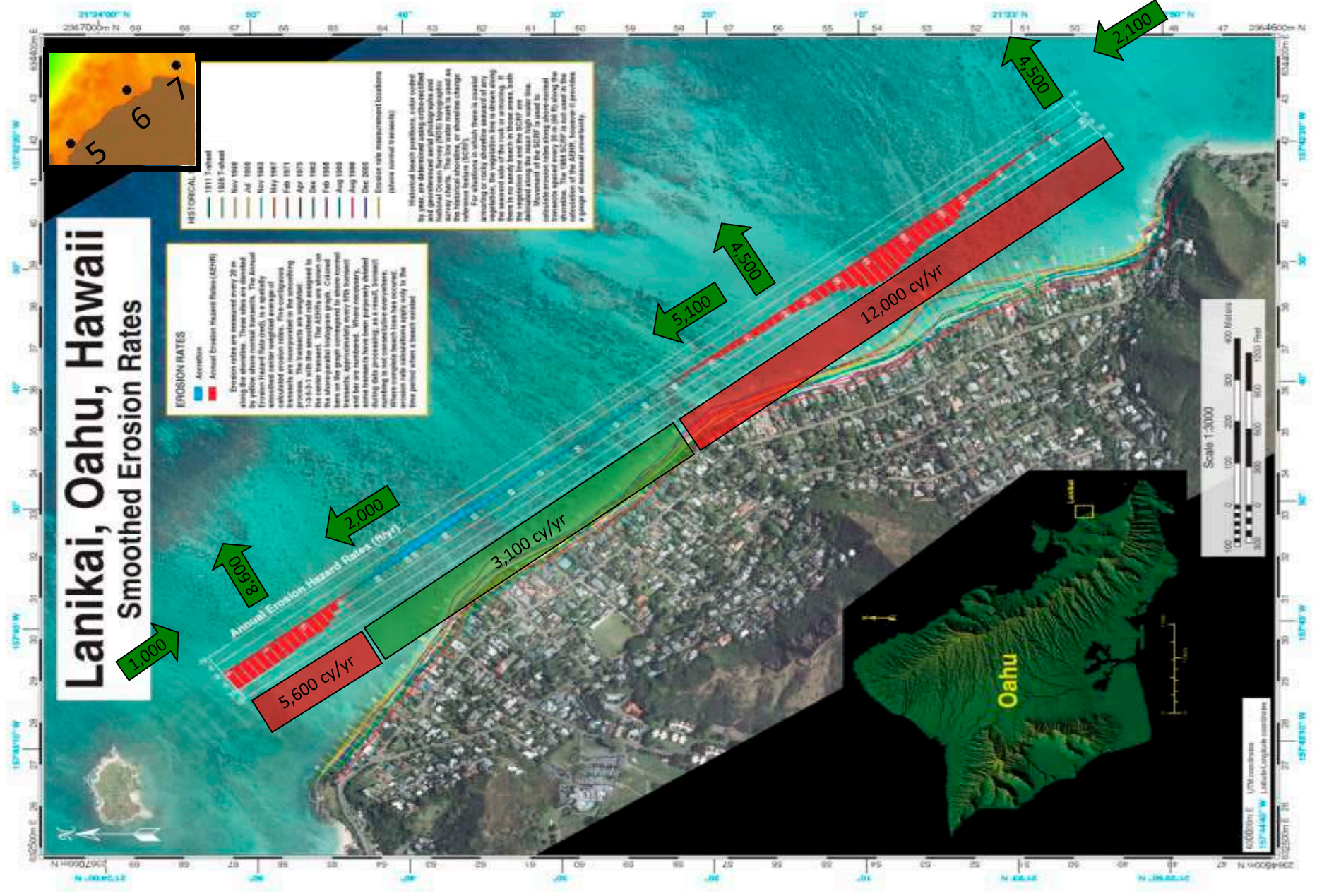
Erosion rates are measured every 20 m along the shoreline. Three sites are labeled: Erosion Hazard Rate (red), Annual Erosion Hazard Rate (red), and Annual Erosion Hazard Rate (red). It is a standard weighted average of calculated erosion rates. Five contributing basins are incorporated in the smoothing process. The basins are weighted by the area of the basin. The AEHRs are shown on the map in the background. Colored lines on the graph correspond to erosion rates basins, approximately every 100 m. The AEHRs are shown on the map in the background. Colored lines on the graph correspond to erosion rates basins, approximately every 100 m. The AEHRs are shown on the map in the background. Colored lines on the graph correspond to erosion rates basins, approximately every 100 m.

**HISTORICAL**

- 1911: Forest
- 1928: Forest
- 1949: Forest
- 1960: Forest
- 1963: Forest
- 1967: Forest
- 1971: Forest
- 1980: Forest
- 1982: Forest
- 1986: Forest
- 1989: Forest
- 1998: Forest
- 2000: Forest

Erosion rate measurement locations (blue normal brackets)

Historical beach profiles, their extent by year, and the location of the National Ocean Survey (NOS) hydrographic survey charts. The low water mark is same as the 1989 NOS chart. The 1989 NOS chart is the same as the 1989 NOS chart. The 1989 NOS chart is the same as the 1989 NOS chart.



Scale 1:3,000

0 100 200 300 400 Meters

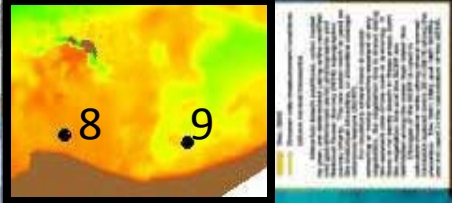
0 100 200 300 400 500 600 700 800 900 1000 Feet

620000m E UTM coordinates  
157°44'45" W Lanikai Longitude coordinate  
19°42'20" N UTM coordinates  
157°44'45" W Lanikai Longitude coordinate

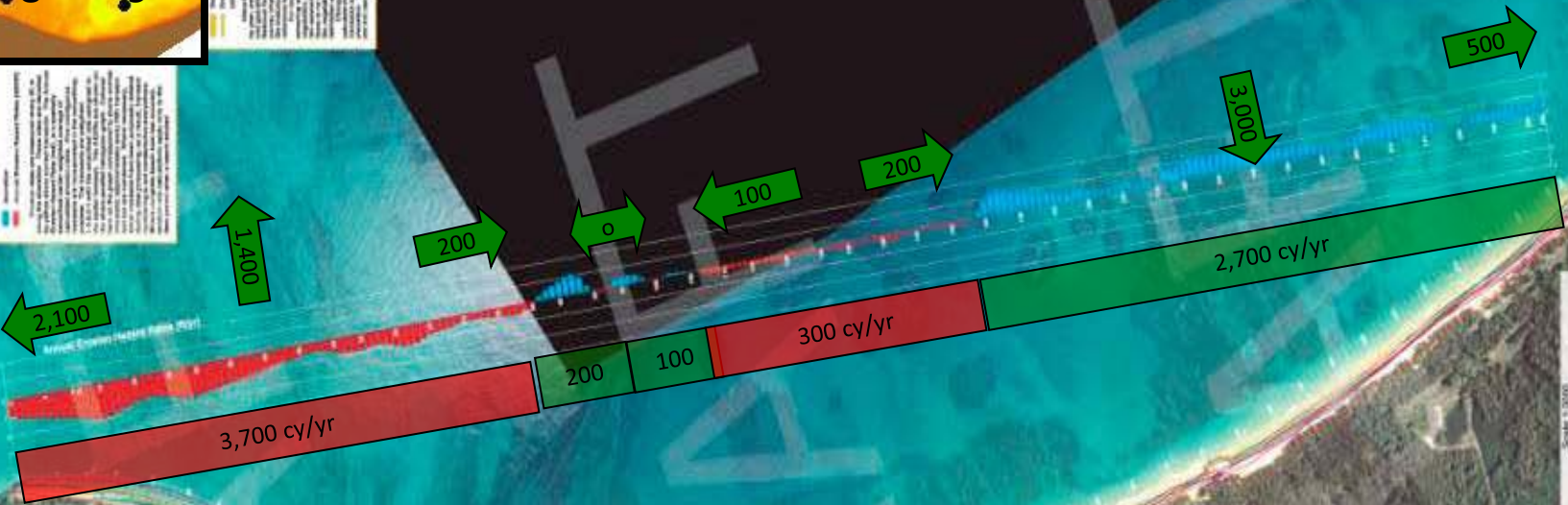


# Bellows, Oahu, Hawaii

## Smoothed Erosion Rates



**EROSION RATES**  
 The erosion rates shown on this map were derived from a Digital Shoreline Assessment System (DSAS) analysis of aerial photography from 1950 to 2000. The erosion rates are smoothed to a 100-foot resolution. The erosion rates are based on the change in shoreline position over time. The erosion rates are shown in cubic yards per year (cy/yr). The erosion rates are shown in green for accretion and red for erosion. The erosion rates are shown in a color scale from 0 to 3,700 cy/yr.





# Potential RSM Projects

- Ka`elepulu Stream
- Bellows Air Force Station
- Kaupo & Kaiona Beaches
- Lanikai Beach



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# KA`ELEPULU STREAM



Dune Erosion Downdrift



Stream Plugged with Sand



# BELLOWS AIR FORCE STATION



Wide Beach to the South



Narrow Hardened Beach to North



# KAUPO & KAIONA BEACHES



Problem  
Area

Kaiona Beach



Problem  
Area

Kaupo Beach



# LANIKAI BEACH



Lanikai Beach Looking North



Lanikai Beach Looking South



# LANIKAI BEACH RESTORATION PILOT PROJECT



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# LANIKAI BEACH RESTORATION PILOT PROJECT

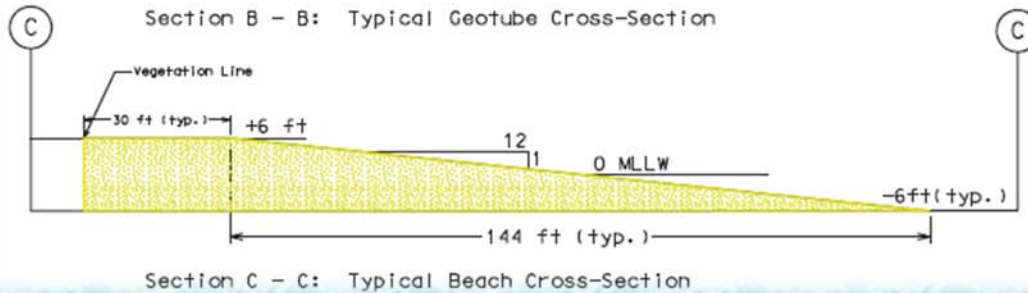
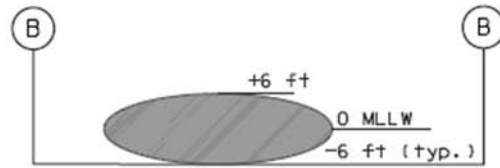
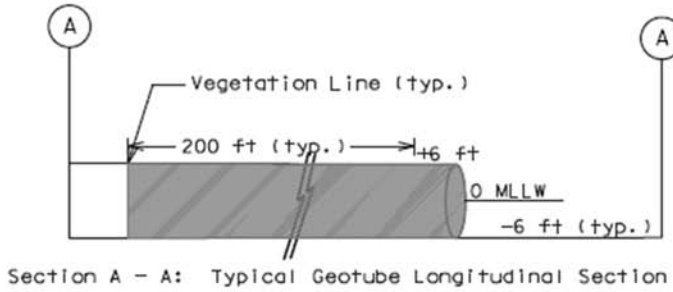
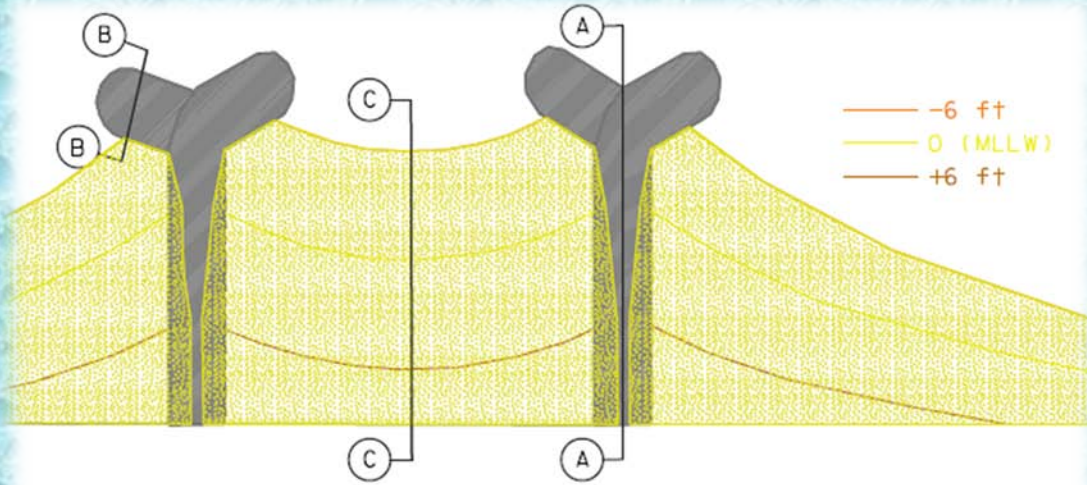


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# LANIKAI BEACH RESTORATION PILOT PROJECT



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**SOUTHEAST OAHU  
REGIONAL SEDIMENT MANAGEMENT  
DEMONSTRATION PROJECT**

**REGIONAL SEDIMENT MANAGEMENT PLAN**

Prepared for:  
U.S. Army Corps of Engineers  
Honolulu District  
and  
State of Hawaii  
Department of Land and Natural Resources  
Office of Conservation and Coastal Lands

Prepared by:  
Oceanit Laboratories, Inc.

December 30, 2006



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# HAWAII REGIONAL SEDIMENT MANAGEMENT

**RELEVANT  
READY  
RESPONSIVE  
RELIABLE**

*Proudly serving the Armed Forces and  
the Nation now and in the future.*

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Welcome to the Hawai'i Regional Sediment Management (RSM) web site. Herein, you will find an abundant amount of information related to the Honolulu District's efforts to manage one of Hawai'i's most valuable assets - sand. Studying the islands from mauka (*towards the mountains*) to makai (*towards the ocean*), the Honolulu District, State of Hawai'i Department of Land and Natural Resources, and various other partners will gain a better understanding of sediment transport and its management on a regional scale.

The Honolulu District has several exciting ongoing RSM projects. Please use the links to the left to navigate to your desired location. You can also explore the [News](#) portion of the web page to get the latest information on Hawai'i RSM activities, such as upcoming activities, new photos and maps, and online tools.

*Modern and Historic Sand Bodies off Waikiki*





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# MAUI REGIONAL SEDIMENT MANAGEMENT FY10 FINDINGS



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# MAUI REGIONAL SEDIMENT MANAGEMENT WAVE CLIMATE

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# MAUI REGIONAL SEDIMENT MANAGEMENT SHORELINE CHANGE



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# MAUI REGIONAL SEDIMENT MANAGEMENT OFFSHORE SAND SOURCES



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# MAUI REGIONAL SEDIMENT MANAGEMENT

## REGIONAL SEDIMENT BUDGET

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# MAUI REGIONAL SEDIMENT MANAGEMENT KAUAI RSM PLAN



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**MAUI**  
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**POTENTIAL RSM PROJECTS**  
**POIPU**

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