

SOUTHEAST OAHU REGIONAL SEDIMENT MANAGEMENT

DIAMOND HEAD TO PEARL HARBOR

Workshop

September 8, 2010

Hale Koa Hotel
Waikiki, HI

co-sponsored by:

State of Hawaii Department of Land and Natural Resources

US Army Corps of Engineers, Honolulu District



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AGENDA

| | | |
|-------------|--|--------------------|
| 1300 - 1315 | Welcome and Introductions | Lemmo Smith |
| 1315 - 1330 | Regional Sediment Management Overview | Smith |
| 1330 - 1500 | Diamond Head to Pearl Harbor Region FY09 Findings | |
| | Waves and Currents | Podoski |
| | Shoreline Change | Fletcher |
| | Regional Sediment Budget | Sloop |
| | Offshore Sand Sources | Fletcher |
| | Regional Sediment Management Plan | Sloop |
| 1500 - 1515 | Break | |
| 1515 - 1615 | Diamond Head to Pearl Harbor Region FY10 Investigations | |
| | Scope of Study | Nuding |
| | Waikiki Beach Video Surveillance | Fletcher |
| | Fort DeRussy Sand Backpassing | Smith |
| | Beneficial Use of Dredged Material | Price |
| 1615 - 1630 | Break | |
| 1630 - 1730 | Diamond Head to Pearl Harbor Region Breakout Sessions | |
| | Waikiki Beach Video Surveillance | Fletcher |
| | Fort DeRussy Sand Backpassing | Smith |
| | Beneficial Use of Dredged Material | Price |
| 1730 - 1755 | Diamond Head to Pearl Harbor Region Breakout Session Highlights | Session Leaders |
| 1755 - 1800 | Wrap-up and Adjourn | Lemmo Smith |



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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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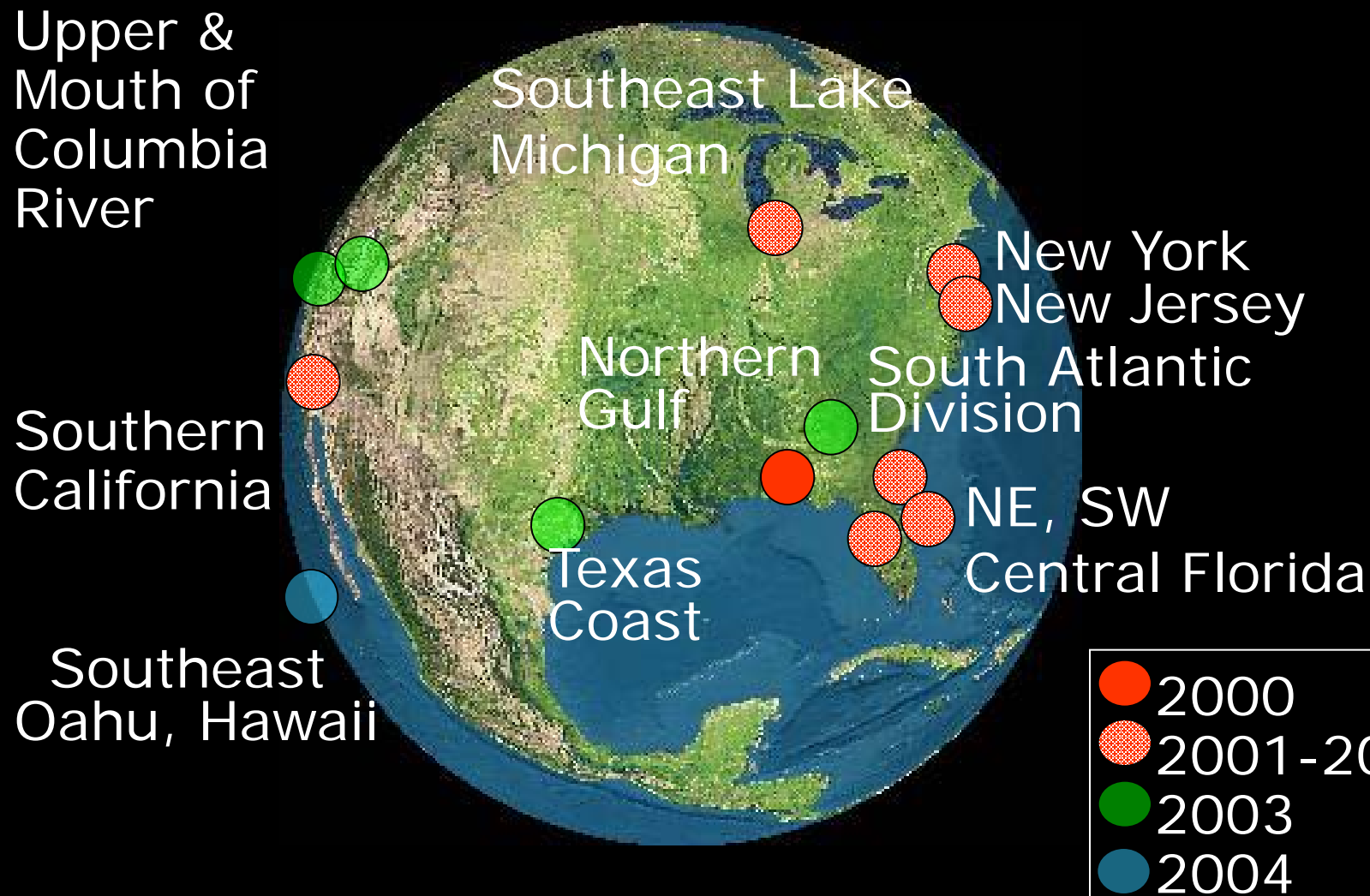
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NATIONAL RSM PROGRAM



SOUTHEAST OAHU RSM

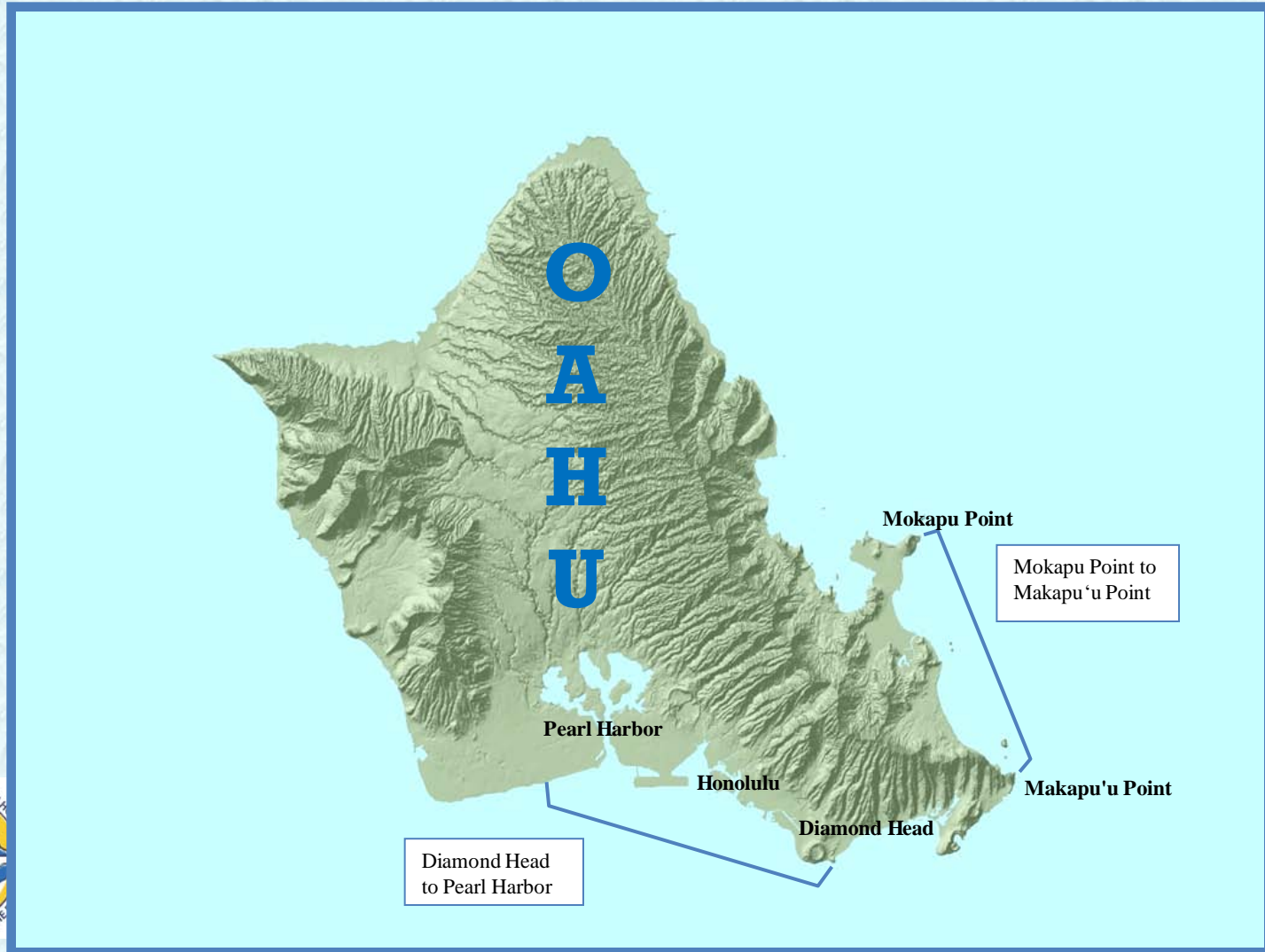
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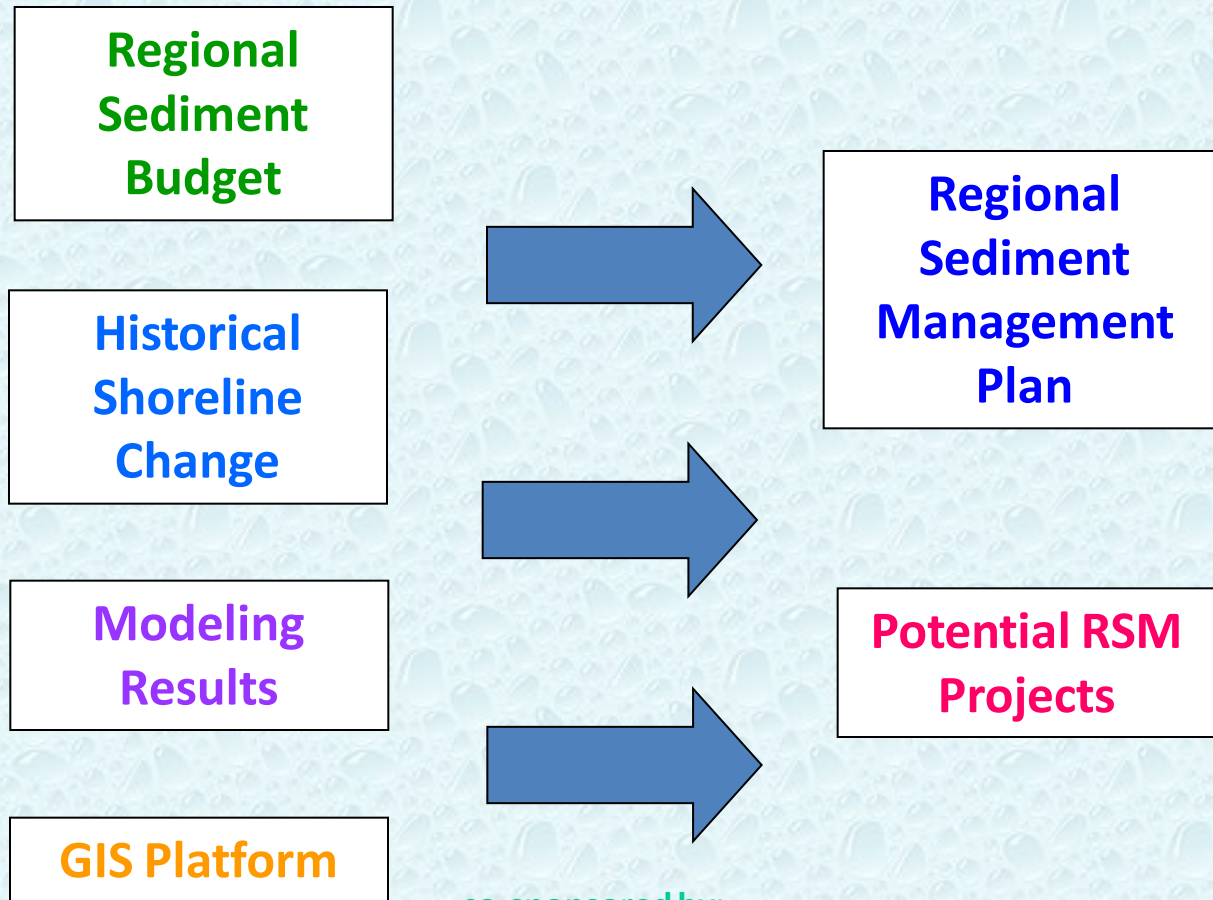
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SOUTHEAST OAHU RSM REGIONS



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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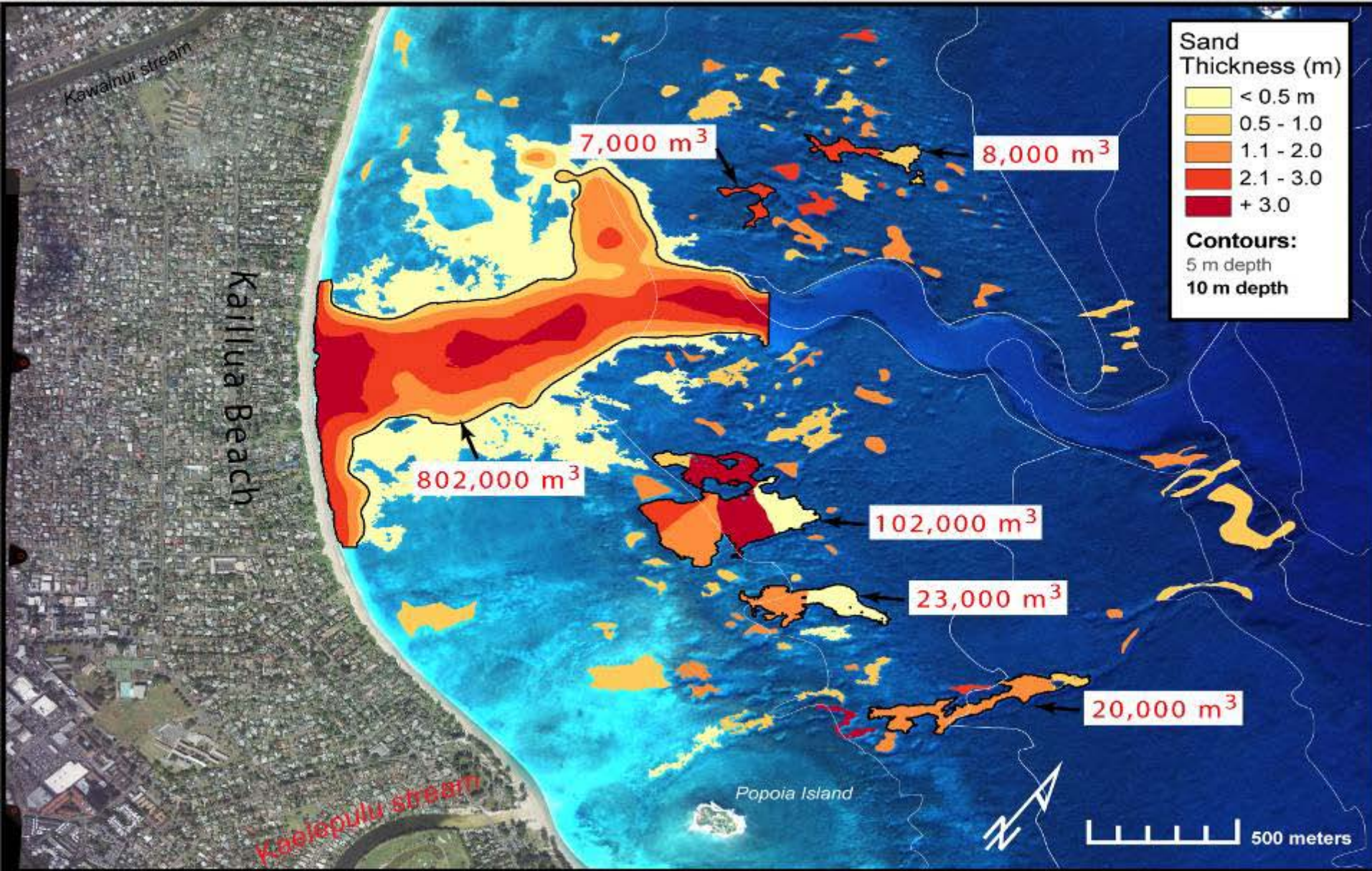
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KAILUA BAY

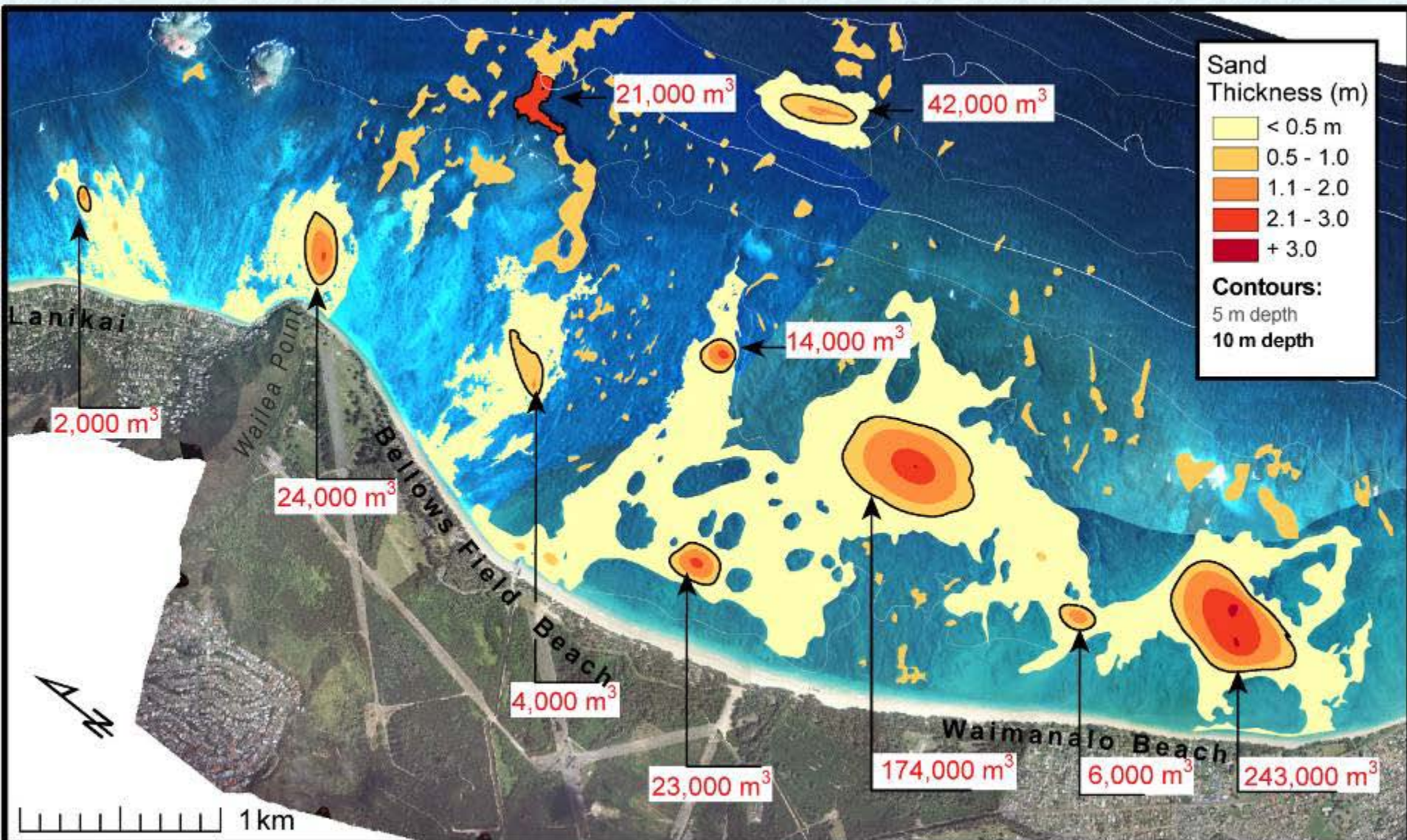




OFFSHORE SAND



NORTH BELLOWS & SOUTH LANIKAI



WAILEA POINT SEDIMENT TREND ANALYSIS

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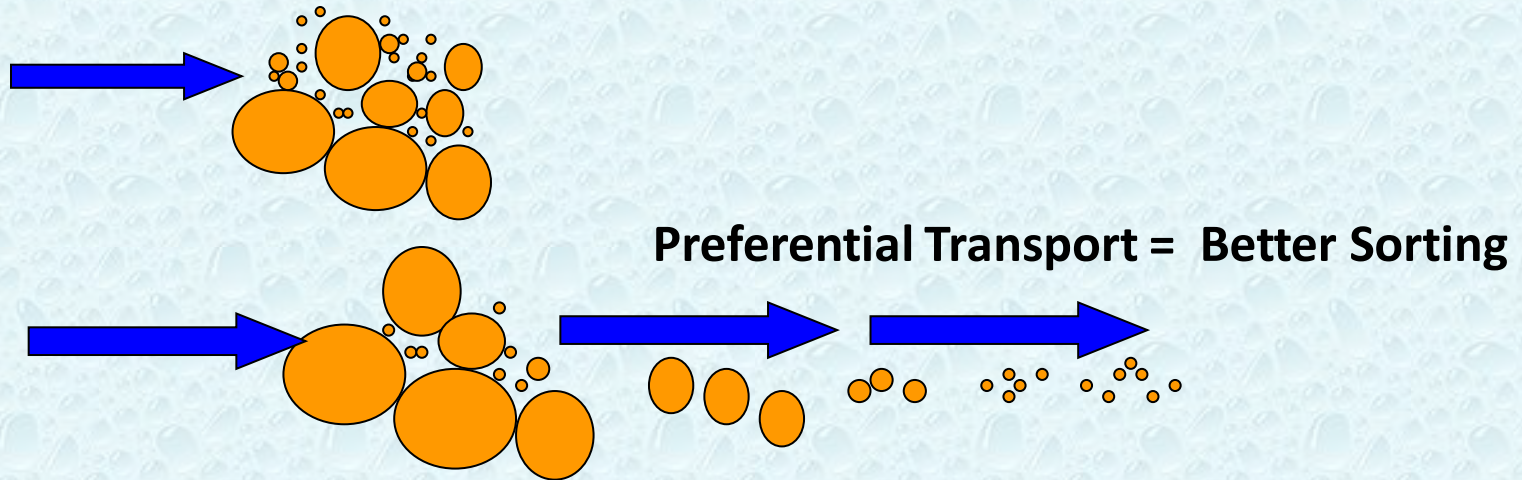




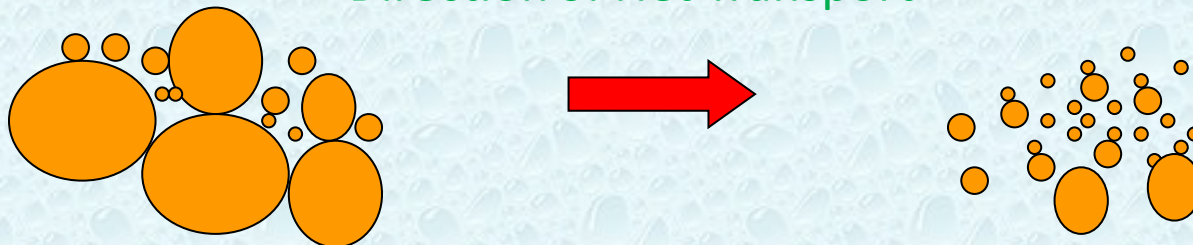
WAILEA POINT S.T.A. ANALYSIS



Sediment becomes better sorted in the direction of transport.



Direction of Net Transport



Lag Deposit

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Lead Deposit

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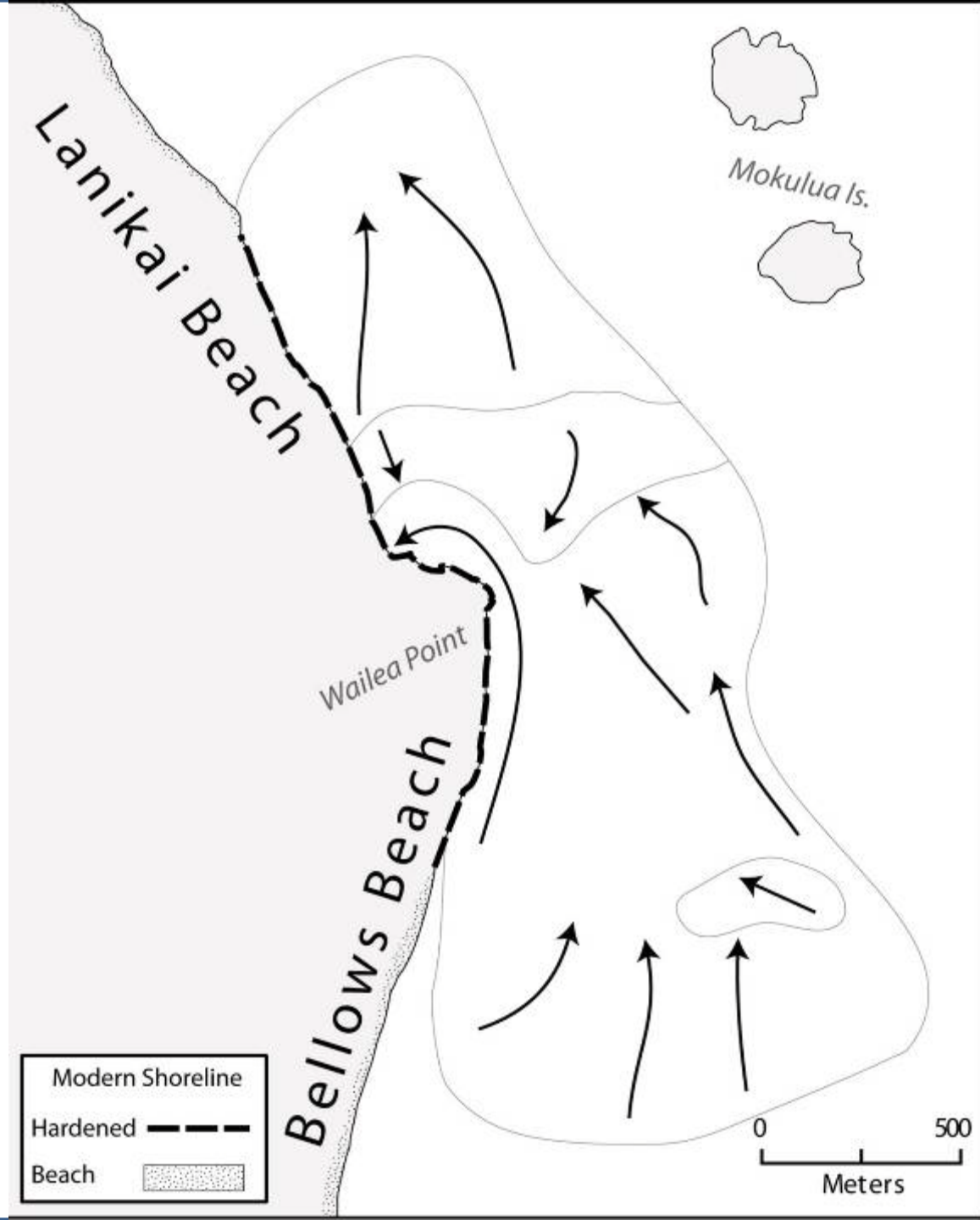


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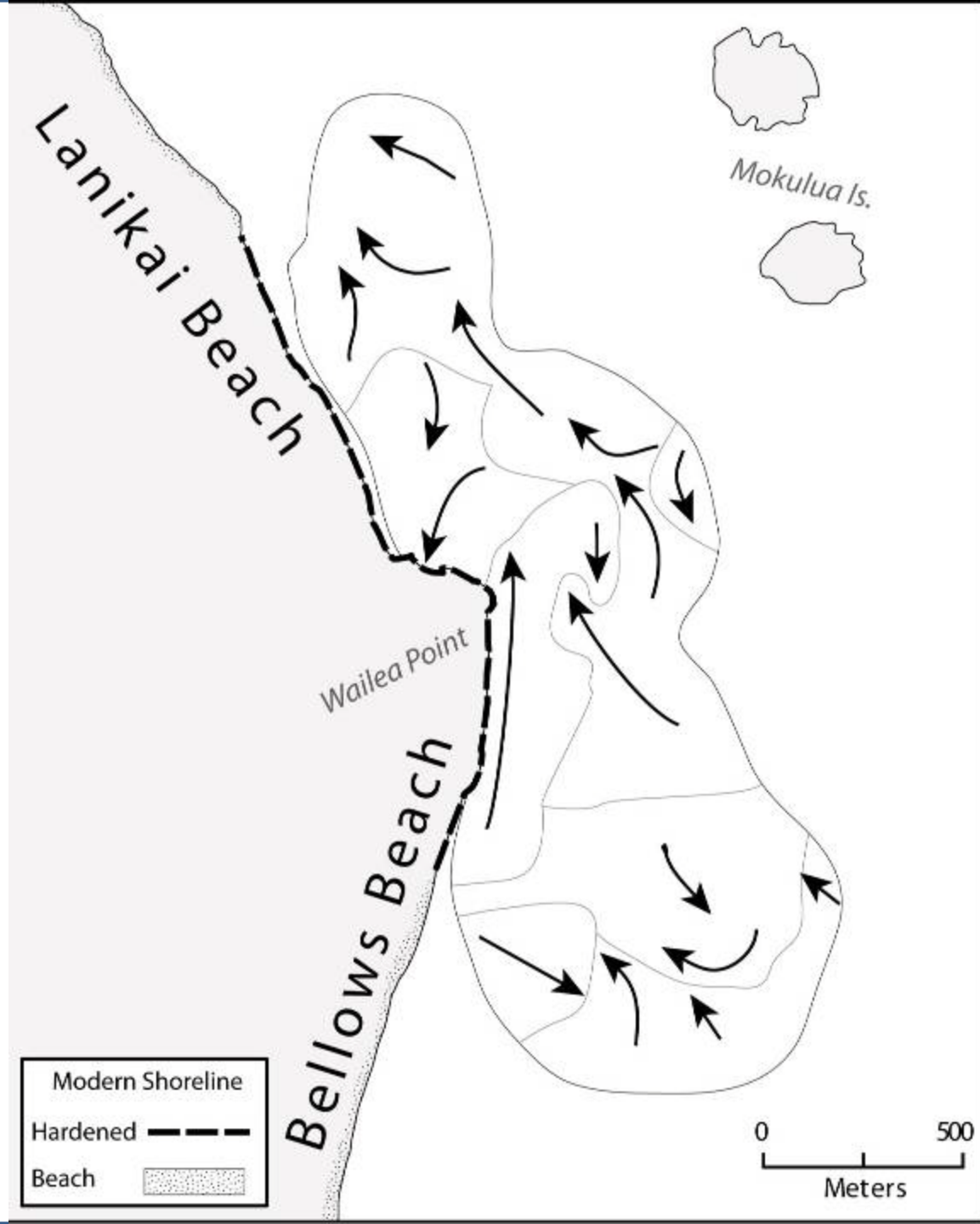
Gao-Collins Method Results

Gao and Collins
(1992)



Roux Method Results

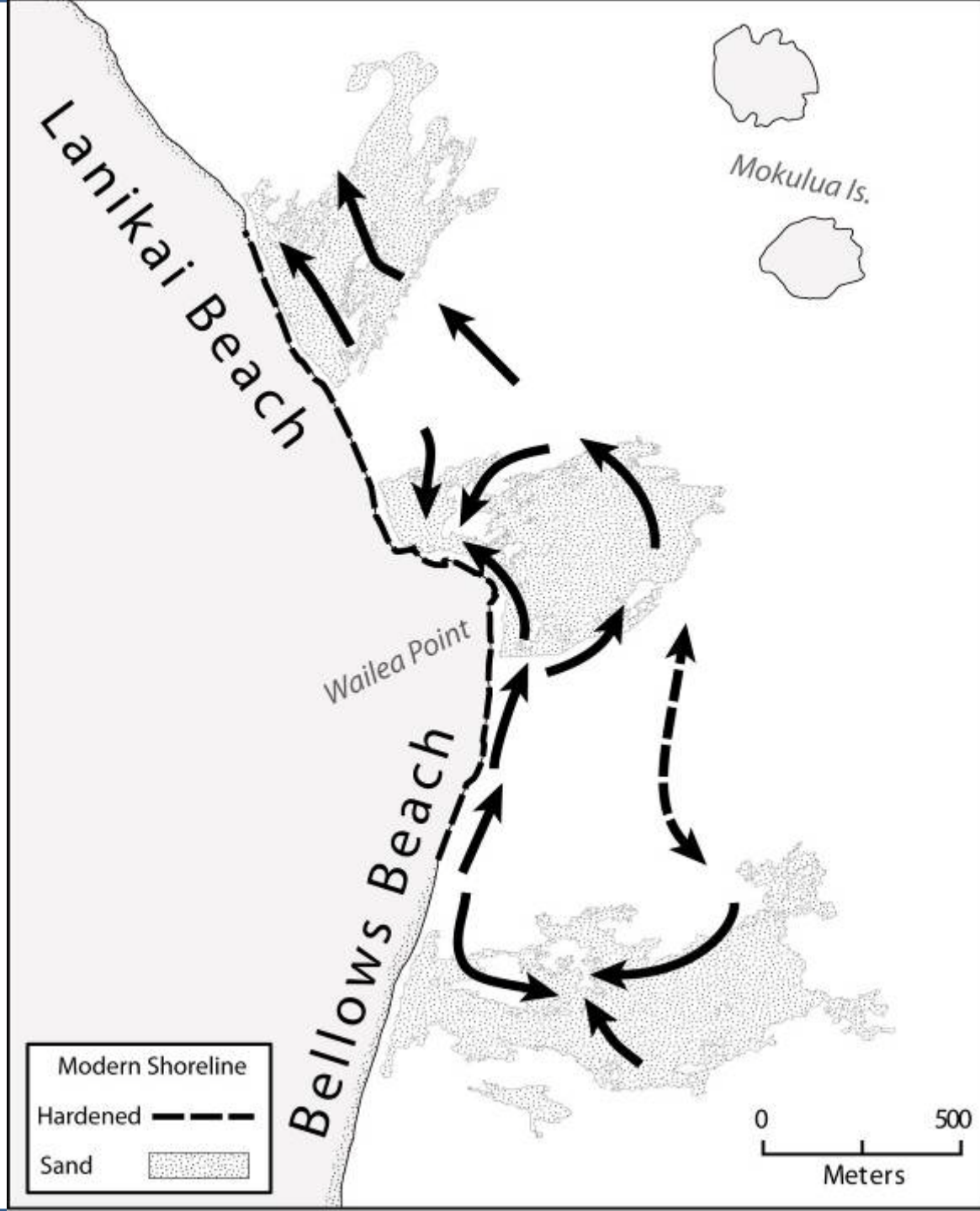
Roux (1994)



Combine Results

Northward transport

Indicates Lanikai has historically received sand from Bellows Beach.



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
 2360700m N 21°21'30" N

UTM coordinates
 Latitude/Longitude coordinates



Bellows Field Beach Park



AREA DESCRIPTION

Waimanalo Beach is located on the southeast shore of Oahu. The study area (trsects 236 - 378) extends 1.7 miles from Bellows Field Beach Park in the north to Kaiona 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 ± 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.

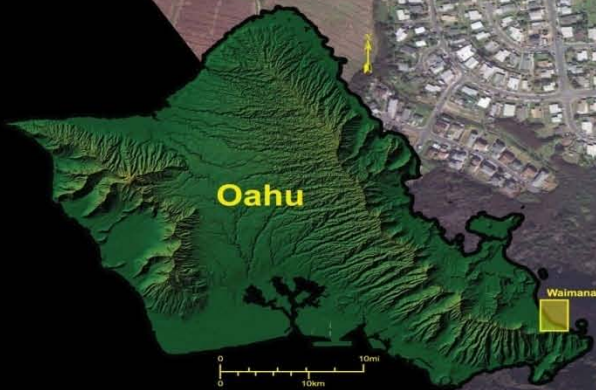
The EX method is used to calculate shoreline change rates for the study area. The rates are smoothed along shore using a 1-3-5-3-1 technique to normalize rate differences on adjacent transects. For more information on erosion rate methods and results see: <http://www.soest.hawaii.edu/asp/coasts/oaahu/index.asp>

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).

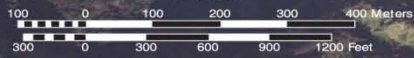
Movement of the SCRF along shore-normal transects (spaced every 66 ft) is used to calculate erosion rates.



Oahu

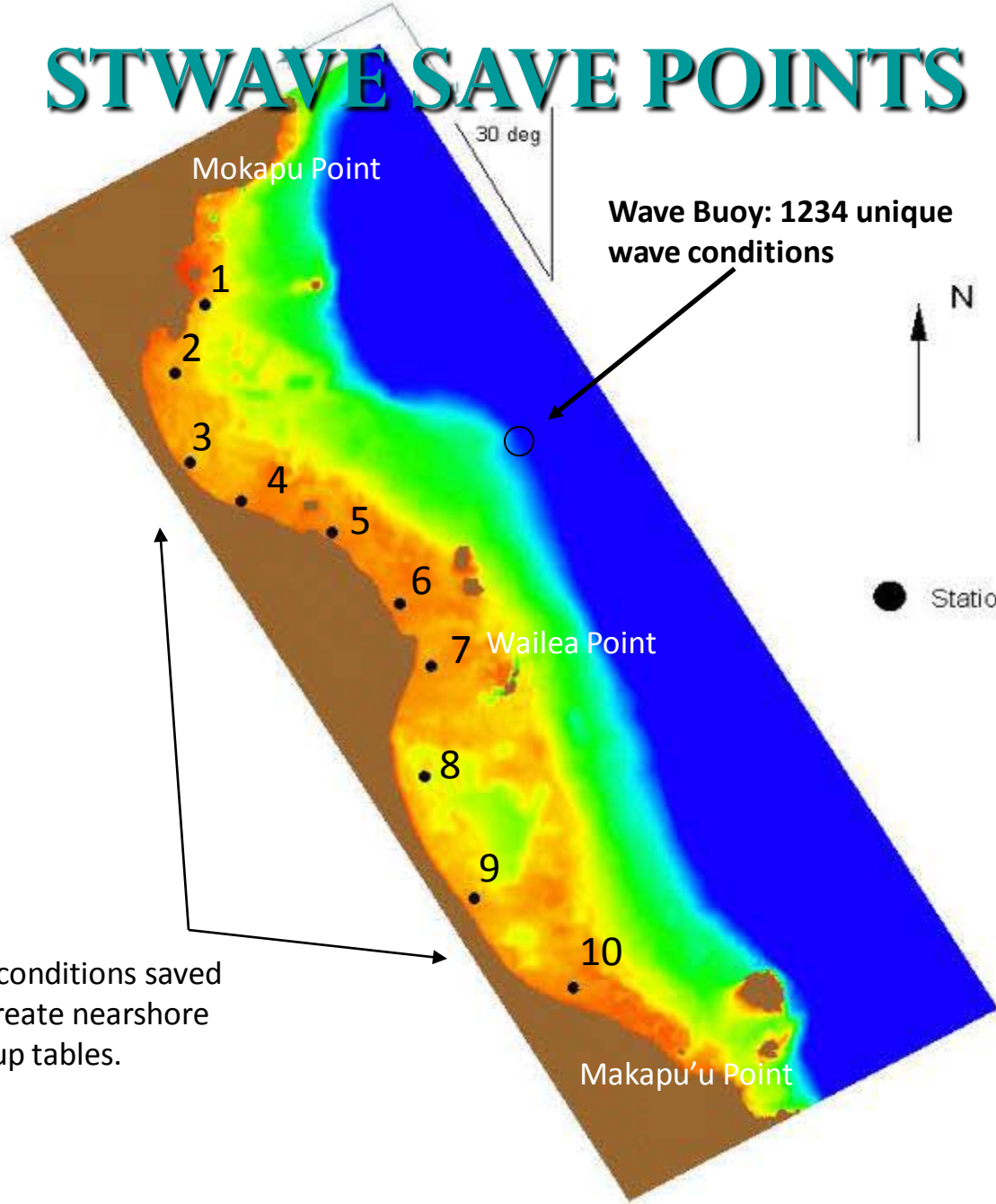
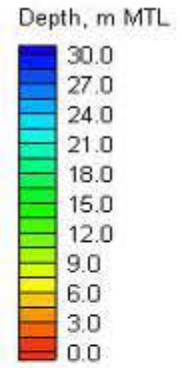
Waimanalo

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/>

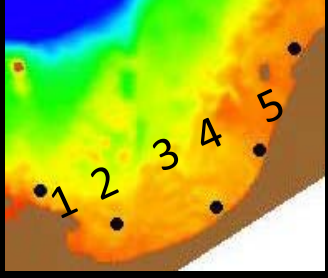
STWAVE SAVE POINTS



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 previously estimated. The amount of sediment entering the ocean from the Kailua Bay watershed is estimated to be 13,600 cy/yr. This is based on the following information:

- The amount of sediment entering the ocean from the Kailua Bay watershed is estimated to be 13,600 cy/yr.
- This is based on the following information:
- The amount of sediment entering the ocean from the Kailua Bay watershed is estimated to be 13,600 cy/yr.
- This is based on the following information:

HISTORICAL SURVEYS

1958 - 1960
 May 1960
 May 1961
 May 1962
 May 1963
 May 1964
 May 1965
 May 1966
 May 1967
 May 1968

1969 - 1971
 May 1969
 May 1970
 May 1971

1972 - 1974
 May 1972
 May 1973
 May 1974

1975 - 1977
 May 1975
 May 1976
 May 1977

1978 - 1980
 May 1978
 May 1979
 May 1980

1981 - 1983
 May 1981
 May 1982
 May 1983

1984 - 1986
 May 1984
 May 1985
 May 1986

1987 - 1989
 May 1987
 May 1988
 May 1989

1990 - 1992
 May 1990
 May 1991
 May 1992

1993 - 1995
 May 1993
 May 1994
 May 1995

1996 - 1998
 May 1996
 May 1997
 May 1998

1999 - 2001
 May 1999
 May 2000
 May 2001

2002 - 2004
 May 2002
 May 2003
 May 2004

2005 - 2007
 May 2005
 May 2006
 May 2007

2008 - 2010
 May 2008
 May 2009
 May 2010

2011 - 2013
 May 2011
 May 2012
 May 2013

2014 - 2016
 May 2014
 May 2015
 May 2016

2017 - 2019
 May 2017
 May 2018
 May 2019

2020 - 2022
 May 2020
 May 2021
 May 2022

00917

16,600

13,600 cy/yr

3,000

1,000

2,200

200 cy/yr



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Lanikai, Oahu, Hawaii

Smoothed Erosion Rates

EROSION RATES

Accretion:

- Blue: Annual Erosion Hazard Rates (AEHR)

Erosion rates are measured every 20 m along the shoreline. Three sites are sampled every 200 m. The Annual Erosion Hazard Rate (AEHR) is a standard weighted average of calculated erosion rates. Five contributing basins are incorporated in the smoothing process. The basins are weighted by their area. The AEHRs are shown on the map as a color gradient. Colored lines on the graph correspond to erosion rates basins, approximately every 800 m, and are numbered. Where necessary, smoothing is not conducted everywhere. Where complete beach loss has occurred, erosion rate calculations apply only to the first point where a beach existed.

HISTORICAL

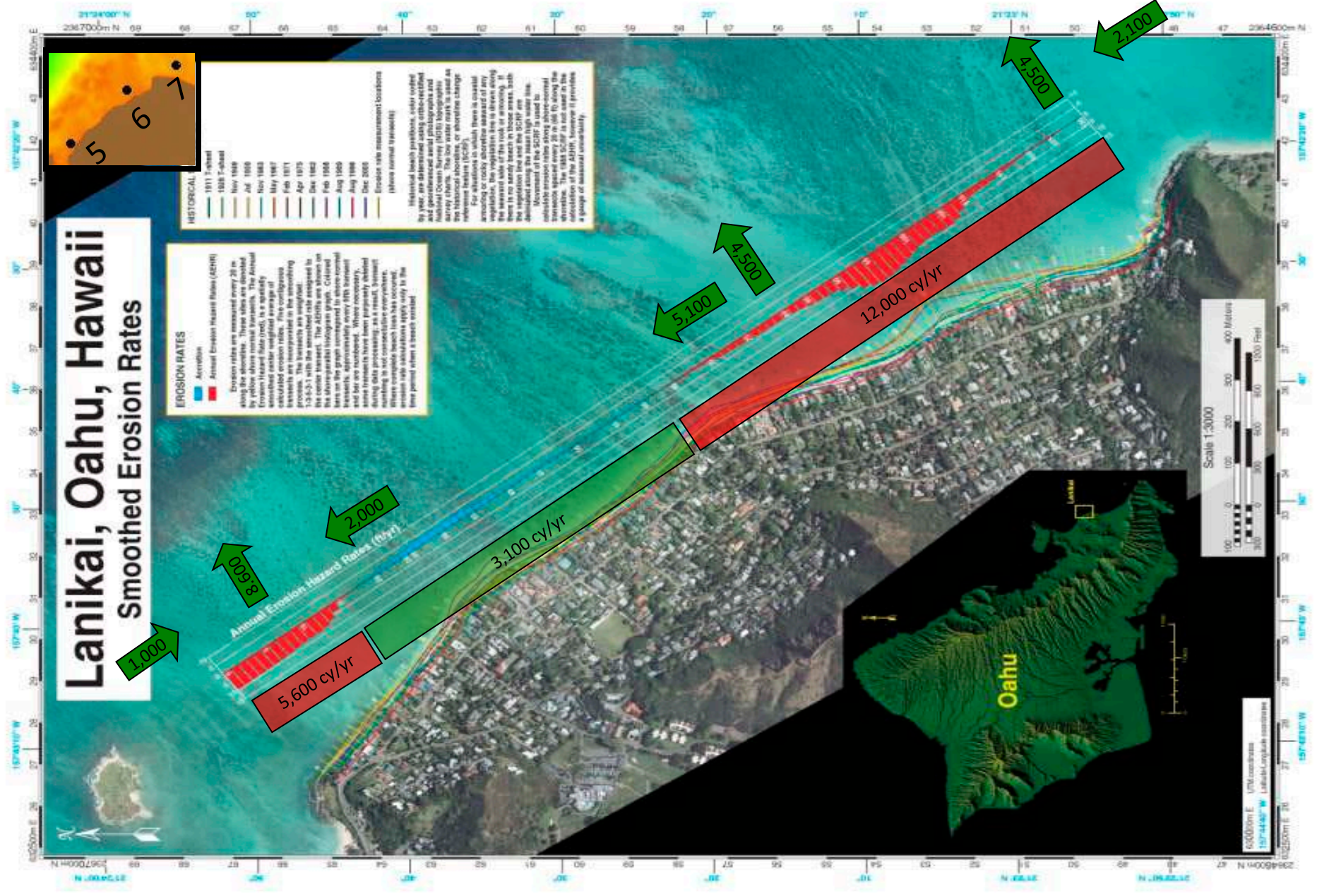
- 1911 Present
- 1928 Present
- Nov 1949
- Jul 1950
- Nov 1963
- May 1967
- Feb 1971
- Dec 1982
- Feb 1986
- Aug 1989
- Aug 1998
- Dec 2005

Erosion rate measurement locations (show normal symmetries)

Historical beach profiles, their extent by year, and the location of the National Ocean Survey (NOS) hydrographic array charts. The low water mark is same as the 1988 SCDF or shoreline change survey marks (SCSM). For situations in which there is coastal accretion or rocky shoreline seaward of any vegetation, the vegetation line is shown along with the 1988 SCDF or shoreline change survey marks (SCSM). Both the vegetation line and the SCDF are shown along the mean high water line. Accretion of the SCDF is used to calculate the AEHR. The 1988 SCDF is not used in the calculation of the AEHR, however it provides a gauge of substantial uncertainty.

Annual Erosion Hazard Rates (AEHR)

Erosion rates are measured every 20 m along the shoreline. Three sites are sampled every 200 m. The Annual Erosion Hazard Rate (AEHR) is a standard weighted average of calculated erosion rates. Five contributing basins are incorporated in the smoothing process. The basins are weighted by their area. The AEHRs are shown on the map as a color gradient. Colored lines on the graph correspond to erosion rates basins, approximately every 800 m, and are numbered. Where necessary, smoothing is not conducted everywhere. Where complete beach loss has occurred, erosion rate calculations apply only to the first point where a beach existed.



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
1922500m N
19°42'30" N

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

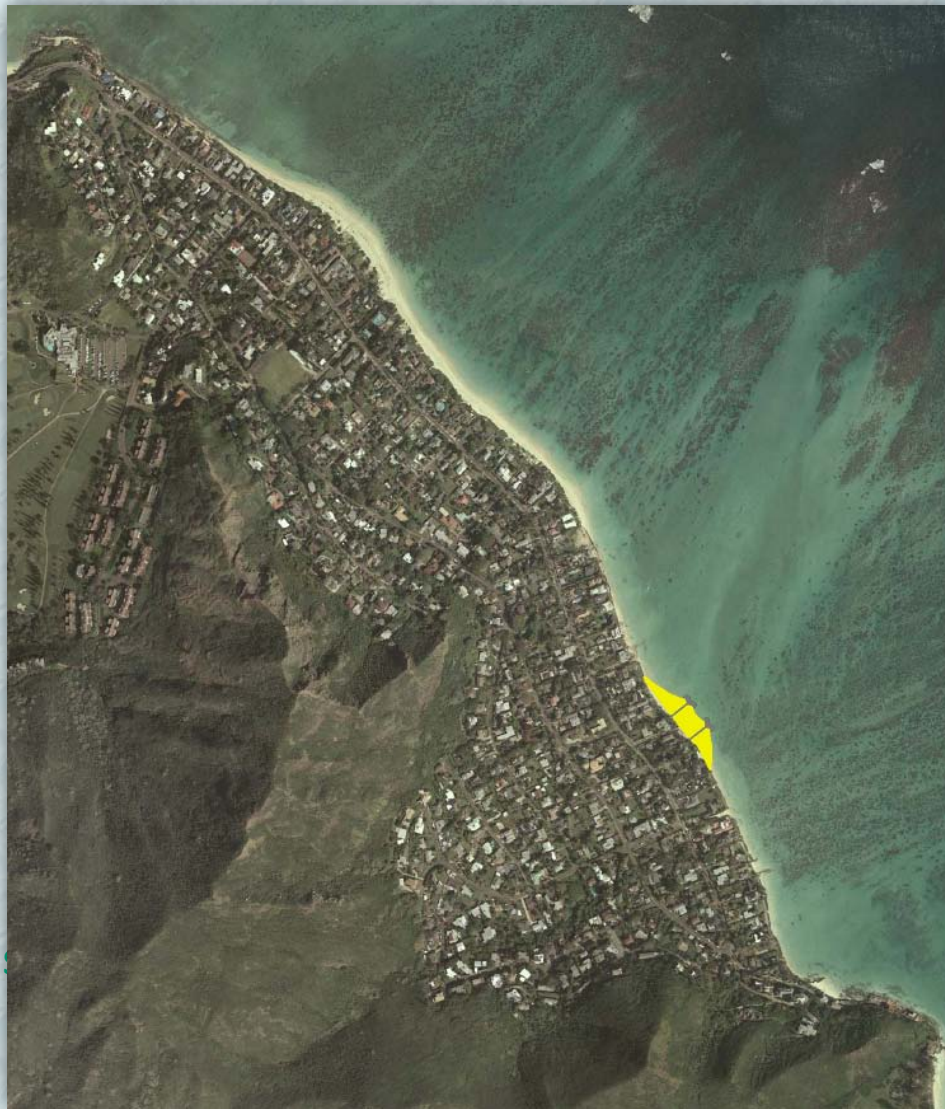


Lanikai Beach Looking North



Lanikai Beach Looking South

LANIKAI BEACH RESTORATION PILOT PROJECT



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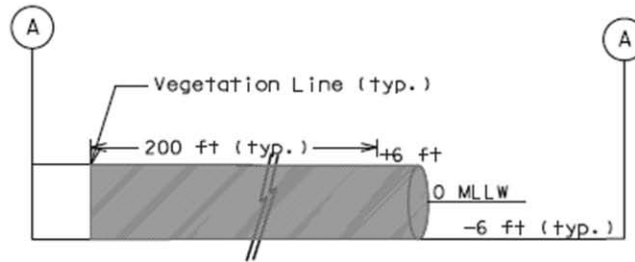
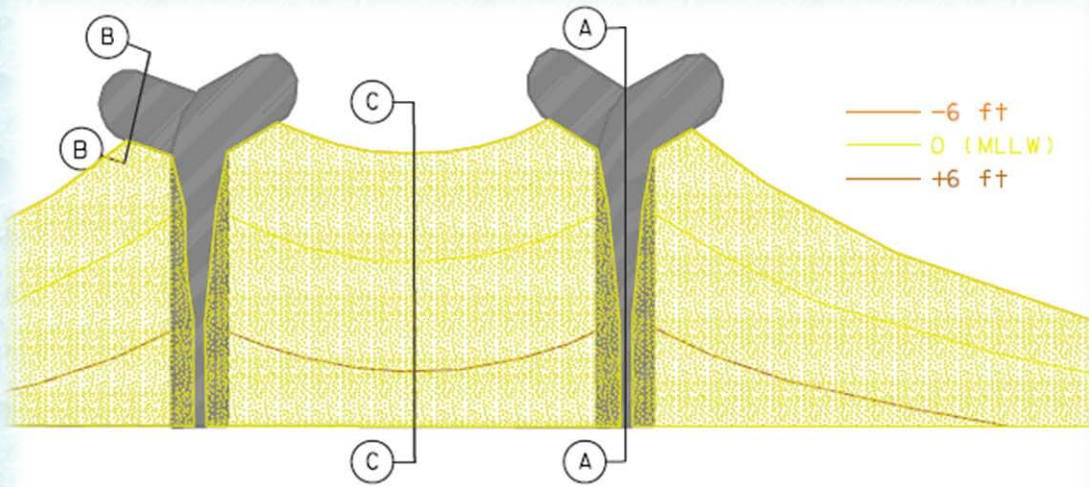
LANIKAI BEACH RESTORATION PILOT PROJECT



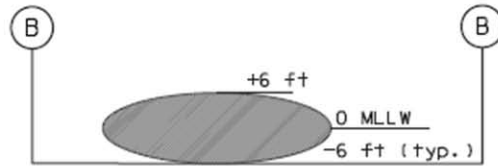
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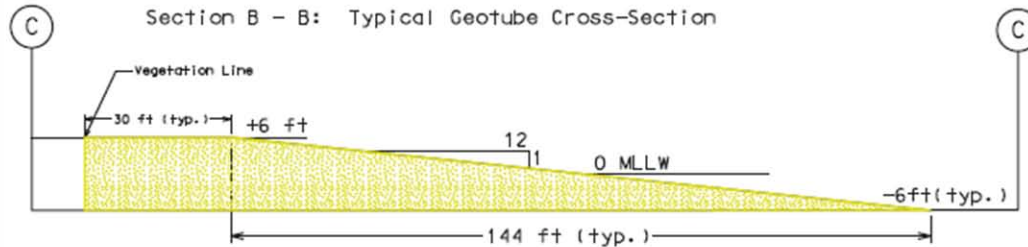
LANIKAI BEACH RESTORATION PILOT PROJECT



Section A - A: Typical Geotube Longitudinal Section



Section B - B: Typical Geotube Cross-Section



Section C - C: Typical Beach Cross-Section



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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

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READY
RESPONSIVE
RELIABLE

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National RSM

Hawai'i RSM

News

Online Mapping

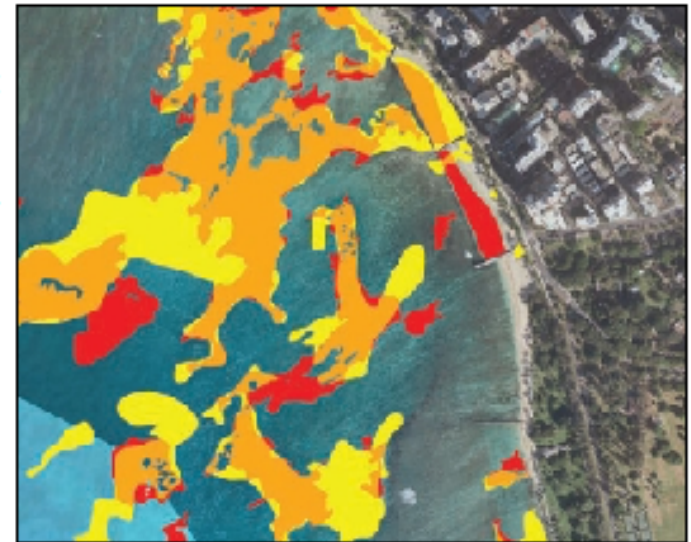
Links

Contact Us

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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DIAMOND HEAD TO PEARL HARBOR REGION

FY09 FINDINGS

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DIAMOND HEAD TO PEARL HARBOR REGION

FY10 INVESTIGATIONS

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BREAKOUT SESSIONS

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DIAMOND HEAD TO PEARL HARBOR REGION

BREAKOUT SESSIONS HIGHLIGHTS

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