

Beach Management Guidelines

Makaha Beach Park

Makaha Beach, Oahu



Prepared By

Dolan Eversole, Coastal Geologist
University of Hawaii Sea Grant College Program

For

The City and County of Honolulu
Department of Parks and Recreation
and
The State of Hawaii
Hawaii Department of Land and Natural Resources
Office of Conservation and Coastal Lands

August, 2010



Acknowledgements

This document was produced by the University of Hawaii Sea Grant College Program and the Hawaii Department of Land and Natural Resources (DLNR) Office of Conservation and Coastal Lands (OCCL)

This paper is funded (in part) by a grant/cooperative agreement from the National Oceanic and Atmospheric Administration, Project A/AS-1 which is sponsored by the University of Hawaii Sea Grant College Program, SOEST, under Institutional Grant No. NA09OAR4170060 from NOAA Office of Sea Grant, Department of Commerce. The views expressed herein are those of the author(s) and do not necessarily reflect the views of NOAA or any of its subagencies.

UNIHI-SEAGRANT-TT-09-04.

EXECUTIVE SUMMARY

The City and County of Honolulu Department of Parks and Recreation (City) and the Department of Land and Natural Resources (DLNR), Office of Conservation and Coastal Lands (OCCL) have a shared regulatory function for the beach and shoreline area through the overlapping jurisdiction of the state Conservation District which is defined by the certified shoreline and the City’s responsibility to manage the beach park area designated from the high watermark to the private property boundaries (Figure 1). Both agencies have fielded public inquiries regarding the City’s annual beach maintenance practice. Concerns are related to excessive beach grooming that may negatively impact local sediment transport and contribute to seasonal beach erosion down drift. Alternatively if the beach is not maintained unsafe drop off and berm conditions can develop along the parking lot, lifeguard towers and other fixed infrastructure and may lead to increased beach erosion the following erosion cycle if not stemmed with sand pushing. The roadway along Farrington Hwy is armored and seasonal erosion of the beach occasionally exposes this shoreline armoring. The long-term intent of beach maintenance at Makaha should include maintaining a sandy beach profile to cover and prevent further erosion of the shoreline armoring. This will minimize the possibility of failure of the armoring due to scour and potential roadway failure.

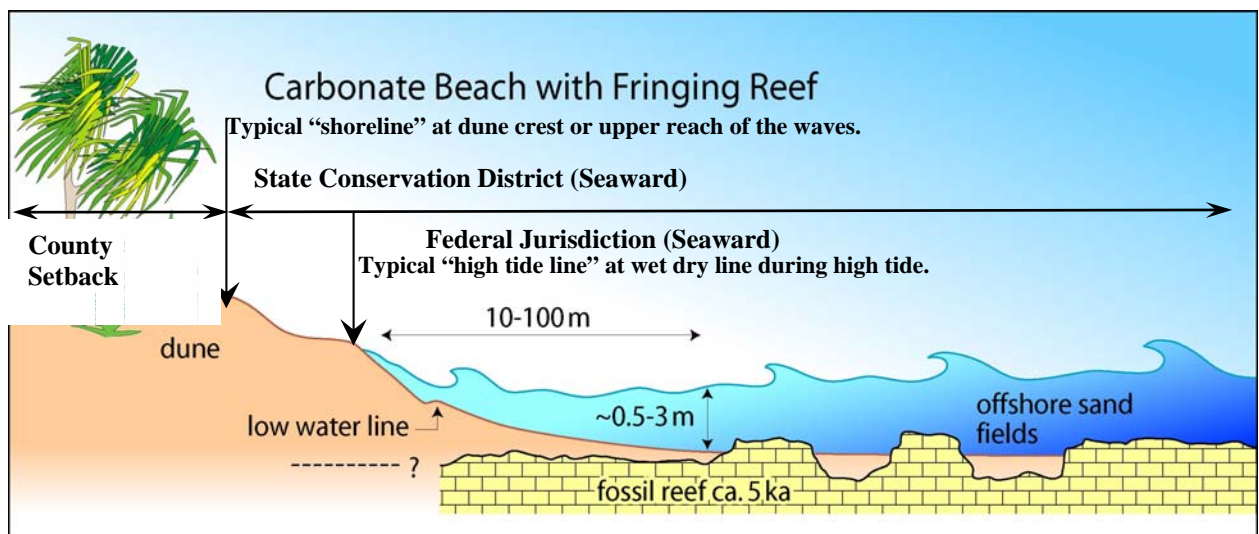


Figure. 1 Conceptualized Shoreline Jurisdiction. Base Image: Chip Fletcher, UH

SUMMARY RECCOMENDATIONS FOR BEACH MAINTENANCE

The need to maintain the beach is made clear each spring after the strong winter surf has eroded the central Makaha Beach park area fronting the parking lot. Fixed infrastructure such as Farrington Highway, the roadside parking area, lifeguard towers and associated support infrastructure require periodic maintenance of the beach to prevent loss to erosion and reduce public safety issued related to steep erosion banks and exposed rip rap. Relocating this infrastructure is the best long-term response to coastal hazards and climate change but may not be practical at this time. Summary recommendations for beach maintenance at Makaha Beach park include.

1. Minimize the volume of sand pushing to only what is needed to restore the bank to the parking lot level.
2. Minimize maintenance to once a year sand pushing or as needed.
3. Avoid pushing sand when the beach width is narrow (end of winter typically). A minimum of 50 feet of dry sand should be present before sand pushing.
4. Re-distribute sand is when the beach is widest. This typically occurs towards the end of summer.
5. Do not push sand outside of the lateral bounds of the parking lot unless there is a justified erosion threat to adjacent improvements.
6. Utilize the existing knowledge of the lifeguards and long-time residents familiar with the seasonal cycles.
7. Things change and prior beach maintenance practices may not longer be practical or desirable.
8. See the beach maintenance guidelines at the end of this document for more detail of the practice of sand pushing.
9. Contact the Department of Land and Natural Resources (DLNR), Office of Conservation and Coastal Lands (OCCL) Coastal Lands Program for additional information and to obtain confirmation the proposed beach maintenance is appropriate.

DLNR- OCCL

Sam Lemmo, Administrator

1151 Punchbowl st. Rm 131

Honolulu Hi, 96813

(808) 587-0377

<http://hawaii.gov/dlnr/occl>

dlnr.occl@hawaii.gov

SITE DESCRIPTION

The project area encompasses Makaha Beach and includes the world-renown surfing at Makaha Point. This reach encompasses the popular sandy beaches and recreational surf spots that have made this region internationally renown. Makaha beach park has approximately 1,000 feet of continuous sandy shoreline and public beach access which is subject to regular beach maintenance by the (City). The park contains a lifeguard tower, and roadside parking areas (Figure 2). A comfort station, a shower, picnic tables, and additional parking are available across Farrington Highway at the Makaha Beach Support

MAKAHA BEACH MANAGEMENT GUIDELINES

Park. The backshore area throughout much of the beach park contains no vegetation, likely due to seasonal high surf and heavy foot and vehicle traffic. The park is bordered along the shoreline at the western and eastern extremity by private residences. The beach park is directly exposed to winter northwest swell and summer southerly waves which dominate the seasonal transport of sand alongshore here. It is this bi-modal sediment transport that requires periodic beach maintenance in order to protect existing fixed improvements.

The purpose of the proposed beach maintenance actions includes:

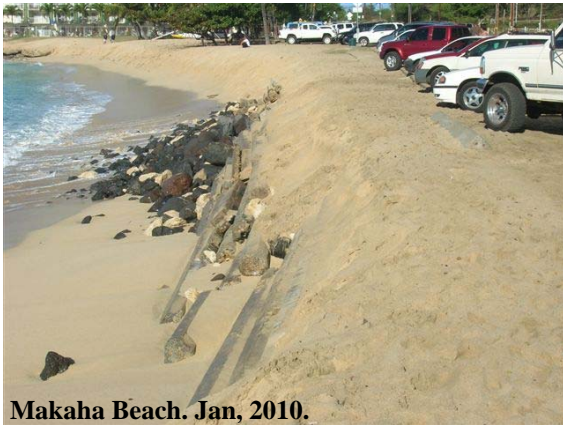
1. Reduce the public safety hazard from the erosion scarp along the parking lot.
2. Facilitate public access to the beach area.
3. Provide protection to existing fixed improvements.
4. Restore the natural back beach slope and help protect the existing natural vegetation.

Figure 2. Makaha Beach Park and Beach Area (Base Image: Sea Engineering, Inc.)



SEDIMENT TRANSPORT CHARACTERISTICS

Makaha beach is characterized by coarse-grained tan to golden marine carbonate sands. These poorly-sorted sands are typical of the high-energy beaches along the north and west shores of the Hawaiian Islands. The sand is of biogenic origin and derived from the carbonate reefs as well as marine tests (shells) of microscopic pelagic organisms. Sediment transport in the Makaha Beach area has not been researched well enough to develop quantitative sediment transport results. We can however describe these processes qualitatively based on abundant empirical knowledge. A fact illustrated by the large population of highly experienced surfers and lifeguards with years of first-hand knowledge of seasonal and episodic events. Many of these local residents offer a valuable resource for understanding the relationship between the offshore wave energy spectrum and the resulting observed sediment transport (erosion or accretion) on the beach.



Makaha Beach. Jan, 2010.



Makaha Beach. June, 2010.

Dramatic seasonal variation in beach width is common and requires site-specific understanding of coastal processes in order to respond to beach maintenance and management issues.

Based on these and other empirical observations, Makaha beach is dominated by a bi-modal longshore seasonal transport mechanism driven by wave direction displacing large sand volumes in a very short time period under high-energy, acute angle swell energy. The northerly transport of sediment is driven by swells from the south-southwest, while the southerly transport is driven by swells from the west to north west (Figure 2). Swells directions from the north and northwest are typical of winter conditions and tend to erode the beach at the beach park area while summertime swells from the south tend to accumulate sediment in the Makaha Beach park region. Historical beach maintenance included pushing sand landward to the edge of the parking lot from lower on the beach profile as it reforms in the summer months. Typical sand push volumes are unknown but estimated to be 2000-5000 cubic yards per effort. Long-term erosion mapping suggests a complex environment with an alternating alongshore pattern of erosion and accretion at Makaha Beach (Figure 3).

MAKAHA BEACH MANAGEMENT GUIDELINES

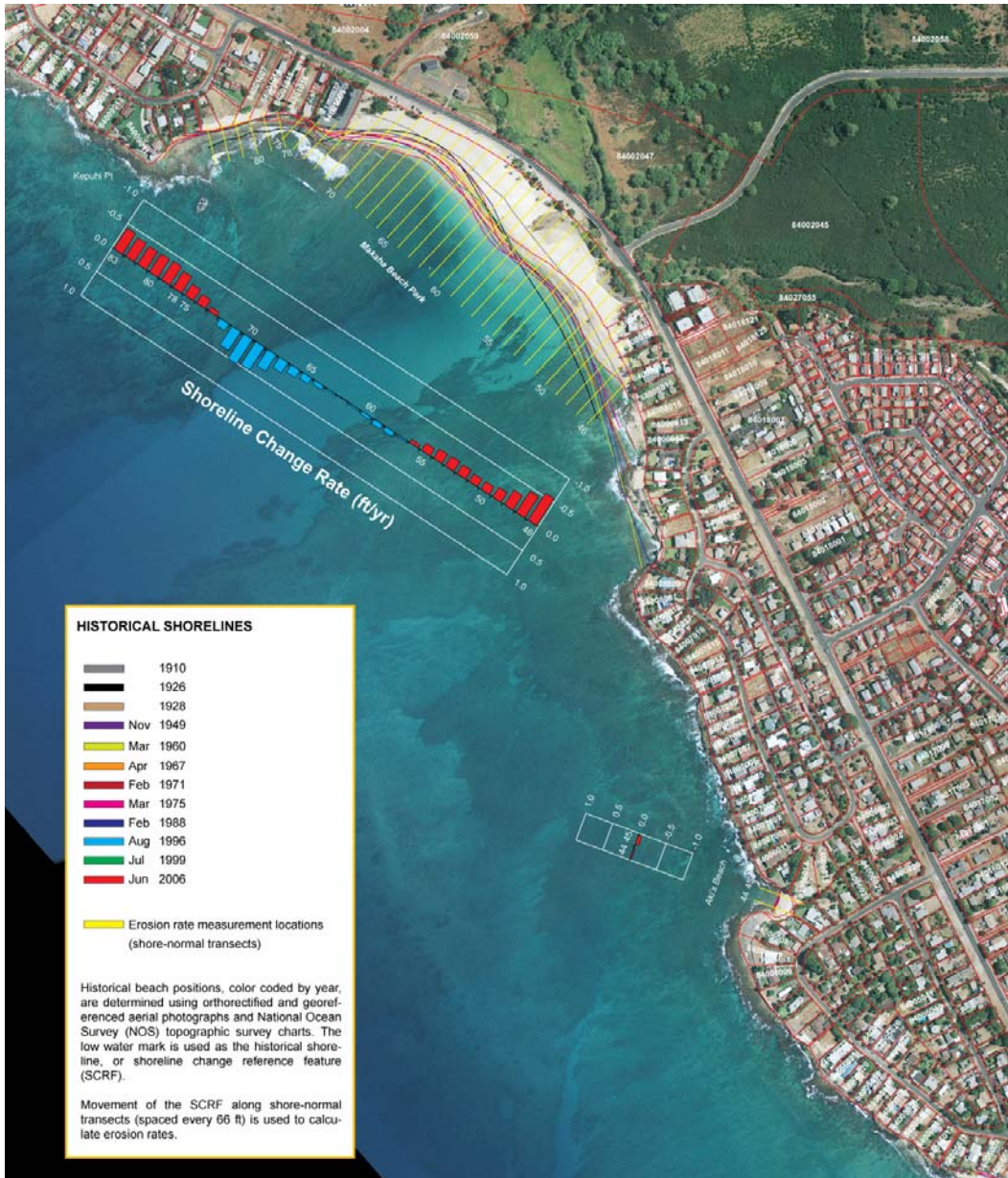


Figure 3. Long-term shoreline erosion mapping indicates the Makaha area experiences relatively minor erosion at the park boundaries (indicated by the red histogram bars) and moderate accretion of the beach (indicated by the blue bars). The colored lines along the shoreline are former shorelines and illustrate the dynamic nature of the shoreline here.

PROBLEM STATEMENT

Background

Studies show that nearly 25 percent of sandy beaches (17 miles) on the island of Oahu have been severely narrowed or lost over the past 70 years due to shoreline armoring. On the island of Maui, nearly 30 percent (9 miles) of the shoreline has experienced beach loss or significant narrowing. Beaches and dune systems are a critical component in the prevention of coastal erosion and flooding by serving as a natural buffer to prevent

MAKAHA BEACH MANAGEMENT GUIDELINES

property damage from storm waves and undermining due to shoreline retreat. Beaches are also the backbone of Hawaii's visitor economy, which provides the majority of Hawaii's jobs and income. Beaches are also critical for ecological, spiritual, local recreational and cultural reasons.

Coastal management policies in Hawaii have not prevented the loss of miles of sandy beach and coastal land to the ravages of erosion and inappropriate development. The administration is poised to implement new, sustainable approaches to the problem of beach management provided that credible supporting scientific studies and data can be established on which to base decisions. This commitment takes on a critical light given global predictions for continued, possibly accelerated, sea-level rise and the ongoing focus of intense development along the Hawaiian shoreline. Hawaii's coastal resource managers are faced with the daunting prospect of managing the effects of erosion while simultaneously monitoring and regulating high-risk coastal development that often impacts the shoreline.

The Makaha dune system has not been adequately protected or effectively managed despite local sand abundance. Along this once pristine coast, the dunes have been graded and developed with homes and highways. This has been to the detriment of the adjoining beach and associated habitat, which relies on this stored source of sand during times of episodic erosion. In addition, the grading of the primary coastal dune also has increased the vulnerability of the residents and infrastructure to coastal hazards such as storm waves and erosion. Elsewhere the dune has been alternately developed, inappropriately landscaped, or altogether removed in random fashion based on localized development styles. A site-specific comprehensive, conservation-oriented management and maintenance plan is needed for the Makaha beach and dune system to ensure the preservation and protection of this unique resource for future generations.

There are a number of direct threats to Makaha beach and dune system that may lead to ecosystem degradation, loss of recreational opportunities, loss of public access and increased exposure to coastal hazards. These include:

1. Continued localized erosion in Makaha Beach Park region due to a lack of a public access plan and coordinated sand management practices related to large seasonal variation in beach width.
2. Diminished coastal access due to seasonal and chronic beach erosion.
3. Haphazard, ad-hoc dune protection and emergency erosion control measures that often result in unintended consequences.
4. Inappropriately sited public improvements such as parking lots and roadways that require the beach maintenance in order to avoid erosion threats.
5. Increased exposure of beachfront residents to coastal hazards due to human-induced and natural shoreline dynamics.
6. Insufficient shoreline construction setbacks to guarantee beach and dune conservation and hazard mitigation.

Beach Maintenance (Sand Pushing)

Beach scraping or "sand pushing" commonly consists of excavating sand from the berm, beach face or nearshore areas and depositing the sand farther landward on the beach or in the dune system. A relatively thin layer of sand (1 ft. or less) is removed from the lower beach and spread over the upper beach. Sand is typically moved with a bulldozer, front-end loader or pan excavator, often in a landward direction across the beach. However, in some cases it may be moved from a shoreline where it is abundant to neighboring beach areas. Beach scraping is often carried out as a temporary erosion control measure before the onset of seasonal high wave activity. Sand pushing in Hawaii is utilized to cover exposed geotextile bags, protect roadways, and to shore up public beach access ways. This procedure is usually carried out over much larger areas of beach in the mainland U.S. than is commonly practiced in Hawaii.



Sand Pushing at Ehukai Beach, Oahu.

Beach scraping is the least expensive erosion mitigation technique. It has served to temporarily alter a limited portion of the beach face to providing infill for an eroded area. Beach scraping should *not* be considered a long-term alternative for erosion management as it is primarily a temporary cosmetic fix. Beach scraping in Hawaii may occur on scales from one-time occurrences for single parcels to ongoing projects across broad sections of beach. Small-scale beach nourishment should be considered to compliment beach scraping projects that are needed regularly. ***Careful judgment and analysis of nearshore processes (such as the dominant transport mechanisms and direction) must be exercised when planning these efforts, as there is evidence that beach scraping may accelerate erosion under some circumstances,*** See beach scraping references Appendix A. Consult with the DLNR-OCCL for more information.

Beach Scraping Restrictions and Limitations:

Beach scraping as practiced and permitted in Hawaii consists of excavating the beach berm and beach face usually with a front-end loader or a bulldozer. This practice has been carried out on a limited basis, typically for public safety at beach right-of-ways or fronting heavily eroded beaches with episodic erosion.

To limit the potential adverse impacts of sand pushing, the following restrictions apply:

- First, assess the potential of beach nourishment as an alternative to beach scraping.
- The depth of excavation is limited to one (1) foot below the original beach profile

MAKAHA BEACH MANAGEMENT GUIDELINES

elevation.

- The seaward limit of excavation should be limited to the mean high water mark usually evidenced by a foreshore berm, debris line and/or a wet/dry line.
- The pushed sand shall *not* be placed any farther landward than the seaward line of dune vegetation. Existing vegetation shall not be buried or otherwise harmed.
- Grading to occur in the shoreline set back zone (40 ft landward of the certified shoreline) should be minimized and where possible, the natural undulations and contours of the shoreline preserved.
- Excavation is generally limited to the lateral bounds of the property where it is placed.
- Scraping is allowed only if the berm is sufficiently wide to provide a reasonable source of sand. If the beach is too narrow fill must be used (nourishment) rather than scraping.
- Sea turtle and Monk Seal and bird nesting may limit scraping location and timing. A check of nesting or resting species must be conducted before and periodically during construction.

APPENDIX A. Beach Scraping Report References

- Bruun, P. 1983. *Beach Scraping - Is It Damaging to Beach Stability?* Coastal Engineering, 7, 167 - 173.
- Kana, Timothy W., and Svetlichny, Michael. 1982. *Artificial Manipulation of Beach Profiles*. Coastal Engineering, 1982, 903 - 922.
- Kerhin, R.T. and Halka, H.P. 1981. *Beach Changes Associated With Bulldozing of the Lower Shoreface*. Maryland Geological Survey, Open File Rept. 7, 28p.
- Leadon, Mark E. 1978. *Beach Shaping Model Study*. Coastal and Oceanographic Engineering Laboratory. University of Florida.
- Lindquist, Neils, and Manning, Lisa. 2001. *Impacts of Beach Nourishment and Beach Scraping on Critical Habitat and Productivity of Surf Fishes*. Final Report - Project # 98-EP-05. North Carolina Sea Grant, Fisheries Resource Grant Program.
- McNinch, Jesse E. 1989. *The Effectiveness of Beach Scraping as a Method of Erosion Control: Topsail Beach, North Carolina*. Unpubl. M.S. Thesis, University of North Carolina, Chapel Hill, N.C., 72 p.
- McNinch, Jesse E. and Wells, John T. 1992. *Effectiveness of Beach Scraping as a Method of Erosion Control*. Shore and Beach, January 1992, 13 - 20.
- Peterson, Charles H.; Hickerson, Darren H.M., and Johnson, Gina Grissom. 2000. *Short-Term Consequences of Nourishment and Bulldozing on the Dominant Large Invertebrates of a Sandy Beach*. Journal of Coastal Research, 16 (2), 368-378.
- Peterson, Charles H.; et al 2001. *Effectiveness of Beach Bulldozing Against Shoreline Erosion and the Impacts of Bulldozing on Biological Resources*. North Carolina Sea Grant & North Carolina Division of Coastal Management.
- Smutz, Morton., et al. 1978. *Nature Assisted Beach Enhancement*. American Shore and Beach Preservation Association Conference Proceedings.
- Tye, Robert S. 1983. *Impact of Hurricane David And Mechanical Dune Restoration On Folly Beach, South Carolina*. Shore and Beach, April 1983, 3 - 9.
- Wells, John T. and McNinch, Jesse. 1990. *Beach Scraping in North Carolina with Special Reference to its Effectiveness During Hurricane Hugo*. Journal of Coastal Research, No. 8, 1991, 249 - 261. Fort Lauderdale, Florida.
- University of Florida. 1969. *Cooperative Study at Jupiter Island, Florida*. Report UF/COEL-69/16. Coastal and Oceanographic Engineering Department. University of Florida.