



## Honolulu District, Southeast Oahu, Hawaii

**ISSUE:** The Regional Sediment Management (RSM) Demonstration Project area includes 12 miles along the windward coast of Southeast Oahu, the most populated island in the Hawaiian Island chain. The project area is bounded by rocky headlands, Mokapu Point to the north, and Makapu'u Point to the south (Figures 1 and 2). Land use along the project area varies widely and includes military bases (Bellows Air Force Station and Marine Corps Base Hawaii), recreational beach parks, residential property, native Hawaiian homelands, and a coastal highway that provides the only access around the southeast portion of the island. The region is dominated by consistent tradewind-driven conditions, and coastal processes are highly influenced by a wide reef flat and wave sheltering from surrounding islands. The islands have limited sediment supply. There is almost no terrestrial supply of sand, and the primary natural source is calcareous from coral and reef-dwelling organisms.

There are three littoral cells within the project area, Kailua in the north, Lanikai in the middle, and Waimanalo in the south. There are geologic controls (both subaerial and offshore) affecting sediment transport along the three cells. As part of the study, possible sediment exchange between the cells will be investigated. The nearshore region includes a wide and flat reef, which causes large waves to break on its outer edge. Waves are depth-limited by the reef, allowing them

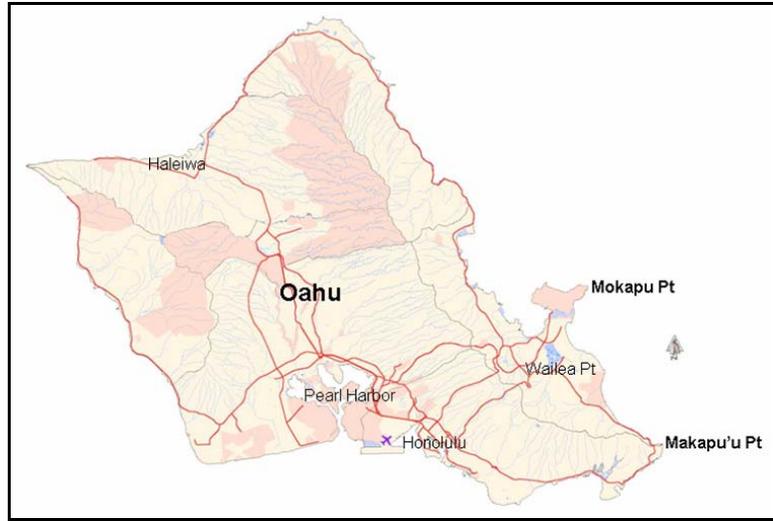


Figure 1. Project boundaries along Southeast Oahu

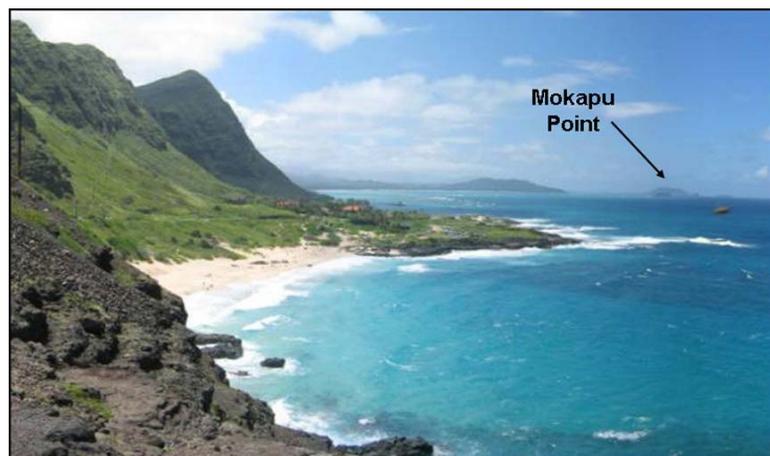


Figure 2. View of project area from Makapu'u Point, facing northwest

to break and reform as they approach the shoreline. Long-term (decadal or more) shifts in wind, wave direction, and wave period may shift sediment transport patterns and magnitudes. As a result, sediment transport processes of these beaches are difficult to understand, and RSM solutions are not readily apparent. In addition, sand sources for this region have not been identified. A strategic plan for sediment management must be developed to optimize use of that which is available.

**PROJECT GOALS:** The goal of this demonstration project is to increase understanding of littoral processes in an island environment for the purpose of preserving and restoring beaches in the region through careful management of sediment, and to use the lessons learned to identify potential applications of RSM from mauka (the mountains) to makai (the sea) in locations elsewhere. The project will use collaboration and sharing of information with government agencies, educational institutions, and local interests to develop decision-making tools for use in the long-term planning of actions that affect sediment movement in the region.

**SUMMARY:** The following initiatives are being undertaken to address sediment related issues within the project area:

**Coastal Processes Analysis.** A better understanding of the circulation patterns and sediment pathways that drive the movement of sand along the coast must be developed to effectively manage the limited sediment supply in the region. This will be initiated through collection of field data and application of numerical models. One of the main processes that must be considered is wave breaking over a wide reef, and the effect that this has on circulation patterns, and in turn, sediment transport. Another objective is to determine whether there is sediment being transported around Wailea Point, a small headland near the center of the region.

**Sediment Budget and Identification of Sand Sources.** Development of a sediment budget for the area will be completed using information learned from the Coastal Processes Analysis, in addition to a historical shoreline analysis completed using aerial photography to determine long-term rates of shoreline change. Identification of excess sand deposited upland, identification and analysis of offshore sand bodies using remote sensing and identification of sources and sinks will also be undertaken to develop a sediment budget and determine possible supplies of useable sand. Coral reef mapping may also provide further information that can be used to develop a sediment budget.

**Web-based Geographic Information System (GIS).** Development of a Web-based GIS will provide stakeholders and sponsors the ability to access existing and newly collected geospatial data within the region. Making this information available will not only provide tools for use in the coastal planning process, but also will encourage collaboration and sharing of knowledge and capabilities between users. The platform will facilitate interactive participation through the life of the project and foster regional sediment management in Hawaii.

## POTENTIAL PROJECT LOCATIONS

### **Kaupo/Kaiona Beaches.**

Erosion along the Kaupo/Kaiona beaches threatens the highway that provides the only access around the southeast portion of Oahu (Figure 3). These beaches are narrow with unstable backshore slopes. The highway has already been moved inland several times, there is little room left for further retreat.



Figure 3. Erosion threatening highway along Kaupo/Kaiona beaches

### **Bellows Air Force Station.**

Erosion threatens military vacation cottages along the shoreline. Existing coastal armoring is tying up sediment supply in the littoral zone and limits recreational use of the area.

**Lanikai Beach.** There is no dry beach along the southern portion of Lanikai. Much of the shoreline along the beach has been hardened with seawalls (Figure 4), and up to 150 ft of beach loss has occurred along areas of the beach during the past 50 years.



Figure 4. Coastal armoring along project area shoreline

**Ka'elepulu Stream.** Sand is being removed from the littoral system through maintenance of the stream mouth, and is being stockpiled along the stream banks (Figure 5). A portion of the sand is blown inland by trade winds and lost from the littoral system.

**STATUS:** A June 2004 workshop, which included Federal, state and local agencies, academia, consultants and the local community, identified data needs, environmental concerns, potential funding sources, and potential demonstration projects within Southeast Oahu. A second workshop in July 2005 developed issues, opportunities, and alternatives at each potential demonstration project location identified in the first workshop.

A Web site has been developed with RSM information concerning the national RSM effort, RSM in Southeast Oahu, and tasks identified for upcoming fiscal years. For details, go to <http://www.poh.usace.army.mil/RSM/index.htm>

Current efforts are focused on linking wave transformation and water circulation models to better understand effects of reefs on coastal processes and to help isolate modes of sediment transport. In August 2005, field data will be collected along Southeast Oahu to enable precise model calibration and verification. By the fall of 2005, it is anticipated that the Web-based GIS system will be on-line.



Figure 5. Stockpiling of sand at the mouth of Ka'elepulu Stream

## LESSONS LEARNED

- Collaboration between Federal, state, and local governments, as well as educational institutions builds on existing knowledge and is invaluable.
- Innovative funding sources in areas with few federally authorized projects should be investigated.
- Dynamics of an area should be studied thoroughly with new and existing data sources and available tools before attempting to implement solutions.
- The island environment including wave breaking and ponding over a wide reef is not fully understood, and many numerical models have not been applied and verified in an island environment

**KEY WORDS:** Hawaii, island, carbonate sediments, reef, seawalls

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