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**Erosion Management Alternatives
for Hawaii**



Prepared by:

University of Hawaii Sea Grant Extension Service

and

State of Hawaii

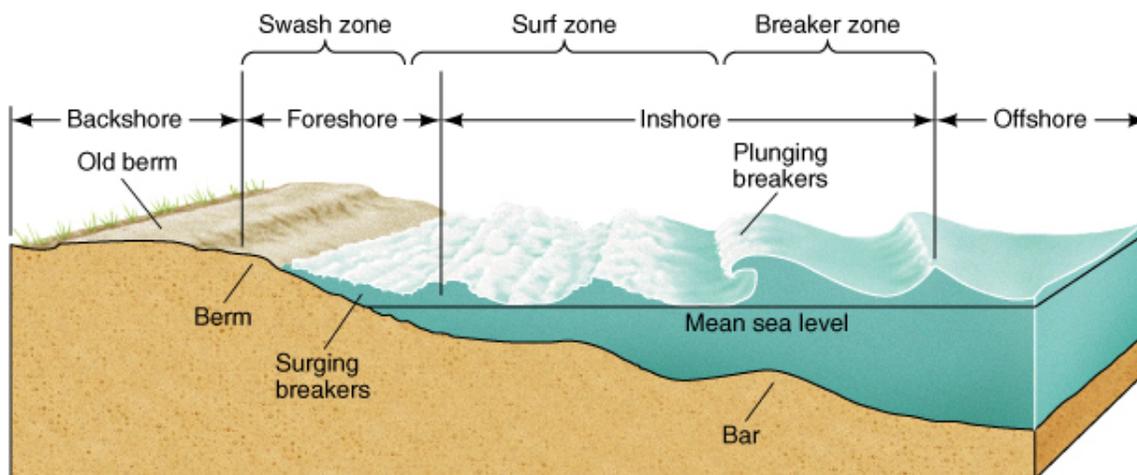
Department of Land and Natural Resources

Office of Conservation and Coastal Lands

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Jurisdiction *Hawaii Revised Statutes 205A-1*

The State of Hawaii defines the shoreline for purposes of jurisdiction and property boundaries as "...the upper reaches of the wash of the waves, other than storm or seismic waves, at the highest tide during the season of the year in which the highest wash of the waves occurs, usually evidenced by the edge of the vegetation growth, or the upper limit of debris left by the wash of the waves." By this definition, "the beach" may be loosely defined as the sandy area from the high wash of the waves to the seaward edge of the foreshore. Similarly, cliffs, dunes or other features landward of the backshore may be defined simply as "coastal" features or uplands. Common shoreline and beach terminology is listed below.



Shoreline Terminology (Image: John Wiley and Sons)

In Hawaii, each county defines unique zoning and setback regulations for coastal development based on the position of the certified shoreline. Most (not all) counties apply a minimum 40 foot setback zone from the certified shoreline where development is prohibited. Maui County is in the process of revising their shoreline setback laws to a variable set back based on the annual rate of erosion. Generally the state is responsible for regulation of the area from the shoreline seaward to the 3-mile offshore limit of the state's jurisdiction, this is often referred to as the Conservation District. Likewise, each county regulates the area from the shoreline landward in a Special Management Area (SMA). Both the Conservation District and the SMA have restrictions on the type of activities that are allowed within this area.



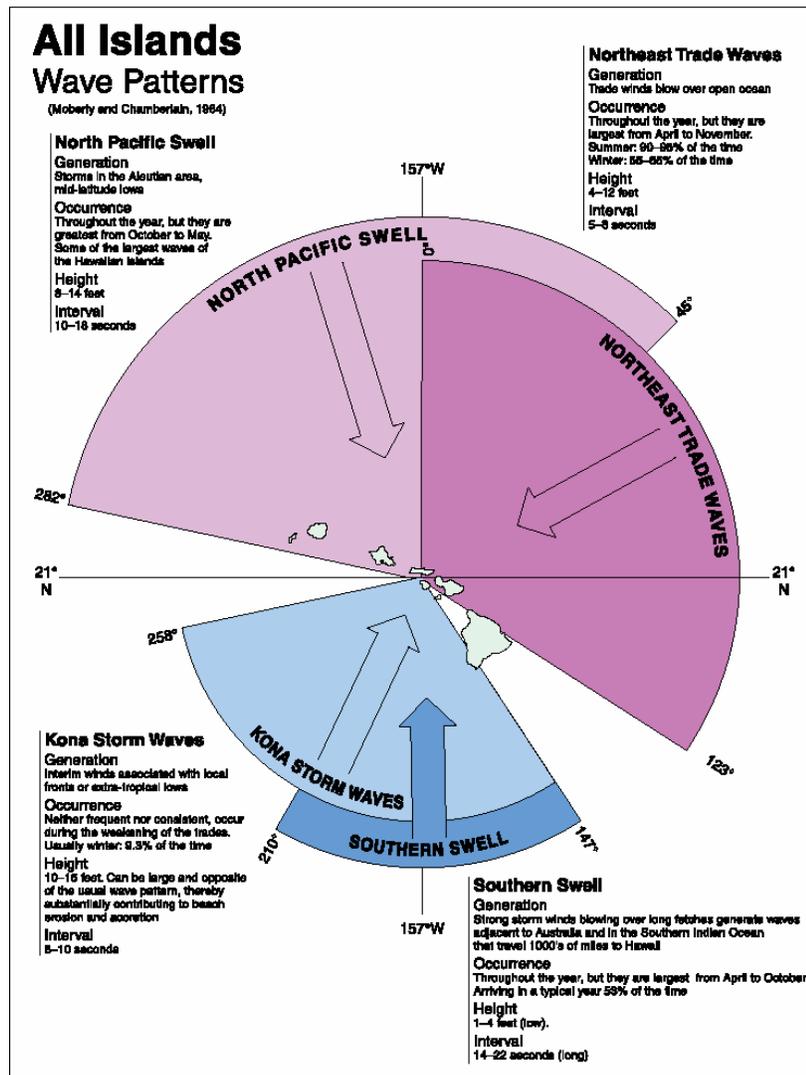
Coastal Jurisdiction -Lanikai

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Seasonal Changes

Many coastal residents are acutely familiar with the seasonal changes that occur along their particular shoreline. The seasonal changes in Hawaii can be quite dramatic and are a result in the seasonal shift in the wave regime. Large North Pacific Storms dominate in the winter while Southern Hemisphere swells and short period trade wind swell are more typical in the summer. The change in direction and energy cause the beach to change shape either through the longshore or cross shore transfer of sand.

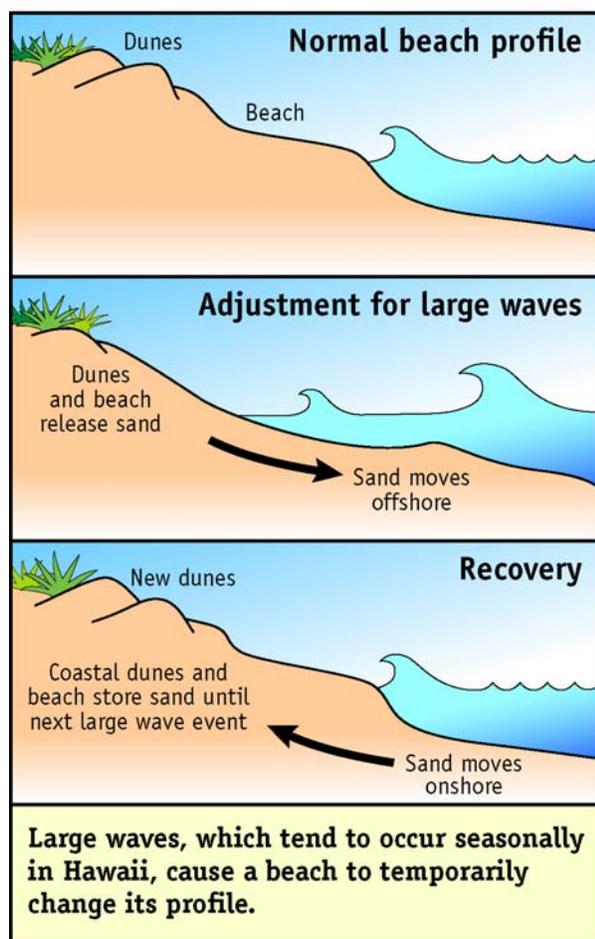
Hawaii's waves originate from four primary sources, North Pacific swell, northeast trade wind swell, south swell, and Kona storm swell. Hurricanes and tropical storms are also important sources of waves that impact Hawaii's coasts on an interannual basis. Short-wave period Kona storms and hurricanes often have a severe erosional effect on the south-facing shores of the Hawaiian Islands. These episodic storms have been found to one of the primary causes of beach loss in some areas of Kaanapali, West Maui (Eversole, 2002)



From: *Atlas of Natural Hazards in the Hawaiian Coastal Zone 2002*

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Seasonal beach profile adjustments

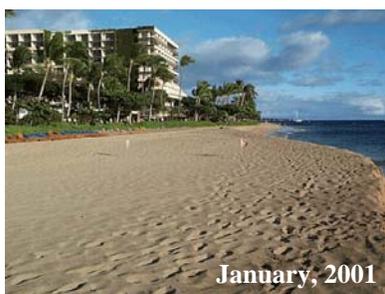


Seasonal fluctuations in the shape of the beach are often somewhat predictable and should be carefully considered while planning any erosion control procedures. Coastal homeowners should be familiar with these seasonal fluctuations and be prepared to anticipate erosion and beach loss issues. Coastal homeowners on north facing shores should pay particular attention to the seasonal changes of the shoreline due to high surf in the winters. Often what appears to be significant beach loss may be normal seasonal adjustment that will recover quite rapidly with the change in the wave regime. Severe coastal erosion and beach loss is sometimes due to a combination of chronic erosion compounded by seasonal beach loss or an unusually large event or series of events that erode beyond the normal seasonal adjustment range. (See Sheraton Kaanapali steel sheets in the following Section).

If historical aerial photographs are used to estimate an erosion rate based on the position of the shoreline an assessment of the seasonal error due to seasonal changes should be applied thus taking into account the season in which the photo was taken. For example, the beach at

Hanakoo Point in Kaanapali Beach reveals a strong seasonal fluctuation of up to 60 meters with fairly predictable regularity. A historical shoreline analysis carried out with aerial photographs must take into account the magnitude of these seasonal fluctuations in order to accurately assess the long-term trend of the shoreline.

Seasonal Change at Kaanapali Beach



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a) Coastal Dune Stabilization, Restoration and Vegetation

Sand dunes play an important part in the beach system. Vegetated dunes trap windblown sand, store excess sand reserves, serve as natural erosion buffers and create an elevated berm and dense root system that may protect against storm and high wave events. The dunes provide an emergency supply of sand to the beach when erosion occurs. It is advisable to plant species that are adapted to the physical and chemical characteristics of the site, maybe with some advice from a professional or nursery. Several species of native Hawaiian plants are adapted to the coastal environment and perform well for erosion control.



'Aki 'Aki



'Akulikuli



Naupaka



Pohuehue (Beach Morning Glory)



Sea Shore Paspalum Grass



Wind Breaks & Walk Over

These salt-tolerant species of plants and grasses provide an effective erosion control for Hawaii dune systems. Natural vegetation is important for stabilizing the dune system. These low-lying plants work well to cover the active dune and protect the backshore against temporary erosion by forming a dense mat that is resistant to wind and wave erosion. Seashore Paspalum grass is ideally suited for Hawaii in the area behind the frontal dune but still in the erosion zone. This salt-tolerant grass can grow directly on the sand with little or no soil needed. It can withstand periodic flooding and can be irrigated with brackish water. As with many of these species, herbicides are not needed because salt water can be used to kill weeds. Dune walkovers and wind breaks also help to prevent erosion to the dune system and should be considered in areas where heavy foot traffic and wind are causing erosion of a dune. Pathways that cross through a dune should be oriented diagonally to the predominant wind direction so that the pathway does not allow wind-blown sand to be funneled through the depressed pathway.

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Advantages: Low cost and aesthetically pleasing natural alternative that is relatively easy to achieve. Helps retain natural appearance and provides habitat for many native species of plants and animals. Trees act as wind breaks while low lying plants and grasses that have dense root systems perform well as erosion control.

Disadvantages: Few vegetation species can survive repeated inundation by salt water. Takes considerable time to establish dense vegetation that is resistant enough to withstand large storms and planted areas are vulnerable to erosion until vegetation is well established. Not as effective against wave erosion as other measures. Requires periodic maintenance and watering. If vegetation encroaches onto state land can complicate the shoreline certification process and can be interpreted to be an encroachment onto state lands.



Seashore Paspalum grass is ideally suited for the area behind the frontal dune and can grow directly on the sand with little or no soil.

Costs: Low cost alternative. Cheapest of the erosion control measures. Cost depends on landscaping style and vegetation choice.

Permits Required: Special Management Area (SMA) Permit



Coastal vegetation at Kailua Beach, Oahu. Naupaka (right), Beach Morning Glory (Left-Center) and Aki Aki (Left) providing a protective mat on the coastal dune.

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