Kāʻanapali Beach Restoration Project
Executive Summary

Kāʻanapali Beach has been negatively impacted by chronic erosion and extreme seasonal erosion over the previous four decades. Sand loss is expected to continue and even accelerate with sea level rise. As an adaptation measure, the beach may be maintained with either sand restoration, or managed retreat, or both. Managed retreat is a multidecadal process. In the meantime, the beach can be maintained through sand nourishment utilizing best practices to ensure protection of the nearshore marine environment.

The State of Hawaiʻi and the Kāʻanapali Operations Association, Inc. have developed a plan to ensure the long-term viability of this sandy coastal resource, which includes both beach restoration and berm enhancement. Beach restoration is proposed for the section of beach between Hanakaʻōʻō Beach Park and Hanakaʻōʻō Point ("Hanakaʻōʻō Littoral Cell"), and beach berm enhancement is proposed for the section of beach between Hanakaʻōʻō Point and Puʻu Kekaʻa ("Kāʻanapali Littoral Cell") (Figure 1). The proposed project is intended to mitigate the impacts of coastal erosion and rising water levels, which are increasing with global sea-level rise and increased storm severity in the tropics. The project provides a nature-based adaptation solution that increases protection for the Kāʻanapali Resort community while restoring recreational resources and natural habitat. Adding beach quality sand to the north and south littoral cells is a key action for restoring the beach back to its former width and volume. The project is intended to make Kāʻanapali more resilient to the effects of seasonal erosion and longer-term climate change.

The Hanakaʻōʻō Littoral Cell is suffering from a combination of chronic and episodic erosion, which has resulted in beach narrowing, shoreline recession, and damage to backshore infrastructure including the Kāʻanapali Beachwalk. The beach in this littoral cell is less seasonally dynamic than the beach in the Kāʻanapali Littoral Cell to the north; however, the long-term changes in beach location and width are far more pervasive along this length of shoreline. The presently narrow beach, chronic erosion, and limited seasonal sand transport make this section of shoreline suitable for beach restoration. Beach restoration would include the addition of beach quality sand from the current beach face out to the former extent of the beach in the 1980s. The proposed project would use approximately 50,000 cubic yards of beach compatible marine carbonate sand to restore the beach to the approximate position shown in the 1988 aerial photograph (Figure 2). This would widen the dry beach by between 41 and 78 feet.

The Kāʻanapali Littoral Cell, between Hanakaʻōʻō Point and Puʻu Kekaʻa, experiences significant seasonal erosion with alternating predominant wave directions in summer and winter. Berm enhancement, or raising the elevation of the beach berm, would create a new reservoir of sand along the backshore to augment the current sediment system with additional volume and help offset temporary beach loss during the natural seasonal erosion cycles. Sand placed at the north end of the beach would be seasonally eroded during the winter months, while sand placed at the south end of the littoral cell, at Hanakaʻōʻō Point, would be released during summer months. Both berm enhancement areas would provide a buffer during extreme erosion events by increasing total beach sand volume within the broader littoral cell. The proposed project would use approximately 25,000 cubic yards of sand to raise the beach berm elevation by 3.5 feet within the Kāʻanapali Littoral Cell (Figure 2). The berm enhancement area would extend from the vegetation in the backshore to the berm crest, at the mauka edge of the beach face.

A total of approximately 75,000 cubic yards of sand is needed for the proposed beach restoration and berm enhancement project, with 50,000 cubic yards and 25,000 cubic yards allocated to the Hanakaʻōʻō and Kāʻanapali littoral cells, respectively. This beach quality sand would be recovered from an 8.5-acre sand deposit, located approximately 150 feet offshore of Puʻu Kekaʻa in 28 to 56 feet water depth (Figure 2). The proposed sand recovery method consists of a moored crane barge equipped with an environmental clamshell bucket, two sand transport barges, several tugboats, and two landing areas at opposite ends of the project area.

The crane barge would lift sand from the seafloor with the environmental clamshell bucket and place it onto two approximately 1,500 cubic yard capacity barges. Environmental clamshell buckets are designed to minimize water volume and maximize precision with each sand recovery scoop, which minimizes potential impacts to the surrounding environment. The sand transport barges would rotate between the sand recovery site and the off-loading sites. Once a sand transport barge is filled at the sand recovery site, it would be towed to the off-loading site by a tugboat, where the barge would be moored adjacent to an elevated trestle or floating bridge (Figure 3). The elevated trestle or floating bridge would extend from approximately 15 feet of water depth to shore. Sand would be transferred from the barge to shore along the bridge/trestle system using a methodology selected by the contractor. Land-based equipment would then transfer the sand from the shoreline, at the end of the elevated trestle or bridge, to the placement area. At the sand placement area, which would move each day as the project advances, bulldozers and crews would spread sand along the shore to meet the lines and grades of the design beach restoration plan and section and the berm enhancement plan and section.

During placement activities there would be heavy equipment operated on the beach at the sand transfer site and at the sand placement site. These areas would be treated as active construction sites and public access would be limited near the heavy machinery and sand loading and grading areas. The sand placement site would move progressively through the berm enhancement and beach restoration areas as sand is added to the beach. Sand would be mechanically hauled by dump trucks between the two transfer sites on the beach and the restoration areas on the berm and beach. During hauling operations, the transit corridor for the trucks would be cordoned off and assistants would be available along the full length of the haul route to facilitate public access to and from the shoreline. During marine sand delivery operations, from the sand recovery barge to the off-loading sites, marine traffic and public access along the navigation route would be restricted. There would be approximately four rotations of barges between the recovery site and off-loading sites each day. There would also be restricted public access around the sand recovery barge and the offloading sites, to protect the public from potentially dangerous contact with the equipment and support materials.

During construction, which is expected to last approximately two months, sand recovery, transfer, and placement activities are expected to take place at least 12 hours per day, seven days per week. The goal is to complete the project in the most efficient manner possible, thereby limiting the inconvenience to the general public and construction related impacts to the environment. The work is projected to take place during October, November, and part of December, minimizing overlap, as much as possible, with southern summer swell and norther winter swell environments.

Other forms of beach nourishment are also effective, have been utilized within the United States and on international coastlines, and may work at this location. Use of other means and methods for beach nourishment at Kā‘anapali would be contingent on the feasibility of given site conditions and on receiving permits from the applicable Federal, State, and County agencies. An alternate sand recovery and transport technique is hydraulic dredging, where sand entrained in seawater as a slurry is delivered via a pipeline to the beach or the inshore waters directly adjacent to the beach. Additional methods include, but are not limited to, sand transfer in submerged pipelines to create submerged sand bars, mechanical placement on the beach through conveyor belts, and dune creation or restoration. Nearshore and connected features are spread throughout the beach and inshore sand field by natural wave and current processes.

The State has developed extensive best management practices through the environmental review process and consultation with natural resource management agencies to ensure that coral and other marine organisms and resources are protected throughout project construction. Identification of a beach compatible and suitable sand source is a critical element of the marine protection program. The sand selected for this project is nearby, which limits travel and sand transfer requirements. Moreover, the character of the sand is very similar in nature to the native sand on Kaanapali beach, which typically results in the restored beach behaving much like the native beach.

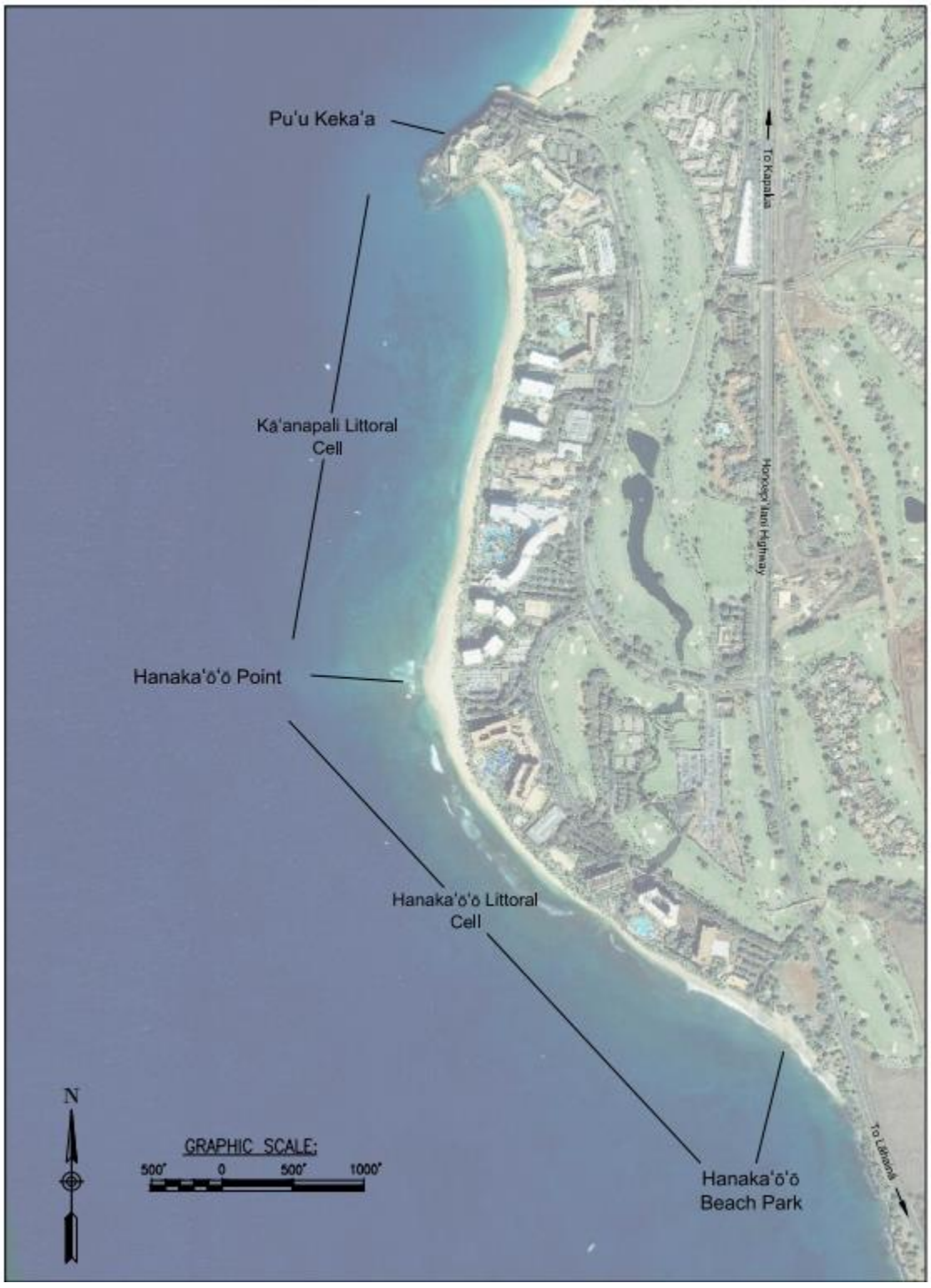

Figure 1. Kāʻanapali Beach overview.

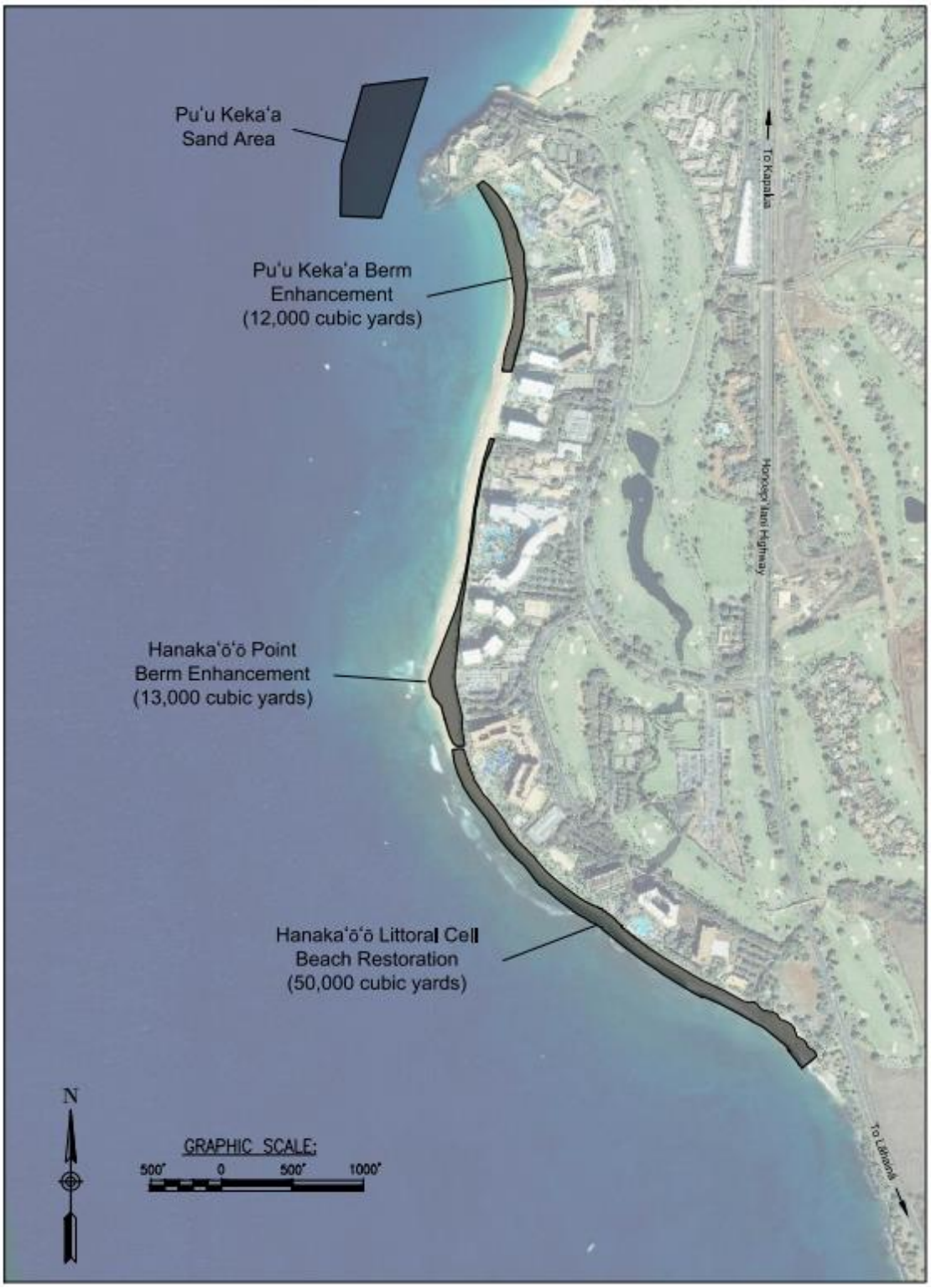

Figure 2. Kā‘anapali Beach restoration and sand recovery areas overview.

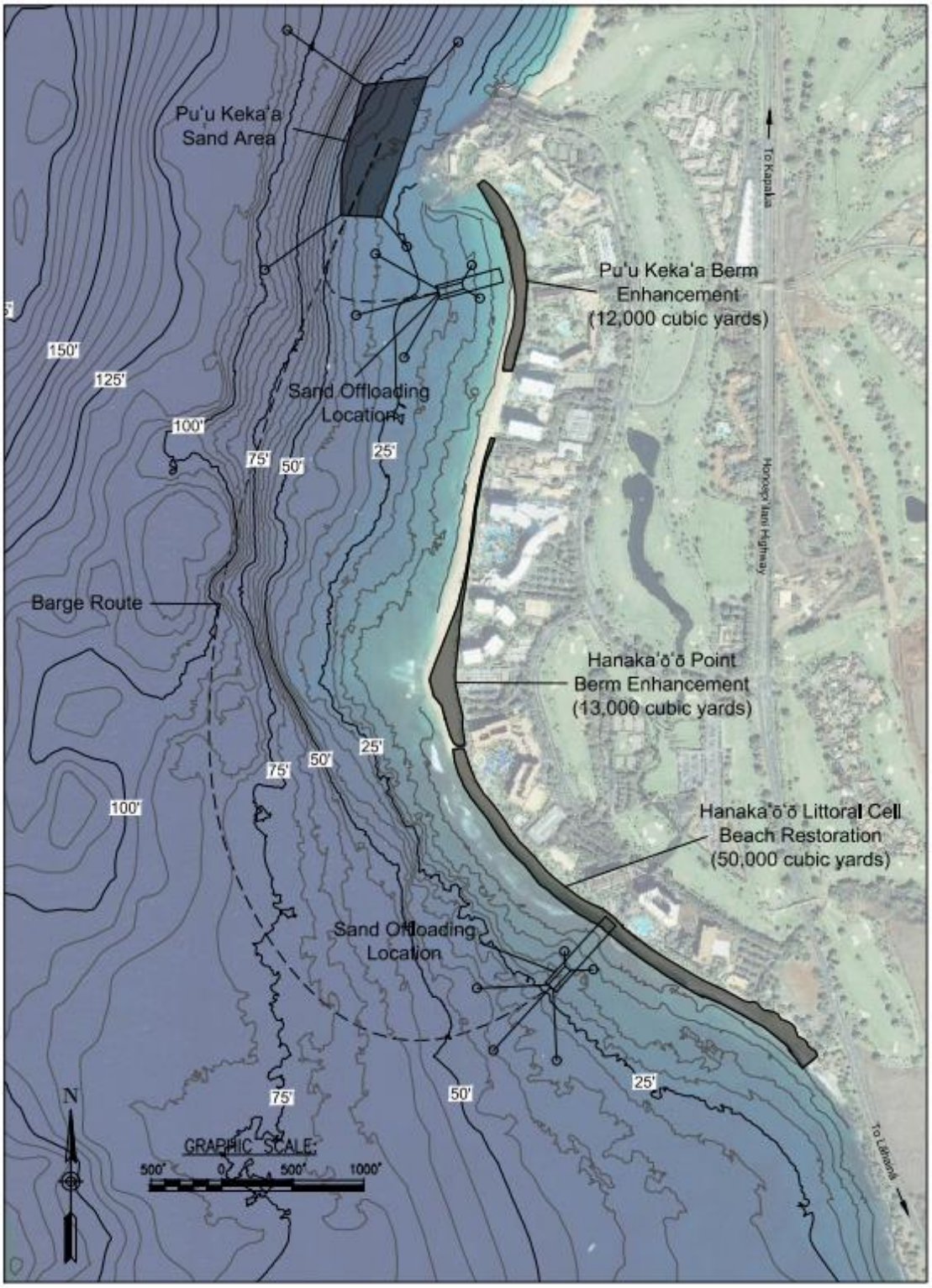

Figure 3. Kā‘anapali Beach restoration sand delivery plan.