



BEACH RESTORATION IN HAWAII: CHALLENGES AND OPPORTUNITIES

The background of the entire page is a photograph of a beach restoration site. In the foreground, a large, light-colored sand dune has been built up. A yellow excavator is positioned on the dune, and another smaller piece of machinery is visible further back. The ocean waves are breaking onto the beach, and a tall, thin pole stands in the water. In the background, a multi-story building and a mountain are visible under a blue sky with scattered white clouds.

**OUTCOMES FROM THE
HAWAII SHORE AND BEACH PRESERVATION ASSOCIATION (HSBPA)
2014 HAWAII BEACH RESTORATION WORKSHOP**

BEACH RESTORATION IN HAWAII: CHALLENGES AND OPPORTUNITIES
Outcomes from the Hawaii Shore and Beach Preservation Association (HSBPA)
2014 Hawaii Beach Restoration Workshop

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The Hawaii Shore and Beach Preservation Association (HSBPA) is a non-profit organization of private sector, academic, and government professionals, students and local community members dedicated to the preservation and restoration of Hawaii's beaches and coastal environments. The HSBPA is a local chapter of the American Shore and Beach Preservation Association (ASBPA) but retains independence in administration, governance and mission. The HSBPA aims to bring together various members of the coastal community to foster dialogue and cooperation on beach and coastal resource conservation, management, and regulation. HSBPA supports professional development of chapter members and provides education to students and community members on Hawaii's beaches and coastal environments.

For more information on the HSBPA see: <http://www.hawaiiishoreandbeach.org/>
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Acknowledgments

This white paper summarizes outcomes and recommendations from the Hawaii Shore and Beach Preservation Association (HSBPA) 2014 Hawaii Beach Restoration Workshop held at Kapiolani Community College, Honolulu on November 24, 2014. The HSBPA thanks the Hawaii Department of Land and Natural Resources (DLNR), Office of Conservation and Coastal Lands (OCCL) for co-sponsoring the event. We also thank the workshop presenters and invitees for attending and lending their expertise and vision to our association and the workshop.

The recommendations and opinions presented in this paper are those of the HSBPA and do not necessarily represent those of the individual presenters or the DLNR.

Cover. 2012 Waikiki Beach restoration project.

EXECUTIVE SUMMARY

The purpose of the Hawaii Shore and Beach Preservation Association (HSBPA) 2014 Beach Restoration Workshop was to identify needs, opportunities, and challenges associated with beach maintenance and coastal management in the State of Hawaii. A focus was on the role of beach restoration as an economically and environmentally viable alternative for managing Hawaii's eroding beaches for the purposes of environmental conservation and mitigation of coastal natural hazards. The workshop was co-sponsored by the HSBPA and the State of Hawaii Department of Land Natural Resources (DLNR), Office of Conservation and Coastal Lands (OCCL). Forty-three attendees participated in the workshop including HSBPA members and invitees selected based on their expertise. The attendees represented a wide cross-section of stakeholders who are regularly involved with coastal management, science, engineering, and land use in Hawaii. The workshop outcomes included the following issues, challenges, and recommendations:

1. **Permitting for beach restoration needs to be streamlined if conservation of the State's sandy beaches is going to be a priority for the environment, hazard mitigation, and the economy.** The permitting process for beach maintenance and restoration is time-consuming and cost-prohibitive for many projects in Hawaii. Two key recommendations included improvements to the State Clean Water Act Section 401 Water Quality Certification process and re-establishment of a State programmatic agreement ("blanket permit") for beach restoration projects.
2. **Increased funding should be developed through local and federal sources to support beach conservation, restoration, and coastal land use planning.** Government agencies tasked with coastal management in Hawaii are underfunded and understaffed. A proactive regional approach to beach management and restoration should be led by DLNR-OCCL and funded through partnership between government and local stakeholders. Innovative public-private partnerships have proven successful on recent state-led beach restoration projects and should serve as models for future projects.
3. **Studies are needed to assess availability and quality of onshore and offshore deposits of sand to support large-scale recovery efforts.** Beach-quality sand is in short supply for restoration projects in Hawaii. Large-scale sand recovery and stockpiling projects can take advantage of economies of scale, which smaller projects cannot afford. Funding is needed for sand recovery, material storage and processing, and to subsidize transport and placement of sand in cost-shared beach restoration projects.
4. **Additional research is needed to assess potential impacts of beach restoration projects to the marine environment.** Hawaii's beaches are an essential coastal habitat that front unique and sensitive marine environments. Improved studies of potential impacts of beach restoration projects will inform best management practices and standardized monitoring guidelines for future restoration projects.

1. Introduction

Hawaii's world-renown beaches are being lost at an alarming rate due to natural and human impacts. Alternatives to hardening our shorelines such as proactive sediment management, beach restoration, innovative erosion control measures, conservation of backshore areas and dunes, and managed retreat are needed in order to conserve and restore Hawaii's critical beach habitat, which is culturally and economically vital for future generations. Beach conservation will become increasingly urgent in the coming decades with accelerating sea-level rise and continued pressure to develop and utilize valuable beachfront property.

The workshop focused on beach restoration as one alternative for conserving and restoring Hawaii's beaches. The workshop explored the needs, opportunities, and challenges of making beach restoration an environmentally and economically viable option for Hawaii through the participation of association members, invited experts, and concerned stakeholders. This white paper is largely the result of input received from members, attendees, and invited presenters through discussion and breakout sessions, which were part of the workshop.



Beach erosion on the north shore of Oahu: January, 2013.

The paper is structured as follows: Section 1 is an introduction; Section 2 provides a background on beach erosion and beach loss in Hawaii; Section 3 explains what beach restoration is; Section 4 presents a historical perspective on beach restoration and nourishment in Hawaii; Section 5 introduces some of the challenges with beach restoration in Hawaii; Section 6 summarizes presentations and results from discussion panels and breakout groups; and Section 7 provides recommendations and conclusions based on the results of the workshop. The workshop agenda is provided in Appendix A and a list of participants is provided in Appendix B.

The paper is intended to help inform and prioritize efforts by HSBPA members, resource managers, policy-makers, scientists, engineers, and public and private stakeholders in preserving and restoring Hawaii's beaches and coastal environments.

2. Beach Erosion and Beach Loss in Hawaii

Coastal erosion and beach loss are critical problems along Hawaii's shoreline. A recent study by researchers at the U.S. Geological Survey and University of Hawaii found that 70% of beaches in Hawaii are undergoing chronic (long-term) erosion and 10%, or over 13 miles, of beach has been completely lost to erosion over the past century[1,2]. In nearly all locations where the beach has been lost, the shoreline is now characterized by hardened shoreline structures such as



Beach loss fronting coastal armoring at Lanikai, Oahu.

seawalls and revetments. With beachfront development and infrastructure often located 20 feet or less from dynamic shorelines, it's no surprise that coastal development is being threatened by chronic erosion and flooding from high waves, storms, and rising sea level. Historically, the typical response to beach erosion has been construction of seawalls and revetment to protect property and infrastructure on private and public lands – typically at the expense of the public beach fronting the structure.

Beaches are highly dynamic environments, existing in a delicate balance between incoming wave energy, sea level, and available sediment supply. On many beaches in Hawaii this balance has been disturbed due to interruption of the natural sand supply by shoreline structures and in some locations by historical removal (mining) of beach sand. There is evidence that sea-level rise due to human-induced climate warming over the last century has contributed to beach erosion trends on an island-wide scale[3].

The value of beaches in Hawaii is multifaceted and beyond estimation in many cases. Beaches are an essential coastal habitat for many species including seals, turtles, birds, fish, and invertebrates, some of which are endangered or protected. Beaches and sand dunes are a central part of Hawaiian culture, recreation, and society. In addition, beaches are a key attraction for Hawaii's tourist-based economy. "Healthy" beaches and dunes provide added protection for coastal development from seasonal high waves, storms, and tsunami.

3. What is Beach Restoration?

Beach restoration (or beach nourishment) projects are intended to supplement sand supply to a beach to compensate for losses from natural and human-induced factors. During a beach restoration project, beach-quality sand, imported from another location, is added to an eroding beach to return it to a former width and volume. Beach nourishment and beach maintenance are somewhat broader terms that have been used to describe both beach restoration, periodic maintenance, and the creation of new beach area. Most recent projects in Hawaii fall under the category of beach restoration, such as the recent Waikiki Beach Restoration Project (2012), which restored the beach to near its former width from the 1980s.

Beach restoration or beach nourishment is one of a range of tools for mitigating coastal erosion and should be considered on a case-by-case basis comparing potential benefits and impacts with alternatives. With beach restoration, periodic follow-up nourishment is typically needed to keep pace with ongoing erosion. Beach maintenance or sediment management (e.g., sand pushing, sand back-passing) involves redistribution of beach sand using heavy equipment in response erosion caused by storms, seasonal variability, blockage of a stream mouth, or human impacts such as foot traffic in beach parks and beach access ways. Erosion control structures (e.g., groins, jetties, breakwaters) can be effective at retaining sand and slowing erosion when used in combination with beach nourishment, in some settings. However, erosion control structures must be designed and sited carefully to mitigate possible impacts to adjacent beaches.



Dune restoration (sand back-passing) at Kailua, Oahu.

Types of projects implemented in Hawaii typically fall into two categories:

1. Beach Restoration

- Using land-based sand resources (e.g., dune sand)
- Using sand dredged from offshore deposits
- Beneficial reuse of sediment, such as from a harbor or stream mouth clearing project
- Sand imported from outside Hawaii (generally not permitted on State submerged lands)

2. Beach Maintenance

- Sand back-passing (recycling) from an area of seasonal beach accretion to an area of seasonal beach erosion
- Sand pushing or beach scraping to rebuild back-beach volume or dunes using seasonally-accreted sand from lower on the beach profile
- Dune restoration using borrowed sediment and other measures such as re-vegetation with native species and dune fencing

4. Historical Perspective of Beach Restoration in Hawaii

Beach restoration and beach nourishment have been practiced in Hawaii since at least 1929 with an experimental project to pump sand from the reef flat to fill a narrow beach fronting the Halekulani Hotel, Waikiki[4]. Beach nourishment, including construction of new beach area, began in earnest at Waikiki in the 1950s.

Beach restoration and maintenance projects have had varying success in Hawaii. The beaches in Waikiki have been maintained only through semi-regular nourishment and construction of a myriad of erosion control structures, including groins and breakwalls. Some past projects in Waikiki and elsewhere have had negative impacts, both locally and on other beaches. The use of erosion control structures (e.g., groins) has resulted in erosion of down-current beaches, most notably at Waikiki and along north Maui beaches. Waikiki beach nourishment projects in the 1940s and 1950 used hundreds of thousands of cubic yards of sand imported from other beaches on Oahu and other islands. Use of pulverized coral material to construct Ft DeRussy Beach at Waikiki in the 1960s resulted in hardening or cementation of much of the beach[4]. Impacts to beach environments and the extraction sites and impacts to water quality and nearshore ecosystems at the placements sites are not well known from these early projects.



2012 Beach restoration at Waikiki.

More recent projects at Waikiki (2012) and Iroquois Point (2013) on Oahu have proven more successful by utilizing modern engineering and design, pre-determined Best Management Practices (BMPs), and environmental monitoring. The Waikiki Beach Restoration Project in 2012 utilized sand dredged from a nearshore sand-filled channel in an effort to recycle sand back to the

shoreline within the existing littoral cell. The Waikiki project was initiated after a smaller demonstration project at Waikiki was completed in 2007. The Waikiki project took over 3 years to plan and permit at a total cost of \$2.4 million. The Iroquois Point project, completed in 2013, was a beneficial reuse of dredged sediment from the Pearl Harbor entrance channel to restore over one mile of heavily eroded beach[5]. The project included construction of a series of “T-head” groins engineered to refract wave patterns to maintain a stable, restored beach. The Iroquois Point project took over 10 years to design and permit. Both the Waikiki and Iroquois Point projects received national awards for “Best Restored Beaches” from the American Shore and Beach Preservation Association. Privately-funded projects have restored smaller “pocket” beaches, particularly along the heavily degraded beaches of north Maui, improving the beach environment and benefiting both shorefront landowners and public beach users.

Concerns have been raised over some beach restoration projects related to perceived impacts to water quality and reef sedimentation, in spite of required environmental monitoring and BMPs. Science and engineering with beach restoration and sediment management continues to evolve and better techniques for monitoring impacts have been developed. A goal of this workshop is to document needs, opportunities, and challenges to make beach restoration a more environmentally holistic option for managing Hawaii’s eroding beaches.

5. Challenges for Beach Restoration in Hawaii

Conducting beach restoration projects in Hawaii is logistically, financially, and environmentally challenging. Compatible beach sand for nourishment is a scarce and expensive resource. Recent projects have been forced to look offshore for suitable material. Beach restoration projects are expensive and often require work in broad coastal regions; however, government funding is limited. While potential environmental impacts of beach restoration deserve careful attention, the permitting process for beach restoration has become unnecessarily burdensome and time consuming making many beach restoration projects impractical and cost-prohibitive.

5.1 Sand Availability

Perhaps the first challenge when planning a beach restoration project is finding compatible sand for a project beach. Hawaii's famous "white" sand beaches are comprised largely of skeletal carbonate (limestone) sediment originally derived from the nearshore reef. Beach sand in Hawaii is a finite resource generally limited to thin deposits overlying a narrow coastal plain, in low-lying dune systems, narrow beaches, and within depressions and channels on the nearshore reef. By comparison, some mainland settings have abundant silicate sands that may be found in extensive terrestrial dune systems and across a wide marine continental shelf. Beaches in Hawaii are typically narrow and short compared to mainland settings. As a result, beach restoration projects in Hawaii are relatively small, typically utilizing thousands to tens of thousands of cubic yards of sand, compared to mainland projects, where hundreds of thousands to millions of cubic yards of sand are routinely used.



Beach sand in Hawaii is typically comprised of carbonate skeletal material from nearshore reefs.

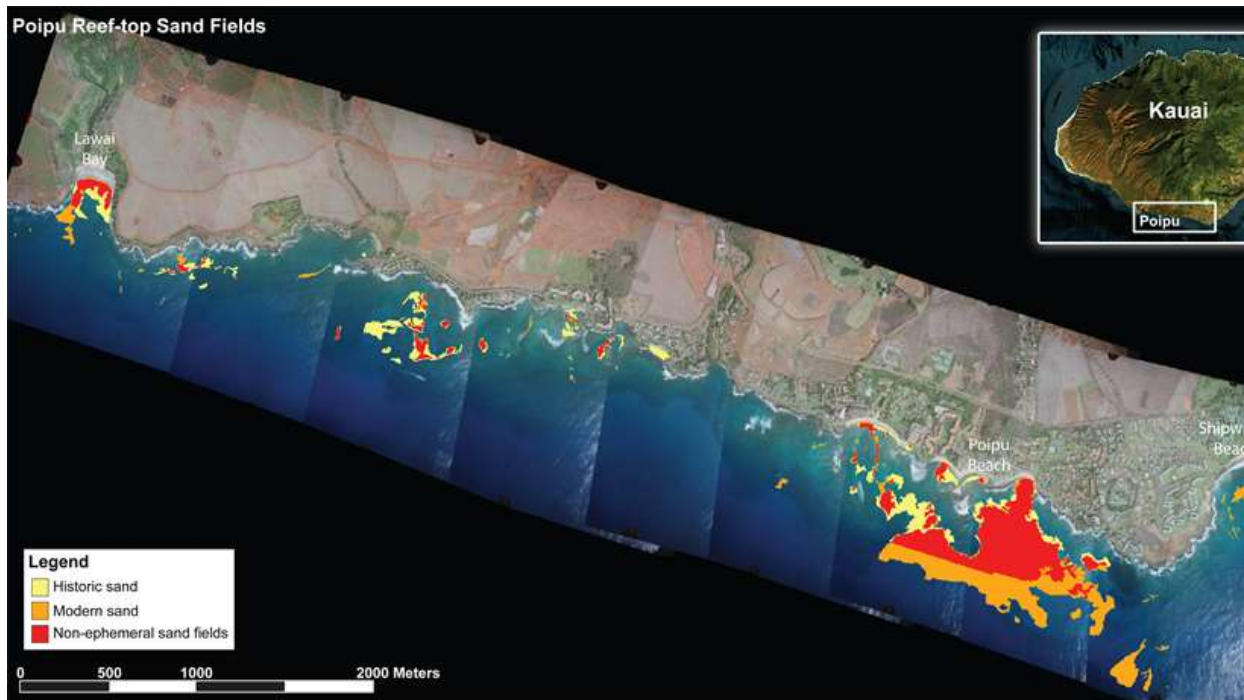
5.1.1 Land-based Sand Sources

Land-based sources of beach-quality sand in Hawaii have become scarce. Based on historical impacts from sand mining, it is illegal to take sand from a beach or dune system in the State Conservation District. A number of beach and dune restoration projects have been completed on Maui using inland dune sands taken from private lands and commercial sand quarries. Inland sand deposits are less developed on Kauai and Oahu and virtually nonexistent on Hawaii Island. Though dune sand is primarily marine (carbonate) in origin, some projects using inland sand have been required to process (screen or wash) the sand to remove clay, silt, and organic debris before it may be used for beach nourishment - at significant added cost. Supplies of beach-quality sand from private companies from existing quarries appear to be diminishing.

5.1.2 Offshore Sand Sources

Due to scarcity of land-based sand sources, recent projects have gone offshore to find beach-quality sand. The 2012 Waikiki Beach Restoration Project recovered 27,000 cubic yards of sand from a channel on the nearshore reef using a hydraulic suction dredge. A smaller, privately-funded project in 2010 on the north shore of Maui nourished a beach with 2,886 cubic yards of sand hydraulically dredged from an offshore sand field. A proposed restoration of eroded portions of Kaanapali Beach, Maui using offshore sand is in the early stages of planning and environmental assessment.

Utilizing offshore sand for beach restoration comes with many challenges. Not all nearshore sand deposits contain material that is compatible with existing beach sand. Offshore sands beds may be poorly sorted, containing beds or lenses of coarse (e.g., gravel) material and fine sediment (e.g., silt). Initial studies to identify potential offshore borrow sites have been conducted on Kauai, Oahu, and Maui by the U.S. Army Corps of Engineers [6] and private marine surveyors. Survey and analyses of offshore sands adds significant upfront costs to a proposed nourishment project. Detailed cost benefit investigations can assist in identifying promising offshore sand sites where large-scale recovery could be used for multiple beach restoration efforts. A large sand recovery and stockpiling project (100,000 cubic yard +) has the potential to significantly reduce costs per cubic yard due to “economies of scale.”



Offshore sand fields identified by the U.S. Army Corps of Engineers along south Kauai.

Dredging and moving sand to shore presents engineering and environmental challenges due to concerns about water quality and possible impacts to benthic and shoreline ecosystems. It is

expensive and logistically challenging to mobilize powerful dredge pumps and other heavy machinery on a barge needed to mine offshore sands. Hawaii is known for its consistent tradewind waves and large seasonal swell, making dredging operations in nearshore waters particularly challenging. Further, landing the sands via barge, slurry through a pipe, or other means is logistically challenging in the shallow reef environments in Hawaii. Water quality regulations require that marine sands are “de-watered” prior to placing the material on a beach, prohibiting the pumping of sand slurry directly on a beach, a common practice on mainland beaches.

5.1.3 Sand from Outside Hawaii

Several commercial sand quarries currently import sand from out of state for commercial uses such as golf courses and cement production. Some of these sand sources are very high quality (e.g., clean and well sorted) and present physical properties (e.g., color, mineral composition) that may work well for beach restoration. However, the use of out of state sand sources for beach nourishment is currently prohibited.

5.2 Cost and Funding

Beach restoration is costly and government funding is not always readily available. The 2012 Waikiki Beach Restoration Project restored 1,700 feet of shoreline with 27,000 cubic yards of sand recovered from offshore at a total cost of \$2.4 million. This equates to about \$90 per cubic yard of sand, including project planning, permitting, construction, and monitoring. The project was funded through a public-private partnership between the DLNR, the Hawaii Tourism Authority, and Kyoya Resorts. A similar project has been proposed for Kaanapali Beach, Maui. Tens of thousands of cubic yards of sand have been placed in smaller private beach restoration projects on Kauai, Oahu, and Maui using both land-based and offshore sand sources with a wide range of costs. “Beach-quality” sand purchased from private suppliers can cost \$100 or more per cubic yard. The cost per cubic yard for sand is an order of magnitude higher than typical large-scale beach restoration projects on the mainland U.S.

The U.S. Army Corps of Engineers has been nourishing beaches on the U.S. mainland for half a century or more. For federally-authorized projects, the federal government pays 65% of beach nourishment projects in partnership with local governments. Larger projects typically require congressional or even Presidential authorization through the federal budget process. The Army Corps spends \$100s of millions on beach restoration each year. Recently, \$4 Billion was allocated to the Army Corps to protect the U.S. northeast coast from future storms in the wake of Hurricane Sandy – much of which will go to replenishment of beaches and dunes. It may be challenging for Hawaii to qualify for federal funds because the funding is typically based on storm damage reduction.

The DLNR-OCCL manages a Beach Restoration Fund, which is comprised of revenues from coastal land use applications and fines and easements issued to private landowners who have encroaching land uses on submerged State lands. \$1.5 million from this fund was used toward the Waikiki Beach Restoration project in 2012. Unfortunately, the fund does not receive enough income to support major beach restoration projects on an annual basis.

5.3 Environmental and Regulatory Challenges

Hawaii's critical beach habitat fronts sensitive reef and marine environments, so understanding and mitigating impacts from restoration projects is crucial. However, the regulatory permitting processes for all nearshore marine activities, including beach restoration have become very burdensome and time consuming. This process makes many beach restoration projects, which will improve the critical sandy coastal ecosystem, both impractical and cost-prohibitive.

5.3.1 Permits for Beach Restoration Projects

As many as seven individual permits may be required to conduct beach restoration projects in Hawaii:

1. A Conservation District Use Permit (CDUP) or (SSBN) Small Scale Beach Nourishment Permit from DLNR
2. A county Special Management Area (SMA) permit / Shoreline Setback Variance
3. Right-of-Entry from DLNR and/or county
4. Federal Coastal Zone Management Act (CZMA) Consistency Assessment administered by the State Office of Planning, Coastal Zone Management Program
5. Clean Water Act (CWA) Section 404 Permit from the U.S. Army Corps of Engineers
6. CWA Section 401 Water Quality Certification (WQC) from the Hawaii Department of Health, Clean Water Branch
7. National Pollutant Discharge Elimination System (NPDES) permit from the Hawaii Department of Health, Clean Water Branch

According to the U.S. Environmental Protection Agency's website[8], "The objective of the Federal Water Pollution Control Act, commonly referred to as the Clean Water Act (CWA), is to restore and maintain the chemical, physical, and biological integrity of the nation's waters by preventing point and nonpoint pollution sources, providing assistance to publicly owned treatment works for the improvement of wastewater treatment, and maintaining the integrity of wetlands."

The two permits required under the CWA to restore a beach in Hawaii are:

1. A CWA Section 404 permit for any work, including construction and dredging, in the Nation's navigable waters – administered by the U.S. Army Corps of Engineers, Regulatory Branch, Honolulu[9].

2. A CWA Section 401 Water Quality Certification (WQC) is a requirement under the U.S. Army Corps of Engineers Section 404 Permit Program and is administered by the Hawaii Department of Health (DOH), Clean Water Branch (CWB). The WQC is a “statement of reasonable assurance that the construction activity will comply with the applicable provisions of the State’s water quality standards. Construction activities include dredge-and-fill work in our nearshore waters and inland waters.”[10]

5.3.2 Sand Compatibility

Sediment used for beach nourishment cannot contain too much coarse (gravel) or fine (silt, clay) material. DLNR-OCCL provides guidelines on beach sand compatibility based on composition, grain size distribution, color, and other factors to provide as close a match as possible to an existing beach[11]. Fine sediment can impact water quality because it is easily suspended in the water column by waves and currents, creating a turbid plume that may impact marine ecosystems when the sediments settle-out in calmer waters. It is important to note, however, that massive loads of fine sediments are intermittently released into nearshore waters by natural wave events, erosion processes, and storm runoff. Therefore, it’s important to compare impacts from sedimentation to appropriate background values. More information and improved understanding is needed regarding potential impacts of carbonate (marine) sediments placed in nearshore waters.

5.3.3 Understanding and Monitoring Potential Impacts to Reefs and Benthic Environments

Hawaii’s beaches are critical component of the coastal environment, providing habitat for a wide range of native and endemic species, some of which are endangered or protected. Beach restoration projects have the potential to impact reefs, benthic environments, and water quality. These projects have been evaluated through a programmatic Environmental Assessment (EA) for small scale beach nourishment projects in the Hawaiian Islands (DLNR, 2000) and for individual beach projects, such as the 2012 Waikiki Beach Restoration Project, with Findings of No Significant Impact (FONSI).

Permits for beach restoration require Best Management Practices (BMPs). BMPs may include periodic water quality monitoring, containment devices (e.g., silt booms) for reducing run-off of fine sediment, and beach profile surveys to monitor sand loss. As mentioned above, the DLNR requires that sand used for nourishment closely match existing beach sand in composition and grain size and be free from pollutants.

The Waikiki Beach Restoration Project (2012) conducted surveys of benthic communities before and after the project to investigate possible impacts on benthic communities; including corals, invertebrates, algae (macro and coralline), and total species diversity[13]. The surveys found no significant changes to corals or invertebrates attributed to the project. Significant changes in rugosity (surface roughness), cyanobacterial mats (increasing), and taxonomic infaunal

composition were documented. However, changes occurred in both the project (impact) and control zones (outside the project area) and may not be related to the project. Total species diversity decreased and algae cover decreased (more sand) in the impact zone relative to controls during the post-project survey period. The report concludes that “Although these benthic changes were detected statistically, the ecological significance of these changes is less clear... [and] recommend a greater focus on monitoring the effects of water quality on coral and invertebrate health to determine the broader-scale impacts.” Very similar findings were noted in the marine surveys conducted in 2007 as part of the demonstration project in Waikiki.

6. Results from Discussion Panels and Breakout Groups

The HSBPA Beach Restoration Workshop was held on November 24th, 2014 at Kapiolani Community College. The Workshop, originally to be held on October 17th, was rescheduled due to the close approach of Hurricane Ana – a timely reminder of the vulnerability of our coastal communities and shoreline environments to damage from high waves and storms.



The HSBPA Beach Restoration Workshop. November 24th, 2014 at Kapiolani Community College, Honolulu.

The workshop featured a keynote address by a veteran of beach restoration projects in Hawaii, three discussion sessions with invited panel members providing short presentations and engaging in discussion with fellow panel members and attendees on key topics, followed by breakout sessions to further examine topics and concerns raised in the discussion sessions. Group comments, concerns, and recommendations were recorded during the sessions, reported back to the whole group at the conclusion of the workshop, and form the basis for the recommendations

and conclusions in this paper. The paper is intended to help inform and prioritize efforts by HSBPA members, resource managers, policy-makers, scientists, engineers, and public and private stakeholders in preserving and restoring Hawaii’s beaches and coastal environments.

The workshop was designed to share thoughts and experiences on past and upcoming beach restoration projects and discuss three major concerns in implementing beach restoration projects in Hawaii: sand availability, funding, and environmental and regulatory challenges. Following are summaries of presentations with key discussion topics and recommendations and suggested actions resulting from the focused discussion and breakout sessions on the three topics. Presentation slideshows are available on the HSBPA website: <https://sites.google.com/site/hisbpa/>.

6.1. Sand Availability for Beach Restoration Projects

The first discussion and breakout session asked the invited presenters and participants if there is enough beach-quality sand available to make beach restoration a viable and cost-effective option for erosion management in Hawaii. Land-based sources are very limited and sand quality can be an issue. Large offshore fields of sand have been identified. However, challenges remain related to sand quality, potential environmental impacts, and landing and transporting sand. Beneficial reuse of sand from other projects may provide an additional source for beach restoration.

6.1.1 Presentation Abstracts

Inland sand for beaches: can't live with it, can't live without it - Tara Owens, Extension Faculty, UH Sea Grant and Maui County Planning Department

In the face of continuing coastal erosion, coastal managers are seeking response options beyond the armoring approach. Beach nourishment and coastal dune restoration in Hawaii has been successfully achieved on limited scales, but major barriers to implementation still include limited sand supply and regulatory constraints. On the issue of sand supply, limited sources are offshore deposits or inland sand dune deposits. In an island state - given a very limited sand supply overall - it may be imperative to consider sand from both sources for beach projects.

There are many successful examples of beach projects in Hawaii that have used inland sand sources, and coastal managers wish to expand on those successes; however, there are concerns with: 1) the dwindling supply of inland sand resources; and 2) the quality of inland sand for beach projects. For coastal managers, some questions have emerged that might be addressed by the HSBPA/ASBPA community. What can be done to protect or conserve inland sand sources? How can beneficial use of sand for beaches be promoted or required? Are there designated uses of inland sand that are generally acceptable without extensive environmental review? Are there strategies for “washing” sand to remove the very fine grains that contribute to water turbidity? What additional research, specific to Hawaii, is needed to understand if and how temporary water turbidity associated with beach nourishment affects the near shore environment?

Regional Sediment Management, offshore sand resources, beneficial reuse of dredge material – Thomas D. Smith, U.S. Army Corps of Engineers

Over the past 10 years, the Honolulu District of the U.S. Army Corps of Engineers has conducted Regional Sediment Management (RSM) studies throughout the State of Hawaii. Hawaii RSM funding has facilitated investigation of offshore sand sources through methods such as sediment sampling, remote sensing and visual identification of sand fields in aerial imagery. Mr. Smith provided an overview of the Hawaii RSM offshore sand source investigations and associated potential RSM projects. He also discussed opportunities for beneficial reuse of dredge material from federally authorized navigation project within the state.

Offshore sand prospecting for Beach Restoration Projects - Jim Barry, Coastal Engineer, Sea Engineering, Inc.

Offshore sand investigations for the purpose of nourishing Hawaii's beaches were started almost 50 years ago by University of Hawaii researchers and were actively pursued through the 1970's. Prospecting was revived in the early 1990's, with funding for new surveys off Waikiki, Honolulu, and Penguin Bank provided by the U.S. Bureau of Mines through the University of Hawaii. With a need for improved instrumentation, a team effort by Sea Engineering, Inc. (SEI) and Precision Signal, Inc. was funded by CEROS to develop a state-of-the-art sub-bottom profiling system. The new system resulted in excellent sub-bottom imagery, and SEI successfully mapped selected sand deposits around the island of Oahu for the United States Geological Survey (USGS) in 1996 and 1998. Recent programs have been funded by both private concerns and State and County agencies to find offshore sand for specific target beaches. From 2008 to the present, SEI has conducted extensive surveys off Kaanapali and Kahului on Maui, off Poipu and Kapaa on Kauai, and off Waikiki on Oahu.

Comprehensive, large scale sand prospecting ideally uses 1) a side scan sonar system to identify deposit locations in plan view, 2) a sub-bottom profiler to show deposit thickness, and 3) vibracore sampling to determine sediment grain size parameters and sediment quality. While massive quantities of sand have been mapped, deposits that exhibit good beach sand characteristics have proven rare.

6.1.2 Discussion

Major discussion topics raised by workshop participants related to sand availability for beach restoration projects included:

- Beach-quality sand is a high-value limited resource that yields a high cost per unit.
- Sand used for nourishment should be compatible with existing beach sand (e.g., grain size compatibility, color, fines).
- Sand supplies are not easily accessible and may require dredging, mining, transportation, storage, and in some cases cleaning and processing (e.g., screening, washing).
- Some known large-scale terrestrial sources exist, e.g., Mana plain (Kauai) and Maui isthmus dune sands, but quantities of land-based beach-quality sands are unknown.
- Studies have identified potential deposits of beach-quality sand offshore but information on volumes and quality is limited.
- Challenges of using offshore sand include permitting, environmental concerns, material quality, complex dredging operations, and logistical and environmental challenges of landing and transporting sand.
- Larger scale offshore sand recovery projects can have a lower per volume cost due to economies of scale.
- Alternative sources of sediment (e.g. imported carbonate sand from outside Hawaii, silica sand) might be a viable options for nourishing some beaches in Hawaii but we lack

information on possible ecosystem impacts (e.g., due to differing mineral composition and material characteristics), permitting, availability, cost, etc.

- Mixed sediment or “veneer beaches” using coarse material (e.g., cobble) as a base may be an alternative for restoring some Hawaii beaches.

6.1.3 Recommendations, Suggested Actions

The workshop participants provided the following recommendations and suggested actions related to sand availability for beach restoration projects:

- Fund and conduct a statewide study on sand availability (onshore and offshore) for beach nourishment, as well as analysis of supply and demand and extraction and storage options.
- Review and modify (if needed) state guidelines for beach sand compatibility for nourishment projects, including Best Management Practices for use of inland dune sands.
- Protect available sources of beach quality sand for beach restoration including proactive and opportunistic government programs to recover, acquire and stockpile sand from government and private construction projects.
- Investigate opportunities for a state-funded project to recover and stockpile offshore sand for use in beach restoration projects.
- Explore options and evaluate the potential for utilizing sand imported from outside Hawaii (e.g., environmental concerns, logistics, cost-benefit).
- Fund localized studies of beach processes to improve understanding of sediment transport and shoreline variability prior to nourishment.

6.2. Cost and Funding of Beach Restoration in Hawaii

The second discussion session and breakout session asked the invited presenters and participants, how we can improve funding for beach restoration in Hawaii? Hundreds of millions of dollars are “pumped” into beach restoration projects on the U.S. mainland. The cost and time span for permitting creates high up-front costs. We lack information on the economic and societal value of our beaches, making it difficult to compare cost-effectiveness of beach restoration with alternatives such as armoring.

6.2.1 Presentation Abstracts

Cost and funding of recent and proposed beach restoration projects - Sam Lemmo, Administrator, DLNR Office of Conservation and Coastal Lands

The presentation discussed funding sources for beach restoration projects at the County, State, and Federal levels, as well as funding from private sources. Discussion covered opportunities for funding, issues and challenges.

Local and federal funding for mainland beach restoration projects - Andrew Wycklendt, Project Manager and Coastal Engineer, CB&I

There are many potential federal, state, and local funding sources available to address costs to implement beach nourishment projects. Funding sources and mechanisms vary depending on location and project goals and objectives. For example, in Florida mechanisms are available for the state to cost share with local sponsors, whereas projects in North Carolina are funded entirely by the local towns and counties. Federal options exist, but the process is time consuming and difficult to secure. This discussion provided an overview of beach nourishment funding sources, summarized the process of securing federal funds, discussed state cost sharing programs, and identified local and tourist based funding alternatives. Additionally, a case study was presented that identifies how funding can vary significantly depending on how project goals and objectives are defined.

Value of Hawaii's coastal ecosystems - Greg Guannel, Coastal Engineer, Natural Capital Project

An ecosystem only has a value if it provides us with important services, or benefits. Hawaii's coastal ecosystems have incredible value because of the recreation, spiritual, fisheries and protection services they supply and deliver. The ecosystems are also under threat because we are not always aware of their value and often impact them in negative ways. The talk introduced some basic concepts related to the quantification and valuation of services delivered by ecosystems. It also highlighted important research needs required to improve our ability to value those services in Hawaii.

6.2.2 Discussion

Major discussion topics raised by workshop participants related to cost and funding of beach restoration projects included:

- Hawaii is one of the few coastal states not receiving federal funding for beach restoration.
- Improved methods are needed to determine the “value” of beaches for assessing cost-benefits of beach conservation and restoration and other alternatives.
- Better numerical models of coastal processes are needed, particularly for reef-dominated island coastal settings, to improve understanding of sediment transport and erosion processes.
- Beach restoration can be cost-prohibitive, especially for privately-funded projects.
- Government agencies are underfunded and understaffed to deal with the scope of erosion and beach management problems in Hawaii.
- Alternative (i.e. non-federal) sources of funding for beach nourishment might be developed through instruments such as beach management/improvement districts with specific local taxes (e.g. Waikiki Beach Improvement District).
- Long-term planning for coastal communities should include regional beach management plans.
- A standardized approach may be needed to prioritize locations for funding for beach conservation and restoration.

- Establish coastal lands acquisition should be explored as an alternative for managing erosion and conserving beaches.

6.2.3 Recommendations, Suggested Actions

The workshop participants provided the following recommendations and suggested actions related to cost and funding of beach restoration projects:

- Preservation of intact natural beach systems (“legacy beaches”) should be considered along with restoration of degraded beaches.
- Re-initiate conversations with federal partners (e.g., US Army Corps of Engineers) to explore funding options for beach restoration in Hawaii.
- Develop a systematic approach for prioritizing locations for government funding of beach restoration projects and for evaluating alternatives for erosion management.
- Establish a zone-based beach management system, such as shoreline management districts, community plans, and/or littoral cells.
- Fund research to develop methods and conduct studies to assess environmental, social and economic values of beach resources.
- Secure adequate long-term funding mechanisms for government agencies responsible for beach conservation and management.

6.3. Environmental and Regulatory Challenges with Beach Restoration

Hawaii beaches are a critical component of the coastal ecosystem. Beaches front sensitive reef and marine environments, so understanding and mitigating impacts from restoration projects is crucial. However, the permitting process for beach restoration has become very burdensome and time consuming making many beach restoration projects impractical and cost-prohibitive. The third discussion and breakout session asked invited presenters and participants if we can strike a balance between environmental concerns, including the loss of beach habitat and potential impacts from nourishment, and the need to authorize beach restoration projects in a timely and cost-effective manner?

6.3.1. Presentation Abstracts

The Clean Water Act and the 401 and 404 process in Hawaii - Rob Walker, Coastal Engineer, Anchor QEA, LLC

The Clean Water Act establishes the basic structure for regulating discharges into waters of the United States and for the regulation of water quality standards for surface waters. Section 404 of the CWA requires a permit from the US Army Corps of Engineers for any discharge of dredged or fill material below the “high tide line”, which applies to beach restoration projects that propose to place sand within the intertidal shoreline. When a Section 404 permit is triggered at the federal level, Section 401 of the CWA requires that the applicant provide a “certification” from the State or other governing body acknowledging that the proposed activity will not violate the State’s water quality standards. In Hawaii, the 401 Water Quality (WQ) Certification is managed by the Department of Health (DOH). Navigating the 401

process through DOH has become an extremely challenging endeavor, with the permit requirements constantly changing and no defined timeline for the processing of application documents. This presentation provided a brief introduction to the 404/401 process in Hawaii, and made some comparisons to other coastal states of the U.S. in an effort to promote a fruitful discussion on ideas and strategies for improving DOH's 401 WQ Certification program.

Overview of benthic surveys for the 2012 Waikiki Beach restoration and future recommendations

- Zac Forsman, Researcher, Hawaii Inst. of Marine Biology and Coral Specialist, DLNR-DAR

The presentation provided an overview of the 2012 benthic surveys for the Waikiki beach sand replenishment project commissioned by the State of Hawaii Division of Aquatic Resources. Detecting statistically significant changes in highly heterogeneous marine benthic communities can be extremely challenging. We were able to detect statistically significant changes with surveys conducted in a Before-After-Control-Impact (BACI) design and the types of benthic changes that were detected will be summarized in this talk. Although corals were very scarce and we were unable to detect statistically significant changes, potential impacts on specific colonies were observed and the sediment plume was larger than the original study design anticipated. Future recommendations include the use of deployable coral nubbin growth and survival assays to more accurately quantify and reduce impacts to coral reefs.

Streamlining beach restoration permits in Hawaii - Brad Romine, Extension Faculty, UH Sea Grant and Coastal Lands Program Coordinator at DLNR-OCCL

The Department of Land and Natural Resources' (DLNR) promotes beach restoration as a viable alternative to coastal armoring. The DLNR currently authorizes small scale beach and dune restoration projects under its Small Scale Beach Nourishment (SSBN) program. However, due to regulatory issues, applicants are currently limited to placing sand above the high water line. Proper restoration of a degraded beach system requires placement of sand across the entire beach profile, above and below the water line. The DLNR wishes to implement a State Programmatic General Permit (SPGP) for Small Scale Beach Restoration (SSBR) projects through the U.S. Army Corps of Engineers, similar to an SPGP that expired in 2010. The SPGP will streamline the permitting process by consolidating permitting and environmental review oversight under DLNR. This will require agreement with other agencies with jurisdiction in the Hawaii coastal zone, including the U.S. Army Corps of Engineers, the Department of Health, and the Coastal Zone Management Office. The first step will be the development of a Programmatic Environmental Assessment in 2015.

6.3.2 Discussion

Major discussion topics raised by workshop participants related to environmental and regulatory challenges with beach restoration:

- The permitting process for beach restoration projects in Hawaii is inefficient, onerous, time-consuming, and costly, particularly in regards to Clean Water Act 401 Water Quality Certifications (lack of responsiveness, limited guidance).

- More information is needed related to environmental impacts of sedimentation on corals and benthic habitats from carbonate beach sands with nourishment projects.
- A streamlined permitting process for Small-scale Beach Nourishment (SSBN) project administered by DLNR under a state programmatic agreement expired in 2010 restricting beach restoration projects from placing sand below the high water line without 404 and 401 authorizations.
- Some State marine water quality standards and monitoring requirements are unreasonable and overly burdensome (i.e. cost prohibitive) for beach restoration projects.
- Other states appear to be less prohibitive about moving existing sand along a beach (e.g., stream mouth clearing, sand back-passing, and sediment management projects).

6.3.3. Recommendations, Suggested Actions

The workshop participants provided the following recommendations and suggested actions related to environmental and regulatory challenges with beach restoration:

- Improvements are needed to the permitting process for State 401 Water Quality Certifications, including guarantees of reasonable permit acceptance and processing times and improved guidance from department staff on completing applications.
- Existing native beach sand should be excluded as a “pollutant” (Hawaii Revised Statutes 342D), if used on the same beach for restoration or sediment management projects.
- A facilitated process between the Department and Health, other government agencies, and stakeholders may help address concerns and initiate improvements to the 401 process.
- Re-establish a state programmatic agreement and streamlined permitting process for small scale beach restoration projects.
- Develop reasonable standards and Best Management Practices for water quality and marine habitat monitoring.

7. Conclusions and Overarching Recommendations

Like many mainland U.S. coastal areas, Hawaii is losing beaches at an alarming rate due to natural variability, chronic erosion, human impacts such as seawall construction, historical sand mining, and sea level rise. Beach restoration is one of a range of tools for conserving degraded beaches in Hawaii. However, beach restoration is only practiced on a limited basis due to a general lack of beach-quality sand for nourishment projects, limited funding, and environmental and regulatory challenges.

The 2014 HSBPA Beach Restoration Workshop provided a venue for members and a range of stakeholders to discuss opportunities and challenges with beach restoration in Hawaii. The presentations and discussion sessions highlighted that Hawaii has some unique challenges in implementing beach restoration compared to mainland settings due to the islands’ unique and sensitive coastal and marine environment. Beaches are a critical habitat, a key natural asset for Hawaii’s visitor based economy, central to local culture and society, and aid in mitigating coastal

natural hazards. Increased conservation and maintenance efforts are needed if beaches are to be sustained for future generations, particularly in the face of changing climate and increasing sea level rise. This will require dedicated funding and efficient government oversight of beach conservation and restoration in Hawaii.

The Workshop presentations and discussion sessions point to a number of overarching challenges and recommendations for improving the viability of beach restoration in Hawaii, including:

1. The permitting process for beach maintenance and restoration is time-consuming and cost-prohibitive for many projects in Hawaii. Permitting for beach restoration needs to be streamlined if conservation of the State's sandy beaches is going to be a priority for the environment, hazard mitigation, and the economy. Two key recommendations included improvements to the State Clean Water Act Section 401 Water Quality Certification process and re-establishment of a State programmatic agreement ("blanket permit") for beach restoration projects.
2. Government agencies tasked with coastal management in Hawaii are underfunded and understaffed. Increased funding should be developed through local and federal sources to support beach conservation, restoration, and coastal land use planning. A proactive regional approach to beach management and restoration should be led by DLNR-OCCL and funded through partnership between government and local stakeholders. Innovative public-private partnerships have proven successful on recent state-led beach restoration projects and should serve as models for future projects.
3. Beach-quality sand is in short supply for restoration projects in Hawaii. Large-scale sand recovery and stockpiling projects can take advantage of economies of scale, which smaller projects cannot afford. Studies are needed to assess availability and quality of onshore and offshore deposits of sand supporting large-scale recovery efforts. Funding is needed for sand recovery, material storage and processing, and to subsidize transport and placement of sand in cost-shared beach restoration projects.
4. Hawaii's beaches are an essential coastal habitat and front unique and sensitive marine environments. Research is needed to better assess potential impacts of beach restoration projects to the marine environment to inform best management practices and standardized monitoring guidelines.

References

- [1] Fletcher, C.H. *et al.*, 2012, National assessment of shoreline change: Historical shoreline change in the Hawaiian Islands: U.S. Geological Survey Open-File Report 2011–1051, 55 p.
- [2] Here, beach erosion is used interchangeably with shoreline recession, meaning the shoreline is retreating landward over time due to sand loss.
- [3] Romine, B.M., *et al.*, 2013. Are beach erosion rates and sea-level rise related in Hawaii?. *Global and Planetary Change*, 108: 149-157.
- [4] Wiegel, W.L., 2008, Waikiki Beach, Oahu, Hawaii: History of its transformation from a natural to an urban shore. *Shore & Beach*, Vol. 76-2.
- [5] See: Coastal Voice: The Newsletter of the American Shore & Beach Preservation Association, September, 2014. 2014 Best Restored Beaches – Iroquois Point Beach, Oahu, Hawaii.
- [6] U.S. Army Corps of Engineers, Hawaii Regional Sediment Management Program: http://gis.poh.usace.army.mil/rsm/hi_overview.htm
- [7] See: Hawaii Department of Land and Natural Resources, Office of Conservation and Coastal Lands Small Scale Beach Nourishment Guidelines at <http://dlnr.hawaii.gov/occl/forms-2/>.
- [8] <http://www.epa.gov/agriculture/lcwa.html>
- [9] <http://www.poh.usace.army.mil/Missions/Regulatory.aspx>
- [10] <http://health.hawaii.gov/cwb/site-map/clean-water-branch-home-page/about-cwb/history-and-mission-statement/>
- [11] <http://dlnr.hawaii.gov/occl/coastal-lands/>
- [12] Forsman, Z.A., 2012. Benthic Surveys for the 2012 Waikiki Beach Sand Replenishment Project.

Appendix A: Workshop Agenda

2014 ANNUAL MEMBERS MEETING AND BEACH RESTORATION WORKSHOP

Monday, November 24th, 2014

Kapiolani Community College, Tamarind Banquet Room

Sponsored by:

The Hawaii Department of Land and Natural Resources, Office of Conservation and Coastal Lands

Hawaii Beach Restoration Workshop

Got Sand? Hawaii's beaches are disappearing at an alarming rate due to natural and human impacts. Sand nourishment is a common approach to restoring beaches and dunes on the U.S. mainland and has been practiced on a smaller scale in Hawaii over the past century with varying success. What are the needs, opportunities and challenges to make beach restoration a viable option for managing Hawaii's eroding beaches? Join us as we share thoughts and experiences on past and upcoming projects and discuss three major concerns in implementing beach restoration projects in Hawaii: sand availability, funding, and environmental and regulatory challenges. Outcomes from discussion panels and breakout groups will be documented in an HSBPA white paper intended to help inform and prioritize efforts by HSBPA members, resource managers, policy-makers, scientists, engineers, and public and private stakeholders in preserving and restoring Hawaii's beaches and coastal environments.

Agenda

Morning Association Meetings

- 8:30-9:20 HSBPA Board of Directors Meeting, continental breakfast (Board members, only)
9:30-10:20 HSBPA Annual Meeting (HSBPA members and invited guests welcome)

Beach Restoration Workshop

- 10:30-10:50 Workshop Introduction
10:50-11:50 Discussion Panel 1: *Sand Availability for Beach Restoration Projects*
12:00-1:00 Lunch (provided) and Keynote Speaker (12:15-1:00): Scott Sullivan, Sea Engineering, Inc.
Recent and Future Hawaii Beach Nourishment
1:10-2:10 Discussion Panel 2: *Cost, Funding, and Value of Beach Restoration in Hawaii*
2:20-3:30 Discussion Panel 3: *Environmental and Regulatory Challenges with Beach Restoration*
3:40-4:10 Breakout Sessions (3 groups address solutions to challenges from Discussions 1-3)
4:10-4:40 Breakout Groups Report Back
4:40-5:00 Closing, final remarks and comments
5:00-7:00 Pau Hana social (pupus, cash bar)

Discussion Panels: Three invited panel members will provide short presentations (10 minutes, ea.) and engage in discussion with fellow panel members and the audience on three key topics, below.

Moderators will record questions, challenges, and recommendations from the panel and audience for further discussion in breakout groups. Outcomes from discussion panels and breakout groups will be documented in an HSBPA white paper.

Discussion Panel 1: *Sand Availability for Beach Restoration Projects*

Is there enough beach-quality sand available to make beach restoration a viable and cost-effective option for erosion management in Hawaii? Land-based sources are very limited and sand quality can be an issue. Large offshore fields of sand have been identified. However, challenges remain related to sand quality, potential environmental impacts, and landing and transporting sand. Beneficial reuse of sand from other projects may provide an additional source for beach restoration.

- *Inland sand for beaches: can't live with it, can't live without it*
Tara Owens, Extension Faculty, UH Sea Grant and Maui County Planning Department
- *Regional Sediment Management, offshore sand resources, beneficial reuse of dredge material*
Jessica Podoski, Engineering, Honolulu District of the U.S. Army Corps of Engineers
- *Offshore sand prospecting for Beach Restoration Projects*
Jim Barry, Coastal Engineer, Sea Engineering, Inc.

Discussion Panel 2: *Cost, Funding, and Value of Beach Restoration Projects*

How can we improve funding for beach restoration in Hawaii? Hundreds of millions of dollars are “pumped” into beach restoration projects on the U.S. mainland. The cost and time span for permitting creates high up-front costs. We lack information on the economic and societal value of our beaches, making it difficult to compare cost-effectiveness of beach restoration with alternatives such as armoring.

- *Cost and funding of recent and proposed beach restoration projects*
Sam Lemmo, Administrator, DLNR Office of Conservation and Coastal Lands
- *Local and federal funding for mainland beach restoration projects*
Andrew Wycklendt, Project Manager and Coastal Engineer, CB&I
- *Value of Hawaii's coastal ecosystems*
Greg Guannel, Coastal Engineer, Natural Capital Project

Discussion Panel 3: *Environmental and Regulatory Challenges with Beach Restoration*

Hawaii beaches front sensitive reef and marine environments, so understanding and mitigating impacts from restoration projects is crucial. However, the permitting process for beach restoration has become very burdensome and time consuming making many beach restoration projects impractical and cost-prohibitive. Can we strike a balance between environmental concerns and the need to authorize beach restoration projects in a timely and cost-effective manner?

- *The Clean Water Act and the 401 and 404 process in Hawaii*
Rob Walker, Coastal Engineer, Anchor QEA, LLC
- *Overview of benthic surveys for the 2012 Waikiki Beach restoration and future recommendations*
Zac Forsman, Researcher, Hawaii Institute of Marine Biology and Coral Specialist, DLNR-DAR
- *Streamlining beach restoration permits in Hawaii*
Brad Romine, Extension Faculty, UH Sea Grant and DLNR-OCCL

Breakout Groups: Three breakout groups will discuss ideas and solutions to challenges raised in Discussion Panels 1-3 and report back to the meeting.

Appendix B: List of Participants

HSBPA Members

Matthew Barbee, University of Hawaii Coastal Geology Group
James Barry, Sea Engineering Inc.
Charles Blay, TEOK Investigations
Andrew Bohlander, University of Hawaii Sea Grant College Program
Patricia Cadiz, HST Inc.
Chris Conger, Sea Engineering Inc.
Marc Ericksen, Sea Engineering, Inc.
Dolan Eversole, University of Hawaii Sea Grant College Program
Greg Guannel, The Natural Capital Project
Barbara Guild, Sugar Cove AOA
Samuel Lemmo, DLNR Office of Conservation and Coastal Lands
Rep. Daynette (Dee) Morikawa, HI State Legislature (Kauai)
Bethany Morrison, County of Hawaii
Tara Owens, University of Hawaii Sea Grant College Program
Ruby Pap, UH Sea Grant / County of Kauai
Jessica Podoski, USACE, Honolulu District
Bob Richardson, South Maui Volunteers
Bradley Romine, University of Hawaii Sea Grant College Program
Richard Salem, Sugar Cove AOA
David Smith, Sea Engineering, Inc.
Scott Sullivan, Sea Engineering Inc.
Thomas Smith, USACE, Honolulu District
Dayan Vithanage, Oceanit
Rob Walker, Anchor QEA, LLC
Andrew Wycklendt, CB&I / Coastal Planning & Engineering

Invited Attendees

Alyssa Agustin
Tiffany Anderson, UH Coastal Geology Group
Annie Bendon
Rafael Bergstrom, Surfrider Foundation, Oahu Chapter Administrator
Jim Buika, Maui County Planning Dept
Michael Cain, DLNR-OCCL
Rick Egged, Waikiki Improvement Association
Zac Forsman, UHHIMB, DLNR-DAR
Oceana Francis, UH ORE
Shellie Habel, UH Coastal Geology Group
Rachel James, Office of U.S. Representative Tulsi Gabbard
William Johnson
Darren Lerner, University of Hawaii Sea Grant College Program
Lauren Molina, USACE
Nathalie Morison, State OP-CZM
Lenny Rapozo, Kauai County Department of Parks and Recreation
Lis Richardson, South Maui Volunteers
William Trugillo, Kauai County Parks