RICHARD T. BISSEN, JR.
Mayor

KATE L. K. BLYSTONE
Director

ANA LILLIS
Deputy Director

DEPARTMENT OF PLANNING
COUNTY OF MAUI
ONE MAIN PLAZA
2200 MAIN STREET, SUITE 315
WAILUKU, MAUI, HAWAIʻI 96793

December 12, 2024

Office of Planning and Sustainable Development
Environmental Review Program
235 South Beretania Street, Suite 702
Honolulu, Hawaiʻi 96813

RE: PUBLICATION OF THE ENVIRONMENTAL ASSESSMENT TITLED ADAPTATION PATHWAYS: SEAWALL REMOVAL AND DUNE RESTORATION

As the Approving Agency, the County of Maui Planning Department (Department) is in receipt of the Draft Environmental Assessment (DEA) titled *Adaptation Pathways: Seawall Removal and Dune Restoration.* The Department requests the publication of this DEA in the December 23 edition of The Environmental Notice.

Should you have questions or need further information please contact James Buika at (808) 270-6271 or james.buika@co.maui.hi.us.

Sincerely,

JAMES BUIKA
Coastal Resources Planner
Planning Department
County of Maui

K:\WP_DOCS\Planning\SM1\2024\00004_KanaiANalu\EnvironmentalNoticeCover Letter.docx

From: webmaster@hawaii.gov
To: DBEDT OPSD Environmental Review Program
Subject: New online submission for The Environmental Notice
Date: Thursday, December 5, 2024 8:07:43 PM

Action Name

Adaptation Pathways: Seawall Removal and Dune Restoration

Type of Document/Determination

Draft environmental assessment and anticipated finding of no significant impact (DEA-AFNSI)

HRS §343-5(a) Trigger(s)

- (3) Propose any use within a shoreline area

Judicial district

Maui - multiple districts

Tax Map Key(s) (TMK(s))

(2) 3:8:014:004
(2) 3:8:014:005

Action type

Applicant

Other required permits and approvals

Special Management Area Approval, Shoreline Setback Variance, Flood Development Permit, Grading Permit

Discretionary consent required

Shoreline Setback Variance

Agency jurisdiction

County of Maui

Approving agency

Planning Department

Agency contact name

James Buika

Agency contact email (for info about the action)

James.Buika@co.maui.hi.us

Email address for receiving comments

James.Buika@co.maui.hi.us

Agency contact phone

(808) 270-7735

Agency address

2200 Main Street
One Main Plaza, Suite 315
Wailuku, HI 96793
United States
Map It

Applicant

Kanai A Nalu Condominium AOAO

Applicant contact name

Kevin Robinson

Applicant contact email

robbys4@aol.com

Applicant contact phone

(509) 290-1130

Applicant address

Kanai A Nalu AOAO
250 Hauoli Street
Wailuku, Hawaii 96793
United States
Map It

Is there a consultant for this action?

Yes

Consultant

Kapalaea Consultants LLC

Consultant contact name

Anders Lyons

Consultant contact email

anders@kapalaeaconsultants.com

Consultant contact phone

(808) 463-4192

Consultant address

Kapalaea Consultants LLC
449 Kealaloa Ave
Makawao, Hawaii 96768-9055
United States
Map It

Action summary

Kanai A Nalu and the County of Maui have agreed to a series of actions to adapt to sea level rise, to restore more natural movement of the shoreline, and to re-establish native plants on the shoreline. As a first step in establishing an adaptation pathway for Kanai A Nalu, the condominium is proposing installation of a geotextile, sand-filled burrito moved back from the shoreline toward the condominium buildings. This soft structure will allow the condominium to negotiate a permit with the State of Hawaii Office of Conservation and Coastal Lands for the removal of the existing seawalls, restoring an unarmored shoreline. Kanai A Nalu also proposes a wooden ramp to allow for safe passage by the public to the beach. And lastly, restoration of native plants along the unarmored shoreline.

Reasons supporting determination

Managed coastal retreat on Maui is a strategic process designed to address the escalating threats of sea level rise, coastal erosion, and extreme weather events. This process involves relocating infrastructure, communities, and ecosystems away from vulnerable coastal areas to safer, inland locations. The aim is to reduce risk while preserving Maui's natural landscapes and cultural heritage.

Attached documents (signed agency letter & EA/EIS)

- 2024-Kanai-A-Nalu-DEA-SSV-SM1-9-25-2024-Complete.pdf

Action location map

- Kanai-A-Nalu-Adaptation-Pathways.zip

Authorized individual

Anders F Lyons

Authorization

- The above named authorized individual hereby certifies that he/she has the authority to make this submission.

Consolidated

Draft Environmental Assessment, Special Management Area Use Permit, & Shoreline Setback Variance Application

Adaptation Pathways: Seawall Removal and Dune Restoration

Tax Map Keys
(2) 3-8-014-004
(2) 3-8-014-005

September 3, 2024

Prepared for:
Kanai A Nalu
Association of Apartment Owners

Prepared by:
Kapalaea Consultants LLC
449 Kealaola Avenue
Makawao, Maui, Hawaii 96768
808-463-4192
anders@kapalaeaconsultants.com

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I. Project Information

Adaptation Pathways- Overview of the Request

The project site is located along the Maalaea shoreline on the southwest coast of Maui. The Kanai A Nalu shoreline has a history of chronic and episodic erosion that has caused structural damage and permanent loss of land. A seawall was built along the entire Kanai A Nalu shoreline in the 1970's to address erosion caused by the building of the Maalaea Harbor and subsequent armoring of the shore between the harbor and Kanai A Nalu. That seawall is reaching the end of its useful life, and it is time for Kanai A Nalu to embrace the Resiliency Toolkit Options outlined by the County of Maui for a phased managed retreat. This environmental assessment and the restoration work proposed herein are the result of years of studies, deployment of alternative efforts, and negotiations with government regulators. An overview of these previous activities can be found later in this document.

Kanai A Nalu proposes several actions to begin to accommodate sea level rise and associated erosion. First, by embedding a geotextile burrito into its lawn adjacent to the ocean. The burrito is a soft erosion control response that will be comprised of one cubic yard sacks filled with in situ sand. Second, this structure will serve as a precursor to the eventual removal of the remaining seawall segments at Kanai A Nalu. Third, native plant dune restoration will take place between the shore and the makai edge of the sand burrito. And Fourth, to provide the public and residents of Kanai A Nalu safe access to the beach, an inset wooden ramp will be installed along the eastern property boundary.

A.1 Project Site

The Kanai A Nalu property is located at 250 Hauoli Street, Wailuku, Maui, HI 96793; Tax Map Keys (2) 3- 8-014:004 & 005. The project site consists of approximately 370 linear feet of shoreline along the Maalaea coastline on the southwest coast of Maui. The project is bounded by Hauoli Street to the north and the Pacific Ocean to the south. The project site is bounded to the east by the Hono Kai Condominiums and a privately-owned residential parcel to the west.

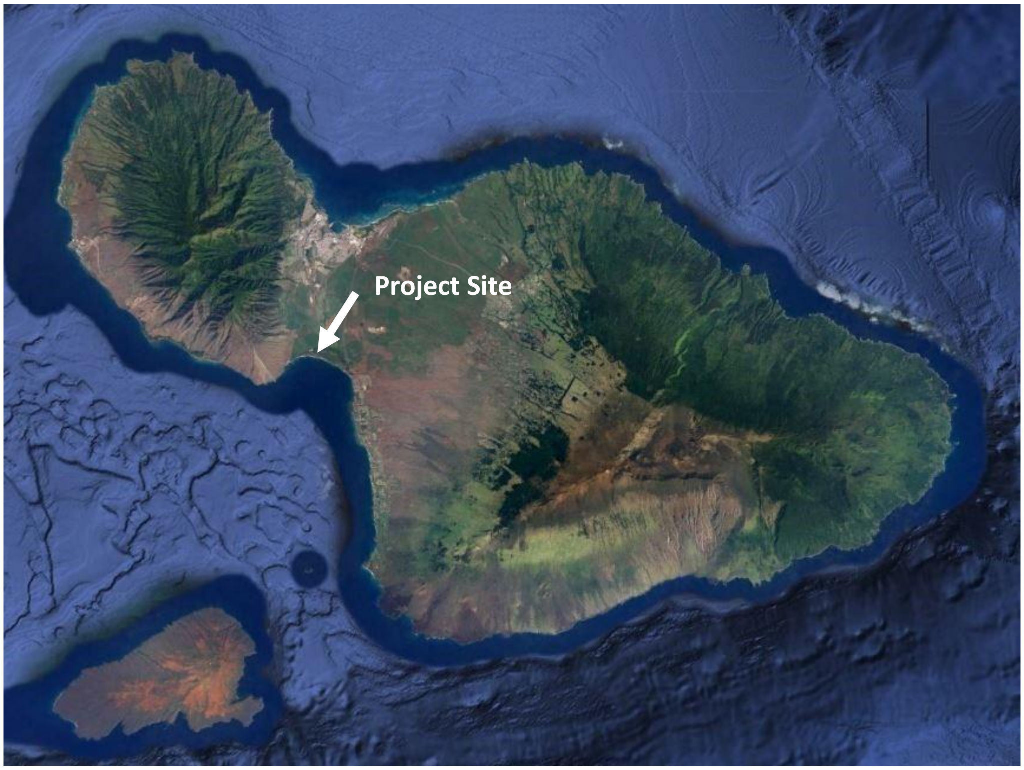


Figure 1: Project Site

A.2 Erosion History

The Maalaea shoreline has a documented history of erosion. Construction of Maalaea Harbor in 1952 resulted in the loss of 1,500 feet of narrow beach to the east of the harbor, which led to construction of shore protection structures (i.e., seawalls and revetments) that currently extend 2,400 feet east of the harbor to Haycraft Park, a 6.5-acre public beach park that is managed by the County of Maui. The Kanai A Nalu property is located at the transition between armored shoreline that extends west to Maalaea Harbor and unarmored shoreline that extends east to North Kihei.

Coastal erosion along the Kanai A Nalu shoreline was evaluated by the University of Hawaii Coastal Geology Group (CGG). The CGG used historical aerial photographs from 1900 to 1997 to determine historical rates of shoreline change. The CGG determined that the beach fronting Kanai A Nalu has been eroding at an average rate of 1.0 foot per year. The Kanai A Nalu property is located in the Maalaea Bay Beach littoral cell. The U.S. Army Corps of Engineers (2011) determined that erosion has resulted in sand loss in the Maalaea Bay Beach littoral cell by an average of 800 cubic yards per year.

In an early attempt to address erosion, Kanai A Nalu conducted beach restoration in 1997 to mitigate erosion and undermining of the seawalls. Sand replenishment of approximately 1,500 cubic yards took place three times from 1997 to 1998 but much of the sand was gone by 2001. Kanai A Nalu conducted beach restoration again in 2003. That project consisted of the placement of 3,000 cubic yards of inland dune sand.

B. Project Profile

Tax Map Keys:	(2) 3-8-014-004 & (2) 3-8-014-005
Project Name:	Kanai A Naluai Building Protection
Street Address:	250 Hauoli Street Wailuku, HI 96790
Land Area:	Parcel 4: 2.591 acres & Parcel 5: 1.251 Acres
Applicant:	Adaptive Pathways: Seawall Removal and Dune Restoration
Landowners:	Maalaea Beach LLC owner of TMK (2) 3-8-014-004, and The Bruce Trust dated May 16, 1974 owner of TMK (2) 3-8-014-005
Planning Consultant:	Anders Lyons, Kapalaea Consultants LLC
State Land Use District:	Urban
Maui Island Plan:	Urban
Kihei-Makena Community Plan:	Multi-Family

Maui County Zoning:	A-2 Apartment District
Flood Insurance Rate Map:	VE, AE & X: VE (coastal high hazard area) at twelve (12) feet on parcel 005 in the western corner, AE (flood fringe area) at eleven (11) feet on parcel 004 in the eastern corner, and Zone X (minimal flood hazard) everywhere else. Panel 1500030558F Dated September 19, 2012
Other Designations:	Special Management Area
Existing Land Use:	Kanai A Nalu Residential Condominium
Proposed Use:	Continued use as the Kanai A Naluai Residential Condominium
Existing Access:	Hauoli Street

C. Chapter 343, HRS Accepting Agency

Agency:	Maui Planning Commission c/o Maui Planning Department Director Kate Blystone 250 S. High Street Wailuku, HI 96793 Phone: (808) 270-7735 Fax: (808) 270-7634

D. Required Permits and Approvals

1. Finding of No Significant Impact (FONSI) through an Environmental Assessment (this document) subject to approval by the Maui County Planning Commission.

2. Shoreline Setback Variance (SSV) for a soft burrito structure and beach access ramp within the setback subject to approval by the Maui County Planning Commission.

3. Special Management Area (SMA) application subject to approval by the Maui County Planning Commission.

4. Building and Grading Permits approval by Development Services Administration, Maui County Department of Public Works.

5. Flood Development Permit approval by Maui Department of Planning Zoning and Enforcement Division.

II. Description of the Property and Proposed Project

E. Property Location

E.1 Project Site

The Kanai A Nalu property is located at 250 Hauoli Street, Wailuku, Maui, HI 96793; Tax Map Keys (2) 3 8-014:004 & 005. The project site consists of approximately 370 linear feet of shoreline along the Maalaea coastline on the southwest coast of Maui. The project is bounded by Hauoli Street to the north and the Pacific Ocean to the south. The project site is bounded to the east by the Hono Kai Condominium and a privately-owned residential parcel to the west.

The backshore is developed and primarily consists of condominium complexes. The shoreline faces southeast and is affected by south swell during the summer months and Kona storm waves in the winter and spring. Kahoolawe, Lanai, and East and West Maui produce sheltering effects that limit the approach direction of waves that can affect Maalaea.

The backshore consists of a relatively flat coastal plain composed primarily of Kealia silt loam (KMW) with slopes of 0 to 1 percent. The foreshore consists of a narrow, sandy beach composed of carbonate sand. In January 2019, beach width ranged from 5 feet at the east end of the shoreline to 25 feet at the west end. Though beach width can vary widely based on seasonal environmental conditions. The Kanai A Nalu property is fronted by a concrete rubble masonry (CRM) seawall. The middle portion of the seawall failed and was removed in 2009. The remaining sections of the seawall are in disrepair and appear to be at risk of failing. The adjacent property to the east also is fronted by a CRM seawall. The property to the west recently removed its deteriorating CRM seawall.

F. Existing Site Conditions

F.1. Erosion History

The Maalaea shoreline has a documented history of erosion. Construction of Maalaea Harbor in 1952 resulted in the loss of 1,500 feet of narrow beach to the east of the harbor, which led to construction of shore protection structures (i.e., seawalls and revetments) that currently extend 2,400 feet east of the harbor to Haycraft Park, a 6.5-acre public beach park that is managed by the County of Maui. The Kanai A Nalu property is located at the transition between armored shoreline that extends west to Maalaea Harbor and unarmored shoreline that extends east to North Kihei.

Coastal erosion along the Kanai A Nalu shoreline was evaluated by the University of Hawaii Coastal Geology Group (CGG). The CGG used historical aerial photographs from 1900 to 1997 to determine historical rates of shoreline change. The CGG determined that the beach fronting Kanai A Nalu has been eroding at an average rate of 1.0 feet/year. The Kanai A Nalu property is located in the Maalaea Bay Beach littoral cell. The U.S. Army Corps of Engineers (2011) determined that erosion has reduced the volume of sand in the Maalaea Bay Beach littoral cell by an average of 800 cubic yards per year.

Kanai A Nalu conducted beach restoration in 1997 to mitigate erosion and undermining of the seawalls. Sand replenishment of approximately 1,500 cubic yards took place three times from 1997 to 1998 but much of the sand was gone by 2001. Kanai A Nalu conducted beach restoration again in 2003. The project consisted of the placement of 3,000 cubic yards of inland dune sand.

F.2. Shoreline Assessment

On January 7, 2019, Sea Engineering, Inc. (SEI) conducted a site inspection at the Kanai A Nalu property with a structural engineer, geotechnical engineer, and construction manager to assess the condition of the shoreline and existing shore protection structures and discuss potential options to address any damages or structural deficiencies. Structural engineering services were provided by MKE Associates LLC (MKE), under subcontract to SEI. MKE visually inspected the condition of the seawalls and developed preliminary repair recommendations. Geotechnical engineering services were provided by Shinsato Engineering, Inc. (Shinsato), under subcontract to SEI. Shinsato visually inspected the soil conditions adjacent to and beneath the existing seawalls to determine the geotechnical soil parameters to inform the structural analysis.

The Kanai A Nalu shoreline consists of approximately 370 linear feet of shoreline at the western terminus of Maalaea Bay Beach, approximately 2,400 feet east of Maalaea Harbor. The backshore is developed and primarily consists of condominium complexes. The shoreline faces southeast and is affected by south swell during the summer months and Kona storm waves in the winter and spring.

Kahoolawe, Lanai, and East and West Maui produce sheltering effects that limit the approach direction of waves that can affect Maalaea.

The backshore consists of a relatively flat coastal plain composed primarily of Kealia silt loam (KMW) with slopes of 0 to 1 percent. The foreshore consists of a narrow, sandy beach composed of carbonate sand. At the time of the site inspection, beach width ranged from 5 feet at the east end of the shoreline to 25 feet at the west end of the shoreline. The Kanai A Nalu property is fronted by a concrete rubble masonry (CRM) seawall that was likely constructed sometime in the 1940's. The middle portion of the seawall failed and was removed in 2009. The remaining sections of the seawall are in a deteriorated condition. The adjacent properties to the east and west are also fronted by CRM seawalls that appear to be damaged.

The seafloor offshore of the Kanai A Nalu property consists of a narrow, shallow reef flat that is bisected by a shore-perpendicular channel. As waves approach the shoreline, the shallow reef outcrops act as shoals that cause wave refraction, which forces wave energy to converge and become concentrated along the shoreline. Refraction also diverts wave energy into the channel, where it dissipates as it approaches the shoreline. As a result, it is expected that wave energy is generally higher at the east and west ends of the shoreline, and lower in the middle of the shoreline fronting the channel

As a means of reference in this document, the Kanai A Nalu shoreline was divided into three (3) sections:

Section 1 consists of a 90-foot-long CRM seawall along the west end of the shoreline.

Section 2 consists of 150 feet of unarmored shoreline along the middle of the property.

Section 3 consists of a 130-foot-long CRM seawall along the east end of the shoreline.

G. Reasons Justifying the Request

A four-story condominium was built on this location nearly five decades ago. Its building and operation were the direct result of the County of Maui zoning of the area as A-2 Apartment. Previous to that time the lots had been single family homes or beach houses. But with the change in zoning the pressure to expand the use to apartments was irresistible both because a new higher tax bracket was imposed on the property and because of the potential income from development of the area. This was an expression of the County government at the time to increase the availability of visitor lodgings. This trend also resulted in the near-simultaneous development of Lahaina, Kaanapali, Kahana, and Kapalua as visitor destinations. There was a time in the late 1970's and throughout the 1980's when coastal development was highly encouraged by the County. Kanai A Nalu, when constructed, was in full compliance with all laws, including coastal laws and regulations.

For much of its existence, the Kanai A Nalu was protected from erosional forces by a seawall along the entire 370-foot property line. This is part of over 2,400 feet of shoreline hardening in the region. In the 1990's a large section of the seawall failed and was removed. Since that time Kanai A Nalu has pursued sand replenishment on numerous occasions to make up for the loss of a portion of the seawall. They have also engaged the County of Maui in lengthy discussions regarding alternatives available to them to address sea level rise and coastal erosion. An alternatives discussion is found later in this document.

In May of 2024, the County of Maui Currents Division reported to the Maalaea Village Association on the results of a sea level rise resiliency study for the Maalaea Region. The study was funded by the County and carried out by a qualified contractor. The contractor evaluated a number of mitigation tools studying the pros and cons, potential for coastal hazard mitigation, construction and maintenance costs, and regulatory constraints. A wide array of actions were evaluated including groins and nearshore breakwaters, beach nourishment and vegetated sand dunes, rock revetments, elevating existing structures, and landward relocation of buildings.

In part, the contractor reported:

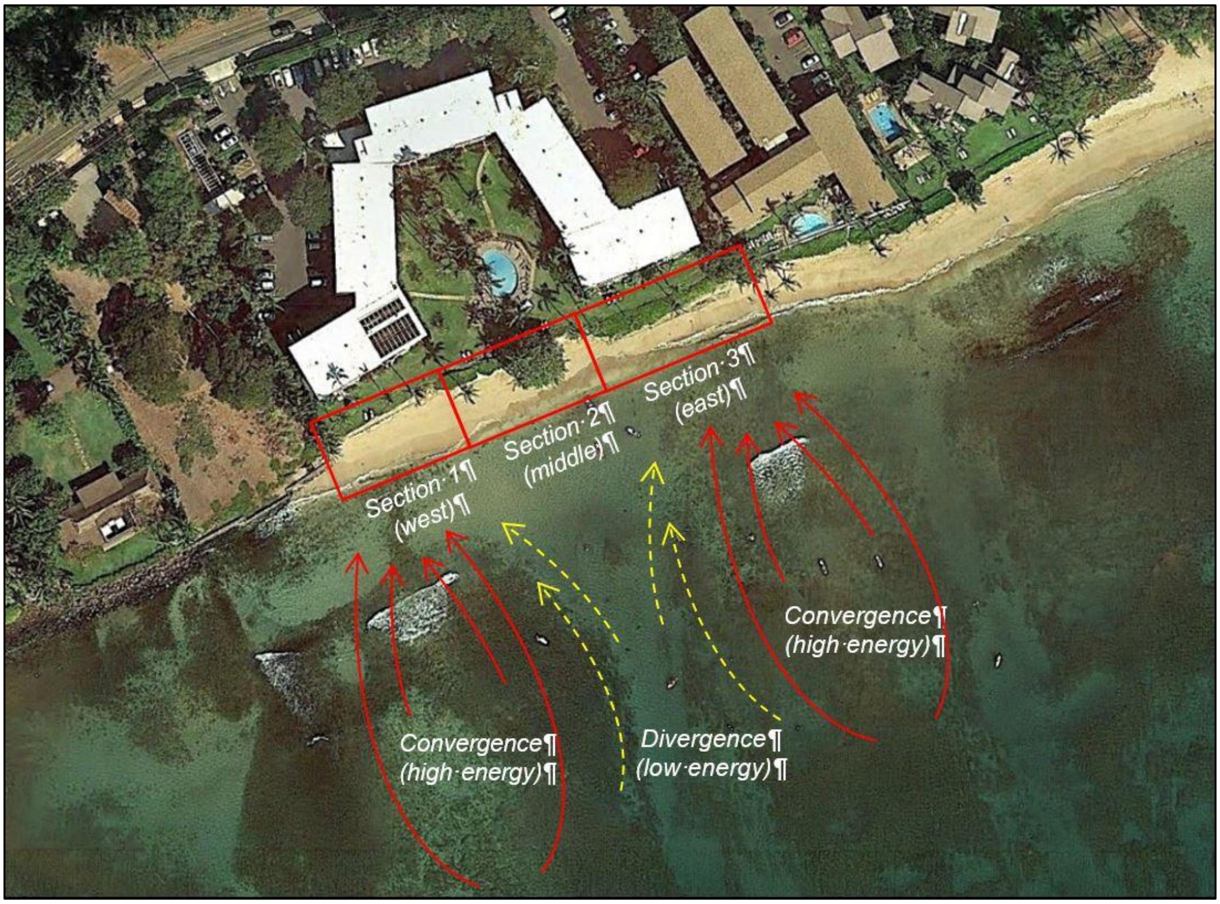
"These tools were evaluated both individually and in combination ("hybrid solutions")…"

"Based on these assessments, the results of the Maalaea sand search, and current state of regulations on shoreline structures, many of the tools were determined to be not currently feasible."

"The analysis indicated that there are tools which can be used for shorter term or interim resiliency improvements but that, ultimately, relocation may be required in the long term due to sea level rise."

Kanai A Nalu and the County of Maui have agreed to a series of actions to adapt to sea level rise, to restore more natural movement of the shoreline, and to re-establish native plants on the shoreline. As a first step in establishing an adaptation pathway for Kanai A Nalu, the condominium is proposing installation of a geotextile, sand-filled burrito moved back from the shoreline toward the condominium buildings. This soft structure will allow the condominium to negotiate a permit with the State of Hawaii Office of Conservation and Coastal Lands for the removal of the existing seawalls, restoring an unarmored shoreline. Kanai A Nalu also proposes a wooden ramp to allow for safe passage by the public to the beach. And lastly, restoration of native plants along the unarmored shoreline. Additional details are found in other sections of this document.

Figure 2: Kanai A Nalu Shoreline Sections and Wave Energy Patterns



G.1 Section 1 (west)

Section 1 consists of approximately 90 linear feet of shoreline that is fronted by a CRM seawall. The seawall is approximately 30 to 35 feet seaward of the west wing of the Kanai A Nalu building.. The seawall is approximately 5 to 6 feet high and appears to be constructed of mortared stone for the top 2 to 3 feet of wall height with a combination of precast concrete pavers and cast-in-place concrete fill at the lower 2 to 3 feet. It appears that the concrete fill was added to address undermining of the original stone wall as well as missing stones, with possibly more than one layer of concrete fill placed at different times. The wall thickness is unknown.

An approximately 3.5-foot-wide concrete cap has been cast on the top of the wall with the bottom of the stone portion of the wall below extending about 1 foot out beyond the cap on average. It appears this cap may have been cast over a previous cap, possibly to address cracked, displaced or missing portions of the original cap. The center portion of the concrete cap appears to have sagged downward, indicating the center portion of the wall may have settled downward.

Cracks, separations in the mortar, and voids in portions of the wall are also indicators of wall displacement.

Almost the entire wall length is undermined along the base of the wall, with voids between the bottom of the wall and top of the sand fronting the wall base varying in height from less than an inch to several inches and varying in depth up to several feet in from the front face of the wall. At the time of the site inspection, the beach sand elevation was below the elevation of the base of the seawall exposing the majority of the footing including undermined portions of the seawall foundation. The undermined portion beneath the seawall footing was measured and found to be up to 18 inches in height below the bottom of the footing and extending horizontally up to 12 feet under the footing (measured from the seaward face of the wall). No observable rotation of the seawall was noted. However, vertical deformation (gaps) between the building blocks was measured up to 6 inches.

Kanai A Nalu staff reported that sand elevations are variable and have been lower in the past. Therefore, it is assumed that both the height and depth of the voids may be larger during these periods of lower sand elevations. The wall and subsequent repairs appear to have been placed within the sand layer. The depth from the bottom of wall to a more erosion resistant layer of substrate is unknown. Based on the history of wall damage, the current extent of undermining beneath the seawalls, and the history of beach restoration, it is reasonable to conclude that the beach fronting Kanai A Nalu is subject to fluctuations in width and elevation.

The wall is currently cordoned off due to concerns regarding public health and safety. The CRM seawall at the west adjacent property (Nellie's on Maui, Ltd.) was removed in 2021.

Figure 3: Shoreline Section 1 (east)

In summary, the following damages and structural deficiencies were observed in Section 1:

- Erosion and loss of mortar due to weathering and wave action.
- Undermining and void formation due to erosion of loose sandy material.
- Wall displacement and settlement due to loss of subgrade support.
- West adjacent seawall is damaged and appears to be failing.

G.2 Section 2 (middle)

Section 2 consists of approximately 150 linear feet of unarmored shoreline. A continuous erosion scarp extends from the CRM seawall at the east end of Section 1 (west) to the CRM stair at the west end of Section 3 (east). The erosion scarp roughly follows the landward edge of the Naupaka hedge and is approximately 30 feet seaward of the Kanai A Nalu pool.

The erosion scarp is approximately 4 to 5 feet above the current sand elevation. There is evidence of undermining, particularly around the tree root structures. In some areas, the undermining extends 4 to 6 feet landward of the edge of the erosion scarp. There is evidence of active erosion and several of the trees located along the edge of the scarp appear to be leaning in a seaward direction, which suggests they are at risk of falling. A pile of loose cobble and debris material accumulated along the base of the erosion scarp.

This section of the shoreline was previously fronted by a CRM seawall. The seawall was damaged, and minor repairs were performed in 2006. The seawall ultimately failed and was removed in 2006. The embankment was graded, a small amount of beach fill was added, and the area was replanted with salt-tolerant grass and Naupaka. The erosion scarp currently appears to be relatively stable; however, the undermining appears to be progressive.

The beach toe was well-defined along this section of the shoreline. Turbidity levels along the beach toe were lower than the adjacent sections of the shoreline, which may be attributable to decreased wave energy in this area. The beach in this section was slightly wider than the adjacent sections, which may be attributable to increased onshore sediment transport in the sand channel.

Figure 4: Shoreline Section 2 (middle)

In summary, the following issues were observed in Section 2:

- Shore protection failed and was removed.
- Active erosion.
- Undermining due to wave action.
- Loss of backshore soils.

G.3 Section 3 (East)

Section 3 consists of approximately 130 linear feet of shoreline that is fronted by a CRM seawall. The seawall is approximately 35 to 45 feet seaward of the east wing of the Kanai A Nalu building.

The seawall is about 5 to 6 feet high and appears to be constructed of mortared stone for the top 3 to 4 feet of wall height with concrete fill at the lower 1 to 3 feet. It appears that the concrete fill may have been added later to address undermining of the original stone wall as well as missing stones. The thickness of the wall is unknown. A CRM stair leading to the ocean is located at the west end of the wall. Portions of the stairs are undermined, and the stairs and wall are cordoned off for safety.

An approximate 3-foot-wide concrete cap has been cast on the top of the wall with the bottom of the stone portion of the wall below appearing to be nearly plumb with the outside edge of the cap. Some portions of the cap have cracked and become displaced, and some stones have been dislodged, apparently by wave action. An approximate 20-foot portion of the wall east of the stairs is heavily deteriorated, with missing top caps, missing portions of wall, and apparent vertical and lateral displacement of portions of the wall. Similarly, the east end of the wall is cracked and dislodged. Multiple repairs appear to have been performed over the years.

Probing found the bottom of the seaward face of the wall to be several inches below the existing sand elevation. Kanai A Nalu staff reported that the sand has receded in the past to the degree that voids are visible beneath the wall. The depth from the bottom of the wall to a more erosion-resistant layer of substrate is unknown. Under the presumption that the top of the seawall was built at a consistent elevation, portions of the seawall were observed to have settled more than 12 inches. Outward rotation of the seawall was also observed. However, measurement of the amount of rotation was difficult due to the deteriorated condition of the seawall.

Based on aerial and ground photographs, the east adjacent property (Hono Kai) appears to be fronted by a CRM seawall along the entire length of shoreline frontage. The seawall appears to be experiencing undermining, portions of the wall appear to have settled, and the west end of the wall is failing. The area inshore of the wall was cordoned off, presumably due to sinkholes.

Figure 5: Shoreline Section 3 (west)

In summary, the following damages and structural deficiencies were observed in Section 3:

- Erosion of mortar, cracking, and dislodged stones due to weathering and wave action.
- Vertical and lateral displacement of portions of the wall.
- Undermining due to erosion of the loose sandy material.
- Outward rotation of the seawall.
- East adjacent seawall is damaged and appears to be failing.

H. Alternatives

H.1. Alternatives Analysis

Coastal erosion control is generally divided into two basic types: soft solutions and hard solutions. Examples of soft solutions include sand pushing, temporary erosion control structures, dune restoration, and beach nourishment. Hard solutions utilize engineered rock or concrete structures, typically a revetment or seawall, to permanently armor the shoreline and stop the erosion and shoreline recession. Beach nourishment can be combined with engineered structures, such as shore-perpendicular groins, to stabilize the beach fill.

Erosion control measures include the following general categories:

- Temporary Erosion Control (erosion skirts, sandbags, geotubes, gabions, mattresses)
- Beach Maintenance (sand pushing, sand backpassing, sand pumping)
- Sand Containment/Stabilization Structures (groins, breakwaters)
- Beach Restoration (with or without containment/stabilization structures)
- Shore Protection (revetments, seawalls, bulkheads)

Erosion control measures should be proven, durable, and effective in protecting the backshore, while minimizing environmental impacts. The measures must also be technically feasible at the scale of the project site.

Alternatives evaluated here:

- Sand Pushing
- Sand Backpassing
- Sand Pumping
- Small-scale Beach Restoration
- Large-scale Beach Restoration
- Erosion Protection Skirt
- Sand Filled Mattress
- Sandbag Revetment
- Seawall Repair
- Seawall Replacement
- Rock Rubblemound Revetment
- Hybrid Seawall-Revetment
- Managed Retreat
- No Action

H.1.1 Sand Pushing

Sand pushing is a beach maintenance strategy that involves moving sand from the lower beach to the upper beach to create a more stable beach profile and reduce exposure of the backshore to wave action. Sand pushing has been a successful beach maintenance strategy at various beaches throughout Hawaii. Agencies are generally supportive of sand pushing as a beach maintenance strategy.

Authorizations for sand pushing are typically limited to the beach immediately fronting the property. While sand pushing may temporarily improve the appearance of the beach, the pushed sand would be expected to mobilize and move alongshore and offshore.

Advantages

- May provide a temporary increase in beach volume and width.
- Lowest cost of the beach maintenance options considered.
- Construction process is timely and efficient.
- Agencies are generally supportive of beach maintenance.

Disadvantages

- Would not protect the backshore land and infrastructure.
- Only feasible when the beach is inflated.
- Sand is unlikely to remain stable without stabilizing structures.
- Recurring costs for repeated sand pushing efforts could be high.

Sand pushing is a beach maintenance activity that Kanai A Nalu could perform routinely when sand is available. However, it is unlikely that sand pushing would provide any long-term protection from erosion. Sand pushing may be feasible at Kanai A Nalu when the beach fronting the property is fully inflated. The loose boulders and cobble along the shoreline may need to be removed to accommodate sand pushing operations. Sand pushing may provide some temporary relief from erosion; however, without the addition of stabilizing structures, the sand is likely to mobilize, and erosion of the backshore is likely to continue.

H.1.2 Sand Backpassing

Sand backpassing involves recovering sand from areas of accretion and placing it in areas of erosion. Sand backpassing counters the natural longshore movement of sand and can be an effective beach maintenance strategy in areas with limited sediment budgets. At Kanai A Nalu, this would involve backpassing a small volume of sand from Maalaea Bay Beach, east of Haycraft Park.

For sand backpassing to be feasible at Kanai A Nalu, an adequate volume of sand would need to be available from another portion of Maalaea Bay Beach. This is unlikely as the majority of Maalaea Bay Beach is experiencing erosion. Sand backpassing would increase the volume of sand along the toe of the erosion scarp, thereby reducing the exposure of the scarp to wave action. The exposed upper portion of the scarp could be stabilized using vegetation and slope stabilization techniques.

The erosion scarp would need to be graded slightly to reduce the angle of repose and provide space to plant vegetation.

Advantages

- May provide a temporary increase in beach volume and width.
- Costs are lower than beach restoration.
- Regulatory permitting process is typically efficient.
- Construction process is efficient.

Disadvantages

- Would not protect the backshore land and infrastructure.
- Would require additional field investigations to confirm feasibility.
- Sand is unlikely to remain stable without additional stabilizing structures.
- Recurring costs for repeated sand backpassing efforts could be high.
- Agencies and the public may object to backpassing sand from the adjacent shoreline.

Sand backpassing is a beach maintenance activity that Kanai A Nalu could perform routinely when sand is available. Sand backpassing may be feasible at Kanai A Nalu if an adequate volume of sand is available from another portion of Maalaea Bay Beach. Sand backpassing may provide some temporary relief from erosion; however, without the addition of stabilizing structures, it is expected that beach narrowing and erosion of the backshore would continue.

H.1.4 Sand Pumping

Sand pumping involves recovering sand from the nearshore waters and placing it on the beach. Sand pumping counters the natural cross-shore movement of sand and can be an effective beach maintenance strategy in areas with limited sediment budgets. There are three options for sand pumping at Kanai A Nalu: 1) suction dredge, 2) floating platform dredge, or 3) diver-operated dredge.

A small suction dredge could be used to recover limited volumes of sand from within the channel fronting the project site. A Piranha PS165-E suction dredge would be capable of recovering 60-100 cubic yards of sand per day. This operation would be conducted on an as-needed basis to augment the beach profile. Sand slurry would be impounded within small dewatering basins trenched into the upper beach face and located entirely above mean higher high water (mhhw). The purpose of the dewatering basin is to allow the water portion of the sand slurry to percolate through the sandy beach substrate, which acts as a natural filter. After the water has percolated from the basins, the dewatered sediment would be distributed across the adjacent beach face. A small Bobcat would be used to push sand from lower on the beach face (above mhhw) to the vegetation line along the erosion scarp. A small berm would be created along the vegetation line to maximize the volume of sand on the upper beach profile.

Another alternative for sand pumping is a floating platform dredge or submersible diver-operated dredge. For example, an Eddy Pump diver operated dredge is a mobile system that is fully submersible and designed for pumping production rates of 50 to 100 cubic yards of material per hour. The system can be powered electrically or hydraulically. A single system can allow up to three suction hoses and divers to operate simultaneously. Suction hoses are 200 feet long with a maximum pumping distance of 2,400 feet.

Advantages

- May temporarily restore and maintain the beach resource.
- More cost effective than purchasing terrestrial sand or recovering offshore sand.
- Sand recovery process is efficient.
- Agencies are generally supportive of beach maintenance.

Disadvantages

- Would not protect the backshore land and infrastructure.
- Would require additional field investigations to confirm feasibility.
- Sand is unlikely to remain stable without engineered stabilizing structures.

- Recurring costs for repeated sand pumping efforts could be high.

Sand pumping is a maintenance activity that Kanai A Nalu could perform routinely when sand is available. Additional investigations would be required to determine if there is an adequate volume of sand in the channel fronting Kanai A Nalu. Sand pumping may provide some temporary relief from erosion; however, without the addition of stabilizing structures, the sand is likely to mobilize, and erosion of the backshore is likely to continue.

H.1.5 Small-scale Beach Restoration

Beach restoration typically involves placement of beach fill to specified design profiles. Beach restoration is intended to augment the natural morphology of the beach to offset the effects of chronic, seasonal, or episodic erosion. Regulatory agencies are generally supportive of beach restoration because it has minimal environmental impacts and is consistent with State and County policies that seek to preserve and enhance beach resources. The Hawaii Department of Land and Natural Resources, Office of Conservation and Coastal Lands (DLNR-OCCL) authorizes beach restoration through the Small-scale Beach Nourishment (SSBN) program, which allows placement of compatible beach quality sand seaward of the shoreline in the Conservation District. There are two categories of SSBN authorizations: Category I (up to 500 cubic yards of sand), and Category II (up to 10,000 cubic yards of sand).

Kanai A Nalu conducted beach restoration in 1997 to mitigate erosion and undermining of the seawalls. Sand replenishment of approximately 1,500 cubic yards took place 3 times between 1997 and 1998 but much of the sand was gone by 2001. Kanai A Nalu conducted beach restoration again in 2003. The project consisted of the placement of 3,000 cubic yards of inland dune sand. Based on the results of these previous beach restoration efforts, it is unlikely that small-scale beach restoration would be effective without engineered stabilizing structures (i.e., groins).

H.1.6 Large-scale Beach Restoration

Beach restoration is typically more effective at the regional, or littoral cell, scale. When sand loss is gradual, and the beach has a high economic value for recreation and tourism, there may be justification to replenish the littoral cell with sand from offshore or other sources.

With a sufficient quantity of beach quality sand that matches the characteristics of the native beach sand, it is possible that the beach at Kanai A Nalu could be restored. Increased beach width would create a natural buffer that would offer some protection for the backshore land and infrastructure. If the Kanai A Nalu shoreline were to be replenished with sand, it is unclear how stable the sand would be, once placed. The beach fill would be subject to local sediment transport dynamics and would likely be mobilized and redistributed throughout the littoral cell by normal seasonal beach processes. The sand would eventually mobilize and move alongshore and offshore during seasonal shifts within the littoral cell and/or large wave events. During periods of beach narrowing, the backshore would likely continue to erode. Moreover, erosion is expected to continue and possibly accelerate over the long term as sea levels continue to rise.

One of the factors that can limit the effectiveness of beach nourishment projects is the loss of sand due to natural processes, such as alongshore and cross-shore sediment transport. In some cases, it may be necessary to design engineered stabilizing structures, such as T-head groins, to maintain a stable beach. T-head groins decrease and reorient the amount of wave energy reaching the beach and create artificial littoral cells to stabilize the sand.

Large-scale beach restoration accompanied by the construction of engineered stabilizing structures to minimize sand movement would be the most effective means for restoring and maintaining the beach, while simultaneously mitigating the erosion and providing long-term protection for the backshore land and infrastructure. A series of groin structures accompanied by beach fill would create stable, wide beach cells between the groins.

There are two (2) options for large-scale beach restoration with engineered stabilizing structures at Kanai A Nalu. The first option would be a smaller scale project that would be confined to the shoreline fronting the Kanai A Nalu property. This option would consist of one T-head groin bounded by two L-head groins. The primary advantage of this option is that it would have the smallest overall footprint of the two options. Limiting the number of groins and the quantity of beach fill required would significantly reduce the cost of the project. The primary disadvantage of this approach is that it could potentially exacerbate erosion on the downdrift side of the east L-head groin. As a result, agencies, adjacent landowners, and the public are more likely to oppose the project.

An alternative option would be a larger scale project that would be expanded to include the properties east of Kanai A Nalu, including the Hono Kai Resort, Makani A Kai, and Haycraft Park. This option would consist of five T-head groins bounded by two L-head groins. The primary advantage of this option is that it would create a stable beach fronting all the properties and the public beach park. As a result, the project is more likely to be supported by the agencies, adjacent landowners, and the public. The primary disadvantage of this approach is that increasing the number of groins and the quantity of beach fill required would significantly increase the project costs.

T-head groins dissipate and defract wave energy to create a wave pattern that produces a stable, arc-shaped beach. In order to produce this effect, the groins' stems must be sufficiently emergent above the water line to an elevation that prevents wave overtopping. Each beach cell is nourished and graded to achieve a stable design profile. The wave pattern produced by the groins' function to maintain the design beach profile. Additional sand pushing is generally required after groin construction.

The groin heads function as offshore breakwaters. The ratio between the groins heads and gaps is 40/60, so the groin heads are expected to block a certain amount of wave energy. While the groins are designed for prevailing wave conditions, they do provide an additional level of protection under storm wave conditions. The groin layouts are based on the incident wave orientation to the beach cells. The groin systems would function properly as long as the angle between the incident wave crest and the gaps between groin heads is less than 20 degrees.

Groins have also been shown to enhance marine species diversity and density. The basalt boulders of the groins support an abundance of fishes and fish species richness and diversity. The boulders support coral colonization and the interstitial spaces between the rocks provide shelter for juvenile reef fishes.

Advantages

- Would restore and maintain a stable beach.
- Would create a stable buffer between the ocean and the backshore land and infrastructure.
- Would improve shoreline public access.
- Low maintenance.
- Groins provide habitat that has been shown to enhance marine species diversity and density.
- Agencies are generally supportive of large-scale beach restoration.

Disadvantages

- Groins have large structural footprints.
- High costs for design, permitting, construction, and easements.
- Would require an adequate quantity of compatible beach quality sand.
- Sand is not currently available for purchase on Maui.
- Offshore sand source investigations have not found compatible sand.
- Would require extensive collaboration with agencies, neighbors, and the community.

Large-scale beach nourishment with engineered stabilizing structures would benefit the beach, enhance lateral shoreline access, mitigate the erosion, and provide long-term protection for the backshore land and infrastructure. Expanding the project to include adjacent properties would benefit the entire community. Ideally, the project would be cost-shared by the community with assistance and project leadership from the State of Hawaii and County of Maui. A similar project is currently underway in Kahana Bay on West Maui.

Sand Sources

A key component to the success of a beach restoration project is the availability of a suitable sand source to support a large-scale beach nourishment effort. While sand may seem like a plentiful commodity, the reality is that good quality beach sand is in short supply in the Hawaiian Islands. There are generally three potential sources of beach-compatible sand: inland dune sand, nearshore sand (e.g., channels, harbors), and offshore sand. Mining sand from beaches is a prohibited activity.

Inland dune sand has been used for beach restoration purposes on Maui. Previous projects have used Maui inland Class “A” dune sand that has, for the past few decades, been commercially available as a result of sand excavation activities in the Maui Lani area. Maui inland Class “A” dune sand has been used for beach nourishment projects at Kanai A Nalu (Maalaea), Halama Street (Kihei), and Sugar Cove (Spreckelsville).

Supplies of beach quality sand from private companies from existing quarries appear to be diminishing (HSBPA, 2014). In 2006, the County of Maui commissioned a study to assess the existing inventory of dune sand on Maui. The study concluded that available inventories of dune sand may last for another five or six years based upon usage rates at the time (Hanzawa, 2006). The County of Maui has implemented a moratorium on mining of inland dune sand. The purpose of the moratorium is to allow time to conduct an updated sand inventory study and establish regulations to preserve existing sand resources and prevent the disturbance of iwi kupuna (ancestral bones). While the moratorium is a temporary measure, it is unclear if inland dune sand will be available to support future beach restoration projects on Maui.

Another potential source of beach-compatible sand is the nearshore waters offshore and adjacent to the project site. Sand often accumulates in channels or depressions in the reef flat. In some cases, these deposits can be recovered to support beach maintenance and restoration. Offshore deposits present an alternative source of sand for beach nourishment, particularly when considering the limited availability of suitable, natural sand from inland sources.

Offshore sand deposits occurring within the same littoral cell tend to have grain size characteristics and composition that are similar to the existing beach sand. Color and abrasion resistance are also important characteristics of fill sand. While natural calcareous beaches range in color from light brown to white, sand in offshore deposits often turns a grayish color as a result of anaerobic conditions typically produced by a lack of wave action and associated mixing.

The U.S. Army Corps of Engineers (2011) identified approximately 13.8 acres of stable sand stored on the reef flat from Maalaea to Kihei. The largest non-ephemeral sand fields are located offshore of Kalama Park and Waipuilani Park outside of the Maalaea littoral cell. While additional sand investigations are necessary to determine accurate volumes and grain size compatibility, these offshore sand deposits could potentially support beach restoration at Kanai A Nalu.

In 2023 The County of Maui contracted Moffatt and Nicol, an Oahu engineering company, to locate offshore sand deposits, evaluate the sand’s composition, and determine the volume of sand. The report written by Moffatt and Nicol has not yet been made public, but County staff did brief the Maalaea Village Association and the Maalaea landowners on preliminary results. There is at least one sand deposit within the Maalaea littoral cell. That deposit is located in a place where the sand could be retrieved for small- or large-scale beach restoration. However, the composition of the sand includes a large percentage of calciferous Halimeda flakes. These flakes are the result of Halimeda macroalgae decomposition. Their presence makes the sand size profile of the offshore sand incompatible, under the current regulatory understanding that the sand should not deviate more than 20% in size from the sand currently found on the beach. These sand deposits do deviate more than 20% in size. Current County thinking has small- and large-scale beach restoration as not feasible in the Maalaea region.

H.1.7 Erosion Protection Skirt

An erosion protection skirt is a method of temporary erosion control that consists of a layer of geotextile fabric (skirt) that is draped over the erosion scarp and anchored to the backshore. The structure consists of a core that is constructed of layers of geotextile material that are filled with sand. The skirt is draped over the core and secured to the backshore using earth anchors.

An advantage of an erosion protection skirt is that the materials are readily available and sand fill is not required. Regulatory agencies have generally been supportive of erosion protection skirts for temporary erosion control. A disadvantage of an erosion protection skirt is that it is typically only authorized under emergency conditions. The cumulative costs for design, construction, repair and replacement can also be substantial.

An erosion protection skirt is not an engineered erosion control structure and is consequently vulnerable to displacement and failure due to wave action and scour. Given the dynamic nature of the beach, the exposure to wave energy, and the dimensions of the erosion scarp, it is unlikely that an erosion protection skirt would be effective at Kanai A Nalu. The erosion scarp is very irregular and at a relatively high elevation when the beach is deflated. Considerable earthwork would be required to prepare a suitable surface on which the geotextile fabric could be placed. Foundation conditions along the toe of the scarp are also irregular and variable. The presence of clay outcrops, cobble, and boulders would make it difficult to prevent undermining. The foundation conditions would also preclude trenching and burial of the skirt toe, which is key to successful implementation.

Advantages

- Would provide temporary protection for the backshore land and infrastructure.
- Less expensive than beach restoration or shore protection.
- Minimal impact on the beach and shoreline public access.

Disadvantages

- Would not improve the condition of the beach.
- Typically, only authorized under emergency conditions.
- Less robust and durable than geotextile sandbags.
- Would require routine maintenance and replacement.
- Unlikely to be effective based on the project site conditions.
- Costs for design, construction, repair and replacement can be substantial.

An erosion protection skirt is unlikely to be effective at Kanai A Nalu. The project site conditions are not conducive to this method of temporary erosion control. The structure would likely require regular repairs and eventually need to be replaced.

H.1.8 Sand Filled Mattress

A Sand Filled Mattress (SFM) is a method of temporary erosion control that is manufactured from two layers of geotextile fabric stitched together at regular intervals. The bottom layer of the mattress is composed of a woven geotextile while the top exposed surface layer is composed of a composite geotextile that provides excellent abrasion resistance and durability. It is delivered in rolls that can be laid out with parallel tubular sections running down an embankment or beach face. The sections are hydraulically filled with sand on-site through the top openings. Adjacent rolls are joined by seaming on-site and anchored in a trench at the top of the slope. When filled with sand, the SFM functions as a temporary revetment.

An advantage of the SFM is that the materials can be stored on-site and rapidly deployed during or after episodic erosion events. When the beach is deflated, the SFM would reduce the amount of time that the erosion scarp is exposed to wave action, which would decrease the amount of erosion and land loss. A disadvantage of the SFM is that they are typically only authorized under emergency conditions and removal is typically required after the beach recovers.

Advantages

- Would provide temporary protection for the backshore land and infrastructure.
- Materials are readily available and construction process is efficient.
- Less expensive than beach restoration or shore protection.
- Minimal impact on the beach and shoreline public access.

Disadvantages

- Would not improve the condition of the beach.
- Typically, only authorized under emergency conditions.
- Requires an adequate volume of sand fill.
- Would require routine maintenance and replacement.

The SFM is a temporary erosion control measure that Kanai A Nalu could install during or after an erosion event to minimize additional loss of land. The SFM materials could be stored on-site and deployed as a rapid erosion response measure. The SFM would likely only be authorized for a brief period of time and would therefore not provide long-term protection for the backshore land and infrastructure.

H.1.9 Sandbag Revetment

A sandbag revetment is a form of temporary erosion control that consists of multiple layers of sandbags that are stacked to a specific design profile. The bags are constructed of geotextile fabric and filled with sand. The structure is designed to absorb wave energy and protect the backshore from wave action. The preferred material is ELCOROCK®, which is a highly durable non-woven, geotextile fabric. Enhanced filtration combined with resistance to abrasion and UV damage makes this material ideal for coastal applications.

An advantage of a geotextile sandbag revetment is that the materials are readily available, and the structures have historically been very effective at mitigating erosion. A disadvantage of a geotextile sandbag revetment is that the structure would have a very large structural footprint. Agencies are generally opposed to the use of geotextile sandbags along the shoreline due to concerns regarding the semi-permanent nature of the structures. Recent proposals for geotextile sandbag revetments on Oahu and Maui have been denied, even under emergency conditions.

Kanai A Nalu discussed the potential of installing a sandbag revetment either on the shore or in the setback area with the County of Maui. County officials were not supportive of a sandbag revetement in either location.

Advantages

- Would provide temporary protection for the backshore land and infrastructure.
- Materials are proven, durable, and readily available.
- Less expensive than beach restoration or shore protection.

Disadvantages

- Would not improve the condition of the beach.
- Very large structural footprint.
- Typically, only authorized under emergency conditions.
- Would require routine maintenance and replacement.
- Agency and public opposition to construction of shore protection structures on Maui.

A geotextile sandbag revetment would be an effective and durable temporary erosion control solution at Kanai A Nalu. To prevent wave overtopping, the crest elevation of the sandbag revetment would be +10 feet msl, which is slightly above the existing grade. The toe of the revetment would be -2 feet msl to provide scour protection. The primary disadvantage of a sandbag revetment is that the structure would have a very large footprint and would occupy most of the existing open space between the Kanai A Nalu buildings and the shoreline.

A geotextile sandbag revetment would be the most effective and durable option for temporary erosion control at Kanai A Nalu; however, it may be difficult to obtain the necessary regulatory approvals. The area seaward of the shoreline is located in the Conservation District. Erosion control and shore protection structures are typically prohibited in the Conservation District. A geotextile sandbag revetment may only be feasible if it is located landward of the shoreline.

H.1.10 Seawall Repair

A seawall is a vertical or sloping structure designed to protect the backshore land and infrastructure from wave damage and erosion. Seawalls are typically constructed using concrete, concrete rubble masonry (CRM), cement masonry unit (CMU), or sheet pile. A seawall, if properly designed and constructed, is a proven, durable, and low-maintenance shore protection method. Seawalls also have the advantage of having a smaller footprint than other shore protection options (e.g., revetments), which helps to preserve open space and lateral shoreline access.

The vertical and lateral displacement and rotation observed in the walls at Kanai A Nalu appears to be due to undermining of the seawalls when the sand elevation recedes below the base of the wall. As the wall undermines, it loses its bearing support at the toe, or in some areas, the entire width of the wall, resulting in downward and outward movement in the wall and the associated cracking and separations. The concrete fill appears to be an attempt to address past undermining; however, as the fill does not extend below the soft sand substrate to a more erosion-resistant hard substrate, the undermining has continued over time. Other possible causes for the observed distress and displacement, particularly at the seawall in Section 3 (east), include the force from large waves displacing the top cap and upper portions of the wall. As the undermining, distress and displacement has severely compromised the structural integrity of the walls, the walls should be repaired or replaced.

A typical undermining repair would consist of removing the soft sand below the wall base down to hard erosion-resistant substrate and filling the void with concrete. The feasibility of this repair is based on a hard substrate located within a few feet of the bottom of the wall. If the hard substrate is much deeper the installation of sheet piles or piers to protect the wall toe from undermining may be required.

As part of the wall repairs, voids and separations in the wall should be filled with mortar and concrete out to the exterior wall face to restore the integrity of the wall and to provide a smoother, less porous face that will reduce the buildup of wave forces within the wall. It is anticipated that similar work would need to be performed on the seawalls at the adjacent properties to protect them from undermining and to restore their structural integrity.

The existing seawalls fronting Kanai A Nalu are considered nonconforming, meaning that they were constructed prior to the adoption of the State Conservation District Rules and County Special Management Area and Shoreline Setback Rules. Repairs to nonconforming structures can be authorized; however, there are statutory limitations as to the nature and extent of the repairs. In general, a nonconforming structure may be repaired under the following conditions:

- The repairs are valued at less than 50% of the current replacement cost of the structure.
- The repairs do not enlarge or expand the structure.

In addition to the recommended repairs to the seawalls in Section 1 (west) and Section 3 (east) under this scenario, Kanai A Nalu could consider reconstructing the failed seawall in Section 2 (middle). Because the seawall was nonconforming prior to its' failure, it is possible that it could be reconstructed with the same density, materials, and footprint as the original structure. An advantage of reconstructing the failed seawall is that it would provide some degree of shore protection and reduce the erosion in Section 2. The original seawall had a shallow-depth foundation. A disadvantage of a shallow-depth foundation is that it would not protect against scour and undermining, so the structure would be more susceptible to damage. If the failed seawall in Section 2 (middle) were to be reconstructed, a deep foundation would be recommended.

Advantages

- Would protect the backshore land and infrastructure.
- Smaller structural footprint when compared to other shore protection options considered.
- Less expensive than removing and replacing the existing seawalls.

Disadvantages

- Would not restore or maintain a stable beach.
- High costs for design, environmental review, permitting, and construction.
- Additional costs to obtain non-exclusive easements.
- Agency and public opposition to shore protection structures on Maui.

The existing seawalls at Kanai A Nalu are in disrepair and have shallow foundations that are susceptible to scour and undermining. Repairing the existing seawalls would be less expensive and less controversial than replacing the structures. Reconstructing the failed section of seawall may be feasible; however, the cumulative costs for repair and reconstruction would exceed 50% of the replacement cost of the structures.

H.1.11 Seawall Replacement

Seawalls are not flexible structures, and their structural stability is dependent on the design and strength of their foundations. If the foundation of a seawall is breached, hydraulic action can erode fill material behind the wall. With the loss of enough fill, the ground surface behind the seawall will collapse and sinkholes will form. Sinkholes can compromise the structural integrity of a seawall and may result in failure of the structure. To avoid foundation problems, the seawall foundation should be well below the potential scour depth, which can require extensive excavation. The impervious and vertical face of a seawall results in very little wave energy dissipation. Incident wave energy is deflected upward, downward, and seaward. Reflected wave energy can inhibit accretion of sand seaward of the wall. The downward energy component can cause scour at the base of the wall. Therefore, the foundation of a seawall is critical for its stability, particularly on sandy and eroding shorelines. Ideally, seawalls are constructed on solid, non-erodible substrate.

The existing seawalls at Kanai A Nalu appear to have been poorly constructed. The wall foundations are insufficiently sized, the materials are variable and deteriorated, damages and structural deficiencies are severe and widespread, and previous attempts to repair the structures have failed.

A new seawall would be constructed of cast-in-place reinforced concrete. Due to existing regulatory restrictions, it is anticipated that the new seawall would be required to be located landward of the certified shoreline outside of the Conservation District. Replacement would also require demolition and removal of the existing structures.

Advantages

- Would protect the backshore land and infrastructure.
- Smallest structural footprint of the shore protection options considered.
- Reduced footprint would maximize open space on the property.
- Would eliminate the requirement and costs to obtain easements from the State of Hawaii.

Disadvantages

- Would likely need to be constructed landward of the certified shoreline.
- Would not restore or maintain a stable beach.
- High costs for design, environmental review, permitting, and construction.
- Agency and public opposition to construction of shore protection structures on Maui.

A seawall would be an appropriate erosion control solution for Kanai A Nalu. A seawall would mitigate the erosion and provide effective long-term protection for the backshore land and infrastructure; however, regulatory agencies and the public are generally opposed to construction of seawalls due to concerns about potential impacts to beaches and dunes, particularly on Maui. A new seawall would be very controversial, even if the structure were located landward of the certified shoreline.

Sheet Pile

In October of 2021, Kanai A Nalu submitted to the County of Maui a Special Management Area Assessment which, via SMA rules, requested the County's concurrence on the process for permitting and installing a sheet pile structure in the setback area. The County's response was received in June of 2022 and confirmed that, among other permits, a sheet pile structure would need an environmental assessment, shoreline setback variance, and a special management area use permit.

In addition, the County provided numerous statements opposing the permitting of a sheet pile structure. Some selected language from their response include:

"Department" refers to the County of Maui Department of Planning.

"The Department notes that beach restoration for the regional Maalaea beach cell represents an interim coastal erosion mitigation alternative to Kanai A Nalu as a preferred solution over a continuous sheet pile wall. Besides authorizing emergency protective measures that remain in place since 2020, the Department has been supporting the regional efforts of the Maalaea Village Association and all the condominiums along Hau'oli Steet to determine the best path forward to manage your ongoing coastal erosion…."

And;

"The Department understands that your request is for preventative actions. The Department advises not to pursue a shoreline setback variance for installation of a sheet pile wall but rather to first pursue an Environmental Assessment with the other condos using a portion of the designated $2.2 million allocated for the sheet pile wall proposal to assess and develop a beach-cell level solution to this management challenge."

Without the County's support for a sheet pile structure in the setback area, Kanai A Nalu felt proceeding with a permit application would not be successful.

Over the course of the last nearly two years since this response, the Department has funded several sand studies performed by Moffatt and Nicol. The results, previously discussed in this document, were that there are offshore sand deposits, but they are not compatible with the sand found on the beach. Therefore, large scale beach restoration at Maalaea is not possible with this sand source.

H.1.11 Rock Rubblemound Revetment

A revetment is a sloping, un-cemented structure constructed of wave-resistant material. The most common method of revetment construction is to place a layer of armor stone, sized according to the design wave height, over an underlayer of smaller rock that sits atop filter fabric. The underlayer is designed to distribute the weight of the armor layer and to prevent loss of fine material through voids in the revetment.

Revetments in Hawaii are typically built on a slope of 1.5 to 2 horizontal to 1 vertical to ensure stability. Toe scour protection can be provided by excavating to place the toe on solid substrate, constructing the foundation below the maximum depth of anticipated scour, or extending the toe to provide a scour apron of excess stone. It is important that the armor stone be carefully chosen and placed in a keyed-and-fitted manner to minimize gaps between stones, which increases the durability of the structure.

An advantage of a rock rubblemound is that the rough, porous rock surface and sloping face of the structure will tend to absorb wave energy, reduce wave reflection, and may help to promote accretion of sand on a sandy beach when sufficient sand volume is available in the littoral environment. Additional advantages of revetments are that materials are readily available and localized damage can be easily repaired by placement of additional armor stone. Properly designed and constructed rock revetments are durable, flexible, and highly resistant to wave damage.

A disadvantage of a rock rubblemound revetment is that it would have the largest structural footprint of the options presented in this report. The location of the revetment would affect the overall cost and permitting requirements. A revetment is not likely to be authorized seaward of the shoreline in the Conservation District. Construction of the revetment landward of the shoreline would require extensive excavation of the backshore. It is important to note that, even if the revetment were constructed landward of the shoreline, the future certified shoreline would likely be located at or near the crest of the structure, so an easement may eventually be required.

Advantages

- Would provide long-term protection for the backshore land and infrastructure.
- May facilitate beach accretion seaward of the structure.
- Would eliminate requirement and costs to obtain easements from the State of Hawaii.
- Very low maintenance.
- Would not require in-water construction.
- Would not impact lateral shoreline access.
- Existing seawalls could remain in place during construction.
- Would have better energy dissipation characteristics than the existing seawalls.

Disadvantages

- Would not restore or maintain a stable beach.
- Would likely need to be constructed landward of the certified shoreline.
- Largest structural footprint of the shore protection options considered.
- Very high costs for design, permitting, and construction.
- Would require extensive excavation of the backshore.
- May require a non-exclusive easement from the State of Hawaii.
- Agency and public opposition to construction of shore protection structures on Maui.

A rock rubblemound revetment could be an appropriate erosion control solution at Kanai A Nalu. A revetment would mitigate the erosion and provide effective long-term protection for the backshore land and infrastructure; however, this solution would require a major construction effort, and the costs for design, permitting, construction would be high. The structure would also occupy near all the open space landward of the shoreline. Due to the location of the shoreline, there may not be enough space to accommodate a rock rubblemound revetment in Section 3 (east).

H.1.12 Hybrid Seawall-Revetment

Another potential long-term solution for the erosion at Kanai A Nalu is a hybrid shore protection structure. A hybrid seawall-revetment would be composed of two primary elements: 1) a seawall (i.e. sheet pile, reinforced concrete, or concrete rock masonry), and 2) a uniform rock rubblemound

A hybrid seawall-revetment would be designed to withstand extreme wave conditions, be minimally reflective, allow for accretion of beach sand, provide lateral shoreline access, reduce turbidity in nearshore waters, and minimize the amount of material placed in Waters of the United States and the State Conservation District. A hybrid seawall-revetment would have a smaller footprint than a traditional rock revetment. The revetment provides toe protection for the seawall and reduces reflective wave energy, which is conducive to maintaining a sand beach.

If a hybrid seawall-revetment were permitted in the Conservation District, Kanai A Nalu would be required to obtain a non-exclusive easement from the State of Hawaii. Even if the structure were located landward of the current certified shoreline, the future certified shoreline would likely be located at or near the crest of the structure, so an easement would eventually be required. In either case, easement costs are likely unavoidable.

Advantages

- Would provide long-term protection for the backshore land and infrastructure.
- May facilitate beach accretion seaward of the structure.
- Very low maintenance.
- Would not require in-water construction.
- Would not impact lateral shoreline access.
- Smaller structural footprint when compared to a rock rubblemound revetment.
- Existing seawalls could remain in place during construction.
- Would have better energy dissipation characteristics than the existing seawalls.

Disadvantages

- Would not restore or maintain a stable beach.
- Would likely need to be constructed landward of the certified shoreline.
- Large structural footprint.
- Very high costs for design, permitting, and construction.
- Would require extensive excavation of the backshore.
- May require a non-exclusive easement from the State of Hawaii.
- Agency and public opposition to construction of shore protection structures on Maui.

A hybrid seawall-revetment would mitigate the erosion and provide effective long-term protection for the backshore land and infrastructure; however, this solution would require a major construction effort in coordination with all of the affected landowners, and the costs for design, permitting, construction, and easements would be high.

H.1.13. Managed Retreat

This approach would involve relocating the existing structures further landward and allowing the erosion to continue. Retreat would allow the backshore to continue to erode and sand to migrate naturally along the beach. Retreat would avoid the costs associated with design, permitting, and construction of shore protection measures or beach restoration; however, costs associated with relocating the existing structures and restoring the landscape after the structures have been removed would likely be substantial. Retreat could eventually negate the economic value of the property.

Given the existing building footprints, the dimensions of the parcel, and the proximity to Hauoli Street, it may not be feasible to relocate the structures landward. It is worth noting that the area landward of Hauoli Street consists of a 423-acre parcel of undeveloped land that is zoned

Agriculture (AG). While this land is currently being used for agricultural purposes, it is possible that it could be rezoned to accommodate landward migration of the existing residential developments. A project of this scope would require extensive coordination with adjacent landowners, agencies, and the public.

The Hawaii Office of Planning (OP) published a report in 2019 entitled, Assessing the Feasibility and Implications of Managed Retreat Strategies for Vulnerable Coastal Areas in Hawaii. The study evaluated options to establish policies, regulations, tools, and programs to support a managed retreat strategy in response to sea level rise. The study found that retreat is one of three primary adaptation strategies, along with accommodation (e.g., freeboard) and protection (e.g., hybrid-seawall revetment), and that, prior to deciding upon retreat, accommodation and protection must be examined to determine which strategy is the best for the area dealing with coastal hazards, climate change and sea level rise. The study also found that retreat is only effective when done voluntarily and that economic incentive programs to fund retreat (e.g., buyouts, transferrable development rights, rolling easements) are unlikely to be effective due to the high cost of real estate in Hawaii. Finally, the report noted that retreat from chronic coastal hazards (e.g., erosion and sea level rise) is incremental and typically takes decades to complete.

Considering the erosion history of the area (Fletcher et al., 2012), and the projected future erosion with rising sea levels (Anderson et al., 2015, State of Hawaii, 2018), retreat may be considered as a long-term option; however, until retreat is determined to be feasible or desirable, and programs and policies are in place to facilitate the process, other appropriate solutions should be considered.

Advantages

- Eliminates the risk to backshore infrastructure.
- Avoids costs and requirements associated with beach restoration and/or shore protection.
- Allows the beach to migrate naturally.

Disadvantages

- Would not restore or maintain the beach.
- Would not protect the backshore land and infrastructure.
- Requires the landowners to voluntarily surrender their property to erosion and sea level rise.
- Timeline for retreat is typically on the order of decades.

Without some form of erosion mitigation, it is likely that the beach will continue to erode, and the existing buildings will eventually become threatened or uninhabitable.

H1.14 No Action

The No Action alternative would involve leaving the existing shore protection structures in place in their current condition, leaving the middle portion of the shoreline unarmored, and allowing the beach and backshore to continue to erode. This approach would do nothing to address the erosion problem, the condition of the shoreline would likely continue to deteriorate, and the existing buildings may eventually become threatened. Given the deteriorated condition of the existing seawalls, the structures are likely to fail in the future. Continued erosion of the backshore would result in the landward migration of the certified shoreline, which has implications for land ownership and public access. If the backshore continues to erode, engineering options may become limited as there may be insufficient land area available to accommodate shore protection structures.

Advantages

- No cost.
- Allows the beach to migrate naturally.
- Preserves lateral shoreline public access.

Disadvantages

- Would not mitigate the erosion.
- Would not protect the backshore land and infrastructure.
- Existing buildings will eventually become threatened or uninhabitable.

No Action would leave the backshore land and infrastructure exposed to erosion. Should the erosion continue as predicted, the existing buildings will eventually become threatened. Without some form of maintenance or restoration, the beach would likely continue to narrow and may eventually be lost to erosion.

I. Description of the Proposed Action (Preferred Alternative)

I.1. Managed Coastal Retreat on Maui: Process and Tools

Managed coastal retreat on Maui is a strategic process designed to address the escalating threats of sea level rise, coastal erosion, and extreme weather events. This process involves relocating infrastructure, communities, and ecosystems away from vulnerable coastal areas to safer, inland locations. The aim is to reduce risk while preserving Maui's natural landscapes and cultural heritage.

Process of Managed Retreat

Assessment and Planning

The process begins with comprehensive assessments of coastal hazards and vulnerabilities. This includes analyzing erosion rates, sea-level rise projections, and the potential impact on infrastructure, homes, and natural ecosystems.

Stakeholders, including government agencies, community members, and environmental experts, collaborate to develop strategic retreat plans. These plans outline priority areas for relocation and establish timelines for implementation.

Land Use and Zoning Adjustments
Zoning laws and land-use policies are revised to discourage new development in high-risk areas. These adjustments are crucial for preventing future losses and ensuring that retreat efforts are sustainable over the long term.

Incentives and regulations may be implemented to encourage property owners to relocate or to prohibit rebuilding in areas identified for retreat.

Acquisition and Relocation
The government or non-profit organizations may purchase properties in at-risk areas to facilitate the retreat process. This step often involves negotiating with property owners and providing compensation or relocation assistance.

Public infrastructure, such as roads, utilities, and public buildings, is also moved or redesigned to accommodate new, safer locations further inland.

Environmental Restoration
After relocation, efforts focus on restoring the vacated coastal areas to natural conditions. This may include removing structures, replanting native vegetation, and allowing natural processes like dune formation or wetland expansion to occur.

Restoring these areas helps to buffer against future coastal hazards and enhances the resilience of nearby ecosystems.

Community Involvement and Education
Public engagement is a critical component of managed retreat. Communities are informed about the risks of staying in vulnerable areas and the benefits of relocation.

Continuous dialogue ensures that the process is transparent, socially equitable, and considers the cultural significance of the land.

Tools Used in Managed Retreat

Mapping and Modeling
Geographic Information Systems (GIS) and other modeling tools are used to visualize future scenarios of sea-level rise and erosion. These tools help in planning and decision-making by identifying high-risk areas.

Economic Instruments
Buyouts, relocation grants, and tax incentives are offered to property owners to encourage voluntary relocation.

Transferable development rights allow property owners to develop in safer areas, compensating them for lost property in vulnerable zones.

Legal and Regulatory Frameworks
Policies are enacted to prevent new development in high-risk areas and to regulate the use of vacated lands. This ensures that retreat efforts are not undermined by future development pressures.

Environmental Engineering
In some cases, engineering solutions like controlled breaching of barriers or managed realignment of shorelines are employed to facilitate natural coastal processes post-retreat.

Timeline and Implementation
Managed retreat is a long-term strategy that typically unfolds over decades. Initial planning and assessments might take 3-5 years, with land acquisition and relocation happening over 10-20 years. Full environmental restoration and community integration can span 30 years or more, making managed retreat a multi-generational effort.

Managed coastal retreat on Maui is a proactive approach to adapting to the inevitable impacts of climate change on coastal areas. It involves careful planning, community engagement, and the use of innovative tools to ensure a safer and more resilient future for the island's residents and ecosystems.

I.2. Geotextile Burrito

For much of its existence, the Kanai A Nalu was protected from erosional forces by a seawall along the entire 370-foot property line. This is part of over 2,400 feet of shoreline hardening in the region. In the 1990's a large section of the seawall failed and was removed. Since that time Kanai A Nalu has pursued sand replenishment on numerous occasions to make up for the loss of a portion of the seawall. They have also engaged the County of Maui in lengthy discussions regarding alternatives available to them to address sea level rise and coastal erosion.

Kanai A Nalu and the County of Maui have agreed to a series of actions to adapt to sea level rise, to restore more natural movement of the shoreline, and to re-establish native plants on the shoreline. As a first step in establishing an adaptation pathway for Kanai A Nalu, the condominium is proposing installation of a geotextile, sand-filled burrito moved back from the shoreline toward the condominium buildings. This soft structure will allow the condominium to negotiate a permit with the State of Hawaii Office of Conservation and Coastal Lands for the removal of the existing seawalls, restoring an unarmored shoreline. Kanai A Nalu also proposes a wooden ramp to allow for safe passage by the public to the beach. And lastly, restoration of native plants along the unarmored shoreline.

Kanai A Naluai proposes to make the conditions right for seawall removal by installing a nine-foot by nine-foot burrito structure in their back lawn, which is located in the SMA Setback Area. The entire structure will be installed four (4), or more, feet inland of the existing shore and will be covered by native soil/sand and native beach strand plants when complete. The geotextile burrito will be formed using a durable, water permeable geotextile fabric wrapped around one cubic yard super sacks. The super sacks will be filled using in situ sand excavated to form a trench which will accommodate the burrito structure. The use of sand, the stacking of the super sacks in a three-by-three pattern and the wrapping of the super sacks in a geotextile fabric will provide a contiguous water-permeable structure along the entire 370 linear feet of shoreline.

On the mauka side of the structure, a three-inch galvanized pipe will be embedded in the geotextile fabric. This pipe will be one side of a Platipus anchoring system. The other side of the Platipus will be secured in the lawn substrate mauka of the burrito. The burrito with its encapsulated sand mass and anchored to the surrounding soil will be able to resist a mass erosion event, like a hurricane, while not creating any hydrostatic pressure mauka of the structure. Water will be able to pass through the structure without taking any of the sand materials with it.

Figure 6: Rear Yard. Location of Geotextile Burrito Installation and Native Dune & Plant Restoration.

I.3. Dune Ramp – Shoreline Access

A wooden walkway, or ramp, will be located along the eastern property boundary and will be used by the public, residents of Kanai A Nalu, and residents of Hono Kai to access the beach. The ramp will have level landings on either side and will traverse the newly established dune to provide access to the shore from the rear yard. There will be a wooden landing, or flat spot, at either end while the ramp will arch from the shore to the rear yard through the dune and over the subterranean geotextile burrito. Commercially available, non-toxic wood products will be used to establish a series of posts for a foundation and a ramp and railing will be built upon that post foundation. This recessed design will be entirely within the County of Maui jurisdiction. While the seawalls are in place, pedestrians will be able to pass through a degraded section of the seawall in this area. After seawall removal, the ramp will open onto the shore, without encroaching on the shore. This structure is necessary to provide a safe way to transition between the rear yard and the ocean.

I.4. Seawall Removal

The seawall segments must remain in place during the execution of this project. The seawalls will provide some soil stability while trenching and installation of the burrito is under way. This equates to both trench safety and the logistics of bringing machines into the rear yard to do the work. Seawall removal will be pursued through a State of Hawaii Office of Conservation and Coastal Lands Permit determination process which will be initiated when the Kanai A Nalu submits an application for a Shoreline Determination upon completion of the project.

Figure 7: New Wooden Ramp Location.

I.5. Dune Restoration

The rear yard has been maintained as a salt resistant grassy lawn for decades. This project allows for adapting the use of the rear yard. To that end, Kanai A Nalu proposes to convert a four to eight-foot band, of what is currently salt resistant grass, into a native plant dune/shoreline. These plants, adapted to the ocean strand, will assist in stabilizing the sand/soil and will perpetuate propagation of native plants along the Maalaea coastline. Plants to be used may include:

- **ʻAkulikuli** - Sesuvium portulacastrum
- **ʻIlima -** Sida fallax
- **ʻAkiʻaki -** Sporobolus virginicus
- **Naupaka -** Scaevola taccada
- **Pōhuehue -** Ipomoea pes-caprae
- **Hinahina kū kahakai -** Heliotropium anomalum var. argenteum
- **ʻEnaʻena -** Pseudognaphalium sandwicensium
- **ʻĀweoweo** - Chenopodium oahuense
- **Pōhinahina -** Vitex rotundifolia
- **Pāʻūohiʻiaka -** Jacquemontia ovalifolia
- **Kāwelu -** Eragrostis variabilis
- **Niu** – Cocos nucifera (Canoe Plant)

I.6. Access and Cost

Access to the work site will be gained through a gate located on the western edge of parcel 005 (the western parcel). There is a corridor on that side of the building that is sufficient for excavators to enter the rear yard from the paved parking lot. A staging area will be established on the parking lot, adjacent to the western buildings, to store machines and materials. These machines and materials will be transported to the worksite as needed.

Construction will take approximately 90 days at an estimated cost of $2,400,000.

J. Shoreline Setback Assessment

J.1. Average Lot Depth (ALD)

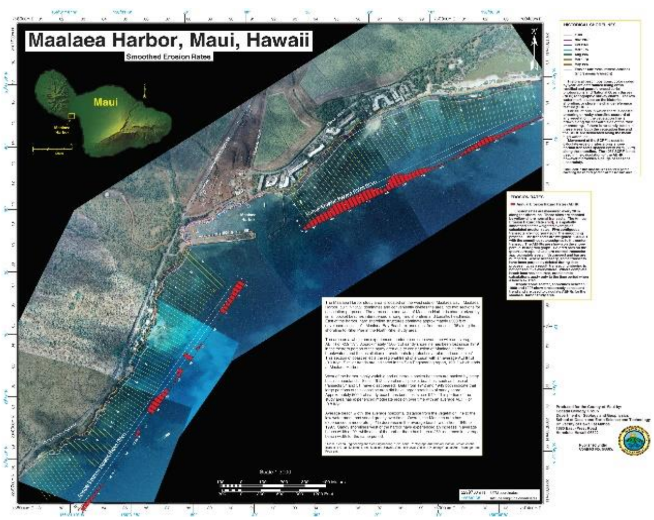
Parcel 004
Western Boundary = 285.18 feet
Middle Boundary = 285.93 feet
Eastern Boundary = 284.34 feet
285.18 + 285.93 + 284.34 = 855.45
855.45/3 = 285.15 Average Lot Depth
ALD Parcel 004 = 285.15 x 0.25 = 71.29 feet

Parcel 005
Western Boundary = 298.70 feet
Middle Boundary = 295.50 feet

Eastern Boundary = 285.18 feet
298.70 + 295.50 + 285.18 = 879.38
879.38/3 = 293.13 Average Lot Depth
ALD Parcel 005 = 293.13 x 0.25 = 73.28 feet

J.2. Annual Erosion Hazard Rate (AEHR)

Transect 128
(1.0 x 50) + 25 = 75
Transect 129
(1.0 x 50) + 25 = 75
Transect 130
(1.0 x 50) + 25 = 75
Transect 131
(0.8 x 50) + 25 = 65



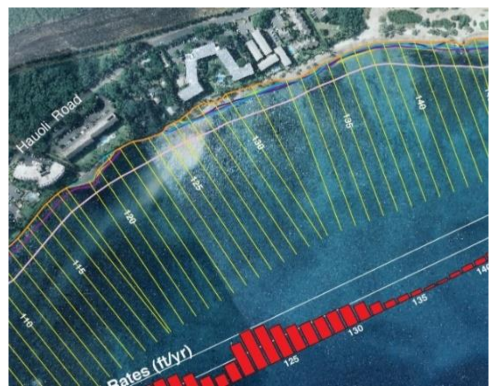


Figure 8: Erosion Transect Maps, Maalaea.

III. Description of the Existing Environment, Potential Impacts and Mitigation Measures

K. Physical Environment

K.1. Surrounding Land Uses

Existing Conditions

The Kanai A Nalu property is located at 250 Hauoli Street, Wailuku, Maui, HI 96793; Tax Map Keys (2) 3-8-014:004 & 005. The project site consists of approximately 370 linear feet of shoreline, approximately 2,400 feet east of Maalaea Harbor, along the Maalaea coastline on the southwest coast of Maui. The project is bounded by Hauoli Street to the north and the Pacific Ocean to the south. The project site is bounded to the east by the Hono Kai Condominiums and a privately-owned residential parcel to the west.

Potential Impacts and Mitigation Measures

The subject parcel is located between an existing residential condominium and an undeveloped private property. Regionally it sits within a developed coastal urban environment. The proposed use of the subject parcel for continued residential condominium purposes will not change as a result of the proposed softening of erosion measures (geotextile burrito) and therefore is compatible with current uses in the surrounding area.

From a long-term perspective, the proposed repair work will not have an adverse impact on land uses in the vicinity as the basic character of the surrounding environs will be maintained. Further resiliency actions will be needed over the next decade.

K.2. Topography and Soils

Existing Conditions

The surficial geology of the low-lying Maalaea coastal plain is primarily composed of younger alluvium (Holocene and Pleistocene) (Sherrod et al., 2007). From the USDA Soil Conservation Service "Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii," the project site is located in an area designated as Kealia silt loam (KMW). This series consists of somewhat poorly drained soils on coastal flats on the islands of Molokai and Maui. On this soil, permeability is moderately rapid. Runoff is slow to very slow, and the erosion hazard of water is not more than slight, but the hazard of wind erosion is severe when the soil is dry and the surface layer becomes loose and fluffy (USDA, 1972, pg. 67, Plate 101).According to the Soil Survey of the Islands of Kauai, Oahu, Maui, Moloka`i, and Lana`i, State of Hawai`i, April 1972, prepared by the United States Department of Agriculture, the soil associated with the subject parcel is EsB. This soil is comprised entirely of the Ewa silty clay, with slopes of 3 to 7 percent.

Potential Impacts and Mitigation Measures

All work will be conducted on the rear yard lawn, away from the shoreline. While there will be grading and grubbing associated with the installation of the geotextile burrito, these effects will be limited to the construction period. Restoration of a coastal dune will positively impact the shoreline native plants used in the project.

Best Management Practices (BMPs) will be implemented during construction activities to control fugitive dust, soil erosion, storm water runoff, and non-point source pollution. The BMPs will be prepared in accordance with Chapter 20.08, Maui County Code (Soil Erosion and Sedimentation Control).

K.3. Flood and Tsunami Hazards

Existing Conditions.

There are three flood zone designations on the subject property: VE (coastal high hazard area) at twelve (12) feet on parcel 005 in the western corner, AE (flood fringe area) at eleven (11) feet on parcel 004 in the eastern corner, and Zone X (minimal flood hazard) everywhere else. A short section of the burrito structure will be adjacent to or in Zone VE in the western portion of parcel 005 and so the entire structure is subject to receiving a Flood Development Permit.

The Civil Defense Tsunami Evacuation Map number 3 for this part of the island reveals that the Kanai A Nalu and all structures makai of Hauoli Street are located within a tsunami inundation zone.

Potential Impacts and Mitigation Measures.

The proposed actions are not anticipated to have any adverse effects with respect to flooding since no habitable structures are being constructed. The proposed geotextile burrito will be designed and engineered to withstand the calculated forces, thus reducing the likelihood that an extreme event would damage the structure. The proposed project should not be affected by or have adverse impacts upon its neighbors with regards to flood hazard potential since drainage patterns are not expected to change.

K.4. Flora and Fauna

Existing Conditions.

The subject parcel has been developed as a four (4) story multi-family condominium since 1977. There are no critical wildlife habitats such as ponds, streams or wetlands located on the site. Due to the developed urban environment, the subject parcel does not provide a natural habitat for rare, threatened or endangered species of flora and fauna. Landscape planting on the subject parcel consists of ornamental tree plantings and other shrubs. Avifauna that is typically found in the area includes the common myna, several species of dove, cardinal, house finch, and house sparrow. Mammals common to this area include cats, dogs, rats, mice, and mongoose.

Potential Impacts and Mitigation Measures.

The proposed project will have a positive impact on native plants. There are no known rare, threatened, or endangered species of flora or fauna on the site, neither are there any species that are candidates for Federal listing nor any important wildlife habitats such as ponds, streams, or wetlands. Endangered plants will not be used in the restoration area. As such, the proposed project will have a positive impact upon plant and animal life.

K.5. Noise Characteristics

Existing Conditions.

The level of ambient noise is an important indicator of environmental quality. Noise in the project area is attributable to the boats and machinery at the Mamkalaea Small Boat Harbor facilities and vehicular traffic on surrounding roads.

Potential Impacts and Mitigation Measures.
For a short time, ambient noise levels will temporarily increase during the work period. Noise from construction equipment, such as excavators, and power tools will be the dominant source of noise during the construction phase. Impacts from these sources can be minimized by using appropriate sound-dampening devices (e.g., baffles, mufflers) and by properly maintaining all equipment, vehicles, and machinery.

To minimize noise impacts during the project, the Applicant will limit construction to normal daylight hours. According to Chapter 11-46, HAR (Community Noise Control), the maximum permissible sound level for construction activities in areas zoned for multi-family, apartment, business, commercial, hotel, resort, or similar type uses is (60 dBA). Should construction noise exceed this threshold, a Community Noise Permit will be obtained from the State Department of Health in accordance with the applicable provisions of Chapter 11- 46, HAR.

In the long-term, the concluded project will not generate noise and therefore will not have an adverse impact on ambient noise levels.

K.6. Air Quality

***Existing Conditions*.**
Air quality refers to the presence or absence of pollutants in the atmosphere. It is the combined result of natural conditions (e.g. dust from wind erosion) and emissions from a variety of pollution sources (e.g. automobiles, power-generating plants). Generally, the impact of a development upon air quality depends upon the type of project (e.g., residential, commercial, industrial) and its stage of progress (e.g., site preparation, infrastructure development, building construction).

The air quality in the Maalaea region and Maui in general is relatively good. Non-point source vehicle emissions do not generate a significant or high concentration of pollutants, as prevailing winds help to disperse emissions quickly.

Potential Impacts and Mitigation Measures.
Some excavation will be required. As necessary, dust control measures that comply with the provisions of Chapter 11-60.1, HAR (Pollution Control) and Section 11-60.1-33, HAR (Fugitive Dust), will be implemented during implementation to minimize the effects of fugitive dust. Examples of such measures include but are not limited to the following:

- Ensure that an adequate source of water is available for dust control before the start of the project.
- Use dust fences, water sprinklers, and water wagons to prevent airborne dust from leaving the site.
- Temporarily cover exposed areas with plywood or plastic sheeting material.
- Phase site work to limit the exposure of bare areas and leave existing vegetation in place for as long as possible prior to clearing.
- Place soil stockpiles away from adjacent properties and cover the stockpiles with plastic sheeting or similar material when not in use.

- Limit the areas of disturbance and hydromulch or grass finished areas on a timely basis.
- Water loose soil until damp and spray water during grading to control airborne dust.
- Use dust control measures during weekends, after hours and prior to daily start-up of construction activities.

From a long-term perspective, the proposed work will not generate adverse air quality impacts.

K.7. Archaeological/Historical Resources

Existing Conditions.

The Kanai A Naluai has been a developed property since the 1960's and the ground has been previously disturbed during the construction of the Kanai A Naluai condominium in the 1970's. Several sections of the rear yard to be included in this project have been previously excavated. At no time have cultural artifacts or human remains been found in the rear yard area.

If human remains are located, work will immediately cease in the vicinity of the find and the find protected from further disturbance. The SHPD and the Maui/Lanai Islands Burial Council will be promptly notified and procedures for the treatment of the remains will be implemented in accordance with Chapter 6E-43, HRS (Historic Preservation).

K.8. Cultural Resources

Existing Conditions.

The Maalaea shoreline has a documented history of erosion. Construction of Maalaea Harbor in 1952 resulted in the loss of 1,500 feet of narrow beach to the east of the harbor, which led to construction of shore protection structures (i.e., seawalls and revetments) that currently extend 2,400 feet east of the harbor to Haycraft Park, a 6.5-acre public beach park that is managed by the County of Maui. The Kanai A Nalu property is located at the transition between armored shoreline that extends west to Maalaea Harbor and unarmored shoreline that extends east to North Kihei.

The subject parcel is located in between an existing residential condominium and an undeveloped private property. Regionally it sits within a developed coastal urban environment. The proposed use of the subject parcel for continued residential condominium purposes will not change as a result of the proposed building protection work (geotextile burrito) and therefore is compatible with current uses in the surrounding area.

Potential Impacts and Mitigation Measures.

The proposed project is not expected to have an adverse impact upon native Hawaiian cultural beliefs, practices, or resources. Previous excavations of the project area have not resulted in the discovery of any type of cultural artifact, site, or remains. There are no known traditional beach and mountain access trails on the subject parcel.

K.9. Scenic Resources

Existing Conditions.

From the coastal property, the Pacific Ocean and the islands of Lanai and Kahoolawe and Molokini Crater can be seen. The property also offers views of the West Maui Mountains and Haleakala.

Potential Impacts and Mitigation Measures.
The Kanai A Nalu is an existing four (4) story condominium building that was built in 1977. The proposed work will not impact the view towards the ocean. In addition, the proposed project will not alter public views to and along the shoreline. The work will not have a significant impact upon mauka and makai facing views from the property or its surroundings.

K.10. Shoreline and Coastal Resources

Existing Conditions - Bathymetry, Benthic Habitat, Zoning and Land Uses, Coastal Uses.

Bathymetry
Nearshore water depths range from 0 to 30 feet relative to mean sea level (msl) on the inner reef flat, which extends approximately 1,500 feet offshore. Water depths beyond the reef flat range from 30 to 60 feet before dropping off into deeper waters offshore.

Benthic Habitat
The National Oceanic and Atmospheric Administration (NOAA) classifies the seafloor offshore of the project site as sand and uncolonized reef flat with 10% to 50% macroalgae coverage. The U.S. Fish and Wildlife Service (USFWS) classifies the nearshore waters as marine, intertidal, unconsolidated shore, that is regularly flooded. The Hawaii Department of Health (DOH) classifies the nearshore waters as Class A Marine Waters (DOH, 2014). The USFWS classifies the offshore coastal waters as marine, subtidal, unconsolidated bottom, and subtidal.

Zoning & Land Uses
The Kanai A Nalu property is situated along approximately 2,400 feet of predominantly armored shoreline that extends from Maalaea Harbor to Haycraft Park. The backshore is densely developed with eight (8) condominium complexes and two (2) privately-owned parcels that are zoned A-2 Apartment. The area between Hauoli Street and the shoreline is located in the Special Management Area (SMA) and Urban Land Use District. The area seaward of the shoreline is located in the Resource Subzone of the Conservation District (CD).

Coastal Uses
The Maalaea area is home to several residential condominiums, visitor accommodations, a boat harbor with restaurants, retail shops, and the Maui Ocean Center. The project site shoreline is primarily used for recreational purposes. Public parking and shoreline access are available at Haycraft Park, east of the project site. The shoreline west of the project site is predominantly armored so lateral shoreline access is limited.

Potential Impacts and Mitigation Measures – Bathymetry, Benthic Habitat, Zoning and Land Uses, Coastal Uses.
Kanai A Nalu is located at the near terminus of 2,400 feet of armored shoreline. Kanai A Nalu has two sections of seawall fronting its approximately 370 feet of shoreline. The addition of a geotextile burrito and wooden ramp will have no effect on Bathymetry, Benthic Habitat, Zoning and Land Uses. And will have a positive effect on Coastal Uses due to the improved access between the rear yard and the beach.

L. Socio-Economic Environment

L.1. Population

Existing Conditions.

The population of the County of Maui has exhibited relatively strong growth over the past decade with a 2010 population of 155,214, a16.8% increase over 2000 population of 129,078. Maui Island was at approximately 164,351 in 2022 and is expected to rise to 207,300 in 2030.

Potential Impacts and Mitigation Measures.

The proposed project does not involve a housing component, nor will it generate a new or secondary demand for housing therefore the proposed project will not impact the population of Maui County.

L.2. Economy

Existing Conditions.

The visitor industry is a major component of the island's economy and the dominant economic force in the Maalaea region. Visitor accommodations and facilities are situated in Kihei, Wailea, Makena, and Maalaea. The Maalaea area is home to several residential condominiums, visitor accommodations, a boat harbor with restaurants, retail and the Maui Ocean Center.

Potential Impacts and Mitigation Measures.

From a short-term perspective, the project will support the economy via direct and indirect construction-related employment, as well as through the purchase of construction materials and building-related services. During the long-term, this project will contribute to the economy through the organized and progressive adaptation to sea level rise on the property.

M. Public Services and Facilities

M.1. Recreational Facilities

Existing Conditions.

The Maui Department of Parks and Recreation operates and maintains a total of 19 parks in the Kihei-Makena region, as well as several community recreational facilities such as the Kihei Recreation Center. In the immediate area, residents have access to Haycraft Beach Park, located at the end of Hauoli Street.

Potential Impacts and Mitigation Measures.

The proposed project will not have an impact upon recreational facilities or the popular surf spot "Freight Trains" nor will it trigger any County requirements for park dedication or assessment fees pursuant to Section 18.16.320, Maui County Code (Parks and Playgrounds).

M.2. Police and Fire Protection

Existing Conditions.

The Maui Department of Police is responsible for the preservation of the public peace, prevention of crime, and protection of life and property. The new Kihei Police Station is being operated mauka of Piilani Highway. In addition to regular patrol duties, the Kihei Patrol District has programs for a bike detail, citizen's patrol, parks patrol officer, school resource officer, parking enforcement officer, and visitor and community-oriented policing. The district also has its own criminal investigation division.

The mandate of the Maui Department of Fire and Public Safety is to protect life, property, and the environment from fires, hazardous material releases and other life-threatening emergencies. The Department of Fire and Public Safety has fourteen (14) stations throughout the County including ten (10) stations on the island of Maui. The Wailuku station is assigned to the Maalaea region.

Potential Impacts and Mitigation Measures.
The proposed project will not impact the current service area limits for police and fire protection. The proposed project will not impact Fire flow requirements for the Kanai A Nalu property.

M.3. Schools

Existing Conditions.
Maui schools are organized into complexes and complex-areas. A complex consists of a high school and all of the intermediate/middle and elementary schools that flow into it. Groups of two (2) to four (4) complexes form a "complex area" that is under the supervision of a complex area superintendent. The Kanai A Nalu residential condominium is located within the State Department of Education’s (DOE) Baldwin High School Complex.

The State DOE has partially constructed the Kulanihakoi high school which received a temporary certificate of occupancy from the County of Maui in July of 2023. Freshmen and Sophomores began school at the facility in the present school year (2023-2024) and a number of Lahaina students were enrolled in the facility after the August 2023 Lahaina fires. The school has a design capacity of 930 students, staff and visitors and Phase II is planned to open in 2025 with a design capacity of 1,941.

Potential Impacts and Mitigation Measures.
The proposed work will not result in increased school enrollment and will not increase population our housing in the district; therefore the proposed project will not impact schools in Maui County.

M.4. Medical Facilities

Existing Conditions.
Located in Wailuku, the approximately 200-bed Maui Memorial Medical Center provides acute and emergency health care services for the County of Maui. Various private care physicians and clinics in the West Maui region also provide medical care and out patient services. In addition, American Medical Response provides 24- hour emergency medical service through ten ambulance facilities stationed throughout the County, including eight (8) facilities on the island of Maui.

Potential Impacts and Mitigation Measures.
The proposed work will not generate a demand for new or additional health care facilities or services or have an adverse impact upon existing medical facilities and emergency medical response.

M.5. Solid Waste

Existing Conditions.

The Solid Waste Division of the Department of Environmental Management is responsible for the collection and disposal of residential refuse on the island of Maui. County landfills located in Hana, Central Maui, Lanai, and Molokai accept residential and commercial solid waste for disposal. In addition to the disposal of solid waste, the Central Maui Landfill, which is located near Puunene, contains recycling, and composting facilities and also accepts green waste and used motor oil.

In the Maalaea area, self-hauled residential refuse is taken to the Central Maui Landfill. The Maui Demolition and Construction Landfill, a commercial facility near Maalaea, accepts construction and demolition waste for disposal.

Potential Impacts and Mitigation Measures.

The proposed work will not contribute towards an increase in solid waste. If construction waste is generated it will be reused or disposed of properly. As such, no significant impacts to solid waste services and facilities are anticipated.

N. Infrastructure

N.1. Water

Existing Conditions.

The Maui Department of Water Supply (DWS) provides domestic water and fire flow service to the Kanai A Nalu residential condominium project. There is an existing 8-inch waterline along Hauoli Road which connects to the existing 300,000-gallon reservoir mauka of Honoapiilani Highway. The water for this water system is supplied from the Central Maui source.

Potential Impacts and Mitigation Measures.

The proposed work will not increase domestic water consumption, fire flow, or irrigation demand, therefore the work is not expected to have an adverse effect upon the County wastewater system.

N.2. Wastewater

Existing Conditions.

There are no County sewer facilities in the Maalaea area. There is an existing privately owned and operated onsite sewage treatment plant which collects and processes wastewater from the Kanai A Nalu Condominium. After the treatment process, wastewater is disposed through an injection well. The landowners along Hauoli Street are collaborating on a regionwide wastewater treatment plant. This facility should be in operation in 2027.

Potential Impacts and Mitigation Measures.

There will be no increase in the quantity of wastewater generated from the project. Wastewater will continue to be processed by the existing onsite private wastewater treatment plant. The proposed work is not expected to have an adverse effect upon the County wastewater system. A regionwide wastewater treatment system should be in place in 2027.

N.3. Drainage

Existing Conditions.

The surficial geology of the low-lying Maalaea coastal plain is primarily composed of younger alluvium (Holocene and Pleistocene) (Sherrod et al., 2007). From the USDA Soil Conservation Service "Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii," the project site is located in an area designated as Kealia silt loam (KMW) with slopes of 0 to 1 percent. This series consists of somewhat poorly drained and poorly drained soils on coastal flats on the islands of Molokai and Maui. On this soil, permeability is moderately rapid. Runoff is slow to very slow, and the erosion hazard of water is not more than slight, but the hazard of wind erosion is severe when the soil is dry and the surface layer becomes loose and fluffy

Potential Impacts and Mitigation Measures.

No new development is being proposed as part of the repair work. Runoff presently generated from the project site will not change and there will be no increase in runoff. Furthermore, the drainage pattern will remain unchanged from the existing condition.

Besides the preceding measures, appropriate Best Management Practices (BMPs) will be implemented during construction to ensure that storm water runoff will not adversely affect downstream and adjacent properties or negatively impact stream and coastal resources and water quality. Examples of BMPs for controlling soil erosion and sedimentation include but are not limited to the following:

- Clearing shall be kept to the minimum necessary for equipment operation.
- Construction shall be sequenced to minimize the time of exposure of cleared surface areas.
- Stabilization shall be accomplished by protecting areas of disturbed soils from rainfall and runoff by use of structural controls such as PVC sheets, geotextile filter fabric, berms or sediment basins, or vegetative controls such as grass seeding and/or hydro-mulching.
- Temporary erosion controls shall not be removed before permanent erosion controls are in place and established.
- All control measures shall be checked and repaired as necessary (e.g., weekly, during dry periods, and within 24 hours after any rainfall event of 0.5 inches or greater within a 24-hour period). During prolonged rainfall, daily inspection will be required. The contractor shall maintain records of checks and repairs to structural and vegetative controls.
- A stabilized construction entrance with a required 50-foot minimum length shall be provided to reduce vehicle tracking of sediments.
- Frequent wetting of exposed surfaces shall be used to minimize fugitive dust.

The proposed seawall repair project is not expected to result in any adverse drainage impacts to adjoining or downstream properties.

N.4. Roadways

Existing Conditions.

The Kanai A Nalu Residential Condominium is directly accessed by Hauoli Street. Honoapiilani Highway intersects with Maalaea Road which provides access to Hauoli Street.

In the project area, Honoapiilani Highway is classified as an arterial by the State, while Maalaea Road and Hauoli Street are considered collectors and are under the control of the Maui Department of Public Works (DPW).

Potential Impacts and Mitigation Measures.

The proposed work will not increase traffic. During the construction phase, which is expected to last twelve (12) weeks, equipment and truck use will be minimal and limited to daytime hours. It is anticipated that the construction vehicle traffic will not impact the Kanai A Nalu or the surrounding area. Therefore, the repair work is not expected to impact the existing roadways on Maui.

N.5. Electrical and Telephone Systems

Existing Conditions.

Maui Electric Company (MECO) and Hawaiian Telcom provide electrical and telephone services to the Maalaea region. In the vicinity of the subject parcel, power and phone lines are placed on overhead utility poles along the southern side of Hauoli Street. Electrical and telephone service for the subject parcel was installed underground from Hauoli Street as part of the Kanai A Nalu Condominium development.

Potential Impacts and Mitigation Measures.

The proposed work will not impact electrical, cable or telephone systems.

IV. Relationship to Governmental Plans, Policies, and Controls

O. State Land Use Law

The rules of the State Land Use Commission are set forth in Chapter 205, HRS. These rules establish four (4) land use districts in the State of Hawai`i into which all lands in the State are placed: Urban, Rural, Agricultural, and Conservation. The subject parcel is located in the State Urban District.

Pursuant to Chapter 15-15, HAR, any and all uses permitted by local (County) government, either by ordinances or rules, may be allowed in the State Urban District, subject to any conditions imposed by the State Land Use Commission.

The proposed work is permissible in the State Urban District.

P. General Plan of the County

The General Plan of the County of Maui refers to a hierarchy of planning documents that together set forth future growth and policy direction in the County. The General Plan is comprised of the following documents: 1) County-wide Policy Plan; 2) Maui Island Plan; and 3) nine community plans.

The Maui Island Plan serves as the regional plan for the Island of Maui. The Plan is comprised of the following ten elements: 1) Population; 2) Heritage Resources; 3) Natural Hazards; 4) Economic Development; 5) Housing; 6) Infrastructure and Public Facilities; 7) Land Use; 8) Directed Growth Plan; 9) Long Range Implementation Plan; and 10) Monitoring and Evaluation. Each element contains goals, objectives, policies and implementing actions. The Directed Growth Plan identifies the location of future development through 2030. The Directed Growth Plan is intended to guide the location and general character of future urban development and will direct future zoning changes and guide the development of the County's short-term and long-term capital improvement plan budgets.

The Maui Island Plan functions as a regional plan and addresses the policies and issues that are not confined to just one community plan area, including regional systems such as transportation, utilities and growth management, for the Island of Maui. Together, the Island and Community Plans develop strategies with respect to population density, land use maps, land use regulations, transportation systems, public and community facility locations, water and sewage systems, visitor destinations, urban design and other matters related to development.

The County-wide Policy Plan was adopted on March 24, 2010 and is a broad policy document that identifies a vision for the future of Maui County. It establishes a set of guiding principles and provides comprehensive goals, objectives, policies and implementing actions that portray the desired direction of the County's future. The County-wide Policy Plan provides the policy framework for the development of the Maui Island Plan and nine Community Plans.

The following County-wide Policy Plan guiding principles, goals, objectives, policies and actions are relevant to the proposed project:

P.1. *A. Protect the Natural Environment*

Goal: Maui County's natural environment and distinctive open spaces will be preserved, managed, and cared for in perpetuity.

Objective:
(3) Improve the stewardship of the natural environment.

Policies:
c. Evaluate development to assess potential short-term and long-term impacts on land, air, aquatic, and marine environments.

h. Provide public access to beaches and shoreline for recreational and cultural purposes where appropriate.

Analysis: Kanai A Nalu is located within the State's Special Management Area. The proposed work is a step in the adaptation of the property to sea level rise. It softens the shoreline and provides the Kanai A Nalu an opportunity to take additional resilience actions. The proposed work is not expected to negatively impact the shoreline or reef environments. Best management practices will be implemented to mitigate non-point source pollution to Maui's coastal resources. In addition, the proposed repair work will stop the current soil erosion entering the ocean. The work will not impact the existing shoreline access. The site itself is not located within an area of critical habitat, and threatened or endangered species of flora or fauna are not on the property.

P.2. *F. Strengthen the Local Economy*

Goal: Maui County's economy will be diverse, sustainable, and supportive of community values.

Objective:
Support a visitor industry that respects the resident culture and the environment.

Policies:
f. Encourage resident ownership of visitor-related businesses and facilities.

Analysis: The ownership group of the Kanai A Nalu are residents of Maui. The condominium has accommodated full-time, part-time, and short-term residents since 1977. The condominium and its residents have been supplying purchase power and taxes for nearly 50 years, and will continue to do so for as long as the buildings are viable. Future adaptation actions will need to be taken to address anticipated sea level rise.

P.3. *J. Promote Sustainable Land Use and Growth Management*

Goal: Community character, lifestyles, economies, and natural assets will be preserved by managing growth and using land in a sustainable manner.

Objective:
1. Improve land use management and implement a directed-growth strategy.

Policies:
k. Preserve the public's rights of access to and continuous lateral access along all shorelines.

Analysis: The Kanai A Nalu is an existing residential condominium on the shoreline. Currently, all from Kanai A Nalu who wish to access the beach must travel east to Haycraft Beach Park. There is no safe access from Kanai A Nalu to the beach. The installation of a wooden ramp on the Kanai A Nalu eastern boarder will greatly improve safe convenient access to and from the beach and the condominium.

Q. Kihei-Makena Community Plan

Maui County has adopted nine (9) community plans. Each community plan examines the conditions and needs of the planning region and outlines objectives, policies, planning standards and implementing actions to guide future growth and development in accordance with the Maui County General Plan. Each community plan serves as a relatively detailed agenda for implementing the broad General Plan themes, objectives and policies.

The subject parcel is located in the Kihei-Makena Community Plan region and is designated for Multi-family use. The Community Plan was adopted by Ordinance No. 2641 and went into effect on March 6, 1998.

The following Kihei-Makena Community Plan goals, objectives, and policies are applicable to the proposed action:

Q.1. Land Use

Goal: A well-planned community with land use and development patterns designed to achieve the efficient and timely provision of infrastructural and community needs while preserving and enhancing the unique character of Maalaea, Kihei, Wailea and Makena as well as the region's natural environment, marine resources and traditional shoreline uses.

Analysis: The proposed project will not impact the Land Use of the Kanai A Nalu property or the surrounding urban area. Kanai A Nalu is an existing residential condominium and no new building development is proposed as part of this work. The proposed work will not impact views of Haleakala, the West Maui Mountains or the Pacific Ocean.

Environment
Goal: Preservation, protection, and enhancement of Kihei-Makena's unique and fragile environmental resources.
c. Require that new shoreline development respect shoreline resources and maintain public

access:

1) *Existing dune formations are important elements of the natural setting and should remain intact.*

2) *Indigenous or endemic strand vegetation should remain undisturbed; new development and landscaping should treat such vegetation as given conditions.*

3) *Planning for new shoreline development, as well as redevelopment, shall consider the cyclic nature of beach processes. Setbacks shall be used to provide a sufficient buffer between the ocean and structures to allow for periodic and long-term accretion and erosion of the shoreline. A Coastal Erosion Rate Analysis shall be developed. The planning commissions are encouraged to incorporate data from the analysis into planning decisions for shoreline areas, especially with respect to shoreline building setbacks. In the interim period prior to the completion of the analysis, the planning commissions are further encouraged to utilize minimum setbacks for multi-family and hotel uses of 150 feet from sandy shorelines, and 75 feet from rocky shorelines, or 25% of the average lot depth, whichever is greater.*

Where shoreline erosion threatens existing structures or facilities, beach replenishment shall be the preferred means of controlling erosion, as opposed to sole reliance on seawalls or other permanent shoreline hardening structures.

4) *Storm water run-off from proposed developments shall not adversely affect the marine environment and nearshore and offshore water quality.*

5) *Planning, design, and layout for new development shall be integrated with public shoreline use and sound principles of resource management.*

Analysis: The proposed project will be conducted entirely in previously disturbed land that has been maintained as a rear yard for nearly five decades. The proposed project will soften the shoreline and is the first in a decadal series of adaptations to sea level rise. It is not anticipated to disrupt Kihei-Makena's unique and fragile environmental resources. During the construction phase best management practices will be implemented to mitigate non-point source pollution to Maui's coastal resources.

Q.2. Economic Activity

Goal: A diversified and stable economic base which serves resident and visitor needs while providing long-term resident employment.

Analysis: In the short term, construction activities would support area businesses who specialize in shoreline resilience projects. The project will influence the long-term economy via purchases made at local stores and businesses, and the payment of over $1,400,000 in annual state and county taxes.

Q.3. Housing and Urban Design.

Goal: A variety of attractive, sanitary, safe and affordable homes for Kihei's residents, especially for families earning less than the median income for families within the County. Also, a built environment which provides complementary and aesthetically pleasing physical and visual linkages with the natural environment.

Analysis: Kanai A Nalu is an existing residential condominium. The work will not include new building development or expansion of the existing building therefore Chapter 2.96, MCC Residential Workforce housing Policy is not applicable.

R. Environmental Review & Regulatory Permitting

The permitting process for shoreline adaptations at Kanai A Nalu will depend on the nature of the selected project(s). It is important to have a general understanding of the environmental review and regulatory permitting requirements along Hawaii's shorelines. Shorelines, beaches, and nearshore waters in Hawaii are considered part of the Public Trust, with access and use available to all people. As a result, Hawaii's shorelines are heavily regulated. The current definition of the "shoreline" in Hawaii is as follows:

"Shoreline means the upper reaches of the wash of the waves, other than storm or seismic waves, at high tide during the season of the year in which the highest wash of the waves occurs, usually evidenced by the edge of vegetation growth, or the upper limit of debris left by the wash of the waves (Hawai'i Administrative Rules §13-222)."

Generally, County jurisdiction begins at the shoreline and extends landward. State jurisdiction begins at the shoreline and extends seaward. Federal jurisdiction begins at the mean higher high water (mhhw) line and extends out to the 200 nautical mile limit of the U.S. exclusive economic zone (EEZ); this area is also defined as the "Waters of the United States".

The County, State, and Federal governments all have different objectives and rules regulating what activities can be authorized along the shoreline. Therefore, the definition and location of the shoreline is critical for the planning and permitting of any coastal construction. The certified shoreline is a line established by a licensed land surveyor and certified by the State, which reflects the shoreline definition stated above. The certified shoreline is valid for 12 months and is used to establish jurisdiction and shoreline setback boundaries. This could create an issue relating to the non-exclusive seawall easement that currently covers a small portion of the existing seawall in Section 3 (east).

In 2001, it was determined that 248 square feet of the seawall was encroaching seaward of the record property boundary on State land. In 2004, Kanai A Nalu obtained a non-exclusive easement for the encroaching portion of the seawall. The landward limits of the easement area followed the property boundary, rather than the shoreline, which was departmental practice at the time. In 2011, the State of Hawaii began using the shoreline to define the landward limits of easement boundaries. The Kanai A Nalu shoreline was certified just prior to this transition.

In 2011, the State certified the shoreline along the vegetation line landward of the existing seawalls. No changes to the existing easement were required. A current certified shoreline will likely be required for the preferred option presented in this assessment. Kanai A Nalu will likely be required to amend the easement to include all of the structures seaward of the shoreline. Easement costs are based on Fair Market Value of the property, so expanding the easement area could potentially be very expensive. It is the intent of the Kanai A Nalu to certify the shoreline and to initiate seawall removal with the Office of Conservation and Coastal Lands, a division of the State of Hawaii Department of Land and Natural Resources.

S. Maui County Zoning

The subject parcel is currently zoned A-2, Apartment District. Apartment Houses are a permitted use in the A-2 Apartment district; therefore the Kanai A Nalu residential condominium is in conformance with the Maui County Zoning designations.

T. Special Management Area Objectives and Policies

The subject project is located within the Special Management Area (SMA). As such, the proposed repairs require an SMA permit. Pursuant to Chapter 205A, Hawaii Revised Statues, and the Rules and Regulations of the Planning Commission of the County of Maui, projects located within the SMA are evaluated with respect to SMA objectives, policies, and guidelines. This section addresses the project's relationship to applicable coastal zone management considerations, as set forth in Chapter 205A and the rules and Regulations of the Maui Planning Commission.

T.1. Recreational Resources

Objective: *Provide coastal recreational resources accessible to the public.*

Policies:

(a) Improve coordination and funding of coastal recreation planning and management; and

(b) Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:

> *(i) Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas;*
>
> *(ii) Requiring placement of coastal resources having significant recreational value, including but not limited to surfing sites, fishponds, and sand beaches, when such resources will be unavoidably damaged by development; or require reasonable monetary compensation to the state for recreation when replacement is not feasible or desirable;*
>
> *(iii) Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;*

(iv) Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;

(v) Ensuring public recreational use of county, state, and federally owned or controlled shoreline lands and waters having standards and conservation of natural resources;

(vi) Adopting water quality standards and regulating point and non-point sources of pollution to protect, and where feasible, restore the recreational value of coastal waters;

(vii) Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing;

(viii) Encourage reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, county planning commissions; and crediting such dedication against the requirements of Section 46-6, HRS.

Analysis. Kanai A Nalu abuts the shore. Currently there is no dedicated access, for residents or the public, to the beach from the Kanai A Nalu property. This is a result of the deteriorating seawalls and erosion of unprotected shoreline. This project will enhance people's ability to enter, exit, and enjoy the rear yard, seasonal beach, and the ocean. Additional public recreation is located a short distance east of Kanai A Nalu at the County's Haycraft Beach Park.

T.2. Historical/Cultural Resources

Objective: *Protect, preserve and, where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.*

Policies:

(a) Identify and analyze significant archeological resources;

(b) Maximize information retention through preservation of remains and artifacts or salvage operations; and

(c) Support state goals for protection, restoration, interpretation, and display of historic structures.

Analysis. The proposed project is not expected to have an adverse impact upon historical and cultural resources or native Hawaiian cultural practices and beliefs. The proposed project is consistent with the SMA objective of protecting and preserving historic and cultural resources in the coastal zone management area that are significant in Hawaiian and American history and culture.

T.3. Scenic and Open Space Resources

Objective: *Protect, preserve and, where desirable, restore or improve the quality of coastal scenic and open space resources.*

Policies:

(a) Identify valued scenic resources in the coastal zone management area;

(b) Ensure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline;

(c) Preserve, maintain, and where desirable, improve and restore shoreline open space and scenic resources; and

(d) Encourage those developments that are not coastal dependent to locate in inland areas.

Analysis. The proposed project is not expected to result in any significant impacts to scenic and open space resources as the subject parcel is not located within a scenic view corridor nor does it contain any scenic features. The proposed work will not alter public views to and along the shoreline.

T.4. Coastal Ecosystems

Objective: *Protect valuable coastal ecosystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems.*

Policies:

(a) Improve the technical basis for natural resource management;

(b) Preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance;

(c) Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs; and

(d) Promote water quantity and quality planning and management practices, which reflect the tolerance of fresh water and marine ecosystems and prohibit land and water uses, which violate state water quality standards.

Analysis. The proposed project is not expected to have an adverse effect upon the region's coastal ecosystem. With the incorporation of Best Management Practices and appropriate mitigation measures during the work, no significant adverse impacts to near shore waters from non-point sources of pollution are anticipated.

T.5. Economic Uses

Objective: *Provide public or private facilities and improvements important to the State's economy in suitable locations.*

Policies:

(a) Concentrate coastal dependent development in appropriate areas;

(b) Ensure that coastal dependent development such as harbors and ports, and coastal related development such as visitor facilities and energy generating facilities, are located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the coastal zone management area;

(c) Direct the location and expansion of coastal dependent developments to areas presently designated and used for such development and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:

(i) Use of presently designated locations is not feasible;

(ii) Adverse environmental impacts are minimized; and

(iii) The development is important to the State's economy.

Analysis. The Maalaea region was selected as an important area for coastal development when it was zoned Light Industrial (at the harbor) and A-2 Apartment. This was further supported in the approval of the Kihei-Makena Community Plan in 1998 which has the region in the Multi-family zone. Kanai A Nalu was legally constructed in 1977 and has operated legally since that time. In addition to the local hiring of maintenance and groundskeeping staff, and purchases in the Maui community (such as supplies, food, and appliances), Kanai A Nalu is anticipated to pay $1,480,688 TAT, GET, and Real Property Taxes for 2023.

The proposed work will support a private facility important to the State's economy. The Kanai A Nalu is an existing residential condominium and will continue to contribute in myriad ways towards Maui's economy.

T.6. Coastal Hazards

Objective: *Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence and pollution.*

Policies:

(a) Develop and communicate adequate information about storm wave, tsunami, flood, erosion, subsidence, and point and non- point source pollution hazards;

(b) Control development in areas subject to storm wave, tsunami, flood, erosion, subsidence, and point and non-point pollution hazards;

(c) Ensure that developments comply with requirements of the Federal Flood Insurance Program;

(d) Prevent coastal flooding from inland projects; and

(e) Develop a coastal point and non-point source pollution control program.

Analysis. The proposed work attempts to balance the unarmoring of the shoreline with interim protection for the buildings against large erosional events like a hurricane or tsunami. This project will allow the continued operation of the condominium while the leadership makes additional plans for accommodating sea level rise.

T.7. Managing Development

Objective: *Improve the development review process, communication, and public participation in the management of coastal resources hazards.*

Policies:

(a) Use, implement, and enforce existing laws effectively to the maximum extent possible in managing present and future coastal zone development;

(b) Facilitate timely processing of applications for development permits and resolve overlapping of conflicting permit requirements; and

(c) Communicate the potential short and long-term impacts of proposed significant coastal developments early in their life cycle and in terms understandable to the public to facilitate public participation in the planning process and review process.

Analysis. The proposed work will be conducted in accordance with applicable State and County requirements. Opportunity for review of the proposed action is provided through the County's Special Management Area permitting process and the States Environmental Assessment review process.

T.8. Public Participation

Objective: *Stimulate public awareness, education, and participation in coastal management.*

Policies:

(a) Maintain a public advisory body to identify coastal management problems and to provide policy advice and assistance to the coastal zone management program.

(b) Disseminate information on coastal management issues by means of educational materials, published reports, staff contact, and public workshops for persons and organizations concerned with coastal-related issues, developments, and government activities; and

(c) Organize workshops, policy dialogues, and site-specific medications to respond to coastal issues and conflicts.

Analysis. Kanai A Nalu is creating publicly available documents through the preparation of this Environmental Assessment as well as the related permit applications (building, grading, etc). They will contribute to the overall understanding of the Maalaea region. These forms contain documentation of past efforts taken by Kanai A Nalu and others to protect their property and enhance the public's enjoyment of the shore. Opportunities for public participation will be available during future SMA permit processing which would involve public notification by mail to surrounding owners within 500 feet of the property and a public hearing before the Maui Planning Commission.

T.9. Beach Protection

Objective: *Protect beaches for public use and recreation.*

Policies:

(a) Locate new structures inland from the shoreline setback to conserve open space and to minimize loss of improvements due to erosion;

(b) Prohibit construction of private erosion-protection structures seaward of the shoreline, except when they result in improved aesthetic and engineering solutions to erosion at the sites and do not interfere with existing recreational and waterline activities; and

(c) Minimize the construction of public erosion-protection structures seaward of the shoreline.

Analysis. The installation of a geotextile burrito and wooden ramp will not change the seasonal nature of the beach fronting Kanai A Nalu.

T.10. Marine Resources

Objective: *Implement the State's ocean resources management plan.*

Policies:

(a) Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;

(b) Assure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;

(c) Coordinate the management of marine and coastal resources and activities management to improve effectiveness and efficiency;

(d) Assert and articulate the interest of the state as a partner with federal agencies in the sound management of the ocean resources within the United States exclusive economic zone;

(e) Promote research, study, and understanding of ocean processes, marine life, and other ocean development activities relate to and impact upon the ocean and coastal resources; and

(f) Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.

Analysis. This project is a step toward adaptation to sea level rise at this location. It will be beneficial to coastal resources and native coastal plant life. The proposed project does not involve the direct use or development of marine resources. In addition, with the incorporation of erosion and drainage control measures during construction and after construction, as identified in this report, there should not be significant adverse impacts to nearshore waters from point and non-point sources of pollution. Therefore, the project will have an overall beneficial impact to coastal resources and no impact on marine resources.

U. 205A-2, HRS – Coastal Zone Management Compliance Review

The environmental setting of the property:

(A) Affects natural or cultural resources (i.e., historic site, excavation on vacant land):
This project improves natural resources through the native plant dune restoration that will occur. And to the extent the native plants have cultural significance, cultural resources will also benefit.

The site has not been identified as an historic site. Likewise, the land is not vacant. In fact, numerous buildings and appurtenant structures have been built on the property. Landscaping and irrigation systems have been installed and maintained over the years. This earlier activity means that most, if not all, of the property has been previously disturbed.

(B) Curtails the range of beneficial uses of the environment:
This project enhances the beneficial uses of the environment by providing safe access to the shore. Likewise, the native plant restoration will be beneficial to the coastal environment and to some extent restore natural processes there.

(C) Conflicts with the county's or the state's long-term environmental policies or goals (i.e. State Plan, County General Plan, and Community Plan):
The geotextile burrito and wooden ramp are appurtenant and ancillary to the operation of the condominium. For an interim period, they will ensure that no emergency situation will arise while larger, more long-term restoration plans are made and implemented. The structures both support the economic AND environmental goals of the State of Hawaii and County of Maui. They do this by providing safeguards against coastal erosion, allowing the seawalls to be removed, by having a negligible footprint, and by providing access to the beach and nearshore waters.

(D) *Affects the economic or social welfare and activities of the community, county, or state: (what are the economic impacts of this project):*
In the short term the construction of the geotextile burrito and wooden ramp will employ local construction companies. These companies employ Maui residents who in turn support the local

economy through their spending. The condominium is also a significant source of taxes paid both to Maui County and the State of Hawaii. In the interim, the proposed structures offer stability to these revenue sources and will provide a bridge to future adaptations.

(E) ***Involves secondary impacts, such as population changes (i.e. increase/decrease) and increased effects on public facilities, streets, drainage, sewage, and water systems, and pedestrian walkways (i.e. increased demands and deficiencies):***
There are no secondary impacts. Once installed, the geotextile burrito will be below grade and indiscernible to anyone in the area. The wooden ramp will facilitate access to and from the beach, but overall foot traffic is not expected to change.

(F) ***By itself has no significant adverse effects but cumulatively has considerable effect upon the environment (i.e. increased traffic and deficiencies in services) or involves a commitment for larger actions (i.e. more public infrastructure, such as, roads, waterlines, sewers, etc.):***
The geotextile burrito and wooden ramp are appurtenant and ancillary to the operation of the Kanai A Nalu condominium. They do not change or intensify any other actions. Nor will they trigger other actions that cumulatively will negatively affect the environment. The converse is the case here. The geotextile burrito and wooden ramp will provide peace of mind allowing for the removal of the seawalls and for providing access to the beach. They have a net positive effect on the environment. This net positive includes the fact that these actions are temporary and are tied to a long-term effort to restore and protect the beach at Maalaea as a region.

(G) Affects a rare, threatened, or endangered species ***of animal or plant, or its habitat (i.e. wetlands, natural area reserve, refuge):***
The subject property does not harbor or provide habitat for any rare, threatened, or endangered species of animal or plant. These actions will take place in a rear yard that has been landscaped in non-native ornamental plants and grasses for nearly 50 years. Green Sea Turtles, listed as Threatened by the federal and state governments, are known to frequent the nearshore waters. Green Sea Turtles may occasionally haul out on dry sand further east (near Haycraft Park) to bask, but turtle basking is difficult on the beach fronting the Kanai A Nalu as there is rarely, if ever, dry sand beach located here. Likewise, the beach fronting Kanai A Nalu is not a suitable location for Green Sea Turtle nests. And lastly, the project site will be located a minimum of four (4) feet inland from the presumed shore and will have no effect on the beach or nearshore environment.

While beneficial to native strand plant species, the dune restoration will not utilize any listed Threatened or Endangered plant species.

(H) ***Is contrary to the state plan, county's general plan, appropriate community plans, zoning and subdivision ordinances:***
Broadly this project is consistent with state, county, and community plans as it is a step toward adaptation to sea level rise and a step away from shoreline hardening. These actions are further

consistent with the county's shoreline planning which calls for actions that adapt and promote resilience in shoreline properties.

Further, the existing land use and proposed improvements are consistent with the state plan, county's general plan, zoning, and subdivision ordinances:

Section 226-13(b)(5) (**Hawaii State Plan**) allows landowners to mitigate threats to life and property from erosion, flooding, tsunamis, hurricanes, earthquakes, volcanic eruptions and other natural and man-made hazards and disasters where appropriate. The actions proposed here are consistent with these objectives.

The **Maui County General Plan** outlines the objective for Health, Family, and Public Safety "*To create an atmosphere which will convey a sense of security for all residents and visitors and aid in the protection of life and property* [by] 1) *Maintain a proper state of preparedness for man-made or natural disasters, and 2) Encourage private industries to provide for themselves protection services to meet their special needs.* The proposed actions are consistent with health and safety objectives contained within the Maui County General Plan.

The property is zoned A-2 Apartment. The operation of a condominium on this property is consistent with this zoning. The addition of appurtenant and ancillary structures is also consistent with this zoning.

The Maui Island Plan has this property in the Urban district. The operation of a condominium on this property is consistent with this districting. The addition of appurtenant and ancillary structures is also consistent with this designation.

The property is designated Multi-Family by the **Kihei-Makena Community Plan**. Operation of the condominium is consistent with that designation. Installation of appurtenant and ancillary structures is also consistent with the Multi-Family designation. The geotextile burrito will be below ground and four (4) feet back from the shoreline, and the wooden ramp will follow the contour of the rear yard and existing erosion scarp. There will be no negative impacts on open space, scenic resources, or shoreline access and so the structures are also consistent with these uses.

(I) ***Affects air or water quality or ambient noise levels (i.e. construction impacts): How might any affects be mitigated?***

There will be no effect on air or water quality. Once installed, there will be no effects on ambient noise levels. During construction there will be periods of increased noise primarily through the operation of construction machinery. To mitigate these noise impacts work will be conducted during daylight and at generally accepted business hours. Work will cease on weekends. The project is anticipated to take up to twelve (12) weeks to mobilize, install, and demobilize.

(J) Located in and does it affect an environmentally sensitive area, such as flood plain, shoreline, dunes, tsunami zone, erosion-prone area, geologically hazardous land, estuary, fresh waters, or coastal waters:

Both the Kanai A Nalu condominium and the proposed actions are in the shoreline as defined by 205A-41. The proposed actions will not affect the shoreline as they will take place in the rear yard as a fail-safe to catastrophic coastal erosion. Over time, should any portion of the structure become exposed to the shore, there may be negligible effects on the environment. Certainly, the exposure of the proposed structure will be less than that of the current sections of hardened shore that exist today.

(K) ***Alters natural land forms (i.e. cut and fill, retaining walls) and existing public views to and along the shoreline:***

The geotextile burrito and wooden ramp do not alter natural land forms. Once installed, the geotextile burrito will be below grade and the ground will be restored to its original height. The wooden ramp will be at grade. The wooden ramp will provide an ingress and egress to the beach in an area that is currently armored by a legal seawall. As such the wooden ramp will enhance the use of the environment. And since both structures are at or below grade, there will be no effect on existing public views to and along the shoreline.

Eventual removal of the seawalls will allow a more natural ebb and flow of the shoreline. The proposed actions will allow for the seawall removal process to begin.

(L) ***Is contrary to the objectives and policies of chapter 205A, HRS.***

The objectives of chapter 205A, HRS are: *Recreational resources, Historic resources, Scenic and open space resources, Coastal ecosystems, Economic uses, Coastal hazards, Managing development, public participation, Beach protection, & Marine resources.*

The action is in alignment with the objectives and policies of chapter 205A, HRS. The temporary backstop to erosion proposed here supports *[c]onsentrating coastal dependent development in appropriate areas* by assuring the viability of the Kanai A Nalu condominium during the interim period (205A-2(C)(5)(A)).

The minimal profile of the geotextile burrito structure is *….located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the coastal zone management area* (205A-2(C)(5)(B)).

The structure is proposed to be constructed inland of the shore and so does not harden or interfere with the shoreline. Though structures are allowed on the shoreline if they comply with 205A, HRS. B*each protection* (205A-2(C)(9)(B)) *Prohibit construction of private erosion-protection structures seaward of the shoreline, except when they result in improved aesthetic and engineering solutions to erosion at the sites and do not interfere with existing recreational and waterline activities.*

V. Chapter 343, HRS Significance Criteria

Since the proposed repair work is within the Shoreline Setback Area this Draft Environmental Assessment (DEA) is required by Chapter 343, Hawaii Revised Statutes (HRS). A finding of no significant impact (FONSI) is anticipated and therefore an Environmental Impact Statement (EIS) will not be required for the proposed action. In accordance with Title 11, Department of Health, chapter 200 and Subchapter 6, 11-200-12, Environmental Impact Statement Rules, and based on the detailed analysis contained within this document, the following conclusions are supported.

(a) The proposed action will not result in an irrevocable commitment to loss or destruction of any natural or cultural resource.

Analysis. As documented in this report, the proposed project will not result in the loss or destruction of any natural or cultural resources and at some level natural and cultural resources will be positively impacted by this project.

(b) The proposed action will not curtail the range of beneficial uses of the environment.

Analysis. The range of beneficial uses of the environment will not be curtailed by the proposed project. The work will enhance safety as the wooden ramp will provide a safe and reliable way to transition between the beach and the rear yard at Kanai A Nalu. Based upon existing development on neighboring properties, it is unlikely the improvements will result in a significant change to the coastal area. Thus, the proposed action will not curtail the range of beneficial uses of the environment.

(c) The proposed action will not conflict with State or County long-term environmental policies and goals as expressed in Chapter 343, HRS, and those which are more specifically outlined in the Conservation District Rules.

Analysis. The repair work is being developed in compliance with the State's long-term environmental goals. As documented in this report, appropriate mitigation measures will be implemented to minimize the potential for negative impacts to the environment, including near and off-shore coastal waters. The project will have a net positive impact on flora and fauna, and is not expected to have a negative impact on archaeological or cultural resources.

(d) The proposed action will not substantially affect the economic or social welfare and activities of the community, County or State.

Analysis. The proposed project will improve public safety in the immediate area. Short-term economic impacts will result from the increase in activity associated with the implementation of the project. Because of the limited scope, improvement of the socio-economic environment will be minimal. The project is a short-term adaptation to sea level rise and expresses a long-term commitment to future adaptation actions. These future actions will allow for Kanai A Nalu's continued support to Maui's economic engine and tax base.

(e). The proposed action will not substantially affect public health.

Analysis. There are no special or unique aspects of the project that will have a direct impact on public health.

(f). The proposed action will not result in substantial secondary impacts.

Analysis. The proposed project is not a population generator nor does it trigger Maui County Residential workforce housing requirements. Increased activity at the site during the repair work may result in an increase in traffic from construction equipment, however the resilience work is limited in scope and will not substantially impact the environment. Based on existing development in the project vicinity, the proposed resilience work is not expected to cause any secondary effects that would significantly impact the coastal area.

(g). The proposed action will not involve substantial degradation of environmental quality.

Analysis. Mitigation measures will be implemented during the construction phase in order to minimize negative impacts on the environment, especially with regards to runoff. During the work, mitigation measures will be incorporated to minimize potential impacts to nearshore water quality that could arise as a result of the work. The proposed work will prevent erosion and keep soil from entering coastal waters. Other environmental resources such as endangered species of flora and fauna, air and water quality and archaeological resources will not be significantly impacted by the work.

(*h). The proposed project will not produce cumulative impacts and does not have considerable effect upon the environment or involve a commitment for larger actions*.

Analysis. The proposed work does not involve a commitment to a larger action on behalf of the applicant or any public agency. The subject property is State and County zoned and community planned for urban development, and as such, is part of the planned future growth of that region. As described in this report, the work will not significantly impact public infrastructure and services including roadways, drainage facilities, water systems, sewers and educational facilities. In addition, the work will not increase population growth and will not produce considerable effect on the environment nor require a commitment for larger actions by governmental agencies.

The project will signal a commitment to future adaptation and resilience actions that will have a positive impact on the coastal processes at this location.

(i). The proposed project will not affect a rare, threatened, or endangered species, or its habitat.

Analysis. There are no rare, threatened, or endangered species of flora and fauna at the project site.

(j). Detrimentally affects air or water quality or ambient noise levels.

Analysis. Short-term impacts upon ambient noise levels could occur during construction, but are expected to be minimized or avoided all together. These effects will be curtailed through the use of appropriate mitigation measures and Best Management Practices. There will be no impact to air and water quality. Adverse long-term impacts to these environmental components are not anticipated.

(k) The proposed action will not substantially affect or be subject to damage by being located in an environmentally sensitive area such as a flood plain, shoreline, tsunami zone, beach, erosion prone areas, estuary, fresh waters, geologically hazardous land, estuary, fresh water, or coastal waters.

Analysis. There are no ponds, wetlands, streams or important plant or animal habitats on the subject parcel nor are there any rare, threatened or endangered species of flora and fauna on the site.

The subject parcel is primarily located in Zone X, an area determined to be outside the 0.2 percent annual chance flood plain (i.e., a low risk flood hazard area). The geotextile burrito will be engineered to withstand the design forces and allow water flow through the structure, thus mitigating any hydrostatic forces that may otherwise have developed. The proposed project therefore should not be affected by flood hazard, or have adverse impacts upon its neighbors with regard to flood hazard potential.

(l) Substantially affects scenic vistas and view planes identified in county or state plans or studies.

Analysis. The rear yard will be restored to its current grade when the project is complete and so will have no effect on scenic vistas and view planes. The wooden ramp railings will rise a few feet above grade but will not impair scenic vistas and view planes.

(m) Requires substantial energy consumption.

Analysis. The proposed work will not require substantial energy consumption.

VI. Justification for Shoreline Setback Variance

As set forth in the Shoreline Rules for the Maui Planning Commission, §12-203-2, *"Purpose":*

Due to competing demands for utilization and preservation of the beach and ocean resources, it is imperative:

(1) That use and enjoyment of the shoreline area be ensured for the public to the fullest extent possible;

Analysis. The proposed wooden ramp in this project will provide greater access to the beach for the public and Kanai A Nalu residents, improving the public's enjoyment of the beach.

(2) That the natural shoreline environment be preserved;

Analysis. Installation of the geotextile burrito will be in the rear yard and will not affect the natural shoreline environment. The eventual removal of the seawalls will contribute to a restoration of the natural shoreline environment.

(3) That man-made features in the shoreline area be limited to features compatible with the shoreline area;

Analysis. This soft structure proposed for the setback will not affect the shoreline area. Installation and the subsequent existence of the burrito structure under the rear yard will have no effect on existing shoreline conditions. The wooden ramp structure will enhance beach enjoyment.

(4) That the natural movement of the shoreline be protected from development;

Analysis. There are functioning, if aging, seawall segments at Kanai A Nalu that are legal structures. They are a segment in approximately 2,400 feet of shoreline hardening at Maalaea. Installation of a geotextile burrito in the setback area of the rear yard will have no impact on the natural movement of the shoreline. The eventual removal of the seawalls will allow for a more natural movement of the shoreline, but seawall removal is contingent on the installation of the geotextile burrito.

(5) That the quality of scenic and open space resources be protected, preserved, and where desirable, restored; and

Analysis. When complete, the current prevailing grade will be restored. The wooden ramp will be embedded into the prevailing grade. These structures will not interfere with the quality of scenic and open space resources in the area.

(6) That adequate public access to and along the shoreline be provided.

The beach in this location is seasonal so public enjoyment of the shore is somewhat seasonal as well. When complete, the geotextile burrito will be below the prevailing grade covered by lawn. The wooden ramp will be embedded into the prevailing grade. Public access to and along the shore will be enhanced by this project.

§12-203-15 Criteria for approval of a variance.

(a) A shoreline area variance may be granted for a structure or activity otherwise prohibited by this chapter, if the commission finds in writing, based on the record presented, that the proposed structure or activity is necessary for or ancillary to:

(8) Private facilities or improvements which will neither adversely affect beach processes nor artificially fix the shoreline; provided that, the commission also finds that hardship will result to the applicant if the facilities or improvements are not allowed within the shoreline area;

Analysis. A single erosional event, like a hurricane, could threaten the stability of the habitable buildings. The association of apartment owners has pursued a wide range of mitigation actions including small scale beach nourishment, permitting of a sheet pile structure in the same location, and regional beach restoration (eg. groin structures and sand pumping). None of these solutions have proven to be either effective (small scale beach nourishment) or feasible (sheet pile, regional beach restoration). This private improvement (geotextile burrito, wooden ramp, and dune restoration) is the best and preferred option for adaptation and accommodation of sea level rise.

(9) Private facilities or improvements that may artificially fix the shoreline; provided that, the commission also finds that shoreline erosion is likely to cause hardship to the applicant if the facilities or improvements are not allowed within the shoreline area; and provided further that, the commission imposes conditions to prohibit any structure seaward of the existing shoreline unless it is clearly in the public interest;

Analysis. A single erosional event, like a hurricane, could threaten the stability of the habitable buildings. The association of apartment owners has pursued a wide range of mitigation actions including small scale beach nourishment, permitting of a sheet pile structure in the same location, and regional beach restoration (eg. groin structures and sand pumping). None of these solutions have proven to be either effective (small scale beach nourishment) or feasible (sheet pile, regional beach restoration). This private improvement (geotextile burrito, wooden ramp, and dune restoration) is the best and preferred option for protection of the habitable buildings.

(b) A structure or activity may be granted a variance upon grounds of hardship if:

(1) The applicant would be deprived of reasonable use of the land if required to fully comply with the shoreline setback rules;

Analysis. Loss of the rear yard to erosion would threaten habitable buildings. This short-term adaptation action will help Kanai A Nalu plan for and implement future adaptation actions. The loss or condemnation of the buildings would deprive the residents of the reasonable use of both their residences as well as the rear yard and pool. Without the geotextile burrito it is easy to envision the loss of the rear yard and the buildings.

(2) The applicant's proposal is due to unique circumstances and does not draw into question the reasonableness of the shoreline setback rules; and

Analysis. The proposed project does not draw into question the reasonableness of the shoreline setback rules. In fact, the rules provide the avenue for this variance. The association of apartment owners has spent decades working to address erosional forces. The solution proposed here addresses the unique circumstances found at Kanai A Nalu and are the result of lengthy discussions with the County of Maui on how to address the adaptation and resilience needs of Kanai A Nalu.

(e) No variance shall be granted unless appropriate conditions are imposed:

(3) The proposal is the practicable alternative which best conforms to the purpose of the shoreline setback rules.

Analysis. As discussed in the above written justification for the requested variance, the preferred alternative is the practicable option which best conforms to the purpose of the Shoreline Setback Rules.

(f) Notwithstanding any provision of this section to the contrary, the commission may consider granting a variance for the protection of a legal habitable structure or public infrastructure; provided that, the structure is at risk of damage from coastal erosion, poses a danger to the health, safety and welfare of the public, and is the best shoreline management option in accordance with relevant state policy on shoreline hardening.

Analysis. The buildings at Kanai A Nalu are threatened by coastal erosion. A single erosional event, like a hurricane, could threaten the stability of the habitable buildings. The association of apartment owners has pursued a wide range of mitigation actions including small scale beach nourishment, permitting of a sheet pile structure in the same location, and regional beach restoration (eg. groin structures and sand pumping). None of these solutions have proven to be either effective (small scale beach nourishment) or feasible (sheet pile, regional beach restoration). This private improvement is the best and preferred option for current adaptation to sea level rise and restoration of a more natural shoreline.

VII. Conclusions

This Draft Environmental Assessment and consolidated applications for a Special Management Area (SMA 1) Use Permit and Shoreline Setback Variance (SSV) for installation of a geotextile burrito, wooden ramp, and native plant dune restoration at the shore at the Kanai A Nalu Condominium Maui, Hawaii, analyzes the environmental and socio-economic impacts associated with the applicant's proposal.

The proposed adaptation work and resulting structure are not anticipated to result in significant environmental impacts to surrounding properties, and/or archaeological and historic resources on the site or in the immediate area. Public infrastructure and services including roadways, sewer and water systems, medical facilities, police and fire protection, parks, and schools, will not be significantly impacted. The proposed action will not impact public view corridors and will not produce significant adverse impacts upon the visual character of the site and its immediate environs.

The subject property is situated within the State's Urban District and is Community Planned for Multi-Family Residential development.

Based on the foregoing analysis and conclusion, the proposed project will not result in significant negative impacts to the environment, and will in fact have positive impacts upon the environment. It is consistent with the requirements of HRS Chapter 343, and a Finding of No Significant Impact (FONSI) is warranted. The applicant also requests approval of the Special Management Area Use Permit and Shoreline Setback Variance applications.

VIII. References

1. Kanai A Nalu Beach Management Erosion Response Plan. July 2019. Sea Engineering, Inc. Makai Research Pier, 41-305 Kalanianaole Hwy, Waimanalo, HI.
2. Special Management Area Assessment Application, Shoreline Setback Assessment Application, for the project Titled: Kanai A Nalu Interim Erosion Control. October 2021. Kapalaea Consultants LLC. 449 Kealaloa Avenue, Makawao, HI.
3. County of Maui, Department of Planning, 2010. Draft Maui Island Plan,
4. Wailuku, Hawaii.
5. County of Maui, Department of Planning, Kihei-Makena Community Plan. 1996.
6. County of Maui, Department of Planning. 2010. The Countywide Policy Plan, County of Maui 2030 General Plan. Wailuku, Hawaii.
7. Environmental Planning Associates. August 31, 1990. Maui Coastal Scenic Resources Study. Lahaina, Hawaii.
8. Federal Emergency Management Agency, Flood Insurance Rate Map. Community Panel 1500030558F Dated September 19, 2012.
9. State of Hawaii, Department of Business, Economic Development and Tourism "Table 1.1 Resident Population by County 1980-2040" DBEDT 2040 Series, March 2012)
10. United States Census Bureau Maui Population July 1, 2022. https://www.census.gov/quickfacts/fact/table/mauicountyhawaii/PST045222
11. University of Hawai`i, Land Study Bureau, Detailed Land Classification – Island of Maui, May 1967.
12. U.S. Department of Agriculture, Soil Conservation Service in Cooperation with the University of Hawaii, Agricultural Experiment Station, Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii, 1972.
13. Consolidated Final Environmental Assessment, Special Management Area, & Shoreline Setback Variance Applications, Milowai Maalaea Seawall Repair. January 2014. Chris Hart & Partners. 115 N. Market Street, Wailuku, Maui, Hawaii.

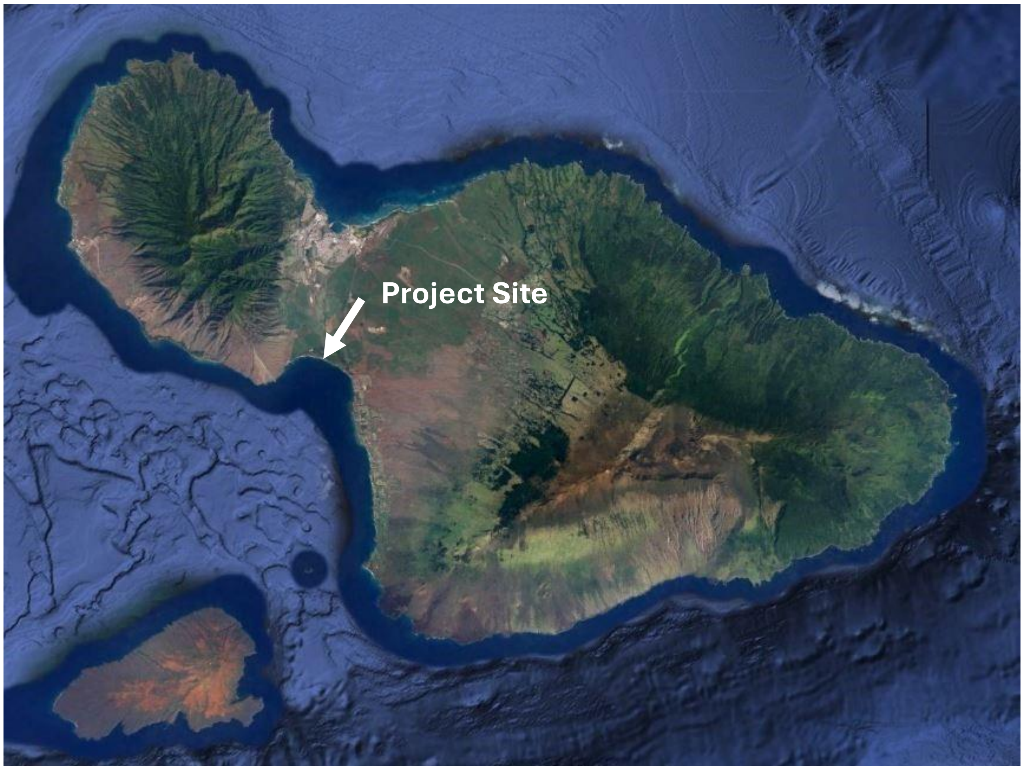
IX. Appendices

IX. Appendices

Appendix A Project Location Map

Project Location Map

Kanai A Nalu Building Protection



Appendix B Notice of Application

NOTICE OF APPLICATION

Date: September 11, 2024

TO: OWNERS/LESSEES

Please be advised that the undersigned has filed an application for a Environmental Assessment with the County of Maui, Department of Planning for the following parcel(s):

1. Tax Map Key Number: (2) 3-8-014:004 & (2) 3-8-014:005 (see attached map)
2. Street address: 250 Hauoli Street, Wailuku, HI 96793
3. Land Use Designations:
   State Land Use District: Urban
   Community Plan: Multi-family
   County Zoning: A-2
   Other: Special Management Area
4. Description of the existing uses on the Property: 80 Unit Condominium
5. Description of the proposed development and uses on the Property: Adaptation Pathways: Seawall Removal and Dune Restoration

The Applicant is responsible for ensuring accuracy of the information.

Owner/Applicant Name:	Owner/Applicant Name:
Kevin Robinson	
Owner/Applicant Signature	Owner/Applicant Signature
for K. Robinson	
Phone Number:	Phone Number:
808-463-4192	
Mailing Address:	Mailing Address:
250 Hauoli Street	
Wailuku, HI 96793	

Appendix C Notice of Public Hearing

NOTICE OF PUBLIC HEARING

DATE: July 15, 2024

TO ALL OWNERS / LESSEES:

Please be informed that the undersigned applicant has applied to the Maui County Planning Commission for a An Environmental Assessment, Shoreline Setback Variance, and Special Management Area Assessment *
*PLEASE INDICATE ALL PLAN CASE TYPES YOU'RE APPLYING FOR
to develop the following:

a. Name of Proposed Development: Adaptive Pathways: Seawall Removal and Dune Restoration

b. Description of Proposed Development: Installation of soft geotextile, shore access stairs, and dune restoration

THIS SECTION TO BE COMPLETED BY THE PLANNING DEPARTMENT

A PUBLIC HEARING WILL BE HELD ON THIS PROPOSED DEVELOPMENT ON:

Date: ______________________ **Time:** ______________________

Place: ______________________

Attached please find a map identifying the location of the specific parcel(s) being considered in the request for a An Environmental Assessment, Shoreline Setback Variance, and Special Management Area Assessment.
Information relative to the application is available for review at the Planning Department, 2200 Main Street, Suite 315, Wailuku, Maui, Hawaii; planning@mauicounty.gov; telephone (808) 270-7735; toll free from Molokai 1-800-272-0117, extension 7735; toll free from Lanai 1-800-272-0125, extension 7735.

Public Testimony: relative to this request may be provided in person at the public hearing, or submitted in writing via US mail or email at least two days prior to the hearing date addressed to the appropriate Planning Commission c/o the County of Maui, Department of Planning.

Testimony via US Mail:
Planning Commission
c/o Maui County Planning Department
2200 Main Street, Suite 315
Wailuku, Maui, HI 96793

Testimony via Email:
planning@mauicounty.gov
(NOTE: Please include the "Name of Proposed Development" from this notice in the subject line and body of email testimony)

The development is proposed at the following location:
c. Street Address: 250 Hauoli St, Wailuku, HI 96793
d. Tax Map Key No: (2) 3 8 014 004 & (2) 3 8 014 004 Sq.Ft./Acreage: 3.842 acres
e. Existing Land Use Designations:
State Land Use District: Urban
Maui Island Plan: Urban
Community Plan: Multi-Family
County Zoning: A-2 Apartment
Other Designation: Special Management Area

THIS SECTION TO BE COMPLETED BY THE PLANNING DEPARTMENT

The public hearing is held under the authority of Chapter 205A, 91 and 92 of the Hawaii Revised Statutes and the appropriate Planning Commission rules.

Petitioners to intervene shall be in conformity with §12-201 of the Rules of Practice and Procedure for the Maui Planning Commission; §12-401 of the Rules of Practice and Procedure for the Molokai Planning Commission; or §12-401 of the Rules of Practice and Procedure for the Lanai Planning Commission. The Petition to Intervene shall be filed with the respective planning commission and served upon the applicant no less than ten (10) business days before the first public hearing date, no later than 4:30 p.m. on the day of ______________. Filing of all documents with the Planning Commission shall be in c/o the County of Maui, Department of Planning, 2200 Main Street, Suite 315, Wailuku, Maui, Hawaii 96793.

Any party may be represented by Counsel or other representative.

Name of Applicant (PRINT): Kanai A Nalu Association of Apartment Owners, Kevin Robinson, President

Mailing Address: 250 Hauoli St, Wailuku, HI 96793

Signature: [signature] Telephone: 808-463-4192

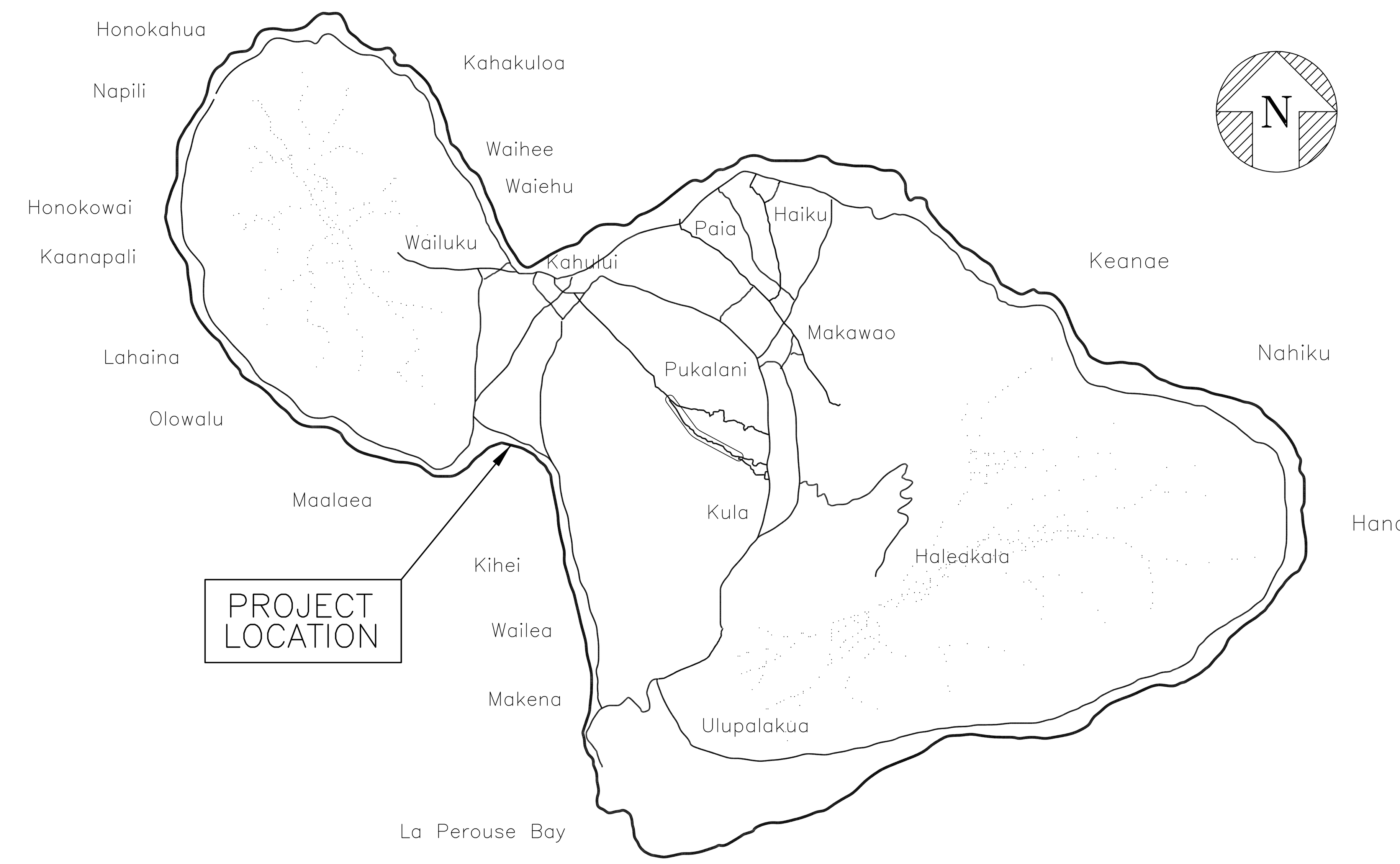
ANDERS LYONS, for KEVIN ROBINSON

Appendix D Civil Plans

CONSTRUCTION PLANS FOR:
KANAI A NALU
ADAPTATION PATHWAYS:
SEAWALL REMOVAL & DUNE RESTORATION
250 HAUOLI STREET
WAILUKU, HI 96793
TMK: (2) 3-8-014:004 & 005

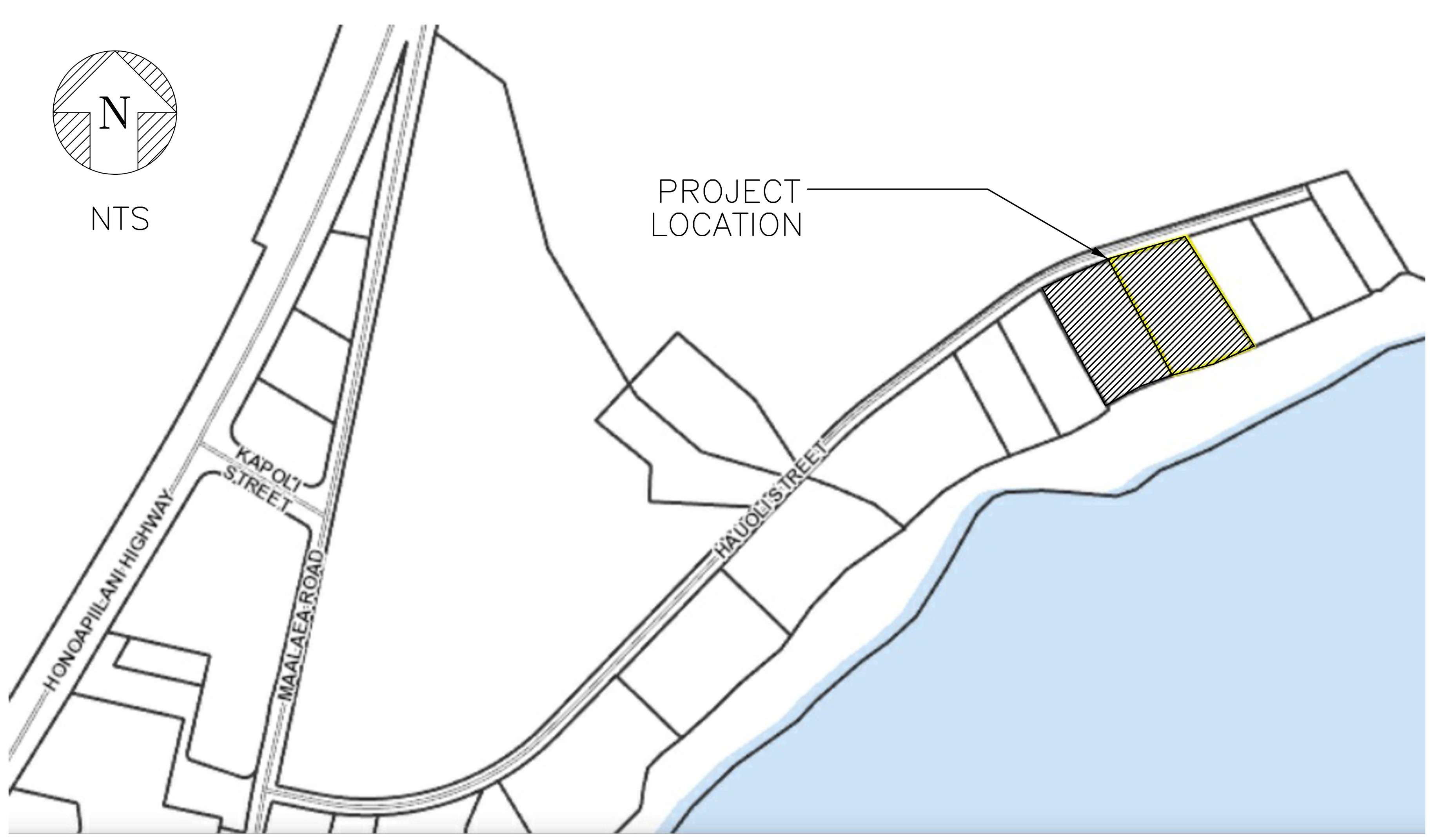
PREPARED FOR: AOAO KANAI A NALU
250 HAUOLI STREET
WAILUKU, HI 96793

PREPARED BY: CDF ENGINEERING, LLC
P.O. BOX 2985
WAILUKU, HI 96793



ISLAND OF MAUI
NOT TO SCALE

VICINITY MAP



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C-2	SITE ACCESS & STAGING
C-3	BMP PLAN
C-4A	BURRITO SITE PLAN
C-4B	RESTORATION AREA SITE PLAN
C-5	CONSTRUCTION DETAILS

GENERAL NOTES

DRAWINGS REPRESENT FINSHED STRUCTURE. CONTRACTOR SHALL BE RESPONSIBLE FOR MEANS AND METHODS OF CONSTRUCTION INCLUDING BUT NOT LIMITED TO SHORING AND TEMPORARY BRACING WHEN AND WHERE REQUIRED. CONTRACTOR SHALL TAKE ALL NECSSARY MEASURES TO ENSURE SAFETY OF ALL PERSONS AND STRUCTURES AT THE PROJECT SITE AND ADJACENT TO THE SITE. OBSERVATION VISITS TO THE SITE DOES NOT RELIEVE THE CONTRACTOR OF SUCH RESPONSIBILITY.

IF CERTAIN FEATURES ARE NOT FULLY SHOWN OR CALLED FOR ON THE DRAWINGS OR NOTES, THEIR CONSTRUCTION SHALL BE OF THE SAME CHARACTER AS FOR SIMILAR CONDITIONS THAT ARE CALLED FOR OR SHOWN.

THE CONTRACTOR AGREES THAT HE SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOBSITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS AND THAT THE CONTRACTOR SHALL DEFEND AND HOLD THE OWNER AND THE ENGINEER HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPT FOR LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE OWNER OR THE ENGINEER.

CONTRACTOR SHALL OBSERVE ALL SAFETY REQUIREMENTS AND FEDERAL, STATE, MAUI COUNTY, AND OSHA REGULATIONS THAT ARE APPLICABLE TO ALL PHASES OF THE PROJECT.

CONTRACTOR SHALL OBSERVE ALL APPLICABLE FEDERAL, STATE, AND LOCAL ENVIRONMENTAL PROTECTION STANDARDS, LAWS AND REGULATIONS, INCLUDING THE BEST MANAGEMENT PRACTICES PLANS, AND HAWAII ADMINISTRATIVE RULES, TITLE II, DEPARTMENT OF HEALTH, CHAPTER 55, WATER POLLUTION CONTROL.

THE CONSTRUCTION WORK AREA SHALL BE CLOSED TO NON-WORKERS AT ALL TIMES. CONTRACTOR SHALL COORDINATE WITH THE OWNER AND PLACE NECESSARY WARNING SIGNS TO ALERT THE PUBLIC OF POSSIBLE DANGER.

CONTRACTOR SHALL VERIFY THE LOCATION OF EXISTING UTILITIES BEFORE BEGINNING WORK. SPECIAL CARE SHALL BE TAKEN TO MAINTAIN AND PROTECT UTILITIES THAT ARE TO REMAIN IN SERVICE DURING CONSTRUCTION.

CONTRACTOR SHALL COORDINATE WITH THE OWNER TO ENSURE ALL PROJECT ACTIVITIES ARE DULY PERMITTED.

NOTHING SHALL BE DISCHARGED IN THE OCEAN. NO WORK IS ALLOWED ON THE SHORELINE WITHOUT OBTAINING THE RIGHT OF ENTRY PERMIT.

CONTRACTOR SHALL BE RESPONSIBLE TO FIELD VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS AND USE THE ACTUAL DIMENSIONS FOR CONSTRUCTION PURPOSES. SCALING DRAWINGS IS NOT ALLOWED.

CONTRACT INCLUDES REMOVING AND RELOCATING ALL LOOSE OR REMOVED/EXCAVATED SOIL TO AUTHORIZED DUMPING LOCATIONS. ADDITIONALLY, CONTRACTOR SHALL REMOVE ALL CONSTRUCTION RELATED DEBRIS/MATERIALS FROM AND CLEAN THE WORK AREA UPON COMPLETION OF CONSTRUCTION ACTIVITIES.

ONLY THE ENGINEER OF RECORD IS AUTHORIZED TO INTERPRET THE INTENT OF DRAWINGS. CONTRACTOR SHALL REVIEW THE DRAWINGS AND SUBMIT ALL QUESTIONS OR REQUESTS FOR CLARIFICATION TO ENGINEER. IT IS EXPRESSLY NOTED IF MORE THAN ONE INTERPRETATION MAY BE MADE FROM DRAWINGS REQUIREMENTS, THE MOST STRINGENT INTERPRETATION MAY BE REQUIRED BY THE ENGINEER AT NO ADDITIONAL COST.

THE BID SHALL BE ALL-INCLUSIVE WITH A LUMP SUM TOTAL PRICE WHICH INCLUDES APPLICABLE TAXES. THE TOTAL BID PRICE SHALL BE FOR THE COMPLETE WORK AS SHOWN ON THE DRAWINGS.

DUE TO THE NATURE OF THE PROJECT, CONTRACTOR SHALL BE PREPARED TO ADJUST HIS METHODS IN FIELD AND AS DIRECTED BY THE ENGINEER TO ADDRESS SPECIFIC SITE CONDITIONS.

CONTRACTOR SHALL BE RESPONSIBLE FOR SELECTING HIS MEANS AND METHOD SUCH AS EXCAVATION & SHORING TO ACCOMPLISH THE WORKS INCLUDED IN THE CONTRACT. CONTRACTOR SHALL PAY SPECIAL ATTENTION TO AND DEVISE AN EFFECTIVE DEWATERING PLAN FOR THE PROJECT. DEWATERING INTO THE OCEAN IS STRICTLY PROHIBITED.

GROUTED BOULDERS SHOWN ON THE DRAWING MUST BE COMPLETELY ENCAPSULATED BY APPLYING SHOTCRETE. FILLING THE VOIDS BETWEEN BOULDERS USING PUMP HOSE IS NOT ACCEPTABLE. PARTIALLY ENCAPSULATED BOULDERS IN CONTACT WITH IN-SITU SOIL SHALL NOT BE ACCEPTABLE AS PART OF THE MIN GROUTED BOULDERS. THE FIRST LAYER OF BOULDERS SHALL BE PLACED AFTER 18" OF SHOTCRETE IS DEPOSITED IN THE EXCAVATED AREA.

THE SPECIFIED DEPTH OF EXCAVATON SHALL BE REACHED UNLESS BEDROCK IS ENCOUNTERED AT A SHALLOWER DEPTH AS CONFIRMED BY THE ENGINEER.

THE EXTENT (DEPTH & WIDTH) OF EXCAVATION SHALL BE AS SHOWN ON DRAWINGS. ALL POCKETS OF EXISTING CONCRETE FROM PREVIOUS REPAIRS MUST BE REMOVED BEFORE NEW FOOTING SHALL BE CAST PER THE DRAWINGS.

UNLESS NOTED OTHERWISE, MINIMUM CLEAR CONCRETE PROTECTION FOR REINFORCEMENT SHALL BE 3".

UNLESS NOTED OTHERWISE, ALL SPLICES SHALL BE LAPPED 48 BAR DIAMETERS.

CONCRETE REINFORCEMENT DETAILING AND PLACEMENT SHALL CONFORM TO ACI 315 AND ACI 318-05 UNLESS OTHERWISE INDICATED.

UNO, ALL SLABS ON GRADE & WALL FOOTINGS SHALL BE POURED ON COMPACTED (95% RELATIVE COMPACTION) BASE MATERIAL.

DRAWINGS SHALL NOT BE SCALED TO FIND DIMENSIONS, SLOPES, OR OTHER INFORMATION.

MATERIAL PROPERTIES

STEEL REINFORCEMENT: ASTM A 615, GRADE 60, DEFORMED, EPOXY COATED PER ASTM A775
PORTLAND CEMENT: ASTM C 150, TYPE II
FLY ASH ADMIXTURE: ASTM C 618, CLASS C OR F
NORMAL WEIGHT AGGREGATE: ASTM C 33, UNIFORMLY GRADED
WATER: POTABLE, COMPLYING WITH ASTM C 94 REQUIREMENTS
ADMIXTURES: CERTIFIED BY MANUFACTURER TO CONTAIN NOT MORE THAN 0.1 PERCENT WATER SOLUBLE CHLORIDE IONS BY MASS OF CEMENTITIOUS MATERIAL AND TO BE COMPATIBLE WITH OTHER ADMIXTURES AND CEMENTITUOUS MATERIALS
DO NOT USE ADMIXTURES CONTAINING CALCIUM CHLORIDE
WATER-REDUCING ADMIXTURE: ASTM C 494, TYPE A
HIGH-RANGE, WATER-REDUCING ADMIXTURE: ASTM C 494, TYPE G
CONCRETE MIX SHALL HAVE COLOR PIGMENT TO MATCH THE COLOR OF EXISTING SEAWALL FRONTING BUILDING F.
HANDRAILS AND RAILINGS FOR RAMPS AND STAIRWAYS SHALL BE ASTM A167, TYPE 316 STAINLESS STEEL, SCHEDULE 40. ALL SURFACE FINISHES SHALL SMOOTH POLISHED SURFACE. ALL PLATES AND HARDWARE SHALL BE STAINLESS STEEL TO MATCH RAILING MATERIAL.
CONSTRUCTION MATERIALS SHALL BE CLEAN, UNCONTAMINATED AND FREE OF DELETERIOUS COMPONENTS.

TECHNICAL NOTES

CONCRETE COMPRESSIVE STRENGTH (28 DAYS): 5,000 PSI

SHOTCRETE COMPRESSIVE STRENGTH (28 DAYS): 5,000 PSI

LIMIT WATER SOLUBLE, CHLORIDE-ION CONTENT IN HARDENED CONCRETE TO 0.15 PERCENT BY WEIGHT OF CEMENT. MEASURE, BATCH, MIX, AND DELIVER CONCRETE ACCORDING TO ASTM C 94 AND FURNISH BATCH TICKET INFORMATION. DO NOT ADD WATER TO CONCRETE MIX AFTER MIXING UNLESS APPROVED BY THE ENGINEER. MAINTAIN CONCRETE TEMPERATURE LESS THAN 90 DEGREES FAHRENHEIT.

TYPICALLY PROVIDE A MINIMUM OF 3-INCH CONCRETE COVER FOR REINFORCING STEEL.

INSPECTION REQUIREMENT

ALL KEY CONSTRUCTION ACTIVITIES SHALL TAKE PLACE IN A CONTROLLED MANNER IN COORDINATION WITH THE ENGINEER TO ALLOW NECESSARY ADJUSTMENT BASED ON FIELD CONDITIONS.

CONTRACTOR SHALL GIVE THE ENGINEER A 48-HOUR ADVANCE NOTICE REGARDING THE START DATE OF EACH PHASE OF THE PROJECT.

INCIDENTAL SITE WORK

CONTRACTOR SHALL INCLUDE COSTS OF INCIDENTAL WORKS SUCH AS BUT NOT LIMITED TO GRUBBING & CLEARING THE SITE AND ALL OTHER WORK ITEMS IN THE BACK YARD THAT MIGHT BE REQUIRED TO COMPLETE THE WORK AS SHOWN ON DRAWINGS IN THE TOTAL PRICE OF THE CONTRACT.

CONTRACTOR SHALL BE RESPONSIBLE FOR DAMAGES TO EXISTING STRUCTURES, SITE FEATURES, AND BURIED PIPES DURING THE CONSTRUCTION. ALL SUCH DAMAGES SHALL BE FIXED BY THE CONTRACTOR AT NO ADDITIONAL EXPENSE TO THE OWNER.

AFTER COMPLETION OF THE PROJECT, CONTRACTOR SHALL RESTORE THE SITE TO A CONDITION SIMILAR TO THE CONDITION PRIOR TO CONSTRUCTION ACTIVITIES. CONTRACTOR SHALL COORDINATE THE SITE WORK WITH THE OWNER TO ALLOW REMOVAL AND REPLANTING OF THE EXISTING TREES.

BEST MANAGEMENT PRACTICES

1. CONTRACTOR SHALL IMPLEMENT THE FOLLOWING BEST MANAGEMENT PRACTICES TO ENSURE WATER QUALITY AND MARINE RESOURCES ARE PROTECTED:
2. NO MATERIALS SHALL BE STOCKPILED IN THE AQUATIC ENVIRONMENT OR ABUTTING MARTINE WATERS WITHOUT APPROPRIATE CONTAINEMENT.
3. ALL CONSTRUCTION RELATED MATERIALS SHALL BE FREE FROM POLLUTANTS AND PLACED AND STORED IN A MANNER THAT PREVENTS OR MINIMIZES DISTURBANCE.
4. NO DEBRIS, PETROLEUM PRODUCTS OR DELETERIOUS MATERIALS OR WASTES SHALL BE ALLOWED TO FALL, FLOW, LEACH, OR OTHERWISE ENTER SHORE WATERS.
5. ANY TURBIDITY AND SILTATION GENERATED FROM CONSTRUCTION ACTIVITIES SHALL BE MINIMIZED AND CONTAINED IN THE IMMEDIATE VICINITY OF CONSTRUCTION THROUGH THE EFFECTIVE USE OF SILT CONTAINMENT DEVICES.
6. CONSTRUCTION DURING INCLEMENT WEATHER CONDITIONS SHALL BE CURTAILED TO MINIMIZE THE POTENTIAL FOR ADVERSE WATER QUALITY IMPACTS.
7. CONTRACTOR SHALL MAINTAIN SAFE LATERAL ACCESS TO AND ALONG THE SHORELINE FOR PUBLIC USE.
8. CONTRACTOR SHALL TAKE ALL PRACTICABLE MEASURES TO MINIMIZE RISK OF ADVERSE IMPACTS ON BEACH PROCESSES.
9. CONTRACTOR SHALL TAKE NECESSARY MEASURES TO PREVENT SEDIMENT RUNOFF FROM AREAS DISTURBED BY CONSTRUCTION ACTIVITIES TO ENTER STATE WATERS.
10. CONTRACTOR SHALL INSTALL TEMPORARY SEDIMENT CONTROL FILTER AT ALL AFFECTED DRAIN INLETS BEFORE WORK BEGINS. SEDIMENT CONTROL FILTERS SHALL REMAIN UNTIL AFTER COMPLETION OF CONSTRUCTION ACTIVITIES.
11. CONTRACTOR IS RESPONSIBLE FOR ENSURING THAT TIRES OF ALL CONSTRUCTION VEHICLES ARE CLEANED OFF BEFORE LEAVING THE PROJECT SITE.
12. CONTRACTOR SHALL TAKE NECESSARY PROTECTIVE MEASURES TO CAPTURE ALL DEBRIS FROM PROJECT OPERATIONS AND ENSURE THAT NO DELETERIOUS MATERIALS ENTERS THE OCEAN WATERS.
13. THE PROJECT SITE SHALL BE CLEANED UP AT THE COMPLETION OF DAILY ACTIVITIES.
14. CONTRACTOR SHALL TAKE ALL MEASURES TO AVOID ADVERSE ENVIRONMENTAL IMPACTS TO THE MAXIMUM EXTENT POSSIBLE. ALL MISHAPS SHALL BE DOCUMENTED IN WRITING AND WITH PHOTOGRAPHS.
15. ALL WORK ACTIVITIES AND HOURS OF ACTIVITIES DURING WEEKENDS AND HOLIDAYS SHALL BE STRICTLY COORDINATED WITH THE PROPERTY MANAGEMENT OFFICE.
16. CONSTRUCTION MATERIALS SHALL BE STORED IN A SUCH A WAY TO PRECLUDE DISCHARGE OF POLLUTANTS INTO THE OCEAN. ALL GENERATED WASTES SHALL BE DISPOSED OF PROPERLY.
17. CONTRACTOR SHALL TAKE ALL MEASURES SHALL TO PREVENT HAZARDOUS SUBSTANCES FROM ENTERING THE GROUND, DRAINAGE AREA, OR BODIES OF WATER. FUELING AND LUBRICATING OF EQUIPMENT AND MOTOR VEHICLES SHALL BE CONDUCTED IN PARKING AREA ON IMPERVIOUS SURFACE NOT WITHIN THE SETBACK AREA OR NEAR STORM DRAIN INLETS.
18. CONTRACTOR SHALL TAKE ALL MEASURES TO PREVENT AIR-BORNE DUST IN CONFORMANCE WITH STATE DEPARTMENT OF HEALTH ADMINISTRATIVE RULES, TITLE 11, CHAPTER 60-AIR POLLUTION.
19. CONTRACTOR SHALL TAKE ALL PRACTICABLE MEASURES FOR SOUND ATTENUATION DURING CONSTRUCTION ACTIVITIES TO LESSEN THE IMPACT ON THE LAND AND MARINE ENVIRONMENT.
20. CONTRACTOR SHALL TAKE ALL PRACTICABLE MEASURES TO MAINTAIN CONSTRUCTION MATERIALS AND MECHANIZED EQUIPMENT UNCONTAMINATED FROM ALL DELETERIOUS SUBSTANCES. ALL EQUIPMENT SHALL BE INSPECTED DAILY FOR LEAKS AND ALL LEAKS SHALL BE FIXED BEFORE USING THE EQUIPMENT.
21. CONTRACTOR SHALL HAVE A DETAILED PLAN FOR AN ACCIDENTAL OIL SPILL SCENARIO TO ENSURE TIMELY AND EFFICIENT RESPONSE IN ORDER TO AVOID MARINE ENVIRONMENTAL CONTAMINATION. NO PETROLEUM PRODUCTS SHALL BE ALLOWED IN THE SHORELINE AND THE CONSTRUCTION ACTIVITIES AREA.
22. ALTHOUGH THE PROJECT DOES NOT INVOLVE ANY WORK IN THE WATER, CONTRACTOR SHALL ADVISE HIS PERSONNEL AND SUB-CONTRACTORS OF THE PROVISIONS OF THE ENDANGERED SPECIES ACT (ESA) THAT MUST BE OBSERVED IN ORDER TO AVOID CONTACT OR HARASSMENT OF THE ESA-LISTED SPECIES THAT MIGHT APPEAR NEAR THE PROJECT SITE.
23. ALTHOUGH THE PROJECT ACTIVITIES ARE LIMITED TO THE AREA PREVIOUSLY DISTURBED BY BUILDING EXISTING SEAWALL AND INSTALLED STORM DRAINS, IN THE EVENT THAT HISTORIC RESOURCES, INCLUDING HUMAN SKELETAL REMAINS ARE FOUND DURING CONSTRUCTION ACTIVITIES, CONTRACTOR SHALL HALT WORK, SECURE THE SITE, AND CONTACT SHPD MAUI OFFICE BY CALLING 808-243-1285.
24. THE IMPORTATION AND PLACEMENT OF SOIL IS PROHIBITED WITHIN THE SHORELINE AREAS AS DEFINED BY CHAPTER 201A-41, HAWAII REVISED STATUTES, EXCEPT FOR SAND AS DEFINED IN CHAPTER 20.08 (SOIL EROSION AND SEDIMENTATION CONTROL) OF THE MAUI COUNTY CODE.
25. ALL FILL MATERIAL SHALL SATISFY THE REQUIREMENTS OF THE COUNTY OF MAUI CODE, SECTION 20.08.035.
26. THE GRADING OF THE COASTAL DUNE IS PROHIBITED PURSUANT TO SECTION 20.08.035.

BRANDON W MURR
LICENSED PROFESSIONAL ENGINEER
No. 18563-C
HAWAII U.S.A.
EXPIRES 04.30.2026

This work was prepared by me or under my supervision and construction will be under my observation. (Observation of construction as defined in Section 1.2 (N) in the rules and regulations of the Board of Preofessional Engineers, Architects, and Surveyors of the State of Hawaii.)

CIVIL ENGINEERING & LANDSCAPE ARCHITECTURE CONSULTANTS

CDF Engineering LLC
PO Box 2985, Wailuku, HI 96793
Phone: (808) 891-2400

KANAI A NALU
ADAPTATION PATHWAYS:
SEAWALL REMOVAL & DUNE RESTORATION

Scale:		DWG No.:
N.T.S.	Construction Notes	C-1
09.04.2024	TMK: (2) 3-8-014:004 & 005	

AVERAGE LOT DEPTH (ALD) ANALYSIS

PARCEL 004
WEST BNDY = 285.18'
MIDDLE BNDY = 285.93'
EAST BNDY =284.34'

ALD = 285.15 x 0.25 = 71.29'

PARCEL 005
WEST BNDY = 298.70'
MIDDLE BNDY = 295.50'
EAST BNDY =285.18'

ALD = 293.13 x 0.25 = 73.28'

ANNUAL EROSION HAZARD RATE (AEHR)

TRANSECT 128
(1.0 x 50') + 25' = 75'

TRANSECT 129
(1.0 x 50') + 25' = 75'

TRANSECT 130
(1.0 x 50') + 25' = 75'

TRANSECT 131
(0.8 x 50') + 25' = 65'

LEGEND

- PALM TREE
- PLUMERIA TREE
- DRAIN INLET
- NAUPAKA BUSHES
- CONCRETE
- ROCK WALL
- FIDDLELEAF TREE

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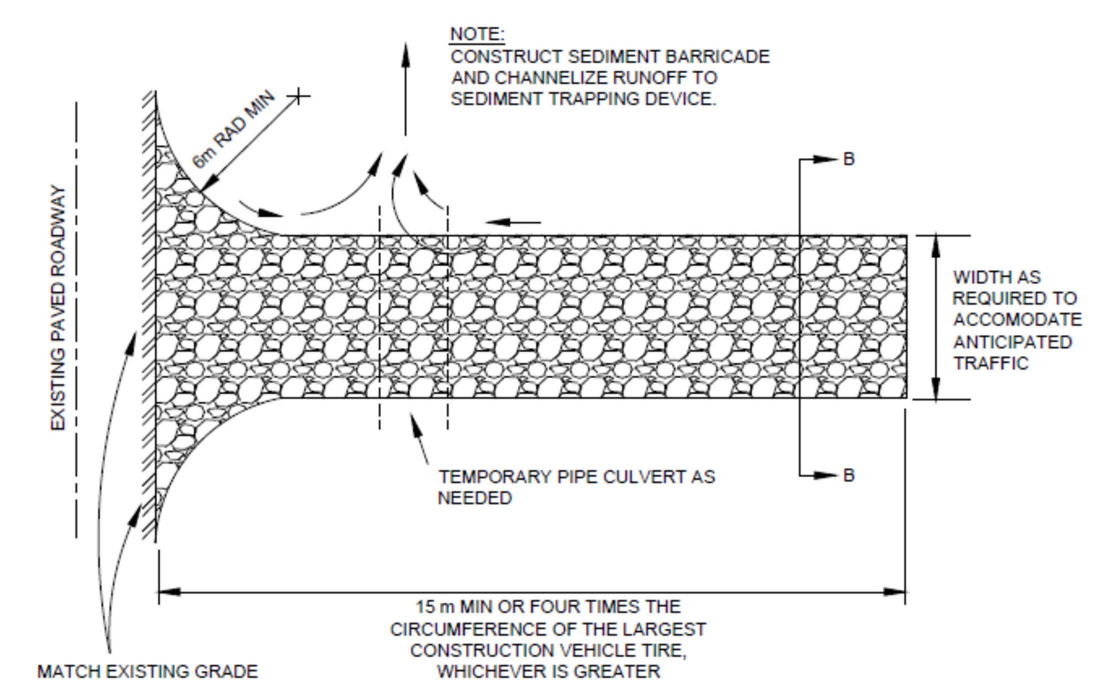
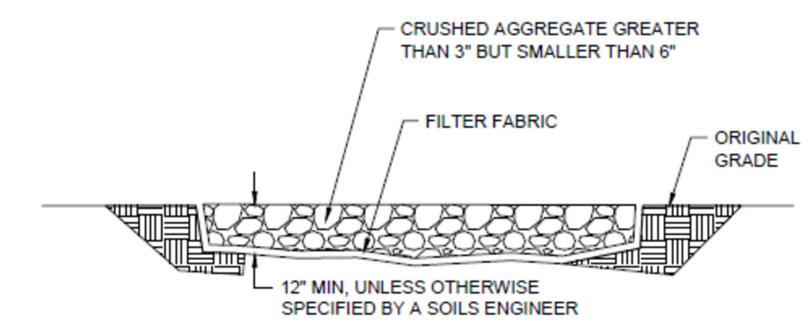
KANAI A NALU
ADAPTATION PATHWAYS:
SEAWALL REMOVAL & DUNE RESTORATION

Scale: 1" = 20'	Site Access & Staging	DWG No.: C-2
09.04.2024	TMK: (2) 3-8-014:004 & 005	



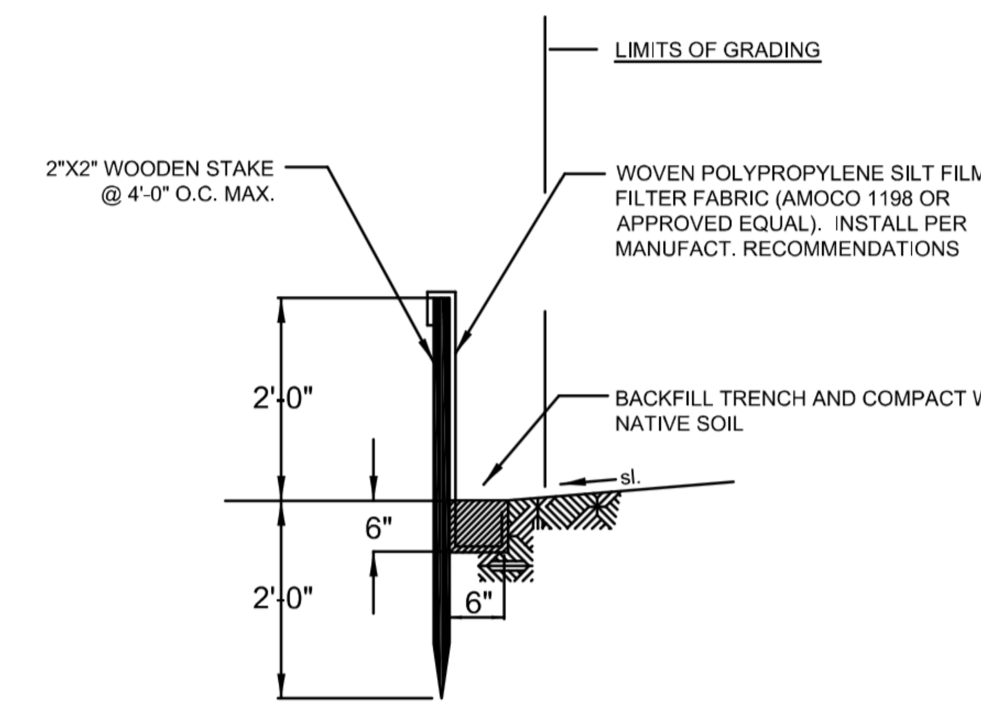


SECTION B-B

NOT TO SCALE

CONSTRUCTION ENTRANCE DETAILS

NOT TO SCALE



SILT FENCE DETAILS

NOT TO SCALE

AVERAGE LOT DEPTH (ALD) ANALYSIS

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WEST BNDY = 285.18'
MIDDLE BNDY = 285.93'
EAST BNDY =284.34'

ALD = 285.15 x 0.25 = 71.29'

PARCEL 005
WEST BNDY = 298.70'
MIDDLE BNDY = 295.50'
EAST BNDY =285.18'

ALD = 293.13 x 0.25 = 73.28'

ANNUAL EROSION HAZARD RATE (AEHR)

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(1.0 x 50') + 25' = 75'

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(1.0 x 50') + 25' = 75'

TRANSECT 130
(1.0 x 50') + 25' = 75'

TRANSECT 131
(0.8 x 50') + 25' = 65'

NOTES:

1. THE IMPORTATION AND PLACEMENT OF SOIL IS PROHIBITED WITHIN THE SHORELINE AREA AS DEFINED BY CHAPTER 201A-41, HAWAII REVISED STATUTES, EXCEPT FOR SAND AS DEFINED IN CHAPTER 20.08 OF THE MAUI COUNTY CODE.

2. TIEBACKS ARE TO BE DETERMINED BY THE STRUCTURAL ENGINEER.

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KANAI A NALU
ADAPTATION PATHWAYS:
SEAWALL REMOVAL & DUNE RESTORATION

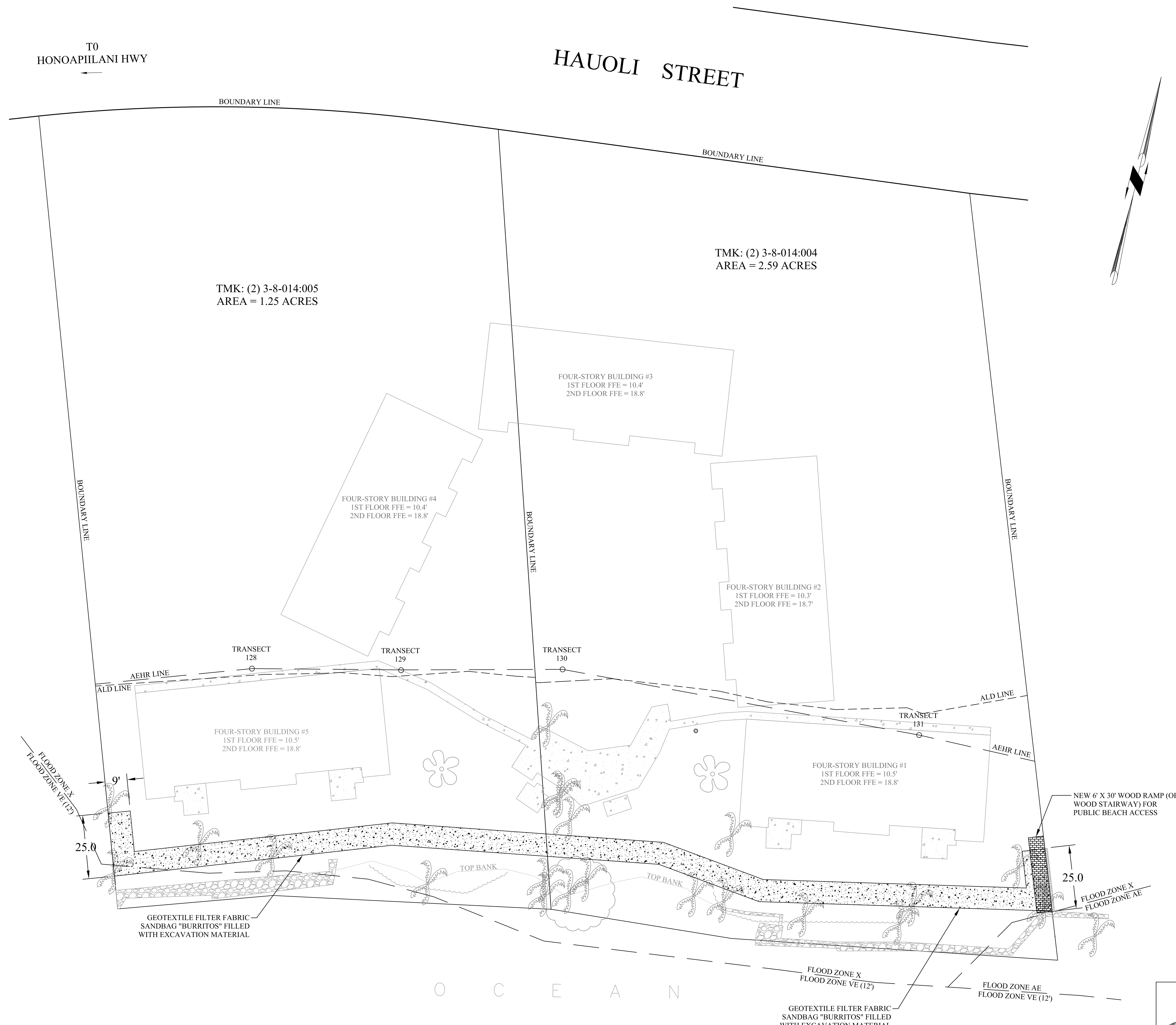
Scale: 1" = 20'

BMP Plan

DWG No.: C-3

09.04.2024

TMK: (2) 3-8-014:004 & 005



AVERAGE LOT DEPTH (ALD) ANALYSIS

PARCEL 004
WEST BNDY = 285.18'
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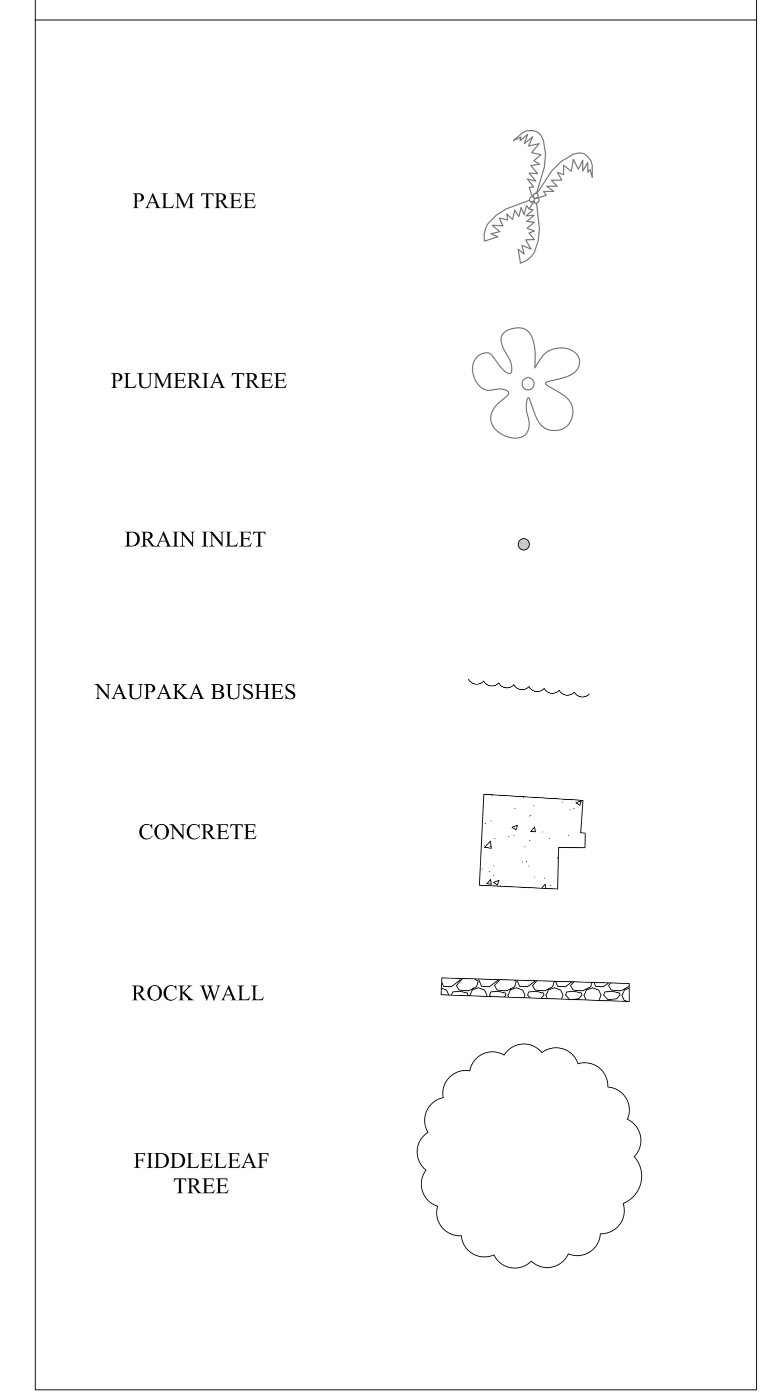

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KANAI A NALU
ADAPTATION PATHWAYS:
SEAWALL REMOVAL & DUNE RESTORATION

Scale: 1" = 20'	Burrito Site Plan	DWG No.: C-4A
09.04.2024	TMK: (2) 3-8-014:004 & 005	

AVERAGE LOT DEPTH (ALD) ANALYSIS

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WEST BNDY = 285.18'
MIDDLE BNDY = 285.93'
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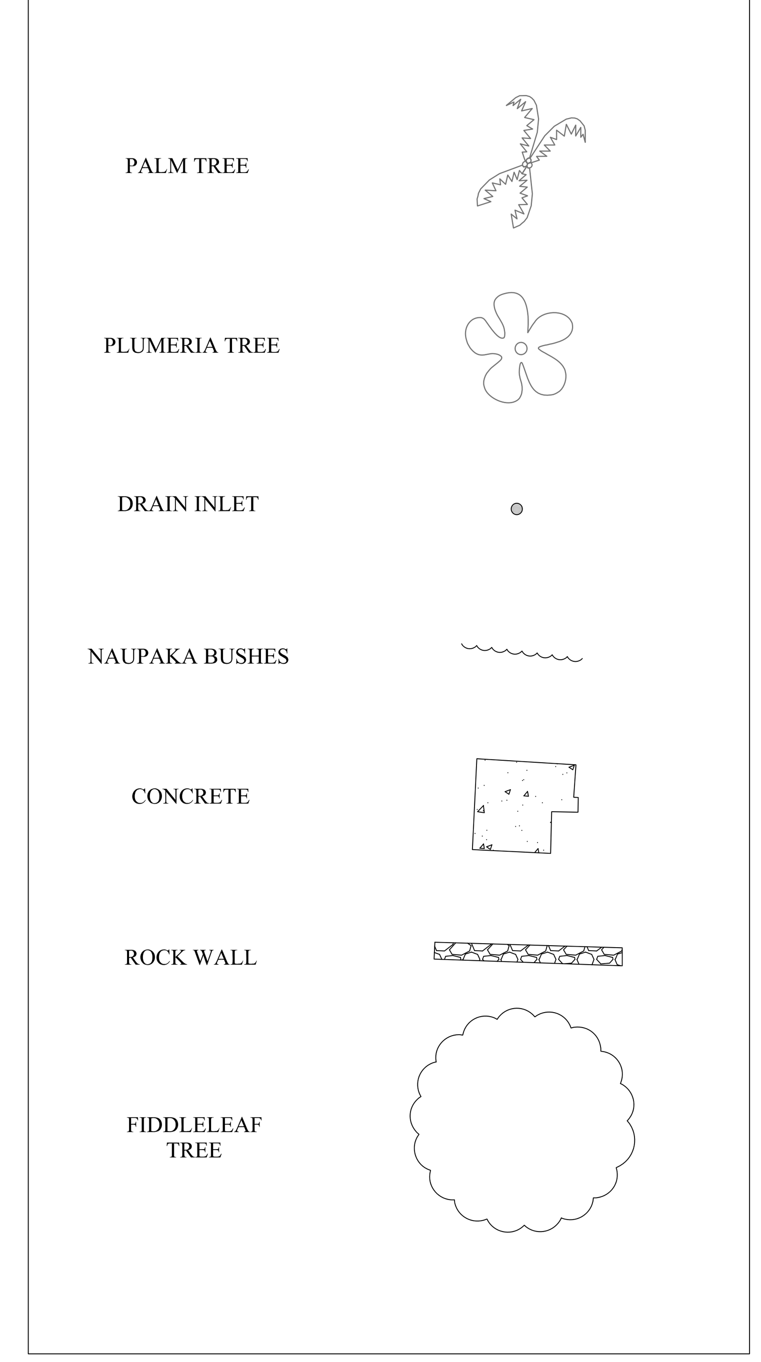
LEGEND



BRANDON W MURR
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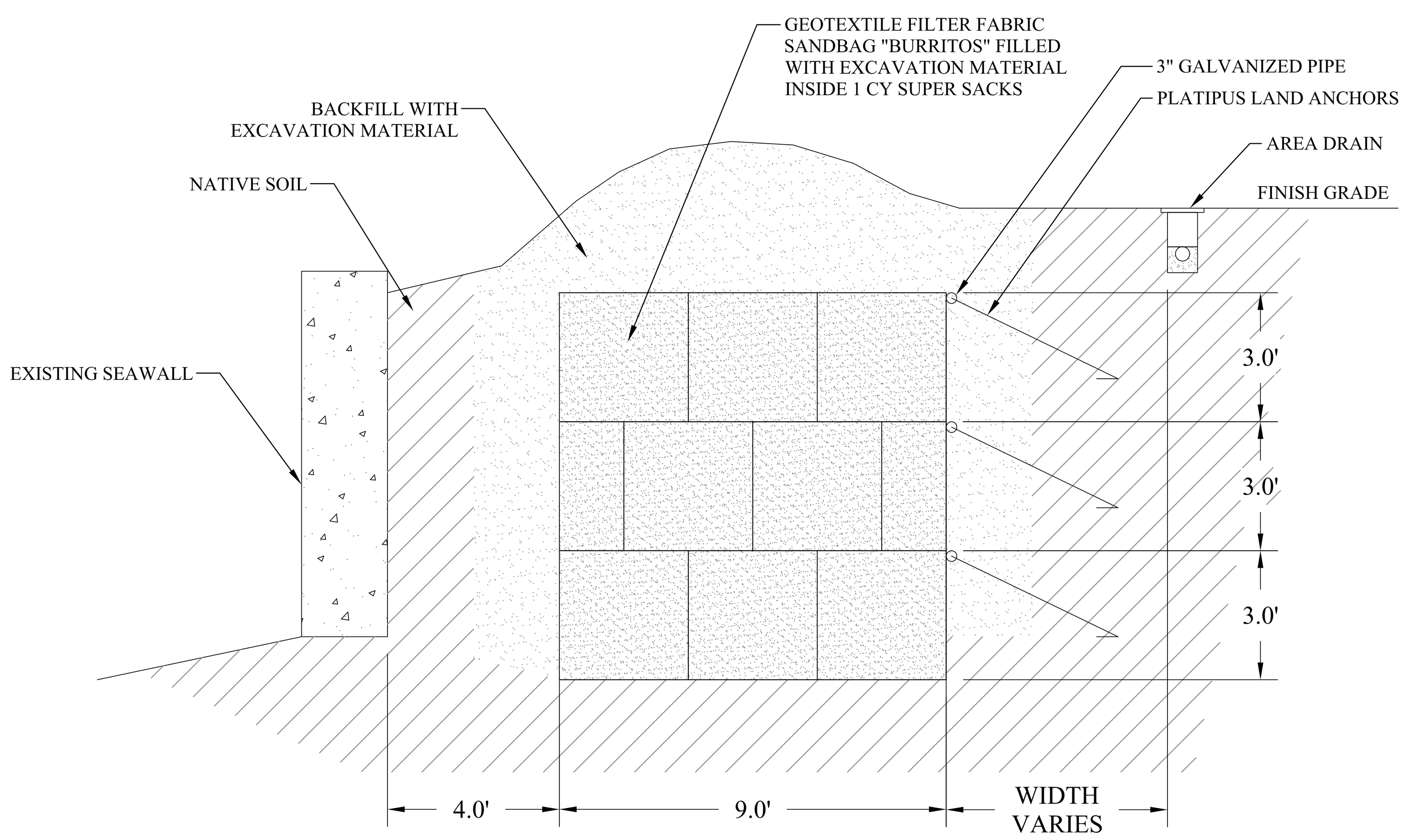
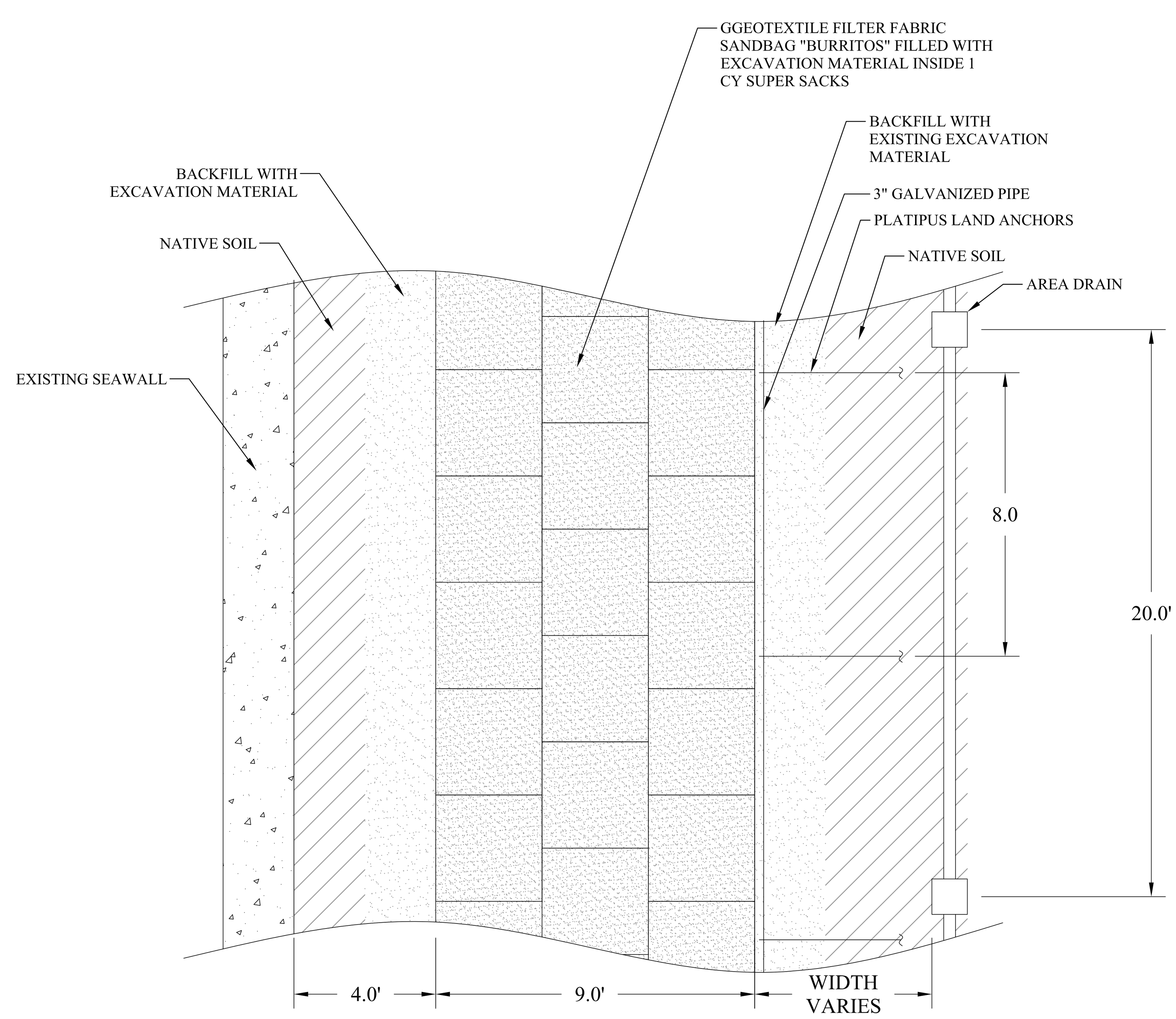
KANAI A NALU
ADAPTATION PATHWAYS:
SEAWALL REMOVAL & DUNE RESTORATION

Scale:		DWG No.:
1" = 20'	Restoration Area Site Plan	C-4B
09.04.2024	TMK: (2) 3-8-014:004 & 005	



1
C-5
SANDBAG "BURRITO" SECTION PROFILE (TYP)
SCALE: N.T.S.



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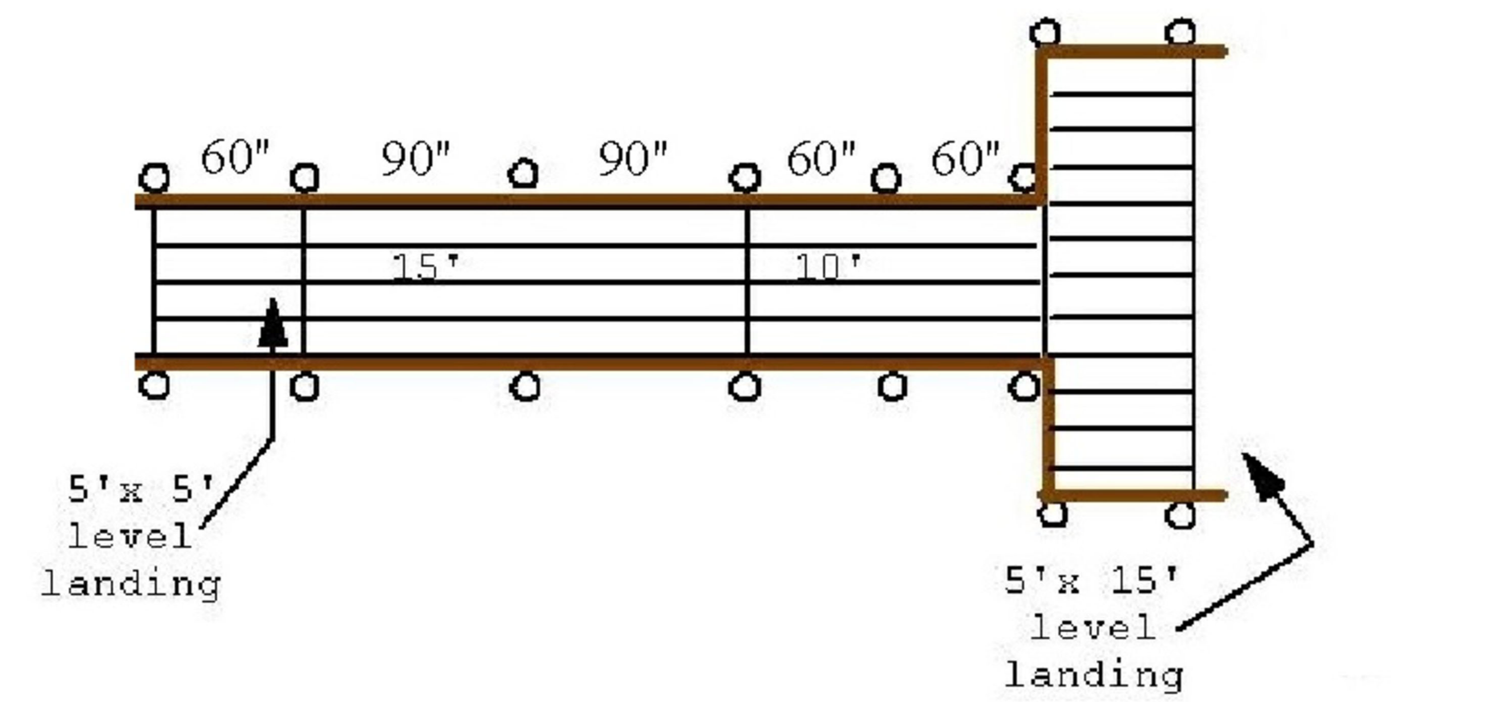
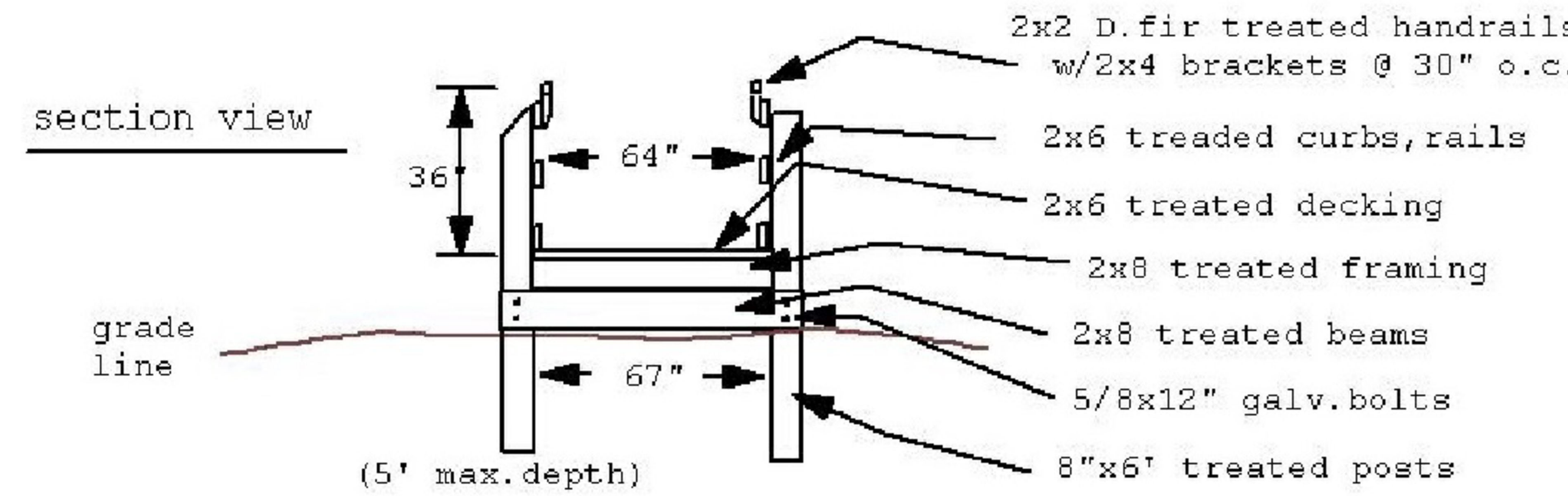
C-5
SANDBAG "BURRITO" SECTION PLAN (TYP)
SCALE: N.T.S.





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KANAI A NALU
ADAPTION PATHWAYS:
SEAWALL REMOVAL & DUNE RESTORATION

Scale: AS NOTED	Construction Details	DWG No.: C-5
09.04.2024	TMK: (2) 3-8-014:004 & 005	

Appendix E Proof of Ownership

COUNTY OF MAUI Hawaii

Parcel Information

Parcel Number	380140050000
Location Address	230 HAUOLI ST UNIT C345 WAILUKU HI 96793
Neighborhood Code	OFHOTEL
Legal Information	
Land Area	1.251 Acres
Parcel Note	Non taxable

View Map

Owner Information

Owner Names
KANA'I A NALU - CONDO MASTER Fee Owner

Mailing Address
KANA'I A NALU - CONDO MASTER

Assessment Information

⊞ Show Historical Assessments

Year	Tax Class	Market Land Value	Agricultural Land Value	Assessed Land	Building Value	Total Assessed Value	Total Exemption Value	Total Net Taxable Value
2021	HOTEL / RESORT	$100	$0	$100	$0	$100	$0	$100

How to calculate real property taxes

Recent Sales In Area

Sale date range:

From:
09/14/2018

To:
09/14/2021

Sales by Neighborhood

1500

Feet

Sales by Distance

Generate Owner List by Radius

Distance:
100

Fe

☑ Show All Owners
☐ Show Parcel ID on Label

Skip Labels
0

Use Address From:
◉ **Owner** ○ **Property**

Select export file format:
Address labels (5160)

International mailing labels that exceed 5 lines are not supported on the Address labels (5160). For international addresses, please use the xlsx, csv or tab download formats.

Download

No data available for the following modules: Agricultural Assessment Information, Current Tax Bill Information, Historical Tax Information, Appeal Information, Home Exemption Information, Improvement Information, Commercial Improvement Information, Accessory Information, Sales Information, Permit Information, Sketches.

Parcel Information

Parcel Number	380140040000
Location Address	250 HAUOLI ST UNIT C345 WAILUKU HI 96793
Neighborhood Code	OFHOTEL
Legal Information	
Land Area	112864 Square Feet
Parcel Note	Non taxable

View Map

Owner Information

Owner Names
KANA'I A NALU- CONDO MASTER Fee Owner

Mailing Address
KANA'I A NALU- CONDO MASTER

Assessment Information

⊞ Show Historical Assessments

Year	Tax Class	Market Land Value	Agricultural Land Value	Assessed Land	Building Value	Total Assessed Value	Total Exemption Value	Total Net Taxable Value
2021	HOTEL / RESORT	$11,060,700	$0	$11,060,700	$0	$11,060,700	$0	$11,060,700

How to calculate real property taxes

Sales Information

Sale Date	Price	Instrument Number	Instrument Type	Valid Sale or Other Reason	Document Type	Record Date	Land Court #	Land Court Cert
7/10/2020	$0	A75590752	Easements	Other	Grant of easement	9/11/2020		
2/17/2004	$0	04-036134	Easements		Grant of easement	2/23/2004		

Permit Information

Date	Permit Number	Reason	Permit Amount
12/9/2011	B20111358	Miscellaneous exterior improvement	$2,000
12/9/2011	B20111357	Miscellaneous exterior improvement	$2,000
12/9/2011	B20111356	Miscellaneous exterior improvement	$2,000
12/9/2011	B20111355	Miscellaneous exterior improvement	$2,000
12/9/2011	B20111354	Miscellaneous exterior improvement	$2,000

KIVA Permit Site

Recent Sales In Area

Sale date range:

From:
09/14/2018

To:
09/14/2021

Sales by Neighborhood

1500

Feet

Sales by Distance

Generate Owner List by Radius

Distance:

100

Fe

Use Address From:

(•) Owner ( ) Property

Select export file format:

Address labels (5160)

International mailing labels that exceed 5 lines are not supported on the Address labels (5160). For international addresses, please use the xlsx, csv or tab download formats.

Download

[x] Show All Owners

[ ] Show Parcel ID on Label

Skip Labels

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No data available for the following modules: Agricultural Assessment Information, Current Tax Bill Information, Historical Tax Information, Appeal Information, Home Exemption Information, Improvement Information, Commercial Improvement Information, Accessory Information, Sketches.

Appendix F Letter of Authorization

ASSOCATION OF APARTMENT OWNERS OF KANAI A NALU
250 Hauoli Street, Maalaea, Hawaii 96793

February 15, 2024

Ms. Kate Blystone, Director Department
of Planning County of Maui
250 South High Street
Wailuku, Maui, Hawaii 96793

Subject: Authorization for Land Use Permitting for the Kanai A Nalu condominium, Proposed Building Protection Project; for the property located at 250 Hauoli Street, Maalaea, Maui. TMK (2) 3-8-014-004 & (2) 3-8-014-005.

Dear Director Blystone:

There are two owners of the real property underlying the Kanai A Nalu condominium units.

Maalaea Beach LLC as owner of TMK (2) 3-8-014-004, and The Bruce Trust dated May 16, 1974 as owner of TMK (2) 3-8-014-005 hereby authorize Kapalaea Consultants LLC, to prepare, file, process and obtain all necessary permits and approvals for the development of the above-referenced project.

Thank you for your attention to this matter.

ASSOCIATION OF APARTMENT
OWNERS OF KANAI A NALU

By:____________________________
Kevin Robinson,
Its President

THE BRUCE TRUST, DATED
MAY 16, 1974

By: Lois M Bruce Trustee
Lois M. Bruce, Trustee

MAALAEA BEACH LLC
a Hawaii limited liability company

By:____________________________
Matthew W. Langa,
Its Co-Manager

By:____________________________
Franklyn H. Story
Its Co-Manager

STATE OF HAWAII)
) SS:
COUNTY OF MAUI)

On this 20 day of February, 2024, before me appeared Lois M. Bruce, Trustee, to me personally known, who, being by me duly sworn or affirmed did say that such person executed the foregoing instrument as the free act and deed of such person, and if applicable, in the capacity shown, having been duly authorized to execute such instrument in such capacity.

KRISTINE MAE G. CALIVA NOTARY PUBLIC No. 15-413 STATE OF HAWAII

Signature: [signature]
Name: Kristine Mae G. Caliva
Notary Public, State of Hawaii

My commission expires: 12/06/2027

(Official Stamp or Seal)

NOTARY CERTIFICATION STATEMENT

Document Identification or Description: Letter of Authorization

Doc. Date: 2/15/2024 or ☐ undated at the time of execution

No. of Pages: 5 Jurisdiction: Second Circuit
(in which notarial act is performed)

[signature] 2/20/2024

Signature of Notary Date of Notarization and Certification Statement

KRISTINE MAE G. CALIVA NOTARY PUBLIC No. 15-413 STATE OF HAWAII

Kristine Mae G. Caliva

Printed Name of Notary (Official Stamp or Seal)

Date of notary commission expiration: 12/06/2027

ASSOCATION OF APARTMENT OWNERS OF KANAI A NALU
250 Hauoli Street, Maalaea, Hawaii 96793

February 15, 2024

Ms. Kate Blystone, Director Department
of Planning County of Maui
250 South High Street
Wailuku, Maui, Hawaii 96793

Subject: Authorization for Land Use Permitting for the Kanai A Nalu condominium, Proposed Building Protection Project; for the property located at 250 Hauoli Street, Maalaea, Maui. TMK (2) 3-8-014-004 & (2) 3-8-014-005.

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Thank you for your attention to this matter.

ASSOCIATION OF APARTMENT
OWNERS OF KANAI A NALU

By:____________________________
Kevin Robinson,
Its President

THE BRUCE TRUST, DATED
MAY 16, 1974

By:____________________________
Lois M. Bruce, Trustee

MAALAEA BEACH LLC
a Hawaii limited liability company

By:____________________________
Matthew W. Langa,
Its Co-Manager

By:____________________________
Franklyn H. Story
Its Co-Manager

STATE OF ~~HAWAII~~ Arizona)
) SS:
COUNTY OF ~~MAUI~~ Pima)

On this 21 day of February, 2024, before me appeared Franklin Hayward Story, to me personally known, who, being by me duly sworn or affirmed did say that such person executed the foregoing instrument as the free act and deed of such person, and if applicable, in the capacity shown, having been duly authorized to execute such instrument in such capacity.

ALEXANDER RACY
Notary Public - State of Arizona
PIMA COUNTY
Commission # 635343
Expires August 23, 2026

Signature: [signature]
Name: Alexander Racy
Notary Public, State of ~~Hawaii~~ Arizona

My commission expires: 8/23/2026

(Official Stamp or Seal)

NOTARY CERTIFICATION STATEMENT

Document Identification or Description: Authorization for Land Use Permitting for the Kana'i A Nalu condominium, Proposed Building Protection Project; for the property located at 250 Hauoli Street Maalaea, Maui. TMK (2) 3-8-014-004 and (2) 3-8-014-005

Doc. Date: 2/15/2024 or ☐ undated at the time of execution

No. of Pages: 1 Jurisdiction: Second Circuit

(in which notarial act is performed)

[signature] 2/21/2024

Signature of Notary | Date of Notarization and Certification Statement

ALEXANDER RACY
Notary Public - State of Arizona
PIMA COUNTY
Commission # 635343
Expires August 23, 2026

Alexander Racy

Printed Name of Notary

(Official Stamp or Seal)

Date of notary commission expiration: 8/23/2026

ASSOCATION OF APARTMENT OWNERS OF KANAI A NALU
250 Hauoli Street, Maalaea, Hawaii 96793

February 15, 2024

Ms. Kate Blystone, Director Department
of Planning County of Maui
250 South High Street
Wailuku, Maui, Hawaii 96793

Subject: Authorization for Land Use Permitting for the Kanai A Nalu condominium, Proposed Building Protection Project; for the property located at 250 Hauoli Street, Maalaea, Maui. TMK (2) 3-8-014-004 & (2) 3-8-014-005.

Dear Director Blystone:

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Thank you for your attention to this matter.

ASSOCIATION OF APARTMENT
OWNERS OF KANAI A NALU

By: ______________________
Kevin Robinson,
Its President

THE BRUCE TRUST, DATED
MAY 16, 1974

By: ______________________
Lois M. Bruce, Trustee

MAALAEA BEACH LLC
a Hawaii limited liability company

By: ______________________
Matthew W. Langa,
Its Co-Manager

By: ______________________
Franklyn H. Story
Its Co-Manager

STATE OF ~~HAWAII~~ Washington)
) SS:
COUNTY OF ~~MAUI~~ Spokane)

On this 20th day of February, 2024, before me appeared Kevin Robinson, to me personally known, who, being by me duly sworn or affirmed did say that such person executed the foregoing instrument as the free act and deed of such person, and if applicable, in the capacity shown, having been duly authorized to execute such instrument in such capacity.

C N BODEAU NOTARY PUBLIC 149858 COMMISSION EXPIRES SEPTEMBER 14, 2026 STATE OF WASHINGTON

(Official Stamp or Seal)

Signature: CBodeau
Name: C N Bodeau
Notary Public, State of ~~Hawaii~~ Washington

My commission expires: September 14, 2026

NOTARY CERTIFICATION STATEMENT

Document Identification or Description: Association of Apartment Owners of Kanai A Nalu
Authorization for land use permitting

Doc. Date: 2/15/2024 or ☐ undated at the time of execution

No. of Pages: 1 Jurisdiction: Second Circuit
(in which notarial act is performed)

CBodeau 2/20/24

Signature of Notary Date of Notarization and Certification Statement

C N BODEAU NOTARY PUBLIC 149858 COMMISSION EXPIRES SEPTEMBER 14, 2026 STATE OF WASHINGTON

CNBodeau (Official Stamp or Seal)

Printed Name of Notary

Date of notary commission expiration: 09/14/26

ASSOCATION OF APARTMENT OWNERS OF KANAI A NALU
250 Hauoli Street, Maalaea, Hawaii 96793

February 15, 2024

Ms. Kate Blystone, Director Department
of Planning County of Maui
250 South High Street
Wailuku, Maui, Hawaii 96793

Subject: Authorization for Land Use Permitting for the Kanai A Nalu condominium, Proposed Building Protection Project; for the property located at 250 Hauoli Street, Maalaea, Maui. TMK (2) 3-8-014-004 & (2) 3-8-014-005.

Dear Director Blystone:

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Thank you for your attention to this matter.

ASSOCIATION OF APARTMENT
OWNERS OF KANAI A NALU

By:____________________________
Kevin Robinson,
Its President

THE BRUCE TRUST, DATED
MAY 16, 1974

By:____________________________
Lois M. Bruce, Trustee

MAALAEA BEACH LLC
a Hawaii limited liability company

By:____________________________
Matthew W. Langa,
Its Co-Manager

By:____________________________
Franklyn H. Story
Its Co-Manager

STATE OF HAWAII) SS: 2nd C

COUNTY OF MAUI)

On this 27 day of February, 2024 before me appeared Matthew Langa, to me personally known, who, being by me duly sworn or affirmed did say that such person executed the foregoing instrument as the free act and deed of such person, and if applicable, in the capacity shown, having been duly authorized to execute such instrument in such capacity.

ANGELA SCHWARZ NOTARY 23-304 PUBLIC STATE OF HAWAII

Signature: Angela Schwarz
Name: Angela Schwarz
Notary Public, State of Hawaii

My commission expires: 12/10/2027

(Official Stamp or Seal)

NOTARY CERTIFICATION STATEMENT

Document Identification or Description:

Doc. Date: 2/15/2024 or ☐ undated at the time of execution

No. of Pages: 1 Jurisdiction: Second Circuit
(in which notarial act is performed)

Angela Schwarz
Signature of Notary

Date of Notarization and Certification Statement 2/27/2024

Angela Schwarz
Printed Name of Notary

(Official Stamp or Seal)

Date of notary commission expiration: 12/10/2027

ANGELA SCHWARZ NOTARY 23-304 PUBLIC STATE OF HAWAII

Appendix G Orientation Photos

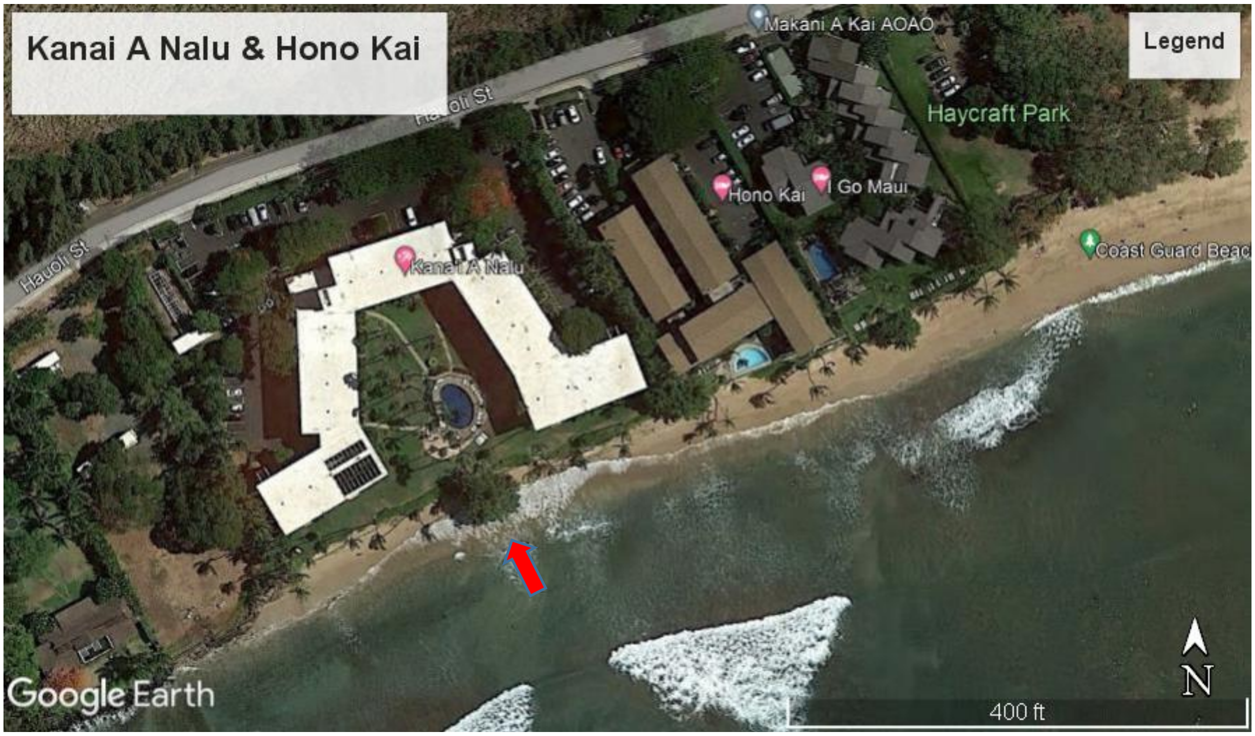
Orientation Photos
Adaptation Pathways: Seawall Removal and Dune Restoration

250 Hauoli Street
Wailuku (Maalaea), HI 96793
TMK: (2) 3 8 014 004 & (2) 3 8 014 005

Pictures as of September 15, 2021 – Google Images from 1985

Photograph 1. Kanai A Nalu in Regional Context

KAPALAEA CONSULTANTS LLC



Photograph 2. Kanai A Nalu Parcels 004 & 005

Photograph 3. Looking East on Hauoli Street


Photograph 4. Looking West on Hauoli Street

Photograph 5. East Driveway

Photograph 6. West Driveway

Photograph 7. Parking Lot Looking West

Photograph 8. Rear Yard East Corner Looking West – Location of Geotextile Burrito and Native Plant Dune.

Photograph 9. Rear Yard Looking West - Pool to Right - – Location of Geotextile Burrito and Native Plant Dune.

Photograph 10. Rear Yard Looking East - Pool to Left - – Location of Geotextile Burrito and Native Plant Dune.

Photograph 11. Rear Yard Looking West - Pool to Right - – Location of Geotextile Burrito and Native Plant Dune.

Photograph 12. West Corner Looking East - – Location of Geotextile Burrito and Native Plant Dune.


Photograph 13. Section 1 Seawall Looking East

Photograph 14. Section 1 Seawall Looking West

Photograph 15. Section 1 Seawall

Photograph 16. Section 2 Looking East


Photograph 17. Section 2 Looking East

Photograph 18. Section 3 Seawall Looking East

Photograph 19. Section 3 (center of photo) Looking West. Hono Kai at Right

Photograph 20. Section 2 Looking Onshore


Photograph 21. Looking West Along Shore

Photograph 22. Looking East Along Shore

Photograph 23. Looking Onshore Section 2

Photograph 24. Looking East Along Shore

Photograph 25. Rear Yard with Pool

Photograph 26. Looking Offshore Section 2

Photograph 27. Looking Offshore Section 2


Photograph 288. Stair Location – East Property Boundary

Appendix H County of Maui SMA Assessment: Sheet Pile Comments

MICHAEL P. VICTORINO
Mayor

MICHELE CHOUTEAU MCLEAN, AICP
Director

JORDAN E. HART
Deputy Director

DEPARTMENT OF PLANNING
COUNTY OF MAUI
ONE MAIN PLAZA
2200 MAIN STREET, SUITE 315
WAILUKU, MAUI, HAWAII 96793

June 30, 2022

Mr. Kevin Robinson, President, Board of Directors
Kanai A Nalu AOAO
250 Hauoli Road
Wailuku, Hawaii 96793

Dear Mr. Robinson:

SUBJECT: COMMENTS TO PROPOSED CONTINUOUS SHEET PILE WALL IN THE SHORELINE SETBACK AREA, REQUEST FOR MORE INFORMATION AND NEXT STEPS OUTLINED FOR KANAI A NALU AOAO LOCATED AT 250 HAUOLI STREET, WAILUKU, ISLAND OF MAUI, HAWAII; TMKS: (2) 3-8-014:004 AND :005 (SMX 2021/0393) (SSA 2021/0052)

The purpose of this letter is to provide comments and request more information as well as to outline a potential planning process with respect to your subject Special Management Area (SMA) and Shoreline Setback Assessment (SSA) permit application request. The Planning Department (Department) understands that your subject permit application proposes to provide for proactive interim erosion control while Kanai A Nalu pursues a long-term solution to continued coastal erosion. Since the Department has received multiple, independent written correspondences, this response is to you, as the applicant, with a copy to Mr. Anders Lyons, Applicant's planning consultant. The Department has been in communications with both of you on multiple occasions and understands and appreciates this application as the next-steps planning approach required to solve ongoing coastal erosion situation at the Kanai A Nalu shoreline.

The Department has read through a recent letter dated March 28, 2022 submitted independently by yourself, Kevin Robinson, President Board of Directors, as well as the subject SMA and SSA permit applications received on October 25, 2021. You shared the latest pictures of the collapsed western seawall at Kanai A Nalu. From multiple site visits, the Department has witnessed the progression of your erosion over time, from an incipient sink hole to today's continued erosion. The Department appreciates the Board of Directors' concerns for minimizing the erosion as well as your proactive communications with the Department. The buildings at Hono Kai, your neighbor, are in the same situation, if not more at risk, due to the makai location of all the buildings. As we have discussed previously, undertaking a beach-cell level management approach may be prudent and timely. This letter responds to your pending application and highlights regulatory constraints that must be addressed as you move forward with your current application and future shoreline management efforts.

As detailed further here, while the Board of Directors may apply for a Shoreline Setback Variance, which is not a permit but a variance to the law, along with a Special Management Area Major Use Permit, a modified scope of work is encouraged. The sheet pile structure that is currently proposed is considered hardening of the shoreline. A sheet pile hardening structure placed in the shoreline setback area is not allowed by the Shoreline Rules. Therefore, should Kanai A Nalu seek to continue to pursue its SMA and SSA applications, more information will be needed to support the processing of a major SMA permit and shoreline setback variance.

The Department provides the following recommendations and considerations to provide further support as you work to revise the scopes of the current applications.

1) **Request for More Information: Proposed Application for a Sheet Pile Wall Requires a Shoreline Setback Variance in order to Proceed**

The Department has reviewed your subject applications and has initially determined that your request for a significant continuous sheet pile wall, valued at $2.2 million and constructed in the shoreline setback area, is a major new development that will require a SMA Major Use Permit and a Shoreline Setback Variance – your subject application to the Department acknowledges these permitting requirements. A variance means an exception to prohibition for a non-minor structure that is located in the shoreline setback area.

The scope of the project is determined to be a new seawall and new shoreline hardening. The *Shoreline Rules for the Maui Planning Commission* (Shoreline Rules) only allow for minor structures with a valuation up to $125,000 to be constructed in the shoreline setback area, with the caveat that the minor structure will not have impact on beach processes. Any proposed structures beyond this limited scope requires a Shoreline Setback Variance application.

To date, the Department has authorized effective temporary protection at the shoreline that complies with the Shoreline Rules as SM3 2020/0001. This adequate protection continues.

Additionally, under Act 16, September 2020, amending the Coastal Zone Management Act HRS 205 A, as amended, new shoreline hardening is prohibited on shorelines for private parcels fronting active beaches. The shoreline at Kanai A Nalu has remained an active sandy beach.

2) **Request for More Information: Environmental Assessment is required if a**

<u>Shoreline Setback Variance is Pursued</u>.

An application for a Shoreline Setback Variance requires an environmental assessment to be completed in order to understand the environmental setting as well as the range of options with respect to the preferred option of the proposed continuous sheet pile wall. This variance application to the permit process will require a public hearing and is a discretionary with the Maui Planning Commission. The Department requests that, as part of the required Variance Environmental Assessment, you development a beach restoration project as a viable alternative to hardening your shoreline. Recognizing your situation with limited options, the County of Maui has been supporting Kanai A Nalu and your neighbors via County funding, planning advice, and limited project management for a beach restoration development plan as a preferred option. It is encouraged that Kanai A Nalu and Hono Kai discuss potential alternatives and funding mechanisms to undertake a beach-cell level environmental assessment that could support project needs at both locations, as any intervention at one parcel would likely need to assess neighboring conditions and potential direct, indirect, and cumulative activities that are reasonably foreseeable at both sites.

3) **<u>Request for More Information: Provide Evidence of Time Extensions for the Emergency Erosion Control Measures that remain in Place via SM3 20200001 permit</u>**

Previously, via Emergency Permit authorization SM3 2020/0001, dated April 30, 2020, both failed sections of walls do now have fortification behind them to provide protection of at-risk buildings for the time being. From site visits, experience, and review of the subject applications, the Department believes the non-engineered seawall fronting Kanai A Nalu, described as being constructed in the 1940s, has reached the end of its useful life. The ocean and waves no longer "see" the dilapidated walls and move right through the debris at the shoreline. The Department notes that a similar rock and mortar sea wall on the adjacent parcel to the north has also failed and was required to be removed by the State Department of Land and Natural Resources Office of Conservation and Coastal Lands (DLNR-OCCL) in order to certify the shoreline locations prior to any future development.

4) **<u>Summary of County Efforts to Promote a Regional Beach Restoration as a Preferred Alternative Interim Coastal Erosion Mitigation Alternative</u>**

The Department notes that beach restoration for the regional Maalaea beach cell represents an interim coastal erosion mitigation alternative to Kanai A Nalu as a preferred solution over a continuous sheet pile wall. Besides authorizing emergency protective measures that remain in place since 2020, the Department has been supporting the regional efforts of the Maalaea Village Association and all the condominiums along Hau'oli Steet to determine the best path forward to manage your ongoing coastal erosion. These efforts include two substantial tranches of County of Maui funds dedicated to offshore geophysical prospecting in order to understand availability of offshore sand deposits that would be suitable for protective beach restoration – exploration for offshore sand resources is a first step to determining the next steps for beach restoration. A smaller dollar component, yet important component, of these County-funded studies is to examine the potential options for relocating at-risk structures, to include infrastructure, more mauka out of harm's way. On multiple site visits, the Department has identified at-risk structures that most likely will be required to be relocated – not if, but when. For your information, in order to gain community support for beach restoration at Maalaea, the Department advises you to pursue managed retreat options for at-risk structures at the same time as exploring options for beach restoration.

The County's next step is to hold general public meetings to further support the beach restoration with options for limited managed retreat for at risk structures and infrastructure. Most likely, the County will conduct a community informational meeting regarding project results and a path forward in September 2022.

5) **<u>Request for More information: Additional Planning Steps to Continue for Kanai A Nalu</u>**

To support the development and implementation of a more comprehensive solution, the Department recommends the following important planning steps for future planning and permitting at Kanai A Nalu.

a) **Step One: Plan to remove all failed sections of both seawalls from the shoreline.** Please gain construction estimates to demolish and remove all sections of collapsed seawalls. From recent site visits, both the remaining 90-foot and 130-foot seawall structures have failed. Seawall structures on both ends will have to be totally removed, similar to the middle section. The collapsed sections of seawalls are a safety hazard and should be removed for safety purposes. Plus, this action will allow the shoreline to equilibrate naturally and will allow for the State to certify the shoreline.

b) **Step Two: Complete the Shoreline Certification Map Process with State of Hawaii.**
As a Step Two, to continue any type of shoreline work will require a State Certified Shoreline Map which, most likely, first will require removal of all failed rocks and debris from the shoreline. This Certified Shoreline Map is an immediate step that will take some time to obtain if State Department of Land and Natural

Resources (DLNR) Board of Land and Natural Resources (BLNR) identifies encroachments (e. g. failed seawall remnants) that are to be removed. The most recent State Certified Shoreline is dated July 15, 2011. Further work at the shoreline will require an updated State Certified Shoreline. The subject application includes a shoreline survey dated June 24, 2021 that will remain valid with this permit. This shoreline map that is not certified and must be certified by the State of Hawaii DLNR Board of Land and Natural Resources.

c) **Step Three: Gain an Understanding for Demolition Costs for the Two Wing Buildings.**
As a Step Three, the Kanai A Nalu BOD could authorize an independent estimate as to the ball park cost to demolish these two wing buildings and to rebuild these same or similar buildings in a more protected mauka location on the property. Obtaining these costs are critical to future decision making for Kanai A Nalu. The Department understands that your condominium property will continue to be impacted by coastal erosion and sea level rise. The only structures threatened currently are the condominium structures that are located too close to the shoreline – the two "wing structures" located on the east and west ends of the entire complex. The other condominium structures are not threatened by coastal erosion at least in the interim time frame. This known impact demands that the Kanai A Nalu Board of Directors and unit owners begin to seriously plan to retreat at least the two wing condominiums that you are now actively attempting to protect via emergency permits as well as proactive planning. Both building wings closest to the ocean appear to be independent structures from the more mauka U-shaped building complex. Both these wing buildings are at risk from continued sea level rise and episodic coastal erosion. As independent structures, both could be relocated mauka as a viable long-term solution. No matter what protective shoreline solutions are implemented, both wing buildings will reach their useful lifespan and will become severely threatened by sea level rise and episodic storm wave events that your shoreline has previously experienced. Using the PACIOOS Hawaii Sea Level Rise Viewer, please consider and, as needed, develop a "mitigation program" to address current and projected future sea level change that includes discussion of the useful life of proposed interventions and "triggers" that would prompt specific mitigation activities.

d) **Step Four: Continue to monitor for potential sink holes on the shoreline lawn fronting the two wing building structures.**
Closely monitoring for any additional sinkholes is important. Via a recent permit, SM3 20200001, dated April 30 2020, the Department authorized expanded sinkhole repairs on the western seawall for its entire length. Details of the remedial fix are described in the permit. Thus, Kanai A Nalu does have temporary erosion control behind the collapsed western seawall and the building.

The eastern end had authorized bulk bags as part of the shoreline erosion protection mainly to minimize wave run up. However, the deployment of the sandbags went well beyond the described action as well as beyond the permit authorization.

e) **Step Five: As President and as the consultant, the two of you should work with the Board of Directors and the unit owners to communicate the impacts of sheet pile walls.**
Although the Applicant describes the social impact of sheet pile walls as minimal, the social impact of sheet pile walls on Maui most likely have the potential to become cumulatively and significantly impactful. Sheet pile by itself requires significant engineering to anchor and protect from wave impacts as well as mauka ground water forces. From the Department's understanding, sheet pile must be engineered, with anchors, to withstand impacts of waves. In turn, sheet pile exposed to direct waves will impact shoreline processes, will prohibit the natural flow of the beach and fix the shoreline – these are criteria to avoid, as described in the Shoreline Rules. Although the applicant claims minimal visual impact, it will have significant visual impact when exposed and most likely, from experience, create end effects to neighboring properties. Plus, from experience, ocean waves will penetrate the sheet pile, requiring more expense for additional protective work. The structure is described as smaller but will most likely be more significantly impactful in that it will have the potential to eliminate the beach fronting the sheet pile, the effects of which would need to be assessed and addressed further.

f) **Step Six: Pursue an Environmental Assessment with your Neighbors.**
The Department understands that your request is for preventative actions. The Department advises not to pursue a shoreline setback variance for installation of a sheet pile wall but rather to first pursue an Environmental Assessment with the other condos using a portion of the designated $2.2 million allocated for the sheet pile wall proposal to assess and develop a beach-cell level solution to this management challenge.

A past condition with the SMA Emergency Permit SM3 20200001included the following: "9) That the Applicant coordinate future work at the west end and the east end with your adjoining neighbor parcels, at minimum, to discuss mitigation options that can benefit each other's properties in a time-effective and cost-effective manner that also minimizes the impacts to each of the adjoining properties."

Thank you for your cooperation. If additional clarification is required, please contact James Buika, Coastal Resource Planner by email at james.buika@mauicounty.gov or by phone at (808) 270-6271.

Sincerely,

ANN T. CUA
Planning Program Administrator

xc:

Michele Chouteau McLean, AICP, Planning Director (PDF)
Jackie Takakura, Acting Planning Program Administrator (PDF)
James Buika, Coastal Resource Planner (PDF)
Tara Owens, University of Hawaii Sea Grant College, Maui (PDF)
Erin Derrington, Shoreline Planner (PDF)
Department of Land and Natural Resources-Office of Conservation and Coastal Lands (PDF)
Kevin Robinson, President, Board of Directors Kanai A Nalu AOAO (PDF)
Anders Lyons, Applicant's Representative (PDF)
Andy Bohlander, Coastal Scientist, Sea Engineering (PDF)

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Appendix I Beach Erosion Management Plan – Sea Engineering, Inc.

Kanai A Nalu Beach Management & Erosion Response Plan

Maalaea, Maui, Hawaii

July 2019

Prepared for:
Kanai A Nalu AOAO
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Job No. 25677

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- Ground photographs presented in this report were taken on January 7, 2019, unless otherwise noted
- Cost estimates are for construction only and do not include costs for design, environmental review, or permitting.

1. INTRODUCTION

1.1 Background

This report has been prepared to support the development of a *Beach Management and Erosion Response Plan (BMERP)* for Kanai A Nalu (KAN). The project site is located along the Maalaea shoreline on the southwest coast of Maui. The KAN shoreline has a history of chronic and episodic erosion that has caused structural damage and permanent loss of land. Sea Engineering, Inc. (SEI) has been contracted to assist KAN in evaluating options to restore and maintain the existing beach and provide long-term protection for the backshore land and infrastructure.

SEI conducted a site visit to collect the data and information necessary to understand the erosion problem and evaluate potential engineering solutions that are appropriate for the project site conditions. The purpose of this report is to describe the existing site conditions and present recommendations for potential beach management and erosion response solutions.

1.2 Project Site

The KAN property is located at 250 Hauoli Street, Wailuku, Maui, HI 96793; Tax Map Keys (2) 3-8-014:004 & 005. The project site consists of approximately 370 linear feet of shoreline along the Maalaea coastline on the southwest coast of Maui. The project is bounded by Hauoli Street to the north and the Pacific Ocean to the south. The project site is bounded to the east by the Hono Kai Condominiums and a privately-owned residential parcel to the west. Aerial photographs showing the location of the project site are shown in Figure 1-1 and Figure 1-2.

1.3 Erosion History

The Maalaea shoreline has a documented history of erosion. Construction of Maalaea Harbor in 1952 resulted in the loss of 1,500 feet of narrow beach to the east of the harbor, which led to construction of shore protection structures (i.e., seawalls and revetments) that currently extend 2,400 feet east of the harbor to Haycraft Park, a 6.5-acre public beach park that is managed by the County of Maui. The KAN property is located at the transition between armored shoreline that extends west to Maalaea Harbor and unarmored shoreline that extends east to North Kihei.

Coastal erosion along the KAN shoreline was evaluated by the University of Hawaii Coastal Geology Group (CGG). The CGG used historical aerial photographs from 1900 to 1997 to determine historical rates of shoreline change. The CGG determined that the beach fronting KAN has been eroding at an average rate of 1.0 feet/year. The KAN property is located in the Maalaea Bay Beach littoral cell. The U.S. Army Corps of Engineers (2011) determined that erosion has reduced the volume of sand in the Maalaea Bay Beach littoral cell by an average of 800 cubic yards per year.

KAN conducted beach restoration in 1997 to mitigate erosion and undermining of the seawalls. Sand replenishment of approximately 1,500 cubic yards took place three times from 1997 to 1998 but much of the sand was gone by 2001. KAN conducted beach restoration again in 2003. The project consisted of the placement of 3,000 cubic yards of inland dune sand.

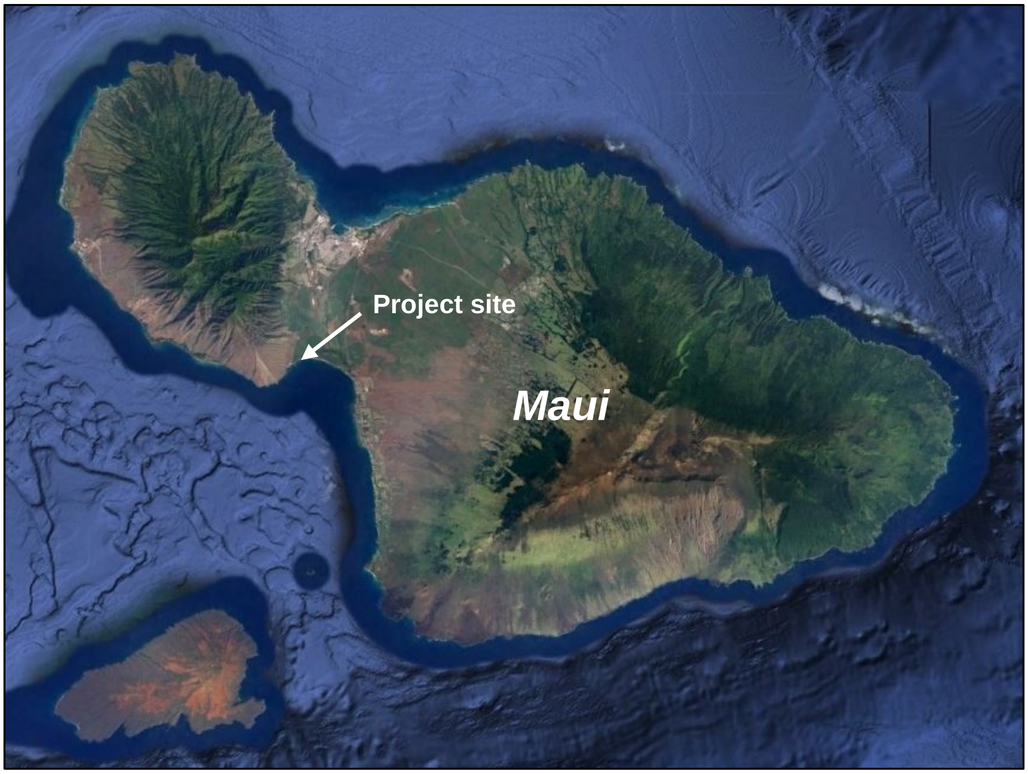

Figure 1-1 Project site location on the Island of Maui (Google Earth)

Figure 1-2 Project site location in Maalaea Bay, Maui (Google Earth)

2. PHYSICAL SETTING

2.1 Geology & Soils

The surficial geology of the low-lying Maalaea coastal plain is primarily composed of younger alluvium (Holocene and Pleistocene) (Sherrod et al., 2007). From the USDA Soil Conservation Service "Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii," the project site is located in an area designated as Kealia silt loam (KMW). This series consists of somewhat poorly drained and poorly drained soils on coastal flats on the islands of Molokai and Maui. On this soil, permeability is moderately rapid. Runoff is slow to very slow, and the erosion hazard of water is not more than slight, but the hazard of wind erosion is severe when the soil is dry and the surface layer becomes loose and fluffy (USDA, 1972, pg. 67, Plate 101).

2.2 Bathymetry

Nearshore water depths range from 0 to 30 feet relative to mean sea level (msl) on the inner reef flat, which extends approximately 1,500 feet offshore. Water depths beyond the reef flat range from 30 to 60 feet before dropping off into deeper waters offshore.

2.3 Benthic Habitat

The National Oceanic and Atmospheric Administration (NOAA) classifies the seafloor offshore of the project site as sand and uncolonized reef flat with 10% to 50% macroalgae coverage. The U.S. Fish and Wildlife Service (USFWS) classifies the nearshore waters as marine, intertidal, unconsolidated shore, that is regularly flooded. The Hawaii Department of Health (DOH) classifies the nearshore waters as Class A Marine Waters (DOH, 2014). The USFWS classifies the offshore coastal waters as marine, subtidal, unconsolidated bottom, and subtidal.

2.4 Zoning & Land Uses

The KAN property is situated along approximately 2,400 feet of predominantly armored shoreline that extends from Maalaea Harbor to Haycraft Park. The backshore is densely developed with eight (8) condominium complexes and two (2) privately-owned parcels that are zoned A-2 Apartment. The area between Hauoli Street and the shoreline is located in the Special Management Area (SMA) and Urban Land Use District. The area seaward of the shoreline is located in the Resource Subzone of the Conservation District (CD).

2.5 Coastal Uses

The Maalaea area is home to several residential condominiums, visitor accommodations, a boat harbor with restaurants, retail shops, and the Maui Ocean Center. The project site shoreline is primarily used for recreational purposes. Public parking and shoreline access are available at Haycraft Park, east of the project site. The shoreline west of the project site is predominantly armored so lateral shoreline access is limited.

2.6 Sea Level Rise

The present rate of global mean sea level change (SLC) is +3.4 ± 0.4 mm/year (NOAA, 2017), where a positive number represents a rising sea level. SLC appears to be accelerating compared to the mean of the 20th Century. Factors contributing to the measured rise in sea level include decreasing global ice volume and warming of the ocean. The historical rate of relative sea level change at Kahului Harbor (station 1615680) is +2.18 ± 0.41 mm/yr (Figure 2-1). This trend is based on monthly mean sea level data from 1947 to 2018, which is equivalent to a change of 0.72 feet in 100 years (NOAA, 2019).

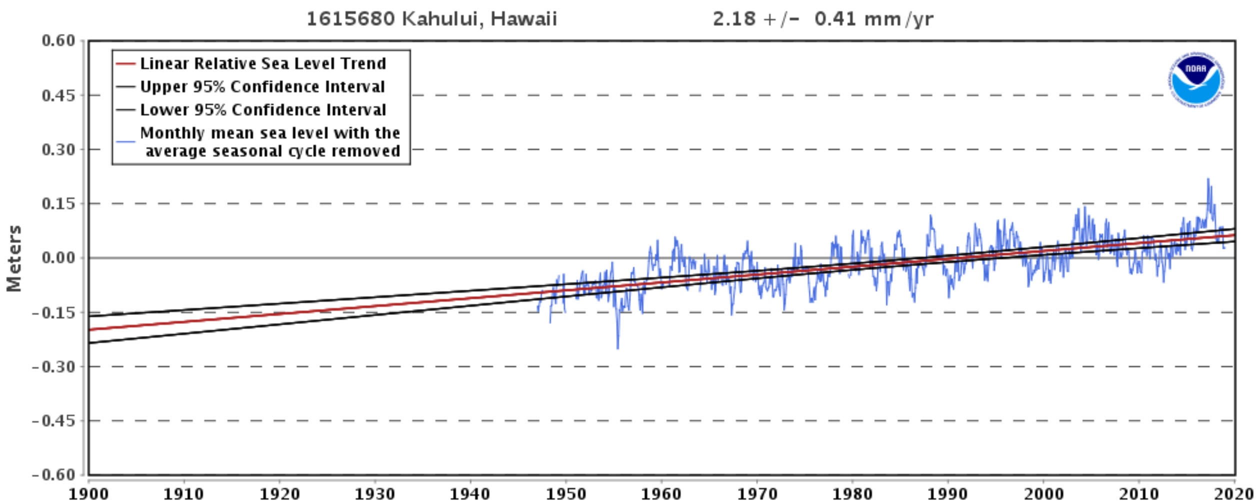

Figure 2-1 Sea level change trend at Kahului Harbor, 1947 to 2018 (NOAA, 2019)

The National Oceanic and Atmospheric Administration (NOAA) recently revised their sea level change projections through the year 2100 taking into account up-to-date scientific research and measurements. NOAA is projecting that global sea level rise as shown by their "Extreme" scenario could be as high as 8.2 feet by the year 2100. NOAA's 2017 report also identifies specific regions that are susceptible to a higher than average rise in sea level. Hawaii has thus far experienced a rate of sea level rise that is less than the global average; however, this is expected to change. Hawaii is in the "far field" of the effects of melting land ice. This means that those effects have been significantly less in Hawaii compared to areas closer to the ice melt. Over the next few decades, this effect is predicted to spread to Hawaii, which is then projected to experience sea level rise greater than the global average.

Table 2-2 and Figure 2-2 present mean sea level rise scenarios for Hawaii based on the revised NOAA projections, taking into account the far-field effects. While the projections are based on the most current scientific models and measurements, discretion is necessary in selecting the appropriate scenario. Selecting the appropriate sea level change projection is a function of many parameters, including topography, coastal setting, criticality of infrastructure, potential for resilience, budget, and function.

Table 2-1 Global mean sea level rise scenarios (in feet)

Scenario	2010	2020	2030	2040	2050	2060	2070	2080	2090	2100
Low	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Intermediate-Low	0.1	0.3	0.4	0.6	0.8	1.0	1.1	1.3	1.5	1.6
Intermediate	**0.1**	**0.3**	**0.5**	**0.8**	**1.1**	**1.5**	**1.9**	**2.3**	**2.8**	**3.3**
Intermediate-High	0.2	0.3	0.6	1.0	1.4	2.0	2.6	3.3	3.9	4.9
High	0.2	0.4	0.7	1.2	1.8	2.5	3.3	4.3	5.6	6.6
Extreme	0.2	0.4	0.8	1.3	2.1	3.0	3.9	5.2	6.6	8.2

(NOAA, 2017)

Table 2-2 Hawaii mean sea level rise scenarios (feet)

Scenario	2010	2020	2030	2040	2050	2060	2070	2080	2090	2100
Low	0.1	0.2	0.3	0.5	0.6	0.7	0.9	1.0	1.2	1.3
Intermediate-Low	0.1	0.3	0.5	0.7	0.9	1.1	1.4	1.6	1.9	2.1
Intermediate	**0.1**	**0.4**	**0.6**	**1.0**	**1.3**	**1.8**	**2.3**	**2.9**	**3.5**	**4.2**
Intermediate-High	0.2	0.4	0.7	1.1	1.7	2.4	3.2	4.1	5.0	6.3
High	0.2	0.4	0.8	1.4	2.1	3.0	4.0	5.3	7.0	8.4
Extreme	0.2	0.4	0.9	1.6	2.4	3.5	4.8	6.5	8.3	10.5

(Adapted from NOAA, 2017)

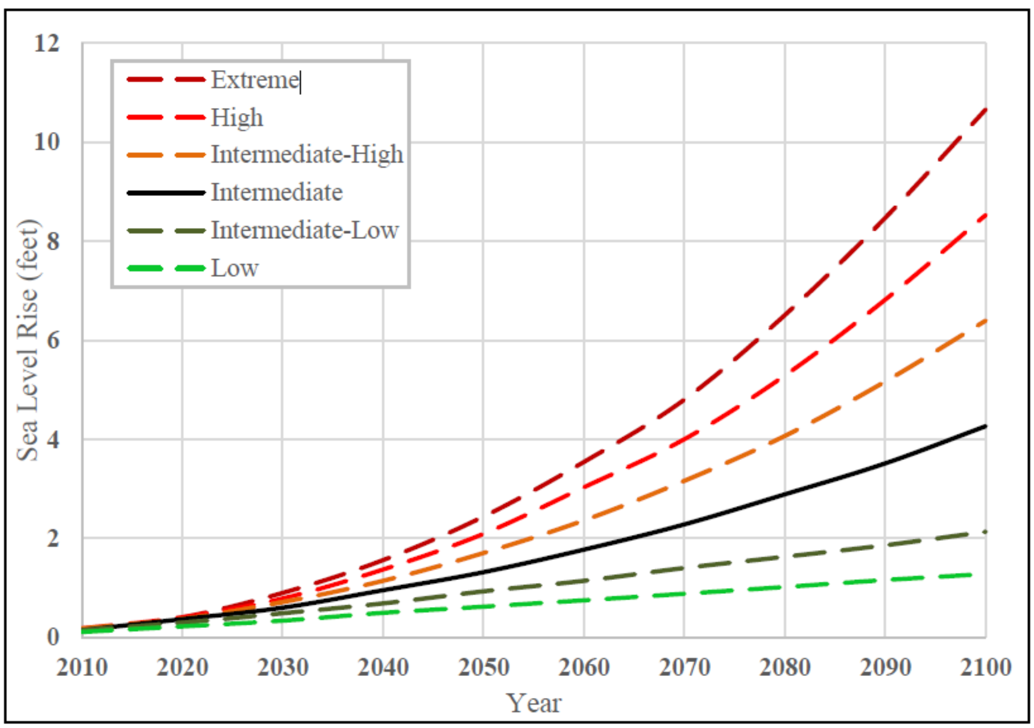

Figure 2-2 Hawaii Local Mean Sea Level Rise Projections (feet)

(Adapted from NOAA, 2017)

A regional climate assessment for Hawaii and the U.S. affiliated Pacific Islands was published in 2018 (USGCRP, 2018). The assessment found that rising sea levels, coupled with high water levels caused by tropical and extra-tropical storms, will incrementally increase coastal flooding and erosion, damage coastal ecosystems, infrastructure, and agriculture, and negatively affect tourism. An important conclusion of the regional assessment is that NOAA's revised *Intermediate* rate is recommended for planning and design purposes in Hawaii. The *Intermediate* scenario projects that sea level in Hawaii will rise 1.3 feet by the year 2050 and 4.2 feet by the year 2100 (Table 2-2 and Figure 2-2). SEI participated in the Hawaiian Islands and Affiliated Pacific Islands climate assessment team, which contributed to the 4th National Climate Assessment. The consensus from the regional team, which included representatives from NOAA, USGS, and UH, was that the *Intermediate-High* scenario projections are recommended for planning purposes in Hawaii. The *Intermediate-High* scenario projects that sea level in Hawaii will rise 1.7 feet by the year 2050 and 6.3 feet by the year 2100.

It is anticipated that sea level rise will negatively impact beaches and shorelines in Hawaii. Impacts may include beach narrowing and beach loss, loss of land due to erosion, and infrastructure damage due to inundation and flooding. Anderson et.al. (2015) found that, due to increasing sea level rise, average shoreline recession (erosion) in Hawaii is expected to be nearly twice the historical extrapolation by the year 2050, and nearly 2.5 times the historical extrapolation by the year 2100. The impacts from anomalous sea level events (e.g., El Nino, king tides, mesoscale eddies, storm surge) are also likely to increase.

The State of Hawaii recently published the *Sea Level Rise Vulnerability and Adaptation Report for Hawaii*, which discusses the anticipated impacts of projected future sea level rise on coastal hazards, and the potential physical, economic, social, environmental, and cultural impacts of sea level rise in Hawaii (State of Hawaii, 2018). A key component of the report was a numerical modeling effort by the University of Hawaii (UH) to estimate the potential impacts of a 3.2-foot rise in sea level.

UH used the best available science on climate change and sea level rise from the Intergovernmental Panel on Climate Change (IPCC) Assessment Report 5 (AR5). The UH numerical modeling is based on the upper end of the IPCC AR5 representative concentration pathway (RCP) 8.5 sea level rise scenario, which predicts up to 3.2 feet of global sea level rise by the year 2100. However, based on recent peer-reviewed publications, it is possible that sea level rise could be significantly greater than the RCP 8.5 sea level rise scenario by the end of this century. Sweet et al. (2017) suggest that global mean sea level rise in the range of 6.4 feet to 8.8 feet is physically plausible by the end of this century, which is much higher than the worst-case IPCC AR5 projections.

UH modeled the potential impacts that a 3.2-foot rise in sea level would have on coastal hazards including passive flooding, annual high wave flooding, and coastal erosion. The footprint of these three hazards were combined to define the projected extent of chronic flooding due to sea level rise, referred to as the *sea level rise exposure area (SLR-XA)*. Flooding in the SLR-XA is associated with long-term, chronic hazards punctuated by annual or more frequent flooding events. The UH model results are presented in Figure 2-3 through Figure 2-6.

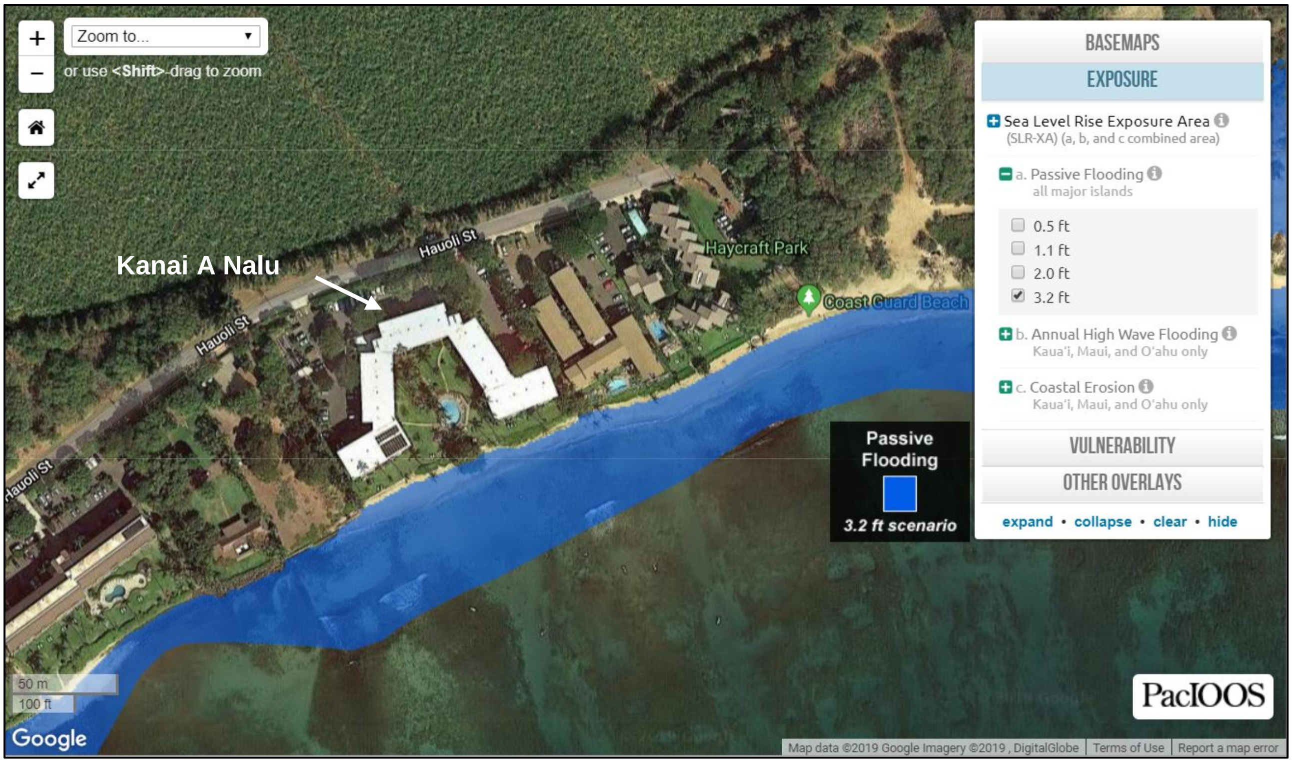

Figure 2-3 Passive flooding with 3.2 feet of sea level rise (PacIOOS)

Figure 2-4 Annual high wave flooding with 3.2 feet of sea level rise (PacIOOS)

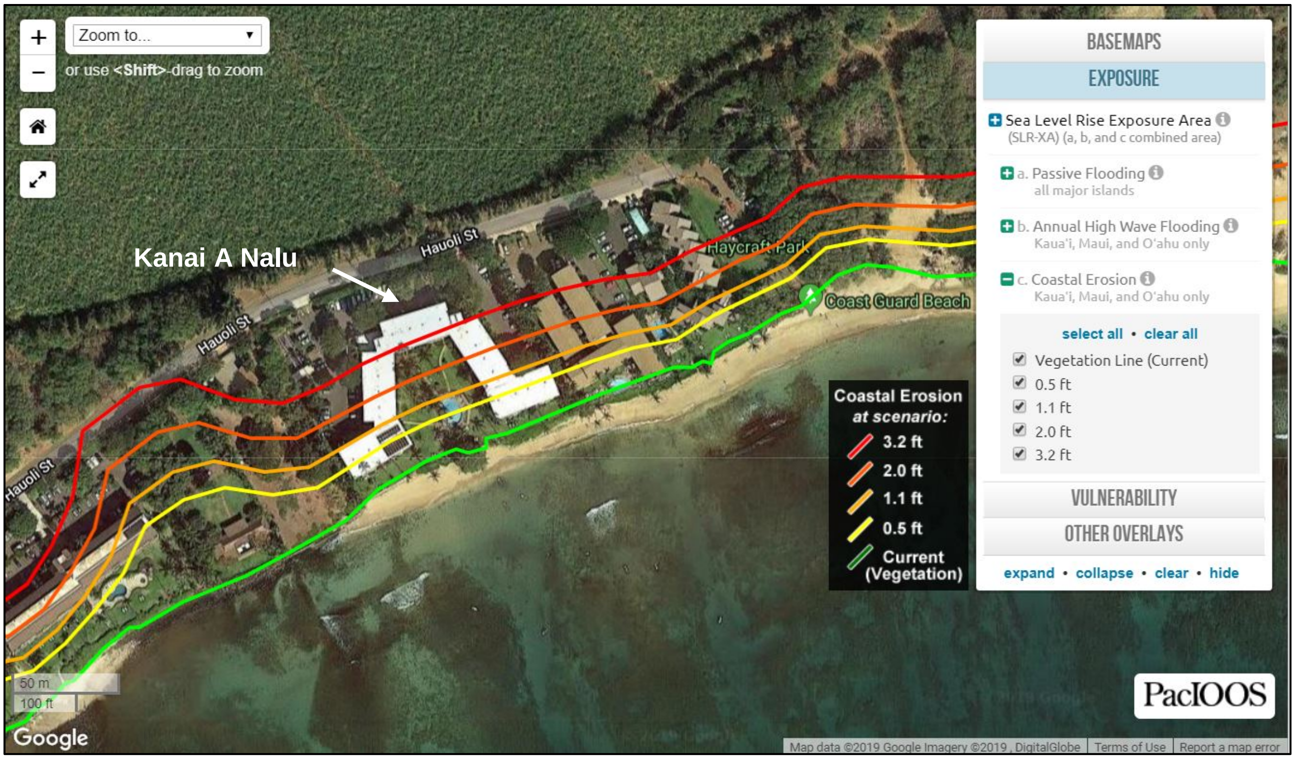

Figure 2-5 Coastal erosion with 0.5 to 3.2 feet of sea level rise (PacIOOS)

Figure 2-6 Sea level rise exposure area with 3.2 feet of sea level rise (PacIOOS)

Figure 2-3 depicts the potential for passive flooding with 3.2 feet of sea level rise. Passive flooding includes areas that are hydrologically connected to the ocean (marine flooding) and low-lying areas that are not hydrologically connected to the ocean (groundwater). The model projects no passive flooding on the KAN property with 3.2 feet of sea level rise.

Figure 2-4 depicts the potential for annual high wave flooding with 3.2 feet of sea level rise. The annual high wave flooding model propagates the maximum annually recurring wave, calculated from historical wave buoy data, over the reef and to the shore along 1-dimensional cross-shore profiles extracted from a 1-meter digital elevation model. The model depicts the spatial extent of inundation that is greater than 10cm in depth.

Figure 2-5 depicts the estimated area that could be exposed to erosion with 3.2 feet of sea level rise. The results of the erosion model represent the combined results of measured, historical erosion rates and the compounding impacts of projected higher water levels associated with projected sea level rise. The erosion model results are a useful tool for considering the potential impacts of erosion at the island or community level; however, there are certain assumptions, limitations, and uncertainties that must be understood when considering the results at the parcel level.

The historical erosion rates are based on shoreline location measurements collected at individual transects that are located 20 meters apart along the coastline. Each transect is characterized by a unique combination of physical and environmental factors that influence shoreline change at that specific transect. While erosion projections that are based on historical erosion rates may not be entirely accurate predictions of the future, they are considered to be accurate for planning purposes.

The portion of the erosion model used to project coastal response to rising sea levels assumes that all coastal changes in the nearshore, shoreline, and backshore (to the maximum extent of erosion) are occurring in mobile sandy substrate. The model implicitly assumes that sand moves freely along the affected dry and submerged profile, allowing the entire system to respond to the effects of a rise in sea level. The assumption that the affected system is composed entirely of sand is not true for much of Maui's coastline, where shallow fringing reefs dominate the nearshore, and clay and rock are present along and within much of the backshore.

Another notable exception is where projected erosion impacts, using both historical erosion rates and the projected coastal response to rising sea levels, are presented along engineered shorelines, such as seawalls and revetments. The portion of the model that predicts shoreline change due to rising sea levels uses the site-specific measurements in the historical erosion rates and feeds them into the 'all sand' model to make predictions about the future condition of the coastline. In this example, the shoreline structure is not included in the coastal response projection. Typically, these structures are utilized to abate the impacts of shoreline erosion and act counter to the natural pressure influencing shoreline retreat.

Maui's coastline is characterized by a broad spectrum of environments that include locations where sand is no longer present, the geology of the coastline has fundamentally changed, the coastline has areas of harder substrate, the shoreline is armored or otherwise engineered, and a myriad of others that are not an 'all sand' environment. A sea level rise influenced model that predicts coastal change in an all sand environment is not expected to accurately predict coastal change across the full spectrum of coastal environments present on Maui.

The KAN property is a location where, due to the presence of an engineered shoreline, the inherent environmental assumptions upon which the erosion model are based are not met. The erosion model does not include an evaluation of the efficacy or potential longevity of the shoreline structure.

Figure 2-6 depicts the projected extent of chronic flooding with 3.2 feet of sea level rise, referred to as the Sea Level Rise Exposure Area (SLR-XA). The SLR-XA represents the combined footprint of the three individual hazards that were modeled - passive flooding, annual high wave flooding, and coastal erosion. Similar to the erosion model, there are assumptions, limitations, and uncertainties that must be understood when considering the SLR-XA results at the parcel level. More detailed information is available at https://www.pacioos.hawaii.edu/shoreline/slr-hawaii/.

3. DESIGN PARAMETERS

3.1 Waves

3.1.1 Prevailing Waves

The wave climate in Hawaii is typically characterized by four general wave types. These include northeast tradewind waves, southern swell, North Pacific swell, and Kona wind waves. Tropical storms and hurricanes also generate waves that can approach the islands from virtually any direction. Unlike winds, any and all of these wave conditions may occur at the same time.

Tradewind waves occur throughout the year and are the most persistent during April through September when they usually dominate the local wave climate. They result from the strong and steady tradewinds blowing from the northeast quadrant over long fetches of open ocean. Tradewind deepwater waves are typically between 3 to 8 feet high with periods of 5 to 10 seconds, depending upon the strength of the tradewinds and how far the fetch extends east of the Hawaiian Islands. The direction of approach, like the tradewinds themselves, varies between north-northeast and east-southeast and is centered on the east-northeast direction. The project site is sheltered from tradewind waves by East Maui.

Southern swell is generated by storms in the southern hemisphere and is most prevalent during the summer months of April through September. Traveling distances of up to 5,000 miles, these waves arrive with relatively low deepwater wave heights of 1 to 4 feet and periods of 14 to 20 seconds. Depending on the positions and tracks of the southern hemisphere storms, southern swells approach between the southeasterly and southwesterly directions. While the island of Kahoolawe shelters the Maalaea area from southwesterly approaching waves, the project site is generally exposed to swell from the southerly direction.

During the winter months in the northern hemisphere, strong storms are frequent in the North Pacific in the mid latitudes and near the Aleutian Islands. These storms generate large North Pacific swells that range in direction from west-northwest to northeast and arrive at the northern Hawaiian shores with little attenuation of wave energy. These are the waves that have made surfing beaches on the north shores of Oahu and Maui famous. Deepwater wave heights often reach 15 feet and in extreme cases can reach 30 feet. Periods vary between 12 and 20 seconds, depending on the location of the storm. The project site is sheltered from north swell by the island of Maui.

Kona storm waves also directly approach the project site; however, these waves are relatively infrequent, occurring only about 10 percent of the time during a typical year. Kona waves typically range in period from 6 to 10 seconds with heights of 5 to 10 feet, and approach from the southwest. Deepwater wave heights during the severe Kona storm of January 1980 were about 17 feet. These waves had a significant impact on the south and west shores of Maui.

Severe tropical storms and hurricanes obviously have the potential to generate extremely large waves, which in turn could potentially result in large waves at the project site. Recent hurricanes impacting the Hawaiian Islands include Hurricane Iwa in 1982 and Hurricane Iniki in 1992. Iniki directly hit the island of Kauai and resulted in large waves along the southern shores of all the Hawaiian Islands. Damage from these hurricanes was extensive. Although not a frequent or even likely event, they should be considered in the project design, particularly with regard to coastal structure stability.

3.1.2 Prevailing Deepwater Wave Climate

The Maalaea project site faces southeast and is affected by south swell during the summer months and Kona storm waves in the winter and spring. Kahoolawe, Lanai, and East and West Maui produce sheltering effects that limit the approach direction of waves that can affect Maalaea. Figure 3-1 shows the possible wave approach windows for Maalaea. The point west of Maalaea Harbor serves to shadow wave energy and cause wave refraction. The closer the wave approach direction is to 260°, the more shadowing can be expected.

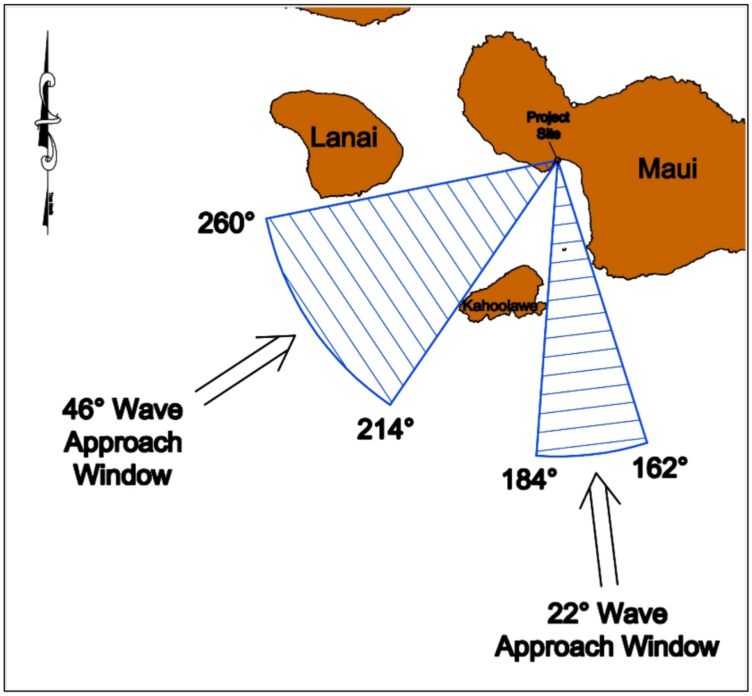

Figure 3-1 Wave approach window toward Maalaea, Maui

Wave information is available in the form of hindcast data sets provided by the U.S. Army Corps of Engineers' Wave Information Studies (WIS). WIS results are generated by numerical simulation of past wind and wave conditions. WIS information produces records of wave conditions based on historical wind and wave conditions at numerous stations around the Hawaiian Islands. These hourly records of wave conditions are available for the years 1981 through 2004.

WIS Station 114, located 65 miles southwest of the project site, was chosen as being representative, since it was exposed to the same waves that would affect Maalaea. Figure 3-2 shows the frequency of occurrence of wave height and period for the WIS data. This data has been filtered into 22.5-degree bins for directions southeast clockwise through west-southwest. Additionally, the wave height and wave period distributions for the full WIS 114 data set are presented as roses in Figure 3-3 and Figure 3-4. The length of each colored spoke in the directional wave rose is related to the percentage of time that the waves arrive from that direction. Each concentric circle represents a different frequency, emanating from zero at the center to increasing frequencies at the outer circles. Each spoke is broken down into color-coded bands that show wave height ranges. Directions follow the nautical convention. The WIS station is located far from shore, so the wave roses show the north swell, south swell, and tradewind waves.

A refraction analysis was completed by Sea Engineering (1994) for 22.5-degree direction bins centered about the 135, 157.5, 180, 202.5, 225, 247.5, and 270-degree azimuths. This analysis revealed that, because of the sheltering effects of Kahoolawe, Lanai, Molokai, and West Maui, waves coming from 247.5, 225, 202.5, and 180 degrees produce the most wave energy in the vicinity of Maalaea. Waves from 247.5, 225, and 180 degrees travel in nearly straight paths toward Maalaea Bay, while waves from 202.5 degrees are refracted around Kahoolawe toward Maalaea Bay. The occurrence of waves from these directions is shown in Figure 3-2. The data shows peak wave occurrence from the south-southwest, with typical heights and periods of 2 to 6 feet and 12 to 18 seconds, respectively.

Dir (°TN)	Hs\Tp	<6	6-8	8-10	10-12	12-14	14-16	16-18	>=18	Total%
SE	<1	-	-	-	-	-	-	-	-	0.0
123.75 -	1-2	-	-	-	-	-	-	-	-	0.0
146.25	2-3	-	-	0.97	0.08	-	-	-	-	1.0
	3-4	-	-	0.85	0.14	-	-	-	-	1.0
	4-5	-	-	0.10	0.02	-	-	-	-	0.1
	5-6	0.06	-	-	-	-	-	-	-	0.1
	Total%	0.1	0.0	1.9	0.2	0.0	0.0	0.0	0.0	**2.2**
Dir (°TN)	**Hs\Tp**	**<6**	**6-8**	**8-10**	**10-12**	**12-14**	**14-16**	**16-18**	**>=18**	**Total%**
SSE	<1	-	-	-	-	-	-	-	-	0.0
146.25 -	1-2	-	-	-	-	-	-	-	-	0.0
168.75	2-3	-	-	0.83	0.75	-	-	-	-	1.6
	3-4	-	-	0.24	1.80	-	-	-	-	2.0
	4-5	-	-	0.45	0.28	-	-	-	-	0.7
	5-6	-	-	-	0.12	-	-	-	-	0.1
	Total%	0.0	0.0	1.5	2.9	0.0	0.0	0.0	0.0	**4.5**
Dir (°TN)	**Hs\Tp**	**<6**	**6-8**	**8-10**	**10-12**	**12-14**	**14-16**	**16-18**	**>=18**	**Total%**
S	<1	-	-	-	-	-	-	-	-	0.0
168.75 -	1-2	-	-	-	-	-	-	-	-	0.0
191.25	2-3	-	-	0.99	2.07	0.32	0.22	0.14	-	3.7
	3-4	-	-	0.14	5.75	5.14	1.88	0.63	-	13.5
	4-5	-	-	-	1.09	3.02	2.01	0.41	-	6.5
	5-6	-	-	-	0.08	-	-	0.02	-	0.1
	6-7	-	-	-	-	-	-	-	-	0.0
	7-8	0.06	-	-	-	-	-	-	-	0.1
	8-9	-	0.18	-	-	-	-	-	-	0.2
	Total%	0.1	0.2	1.1	9.0	8.5	4.1	1.2	0.0	**24.1**
Dir (°TN)	**Hs\Tp**	**<6**	**6-8**	**8-10**	**10-12**	**12-14**	**14-16**	**16-18**	**>=18**	**Total%**
SSW	<1	-	-	-	-	-	-	-	-	0.0
191.25 -	1-2	-	-	-	-	-	-	-	-	0.0
213.75	2-3	-	-	0.30	1.96	3.42	2.19	1.24	0.24	9.3
	3-4	-	-	0.36	3.73	11.63	7.53	3.79	0.36	27.4
	4-5	-	-	-	1.28	4.98	4.62	1.84	0.08	12.8
	5-6	-	-	-	0.04	0.41	1.96	0.59	0.16	3.2
	6-7	-	-	-	-	0.04	0.40	0.55	-	1.0
	7-8	-	-	-	-	-	-	-	-	0.0
	8-9	-	0.06	-	-	-	-	-	-	0.1
	9-10	-	0.02	-	-	-	-	-	-	0.0
	Total%	0.0	0.1	0.7	7.0	20.5	16.7	8.0	0.8	**53.7**
Dir (°TN)	**Hs\Tp**	**<6**	**6-8**	**8-10**	**10-12**	**12-14**	**14-16**	**16-18**	**>=18**	**Total%**
SW	<1	-	-	-	-	-	-	-	-	0.0
213.75 -	1-2	-	-	-	0.02	-	-	-	-	0.0
236.25	2-3	-	-	0.41	1.19	0.93	0.18	-	-	2.7
	3-4	-	-	0.18	1.66	2.05	0.75	0.16	-	4.8
	4-5	-	-	-	0.63	1.07	0.14	0.02	-	1.9
	5-6	-	-	-	0.02	0.24	-	-	-	0.3
	6-7	-	-	-	-	0.04	-	-	-	0.0
	7-8	-	-	-	-	-	-	-	-	0.0
	8-9	-	-	-	-	-	-	-	-	0.0
	9-10	-	0.04	-	-	-	-	-	-	0.0
	Total%	0.0	0.0	0.6	3.5	4.3	1.1	0.2	0.0	**9.7**
Dir (°TN)	**Hs\Tp**	**<6**	**6-8**	**8-10**	**10-12**	**12-14**	**14-16**	**16-18**	**>=18**	**Total%**
WSW	<1	-	-	-	-	-	-	-	-	0.0
236.25 -	1-2	-	-	-	-	-	-	-	-	0.0
258.75	2-3	-	-	0.32	0.38	0.04	-	-	-	0.7
	3-4	-	-	0.10	1.24	1.62	0.14	-	-	3.1
	4-5	-	-	-	0.87	0.65	0.06	-	-	1.6
	5-6	-	-	-	0.04	0.12	-	-	-	0.2
	6-7	-	-	-	-	0.02	-	-	-	0.0
	7-8	-	-	-	-	0.04	-	-	-	0.0
	8-9	-	-	-	-	0.08	-	-	-	0.1
	Total%	0.0	0.0	0.4	2.5	2.6	0.2	0.0	0.0	**5.7**
	All %	0.1	0.2	6.2	25.2	35.8	22.1	9.4	0.8	**100.0**

Figure 3-2 Frequency of occurrence of wave height and period (WIS Station 114)

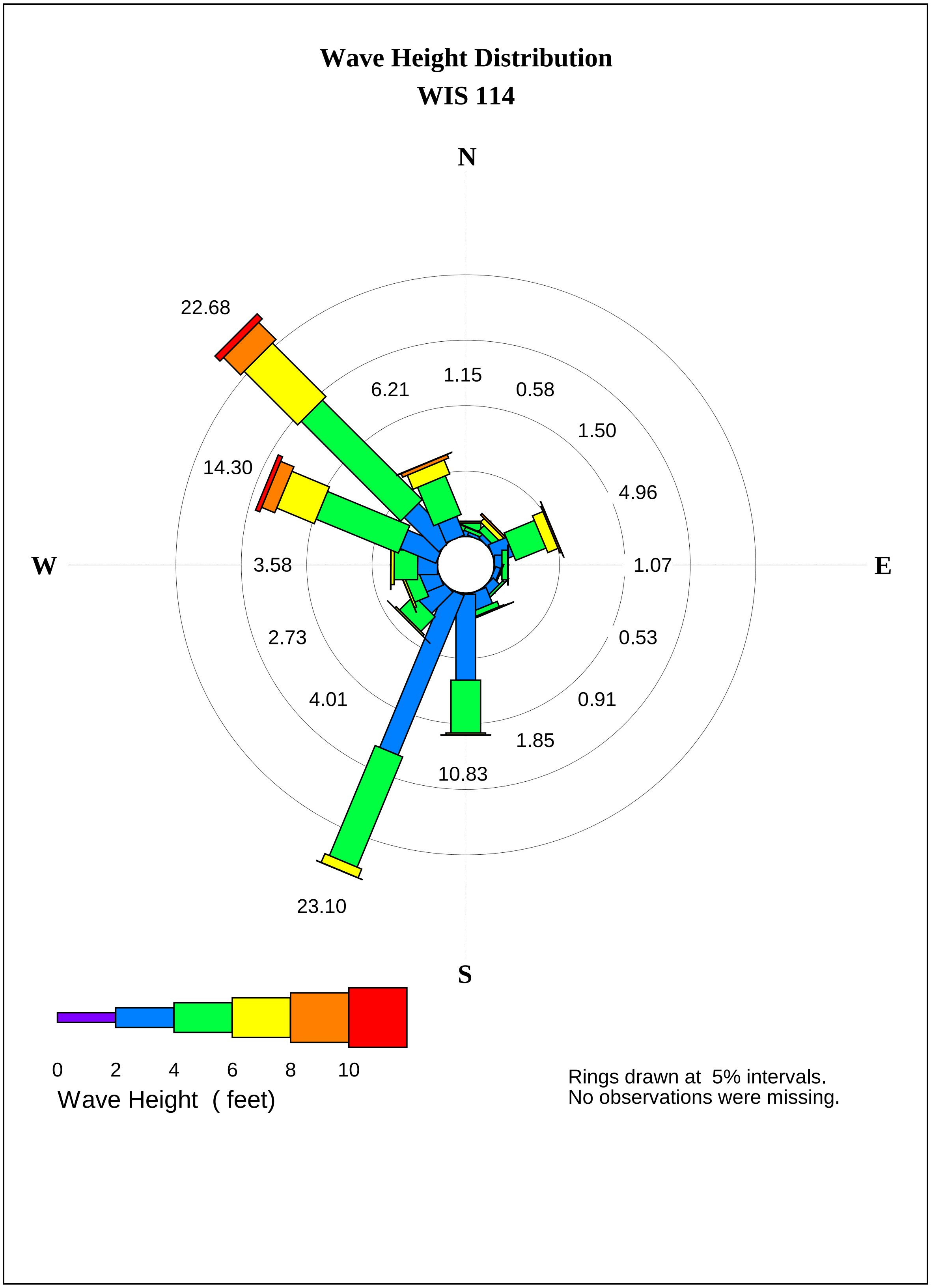

Figure 3-3 Wave height distribution (WIS Station 114)

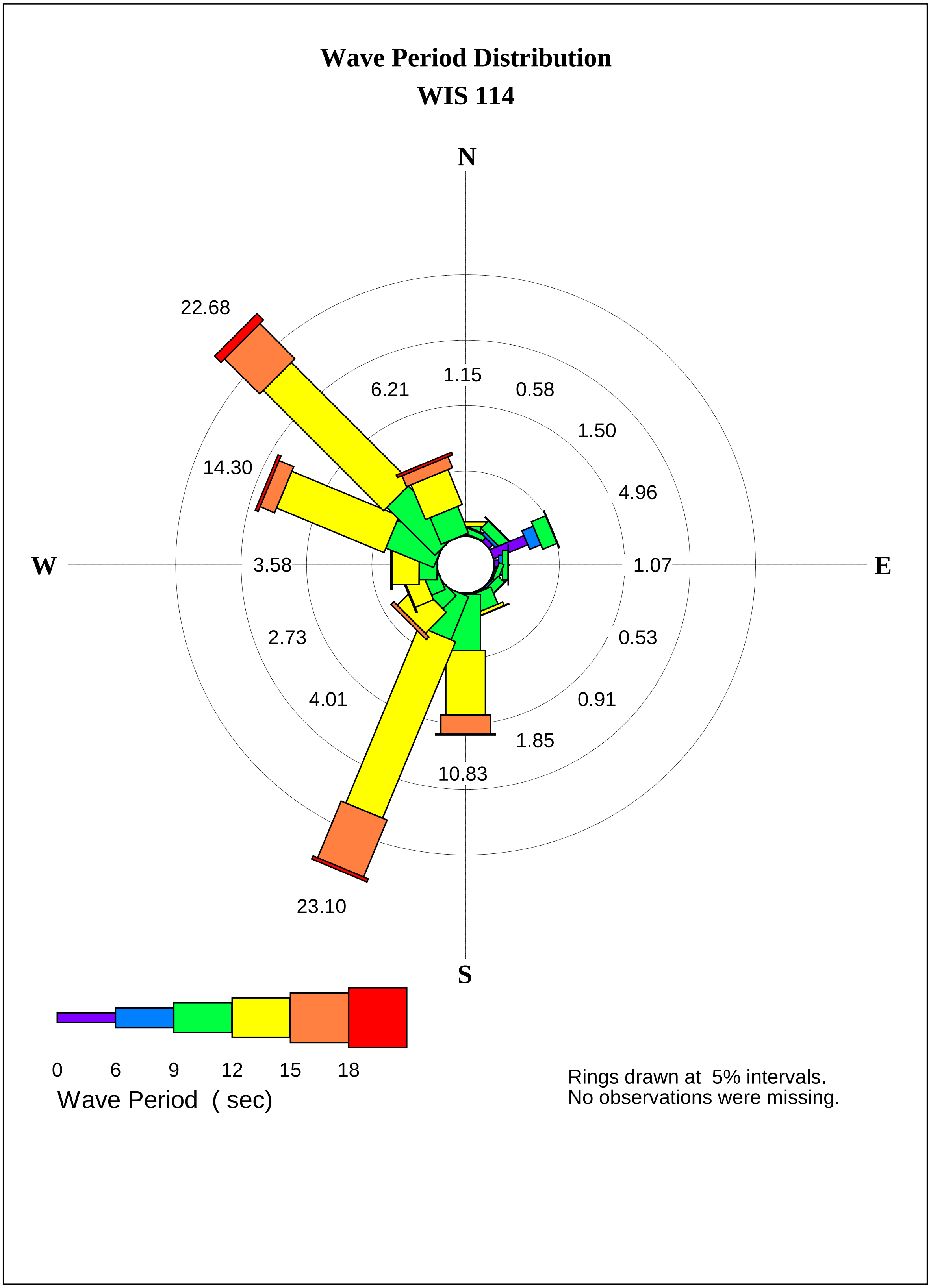

Figure 3-4 Wave period distribution (WIS Station 114)

3.1.3 Extreme Deepwater Wave Height

The Hawaiian Islands are annually exposed to severe storms and storm waves generated by-passing low-pressure systems, tropical storms including hurricanes, and large swell waves generated by distant north or south Pacific storms. Storms and high wave events considered here include:

- 1-year return period wave
- 50-year return period wave
- Severe Kona storm wave
- Close approach hurricane-generated waves

It should be noted that the definition of the "50-year return period wave" is the wave that has a 1-in-50, or 2%, chance of occurrence in any given year.

The WIS hindcast wave data set presented previously can be further analyzed using a Gumbel distribution of extreme events to obtain design wave heights and return periods. The data set was filtered for waves whose approach direction was between south and west-southwest, which was shown by Sea Engineering (1994) to be the range of wave directions that affects the project site. The annual highest waves from the filtered data were obtained and these 24 waves ranged from 6.0 feet to 18.9 feet. The wave periods corresponding to these waves ranged from 6.5 seconds to 16.5 seconds. The design wave heights and return periods based on the Gumbel analysis are shown in Table 3-1.

Table 3-1 Wave heights vs. return periods

Return Period (years)	Wave Height (feet)
1	8.5
5	11.8
10	13.2
25	15.1
50	16.6
75	17.4
100	18.0

The severe Kona storm of January 1980 is commonly used as a "design" Kona storm condition. The severity of this storm has been described as a "50-year" or even less frequent (i.e., more extreme) event. The approach direction of the 1980 Kona Storm was 210°. A storm from that direction could pass over Kahoolawe and directly strike the KAN shoreline. Additionally, the direction of Kona storms varies, and such a storm could conceivably approach from the south to west directions. Hindcasts of the wave conditions by Sea Engineering following the storm indicated a deepwater wave height of 17 feet with a 9-second period approaching from 210 degrees. For this study, the 50-year wave is selected as being representative of a severe storm condition. Selection of such an event is typical for coastal engineering design, and the selection is further justified by the agreement between the 50-year wave and the 1980 Kona storm waves. Within the 24 years of data, the five largest waves have periods of 7.1 to 12.9 seconds, which appear to be associated with Kona or tropical storms. Thus, the wave period of the 50-year wave is taken to be 10 seconds. The 1-year event has a wave height of 8.5 feet and may be either a storm wave or swell. The average period of an 8 to 9-foot wave in the complete WIS 114 data set is 10 seconds.

The report *Hurricanes in Hawaii* (Haraguchi, 1984), prepared for the U.S. Army Corps of Engineers, Honolulu Engineer District, presents hypothetical model and worst-case hurricane scenarios for the Hawaiian Islands. These scenario hurricanes have been used for detailed studies of hurricane storm wave inundation limits for the islands of Oahu and Kauai, prepared by Bretschneider and Noda (1985), and Sea Engineering, Inc. (1986, 1993, and 2000) for the USACE-HED. The direction of the model hurricane is a typical or statistical value, rather than a deterministic value.

The model hurricane is defined as the probable hurricane that will strike Hawaii in the future, based on the characteristics of storms previously approaching or striking the islands. The model hurricane could be expected to approach from a range of directions centered around 175°. A hurricane approaching Maalaea from 175° would pass between Kahoolawe and Wailea. The worst-case hurricane characteristics are based on subjective analysis of the data from 20 critical hurricanes in the Central Pacific and understanding of the basic atmospheric and oceanic conditions surrounding the Hawaiian Islands. For this study, deepwater model hurricane wave parameters off the south shore of Oahu as reported by Bretschneider and Noda (1985) are selected as hurricane waves. Wave heights, periods and approach directions for the model hurricanes are 31 feet, 12 seconds, 175 degrees, and 36 feet, 13.5 seconds, and 210 degrees, respectively.

The design wave conditions selected for further analysis are summarized in Table 3-2.

Table 3-2 Selected design wave conditions

Type of Wave	Deepwater Wave Height (feet)	Breaking Wave Height (feet)	Wave Period (sec.)
1-Year Wave	8.5	12.3	10
50-Year Wave	16.6	20.5	10
Kona Storm Wave (1980)	17	19.8	9
Model Hurricane	31	35.3	12

3.2 Nearshore Water Levels

3.2.1 Wave Transformation in Shallow Water

As deepwater waves approach the shoreline, they begin to transform due to the effects of shoaling, bottom friction, refraction, and diffraction. As waves shoal, heights increase, and the wave crests steepen, to the point that the waves become unstable, leading to breaking and dissipation of wave energy. Wave energy is also attenuated due to bottom friction. The approach direction can change as the wave front refracts or becomes oriented parallel to the existing bathymetric contours. Lateral spreading of energy, known as diffraction, can occur behind a natural or man-made barrier. The breaking wave values given in Table 3-3 for the selected design wave conditions reflect the shoaling and refraction characteristics of these waves offshore of the project site.

3.2.2 Tsunamis

Loomis (1976) presented runup elevations for tsunamis that have affected the Hawaiian Islands. Table 3-3 shows the tsunami runup elevations that were measured near the Maalaea project site. Runup elevations are relative to mean lower low water. The 1946 and 1957 tsunamis were generated near Alaska, while the 1960 tsunami was generated near Chile. Based on these historical tsunamis, a tsunami of similar size may cause minor overtopping and inundation.

The March 2011 tsunami generated near Japan produced waves that overtopped the mole that houses the Maalaea Ferry Terminal building at Maalaea Harbor. There were no reports of inundation and no obvious signs of damage at the project site; however, it is possible that the tsunami exacerbated the undermining and further damaged the seawalls.

Table 3-3 Tsunami runup elevations at Maalaea, Maui

Tsunami	Runup elevation (feet)
1946	9
1957	8
1960	11

3.2.3 Tides

Hawaii tides are semi-diurnal with pronounced diurnal inequalities (i.e., two high and low tides each 24-hour period with different elevations). Tidal predictions and historical extreme water levels are given by the Center for Operational Oceanographic Products and Services, NOS, NOAA, website. The water level data for Kihei/Maalaea Bay, based on the 1983-2001 tidal epoch, are shown in Table 3-4. Hawaii is also subject to periodic extreme tide levels due to large-scale oceanic eddies that propagate through the islands. These eddies produce tide levels up to 0.5 feet higher than normal for periods of up to several weeks, and shoreline damage during these elevated water levels has been documented.

Table 3-4 Water level data for Maalaea Bay (feet)

Mean Higher High Water	2.30
Mean High Water	1.95
Mean Tide Level	1.15
Mean Low Water	0.35
Mean Lower Low Water	0.00

3.2.4 Still Water Levels and Nearshore Wave Heights

During high wave conditions, the nearshore water level may be elevated above the tide level by the action of breaking waves offshore. This water level rise is termed wave setup, and the water level could be elevated an estimated 1 to 2 feet during severe storm wave conditions. During hurricane conditions, an additional water level rise due to wind stress and reduced atmospheric pressure can occur. Collectively termed “storm surge,” this can potentially add another 1 to 2 feet to the stillwater level. For example, during the 1992 passage of Hurricane Iniki over Port Allen Harbor on the island of Kauai, a National Weather Service tide gauge recorded a water level rise of 4.4 feet above the predicted tide elevation.

During storm or large wave conditions, there may be multiple zones of wave breaking. Wave heights are said to be *depth-limited* because once the water depth becomes shallow enough the wave breaks, losing size and energy. The wave, however, may reform before it reaches the shoreline and break again when the depth-limited ratio is attained. The still water level rise during storm events is an important design consideration because it allows larger wave heights to reach the shoreline.

3.2.5 Design Still Water Level

Still water level rise at the shoreline is a combination of astronomical tide, mesoscale eddies, storm surge, and wave setup. The astronomical tide level chosen for design conditions is mhhw due its frequency of occurrence. In Maalaea Bay, mhhw is 2.3 feet (Table 3-4).

Wave setup is a function of the breaking wave height, period, and bottom topography. The mass transport of water due to breaking waves produces wave setup—the increase in water depth shoreward of the breaker zone. The available methods for calculating wave setup have been simplified and assume long, straight, parallel bathymetric contours, continuous breaking waves, and breaker zones relatively close to the shoreline.

The project site is exposed to waves from south through west. While all of these waves would lose some energy through refraction, a wave approaching with a deepwater direction from the south would experience the least refraction. For design purposes, the design wave is considered to approach from the south, which will yield a more conservative result. The 50-year wave is selected as the design wave; however, due to the relatively flat offshore bathymetry, the initial breaking zone would be far offshore. The waves reform from the breaker zone toward shore and shoal to a height limited by the water depth. The appropriate wave breaker index for shallow, mildly sloping bathymetry is 0.78, and the controlling water depth in the nearshore is approximately 1 foot below mllw. The design wave height at the shoreline is therefore purely a function of water depth. For purposes of comparison, the design wave and water levels for the four wave conditions mentioned are presented in Table 3-5.

The sea level rise condition selected for design is 1.3 feet, which is the *Intermediate* projected sea level rise by 2050. As an added level of conservatism, a 50-year return period swell was selected as the design wave condition. The selection of these design criteria is based on the type of project and anticipated project lifespan. While critical infrastructure such as roads, power plants, and hospitals may require the highest level of protection, it is reasonable to design coastal structures and sand beach systems for a lesser level, in this case a 30-year lifespan. Designing for a lesser sea level rise is still consistent with sea level rise projections, as the sea level rise those coastal systems are expected to experience during its lifetime would be much less than the 4.2 feet projection for the year 2100.

Table 3-5 shows that the annual event and the 50-year (design) event result in similar design wave heights at the structure. This is because the wave at the shoreline is a function of water depth, and the factors that contribute to water level rise are generally consistent for these two events. Due to the initial breaking far from shore, the wave setup produced is expected to be quite small. In Table 3-5, wave setup values of 0.5 foot for the 1-year wave and 1.0 foot for the 50-year and Kona Storm waves are included and are considered to be conservative values. A hurricane would produce an atmospheric pressure drop, resulting in an additional water level rise known as storm surge.

The design waves presented in Table 3-5 are 3.4 feet and 4.8 feet for the 1-year wave and the 50-year wave, respectively.

Table 3-5 Design wave conditions with a 30-year sea level rise projection

	1-year wave	50-year wave	Kona Storm	Hurricane
Deepwater Wave Height, H_o (ft)	8.5	16.6	17.0	31.0
Still Water Level Rise				
Astronomical tide (ft)	2.3	2.3	2.3	2.3
Large-scale eddy (ft)	0.5	0.5	0.5	0.5
Wave setup (ft)	0.5	1.0	1.0	4.4*
Sea level rise (ft)	0.0	1.3	1.3	1.3
Total SWL Rise (ft)	3.3	5.2	5.2	8.6
Nominal Water Depth (ft)	1.0	1.0	1.0	1.0
Design Water Depth (ft)	4.3	6.2	6.2	9.6
Design Wave Height *H* (design, ft)	3.4	4.8	4.8	7.5

*Combined wave setup and storm surge

3.3 Geotechnical Design Parameters

From the USDA Soil Conservation Service "Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii," the project site is located in an area designated as Kealia silt loam (KMW). This series consists of somewhat poorly drained and poorly drained soils on coastal flats on the islands of Molokai and Maui. On this soil, permeability is moderately rapid. Runoff is slow to very slow, and the erosion hazard of water is not more than slight, but the hazard of wind erosion is severe when the soil is dry, and the surface layer becomes loose and fluffy (USDA, 1972, pg. 67, Plate 101). Observations of the surficial soils at the site indicates that the seawall backfill may be composed of a combination of loose, fine grained, calcareous sand and/or a highly plastic silty clay loam intermixed with basalt cobbles and boulders. The seawall foundations are presumed to be constructed on loose sand which is followed by a silty clay loam in lower depths. Based on the observations made during the site visit, presumptive geotechnical design parameters are as follows:

a) Ultimate bearing value: 6,000 psf (for footings in positive contact with relatively stable underlying soils)
b) Lateral earth pressure coefficients: Kp = 2.00
Ka = 0.50
Coefficient of Friction = 0.4 x DL
Unit Weight (moist) = 110 pcf
Unit Weight (submerged) = 60 pcf

The above are ultimate values. An appropriate factor of safety should be applied as may be needed for the analysis and preliminary design. A Phase 2 Geotechnical Investigation would be required to ascertain pertinent design information relative to the Structural Engineer's conceptual repair and/or replacement options. A minimum of four (4) borings would be required.

4. SHORELINE ASSESSMENT

On January 7, 2019, SEI conducted a site inspection at the KAN property with a structural engineer, geotechnical engineer, and construction manager to assess the condition of the shoreline and existing shore protection structures and discuss potential options to address any damages or structural deficiencies. Structural engineering services were provided by MKE Associates LLC (MKE), under subcontract to SEI. MKE visually inspected the condition of the seawalls and developed preliminary repair recommendations. Geotechnical engineering services were provided by Shinsato Engineering, Inc. (Shinsato), under subcontract to SEI. Shinsato visually inspected the soil conditions adjacent to and beneath the existing seawalls to determine the geotechnical soil parameters to inform the structural analysis.

The KAN shoreline consists of approximately 370 linear feet of shoreline at the western terminus of Maalaea Bay Beach, approximately 2,400 feet east of Maalaea Harbor. The backshore is developed and primarily consists of condominium complexes. The shoreline faces southeast and is affected by south swell during the summer months and Kona storm waves in the winter and spring. Kahoolawe, Lanai, and East and West Maui produce sheltering effects that limit the approach direction of waves that can affect Maalaea.

The backshore consists of a relatively flat coastal plain composed primarily of Kealia silt loam (KMW) with slopes of 0 to 1 percent. The foreshore consists of a narrow, sandy beach composed of carbonate sand. At the time of the site inspection, beach width ranged from 5 feet at the east end of the shoreline to 25 feet at the west end of the shoreline. The KAN property is fronted by a concrete rubble masonry (CRM) seawall that was likely constructed sometime in the 1940’s. The middle portion of the seawall failed and was removed in 2009. The remaining sections of the seawall are in a deteriorated condition. The adjacent properties to the east and west are also fronted by CRM seawalls that appear to be damaged.

The seafloor offshore of the KAN property consists of a narrow, shallow reef flat that is bisected by a shore-perpendicular channel. As waves approach the shoreline, the shallow reef outcrops act as shoals that cause wave refraction, which forces wave energy to converge and become concentrated along the shoreline. Refraction also diverts wave energy into the channel, where it dissipates as it approaches the shoreline. As a result, it is expected that wave energy is generally higher at the east and west ends of the shoreline, and lower in the middle of the shoreline fronting the channel (Figure 4-2).

For the purposes of this report, the KAN shoreline was divided into three (3) sections (Figure 4-1):

- ***Section 1*** consists of a 90-foot-long CRM seawall along the west end of the shoreline.
- ***Section 2*** consists of 150 feet of unarmored shoreline along the middle of the property.
- ***Section 3*** consists of a 130-foot-long CRM seawall along the east end of the shoreline.

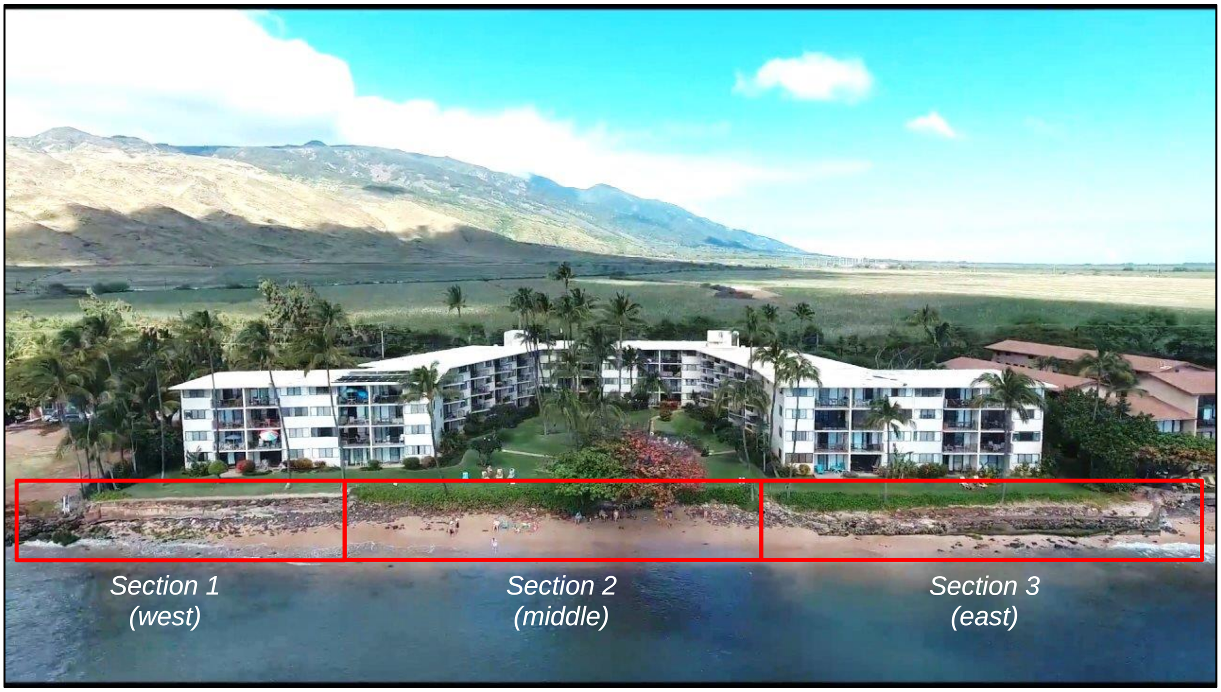

Figure 4-1 KAN shoreline sections

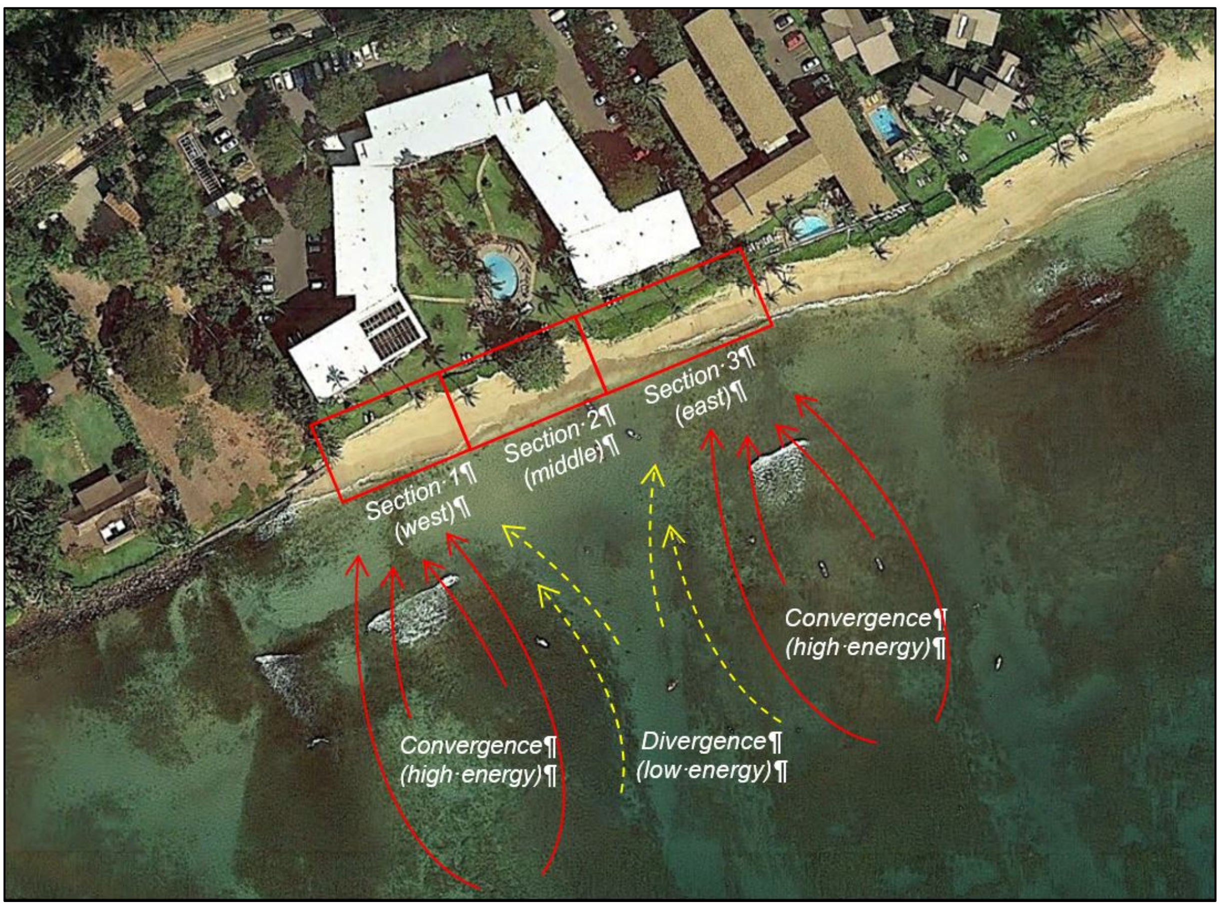

Figure 4-2 Wave dynamics along the KAN shoreline

4.1 Section 1 (West)

Section 1 consists of approximately 90 linear feet of shoreline that is fronted by a CRM seawall. The seawall is approximately 30 to 35 feet seaward of the west wing of the KAN building. A typical section view of the seawall based on field observations is shown in Figure 4-3. The seawall is approximately 5 to 6 feet high and appears to be constructed of mortared stone for the top 2 to 3 feet of wall height with a combination of precast concrete pavers and cast-in-place concrete fill at the lower 2 to 3 feet (Figure 4-4). It appears that the concrete fill was added to address undermining of the original stone wall as well as missing stones, with possibly more than one layer of concrete fill placed at different times. The wall thickness is unknown.

An approximately 3.5-foot-wide concrete cap has been cast on the top of the wall with the bottom of the stone portion of the wall below extending about 1 foot out beyond the cap on average (Figure 4-5). It appears this cap may have been cast over a previous cap, possibly to address cracked, displaced or missing portions of the original cap. The center portion of the concrete cap appears to have sagged downward, indicating the center portion of the wall may have settled downward. Cracks, separations in the mortar, and voids in portions of the wall are also indicators of wall displacement (Figure 4-6).

Almost the entire wall length is undermined along the base of the wall, with voids between the bottom of the wall and top of the sand fronting the wall base varying in height from less than an inch to several inches and varying in depth up to several feet in from the front face of the wall (Figure 4-7 and Figure 4-8). At the time of the site inspection, the beach sand elevation was below the elevation of the base of the seawall exposing the majority of the footing including undermined portions of the seawall foundation. The undermined portion beneath the seawall footing was measured and found to be up to 18 inches in height below the bottom of the footing and extending horizontally up to 12 feet under the footing (measured from the seaward face of the wall). No observable rotation of the seawall was noted. However, vertical deformation (gaps) between the building blocks was measured up to 6 inches.

KAN staff reported that sand elevations are variable and have been lower in the past. Therefore, it is assumed that both the height and depth of the voids may be larger during these periods of lower sand elevations. The wall and subsequent repairs appear to have been placed within the sand layer. The depth from the bottom of wall to a more erosion resistant layer of substrate is unknown. Based on the history of wall damage, the current extent of undermining beneath the seawalls, and the history of beach restoration, it is reasonable to conclude that the beach fronting KAN is subject to fluctuations in width and elevation.

The wall is currently cordoned off due to concerns regarding public health and safety. The CRM seawall at the west adjacent property (Nellie's on Maui, Ltd.) also shows signs of damage. Portions of the wall have failed, and a large sinkhole has formed in the backshore (Figure 4-9).

In summary, the following damages and structural deficiencies were observed in *Section 1*:

- Erosion and loss of mortar due to weathering and wave action.
- Undermining and void formation due to erosion of loose sandy material.
- Wall displacement and settlement due to loss of subgrade support.
- West adjacent seawall is damaged and appears to be failing.

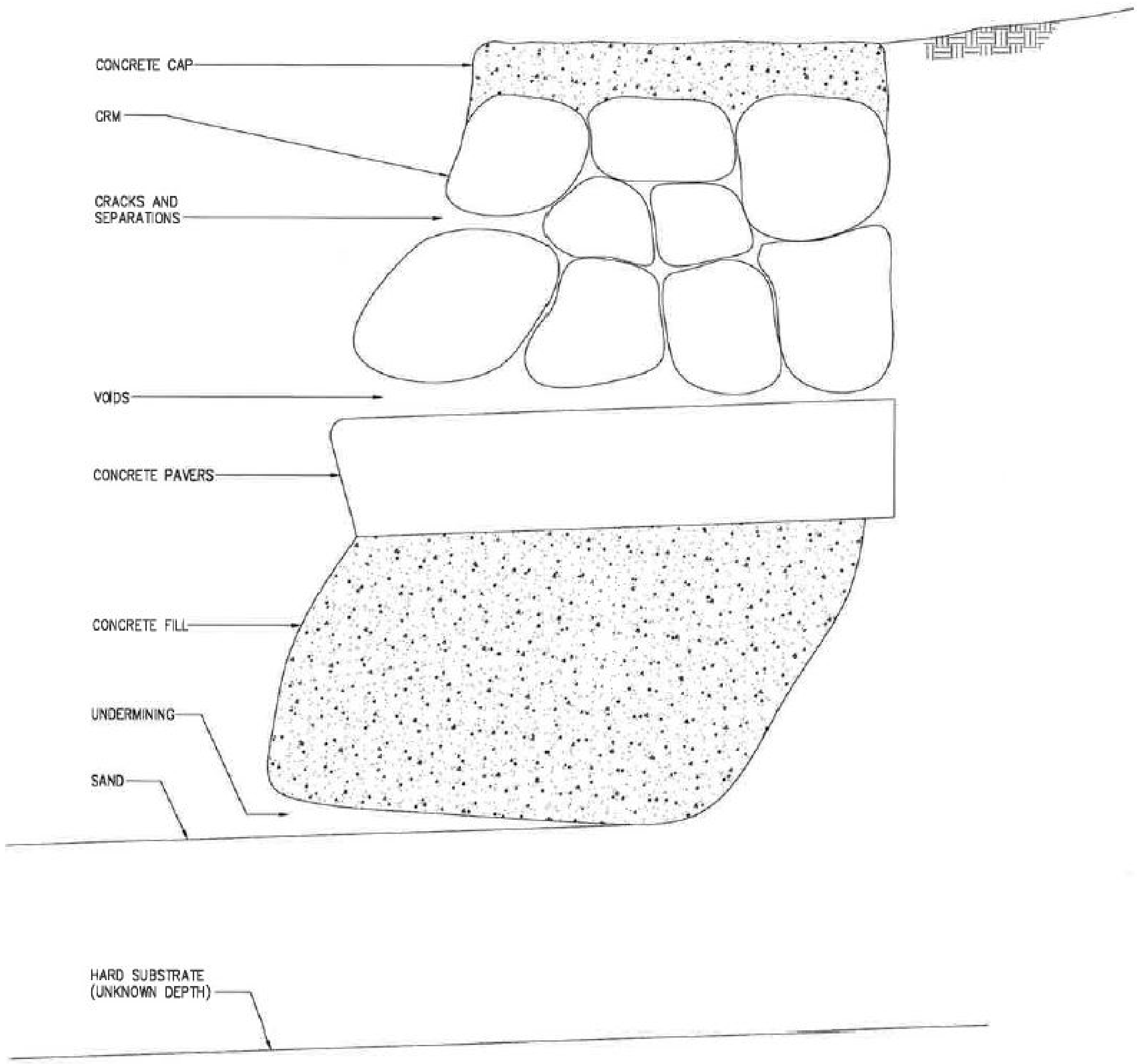

Figure 4-3 Section 1 (west) existing seawall section

Figure 4-4 CRM seawall in Section 1 (west)

Figure 4-5 Concrete cap on top of seawall

Figure 4-6 Cracks, mortar separation, and voids

Figure 4-7 Undermining along toe of seawall

Figure 4-8 Void under seawall due to undermining

Figure 4-9 Damaged seawall on west adjacent property

4.2 Section 2 (Middle)

Section 2 consists of approximately 150 linear feet of unarmored shoreline. A continuous erosion scarp extends from the CRM seawall at the east end of *Section 1 (west)* to the CRM stair at the west end of *Section 3 (east)* (Figure 4-10 and Figure 4-11). The erosion scarp roughly follows the landward edge of the Naupaka hedge and is approximately 30 feet seaward of the KAN pool.

The erosion scarp is approximately 4 to 5 feet above the current sand elevation. There is evidence of undermining, particularly around the tree root structures. In some areas, the undermining extends 4 to 6 feet landward of the edge of the erosion scarp (Figure 4-12). There is evidence of active erosion (Figure 4-13) and several of the trees located along the edge of the scarp appear to be leaning in a seaward direction, which suggests they are at risk of falling. A pile of loose cobble and debris material is accumulated along the base of the erosion scarp.

This section of the shoreline was previously fronted by a CRM seawall. The seawall was damaged, and minor repairs were performed in 2006. The seawall ultimately failed and was removed in 2009 (Figure 4-14 and Figure 4-15). The embankment was graded, a small amount of beach fill was added, and the area was replanted with salt-tolerant grass and Naupaka. The erosion scarp currently appears to be relatively stable; however, the undermining appears to be progressive.

The beach toe was well-defined along this section of the shoreline. Turbidity levels along the beach toe were lower than the adjacent sections of the shoreline, which may be attributable to decreased wave energy in this area. The beach in this section was slightly wider than the adjacent sections, which may be attributable to increased onshore sediment transport in the sand channel.

In summary, the following issues were observed in *Section 2*:

- Shore protection failed and was removed.
- Active erosion.
- Undermining due to wave action.
- Loss of backshore soils.

Figure 4-10 Approximate location of erosion scarp (dashed line)

Figure 4-11 Approximate location of erosion scarp (dashed line)

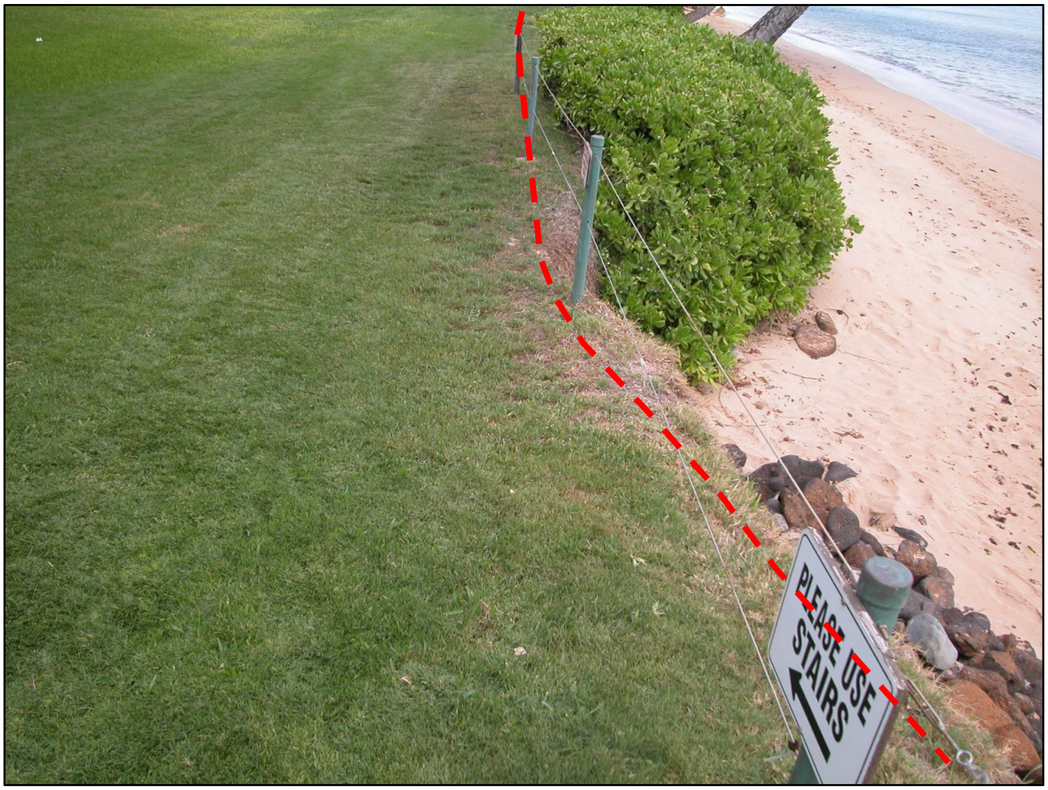

Figure 4-12 Erosion scarp along edge of lawn

Figure 4-13 Evidence of active erosion

Figure 4-14 Failed seawall section (2009)

Figure 4-15 Removal of failed seawall section (2009)

4.3 Section 3 (East)

Section 3 consists of approximately 130 linear feet of shoreline that is fronted by a CRM seawall. The seawall is approximately 35 to 45 feet seaward of the east wing of the KAN building. A typical section view of the seawall based on field observations is shown in Figure 4-16.

The seawall is about 5 to 6 feet high and appears to be constructed of mortared stone for the top 3 to 4 feet of wall height with concrete fill at the lower 1 to 3 feet (Figure 4-17). It appears that the concrete fill may have been added later to address undermining of the original stone wall as well as missing stones. The thickness of the wall is unknown. A CRM stair leading to the ocean is located at the west end of the wall (Figure 4-18). Portions of the stair are undermined.

An approximate 3-foot-wide concrete cap has been cast on the top of the wall with the bottom of the stone portion of the wall below appearing to be nearly plumb with the outside edge of the cap (Figure 4-19). Some portions of the cap have cracked and become displaced, and some stones have been dislodged, apparently by wave action (Figure 4-20). An approximate 20-foot portion of the wall east of the stair is heavily deteriorated, with missing top caps, missing portions of wall, and apparent vertical and lateral displacement of portions of the wall (Figure 4-21). Similarly, the east end of the wall is cracked and dislodged (Figure 4-22). Multiple repairs appear to have been performed over the years.

Probing found the bottom of the seaward face of the wall to be several inches below the existing sand elevation. KAN staff reported that the sand has receded in the past to the degree that voids are visible beneath the wall. The depth from the bottom of the wall to a more erosion-resistant layer of substrate is unknown. Under the presumption that the top of the seawall was built at a consistent elevation, portions of the seawall were observed to have settled more than 12 inches. Outward rotation of the seawall was also observed. However, measurement of the amount of rotation was difficult due to the deteriorated condition of the seawall.

Based on aerial and ground photographs, the east adjacent property (Hono Kai) appears to be fronted by a CRM seawall along the entire length of shoreline frontage. The seawall appears to be experiencing undermining, portions of the wall appear to have settled, and the west end of the wall is failing (Figure 4-22). The area inshore of the wall was cordoned off, presumably due to sinkholes.

In summary, the following damages and structural deficiencies were observed in *Section 3*:

- Erosion of mortar, cracking, and dislodged stones due to weathering and wave action.
- Vertical and lateral displacement of portions of the wall.
- Undermining due to erosion of the loose sandy material.
- Outward rotation of the seawall.
- East adjacent seawall is damaged and appears to be failing.

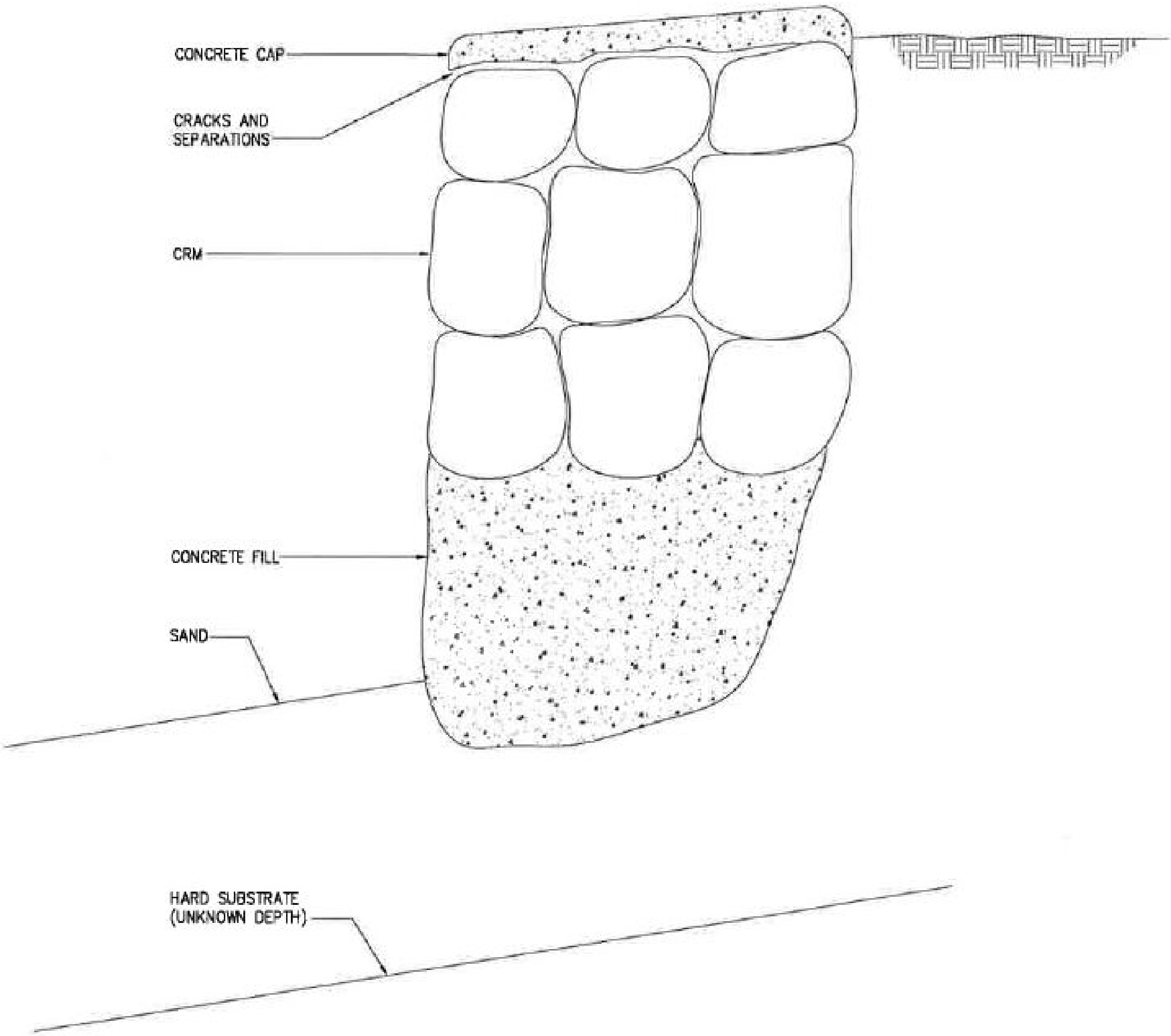

Figure 4-16 Section 3 (east) existing seawall section

Figure 4-17 CRM seawall in Section 3 (east)

Figure 4-18 CRM stair at west end of seawall

Figure 4-19 Cracking along concrete cap

Figure 4-20 Cracking and dislodged stones on seawall face

Figure 4-21 Damaged wall section east of CRM stair

Figure 4-22 Damaged wall section at east end (adjacent seawall is also damaged)

5. ALTERNATIVES ANALYSIS

The objectives of the *BMERP* are to restore and maintain the existing beach and provide long-term protection for the backshore land and infrastructure. Ideally, the recommended engineering solutions(s) would satisfy both project objectives, while minimizing potential negative impacts to the environment, adjacent shorelines, and public access.

Coastal erosion control is generally divided into two basic types: soft solutions and hard solutions. Examples of soft solutions include sand pushing, temporary erosion control structures, dune restoration, and beach nourishment. Hard solutions utilize engineered rock or concrete structures, typically a revetment or seawall, to permanently armor the shoreline and stop the erosion and shoreline recession. Beach nourishment can be combined with engineered structures, such as shore-perpendicular groins, to stabilize the beach fill.

Erosion control measures include the following general categories:

- Temporary Erosion Control (erosion skirts, sandbags, geotubes, gabions, mattresses)
- Beach Maintenance (sand pushing, sand backpassing, sand pumping)
- Sand Containment/Stabilization Structures (groins, breakwaters)
- Beach Restoration (with or without containment/stabilization structures)
- Shore Protection (revetments, seawalls, bulkheads)

Erosion control measures should be proven, durable, and effective in protecting the backshore, while minimizing environmental impacts. The measures must also be technically feasible at the scale of the project site. SEI evaluated beach management and erosion response alternatives to determine if they are suitable for the project site and capable of satisfying the project objectives:

The objective of the *beach management alternatives* is to restore and maintain the existing beach. SEI evaluated the following alternatives:

- Sand Pushing
- Sand Backpassing
- Sand Pumping
- Small-scale Beach Restoration
- Large-scale Beach Restoration

The objective of the *erosion response alternatives* is to protect the backshore land and infrastructure from erosion, wave overtopping, and flooding. SEI evaluated the following alternatives:

- Erosion Protection Skirt
- Sand Filled Mattress
- Sandbag Revetment
- Seawall Repair
- Seawall Replacement
- Rock Rubblemound Revetment
- Hybrid Seawall-Revetment
- Managed Retreat
- No Action

5.1 Beach Management Alternatives

5.1.1 Sand Pushing

Sand pushing is a beach maintenance strategy that involves moving sand from the lower beach to the upper beach to create a more stable beach profile and reduce exposure of the backshore to wave action. Sand pushing has been a successful beach maintenance strategy at various beaches throughout Hawaii. An example of a sand pushing project at Sunset Beach, Oahu, is shown in Figure 5-1. Agencies are generally supportive of sand pushing as a beach maintenance strategy. Authorizations for sand pushing are typically limited to the beach immediately fronting the property. While sand pushing may temporarily improve the appearance of the beach, the pushed sand would be expected to mobilize and move alongshore and offshore.

Figure 5-1 Sand pushing at Sunset Beach, Oahu (2014)

<u>Advantages</u>

- May provide a temporary increase in beach volume and width.
- Lowest cost of the beach maintenance options considered.
- Construction process is timely and efficient.
- Agencies are generally supportive of beach maintenance.

<u>Disadvantages</u>

- Would not protect the backshore land and infrastructure.
- Only feasible when the beach is inflated.
- Sand is unlikely to remain stable without stabilizing structures.
- Recurring costs for repeated sand pushing efforts could be high.

Sand pushing is a beach maintenance activity that KAN could perform routinely when sand is available. However, it is unlikely that sand pushing would provide any long-term protection from erosion. Sand pushing may be feasible at KAN when the beach fronting the property is fully inflated. The loose boulders and cobble along the shoreline may need to be removed to accommodate sand pushing operations. Sand pushing may provide some temporary relief from erosion; however, without the addition of stabilizing structures, the sand is likely to mobilize, and erosion of the backshore is likely to continue.

5.1.2 Sand Backpassing

Sand backpassing involves recovering sand from areas of accretion and placing it in areas of erosion. Sand backpassing counters the natural longshore movement of sand and can be an effective beach maintenance strategy in areas with limited sediment budgets. At KAN, this would involve backpassing a small volume of sand from Maalaea Bay Beach, east of Haycraft Park.

For sand backpassing to be feasible at KAN, an adequate volume of sand would need to be available from another portion of Maalaea Bay Beach. This is unlikely as the majority of Maalaea Bay Beach is experiencing erosion. Sand backpassing would increase the volume of sand along the toe of the erosion scarp, thereby reducing the exposure of the scarp to wave action. The exposed upper portion of the scarp could be stabilized using vegetation and slope stabilization techniques. The erosion scarp would need to be graded slightly to reduce the angle of repose and provide space to plant vegetation.

Advantages

- May provide a temporary increase in beach volume and width.
- Costs are lower than beach restoration.
- Regulatory permitting process is typically efficient.
- Construction process is efficient.

Disadvantages

- Would not protect the backshore land and infrastructure.
- Would require additional field investigations to confirm feasibility.
- Sand is unlikely to remain stable without additional stabilizing structures.
- Recurring costs for repeated sand backpassing efforts could be high.
- Agencies and the public may object to backpassing sand from the adjacent shoreline.

Sand backpassing is a beach maintenance activity that KAN could perform routinely when sand is available. Sand backpassing may be feasible at KAN if an adequate volume of sand is available from another portion of Maalaea Bay Beach. Sand backpassing may provide some temporary relief from erosion; however, without the addition of stabilizing structures, it is expected that beach narrowing and erosion of the backshore would continue.

5.1.4 Sand Pumping

Sand pumping involves recovering sand from the nearshore waters and placing it on the beach. Sand pumping counters the natural cross-shore movement of sand and can be an effective beach maintenance strategy in areas with limited sediment budgets. There are three options for sand pumping at KAN: 1) suction dredge, 2) floating platform dredge, or 3) diver-operated dredge.

A small suction dredge could be used to recover limited volumes of sand from within the channel fronting the project site. A Piranha PS165-E suction dredge would be capable of recovery 60-100 cubic yards of sand per day. This operation would be conducted on an as-needed basis to augment the beach profile. Sand slurry would be impounded within small dewatering basins trenched into the upper beach face and located entirely above mean higher high water (mhhw). The purpose of the dewatering basin is to allow the water portion of the sand slurry to percolate through the sandy beach substrate, which acts as a natural filter. After the water has percolated from the basins, the dewatered sediment would be distributed across the adjacent beach face. A small Bobcat would be used to push sand from lower on the beach face (above mhhw) to the vegetation line along the erosion scarp. A small berm would be created along the vegetation line to maximize the volume of sand on the upper beach profile. Figure 5-2 shows an example of a small-scale suction dredging operation at Koʻolina, Oahu.

Figure 5-2 Sand pumping at Koʻolina, Oahu (2017)

Another alternative for sand pumping is a floating platform dredge or submersible diver-operated dredge. For example, an Eddy Pump diver operated dredge is a mobile system that is fully submersible and designed for pumping production rates of 50 to 100 cubic yards of material per hour. The system can be powered electrically or hydraulically. A single system can allow up to three suction hoses and divers to operate simultaneously. Suction hoses are 200 feet long with a maximum pumping distance of 2,500 feet.

Advantages

- May temporarily restore and maintain the beach resource.
- More cost effective than purchasing terrestrial sand or recovering offshore sand.
- Sand recovery process is efficient.
- Agencies are generally supportive of beach maintenance.

Disadvantages

- Would not protect the backshore land and infrastructure.
- Would require additional field investigations to confirm feasibility.
- Sand is unlikely to remain stable without engineered stabilizing structures.
- Recurring costs for repeated sand pumping efforts could be high.

Sand pumping is a maintenance activity that KAN could perform routinely when sand is available. Additional investigations would be required to determine if there is an adequate volume of sand in the channel fronting KAN. Sand pumping may provide some temporary relief from erosion; however, without the addition of stabilizing structures, the sand is likely to mobilize, and erosion of the backshore is likely to continue.

5.1.5 Small-scale Beach Restoration

Beach restoration typically involves placement of beach fill to specified design profiles. Beach restoration is intended to augment the natural morphology of the beach to offset the effects of chronic, seasonal, or episodic erosion. Regulatory agencies are generally supportive of beach restoration because it has minimal environmental impacts and is consistent with State and County policies that seek to preserve and enhance beach resources. The Hawaii Department of Land and Natural Resources, Office of Conservation and Coastal Lands (DLNR-OCCL) authorizes beach restoration through the Small-scale Beach Nourishment (SSBN) program, which allows placement of compatible beach quality sand seaward of the shoreline in the Conservation District. There are two categories of SSBN authorizations: Category I (up to 500 cubic yards of sand), and Category II (up to 10,000 cubic yards of sand). An example of a small-scale beach restoration project at Sugar Cove (Paia, Maui, Hawaii), is shown in Figure 5-3.

KAN conducted beach restoration in 1997 to mitigate erosion and undermining of the seawalls. Sand replenishment of approximately 1,500 cubic yards took place 3 times between 1997 and 1998 but much of the sand was gone by 2001. KAN conducted beach restoration again in 2003. The project consisted of the placement of 3,000 cubic yards of inland dune sand. Based on the results of these previous beach restoration efforts, it is unlikely that small-scale beach restoration would be effective without engineered stabilizing structures (i.e., groins).

Figure 5-3 Small-scale beach restoration at Paia, Maui (2016)

Advantages

- May provide a temporary increase in beach volume and width.
- Agencies are generally supportive of beach restoration.
- SSBN authorizations may allow for periodic renourishment.

Disadvantages

- Would not protect the backshore land and infrastructure.
- Requires an adequate quantity of compatible beach quality sand.
- Sand is not currently available for purchase on Maui.
- Sand is unlikely to remain stable without engineered stabilizing structures.
- Recurring costs for periodic renourishment could be high.

Small-scale beach restoration could provide a short-term increase in beach volume and width at KAN. A source of compatible sand to support beach restoration at KAN has yet to be identified. Previous beach restoration efforts at KAN have not been effective and the beach fill is unlikely to remain stable without engineered stabilizing structures (i.e., groins).

5.1.6 Large-scale Beach Restoration

Beach restoration is typically more effective at the regional, or littoral cell, scale. When sand loss is gradual, and the beach has a high economic value for recreation and tourism, there may be justification to replenish the littoral cell with sand from offshore or other sources. An example of large-scale beach restoration at Waikiki Beach (Waikiki, Oahu, Hawaii) is shown in Figure 5-4.

Figure 5-4 Beach restoration at Waikiki, Oahu (2012)

With a sufficient quantity of beach quality sand that matches the characteristics of the native beach sand, it is possible that the beach at KAN could be restored. Increased beach width would create a natural buffer that would offer some protection for the backshore land and infrastructure. If the KAN shoreline were to be replenished with sand, it is unclear how stable the sand would be, once placed. The beach fill would be subject to local sediment transport dynamics and would likely be mobilized and redistributed throughout the littoral cell by normal seasonal beach processes. The sand would eventually mobilize and move alongshore and offshore during seasonal shifts within the littoral cell and/or large wave events. During periods of beach narrowing, the backshore would likely continue to erode. Moreover, erosion is expected to continue and possibly accelerate over the long-term as sea levels continue to rise.

One of the factors that can limit the effectiveness of beach nourishment projects is the loss of sand due to natural processes, such as longshore and cross-shore sediment transport. In some cases, it may be necessary to design engineered stabilizing structures, such as T-head groins, to maintain a stable beach. T-head groins decrease and reorient the amount of wave energy reaching the beach and create artificial littoral cells to stabilize the sand. An example of large-scale beach restoration with stabilizing T-head groin structures is shown in Figure 5-5.

Figure 5-5 Beach restoration with T-head groins at Iroquois Point, Oahu (2017)

Large-scale beach restoration accompanied by the construction of engineered stabilizing structures to minimize sand movement would be the most effective means for restoring and maintaining the beach, while simultaneously mitigating the erosion and providing long-term protection for the backshore land and infrastructure. A series of groin structures accompanied by beach fill would create stable, wide beach cells between the groins.

There are two (2) options for large-scale beach restoration with engineered stabilizing structures at KAN. The first option would be a smaller scale project that would be confined to the shoreline fronting the KAN property. This option would consist of one T-head groin bounded by two L-head groins (Figure 5-6). The primary advantage of this option is that it would have the smallest overall footprint of the two options. Limiting the number of the groins and the quantity of beach fill required would significantly reduce the cost of the project. The primary disadvantage of this approach is that it could potentially exacerbate erosion on the downdrift side of the east L-head groin. As a result, agencies, adjacent landowners, and the public are more likely to oppose the project.

An alternative option would be a larger scale project that would be expanded to include the properties east of KAN, including the Hono Kai Resort, Makani A Kai, and Haycraft Park. This option would consist of five T-head groins bounded by two L-head groins (Figure 5-7). The primary advantage of this option is that it would create a stable beach fronting all the properties and the public beach park. As a result, the project is more likely to be supported by the agencies, adjacent landowners, and the public. The primary disadvantage of this approach is that increasing the number of groins and the quantity of beach fill required would significantly increase the project costs.

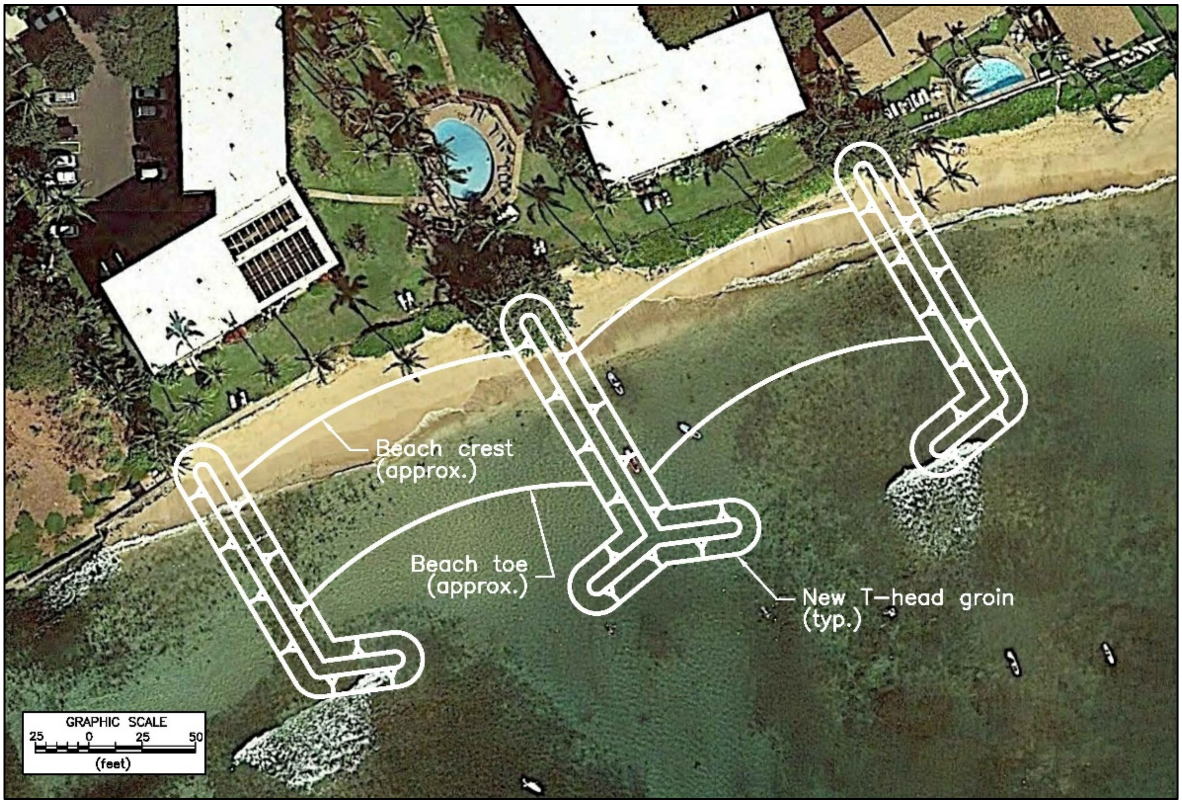

Figure 5-6 Small-scale beach restoration with T-head groins

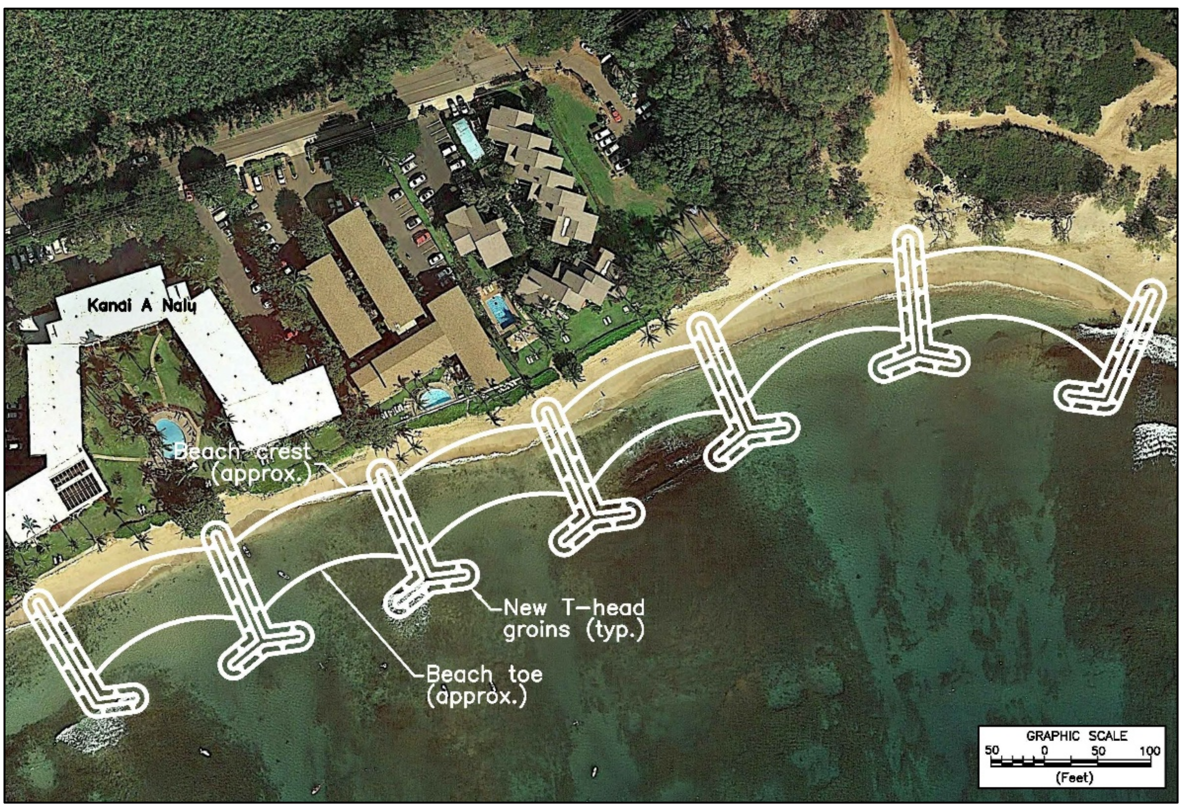

Figure 5-7 Large-scale beach restoration with T-head groins

T-head groins dissipate and defract wave energy to create a wave pattern that produces a stable, arc-shaped beach. In order to produce this effect, the groins stems must be sufficiently emergent above the water line to an elevation that prevents wave overtopping. Each beach cell is nourished and graded to achieve a stable design profile. The wave pattern produced by the groins function to maintain the design beach profile. Additional sand pushing is generally required after groin construction.

The groin heads function as offshore breakwaters. The ratio between the groins heads and gaps is 40/60, so the groin heads are expected to block a certain amount of wave energy. While the groins are designed for prevailing wave conditions, they do provide an additional level of protection under storm wave conditions. The groin layouts are based on the incident wave orientation to the beach cells. The groin systems would function properly as long as the angle between the incident wave crest and the gaps between groin heads is less than 20 degrees.

The conceptual groin layouts presented in Figure 5-6 and Figure 5-7 are intended to improve and maintain the area where a beach currently exists. The property to the west has no beach and was therefore not included. The groins layouts can be modified to expand the project in either direction with consent from the adjacent landowners.

Groins have also been shown to enhance marine species diversity and density. The basalt boulders of the groins support an abundance of fishes and fish species richness and diversity. The boulders support coral colonization and the interstitial spaces between the rocks provide shelter for juvenile reef fishes.

<u>Advantages</u>

- Would restore and maintain a stable beach.
- Would create a stable buffer between the ocean and the backshore land and infrastructure.
- Would improve shoreline public access.
- Low maintenance.
- Groins provide habitat that has been shown to enhance marine species diversity and density.
- Agencies are generally supportive of large-scale beach restoration.

<u>Disadvantages</u>

- Groins have large structural footprints.
- High costs for design, permitting, construction, and easements.
- Would require an adequate quantity of compatible beach quality sand.
- Sand is not currently available for purchase on Maui.
- May require offshore sand source investigations.
- Would require extensive collaboration with agencies, neighbors, and the community.

Large-scale beach nourishment with engineered stabilizing structures would benefit the beach, enhance lateral shoreline access, mitigate the erosion, and provide long-term protection for the backshore land and infrastructure. Expanding the project to include adjacent properties would benefit the entire community. Ideally, the project would be cost-shared by the community with assistance and project leadership from the State of Hawaii and County of Maui. A similar project is currently underway in Kahana Bay on West Maui.

Sand Sources

A key component to the success of a beach restoration project is the availability of a suitable sand source to support a large-scale beach nourishment effort. While sand may seem like a plentiful commodity, the reality is that good quality beach sand is in short supply in the Hawaiian Islands. There are generally three potential sources of beach-compatible sand: inland dune sand, nearshore sand (e.g., channels, harbors), and offshore sand. Mining of sand from beaches is a prohibited activity.

Inland dune sand has been used for beach restoration purposes on Maui. Previous projects have used Maui inland Class “A” dune sand that has, for the past few decades, been commercially-available as a result of sand excavation activities in the Maui Lani area (Figure 5-8). Maui inland Class “A” dune sand has been used for beach nourishment projects at Kanai A Nalu (Maalaea), Halama Street (Kihei), and Sugar Cove (Spreckelsville).

Supplies of beach quality sand from private companies from existing quarries appear to be diminishing (HSBPA, 2014). In 2006, the County of Maui commissioned a study to assess the existing inventory of dune sand on Maui. The study concluded that available inventories of dune sand may last for another five or six years based upon usage rates at the time (Hanzawa, 2006). The County of Maui recently implemented a moratorium on mining of inland dune sand. The purpose of the moratorium is to allow time to conduct an updated sand inventory study and establish regulations to preserve existing sand resources and prevent the disturbance of iwi kupuna (ancestral bones). While the moratorium is a temporary measure, it is unclear if inland dune sand will be available to support future beach restoration projects on Maui.

Another potential source of beach-compatible sand is the nearshore waters offshore and adjacent to the project site. Sand often accumulates in channels or depressions in the reef flat. In some cases, these deposits can be recovered to support beach maintenance and restoration. The channel fronting KAN appears to be filled with carbonate sand. While additional field investigations would be necessary to determine accurate volumes and grain size compatibility, these nearshore sand deposits could potentially support beach maintenance at KAN.

Offshore deposits present an alternative source of sand for beach nourishment, particularly when considering the limited availability of suitable, natural sand from inland sources (Figure 5-9). Offshore sand deposits occurring within the same littoral cell tend to have grain size characteristics and composition that are similar to the existing beach sand. Color and abrasion resistance are also important characteristics of fill sand. While natural calcareous beaches range in color from light brown to white, sand in offshore deposits often turns a grayish color as a result of anaerobic conditions typically produced by a lack of wave action and associated mixing.

The U.S. Army Corps of Engineers (2011) identified approximately 13.8 acres of stable sand stored on the reef flat from Maalaea to Kihei. The largest non-ephemeral sand fields are located offshore of Kalama Park and Waipuilani Park. While additional sand investigations are necessary to determine accurate volumes and grain size compatibility, these offshore sand deposits could potentially support beach restoration at KAN. SEI is not aware of any other offshore sand source investigations in the vicinity of KAN.

Figure 5-8 Excavation of inland dune sand at Maui Lani

Figure 5-9 Offshore sand recovery at Waikiki Beach, Oahu (2012)

Sand Source Investigations

Potential offshore sand sources require exploration using marine geophysical survey techniques to characterize deposit area and volume, and extensive sampling and analysis to ensure that grain size characteristics are suitable for beach restoration purposes. Offshore sand deposits are often located in areas with high wind and wave exposure, and water depths of 60 to 100 feet. Offshore sand source investigations typically involve a *reconnaissance level survey* and a *detailed survey*.

A *Reconnaissance Level Sand Survey* typically includes:

- Side scan survey to locate sand deposits;
- Grab sampling of surface sand along survey transects;
- Air jet probing at selected locations;
- Diver push core sampling at selected locations to assess subsurface sand quality; and;
- Grain size analysis of sand samples.

A side scan sonar is used to locate and map sandy areas offshore of the project area. Once the sandy areas are mapped, diver probing, coring, and sampling would be planned and conducted. An air jet probe is used to measure sand thickness. Air jet probing is used to acquire indirect physical information on subsurface lithology by surveying the thickness and stratigraphic layering of marine sediments. It provides a rapid means for determining the nature of unconsolidated sedimentary deposits. Air jet probing can also help to differentiate layers of materials that are present below the surface of the seafloor. A push core is used to collect composite sand samples. Push core samples are an inexpensive means of recovering relatively undisturbed cores to assess the composition, stratigraphy, and grain sizes of the sand. Composite samples are collected by taking equal quantities of sand from the upper, middle, and lower sections of each core. A laboratory sieve analysis is performed to determine the grain size characteristics for the composite sand samples. If the sand samples are determined to be suitable, then a more detailed survey may be justified.

Costs for a reconnaissance level survey can range from **$50,000 to $75,000**.

A *Detailed Sand Survey* typically includes:
1) Sub-bottom profiling;
2) Vibracoring, and;
3) Additional side scan survey (if necessary).

A sub-bottom profiler is used to survey the thickness of the sand deposits offshore of the project area. The side scan and sub-bottom data collected during the surveys is used to produce maps showing the extent and thickness of sand deposits offshore of the project area. The sidescan and sub-bottom maps are then used to select locations to conduct vibracoring. Vibracoring is a coring technique typically used in sand whereby a core barrel is vibrated into the sand deposit and a sand core is extracted. These sand cores allow detailed evaluation of the subsurface quality of the sand, and how the sand changes with depth in the deposit. Beach restoration may be feasible if the sand samples are determined to be suitable and the volume of the deposits is determined to be adequate,

Costs for a detailed level survey can range from **$100,000 to $250,000**.

5.2 Erosion Response Alternatives

5.2.1 Erosion Protection Skirt

An erosion protection skirt is a method of temporary erosion control that consists of a layer of geotextile fabric (skirt) that is draped over the erosion scarp and anchored to the backshore. An example of an erosion protection skirt at Honokowai, Maui, is shown in Figure 5-10. The structure consists of a core that is constructed of layers of geotextile material that are filled with sand. The skirt is draped over the core and secured to the backshore using earth anchors.

Figure 5-10 Geotextile erosion protection skirt at Honokowai, Maui (2018)

An advantage of an erosion protection skirt is that the materials are readily available and sand fill is not required. Regulatory agencies have generally been supportive of erosion protection skirts for temporary erosion control. A disadvantage of an erosion protection skirt is that it is typically only authorized under emergency conditions. The cumulative costs for design, construction, repair and replacement can also be substantial.

An erosion protection skirt is not an engineered erosion control structure and is consequently vulnerable to displacement and failure due to wave action and scour. Given the dynamic nature of the beach, the exposure to wave energy, and the dimensions of the erosion scarp, it is unlikely that an erosion protection skirt would be effective at KAN. The erosion scarp is very irregular and at a relatively high elevation when the beach is deflated. Considerable earthwork would be required to prepare a suitable surface on which the geotextile fabric could be placed. Foundation conditions along the toe of the scarp are also irregular and variable. The presence of clay outcrops, cobble, and boulders would make it difficult to prevent undermining. The foundation conditions would also preclude trenching and burial of the skirt toe, which is key to successful implementation.

Advantages

- Would provide temporary protection for the backshore land and infrastructure.
- Less expensive than beach restoration or shore protection.
- Minimal impact on the beach and shoreline public access.

Disadvantages

- Would not improve the condition of the beach.
- Typically, only authorized under emergency conditions.
- Less robust and durable than geotextile sandbags.
- Would require routine maintenance and replacement.
- Unlikely to be effective based on the project site conditions.
- Costs for design, construction, repair and replacement can be substantial.

An erosion protection skirt is unlikely to be effective at KAN. The project site conditions are not conducive to this method of temporary erosion control. The structure would likely require regular repairs and eventually need to be replaced.

5.2.2 Sand Filled Mattress

A Sand Filled Mattress (SFM) is a method of temporary erosion control that is manufactured from two layers of geotextile fabric stitched together at regular intervals. The bottom layer of the mattress is composed of a woven geotextile while the top exposed surface layer is composed of a composite geotextile that provides excellent abrasion resistance and durability. It is delivered in rolls that can be laid out with parallel tubular sections running down an embankment or beach face. The sections are hydraulically filled with sand on-site through the top openings. Adjacent rolls are joined by seaming on-site and anchored in a trench at the top of the slope. When filled with sand, the SFM functions as a temporary revetment. An example of an SFM at Kaanapali, Maui, is shown in Figure 5-11.

An advantage of the SFM is that the materials can be stored on-site and rapidly deployed during or after episodic erosion events. When the beach is deflated, the SFM would reduce the amount of time that the erosion scarp is exposed to wave action, which would decrease the amount of erosion and land loss. A disadvantage of the SFM is that they are typically only authorized under emergency conditions and removal is typically required after the beach recovers.

Advantages

- Would provide temporary protection for the backshore land and infrastructure.
- Materials are readily available and construction process is efficient.
- Less expensive than beach restoration or shore protection.
- Minimal impact on the beach and shoreline public access.

Disadvantages

- Would not improve the condition of the beach.
- Typically, only authorized under emergency conditions.
- Requires an adequate volume of sand fill.
- Would require routine maintenance and replacement.

Figure 5-11 Geotextile sand filled mattress at Kaanapali, Maui (2018)

The SFM is a temporary erosion control measure that KAN could install during or after an erosion event to minimize additional loss of land. The SFM materials could be stored on-site and deployed as a rapid erosion response measure. The SFM would likely only be authorized for a brief period of time and would therefore not provide long-term protection for the backshore land and infrastructure.

5.2.3 Sandbag Revetment

A sandbag revetment is a form of temporary erosion control that consists of multiple layers of sandbags that are stacked to a specific design profile. The bags are constructed of geotextile fabric and filled with sand. The structure is designed to absorb wave energy and protect the backshore from wave action. The preferred material is ELCOROCK®, which is a highly durable non-woven, geotextile fabric. Enhanced filtration combined with resistance to abrasion and UV damage makes this material ideal for coastal applications. An example of a geotextile sandbag revetment at Kahana, Maui, is shown in Figure 5-12.

An advantage of a geotextile sandbag revetment is that the materials are readily available, and the structures have historically been very effective at mitigating erosion. A disadvantage of a geotextile sandbag revetment is that the structure would have a very large structural footprint. Agencies are generally opposed to the use of geotextile sandbags along the shoreline due to concerns regarding the semi-permanent nature of the structures. Recent proposals for geotextile sandbag revetments on Oahu and Maui have been denied, even under emergency conditions.

Figure 5-12 Geotextile sandbag revetment at Kahana, Maui (2018)

Advantages

- Would provide temporary protection for the backshore land and infrastructure.
- Materials are proven, durable, and readily available.
- Less expensive than beach restoration or shore protection.

Disadvantages

- Would not improve the condition of the beach.
- Very large structural footprint.
- Typically, only authorized under emergency conditions.
- Would require routine maintenance and replacement.
- Agency and public opposition to construction of shore protection structures on Maui.

A geotextile sandbag revetment would be an effective and durable temporary erosion control solution at KAN. A conceptual plan view and section view of a geotextile sandbag revetment at KAN are shown in Figure 5-13 and Figure 5-14 respectively. To prevent wave overtopping, the crest elevation of the sandbag revetment would be +10 feet msl, which is slightly above the existing grade. The toe of the revetment would be -2 feet msl to provide scour protection. The primary disadvantage of a sandbag revetment is that the structure would have a very large footprint and would occupy most of the existing open space between the KAN buildings and the shoreline.

A geotextile sandbag revetment would be the most effective and durable option for temporary erosion control at KAN; however, it may be difficult to obtain the necessary regulatory approvals. The area seaward of the shoreline is located in the Conservation District. Erosion control and shore protection structures are typically prohibited in the Conservation District. A geotextile sandbag revetment may only be feasible if it is located landward of the shoreline.

The Rough Order of Magnitude cost to construct a geotextile sandbag revetment is **$2,400,000**.

Figure 5-13 Conceptual plan view of a geotextile sandbag revetment at KAN

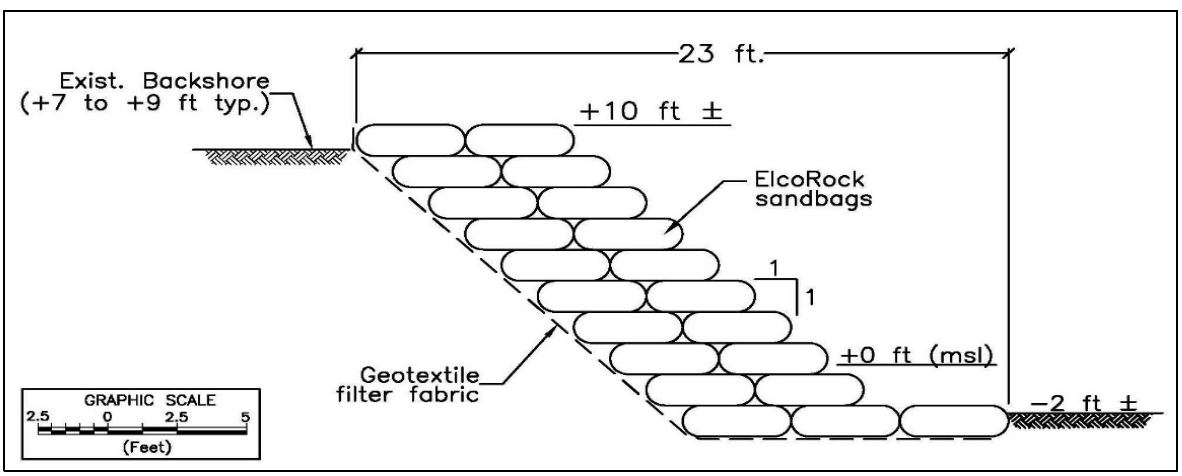

Figure 5-14 Conceptual section view of a geotextile sandbag revetment at KAN

5.2.4 Seawall Repair

A seawall is a vertical or sloping structure designed to protect the backshore land and infrastructure from wave damage and erosion. Seawalls are typically constructed using concrete, concrete rubble masonry (CRM), cement masonry unit (CMU), or sheet pile. A seawall, if properly designed and constructed, is a proven, durable, and low-maintenance shore protection method. Seawalls also have the advantage of having a smaller footprint than other shore protection options (e.g., revetments), which helps to preserve open space and lateral shoreline access. The existing CRM seawalls at KAN are shown in Figure 5-15 and Figure 5-16.

The vertical and lateral displacement and rotation observed in the walls appears to be due to undermining of the seawalls when the sand elevation recedes below the base of the wall. As the wall undermines, it loses its bearing support at the toe, or in some areas, the entire width of the wall, resulting in downward and outward movement in the wall and the associated cracking and separations. The concrete fill appears to be an attempt to address past undermining; however, as the fill does not extend below the soft sand substrate to a more erosion-resistant hard substrate, the undermining has continued over time. Other possible causes for the observed distress and displacement, particularly at the seawall in Section 3 (east), include the force from large waves displacing the top cap and upper portions of the wall. As the undermining, distress and displacement has severely compromised the structural integrity of the walls, the walls should be repaired or replaced.

A typical undermining repair would consist of removing the soft sand below the wall base down to hard erosion-resistant substrate and filling the void with concrete. The feasibility of this repair is based on a hard substrate located within a few feet of the bottom of the wall. If the hard substrate is much deeper, as may be the case with these walls, the installation of sheet piles or piers to protect the wall toe from undermining may be required.

Assuming a 3 to 4-foot wall thickness based on the width of the top cap, the walls may have sufficient mass to resist wall design forces for their current 5 to 6-foot height. However, if the wall height is increased significantly in order to extend to the hard substrate or the wall thickness is significantly less than assumed, an increased wall thickness may be required, in which case additional concrete should be added behind the wall. Additional investigations and structural analysis would be required to determine the required wall thickness.

As part of the wall repairs, voids and separations in the wall should be filled with mortar and concrete out to the exterior wall face to restore the integrity of the wall and to provide a smoother, less porous face that will reduce the buildup of wave forces within the wall. It is anticipated that similar work would need to be performed on the seawalls at the adjacent properties to protect them from undermining and to restore their structural integrity.

Figure 5-15 Existing CRM seawall at west end of KAN shoreline

Figure 5-16 Existing CRM seawall at east end of KAN shoreline

The existing seawalls fronting KAN are considered *nonconforming*, meaning that they were constructed prior to the adoption of the State Conservation District Rules and County Special Management Area and Shoreline Setback Rules. Repairs to nonconforming structures can be authorized; however, there are statutory limitations as to the nature and extent of the repairs. In general, a nonconforming structure may be repaired under the following conditions:

- The repairs are valued at less than 50% of the current replacement cost of the structure.
- The repairs do not enlarge or expand the structure.

In addition to the recommended repairs to the seawalls in Section 1 (west) and Section 3 (east), KAN may consider reconstructing the failed seawall in Section 2 (middle). Because the seawall was nonconforming prior to its' failure, it is possible that it could be reconstructed with the same density, materials, and footprint as the original structure. An advantage of reconstructing the failed seawall is that it would provide some degree of shore protection and reduce the erosion in Section 2. The original seawall had a shallow-depth foundation. A disadvantage of a shallow-depth foundation is that it would not protect against scour and undermining, so the structure would be more susceptible to damage. If the failed seawall in Section 2 (middle) were to be reconstructed, a deep foundation would be recommended.

The Rough Order of Magnitude cost to repair the existing seawalls in Section 1 (west) and Section 3 (east) is **$1,025,000**. This value represents **47%** of the current replacement cost of the structures.

The Rough Order of Magnitude cost to reconstruct the failed section of seawall in Section 2 (middle) is **$950,000**. This value represents **43%** of the current replacement cost of the structures.

The Rough Order of Magnitude cost to repair the existing seawalls in Section 1 (west) and Section 3 (east) <u>and</u> reconstruct the failed section of seawall in Section 2 (middle) concurrently is **$1,700,000**. This value represents **77%** of the current replacement cost of the structures.

<u>Advantages</u>

- Would protect the backshore land and infrastructure.
- Smaller structural footprint when compared to other shore protection options considered.
- Less expensive than removing and replacing the existing seawalls.

<u>Disadvantages</u>

- Would not restore or maintain a stable beach.
- High costs for design, environmental review, permitting, and construction.
- Additional costs to obtain non-exclusive easements.
- Agency and public opposition to shore protection structures on Maui.

The existing seawalls at KAN are in disrepair and have shallow foundations that are susceptible to scour and undermining. Repairing the existing seawalls would be less expensive and less controversial than replacing the structures. Reconstructing the failed section of seawall may be feasible; however, the cumulative costs for repair <u>and</u> reconstruction would exceed 50% of the replacement cost of the structures. It is possible that the projects could be performed separately in order to comply with the existing rules for repair of nonconforming structures.

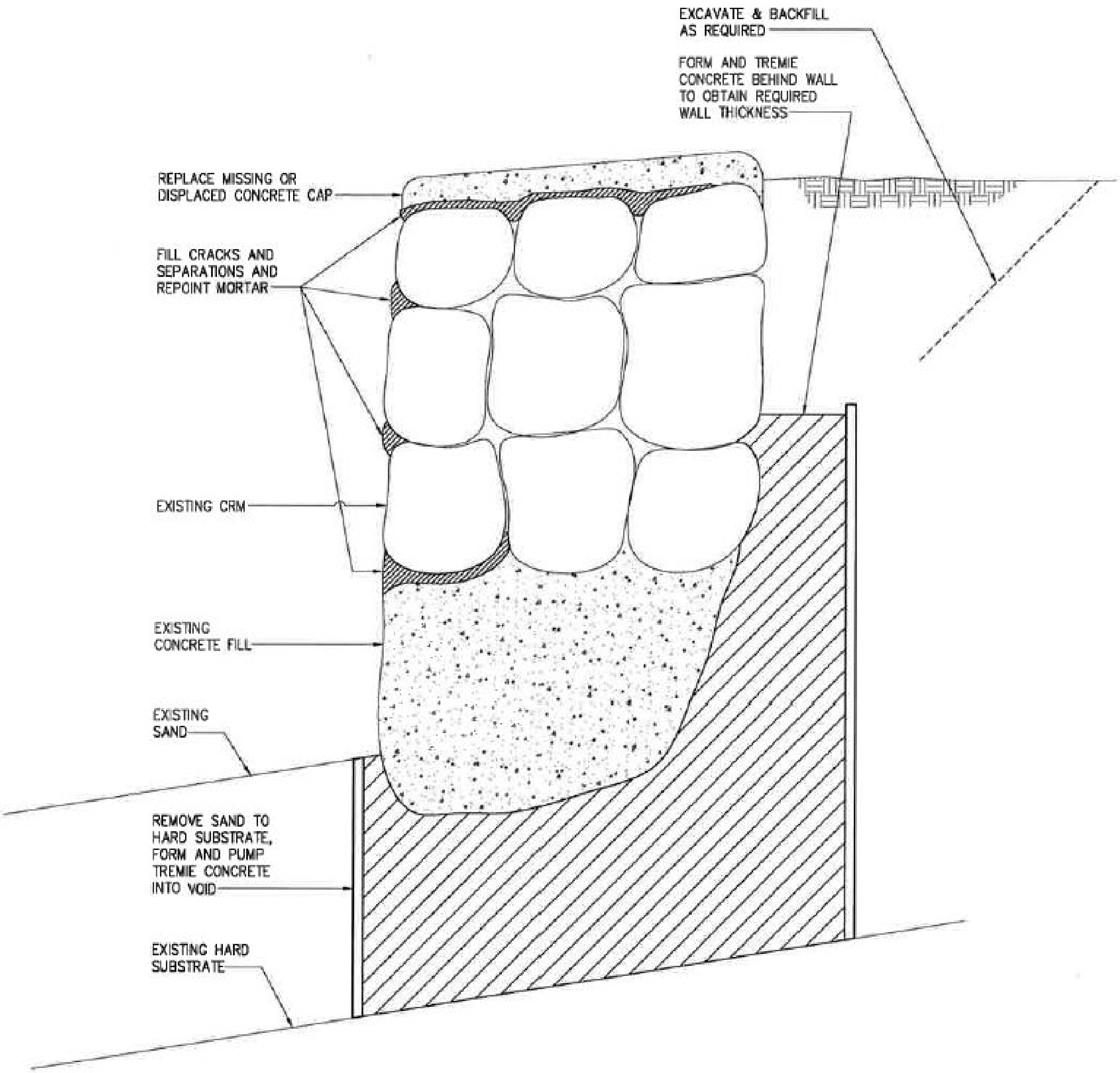

Figure 5-17 Conceptual scheme for seawall repairs in Sections 1 (west) and 3 (east)

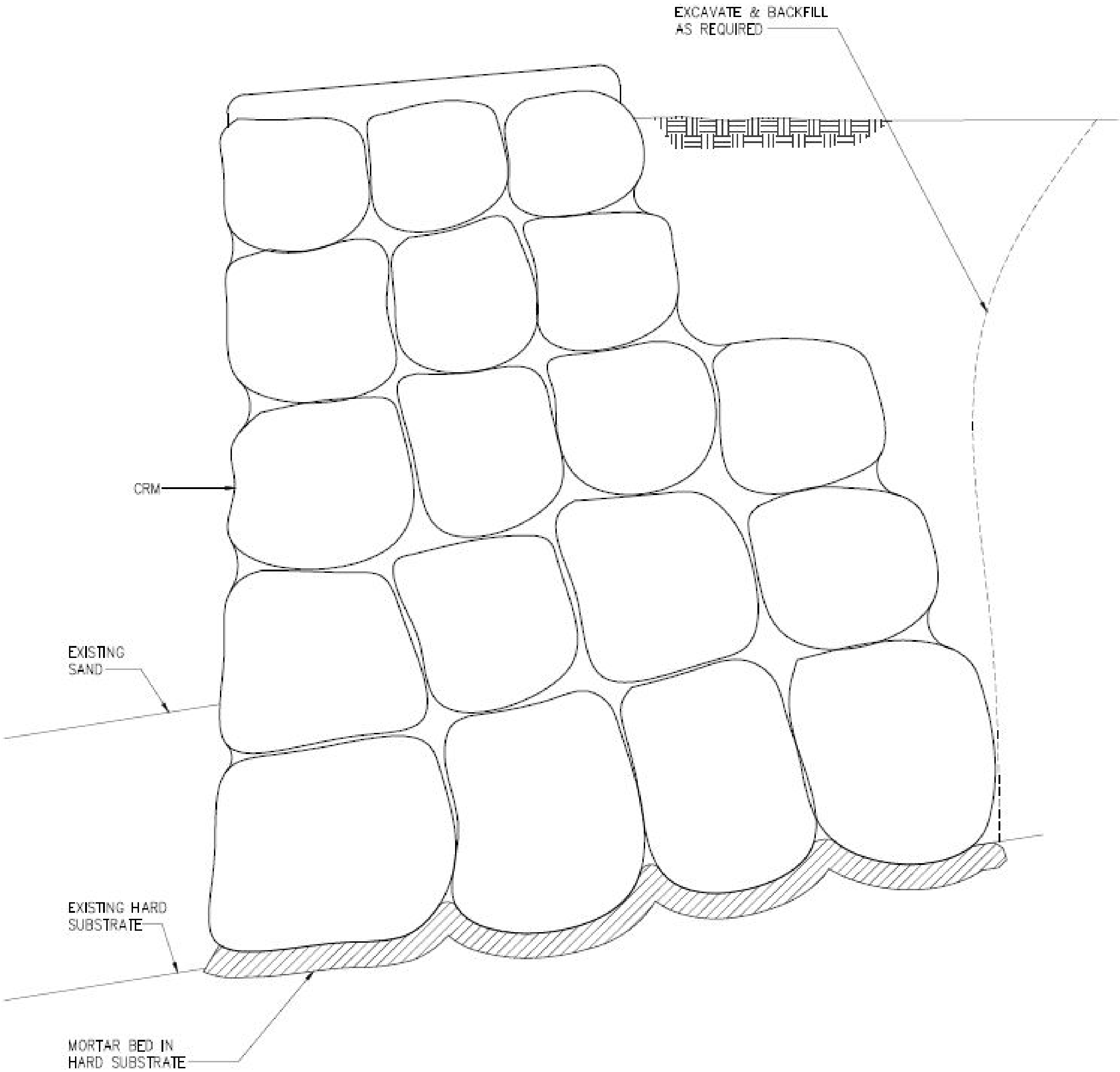

Figure 5-18 Conceptual scheme for seawall reconstruction in Section 2 (middle)

5.2.5 Seawall Replacement

Seawalls are not flexible structures and their structural stability is dependent on the design and strength of their foundations. If the foundation of a seawall is breached, hydraulic action can erode fill material behind the wall. With the loss of enough fill, the ground surface behind the seawall will collapse and sinkholes will form. Sinkholes can compromise the structural integrity of a seawall and may result in failure of the structure. To avoid foundation problems, the seawall foundation should be well below the potential scour depth, which can require extensive excavation. The impervious and vertical face of a seawall results in very little wave energy dissipation. Incident wave energy is deflected upward, downward, and seaward. Reflected wave energy can inhibit accretion of sand seaward of the wall. The downward energy component can cause scour at the base of the wall. Therefore, the foundation of a seawall is critical for its stability, particularly on sandy and eroding shorelines. Ideally, seawalls are constructed on solid, non-erodible substrate.

The existing seawalls at KAN appear to have been poorly constructed. The wall foundations are insufficiently sized, the materials are variable and deteriorated, damages and structural deficiencies are severe and widespread, and previous attempts to repair the structures have failed. The existing structures will eventually need to be repaired or replaced to protect the KAN property from erosion and sea level rise.

It is anticipated that a new seawall would be constructed of cast-in-place reinforced concrete. Due to existing regulatory restrictions, it is anticipated that the new seawall would be required to be located landward of the certified shoreline outside of the Conservation District. Replacement would also require demolition and removal of the existing structures. A conceptual plan view and section view of a new cast-in-place seawall at KAN are shown in Figure 5-19 and Figure 5-20, respectively.

Figure 5-19 Conceptual plan view of a new cast-in-place seawall at KAN

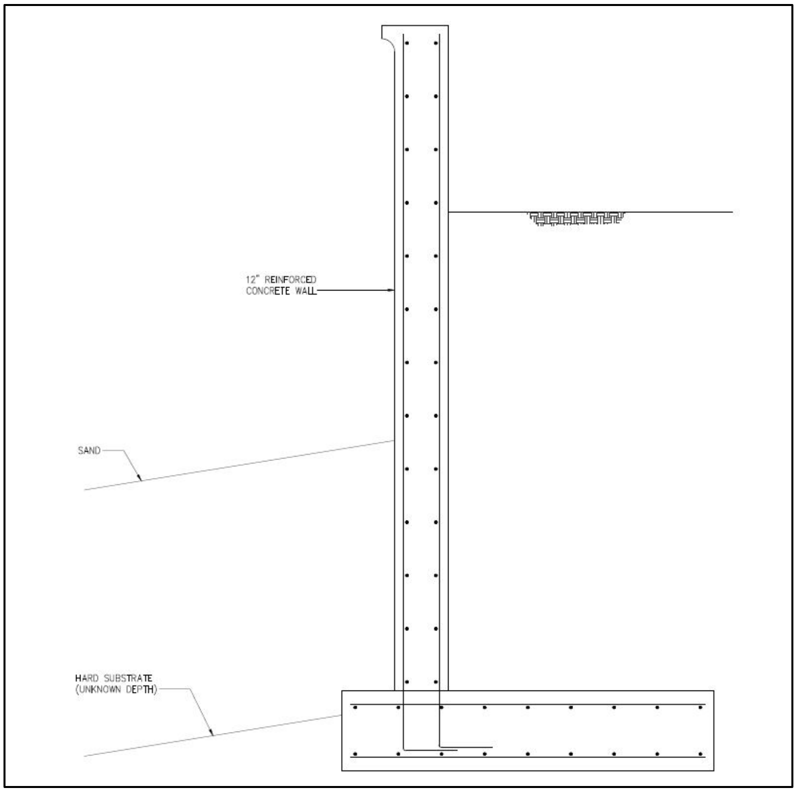

Figure 5-20 Conceptual section view of a new cast-in-place seawall at KAN

Advantages

- Would protect the backshore land and infrastructure.
- Smallest structural footprint of the shore protection options considered.
- Reduced footprint would maximize open space on the property.
- Would eliminate the requirement and costs to obtain easements from the State of Hawaii.

Disadvantages

- Would likely need to be constructed landward of the certified shoreline.
- Would not restore or maintain a stable beach.
- High costs for design, environmental review, permitting, and construction.
- Agency and public opposition to construction of shore protection structures on Maui.

A seawall would be an appropriate erosion control solution for KAN. A seawall would mitigate the erosion and provide effective long-term protection for the backshore land and infrastructure; however, regulatory agencies and the public are generally opposed to construction of seawalls due to concerns about potential impacts to beaches and dunes, particularly on Maui. A new seawall would be very controversial, even if the structure were located landward of the certified shoreline.

The Rough Order of Magnitude cost to demolish and remove the existing seawalls and construct a new cast-in-place seawall is **$2,200,000**.

5.2.6 Rock Rubblemound Revetment

A revetment is a sloping, un-cemented structure constructed of wave-resistant material. The most common method of revetment construction is to place a layer of armor stone, sized according to the design wave height, over an underlayer of smaller rock that sits atop filter fabric. The underlayer is designed to distribute the weight of the armor layer and to prevent loss of fine material through voids in the revetment.

Revetments in Hawaii are typically built on a slope of 1.5 to 2 horizontal to 1 vertical to ensure stability. Toe scour protection can be provided by excavating to place the toe on solid substrate, constructing the foundation below the maximum depth of anticipated scour, or extending the toe to provide a scour apron of excess stone. It is important that the armor stone be carefully chosen and placed in a keyed-and-fitted manner to minimize gaps between stones, which increases the durability of the structure. An example of a rock revetment at Kahului Harbor (Kahului, Maui) is shown in Figure 5-21.

Figure 5-21 Rock rubblemound revetment at Kahului, Maui (2011)

An advantage of a rock rubblemound is that the rough porous rock surface and sloping face of the structure will tend to absorb wave energy, reduce wave reflection, and may help to promote accretion of sand on a sandy beach when sufficient sand volume is available in the littoral environment. Additional advantages of revetments are that materials are readily available and localized damage can be easily repaired by placement of additional armor stone. Properly designed and constructed rock revetments are durable, flexible, and highly resistant to wave damage.

A disadvantage of a rock rubblemound revetment is that it would have the largest structural footprint of the options presented in this report. The location of the revetment would affect the overall cost and permitting requirements. A revetment is not likely to be authorized seaward of the shoreline in the Conservation District. Construction of the revetment landward of the shoreline would require extensive excavation of the backshore. It is important to note that, even if the revetment were constructed landward of the shoreline, the future certified shoreline would likely be located at or near the crest of the structure, so an easement may eventually be required.

A conceptual plan view and section view of a rock rubblemound revetment at KAN are shown in Figure 5-22 and Figure 5-23, respectively.

Figure 5-22 Conceptual plan view of a rock rubblemound revetment at KAN

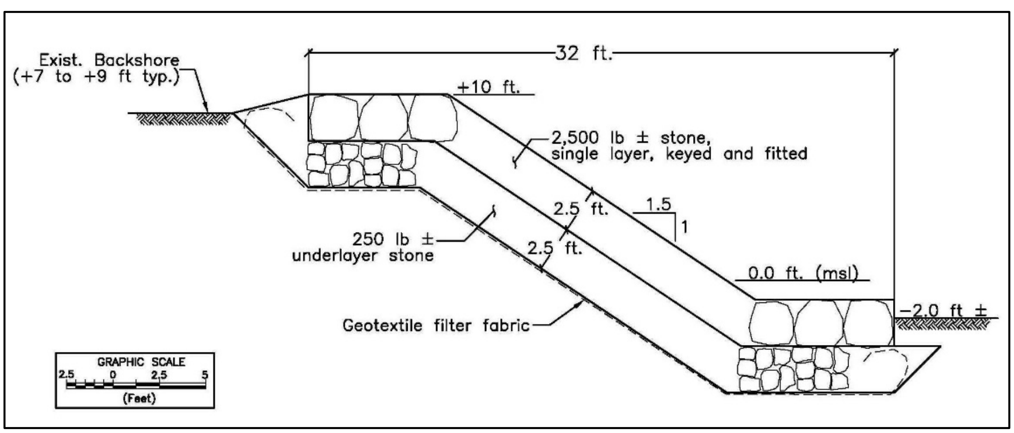

Figure 5-23 Conceptual section view of a rock rubblemound revetment at KAN

The revetment is designed to prevent wave overtopping. The revetment crest and face consist of armor stone with a median stone size of 2.5 feet based on the design wave conditions. The revetment would be situated inshore of the certified shoreline and would have a cross section of about 32 feet. The crest elevation would be +10 feet msl, which is slightly higher than the existing grade immediately inshore of the certified shoreline. The revetment crest is three stones wide, or approximately 7.5 feet. The revetment face would have a slope of 1V:1.5H, which is the steepest face recommended by the Shore Protection Manual. The armor stone would be placed in a keyed-and-fitted configuration to increase structural stability. The revetment toe would be 8 feet wide and constructed of the largest recommended stone (approximately 3,100 lbs). The rough face and porosity of the revetment and toe stones would help dissipate wave energy, reduce wave reflection, and potentially assist in the accretion of sand along the toe of the structure.

Advantages

- Would provide long-term protection for the backshore land and infrastructure.
- May facilitate beach accretion seaward of the structure.
- Would eliminate requirement and costs to obtain easements from the State of Hawaii.
- Very low maintenance.
- Would not require in-water construction.
- Would not impact lateral shoreline access.
- Existing seawalls could remain in place during construction.
- Would have better energy dissipation characteristics than the existing seawalls.

Disadvantages

- Would not restore or maintain a stable beach.
- Would likely need to be constructed landward of the certified shoreline.
- Largest structural footprint of the shore protection options considered.
- Very high costs for design, permitting, and construction.
- Would require extensive excavation of the backshore.
- May require a non-exclusive easement from the State of Hawaii.
- Agency and public opposition to construction of shore protection structures on Maui.

A rock rubblemound revetment would be an appropriate erosion control solution at KAN. A revetment would mitigate the erosion and provide effective long-term protection for the backshore land and infrastructure; however, this solution would require a major construction effort, and the costs for design, permitting, construction would be high. The structure would also occupy near all the open space landward of the shoreline. Due to the location of the shoreline, there may not be enough space to accommodate a rock rubblemound revetment in Section 3 (east).

The Rough Order of Magnitude cost to construct a rock rubblemound revetment is **$1,500,000**.

5.2.8 Hybrid Seawall-Revetment

Another potential long-term solution for the erosion at KAN is a hybrid shore protection structure. A hybrid seawall-revetment would be composed of two primary elements: 1) a seawall (i.e. sheet pile, reinforced concrete, or concrete rock masonry), and 2) a uniform rock rubblemound revetment. An example of a hybrid seawall-revetment at Kapaa, Kauai is shown in Figure 5-24.

Figure 5-24 Hybrid seawall-revetment at Kapaa, Kauai (2012)

A hybrid seawall-revetment would be the most effective engineering solution to mitigate the erosion and protect the backshore land and infrastructure at KAN. A conceptual plan view and section view of a hybrid seawall-revetment at KAN are shown in Figure 5-25 and Figure 5-26, respectively.

A hybrid seawall-revetment would be designed to withstand extreme wave conditions, be minimally reflective, allow for accretion of beach sand, provide lateral shoreline access, reduce turbidity in nearshore waters, and minimize the amount of material placed in Waters of the United States and the State Conservation District. A hybrid seawall-revetment would have a smaller footprint than a traditional rock revetment. The revetment provides toe protection for the seawall and reduces reflective wave energy, which is conducive to maintaining a sand beach.

If a hybrid seawall-revetment were permitted in the Conservation District, KAN would be required to obtain a non-exclusive easement from the State of Hawaii. Even if the structure were located landward of the current certified shoreline, the future certified shoreline would likely be located at or near the crest of the structure, so an easement would eventually be required. In either case, easement costs are likely unavoidable.

Figure 5-25 Conceptual plan view of a hybrid seawall-revetment at KAN

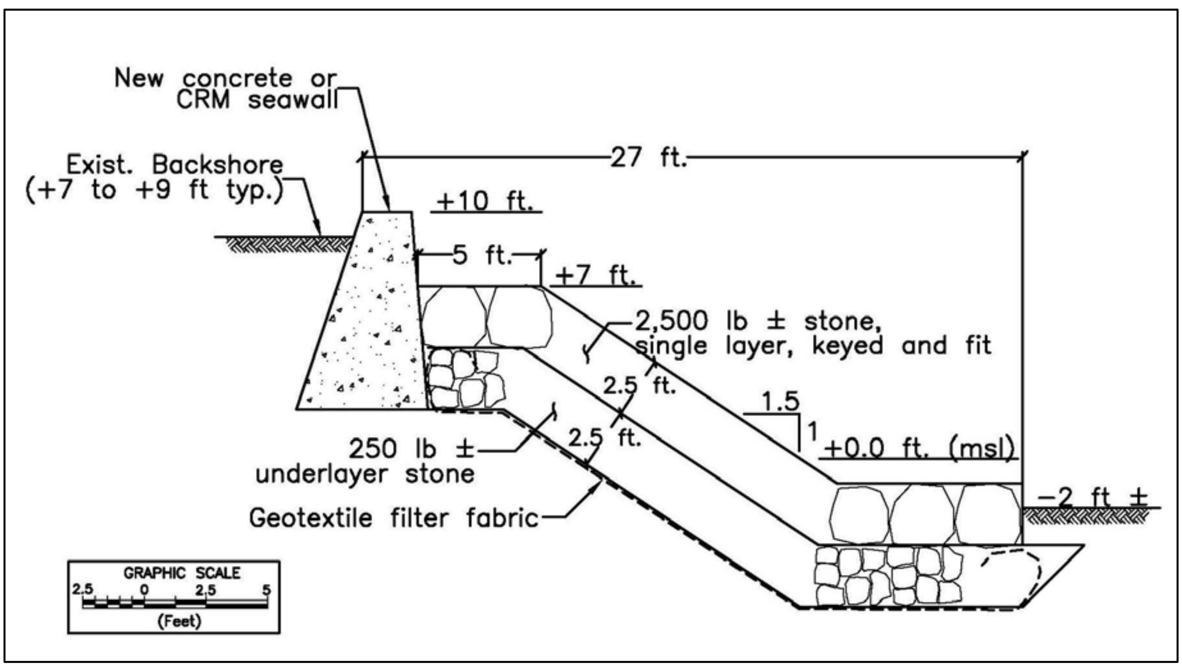

Figure 5-26 Conceptual section view of a hybrid seawall-revetment at KAN

Advantages

- Would provide long-term protection for the backshore land and infrastructure.
- May facilitate beach accretion seaward of the structure.
- Very low maintenance.
- Would not require in-water construction.
- Would not impact lateral shoreline access.
- Smaller structural footprint when compared to a rock rubblemound revetment.
- Existing seawalls could remain in place during construction.
- Would have better energy dissipation characteristics than the existing seawalls.

Disadvantages

- Would not restore or maintain a stable beach.
- Would likely need to be constructed landward of the certified shoreline.
- Large structural footprint.
- Very high costs for design, permitting, and construction.
- Would require extensive excavation of the backshore.
- May require a non-exclusive easement from the State of Hawaii.
- Agency and public opposition to construction of shore protection structures on Maui.

A hybrid seawall-revetment is an appropriate erosion control solution for a project of this scale. A hybrid seawall-revetment would mitigate the erosion and provide effective long-term protection for the backshore land and infrastructure; however, this solution would require a major construction effort in coordination with all of the affected landowners, and the costs for design, permitting, construction, and easements would be high. A hybrid seawall-revetment would not satisfy the project objective to restore and maintain the beach resource and is therefore not considered a preferred alternative.

The Rough Order of Magnitude cost to construct a hybrid seawall-revetment is **$1,850,000**.

5.2.9 Managed Retreat

This approach would involve relocating the existing structures further landward and allowing the erosion to continue. Retreat would allow the backshore to continue to erode and sand to migrate naturally along the beach. Retreat would avoid the costs associated with design, permitting, and construction of shore protection measures or beach restoration; however, costs associated with relocating the existing structures and restoring the landscape after the structures have been removed would likely be substantial. Retreat could eventually negate the economic value of the property.

Given the existing building footprints, the dimensions of the parcel, and the proximity to Hauoli Street, it may not be feasible to relocate the structures landward. It is worth noting that the area landward of Hauoli Street consists of a 423-acre parcel of undeveloped land that is zoned Agriculture (AG). While this land is currently being used for agricultural purposes, it is possible that it could be rezoned to accommodate landward migration of the existing residential developments. A project of this scope would require extensive coordination with adjacent landowners, agencies, and the public.

The Hawaii Office of Planning (OP) recently published a report entitled, *Assessing the Feasibility and Implications of Managed Retreat Strategies for Vulnerable Coastal Areas in Hawaii*. The study evaluated options to establish policies, regulations, tools, and programs to support a managed retreat strategy in response to sea level rise. The study found that retreat is one of three primary adaptation strategies, along with accommodation (e.g., freeboard) and protection (e.g., hybrid-seawall revetment), and that, prior to deciding upon retreat, accommodation and protection must be examined to determine which strategy is the best for the area dealing with coastal hazards, climate change and sea level rise. The study also found that retreat is only effective when done voluntarily and that economic incentive programs to fund retreat (e.g., buyouts, transferrable development rights, rolling easements) are unlikely to be effective due to the high cost of real estate in Hawaii. Finally, the report noted that retreat from chronic coastal hazards (e.g., erosion and sea level rise) is incremental and typically takes decades to complete.

While managed retreat would not satisfy the project objectives to restore and maintain the existing beach and provide long-term protection for the backshore land and infrastructure, there are options that could potentially reduce exposure to wave overtopping and flooding. For example, the first-floor units could be converted to non-habitable space and repurposes for other purposes (e.g., covered lanai). This approach could be considered a form of “vertical retreat” whereby the at-risk infrastructure is modified to accommodate flooding in a manner that limits the impacts of flooding. Another option could be a “phased reconfiguration” of the property designed to concentrate the infrastructure as far from the shoreline as possible while retaining the economic and recreational value of the property. This approach could involve removal of the buildings closest to the shoreline, and expansion of the buildings furthest from the shoreline.

Considering the erosion history of the area (Fletcher et al., 2012), and the projected future erosion with rising sea levels (Anderson et al., 2015, State of Hawaii, 2018), retreat may be considered as a long-term option; however, until retreat is determined to be feasible or desirable, and programs and policies are in place to facilitate the process, other appropriate solutions should be considered.

Advantages

- Eliminates the risk to backshore infrastructure.
- Avoids costs and requirements associated with beach restoration and/or shore protection.
- Allows the beach to migrate naturally.

Disadvantages

- Would not restore or maintain the beach.
- Would not protect the backshore land and infrastructure.
- Requires the landowners to voluntarily surrender their property to erosion and sea level rise.
- Timeline for retreat is typically on the order of decades.

Retreat would not achieve the project objectives of restoring and maintaining a stable beach and protecting the backshore land and infrastructure. Without some form of erosion mitigation, it is likely that the beach will continue to erode, and the existing buildings will eventually become threatened or uninhabitable.

5.2.10 No Action

The No Action alternative would involve leaving the existing shore protection structures in place in their current condition, leaving the middle portion of the shoreline unarmored, and allowing the beach and backshore to continue to erode. This approach would do nothing to address the erosion problem, the condition of the shoreline would likely continue to deteriorate, and the existing buildings may eventually become threatened. Given the deteriorated condition of the existing seawalls, the structures are likely to fail in the future. Continued erosion of the backshore would result in the landward migration of the certified shoreline, which has implications for land ownership and public access. If the backshore continues to erode, engineering options may become limited as there may be insufficient land area available to accommodate shore protection structures.

<u>Advantages</u>

- No cost.
- Allows the beach to migrate naturally.
- Preserves lateral shoreline public access.

<u>Disadvantages</u>

- Would not mitigate the erosion.
- Would not protect the backshore land and infrastructure.
- Existing buildings will eventually become threatened or uninhabitable.

No Action would leave the backshore land and infrastructure exposed to erosion. Should the erosion continue as predicted, the existing buildings will eventually become threatened. Without some form of maintenance or restoration, the beach would likely continue to narrow and may eventually be lost to erosion.

6. RECOMMENDATIONS

6.1 Beach Management

The objectives of the beach management component of the BMERP are to restore and maintain a stable beach. This report presents five (5) potential options for beach management at KAN:

- Sand Pushing
- Sand Backpassing
- Sand Pumping
- Small-scale Beach Restoration
- Large-scale Beach Restoration

The alternatives listed above have previously been authorized in Hawaii. The first three options – sand pushing, sand backpassing, and sand pumping – are beach maintenance strategies that seek to leverage existing sand resources from within the littoral cell. The beach restoration options involve the addition of new sand to nourish the beach and, in some cases, additional structures to stabilize the beach fill. The primary challenge associated with beach maintenance and restoration at KAN is the availability of compatible beach quality sand. Sand is not currently available for purchase on Maui and SEI is not aware of any offshore sources of sand to support beach maintenance and restoration at KAN. Previous beach restoration efforts at KAN have been ineffective and sand is unlikely to remain stable without engineered stabilizing structures. A large-scale beach restoration effort would require extensive collaboration with agencies, adjacent landowners, and the public. If an adequate supply of locally-sourced sand can be identified, and the necessary approvals can be obtained, KAN could implement a long-term maintenance program to improve the condition of the beach and potentially slow the pace of the erosion.

<u>Recommendation 1: Develop a beach maintenance plan.</u>

Due to the lack of sand available to support beach restoration on Maui, KAN should investigate options to conduct beach maintenance using sand sourced from within the littoral cell. This could include pushing sand on the existing beach fronting KAN, backpassing sand from an adjacent section of the beach, or pumping sand from nearshore deposits.

Developing a beach maintenance program would involve the following steps:

1. *Shoreline Monitoring* – Develop a program to monitor the shoreline to identify conditions that cause erosion and beach narrowing.
2. *Feasibility Study* – Determine the volume of sand in the channel fronting KAN to assess the feasibility of sand pumping. Conduct grain size analysis to determine if sand is compatible with the existing beach. Engage regulatory agencies to assess the feasibility of sand backpassing.
3. *Plan Development* – Develop a plan detailing the rationale, means, methods, and timeline to conduct beach maintenance operations.
4. *Agency Consultations* - Consult with key agencies to review the plan and assess permitting requirements. Modify the means, methods, and timeline based on agency feedback.
5. *Regulatory Permitting* –Prepare and submit all required permit applications. Obtain regulatory approvals.
6. *Implementation* – Determine the project delivery method (i.e., design-build vs'; design-bid-build. Select contractor(s). Implement plan.

Recommendation 2: Assess the feasibility of large-scale beach restoration.

Given the long-term projections for erosion and sea level rise, KAN should investigate the feasibility of large-scale beach restoration with engineered stabilizing structures (i.e., groins). Offshore sand source investigations would be an important first step in determining if large-scale beach restoration is feasible.

Assessing the feasibility of large-scale beach restoration would involve the following steps:

1. *Reconnaissance Level Sand Survey* – Conduct field investigations to investigate potential sources of offshore sand to support beach restoration at KAN. If sand deposits are identified and sand samples are determined to be compatible with the existing beach, then a more detailed survey may be justified.
2. *Detailed Sand Survey* – Conduct field investigations to determine the spatial extent, thickness, and volume of offshore sand deposits. The size and scope of the project will depend on the estimated volume of sand available.

If beach restoration is determined to be feasible, the project would proceed as follows:

3. *Stakeholder Engagement* – Engage neighboring landowners and key agencies to determine the geographic scope of the project.
4. *Funding* – If the project will involve one or more partners, it may be necessary to establish a funding mechanism. Potential funding mechanisms include but are not limited to: Special Improvement Districts, Community Facilities Districts (CFD), Associations (e.g., AOAO), and Corporations (e.g., non-profit organizations).
5. *Functional Concept Design* – Develop a functional concept design that describes the technical requirements for beach restoration, including but not limited to design parameters and calculations, material quantities and specifications, representative design profiles, and plan and section view drawings. The functional concept design phase should include a budgetary cost estimate for construction. The estimate should include costs for sand recovery, transportation, and treatment (if required).
6. *Stakeholder Engagement* – Consult with project partners (if any) and key agencies to review the functional concept design, assess environmental review and permitting requirements, and modify the design based on stakeholder feedback.
7. *Environmental Review* – Hire a consultant to prepare an EA or EIS. This typically involves additional studies including but not limited to a marine biota and water quality assessment, historical, cultural, and archaeological assessment, cultural impact assessment, and recreational use study. The design may need to be modified based on feedback received during the environmental review process. Upon receipt of a Final Environmental Assessment (FEA) or Final Environmental Impact Statement (FEIS), the project can proceed to permitting and construction.
8. *Regulatory Permitting* –Prepare and submit all required permit applications. Obtain regulatory approvals.
9. *Construction* – Determine the project delivery method (i.e., design-build vs'; design-bid-build. Select contractor(s). Proceed to construction.

6.2 Erosion Response

The objectives of the erosion response component of the BMERP are to mitigate the erosion and protect the backshore land and infrastructure. There are two categories of erosion control options: temporary (short-term) and permanent (long-term).

This report presents three (3) potential options for temporary erosion control at KAN:

- Erosion Protection Skirt
- Sand Filled Mattress
- Sandbag Revetment

The alternatives listed above have previously been authorized in Hawaii; however, the effectiveness of these alternatives in mitigating the erosion would be limited due to the project site conditions, material durability, and limited duration of regulatory authorizations. Costs can also be significant due to the need for recurring maintenance, repair, and replacement. Temporary erosion control measures are typically only authorized under emergency conditions. The existing buildings at KAN are not imminently threatened so it is unlikely that temporary erosion control would be authorized.

<u>Recommendation 3: Conduct berm restoration.</u>

The shoreline in Section 2 (middle) is unarmored and vulnerable to erosion. Options for temporary erosion control are limited due to a combination of physical conditions, technical limitations, and regulatory constraints. KAN should seek authorization to conduct sand pushing to restore the sand berm in Section 2 (middle). Restoring the berm and increasing the volume of sand in the upper beach profile would improve the appearance of the beach and reduce the exposure of the erosion scarp to wave action. Sand pushing would be performed during periods when the beach is inflated.

Berm restoration would involve the following steps:

1. *Plan Development* – Develop a plan detailing the rationale, objectives, means, methods, and timeline for berm restoration. SEI recommends consulting with a Landscape Architect to explore options for using vegetation for slope stabilization purposes.
2. *Agency Consultations* - Consult with key agencies to review the berm restoration plan and assess permitting requirements. Modify the means, methods, and timeline based on agency feedback.
3. *Regulatory Permitting* –Prepare and submit all required permit applications. Obtain regulatory approvals.
4. *Implementation* – Determine the project delivery method (i.e., design-build vs'; design-bid-build. Select contractor(s). Implement plan.

<u>Recommendation 4: Develop an emergency erosion response plan.</u>

Due to the lack of imminently threatened structures, options for temporary and permanent erosion control may be limited. KAN could consider developing a plan to have materials staged on-site and available for rapid deployment after an erosion event. KAN could invest in a functional concept design, purchase materials, and possibly obtain regulatory approvals in advance of an erosion event. This approach could potentially streamline the permitting process when an erosion event occurs. An erosion response plan would likely consist of constructing a geotextile sandbag revetment or a sand filled mattress after an erosion event.

Developing an emergency erosion response plan would involve the following steps:

1. *Functional Concept Design* – Develop a functional concept design that describes the technical requirements for the emergency erosion control measures, including but not limited to design parameters and calculations, material quantities and specifications, representative design profiles, and plan and section view drawings.
2. *Plan Development* – Develop a plan detailing the rationale, means, methods, and timeline to implement emergency erosion control measures after an erosion event.
3. *Agency Consultations* - Consult with key agencies to review the plan and assess permitting requirements. Determine if regulatory approvals can be obtained in advance of an erosion event. Modify the means, methods, and timeline based on agency feedback.
4. *Regulatory Permitting* –Prepare and submit all required permit applications. Obtain regulatory approvals.
5. *Construction* – Determine the project delivery method (i.e., design-build vs'; design-bid-build. Select contractor(s). Proceed to construction.

This report presents four (4) potential options for permanent erosion control at KAN:

- Seawall Repairs
- Seawall Replacement
- Rock Rubblemound Revetment
- Hybrid Seawall-Revetment

The alternatives listed above could effectively mitigate the erosion and provide long-term protection for the backshore land and infrastructure; however, these options are typically very controversial, require extensive environmental and regulatory review, and can be very expensive. Agencies and the public are typically opposed to shoreline armoring, particularly on Maui, so the likelihood of obtaining the necessary regulatory permits is uncertain. Permanent erosion control measures are typically only authorized under emergency conditions. The existing buildings at KAN are not imminently threatened so it is unlikely that permanent erosion control would be authorized.

<u>Recommendation 5: Repair and maintain existing seawalls.</u>

Options to repair or modify the existing seawalls are limited due to the inherent design limitations (e.g., shallow-depth foundation), the extent of the damages and structural deficiencies, and the nonconforming status of the structures. The structures are in disrepair and appear to be at risk of failing. The objective of the repairs would be to stabilize and maintain the existing structures to prevent further erosion until a long-term solution can be developed and implemented.

Repairing and maintaining the existing seawalls would involve the following steps:

1. *Design* – Develop a functional concept design that describes the technical requirements for seawall repairs, including but not limited to design parameters and calculations, material quantities and specifications, representative design profiles, and plan and section view drawings.
2. *Regulatory Permitting* –Prepare and submit all required permit applications. Obtain regulatory approvals.
3. *Construction* – Determine the project delivery method (i.e., design-build vs'; design-bid-build. Select contractor(s). Proceed to construction.

Recommendation 6: Replace existing seawalls.

Options to replace the existing seawalls are challenging due to current agency and public opposition to shoreline armoring, particularly on Maui. The Hawaii Legislature recently considered adopting a bill to prohibit construction of shoreline hardening structures, such as seawalls and revetments, at sites with sandy beaches. Considering future projections for erosion and sea level rise, shoreline armoring may be necessary to protect the backshore land and infrastructure. KAN should consider options to replace the existing seawalls with a more robust structure. A hybrid seawall-revetment is the recommended engineering solution.

Replacing the existing seawalls would involve the following steps:

1. *Design* – Develop a functional concept design that describes the technical requirements for seawall replacement, including but not limited to design parameters and calculations, material quantities and specifications, representative design profiles, and plan and section view drawings.
2. *Agency Consultations* - Consult with key agencies to review the plan and assess environmental review and permitting requirements. Modify the means, methods, and timeline based on agency feedback.
3. *Environmental Review* – Hire a consultant to prepare an EA or EIS. This typically involves additional studies including but not limited to a marine biota and water quality assessment, historical, cultural, and archaeological assessment, cultural impact assessment, and recreational use study. The design may need to be modified based on feedback received during the environmental review process. Upon receipt of a Final Environmental Assessment (FEA) or Final Environmental Impact Statement (FEIS), the project can proceed to permitting and construction.
4. *Regulatory Permitting* –Prepare and submit all required permit applications. Obtain regulatory approvals.
5. *Construction* – Determine the project delivery method (i.e., design-build vs'; design-bid-build. Select contractor(s). Proceed to construction.

7. ENVIRONMENTAL REVIEW & REGULATORY PERMITTING

The permitting process for shoreline improvements at KAN will depend on the nature of the selected project(s). It is important to have a general understanding of the environmental review and regulatory permitting requirements along Hawaii's shorelines. Shorelines, beaches, and nearshore waters in Hawaii are considered part of the Public Trust, with access and use available to all people. As a result, Hawaii's shorelines are heavily regulated. The current definition of the "*shoreline*" in Hawaii is as follows:

> "*Shoreline* means the upper reaches of the wash of the waves, other than storm or seismic waves, at high tide during the season of the year in which the highest wash of the waves occurs, usually evidenced by the edge of vegetation growth, or the upper limit of debris left by the wash of the waves (Hawaiʻi Administrative Rules §13-222)."

Generally, County jurisdiction begins at the shoreline and extends landward. State jurisdiction begins at the shoreline and extends seaward. Federal jurisdiction begins at the mean higher high water (mhhw) line and extends out to the 200 nautical mile limit of the U.S. exclusive economic zone (EEZ); this area is also defined as the "Waters of the United States". Figure 7-1 shows relevant permit jurisdiction lines for shoreline construction in Hawaii.

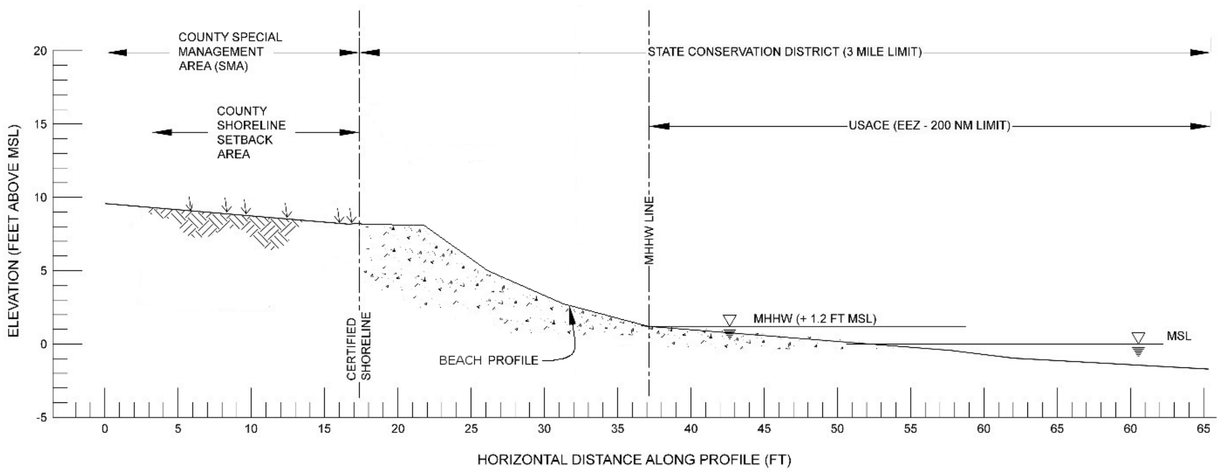

Figure 7-1 Jurisdictional boundaries for shoreline construction in Hawaii

The County, State, and Federal governments all have different objectives and rules regulating what activities can be authorized along the shoreline. Therefore, the definition and location of the *shoreline* is critical for the planning and permitting of any coastal construction. The *certified shoreline* is a line established by a licensed land surveyor and certified by the State, which reflects the shoreline definition stated above. The *certified shoreline* is valid for 12 months and is used to establish jurisdiction and shoreline setback boundaries. The KAN shoreline was previously certified by the State of Hawaii on July 15, 2011. This could create an issue relating to the non-exclusive seawall easement that currently covers a small portion of the existing seawall in Section 3 (east).

In 2001, it was determined that 248 square feet of the seawall was encroaching seaward of the record property boundary on State land. In 2004, KAN obtained a non-exclusive easement for the encroaching portion of the seawall. The landward limits of the easement area followed the property boundary, rather than the shoreline, which was departmental practice at the time. In 2011, the State of Hawaii began using the shoreline to define the landward limits of easement boundaries. The KAN shoreline was certified just prior to this transition.

In 2011, the State certified the shoreline along the vegetation line landward of the existing seawalls. No changes to the existing easement were required. A current certified shoreline will likely be required for many of the options presented in this report. KAN will likely be required to amend the easement to include all of the structures seaward of the shoreline. Easement costs are based on Fair Market Value of the property, so expanding the easement area could potentially be very expensive. The easement area would also be considered part of the Conservation District, which could further limit options to repair or replace the existing structures.

7.1 Environmental Review

Hawaii's environmental impact statement law (Chapter 343, Hawaii Revised Statutes) requires the preparation of an Environmental Assessment (EA) or Environmental Impact Statement (EIS) for more substantial projects. When a project is anticipated to result in significant environmental impacts, a full EIS is often required. SEI anticipates that an EIS would be required for beach restoration or shore protection.

Depending on the nature of the selected project(s), additional studies and engineering services may be required. Additional studies and services may include the following:

- Marine Biota and Water Quality Assessment
- Historical, Cultural, and Archaeological Assessment
- Cultural Impact Assessment
- Recreational Impact Assessment

7.2 Regulatory Permitting

The environmental review process will determine whether the project(s) can be advanced to final design, permitting, and construction. Any activity along the shoreline will require approvals from County, State, and/or Federal agencies. A certified shoreline will likely be required.

The area seaward of the shoreline is in the Conservation District (CD), which is regulated by Hawaii Department of Land and Natural Resources. Permitting requirements in the CD may include but not be limited to:

- Conservation District Use Permit (CDUP)
- Site Plan Approval (SPA)
- Right-of-Entry (ROE)
- Small-scale Beach Nourishment Permit (SSBN)

The area landward of the shoreline is in the Special Management Area (SMA), which is regulated by the County of Maui. Permitting requirements in the SMA may include but not be limited to:

- Shoreline Certification
- Special Management Area Permit (SMA)
- Shoreline Setback Assessment (SSA)
- Shoreline Setback Variance (SSV)
- Building Permit
- Flood Development Permit
- Coastal High Hazard Certificate
- Dune Certification
- Grading Permit

For projects seaward of the shoreline, a "jurisdictional determination" may be required to determine the limits of Federal jurisdiction. The mean higher high water (mhhw) elevation defines the landward limit of "waters of the United States", which are regulated by the Federal government. Department of the Army (U.S. Army Corps of Engineers) and additional State permits are required for work below mhhw.

Permitting requirements in waters of the United States may include but not be limited to:

- Department of the Army, Section 10 Permit
- Department of the Army, Section 404 Individual Permit (DA-IP)
- Department of the Army, Section 404 Nationwide Permit (DA-NWP)
- Section 401 Water Quality Certification (WQC)
- National Pollution Discharge Elimination System (NPDES)
- Coastal Zone Management Federal Consistency Determination

A summary of the anticipated environmental review and regulatory permitting requirements for the alternatives presented in this report is shown in Figure 7-2.

	Sand pushing	Sand Backpassing	Sand Pumping	Small-scale Beach Restoration	Regional Beach Restoration	Erosion Protection Skirt	Sand Filled Mattress	Sandbag Revetment	Seawall Repair	Seawall Replacement	Rock Rubblemound Revetment	Hybrid Seawall-Revetment
FEDERAL												
Department of the Army Individual Permit (IP)	N	N	Y	N	Y	N	N	N	N	Y	Y	Y
Department of the Army Nationwide Permit (NWP)	N	N	N	N	N	N	N	N	Y	N	N	N
STATE												
Environmental Impact Statement (EIS)	N	N	N	N	Y	N	N	N	N	Y	Y	Y
Environmental Assessment (EA)	N	N	N	N	Y	N	N	N	N	Y	Y	Y
Shoreline Certification	N	N	N	N	Y	Y	N	Y	Y	Y	Y	Y
Conservation District Use Permit (CDUP)	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N
Small Scale Beach Restoration (SSBR)	Y	Y	Y	Y	N	N	N	N	N	N	N	N
Right of Entry (ROE)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Coastal Zone Management Federal Consistency (CZM)	N	N	N	N	Y	N	N	Y	N	Y	Y	Y
National Pollution Discharge Elimination System (NPDES)	N	N	N	N	Y	N	N	N	N	N	N	N
Section 401 Water Quality Certification (WQC)	N	N	Y	Y	Y	N	N	Y	Y	Y	Y	Y
COUNTY												
Shoreline Setback Determination	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Shoreline Setback Variance	N	N	N	N	N	N	N	Y	N	Y	Y	Y
Special Management Area Major	N	N	N	N	N	N	N	N	N	Y	Y	Y
Special Management Area Minor	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N
Building Permit	N	N	N	N	Y	Y	N	Y	Y	Y	Y	Y
Grubbing & Grading Permit	N	N	N	Y	Y	Y	N	Y	N	Y	Y	Y

Y = anticipated to be required. **N** = not anticipated to be required

Figure 7-2 Anticipated environmental review and permitting requirements

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Appendix J Land Use Development Form

COUNTY OF MAUI
DEPARTMENT OF PLANNING
One Main Plaza Building
2200 MAIN STREET, SUITE 315
WAILUKU, HAWAII 96793

Zoning Administration and Enforcement Division (ZAED)
Telephone: (808) 270-7253

LAND USE DESIGNATION FORM

TAX MAP KEY 2380140040000

PROPERTY ADDRESS 250 HAUOLI ST, WAILUKU, HI 96793

☐ Yes ☑ No **Will this Land Use Designation Form be used with a Subdivision Application?**

IF YES, answer questions A and B below and comply with instructions 2 & 3 below:

A) ☐ Yes ☑ No **Will it be processed under a consistency exemption from** Section 18.04.030(B), MCC?

IF YES, which exemption? (No. 1, 2, 3, 4 or 5) ____

B) State the purpose of subdivision and the proposed land uses (ie 1-lot into 2-lots for all land uses allowed by law):

INSTRUCTIONS:

1) **Please use a separate Land Use Designation Form for each Tax Map Key (TMK) number.**
2) **If this will be used with a subdivision application AND the subject property contains multiple districts/designations of (1) State Land Use Districts, (2) Maui Island Plan Growth Boundaries, (3) Community Plan Designations, or (4) County Zoning Districts; submit a signed and dated Land Use Designations Map, prepared by a licensed surveyor, showing the metes & bounds of the subject parcel and of each district/designation including any subdistricts.**
3) **If this will be used with a subdivision application AND the subject property contains multiple State Land Use Districts; submit an approved District Boundary Interpretation from the State Land Use Commission.**

(This section to be completed by ZAED)

LAND USE DISTRICTS/DESIGNATIONS (LUD) AND OTHER INFORMATION:[1]

☑ (SMA) Special Management Area

STATE DISTRICT: ☑ Urban ☐ Rural ☐ Agriculture ☐ Conservation

MAUI ISLAND PLAN
Growth Boundary:[2] ☑ Urban ☐ Small Town ☐ Rural ☐ Planned Growth Area ☐ Outside Growth Boundaries
Protected Area:[2] ☐ Preservation ☐ Park ☐ Greenbelt ☐ Greenway ☐ Sensitive Land ☑ Outside Protected Areas

COMMUNITY PLAN:[2] MULTI FAMILY RESIDENTIAL

COUNTY ZONING: A2-APARTMENT

OTHER/COMMENTS: SEE ATTACHED MAP: TMK 238014005 WAS DROPPED

☐ (PD) Planned Development
☐ (PH) Project District
☐ See Additional Comments (Pg. 2)
☐ See Attached LUD Map

FEMA FLOOD INFORMATION: A Flood Development Permit is required if any portion of a parcel is designated V, VE, A, AO, AE, AH, D, or Floodway, and the project is on that portion.

FLOOD HAZARD AREA ZONES[3]
& BASE FLOOD ELEVATIONS: ZONE: X,AE(11'),VE(12')

☐ FEMA DESIGNATED FLOODWAY | For Flood Zone AO, FLOOD DEPTH:

SUBDIVISION LAND USE CONSISTENCY: ☐ Not Consistent, (LUDs appear to have NO permitted uses in common).

☐ Not Applicable, (Due to processing under consistency exemption No. ☐ 1, ☐ 2, ☐ 3, ☐ 4, ☐ 5).

(Signature) ☐ Interim Zoning, (The parcel or portion of the parcel that is zoned interim shall not be subdivided).

☐ Consistent, (LUDs appear to have ALL permitted uses in common).

☐ Consistent, upon obtaining an SMA, PD, or PH subdivision approval from Planning.

☐ Consistent, upon recording a permissible uses unilateral agreement processed by Public Works (See Pg. 2).

NOTES:

1) **The conditions and/or representations made in the approval of a State District Boundary Amendment, Community Plan Amendment, County Change in Zoning, SMA Permit, Planned Development, Project District and/or a previous subdivision, may affect building permits, subdivisions, and uses on the land.**
2) **Please review the Maui Island Plan and the Community Plan document for any goals, objectives, policies or actions that may affect this parcel.**
3) **Flood development permits might be required in zones X and XS for any work done in streams, gulches, low-lying areas, or any type of drainageway might require the following designations to be shown on the subdivision map: 100-year flood inundation limits; base flood elevations; drainage reserves,**
4) **Subdivisions will be further reviewed during the subdivision application process to verify consistency, unilateral agreement requirements, and the conditions associated with a unilateral agreement [Section 18.04.030.D, Maui County Code]**

REVIEWED & CONFIRMED BY:

Jacob Alison — Date: 03/04/2024

For: Planning Program Administrator, Jordan Hart

VALID FOR 2 YEARS FROM THE DATE ISSUED. DESIGNATIONS MAY CHANGE

01/01/2023

INSTR-DESC: ROUTE SLIP

TRANS NO: 417526
INSTR-DATE: 01/01/2023
REC-DATE: 01/01/2023

OTHER-TMKS: 3-8-014-004-0000 ETC.

TO: 3814-4   POR LOT B 1.251 AC OR 54,429 SF

ENTRY OF ROUTE SLIP HEREIN IS TO RECOGNIZE THE BEACH HOUSE CONSOLIDATION PROJECT LOT B, FILE 3.754 AND DROPPING TMK 3814-5 INTO CONDO MASTER 3814-4

TMB NOTE:

1) LUCA 3.754 APPROVED 9/13/1973 WHICH CONSOLIDATED LOT B1 (1.251 AC OR 54,489 SF) UNDER TMKS 3814-5 & 34 AND LOT B2 (1.340 AC OR 58,387 SF) UNDER TMK 3814-4 INTO LOT B (112,876 SF) WAS NOT WORKED DUE TO UNLIKE OWNERS BUT WAS NOTED ON TMKS 3814-4 & 5 OWNERSHIP HISTORY
2) TMK 3814-34 WAS DROPPED INTO 3814-5 ON 11/28/1973 BY LEASE DOC 9536, PG 419 REC 10/9/73
3) DECLARATION OF CPR IN LIBER 11047, PG 429 REC 11/26/75 SUBMITTED TO THE KANA'I A NALU CONDO IN EXHIBIT A AREA OF 2.591 AC OR 112,876 SF; FEE OWNERS SHOWN AS ROBERT P BRUCE, TRUSTEE OF TRUST DTD 5/16/74; AND FRANKLYN E LANGA AND SANFORD J LANGA, TRUSTEES OF TRUST DTD 7/29/66
   A) TMK 3814-5 (1.251 AC OR 54,429 SF) WAS NOT DROPPED INTO 3814-4 (1.34 AC OR 58,387 SF) BY THE CONDO MASTER ENTRY; CONDO MASTER INCLUDED BOTH 3814-4 & 5
4) AREA OF 3814-4 WAS CHANGED TO 112,864 SF AT TIME OF CONVERSION BUT TMK 3814-5 WAS NOT DROPPED

F/D: DROPPED

GROUP#	NAME	F	TC	%-OWNER	TITLE-DESC
2 0011	DROPPED 1/1/2023				

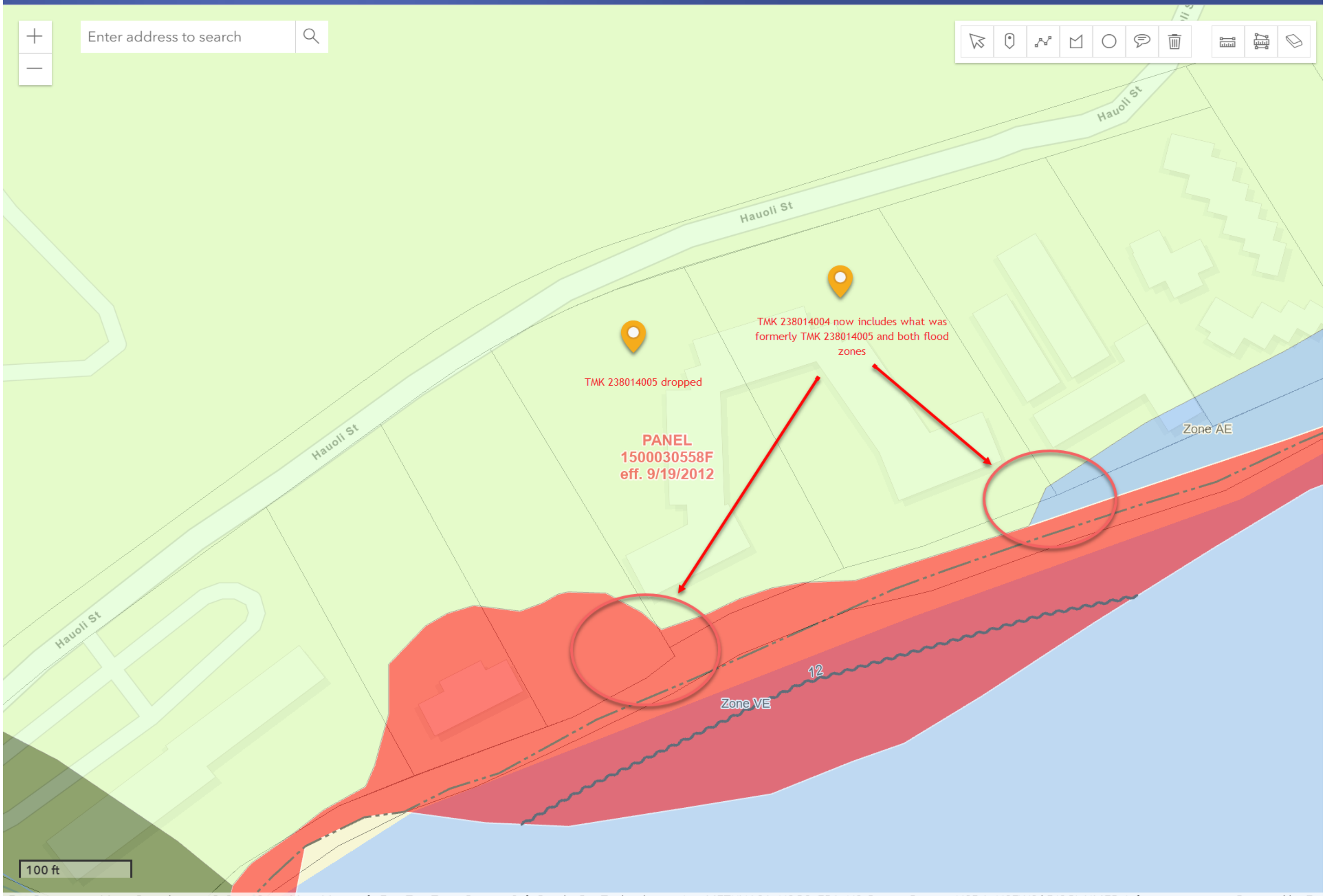
10/07/1987

GROUP#	NAME	F	TC	%-OWNER	TITLE-DESC
2 0011	KANA'I A NALU - CONDO MASTER				CONDO MASTER

-------------------SEE HISTORY SHEET FOR MORE INFORMATION------------------

State of Hawaii, Department of Land and Natural Resources

Flood Hazard Assessment Tool



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Home

Base Maps

Select Base Map: Esri Streets Vector

Layer Transparency

National Flood Hazard Layer (NFHL):

0 10 20 30 40 50 60 70 80 90 100

Parcel (TMK) Layer:

0 10 20 30 40 50 60 70 80 90 100

TMK Search

Enter a 9-digit tax map key:

238014005

Search | Clear

County numbers:
1 = City and County of Honolulu
2 = Maui County
3 = Hawaii County
4 = Kauai County

Coordinate Search

Estimated Ground Elevation

Map Legend

NGS Datasheets

Elevation Certificate Generator

Flood Insurance Studies

State Regulated Dams

Tsunami Evacuation Zones

-156.507024, 20.797043

Appendix K Flood Hazard Assessment Tool

Flood Hazard Assessment Report

www.hawaiinfip.org

KAN Interim Erosion Contr

Property Information

COUNTY: MAUI

TMK NO: (2) 3-8-014:004

WATERSHED: POHAKEA

PARCEL ADDRESS: PARCEL 004
WAILUKU, HI 96793

Notes:

Flood Hazard Information

FIRM INDEX DATE:	NOVEMBER 04, 2015
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL:	1500030558F
PANEL EFFECTIVE DATE:	SEPTEMBER 19, 2012

THIS PROPERTY IS WITHIN A TSUNAMI EVACUTION ZONE: YES
FOR MORE INFO, VISIT: http://www.scd.hawaii.gov/

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: NO
FOR MORE INFO, VISIT: http://dlnreng.hawaii.gov/dam/

N

0 400 800 ft

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If this map has been identified as 'PRELIMINARY', please note that it is being provided for informational purposes and is not to be used for flood insurance rating. Contact your county floodplain manager for flood zone determinations to be used for compliance with local floodplain management regulations.

FLOOD HAZARD ASSESSMENT TOOL LAYER LEGEND
(*Note: legend does not correspond with NFHL)*

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD - The 1% annual chance flood (100-year), also know as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. SFHAs include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

- **Zone A**: No BFE determined.
- **Zone AE**: BFE determined.
- **Zone AH**: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
- **Zone AO**: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
- **Zone V**: Coastal flood zone with velocity hazard (wave action); no BFE determined.
- **Zone VE**: Coastal flood zone with velocity hazard (wave action); BFE determined.
- **Zone AEF**: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

NON-SPECIAL FLOOD HAZARD AREA - An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

- **Zone XS (X shaded)**: Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
- **Zone X**: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

- **Zone D**: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase apply, but coverage is available in participating communities.

Flood Hazard Assessment Report

www.hawaiinfip.org

KAN Interim Erosion Contr

Property Information

COUNTY: MAUI

TMK NO: (2) 3-8-014:005

WATERSHED: POHAKEA

PARCEL ADDRESS: PARCEL 005
WAILUKU, HI 96793

Notes:

Flood Hazard Information

FIRM INDEX DATE: NOVEMBER 04, 2015

LETTER OF MAP CHANGE(S): NONE

FEMA FIRM PANEL: 1500030558F

PANEL EFFECTIVE DATE: SEPTEMBER 19, 2012

THIS PROPERTY IS WITHIN A TSUNAMI EVACUTION ZONE: YES
FOR MORE INFO, VISIT: http://www.scd.hawaii.gov/

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: NO
FOR MORE INFO, VISIT: http://dlnreng.hawaii.gov/dam/

0 400 800 ft

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FLOOD HAZARD ASSESSMENT TOOL LAYER LEGEND
(*Note: legend does not correspond with NFHL)*

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD - The 1% annual chance flood (100-year), also know as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. SFHAs include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

- **Zone A**: No BFE determined.
- **Zone AE**: BFE determined.
- **Zone AH**: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
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- **Zone V**: Coastal flood zone with velocity hazard (wave action); no BFE determined.
- **Zone VE**: Coastal flood zone with velocity hazard (wave action); BFE determined.
- **Zone AEF**: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

NON-SPECIAL FLOOD HAZARD AREA - An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

- **Zone XS (X shaded)**: Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
- **Zone X**: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

- **Zone D**: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase apply, but coverage is available in participating communities.